ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Douglas A. Ducey
Governor

Misael Cabrera
Director

Ms. Alexis Strauss, Acting Regional Administrator
U.S. Environmental Protection Agency, Region IX
Mail Code ORA-1
75 Hawthorne Street
San Francisco, CA 94105

DEC 13 2016

RE: Arizona State Implementation Plan Revision, Maricopa Association of Governments 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area

Dear Ms. Strauss:

The Arizona Department of Environmental Quality (ADEQ), on behalf of Maricopa Association of Governments (MAG), hereby adopts and submits to the U.S. Environmental Protection Agency (EPA) the below State Implementation Plan (SIP) revision pursuant to the provisions of Arizona Revised Statutes (ARS) Sections 49-104, 49-106, 49-404, 49-406, and 49-425, and Code of Federal Regulations (CFR) Title 40, Sections 51.102 through 51.104:

- MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area.

In 2008, EPA revised the eight-hour ozone standard from 0.08 parts per million to 0.075 parts per million. On May 21, 2012, EPA designated the Maricopa Nonattainment Area as a Marginal Area with a December 31, 2015 attainment date.

On May 4, 2016, EPA determined the Maricopa Eight-Hour Ozone Nonattainment Area did not attain the 2008 standard and reclassified the area from Marginal to Moderate. The attainment date for Moderate Areas is July 20, 2018. A Moderate Area Plan is due by January 1, 2017.

This submission contains the final version of the MAG 2017 Eight-Hour Ozone Moderate Area Plan consistent with the requirements of Section 182(b) of the Clean Air Act. ADEQ requests, on behalf of MAG, that EPA approve this revision into the Arizona SIP. If you have any questions, please contact Dennis Smith, Executive Director, Maricopa Association of Governments, at (602) 254-6300.

Sincerely,

Timothy S. Franquist
Director, Air Quality Division

Enclosures (2)
cc: Matthew Lakin, EPA Region IX
Colleen McKaughan, EPA Region IX

ARIZONA DEPARTMENT
OF
ENVIRONMENTAL QUALITY

Douglas A. Ducey
Governor

Misael Cabrera
Director

April 15, 2016

To: Timothy S. Franquist Jr.
Division Deputy Director
Air Quality Division

Under A.R.S. §49-104 (D) (2), I authorize you, Timothy S. Franquist Jr., Division Deputy Director, Air Quality Division, Arizona Department of Environmental Quality, to perform any act, including execution of any pertinent documents, which I as Director of the Arizona Department of Environmental Quality am authorized or required to do by law with respect to A.R.S. Title 49, chapters 1 and 2 and any other acts relating to air quality including personnel actions.

This authority shall remain in effect until it is revoked or upon your separation from the Arizona Department of Environmental Quality. You may further delegate this authority in the best interest of the agency, however, those delegations must be in writing and you must forward a copy of any further delegations to me.

This delegation is effective as of April 18, 2016 and revokes all earlier delegations. I ratify all acts performed by you as Air Quality Division Deputy Director concerning the duties and functions in this delegation letter.

Misael Cabrera
Director

MARICOPA ASSOCIATION of GOVERNMENTS

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50th Anniversary
1967–2017

December 9, 2016

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DEC 09 2016
ADEQ

Mr. Misael Cabrera, Director
Arizona Department of Environmental Quality
1110 West Washington Street
Phoenix, Arizona 85007

Dear ~~Mr. Cabrera~~ Misael:

As the designated Regional Air Quality Planning Agency, the Maricopa Association of Governments Regional Council adopted the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area on December 7, 2016. At this time, it is requested that the Arizona Department of Environmental Quality officially submit the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area to the Environmental Protection Agency (EPA) for approval.

The MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area is designed to meet the requirements of Section 182(b) of the Clean Air Act and demonstrate attainment of the 2008 ozone standard (0.075 parts per million). The attainment date for Moderate Areas is July 20, 2018. The deadline for submittal to the Environmental Protection Agency is January 1, 2017. The plan addresses the Moderate Area requirements such as reasonable further progress; reasonably available control technology; reasonably available control measures; new source review; emissions inventories; modeling attainment demonstration for 2017 (ozone season prior to the attainment date); contingency measures; and motor vehicle emissions budgets for conformity.

Collectively, the plan includes 93 existing control measures approved by EPA in prior air quality plans and existing federal control measures. The existing measures in the plan provide continuing emission reduction benefits of 3.86 percent above and beyond attainment that are used to meet the contingency requirements.

In accordance with the Clean Air Act, a public hearing was conducted on the plan on October 17, 2016. The public hearing process documentation is contained in Appendix C, Exhibit 1. For your convenience, three hard copies of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area and three CDs are provided. Each CD is an exact duplicate of the hard copy.

We are looking forward to working cooperatively with the Arizona Department of Environmental Quality in our continuing efforts to improve air quality. If you have any questions, please do not hesitate to contact Lindy Bauer or me at (602) 254-6300.

Sincerely,

Dennis Smith
Executive Director

cc: Timothy Franquist, Arizona Department of Environmental Quality
Colleen McKaughan, Environmental Protection Agency

MAG 2017 Eight- Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area

Completeness Criteria
(40 C.F.R. Part 51, Appendix V, § 2.0)

Appendix V § 2.1 - Administrative Materials

(a) A formal signed, stamped, and dated letter of submittal from the Governor or his designee, requesting EPA approval of the plan or revision thereof (hereafter "the plan").

See the cover letter for this SIP submission for delegation of authority letter from Misael Cabrera, Director of ADEQ, to Timothy Franquist, Director of the ADEQ Air Quality Division, authorizing Mr. Franquist to perform any act the ADEQ Director is authorized to perform under the state air quality statutes, including the submission of SIPs to EPA.

(b) Evidence that the State has adopted the plan in the State code or body of regulations; or issued the permit, order, consent agreement (hereafter "document") in final form.

See the cover letter to this document wherein the state adopts and submits this SIP revision. This is the method of Arizona state adoption.

(C) Evidence that the State has the necessary legal authority under State law to adopt and implement the plan.

The Arizona Department of Environmental Quality (ADEQ) has responsibility for air pollution control and abatement, and as such, is required to adopt and "maintain a state implementation plan that provides for implementation, maintenance, and enforcement of national ambient air quality standards and protection of visibility as required by the clean air act."[1] ADEQ also maintains authority to issue and administer rules, adopt county rules, and to submit such rules for approval in the SIP. Copies of Arizona Revised Statutes sections 49-101, 49-104, 49-106, 49-404, and 49-425 are attached in Appendix C, Exhibit 1.

[1] A.R.S. §49-404(A).

(d) A copy of the actual regulation, or document submitted for approval and incorporation by reference into the plan, including indication of the changes made (such as redline/strikethrough) to the existing approved plan, where applicable.

See MCAQD Ozone Rule Revisions; Rules 322, 323, 324, 336, 342, 350, 351, 352, and 353.

(e) Evidence that the State followed all of the procedural requirements of the State's laws and constitution in conducting and completing the adoption/issuance of the plan.

As demonstrated in Sections (b), (c), and (g), ADEQ has complied with all requirements of state law for adoption of this SIP Revision.

(f) Evidence that public notice was given of the proposed change consistent with procedures approved by EPA, including the date of publication of such notice.

Proof that ADEQ gave public notice in accordance with A.R.S. § 49-444 is attached as Appendix C, Exhibit 1.

(g) Certification that public hearing(s) were held in accordance with the information provided in the public notice and the State's laws and constitution, if applicable and consistent with the public hearing requirements in 40 CFR 51.102.

The certification and other documents related to the public hearing are attached as Appendix C, Exhibit 1.

(h) Compilation of public comments and the State's response thereto.

A compilation of comments received and the State's responses is attached as Appendix C, Exhibit 1.

Appendix V § 2.2 - Technical Support

(a) Identification of all regulated pollutants affected by the plan.

All regulated pollutants affected by the plan can be identified as Ozone, and Ozone precursors (NO_x and VOCs).

(b) Identification of the locations of affected sources including the EPA attainment/ nonattainment designation of the locations and the status of the attainment plan for the affected areas(s).

For the locations of affected point sources see Appendices Volume 1, Appendix A, Exhibit 1 page 12, Table 2.2-1.

(c) Quantification of the changes in plan allowable emissions from the affected sources; estimates of changes in current actual emissions from affected sources or, where appropriate, quantification of changes in actual emissions from affected sources through calculations of the differences between certain baseline levels and allowable emissions anticipated as a result of the revision.

Summary tables regarding emissions can be found on page 6-3 in the "MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA" document. The sections listed below present emissions summary information as well.

Appendices Volume 3, Appendix B, Exhibit 1, sections:

III-1-1 Point Source Emissions

III-1-2 Area Source Emissions

III-1-3 Non-road Mobile Source Emissions

III-1-4 On-road Mobile Source Emissions

III-1-5 Biogenic Source Emissions

III-1-6 Wild Fires & Prescribed Burning.

III-3 Emissions Summaries.

(d) The State's demonstration that the national ambient air quality standards, prevention of significant deterioration increments, reasonable further progress demonstration, and visibility, as applicable, are protected if the plan is approved and implemented.

For documentation supporting NAAQS attainment see "MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA" Chapter 6.

For information regarding PSD see the "New Source Review" section on page 4-46 (in the document mentioned above).

For information regarding RFP and contingency measures see pages 6-16 and 6-17 (in the document mentioned above).

(e) Modeling information required to support the proposed revision, including input data, output data, models used, justification of model selections, ambient monitoring data used, meteorological data used, justification for use of offsite data (where used), modes of models used, assumptions, and other information relevant to the determination of adequacy of the modeling analysis.

For supporting model documentation see Appendices Volume 3, Appendix B, Exhibit 1, "Technical Support Document in Support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area"

(f) Evidence, where necessary, that emission limitations are based on continuous emission reduction technology.

Not applicable.

(g) Evidence that the plan contains emission limitations, work practice standards and recordkeeping/reporting requirements, where necessary, to ensure emission levels.

See "MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA", Chapter 5 (pg 5-1), and Chapter 6 (page 6-7).

(h) Compliance/enforcement strategies, including how compliance will be determined in practice.

See "MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA", Chapters 5, and 6.

(i) Special economic and technological justifications required by any applicable EPA policies, or an explanation of why such justifications are not necessary.

No known deviation from EPA policy.

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

DECEMBER 2016

MARICOPA ASSOCIATION of GOVERNMENTS

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

Prepared by:

December 2016

Technical Assistance Provided By:

Arizona Department of Environmental Quality
Arizona Department of Transportation
Maricopa County Air Quality Department
U.S. Environmental Protection Agency

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

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MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

APPENDICES

APPENDIX A

Exhibit 1: 2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. February 2014. Addendum August 2015.

Exhibit 2: 2014 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. September 2016.

APPENDIX B

Exhibit 1: Technical Support Document in Support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments.

Exhibit 2: State of Arizona Fifty-Second Legislature Senate Bill 1255 and Final Revised Fact Sheet for Senate Bill 1255.

APPENDIX C

Exhibit 1: Public Hearing Process Documentation.

Exhibit 2: Certification of Adoption and MAG Authority for Regional Air Quality Planning.

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

EXECUTIVE SUMMARY

MARICOPA ASSOCIATION of GOVERNMENTS

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

EXECUTIVE SUMMARY

Within the Maricopa nonattainment area, the National Ambient Air Quality Standard has not yet been attained for the 2008 eight-hour ozone standard of 0.075 parts per million (ppm). The area is classified as a Moderate Area under the Clean Air Act. The Maricopa Association of Governments (MAG) was designated by the Governor of Arizona in 1978 and recertified by the Arizona Legislature in 1992 to serve as the Regional Air Quality Planning Agency to develop plans to address air pollution problems (A.R.S. Section 49-406 A.). On June 22, 2016, the Governor of Arizona transmitted a letter to the Environmental Protection Agency (EPA) to update the planning certifications. This plan was prepared through a coordinated effort with the Arizona Department of Environmental Quality (ADEQ), Arizona Department of Transportation, Maricopa County Air Quality Department, Pinal County Air Quality Department and Maricopa Association of Governments.

The MAG 2017 Eight-Hour Ozone Moderate Area Plan has been prepared to meet the requirements in Section 182(b) of the Clean Air Act and improve air quality in the Maricopa eight-hour ozone nonattainment area. The attainment date for Moderate Areas is July 20, 2018. A Moderate Area Plan is due by January 1, 2017. The Moderate Area Plan is required to include reasonable further progress; reasonably available control technology; reasonably available control measures; new source review; emissions inventories; modeling attainment demonstration for 2017 (ozone season prior to the attainment date); contingency measures; and motor vehicle emissions budgets for transportation conformity. Moderate Areas are also required to make the submissions for Marginal Areas. On October 16, 2015, EPA published a final notice to take direct final action to approve the MAG 2014 Eight-Hour Ozone Plan-Submittal of Marginal Area Requirements for the Maricopa Nonattainment Area.

Unlike other pollutants, ozone is not directly emitted into the atmosphere. Ozone is formed through a chemical reaction that occurs between volatile organic compounds (VOC) and nitrogen oxides (NOx) in the presence of sunlight. As a result, meteorological variability has a strong influence on ozone formation in the nonattainment area. Peak ozone concentrations typically occur from May through September and are influenced by several factors, including: westerly transport of upwind pollutants; a favorable synoptic weather pattern featuring high pressure over the northeastern portion of the state; a low pressure center in the southwest portion of the state; daytime local temperatures above 100 degrees Fahrenheit; and local emissions that are coincident with valley-wide stagnant and weak winds.

Ozone irritates the lungs and repeated exposure may cause permanent lung damage. Symptoms of ozone exposure may include wheezing, coughing, and pain when taking a

deep breath. Children, older adults, persons with pre-existing respiratory conditions such as asthma, and others who are active outdoors when ozone levels are high are most affected by the adverse health effects of ozone. Even low levels of ozone may cause a number of respiratory health effects.

In 2008, the Environmental Protection Agency revised the eight-hour ozone standard from 0.08 parts per million to 0.075 parts per million. The 2008 standard is met when the three-year average of the annual fourth-highest daily maximum eight-hour average ozone concentrations measured at each monitor over each year is less than or equal to 0.075 parts per million. Collectively, there are twenty ozone monitors in the 2008 eight-hour ozone nonattainment area. The nonattainment area encompasses approximately 5,017 square miles. The geographic locations of the monitors within the nonattainment area are shown in Figure ES-1.

Overall, the region has been experiencing a downward trend in ozone concentrations. The trend data for the monitors in the nonattainment area with the highest three-year average of the fourth-highest eight-hour ozone concentration and the number of eight-hour ozone violations recorded since 2008 are summarized in Figures ES-2 and ES-3. It is important to note that the 2016 values are based upon preliminary data through August 31, 2016. Based upon the preliminary data through August 31, 2016, there is only one monitor (Pinnacle Peak) that is violating the standard for 2014-2016. The preliminary 2016 design value at Pinnacle Peak is 0.076 parts per million, just slightly over the 0.075 parts per million standard. All other ozone monitors in the nonattainment area had a three-year average of the fourth-high ozone concentration at or below 0.075 parts per million.

The sources of ozone precursor emissions that contribute to ozone formation are grouped into five major categories: onroad mobile sources, area sources, nonroad mobile sources, point sources, and biogenic sources. Collectively, all five categories are estimated to contribute 599.87 (English) tons of volatile organic compounds, 253.86 tons of nitrogen oxides, and 1,375.98 tons of carbon monoxide per day in the 2011 ozone season for the Maricopa nonattainment area; Figures ES-4 and ES-5 show the relative contribution of each category for volatile organic compounds and nitrogen oxides, respectively. A complete description of these sources and the corresponding methodology used to calculate the emissions for 2011 are included in the 2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Nonattainment Area, February 2014, and Addendum, August 2015, contained in Appendix A, Exhibit 1.

The new MAG 2017 Eight-Hour Ozone Moderate Area Plan includes 93 existing and approved ozone control measures in the Maricopa nonattainment area from EPA approved regional air quality plans and separate EPA actions. The overall approach taken in the plan is to demonstrate attainment with existing federal, state and local ozone control measures. The implementation of existing ozone control measures in the Maricopa eight-hour ozone nonattainment area has already been effective in reducing ozone. These measures have allowed the area to attain and maintain both the one-hour ozone standard and the 1997 eight-hour ozone standard of 0.08 parts per million.

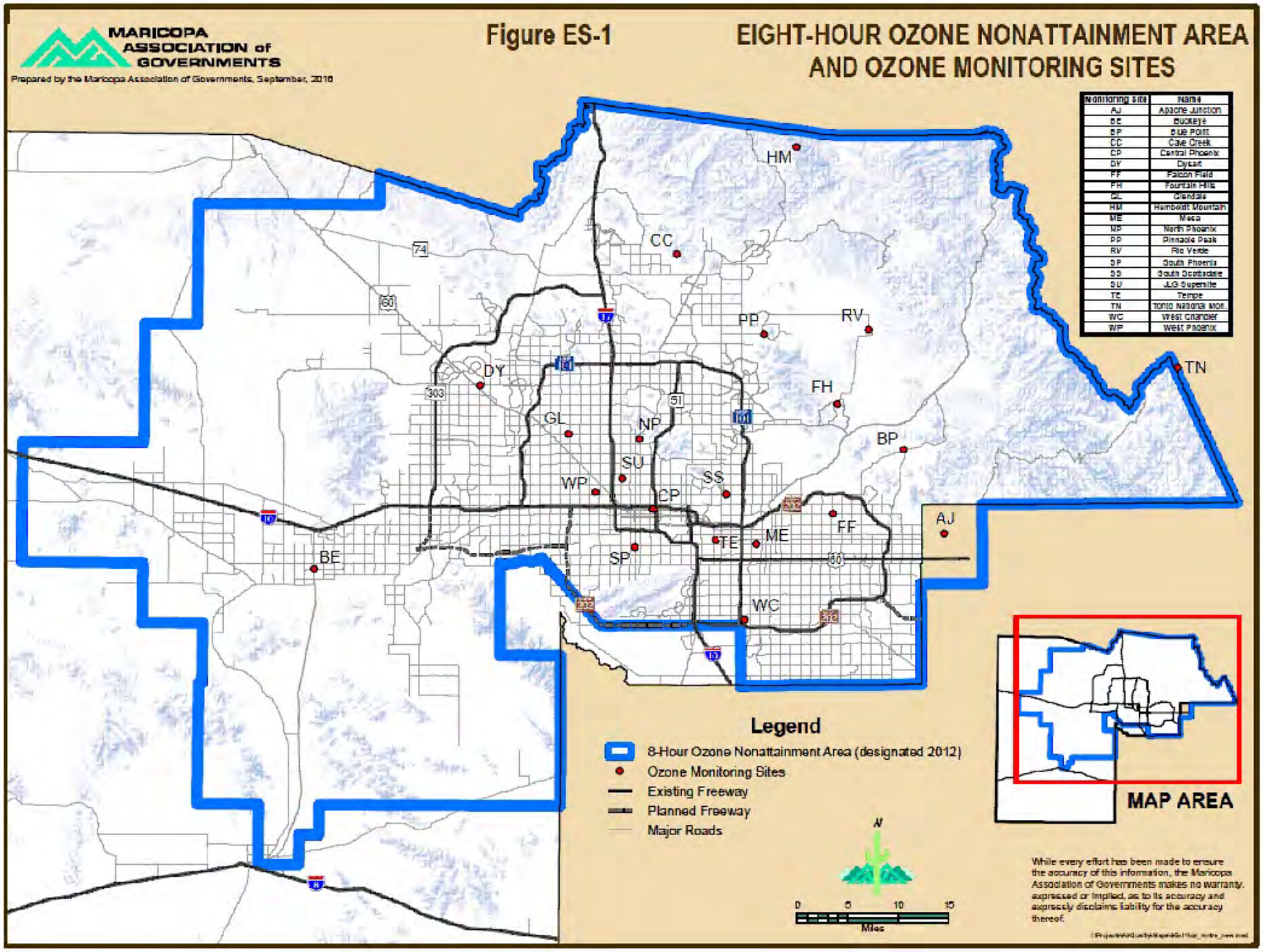
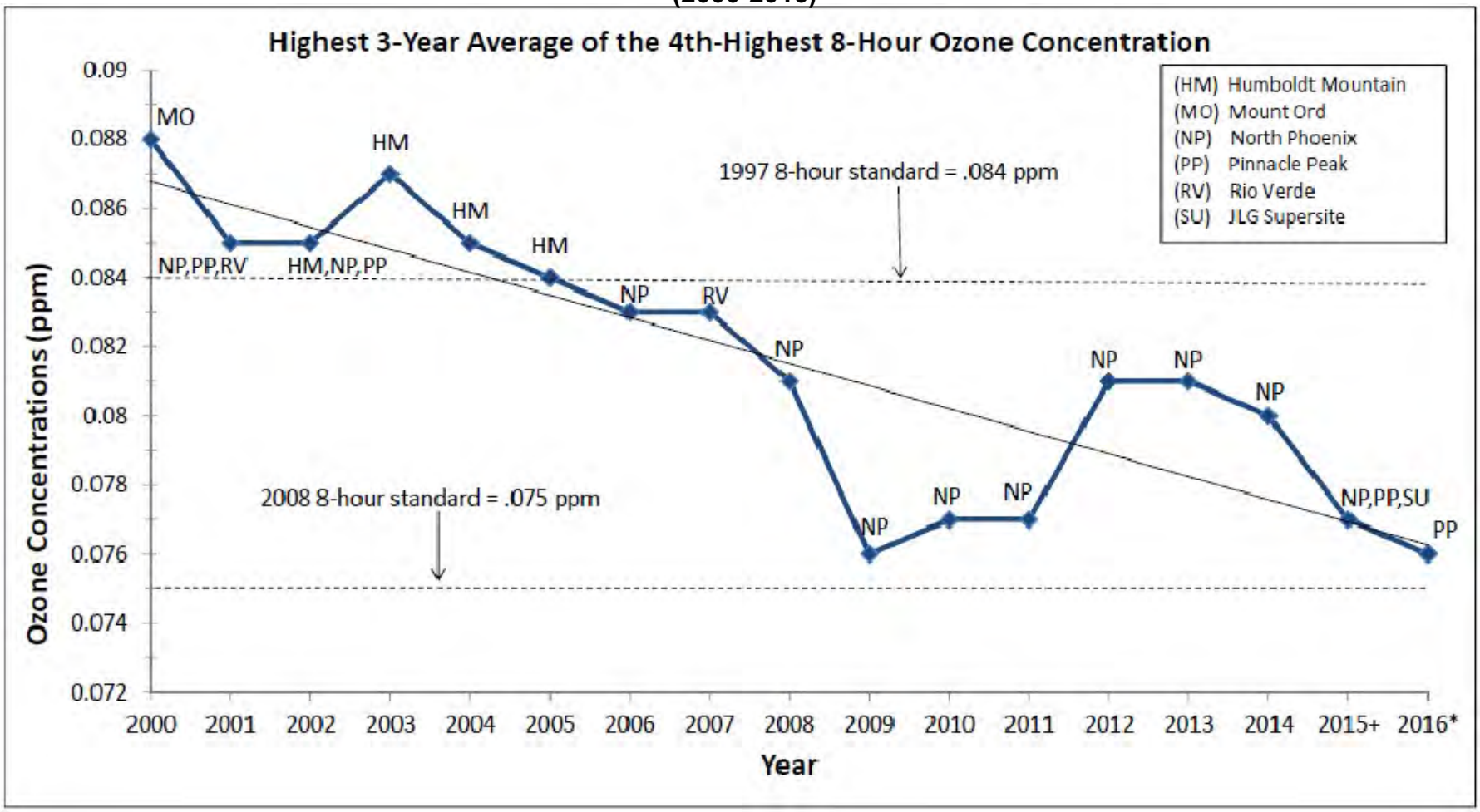

MARICOPA ASSOCIATION of GOVERNMENTS
Prepared by the Maricopa Association of Governments, September, 2016
Figure ES-1
EIGHT-HOUR OZONE NONATTAINMENT AREA AND OZONE MONITORING SITES
Monitoring Site | Name
AJ | Apache Junction
BE | Buckeye
BP | Blue Point
CC | Cave Creek
CP | Central Phoenix
DY | Dysart
FF | Falcon Field
FH | Fountain Hills
GL | Glendale
HM | Humboldt Mountain
ME | Mesa
NP | North Phoenix
PP | Pinnacle Peak
RV | Rio Verde
SP | South Phoenix
SS | South Scottsdale
SU | JLG Supersite
TE | Tempe
TN | Tonto National Mon.
WC | West Chandler
WP | West Phoenix
HM
CC
PP
RV
TN
DY
FH
GL
NP
BP
SU
SS
WP
CP
AJ
FF
ME
TE
BE
SP
WC
74
60
303
10
17
51
202
30
8
Legend
8-Hour Ozone Nonattainment Area (designated 2012)
Ozone Monitoring Sites
Existing Freeway
Planned Freeway
Major Roads
N
0 5 10 15
Miles
MAP AREA
While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.

Figure ES-2

Eight-Hour Ozone Trends
(2000-2016)

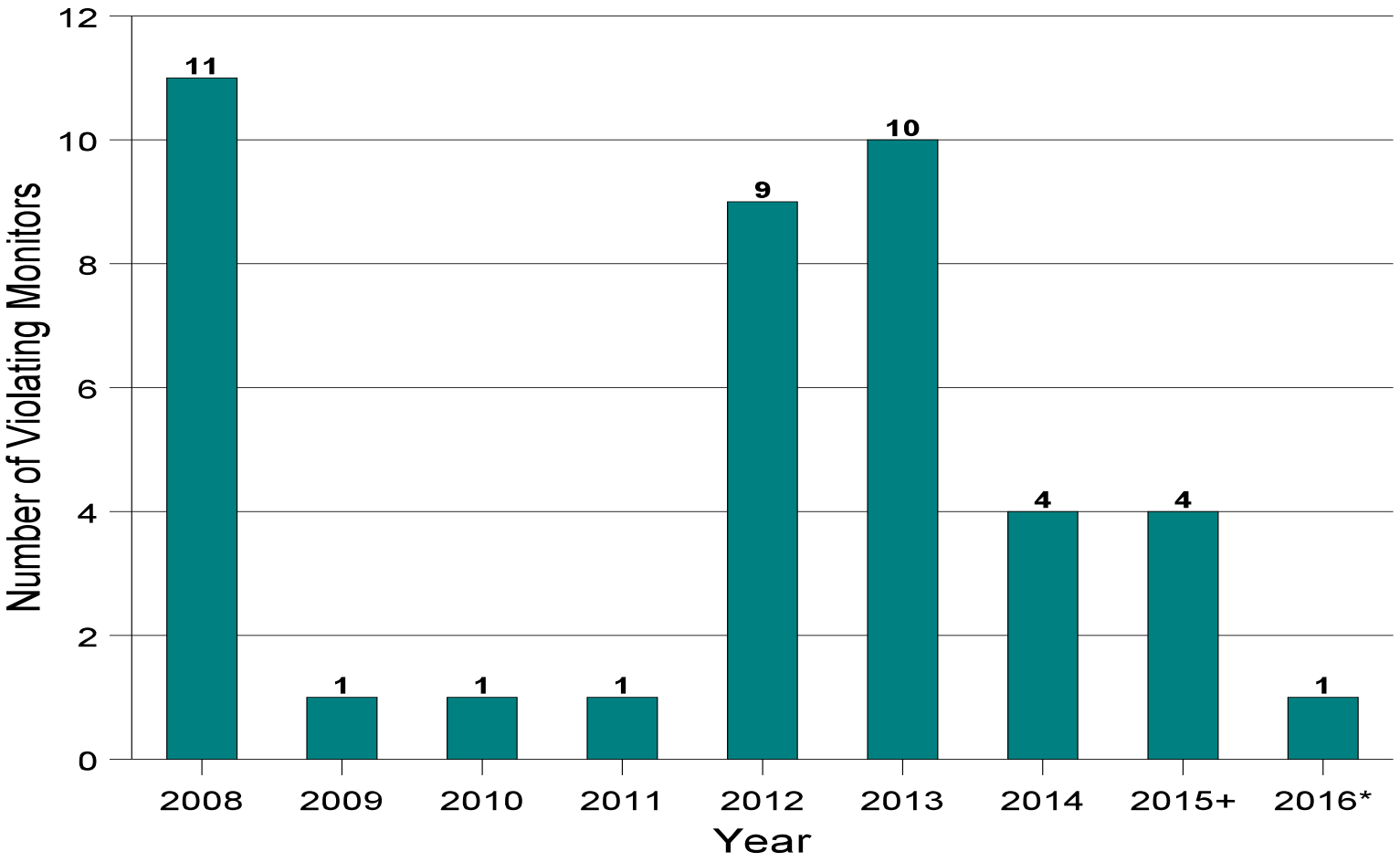


\+ Exceedances from the June 20, 2015 exceptional event have been removed. EPA concurrence of the exceptional event is pending.
* The 2016 values are based on preliminary data through August 31, 2016.
Note: Due to mathematical rounding, values greater than or equal to 0.085 ppm are necessary to exceed the 0.080 ppm standard.

Sources: 2000-2008: MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa Nonattainment Area, February 2009; 2009-2015: Environmental Protection Agency Air Quality System; 2016: Arizona Department of Environmental Quality; Maricopa County; Pinal County.

Figure ES-3

Violations of the 0.075 ppm Eight-Hour Ozone Standard in the Maricopa Nonattainment Area



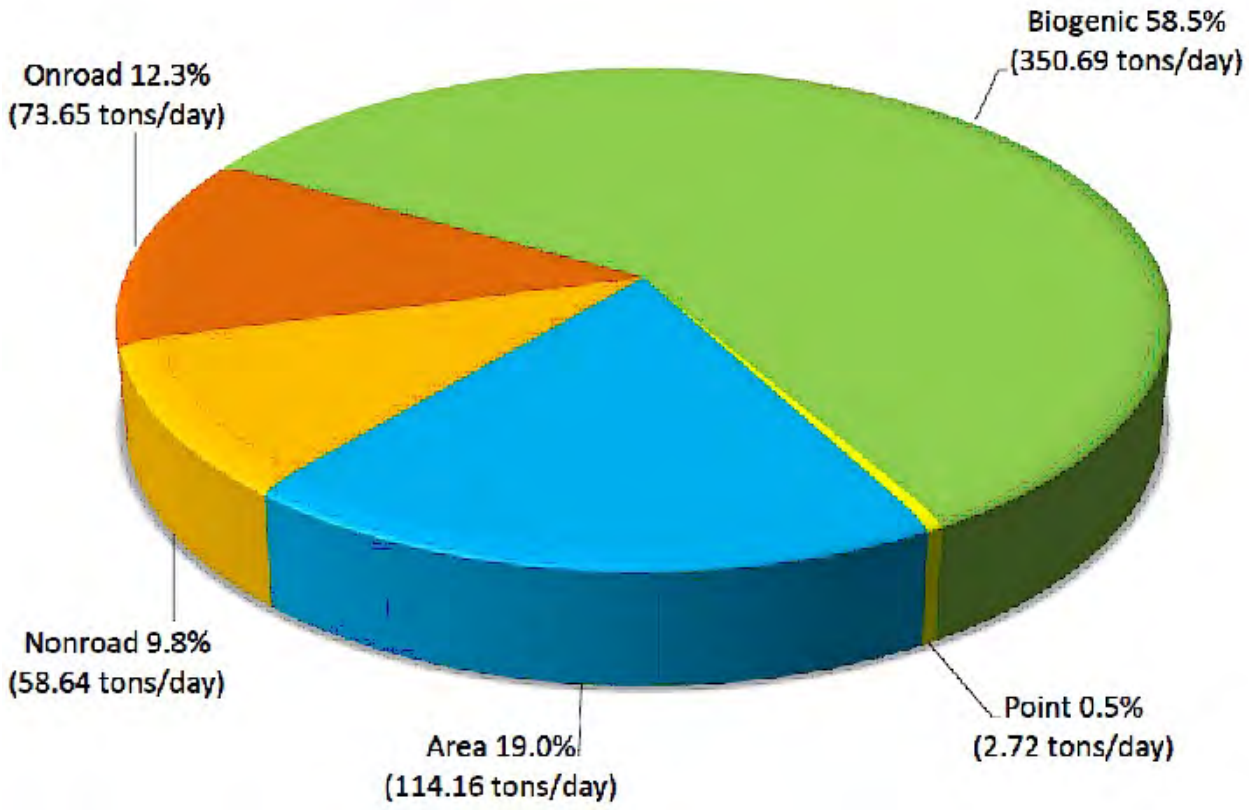
\+ Exceedances from the June 20, 2015 exceptional event have been removed. EPA concurrence of the exceptional event is pending.
* The 2016 values are based on preliminary data through August 31, 2016.

Sources: Environmental Protection Agency Air Quality System; Arizona Department of Environmental Quality; Maricopa County; Pinal County.

Figure ES-4

Sources of Volatile Organic Compound Emissions
2011 Periodic Emissions Inventory (Ozone Season Day Emissions)

2011 Ozone Season-Day VOC Emissions = 599.87 tons/day



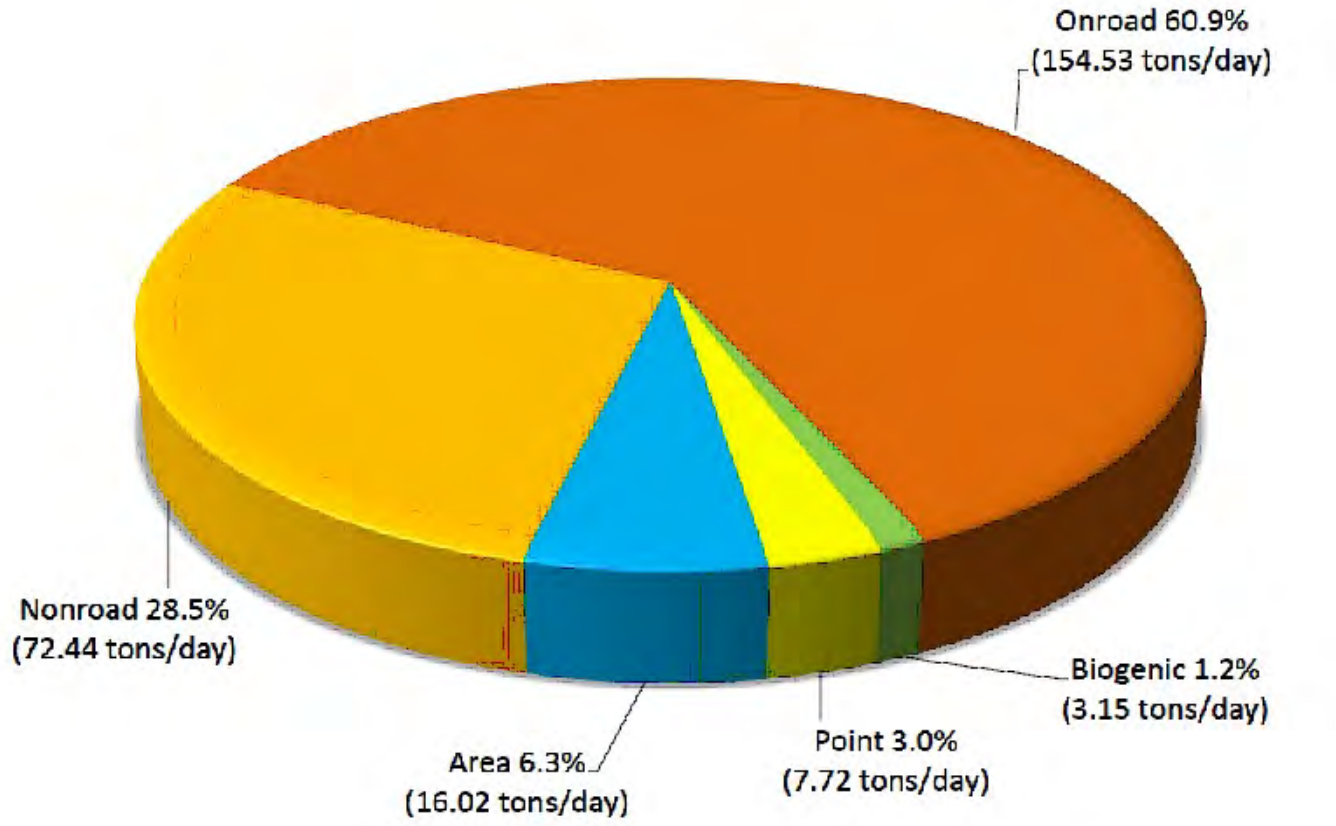
Sources

Point:	Industrial, manufacturing and electrical power generating facilities
Area:	Solvents and coatings use, fuel storage and transport, waste treatment and disposal, industrial/chemical processes, residential/industrial fuel combustion, open burning and wildfires
Onroad:	Cars and trucks
Nonroad:	Commercial, industrial, construction, mining, lawn and garden, farm and recreational equipment, aircraft and locomotives
Biogenic:	Natural vegetation

Figure ES-5

Sources of Nitrogen Oxide Emissions
2011 Periodic Emissions Inventory (Ozone Season Day Emissions)

2011 Ozone Season-Day NOx Emissions = 253.86 tons/day



Sources

Point:	Industrial, manufacturing and electrical power generating facilities
Area:	Waste treatment and disposal, industrial/chemical processes, residential/industrial fuel combustion, open burning and wildfires
Onroad:	Cars and trucks
Nonroad:	Commercial, industrial, construction, mining, lawn and garden, farm and recreational equipment, aircraft and locomotives
Biogenic:	Natural vegetation

The existing ozone control measures continue to have emission reduction benefits that provide for attainment of the 2008 ozone standard in the 2017 ozone season prior to the July 20, 2018 attainment date. The emission reduction benefits of the existing measures also continue beyond the attainment year of 2017, providing the emissions reductions needed in 2018 to satisfy the contingency measure requirements of Clean Air Act Section 172(c)(9).

The majority of the existing measures are committed state and local measures that have been adopted and approved by EPA in prior regional air quality plans such as the ADEQ 2000 Serious Area Ozone Plan, the MAG 2001 Serious Area Carbon Monoxide Plan, the MAG 2003 Carbon Monoxide Maintenance Plan, the MAG 2004 One-Hour Ozone Maintenance Plan, MAG 2007 Eight-Hour Ozone Plan, and the MAG 2009 Eight-Hour Ozone Maintenance Plan. Existing federal measures that reduce ozone in the Maricopa nonattainment area are also included.

In accordance with Clean Air Act Section 172(c)(1), the MAG 2017 Eight-Hour Ozone Moderate Area Plan is required to provide for the implementation of all reasonably available control measures (RACM), including reasonably available control technology, as expeditiously as practicable to attain the National Ambient Air Quality Standards and to meet reasonable further progress requirements. The EPA final rule on the implementation of the 2008 ozone standard indicates that states should consider all available measures, including those being implemented in other areas, and that a state must adopt measures for an area only if those measures are economically and technologically feasible and will advance the attainment date or are necessary for reasonable further progress.

For the RACM demonstration, the 93 existing control measures were evaluated in comparision to EPA's National Menu of Control Measures. The Menu of Control Measures provides a broad listing of potential emission reduction measures that have been gathered from control programs across the United States. Many of the control measures in the EPA Menu are already in place within the Maricopa eight-hour ozone nonattainment area. In addition, the existing measures were evaluated in comparison to the NOx and VOC rules in place in the Sacramento Metropolitan Air Quality Management District (SMAQMD). The SMAQMD rules apply within the Sacramento Metropolitan eight-hour ozone nonattainment area, which is currently classified as a Severe-15 nonattainment area for the 2008 ozone standard. The SMAQMD recently completed a RACM analysis for their NOx and VOC rules for the 1997 ozone standard. EPA approved the SMAQMD RACM analysis on January 29, 2015. No new or strengthened measures were necessary to demonstrate attainment or meet reasonable further progress requirements.

While all of the existing ozone control measures in the nonattainment area assist in the improvement of air quality, only a subset of measures have emissions reductions benefits that can be quantified. These measures have quantifiable benefits that are used to both demonstrate attainment and meet contingency measure requirements.

The key existing federal, state and local ozone control measures used for numeric credit are listed below:

1. Summer Fuel Reformulation: California Phase 2 and Federal Phase II Reformulated Gasoline with 7 psi from May 1 through September 30
2. Phased-In Emission Test Cutpoints
3. One-Time Waiver from Vehicle Emissions Test
4. Tougher Enforcement of Vehicle Registration and Emissions Test Compliance
5. Expansion of Area A Boundaries
6. Gross Polluter Option for I/M Program Waivers
7. Coordinated Traffic Signal Systems
8. Develop Intelligent Transportation Systems
9. Federal Tier 2 and Tier 3 Motor Vehicle Emissions and Fuel Standards
10. Federal Phase 1 and 2 Light-Duty Vehicle and Phase 1 Medium and Heavy-Duty Vehicle Greenhouse Gas Rules
11. Federal Nonroad Equipment Standards
12. Federal Heavy Duty Diesel Vehicle Emissions Standards
13. Federal Portable Fuel Container Rules

The emissions reduction benefits of ozone control measures 1 through 12 are included in the onroad and nonroad emissions inventories that were developed using the EPA MOVES2014a model. The emissions reduction credit of these measures are aggregated by onroad and nonroad mobile source categories. Measures 1 through 12 provide onroad mobile source emission reductions, on an average ozone season day in 2017, of 25.3 metric tons per day of volatile organic compounds (VOC) and 54.5 metric tons per day of nitrogen oxides (NOx). Nonroad mobile source emission reductions in 2017 for these measures are 7.6 metric tons per day of VOC and 17.3 metric tons per day of NOx.

The emission reduction credit for measure 13, on an average ozone season day in 2017, is 6.2 metric tons per day of VOC, as calculated with emissions data provided by EPA. The methodologies used to quantify the emission reduction credit for the measures are further described in Section V of the Technical Support Document.

The attainment demonstration for the MAG 2017 Eight-Hour Ozone Moderate Area Plan was conducted using photochemical grid modeling for the 4 kilometer MAG modeling domain for the Maricopa nonattainment area. The Comprehensive Air Quality Model with Extensions (CAMx) was used to simulate ozone concentrations during the ozone season months of May 1 through September 30 for the 2011 base year and the 2017 attainment year. Modeling the entire months of May through September (153 days) ensures that the model not only demonstrates attainment on the ten highest modeled ozone concentration days, but also under a variety of meteorological conditions, during periods of low and high ozone production. The emissions inventories used in the modeling attainment demonstration are described in Chapter Six and depicted in Figures 6-1 through 6-6.

To demonstrate attainment of the 2008 ozone standard, the modeled eight-hour ozone concentrations in 2017 should be less than 0.0759 parts per million for all modeled episode days. The attainment demonstration followed the modeling procedures recommended in

the EPA guidance (EPA, 2014a). The modeling attainment demonstration indicated that the peak design value for 2017 at the North Phoenix monitor would be 0.0756 parts per million. Following truncation to three digits, the modeling demonstrates attainment at 0.075 parts per million or less for all of the monitors.

The Environmental Protection Agency requires a supplemental analysis or Weight-of-the-Evidence analysis to show that attainment can be reached in the future with some margin of safety, especially when projected future design values are close to the 2008 ozone standard. A Weight-of-the-Evidence analysis was also conducted for the MAG 2017 Eight-Hour Ozone Moderate Area Plan. The results support the attainment demonstration.

In accordance with Clean Air Act Section 182(b)(1), Moderate Area plans are required to provide a Rate of Progress (ROP) plan that demonstrates a 15 percent reduction in VOC emissions across the nonattainment area over a six-year period from the base year anthropogenic emissions, in this case, the years 2012 through 2017. The 2017 average daily anthropogenic VOC emissions of 165.28 metric tons per day is less than the 2017 ROP 15 percent reduction target of 166.41 metric tons per day, and is equivalent to a 15.6 percent reduction in 2011 base year anthropogenic VOC emissions. Therefore, the 2017 average daily anthropogenic VOC emissions in the Maricopa eight-hour ozone nonattainment area satisfy the Clean Air Act Section 182(b)(1) reasonable further progress and 15 percent ROP plan requirements.

In accordance with the Clean Air Act Section 172(c)(9), the MAG 2017 Eight-Hour Ozone Moderate Area Plan also contains contingency measures. The contingency measures are committed measures in the adopted plan which achieve emissions reductions beyond those measures relied upon to model attainment of the standard and demonstrate progress toward attainment. Since EPA allows early implementation of contingency measures, existing measures that have already been implemented may be contingency measures if they are not needed to show attainment and do not hasten attainment. EPA also allows federal measures to be contingency measures if they are not needed for attainment.

For the MAG 2017 Eight-Hour Ozone Moderate Area Plan, the existing control measures provide enough continuing emission reduction benefits in 2018 to meet the contingency measure requirements. EPA requires that contingency measures represent one-year's worth of reasonable further progress, amounting to reductions of 3 percent of the 2011 base year VOC and/or NOx emissions for the Maricopa eight-hour ozone nonattainment area. The combined VOC and NOx emissions reductions of 3.86 percent in the Maricopa nonattainment area meets the 3 percent emission reduction requirement for contingency measures.

The MAG 2017 Eight-Hour Ozone Moderate Area Plan also establishes motor vehicle emissions budgets for transportation conformity analyses in accordance with Clean Air Act Section 176. The motor vehicle emissions budget is 45.7 metric tons per day for volatile organic compounds and 62.7 metric tons per day for nitrogen oxides.

CHAPTER ONE

INTRODUCTION

Within the Maricopa nonattainment area, the National Ambient Air Quality Standard has not yet been attained for the 2008 eight-hour ozone standard of 0.075 parts per million (ppm). The area is classified as a Moderate Area under the Clean Air Act. The Maricopa Association of Governments (MAG) was designated by the Governor of Arizona in 1978 and recertified by the Arizona Legislature in 1992 to serve as the Regional Air Quality Planning Agency to develop plans to address air pollution problems (A.R.S. Section 49-406 A.). On June 22, 2016, the Governor of Arizona transmitted a letter to the Environmental Protection Agency (EPA) to update the planning certifications. This plan was prepared through a coordinated effort with the Arizona Department of Environmental Quality, Arizona Department of Transportation, Maricopa County Air Quality Department and Maricopa Association of Governments.

The MAG 2017 Eight-Hour Ozone Moderate Area Plan has been prepared to meet the requirements in Section 182(b) of the Clean Air Act and improve air quality in the Maricopa eight-hour ozone nonattainment area. The attainment date for Moderate Areas is July 20, 2018. A Moderate Area Plan is due by January 1, 2017. The Moderate Area Plan is required to include reasonable further progress; reasonably available control technology; reasonably available control measures; new source review; emissions inventories; modeling attainment demonstration for 2017 (ozone season prior to the attainment date); contingency measures; and motor vehicle emissions budgets for transportation conformity. Moderate Areas are also required to make the submissions for Marginal Areas. On October 16, 2015, EPA published a final notice to take direct final action to approve the MAG 2014 Eight-Hour Ozone Plan-Submittal of Marginal Area Requirements for the Maricopa Nonattainment Area.

HISTORICAL BACKGROUND

Over time, the region has made significant progress in reducing ozone pollution. There have been no violations of the 1978 one-hour ozone standard of 0.12 parts per million since 1996. On June 14, 2005, EPA redesignated the Maricopa nonattainment area to attainment status. The Environmental Protection Agency also approved the MAG One-Hour Ozone Redesignation Request and Maintenance Plan, dated March 2004, which demonstrated that the standard would be maintained through 2015. The nonattainment area then became a maintenance area. On June 15, 2005, EPA revoked the one-hour ozone standard.

On June 15, 2004, the Environmental Protection Agency designated a 4,880 square mile area located mainly in Maricopa County and Apache Junction in Pinal County as the nonattainment area for the eight-hour ozone standard (0.08 ppm) established by EPA in 1997. The area had a June 2009 attainment date. The MAG 2007 Eight-Hour Ozone Plan

demonstrated attainment of the standard by June 2008. In February 2009, the MAG 2009 Eight-Hour Ozone Redesignation Request and Maintenance Plan was submitted to EPA, which demonstrated that the standard would be maintained through 2025. There have been no violations of the 0.08 ppm standard since 2004. On June 13, 2012, EPA published a final notice to approve the MAG 2007 Eight-Hour Ozone Plan. On September 17, 2014, EPA published a final notice to approve the MAG 2009 Eight-Hour Ozone Redesignation Request and Maintenance Plan.

In 2008, EPA revised the eight-hour ozone standard to 0.075 parts per million (from 0.08 ppm). On May 21, 2012, EPA published a final rule to designate the Maricopa nonattainment area as a Marginal Area with a December 31, 2015 attainment date. The boundaries of the ozone nonattainment area were also expanded slightly to the west and south to include new power plants. The eight-hour ozone nonattainment area boundary encompasses 5,017 square miles.

On June 27, 2014, the MAG 2014 Eight-Hour Ozone Plan-Submittal of Marginal Area Requirements for the Maricopa Nonattainment Area was transmitted to EPA. For Marginal Areas, EPA assumed that the areas would be in attainment within three years of designation without any additional control measures. Marginal Areas were not required to submit an attainment demonstration; reasonably available control technologies and measures; reasonable further progress demonstration; and contingency measures. On October 16, 2015, EPA published a final notice to take direct final action to approve the MAG 2014 Eight-Hour Ozone Plan-Submittal of Marginal Area Requirements for the Maricopa Nonattainment Area.

On December 23, 2014, the U.S. Court of Appeals for the District of Columbia had issued a ruling that vacated the Environmental Protection Agency's extension of the attainment dates for the 2008 ozone standard to the end of the calendar year. On March 6, 2015, EPA published a final rule revising the attainment date for Marginal Areas from December 31, 2015 to July 20, 2015. Since the attainment date was now in the middle of the ozone season, the region would have to be in attainment in the prior 2014 ozone season.

On October 26, 2015, the Environmental Protection Agency published a final rule to strengthen the federal eight-hour ozone standard from 0.075 to 0.07 parts per million. The rule became effective on December 28, 2015. By October 1, 2016, states are required to submit designation recommendations for attainment/nonattainment to EPA. By October 1, 2017, EPA anticipates finalizing the designations, classifications, and attainment dates based upon the ozone levels in the area (Marginal-Extreme).

On May 4, 2016, EPA published a final notice to determine that the Maricopa Eight-Hour Ozone Nonattainment Area did not attain the 2008 standard and reclassified the area from Marginal to Moderate. The attainment date for Moderate Areas is July 20, 2018. A Moderate Area Plan is due by January 1, 2017.

OUTLINE OF THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN

The purpose of this document is to present the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. The plan includes a wide variety of existing control measures that continue to be implemented to reduce ozone pollution.

The MAG 2017 Eight-Hour Ozone Moderate Area Plan is composed of the following major sections:

1. Introduction (This Chapter) - Includes a general discussion of historical background and the outline of the MAG 2017 Eight-Hour Ozone Moderate Area Plan.

2. Description of the Nonattainment Area - Includes a description of the nonattainment area; geography and climatic conditions.

3. Assessment of Air Quality Conditions - Includes a discussion of ozone formation and health effects; sources of ozone precursor emissions; and air quality monitoring data and trend analysis.

4. Evaluation of Ozone Control Measure Requirements in the Clean Air Act - Includes a discussion of the reasonably available control measure analysis; reasonably available control technology analysis; and new source review.

5. The Adopted Plan - Includes a description of existing measures; measures used for numeric credit; contingency measures; assurances that the State has the authority to implement the measures in the plan; and tracking plan implementation.

6. Attainment Demonstration and Weight of the Evidence Analysis - Includes a discussion of the attainment date; emissions inventories; attainment measures; attainment demonstration; weight of the evidence analysis; onroad mobile emissions budgets for conformity; reasonable further progress-15 percent rate of progress demonstration; contingency measures; and conclusions.

7. Public Participation - Includes a discussion of the decision making structure; public participation in the preparation of the MAG 2017 Moderate Area Ozone Plan; public involvement process for transportation and air quality; and Title VI considerations.

CHAPTER TWO

DESCRIPTION OF THE NONATTAINMENT AREA

The Maricopa nonattainment area for the 0.075 parts per million (ppm) eight-hour ozone standard was formally designated on May 21, 2012. As defined in the 1977 Clean Air Act, the term nonattainment area refers to locations which exceed any national ambient air quality standard for any pollutant based upon the data collected through air quality monitoring. A general description of the eight-hour ozone nonattainment area, including a discussion of the boundaries of the area and the geography and climatic conditions is provided below.

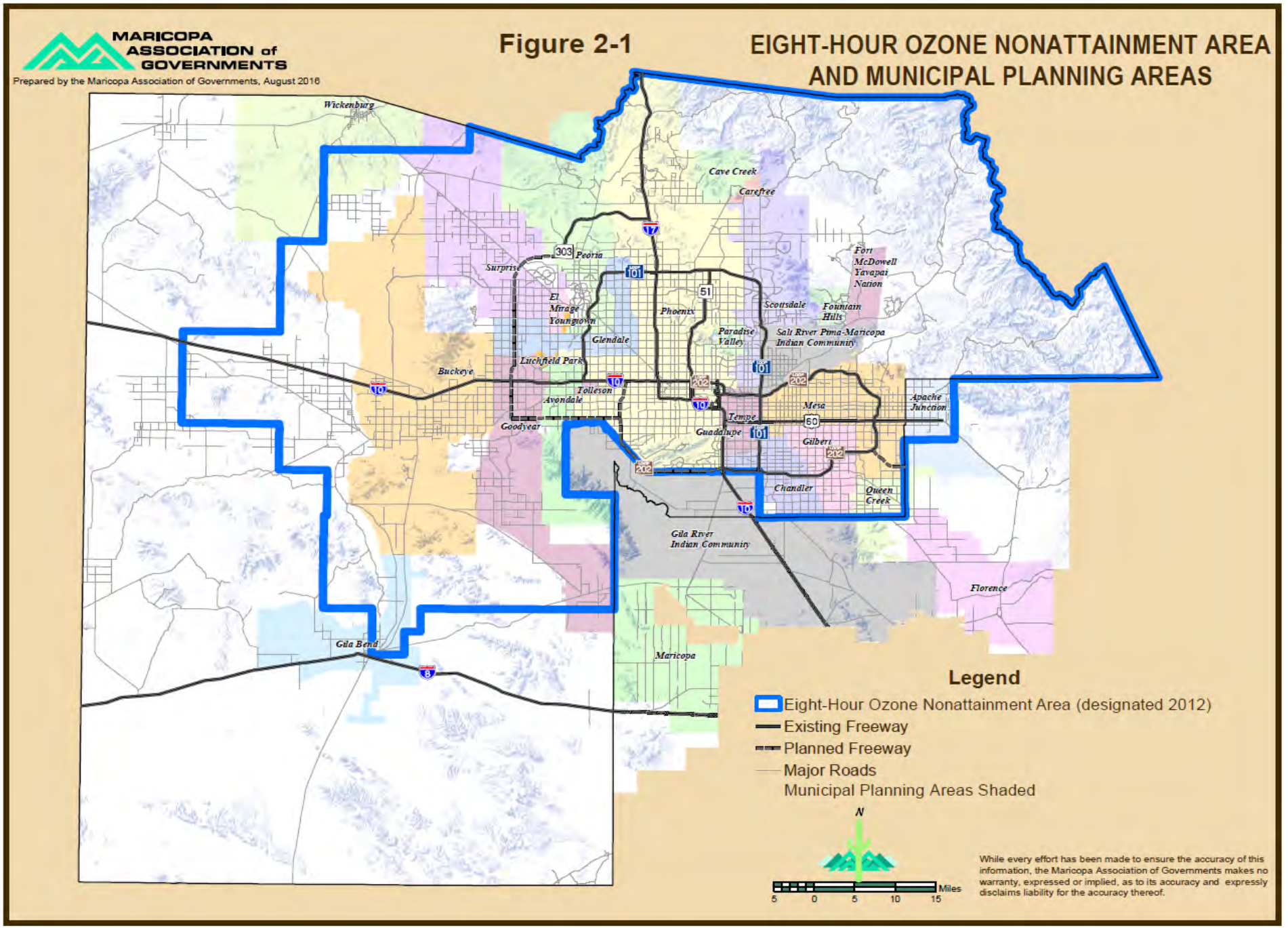
NONATTAINMENT AREA BOUNDARIES

On May 21, 2012, the Environmental Protection Agency (EPA) published a final rule to designate the Maricopa nonattainment area as a Marginal Area for the 0.075 ppm eight-hour ozone standard. In the final rule, EPA expanded the existing nonattainment area boundary slightly to the west and south to include new power plants. The eight-hour ozone nonattainment area is located in the Salt River Valley in the central portion of Arizona and encompasses 5,017 square miles. The northern boundary of the area is the Yavapai County line and the southern boundary is located generally along Hunt Highway, excluding the Gila River Indian Community, and approximately six miles north of Interstate 8, except for a portion that extends to Interstate 8 at the Town of Gila Bend. On the east, the area is bound by Gila County and Pinal County lines, except to include the City of Apache Junction; and on the west by approximately 355th, 403rd, and 499th Avenues. The area contains portions of the municipal planning areas for twenty-five cities and towns, and the Fort McDowell and Salt River Pima-Maricopa Indian Communities, as well as unincorporated areas under the jurisdiction of Maricopa County (see Figure 2-1).

GEOGRAPHY AND CLIMATIC CONDITIONS

The elevation of the Phoenix metropolitan area is approximately 1,105 feet above mean sea level (MSL); however, the elevation in the nonattainment area ranges from approximately 600 feet above MSL near Gila Bend to 7,638 feet above MSL at Four Peaks in the Mazatzal Mountains in eastern Maricopa County. In addition to the Mazatzal Mountains, there are several mountain ranges throughout the nonattainment area. The Salt River Mountains are located on the southern border near the Gila River Indian Community and rise to an elevation of 2,507 feet above MSL. The Sierra Estrella Mountains located in the southwestern portion of the nonattainment area have an elevation of 3,320 feet above MSL. To the west, the White Tank Mountains rise to an elevation of 4,026 feet above MSL and the Phoenix Mountains have an elevation of 2,310 feet above MSL. Additional mountain ranges in the nonattainment area include the Hieroglyphic, McDowell, Maricopa, and Gila Bend Mountains.

There are six main rivers that run through the nonattainment area. These rivers are: the Salt River, Agua Fria River, Gila River, New River, Verde River, and Hassayampa River.


MARICOPA ASSOCIATION of GOVERNMENTS
Prepared by the Maricopa Association of Governments, August 2016
Figure 2-1
EIGHT-HOUR OZONE NONATTAINMENT AREA AND MUNICIPAL PLANNING AREAS
Wickenburg
Cave Creek
Carefree
Fort McDowell Yavapai Nation
Peoria
Surprise
El Mirage
Youngtown
Phoenix
Scottsdale
Fountain Hills
Glendale
Paradise Valley
Salt River Pima-Maricopa Indian Community
Litchfield Park
Buckeye
Tolleson
Avondale
Goodyear
Mesa
Apache Junction
Tempe
Guadalupe
Gilbert
Chandler
Queen Creek
Gila River Indian Community
Florence
Gila Bend
Maricopa
Legend
Eight-Hour Ozone Nonattainment Area (designated 2012)
Existing Freeway
Planned Freeway
Major Roads
Municipal Planning Areas Shaded
N
5 0 5 10 15 Miles
While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.

The climate in the nonattainment area is arid continental, experiencing extreme ranges in daily temperatures. Temperatures range from a mean of 55.4 degrees Fahrenheit in December to a mean of 94.8 degrees Fahrenheit in July; the annual mean temperature is 75.0 degrees Fahrenheit. The sun shines approximately 85 percent of the time and the annual average rainfall is 8.03 inches. Most of the rainfall occurs from December through March and during the months of July and August (NOAA, 2016).

In the Maricopa nonattainment area, there are several meteorological factors that influence elevated ozone concentrations throughout the summer ozone season. These factors include: early summer westerly transport of upwind air pollutants; a synoptic weather pattern featuring a high pressure over the northeastern portion of Arizona; a low pressure centered in the southwestern portion of Arizona; daytime local temperatures above 100 degrees Fahrenheit; and local emissions coinciding with valley-wide stagnant winds. The spatial distribution of elevated ozone concentrations in the region depends on surface winds that exhibit diurnal valley breezes and directional changes due to surrounding topography. The average annual wind speed is 6.1 miles per hour.

CHAPTER THREE

ASSESSMENT OF AIR QUALITY CONDITIONS

Within the Maricopa nonattainment area, ozone is an air pollution problem during the warmest months. Ozone is not directly emitted from a source, but is produced by the mixing of volatile organic compounds (VOCs) and nitrogen oxides (NOx) in the presence of sunlight. Precursors to ozone, volatile organic compounds, and nitrogen oxides are emitted from onroad and nonroad engines; industrial, manufacturing and electrical power generation facilities; architectural coatings and consumer and commercial solvent use; and natural vegetation (biogenics). Peak ozone concentrations typically occur from May through September and are influenced by several factors, including: westerly transport of upwind pollutants; a favorable synoptic weather pattern featuring high pressure over the northeastern portion of the state; a low pressure center in the southwest portion; daytime local temperatures above 100 degrees Fahrenheit; and local emissions that are coincident with valley-wide stagnant and weak winds.

In order to effectively reduce ozone, it is important to assess air quality conditions in the Maricopa nonattainment area. This chapter presents a discussion of ozone formation and health effects, sources of ozone precursor emissions, and air quality monitoring data.

OZONE FORMATION AND HEALTH EFFECTS

Unlike other air pollutants, ozone is not directly emitted into the atmosphere. Ozone is formed through a chemical reaction between NOx and VOCs in the presence of sunlight. As a result, meteorological variability has a strong influence on ozone formation in the nonattainment area.

Ozone concentrations in the nonattainment area are elevated during the summer due to intense photochemical reactions associated with increased solar radiation, local stagnation or long range transport of natural and anthropogenic ozone precursor emissions, and synoptic and mesoscale atmospheric dynamics. Anthropogenic emissions are generally repetitive throughout the summer, however, biogenic emissions substantially fluctuate depending on the weather conditions. Elevated ozone is created by combinations of these meteorological conditions and ozone precursor emissions generated from anthropogenic and biogenic sources. Also, the interaction of upwind transported and local emissions under various weather conditions characterizes elevated ozone concentrations in the region.

Ozone irritates the lungs and repeated exposure may cause permanent lung damage. Symptoms of ozone exposure may include wheezing, coughing, and pain when taking a deep breath. Children, older adults, persons with pre-existing respiratory conditions such as asthma, and others who are active outdoors when ozone levels are high are most affected by the adverse health effects of ozone. Even low levels of ozone may cause a number of respiratory health effects.

SOURCES OF OZONE PRECURSOR EMISSIONS

The Clean Air Act requires a comprehensive, accurate, and current inventory of actual emissions from all sources. For the Moderate Area Plan, the Environmental Protection Agency (EPA) recommended that a revised 2011 season-day emissions inventory based on June through August data be included (80 FR 62457). In August 2015, the Maricopa County Air Quality Department completed an addendum to the 2011 periodic emissions inventory that used June through August ozone season-day emissions. The 2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area, February 2014, and Addendum, August 2015, are contained in Appendix A, Exhibit 1. The Maricopa County Air Quality Department has also complied a 2014 periodic emissions inventory for ozone precursors in the nonattainment area, which is included in Appendix A, Exhibit 2, to meet the periodic inventory requirements of Clean Air Act Section 182(a)(3)(A).

The 2011 periodic emissions inventory for ozone precursors determines the sources of VOCs, NOx, and carbon monoxide (CO) for the Maricopa eight-hour ozone nonattainment area. The August 2015 addendum provides the average daily emissions, which are calculated for a typical day during the three month period from June through August 2011. The inventory also provides annual emissions for the twelve-month period beginning January 1 and ending December 31, 2011 for the categories listed in the inventory.

The sources of ozone precursor emissions are grouped into five major categories: onroad mobile sources, area sources, nonroad mobile sources, point sources, and biogenic sources. Collectively, all five categories are estimated to contribute 599.87 (English) tons of VOCs, 253.86 tons of NOx, and 1,375.98 tons of CO per day in the 2011 ozone season for the Maricopa nonattainment area; Figures 3-1 and 3-2 show the relative contribution of each category for VOCs and NOx, respectively. A complete description of these sources and the corresponding methodology used to calculate the emissions for 2011 are included in the 2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Nonattainment Area, February 2014, and Addendum, August 2015, contained in Appendix A, Exhibit 1.

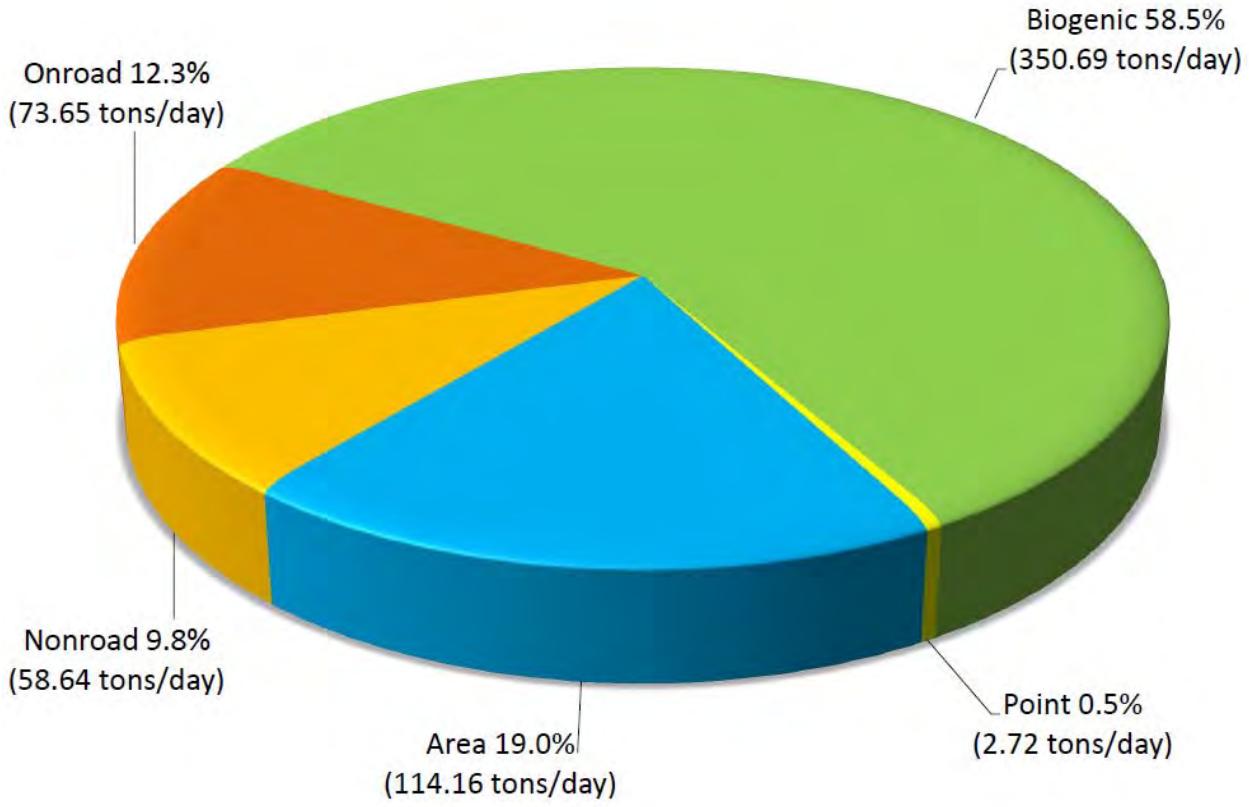
The onroad mobile source category consists of 12 onroad vehicle classes. The estimated 2011 ozone season onroad mobile source emissions in the Maricopa nonattainment area include 73.65 tons of VOCs per day, 154.53 tons of NOx per day, and 655.49 tons of CO per day. Onroad mobile sources account for 12.3 percent of the average season-day VOC emissions, 60.9 percent of the average season-day NOx emissions, and 47.6 percent of the average season-day CO emissions. Table 3-1 includes a breakdown of emissions from all sources in the 2011 periodic emissions inventory.

Area sources consist of numerous small stationary sources which, when added together, emit significant amounts of ozone precursors. Examples of area sources include solvents and coatings use, fuel storage and transport, waste treatment and disposal, industrial/chemical processes, residential/industrial fuel combustion, and open burning and wildfires. The estimated 2011 ozone season area source emissions for the Maricopa nonattainment area include 114.16 tons of VOCs per day, 16.02 tons of NOx per day, and

Figure 3-1

Sources of Volatile Organic Compound Emissions
2011 Periodic Emissions Inventory (Ozone Season Day Emissions)

2011 Ozone Season-Day VOC Emissions = 599.87 tons/day



Sources

Point: Industrial, manufacturing and electrical power generating facilities

Area: Solvents and coatings use, fuel storage and transport, waste treatment and disposal, industrial/chemical processes, residential/industrial fuel combustion, open burning and wildfires

Onroad: Cars and trucks

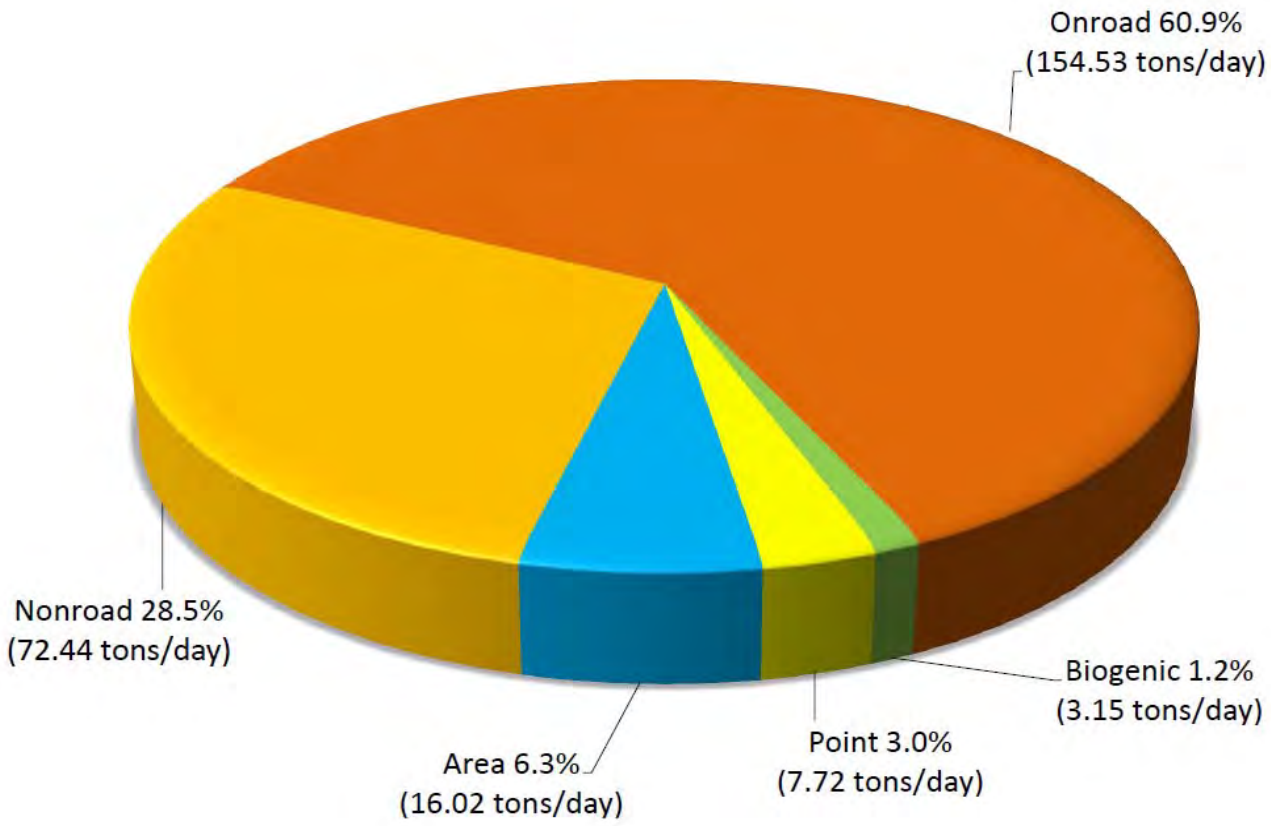
Nonroad: Commercial, industrial, construction, mining, lawn and garden, farm and recreational equipment, aircraft and locomotives

Biogenic: Natural vegetation

Figure 3-2

Sources of Nitrogen Oxide Emissions
2011 Periodic Emissions Inventory (Ozone Season Day Emissions)

2011 Ozone Season-Day NOx Emissions = 253.86 tons/day



Sources

Point:	Industrial, manufacturing and electrical power generating facilities
Area:	Waste treatment and disposal, industrial/chemical processes, residential/industrial fuel combustion, open burning and wildfires
Onroad:	Cars and trucks
Nonroad:	Commercial, industrial, construction, mining, lawn and garden, farm and recreational equipment, aircraft and locomotives
Biogenic:	Natural vegetation

Table 3-1

Emissions From all Source Categories Included in the 2011 Periodic Emissions Inventory for Ozone Precursors Addendum, August 2015

TPY = English Tons/Year TPD = English Tons/Day	VOC		NOx		CO	
	(TPY)	(TPD)	(TPY)	(TPD)	(TPY)	(TPD)
TOTAL POINT SOURCES	**866.87**	**2.72**	**1,758.46**	**7.72**	**1,078.48**	**4.86**
AREA						
Fuel Combustion	659.63	0.30	4,670.68	11.74	4,898.99	4.62
Industrial Processes	2,276.48	8.73	263.41	0.74	590.27	1.71
Solvent Use	28,139.77	83.28	---	---	---	---
Storage/Transport	5,211.35	14.37	---	---	---	---
Waste Treatment/Disposal	116.10	0.42	56.04	0.16	190.06	0.56
Miscellaneous Area Sources	261.09	7.07	161.70	3.38	4,664.71	144.47
TOTAL AREA SOURCES	**36,664.42**	**114.16**	**5,151.83**	**16.02**	**10,344.03**	**151.36**
NONROAD MOBILE						
Agricultural	22.52	0.10	193.22	0.84	177.56	0.79
Airport GSE (+APU)	111.43	0.30	404.49	1.08	3,259.08	8.62
Commercial	1,916.15	7.41	1,355.57	4.14	30,094.46	101.76
Construction & Mining	1,941.80	6.96	13,349.23	46.58	14,855.32	53.05
Industrial	339.78	1.10	1,831.45	5.86	7,110.33	23.02
Lawn & Garden	4,970.15	27.41	876.55	3.66	55,425.05	276.35
Pleasure Craft	530.39	6.60	96.56	1.21	1,249.66	16.31
Railway Maintenance	1.96	0.01	8.64	0.03	16.67	0.06
Recreational	684.30	4.43	29.78	0.17	2,871.27	18.76
Aircraft	1,705.43	4.18	2,585.98	6.39	11,719.36	31.87
Locomotives	50.15	0.14	901.12	2.47	153.29	0.42
TOTAL NONROAD MOBILE SOURCES	**12,274.06**	**58.64**	**21,632.59**	**72.44**	**126,932.05**	**531.01**

Table 3-1 (Continued)

Emissions From all Source Categories Included in the 2011 Periodic Emissions Inventory for Ozone Precursors Addendum, August 2015

TPY = English Tons/Year TPD = English Tons/Day	VOC		NOx		CO	
	(TPY)	(TPD)	(TPY)	(TPD)	(TPY)	(TPD)
TOTAL ONROAD MOBILE SOURCES	**24,110.04**	**73.65**	**56,861.82**	**154.53**	**226,581.20**	**655.49**
TOTAL BIOGENIC SOURCES	**55,311.84**	**350.69**	**527.18**	**3.15**	**5,934.55**	**33.27**
TOTAL ALL SOURCES	**129,277.24**	**599.87**	**85,931.88**	**253.86**	**370,870.31**	**1,375.98**

Notes: Totals shown may not equal the sum of individual values due to independent rounding.
1.00 ton = 0.91 metric tons

Source: 2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area Addendum. Maricopa County Air Quality Department, August 2015.

151.36 tons of CO per day. Area sources account for 19.0 percent of the average season-day VOC emissions, 6.3 percent of the average season-day NOx emissions, and 11.0 percent of the average season-day CO emissions.

Nonroad mobile sources include commercial, industrial, construction, mining, lawn and garden, farm and recreational equipment, aircraft, and locomotives. The estimated 2011 ozone season nonroad mobile source emissions for the Maricopa nonattainment area include 58.64 tons of VOCs per day, 72.44 tons of NOx per day, and 531.01 tons of CO per day. Nonroad mobile sources account for 9.8 percent of the average season-day VOC emissions, 28.5 percent of the average season-day NOx emissions, and 38.6 percent of the average season-day CO emissions.

The point source category includes stationary sources that emit a significant amount of pollution into the air. Examples of point sources include industrial, manufacturing, and electrical power generating facilities. A total of 18 point sources are identified in the inventory, and all are located within the eight-hour ozone nonattainment area. The estimated 2011 ozone season point source emissions for the Maricopa nonattainment area include 2.72 tons of VOCs per day, 7.72 tons of NOx per day, and 4.86 tons of CO per day. Point sources account for 0.5 percent of the average season-day VOC emissions, 3.0 percent of the average season-day NOx emissions, and 0.4 percent of the average season-day CO emissions.

Biogenic sources consist of emissions from all vegetation. These sources include indigenous vegetation, crops, and landscaping. The estimated 2011 ozone season biogenic source emissions for the Maricopa nonattainment area include 350.69 tons of VOCs per day, 3.15 tons of NOx per day, and 33.27 tons of CO per day. Biogenic sources account for 58.5 percent of the average season-day VOC emissions, 1.2 percent of the average season-day NOx emissions, and 2.4 percent of the average season-day CO emissions.

AIR QUALITY MONITORING DATA AND TREND ANALYSIS

In addition to identifying sources of ozone emissions, it is important to examine the impact of these emissions on the ambient concentrations. This section includes discussions of the National Ambient Air Quality Standards (NAAQS) and the air quality data recorded by the areawide monitoring network.

In 2008, EPA revised the eight-hour ozone standard from 0.08 parts per million (ppm) to 0.075 ppm. The standard is met when the three-year average of the annual fourth-highest daily maximum eight-hour average ozone concentrations measured at each monitor over each year is less than or equal to 0.075 ppm.

In order to determine the extent of the regional ozone pollution problem, it is necessary to examine the air quality data collected by the areawide network. A total of 28 criteria pollutant monitoring stations are operated by the Maricopa County Air Quality Department (MCAQD), Pinal County Air Quality Control District (PCAQCD), and Arizona Department

of Environmental Quality (ADEQ) in the Maricopa eight-hour ozone nonattainment area. Twenty of these sites monitor ozone. The Tonto National Monument monitoring site is located just outside the nonattainment area in Gila County and also monitors ozone. The network is dispersed geographically so as to monitor air quality in the many diverse physical environments in the region. Land use patterns near the monitoring sites vary from heavily populated urban areas to sparsely populated rural areas. Site-specific information regarding the ozone monitoring stations is provided in Table 3-2, and the geographic location of each site is indicated in Figure 3-3.

Fifteen of the ozone monitoring stations in the Maricopa nonattainment area are neighborhood scale sites. These stations record the ambient ozone level present in the neighborhood scale air mass surrounding the monitor. The dimensions for neighborhood scale is 0.5 to 4 kilometers. Four of the ozone monitoring stations are urban scale sites and the remaining one is regional scale. The dimensions for urban scale and regional scale are 4 to 50 kilometers and 10 to 100s of kilometers, respectively. The spatial scale for each ozone monitor station is provided in Table 3-2.

All of the ozone monitors within the network operate continuously (24 hours per day) and throughout the year, with periodic short-duration shutdowns for maintenance and calibration. Each monitoring station is linked electronically to computers at the agencies operating the monitors. This allows assessments of overall regional air quality to be readily performed by acquiring near real-time pollutant concentration data from the monitoring sites.

One method of assessing the overall air quality of a region is to examine the concentrations measured at the monitoring stations. An exceedance of the standard occurs when a monitoring station records a daily maximum eight-hour average value greater than 0.075 ppm. A violation occurs when the three-year average of the annual fourth-highest daily maximum eight-hour average concentration measured at each site is greater than 0.075 ppm. Figures 3-4 and 3-5 summarize the trend for monitors in the nonattainment area with the highest three-year average of the fourth-highest eight-hour ozone concentration and the number of eight-hour ozone violations recorded since 2008, respectively. In addition, Table 3-3 provides monitoring data for the most recent three year period (2014-2016). Table 3-4 contains an eight-hour ozone monitoring data summary for the three-year average of the annual fourth-high from 2012-2016. It is important to note that the 2016 values are based on preliminary data through August 31, 2016.

While the 2016 data are still preliminary, and the ozone season is not yet complete, the concentrations for the 2016 ozone season alone indicate that all monitors in the nonattainment area had a fourth-high ozone concentration at or below 0.075 ppm. In 2015, there were also no monitors that experienced a fourth-high above 0.075 ppm, after excluding a wildfire exceptional event that occurred on June 20, 2015. Based on the preliminary data through August 31, 2016, there is only one monitor (Pinnacle Peak) violating the standard for 2014-2016. The preliminary 2016 design value at Pinnacle Peak is 0.076 ppm, just slightly over the 0.075 ppm standard. All other ozone monitors in the nonattainment area are meeting the standard.

Table 3-2

Ozone Monitoring Stations

FIGURE 3-3 MAP INDEX	SITE	ADDRESS	OPERATING AGENCY	SCALE
AJ	Apache Junction Maintenance Yard	305 E. Superstition Blvd.	PCAQCD	Neighborhood
BE	Buckeye	26453 W. MC 85	MCAQD	Neighborhood
BP	Blue Point	Usery Pass and Bush Highway	MCAQD	Urban
CC	Cave Creek	37019 N. Lava Lane	MCAQD	Urban
CP	Central Phoenix	1645 E. Roosevelt	MCAQD	Neighborhood
DY	Dysart	16825 N. Dysart Rd.	MCAQD	Neighborhood
FF	Falcon Field	4530 E. McKellips Rd.	MCAQD	Neighborhood
FH	Fountain Hills	16426 E. Palisades Blvd.	MCAQD	Neighborhood
GL	Glendale	6001 W. Olive	MCAQD	Neighborhood
HM	Humboldt Mountain	Seven Springs Rd. - FAA Radar Station	MCAQD	Regional
ME	Mesa	310 S. Brooks	MCAQD	Neighborhood
NP	North Phoenix	601 E. Butler Dr.	MCAQD	Neighborhood
PP	Pinnacle Peak	24295 N. Alma School Rd.	MCAQD	Urban
RV	Rio Verde	25608 N. Forest Rd.	MCAQD	Urban
SP	South Phoenix	33 W. Tamarisks	MCAQD	Neighborhood
SS	South Scottsdale	2857 N. Miller Rd.	MCAQD	Neighborhood
SU	JLG Supersite	4530 N. 17th Ave.	ADEQ	Neighborhood
TE	Tempe	1525 S. College	MCAQD	Neighborhood
TN*	Tonto National Monument	Tonto National Forest	ADEQ/United States Forest Service	Regional
WC	West Chandler	275 S. Ellis	MCAQD	Neighborhood
WP	West Phoenix	3847 W. Earll	MCAQD	Neighborhood

* The Tonto National Monument monitor is located outside the eastern boundary of the nonattainment area.

Sources: Pinal County Air Quality Website; Arizona Department of Environmental Quality State of Arizona Air Monitoring Network Plan for the Year 2015; Maricopa County Air Quality Department 2015 Air Monitoring Network Plan.

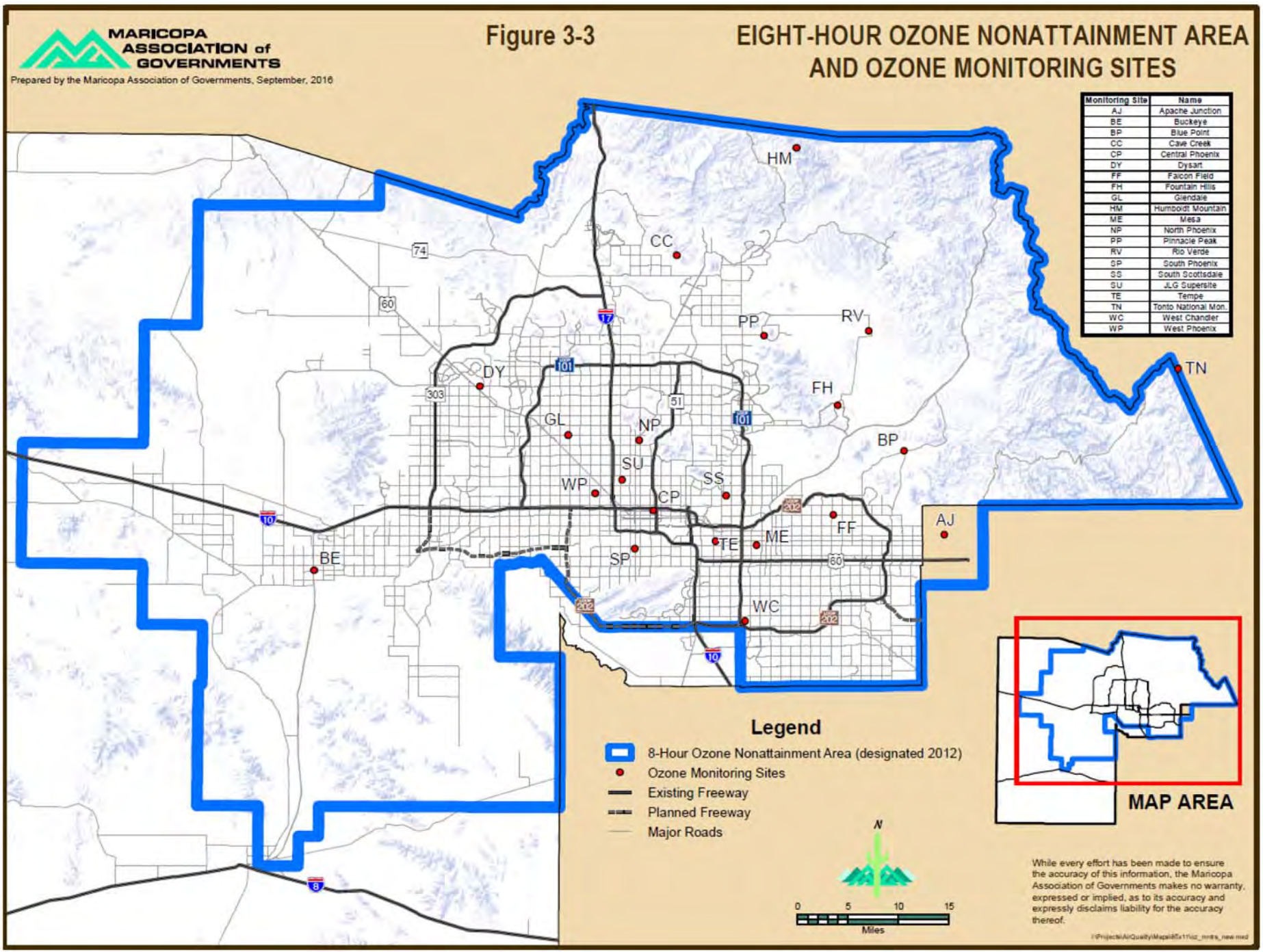
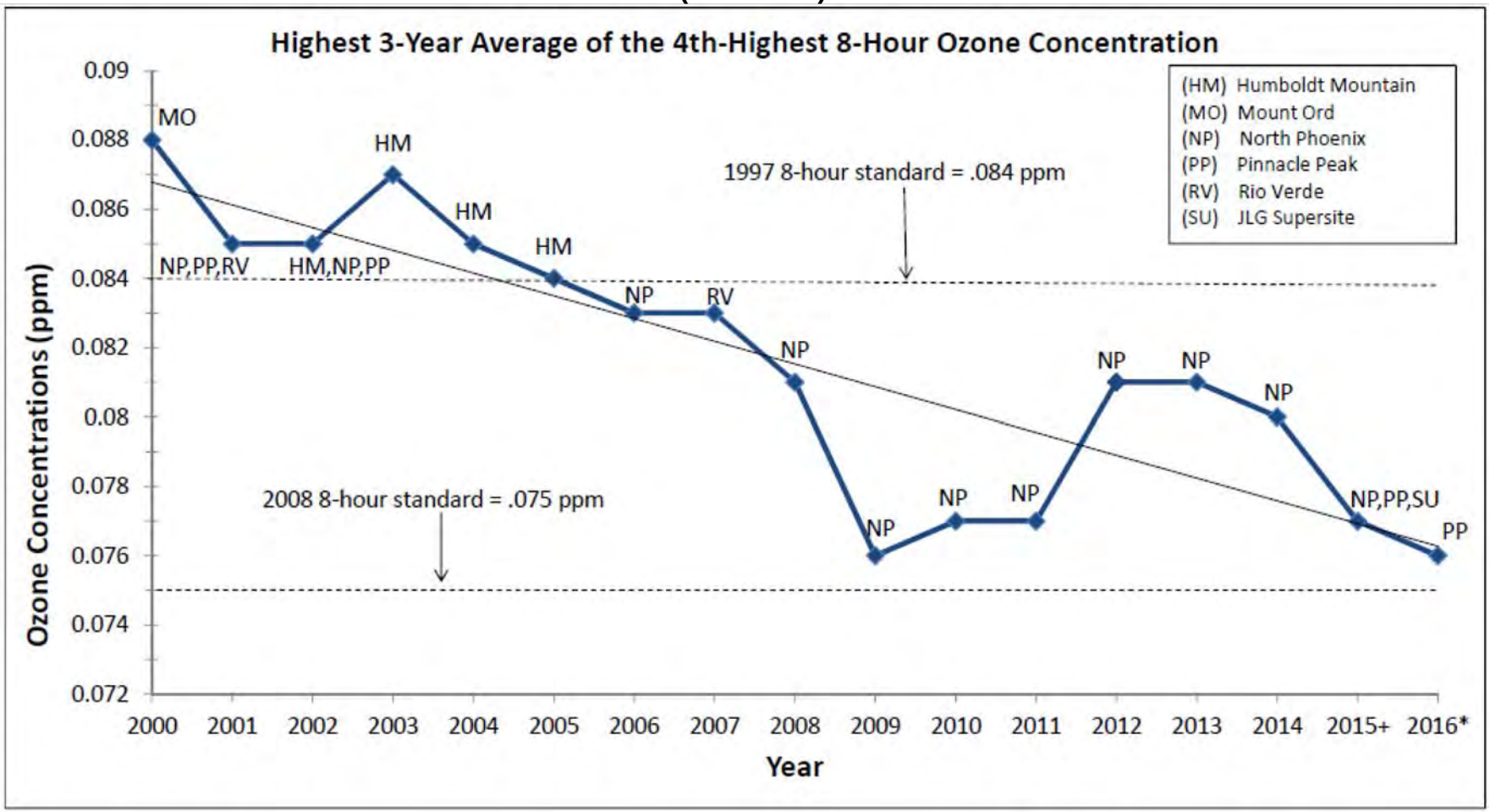

MARICOPA ASSOCIATION of GOVERNMENTS
Prepared by the Maricopa Association of Governments, September, 2016
Figure 3-3
EIGHT-HOUR OZONE NONATTAINMENT AREA AND OZONE MONITORING SITES
Monitoring Site | Name
AJ | Apache Junction
BE | Buckeye
BP | Blue Point
CC | Cave Creek
CP | Central Phoenix
DY | Dysart
FF | Falcon Field
FH | Fountain Hills
GL | Glendale
HM | Humboldt Mountain
ME | Mesa
NP | North Phoenix
PP | Pinnacle Peak
RV | Rio Verde
SP | South Phoenix
SS | South Scottsdale
SU | JLG Supersite
TE | Tempe
TN | Tonto National Mon.
WC | West Chandler
WP | West Phoenix
HM
CC
PP
RV
TN
DY
FH
GL
NP
BP
SU
WP
SS
CP
AJ
FF
ME
TE
SP
BE
WC
74
60
17
101
303
51
10
202
8
Legend
8-Hour Ozone Nonattainment Area (designated 2012)
Ozone Monitoring Sites
Existing Freeway
Planned Freeway
Major Roads
N
0 5 10 15
Miles
MAP AREA
While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.

Figure 3-4

Eight-Hour Ozone Trends
(2000-2016)



\+ Exceedances from the June 20, 2015 exceptional event have been removed. EPA concurrence of the exceptional event is pending.

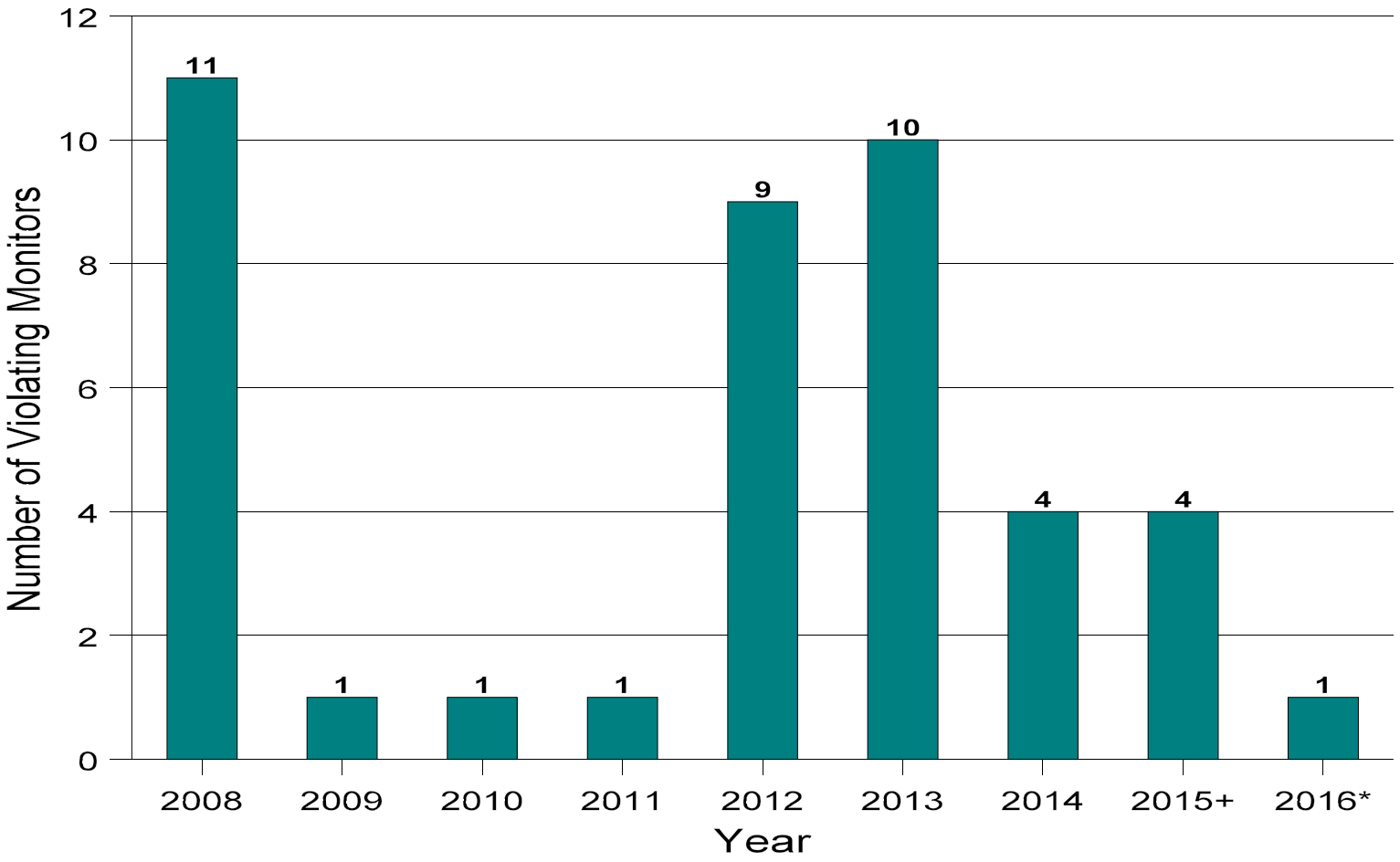
* The 2016 values are based on preliminary data through August 31, 2016.

Note: Due to mathematical rounding, values greater than or equal to 0.085 ppm are necessary to exceed the 0.080 ppm standard.

Sources: 2000-2008: MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa Nonattainment Area, February 2009; 2009-2015: Environmental Protection Agency Air Quality System; 2016: Arizona Department of Environmental Quality; Maricopa County; Pinal County.

Figure 3-5

Violations of the 0.075 ppm Eight-Hour Ozone Standard in the Maricopa Nonattainment Area



\+ Exceedances from the June 20, 2015 exceptional event have been removed. EPA concurrence of the exceptional event is pending.
* The 2016 values are based on preliminary data through August 31, 2016.

Sources: Environmental Protection Agency Air Quality System; Arizona Department of Environmental Quality; Maricopa County; Pinal County.

Table 3-3

Eight-Hour Ozone Monitoring Data Summary
Three-Year Average of the Fourth-High, 2016*
(Standard: 8-Hour: 0.075 ppm)

Site	2014 4th High (PPM)	2015 4th High (PPM)+	2016 4th High (PPM)*	3-Year Avg. 4th Highest (PPM)*
Apache Junction	.066	.073	.072	.070
Blue Point	.074	.071	.071	.072
Buckeye	.060	.060	.059	.059
Cave Creek	.074	.069	.071	.071
Central Phoenix	.071	.071	.070	.070
Dysart	.070	.067	.063	.066
Falcon Field	.076	.072	.073	.073
Fountain Hills	.068 #	.069	.068	N/A
Glendale	.071	.067	.066	.068
Humboldt Mountain	.074	.073	.072	.073
JLG Supersite	.077	.075	.075	.075
Mesa	.078	.072	.075	.075
North Phoenix	.078	.074	.075	.075
Pinnacle Peak	.080	.074	.074	.076
Rio Verde	.073	.068	.070	.070
South Phoenix	.073	.070	.067	.070
South Scottsdale	.072	.068	.070	.070
Tempe	.071	.051 #	.068	N/A
Tonto National Monument**	.072	.070	.070	.070
West Chandler	.070	.070	.069	.069
West Phoenix	.076	.074	.071	.073

+ Exceedances from the June 20, 2015 exceptional event have been removed. EPA concurrence of the exceptional event is pending.

* The 2016 values are based on preliminary data through August 31, 2016.

# Indicates < 75 percent data completeness.

** The Tonto National Monument monitor is located outside the eastern boundary of the nonattainment area.

Sources: Environmental Protection Agency Air Quality System; Arizona Department of Environmental Quality; Maricopa County; Pinal County.

Table 3-4

Eight-Hour Ozone Monitoring Data Summary
Three-Year Average of the Fourth-High, 2012-2016*
(Standard: 8-Hour: 0.075 ppm)

Site	2010-2012 Avg. 4th High (PPM)	2011-2013 Avg. 4th High (PPM)	2012-2014 Avg. 4th High (PPM)	2013-2015 Avg. 4th High (PPM)+	2014-2016 Avg. 4th High (PPM)*
Apache Junction	.074	.073	.070	.069	.070
Blue Point	.075	.077	.075	.073	.072
Buckeye	.066	.065	.062	.060	.059
Cave Creek	.077	.077	.074	.071	.071
Central Phoenix	.074	.075	.074	.072	.070
Dysart	.071	.072	.072	.070	.066
Falcon Field	.069	.072	.074	.075	.073
Fountain Hills	.076	N/A	N/A	N/A	N/A
Glendale	.076	.076	.074	.070	.068
Humboldt Mountain	.075	.076	.075	.073	.073
JLG Supersite	.076	.077	.077	.077	.075
Mesa	N/A	N/A	N/A	.076	.075
North Phoenix	.081	.081	.080	.077	.075
Pinnacle Peak	.077	.077	.078	.077	.076
Rio Verde	.074	.075	.072	.071	.070
South Phoenix	.076	.076	.075	.072	.070
South Scottsdale	.077	.076	.075	.071	.070
Tempe	.070	.071	.071	N/A	N/A
Tonto National Monument**	.074	.075	.074	.071	.070
West Chandler	.074	.072	.071	.070	.069
West Phoenix	.078	.079	.078	.075	.073

+ Exceedances from the June 20, 2015 exceptional event have been removed. EPA concurrence of the exceptional event is pending.

* The 2016 values are based on preliminary data through August 31, 2016.

** The Tonto National Monument monitor is located outside the eastern boundary of the nonattainment area.

N/A - Data not available. The 90 percent data completeness requirement was not met.

Sources: Environmental Protection Agency Air Quality System; Arizona Department of Environmental Quality; Maricopa County; Pinal County.

The region has been experiencing a downward trend in ozone concentrations. As shown in Figure 3-4, the highest-three year average of the fourth high has decreased from 0.081 ppm in 2013 to 0.076 ppm in 2016. Consequently, the number of monitors violating the eight-hour ozone standard have also decreased. Figures 3-5 illustrates that there were 10 monitors violating the 0.075 ppm ozone standard in 2013 and only four in 2014 and 2015. The preliminary data shows just the Pinnacle Peak monitor violating in 2016.

The Pinnacle Peak monitor is located in the northeast portion of the nonattainment area, downwind of the Phoenix metropolitan area. Population near the monitoring site is low-density. The higher ozone concentrations in the area are attributed to emissions from the urbanized area reacting photochemically in the presence of sunlight, and being transported by prevailing winds to this less populated area. In addition, biogenics may contribute to higher concentrations at the monitor. While the Pinnacle Peak site is currently violating the 0.075 ppm standard, there continues to be a downward trend in concentrations at the monitor similar to that being experienced throughout the nonattainment area.

In summary, the eight-hour ozone concentration data collected by the monitoring network provide an indication of the progress being made toward attainment by the MAG region. Preliminary 2016 data from the regional monitoring network indicates that the Maricopa nonattainment area is violating the National Ambient Air Quality Standard for eight-hour ozone at only one monitor. The design value at the site is just slightly over the standard at 0.076 ppm. The magnitude of observed eight-hour ozone concentrations have been declining and this trend is expected to continue due to the control measures already implemented within the nonattainment area.

CHAPTER FOUR

EVALUATION OF OZONE CONTROL MEASURE REQUIREMENTS IN THE CLEAN AIR ACT

This chapter addresses the Clean Air Act requirements for implementation of reasonably available control measures (RACM), reasonably available control technology (RACT) and New Source Review (NSR) in the Maricopa eight-hour ozone nonattainment area. RACM requirements are shown to be met through implementation of existing ozone control measures that have been approved by the U.S. Environmental Protection Agency (EPA) in prior regional air quality plans and separate EPA actions.

In regard to the RACT requirements, descriptions of the RACT State Implementation Plan (SIP) revisions independently prepared and submitted to EPA by the Maricopa County Air Quality Department and the Pinal County Air Quality Control District are included. Additionally, a discussion of New Source Review implementation and other associated Clean Air Act permitting requirements in the Maricopa nonattainment area is included at the end of the chapter.

REASONABLY AVAILABLE CONTROL MEASURES ANALYSIS

In accordance with Section 172(c)(1) of the Clean Air Act, the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area “shall provide for the implementation of all reasonably available control measures [RACM] as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through adoption, at a minimum, of reasonably available control technology [RACT]) and shall provide for attainment of the national primary ambient air quality standards”. Regulation finalized in the EPA rule on implementation of the 2008 ozone standards (80 FR 12282) at 40 CFR Section 51.1112(c) also requires the State to submit “with the attainment demonstration a SIP [State Implementation Plan] revision demonstrating that it has adopted all RACM necessary to demonstrate attainment as expeditiously as practicable and to meet RFP [reasonable further progress] requirements.”

The EPA final rule on implementation of the 2008 ozone standards (80 FR 12282) states that an area subject to the reasonably available control measures (RACM) requirements of Clean Air Act Section 172(c)(1) should provide “a demonstration that the state has adopted all reasonable measures (including RACT) to meet RFP [reasonable further progress] requirements and to demonstrate attainment as expeditiously as practicable and thus that no additional measures that are reasonably available will advance that attainment date or contribute to RFP for the area.” The EPA implementation rule further states that "EPA is finalizing the interpretation of the CAA requirements that states should consider all available measures, including those being implemented in other areas, and that a state must adopt measures for an area only if those measures are economically and technologically feasible and will advance the attainment date or are necessary for RFP."

To address these RACM requirements, Tables 4-1 through 4-3 have been developed to analyze the implementation of RACM in the Maricopa eight-hour ozone nonattainment area.

Table 4-1 identifies 93 existing and approved ozone control measures in the Maricopa nonattainment area from EPA-approved regional air quality plans and separate EPA actions. The source of the existing measures listed in Table 4-1 is most often the EPA approved plan or separate action in which the measure first appeared, although a specific measure may appear in more than one EPA-approved plan or action. The majority of the existing measures are committed state and local measures that have been adopted and approved by EPA in prior regional air quality plans such as the Serious Area Ozone Plan (ADEQ, 2000), the Serious Area Carbon Monoxide Plan (MAG, 2001), the Carbon Monoxide Maintenance Plan (MAG, 2003), the One-Hour Ozone Maintenance Plan (MAG, 2004), the Eight-Hour Ozone Plan (MAG, 2007), and the Eight-Hour Ozone Maintenance Plan (MAG, 2009). Existing federal measures that reduce ozone in the Maricopa nonattainment area are also included in Table 4-1.

Table 4-2 evaluates the existing ozone control measures in the Maricopa nonattainment in comparison to EPA's National Menu of Control Measures (EPA, 2016a). EPA describes the Menu of Control Measures as a document which "provides state, local and tribal air agencies with the existing emission reduction measures as well as relevant information concerning the efficiency and cost effectiveness of the measures. State, local and tribal agencies will be able to use this information in developing emission reduction strategies, plans, and programs to assure they attain and maintain the National Ambient Air Quality Standards (NAAQS)". The Menu of Control Measures provides a broad listing of potential emission reduction measures for the precursors of ozone production (nitrogen oxides (NOx) and volatile organic compounds (VOC)) which have been gathered from control programs across the United States. Many of the control measure listed in EPA's Menu are already in place within the Maricopa eight-hour ozone nonattainment area.

As EPA recommends evaluating ozone control measures in other nonattainment areas, existing Maricopa County Air Quality Department NOx and VOC rules were also evaluated in comparison to NOx and VOC rules in place in the Sacramento Metropolitan Air Quality Management District (SMAQMD) in Table 4-3. The SMAQMD rules apply within the Sacramento Metropolitan eight-hour ozone nonattainment area, which is currently classified as a Severe-15 nonattainment area for the 2008 ozone standard. SMAQMD recently completed a RACM analysis of their NOx and VOC rules for the 1997 ozone standard. EPA approved the SMAQMD RACM analysis on January 29, 2015 (80 FR 4795).

A small portion of Pinal County, located in the city of Apache Junction, is included in the Maricopa eight-hour ozone nonattainment area. Mobile sources in this area are subject to the same measures that exist within the Maricopa County portion of the nonattainment area through state statutes that apply to Area A, an area that includes the Pinal County portion of the nonattainment area. Point and area sources of NOx and VOC in this area are regulated by the Pinal County Air Quality Control District (PCAQCD). Pinal County Air

Quality Control District point and area source NOx and VOC rules were not evaluated in Tables 4-2 and 4-3 for the following reasons: (1) Within the Pinal County portion of the Maricopa nonattainment area, there are no major sources of NOx and VOC and there are only two source categories that are subject to RACT requirements, gas stations and a metal surface coating operation; (2) the RACT rules for these two source categories are being updated as part of a RACT SIP submittal by PCAQCD; and (3) the few remaining permitted stationary sources in the Pinal County portion of the nonattainment area that are not gas stations or surface coating operations have negligible emissions in comparison to total anthropogenic emissions in the nonattainment area and do not warrant inclusion in Table 4-3.

RACM Analysis Findings

As discussed in detail in Chapter Six, attainment modeling indicates that the existing Maricopa nonattainment area ozone control measures are sufficient to demonstrate attainment as expeditiously as practicable and to meet reasonable further progress (RFP) requirements in the Maricopa nonattainment area. No new measures were necessary to demonstrate attainment at the ozone monitors or to meet the reasonable further progress requirements (i.e., a 15 percent rate of progress reduction of anthropogenic VOC emissions across the entire nonattainment area). The evaluation of RACM in Tables 4-2 and 4-3 therefore concludes that the adoption of additional measures, or the strengthening of existing measures, is not necessary.

Additionally, any identified new or strengthened measure will not be available in time to meet a one-year advancement of the attainment date, which is July 20, 2017. EPA requires that ozone control measures be implemented, and attainment be modeled, for the last full ozone season preceding the attainment date, which would be 2016 if the attainment date were July 20, 2017. It is infeasible to have any new measure in place by April 1, 2016 (the beginning of the 2016 ozone season), as this date both precedes the MAG 2017 Eight-Hour Ozone Moderate Area Plan adoption and submittal date of January 1, 2017, and the June 3, 2016 effective date of the final EPA rule reclassifying the Maricopa nonattainment area from a Marginal Area to a Moderate Area (81 FR 26697).

In summary, the existing and approved federal, state and local ozone control measures in the Maricopa eight-hour ozone nonattainment area lead to expeditious attainment of the 2008 ozone standard by the July 20, 2018 attainment date and meet all reasonable further progress requirements of the Clean Air Act. Furthermore, any available new or strengthened measure cannot be feasibly implemented in time to advance the attainment date by at least one year.

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
1	Phased-In Emission Test Cutpoints	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
2	Enhanced Emission Testing of Constant Four-Wheel Drive Vehicles	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
3	One-Time Waiver from Vehicle Emissions Test	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
4	Increased Waiver Repair Limit Options	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
5	Gross Polluter Option for I/M Program Waivers	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
6	Catalytic Converter Replacement Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
7	Vehicle Repair Grant Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
8	Voluntary Vehicle Repair and Retrofit Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
9	Tougher Enforcement of Vehicle Registration and Emissions Test Compliance	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
10	Random Roadside Testing of Diesel Vehicles	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
11	Snap Acceleration Test for Heavy-Duty Diesel	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
12	Require Pre-1988 Heavy-Duty Diesel Commercial Vehicles Registered in the Nonattainment Area to Meet 1988 Federal Emissions Standards; Provide Incentives to Encourage Voluntary Accelerated Vehicle Replacement by the Year 2004	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
13	Long-Term Fuel Reformulation: From and After May 1, 1999	Onroad/Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
14	Limit Sulfur Content of Diesel Fuel Oil to 500 ppm	Onroad/Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
15	Diesel Fuel Sampling and Reporting	Onroad/Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
16	Alternative Fuel Vehicles for Local Governments, School Districts and Federal Government/Low Emission Vehicle Requirements	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
17	Alternative Fuel Vehicles for State Government/Low Emission Vehicle Requirements	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
18	Alternative Fuel Vehicle and Equipment Tax Incentives/Low Emission Vehicle Requirements	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
19	Public Awareness Program for Alternative Fuels	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
20	National Low Emission Vehicle Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
21	Voluntary Gasoline Vehicle Retirement Program/Maricopa County Travel Reduction Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
22	Oxidation Catalyst for Heavy Duty Diesel Vehicles	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
23	Mass Transit Alternatives	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
24	Develop Intelligent Transportation Systems	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
25	Special Event Controls-Required Implementation from List of Approved Strategies	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
26	Voluntary Lawn Mower Emission Reduction Program	Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
27	Off-Road Vehicle and Engine Standards	Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
28	Encourage the Use of Temporary Electrical Power Lines Rather than Portable Generators at Construction Sites	Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
29	Defer Emissions Associated with Government Activities	Onroad/Nonroad/ Area	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
30	Encourage Limitations on Vehicle Idling	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
31	Expansion of Area A boundaries	Onroad/Nonroad/ Area	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
32	Voluntary No-Drive Days	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
33	Analysis of Intersource Credit Trading and Banking Program	Onroad/Nonroad/ Area/Point	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
34	Expansion of Public Transportation Programs	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
35	Employer Rideshare Program Incentives	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
36	Preferential Parking for Carpools and Vanpools	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
37	Coordinate Traffic Signal Systems	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
38	Reduce Traffic Congestion at Major Intersections	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
39	Site-Specific Transportation Control Measures	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
40	Encouragement of Bicycle Travel	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
41	Development of Bicycle Travel Facilities	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
42	Alternative Work Schedules	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
43	Land Use/Development Alternatives	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
44	Encouragement of Pedestrian Travel	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
45	Restrictions on the Use of Gasoline-Powered Blowers for Landscaping Maintenance	Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
46	Alternative Fuels for Fleets	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
47	Areawide Public Awareness Programs	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
48	Encouragement of Vanpooling	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
49	Trip Reduction Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
50	Park and Ride Lots	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
51	Encouragement of Telecommuting, Teleworking and Teleconferencing	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
52	Promotion of High Occupancy Vehicle Lanes and By-Pass Ramps	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
53	MCAQD Rule 331 - Solvent Cleaning	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
54	MCAQD Rule 333 - Petroleum Solvent Dry Cleaning	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
55	MCAQD Rule 334 - Rubber Sports Ball Manufacturing	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
56	MCAQD Rule 335 - Architectural and Industrial Coating	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
57	MCAQD Rule 336 - Surface Coating Operations	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
58	MCAQD Rule 337 - Graphic Arts	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
59	MCAQD Rule 338 - Semiconductor Manufacturing	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
60	MCAQD Rule 339 - Vegetable Oil Extraction Process	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
61	MCAQD Rule 340 - Cutback and Emulsified Asphalt	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
62	MCAQD Rule 341 - Metal Casting	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
63	MCAQD Rule 342 - Coating Wood Furniture and Fixtures	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
64	MCAQD Rule 343 - Commercial Bread Bakeries	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
65	MCAQD Rule 344 - Windshield Washer Fluid	Point/Area	VOC	Final Serious Area Ozone SIP, Appendix A. (2000) EPA final approval June 2005, 70 FR 34362
66	MCAQD Rule 346 - Coating Wood Millwork	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
67	MCAQD Rule 347 - Ferrous Sand Casting	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
68	MCAQD Rule 348 - Aerospace Manufacturing and Rework Operations	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
69	MCAQD Rule 349 - Vitamin Manufacturing	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
70	MCAQD Rule 350 - Storage of Organic Liquids at Bulk Plants and Terminals	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
71	MCAQD Rule 351 - Loading of Organic Liquids	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
72	MCAQD Rule 352 - Gasoline Delivery Vessel Testing and Use	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
73	MCAQD Rule 353 - Transfer of Gasoline in Stationary Storage Dispensing Tanks	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
74	Clean Air Campaign	Onroad/Nonroad/ Point/Area	VOC, NOx, CO	Final Serious Area Ozone SIP, Appendix A. (2000) EPA final approval June 2005, 70 FR 34362
75	Allow Use of High Occupancy Vehicle Lanes and Freeway Ramps by Alternative Fueled Vehicles	Onroad	VOC, NOx, CO	Final Serious Area Ozone SIP, Appendix A. (2000) EPA final approval June 2005, 70 FR 34362
76	MCAQD Rule 358 - Polystyrene Foam Operations	Point/Area	VOC	MAG Eight-Hour Ozone Plan (2007) EPA final approval June 2012, 77 FR 35285
77	Federal Heavy Duty Diesel Vehicle Emissions Standards (Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, EPA final rule January 2001, 66 FR 5002)	Onroad	VOC, NOx, CO	MAG Eight-Hour Ozone Plan (2007) EPA final approval June 2012, 77 FR 35285

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
78	Federal Nonroad Equipment Emissions Standards (Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel, EPA final rule June 2004, 69 FR 38958 and Control of Emissions of Air Pollution From Nonroad Diesel Engines, EPA final rule October 1998, 63 FR 56968)	Nonroad	VOC, NOx, CO	MAG Eight-Hour Ozone Plan (2007) EPA final approval June 2012, 77 FR 35285
79	Ban on Open Burning	Area	VOC, NOx, CO	MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan (2009) EPA final approval September 2014, 79 FR 55645
80	National Autobody Refinishing Rule	Point/Area	VOC	15 Percent Rate of Progress FIP (1998) EPA final rule July 1999, 64 FR 36243
81	National Consumer Products Rule	Area	VOC	15 Percent Rate of Progress FIP (1998) EPA final rule July 1999, 64 FR 36243
82	Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements	Onroad	VOC, NOx, CO	EPA final rule February 2000, 65 FR 6698
83	Control of Hazardous Air Pollutants From Mobile Sources (Including VOCs from portable gas cans)	Onroad/Area	VOC	EPA final rule February 2007, 72 FR 8428
84	Control of Emissions of Air Pollution From Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder	Nonroad	VOC, NOx, CO	EPA final rule May 2008, 73 FR 25098

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
85	Control of Emissions From Nonroad Spark-Ignition Engines and Equipment	Nonroad	VOC, NOx, CO	EPA final rule October 2008, 73 FR 59034
86	MCAQD Rule 322 - Power Plant Operations	Point/Area	NOx	EPA final approval October 2009, 74 FR 52693
87	MCAQD Rule 323 - Fuel Burning Equipment from Industrial/Commercial/Institutional (ICI) Sources	Point/Area	NOx	EPA final approval October 2009, 74 FR 52693
88	MCAQD Rule 324 - Stationary Internal Combustion (IC) Engines	Point/Area	NOx	EPA final approval October 2009, 74 FR 52693
89	National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters	Point	VOC, NOx, CO co-benefit	EPA final rule March 2011, 76 FR 15608
90	Phase 1 Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles	Onroad	VOC, NOx, CO co-benefit	EPA final rule September 2011, 76 FR 57106
91	Phase 1 and Phase 2 Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards	Onroad	VOC and NOx co-benefit	EPA final rules May 2010, 75 FR 25324 and October 2012, 77 FR 62624

Table 4-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
92	National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines; New Source Performance Standards for Stationary Internal Combustion Engines	Point/Area	VOC, NOx, CO co-benefit	EPA final rules January 2013, 78 FR 6674; August 2010, 75 FR 51570; March 2010, 75 FR 9648
93	Tier 3 Motor Vehicle Emission and Fuel Standards	Onroad	VOC, NOx, CO	EPA final rule April 2014, 79 FR 23414

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Area Sources	Commercial/Institutional - Natural Gas	Water heater replacement	Water heaters are generally exempted from regulation by MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources. The listed control measure may provide reductions in NOx emissions for water heaters. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Area Sources	Industrial Coal/Natural Gas/Oil Combustion	RACT to 50 tpy, and to 25 tpy (Low NOx Burner)	MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources, includes a parts per million by volume (ppmv) NOx emission limit. A combustion source may select low NOx burners to help meet the NOx emissions limit. This measure may provide reductions in NOx emissions beyond what is required in Rule 323. Requiring a combustion source to use low NOx burners may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Area Sources	Open Burning	Episodic Ban (Daily Only)	Arizona Revised Statute Section 49-501 bans open burning during May 1 through September 30 and is equivalent to this measure.
NOx Controls for Area Sources	Process Heaters - Distillate Oil, Residual Oil, or Other Fuel	Low NOx Burner, and Selective Noncatalytic Reduction	MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources, includes a parts per million by volume (ppmv) NOx emission limit. A process heater may select this control measure to help meet NOx emission limit. This measure may provide reductions in NOx emissions beyond what is required in Rule 323. Requiring all process heaters to use this control measure may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Area Sources	Residential/Commercial/ Institutional Water Heaters and Space Heaters	Low NOx Water Heaters, and Low NOx Burner Space Heaters	Water heaters are generally exempted from regulation by MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources. Space heaters are also normally too small to be regulated by MCAQD Rule 323. This measure may provide reductions in NOx emissions beyond what is required in Rule 323. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Adipic Acid Manufacturing	Extended Absorption, and Thermal Reduction	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Ammonia Production - Natural Gas-Fired/Oil-Fired Reformers	Low NOx Burner, Low NOx Burner and Flue Gas Recirculation, Oxygen Trim and Water Injection, Selective Catalytic Reduction, and Selective Non-Catalytic Reduction	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Asphalt Plant Manufacture	Low NOx Burner and Flue Gas Recirculation	No current requirement exists to install this control. This measure may provide reductions in NOx emissions beyond what is currently required at asphalt batch plants. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Asphaltic Concrete - Rotary Dryer - Conventional Plant	Low NOx Burner	No current requirement exists to install this control. This measure may provide reductions in NOx emissions beyond what is currently required at asphalt batch plants. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	By-Product Coke Manufacturing - Oven Underfiring	Selective Non-Catalytic Reduction	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Cement Kilns	Biosolid Injection Technology, Changing Feed Composition, and Process Control Systems	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Cement Manufacturing - Dry and Wet Process	Selective Non-Catalytic Reduction - Ammonia and/or Urea, Low NOx Burner, Mid-Kiln Firing, and Selective Catalytic Reduction	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Ceramic Clay Manufacturing - Drying	Low NOx Burner	No current requirement exists to install this control. This measure may provide reductions in NOx emissions beyond what is currently required at ceramic clay manufacturing facilities. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Coal Cleaning-Thermal Dryer - Fluidized Bed	Low NOx Burner	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Combustion Turbine - Aeroderivative Gas Turbines/Natural Gas/Oil or Jet Fuel	Water Injection, Low NOx Burner, Selective Catalytic Reduction and Low NOx Burner, Selective Catalytic Reduction and Steam Injection, Selective Catalytic Reduction and Water Injection, and Steam Injection	MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources, includes a parts per million by volume (ppmv) NOx emission limit. A combustion turbine may select these control measures to help meet the NOx emission limit. These measures may provide for reductions in NOx emissions beyond what is required in Rule 323. Requiring all combustion turbines to use these control measure may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Commercial/Institutional or Industrial Incinerators	Selective Non-Catalytic Reduction, and Selective Catalytic Reduction	No current requirement exists to install these controls. These measures may provide reductions in NOx emissions beyond what is currently required for facilities with incinerators. These measures are not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Fluid Catalytic Cracking Units - Cracking Unit	Low NOx Burner and Flue Gas Recirculation, and Selective Catalytic Reduction	Source not present in the nonattainment area.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Furnaces - Natural Gas	Low NOx Burner	Most natural gas furnaces are required to obtain a MCAQD general permit for fuel burning equipment and are too small to be regulated by MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources. No current requirement exists to install this control measure. This measures may provide for reductions in NOx emissions beyond what is required in Rule 323. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Glass Manufacturing - Container/Flat/General/ Pressed	Cullet Preheat, Electric Boost, OXY-Firing, Selective Catalytic Reduction, Selective Non-Catalytic Reduction, and Low NOx Burner	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Industrial Natural Gas Internal Combustion Engines - 2cycle (lean) and 4-cycle (rich)	Low Emission Combustion, and Non-Selective Catalytic Reduction	MCAQD Rule 324, Stationary Internal Combustion (IC) Engines, controls NOx emissions from these sources. A stationary internal combustion engine may select these control measures to help meet the NOx controls and limits in Rule 324. These control measures may provide reductions in NOX emissions beyond what is required in Rule 324. Requiring all stationary internal combustion engines to use these control measures may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Industrial/ Commercial/ Institutional Boilers - Bagasse/Coal/Distillate Oil/Gas/Liquid Waste/LPG/Municipal Solid Waste/Natural Gas/Process Gas/Oil/Petroleum Coke/Residual Oil/Wood/Bark/Waste	Coal Reburn, Low NOx Burner, Low NOx Burner and Flue Gas Recirculation, Low NOx Burner and Over Fire Air, Natural Gas Reburn, Oxygen Trim and Water Injection, Selective Catalytic Reduction, Selective Non-Catalytic Reduction, and Selective Non-Catalytic Reduction - Urea	MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources, includes a parts per million by volume (ppmv) NOx emission limit. A boiler may select these control measures to help meet the NOx emission limit. These control measures may provide reductions in NOx emissions beyond what is required in Rule 323. Requiring all boilers to use these control measures may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	In-Process - Bituminous Coal - Cement Kilns or Lime Kilns	Selective Catalytic Reduction, and Selective Non-Catalytic Reduction - Urea	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	In-Process - Process Gas - Coke Oven Gas/Blast Furnace	Low NOx Burner and Flue Gas Recirculation, and Selective Catalytic Reduction	Source not present in the nonattainment area.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Internal Combustion Engines - Gasoline/Diesel/LPG/Oil /Natural Gas	Adjust Air to Fuel Ratio, Adjust Air to Fuel Ratio and Ignition Retard, Ignition Retard, Non-Selective Catalytic Reduction, Selective Catalytic Reduction, Low Emissions Combustion (Low Speed), and Low Emissions Combustion (Medium Speed)	MCAQD Rule 324, Stationary Internal Combustion (IC) Engines, controls NOx emissions from this source. A stationary internal combustion engine may select these control measures to help meet the NOx controls and limits in MCAQD Rule 324. These control measures may provide reductions in NOx emissions beyond what is required in Rule 324. Requiring all internal combustion engines to use these control measures may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Iron & Steel - In-Process Combustion - Bituminous Coal/Natural Gas/Process Gas/Coke Oven Gas/Blast Furnace/Residual Oil	Selective Catalytic Reduction, Low NOx Burner, and Low NOx Burner and Flue Gas Recirculation	No current requirement exists to install these controls. These control measures may provide reductions in NOx emissions beyond what is currently required at iron and steel manufacturers. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Iron & Steel Mills - Annealing/Cupola Melt Furnaces/Galvanizing/ Reheating	Low Excess Air, Low NOx Burner, Low NOx Burner and Flue Gas Recirculation, Low NOx Burner and Selective Catalytic Reduction, Low NOx Burner and Selective Non-Catalytic Reduction, Selective Catalytic Reduction, and Selective Non-Catalytic Reduction	No current requirement exists to install these controls. These control measures may provide reductions in NOx emissions beyond what is currently required at iron and steel manufacturers. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Iron Production - Blast Furnace - Blast Heating Stoves	Low NOx Burner and Flue Gas Recirculation	No current requirement exists to install these controls. These control measures may provide reductions in NOx emissions beyond what is currently required at iron manufacturers. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Lime Kilns	Low NOx Burner	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Medical Waste Incinerators	Selective Non-Catalytic Reduction	Source not present in the nonattainment area.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Natural Gas Production - Compressors	Selective Catalytic Reduction	MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources, includes a parts per million by volume (ppmv) NOx emission limit. A compressor may select this control measure to help meet the NOx emission limit. This control measure may provide reductions in NOx emissions beyond what is required in Rule 323. Requiring all compressors to use this control measure may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Nitric Acid Manufacturing	Extended Absorption, Non-Selective Catalytic Reduction, and Selective Catalytic Reduction	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Primary Copper Smelters - Reverberatory Smelter Furnace	Low NOx Burner and Flue Gas Recirculation	Source not present in the nonattainment area.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Process Heaters - Distillate Oil/LPG/Natural Gas/Process Gas/Residual Oil/Other Fuel	Low NOx, Burner, Low NOx Burner and Flue Gas Recirculation, Low NOx Burner and Selective Catalytic Reduction, Low NOx Burner and Selective Non-Catalytic Reduction, Selective Catalytic Reduction, Selective Non-Catalytic Reduction, and Ultra-Low NOx Burner	MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources, includes a parts per million by volume (ppmv) NOx emission limit. A process heater may select these control measures to help meet NOx emission limit. These control measures may provide reductions in NOx emissions beyond what is required in Rule 323. Requiring all process heaters to use these control measures may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Pulp and Paper - Natural Gas - Incinerators	Selective Catalytic Reduction	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Sand/ Gravel - Dryer	Low NOx Burner and Flue Gas Recirculation	No current requirement exists to install this control. This measure may provide reductions in NOx emissions beyond what is currently required at sand and gravel facilities. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Secondary Aluminum Production - Smelting Furnace/ Reverberatory	Low NOx Burner	No current requirement exists to install this control. This measure may provide reductions in NOx emissions beyond what is currently required at secondary aluminum production facilities. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Sewage Sludge Incinerators	Selective Catalytic Reduction	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Space Heaters - Distillate Oil/Natural Gas	Low NOx Burner, Low NOx Burner and Flue Gas Recirculation, Oxygen Trim and Water Injection, Selective Catalytic Reduction, and Selective Non-Catalytic Reduction	Most space heaters in the nonattainment area are too small to be regulated by MCAQD Rule 323, Fuel Burning Equipment From Industrial/Commercial/Institutional (ICI) Sources or through a fuel burning general permit. These control measures may provide reductions in NOx emissions beyond what is required in Rule 323. Requiring these control measures is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Steel Foundries - Heat Treating Furnaces/Soaking Pits	Low NOx Burner, and Low NOx Burner and Flue Gas Recirculation	No current requirement exists to install these controls. These control measures may provide reductions in NOx emissions beyond what is currently required at steel foundries. These measures are not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Non-EGU Point Sources	Sulfate Pulping - Recovery Furnaces	Low NOx Burner, Low NOx Burner and Flue Gas Recirculation, Oxygen Trim and Water Injection, Selective Catalytic Reduction, and Selective Non-Catalytic Reduction	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Surface Coating Operations - Coating Oven Heater -Natural Gas	Low NOx Burner	No current requirement exists to install this control. This measure may provide reductions in NOx emissions beyond what is currently required at surface coating operations. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Non-EGU Point Sources	Taconite Iron Ore Processing - Induration - Coal or Gas	Selective Catalytic Reduction	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Textile-Type Fiberglass Manufacturing - Recuperative Furnace	Low NOx Burner	Source not present in the nonattainment area.
NOx Controls for Non-EGU Point Sources	Waste Incineration - Municipal Waste Combustors or Solid Waste Disposal - Sludge Incinerators (Government)	Selective Non-Catalytic Reduction	Source not present in the nonattainment area.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Electricity Generating Units (EGUs)	External Combustion Boilers - Electric Generation - Natural Gas (Tangential or Non-Tangential Firing)/Coal/Residual Oil/Solid Waste/Distillate Oil	Natural Gas Reburn, and Selective Non-Catalytic Reduction	MCAQD Rule 322, Power Plant Operations, includes a parts per million by volume (ppmv) NOx emission limit. An EGU may select these control measures to help meet the NOx emission limit. These control measures may provide reductions in NOx emissions beyond what is required in Rule 322. Requiring all EGUs to use these control measures may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Electricity Generating Units (EGUs)	External Combustion Boilers for Electricity Generation	Energy Efficiency Policies & Programs	Energy efficiency programs exist within the nonattainment area but have not been specifically identified and included in prior air quality plans addressing ozone. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Electricity Generating Units (EGUs)	Utility Boiler - Coal Wall/Coal Tangential/Cyclone/Oil-Gas Tangential/Oil-Gas Wall	Low NOx Burner, Low NOx Burner and Over Fire Air, Low NOx Coal-and-Air Nozzles with Cross-Coupled and Separated Over Fire Air, Low NOx Coal-and-Air Nozzles with Cross-Coupled Over Fire Air, Low NOx Coal-and-Air Nozzles with Separated Over Fire Air, Natural Gas Reburn, Selective Catalytic Reduction, and Selective Non-Catalytic Reduction	MCAQD Rule 322, Power Plant Operations, includes a parts per million by volume (ppmv) NOx emission limit. An EGU may select these control measures to help meet the NOx emission limit. These control measures may provide reductions in NOx emissions beyond what is required in Rule 322. Requiring all EGUs to use these control measures may not result in reduced NOx emissions in all cases and is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Adhesives - Industrial	Reformulation	Industrial adhesives are regulated in multiple MCAQD coating rules. The VOC content limits for adhesives in the listed measure may provide reductions in VOC emissions beyond what is currently required in MCAQD rules. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Point and Area Sources	Aerosol Coatings	National Rule	This measure refers to the EPA final rule, National Volatile Organic Compound Emission Standards for Aerosol Coatings, which limits the reactivity of the VOCs in aerosol coatings (73 FR 15604). This final rule became effective on March 24, 2008. The nonattainment area is already subject to this national rule.
VOC Controls for Point and Area Sources	Architectural, Traffic, and Industrial Maintenance Coatings	OTC Model Rule and South Coast -Rule 1113 Phase III VOC limits	MCAQD Rule 335, Architectural Coatings, limits VOC emissions from architectural, traffic and industrial maintenance coatings. The listed measure contains VOC limits that may provide reductions in VOC emissions beyond what is required in Rule 335. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Auto and Light-Duty Truck Assembly Coatings	Control Technique Guidelines	MCAQD Coatings Rule 345, Vehicle and Mobile Equipment Coating, limits VOC emissions from auto and light-duty truck assembly coatings. The listed measure may provide reductions in VOC emissions beyond what is required in Rule 345. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Bakery Products	Catalytic Incineration	MCAQD Rule 343, Commercial Bread Bakeries, limits VOC emissions from bakeries. The listed measure requires a higher VOC capture and control percentage rate than Rule 343 and may provide reductions in VOC emissions beyond what is required in Rule 343. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Coating Operations at Aerospace Manufacturing and Rework Operations	Control Technique Guidelines	MCAQD Coating Rule 348, Aerospace Manufacturing and Rework Operations, limits VOC emissions from aerospace manufacturing and rework operations. Rule 348 is equivalent to this control measure.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Point and Area Sources	Cold Cleaning Degreasing	Process Modification, Reformulation-Process Modification (OTC Rule)	MCAQD Rule 331, Solvent Cleaning, limits VOC emissions from solvent cleaning. The listed control measure may provide reductions in VOC emissions beyond what is required in Rule 331. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Consumer Products	California Consumer Products Rules Cumulative through 2010 Proposed Amendments, Reformulation (2001 and 2006 OTC Model Rule)	Consumer products in the nonattainment area are regulated by EPA's national rule. This measure may provide for reductions in VOC emissions beyond what is required in the national rule. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Cutback Asphalt	Reformulation-Process Modification	MCAQD Rule 340, Cutback and Emulsified Asphalt, limits VOC emissions from asphalt application. Not enough information is provided to evaluate if this measure would provide VOC reductions beyond what is required in Rule 340.
VOC Controls for Point and Area Sources	Fabric Printing and Coating	Permanent Total Enclosure (PTE)	MCAQD Coating Rule 336, Miscellaneous Surface Coatings Operations, limits VOC emissions from the coating of fabric. The listed control measure may provide for reductions in VOC emissions beyond what is required in Rule 336. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Fiberglass Boat Manufacturing	Solvent substitution, non-atomized resin application methods	Source not present in the nonattainment area.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Point and Area Sources	Flat Wood Paneling Coatings	Low-VOC materials coatings	Source not present in the nonattainment area.
VOC Controls for Point and Area Sources	Flexible Package Printing	Add-on controls, work practices, and material reformulation or substitution	MCAQD Rule 337, Graphic Arts, limits VOC emissions from printing operations and is equivalent to these measures.
VOC Controls for Point and Area Sources	Flexographic Printing	Permanent Total Enclosure (PTE)	MCAQD Rule 337, Graphic Arts, limits VOC emissions from printing operations. A permanent total enclosure is one type of emission control system that may be used to meet the requirements of Rule 337 and may provide higher VOC capture and control efficiencies than other systems, possibly resulting in the reduction of VOC emissions beyond what is required in Rule 337. Requiring this particular type of control for all flexographic printing operations is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Industrial Cleaning Solvents, Non-Halogenated Solvent - Parts Cleaners, Other Non-Halogenated Solvent Cleaning Operations	Solvent Substitution, and Add-on Controls, Low VOC Cleaning Materials and Improved Work Practices	MCAQD Rule 331, Solvent Cleaning, limits VOC emissions from solvent cleaning and is equivalent to these measures.
VOC Controls for Point and Area Sources	Large Appliance Surface Coating	Low-VOC coating materials	Source not present in the nonattainment area.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Point and Area Sources	Lithographic Printing & Letterpress Printing	Add-on controls, work practices, and material reformulation or substitution	MCAQD Rule 337, Graphic Arts, limits VOC emissions from printing operations and is equivalent to these measures.
VOC Controls for Point and Area Sources	Metal Can and Coil Surface Coating	Incineration, Permanent Total Enclosure (PTE), Process Modification	MCAQD Coating Rule 336, Miscellaneous Surface Coating Operations, limits VOC emissions from the coating of metal cans and coils. The listed control measures may provide reductions in VOC emissions beyond what Rule 336 requires. These control measures are not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Metal Furniture Coatings	Low-VOC coating materials, Permanent Total Enclosure, and Reduced Solvent Utilization	MCAQD Coating Rule 336, Miscellaneous Surface Coating Operations, limits VOC emissions from the coating of metal furniture. The listed control measures may provide reductions in VOC emissions beyond what is required in Rule 336. These control measures are not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Metal Furniture, Appliances, Parts	Reformulation-Process Modification	MCAQD Coating Rule 336, Miscellaneous Surface Coating Operations, limits VOC emissions from the coating of metal furniture, appliances and parts. The listed control measure may provide reductions in VOC emissions beyond what is required in Rule 336. This control measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Metal Parts and Products coating	Reformulation-Process Modification	MCAQD Coating Rule 336, Miscellaneous Surface Coating Operations, limits VOC emissions from the coating of metal parts and products. The listed control measure may provide reductions in VOC emissions beyond what is required in Rule 336. This control measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Point and Area Sources	Miscellaneous Industrial Adhesives	Low VOC Adhesives and Improved Application Methods, Solvent Substitution	Industrial adhesives are regulated in multiple MCAQD coating rules. The VOC content limits for adhesives in the listed measures may provide reductions in VOC emissions beyond what is currently required in MCAQD rules. These measures are not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Miscellaneous Metal and Plastic Parts Coatings	Coating Reformulation	MCAQD Coating Rule 336, Miscellaneous Surface Coatings Operations, limits VOC emissions from the coating of metal and plastic parts and is equivalent to this measure.
VOC Controls for Point and Area Sources	Mobile Equipment Repair and Refinishing	California Air Resources Board - Suggested Control Measures for Automotive Coatings, OTC Model Rule	MCAQD Coatings Rule 345, Vehicle and Mobile Equipment Coating, limits VOC emissions from mobile equipment. The listed measure may provide reductions in VOC emissions beyond what is required in Rule 345. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Municipal Solid Waste Landfill	Gas Recovery	MCAQD Rule 321, Municipal Solid Waste Landfills, limits VOC emissions from landfills and is equivalent to this control measure.
VOC Controls for Point and Area Sources	Oil and Natural Gas Production - Fugitive Emissions	SCAQMD Rule 1148.1	Source not present in the nonattainment area.
VOC Controls for Point and Area Sources	Open Top Degreasing	Process Modification, Reformulation-Process Modification	MCAQD Rule 331, Solvent Cleaning, limits VOC emissions from solvent cleaning. The listed control measure is based off of SCAQMD Rule 1122, which may provide reductions in VOC emissions beyond what is required in Rule 331. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Point and Area Sources	Paper Film and Foil Coatings	Low-VOC coating materials and/or add-on controls	MCAQD Coating Rule 336, Miscellaneous Surface Coatings Operations, limits VOC emissions from the coating of paper film and foil and is equivalent to this measure.
VOC Controls for Point and Area Sources	Pesticide Application	Reformulation	The nonattainment area does not currently regulate the VOC content of pesticides. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Petroleum Flare	Flare	Source not present in the nonattainment area.
VOC Controls for Point and Area Sources	Petroleum Refinery Fugitives	Process Modification	Source not present in the nonattainment area.
VOC Controls for Point and Area Sources	Petroleum Wastewater	Wastewater	Source not present in the nonattainment area.
VOC Controls for Point and Area Sources	Pharmaceutical and Cosmetic Manufacturing Operations	SCAQMD Rule 1103	MCAQD Rule 349, Pharmaceutical, Cosmetic, and Vitamin Manufacturing Operations, limits VOC emissions from pharmaceutical and cosmetic manufacturing operations. The listed control measure may provide reductions in VOC emissions beyond what is required in Rule 349. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Polystyrene Foam Manufacturing	Control Technique Guidelines	MCAQD Rule 358, Polystyrene Foam Operations, limits VOC emissions from polystyrene foam manufacturing and is equivalent to this measure.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Point and Area Sources	Rubber/Plastics Coating	Reformulation-Process Modification	MCAQD Coating Rule 336, Miscellaneous Surface Coating Operations, limits VOC emissions from the coating of rubber and plastics. The listed control measure may provide reductions in VOC emissions beyond what is required in Rule 336. This control measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Semi-Conductor Manufacturing	Reformulation-Process Modification	MCAQD Rule 338, Semiconductor Manufacturing, limits VOC emissions from semiconductor manufacturing. The listed control measure may provide reductions in VOC emissions beyond what is required in Rule 338. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Shipbuilding and Ship Repair (Surface Coating)	Incineration, Reformulation, and Process Modification	Source not present in the nonattainment area.
VOC Controls for Point and Area Sources	Stage II Service Stations - Underground Tanks (Breathing and Emptying)	LPV Relief Valve	EPA has approved the phased removal of Stage II controls in the nonattainment area to avoid a VOC emissions disbenefit beginning in 2018.
VOC Controls for Point and Area Sources	Storage Tanks at Petroleum Facilities	SCAQMD Rule 1178	MCAQD Rule 350, Storage of Organic Liquids at Bulk Plants and Terminals, limits VOC emissions from storage tanks. The listed control measure may provide reductions in VOC emissions beyond what is required in Rule 350. This control measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

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Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Point and Area Sources	Wood Furniture Surface Coating	Add-On Controls, and Control Technique Guidelines	MCAQD Coating Rule 342, Coating Wood Furniture and Fixtures, limits VOC emissions from the coating of wood furniture. The listed control measures may provide reductions in VOC emissions beyond what is required in Rule 342. These measures are not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Point and Area Sources	Wood Product Surface Coating	Incineration, and Reformulation	MCAQD Coating Rule 342, Coating Wood Furniture and Fixtures, and MCAQD Coatings Rule 346, Coating Wood Millwork limit VOC emissions from the coating of wood products. The listed control measures may provide reductions in VOC emissions beyond what is required in Rule 342 or Rule 346. These control measures are not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Onroad and Nonroad Mobile Sources	Onroad Heavy Duty Diesel Vehicles (Class 6 and above)	Diesel Retrofit, and Eliminate Long Duration Idling	Existing measures have been implemented within the nonattainment area that are equivalent to these control measures (see measure number 8 and 30 in Table 4-1). MCAQD Ordinance P-21 also limits vehicle idling.
NOx Controls for Onroad and Nonroad Mobile Sources	Onroad Light Duty Vehicles	Continuous Inspection and Maintenance	The listed measure may provide reductions in NOx emissions beyond what is required in the current vehicle inspection and maintenance program. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Onroad and Nonroad Mobile Sources	Onroad Light Duty Gasoline Vehicles and Trucks	Travel Efficiency Strategies	Many existing measures have been implemented within the nonattainment area that are equivalent to this control measure (see measures 35-44 in Table 4-1).

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
NOx Controls for Onroad and Nonroad Mobile Sources	Onroad and Nonroad Vehicles	Ozone Action Days - Education and promotion campaigns	The Arizona Department of Environmental Quality provides public notification of High Pollution Advisory Days and Health Watch Days during the ozone season in the nonattainment area.
NOx Controls for Onroad and Nonroad Mobile Sources	Nonroad Aircraft Ground Support Equipment	Alternative Fuels - CNG/LPG/Electric	Conversion of aircraft ground support equipment to LPG or CNG engines is not a currently required control measure. The listed measure may provide reductions in NOx emissions. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Onroad and Nonroad Mobile Sources	Nonroad Commercial Marine - Ocean Going Vessels	Shore Based Electrical Power - Cold Ironing	Source not present in the nonattainment area.
NOx Controls for Onroad and Nonroad Mobile Sources	Nonroad Heavy Duty Diesel Equipment	Diesel Retrofits and Engine Rebuilds	Diesel retrofits and engine rebuilds for nonroad equipment is not a currently required control measure. The listed measure may provide reductions in NOx emissions. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx Controls for Onroad and Nonroad Mobile Sources	Nonroad Locomotives	Idling Reduction, and Upgrade Engines in Switcher Locomotives - Diesel-electric hybrid locomotives	These control measures for locomotives are currently not required. These measures may provide reductions in NOx emissions. These measures are not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Onroad and Nonroad Mobile Sources	Onroad and Nonroad Gasoline Vehicles	Opt into Reformulated Gasoline (RFG) standards	Existing measures have been implemented within the nonattainment area that are equivalent to this control measure (see measure number 13 in Table 4-1).

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Onroad and Nonroad Mobile Sources	Onroad and Nonroad Gasoline Vehicles	Petition EPA to remove the 1 psi allowance for 9-10% ethanol blends	Petitioning EPA to remove the 1 psi allowance for 9-10% ethanol blends is not a currently required control measure. This measure may provide reductions in VOC emissions. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC Controls for Onroad and Nonroad Mobile Sources	Onroad and Nonroad Vehicles	Ozone Action Days - Education and promotion campaigns	The Arizona Department of Environmental Quality provides public notification of High Pollution Advisory Days and Health Watch Days during the ozone season in the nonattainment area.
VOC Controls for Onroad and Nonroad Mobile Sources	Onroad Heavy Duty Vehicles	Alternative Fuel Programs	Existing measures have been implemented within the nonattainment area that are equivalent to this control measure (see measure numbers 16-19 in Table 4-1).
VOC Controls for Onroad and Nonroad Mobile Sources	Onroad Gasoline Vehicles	Low RVP Gasoline	Existing measures have been implemented within the nonattainment area that are equivalent to this control measure (see measure number 13 in Table 4-1).
VOC Controls for Onroad and Nonroad Mobile Sources	Nonroad Gasoline Vehicles	Low RVP Gasoline	Existing measures have been implemented within the nonattainment area that are equivalent to this control measure (see measure number 13 in Table 4-1).
VOC Controls for Onroad and Nonroad Mobile Sources	Onroad Light Duty Vehicles	Continuous Inspection and Maintenance	The listed measure may provide reductions in VOC emissions beyond what is required in the current vehicle inspection and maintenance program. This measure is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-2

Comparison of Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area With the EPA Menu of Control Measures

Control Category	Source Category	EPA Emission Reduction Measure(s) from Menu of Controls	Evaluation of EPA Measure
VOC Controls for Onroad and Nonroad Mobile Sources	Onroad Light Duty Gasoline Vehicles and Trucks	Travel Efficiency Strategies	Many existing measures have been implemented within the nonattainment area that are equivalent to this control measure (see measures 35-44 in Table 4-1).

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-3

Comparison of Existing Maricopa County Air Quality Department (MCAQD) and Sacramento Metropolitan Air Quality Management District (SMAQMD) NOx and VOC Rules

Pollutant	Sacramento Metropolitan Rule (date last amended)	Existing Maricopa County Rule (date last amended)	Evaluation of SMAQMD Rule
NOx	Rule 411 - NOx from Boilers, Process Heaters and Steam Generators (8-23-2007)	Rule 323 - Fuel Burning Equipment From Industrial/Commercial/ Institutional (ICI) Sources (10-17-2007)	Sections of SMAQMD Rule 411 contain provisions that may provide reductions in NOx emissions beyond what is currently required in MCAQD Rule 323, such as lower NOx emission limits and lower BTU/hr exemption limits for boilers, process heaters and steam generators. Adoption of these provisions of Rule 411 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx	Rule 412 - Stationary IC Engines at Major Stationary Sources of NOx (6-01-1995)	Rule 324 - Stationary Internal Combustion (IC) Engines (10-17-2007)	Sections of SMAQMD Rule 412 contain provisions that may provide reductions in NOx emissions beyond what is currently required in MCAQD Rule 324, such as lower NOx emission limits for existing stationary internal combustion engines. Adoption of these provisions of Rule 412 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx	Rule 413 - Stationary Gas Turbines (3-24-2005)	Rule 322 - Power Plant Operations (10-17-2007)	Sections of SMAQMD Rule 413 contain provisions that may provide reductions in NOx emissions beyond what is currently required in MCAQD Rule 322, such as lower NOx emission limits for stationary gas turbines. Adoption of these provisions of Rule 413 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
NOx	Rule 414 - Water Heaters, Boilers and Process Heaters Rated Less than 1,000,000 BTU per Hour (3-25-2010)	N/A	MCAQD currently does not have a rule that is similar to SMAQMD Rule 414. Boilers and process heaters in the nonattainment area rated greater than 300,000 BTU/hr may be regulated through a general or site-specific permit. There are no NOx limits currently for equipment of this size in the nonattainment area. Adoption of a rule similar to SMAQMD Rule 414 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 441 - Organic Solvents (12-6-1978)	Rule 330 - Volatile Organic Compounds (9-25-2013)	MCAQD Rule 330 provides equivalent control of VOC emissions as compared to SMAQMD Rule 441.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-3

Comparison of Existing Maricopa County Air Quality Department (MCAQD) and Sacramento Metropolitan Air Quality Management District (SMAQMD) NOx and VOC Rules

Pollutant	Sacramento Metropolitan Rule (date last amended)	Existing Maricopa County Rule (date last amended)	Evaluation of SMAQMD Rule
VOC	Rule 442 - Architectural Coatings (9-24-2015)	Rule 335 - Architectural Coatings (9-25-2013)	Sections of SMAQMD Rule 442 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 335, such as lower VOC content limits for architectural coatings. Adoption of these provisions of Rule 442 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 443 - Leaks from Synthetic Organic Chemical and Polymer Manufacturing (9-5-1996)	N/A	MCAQD currently does not have a rule that is similar to SMAQMD Rule 443. Sources in the nonattainment area that would be subject to SMAQMD's Rule 443 are regulated through source-specific permits and MCAQD's other VOC rules that may apply to these operations. Adoption of a rule similar to SMAQMD Rule 443 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 444 - Petroleum Solvent Dry Cleaning (8-13-1981)	Rule 333 - Petroleum Solvent Dry Cleaning (9-25-2013)	MCAQD Rule 333 provides equivalent control of VOC emissions as compared to SMAQMD Rule 444.
VOC	Rule 446 - Storage of Petroleum Products (11-16-1993)	Rule 350 - Storage of Organic Liquids at Bulk Plants and Terminals (4-6-1992)	MCAQD Rule 350 provides equivalent control of VOC emissions as compared to SMAQMD Rule 446.
VOC	Rule 447 - Organic Liquid Loading (4-02-1998)	Rule 351 - Loading of Organic Liquids (2-15-1995)	Sections of SMAQMD Rule 447 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 351, such as a lower vapor pressure exemption limit for organic liquids. Adoption of these provisions of Rule 447 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-3

Comparison of Existing Maricopa County Air Quality Department (MCAQD) and Sacramento Metropolitan Air Quality Management District (SMAQMD) NOx and VOC Rules

Pollutant	Sacramento Metropolitan Rule (date last amended)	Existing Maricopa County Rule (date last amended)	Evaluation of SMAQMD Rule
OC	Rule 448 - Gasoline Transfer into Stationary Storage Containers (2-26-2009)	Rule 353 - Gasoline in Stationary Dispensing Tanks (9-25-2013) and Rule 352 Gasoline Delivery Vessel Testing and Use (9-25-2013)	Sections of SMAQMD Rule 448 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rules 352 and 353, such as a lower exemption limit for vapor recovery controls on gasoline storage tanks. Adoption of these provisions of Rule 448 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 449 - Transfer of Gasoline into Vehicle Fuel Tanks (2-26-2009)	N/A	On November 16, 2015, EPA approved removal of Stage II vapor recovery systems in the Maricopa nonattainment area in order to avoid a VOC disbenefit beginning in 2018 from the use of such systems in the nonattainment area. Adoption of SMAQMD Rule 449 is therefore not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 450 - Graphic Arts Operations (10-23-2008)	Rule 337 - Graphic Arts (8-17-2011)	Sections of SMAQMD Rule 450 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 337, such as lower exemption limits for VOC content limits on inks and coatings. Adoption of these provisions of Rule 450 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 451 - Surface Coating of Miscellaneous Metal Parts and Products (10-28-2010)	Rule 336 - Surface Coating Operations (9-25-2013)	Sections of SMAQMD Rule 451 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 336, such as lower VOC content limits for solvents used in the cleaning of application equipment. Adoption of these provisions of Rule 451 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-3

Comparison of Existing Maricopa County Air Quality Department (MCAQD) and Sacramento Metropolitan Air Quality Management District (SMAQMD) NOx and VOC Rules

Pollutant	Sacramento Metropolitan Rule (date last amended)	Existing Maricopa County Rule (date last amended)	Evaluation of SMAQMD Rule
VOC	Rule 452 - Can Coating (9-25-2008)	Rule 336 - Surface Coating Operations (9-25-2013)	Sections of SMAQMD Rule 452 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 336, such as lower VOC content limits for can coatings. Adoption of these provisions of Rule 452 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 453 - Cutback and Emulsified Asphalt Paving Materials (8-31-1982)	Rule 340 - Cutback and Emulsified Asphalt (9-25-2013)	MCAQD Rule 340 provides equivalent control of VOC emissions as compared to SMAQMD Rule 453.
VOC	Rule 454 - Degreasing Operations (9-25-2008)	Rule 331 - Solvent Cleaning (9-25-2013)	Sections of SMAQMD Rule 454 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 331, such as lower VOC content limits for cleaning solvents. Adoption of these provisions of Rule 454 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 455 - Pharmaceuticals Manufacturing (9-5-1996)	Rule 349 - Pharmaceutical, Cosmetic and Vitamin Manufacturing Operations (9-25-2013)	MCAQD Rule 349 provides equivalent control of VOC emissions as compared to SMAQMD Rule 455.
VOC	Rule 456 - Aerospace Coating Operations (10-23-2008)	Rule 348 - Aerospace Manufacturing and Rework Operations (9-25-2013)	Sections of SMAQMD Rule 456 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 348, such as lower VOC content limits for aerospace coatings. Adoption of these provisions of Rule 456 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-3

Comparison of Existing Maricopa County Air Quality Department (MCAQD) and Sacramento Metropolitan Air Quality Management District (SMAQMD) NOx and VOC Rules

Pollutant	Sacramento Metropolitan Rule (date last amended)	Existing Maricopa County Rule (date last amended)	Evaluation of SMAQMD Rule
VOC	Rule 458 - Large Commercial Bread Bakeries (9-5-1996)	Rule 343 - Commercial Bread Bakeries (9-25-2013)	Sections of SMAQMD Rule 458 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 343, such as a higher VOC control efficiency for bakery ovens and a lower rule exemption level. Adoption of these provisions of Rule 458 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 459 - Automotive, Mobile Equipment, and Associated Parts and Components Coating Operations (8-25-2011)	Rule 345 - Vehicle and Mobile Equipment Coating (9-25-2013)	Sections of SMAQMD Rule 459 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 345, such as lower VOC content limits for vehicle and mobile equipment coatings. Adoption of these provisions of Rule 459 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 460 - Adhesives and Sealants (11-30-2000)	N/A	MCAQD currently regulates adhesives and sealants in their suite of coating rules. Sections of SMAQMD Rule 460 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD coatings rules, such as lower VOC content limits for adhesives and sealants. Adoption of a rule similar to SMAQMD Rule 460 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 463 - Wood Products Coatings (9-25-2008)	Rule 342 - Coating Wood Furniture (9-25-2013) and Rule 346 - Coating Wood Millwork (9-25-2013)	Sections of SMAQMD Rule 463 contain provisions that may provide reductions in VOC emissions beyond what is currently required in MCAQD Rule 342 and MCAQD Rule 346, such as lower VOC content limits for wood coatings. Adoption of these provisions of Rule 463 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

Table 4-3

Comparison of Existing Maricopa County Air Quality Department (MCAQD) and Sacramento Metropolitan Air Quality Management District (SMAQMD) NOx and VOC Rules

Pollutant	Sacramento Metropolitan Rule (date last amended)	Existing Maricopa County Rule (date last amended)	Evaluation of SMAQMD Rule
VOC	Rule 464 - Organic Chemical Manufacturing Operations (9-25-2008)	N/A	MCAQD currently does not have a rule that is similar to SMAQMD Rule 464. Sources in the nonattainment area that would be subject to SMAQMD's Rule 464 are regulated through source-specific permits and MCAQD's other VOC rules that may apply to these operations. Adoption of a rule similar to SMAQMD Rule 464 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 465 - Polyester Resin Operations (9-25-2008)	N/A	MCAQD currently does not have a rule that directly controls VOC emissions from polyester resin operations. Sources that perform polyester resin operations in the nonattainment area are currently regulated by site-specific permits. Adoption of the VOC controls in SMAQMD Rule 465 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 466 - Solvent Cleaning (10-28-2010)	Rule 331 - Solvent Cleaning (9-25-2013)	Sections of SMAQMD Rule 466 contain provisions that may provide reductions in VOC emissions beyond what currently exists in MCAQD Rule 331, such as lower VOC content limits of cleaning solvents. Adoption of these provisions of Rule 466 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.
VOC	Rule 485 - Municipal Landfill Gas (7-23-2008)	Rule 321 - Municipal Solid Waste Landfills (11-18-2015)	MCAQD Rule 321 provides equivalent control of VOC emissions as compared to SMAQMD Rule 485.
VOC	Rule 496 - Large Confined Animal Operations (8-24-06)	N/A	There are currently no requirements to control VOC emissions from large confined animal operations in the nonattainment area. Adoption of a rule similar to SMAQMD Rule 496 is not necessary for attainment or reasonable further progress and will not advance the Moderate Area attainment date.

Note: Maricopa County is revising their existing VOC and NOx rules in Tables 4-2 and 4-3 as necessary to meet RACT requirements.

REASONABLY AVAILABLE CONTROL TECHNOLOGY ANALYSIS

Sections 182(b)(2) and 182(f) of the Clean Air Act require reasonably available control technology (RACT) to be implemented in ozone nonattainment areas classified as Moderate or higher. Additionally, 40 CFR Section 51.1112(a) requires the State to submit a SIP revision "that meets the VOC and NOx RACT requirements in Clean Air Act Sections 182(b)(2) and 182(f)" for nonattainment areas classified as Moderate or higher. The RACT SIP revision for the Maricopa eight-hour ozone nonattainment area is required to be submitted to EPA by January 1, 2017, as stated in the EPA final rule reclassifying the Maricopa nonattainment area to a Moderate Area (81 FR 26697).

EPA defines RACT (44 FR 53762) as "the lowest emission limitation that a particular source is capable of meeting by the application of technology that is reasonably available considering technological and economic feasibility." RACT is required for all major sources of VOC and NOx within the nonattainment area, and for each category of VOC sources in the nonattainment area covered by a Control Techniques Guideline (CTG) issued by the EPA. The requirement to implement RACT in the Maricopa eight-hour ozone nonattainment area is separate and independent from the Clean Air Act Section 172(c)(1) requirement to adopt the reasonably available control measures (RACM) necessary to meet reasonable further progress requirements and attain the 2008 ozone standard.

Within the Maricopa nonattainment area, the Maricopa County Air Quality Department (MCAQD) and the Pinal County Air Quality Control District (PCAQCD) implement RACT for point and area sources. MCAQD and PCAQCD are independently preparing RACT SIP submittals that meet the requirements of Clean Air Act Section 182(b)(2) and 182(f). Emission reductions of NOx and VOC due to RACT implementation by MCAQD and PCAQCD have not been quantified and were not necessary to demonstrate attainment of the 2008 ozone standard or meet reasonable further progress requirements in the Maricopa nonattainment area. The implementation of RACT by MCAQD and PCAQCD in the Maricopa nonattainment area is described below.

RACT for the Maricopa County Portion of the Nonattainment Area

In coordination with EPA Region IX, the Maricopa County Air Quality Department conducted an analysis of permitted sources within the Maricopa County portion of the eight-hour ozone nonattainment area. The analysis incorporated actual emissions of the permitted facilities and compared them to the Control Techniques Guidelines (CTGs) emissions thresholds and addressed the RACT requirements for major sources of VOC and NOx (both CTG and non-CTG), i.e., sources that emit or have the potential to emit, 100 tons per year of either VOC or NOx. The analysis showed that permitted facilities covered under twelve CTG source categories surpassed the CTG thresholds and needed ozone RACT rules revisions in order to comply with the Clean Air Act RACT requirements for Moderate ozone nonattainment areas.

MCAQD revised six VOC RACT rules for these twelve CTG source categories. MCAQD also revised three NOx RACT rules in response to the analysis of non-CTG source categories. The MCAQD rulemaking timeline had a formal process starting with a Notice of Proposed Rulemaking that was published in the Arizona Administrative Register on May 13, 2016. The rulemaking included twenty-one Stakeholder Workshops and a 30-day comment period. A public hearing before the Maricopa County Board of Supervisors was conducted on November 2, 2016, at which the Maricopa County Board of Supervisors approved the revisions to the nine rules. The ozone RACT rules State Implementation Plan (SIP) package will be submitted to the EPA by the Arizona Department of Environmental Quality. The rules became effective upon adoption by the Maricopa County Board of Supervisors.

RACT for the Pinal County Portion of the Nonattainment Area

In coordination with EPA Region IX and the Maricopa County Air Quality Department, the Pinal County Air Quality Control District conducted an analysis of permitted sources within the Apache Junction portion of the Maricopa eight-hour ozone nonattainment area. The analysis incorporated actual emissions of the permitted facilities and compared them to the Control Technique Guidelines emissions thresholds. The analysis showed that permitted facilities covered under two source categories (gas stations, surface coatings) surpassed the CTG thresholds and needed ozone RACT rules in order to comply with the Clean Air Act RACT requirements for Moderate ozone nonattainment areas. There are no major sources of VOC or NOx located within the Pinal County portion of the Maricopa nonattainment area.

In tandem with MCAQD's ozone RACT rulemaking, PCAQCD drafted ozone RACT rules for these two source categories. The PCAQCD rulemaking timeline has the formal process starting with a Notice of Proposed Rulemaking being published in the Arizona Administrative Register on August 26, 2016. The rulemaking includes one stakeholder meeting for each draft rule, a 30 day public comment period including oral proceedings with the Control Officer and a Public Hearing with the Pinal County Board of Supervisors. Upon adoption by the Pinal County Board of Supervisors, the ozone RACT rules State Implementation Plan (SIP) package will be submitted to EPA by the Arizona Department of Environmental Quality. The rules will go into effect on January 1, 2017.

NEW SOURCE REVIEW

Section 182(a)(2)(C) requires the State to submit a revision that requires permits, in accordance with Sections 172(c)(5) and 173 of the Clean Air Act, for the construction and operation of each new or modified major stationary source (with respect to ozone) located within the Moderate nonattainment area. Except as noted below, the nonattainment area preconstruction permit program for the portions of the Moderate ozone nonattainment area located in Maricopa County is administered by the Maricopa County Air Quality Department. On August 15, 1994, the Arizona Department of Environmental Quality submitted to EPA the State Implementation Plan - Maricopa County New Source Review

and Prevention of Significant Deterioration (NSR/PSD) Program for Major Sources and Major Modifications, and New Source Review (NSR) for Minor Sources. The submission included new or amended Maricopa County Air Quality Rules 100, 200, 210, 220, 240, 241, 245, 270, 500 and Appendix B as revisions to the County's approved nonattainment new source review program. These new and amended rules were designed in part to satisfy the requirements of Title I, Part D, Subpart 2 of the Clean Air Act Amendments of 1990 for nonattainment new source review in ozone nonattainment areas as well as all of the requirements of sections 172(c)(5) and 173 of the Clean Air Act. The Arizona Department of Environmental Quality submitted supplemental documentation, amendments to these rules and additional rules implementing the County's new source review program (County Rules 242 and 510) on August 30, 1994, August 31, 1995, February 26, 1997, June 7, 2007 and July 5, 2007.

On May 18, 2016, The Arizona Department of Environmental Quality submitted to EPA the Maricopa County SIP Revision Package: New Source Review Rules as a revision to the Arizona State Implementation Plan. The submission included amended Maricopa County Air Quality Rules 100, 200, 210, 220, 230, 240, 241,500, 510, 600 and Appendices D and E as revisions to the County's new source review program.

The nonattainment area preconstruction permit program for the portions of the Moderate ozone nonattainment area located in Pinal County is administered by the Pinal County Air Quality Control District under a delegation agreement with the Arizona Department of Environmental Quality. Pinal County does not have an approved nonattainment new source review program. Under A.R.S. Section 49-402 A.1., the Arizona Department of Environmental Quality therefore has original jurisdiction over major sources located in the County, and the Department's permitting rules, rather than Pinal County's, apply to these sources. Except as noted below, the Department has delegated responsibility for administering the permitting program for major sources in Pinal County to the District.

On October 29, 2012, the Department submitted to EPA the State Implementation Plan Revision - New Source Review, as a revision to the Arizona State Implementation Plan. The submitted revision included amended state new source review rules (such as Rule R18-2-403, Permits for Sources Located in Nonattainment Areas) that meet current federal requirements. EPA published a limited approval/limited disapproval of the 2012 Revision on November 2, 2015. EPA found that the Revision generally strengthened the State's New Source Review Program but identified deficiencies that the Department must correct before full approval can be granted.

Under A.R.S. Section 49-402 A.1., the Arizona Department of Environmental Quality has original jurisdiction throughout the state, including Maricopa and Pinal Counties, over the following stationary source types: smelting of metal ore, petroleum refineries, coal fired electric generating stations, Portland cement plants and portable sources. In its delegation agreement with Pinal County, the Department retained jurisdiction over these source types. The Department therefore administers the nonattainment area preconstruction permit

program in both Maricopa and Pinal County with respect to sources falling within these categories.

Offset Requirements

Section 182(b)(5) of the Clean Air Act requires emission offsets in the form of a ratio of total emission reductions of volatile organic compounds to total increased volatile organic compound emissions of at least 1.15 to 1 for major sources in the Maricopa nonattainment area. Clean Air Act Section 182(f) triggers application of the emission ratio offset requirement in Section 182(b)(5) to major sources of NOx. Both the Maricopa County and State rules included in the New Source Review SIP revisions referenced above satisfy this requirement. See Arizona Administrative Code Rule 18-2-404(J) and Maricopa County Air Pollution Control Regulations, Rule 240, Section 304.6.

CHAPTER FIVE

THE ADOPTED PLAN

The overall approach taken in the MAG 2017 Eight-Hour Ozone Moderate Area Plan is to demonstrate attainment in the Maricopa eight-hour ozone nonattainment area with existing federal, state and local ozone control measures. The implementation of existing ozone control measures in the Maricopa eight-hour ozone nonattainment area has already been effective in reducing ozone. These measures have allowed the area to attain and maintain both the one-hour ozone standard and the 1997 eight-hour ozone standard of 0.08 parts per million.

The existing ozone control measures continue to have emission reduction benefits that provide for attainment of the 2008 ozone standard in the Maricopa nonattainment area by the July 20, 2018 attainment date, as demonstrated in Chapter Six. The emission reduction benefits of the existing measures also continue beyond the attainment year of 2017, providing the emission reductions needed in 2018 to satisfy the contingency measure requirements of Clean Air Act Section 172(c)(9).

Descriptions of the 93 existing ozone control measures in the Maricopa nonattainment area are included below. While all of the existing measures in the nonattainment area assist in the improvement of air quality, only a subset of measures have emission reduction benefits that can be quantified. Measures with quantifiable benefits that are used to both demonstrate attainment and meet contingency measure requirements are described separately below.

EXISTING MEASURES

Table 5-1 identifies 93 existing and approved ozone control measures in the Maricopa nonattainment area from EPA-approved regional air quality plans and separate EPA actions. The source of the existing measures listed in Table 5-1 is most often the EPA approved plan or separate action in which the measure first appeared, although a specific measure may appear in more than one EPA-approved plan or action.

The majority of the existing measures are committed state and local measures that have been adopted and approved by EPA in prior regional air quality plans such as the Serious Area Ozone Plan (ADEQ, 2000), the Serious Area Carbon Monoxide Plan (MAG, 2001), the Carbon Monoxide Maintenance Plan (MAG, 2003), the One-Hour Ozone Maintenance Plan (MAG, 2004), the Eight-Hour Ozone Plan (MAG, 2007), and the Eight-Hour Ozone Maintenance Plan (MAG, 2009). Existing federal measures that reduce ozone in the Maricopa nonattainment area are also included in Table 5-1. Table 5-1 lists the existing control measure, the source category the control measure is applicable to (e.g., point sources), the ozone precursor pollutants reduced by the measure, and the approved plan or EPA action in which the measure appears.

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

Existing Control Measure		Source Category	Pollutant	Source
1	Phased-In Emission Test Cutpoints	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
2	Enhanced Emission Testing of Constant Four-Wheel Drive Vehicles	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
3	One-Time Waiver from Vehicle Emissions Test	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
4	Increased Waiver Repair Limit Options	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
5	Gross Polluter Option for I/M Program Waivers	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
6	Catalytic Converter Replacement Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
7	Vehicle Repair Grant Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
8	Voluntary Vehicle Repair and Retrofit Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
9	Tougher Enforcement of Vehicle Registration and Emissions Test Compliance	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
10	Random Roadside Testing of Diesel Vehicles	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
11	Snap Acceleration Test for Heavy-Duty Diesel	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
12	Require Pre-1988 Heavy-Duty Diesel Commercial Vehicles Registered in the Nonattainment Area to Meet 1988 Federal Emissions Standards; Provide Incentives to Encourage Voluntary Accelerated Vehicle Replacement by the Year 2004	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
13	Long-Term Fuel Reformulation: From and After May 1, 1999	Onroad/Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
14	Limit Sulfur Content of Diesel Fuel Oil to 500 ppm	Onroad/Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
15	Diesel Fuel Sampling and Reporting	Onroad/Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
16	Alternative Fuel Vehicles for Local Governments, School Districts and Federal Government/Low Emission Vehicle Requirements	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
17	Alternative Fuel Vehicles for State Government/Low Emission Vehicle Requirements	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
18	Alternative Fuel Vehicle and Equipment Tax Incentives/Low Emission Vehicle Requirements	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
19	Public Awareness Program for Alternative Fuels	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
20	National Low Emission Vehicle Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
21	Voluntary Gasoline Vehicle Retirement Program/Maricopa County Travel Reduction Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
22	Oxidation Catalyst for Heavy Duty Diesel Vehicles	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
23	Mass Transit Alternatives	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
24	Develop Intelligent Transportation Systems	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
25	Special Event Controls-Required Implementation from List of Approved Strategies	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
26	Voluntary Lawn Mower Emission Reduction Program	Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
27	Off-Road Vehicle and Engine Standards	Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
28	Encourage the Use of Temporary Electrical Power Lines Rather than Portable Generators at Construction Sites	Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
29	Defer Emissions Associated with Government Activities	Onroad/Nonroad/ Area	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
30	Encourage Limitations on Vehicle Idling	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
31	Expansion of Area A boundaries	Onroad/Nonroad/ Area	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
32	Voluntary No-Drive Days	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
33	Analysis of Intersource Credit Trading and Banking Program	Onroad/Nonroad/ Area/Point	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
34	Expansion of Public Transportation Programs	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
35	Employer Rideshare Program Incentives	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
36	Preferential Parking for Carpools and Vanpools	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
37	Coordinate Traffic Signal Systems	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
38	Reduce Traffic Congestion at Major Intersections	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
39	Site-Specific Transportation Control Measures	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
40	Encouragement of Bicycle Travel	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
41	Development of Bicycle Travel Facilities	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
42	Alternative Work Schedules	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
43	Land Use/Development Alternatives	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
44	Encouragement of Pedestrian Travel	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
45	Restrictions on the Use of Gasoline-Powered Blowers for Landscaping Maintenance	Nonroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

Existing Control Measure		Source Category	Pollutant	Source
46	Alternative Fuels for Fleets	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
47	Areawide Public Awareness Programs	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
48	Encouragement of Vanpooling	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
49	Trip Reduction Program	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
50	Park and Ride Lots	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
51	Encouragement of Telecommuting, Teleworking and Teleconferencing	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
52	Promotion of High Occupancy Vehicle Lanes and By-Pass Ramps	Onroad	VOC, NOx, CO	Revised MAG 1999 Serious Area Carbon Monoxide Plan (2001) EPA final approval March 2005, 70 FR 11553
53	MCAQD Rule 331 - Solvent Cleaning	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
54	MCAQD Rule 333 - Petroleum Solvent Dry Cleaning	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
55	MCAQD Rule 334 - Rubber Sports Ball Manufacturing	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
56	MCAQD Rule 335 - Architectural and Industrial Coating	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
57	MCAQD Rule 336 - Surface Coating Operations	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
58	MCAQD Rule 337 - Graphic Arts	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
59	MCAQD Rule 338 - Semiconductor Manufacturing	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
60	MCAQD Rule 339 - Vegetable Oil Extraction Process	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
61	MCAQD Rule 340 - Cutback and Emulsified Asphalt	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
62	MCAQD Rule 341 - Metal Casting	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
63	MCAQD Rule 342 - Coating Wood Furniture and Fixtures	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
64	MCAQD Rule 343 - Commercial Bread Bakeries	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
65	MCAQD Rule 344 - Windshield Washer Fluid	Point/Area	VOC	Final Serious Area Ozone SIP, Appendix A. (2000) EPA final approval June 2005, 70 FR 34362
66	MCAQD Rule 346 - Coating Wood Millwork	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
67	MCAQD Rule 347 - Ferrous Sand Casting	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
68	MCAQD Rule 348 - Aerospace Manufacturing and Rework Operations	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
69	MCAQD Rule 349 - Vitamin Manufacturing	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
70	MCAQD Rule 350 - Storage of Organic Liquids at Bulk Plants and Terminals	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
71	MCAQD Rule 351 - Loading of Organic Liquids	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
72	MCAQD Rule 352 - Gasoline Delivery Vessel Testing and Use	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
73	MCAQD Rule 353 - Transfer of Gasoline in Stationary Storage Dispensing Tanks	Point/Area	VOC	Final Serious Area Ozone SIP (2000) EPA final approval June 2005, 70 FR 34362
74	Clean Air Campaign	Onroad/Nonroad/ Point/Area	VOC, NOx, CO	Final Serious Area Ozone SIP, Appendix A. (2000) EPA final approval June 2005, 70 FR 34362
75	Allow Use of High Occupancy Vehicle Lanes and Freeway Ramps by Alternative Fueled Vehicles	Onroad	VOC, NOx, CO	Final Serious Area Ozone SIP, Appendix A. (2000) EPA final approval June 2005, 70 FR 34362
76	MCAQD Rule 358 - Polystyrene Foam Operations	Point/Area	VOC	MAG Eight-Hour Ozone Plan (2007) EPA final approval June 2012, 77 FR 35285
77	Federal Heavy Duty Diesel Vehicle Emissions Standards (Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, EPA final rule January 2001, 66 FR 5002)	Onroad	VOC, NOx, CO	MAG Eight-Hour Ozone Plan (2007) EPA final approval June 2012, 77 FR 35285

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
78	Federal Nonroad Equipment Emissions Standards (Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel, EPA final rule June 2004, 69 FR 38958 and Control of Emissions of Air Pollution From Nonroad Diesel Engines, EPA final rule October 1998, 63 FR 56968)	Nonroad	VOC, NOx, CO	MAG Eight-Hour Ozone Plan (2007) EPA final approval June 2012, 77 FR 35285
79	Ban on Open Burning	Area	VOC, NOx, CO	MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan (2009) EPA final approval September 2014, 79 FR 55645
80	National Autobody Refinishing Rule	Point/Area	VOC	15 Percent Rate of Progress FIP (1998) EPA final rule July 1999, 64 FR 36243
81	National Consumer Products Rule	Area	VOC	15 Percent Rate of Progress FIP (1998) EPA final rule July 1999, 64 FR 36243
82	Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements	Onroad	VOC, NOx, CO	EPA final rule February 2000, 65 FR 6698
83	Control of Hazardous Air Pollutants From Mobile Sources (Including VOCs from portable gas cans)	Onroad/Area	VOC	EPA final rule February 2007, 72 FR 8428
84	Control of Emissions of Air Pollution From Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder	Nonroad	VOC, NOx, CO	EPA final rule May 2008, 73 FR 25098

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
85	Control of Emissions From Nonroad Spark-Ignition Engines and Equipment	Nonroad	VOC, NOx, CO	EPA final rule October 2008, 73 FR 59034
86	MCAQD Rule 322 - Power Plant Operations	Point/Area	NOx	EPA final approval October 2009, 74 FR 52693
87	MCAQD Rule 323 - Fuel Burning Equipment from Industrial/Commercial/Institutional (ICI) Sources	Point/Area	NOx	EPA final approval October 2009, 74 FR 52693
88	MCAQD Rule 324 - Stationary Internal Combustion (IC) Engines	Point/Area	NOx	EPA final approval October 2009, 74 FR 52693
89	National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters	Point	VOC, NOx, CO co-benefit	EPA final rule March 2011, 76 FR 15608
90	Phase 1 Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles	Onroad	VOC, NOx, CO co-benefit	EPA final rule September 2011, 76 FR 57106
91	Phase 1 and Phase 2 Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards	Onroad	VOC and NOx co-benefit	EPA final rules May 2010, 75 FR 25324 and October 2012, 77 FR 62624

Table 5-1

Existing Ozone Control Measures in the Maricopa Eight-Hour Ozone Nonattainment Area

	Existing Control Measure	Source Category	Pollutant	Source
92	National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines; New Source Performance Standards for Stationary Internal Combustion Engines	Point/Area	VOC, NOx, CO co-benefit	EPA final rules January 2013, 78 FR 6674; August 2010, 75 FR 51570; March 2010, 75 FR 9648
93	Tier 3 Motor Vehicle Emission and Fuel Standards	Onroad	VOC, NOx, CO	EPA final rule April 2014, 79 FR 23414

MEASURES USED FOR NUMERIC CREDIT

The existing federal, state and local ozone control measures used in demonstrating attainment of the 2008 ozone standard are listed below:

1. Summer Fuel Reformulation: California Phase 2 and Federal Phase II Reformulated Gasoline with 7 psi from May 1 through September 30 (Measure 13 in Table 5-1)
2. Phased-In Emission Test Cutpoints (Measure 1 in Table 5-1)
3. One-Time Waiver from Vehicle Emissions Test (Measure 3 in Table 5-1)
4. Tougher Enforcement of Vehicle Registration and Emissions Test Compliance (Measure 9 in Table 5-1)
5. Expansion of Area A Boundaries (Measure 31 in Table 5-1)
6. Gross Polluter Option for I/M Program Waivers (Measure 5 in Table 5-1)
7. Coordinated Traffic Signal Systems (Measure 37 in Table 5-1)
8. Develop Intelligent Transportation Systems (Measure 24 in Table 5-1)
9. Federal Tier 2 and Tier 3 Motor Vehicle Emissions and Fuel Standards (Measures 82 and 93 in Table 5-1)
10. Federal Phase 1 and 2 Light-Duty Vehicle and Phase 1 Medium and Heavy-Duty Vehicle Greenhouse Gas Rules (Measures 90 and 91 in Table 5-1)
11. Federal Nonroad Equipment Standards (Measures 78 and 85 in Table 5-1)
12. Federal Heavy Duty Diesel Vehicle Emissions Standards (Measure 77 in Table 5-1)
13. Federal Portable Fuel Container Rules (Measure 83 in Table 5-1)

The emissions reduction benefits of ozone control measures 1 through 12 listed above are included in the onroad and nonroad emissions inventories that were developed using the EPA MOVES2014a model. The emissions reduction credit of these measures are aggregated by onroad and nonroad mobile source categories. Measures 1 through 12 provide onroad mobile source emission reductions, on an average ozone season day in 2017, of 25.3 metric tons per day of volatile organic compounds (VOC) and 54.5 metric tons/day of nitrogen oxides (NOx). Nonroad mobile source emission reductions in 2017 for these measures are 7.6 metric tons per day of VOC and 17.3 metric tons per day of NOx.

The emission reduction credit for measure 13 listed above, on an average ozone season day in 2017, is 6.2 metric tons per day of VOC, as calculated with emissions data provided by EPA. The methodologies used to quantify the emission reduction credit for the above listed measures is further described in Section V of the Technical Support Document. A detailed description of each measure used for numeric credit is provided below.

1. *Summer Fuel Reformulation: California Phase 2 and Federal Phase II Reformulated Gasoline with 7 psi from May 1 through September 30*

The Arizona Legislature passed H.B. 2307 in 1997 which contains requirements for the sale of gasoline from and after May 1, 1999 in Area A, subject to an appropriate waiver granted

under Section 211(c)(4) of the Clean Air Act, that meets the following fuel reformulation options:

- California Phase 2 Reformulated Gasoline, including alternative formulations allowed by the predictive model, as adopted by the California Air Resources Board pursuant to the California Code of Regulations, Title 13, Sections 2261 through 2262.7 and 2265, in effect on January 1, 1997, that meets the maximum 7.0 psi summertime vapor pressure requirements in A.R.S. Section 41-2083, Subsections D and F. (now in A.R.S. Section 3-3433, Subsection F)

- Gasoline that meets the standards for Federal Phase II Reformulated Gasoline, as provided in 40 CFR Section 80.41, paragraphs (a) through (h), in effect on January 1, 1997, that meets the maximum 7.0 psi summertime vapor pressure requirement in A.R.S. Section 41-2083 Subsections D and F. (now in A.R.S. Section 3-3433, Subsection F).

On February 10, 1998, the Environmental Protection Agency approved Arizona's cleaner burning gasoline (CBG) program into the State Implementation Plan. The program was implemented in two stages - from June to September 1998, gasoline sold in the area had to meet the standards similar to Federal Phase I Reformulated Gasoline or California's Phase 2 Reformulated Gasoline. Then, beginning May 1, 1999, all gas sold in the area had to meet standards similar to Federal Phase II or California's Phase 2 Reformulated Gasoline.

Arizona's CBG Program was included in the 1998 metropolitan Phoenix Ozone 15 Percent Rate of Progress Federal Implementation Plan as a committed control measure for emissions reduction credit. On July 6, 1999, EPA finalized a rule revising the federal plan as it related to the CBG Program.

On April 28, 2000, Senate Bill 1504 was signed into law by the Governor of Arizona. The law revised A.R.S. Section 41-2124 by eliminating the minimum oxygenate requirement for summertime gasoline in Maricopa County. Because of the cost and difficulty of blending ethanol in CBG and meeting the 7.0 psi Reid Vapor Pressure standard, methyl tertiary butyl ether (MTBE) had been the primary oxygenate used in Arizona's summertime CBG. In addition, A.R.S. Section 41-2122. E. (now in A.R.S. Section 3-3491. E.) prohibited the use of MTBE in gasoline beginning on January 1, 2005.

On September 29, 2003, the Environmental Protection Agency published a notice proposing to approve revisions to the Arizona Clean Burning Gasoline Program currently approved in the State Implementation Plan. The revisions replace Arizona's interim CBG program with a permanent program, amend the wintertime CBG program to limit the types of gasoline that may be supplied, and remove the minimum oxygen requirement for summertime gasoline. On January 26, 2004, the EPA Administrator signed the final

approval notice for the revisions to the Arizona Clean Burning Gasoline Program. The final notice was published in the Federal Register on March 4, 2004, effective on April 5, 2004.

2. *Phased-In Emission Test Cutpoints*

The Arizona Vehicle Inspection Maintenance Program was established in 1976 to promote the clean operation of motor vehicles by controlling vehicle exhaust emissions. The program is operated by the Arizona Department of Environmental Quality and contains the provisions listed in Section 182(c)(3) of the Clean Air Act for an Enhanced Vehicle Inspection and Maintenance Program. This program exceeds the motor vehicle inspection and maintenance requirements for Moderate areas listed in Clean Air Act Section 182(b)(4).

The Vehicle Emissions Inspection Maintenance Program was significantly enhanced and strengthened by the Arizona Legislature in 1993 (H.B. 2001). The Legislature established a biennial, transient loaded (I/M 240) emissions test for gasoline powered vehicles model year 1981 or newer with a gross vehicle weight of up to 8,500 pounds, beginning January 1, 1995.

In 1993, the Arizona Legislature passed H.B. 2001 which increased the repair threshold limits for gasoline powered vehicles in order to be eligible for a waiver through the Vehicle Emissions Inspection Maintenance Program. The repair limits were increased in the following manner: 1967-1974 from $50 to $100; 1975-1980 from $200 to $300; and 1981 and newer from $300 to $450. The bill also increased the repair threshold limits from $300 to $500 for diesel powered vehicles with tandem axles or a gross vehicle weight in excess of 26,000 pounds.

The Arizona Legislature passed H.B. 2237 in 1997 which contained an appropriation of $120,000 from the State General Fund to the Arizona Department of Environmental Quality to develop and implement an alternative test protocol to reduce the false failure rates associated with the more stringent pass-fail standards for the Vehicle Emissions Testing Program (Section 19 of H.B. 2237).

In addition, the Arizona Department of Environmental Quality was to implement Interim Test Cutpoints for the Vehicle Emissions Inspection Program until issues were resolved with the final test cutpoints for the I/M 240 Program. The Interim Cutpoints were selected to achieve the following failure rates in three vehicle class categories (Light Duty Gasoline Vehicles, Light Duty Gasoline Trucks 1, and Light Duty Gasoline Trucks 2: 50 percent for Model Years 1981-85; 25 percent for 1986 to 1989 model years, and 10 percent for Model Years 1990-93).

In August 2002, EPA proposed approval of the Arizona I/M Program and signed the final approval notice on October 31, 2002. The final approval notice was published in the Federal Register on January 22, 2003. In 2016, the Arizona Legislature passed S.B. 1255 which includes a statutory provision that authorizes the Arizona Vehicle Emissions

Inspection Program through July 1, 2022 (A.R.S. Section 41-3022.09). S.B. 1255 and associated fact sheet are included in Appendix B, Exhibit 2.

3. *One-Time Waiver from Vehicle Emissions Test*

The Arizona Legislature passed S.B. 1002 in 1996 which limits the issuance of a waiver for failure to comply with the emission testing requirements to one-time only beginning January 1, 1997 (A.R.S. Section 49-542 D)

4. *Tougher Enforcement of Vehicle Registration and Emissions Test Compliance*

The Motor Vehicle Division (MVD) of the Arizona Department of Transportation (ADOT) has instituted a comprehensive vehicle registration enforcement program. Three key elements of the new program are a Registration Enforcement Team, a Registration Enforcement Tracking System, and a New Resident Tracking Program. Through public participation, consistent policy and procedure application, and new tracking methods, MVD will enforce the Arizona registration laws to ensure vehicles in question are registered properly. This will be an ongoing effort.

Another phase of the Program is an initiative to coordinate ADOT efforts with other law enforcement agencies to assist MVD personnel in enforcing registration compliance. Other initiatives include a system user agreement between MVD and the City Courts to utilize information in conjunction with registration compliance and discussions with U.S. West (now known as Century Link) for obtaining information relating to new connect customers.

The Arizona Legislature passed S.B. 1427 in 1998 which requires school districts and special districts in Area A to prohibit parking in employee parking lots by employees who have not complied with emissions testing requirements. Cities, towns, and counties in Area A and Area B are currently subject to this provision (A.R.S. Section 49-552).

In 1999, the Arizona Legislature passed H.B. 2254 which requires each vehicle that is owned by the United States government and that is domiciled in this state for more than ninety consecutive days and each vehicle that is owned by a state or political subdivision of this state to comply with A.R.S. Section 49-542.

5. *Expansion of Area A Boundaries*

The Arizona Legislature passed H.B. 2538 in 2001 which expands the boundaries of Area A. Previously, the Area A boundaries followed the boundaries defined by S.B. 1427, which was passed by the Arizona Legislature in 1998. Specifically, H.B. 2538 expands the boundaries of Area A past those described in S.B. 1427, adding additional portions of Maricopa County west of Goodyear and Peoria and a small piece of land on the north side of Lake Pleasant. The implementation of air quality measures in the areas described in H.B. 2538 began on January 1, 2002, except for public sector alternative fuel requirements that are phased in over a seven year period.

"Area A" means the area delineated as follows (A.R.S. 49-541.1.):

(a) In Maricopa County:
Township 8 North, Range 2 East and Range 3 East
Township 7 North, Range 2 West Through Range 5 East
Township 6 North, Range 5 West Through Range 6 East
Township 5 North, Range 5 West Through Range 7 East
Township 4 North, Range 5 West Through Range 8 East
Township 3 North, Range 5 West Through Range 8 East
Township 2 North, Range 5 West Through Range 8 East
Township 1 North, Range 5 West Through Range 7 East
Township 1 South, Range 5 West Through Range 7 East
Township 2 South, Range 5 West Through Range 7 East
Township 3 South, Range 5 West Through Range 1 East
Township 4 South, Range 5 West Through Range 1 East

(b) In Pinal County:
Township 1 North, Range 8 East And Range 9 East
Township 1 South, Range 8 East And Range 9 East
Township 2 South, Range 8 East And Range 9 East
Township 3 South, Range 7 East Through Range 9 East

(c) In Yavapai County:
Township 7 North, Range 1 East And Range 1 West Through Range 2 West
Township 6 North, Range 1 East And Range 1 West

6. *Gross Polluter Option for I/M Program Waivers*

The Arizona Legislature passed Senate Bill 1427 in 1998. This legislation requires that in order to obtain a waiver from compliance with the Vehicle Emissions Inspection Program, the owner of a vehicle emitting more than twice the emission standard has to repair the vehicle sufficiently to reduce the emission levels to less than twice the emissions standard (A.R.S. Section 49-542).

7. *Coordinated Traffic Signal Systems*

House Bill 2237 passed in 1997 contained an appropriation of $500,000, in each of fiscal years 1997-1998 and 1998-1999 from the State General Fund, to the Arizona Department of Transportation for distribution to cities and counties for synchronization of traffic control signals within and across jurisdictional boundaries (Section 23 of H.B. 2237).

In addition, the cities, towns, and ADOT also responded to the measure, Coordinate Traffic Signal Systems. The synchronization of existing traffic signals, as well as the enhancement of coordination in signal systems which are already synchronized, has been identified by many jurisdictions through a number of programs. Enhancement efforts range from large

scale programs covering broad geographic areas to incremental additions of a few synchronized signals to the network. This includes both individual city projects and regional level programs, such as “AZ Tech” which is noted under measure #8, “Develop Intelligent Transportation Systems” below. This measure reduces VOC and NOx emissions by increasing vehicle speeds and reducing congestion.

8. *Develop Intelligent Transportation Systems*

Nearly all of the local jurisdictions are planning and implementing advanced technology based solutions to address complex traffic management issues on the regional transportation network. These technologies involve the application of electronics, telecommunications and sensor technologies and are collectively referred to as Intelligent Transportation Systems (ITS). This measure reduces VOC and NOx emissions by increasing vehicle speeds and reducing congestion.

9. *Federal Tier 2 and Tier 3 Motor Vehicle Emissions and Fuel Standards*

In 2000, EPA issued a final rule setting Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements (65 FR 6698). The Tier 2 Program set the standards for tailpipe emissions for all passenger vehicles, including sport utility vehicles (SUVs), minivans, vans, and pick-up trucks, beginning in 2004. The Tier 2 Program also required reduced levels of sulfur in gasoline.

In 2014, EPA issued Tier 3 motor vehicle emission and fuel standards (79 FR 23414). Starting in 2017, Tier 3 sets new vehicle emissions standards and lowers the sulfur content of gasoline. The vehicle emissions standards reduce both tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles.

10. *Federal Phase 1 and 2 Light-Duty Vehicle and Phase 1 Medium and Heavy-Duty Vehicle Greenhouse Gas Rules*

In 2010, EPA finalized phase 1 light-duty vehicle greenhouse gas emissions standards and corporate average fuel economy standards for model year 2012-2016 vehicles (75 FR 25324). In 2012, EPA finalized phase 2 light-duty vehicle greenhouse gas emissions standards and corporate average fuel economy standards for model year 2017-2025 vehicles (77 FR 62624). Phase 1 greenhouse gas emissions standards and fuel efficiency standards for medium- and heavy-duty engines and vehicles were adopted by EPA in 2011 for model year 2014-2018 vehicles and engines (76 FR 57106).

These rules reduce fuel consumption and greenhouse gas emissions from light-duty, medium-duty and heavy-duty vehicles and engines. Reductions in fuel consumption by these vehicles provides a co-benefit in the form of reduced VOC and NOx emissions from the use and refueling of these vehicles.

11. *Federal Nonroad Equipment Standards*

In 1998, EPA issued a final rule setting more stringent Tier 2 and Tier 3 emission standards for new diesel nonroad equipment (63 FR 56968). The Tier 2 program phased in more stringent standards for all equipment types between 2001 and 2006. The Tier 3 program imposed even more stringent standards for 50 to 750 horsepower (hp) engines, beginning in 2005 through 2008.

In 2004, EPA issued the Clean Air Diesel - Tier 4 Final Rule that requires manufacturers to produce nonroad engines with advanced emission-control technologies that will reduce emissions by an additional 90 percent or more (69 FR 38958). The Tier 4 standards apply to nonroad engines with less than 25 hp, beginning in 2008. The Tier 4 standards for larger engines will be phased in between 2011 and 2015, depending upon the size and type of engine.

In 2008, EPA adopted new standards for emissions of hydrocarbons (HC), nitrogen oxides (NOx), and carbon monoxide (CO) from a variety of nonroad engines, equipment, and vessels that cause or contribute to air pollution (73 FR 59034). For small nonroad engines, EPA set new HC+NOx exhaust emission standards of 10 g/kW-hr for Class I engines starting in the 2012 model year and 8 g/kW-hr for Class II engines starting in the 2011 model year. The EPA rule additionally includes new evaporative emission standards for both handheld and non-handheld equipment EPA also set a more stringent level of emission standards for outboard and personal watercraft engines starting with the 2010 model year in the final rule.

12. *Federal Heavy Duty Diesel Vehicle Emissions Standards*

In 2001, EPA issued a final rule setting more stringent emission standards for new heavy duty diesel vehicles (66 FR 5002). The rule requires that high-efficiency catalytic converters or comparably effective technologies be installed on 2007 and later model year diesel vehicles. Because these devices are damaged by sulfur, the rule also mandated that ultra-low sulfur (i.e., 15 ppm sulfur or less) diesel fuel be used in all onroad diesel vehicles beginning in 2006. The requirement for all onroad diesel vehicles to use ultra-low sulfur fuel went into effect nationwide on October 15, 2006.

13. *Federal Portable Fuel Container Rules*

In 2007, EPA issued a final rule that includes emission standards for portable fuel containers, such as gas cans (72 FR 8428). Gas cans are consumer products used to refuel a wide variety of gasoline-powered equipment, including lawn and garden equipment, recreational equipment, and passenger vehicles. Starting with containers manufactured in 2009, the standard limits evaporation and permeation emissions from these containers to 0.3 grams of hydrocarbons per gallon per day.

CONTINGENCY MEASURES

Section 172(c)(9) of the Clean Air Act requires that the State Implementation Plans provide for the implementation of contingency measures without any further rulemaking action if the Moderate area fails to attain or to meet the standard by the attainment date. Since EPA allows early implementation of contingency measures (EPA, 1993), existing measures that have already been implemented may be contingency measures if they are not needed to show attainment and do not hasten attainment. EPA also allows federal measures to be contingency measures if they are not needed for attainment (EPA, 2015a).

The emission reduction benefits of the existing measures in Table 5-1 continue to provide emission reductions beyond the attainment year of 2017, into the continency year of 2018. The same 13 existing measures that were quantified to show attainment in 2017, as discussed in the prior section, were also used to quantify emission reductions in 2018. The emission reductions achieved by these measures in 2018 allow these measures to be used as contingency measures that meet the requirements of Clean Air Act Section 172(c)(9). The methodologies used to quantify the emission reduction impact of these contingency measures are described in Chapter Six of this plan and Section V of the Technical Support Document.

ASSURANCES THAT THE STATE HAS THE AUTHORITY TO IMPLEMENT THE MEASURES IN THE PLAN

In order to comply with Section 110(a)(2)(E) of the Clean Air Act, a State law was passed in 1992 which provides an approach for assurances that State and local measures will be adequately implmented (A.R.S. Section 49-406 I. and J.). If any person (includes State, County, local governments, regional agencies, and other entities) fails to implement a measure as described in the resolution adopted pursuant to A.R.S. Section 49-406 G., the County would file an action in Superior Court to have the Court order that the measure be implemented. Likewise, the Director of the Arizona Department of Environmental Quality will backstop the County if it fails to implement a measure or if the County fails to backstop the local governments and regional agencies.

Regarding measures, A.R.S. Section 49-406 G. (passed by the Legislature in 1992) requires that each agency which commits to implement any control measure contained in the State Implementation Plan must describe the commitment in a resolution. The resolution must be adopted by the appropriate governing body of the agency. State law also requires the entity to specify the following information in the resolutions: (1) its authority for implementing the limitation or measure as provided in statute, ordinance, or rule; (2) a program for the enforcement of the limitation or measure; and (3) the level of personnel and funding allocated to the implementation of the measure.

As noted in the MAG regional air quality plans, the action taken by the MAG Regional Council to approve the Suggested Measures and Adopted Plan Measures does not commit each jurisdiction to implement those measures. As indicated in the resolutions and

commitments, each jurisdiction determines which measures are reasonably available for implementation by that jurisdiction.

TRACKING PLAN IMPLEMENTATION

The Maricopa County Air Quality Department determines reasonable further progress and reviews the implementation status of the various measures contained in the air quality plans. The Maricopa County Air Quality Department will also continue to have the responsibility for conducting ambient air quality monitoring.

Supplemental to these tracking efforts, the Maricopa Association of Governments publishes regional traffic flow maps and calculates regional vehicle miles of travel from these flow maps. MAG also conducts vehicle occupancy studies and performs special traffic volume and speed studies, as needed. Phoenix Public Transit continuously monitors transit ridership for each month. The Regional Public Transportation Authority will also be collecting transit and carpooling ridership information. The Arizona Department of Environmental Quality continuously monitors the number of vehicles inspected in the Vehicle Emissions Inspection Maintenance Program, the number of vehicles failing the test, and the improvement in tail pipe emissions after failed vehicles are repaired.

In addition, the MAG Air Quality Technical Advisory Committee will review the information pertaining to the implementation of measures. The committee will also review the air quality monitoring data to assist in tracking air quality improvement over time.

CHAPTER SIX

ATTAINMENT DEMONSTRATION AND WEIGHT OF THE EVIDENCE ANALYSIS

This chapter documents the attainment demonstration for the 2008 ozone standard for the Maricopa eight-hour ozone nonattainment area. Photochemical air quality grid modeling has been performed to determine if the Maricopa eight-hour ozone nonattainment area will meet the 2008 ozone standard of 0.075 ppm by July 20, 2018. The modeling concludes that the Maricopa eight-hour ozone nonattainment area will meet the 2008 ozone standard with existing federal, state, and local ozone control measures.

The conclusion that the 2018 ozone standard will be attained by July 20, 2018 is supported by results of EPA-recommended supplemental or weight of evidence analyses. A detailed description of the modeled attainment demonstration and weight of evidence analysis is provided in the Technical Support Document (TSD).

To support the finding of attainment, this chapter discusses the attainment date, modeling emissions inventories, attainment measures, modeled attainment demonstration, and weight of evidence analysis. Other Clean Air Act requirements for an attainment demonstration, addressed at the end of this chapter, include the onroad mobile source emissions budgets for conformity, reasonable further progress, and contingency measures.

ATTAINMENT DATE

The Maricopa eight-hour ozone nonattainment area is classified as a Moderate Area for the 2008 ozone standard of 0.075 parts per million (81 FR 26697). The attainment date for the Moderate nonattainment area is July 20, 2018. Since the attainment date is in the middle of the 2018 ozone season, EPA requires that control measures be implemented and attainment be modeled for the ozone season in the year that precedes the attainment date, in this case, 2017.

The MAG 2017 Eight-Hour Ozone Moderate Area Plan demonstrates through photochemical air quality grid modeling and other supporting technical analyses that attainment will be achieved by the end of the 2017 ozone season. For the eight-hour ozone modeling analysis, the Comprehensive Air Quality Model with Extensions (CAMx) was used to simulate ozone concentrations during the ozone season months of May 1 through September 30 for the 2011 base year and the 2017 attainment year. Modeling the entire months of May through September (153 days) ensures that the model not only demonstrates attainment on the ten highest modeled ozone concentration days, but also under a variety of meteorological conditions, during periods of low and high ozone production.

The purpose of the photochemical grid modeling is to demonstrate attainment of the eight-

hour ozone standard with the existing and implemented federal, state and local ozone control measures. The modeled attainment demonstration in this chapter verifies that the implemented federal, state and local control measures provide the emission reductions necessary to attain the 2008 ozone standard by the end of the 2017 ozone season.

Expeditious Attainment

The attainment demonstration discussed in this chapter indicates that the existing ozone control measures will achieve modeled attainment at all monitors in 2017, meeting the July 20, 2018 attainment date for Moderate nonattainment areas. The reasonably available control measures analysis in Chapter Four analyzed whether the attainment date could be advanced by up to one year, which would be July 20, 2017. That analysis concluded it would be infeasible to meet the standard by July 20, 2017, as any new or strengthened ozone control measure would have to be in place by April 1, 2016, which would be prior to both the adoption and submittal date of the MAG 2017 Eight-Hour Ozone Moderate Area Plan and the effective date of the EPA final rule reclassifying the Maricopa nonattainment area to a Moderate Area.

In addition, preliminary 2016 ozone concentration data at the Pinnacle Peak monitor indicates that the monitor may violate the 2008 ozone standard with a 2014-2016 ozone design value of 0.076 ppm, just 0.001 ppm over the standard. For these reasons, the existing measures included in the MAG 2017 Eight-Hour Ozone Moderate Area Plan demonstrate attainment as expeditiously as practicable by the end of the 2017 ozone season.

EMISSIONS INVENTORIES

The ozone season average daily modeling emissions for the period of May - September in 2011 and 2017 by source category are provided in Table 6-1 for the Maricopa eight-hour ozone nonattainment area and Table 6-2 for the 4 km grid modeling domain. Wildfire emissions are excluded from the ozone season average daily emissions for the five month period because wildfires occurred on specific days in 2011 and assumed to be constant between 2011 and 2017. The methodologies and assumptions used in developing the base year (2011) and attainment year (2017) emissions inventories are described in Section III of the Technical Support Document.

Pie charts of the average daily 2011 and 2017 VOC, NOX and CO emissions by source category are presented for the Maricopa eight-hour ozone nonattainment area in Figures 6-1 through 6-3, respectively. Figures 6-4 through 6-6 present pie charts of the VOC, NOx and CO emissions by source category in the 4 km grid modeling domain. The daily average ozone season (May through September) emissions for anthropogenic and biogenic sources, and wildfires are provided in Appendix E of the Technical Support Document.

Table 6-1

Ozone Season Average Daily Emissions during May - September in 2011 and 2017 for the Maricopa Eight-Hour Ozone Nonattainment Area (metric tons/day)

	2011			2017		
	VOC	NOx	CO	VOC	NOx	CO
Point	2.47	7.02	4.41	3.32	13.75	6.75
Area	94.46	10.96	7.71	96.05	12.59	8.50
Nonroad Mobile	27.89	53.58	343.58	20.26	36.26	310.41
Onroad Mobile	70.96	117.15	675.97	45.65	62.69	492.98
Biogenic	487.52	2.37	63.46	487.52	2.37	63.46
Total	683.30	191.08	1,095.13	652.80	127.66	882.10

Table 6-2

Ozone Season Average Daily Emissions during May - September in 2011 and 2017 for the 4 km Grid Modeling Domain (metric tons/day)

	2011			2017		
	VOC	NOx	CO	VOC	NOx	CO
Point	3.33	7.40	5.95	4.16	14.16	7.98
Area	103.79	11.16	10.09	105.54	12.81	11.02
Nonroad Mobile	36.60	62.78	387.21	26.89	43.49	350.04
Onroad Mobile	78.71	144.63	748.33	51.31	80.85	543.04
Biogenic	1,336.57	6.32	169.62	1,336.57	6.32	169.62
Total	1,559.00	232.29	1,321.20	1,524.47	157.63	1,081.70

Figure 6-1

Ozone Season Average Daily VOC Emissions in 2011 and 2017 in the Maricopa Eight-Hour Ozone Nonattainment Area

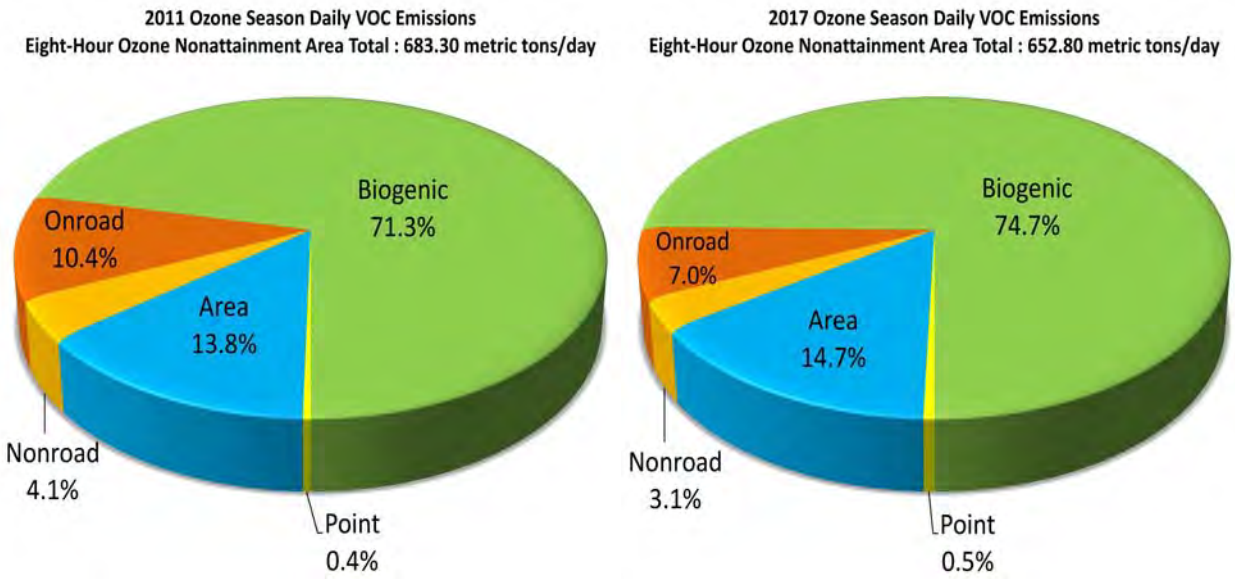


Figure 6-2

Ozone Season Average Daily NOx Emissions in 2011 and 2017 in the Maricopa Eight-Hour Ozone Nonattainment Area

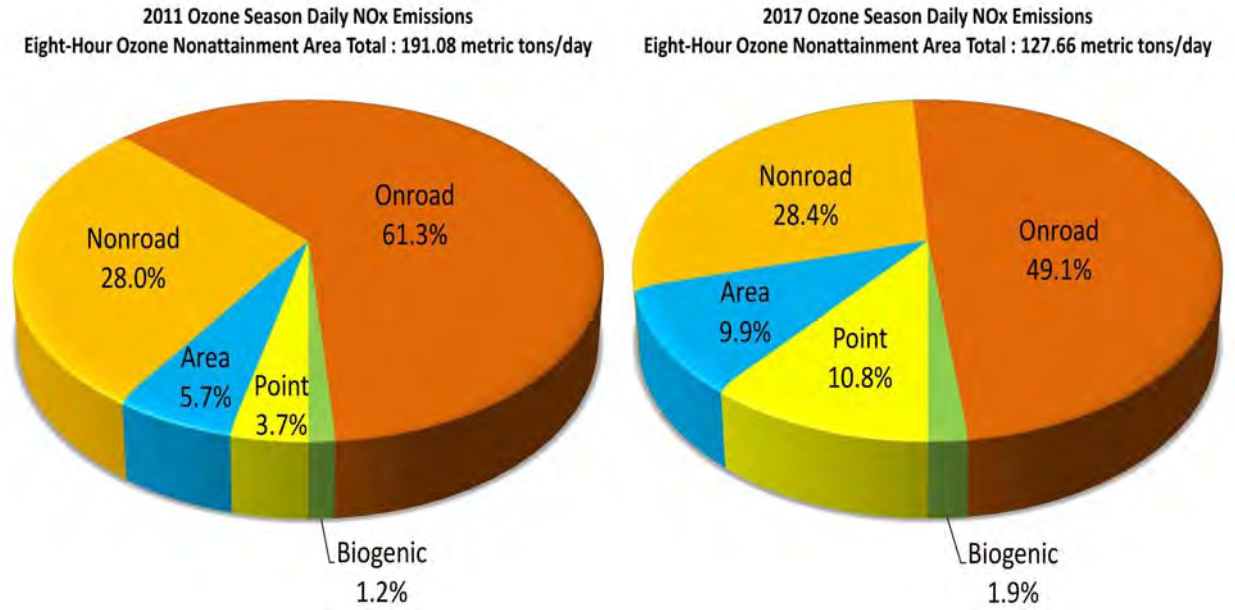


Figure 6-3

Ozone Season Average Daily CO Emissions in 2011 and 2017 in the Maricopa Eight-Hour Ozone Nonattainment Area

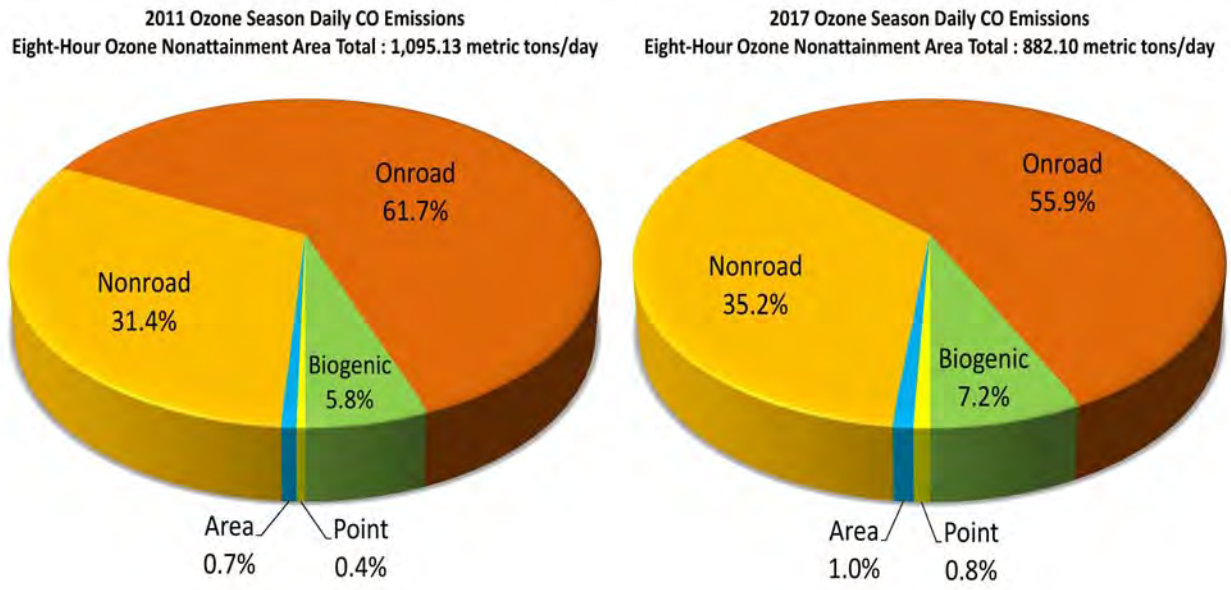


Figure 6-4

Ozone Season Average Daily VOC Emissions in 2011 and 2017 in the 4 km Grid Modeling Domain

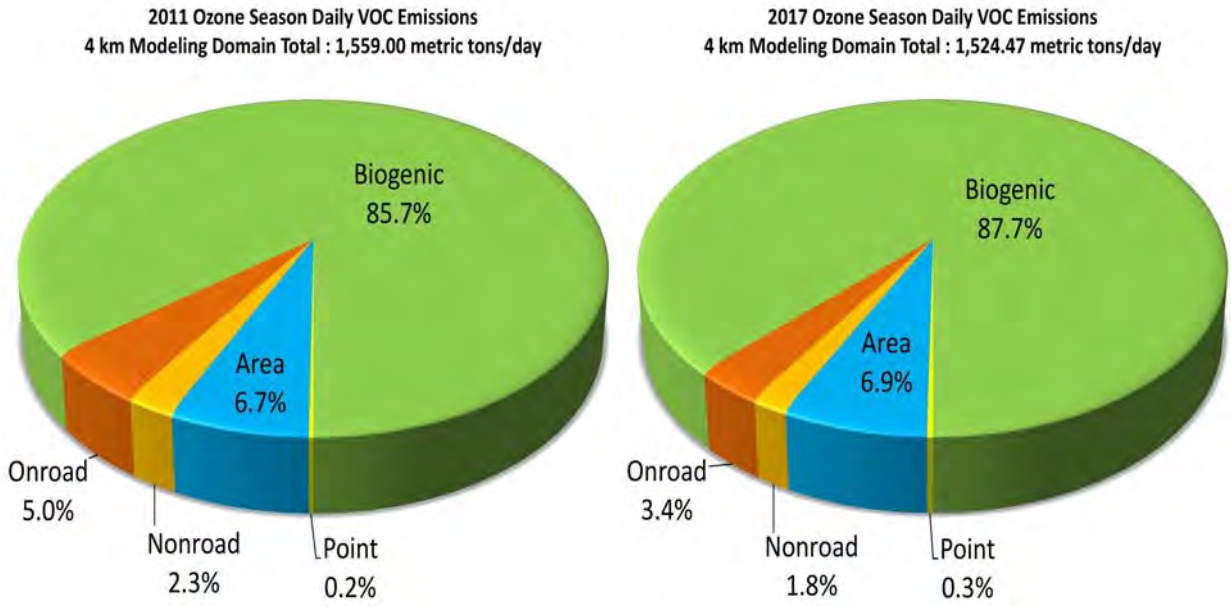


Figure 6-5

Ozone Season Average Daily NOx Emissions in 2011 and 2017 in the 4 km Grid Modeling Domain

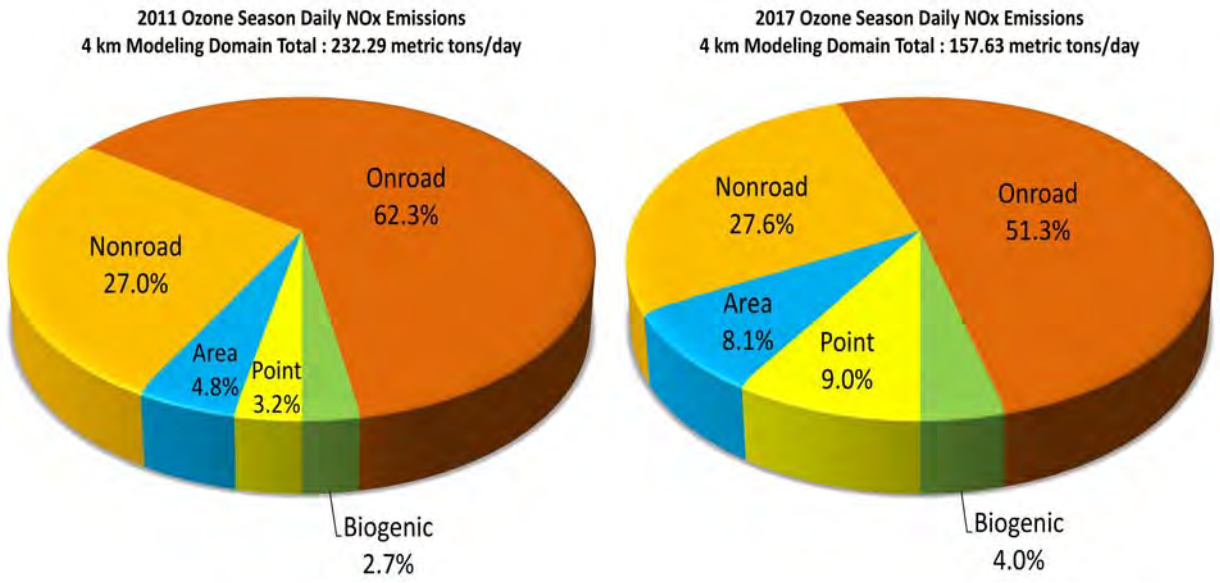
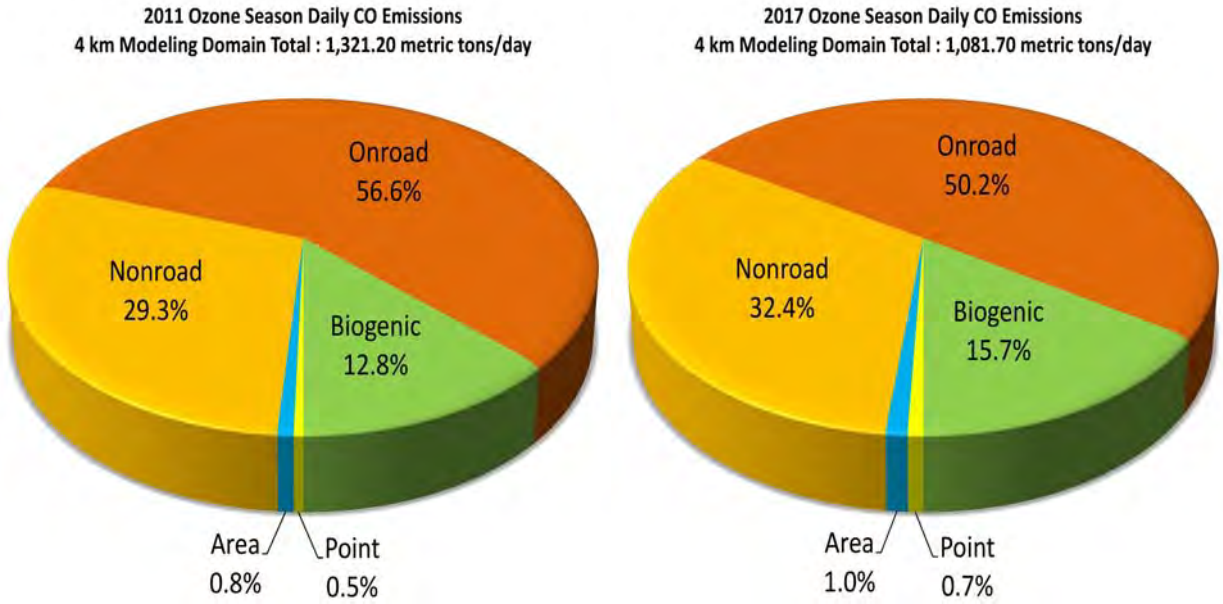


Figure 6-6

Ozone Season Average Daily CO Emissions in 2011 and 2017 in the 4 km Grid Modeling Domain



ATTAINMENT MEASURES

Chapter Five of the MAG 2017 Eight-Hour Ozone Moderate Area Plan includes a table of the 93 existing federal, state and local ozone control measures. The 93 existing ozone control measures have been approved by EPA in prior regional air quality plans or in separate EPA actions. The continuous implementation of these existing control measures in the nonattainment area assists in the attainment of the 2008 ozone standard in 2017. Only a subset of these control measures has quantifiable emission reduction benefits that were used to demonstrate attainment and meet contingency measure requirements. The federal, state, and local control measures used in demonstrating attainment of the 2008 ozone standard are as follows:

1. Summer Fuel Reformulation: California Phase 2 and Federal Phase II Reformulated Gasoline with 7 psi from May 1 through September 30
2. Phased-In Emission Test Cutpoints
3. One-time Waiver from Vehicle Emissions Test
4. Tougher Enforcement of Vehicle Registration and Emissions Test Compliance
5. Expansion of Area A Boundaries
6. Gross Polluter Option for I/M Program Waivers
7. Coordinated Traffic Signal Systems
8. Develop Intelligent Transportation Systems
9. Federal Tier 2 and Tier 3 Motor Vehicle Emissions and Fuel Standards
10. Federal Phase 1 and 2 Light-Duty Vehicle and Phase 1 Medium and Heavy-Duty Vehicle Greenhouse Gas Rules
11. Federal Nonroad Equipment Standards
12. Federal Heavy Duty Diesel Vehicle Emissions Standards
13. Federal Portable Fuel Container Rules

The emissions reduction benefits of ozone control measures 1 through 12 are included in the onroad and nonroad emissions inventories that were developed by MOVES2014a. The aggregated emission reductions from these measures are used in modeling attainment in this plan. Measures 1 through 6, 9, 11, and 12 are reflected in the fuel parameters (e.g., RVP, gasoline and diesel sulfur contents, oxygen contents, etc.), vehicle registration data, and I/M programs for the MOVES2014a onroad and nonroad modeling. Measures 7 and 8 are incorporated into transportation network assignments of the Travel Demand Model (TDM), which were developed by the MAG Transportation Division. Onroad and nonroad mobile source emissions factors in MOVES2014a reflect the benefits of measures 9, 11, and 12 through the onroad and nonroad engine and fuel standards. Measure 10 contributes to ozone precursor emissions reductions by way of improved fuel efficiency.

The MOVES2014a and SMOKE models estimated aggregated emissions reductions of 25.3 metric tons per day of VOC and 54.5 metric tons per day of NOx for onroad mobile sources in the Maricopa eight-hour ozone nonattainment area. Aggregated nonroad mobile source emissions reductions of 7.6 metric tons per day of VOC and 17.3 metric tons per day of NOx were estimated in the Maricopa eight-hour ozone nonattainment area. The

benefits of measure 13, the federal portable fuel container rules, were provided by EPA for Maricopa and Pinal Counties. The 2011 controlled emissions for the portable fuel containers were obtained from the EPA 2011 National Emissions Inventory (NEI). The 2017 emission reduction benefits were interpolated using the EPA 2015 and 2020 emissions benefits for the portable fuel container rules. Measure 13 provided 6.2 metric tons per day of VOC emission reduction benefit in the Maricopa eight-hour ozone nonattainment area in 2017. The attainment demonstration in this plan was primarily dependent upon the emissions benefits of the tighter federal standards for new onroad and nonroad engines and fuel requirements, and the continuing fleet turnover in the nonattainment area.

In addition to the ozone control measures used for numeric credit in the attainment demonstration, numerous other control measures, as shown in the Chapter Five of this plan, have been implemented in the Maricopa eight-hour ozone nonattainment area. These measures have been approved by EPA in prior regional air quality plans or separate EPA action and contribute to improved air quality, but cannot be quantified. As a result, the measures were not used as numeric credit for the attainment demonstration.

As an example, the Arizona Department of Environmental Quality (ADEQ) issues an ozone High Pollution Advisory (HPA) when ozone is likely to exceed the NAAQS and pose health risks. When the HPA is issued, notices are sent to employers participating in trip reduction programs. At that time, employers activate HPA plans to help reduce air pollutants. The HPA plans may include commuting on public transportation, carpooling, vanpooling, and teleworking. The general public is also encouraged to take actions during an HPA such as limiting engine idling, refueling after dark, and limiting uses of gas-powered garden equipment and charcoal BBQs. The emissions reductions attributable to an HPA are not easily quantified, and thus are not used in the attainment demonstration. Many of the 93 existing control measures, such as the HPA program, were not used as numeric credit in the CAMx model attainment demonstration. These measures, while not quantified, improve air quality and contribute to attainment of the 2008 ozone standard in 2017.

ATTAINMENT DEMONSTRATION

To demonstrate attainment of the 2008 ozone standard, modeled eight-hour ozone concentrations in 2017 should be less than 0.0759 ppm (75.9 ppb) for all modeled episode days. The attainment demonstration followed the modeling procedures recommended in EPA guidance (EPA, 2014a).

The process for selecting the models, modeling domains, and episode period for the attainment demonstration is fully described in the modeling protocol included in Appendix A to the Technical Support Document. The Technical Support Document includes a detailed discussion of the models that were applied, as well as the model inputs, validation, and predictions.

The Comprehensive Air Quality Model with Extensions (CAMx) is the photochemical grid

model that was selected and applied to model attainment of the 2008 ozone standard in 2017. The entire ozone season episode period of May 1 through September 30 (153 days) was modeled using CAMx for the base year (2011) and the attainment year (2017). The CAMx model attainment demonstration was performed based on the five-year weighted 2011 base year design values for all monitoring sites which included the worst ozone episodes induced by the unfavorable meteorology of 2011 and 2012.

CAMx eight-hour ozone concentration predictions from the base year and attainment year simulations were used in calculating a Relative Response Factor (RRF) in accordance with EPA modeling guidance (EPA, 2014a). The RRF is the ratio of the 2017 attainment year modeled ozone concentrations to the 2011 base year modeled ozone concentrations at each monitoring location. The 2011 base year design value (DVB) at each monitoring site is multiplied by the RRF to produce the 2017 design value (DVF) at each monitoring site as depicted in the following equation:

$$(DVF)_i = (RRF)_i (DVB)_i$$

where:
$(DVB)_i$ = Baseline (2011) design value monitored at monitoring site *i* (unit: ppb)
$(RRF)_i$ = Relative response factor for monitoring site *i* (unitless)
$(DVF)_i$ = Estimated design value for the future year (2017) at monitoring site *i* (unit: ppb)

The resulting 2017 design values at each monitoring site were compared to the 2008 ozone standard for the attainment test. All monitoring sites within the Maricopa nonattainment area demonstrate modeled attainment of the 2008 ozone standard in 2017. The peak 2017 DVF was predicted at the North Phoenix monitoring site with a eight-hour ozone concentration of 75.6 ppb or 0.0756 ppm. Table 6-3 presents the 2011 and 2017 design values and RRF at each monitoring site in the Maricopa eight-hour ozone nonattainment area.

Since high ozone concentrations may occur in the areas where no ozone monitors were situated, an unmonitored area analysis was performed using the CAMx 2011 and 2017 ozone simulations data and the EPA Model Attainment Test Software (MATS) (EPA, 2014b). The EPA MATS interpolated the 2011 base year design values of monitors for ozone spatial fields, and adjusted the ozone spatial fields using the CAMx gridded ozone predictions for the unmonitored area. The 2017 future design values for the unmonitored area in the 4 km modeling domain were calculated using the adjusted ozone spatial fields and RRFs. The RRFs for grid cells were derived from the CAMx 2011 and 2017 gridded ozone predictions. Figure 6-7 provides an isopleth plot of the results from the unmonitored area analysis. The peak 2017 future design value of 75.5 ppb in the unmonitored area was predicted at a grid cell in the northwest of the Supersite monitor, as indicated by a red square in Figure 6-7. Since the 2017 peak unmonitored area ozone concentration is less than the 2008 ozone standard, attainment is demonstrated throughout the unmonitored areas of the 4 km modeling domain.

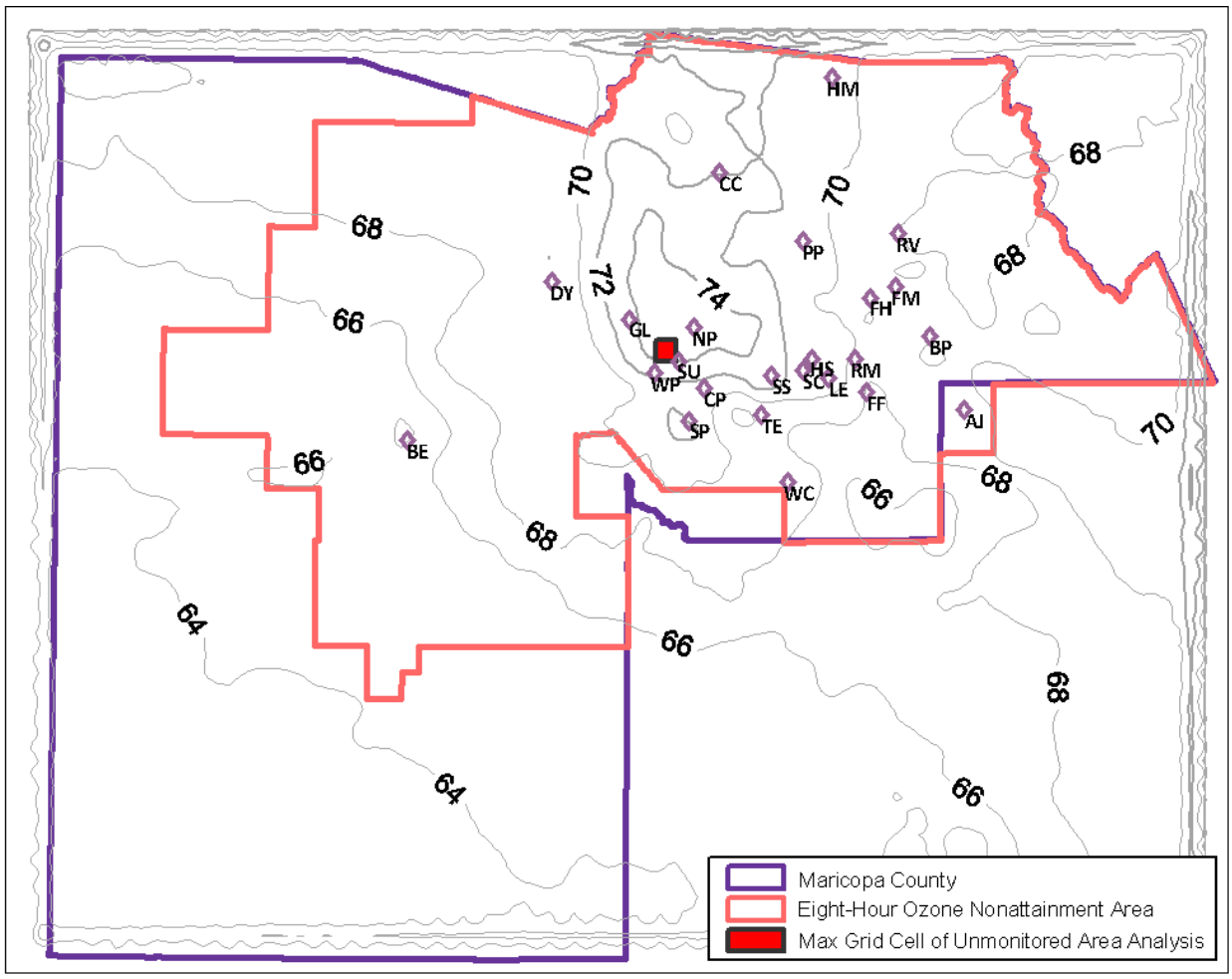
Table 6-3

2011 and 2017 Design Values and Relative Response Factors for Monitoring Sites in the Maricopa Eight-Hour Ozone Nonattainment Area

Site Name	Abbr	AIRS	2011 Design Value (ppb)	RRF	2017 Design Value (ppb)
West Phoenix	WP	040130019	76.7	0.9561	73.3
North Phoenix	NP	040131004	79.7	0.9487	**75.6**
Falcon Field	FF	040131010	69.7	0.9318	64.9
Glendale	GL	040132001	74.7	0.9633	71.9
Pinnacle Peak	PP	040132005	76.0	0.9232	70.1
Central Phoenix	CP	040133002	73.3	0.9518	69.7
South Scottsdale	SS	040133003	75.7	0.9463	71.6
South Phoenix	SP	040134003	74.7	0.9580	71.5
West Chandler	WC	040134004	72.7	0.9602	69.8
Tempe	TE	040134005	69.7	0.9721	67.7
Cave Creek	CC	040134008	76.3	0.9391	71.6
Dysart	DY	040134010	71.0	0.9597	68.1
Buckeye	BE	040134011	65.0	0.9754	63.4
Fort McDowell/Yuma	YF	040135100	70.3	0.9309	65.4
Senior Center	SC	040137020	73.7	0.9454	69.6
Red Mountain	RM	040137021	76.7	0.9343	71.6
Lehi	LE	040137022	73.3	0.9470	69.4
High School	HS	040137024	73.3	0.9403	68.9
Humboldt Mountain	HM	040139508	74.0	0.9438	69.8
Blue Point	BP	040139702	74.7	0.9383	70.0
Fountain Hills	FH	040139704	74.3	0.9351	69.4
Rio Verde	RV	040139706	74.0	0.9243	68.3
Super Site	SU	040139997	76.0	0.9590	72.8
Apache Junction	AJ	040213001	73.0	0.9314	67.9

Figure 6-7

Isopleth Plot of the 2017 Design Values for the Unmonitored Area in the 4 km Grid Modeling Domain



WEIGHT OF EVIDENCE ANALYSIS

EPA requires the supplemental analysis or the Weight-of-Evidence (WOE) analysis to show that attainment can be reached in the future with some margin of safety, especially when projected future design values are close to the 2008 ozone standard. Technical details on the WOE analyses are provided in Section VI of the Technical Support Document (TSD). As part of the Weight-of-Evidence analysis, MAG contracted with RAMBOLL ENVIRON for additional technical assistance and analysis. The WOE analysis report provided by RAMBOLL ENVIRON is included in Appendix B to the TSD. The WOE analyses provided in the TSD are summarized as follows:

- *Ambient Air Quality Trends*: The ambient eight-hour ozone concentration trends in the Maricopa nonattainment area were provided to evaluate progress towards attainment of the 2008 ozone standard. The number of annual exceedance days for the 2008 ozone standard in the nonattainment area have steadily decreased from seventy-two in 2000, to nineteen in 2011, and to seven in 2015. The peak eight-hour ozone design values decreased from 85 ppb to 77 ppb over 2002-2015. Additionally, preliminary 2016 ozone season data through August 30, 2016 indicates that only one monitor (Pinnacle Peak) in the Maricopa nonattainment area has a 2014-2016 design value (0.076 ppm) that just slightly exceeds the 2008 ozone standard.

- *Trends in Ambient Ozone Precursors*: Ozone precursor trends as represented by nitrogen oxides (NOx), total non-methane organic compounds (TNMOC, a surrogate for volatile organic compounds), and carbon monoxide (CO) at the Supersite monitor were provided to support the decreasing trends seen in ambient ozone concentrations. The ambient NOx concentrations at the Supersite have decreased on the order of 1.6 ppb per year, a 30-40% reduction over the period of 1999-2015. The ambient TNMOC concentrations at the site have decreased on the order of 11.6 ppbC per year, a reduction of 55-65% over 1999-2015. The ambient CO concentrations at the site have decreased on the order of 40.9 ppb per year, a reduction of 55-65% over 1999-2015.

- *Absolute Model Forecasts*: This analysis is used to demonstrate substantial reductions in absolute model concentrations from the base year to the future year. The percent changes in the total amount of ozone, the number of grid cells, the grid cell hours (or days), and the maximum modeled eight-hour ozone concentration were estimated as metrics to verify substantial reductions in ozone values in the nonattainment area. The results of the analysis affirm that reductions of ozone predictions from the base year to the future year are substantial in terms of magnitudes, frequencies, and relative amounts.

- *Process Analysis*: This chemical process analysis is used to identify NOx-limited vs. VOC-limited chemistry. Since the ozone formation process is controlled by the relative availability of NOx and VOC emissions, ozone formation is described as

either NOx-limited or VOC-limited. The analysis results indicated a movement from 2011 VOC-limited conditions in the urban core to 2017 NOx-limited chemistry. This means that NOx emissions controls may be the best mechanism to reduce ozone levels in the nonattainment area in 2017 and beyond.

- *Zero-out Anthropogenic Emissions Analysis*: The zero-out anthropogenic emissions analysis was performed to evaluate the impact of transported anthropogenic emissions from a variety of regions in the U.S. and Mexico on ozone levels at the North Phoenix monitor. California contributed to ozone concentrations at the North Phoenix monitor in 2017 by up to 4.5 ppb in June, Texas by up to 1.6 ppb in July, and Mexico by up to 7.1 ppb in July.

- *Decoupled Direct Method Analysis*: This analysis is used to characterize the potential uncertainties in the predicted future (2017) ozone concentrations by evaluating the sensitivity of ozone concentrations to changes in VOC and NOx emissions in the nonattainment area. The analysis indicated that increases of anthropogenic VOC emissions by up to 15%, NOx emissions by up to 5%, and combined VOC and NOx emissions less than 5% in the 2017 emissions inventory provide a margin of safety whereby attainment of the 2008 ozone standard can still be modeled in 2017.

- *Source Apportionment Technology*: The purpose of this analysis is to estimate the contribution of multiple emission source areas, source categories, and pollutant types to ozone in the nonattainment area. The analysis is used to rank the anthropogenic emission source categories in the 4 km modeling domain based on the contributions of individual emission source categories to ozone levels at the North Phoenix monitor. Onroad mobile sources were a major contributor to ozone concentrations at the North Phoenix monitor. As a result, controls in onroad mobile source emissions are the most efficient in further reducing ozone in the nonattainment area.

- *Uncertainty of Projected 2017 Emissions for Electric Generating Units (EGU)*: The ten-year maximum EGU emissions over 2005-2014 in Maricopa County were used as the 2017 projected EGU emissions for the attainment demonstration. Using the ten-year maximum for the 2017 EGU emissions is very conservative because the EPA's national inventory of NOx emissions for power plants show substantial decreases over 1990-2015. An alternative no-growth assumption for the EGU emissions between 2011 and 2017 was tested for the modeled attainment of the 2008 ozone standard. The alternative no-growth approach lowered the future design values by up to 0.6 ppb. The no-growth assumption for the 2017 EGU emissions projection provides a significant safety margin for the modeled attainment demonstration.

- *EPA Projected 2017 Ozone Concentrations*: The modeling results from EPA's proposed Cross-State Air Pollution Rule (CSAPR) for the 2008 ozone standard

(EPA, 2015b) affirmed that the Maricopa eight-hour ozone nonattainment area is expected to attain the 2008 ozone standard in 2017. None of the monitoring sites in Maricopa County were projected to exceed the 2008 ozone standard in 2017 in EPA's CSAPR ozone modeling.

- *NOx Model Performance Evaluation*: Recent studies by the National Aeronautics and Space Administration (NASA), based on satellite and aircraft remote sensing data, indicated that a high bias in EPA's Motor Vehicle Emissions Simulator (MOVES) model might cause overestimations of NOx emissions from mobile sources. As such, RAMBOLL ENVIRON conducted a NOx model performance evaluation. Hourly NO_2 concentrations from the 2011 simulation are compared to observations at six monitors within Maricopa County. Scatter plots of predicted and observed hourly NO_2 concentrations show over estimation biases with the predictions at five urban monitors in Maricopa County. The over prediction is largest at the West Phoenix and Supersite monitors. Time series at the Supersite monitor show that the model reproduces the diurnal pattern of NO_2 relatively well, but largely overestimates both morning and evening peaks. Midday NO_2 predictions agree well with the observations. In contrast, NO_2 is under predicted at the Buckeye site. RAMBOLL ENVIRON concludes that the effectiveness of NOx emission reductions in lowering ozone concentrations in Maricopa County may be understated in the model, if input NOx emissions are overstated as suggested by this analysis.

- *Review of Trajectory Analyses and Conceptual Model*: The conceptual model developed for the Maricopa eight-hour ozone nonattainment area found that elevated ozone concentrations are associated with intense summer photochemical reactions, local stagnation or long range transport of ozone precursor emissions, and synoptic and mesoscale atmospheric dynamics. Analyses of 24-hour back trajectories on ozone exceedance days in 2011 revealed varied geographic origins of air masses: May exceedances are associated with westerly wind bringing air from Southern California enhanced by cold fronts and stratospheric intrusions from late spring low pressure systems; July exceedances are associated with westerly wind bringing air from Southern California enhanced by high temperature and long exposure to sunlight; and July and August exceedances are associated with extremely high daytime temperatures and are influenced by the regional monsoon pattern. Peak biogenic VOC emissions can also enhance ozone formation.

- *Background Ozone and Interstate Transport*: US Background (USB) includes all global natural sources and anthropogenic sources of ozone from outside the U.S. High background contributions make local ozone less responsive to local emission controls. The MAG CAMx modeling results show that USB contributes 63% (47.3 ppb) to the 2017 design value (DVF), with more than 60% in all summer months except August. The EPA's CSAPR modeling also indicates that the 2017 ozone contributions from non-US anthropogenic sources (USB) are 52% at North Phoenix, the site with highest predicted 2017 ozone concentrations, and 55% averaged across all Maricopa County sites. The results confirm significant impact from USB

to local ozone in Maricopa County. In addition, ozone precursor emissions from California play a major role in attaining the eight-hour ozone NAAQS in Maricopa County. California contributions are roughly 2 ppb in May across all monitors, increase to a range of 2.7-7.3 ppb in June, and then drop to under 2 ppb in July and August. Peak contributions of California in June are consistent with HYSPLIT back trajectories performed by RAMBOLL ENVIRON. Contributions from other states are almost entirely below the EPA threshold of 0.75 ppb.

ONROAD MOBILE EMISSIONS BUDGETS FOR CONFORMITY

In accordance with the 1990 Clean Air Act (CAA) Amendments, transportation conformity requirements are intended to ensure that transportation activities do not result in air quality degradation. Section 176 of the CAA requires that transportation plans, programs, and projects conform to applicable air quality plans before the transportation action is approved by a Metropolitan Planning Organization (MPO). The designated MPO for Maricopa County is the Maricopa Association of Governments.

Section 176(c) of the CAA provides the framework for ensuring that Federal actions conform to air quality plans under section 110. Conformity to an implementation plan means that proposed activities should not: (1) cause or contribute to any new violation of any standard in any area, (2) increase the frequency or severity of any existing violation of any standard in any area, or (3) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

EPA transportation conformity regulations establish criteria involving comparison of projected transportation plan emissions with the motor vehicle emissions assumed in applicable air quality plans. These regulations define the term “motor vehicle emissions budget” as meaning “the portion of the total allowable emissions defined in a revision of the applicable implementation plan (or in an implementation plan revision which was endorsed by the Governor or his or her designee) for a certain date for the purpose of meeting reasonable further progress milestones or attainment demonstrations, for any criteria pollutants or its precursors, allocated by the applicable implementation plan to highway and transit vehicles.”

On June 13, 2012, EPA published the final rule approving the MAG 2007 Eight-Hour Ozone Plan, including the 2008 emissions budgets for VOC of 67.9 metric tons per day and NOx of 138.2 metric tons per day, effective July 13, 2012. On September 17, 2014, EPA published a final rule approving the MAG 2009 Eight-Hour Ozone Maintenance Plan, including the 2025 emissions budget for VOC of 43.8 metric tons per day and NOx of 101.8 metric tons per day, effective October 17, 2014.

The MAG 2017 Eight-Hour Ozone Moderate Area Plan establishes 2017 conformity budgets based on 2017 onroad mobile source VOC and NOx emissions in the Maricopa eight-hour ozone nonattainment area that were used to model attainment of the 2008 ozone standard of 0.075 ppm. The 2017 conformity budgets are represented by the

average daily onroad VOC and NOx emissions from May 1 through September 30. The methodology used in estimating onroad mobile source emissions in 2017 is discussed in Section III-1-4 of the TSD. The average daily onroad motor vehicle emissions in the Maricopa eight-hour ozone nonattainment area for the period of May through September are 45.7 metric tons per day for VOC and 62.7 metric tons per day for NOx, as listed in Table 6-1. These represent the 2017 emissions budgets that will be used in future transportation conformity analyses that begin after these emissions budgets have been found to be adequate or are approved by EPA as part of this plan. In subsequent conformity analyses, onroad mobile source emissions for conformity horizon years of 2017 and beyond should not exceed the 2017 VOC and NOx emissions budgets.

REASONABLE FURTHER PROGRESS - 15 PERCENT RATE OF PROGRESS DEMONSTRATION

In accordance with Clean Air Act Section 182(b)(1), a Moderate nonattainment area must provide a Rate of Progress (ROP) plan that demonstrates a 15 percent reduction in VOC emissions across the nonattainment area over a six-year period from the base year anthropogenic emissions, in this case, the years 2012 through 2017. For the purpose of meeting the 15 percent ROP requirements in the Maricopa eight-hour ozone nonattainment area, the base year 2011 average daily anthropogenic VOC emissions for the period of May 1 through September 30 in the nonattainment area are shown to be reduced by at least 15 percent by 2017 through the following calculations. The 2017 ROP 15 percent reduction target of 166.41 metric tons per day in the Maricopa nonattainment area is calculated by multiplying the 2011 average daily anthropogenic VOC emissions of 195.78 metric tons/day (sum of 2011 point, area, nonroad and onroad VOC emissions in Table 6-1) by 85% (100% - 15%) as follows:

195.78 metric tons/day x (100% - 15%) = 166.41 metric tons/day

The 2017 average daily anthropogenic VOC emissions of 165.28 metric tons/day in Table 6-1 (sum of 2017 point, area, nonroad and onroad VOC emissions) is less than the 2017 ROP 15 percent reduction target of 166.41 metric tons/day, and is equivalent to a 15.6% reduction in 2011 base year anthropogenic VOC emissions. Therefore, the 2017 average daily anthropogenic VOC emissions in the Maricopa eight-hour ozone nonattainment area satisfy the CAA Section 182(b)(1) reasonable further progress and 15 percent ROP plan requirements.

CONTINGENCY MEASURES

Section 172(c)(9) of the Clean Air Act requires that the State Implementation Plans provide for the implementation of contingency measures without any further rulemaking action if the Moderate area fails to attain or to meet the standard by the attainment date. Since EPA allows early implementation of contingency measures (EPA, 1993), existing measures that have already been implemented may be contingency measures if they are not needed to show attainment and do not hasten attainment. EPA also allows federal measures to be

contingency measures if they are not needed for attainment (EPA, 2015a).

EPA requires that contingency measures represent one-year's worth of progress, amounting to reductions of 3 percent of the 2011 base year VOC and/or NOx emissions for the Maricopa eight-hour ozone nonattainment area. These reductions would be achieved in 2018 in the Maricopa eight-hour ozone nonattainment area while the state is revising its plans for the area, if the area failed to meet the ozone standard by the required attainment date of July 20, 2018.

For the MAG 2017 Eight-Hour Ozone Moderate Area Plan, the existing control measures provide enough continuing emission reduction benefits in 2018 to meet the contingency measure requirements. The VOC and NOx emissions reductions of the contingency measures in 2018 for the Maricopa eight-hour ozone nonattainment area are provided in Table 6-4. Details on the emission reductions in 2018 are provided in the TSD. Average daily anthropogenic VOC emissions of the modeling episode from May 1 through September 30 in the Maricopa eight-hour ozone nonattainment area are 165.28 metric tons per day in 2017 and 164.08 metric tons per day in 2018. The difference of total anthropogenic VOC emissions between 2017 and 2018 is 1.20 metric tons per day., which amounts to a 0.61 percent reduction from the 2011 base year emissions. In the same manner, NOx emissions reductions are estimated to be at 3.25 percent from the 2011 base year NOx emissions. The combined VOC and NOx emissions reduction of 3.86 percent in the Maricopa eight-hour ozone nonattainment area meets the 3 percent emission reduction requirement for contingency measures.

CONCLUSIONS

Photochemical air quality grid modeling by the CAMx model demonstrated that the Maricopa eight-hour ozone nonattainment area would attain the 2008 ozone standard by the end of ozone season in 2017. The CAMx model attainment demonstration was performed based on the five-year weighted 2011 base year design values for monitors. The CAMx modeling predicted the 2017 maximum design value of 0.0756 ppm (or 75.6 ppb) at the North Phoenix monitor. The unmonitored area analysis with CAMx and MATS predicted the 2017 maximum design value of 0.0755 ppm (75.5 ppb) in the unmonitored area of the 4 km modeling domain, located northwest of the Supersite monitor. Since both the 2017 maximum design values at the monitors and in the unmonitored area of the 4 km modeling domain are 0.075 ppm (after truncation to three digits), the photochemical modeling demonstrates attainment of the 2008 ozone standard in the Maricopa eight-hour ozone nonattainment area by the July 20, 2018 attainment date.

To support the CAMx model attainment demonstration for the monitors and the unmonitored area in the Maricopa eight-hour ozone nonattainment area, supplemental or Weight of Evidence (WOE) analyses were provided in the TSD. Key findings of the

Table 6-4

Average Daily Anthropogenic VOC and NOx Emission Reductions in 2018 for Contingency Measure Requirements (metric tons/day)

Source Category	VOC					NOx				
	2011	2017	2018	2018 minus 2017	2018 Percent Reduced from 2011	2011	2017	2018	2018 minus 2017	2018 Percent Reduced from 2011
Point	2.47	3.32	3.39	+0.07	2.83%	7.02	13.75	13.76	+0.01	0.14%
Area	94.46	96.05	97.88	+1.83	1.94%	10.96	12.59	12.98	+0.39	3.56%
Nonroad	27.89	20.26	20.07	-0.19	-0.68%	53.58	36.26	34.36	-1.90	-3.55%
Onroad	70.96	45.65	42.74	-2.91	-4.10%	117.15	62.69	58.05	-4.64	-3.96%
Total	195.78	165.28	164.08	-1.20	-0.61%	188.71	125.29	119.15	-6.14	-3.25%
Combined VOC and NOx Emissions Reduction Percent in 2018 from 2011: 3.86%										

analyses are as follows:

- Ambient concentration trends show a persistent decline over 1999-2015. Preliminary 2016 ozone data indicates only one monitor is currently violating the 2008 standard in the Maricopa nonattainment area based upon 2014-2016 data.

- Absolute model forecast confirm that ozone reductions from 2011 to 2017 are substantial in terms of magnitude, frequency and relative amount.

- Safety margins exists in the modeled attainment demonstration whereby anthropogenic emissions of VOC may increase by up to 15%, NOx may increase by up to 5%, and combined VOC and NOx may increase by less than 5%, while attainment can still be modeled in 2017.

- An alternative no-growth assumption for emissions from Electric Generating Units in 2017 from 2011 base emissions also provides a safety margin by lowering predicted 2017 ozone design values by up to 0.6 ppb.

- Chemical ozone process analysis indicate the urban core of the nonattainment area is transitioning from a VOC-limited area to a NOx-limited area and that reductions in NOx may provide the best mechanism to reduce ozone in 2017 and beyond.

- Source apportionment analysis concludes that reductions in onroad mobile source emissions will be the most efficient at reducing ozone in the nonattainment area.

- Modeling performed by EPA for the Cross-State Air Pollution Rule predicts that the Maricopa nonattainment area will attain the 2008 ozone standard in 2008.

- The zero-out anthropogenic emissions analysis indicates that the peak ozone design value monitoring site of North Phoenix is significantly impacted by transported anthropogenic emissions from California, and non-US emissions.

In summary, the photochemical air quality modeling at the monitoring sites and in the unmonitored area demonstrated attainment of the 2008 ozone standard in 2017, meeting the July 20, 2018 attainment date. The results of the modeled attainment demonstration for the Maricopa nonattainment area are supported and affirmed by extensive supplemental and weight of evidence analyses.

CHAPTER SEVEN

PUBLIC PARTICIPATION

The Transportation-Air Quality Guidelines for public participation are issued jointly by the U.S. Environmental Protection Agency and the U.S. Department of Transportation. These guidelines are designed to encourage an effective public participation program for the development and implementation of the State Implementation Plan (SIP). According to the guidelines, the objectives of the public participation program should be to:

1. Promote public awareness of the air pollution problem, the SIP revision process, and the effects of various transportation control measures;

2. Encourage active participation from a variety of interest groups in the plan preparation process;

3. Promote public understanding and agreement on the transportation control measures necessary to improve air quality;

4. Provide for the identification of both interested and affected constituencies;

5. Ensure that the agencies and elected officials are responsive to these constituencies; and

6. Encourage a spirit of openness and trust among elected officials, agencies, and the public.

In order to be responsive to these guidelines, the Maricopa Association of Governments has established a formal public participation program. The program includes the MAG Air Quality Technical Advisory Committee, additional Air Quality Working Groups, as necessary, the MAG Management Committee, and the MAG Regional Council. Technical support for the public participation program is provided by MAG, the Arizona Department of Environmental Quality, the Arizona Department of Transportation, and Maricopa County Air Quality Department (see Figure 7-1). A brief description of these components of the program is described below.

DECISION MAKING STRUCTURE

The Maricopa Association of Governments has been designated as the lead planning agency for air quality planning within the Maricopa and Pinal County areas. MAG member agencies include twenty-seven cities and towns within Maricopa County and portions of Pinal County, Maricopa County, Pinal County, the Gila River Indian Community, the Salt River Pima-Maricopa Indian Community, Fort McDowell Yavapai Nation, and the Arizona Department of Transportation. A representative from the Regional Public Transportation

Figure 7-1

MAG Regional Air Quality Planning Technical Process

- The MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area was prepared through a coordinated effort among the Arizona Department of Environmental Quality, Arizona Department of Transportation, Maricopa County Air Quality Department, and Maricopa Association of Governments.

MAG AIR QUALITY POLICY TEAM

Composition: Director of Arizona Department of Environmental Quality; Director of Arizona Department of Transportation; Air Pollution Control Officer of Maricopa County; MAG Executive Director

- Oversees preparation of plans and overall technical planning effort
- Resolves technical problems and issues

MAG AIR QUALITY PLANNING TEAM

Composition: Staff from the Arizona Department of Environmental Quality, Arizona Department of Transportation; Maricopa County Air Quality Department; Maricopa Association of Governments

Agency Roles

- Arizona Department of Environmental Quality - air quality modeling and technical assistance, mobile source emissions research and inventory, input for the comprehensive list of measures and feasibility analysis, information, relating to the Vehicle Emission Inspection Maintenance Program, stationary and portable source control strategies, air quality research studies, State Air Quality Fund administration, adoption and submittal of State Implementation Plans to the Environmental Protection Agency, tracking plan implementation, assurances, special purpose air quality and meteorological monitoring for plan development and compliance
- Arizona Department of Transportation - State Transportation Improvement Program, other transportation plans and programs, input for the comprehensive list of measures and feasibility analysis
- Maricopa County Air Quality Department - stationary source emissions inventory and controls, coordinating the comprehensive emissions, inventory, air quality monitoring data, input for comprehensive list of measures and feasibility analysis, mandatory travel reduction program, trip reduction data, voluntary no drive days program, tracking plan implementation, reasonable further progress, assurances, special purpose air quality and meteorological monitoring for plan development and compliance
- Maricopa Association of Governments - demographic projections and socioeconomic data, transportation modeling, air quality modeling, Regional Transportation improvement Program, Regional Transportation Plan, other transportation plans and programs, congestion management system, conformity, input for comprehensive list of measures and feasibility analysis, development of the air quality plans, interface with state, county, and local entities, recommending future year travel reduction goals, policies, and standards to Maricopa County, assistance to Maricopa County for the mandatory travel reduction program, review reasonable further progress made to reduce air pollution and plan adjustments if necessary, review plan implementation

The technical planning work is closely coordinated with EPA Region IX staff, Federal Highway Administration, and Federal Transit Administration.

Authority is also included on the MAG Management Committee. A representative from the Citizens Transportation Oversight Committee is also on the Regional Council. The policy development process is influenced by input from the MAG member agencies, MAG committees, local citizens, and staff. The decision making body for MAG is the Regional Council, which is composed of elected officials from the member agencies. The MAG Management Committee, which is composed of managers from the member agencies, makes recommendations to the Regional Council (see Figure 7-2).

The MAG Air Quality Technical Advisory Committee was established by the MAG Regional Council in 1995. The purpose of the Committee is to review and comment on technical information generated during the planning process and make technical recommendations to the MAG Management Committee.

PUBLIC PARTICIPATION IN THE PREPARATION OF THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

The process used to develop the MAG 2017 Eight-Hour Ozone Moderate Area Plan included numerous meetings of the MAG Air Quality Technical Advisory Committee, MAG Management Committee and MAG Regional Council. All of these meetings were open to public attendance. During the preparation of the Eight-Hour Ozone Moderate Area Plan, a public hearing was conducted to solicit additional citizen input. A brief description of the Air Quality Technical Advisory Committee meetings conducted in preparing the plan is provided below.

Meetings of the MAG Air Quality Technical Advisory Committee

On January 22, 2015, a meeting of the Air Quality Technical Advisory Committee was conducted to discuss the Update on the Arizona Center for Law in the Public Interest Lawsuit on the MAG 2012 Five Percent Plan for PM-10; Final Designations for the PM-2.5 Standard; Update on the Winter Holiday Non Burn Campaign; and Court Ruling on Ozone Attainment Dates and Transportation Conformity.

On March 26, 2015, a meeting of the Air Quality Technical Advisory Committee was conducted to discuss the Update on the Arizona Center for Law in the Public Interest Lawsuit on the MAG 2012 Five Percent Plan for PM-10; CMAQ Annual Report; EPA Final State Implementation Plan Requirements Rule for the 2008 Ozone Standard (0.075 parts per million); Comments on the EPA Proposed Ozone Standards; and Proposed New Air Quality Project for the MAG FY 2016 Work Program.

On May 21, 2015, a meeting of the Air Quality Technical Advisory Committee was conducted to discuss the EPA Approval of the MAG 2014 State Implementation Plan Revision for the Removal of Stage II Vapor Recovery; Maricopa County Ozone Campaign; and Development of the 2014 Periodic Emissions Inventory.

On August 27, 2015, a meeting of the MAG Air Quality Technical Advisory Committee

Figure 7-2

MAG Regional Air Quality Planning Process

was conducted to discuss the EPA Notice Proposing to Reclassify the Maricopa Eight-Hour Ozone Nonattainment Area From Marginal to Moderate for the 2008 Ozone Standard; Air Quality Status Report; Update on the MAG Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area; Draft Maricopa County 2014 Air Monitoring Network Plan; and Tentative MAG Air Quality Project Schedule.

On October 22, 2015, a meeting of the MAG Air Quality Technical Advisory Committee was conducted to discuss the Evaluation of Proposed FY 2018, 2019, and 2020 CMAQ Projects for the FY 2017-2021 MAG Transportation Improvement Program; Evaluation of Proposed PM-10 Certified Street Sweeper Projects for FY 2016 CMAQ Funding; Evaluation of Proposed PM-10 Paving Unpaved Road Projects for FY 2018, 2019, and 2020 CMAQ Funding; EPA Approval of the MAG 2014 Eight-Hour Ozone Plan-Submittal of Marginal Area Requirements (2008 Ozone Standard 0.075 parts per million); New Strengthed Ozone Standard; EPA Withdrawal of the Direct Final Rule to Approve the Removal of Stage II Vapor Recovery; and EPA Approval of the MAG 2013 Carbon Monoxide Maintenance Plan.

On January 28, 2016, a meeting of the MAG Air Quality Technical Advisory Committee was conducted to discuss the EPA Proposed Revisions to the Exceptional Events Rule; Draft MAG 2014 Inventory of Unpaved Roads; Update on the New Strengthened Ozone Standard; Update on the Moderate Area Ozone Plan; and EPA Final Rule to Approve the Removal of Stage II Vapor Recovery at Gasoline Stations.

On March 24, 2016, a meeting of the MAG Air Quality Technical Advisory Committee was conducted to discuss the Update on the Moderate Area Ozone Plan; Ozone Boundary Designations (2015 Ozone Standard); Update on the Maricopa County Winter No Burn Campaign; Maricopa County Ozone Campaign; and Update on the PM-10 Lawsuit.

On May 26, 2016, a meeting of the MAG Air Quality Technical Advisory Committee was conducted to discuss the Draft April 2016 Conformity Analysis for the Draft FY 2017-2021 MAG Transportation Improvement Program and Draft Amendment to the 2035 MAG Regional Transportation Plan; Update on the Moderate Area Ozone Plan; Ozone Boundary Designations (2015 Ozone Standard); and CMAQ Annual Report.

On August 25, 2016, a meeting of the MAG Air Quality Technical Advisory Committee was conducted to discuss the Update on the Ozone Monitoring Data; Update on the Moderate Area Ozone Plan; and Ozone Boundary Designations (2015 Ozone Standard).

PUBLIC INVOLVEMENT PROCESS FOR TRANSPORTATION AND AIR QUALITY

Federal transportation legislation emphasizes public involvement in the metropolitan transportation planning process. New transportation authorization was signed into law on December 4, 2015. The new enabling legislation, Fixing America's Surface Transportation Act (FAST Act) continues to emphasize public involvement in the metropolitan transportation planning process. Current legislation requires that the metropolitan planning organization work cooperatively with the state department of transportation and the regional

transit operator to provide citizens, affected public agencies, representatives of transportation agency employees, freight shippers, private providers of transportation, representatives of users of public transit, and other interested parties a reasonable opportunity to comment on proposed transportation plans and programs. The Maricopa Association of Governments will continue to adhere to the federal requirements for public involvement, in addition to finding new ways of engaging Valley residents in the transportation planning and programming process.

In response to previous federal guidelines under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), in December 2006 the MAG Regional Council approved a Public Participation Plan to guide the MAG public input process. This enhanced plan incorporated many of the previously adopted public involvement guidelines set forth by the Regional Council in 1994 and enhanced in 1998. The MAG Public Participation Plan sets forth guidelines for receiving public opinions, comments and suggestions on transportation planning and programming in the MAG region. This process provides complete information on transportation plans, timely public notice, full public access to key decisions, and opportunities for early and continuing involvement in the planning process.

The public involvement process is divided into four phases: Early Input Phase, Mid-Phase, Final Phase and Continuous Involvement. The Early Input meetings ensure early involvement of the public in the development of these plans and programs. The Mid-Phase process provides for input on initial plan analysis for the Regional Transportation Plan (RTP) and Transportation Improvement Program (TIP) and generally includes a public hearing on regional transportation issues. The Final Phase provides an opportunity for final comment on the RTP, TIP and Air Quality Conformity Analysis. The Final Phase generally culminates with a public hearing. The hearing is advertised with a formal public notice and draft reports are also available for thirty days for public review. Air quality information is often provided at the input meetings and on a continual basis throughout the year. In addition, Continuous Involvement is conducted throughout the annual update process and includes activities such as presentations to community and civic groups, distributing press releases and newsletters, and coordinating with the Citizens Transportation Oversight Committee.

In accordance with 40 CFR §93.105, consultation is conducted on the draft air quality plans with the State air and transportation agencies, local air quality and transportation agencies, Environmental Protection Agency, Federal Transit Administration, and Federal Highway Administration. Public hearings are conducted on draft air quality plans in accordance with State and federal requirements.

TITLE VI CONSIDERATIONS

Title VI of the Civil Rights Act of 1964 prohibits discrimination on the basis of race, color and national origin by recipients and sub-recipients of federal funds and prohibits exclusion from participation in, denial of benefits, or being subjected to discrimination under any program or activity receiving federal financial assistance. Additional federal and state laws and directives prohibit discrimination on the basis of age, gender, handicap or disability.

The Executive Order on Environmental Justice encourages consideration of environmental justice concerns, especially the impact of programs and activities on low-income and minority populations. The Act and its related laws and directives hereinafter are called, collectively, *Title VI*.

MAG is responsible for incorporating Title VI requirements and environmental justice concerns in its planning and programming processes, and the enforcement of statewide compliance, including the MAG region, is the responsibility of the Arizona Department of Transportation. MAG's policy is to assist the Arizona Department of Transportation in its compliance efforts.

For more than forty years, MAG has fully integrated the voices of vulnerable populations into regional planning activities. The Maricopa Association of Governments is the Metropolitan Planning Organization and Council of Governments for the region, comprising twenty-seven cities and towns within Maricopa County and portions of Pinal County, Maricopa County, Pinal County, the Gila River Indian Community, the Salt River Pima-Maricopa Indian Community, Fort McDowell Yavapai Nation, and the Arizona Department of Transportation. A representative from the Regional Public Transportation Authority is a member of the MAG Management Committee. A representative of the Arizona Department of Transportation Board and a representative of the Citizens' Transportation Oversight Committee are members of the MAG Regional Council. MAG receives funds from a variety of sources, including direct federal, indirect federal, and state and local government funds.

Historically, the MAG Human Services Planning Program has considered the needs of populations vulnerable to discrimination or exclusion. These populations may be described by minority race or ethnicity, low income, functional limitations or disabilities, or advanced age. Program activities intentionally solicit public input, participation and feedback regarding local needs.

The MAG Title VI Program is implemented through the Title VI Coordinator. The Coordinator is responsible for reviewing and updating the program in collaboration with the division liasions. The liasions in each of the MAG divisions are the main point of contact for both the public and Coordinator on Title VI issues.

On May 28, 2014, the MAG Regional Council approved the MAG Title VI and Environmental Justice Program. On April 26, 2016, the Arizona Department of Transportation requested changes to the MAG program to remain in compliance with federal legislation. The new program reflects activities that fulfill the responsibilities set forth by the Federal Transit Administration, the Federal Highway Administration, and the U.S. Department of Justice. The new MAG Title VI and Environmental Justice Program was approved by the MAG Regional Council on June 22, 2016.

Public Involvement Process

MAG currently conducts activities to encourage public participation in its decisions. These activities include open houses, community meetings, and presentations to local

committees. This open process offers complete information on plans, timely public notice, public access to decisions, and opportunities for early and continuing involvement. In addition to general public involvement processes, the MAG Human Services Planning Program solicits input from local minority populations and people in under served communities. The processes and findings of the Human Services Planning Program are integrated into MAG's planning programs, and members of the MAG Human Services Planning Program staff are part of the MAG Title VI team.

MAG reaches out to known potential populations that could be affected by proposed policies of this plan. Each entity or individual was sent a personal invitation to comment on the Draft MAG 2017 Eight-Hour Ozone Moderate Area Plan (see Appendix C, Exhibit 1).

Information Dissemination

MAG employs a strategy of expanded information dissemination and public access to plans and decisions. Copies of studies and reports are placed in public libraries in the region as standard procedure.

MAG committee meetings are conducted in accordance with the Open Meeting Law, and therefore provide citizens public opportunities to comment before meetings of MAG technical and policy committees. Alternative formats, accessible meeting locations and accessible meeting times are encouraged for MAG meeting planning.

MAG houses numerous records of data, statistics and information. Data collection, analysis and portrayal methods and products are evaluated periodically. Program area managers assess MAG's available data sources for relevance to Title VI requirements not less often than annually.

These partnerships will continue in the form of periodic meetings and communications with Arizona Department of Transportation, the Regional Public Transportation Authority, and MAG member agencies. MAG maintains an open dialogue with the Arizona Department of Transportation Office of Civil Rights.

Since 1976, the MAG human services committees have collaborated with a number of key stakeholders, such as state and county agencies, municipalities, community-based organizations and funders of human services within the region to identify strategies to address human services priorities at the regional level. The MAG human services planning process enhances the organization's consideration and participation of minority, poor and other population groups in developing regional plans and projects.

MAG maintains a home page on the Internet (www.azmag.gov) which provides the public with access to information on the role and history of the agency and its programs, as well as the agendas and minutes of Committee meetings. The web page serves as an excellent portal for disseminating information about MAG events, programs and plans.

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APPENDICES

VOLUME ONE

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APPENDICES

DECEMBER 2016

MARICOPA ASSOCIATION of GOVERNMENTS

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

APPENDICES

APPENDIX A

Exhibit 1: 2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. February 2014. Addendum August 2015.

Exhibit 2: 2014 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. September 2016.

APPENDIX B

Exhibit 1: Technical Support Document in Support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments.

Exhibit 2: State of Arizona Fifty-Second Legislature Senate Bill 1255 and Final Revised Fact Sheet for Senate Bill 1255.

APPENDIX C

Exhibit 1: Public Hearing Process Documentation.

Exhibit 2: Certification of Adoption and MAG Authority for Regional Air Quality Planning.

APPENDIX A

APPENDIX A

EXHIBIT 1:

2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. February 2014. Addendum August 2015.

Maricopa County
Air Quality Department

2011 Periodic Emissions Inventory for Ozone Precursors

for the
Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area

February 2014

Foreword

Maricopa County Air Quality Department released a draft version of this document, its 2011 emission inventory of ozone precursors, for a 30-day public review period on January 22, 2014. (The department's news release to announce the availability of the draft report, which outlines the schedule for public review and comment, is contained in Appendix D, along with a copy of the department's calendar item providing details on the workshop). The department held a public workshop on February 14, 2014 to discuss the draft inventory. No formal comments were received during the 30-day public review period.

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2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona Eight-Hour Ozone Nonattainment Area

February 2014

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Appendices

Appendix A Instructions for Reporting 2011 Annual Air Pollution Emissions

Appendix B Rule Effectiveness Studies

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Appendix C MOVES2010b Local Input Data and RunSpecs

MOVES2010b RunSpec Summary (Maricopa County, December 2011)
MOVES2010b RunSpec (Maricopa County, December 2011)
MOVES2010b Local Input Data (Maricopa County, December 2011)

Appendix D Public Comment Period Documentation

1. Introduction

1.1 Overview

This 2011 periodic ozone emissions inventory was developed to meet requirements set forth in Title I of the Clean Air Act Amendments of 1990 (CAAA). The CAAA require development of a baseline emissions inventory and periodic revisions for areas that fail to meet the National Ambient Air Quality Standards (NAAQS). A portion of Maricopa County is classified as nonattainment for the eight-hour ozone standard.

This inventory includes emission estimates for three ozone precursors: volatile organic compounds (VOCs), carbon monoxide (CO) and nitrogen oxides (NO_x). VOC is defined by Maricopa County's Rule 100 as "any organic compound, which participates in atmospheric photochemical reactions, except the non-precursor organic compounds". The inventory provides emission estimates from point, area, nonroad mobile, onroad mobile, and biogenic sources. Note that totals shown in tables may not equal the sum of individual values due to independent rounding.

1.2 Agencies responsible for the emissions inventory

Maricopa County Air Quality Department (MCAQD) has primary responsibility for preparing and submitting the 2011 Periodic Emissions Inventory for Ozone Precursors for Maricopa County. Point, area, and some nonroad mobile source emission estimates were prepared by MCAQD. The Maricopa Association of Governments (MAG) prepared the emission estimates for onroad mobile, biogenic, and the majority of nonroad mobile sources. Table 1.2–1 lists those responsible for inventory preparation and quality assurance/quality control activities, which are described in the respective chapters.

Table 1.2–1. Chapter authors and QA/QC contacts for this report.

Chapter	Author(s)	QA/QC contact persons
2. Point sources	Bob Downing, MCAQD (602) 506-6790	Eric Raisanen, MCAQD (602) 506-6790 Matt Poppen, MAG (602) 254-6300
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6. Biogenic sources	Feng Liu, MAG (602) 254-6300	Matt Poppen, MAG (602) 254-6300 Cathy Arthur, MAG (602) 254-6300

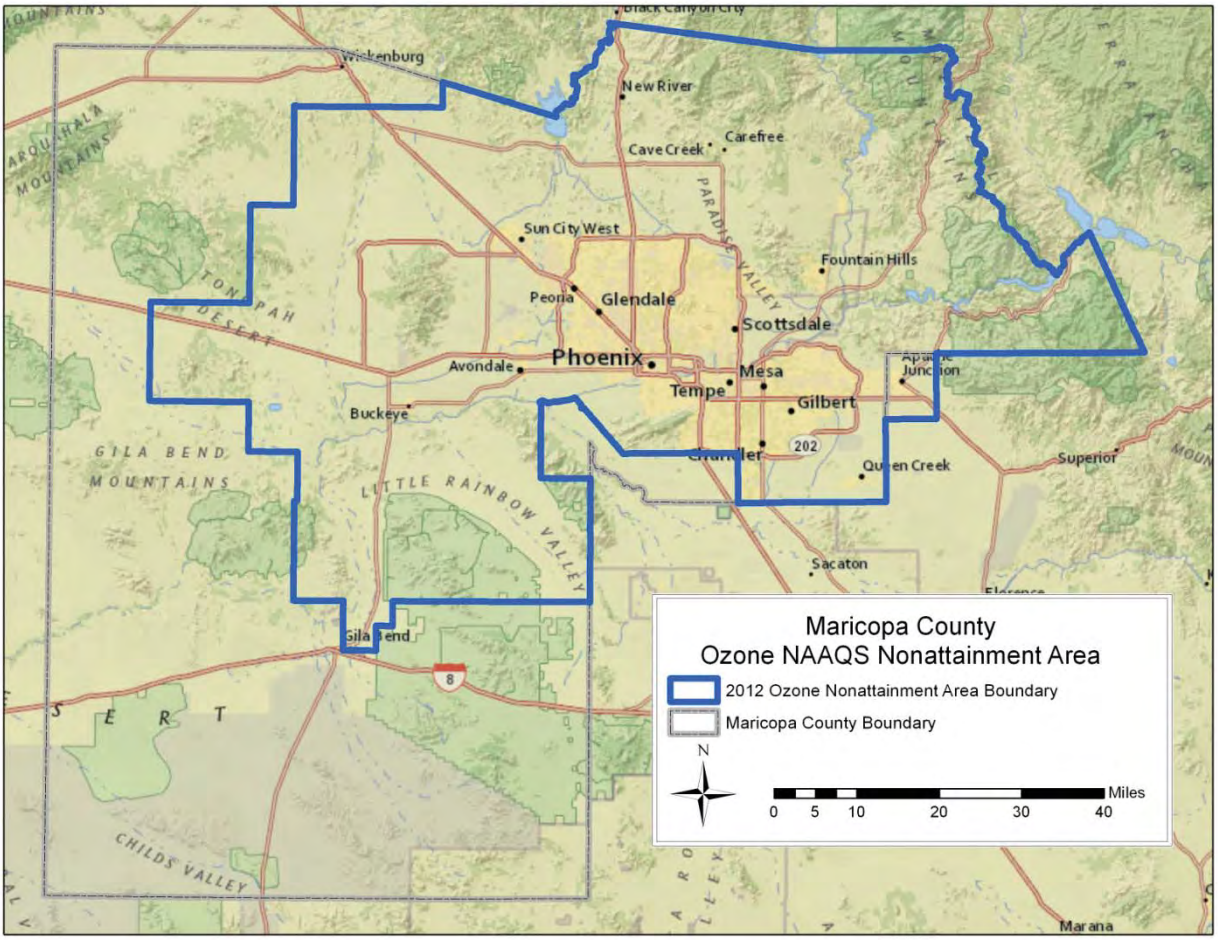
1.3 Temporal scope

Annual and ozone season-day emissions were estimated for the year 2011, for Maricopa County and the Maricopa County eight-hour ozone nonattainment area (NAA). The three-month peak ozone season for the Maricopa County nonattainment area has been defined as July 1 through September 30, based on the 1981–1991 pattern of ozone exceedances.

1.4 Geographic scope

This inventory includes emission estimates for Maricopa County and for the Maricopa County eight-hour ozone nonattainment area. Maricopa County encompasses approximately 9,223 square miles of land area, while the Maricopa County eight-hour ozone nonattainment area is approximately 5,018 square miles or about 54 percent of the Maricopa County land area.[1] A portion of the southeastern boundary of the eight-hour ozone nonattainment area includes areas of Pinal County totaling 48 square miles or 0.96% of the nonattainment area. A map of Maricopa County and the eight-hour ozone nonattainment area is provided in Figure 1.4–1.

Figure 1.4–1. Map of Maricopa County and the eight-hour ozone nonattainment area.



1. In May 2012, EPA designated a new eight-hour ozone nonattainment area based on the 2008 eight-hour ozone NAAQS (***77 FR 30088***, May 12, 2012). The previous eight-hour ozone nonattainment area was based on the 1997 eight-hour ozone NAAQS. The 2012 nonattainment area boundary was used for this 2011 inventory, as it is expected to be used as a base-year inventory for a future state implementation plan.

1.5 Overview of local demographic and land use data

Many of the emissions estimates generated in this report were calculated using demographic and land use data provided by the Maricopa Association of Governments (MAG). These data were used to apportion and/or scale Maricopa County emissions estimates to the nonattainment area and vice versa. (For example, county-level emissions from residential natural gas usage in Maricopa County were apportioned to the nonattainment area using the ratio of total population in each area). Detailed explanations of how emission estimates were apportioned or scaled are presented in each of the following chapters, along with the data sources used.

1.5.1 Demographic profile

The demographic data provided by MAG included population, employment data, and single family/multi-family splits for calendar year 2011, for both Maricopa County and the eight-hour ozone nonattainment area. Table 1.5–1 provides an overview of the key demographic data used in this report. As noted throughout the text, these data are frequently used to derive estimates of activity or emissions within the eight-hour ozone nonattainment area from county-level calculations. It is important to note, however, that the nonattainment area includes a portion of Pinal County, AZ as shown in Figure 1.4–1. Thus in some cases (e.g., those source categories calculated based on total population), the multiplier used to derive nonattainment area estimates from County-level values may be greater than 1, and thus the resulting NAA emission totals are larger than the County-level estimates from which they are derived.

Table 1.5–1. Demographic profile of Maricopa County and the eight-hour ozone NAA.

Demographic variable	Maricopa County	8-hr ozone NAA	Percentage within 8-hr ozone NAA
Total resident population	3,843,370	3,873,528	100.78%
Total non-resident population	286,276	303,342	105.96%
Total population:	**4,129,646**	**4,176,870**	**101.14%**
Retail employment	414,477	415,672	100.29%
Office employment	320,536	320,189	99.89%
Industrial employment	374,338	372,731	99.57%
Public employment	240,952	241,429	100.20%
Other employment	261,769	258,963	98.93%
Construction	24,026	24,791	103.18%
Work at home	100,016	100,617	100.60%
Total employment:	**1,736,114**	**1,734,392**	**99.90%**
Single-family/multi-family household split:			
Single-family	77%	77%	
Multi-family	23%	23%	

1.5.2 Land use data

MAG provided draft 2010 land use data. The 2010 land use data was assumed to be representative of 2011. Table 1.5–2 presents a summary of the land use categories and acreage used to develop emission estimates for this inventory.

Table 1.5–2. Land use categories used to apportion emissions.

Land use category	Acreage within Maricopa County	Acreage within 8-hour ozone NAA	Percentage within 8-hour ozone NAA
General/active open space/golf course (e.g., parks)	210,159	211,297	100.54%
Passive/restricted open space, washes	2,614,870	1,188,251	45.44%
Lakes	12,525	12,525	100.00%
Agriculture	276,016	161,371	58.46%
Vacant (e.g., developable land)	2,045,587	911,304	44.55%

1.6 Emissions overview by source category

1.6.1 Point sources

The point source category includes those stationary sources that emit a significant amount of pollution into the air such as power plants, petroleum product storage and transfer facilities, and large industrial facilities. MCAQD utilizes the US EPA's Annual Emissions Reporting Requirements (AERR) rule to define which stationary sources are listed as point sources. A detailed definition of a point source can be found in Section 2.1 of Chapter 2.

Table 1.6–1 summarizes annual and season-day emissions from point sources (including emission reduction credits) in Maricopa County and the eight-hour ozone nonattainment area, respectively. A detailed breakdown of emissions calculations for all point sources is contained in Chapter 2.

Table 1.6–1. Annual and season-day emissions from point sources.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	768.54	1,754.12	1,078.48	4,908.3	15,407.1	9,715.8
8-hour ozone NAA	768.54	1,754.12	1,078.48	4,908.3	15,407.1	9,715.8

1.6.2 Area sources

Area sources are facilities or activities whose individual emissions do not qualify them as point sources. Area sources represent numerous facilities or activities that individually release small amounts of a given pollutant, but collectively they can release significant amounts of a pollutant. Emissions from stationary sources that were not identified as point sources in this report have been included in the area source inventory. Examples of area source categories include residential wood burning, commercial cooking, waste incineration and wildfires.

Tables 1.6–2 and 1.6–3 summarize annual and season-day emissions of the chief area source categories, for Maricopa County and the eight-hour ozone nonattainment area, respectively. A detailed breakdown of emissions calculations for each area source category is contained in Chapter 3.

Table 1.6–2. Annual and season-day emissions from area sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel combustion	653.61	4,675.41	4,866.67	593.3	23,544.5	9,255.2
Industrial processes	2,284.00	263.41	585.79	17,516.5	1,489.5	3,396.2
Solvent use	28,153.45			167,043.9		
Storage/transport	5,176.39			28,577.9		
Waste treatment/disposal	115.61	56.21	193.56	842.6	320.7	1,227.1
Misc. area sources	271.58	166.54	4,765.93	13,982.3	6,680.5	281,693.1
All area sources:	**36,654.65**	**5,161.56**	**10,411.95**	**228,556.4**	**32,035.2**	**295,571.5**

Table 1.6–3. Annual and season-day emissions from area sources in the eight-hour ozone NAA.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel combustion	659.63	4,670.68	4,898.99	593.0	23,483.5	9,235.4
Industrial processes	2,276.48	263.41	590.27	17,452.4	1,489.5	3,420.8
Solvent use	28,139.77			166,557.4		
Storage/transport	5,211.35			28,766.2		
Waste treatment/disposal	116.10	56.04	190.06	837.8	315.6	1,119.6
Misc. area sources	261.09	161.70	4,664.71	13,650.0	6,531.8	278,544.9
All area sources:	**36,664.42**	**5,151.83**	**10,344.03**	**227,856.8**	**31,820.5**	**292,320.7**

1.6.3 Nonroad mobile sources

Nonroad mobile sources include off-highway vehicles and engines that move or are moved within a 12-month period. Tables 1.6–4 and 1.6–5 summarize annual and season-day emissions from nonroad mobile sources, for Maricopa County and the eight-hour ozone nonattainment area, respectively. A detailed breakdown of emissions calculations for each source category is contained in Chapter 4.

Table 1.6–4. Annual and season-day emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural equipment	38.53	330.49	303.71	329.3	2,762.6	2,584.4
Airport GSE (+APU)	111.98	406.04	3,275.98	587.3	2,136.6	17,155.0
Commercial equipment	1,924.41	1,361.42	30,224.21	14,537.1	8,334.7	203,404.4
Construction & mining	1,881.88	12,937.30	14,396.92	13,116.9	87,972.9	99,942.8
Industrial equipment	341.25	1,839.35	7,140.99	2,212.6	11,763.4	46,138.5
Lawn & garden	4,913.96	866.64	54,798.41	51,990.4	6,998.4	523,235.5
Pleasure craft	530.39	96.56	1,249.66	11,527.0	1,996.8	26,738.3
Railway maintenance	1.94	8.55	16.48	14.2	59.0	117.8
Recreational equipment	1,518.97	66.10	6,373.46	17,804.4	679.3	74,424.8
Aircraft	1,719.33	2,588.82	11,781.38	8,451.0	12,548.2	65,325.4
Locomotives	77.60	1,406.08	245.74	425.2	7,704.5	1,346.5
All nonroad mobile sources:	**13,060.24**	**21,907.35**	**129,806.94**	**120,995.4**	**142,956.4**	**1,060,413.4**

Table 1.6–5. Annual and season-day emissions from nonroad mobile sources in the eight-hour ozone NAA.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural equipment	22.52	193.22	177.56	192.5	1,615.1	1,510.9
Airport GSE (+APU)	111.43	404.49	3,259.08	584.5	2,128.9	17,071.7
Commercial equipment	1,916.15	1,355.57	30,094.46	14,474.7	8,299.0	202,531.2
Construction & mining	1,941.80	13,349.23	14,855.32	13,534.5	90,774.0	103,125.0
Industrial equipment	339.78	1,831.45	7,110.33	2,203.1	11,712.9	45,940.4
Lawn & garden	4,970.15	876.55	55,425.05	52,584.9	7,078.4	529,218.9
Pleasure craft	530.39	96.56	1,249.66	11,527.0	1,996.8	26,738.3
Railway maintenance	1.96	8.64	16.67	14.4	59.7	119.1
Recreational equipment	684.30	29.78	2,871.27	8,020.9	306.0	33,528.7
Aircraft	1,705.43	2,585.98	11,719.36	8,385.8	12,535.3	64,993.6
Locomotives	50.15	901.12	153.29	274.8	4,937.7	839.9
All nonroad mobile sources:	**12,274.06**	**21,632.59**	**126,932.05**	**111,797.1**	**141,443.8**	**1,025,617.7**

1.6.4 Onroad mobile sources

Emissions from onroad mobile sources were calculated for Maricopa County and the eight-hour ozone nonattainment area. A detailed description of emissions calculations is contained in Chapter 5.

Table 1.6–6 summarizes annual and season-day emissions from onroad mobile sources in Maricopa County and the eight-hour ozone nonattainment area, respectively.

Table 1.6–6. Annual and season-day emissions from onroad mobile sources in Maricopa County and the eight-hour ozone NAA.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	24,556.85	60,269.94	235,088.25	150,603.7	319,470.2	1,378,165.5
8-hour ozone NAA	24,110.04	56,861.82	226,581.20	148,186.2	301,823.7	1,321,680.2

1.6.5 Biogenic sources

The biogenic source category includes emissions from all vegetation (e.g., crops, indigenous vegetation, landscaping, etc.) in Maricopa County and the eight-hour ozone nonattainment area. Emissions were estimated using the Model of Emissions of Gases and Aerosols from Nature (MEGAN). MEGAN is a state-of-the-art biogenic emissions model developed by the National Center for Atmospheric Research (NCAR). Some corrections and improvements were made in the latest version of MEGAN2.1. MEGAN2.1 was used to compute biogenic emissions in Maricopa County and the eight-hour ozone nonattainment area. Annual and season-day emissions from biogenic sources are shown in Table 1.6–7 for Maricopa County and the eight-hour ozone nonattainment area.

Table 1.6–7. Annual and season-day emissions from biogenic sources in Maricopa County and the eight-hour ozone NAA.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	79,714.87	779.52	11,548.84	895,860.0	9,199.0	122,186.2
8-hour ozone NAA	55,311.84	527.18	5,934.55	624,395.0	6,231.7	62,584.2

1.6.6 Summary of all source categories

Tables 1.6–8 and 1.6–9 provide summary totals of annual and season-day emissions from all emission sources in Maricopa County and the eight-hour ozone nonattainment area, respectively.

Table 1.6–8. Annual and season-day emissions from all sources in Maricopa County.

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
POINT SOURCES:	**768.54**	**1,754.12**	**1,078.48**	**4,908.3**	**15,407.1**	**9,715.8**
AREA SOURCES:						
Fuel combustion:						
Industrial distillate oil: Boilers	0.61	60.87	15.22	3.9	390.2	97.5
Industrial distillate oil: Engines	0.00	1,838.26	395.65	0.0	11,783.7	2,536.2
Industrial natural gas	36.99	730.94	455.30	217.8	4,303.8	2,680.8
Comm./inst. distillate oil: Boilers	0.00	0.12	0.03	0.0	0.8	0.2
Comm./inst. distillate oil: Engines	0.00	3.72	0.80	0.0	23.8	5.1
Comm./inst. natural gas	54.48	1,080.73	662.84	252.0	4,998.0	3,065.4
Residential distillate oil	0.01	0.35	0.10	0.0	0.0	0.0
Residential natural gas	49.81	851.32	362.26	119.6	2,044.2	869.9
Residential LPG	2.00	51.35	14.56	0.0	0.0	0.0
Residential wood combustion	509.7	57.72	2,959.91	0.0	0.0	0.0
Residential kerosene	0.00	0.03	0.01	0.0	0.0	0.0
All Fuel Combustion	**653.61**	**4,675.41**	**4,866.67**	**593.3**	**23,544.5**	**9,255.2**
Industrial Processes:						
Chemical manufacturing	77.42			599.0		
Commercial cooking	149.33		392.60	820.5		2,157.1
Bakeries	78.18			547.8		
Secondary metal production	41.01	15.02	98.36	306.4	107.9	697.4
Rubber/plastic product mfg.	1,766.75			14,171.0		
Electrical equipment mfg.	122.80	23.47	2.98	746.2	135.8	16.4
Industrial processes, NEC	48.51	224.92	91.84	325.6	1,245.8	525.2
All Industrial Processes	**2,284.00**	**263.41**	**585.79**	**17,516.5**	**1,489.5**	**3,396.2**
Solvent Use:						
Architectural coatings	4,976.22			30,622.9		
Auto refinishing	1,333.26			10,255.9		
Traffic markings	179.60			1,823.6		
Factory finished wood	137.72			1,396.7		
Wood furniture	416.56			3,434.7		
Aircraft surface coating	65.84			473.1		
Miscellaneous surface coating	316.38			2,450.5		
Degreasing	217.55			1,451.4		
Dry cleaning	23.15			178.1		
Graphics arts	290.98			2,225.7		
Miscellaneous industrial solvent use	721.85			5,126.6		
Consumer and commercial products	17,406.46			95,377.9		
Cutback asphalt	835.84			4,567.4		
Emulsified asphalt	866.06			4,732.6		
Roofing asphalt	3.04			23.4		
Agricultural pesticides	362.93			2,903.4		
All Solvent Use	**28,153.45**			**167,043.9**		

Table 1.6–8. Annual and season-day emissions from all sources in Maricopa County (continued).

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Storage/Transport:						
Residential portable gas cans	2,935.09			16,126.8		
Commercial portable gas cans	564.43			3,101.2		
Bulk plants	120.91			659.3		
Gas stations Stage I: Submerged fill	85.08			528.7		
Gas stations Stage I: Bal. submerged fill	229.60			1,426.8		
Gas stations Stage II	0.00			0.0		
Underground tanks: Breathing/emptying	777.00			4,138.6		
Airports: aviation gasoline Stage I	347.57			1,904.5		
Airports: aviation gasoline Stage II	18.04			98.8		
Truck: gasoline (tank trucks in transit)	50.82			315.8		
Pipeline gasoline	17.32			94.5		
Volatile organic liquids storage/transport	30.54			182.7		
All Storage/Transport	**5,176.39**			**28,577.9**		
Waste Treatment/Disposal:						
On-site incineration	0.17	3.31	0.79	1.1	21.4	5.3
Open burning: Land clearing debris	0.67	0.30	6.30	20.5	9.1	193.8
Landfills	36.59	30.40	108.55	200.7	167.4	596.4
Publicly owned treatment works	75.02			577.1		
Leaking underground storage tanks	1.05			32.3		
Other waste	2.12	22.19	77.93	10.9	122.8	431.4
All Waste Treatment/Disposal	**115.61**	**56.21**	**193.56**	**842.6**	**320.7**	**1,227.1**
Miscellaneous Area Sources:						
Agricultural field burning	26.14	11.62	246.85	804.2	357.4	7,595.5
Structure fires	14.78	1.88	80.63	72.4	9.2	395.2
Aircraft engine testing	4.72	46.36	16.16	26.1	259.3	91.2
Vehicle fires	9.27	1.16	36.23	50.8	6.4	198.5
Crematories	1.18	11.19	2.23	51.1	88.5	17.3
Accidental releases	0.45	0.00	0.00	2.1	0.0	0.0
Hospitals	8.57			52.3		
Wildfires	206.08	93.95	4,379.29	12,794.0	5,832.6	271,872.2
Prescribed fires	0.39	0.38	4.54	129.2	127.1	1,523.2
All Misc. Area Sources	**271.58**	**166.54**	**4,765.93**	**13,982.3**	**6,680.5**	**281,693.1**
ALL AREA SOURCES	**36,654.65**	**5,161.56**	**10,411.95**	**228,556.4**	**32,035.2**	**295,571.5**
NONROAD MOBILE SOURCES:						
Agricultural equipment	38.53	330.49	303.71	329.3	2,762.6	2,584.4
Airport GSE (+APU)	111.98	406.04	3,275.98	587.3	2,136.6	17,155.0
Commercial equipment	1,924.41	1,361.42	30,224.21	14,537.1	8,334.7	203,404.4
Construction & mining equipment	1,881.88	12,937.30	14,396.92	13,116.9	87,972.9	99,942.8
Industrial equipment	341.25	1,839.35	7,140.99	2,212.6	11,763.4	46,138.5
Lawn and garden equipment	4,913.96	866.64	54,798.41	51,990.4	6,998.4	523,235.5
Pleasure craft	530.39	96.56	1,249.66	11,527.0	1,996.8	26,738.3
Railway maintenance equipment	1.94	8.55	16.48	14.2	59.0	117.8
Recreational equipment	1,518.97	66.10	6,373.46	17,804.4	679.3	74,424.8
Aircraft	1,719.33	2,588.82	11,781.38	8,451.0	12,548.2	65,325.4
Locomotives	77.60	1,406.08	245.74	425.2	7,704.6	1,346.5
ALL NONROAD MOBILE	**13,060.24**	**21,907.35**	**129,806.94**	**120,995.4**	**142,956.4**	**1,060,413.4**
ONROAD MOBILE SOURCES	24,556.85	60,269.94	235,088.25	150,603.7	319,470.2	1,378,165.5
BIOGENIC SOURCES	79,714.87	779.52	11,548.84	895,860.0	9,199.0	122,186.2
TOTAL, ALL SOURCE CATEGORIES	**154,755.15**	**89,872.48**	**387,934.46**	**1,400,923.9**	**519,067.9**	**2,866,052.4**

Table 1.6–9. Annual and season-day emissions from all sources in the eight-hour ozone nonattainment area.

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
POINT SOURCES:	**768.54**	**1,754.12**	**1,078.48**	**4,908.3**	**15,407.1**	**9,715.8**
AREA SOURCES:						
Fuel combustion:						
Industrial distillate oil: Boilers	0.61	60.61	15.15	3.9	388.5	97.1
Industrial distillate oil: Engines	0.00	1,830.35	393.95	0.0	11,733.0	2,525.3
Industrial natural gas	36.83	727.80	453.34	216.9	4,285.3	2,669.3
Comm./inst. distillate oil: Boilers	0.00	0.12	0.03	0.0	0.8	0.2
Comm./inst. distillate oil: Engines	0.00	3.70	0.80	0.0	23.7	5.1
Comm./inst. natural gas	54.42	1,079.44	662.05	251.7	4,992.0	3,061.7
Residential distillate oil	0.01	0.35	0.10	0.0	0.0	0.0
Residential natural gas	50.20	857.96	365.09	120.5	2,060.1	876.7
Residential LPG	2.02	51.93	14.73	0.0	0.0	0.0
Residential wood combustion	515.53	58.38	2,993.75	0.0	0.0	0.0
Residential kerosene	0.00	0.03	0.01	0.0	0.0	0.0
All Fuel Combustion:	**659.63**	**4,670.68**	**4,898.99**	**593.0**	**23,483.5**	**9,235.4**
Industrial processes:						
Chemical manufacturing	77.09			596.5		
Commercial cooking	151.03		397.07	829.8		2,181.7
Bakeries	77.85			545.4		
Secondary metal production	41.01	15.02	98.36	306.4	107.9	697.4
Rubber/plastic product manufacturing	1,759.15			14,110.1		
Electrical equipment manufacturing	122.80	23.47	2.98	746.2	135.8	16.4
Industrial processes, NEC	47.55	224.92	91.84	318.0	1,245.8	525.2
All Industrial Processes:	**2,276.48**	**263.41**	**590.27**	**17,452.4**	**1,489.5**	**3,420.8**
Solvent use:						
Architectural coatings	5,033.13			30,973.1		
Auto refinishing	1,327.53			10,211.8		
Traffic markings	171.12			1,737.5		
Factory finished wood	137.12			1,390.7		
Wood furniture	414.77			3,419.9		
Aircraft surface coating	65.84			473.1		
Miscellaneous surface coating	315.02			2,440.0		
Degreasing	216.62			1,445.1		
Dry cleaning	23.42			180.1		
Graphics arts	289.73			2,216.1		
Miscellaneous industrial solvent use	718.75			5,104.6		
Consumer and commercial products	17,605.51			96,468.5		
Cutback asphalt	788.72			4,309.9		
Emulsified asphalt	817.24			4,465.8		
Roofing asphalt	3.08			23.7		
Agricultural pesticides	212.18			1,697.5		
All Solvent Use:	**28,139.77**			**166,557.4**		

Table 1.6–9. Annual and season-day emissions from all sources in the eight-hour ozone nonattainment area (continued).

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Storage/transport:						
Residential portable gas cans	2,968.67			16,311.39		
Commercial portable gas cans	570.89			3,136.73		
Bulk plants	120.91			659.3		
Gas stations Stage I: Submerged fill	85.08			528.7		
Gas stations Stage I: Bal. submerged fill	229.60			1,426.8		
Gas stations Stage II	0.00			0.0		
Underground tanks: Breathing/emptying	777.00			4,138.6		
Airports: Aviation gasoline Stage I	344.41			1,887.2		
Airports: Aviation gasoline Stage II	17.87			97.9		
Truck: Gasoline (tank trucks in transit)	50.82			315.8		
Pipeline gasoline	17.32			94.5		
Volatile organic liquids storage/transport	28.80			169.3		
All Storage/Transport:	**5,211.35**			**28,766.2**		
Waste treatment/disposal:						
On-site incineration	0.17	3.31	0.79	1.1	21.4	5.3
Open Burning: Land clearing debris	0.30	0.13	2.81	9.1	4.1	86.4
Landfills	36.59	30.40	108.55	200.7	167.4	596.4
Publicly owned treatment works	75.88			583.7		
Leaking underground storage tanks	1.05			32.3		
Other waste	2.12	22.19	77.93	10.9	122.8	431.4
All Waste Treatment/Disposal:	**116.10**	**56.04**	**190.06**	**837.8**	**315.6**	**1,119.6**
Misc. area sources:						
Agricultural field burning	15.28	6.79	144.32	470.2	209.0	4,440.7
Structure fires	14.95	1.90	81.55	73.3	9.3	399.7
Aircraft engine testing	4.72	46.36	16.16	26.1	259.3	91.2
Vehicle fires	9.38	1.17	36.64	51.4	6.4	200.8
Crematories	1.18	11.14	2.22	50.9	88.1	17.2
Accidental releases	0.45	0.00	0.00	2.1	0.0	0.0
Hospitals	8.66			52.9		
Wildfires	206.08	93.95	4,379.28	12,794.0	5,832.6	271,872.2
Prescribed fires	0.39	0.38	4.54	129.2	127.1	1,523.2
All Misc. Area Sources	**261.09**	**161.70**	**4,664.71**	**13,650.0**	**6,531.8**	**278,544.9**
ALL AREA SOURCES:	**36,664.42**	**5,151.83**	**10,344.03**	**227,856.8**	**31,820.5**	**292,320.7**
NONROAD MOBILE SOURCES:						
Agricultural equipment	22.52	193.22	177.56	192.5	1,615.1	1,510.9
Airport ground support equipment (+APU)	111.43	404.49	3,259.08	584.5	2,128.9	17,071.7
Commercial equipment	1,916.15	1,355.57	30,094.46	14,474.7	8,299.0	202,531.2
Construction & mining equipment	1,941.80	13,349.23	14,855.32	13,534.5	90,774.0	103,125.0
Industrial equipment	339.78	1,831.45	7,110.33	2,203.1	11,712.9	45,940.4
Lawn and garden equipment	4,970.15	876.55	55,425.05	52,584.9	7,078.4	529,218.9
Pleasure craft	530.39	96.56	1,249.66	11,527.0	1,996.8	26,738.3
Railway maintenance equipment	1.96	8.64	16.67	14.4	59.7	119.1
Recreational equipment	684.30	29.78	2,871.27	8,020.9	306.0	33,528.7
Aircraft	1,705.43	2,585.98	11,719.36	8,385.8	12,535.3	64,993.6
Locomotives	50.15	901.12	153.29	274.8	4,937.7	839.9
ALL NONROAD MOBILE SOURCES:	**12,274.06**	**21,632.59**	**126,932.05**	**111,797.1**	**141,443.8**	**1,025,617.7**
ONROAD MOBILE SOURCES:	**24,110.04**	**56,861.82**	**226,581.20**	**148,186.2**	**301,823.7**	**1,321,680.2**
BIOGENIC SOURCES:	**55,311.84**	**527.18**	**5,934.55**	**624,395.0**	**6,231.7**	**62,584.2**
TOTAL, ALL SOURCE CATEGORIES:	**129,128.91**	**85,927.54**	**370,870.31**	**1,117,143.4**	**496,726.7**	**2,711,918.6**

2. Point Sources

2.1 Introduction and scope

This inventory of ozone precursors (VOC, NO_x, and CO) is one of two 2011emissions inventory reports being prepared to meet US EPA reporting requirements. This inventory has been developed concurrently with a similar inventory for PM_{10} and related pollutants ($PM_{2.5}$, NO_x, SO_x, and NH_3) as part of Maricopa County's requirements under the respective SIPs.

In addition to preparing a periodic emissions inventory for the eight-hour ozone nonattainment area (NAA) as a commitment under the current ozone State Implementation Plan (SIP), the federal Air Emission Reporting Requirements (AERR) rule requires that state and local agencies prepare emissions estimates on a county basis, and submit data electronically to the US EPA for inclusion in the National Emissions Inventory (NEI) for 2011.

In order to provide consistency among all these inventories, it was decided to standardize the definition of a "point source" by adopting the designation of point sources as outlined in the AERR:

> *We are basing the requirement for point source format reporting on whether the source is major under 40 CFR part 70 for the pollutants for which reporting is required, i.e., CO, VOC, NO_x, SO_2, $PM_{2.5}$, PM_{10}, lead and NH_3 but without regard to emissions of HAPs… [T]his approach will result in a more stable universe of reporting point sources, which in turn will facilitate elimination of overlaps and gaps in estimating point source emissions, as compared to nonpoint source emissions. Under this requirement, states will know well in advance of the start of the inventory year which sources will need to be reported.* (US EPA, 2008)

This chapter contains several tables that provide information on point source emissions. Table 2.2–1 provides an alphabetical listing of all point sources and their location. Table 2.4–1 shows the annual and ozone season-day emissions of VOC, NO_x, and CO for those point sources which reported emissions of one or more of these pollutants in 2011. Table 2.5–1 lists emission reduction credits for the area, while Table 2.6–1 summarizes point source emission totals for both Maricopa County and the eight-hour ozone nonattainment area. Note that the totals shown in tables may not equal the sum of individual values due to independent rounding.

2.2 Identification of point sources

The Maricopa County Air Quality Department (MCAQD) identified point sources within Maricopa County through its electronic permit system database, EMS, and the 2011 annual emissions reports submitted to the department. A total of 18 stationary sources were identified as point sources using the definition described in Section 2.1. While the Arizona Department of Environmental Quality (ADEQ) retains permitting authority for a limited number of industrial source categories in Maricopa County, no ADEQ-permitted facilities are considered point sources, and are addressed instead as area sources.

Table 2.2–1 contains an alphabetical listing of all point sources, including a unique business identification number, NAICS industry classification code, business name, and physical address.

Table 2.2–1. Name and location of all point sources in Maricopa County.

ID #	NAICS	Business name	Address	City	ZIP
3313	221112	APS West Phoenix Power Plant	4606 W Hadley St	Phoenix	85043
43063	221112	Arlington Valley LLC	39027 W Elliot Rd	Arlington	85322
127771	331111	CMC Steel Fabricators Inc	11444 E Germann Rd	Mesa	85212
44439	221112	Gila River Power Station	1250 E Watermelon Rd	Gila Bend	85337
3300	92811	Luke AFB – 56th Fighter Wing	14002 W Marauder St	Glendale	85309
44186	221112	Mesquite Generating Station	37625 W Elliot Rd	Arlington	85322
43530	221112	New Harquahala Generating Co	2530 N 491st Ave	Tonopah	85354
20706	32614	New Wincup Holdings Inc	7980 W Buckeye Rd	Phoenix	85043
1879	562212	Northwest Regional Landfill	19401 W Deer Valley Rd	Surprise	85387
1331	337122	Oak Canyon Manufacturing Inc	3021 N 29th Dr	Phoenix	85017
52382	221112	Ocotillo Power Plant	1500 E University Dr	Tempe	85281
42956	221112	Redhawk Generating Facility	11600 S 363rd Ave	Arlington	85322
303	332431	Rexam Beverage Can Company	211 N 51st Ave	Phoenix	85043
3315	221112	Santan Generating Station	1005 S Val Vista Rd	Gilbert	85296
4175	424710	SFPP LP Phoenix Terminal	49 N 53rd Ave	Phoenix	85043
3316	221112	SRP Agua Fria Generating Station	7302 W Northern Ave	Glendale	85303
3317	221112	SRP Kyrene Generating Station	7005 S Kyrene Rd	Tempe	85283
1210	337122	Trendwood Inc	2402 S 15th Ave	Phoenix	85007

2.3 Procedures for estimating emissions from point sources

Annual and season-day emission estimates were determined from annual source emissions reports, MCAQD investigation reports, permit files and logs, or telephone contacts with sources. For most of the sources, material balance methods were used for determining emissions. Emissions were estimated using the emission factors from AP–42, source tests, engineering calculations, or manufacturers' specifications.

MCAQD distributes annual emissions survey forms to nearly all facilities for which MCAQD has issued an operating permit. Facilities are required to report detailed information on stacks, control devices, operating schedules, and process-level information concerning their annual activities. (See Appendix A for a copy of the instructions to complete the emissions inventory.) These instructions include examples and explanations on how to complete the annual emissions reporting forms that facilities must submit to MCAQD.

After a facility has submitted an annual emissions report to MCAQD, emissions inventory staff check all reports for missing and questionable data, and check the accuracy and reasonableness of all emissions calculations with AP–42, the Factor Information and REtrieval (*webFIRE*) software, and other EPA documentation. Control efficiencies are determined by source tests when available, or by AP–42 factors, engineering calculations, or manufacturers' specifications. MCAQD has conducted annual emissions surveys for permitted facilities since 1988, and the department's database system, EMS, contains numerous automated quality assurance/quality control checks for data input and processing.

2.3.1 Application of rule effectiveness

Rule effectiveness reflects the actual ability of a regulatory program to achieve the emission reductions required by regulation. The concept of applying rule effectiveness in a SIP emissions inventory has evolved from the observation that regulatory programs may be less than 100 percent effective for some source categories. Rule effectiveness ("RE") is applied to those sources affected by a regulation and for which emissions are determined by means of emission factors and control efficiency estimates.

For processes that claimed emissions reductions through the use of a control device, RE calculations were performed separately for Title V and non-Title V sources. Overall RE values of 91.81% (for Title V processes) and 87.81% (for non-Title V processes) were calculated.

Appendix B contains further details on the methods and data used in computing the above RE rates.

2.4 Detailed overview of point source emissions

Table 2.4–1 provides a summary of annual and season-day emissions from all point sources. All point sources are located within the eight-hour ozone nonattainment area, therefore, county and nonattainment area emissions are equal. Sources for which rule effectiveness has been applied are noted. Values of "0.00" and "0.0" for annual and daily emissions denote a value below the level of significance (0.005 tons/yr and 0.05 lbs/day, respectively).

Table 2.4–1. Annual and season-day point source emissions, by facility.

			Annual emissions (tons/yr)			Ozone season day (lbs/day)		
ID #	**Business name**		**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
3313	APS West Phoenix Power Plant	*	28.43	596.56	80.92	163.6	4,162.0	422.6
43063	Arlington Valley LLC		0.52	38.68	24.12	8.7	605.4	377.5
127771	CMC Steel Fabricators Inc	*	23.63	34.05	455.94	226.7	318.6	4,376.6
44439	Gila River Power Station		10.40	194.22	53.43	93.9	1,777.7	501.0
3300	Luke AFB – 56th Fighter Wing	*	8.07	10.04	5.36	53.1	52.2	22.5
44186	Mesquite Generating Station	*	22.53	192.49	22.99	134.0	1,146.1	137.2
43530	New Harquahala Generating Co	*	15.50	23.24	35.24	169.0	251.0	386.3
20706	New Wincup Holdings Inc		125.98	11.82	2.10	684.0	65.1	12.9
1879	Northwest Regional Landfill		2.47	9.74	5.18	13.6	53.5	28.5
1331	Oak Canyon Manufacturing Inc		62.86			483.5		
52382	Ocotillo Power Plant		4.79	82.96	15.54	51.1	1,087.8	203.7
42956	Redhawk Generating Facility		5.61	150.82	168.87	26.6	813.2	890.8
303	Rexam Beverage Can Company		99.49	4.35	3.65	481.1	21.0	17.7
3315	Santan Generating Station	*	8.78	257.77	150.24	87.7	2,817.6	1,648.7
4175	SFPP LP Phoenix Terminal		101.15	4.89	5.53	556.6	36.2	47.4
3316	SRP Agua Fria Generating Station	*	1.88	104.92	25.55	32.2	1,900.1	481.8
3317	SRP Kyrene Generating Station		3.16	27.77	8.51	25.2	245.8	76.9
1210	Trendwood Inc		128.59			989.1		
	TOTAL:		**653.84**	**1,744.32**	**1,063.18**	**4,279.8**	**15,353.4**	**9,632.0**

* = Facility for which rule effectiveness has been applied.

2.5 Emission reduction credits

A major source or major modification planned in a nonattainment area must obtain emissions reductions as a condition for approval. These emissions reductions, generally obtained from

existing sources located in the vicinity of a proposed source, must offset the emissions increase from the new source or modification. The obvious purpose of acquiring offsetting emissions decreases is to allow an area to move towards attainment of the national ambient air quality standards while still allowing some industrial growth.

In order for these emission reductions to be available in the future for offsetting, they must be: 1) explicitly included and quantified as growth in projection-year inventories required in rate of progress plans or attainment demonstrations that were based on 1990 actual inventories, and 2) meet the requirements outlined in MCAQD Rule 240 (Permit Requirements for New Major Sources and Major Modification to Existing Major Sources).

Table 2.5–1 provides a list of emission reduction credits for VOC, NO_x, and CO.

Table 2.5–1. Emission reduction credits as of December 31, 2011.

			Emission reduction credits (tons/yr)		
ID	**Facility/ Owner**	**Reduction Date**	**VOC**	**NO_x**	**CO**
1151	Freescale Semiconductor, Inc.	3/1/2004	17.1	9.8	15.3
	Grey K Envl Fund, NYC	12/11/2006	80.0		
	Woodstuff Mfg	11/30/2007	17.6		
	TOTAL:		**114.7**	**9.8**	**15.3**

2.6 Summary of point source emissions

Table 2.6–1 provides a summary of point source emissions for Maricopa County and the eight-hour ozone nonattainment area, including emission reduction credits.

Table 2.6–1. Annual and season-day point source emissions (including emission reduction credits).

	Annual (tons/yr)			Season-day emissions (lbs/day)		
Geographic Area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	768.54	1,754.12	1,078.48	4,908.3	15,407.1	9,715.8
8-hr ozone NAA	768.54	1,754.12	1,078.48	4,908.3	15,407.1	9,715.8

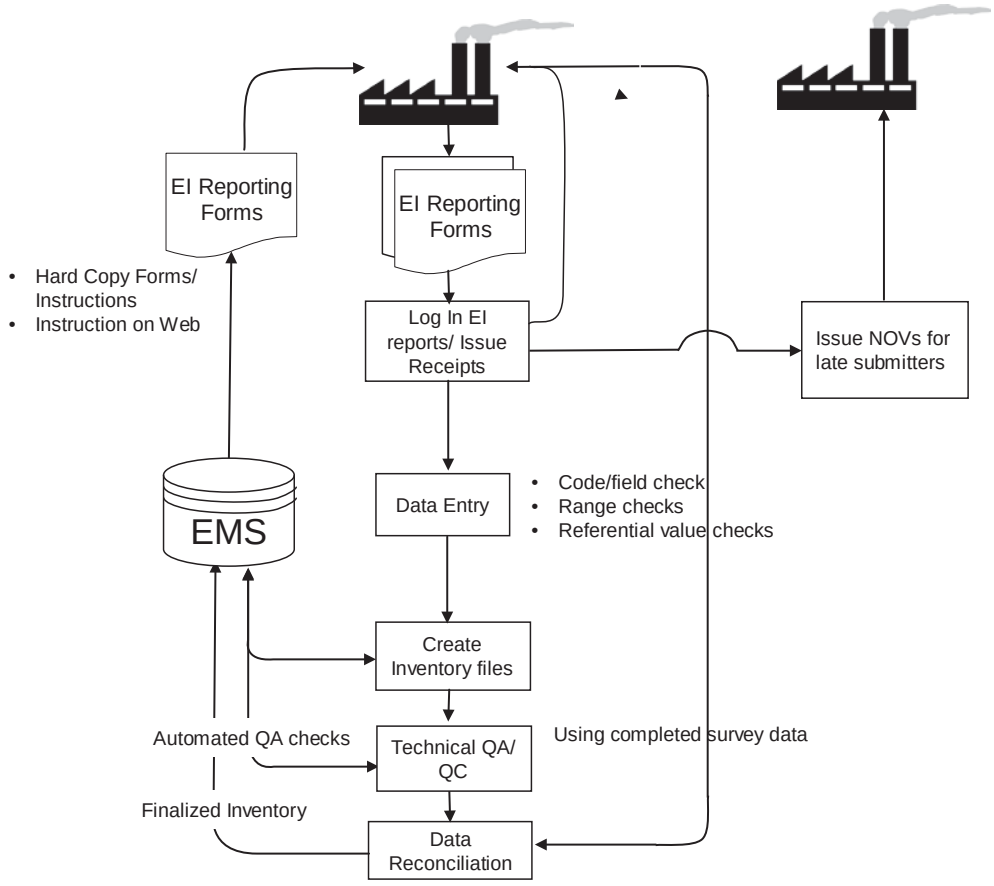
2.7 Quality assurance/quality control procedures

2.7.1 Emission survey preparation and data collection

The MCAQD's Emissions Inventory (EI) Unit annually collects point source criteria pollutant emission data from sources in the county. MCAQD annually reviews EPA guidance, documents from the Emissions inventory Improvement Program (EIIP), and other source materials to ensure that the most current emission factors and emission calculation methods are used for each year's survey. Each January, the EI Unit prepares a pre-populated hard copy of the preceding year's submissions and mails reporting forms to permitted sources, along with detailed instructions for completing the forms. (A copy of these instructions is included as Appendix A). The EI Unit asks sources to verify and update the data. The EI Unit also holds numerous workshops each spring to assist businesses in completing EI forms.

The general data flow for data collection and inventory preparation is shown in Figure 2.7–1.

Figure 2.7–1. Data flow for annual point source emissions inventory reporting.



2.7.2 Submission processing

Submitted EI reports are logged in as they are received, and receipts are issued for emissions fees paid. The data are input "as received" into the department's data base. During data entry, a variety of automated quality control (QC) checks are performed, including:

- pull-down menus to minimize data entry errors (e.g., city, pollutant, emission factor unit, etc.)
- mandatory data field requirement checks (e.g., a warning screen appears if a user tries to save an emission record with a missing emission factor).
- range checks (e.g., were valid SCC, Tier, SIC, and NAICS codes entered?)
- referential value checks (e.g., emission factor units, annual throughput units)
- automatic formatting of date, time, telephone number fields, etc.

Automated quality assurance (QA) checks on the report that has been entered include the following:

- Comparing reported emission factors to SCC reference lists
- Comparing reported emission factors to material name reference list

- Checking the report for calculation errors. This includes annual throughput, emission factors, unit conversion factors (e.g., BTU to therms), capture efficiency, primary / secondary control device efficiency, and any offsite recycling credits claimed.
- Checking the report for completeness of required data.

When data entry is complete, an electronic version of the original data is preserved separately to document changes made during the technical review and QA/QC process.

When errors are flagged, the businesses are contacted and correct information is obtained and input to the EMS. Outstanding reporting issues are documented. Confidential business information (CBI) is identified by a checkbox on the form, and these data elements are flagged during data entry and are not transmitted to the EPA.

To prepare the inventory for submittal to the National Emissions Inventory (NEI), the EI Unit has developed a series of MS-Access queries to extract data from EMS; and to append or convert codes, units of measure, etc., in order to create staging tables that adhere to the EPA's Consolidated Emissions Reporting Schema (CERS). These tables are then converted to XML files using EPA's Bridge conversion tool for submittal to the EPA's Emissions inventory System (EIS).

2.7.3 Analysis of annual point source emissions data for this inventory

Two air quality planners checked inventory accuracy and reasonableness, and assured that all point sources had been identified and that the methodology applied to calculate emissions was appropriate and that the calculations were correct. Other reasonableness checks were conducted by recalculating emissions using methods other than those used to make the initial emissions calculations and then comparing results. QA was conducted by checking all emissions reports submitted to MCAQD for the year 2011 for missing and questionable data and by checking the accuracy and reasonableness of all emissions calculations made for such reports. Notes concerning follow-up calls and corrections to calculations were documented on each 2011 annual emissions report.

The QA point source coordinator reviewed and checked calculations, identified errors, and performed completeness, reasonableness and accuracy checks.

2.8 References

US EPA, 2008. Air Emissions Reporting Requirements: Final Rule. 73 Fed. Reg. 76539. Available at: *http://www.epa.gov/ttn/chief/aerr/final_published_aerr.pdf*.

3. Area Sources

3.1 Scope and methodology

This chapter considers all stationary sources which are too small or too numerous to be treated as point sources. US EPA guidance documents, including "Introduction to Area Source Inventory Development" (US EPA, 2001a) as well as permit and emissions data in the MCAQD's Environmental Management System (EMS) database, and previous SIP inventories, were evaluated to develop the list of area source categories for inclusion. Some source categories were deemed "insignificant" because there are no large production facilities and/or very few small sources, and therefore emissions were not quantified. MCAQD prepared the emission estimates for all area sources and provided quality assurance checks on all data. Table 3.1–1 contains a list of all area source categories, with Source Classification Codes (SCCs), addressed in this chapter.

Table 3.1–1. List of area source categories included in this ozone precursor inventory.

SCC code	Area source description	Section
	Fuel combustion:	**3.2**
2102004001	Industrial distillate oil: Boilers	3.2.1
2102004002	Industrial distillate oil: Engines	3.2.1
2102006000	Industrial natural gas	3.2.2
2103004001	Commercial/institutional distillate oil: Boilers	3.2.3
2103004002	Commercial/institutional distillate oil: Engines	3.2.3
2103006000	Commercial/institutional natural gas	3.2.4
2104004000	Residential distillate oil	3.2.5
2104006000	Residential natural gas	3.2.6
2104007000	Residential liquefied petroleum gas (LPG)	3.2.7
2104011000	Residential kerosene	3.2.8
2104008100	Residential Wood Combustion (RWC): Fireplace	3.2.9
2104008210	RWC: Woodstove: fireplace inserts: Non-EPA certified	3.2.9
2104008220	RWC: Woodstove: fireplace inserts: EPA certified; non-catalytic	3.2.9
2104008230	RWC: Woodstove: fireplace inserts: EPA certified; catalytic	3.2.9
2104008310	RWC: Woodstove: freestanding: Non-EPA certified	3.2.9
2104008320	RWC: Woodstove: freestanding: EPA certified, non-catalytic	3.2.9
2104008330	RWC: Woodstove: freestanding: EPA certified, catalytic	3.2.9
2104008400	RWC: Woodstove: Pellet-fired	3.2.9
2104008610	RWC: Hydronic heater: Outdoor	3.2.9
2104008700	RWC: Outdoor wood burning device, NEC	3.2.9
2104009000	RWC: Residential firelog	3.2.9
	Industrial processes:	**3.3**
2301000000	Chemical manufacturing	3.3.1
2302002100	Commercial cooking: Conveyorized charbroiling	3.3.2.1
2302002200	Commercial cooking: Under-fired charbroiling	3.3.2.1
2302003000	Commercial cooking: Deep fat frying	3.3.2.1
2302003100	Commercial cooking: Flat griddle frying	3.3.2.1
2302003200	Commercial cooking: Clamshell griddle frying	3.3.2.1
2302050000	Bakeries	3.3.2.2
2304000000	Secondary metal production	3.3.3
2308000000	Rubber/plastics product manufacturing	3.3.4
2312000000	Electrical equipment manufacturing	3.3.5
2399000000	Industrial processes not elsewhere classified (NEC)	3.3.6
	Solvent use:	**3.4**
2401001000	Architectural coatings	3.4.1.1
2401005000	Auto refinishing	3.4.1.2
2401008000	Traffic markings	3.4.1.3
2401015000	Factory-finished wood	3.4.1.4

Table 3.1–1. List of area source categories included in this inventory (continued).

AMS code	Area source description	Section
2401020000	Wood furniture	3.4.1.5
2401075000	Aircraft surface coating	3.4.1.6
2401090000	Miscellaneous surface coating	3.4.1.7
2415000000	Degreasing	3.4.2
2420000000	Dry cleaning	3.4.3
2425000000	Graphic arts	3.4.4
2440000000	Miscellaneous industrial solvent use	3.4.5
2460100000	Consumer & commercial products (C&CP): Personal care products	3.4.6
2460200000	C&CP: Household products	3.4.6
2460400000	C&CP: Automotive aftermarket products	3.4.6
2460500000	C&CP: Coatings and related products	3.4.6
2460600000	C&CP: Adhesives and sealants	3.4.6
2460800000	C&CP: FIFRA related products	3.4.6
2460900000	C&CP: Miscellaneous products, NEC	3.4.6
2461021000	Cutback asphalt	3.4.7
2461022000	Emulsified Asphalt	3.4.7
2461023000	Roofing Asphalt	3.4.7
2461850000	Agricultural pesticides	3.4.8
	Storage and transport:	**3.5**
2501011011	Residential portable gas cans (RPG): Permeation	3.5.1
2501011012	RPG: Evaporation	3.5.1
2501011013	RPG: Spillage during transport	3.5.1
2501011014	RPG: Refilling at the pump - vapor displacement	3.5.1
2501011015	RPG: Refilling at the pump - spillage	3.5.1
2501012011	Commercial portable gas cans (CPG): Permeation	3.5.1
2501012012	CPG: Evaporation	3.5.1
2501012013	CPG: Spillage during transport	3.5.1
2501012014	CPG: Refilling at the pump - vapor displacement	3.5.1
2501012015	CPG: Refilling at the pump - spillage	3.5.1
2501055120	Bulk plants	3.5.2
2501060051	Gasoline service stations Stage I: Submerged filling	3.5.3
2501060053	Gasoline service stations Stage I: Balanced submerged filling	3.5.3
2501060201	Gasoline service stations: Underground tank, breathing/emptying	3.5.5
2501080050	Airports: Aviation gasoline Stage I: Total	3.5.6
2501080100	Airports: Aviation gasoline Stage II: Total	3.5.6
2505030120	Gasoline tank trucks in transit	3.5.7
2505040120	Pipeline gasoline	3.5.8
2510000000	Volatile organic liquid (VOL) storage and transport	3.5.9
	Waste treatment and disposal:	**3.6**
2601000000	On-site incineration	3.6.1
2610000500	Open burning: Land clearing debris	3.6.2
2620000000	Landfills	3.6.3
2630020000	Publicly owned treatment works	3.6.4
2660000000	Leaking underground storage tanks	3.6.5
2650000000	Other waste	3.6.6
	Miscellaneous area sources:	**3.7**
2801500000	Agricultural field burning	3.7.1
2810030000	Structure fires	3.7.2
2810040000	Aircraft engine testing	3.7.3
2810050000	Vehicle fires	3.7.4
2810060100	Crematories	3.7.5
2830001000	Accidental releases	3.7.6
2850000000	Hospitals	3.7.7
n/a	Wildfires	3.7.8
n/a	Prescribed fires	3.7.9

For nearly all categories, emissions were calculated in one of the following ways:

- Emissions estimates for some categories were developed by conducting surveys on local usage (e.g., natural gas consumption) or derived from state-wide data (e.g., fuel oil use).
- For some widespread or diverse categories (e.g., consumer solvent use), emissions were calculated using published per-capita or per-employee emission factors.
- For source categories with some information available from annual emissions reports (e.g., bakeries), these data were combined with employment data to "scale up" reported emissions to reflect the entire source category.
- For those source categories with detailed emissions data available from most or all of the significant sources in the category, emissions were calculated based on detailed process-level and operational data provided by these sources.

The specific emissions estimation methodologies used for each source category (including the derivation and application of rule effectiveness) are described in greater detail in the respective sections.

3.2 Fuel combustion

Area-source emission estimates are provided in this section for the following categories of fuel consumption: Industrial distillate oil, industrial natural gas, commercial/institutional distillate oil, commercial/institutional natural gas, residential distillate oil, residential natural gas, residential liquefied petroleum gas, residential kerosene, and residential wood.

Data for natural gas combustion emission estimates came from a survey of the three natural gas suppliers in Maricopa County. Table 3.2–1 summarizes the natural gas sales data received from Maricopa County natural gas suppliers.

Table 3.2–1. Maricopa County natural gas sales by end-user category and supplier.

	Sales by end-user category (in MMCF/yr)					
Natural gas supplier	**Electric Utilities**	**Industrial**	**Commercial/ Institutional**	**Residential**	**Transport***	**Other***
Southwest Gas	n/a	592.74	13,303.23	17,083.04	9,288.47	406.92
City of Mesa	n/a	91.17	1,631.61	1,030.07	175.13	n/a
El Paso	112,963.97	150.78	n/a	n/a	n/a	n/a
Total:	**112,963.97**	**834.68**	**14,934.84**	**18,113.11**	**9,463.60**	**406.92**

*For emissions calculations, sales from transport and other were grouped with industrial sales.

3.2.1 Industrial distillate oil

Annual emissions from industrial distillate oil combustion were derived from EPA NEI (US EPA, 2012c) calculations. Emissions come from two different sources, boilers and engines burning distillate oil.

Ozone season-day emissions for the county are calculated by first multiplying annual emissions by 25% to estimate ozone season totals. Ozone season emission totals are then divided by the number of days that activity occurs during the ozone season (6 days/week and 13 weeks), as recommended by EIIP guidance (US EPA, 2001a). Annual and season-day emissions in the eight-hour ozone nonattainment area were calculated by applying the ratio of industrial

employment in the nonattainment area to county-level emission calculations (99.57%). (See Section 1.5.1 for a discussion of the employment data used). Results for boilers and engines are shown in Tables 3.2–2 and 3.2–3, respectively.

Table 3.2–2. Annual and season-day emissions from area-source industrial distillate oil combustion for boilers.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.61	60.87	15.22	3.9	390.2	97.5
8-hr ozone NAA	0.61	60.61	15.15	3.9	388.5	97.1

Table 3.2–3. Annual and season-day emissions from area-source industrial distillate oil combustion for engines.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.00	1,838.26	395.65	0.0	11,783.7	2,536.2
8-hr ozone NAA	0.00	1,830.35	393.95	0.0	11,733.0	2,525.3

3.2.2 Industrial natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information on the volume of natural gas distributed, by user category, within the county in 2011. Area-source industrial natural gas usage for the county is based on the reported total volume of natural gas sold to industrial sources (10,705.20 MMCF), minus natural gas used by industrial point sources (463.95 MMCF).

Natural gas is used for both external combustions (boilers and heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source natural gas usage derived above must be divided between these two categories. This apportionment was based on the percentages of external and internal natural gas combustion reported by all industrial area sources in 2008. A 2008 apportionment was used because 2011 data were not available for all industrial area sources at the time that these emission estimates were developed.

Annual emissions for the county were calculated by multiplying natural gas usage by the respective emission factors for external (SCC=102006* & 103006*) and internal (SCC=2020020*) combustion obtained from EPA's WebFIRE database (US EPA, 2012a).

Table 3.2–4. Natural gas usage, emission factors, and annual emissions from area-source industrial natural gas consumption, by combustion type.

Combustion	% of	Natural gas usage	Emission factors (lb/MMCF)			Annual emissions (tons/yr)		
type	**total**	**(MMCF)**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
External	98.44	10,081.49	5.5	100	84	27.72	504.07	423.42
Internal	1.56	159.76	116	2,840	399	9.27	226.86	31.87
Total:	**100.00**	**10,241.25**				**36.99**	**730.94**	**455.30**

Ozone season-day emissions for the county are calculated by first multiplying annual emissions by the percentage of industrial natural gas sold used during the ozone season (22.96%). (Figures reported by natural gas suppliers for the June–August time period are assumed to be representative for the July–September ozone season.) Ozone season emission totals are then divided by the number of days that activity occurs during the ozone season (6 days/wk × 13 wks/season).

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations (99.57%). (See Section 1.5.1 for a discussion of the employment data used).

Table 3.2–5. Annual and season-day emissions from area-source industrial natural gas combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	36.99	730.94	455.30	217.8	4,303.8	2,680.8
8-hr ozone NAA	36.83	727.80	453.34	216.9	4,285.3	2,669.3

3.2.3 Commercial/institutional distillate oil

Annual emissions from commercial/institutional distillate oil combustion were derived from EPA NEI (US EPA, 2012c) calculations. Emissions come from two different sources, boilers and engines burning distillate oil.

Ozone season-day emissions for the county are calculated by first multiplying annual emissions by 25% to estimate ozone season totals. Ozone season emission totals are then divided by the number of days that activity occurs during the ozone season (6 days/week and 13 weeks), as recommended by EIIP guidance (US EPA, 2001a). Annual and season-day emissions in the eight-hour ozone nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations (99.57%). (See Section 1.5.1 for a discussion of the employment data used.) Emissions estimates for boilers and engines are shown in Tables 3.3–6 and 3.3–7, respectively.

Table 3.2–6. Annual and season-day emissions from area-source commercial/institutional distillate oil combustion for boilers.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.00	0.12	0.03	0.0	0.8	0.2
8-hr ozone NAA	0.00	0.12	0.03	0.0	0.8	0.2

Table 3.2–7. Annual and season-day emissions from area-source commercial/institutional distillate oil combustion for engines.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.00	3.72	0.80	0.0	23.8	5.1
8-hr ozone NAA	0.00	3.70	0.80	0.0	23.7	5.1

3.2.4 Commercial/institutional natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information on the volume of natural gas distributed, by user category, within the county in 2011. Area-source commercial and institutional (C&I) natural gas usage for the county is based on the reported total volume of natural gas sold to C&I sources (14,934.84 MMCF), minus natural gas used by C&I point sources (77.80 MMCF).

Natural gas is used for both external combustion (boilers, heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source natural gas usage derived above must be apportioned between these two categories. This apportionment was

based on the percentages of external and internal natural gas combustion reported by all C&I area sources in 2008. A 2008 apportionment was used because 2011 data were not available for all C&I area sources at the time that these emission estimates were developed.

Annual emissions for the county were calculated by multiplying natural gas usage by the respective emission factors for external (SCC=1020060*) and internal (SCC=2020020*) combustion obtained from EPA's WebFIRE database (US EPA, 2012a).

Table 3.2–8. Emission factors and annual emissions from area-source commercial/institutional natural gas combustion, by combustion type.

Combustion type	% of total	Natural gas usage (MMCF)	Emission factors (lb/MMCF)			Annual emissions (tons/yr)		
			VOC	NO_x	CO	VOC	NO_x	CO
External	98.34	14,610.42	5.5	100	84	40.18	730.52	613.64
Internal	1.66	246.63	116	2,840	399	14.30	350.21	49.20
Total:	**100.00**	**14,857.04**				**54.48**	**1,080.73**	**662.84**

Ozone season-day emissions for the county were calculated by first multiplying annual emissions by the percentage of C&I natural gas used during the ozone season (18.04%). (Figures reported by natural gas suppliers for the June–August time period are assumed to be representative of the July–September ozone season.) Ozone season emission totals are then divided by the number of days that activity occurs during the ozone season (6 days/wk × 13 wks/yr).

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by applying the combined ratio of retail, office, public and other employment in the nonattainment area to county-level emission calculations (99.88%). (See Section 1.5.1 for a discussion of the employment data used).

Table 3.2–9. Annual and season-day emissions from area-source commercial/institutional natural gas combustion.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	54.48	1,080.73	662.84	252.0	4,998.0	3,065.4
8-hr ozone NAA	54.42	1,079.44	662.05	251.7	4,992.0	3,061.7

3.2.5 Residential distillate oil

Annual emissions from residential distillate oil were derived from EPA NEI (US EPA, 2012c) calculations. Ozone season-day emissions would normally be calculated by dividing ozone season emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). However, data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there were no heating degree days reported during the 2011 ozone season (July–September). Thus, ozone season-day emissions from residential distillate oil combustion are assumed to be zero.

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a further discussion of the population used. Table 3.2–10 summarizes annual and ozone season-day emissions from residential distillate oil combustion for both the county and the eight-hour ozone nonattainment area.

Table 3.2–10. Annual and season-day emissions from residential distillate oil combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.01	0.35	0.10	0.0	0.0	0.0
8-hr ozone NAA	0.01	0.35	0.10	0.0	0.0	0.0

3.2.6 Residential natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information on the volume of natural gas sold, by user category, within the county. Annual emissions from residential natural gas combustion emissions were calculated by multiplying 2011 residential natural gas sales (18,113.11 MMCF) by emission factors for residential natural gas combustion summarized in the table below (US EPA, 1998).

Table 3.2–11. Residential natural gas combustion emission factors.

Pollutant	Emission Factor (lb/MMCF)
VOC	5.5
NO_x	94.0
CO	40.0

Ozone season-day emissions were calculated by first multiplying reported natural gas usage during the ozone season (1,978.95 MMCF) by the AP-42 emission factors for residential natural gas combustion to produce ozone season emissions. (Natural gas usage reported for the months of June–August is assumed to represent ozone season usage). Ozone season emissions were then divided by days during the ozone season that residential natural gas combustion occurs (7 days/wk × 13 wks/yr) (US EPA, 2001a).

Annual and season-day residential natural gas emissions in the eight-hour ozone nonattainment area were calculated by multiplying county-level emissions by the percentage of total resident population in the eight-hour ozone nonattainment area (100.78%).

Table 3.2–12. Annual and season-day emissions from residential natural gas combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	49.81	851.32	362.26	119.6	2,044.2	869.9
8-hr ozone NAA	50.20	857.96	365.09	120.5	2,060.1	876.7

3.2.7 Residential liquefied petroleum gas (LPG)

Annual emissions from residential liquefied petroleum gas (LPG) were derived from EPA NEI (US EPA, 2012c) calculations.

Ozone season-day emissions would normally be calculated by dividing ozone season emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). However, data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there were no heating degree days reported during the 2011 ozone season (July–September). Thus, ozone season-day emissions from residential liquefied petroleum gas (LPG) combustion are assumed to be zero.

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a further discussion of the population used.

Table 3.2–13 summarizes annual and ozone season-day emissions from residential liquefied petroleum gas (LPG) combustion for both the county and the eight-hour ozone nonattainment area.

Table 3.2–13. Annual and season-day emissions from residential liquefied petroleum gas (LPG) combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	2.00	51.35	14.56	0.0	0.0	0.0
8-hr ozone NAA	2.02	51.93	14.73	0.0	0.0	0.0

3.2.8 Residential kerosene

Annual emissions from residential kerosene were derived from EPA NEI (US EPA, 2012c) calculations.

Ozone season-day emissions would normally be calculated by dividing annual emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). However, data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there was no heating degree days reported during the 2011 ozone season (July–September). Thus, ozone season-day emissions from residential kerosene combustion are assumed to be zero.

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a further discussion of the population used.

Table 3.2–14 summarizes annual and season-day emissions from residential kerosene combustion for both the county and the eight-hour ozone nonattainment area.

Table 3.2–14. Annual and season-day emissions from residential kerosene combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.00	0.03	0.01	0.0	0.0	0.0
8-hr ozone NAA	0.00	0.03	0.01	0.0	0.0	0.0

3.2.9 Residential wood combustion

Annual emissions from residential wood combustion for Maricopa County were obtained from the US Environmental Protection Agency's Residential Wood Combustion Estimation Tool (US EPA, 2012b). County-level annual emissions by appliance type are shown below in Table 3.2–15.

Table 3.2–15. Annual emissions by appliance type for Maricopa County from EPA's residential wood combustion estimation tool.

SCC	Appliance Type	Annual emissions (tons/yr) VOC	NO_x	CO
2104008100	Fireplace	191.08	26.29	1,506.38
2104008210	Woodstove: fireplace inserts; non-EPA certified	147.35	7.78	641.66
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	10.70	2.03	125.54
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	4.46	0.59	31.02
2104008310	Woodstove: freestanding, non-EPA certified	71.45	3.77	311.15
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	5.18	0.99	60.83
2104008330	Woodstove: freestanding, EPA certified, catalytic	2.16	0.29	15.04
2104008400	Woodstove: pellet-fired, general	0.01	1.19	4.97
2104008610	Hydronic heater: outdoor	0.00	0.00	0.00
2104008700	Outdoor wood burning device, NEC	3.99	0.55	31.49
2104009000	Residential firelog	73.32	14.24	231.82
Total		**509.70**	**57.72**	**2,959.91**

Ozone season-day emissions would normally be calculated by dividing ozone season emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). However, data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there was no heating degree days reported during the 2011 ozone season (July–September). Thus, ozone season-day emissions from residential wood combustion are assumed to be zero.

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a further discussion of the population used.

Table 3.2–16 summarizes annual and season-day emissions from residential wood combustion for both the county and the eight-hour ozone nonattainment area.

Table 3.2–16. Annual and season-day emissions from residential wood combustion.

Geographic area	Annual emissions (tons/yr) VOC	NO_x	CO	Season-day emissions (lbs/day) VOC	NO_x	CO
Maricopa County	509.70	57.72	2,959.91	0.0	0.0	0.0
8-hr ozone NAA	515.53	58.38	2,993.75	0.0	0.0	0.0

3.3 Industrial processes

3.3.1 Chemical manufacturing

Emissions from area-source chemical manufacturing were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP), representing 2010 employment, were used. Table 3.3–1 shows the NAICS codes and employment data used to calculate emissions from chemical manufacturing.

Table 3.3–1. County-level employment estimates for chemical manufacturing, by NAICS code.

NAICS code	NAICS description (and employment range)	Estimated employment
325	Chemical manufacturing	4,605
42469	Other chemical & allied products merchant wholesalers	1,484
424910	Farm supplies merchant wholesalers	904
33312	Construction machinery manufacturing (250–499)	375
Total:		**7,368**

Since there were no point sources in this category, an area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2011.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage industrial employment within the nonattainment area. See Section 1.5.1 for a discussion of the employment data used.

Table 3.3–2 summarizes annual and season-day emissions from chemical manufacturing in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.3–2. Annual and season-day emissions from area-source chemical manufacturing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	77.42	599.0
8-hr ozone NAA	77.09	596.5

3.3.2 Food and kindred products

3.3.2.1 Commercial cooking

Emissions from commercial cooking were estimated for five types of commercial cooking equipment using per capita emissions factors developed by EPA for the 2008 National Emissions Inventory (NEI) (Pechan, 2012a). The per capita emission factors for each equipment type are contained in Table 3.3–3. EPA created the emission factors listed in Table 3.3–3 by taking 2002 emissions in the NEI and dividing by the 2002 population to develop per capita emission factors. The equipment types include: chain-driven charbroilers, under-fired charbroilers, deep-fat fryers, flat griddles, and clamshell griddles.

Table 3.3–3. Emission factors for commercial cooking equipment, by device type.

	Emission Factor (lb/person)	
Equipment type	**VOC**	**CO**
Chain-driven charbroilers	0.012056010	0.042446624
Under-fired charbroilers	0.041480307	0.135002176
Deep-fat fryers	0.012608151	0.000000000
Flat griddle fryers	0.005943281	0.012687330
Clamshell griddles	0.000231564	0.000000000

Annual commercial cooking emissions for Maricopa County were estimated by multiplying the MAG-estimated county population (4,129,646) by the per capita emission factors for each type of cooking equipment. See Section 1.5.1 for a discussion of the population data used.

Commercial cooking is assumed to occur uniformly throughout the year, therefore, it was assumed that 25% of annual activity occurs during the ozone season, and that activity occurs 7 days/week. Thus, season-day emissions were estimated by multiplying annual emissions by 25% then dividing the result by 91 (7 days/wk × 13 wks/ozone season). The results are shown in Table 3.3–4 below.

Table 3.3–4. Annual and daily emissions from commercial cooking equipment in Maricopa County.

	Annual Emissions (tons/yr)		Season-day emissions (lbs/day)	
Equipment type	**VOC**	**CO**	**VOC**	**CO**
Chain-driven charbroilers	24.89	87.64	136.8	481.6
Under-fired charbroilers	85.65	278.76	470.6	1,531.6
Deep-fat fryers	26.03	—	143.0	0.0
Flat griddles	12.27	26.20	67.4	143.9
Clamshell griddles	0.48	—	2.6	0.0
Total:	**149.33**	**392.60**	**820.5**	**2,157.1**

Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a discussion of the population data used. Table 3.3–5 summarizes the annual and season-day emissions from commercial cooking for the eight-hour ozone nonattainment area.

Table 3.3–5. Annual and daily emissions from commercial cooking equipment in the eight-hour ozone NAA.

	Annual emissions (tons/yr)		Season-day emissions (lbs/day)	
Equipment type	**VOC**	**CO**	**VOC**	**CO**
Chain-driven charbroilers	25.18	88.64	138.3	487.1
Under-fired charbroilers	86.63	281.93	476.0	1,549.1
Deep-fat fryers	26.33	0.00	144.7	0.0
Flat griddles	12.41	26.50	68.2	145.6
Clamshell griddles	0.48	0.00	2.7	0.0
Total:	**151.03**	**397.07**	**829.8**	**2,181.7**

3.3.2.2 Bakeries

Emissions from area-source bakeries were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources and County-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. (Where employment estimates were provided as a range of values, the midpoint was used.) CBP estimates for Maricopa County employment in NAICS codes 311812 and 31183 (Commercial bakeries and Tortilla manufacturing) to total 2,491 persons. There were no point sources in this category, thus all emissions from this source category are reported as area sources. Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals.

Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county. Results are summarized in Table 3.3–6. See section 1.5.1 for a discussion of the employment data used.

Table 3.3–6. Annual and season-day emissions from area-source bakeries.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	78.18	547.8
8-hr ozone NAA	77.85	545.4

3.3.3 Secondary metal production

Annual emissions from secondary metal production facilities were derived from annual emissions reports from permitted sources. As this category consists primarily of foundries, it was assumed that there were no significant unpermitted sources within Maricopa County. Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, total emission values for the county and the nonattainment area from secondary metal production are equal. Annual and season-day emissions are shown in Table 3.3–7.

Table 3.3–7. Annual and season-day emissions from area-source secondary metal production.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	41.01	15.02	98.36	306.4	107.9	697.4
8-hr ozone NAA	41.01	15.02	98.36	306.4	107.9	697.4

3.3.4 Rubber/plastics product manufacturing

Emissions from area-source rubber and plastic manufacturing facilities were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category. The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. Where CBP employment estimates were presented as a range, the midpoint values were chosen for these calculations. Table 3.3–8 shows the NAICS codes and employment data used to calculate emissions from rubber and plastic manufacturing facilities.

Table 3.3–8. County-level employment estimates for rubber and plastic product manufacturing, by NAICS code.

NAICS code	NAICS description (and employment range)	Estimated employment
325211	Plastic material and resin manufacturing (0–19)	10
325991	Custom compounding of purchased resins (100–249)	175
326140	Polystyrene foam product manufacturing	164
326199	All other plastics product manufacturing	3,027
326212	Tire retreading	135
326299	All other rubber product manufacturing	92
332313	Plate work manufacturing	151
336413	Other aircraft parts and aux. equipment manufacturing	2,086
337920	Blind and shade manufacturing (250–499)	375
339115	Ophthalmic goods manufacturing	97
423830	Industrial machinery & equip. merchant wholesalers	2,634
423930	Recyclable material merchant wholesalers	1,268
441310	Automotive parts and accessories stores	3,392
441320	Tire dealers	2,095
Total:		**15,701**

Some facilities in this category are considered point sources, and have been addressed in Chapter 2. To avoid double-counting, employment at point sources is subtracted from total employment.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county. See Section 1.5.1 for a discussion of the employment data used.

Table 3.3–9 summarizes annual and season-day emissions from area source rubber and plastic products manufacturing in Maricopa County and the eight-hour ozone nonattainment area.

Table 3.3–9. Annual and season-day emissions from area-source rubber/plastic product manufacturing.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	1,766.75	14,171.0
8-hr ozone NAA	1,759.15	14,110.1

3.3.5 Electrical equipment manufacturing

Annual and season-day emissions from electric equipment manufacturing were derived from annual emissions reports submitted by permitted sources. It was assumed that there were no significant unpermitted sources within Maricopa County and all electrical equipment manufacturing permitted sources are reported here as area-sources.

As all facilities addressed in this source category are located within the eight-hour ozone nonattainment area, emission totals for both areas are equal. Annual and season-day emissions are shown in Table 3.3–10.

Table 3.3–10. Annual and season-day emissions from area-source electric equipment manufacturing.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	122.80	23.47	2.98	746.2	135.8	16.4
8-hr ozone NAA	122.80	23.47	2.98	746.2	135.8	16.4

3.3.6 Industrial processes not elsewhere classified (NEC)

Annual area-source emissions from other industrial processes not elsewhere classified (NEC) were derived primarily from annual emissions reports from permitted facilities. Other industrial processes include a wide array of industrial activities that are often specific to the permitted facility that reported the process. For this reason, it is assumed there are no significant emissions from other industrial processes, other than those reported by permitted facilities on their annual emissions reports. Ozone season-day emissions were calculated based on operating schedule information provided by individual facilities through MCAQD's annual emissions reporting program. Emissions estimates for the eight-hour ozone nonattainment area were derived using data on the location of the facilities that report other industrial processes.

In addition, emissions from ADEQ-permitted sources are included in this category due to a lack of specificity regarding the nature of the reported emissions. As a conservative estimate, all of these emissions were assumed to occur within the eight-hour ozone nonattainment area. Estimates of total emissions from this source category are presented in Table 3.3–11.

Table 3.3–11. Annual and season-day emissions from industrial processes not elsewhere classified.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	48.51	224.92	91.84	325.6	1,245.8	525.2
8-hr ozone NAA	47.55	224.92	91.84	318.0	1,245.8	525.2

3.4 Solvent use

3.4.1 Surface coating

3.4.1.1 Architectural coatings

VOC emissions from architectural coatings were calculated using a per-capita emission factor developed and used by EPA for the 2008 NEI (Pechan, 2012). Because Maricopa County Rule 335 contains an emission limit for coatings, the "controlled" VOC emission factor (2.41 lbs/person) was used.

Annual VOC emissions for architectural coating for both Maricopa County and the eight-hour ozone nonattainment area were calculated by multiplying the per-capita emission factor by the county and nonattainment area populations (4,129,646 and 4,176,870, respectively). See Section 1.5.1 for a discussion of the population data used.

Ozone season-day emissions were developed using default assumptions from EIIP (US EPA, 1995a). The seasonal factor for ozone season architectural coating activity was assumed to be 28 percent of annual activity. In addition, it was assumed that coating use may take place 7 days a week during the ozone season (13 wks/season). Thus, season-day emissions were calculated by multiplying annual VOC emissions by the seasonal factor and then dividing the results by 91 days per season. Table 3.4–1 presents the assumptions used as well as annual and season-day

VOC emissions from architectural coatings for Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–1. Annual and season-day emissions from architectural coating.

Geographic area	Population	Annual VOC emissions (tons/yr)	% annual activity in ozone season	Activity level (days/wk)	Season-day VOC emissions (lbs/day)
Maricopa County	4,129,646	4,976.22	28 %	7	30,622.9
8-hr ozone NAA	4,176,870	5,033.13	28 %	7	30,973.1

3.4.1.2 Auto refinishing

VOC emissions from auto refinishing were calculated using the per employee emission factor (89.0 lbs of VOC/employee) developed and reviewed by the Eastern Regional Technical Advisory Committee (ERTAC) advisory panel for the 2008 NEI (Pechan, 2012).

The most recent employment estimates (for the year 2010) from the US Census Bureau's County Business Patterns (CBP) were used (US Census Bureau, 2012). Employment data is listed by the North American Industry Classification System (NAICS) code(s). Table 3.4–2 shows the NAICS codes and employment estimates used to calculate emissions from auto refinishing.

Table 3.4–2. County-level employment estimates for auto refinishing, by NAICS code.

NAICS code	NAICS description	Estimated employment
81112	Auto body, paint, interior, & glass repair	4,236
4411	Auto dealers	22,632
4412	Other motor vehicle dealers	3,093
Total:		**29,961**

The seasonal activity factor for ozone season auto refinishing was assumed to be 25 percent of annual activity. In addition, it was assumed that auto refinishing occurs evenly throughout the year, 5 days/wk (US EPA, 2001a). Thus, ozone season-day emissions were calculated by multiplying annual VOC emissions by the seasonal factor and then dividing the results by 65 days per season (5 days/wk × 13 wks/season).

Annual and season-day emissions for the eight-hour ozone nonattainment area were derived by multiplying Maricopa County annual and season-day emissions by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–3. Annual and season-day emissions from auto refinishing.

Geographic area	Annual VOC emissions (tons/yr)	% annual activity in ozone season	Activity level (days/wk)	Season-day VOC emissions (lbs/day)
Maricopa County	1,333.26	25 %	5	10,255.9
8-hr ozone NAA	1,327.53	25 %	5	10,211.8

3.4.1.3 Traffic markings

VOC emissions from traffic markings were calculated using the emissions factor developed by EPA for the 2008 NEI (22.1 lbs of VOC/road mile) (Pechan, 2012). Annual VOC emissions for

the county were calculated by multiplying the VOC emission factor by 2010 Maricopa County public road and street mileage obtained from the Arizona Department of Transportation Highway Performance Monitoring System (HPMS). ADOT reported 16,253 miles of public roads and streets in Maricopa County in 2010, which was assumed to be representative of 2011 (M. Catchpole, pers. commun., August 9, 2012).

Annual VOC emissions for the eight-hour ozone nonattainment area were estimated by multiplying the 2010 Maricopa County public road and street mileage by the percentage of miles within the nonattainment area (95.28%) and then multiplying by the VOC emission factor.

MAG estimated the percentage of miles within the eight-hour ozone nonattainment area as compared to Maricopa County based on 2012 GIS highways and streets data (M. Poppen, pers. commun., October 1, 2012). The 2012 mileage data was assumed to be representative of 2011.

Ozone season-day emissions during the ozone season for Maricopa County and the eight-hour ozone nonattainment area were calculated assuming 33 percent of annual activity occurred during the ozone season (13 wks per year) and a typical activity level of 5 days per week (US EPA, 1997).

Table 3.4–4. Annual and season-day emissions from traffic markings.

Geographic area	Annual VOC emissions (tons/yr)	% annual activity in ozone season	Activity level (days/wk)	Season-day VOC emissions (lbs/day)
Maricopa County	179.60	33 %	5	1,823.6
8-hr ozone NAA	171.12	33 %	5	1,737.5

3.4.1.4 Factory-finished wood

Emissions from factory-finished wood coating were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2011 employment were used. Where CBP employment estimates were presented as a range, the midpoint value was chosen for these calculations. Table 3.4–5 shows the NAICS codes and employment data used to calculate emissions from factory-finished wood surface coating.

Table 3.4–5. County-level employment estimates for factory-finished wood coating, by NAICS code.

NAICS code	NAICS description (and employment range)	Estimated employment
321911	Wood window & door manufacturing	299
321918	Other millwork	163
337212	Custom architectural woodwork & millwork manufacturing	368
337215	Showcase, partition, shelving & locker manufacturing	163
337920	Blind & shade manufacturing (250–499)	375
Total:		**1,368**

Since there were no point sources in this category, an area-source employment estimate was used to "scale up" emissions reported from those facilities surveyed in 2011.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used. Table 3.4–6 summarizes annual and season-day VOC emissions from factory-finished wood surface coating in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–6. Annual and season-day emissions from area-source factory-finished wood surface coating.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	137.72	1,396.7
8-hr ozone NAA	137.12	1390.7

3.4.1.5 Wood furniture

Emissions from wood furniture surface coating were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–7 shows the NAICS codes and employment data used to calculate emissions from wood furniture surface coating.

Table 3.4–7. County-level employment estimates for wood furniture surface coating, by NAICS code.

NAICS code	NAICS code description	Estimated employment
337110	Wood kitchen cabinet & countertop manufacturing	693
337121	Upholstered household furniture manufacturing	72
337122	Non-upholstered wood household furniture manufacturing	1,303
337129	Wood television, radio & sewing machine cabinet mfg. (0–19)	10
337211	Wood office furniture manufacturing (0–19)	10
811420	Re-upholstery & furniture repair	132
Total:		**2,220**

Some facilities in this category are considered point sources and have been addressed in Chapter 2. To avoid double-counting, employment at point sources was subtracted from total employment.

Annual emissions were calculated by "scaling up" area-source emissions reported from those facilities surveyed in 2011.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial

employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–8 summarizes annual and season-day VOC emissions from wood furniture surface coating in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–8. Annual and season-day emissions from area-source wood furniture surface coating.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	416.56	3,434.7
8-hr ozone NAA	414.77	3,419.9

3.4.1.6 Aircraft surface coating

Annual emissions from aircraft surface coating facilities were derived from annual emissions reports from permitted sources. It is assumed that all aircraft surface coating facilities were surveyed in 2011 based on a comparison of county-level employment data (US Census Bureau, 2012) and annual emissions report employment data. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities' annual emissions reports. Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, total emission values for the county and the nonattainment area are equal.

Table 3.4–9. Annual and season-day VOC emissions from area-source aircraft surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	65.84	473.1
8-hr ozone NAA	65.84	473.1

3.4.1.7 Miscellaneous surface coating

Area-source VOC emissions from miscellaneous surface coating were estimated by a "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions and employment data from Maricopa County permitted facilities to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category

The typical "scale-up" methodology was revised slightly for this source category for a number of reasons. First, miscellaneous surface coating activity occurs, at some level, across an exceptionally broad spectrum of industries, both industrial and commercial/institutional. Additionally, annual emissions reports may be inconsistent in how activities are reported, and it is uncertain if all relevant activities are categorized as "miscellaneous surface coating" vs. some other category (e.g., manufacturing). Estimating total emissions from miscellaneous surface coating based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no miscellaneous surface coating activities) would therefore be misleading and lead to an over-estimate of area-source emissions from this source category. Instead, the list of SIC codes used by facilities that reported miscellaneous surface coating activities was conservatively assumed to represent the "universe" of businesses that could possibly have significant miscellaneous surface coating activity. To avoid double-counting, employment at point sources was subtracted from total employment within these SIC categories.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–10 summarizes annual and season-day VOC emissions from area-source miscellaneous surface coating in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–10. Annual and season-day emissions from miscellaneous surface coating.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	316.38	2,450.5
8-hr ozone NAA	315.02	2,440.0

3.4.2 Degreasing

Area-source VOC emissions from degreasing were estimated by a "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions and employment data from Maricopa County permitted facilities to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The typical "scale-up" methodology was revised slightly for this source category for a number of reasons. First, degreasing activity occurs at some level across a wide spectrum of industries, both industrial and commercial/ institutional. Additionally, annual emissions reports may be inconsistent in how activities are reported and it is uncertain if all relevant activities are categorized as "degreasing" vs. some other category (e.g., manufacturing). Estimating total emissions from degreasing based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no degreasing activities) would therefore be misleading and lead to an overestimate of area-source emissions from this source category.

Instead, the list of SIC codes used by businesses that reported degreasing activities was conservatively assumed to represent the "universe" of businesses that could possibly have significant degreasing activity. To avoid double-counting, employment at point sources was subtracted from total employment within these SIC.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of industrial employment within the nonattainment area. (See Section 1.5.1 for a discussion of the employment data used.)

Table 3.4–11 summarizes annual and season-day emissions from area-source degreasing in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–11. Annual and season-day VOC emissions from area-source degreasing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	217.55	1,451.1
8-hr ozone NAA	216.62	1,445.1

3.4.3 Dry cleaning

Dry cleaning facilities are identified as one of two types: those that use perchloroethylene and those that use a petroleum solvent (140 or Stoddard solvent) or other VOC-based solvent. Perchloroethylene is a synthetic solvent that is not considered photochemically reactive and therefore is not included in this inventory. Data from the 2008 periodic emissions inventory were grown to 2011 based on total population.

Based on operating schedule information provided in the facilities' historic annual emissions reports, it is assumed that operations occur evenly throughout the year, 5 days per week, thus season-day emissions were derived by dividing the annual total emissions by 260 (= 5 days/ wk × 52 weeks/yr).

Annual and season-day emissions estimates for the eight-hour ozone nonattainment area were calculated by multiplying county-level emissions by the ratio of Maricopa County population to nonattainment area population. See Section 1.5.1 for a discussion of the population data used.

Table 3.4–12 summarizes the annual and season-day VOC emissions from dry cleaning.

Table 3.4–12. Annual and season-day emissions from dry cleaning.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	23.15	178.1
8-hr ozone NAA	23.42	180.1

3.4.4 Graphic arts

Emissions from graphic arts were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. Table 3.4–13 shows the NAICS codes and employment data used to calculate emissions from graphic arts.

Table 3.4–13. County-level employment estimates for graphic arts, by NAICS code.

NAICS code	NAICS description	Estimated employment
323	Printing & related support activities	3,892
5111	Newspaper, periodical, book & database publishers	3,800
Total:		**7,692**

There were no point sources in this category. An area-source employment estimate was used to "scale up" emissions reported from those facilities surveyed in 2011.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–14 summarizes annual and season-day emissions from graphic arts in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–14. Annual and season-day VOC emissions from area-source graphic arts sources.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	290.98	2,225.7
8-hr ozone NAA	289.73	2,216.1

3.4.5 Miscellaneous industrial solvent use

Area-source VOC emissions from miscellaneous industrial solvent use were estimated by a "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions and employment data from Maricopa County permitted facilities to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The typical "scale-up" methodology was revised slightly for this source category for a number of reasons. First, miscellaneous industrial solvent use occurs at some level across a wide spectrum of industries. Additionally, annual emissions reports may be inconsistent in how activities are reported, and it is uncertain if all relevant activities are categorized as "miscellaneous industrial solvent use" vs. some other category (e.g., manufacturing). Estimating total emissions from miscellaneous industrial solvent use based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no solvent use activities) would therefore be misleading and lead to an overestimate of area-source emissions from this source category.

Instead, the list of SIC codes used by businesses that reported miscellaneous industrial solvent use activities was conservatively assumed to represent the "universe" of businesses that could possibly have significant miscellaneous industrial solvent use activity. To avoid double-counting, employment at point sources (addressed in Chapter 2) was subtracted from total employment within these SICs.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county. See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–15 summarizes annual and season-day VOC emissions from area-source miscellaneous industrial solvent use in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–15. Annual and season-day emissions from area-source miscellaneous industrial solvent use.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	721.85	5,126.6
8-hr ozone NAA	718.75	5,104.6

3.4.6 Consumer and commercial products

Consumer and commercial products emissions include emissions from the following seven product categories: personal care products, household products, automotive aftermarket products, adhesives and sealants, FIFRA-regulated products, coatings and related products, and miscellaneous products.

Annual area-source VOC emissions from consumer and commercial products were calculated by multiplying per-capita emission factors recommended by the Eastern Regional Technical Advisory Committee (Pechan, 2012c) by the population estimates for Maricopa County and the eight-hour ozone nonattainment area (see Section 1.5.1 for a discussion of population data). Ozone season-day emissions for the county and the eight-hour ozone nonattainment area were calculated by dividing annual emissions by 365 days as activity is assumed to occur uniformly throughout the year according to EIIP guidance (US EPA, 2001a).

Table 3.4–16. Annual and season-day emissions from consumer and commercial products.

		Maricopa County		8-hr ozone NAA	
Product category	Emission factor (lbs/person)	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Personal care	1.9	3,923.16	21,496.8	3,968.03	21,742.6
Household	1.8	3,716.68	20,365.4	3,759.18	20,598.3
Automotive aftermarket	1.36	2,808.16	15,387.2	2,840.27	15,563.1
Coatings and related	0.95	1,961.58	10,748.4	1,984.01	10,871.3
Adhesives/sealants	0.57	1,176.95	6,449.0	1,190.41	6,522.8
FIFRA-regulated	1.78	3,675.38	20,139.1	3,717.41	20,369.4
Miscellaneous	0.07	144.54	792.0	146.19	801.0
Total:	**8.43**	**17,406.46**	**95,377.9**	**17,605.51**	**96,468.5**

3.4.7 Asphalt application

Asphalt is applied to pave, seal, and repair surfaces such as roads, parking lots, drives, walkways, roofs, and airport runways. In the past, MCAQD estimated emissions from asphalt application by allocating state-level asphalt usage data obtained from the Asphalt Institute to Maricopa County by the use of two surrogates: vehicle miles traveled (VMT) and population. However, the Asphalt Institute no longer compiles asphalt usage data by state. Therefore, 2011 emissions from asphalt application were calculated by growing 2008 asphalt emissions to 2011 based on VMT and population.

Asphalt emissions were grown for three categories of asphalt application: roofing, cutback and emulsified. A population-based growth factor was used to grow 2008 roofing asphalt emissions

to 2011, while a VMT-based growth factor was used to grow 2008 cutback and emulsified asphalt emissions to 2011.

Table 3.4–17 shows 2008 and 2011 VMT and population for Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–17. 2008 and 2011 population and VMT, by geographic area.

Total population	Maricopa County	8-hr ozone NAA
2008	4,279,760	4,322,710
2011	4,129,646	4,176,870
Change, 2008–2011	**–3.51%**	**–3.37%**
Vehicle miles traveled (mi/day)		
2008	91,257,000	88,713,000
2011	88,885,000	83,874,000
Change, 2008–2011	–2.60%	–5.45%

Table 3.4–18 details county VOC emissions from asphalt application by asphalt type and the growth factors used to estimate 2011 emissions.

Table 3.4–18. Emissions from asphalt use, by type, in Maricopa County.

	2008			2011	
Asphalt type	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)	2008:2011 growth factor	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Cutback	858.15	4,689.3	–2.60%	835.84	4,567.4
Emulsified	889.17	4,858.9	–2.60%	866.06	4,732.6
Roofing	3.15	24.3	–3.51%	3.04	23.4
Total:	**1,750.47**	**9,572.5**		**1,704.94**	**9,323.5**

Annual and season-day emissions for the eight-hour ozone nonattainment area were also grown from 2008 by multiplying the 2008 nonattainment area emission by a 2008:2011 growth factor for VMT within the nonattainment area (for cutback and emulsified asphalt) and population within the nonattainment area (for roofing asphalt). Table 3.4–19 details nonattainment area asphalt emissions by type and the factors used to grow 2008 nonattainment area emissions to 2011.

Table 3.4–19. Emissions from asphalt use, by type, in the eight-hour ozone NAA.

	2008			2011	
Asphalt type	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)	2008:2011 growth factor	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Cutback	834.22	4,558.6	–5.45%	788.72	4,309.9
Emulsified	864.39	4,723.4	–5.45%	817.24	4,465.8
Roofing	3.19	24.5	–3.37%	3.08	23.7
Total:	**1,701.80**	**9,306.5**		**1,609.04**	**8,799.4**

3.4.8 Agricultural pesticides

Annual emissions from agricultural pesticide usage within Maricopa County were obtained from the US Environmental Protection Agency's 2011 National Emissions Inventory data and documentation (US EPA, 2012c). US EPA estimated 362.93 tons of VOCs were emitted from agricultural pesticide usage in Maricopa County in 2011.

Agricultural pesticide data for 2011 were obtained from the Arizona Department of Agriculture's 1080 Investigative Search website (ADA, 2013). This data was used to determine ozone season emissions from agricultural pesticide applications. The data included quantities of pesticides applied and the date of pesticide application. Quantities reported in gallons were converted to pounds assuming 8.33 lbs per gallon.

The data showed approximately 2,086,356 lbs of agricultural pesticides were applied in Maricopa County in 2011. Based on the date of pesticide application, approximately, 36.4% (759,349 lbs.) of agricultural pesticides were applied during the ozone season. Ozone season-day emissions for Maricopa County were calculated by multiplying annual emissions (362.93 tons) by 36.4% and then dividing the result by 91 days/season (7 days/wk × 13 wks/ozone season).

Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of agricultural land located in the nonattainment area to the agricultural land in the county (58.46%). See Section 1.5.1 for a further discussion of the land use data used.

Table 3.4–20. Annual and season-day emissions from agricultural pesticide application.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	362.93	2,903.4
8-hr ozone NAA	212.18	1,697.5

3.5 Storage and transport

3.5.1 Portable fuel containers

Annual Maricopa County emissions from area-source portable fuel containers (PFCs) were obtained from the US Environmental Protection Agency's 2011 National Emissions Inventory (US EPA, 2012c). These calculations identify a total of seven mechanisms by which emissions can be generated from portable fuel containers:

- Emissions associated with filling the gas can at the gas pump:
  - Displacement of the vapor within the can, and
  - Spillage of gasoline while filling the can
- Emissions associated with transporting the gas can:
  - Spillage of gasoline during transport
- Emissions (adjusted for changes in ambient temperature) associated with storage of the gasoline in the PFCs:
  - Emissions due to evaporation (i.e., diurnal emissions), and
  - Emissions due to permeation.

Two additional sources of emissions associated with using PFCs to refuel pieces of nonroad equipment are considered by the NONROAD model (described in Chapter 4) and thus not addressed here:

– Displacement of the vapor within nonroad equipment, and
– Spillage of gasoline while filling nonroad equipment.

Ozone season-day emissions for the county were calculated by dividing annual emissions by 365 days as activity is assumed to occur uniformly throughout the year.

Annual and ozone season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the county totals by the ratio of total population in the nonattainment area to total population in the county (101.14%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.5–1 summarizes annual and season-day VOC emissions from portable fuel containers in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.5–1. Annual and season-day emissions from portable fuel containers (PFCs).

	Maricopa County		Eight-hour ozone NAA	
Emissions source	**Annual VOC emissions (tons/yr)**	**Season-day VOC emissions (lbs/day)**	**Annual VOC emissions (tons/yr)**	**Season-day VOC emissions (lbs/day)**
Permeation: Residential	887.25	4,875.0	897.40	4,930.8
Evaporation/diurnal: Residential	1,732.33	9,518.3	1,752.15	9,627.2
Spillage during transport: Residential	226.04	1,242.0	228.63	1,256.2
Vapor displacement in PFCs: Residential	82.87	455.3	83.82	460.5
Spillage at pump: Residential	6.60	36.2	6.67	36.7
Permeation: Commercial	28.34	155.7	28.66	157.5
Evaporation/diurnal: Commercial	55.33	304.0	55.96	307.5
Spillage during transport: Commercial	308.36	1,694.3	311.89	1,713.7
Vapor displacement in PFCs: Commercial	159.71	877.5	161.54	887.6
Spillage at pump: Commercial	12.69	69.7	12.84	70.5
Displacement during refueling of nonroad equipment*				
Spillage during refueling of nonroad equipment*				
Total:	**3,499.52**	**19,228.2**	**3,539.56**	**19,448.1**

*These activities are included in the NONROAD model emissions calculations, described in Chapter 4.

3.5.2 Bulk plants

Emissions from this source category were calculated from annual emissions inventory reports from all bulk plants located within the county. It is assumed that there are no unpermitted bulk plants in Maricopa County. To avoid double-counting, emissions from bulk terminals are treated as point sources (totaling 105.94 tons/yr) and thus are reported in Chapter 2. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities annual emissions reports. Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, total emission values for the county and the eight-hour ozone nonattainment area are equal.

Table 3.5–2. Annual and season-day emissions from bulk plants.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	120.91	659.3
8-hr ozone NAA	120.91	659.3

3.5.3 Gasoline stations (Stage I)

Stage I gasoline distribution emissions occur when gasoline vapors are displaced from storage tanks during unloading of gasoline from tank trucks at service stations.

Following EPA methodologies (US EPA, 2001b), annual VOC emissions from gasoline service station unloading were calculated by multiplying gasoline sales (1,553,993 Mgals) (B. Steen, pers. commun., September 13, 2012) by emission factors provided in AP-42 (US EPA, 1995b) for each filling technology. Based on annual emissions reports from 2002, 98.5% of gasoline is delivered using balanced submerged filling with the remaining 1.5% delivered by submerged filling. Table 3.5–3 below shows the emission factors used.

Table 3.5–3. Emission factors for gasoline service stations (Stage I).

Emission source	VOC emission factors (lbs of VOC/Mgal throughput)
Submerged filling	7.3
Balanced submerged filling	0.3

Ozone season-day emissions were calculated by multiplying ozone-season (July–September) gasoline sales (376,616 Mgal) by the emission factors listed above, then dividing by 78 days (13 weeks in the ozone season × 6 days/week).

As a conservative assumption, annual and season-day emissions for the eight-hour ozone nonattainment area are assumed to be equal to Maricopa County emissions.

Table 3.5–4. Annual and season-day emissions from gasoline service stations (Stage I).

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County and 8-hr ozone NAA:		
–Submerged filling	85.08	528.7
–Balanced submerged filling	229.60	1,426.8
Total:	**314.68**	**1,955.5**

3.5.4 Gasoline stations (Stage II)

Stage II gasoline service station emissions are the refueling emissions that occur during the transfer of gasoline from storage tanks at service stations to vehicle fuel tanks (i.e. vehicle refueling and spillage emissions). The MOVES2010b model that was used to calculate onroad emissions captures stage II emissions. Therefore, these emissions are addressed in Chapter 5 as part of the onroad mobile sources emissions and are no longer reported as an area source.

3.5.5 Gasoline stations underground tanks, breathing/emptying

Breathing losses are the expulsion of vapor from a tank vapor space that has expanded or contracted because of daily changes in temperature and barometric pressure; these emissions occur in the absence of any liquid level change in the tank. Emptying losses occur when the air that is drawn into the tank during liquid removal saturates with hydrocarbon vapor and expands, thus exceeding the fixed capacity of the vapor space and overflowing through the pressure vacuum valve.

Following EPA methodologies (US EPA, 2001b), annual VOC emissions from storage tank breathing and emptying were calculated by multiplying annual gasoline throughput (1,553,993 Mgal [B. Steen, ADOT, pers. commun., September 13, 2012]) by the emission factor for underground tank breathing and emptying (1.0 lb/Mgal) found in AP-42 Table 5.2–7 (US EPA, 1995b).

Ozone season-day VOC emissions were calculated using the same formula as above, using only the gasoline distributed during the ozone season (July–September, 376,616 Mgal) and dividing by the 91 days (13 weeks in the ozone season × 7 days per week that gasoline storage occurs).

As a conservative estimate, all activity was assumed to occur within the nonattainment area; thus annual and season-day emissions estimates for the nonattainment area are equal to county totals.

Table 3.5–5. Annual and season-day emissions from gasoline service stations underground tank, breathing and emptying.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	777.00	4,138.6
8-hr ozone NAA	777.00	4,138.6

3.5.6 Airports: Aviation gasoline

Aviation gasoline is used by small reciprocating, piston-engine aircraft in civil aviation. Commercial and military aviation rarely use aviation gasoline. Aviation gasoline is shipped to airports and is filled into bulk terminals, and then into tanker trucks. The displacement vapors during the transfer of gasoline from tank trucks to storage tanks, and vice versa falls under the definition of stage I. Stage II involves the transfer of fuel from the tanker trucks into general aviation aircraft.

Annual emissions from aviation gasoline Stage I and Stage II were obtained from the US Environmental Protection Agency's 2011 National Emissions Inventory (US EPA, 2012c). Table 3.5–6 shows US EPA 2011 estimated VOC emissions from aviation gasoline for Maricopa County.

Table 3.5–6. Annual emissions from aviation gasoline for Maricopa County.

	VOC Emissions (tons/yr)
Aviation Gasoline Stage I	347.57
Aviation Gasoline Stage II	18.04

Due to lack of data, daily emissions were assumed to be equal throughout the year and were calculated by dividing annual emissions by 365 days/year.

Annual and season-day emission in the eight-hour ozone nonattainment area were calculated by multiplying county totals by the percentage of general aviation operations that occurred within the nonattainment area in 2011 (99.1%) (See Table 4.11–1 for general aviation aircraft operational data used).

Table 3.5–7. Annual and season-day emissions from aviation gasoline.

	Maricopa County		8-hr ozone NAA	
	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day
Aviation Gasoline Stage I	347.57	1904.5	344.41	1,887.2
Aviation Gasoline Stage II	18.04	98.8	17.87	97.9

3.5.7 Gasoline tank trucks in transit

Emissions from tank trucks in transit occur when gasoline vapor evaporates from (1) loaded tank trucks during transportation of gasoline from bulk terminals/plants to service stations, and (2) empty tank trucks returning from service stations to bulk terminals/plants. Annual VOC emissions from gasoline trucks in transit were calculated by multiplying county-level tank truck gasoline throughput by a 0.06 lb of VOC per 1,000 gallon emission factor (Pechan, 2012b).

Gasoline consumption for Maricopa County was determined from gasoline tax sales reports obtained from the Arizona Department of Transportation for 2011 (ADOT, 2012). Gasoline throughput for tank trucks was computed by multiplying the Maricopa County gasoline sales (1,553,992,539 gallons) by a transportation adjustment factor of 1.09 to account for gasoline that is transported more than once in a given area (i.e., transported from bulk terminals to bulk plant and then from bulk plant to service station) (Pechan, 2012b).

Ozone season gasoline throughput for tank trucks was estimated by multiplying the gallons of gasoline sold (376,615,906 gallons) during the ozone-season (July-September) in Maricopa County by the 1.09 transportation adjustment factor noted above to account for gasoline that is transported more than once. Ozone season-day VOC emissions were calculated by multiplying the estimated ozone season gasoline throughput for tank trucks by the 0.06 lb of VOC per 1,000 gallon emission factor noted above and then dividing by 78 days (13 weeks × 6 days/wk).

As a conservative estimate, all activity was assumed to occur within the nonattainment area; thus annual and season-day emissions estimates for the nonattainment area are equal to county totals.

Table 3.5–8. Annual and season-day emissions from gasoline trucks in transit.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	50.82	315.8
8-hr ozone NAA	50.82	315.8

3.5.8 Pipeline gasoline

Pipeline emissions result from the valves and pumps found at pipeline pumping stations and from the valves, pumps, and storage tanks at pipeline breakout stations.

Annual VOC emissions from gasoline pipelines were derived based on the ratio of pipeline emissions to total emissions for bulk terminals, bulk plants, and pipelines as reported in the US Environmental Protection Agency's 2011 National Emissions Inventory (NEI) (US EPA, 2012c). The NEI reported that 2011 pipeline emissions for Maricopa County were 12.53% of total emissions from bulk terminals, bulk plants, and pipelines.

Thus, annual pipeline emissions for the county were derived by multiplying annual emissions reported in bulk plant emissions reports by 12.53%.

Ozone season-day emissions were calculated in the same manner, by multiplying season-day emissions (derived from operating schedule information provided in the facilities annual emissions reports) by 12.53%.

Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, emissions for the county and the eight-hour ozone nonattainment area are equal.

Table 3.5–9. Annual and season-day emissions from pipeline gasoline.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	17.32	94.5
8-hr ozone NAA	17.32	94.5

3.5.9 Volatile organic liquid (VOL) storage and transport

Emissions from this source category were calculated by summing reported VOC emissions from volatile organic liquid storage/transfer emissions inventory reports. It is assumed that there are no significant unpermitted volatile organic liquid storage/transfer facilities in Maricopa County. To avoid double-counting, emissions from those facilities treated as point sources (totaling 28.8 tons/yr) are addressed in Chapter 2. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities annual emissions reports.

Table 3.5–10. Annual and season-day emissions from area-source volatile organic liquid storage/transport.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	30.54	182.7
8-hr ozone NAA	28.80	169.3

3.6 Waste treatment and disposal

3.6.1 On-site incineration

This section includes emissions from on-site industrial incinerators, primarily burn-off ovens used to reclaim electric wire or other materials. Emissions from human and animal crematories are addressed in Section 3.7.5. There were no incinerators at residential (e.g., apartment complexes) or commercial/institutional facilities (e.g., hospitals, service establishments) in operation during 2011.

Emissions from on-site incineration were determined from annual emissions inventory reports. It is assumed that all incinerator emissions are accounted for, since all permitted incinerators

received surveys in 2011. All surveyed facilities are located within the eight-hour ozone nonattainment area, thus total emissions for the county and nonattainment area are equal.

Table 3.6–1. Annual and season-day emissions from on-site incineration.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.17	3.31	0.79	1.1	21.4	5.3
8-hr ozone NAA	0.17	3.31	0.79	1.1	21.4	5.3

3.6.2 Open burning: Land clearing debris

Emissions from controlled open burning are regulated by Maricopa County Air Pollution Control Regulations Rule 314 (Open Outdoor Fires and Indoor Fireplaces at Commercial and Institutional Establishments), which requires a burn permit for open burning in Maricopa County. Burn permits are issued primarily for purposes of agricultural ditchbank and fence row burning, tumbleweed burning, land clearance, and firefighting training. Maricopa County's burn permit data base was used to identify all burn permits issued in 2011. A total of 57 open burn permits were issued during the year. The quantity and reported activity for the open burn permits (except for firefighting burn permits) are shown in Table 3.6–2.

Table 3.6–2. Maricopa County burn permit activity.

Category	Number of permits	Unit of measure	Total reported activity
Annual ditchbank & fence row	41	Linear Feet	1,967,795
Land clearance	4	Acres	14.14
Fire hazard	1	Acres	2

Emissions from land clearance and fire hazard open burning are addressed in this section whereas ditchbank and fence row burning are addressed in Section 3.7.1.

The activity data for land clearance and fire hazard were converted to tons of material burned using fuel loading factor for "weeds, unspecified" from AP-42 (US EPA, 1992). The emission and loading factors used are shown in Table 3.6–3.

Table 3.6–3. Emission and fuel loading factors for open burning.

	Emission factors (lbs/ton burned)			Fuel loading factors
Category	**VOC**	**NO_x**	**CO**	**(tons/acre)**
Weeds, unspecified	9	4	85	3.2

Activity data were multiplied by the 3.2 tons/acre fuel loading factor to derive the total mass of material burned. Annual emissions were then calculated by multiplying the amount of material burned by the AP-42 emission factors for "weeds, unspecified" (shown in Table 3.6–3). Based on an analysis of complaints received in 2011 reporting suspected open or illegal outside burning, emissions estimates were multiplied by a factor of 2.87 to account for unpermitted illegal outdoor burning.

It was assumed that land clearance and fire hazard open burning occur 5 days per week (most burn permits are issued for weekdays but permits may be issued on weekends depending on

circumstances) and evenly during the ozone season months (July–September). Thus, season-day emissions for Maricopa County were derived by dividing annual emissions (lbs/year) by 65 (5 days/wk × 13 wks/yr).

Annual and season-day emissions for the nonattainment area were calculated by multiplying the percentage of vacant land use located in the eight-hour ozone nonattainment area (44.55%) by the Maricopa County emissions estimates. See Section 1.5.2 for a discussion of the land use data used.

Table 3.6–4 summarizes 2011 annual and season-day emissions for the Maricopa County and the eight-hour ozone nonattainment area from land clearance and fire hazard open burning activity.

Table 3.6–4. Annual and season-day emissions from land clearance and fire hazard open burning.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.67	0.30	6.30	20.5	9.1	193.8
8-hr ozone NAA	0.30	0.14	2.81	9.1	4.1	86.4

3.6.3 Landfills

Emissions from municipal solid waste (MSW) landfills come from uncontrolled landfill gas emissions as well as from combustion from control measures, such as a flare. Total emissions were calculated from annual emissions inventory reports from all landfills located within the county. Northwest Regional Landfill was considered a point sources; all other MSW landfills are reportered here as area source landfills.

Since there are no landfills located outside the eight-hour ozone nonattainment area, total emission values for the county and the eight-hour ozone nonattainment area are equal. Annual and season-day emissions are shown in Table 3.6–5.

Table 3.6–5. Annual and season-day emissions from landfills.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	36.59	30.40	108.55	200.7	167.4	596.4
8-hr ozone NAA	36.59	30.40	108.55	200.7	167.4	596.4

3.6.4 Publicly owned treatment works

Annual emissions from publicly owned treatment works (POTW) in Maricopa County were obtained from the US Environmental Protection Agency's 2011 National Emissions Inventory (US EPA, 2012c). EPA estimated 75.02 tons of VOC were emitted from POTWs in Maricopa County in 2011. There were no point sources in this category that needed to be subtracted.

Ozone season-day emissions were calculated by multiplying annual emissions by a 35% season adjustment factor and then dividing by 91 days per season (US EPA, 2001a).

Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a discussion of the population data used.

Table 3.6–6. VOC emissions from publicly owned treatment works.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	75.02	577.1
8-hr ozone NAA	75.88	583.7

3.6.5 Leaking underground storage tanks

Leaking underground storage tanks (LUST) are typically not considered a quantifiable source of air emissions until excavation and remediation efforts begin. The majority of air emissions from LUST site remediation occur during initial site action, which is typically tank removal. Emissions from soil occur as the tank is being removed and when soil is deposited on the ground before treatment/disposal occurs (US EPA, 2001c).

A default emission rate of 28 lbs/day per remediation event was used to estimate VOC emissions from LUST remediation (US EPA, 2001c). Data obtained from the Arizona Department of Environmental Quality Leaking Underground Storage Tank Section indicated that 15 LUST opened in Maricopa County in 2011 (N. Giuntoli, pers. commun., March 19, 2013). Data were not available on the number or date of remediation that occurred in 2011; therefore, it was conservatively assumed that all 15 LUST were remediated in 2011 during the ozone season. It was also assumed that an initial site action (tank and soil removal) for an average LUST remediation lasts five days.

Ozone season-day emissions were calculated by dividing annual values by 65 (5 days/wk × 13 wks/ozone season). To be conservative, it was assumed that all gasoline retail outlets were located within the ozone nonattainment area and therefore, annual and season-day emissions for the eight-hour ozone nonattainment area were assumed to be equal to the Maricopa County totals.

Table 3.6–7. Annual and season-day emissions from remediation of leaking underground storage tanks.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	1.05	32.3
8-hr ozone NAA	1.05	32.3

3.6.6 Other waste

Annual area-source emissions from other industrial waste disposal were derived from annual emissions reports from permitted facilities. Other industrial waste disposal processes include a wide array of industrial activities that are often specific to the permitted facility that reported the process. For this reason, it is assumed there are no significant emissions from this category, other than those reported by permitted facilities on their annual emissions reports. Ozone season-day emissions were calculated based on operating schedule information provided by the facilities in their annual emissions report.

All surveyed facilities for this area source category are located inside the eight-hour ozone nonattainment area; therefore emissions for Maricopa County and the eight-hour ozone nonattainment area are equal. Table 3.6–8 summarizes annual and season-day emissions for Maricopa County and the nonattainment area.

Table 3.6–8. Annual and season-day emissions from other waste.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	2.12	22.19	77.93	10.9	122.8	431.4
8-hr ozone NAA	2.12	22.19	77.93	10.9	122.8	431.4

3.7 Miscellaneous area sources

3.7.1 Agricultural field burning

Agricultural ditchbank and fence row burning are regulated by Maricopa County Air Pollution Control Regulations Rule 314 (Open Outdoor Fires and Indoor Fireplaces at Commercial and Institutional Establishments) which requires a burn permit for open burning activity in Maricopa County. A total of 41 permits were issued during the year for ditchbank and fence row burning. The permit data indicated that a total of 1,967,795 linear feet of ditchbank and fence rows were burned in 2011.

To calculate the amount of material burned, MCAQD assumed that ditchbanks and fence rows in Maricopa County average 7 feet in width and are burned twice per year, based on a previous Maricopa County emissions inventory (MCESD, 1999).

MCAQD estimated 632.44 acres burned [(1,967,795 linear ft. × 7 ft. × 2)/43,560 ft/acre]. Acres burned were converted to tons of material burned using a 3.2 tons/acre fuel loading factor for "weeds, unspecified" from AP-42 (US EPA, 1992). This resulted in an estimated 2,023.81 ton of material burned.

Annual emissions were then calculated by multiplying the amount of material burned by AP-42 emission factors for "weeds, unspecified" as shown in Table 3.7–1.

Table 3.7–1. Emission factors for open burning.

	Emission factors (lbs/ton burned)		
Category	**VOC**	**NO_x**	**CO**
Weeds, unspecified	9	4	85

Based on an analysis of 2011 complaints received reporting suspected open or illegal outside burning, emissions estimates were multiplied by a factor of 2.87 to account for unpermitted illegal outdoor burning.

It was assumed that ditchbank and fence row burning occurs 5 days per week. Thus, season-day emissions were calculated by dividing annual emissions (in lbs) by 65 (5 days/wk × 13 wks/ozone season).

Annual and season-day emissions for the nonattainment area were calculated by multiplying the percentage of agricultural land use within the eight-hour ozone nonattainment area (58.46%) by the Maricopa County emissions estimates. See Section 1.5.2 for a discussion of the land use data used.

Table 3.7–2 summarizes annual and season-day emissions from ditchbank and fence row burning for Maricopa County and the eight-hour ozone nonattainment area.

Table 3.7–2. Annual and season-day emissions from ditchbank and fence row burning.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	26.14	11.62	246.85	804.2	357.4	7,595.5
8-hr ozone NAA	15.28	6.79	144.32	470.2	209.0	4,440.7

3.7.2 Structure fires

Structure fire emissions for Maricopa County were grown from 2008 based on county population growth from 2008 to 2011. Population data was provided by MAG and is shown in Table 3.7−3.

Table 3.7–3. Maricopa County population growth, 2008 to 2011.

	2008	2011	% change
Maricopa Co. Total Population	4,279,760	4,129,646	–3.51%

The 2008 annual emissions from structure fires in Maricopa County and the subsequently grown 2011 annual emissions are shown in Table 3.7−4.

Table 3.7–4. 2008 and 2011 annual emissions from structure fires in Maricopa County.

	Annual emissions (tons/yr)		
Year	**VOC**	**NO_x**	**CO**
2008	15.32	1.95	83.56
2011	14.78	1.88	80.63

Annual emissions for the eight-hour ozone nonattainment area were derived by multiplying annual county emissions by the percentage of total residential population within the nonattainment area (101.14%). See Section 1.5.1 for a discussion of the population data used.

It was assumed that structure fires occur 7 days a week; however, structure fires vary seasonally and may increase during cold weather. Because local season-specific data were not readily available, seasonal occurrences of residential and non-residential structure fires reported by the Federal Emergency Management Agency (FEMA) were used to derive a seasonal adjustment factor for the ozone season (US EPA, 2001d). FEMA reported that 20.9% of residential structure fires and 23.7% of non-residential structural fires occurred during July, August, and September 1994. Thus, an average occurrence of 22.3% [(20.9% + 23.7%) ÷ 2] was used as a seasonal adjustment factor to estimate ozone season-day emissions.

Ozone season-day emissions for Maricopa County and the nonattainment area were derived by multiplying the annual emissions (in lbs) by the seasonal adjustment factor (22.3%) and then dividing by 91 (7 days/wk × 13 wks/ozone season).

Table 3.7–5. Annual and season-day emissions from structure fires.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	14.78	1.88	80.63	72.4	9.2	395.2
8-hr ozone NAA	14.95	1.90	81.55	73.3	9.3	399.7

3.7.3 Aircraft engine testing

Annual emissions from engine testing facilities were derived from annual emissions reports from permitted sources that were not considered point sources in this inventory. It was assumed that there were no significant unpermitted sources within Maricopa County. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities' annual emissions reports.

Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, total emission values for the county and the nonattainment area are equal. Results are shown in Table 3.7–6.

Table 3.7–6. Annual and season-day emissions from aircraft engine testing.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	4.72	46.36	16.16	26.1	259.3	91.2
8-hr ozone NAA	4.72	46.36	16.16	26.1	259.3	91.2

3.7.4 Vehicle fires

Vehicle fire emissions for Maricopa County were grown from 2008 based on county population growth from 2008 to 2011. The population data used is shown in Table 3.7−3.

The 2008 annual emissions from vehicle fires in Maricopa County and the subsequently grown 2011 annual emissions are shown in Table 3.7**–7**.

Table 3.7–7. 2008 and 2011 annual emissions from vehicle fires in Maricopa County.

Year	Annual emissions (tons/yr)		
	VOC	NO_x	CO
2008	9.61	1.20	37.55
2011	9.27	1.16	36.23

Annual emissions for the eight-hour ozone nonattainment area were derived by multiplying annual county emissions by the percentage of total residential population within the nonattainment area (101.14%). See Section 1.5.1 for a discussion of the population data used.

It was assumed that vehicle fires occur evenly throughout the year. Thus, ozone season-day emissions were derived by dividing the Maricopa County and nonattainment area annual emissions (in lbs.) by 365 days/year. The results are shown in Table 3.7−8 below.

Table 3.7–8. Annual and season-day emissions from vehicle fires.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	9.27	1.16	36.23	50.8	6.4	198.5
8-hr ozone NAA	9.38	1.17	36.64	51.4	6.4	200.8

3.7.5 Crematories

Emissions from human and animal crematories were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. Table 3.7–9 shows the NAICS code and employment data used to calculate emissions from crematories.

Table 3.7–9. County-level employment estimates for crematories, by NAICS code.

NAICS code	NAICS description	Estimated employment
81222	Cemeteries and crematories	251

There were no point sources in this category. Area-source employment estimate were used to "scale up" emissions reported from those facilities surveyed in 2011.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county. See Section 1.5.1 for a discussion of the employment data used. Table 3.7–10 summarizes annual and season-day emissions from crematories in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.7–10. Annual and season-day emissions from crematories.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	1.18	11.19	2.23	51.1	88.5	17.3
8-hr ozone NAA	1.18	11.14	2.22	50.9	88.1	17.2

3.7.6 Accidental releases

As part of its air quality permit compliance program, MCAQD keeps an "upset log" for each calendar year that records excess emissions and accidental releases at permitted facilities. Annual emissions inventory reports also provide for recording of accidental releases. Data from these two sources documented the release of 0.45 tons of VOC for the year 2012.

Ozone season-day emissions were calculated based on the whether the reported release occurred during the ozone season. If emissions occurred during the ozone season, those emissions were summed and divided by the number of days in the ozone season to produce season-day emissions. Emissions within the eight-hour ozone nonattainment area are calculated based on locations of facilities that reported releases. Results are shown in Table 3.7–11.

Table 3.7–11. Annual and season-day emissions from accidental releases.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.45	0.0	0.0	2.1	0.0	0.0
8-hr ozone NAA	0.45	0.0	0.0	2.1	0.0	0.0

3.7.7 Hospitals

Emissions from hospitals were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category. The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. CBP employment data for NAICS code 662110 (general medical and surgical hospitals) indicated 59,646 employees in this industry in Maricopa County.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of population in the nonattainment area to population in the county. See Section 1.5.1 for a discussion of the employment data used.

Table 3.7–12 summarizes annual and season-day emissions from hospitals in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.7–12. Annual and season-day emissions from hospitals.

Geographic area	**Annual VOC emissions (tons/yr)**	**Season-day VOC emissions (lbs/day)**
Maricopa County	8.57	52.3
8-hr ozone NAA	8.66	52.9

3.7.8 Wildfires

2011 Maricopa County wildfire data were obtained from the Arizona State Forestry Division (ASFD) (G. Buettner, pers. commun., December 17, 2012); the National Wildfire Coordinating Group (NWCG, 2012), and the US Fire Administration, National Fire Data Center (USFA, 2012).

The Arizona State Forestry Division (ASFD) provides for the prevention and suppression of wildfires on state trust land and private lands located outside of incorporated communities. The wildfire data provided by ASFD includes wildfires that occur outside of local fire districts and municipalities on State, private, and U.S. Bureau of Land Management (BLM) land. In 2011, the (ASFD) reported 5 wildfires in Maricopa County, encompassing 15.2 acres.

Wildfire data provided by ASFD were compared to 2011 Incident Status Summary reports (ICS-209) to identify wildfires that may have occurred outside of ASFD jurisdiction. ICS-209 reports only include large wildfires, generally fires greater than 100 acres. ICS-209 reports showed two additional Maricopa County wildfires in 2011, totaling 2,006 acres (NWCG, 2012).

Lastly, 2011 National Fire Incident Reporting System (NFIRS) data were obtained from the US Fire Administration (USFA, 2012). NFIRS is a voluntary national reporting system used by fire departments to report fires and other incidents to which they respond and to maintain records of these incidents in a uniform manner. However, not all fire departments report to NFIRS and they may not report all of their fire incidents. The 2011 NFIRS data was culled for wildland fires greater than 1 acre that contained either latitude and longitude or township and range information. Wildfire data for Arizona included 18 fires which met these criteria; however, only 2 of these fires were located within Maricopa County, encompassing 7 acres. The NFIRS data was compared to the ASFD data to identify duplicates by comparing the incident dates and locations. One NFIRS fire was excluded from the combined dataset because it may have been a duplicate already captured in the ASFD data. Table 3.7–13 summarizes fire data obtained from each data source.

Table 3.7–13. 2011 wildfire activity in Maricopa County.

Data source	Number of fires in 2011	Acres burned
Arizona State Forestry Division	5	15.2
2011 NFIRS data	1	1.5
ICS-209	2	2,006.0
Total:	**8**	**2,022.7**

Estimates for fuel loading rates were assigned using fuel model codes from the National Fire Danger Rating System (NFDRS) and a table of fuel loading values for NFDRS fuel model categories (WGA/WRAP, 2005). The department used the NFDRS Fuel Model map in ArcGIS to identify NFDRS fuel types for fires with latitude and longitude data.

Table 3.7–14. Data used to estimate 2011 wildfire emissions.

NFDRS model category	Number of fires in 2011	Acres burned	Fuel loading factor (tons/acre)
Agriculture*	1	1.5	4.5
Barren*	1	0.1	0.75
Intermediate brush	4	2,019.5	15.0
Sagebrush grass	2	1.6	4.5
Total:	**8**	**2,022.7**	**—**

* “Agriculture” and “barren” NFDRS model descriptions were not included in WGA/WRAP 2002 fuel loading values for NFDRS fuel model categories. Therefore, it was assumed that “Agriculture” is similar to "sagebrush grass" and “Barren” is similar to “western grasses (annual)” and fuel loadings were assigned accordingly.

Estimates of the material burned were derived by multiplying the acres burned for each category by the applicable fuel loading factor.

Latitude and longitude data were used to determine the number of acres burned inside of the nonattainment area. Only one wildfire (=0.1 acre) occurred outside of the eight-hour ozone nonattainment area. Table 3.7–15 shows the number of wildfires and acres burned for Maricopa County and the eight-hour ozone nonattainment area and an estimate of material burned.

Table 3.7–15. Summary of 2011 wildfires, acres burned, and estimate of material burned.

Geographic Area	No. of fires	Acres burned	Material burned annually (tons/yr)	Material burned in 8-hr ozone season (tons/season)
Maricopa County	8	2,023	30,307	30,104
8-hr ozone NAA	7	2,023	30,306	30,104

Annual emissions from wildfires for each geographic area were calculated by multiplying the material burned for each area by the emission factor shown in Table 3.7–16 below. Emission factors were obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emissions Inventory (WGA/WRAP, 2005).

Table 3.7–16. Emission factors for wildfires and prescribed broadcast burning.

	Emission factors (lb/ton)		
Activity	**VOC**	**NO_x**	**CO**
Wildfires and prescribed broadcast burning	13.6	6.2	289

Annual emissions from wildfires for Maricopa County and the nonattainment area are shown in Table 3.7–17.

Table 3.7–17. Annual emissions from wildfires.

	Annual emissions (tons/yr)		
Geographic Area	**VOC**	**NO_x**	**CO**
Maricopa County	206.08	93.95	4,379.29
8-hr ozone NAA	206.08	93.95	4,379.28

Because all fires that occurred during ozone season were within the nonattainment area, season-day emissions for the county and the nonattainment area were the same. Ozone season-day emissions were estimated by multiplying the material burned during ozone season by the appropriate emission factor and dividing the result by the number of ozone season burn days. In 2011, 32 burn days occurred during the ozone season in Maricopa County. Table 3.7–18 shows season-day emissions from wildfires in Maricopa County and the nonattainment area.

Table 3.7–18. Season-day emissions from wildfires.

	Ozone-season	Season-day emissions (lbs/day)		
Geographic Area	**burn days**	**VOC**	**NO_x**	**CO**
Maricopa County	32	12,794.0	5,832.6	271,872.2
8-hr ozone NAA		12,794.0	5,832.6	271,872.2

3.7.9 Prescribed fires

Prescribed fire data were obtained from the Arizona Department of Environmental Quality (ADEQ) (B. Busby, pers. commun., November 8, 2012). The ADEQ reported that fourteen prescribed fires occurred in Maricopa County in 2011. Sixty-two acres of piled fuels were burned. All fourteen prescribed fires occurred inside the eight-hour ozone nonattainment area. Because all 2011 prescribed fires were piled fuels, material burned was derived by multiplying the number of acres burned by tons of piles per acre for each fire. Table 3.7–19 shows the data provided by the ADEQ, the amount of material burned for each fire, whether the fire occurred within the nonattainment area and during the ozone season.

Table 3.7–19. 2011 prescribed fire activity in Maricopa County.

Date	Burn number	Burn location	Tons/ acre	Acres burned	Material burned (tons)	Within 8-hr NAA?	During ozone season?
01/05/2011	TNF0301	T7N,R8E,S36	1	5	5	Y	N
04/06/2011	TNF0301	T2N,R7E,S18	1	1	1	Y	N
04/13/2011	TNF0106	T6N,R7E,S33	1	1	1	Y	N
04/14/2011	TNF0106	T7N,R5E,S7	1	1	1	Y	N
04/19/2011	TNF0301	T3N,R8E,S27	1	10	10	Y	N
07/23/2011	TNF0611	T3N,R11E,S2	5	15	75	Y	Y
08/10/2011	TNF0301	T3N,R8E,S27	0.25	6	1.5	Y	Y
08/11/2011	TNF0301	T3N,R8E,S27	0.25	6	1.5	Y	Y
08/16/2011	TNF0301	T3N,R8E,S25	1	4	4	Y	Y
10/20/2011	TNF0301	T2N,R9E,S31	1	5	5	Y	N
11/08/2011	TNF0301	T2N,R9E,S31	3	5	15	Y	N
11/15/2011	TNF0106	T6N,R7E,S15	1	1	1	Y	N
11/16/2011	TNF0106	T7N,R6E,S1	1	1	1	Y	N
12/20/2011	TNF0301	T2N,R9E,S11	0.25	1	0.25	Y	N
Total:				**62**	**122.25**		

Prescribed fire emission factors for "piled fuels" were obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emissions Inventory (WGA/WRAP, 2005). The emission factors are listed below in Table 3.7–20.

Table 3.7–20. Emission factors for prescribed fire (piled fuels).

	Emission factors (lbs/ton burned)		
Type of fire	**VOC**	**NO_x**	**CO**
Prescribed fire (piled fuels)	6.3	6.2	74.3

Annual emissions from prescribed fires in Maricopa County were derived by multiplying material burned by the emission factor then dividing by 2000 lbs/ton.

Four prescribed fires occurred during the ozone season. The fires resulted in 82 tons of material burned. It was assumed the prescribed fires lasted one day. Ozone-season day emissions were derived by multiplying 82 tons of material burned by the emission factor (lbs/ton) and then dividing the resulting emissions by four burn days.

Since the prescribed fire data provided by ADEQ included burn location, GIS was used to determine the fires that burned inside the nonattainment area. All the 2011 prescribed fires burned within the eight-hour nonattainment area; therefore, annual and season-day emissions estimates for the nonattainment area are equal to county totals . Table 3.7–21 shows the annual and season-day from prescribed fires for Maricopa County and the nonattainment area.

Table 3.7–21. Annual and season-day emissions from prescribed fires.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic Area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.39	0.38	4.54	129.2	127.1	1,523.2
8-hr ozone NAA	0.39	0.38	4.54	129.2	127.1	1,523.2

3.8 Summary of all area sources

Tables 3.8–1 and 3.8–2 summarize the total annual and average season-day emissions from all area sources addressed in this chapter, for both Maricopa County and the eight-hour ozone NAA, respectively.

Table 3.8–1. Annual and season-day emissions from all area sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel combustion:						
Industrial distillate oil: Boilers	0.61	60.87	15.22	3.9	390.2	97.5
Industrial distillate oil: Engines	0.00	1,838.26	395.65	0.0	11,783.7	2,536.2
Industrial natural gas	36.99	730.94	455.30	217.8	4,303.8	2,680.8
Comm./inst. distillate oil: Boilers	0.00	0.12	0.03	0.0	0.8	0.2
Comm./inst. distillate oil: Engines	0.00	3.72	0.80	0.0	23.8	5.1
Comm./inst. natural gas	54.48	1,080.73	662.84	252.0	4,998.0	3,065.4
Residential distillate oil	0.01	0.35	0.10	0.0	0.0	0.0
Residential natural gas	49.81	851.32	362.26	119.6	2,044.2	869.9
Residential LPG	2.00	51.35	14.56	0.0	0.0	0.0
Residential wood combustion	509.7	57.72	2,959.91	0.0	0.0	0.0
Residential kerosene	0.00	0.03	0.01	0.0	0.0	0.0
All Fuel Combustion:	**653.61**	**4,675.41**	**4,866.67**	**593.3**	**23,544.5**	**9,255.2**
Industrial processes:						
Chemical manufacturing	77.42			599.0		
Commercial cooking	149.33		392.60	820.5		2,157.1
Bakeries	78.18			547.8		
Secondary metal production	41.01	15.02	98.36	306.4	107.9	697.4
Rubber/plastic product mfg.	1,766.75			14,171.0		
Electrical equipment mfg.	122.80	23.47	2.98	746.2	135.8	16.4
Industrial processes, NEC	48.51	224.92	91.84	325.6	1,245.8	525.2
All Industrial Processes:	**2,284.00**	**263.41**	**585.79**	**17,516.5**	**1,489.5**	**3,396.2**
Solvent use:						
Architectural coatings	4,976.22			30,622.9		
Auto refinishing	1,333.26			10,255.9		
Traffic markings	179.60			1,823.6		
Factory finished wood	137.72			1,396.7		
Wood furniture	416.56			3,434.7		
Aircraft surface coating	65.84			473.1		
Miscellaneous surface coating	316.38			2,450.5		
Degreasing	217.55			1,451.4		
Dry cleaning	23.15			178.1		
Graphics arts	290.98			2,225.7		
Miscellaneous industrial solvent use	721.85			5,126.6		
Consumer and commercial products	17,406.46			95,377.9		
Cutback asphalt	835.84			4,567.4		
Emulsified asphalt	866.06			4,732.6		
Roofing asphalt	3.04			23.4		
Agricultural pesticides	362.93			2,903.4		
All Solvent Use	**28,153.45**			**167,043.9**		

Table 3.8–1. Annual and season-day emissions from all area sources in Maricopa County (continued).

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Storage/transport:						
Residential portable gas cans	2,935.10			16,126.9		
Commercial portable gas cans	564.43			3,101.3		
Bulk plants	120.91			659.3		
Gas stations Stage I: Submerged fill	85.08			528.7		
Gas stations Stage I: Bal. submerged fill	229.60			1,426.8		
Gas stations Stage II	0.00			0.0		
Underground tanks: Breathing/emptying	777.00			4,138.6		
Airports: aviation gasoline Stage I	347.57			1,904.5		
Airports: aviation gasoline Stage II	18.04			98.8		
Truck: gasoline (tank trucks in transit)	50.82			315.8		
Pipeline gasoline	17.32			94.5		
Volatile organic liquids storage/transport	30.54			182.7		
All Storage/Transport	**5,176.39**			**28,577.9**		
Waste treatment/disposal:						
On-site incineration	0.17	3.31	0.79	1.1	21.4	5.3
Open burning: Land clearing debris	0.67	0.30	6.30	20.5	9.1	193.8
Landfills	36.59	30.40	108.55	200.7	167.4	596.4
Publicly owned treatment works	75.02			577.1		
Other waste	2.12	22.19	77.93	10.9	122.8	431.4
Leaking underground storage tanks	1.05			32.3		
All Waste Treatment/Disposal	**116.10**	**56.04**	**190.06**	**837.8**	**315.6**	**1,119.6**
Misc. area sources:						
Agricultural field burning	26.14	11.62	246.85	804.2	357.4	7,595.5
Structure fires	14.78	1.88	80.63	72.4	9.2	395.2
Aircraft engine testing	4.72	46.36	16.16	26.1	259.3	91.2
Vehicle fires	9.27	1.16	36.23	50.8	6.4	198.5
Crematories	1.18	11.19	2.23	51.1	88.5	17.3
Accidental releases	0.45	0.00	0.00	2.1	0.0	0.0
Hospitals	8.57			52.3		
Wildfires	206.08	93.95	4,379.29	12,794.0	5,832.6	271,872.2
Prescribed fires	0.39	0.38	4.54	129.2	127.1	1,523.2
All Misc. Area Sources	**271.58**	**166.54**	**4,765.93**	**13,982.3**	**6,680.5**	**281,693.1**
TOTAL, ALL AREA SOURCES	**36,654.65**	**5,161.56**	**10,411.95**	**228,556.4**	**32,035.2**	**295,571.5**

Table 3.8–2. Annual and season-day emissions from all area sources in the eight-hour ozone NAA.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Fuel combustion:						
Industrial distillate oil: Boilers	0.61	60.61	15.15	3.9	388.5	97.1
Industrial distillate oil: Engines	0.00	1,830.35	393.95	0.0	11,733.0	2,525.3
Industrial natural gas	36.83	727.80	453.34	219.9	4,285.3	2,669.3
Comm./inst. distillate oil: Boilers	0.00	0.12	0.03	0.0	0.8	0.2
Comm./inst. distillate oil: Engines	0.00	3.70	0.80	0.0	23.7	5.1
Comm./inst. natural gas	54.42	1,079.44	662.05	251.7	4,992.0	3,061.7
Residential distillate oil	0.01	0.35	0.10	0.0	0.0	0.0
Residential natural gas	50.20	857.96	365.09	120.5	2,060.1	876.7
Residential LPG	2.02	51.93	14.73	0.0	0.0	0.0
Residential wood combustion	515.53	58.38	2,993.75	0.00	0.00	0.00
Residential kerosene	0.00	0.03	0.01	0.0	0.0	0.0
All Fuel Combustion	**659.63**	**4,670.68**	**4,898.99**	**593.0**	**23,483.5**	**9,235.4**
Industrial processes:						
Chemical manufacturing	77.09			596.5		
Commercial cooking	151.03		397.07	829.8		2,181.7
Bakeries	77.85			545.4		
Secondary metal production	41.01	15.02	98.36	306.4	107.9	697.4
Rubber/plastic product manufacturing	1,759.15			14,110.1		
Electrical equipment manufacturing	122.80	23.47	2.98	746.2	135.8	16.4
Industrial processes, NEC	47.55	224.92	91.84	318.0	1,245.8	525.2
All Industrial Processes	**2,276.48**	**263.41**	**590.27**	**17,452.4**	**1,489.5**	**3,420.8**
Solvent use:						
Architectural coatings	5,033.13			30,973.1		
Auto refinishing	1,327.53			10,211.8		
Traffic markings	171.12			1,737.5		
Factory finished wood	137.12			1,390.7		
Wood furniture	414.77			3,419.9		
Aircraft surface coating	65.84			473.1		
Miscellaneous surface coating.	315.02			2,440.0		
Degreasing	216.62			1,445.1		
Dry cleaning	23.42			180.1		
Graphics arts	289.73			2,216.1		
Miscellaneous industrial solvent use	718.75			5,104.6		
Consumer and commercial products	17,605.51			96,468.5		
Cutback asphalt	788.72			4,309.9		
Emulsified asphalt	817.24			4,465.8		
Roofing asphalt	3.08			23.7		
Agricultural pesticides	212.18			1,697.5		
All Solvent Use	**28,139.77**			**166,557.4**		

Table 3.8–2. Annual and season-day emissions from all area sources in the eight-hour ozone NAA (continued).

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Storage/transport:						
Residential portable gas cans	2,968.67			16,311.4		
Commercial portable gas can:	570.89			3,136.7		
Bulk plants	120.91			659.3		
Gas stations Stage I: Submerged fill	85.08			528.7		
Gas stations Stage I: Bal. submerged fill	229.60			1,426.8		
Gas stations Stage II	0.00			0.0		
Underground tanks: Breathing/emptying	777.00			4,138.6		
Airports : Aviation gasoline Stage I	344.41			1,887.2		
Airports : Aviation gasoline Stage II	17.87			97.9		
Truck: Gasoline (tank trucks in transit)	50.82			315.8		
Pipeline gasoline	17.32			94.5		
Volatile organic liquids storage/transport	28.80			169.3		
All Storage/Transport:	**5,211.35**			**28,766.2**		
Waste treatment/disposal:						
On-site incineration	0.17	3.31	0.79	1.1	21.4	5.3
Open burning: Land clearing debris	0.30	0.13	2.81	9.1	4.1	86.4
Landfills	36.59	30.40	108.55	200.7	167.4	596.4
Publicly owned treatment works	75.88			583.7		
Other waste	2.12	22.19	77.93	10.9	122.8	431.4
Leaking underground storage tanks	1.05			32.3		
All Waste Treatment/Disposal	**116.10**	**56.04**	**190.06**	**837.8**	**315.6**	**1,119.6**
Misc. area sources:						
Agricultural field burning	15.28	6.79	144.32	470.2	209.0	4,440.7
Structure fires	14.95	1.90	81.55	73.3	9.3	399.7
Aircraft engine testing	4.72	46.36	16.16	26.1	259.3	91.2
Vehicle fires	9.38	1.17	36.64	51.4	6.4	200.8
Crematories	1.18	11.14	2.22	50.9	88.1	17.2
Accidental releases	0.45	0.00	0.00	2.1	0.0	0.0
Hospitals	8.66			52.9		
Wildfires	206.08	93.95	4,379.28	12,794.0	5,832.6	271,872.2
Prescribed fires	0.39	0.38	4.54	129.2	127.1	1,523.2
All Misc. Area Sources	**261.09**	**161.70**	**4,664.71**	**13,650.0**	**6,531.8**	**278,544.9**
ALL AREA SOURCES:	**36,664.42**	**5,151.83**	**10,344.03**	**227,856.8**	**31,820.5**	**292,320.7**

3.9 Quality assurance / quality control procedures

Quality assurance and quality control (QA/QC) activities for the area source emissions inventory were designed to create a comprehensive, accurate, representative and comparable inventory of area source emissions for Maricopa County and the nonattainment area. During each step of creating, building and reviewing the area source emissions inventory, quality checks and assurances were performed to establish confidence in the inventory structure and data.

Area source categories were identified for inclusion in the inventory based on the latest Emissions Inventory Improvement Program (EIIP) guidance available. In addition, recent EPA activities to develop county-level emissions estimates for newly created source categories (such as portable fuel containers) or refined source classification codes were also reviewed, and incorporated where relevant. Prior-year inventories for the region were also examined to identify possible additional categories for inclusion in the present inventory. The list of area source

categories developed based on these guidance documents was modified to fit the characteristics of Maricopa County, with some area source categories determined to be insignificant (e.g., emissions from industrial coal combustion, or oil and natural gas production, and snowmobile use).

Data for area source emission calculations were gathered from a wide universe of resources. Whenever applicable, local surveyed data (such as annual emissions report) was used as this data best reflects activity in the county and the nonattainment area. When local data was not available, state data from state agencies (such as the Arizona Department of Transportation) and regional bodies (such as the Western Regional Air Partnership [WRAP]) were used. National level data (such as the US Census Bureau) was used when no local, state or regional data was available. In addition, the most recent EIIP guidance for area sources was consulted for direction in determining the most relevant data source for use in emissions calculations.

Emissions calculations for area sources were performed by three air quality planners and one unit manager. All area source emission estimates were calculated in spreadsheets to ensure the calculations could be verified and reproduced. Whenever possible or available, the "preferred method" described in the most recent EIIP guidance documents for area sources was used to calculate emissions. Emissions were estimated using emission factors from EIIP guidance, AP-42, and local source testing. Local seasonal and activity data were used when available, with EPA and EIIP guidance used when no local seasonal or activity data existed. All calculations were evaluated to ensure that emissions from point sources were not being double-counted and to determine if rule effectiveness applied.

Once area source emission estimates had been produced, several quality control checks were performed to substantiate the calculations. Most area source calculations were peer-reviewed by two other planners, with all area sources being reviewed by at least one other planner. Peer review ensured that all emission calculations were reasonable and could be reproduced. Sensitivity analyses and computational method checks were performed on area sources when emissions seemed to be outside the expected ranges. When errors were found, the appropriate changes were made by the author of the calculations to ensure consistency of the emissions calculations. The peer-reviewed emissions estimates were combined into a draft area source chapter. This draft chapter was read through in its entirety by the unit manager and the three air quality planners for final review, with any identified errors corrected by the author of the section.

The draft version of the area source chapter was sent to the Arizona Department of Environmental Quality, the Arizona Department of Transportation, and the Maricopa Association of Governments for a quality assurance review. These agencies provided comments which were addressed and incorporated into the final area source chapter. The QA/QC activities described here have produced high levels of confidence in the area source emissions estimates detailed in this chapter, and represent the best efforts of the inventory preparers.

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4. Nonroad Mobile Sources

4.1 Introduction

Nonroad mobile sources are defined as those that move or are moved within a 12-month period and are not licensed or certified as highway vehicles. Nonroad mobile sources are vehicles and engines that fall under the following categories:

- Agricultural equipment, such as tractors, combines and balers;
- Airport ground support equipment, such as baggage tugs and terminal tractors;
- Commercial equipment, such as generators and pumps;
- Industrial equipment, such as forklifts and sweepers;
- Construction and mining equipment, such as graders, back hoes and trenchers;
- Lawn and garden equipment, such as leaf blowers and lawn mowers;
- Logging equipment (not present in Maricopa County);
- Pleasure craft, such as power boats and personal watercraft;
- Railway maintenance equipment, such as rail straighteners;
- Recreational equipment, such as all-terrain vehicles and off-road motorcycles;
- Underground mining and oil field equipment (not present in Maricopa County);
- Aircraft, such as jet and piston engines; and
- Locomotives, such as switching and line haul trains.

Emission calculations for most nonroad mobile source categories except aircraft, airport ground support equipment (GSE) and locomotives were derived using EPA's NONROAD2008a model (Core version 2008a, July 2009). Aircraft and airport GSE emission estimates were made using the Federal Aviation Administration's EDMS (Emissions Dispersion Modeling System) model, ver. 5.1.1. Locomotive emission calculations were derived from surveys of the three railroad companies that have operations in the county.

County specific temperature and fuel-related inputs are required for the operation of the NONROAD2008a model. Monthly temperature and fuel data were provided by the Arizona Department of Weights and Measures. The following table lists the local county inputs used:

Table 4.1–1. NONROAD2008 model county temperature and fuel-related inputs.

	Temperatures (°F)			Fuel RVP	Diesel Sulfur	Gasoline Sulfur	Ethanol Blend		
Month	Max.	Min.	Average	(psi)	(ppm)	(ppm)	ETOH (vol %)	Market share (%)	Total Oxygen (wt %)
January	64	45	54.9	9	9	15	9.92	100	3.66
February	69	48	58.5	9	9	16	10.29	100	3.85
March	79	54	66.8	8	9	11	9.52	100	3.58
April	87	61	74.2	8	9	14	7.90	100	2.98
May	91	66	78.7	7	9	13	9.41	100	3.48
June	107	80	93.4	7	10	18	9.38	100	3.45
July	106	84	95.2	7	9	21	9.70	100	3.62
August	104	82	93.2	7	6	18	9.58	100	3.70
September	101	79	90.1	7	6	18	9.73	100	3.60
October	91	65	78.1	8	9	15	9.49	100	3.56
November	81	56	68.7	8	6	14	10.17	100	3.80
December	65	46	56.0	8	16	12	9.02	100	3.41

Note: All other required temperature and fuel-related inputs not listed assumed NONROAD2008 default values.

The US EPA recommends adjusting default NONROAD2008a model values (such as equipment

population, activity levels of equipment, growth factors, etc.) where local data is available, as the default values in the model are derived from national averages. The NONROAD2008a model defaults were adjusted in the following manner:

- Equipment population numbers and activity levels for commercial lawn and garden equipment were adjusted based on 2003 survey results of the commercial lawn and garden industry performed by ENVIRON as part of an inventory developed to study the impact of visibility impairing pollutants (ENVIRON et al., 2003). Survey results show that for most categories of lawn and garden equipment, the equipment populations for Maricopa County are significantly lower than EPA default values, while the average annual hours of operation for most equipment types are slightly higher than EPA's values. Using these new local data results in a considerable decrease in emissions from this category, compared with earlier results using EPA default data.

Spatial allocation factors were developed (based on EPA guidance documents) to apportion nonroad emissions to the eight-hour ozone nonattainment area. The approaches used are described in each section of this chapter.

Temporal allocations (used to calculate ozone season-day emissions) for nonroad equipment categories modeled in the NONROAD2008a model are based on EPA recommendations on weekday and weekend day activity levels for each nonroad equipment category (US EPA, 1999). Table 4.1–2 below lists the weighted activity level allocation fractions for each equipment class for weekdays and weekend days. For this report, the most conservative (highest) allocation fraction in each nonroad equipment class was used to calculate season-day emissions.

Table 4.1–2. Default weekday and weekend day activity allocation fractions.

Equipment category	Weekday	Weekend day
Agricultural	0.1666667	0.0833334
Airport ground support	0.1428571	0.1428571
Commercial	0.1666667	0.0833334
Construction and mining	0.1666667	0.0833334
Industrial	0.1666667	0.0833334
Lawn and garden (residential)	0.1111111	0.2222222
Lawn and garden (commercial)	0.1600000	0.1000000
Logging	0.1666667	0.0833334
Pleasure craft	0.0600000	0.3500000
Railway maintenance	0.1800000	0.0500000
Recreational	0.1111111	0.2222222

4.2 Agricultural equipment

Annual emissions from agricultural equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as discussed above. Ozone nonattainment area annual emissions were calculated based on EIIP guidance (US EPA, 2002) which recommends using the ratio of agricultural land inside the nonattainment area (161,371 acres) to agricultural land inside the county (276,016 acres). See Section 1.5.2 for a discussion of land use data used.

Ozone nonattainment area emissions from agricultural equipment = Total Maricopa County VOC emissions from agricultural equipment × Agricultural land use allocation factor

= 38.53 tons × 58.46%

= 22.52 tons VOC/yr

County season-day emissions were calculated by multiplying ozone season emissions (generated by the NONROAD2008a model) by the most conservative weekday/weekend day activity allocation factor for agricultural equipment listed in Table 4.1–2, and dividing the product by the number of weeks (13) in the ozone season (US EPA, 1999), as follows:

Maricopa County VOC season-day emissions (lbs/day)	= Ozone season VOC emissions (tons/season)	× 2,000 (lb/ton)	×	daily activity allocation factor for agricultural equipment expressed as (week/day)	÷ 13 (weeks/season)	
	= 12.84	× 2,000	×	0.166667	÷ 13	
	= 392.3 lbs/day					

Ozone nonattainment area season-day emissions were calculated by multiplying County season-day emissions by the agricultural land use allocation factor:

Ozone nonattainment area season-day emissions	= Maricopa County VOC season-day emissions	×	Agricultural land use allocation factor
	= 392.3 lbs/day	×	58.46%
	= 192.5 lbs/day		

Table 4.2–1. Annual and season-day emissions from agricultural equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	38.53	330.49	303.71	329.3	2,762.6	2,584.4
8-hr ozone NAA	22.52	193.22	177.56	192.5	1,615.1	1,510.9

4.3 Airport ground support equipment

Annual emissions from airport ground support equipment (GSE) and auxiliary power units (APUs) were calculated using the Emissions Dispersion Modeling System (EDMS, v. 5.1.3) from the U.S. Federal Aviation Administration (FAA). Activity data on 2011 aircraft operations and GSE use for eight major airports were obtained from FAA's Air Traffic Activity Data System. In addition, activity data for 2011 for six small general aviation airports were assumed to be the same as those in 2008, which was included in MAG's 2009 survey data. (Further details concerning the modeling input data and results are described in Section 4.11, Aircraft). Emissions from GSE and APUs at Luke Air Force Base (AFB) for the year 2011 are assumed to be the same as those used in the 2008 PM_{10} Periodic Emissions Inventory Report for the Maricopa County, Arizona, Nonattainment Area (MCAQD, 2011) based on input from Luke AFB.

Table 4.3–1. Annual emissions (tons/yr) from airport ground support equipment (GSE) and auxiliary power units (APUs).

	Maricopa County			8-hr ozone NAA		
	VOC	NO_x	CO	VOC	NO_x	CO
GSE	104.94	317.86	3,171.63	104.40	316.39	3,155.22
APU	7.04	88.18	104.36	7.03	88.10	103.86
Total:	**111.98**	**406.04**	**3,275.99**	**111.43**	**404.49**	**3,259.08**

Table 4.3–2. Season-day emissions (lbs/day) from airport GSE and APU.

	Maricopa County			8-hr ozone NAA		
	VOC	NO_x	CO	VOC	NO_x	CO
GSE	549.4	1,663.2	16,597.8	546.7	1,656.0	16,516.8
APU	37.8	473.4	557.3	37.8	473.0	554.8
Total:	**587.3**	**2,136.6**	**17,155.0**	**584.5**	**2,128.9**	**17,071.7**

4.4 Commercial equipment

Annual emissions from commercial equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the eight-hour ozone nonattainment area for this category were derived by applying the ratio of industrial employment in the nonattainment area to Maricopa County totals, as data on the number of wholesale establishments recommended by EIIP guidance (US EPA, 2002) was not available. See Section 1.5.1 for a discussion of the industrial employment data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2008a model) by the most conservative weekday/ weekend day activity allocation factor for commercial equipment (0.1666667) listed in Table 4.1–2, and dividing the product by the number of weeks (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on industrial employment ratios as described above.

Table 4.4–1. Annual and season-day emissions from commercial equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	1,924.41	1,361.42	30,224.21	14,537.1	8,334.7	203,404.4
8-hr ozone NAA	1,916.15	1,355.57	30,094.46	14,474.7	8,299.0	202,531.2

4.5 Construction and mining equipment

Annual emissions from construction and mining equipment in Maricopa County were calculated using EPA's NONROAD2008a model as described in Section 4.1. Annual emissions for the eight-hour ozone nonattainment area for this category were derived by applying the ratio of construction employment in the nonattainment area to Maricopa County totals as a conservative estimate, since the EIIP-recommended allocation factor of total dollar value of construction was unavailable (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2008a model) by the most conservative weekday/ weekend day activity allocation factor for construction/mining equipment (0.1666667) listed in Table 4.1–2, and dividing the product by the number of weeks (13) in the ozone season (US

EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on construction employment ratios as described above.

Table 4.5–1. Annual and season-day emissions from construction and mining equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1,881.88	12,937.30	14,396.92	13,116.9	87,972.9	99,942.8
8-hr ozone NAA	1,941.80	13,349.23	14,855.32	13,534.5	90,774.0	103,125.0

4.6 Industrial equipment

Annual emissions from industrial equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the eight-hour ozone nonattainment area for this category were derived by applying the ratio of industrial employment in the nonattainment area to Maricopa County totals as a conservative estimate, since the number of employees in manufacturing, as recommended by EIIP guidance (US EPA, 2002), was not available. See Section 1.5.1 for a discussion of the industrial employment data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2008a model) by the most conservative weekday/ weekend day activity allocation factor for industrial equipment (0.1666667) listed in Table 4.1–2, and dividing the product by the number of weeks (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on industrial employment ratios as described above.

Table 4.6–1. Annual and season-day emissions from industrial equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	341.25	1,839.35	7,140.99	2,212.6	11,763.4	46,138.5
8-hr ozone NAA	339.78	1,831.45	7,110.33	2,203.1	11,712.9	45,940.4

4.7 Lawn and garden equipment

Annual emissions from lawn and garden equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. These results reflect new equipment population and usage estimates from survey work done in early 2003 for the Arizona Department of Environmental Quality (discussed further in Section 4.1). Annual emissions for the eight-hour ozone nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County totals, since the number of housing units, as recommended by EIIP guidance, was not available (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2008a model) by the most conservative weekday/ weekend day activity allocation factor for lawn and garden equipment (0.1600000 for the commercial segment, 0.2222222 for residential) listed in Table 4.1–2, and dividing the product by the number of weeks (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on population as described above.

Table 4.7–1. Annual and season-day emissions from lawn and garden equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	4,913.96	866.64	54,798.41	51,990.4	6,998.4	523,235.5
8-hr ozone NAA	4,970.15	876.55	55,425.05	52,584.9	7,078.4	529,218.9

4.8 Pleasure craft

Annual emissions from pleasure craft equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the eight-hour ozone nonattainment area for this category were derived by applying the ratio of lake surface area in the nonattainment area to Maricopa County totals, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land use data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2008a model) by the most conservative weekday/ weekend day activity allocation factor for pleasure craft (0.350000) listed in Table 4.1–2, and dividing the product by the number of weeks (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on lake surface area as described above.

Table 4.8–1. Annual and season-day emissions from pleasure craft equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	530.39	96.56	1,249.66	11,527.0	1,996.8	26,738.3
8-hr ozone NAA	530.39	96.56	1,249.66	11,527.0	1,996.8	26,738.3

4.9 Railway maintenance equipment

Annual emissions from railway maintenance equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the eight-hour ozone nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County totals, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2008a model) by the most conservative weekday/ weekend day activity allocation factor for railway maintenance equipment (0.1800000) listed in Table 4.1–2, and dividing the product by the number of weeks (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on the population ratio as described above.

Table 4.9–1. Annual and season-day emissions from railway maintenance equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1.94	8.55	16.48	14.2	59.0	117.8
8-hr ozone NAA	1.96	8.64	16.67	14.4	59.7	119.1

4.10 Recreational equipment

Annual emissions from recreational equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the eight-hour ozone nonattainment area for this category were derived by applying the ratio of passive open space and vacant land use in the nonattainment area to Maricopa County totals, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land use data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2008a model) by the most conservative weekday/ weekend day activity allocation factor for recreational equipment (0.2222222) listed in Table 4.1–2, and dividing the product by the number of weeks (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on land use as described above.

Table 4.10–1. Annual and season-day emissions from recreational equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1,518.97	66.10	6,373.46	17,804.4	679.3	74,424.8
8-hr ozone NAA	684.30	29.78	2,871.27	8,020.9	306.0	33,528.7

4.11 Aircraft

Emissions from aircraft at the largest airports in Maricopa County were estimated using the Federal Aviation Administration's Emissions and Dispersion Model (EDMS, v. 5.1.3). The FAA EDMS model combines specified aircraft and activity levels with default emissions factors in order to estimate annual emissions inventories for a specific airport. The model calculates emissions of sulfur oxides (SO_x), oxides of nitrogen (NO_x), particulate matter (only for certain categories of airframes and engines), carbon monoxide (CO), and hydrocarbons (HC). The model can also estimate emissions from ground support equipment (GSE) and auxiliary power units (APUs), using either default profiles or user-specified activity of these components. The EDMS runs were executed by the Maricopa Association of Governments. The contact person for the EDMS emission estimates is Adam Xia (602-254-6300).

Aircraft emissions were estimated for four aircraft categories:

1. Air carriers (abbreviated "AC"): Larger commercial aircraft with at least 60 seats or 18,000 lbs payload capacity, used for scheduled service to transport passengers and/or freight;
2. Air taxis ("AT"): Smaller commercial turbine- or piston-powered aircraft with less than 60 seats or 18,000 lbs payload capacity;
3. General aviation ("GA"): Aircraft used on an unscheduled basis for recreational flying, personal transportation, and other activities, including business travel; and
4. Military ("ML"): Aircraft used to support military operations.

First, three databases from FAA's website provide the year 2011 aircraft activity, fleet mix for the types of aircraft used, and hourly/weekly/monthly operational profiles for eight major airports (Chandler Municipal, Falcon Field, Glendale Municipal, Phoenix Deer Valley, Phoenix Goodyear, Phoenix-Mesa Gateway, Phoenix Sky Harbor, and Scottsdale airport). The three databases are (1) FAA's Air Traffic Activity Data System (ATADS) (FAA, 2012a); (2)

Enhanced Traffic Management System Counts (ETMSC) database; and (3) FAA Aviation Performance Metrics (APM) database (FAA, 2012b).

To supplement the FAA's database for the eight major airports, MAG conducted a survey of six additional small general aviation airports (Buckeye Municipal, Gila Bend Municipal, Pleasant Valley, Sky Ranch at Carefree, Stellar Airpark, and Wickenburg Municipal airport) in Maricopa County to gather the year 2008 data on aircraft activity (landings and take-offs or LTOs) and estimated average taxi/idle times in 2009. The year 2008 data for these small general aviation airports are assumed to be the same as those in year 2011, since no updated aircraft activity data were available for the year 2011. Table 4.11–1 summarizes the activity level for each aircraft category for each airport included in the modeling, and indicates the data sources for each airport's activity (reported number of operations) and fleet mix.

One required meteorological input for EDMS is an atmospheric mixing height, which is defined as the height (or depth) above ground where relatively vigorous vertical mixing occurs due to convection. To calculate the time-varying mixing height, the latest version of the EPA AERMOD Meteorological Preprocessor (AERMET version 11059) was employed.

Table 4.11–1. Annual airport operations (by aircraft category) and related data sources.

Airport	Airport Code	Operations Data Source[1]	Fleet Mix Data Source[2]	Aircraft Type[3]	2011 Operations
Buckeye Municipal	BXK	airnav.com	Generic GA profile	GA	53,070
Chandler Municipal	CHD	FAA/ATADS	FAA/ETMSC	AC	6
				AT	2,168
				GA	158,960
				ML	456
Falcon Field	FFZ	FAA/ATADS	FAA/ETMSC	AC	4
				AT	2,718
				GA	214,486
				ML	2,872
Gila Bend Municipal	E63	airnav.com	Generic GA profile	GA	3,536
Glendale Municipal	GEU	FAA/ATADS	FAA/ETMSC	AT	1,070
				GA	85,998
				ML	56
Luke Air Force Base	LUF	[2011 F-16 aircraft emissions were grown based on the total number of F-16 operations in 2008 vs. 2011]			
Phoenix Deer Valley	DVT	FAA/ATADS, Survey response	Survey response, FAA/ETMSC	AC	2
				AT	3,832
				GA	313,362 *
				ML	248
Phoenix Goodyear	GYR	FAA/ATADS, Survey response	Survey response, FAA/ETMSC	AC	146
				AT	312
				GA	132,566 *
				ML	5,582
Phoenix-Mesa Gateway (formerly Williams Gateway)	IWA	FAA/ATADS	FAA/ETMSC	AC	7,782
				AT	9,176
				GA	147,596
				ML	6,646
Phoenix Sky Harbor	PHX	FAA/ATADS	FAA/ETMSC	AC	375,104
				AT	63,796
				GA	20,582
				ML	2,506
Pleasant Valley	P48	airnav.com	Generic GA profile	GA	6,010
Scottsdale	SDL	FAA/ATADS	FAA/ETMSC	AC	6
				AT	12,970
				GA	127,924
				ML	740
Sky Ranch at Carefree	18AZ	Survey response	Generic GA profile	GA	3,030
Stellar Airpark	P19	airnav.com	Generic GA profile	GA	39,056
Wickenburg Municipal	E25	Survey responses	Generic GA profile	GA	12,000

1. FAA/ATADS: Federal Aviation Administration's Air Traffic Activity Data System (database); http://aspm.faa.gov.
2. FAA/ETMSC: Federal Aviation Administration's Enhanced Traffic Management System Counts (database); http://aspm.faa.gov.
3. AC: Air Commercial; AT: Air Taxi; GA: General Aviation; ML: Military

* includes touch-and-go operations reported by airport.

Both the 2011 hourly surface meteorological data and the 2011 one-minute Automated Surface Observing System (ASOS) wind data from the National Weather Service (NWS) station at the Phoenix Sky Harbor were used (NCDC, 2012). Full year upper air data in 2011 at the Tucson station (station number 23160) were obtained from the National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL) Radiosonde Database (ESRL, 2012). Ultimately, a single mixing height dataset in 2011 is used for all airports, except Luke Air Force Base.

F-16 aircraft emissions estimates for Luke AFB for the year 2011 were scaled using a ratio of the number of F-16s in 2011 to the number of F-16s in 2008. The emissions from "transient" aircraft and on-wing engine testing in 2011 were assumed to be the same as those in 2008 based on input from Luke AFB. Emissions from the military aircraft, "transient" aircraft, and on-wing engine testing were summed into a single "ML" category for Luke AFB. This summation method is consistent with that used in the 2008 PM_{10} Periodic Emissions Inventory Report for the Maricopa County, Arizona, Nonattainment Area (MCAQD, 2011).

As with all other airports included in this inventory, emissions from ground support equipment (GSE) at Luke AFB are addressed in Section 4.3, Airport ground support equipment and auxiliary power units.

The following section describes how activity and emissions were estimated for a representative airport, Falcon Field (FFZ). The FAA's Air Traffic Activity System (ATADS, available at www.aspm.faa.gov) provided data on 2011 activity by aircraft type; these results are contained in Table 4.11–1. While ATADS reported a total of 214,486 general aviation operations at this airport in 2011, further information on the aircraft types comprising this activity was needed. The FAA's Enhanced Traffic Management System Counts (ETMSC) database was used to "grow" available aircraft-specific operational data as described below.

The ETMSC database on general aviation activity at Falcon Field airport (FFZ) in 2011 comprises 145 different aircraft types, totaling 3,731 operations (See Table 4.11–2). To simplify modeling input requirements, this aircraft-specific activity data were ranked in order of decreasing frequency. Activity data for the most frequently reported aircraft was then grown to represent all general aviation activity. How this approach was applied for general aviation activity at Falcon Field airport is shown in Table 4.11–2.

This approach of ranking reported activity, and then growing this subset of data, typically resulted in a set of 10 to 30 aircraft types being modeled for each airport/aircraft class combination, representing 75 to 100% of all reported activity.

Ozone season-day emissions were calculated by dividing ozone season total emissions by 92 (the number of days in the ozone season). Tables 4.11–3 and 4.11–4 list the total annual emissions and season-day emissions, by airport and aircraft type for airports within and outside the eight-hour ozone nonattainment area, respectively.

Tables 4.11–3 and 4.11–4 list the total annual and seasonal daily emissions by aircraft type, for airports located inside and outside the eight-hour ozone nonattainment area, respectively.

Table 4.11–2. Growing aircraft-specific activity for EDMS modeling input.

Rank	Aircraft Type	ETMSC-Reported Operations	% of Total Reported Operations	Cumulative Percent	"Grown" Operations for EDMS Modeling
1	DA40 - Diamond Star DA40	536	14.37%	14.37%	40,796
2	BE9L - Beech King Air 90	350	9.38%	23.75%	26,640
3	P28R - Cherokee Arrow/Turbo	250	6.70%	30.45%	19,028
4	DA42 - Diamond Twin Star	163	4.37%	34.82%	12,406
5	BE20 - Beech 200 Super King	130	3.48%	38.30%	9,894
6	C25B - Cessna Citation CJ3	118	3.16%	41.46%	8,982
7	PC12 - Pilatus PC-12	110	2.95%	44.41%	8,372
8	C680 - Cessna Citation Sovereign	103	2.76%	47.17%	7,840
9	C441 - Cessna Conquest	99	2.65%	49.83%	7,536
10	B350 - Beech Super King Air 350	86	2.31%	52.13%	6,546
11	BE36 - Beech Bonanza 36	84	2.25%	54.38%	6,394
12	C172 - Cessna Skyhawk 172/Cutlass	83	2.22%	56.61%	6,318
13	CL60 - Bombardier Challenger 600/601/604	70	1.88%	58.48%	5,328
14	P46T - Piper Malibu Meridian	68	1.82%	60.31%	5,176
15	SR22 - Cirrus SR 22	67	1.80%	62.10%	5,100
16	P28A - Piper Cherokee	62	1.66%	63.76%	4,718
17	COL4 - Lancair LC-41 Columbia 400	52	1.39%	65.16%	3,958
18	TBM7 - Socata TBM-7	50	1.34%	66.50%	3,806
19	C182 - Cessna Skylane 182	48	1.29%	67.78%	3,654
20	C560 - Cessna Citation V/Ultra/Encore	47	1.26%	69.04%	3,578
21	M20P - Mooney M-20C Ranger	46	1.23%	70.28%	3,502
22	C210 - Cessna 210 Centurion	44	1.18%	71.46%	3,348
23	PAY2 - Piper Cheyenne 2	40	1.07%	72.53%	3,044
24	C525 - Cessna CitationJet/CJ1	38	1.02%	73.55%	2,892
25	BE35 - Beech Bonanza 35	37	0.99%	74.54%	2,816
26	C414 - Cessna Chancellor 414	37	0.99%	75.53%	2,814
⋮	⋮	⋮	⋮	⋮	
145	T34P - Beech T-34B Mentor	1	< 0.1%	100.00%	(n/a)
	Total:	**3,731**			**214,486**

Table 4.11–3. Annual and season-day emissions, by aircraft type, for airports in the eight-hour ozone NAA.

		Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Facility	**Category**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Buckeye Municipal	GA	5.46	2.69	211.10	26.7	11.3	1,172.3
Chandler Municipal	AC	0.02	0.00	0.04	0.4	0.0	0.8
	AT	12.82	1.23	13.52	69.0	6.2	73.5
	GA	127.56	14.18	1,329.77	629.0	62.4	7,236.4
	ML	0.05	0.04	4.85	1.0	0.7	91.2
	Total	***140.45***	***15.45***	***1,348.17***	***699.3***	***69.2***	***7,401.9***
Falcon Field	AC	0.01	0.00	0.02	0.2	0.0	0.4
	AT	7.15	2.27	11.43	36.5	10.5	58.9
	GA	103.99	31.13	1,170.22	484.1	126.8	6,009.2
	ML	3.73	2.67	9.86	17.4	10.8	47.2
	Total	***114.88***	***36.07***	***1,191.53***	***538.1***	***148.1***	***6,115.7***
Gila Bend Municipal	GA	0.36	0.18	14.29	1.8	0.9	71.0
Glendale Municipal	AT	3.67	0.88	5.17	15.6	3.6	22.3
	GA	88.19	17.14	519.57	449.8	78.3	2,899.0
	ML	0.05	0.01	0.14	0.1	0.0	0.4
	Total	***91.91***	***18.02***	***524.88***	***465.5***	***81.9***	***2,921.7***
Luke Air Force Base	ML	154.13	347.83	601.72	844.5	1905.9	3,297.1
Phoenix Deer Valley	AC	0.00	0.00	0.00	0.0	0.0	0.0
	AT	13.65	3.00	17.69	60.0	11.9	78.4
	GA	93.34	52.99	2,382.41	525.7	278.4	15,313.0
	ML	0.20	0.11	0.70	1.2	0.5	3.9
	Total	***107.19***	***56.10***	***2,400.81***	***586.9***	***290.8***	***15,395.2***
Phoenix Goodyear	AC	0.12	0.40	0.92	0.5	1.6	4.4
	AT	0.53	1.01	1.49	2.4	4.5	6.9
	GA	43.39	13.80	1,224.97	234.8	62.9	7,380.0
	ML	3.55	1.31	17.22	25.8	8.6	132.6
	Total	***47.60***	***16.52***	***1,244.61***	***263.6***	***77.6***	***7,523.9***
Phoenix Sky Harbor Intl	AC	266.99	1,823.15	1,893.82	1,414.1	8,732.7	9,944.4
	AT	26.03	101.94	182.25	143.0	506.8	1,004.2
	GA	42.59	7.41	140.93	198.2	31.1	702.2
	ML	110.67	14.01	119.21	474.6	52.9	510.3
	Total	***446.28***	***1,946.50***	***2,336.21***	***2,230.0***	***9,323.5***	***12,161.0***
Phoenix-Mesa Gateway Airport	AC	2.25	27.46	33.32	12.3	138.9	179.9
	AT	56.62	3.53	58.50	285.8	16.2	298.1
	GA	146.94	9.81	713.40	666.4	39.8	3,512.1
	ML	47.87	25.62	100.88	202.6	95.6	428.0
	Total	***253.68***	***66.42***	***906.11***	***1,167.2***	***290.5***	***4,418.1***
Pleasant Valley	GA	0.21	1.61	2.69	1.1	7.6	14.6
Scottsdale	AC	0.02	0.00	0.04	0.0	0.0	0.0
	AT	57.90	8.19	69.79	242.1	31.8	295.1
	GA	274.72	67.08	650.51	1,271.3	283.6	3,082.5
	ML	1.33	0.35	3.64	5.3	1.2	14.6
	Total	***333.96***	***75.63***	***723.98***	***1,518.7***	***316.5***	***3,392.1***
Skyranch at Carefree	GA	1.63	0.58	16.13	4.9	1.6	55.5
Stellar Airpark	GA	7.69	2.38	197.13	37.5	9.9	1,053.5
8–hr ozone NAA total:		**1,705.43**	**2,585.98**	**11,719.36**	**8,385.8**	**12,535.3**	**64,993.6**

AC: Air Commercial; AT: Air Taxi; GA: General Aviation; ML: Military

Table 4.11–4. Annual and season-day emissions, by aircraft type, for airports outside the eight-hour ozone NAA.

		Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Facility	**Category**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Wickenburg Municipal	GA	13.90	2.84	62.02	65.2	12.9	331.8
Maricopa County total:		**1,719.33**	**2,588.82**	**11,781.38**	**8,451. 0**	**12,548.2**	**65,325.4**

4.12 Locomotives

Annual emissions from locomotives were calculated based on diesel fuel usage provided by Burlington Northern/Santa Fe Railway (BNSF), Union Pacific Railway (UP) and Amtrak. Railway operations from these companies fall into three categories: Class I haul lines, yard/switching operations, and passenger trains. Annual emissions were calculated by multiplying diesel fuel usage by the emission factors listed in Table 4.12–1 (US EPA, 2009).

Table 4.12–1. Emission factors for locomotives.

	Emission factors (lbs/gal diesel)		
Activity type	**VOC**	**NO_x**	**CO**
Class I haul line	0.018	0.328	0.059
Yard/switch operations	0.032	0.517	0.060
Passenger trains	0.019	0.367	0.059

Fuel use reported by railroads and emission totals are summarized in Table 4.12–2.

Table 4.12–2. Fuel use and annual emissions from locomotives in Maricopa County.

		Annual emissions (tons/yr)		
Locomotive type	**Diesel fuel used (gals)**	**VOC**	**NO_x**	**CO**
Class I haul line	7,706,715	68.74	1,263.13	231.75
Yard/switch operations	520,076	8.43	134.44	12.63
Passenger trains	46,301	0.43	8.51	1.36
Total:	**8,273,092**	**77.60**	**1,406.08**	**245.74**

Eight-hour ozone nonattainment area emissions were calculated by multiplying Maricopa County emissions by the percentage of track miles inside the eight-hour ozone nonattainment area, determined by GIS mapping. Results are shown in Table 4.12–3.

Table 4.12–3. Annual emissions from locomotives in the eight-hour ozone NAA.

	Track in nonattain-	Annual emissions (tons/yr)		
Locomotive type	**ment area (%)**	**VOC**	**NO_x**	**CO**
Class I haul line	60.65%	41.69	766.09	140.56
Yard/switch operations	100.00%	8.43	134.44	12.63
Passenger trains	6.98%	0.03	0.59	0.09
Total:		**50.15**	**901.12**	**153.29**

Ozone season-day emissions for both the county and the eight-hour ozone nonattainment area (shown in Table 4.12–4) were calculated by dividing annual totals by 365 days per year, as locomotive activity is assumed to be uniform throughout the year.

Table 4.12–4. Season-day emissions from locomotives in Maricopa County and the eight-hour ozone NAA.

	Maricopa County			8-hr ozone NAA		
	Season-day emissions (lbs/day)					
Locomotive type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Class I haul line	376.6	6,921.3	1,269.9	228.4	4,197.7	770.2
Yard/switch operations	46.2	736.7	69.2	46.2	736.7	69.2
Passenger trains	2.4	46.6	7.4	0.2	3.3	0.5
Total:	**425.2**	**7,704.5**	**1,346.5**	**274.8**	**4,937.7**	**839.9**

4.13 Summary of all nonroad mobile source emissions

Table 4.13–1 summarizes annual and season day emissions of VOC, NO_x, and CO from nonroad mobile sources in Maricopa County, respectively. Table 4.13–2 shows annual and season-day emissions for these pollutants for the eight-hour ozone nonattainment area.

Table 4.13–1. Annual and season-day emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural	38.53	330.49	303.71	329.3	2,762.6	2,584.4
Airport GSE & APUs	111.98	406.04	3,275.98	587.3	2,136.6	17,155.0
Commercial	1,924.41	1,361.42	30,224.21	14,537.1	8,334.7	203,404.4
Construction & mining	1,881.88	12,937.30	14,396.92	13,116.9	87,972.9	99,942.8
Industrial	341.25	1,839.35	7,140.99	2,212.6	11,763.4	46,138.5
Lawn & garden	4,913.96	866.64	54,798.41	51,990.4	6,998.4	523,235.5
Pleasure craft	530.39	96.56	1,249.66	11,527.0	1,996.8	26,738.3
Railway maintenance	1.94	8.55	16.48	14.2	59.0	117.8
Recreational	1,518.97	66.10	6,373.46	17,804.4	679.3	74,424.8
Aircraft	1,719.33	2,588.82	11,781.38	8,451. 0	12,548.2	65,325.4
Locomotives	77.60	1,406.08	245.74	425.2	7,704.5	1,346.5
Total:	**13,060.24**	**21,907.35**	**129,806.94**	**120,995.4**	**142,956.4**	**1,060,413.4**

Table 4.13–2. Annual and season-day emissions from nonroad mobile sources in the eight-hour ozone NAA.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural	22.52	193.22	177.56	192.5	1,615.1	1,510.9
Airport GSE & APUs	111.43	404.49	3,259.08	584.5	2,128.9	17,071.7
Commercial	1,916.15	1,355.57	30,094.46	14,474.7	8,299.0	202,531.2
Construction & mining	1,941.80	13,349.23	14,855.32	13,534.5	90,774.0	103,125.0
Industrial	339.78	1,831.45	7,110.33	2,203.1	11,712.9	45,940.4
Lawn & garden	4,970.15	876.55	55,425.05	52,584.9	7,078.4	529,218.9
Pleasure craft	530.39	96.56	1,249.66	11,527.0	1,996.8	26,738.3
Railway maintenance	1.96	8.64	16.67	14.4	59.7	119.1
Recreational	684.30	29.78	2,871.27	8,020.9	306.0	33,528.7
Aircraft	1,705.43	2,585.98	11,719.36	8,385.8	12,535.3	64,993.6
Locomotives	50.15	901.12	153.29	274.8	4,937.7	839.9
Total:	**12,274.06**	**21,632.59**	**126,932.05**	**111,797.1**	**141,443.8**	**1,025,617.7**

4.14 Quality assurance procedures

Established procedures were used to check, and correct when necessary, the nonroad mobile sources emissions estimates. All NONROAD model input and output files, and Excel spreadsheets used to calculate the emissions, were checked by personnel who were not involved in the development of the modeling inputs/outputs and spreadsheets. In addition, the emissions estimates were reviewed for reasonableness by external agency staff.

4.15 References

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5. Onroad Mobile Sources

5.1 Introduction

Onroad mobile source emissions for ozone precursors, such as volatile organic compounds (VOCs), nitrogen oxides (NO_x), and carbon monoxide (CO), have been calculated for the eight-hour ozone nonattainment area (NAA) and Maricopa County for the 2011 Periodic Emissions Inventory (PEI).

Motor Vehicle Emission Simulator (MOVES2010b) is the latest model developed by the U.S. Environmental Protection Agency (EPA) for the purpose of estimating onroad and off-network motor vehicle emission factors.

The MOVES2010b modeling accounted for the oxygenated fuel and the Arizona Vehicle Inspection/Maintenance (I/M) programs applied in Maricopa County in 2011. The fuel use assumptions, including oxygen content and Reid Vapor Pressure (RVP), were derived from the 2011 fuel inspection results provided by the Arizona Department of Weights and Measures.

In order to develop the 2011 onroad mobile source emissions, the 2011 vehicle miles traveled (VMT) estimates by facility type and road type were derived from the 2011 Highway Performance Monitoring System (HPMS) data provided by the Arizona Department of Transportation (ADOT). The distribution of VMT by vehicle type is based on the July 2011 vehicle registration data for Maricopa County provided by ADOT. The VMT by vehicle type was provided as local input data for MOVES2010b to produce onroad emissions.

The main references for preparing the onroad mobile source portion of the 2011 emissions inventory were:

- Emission Inventory Requirements for Ozone State Implementation Plans (US EPA, 1991);
- Procedures for Emission Inventory Preparation Volume IV: Mobile Sources (US EPA, 1992a);
- Quality Review Guidelines for 1990 Base Year Emission Inventories (US EPA, 1992b);
- User's Guide for the SMOKE-MOVES Integration Tool (US EPA, 2010);
- Motor Vehicle Emission Simulator (MOVES) - User Guide Version, MOVES2010b (US EPA, 2012a);
- Policy Guidance on the Use of MOVES2010 and Subsequent Minor Revisions for State Implementation Plan Development, Transportation Conformity, and Other Purposes (US EPA, 2012b); and
- Using MOVES to Prepare Emissions Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a and 2010b (US EPA, 2012c).

5.2 Onroad emissions

Vehicle exhaust and evaporative emission factors for VOC, NO_x, and CO were calculated using MOVES2010b. The MOVES2010b runs were executed by MAG. The contact person for the MOVES2010b emission estimates is Ieesuck Jung (602-254-6300).

5.2.1 MOVES2010b model

The emissions were calculated using MOVES2010b. MOVES2010b is EPA's state-of-the-art emissions modeling tool, which replaces EPA's previous mobile source emissions model, MOBILE6.2. MOVES2010b is intended for official use to estimate national, state, and county level inventories of criteria air pollutants from highway vehicles. The user of MOVES2010b is allowed to specify vehicle types, time periods, geographical areas, pollutants, vehicle operating characteristics, and road types for a particular scenario to be modeled by creating a Run Specification (RunSpec).

In order to calculate vehicle emissions for the calendar year 2011, MOVES2010b was executed using local input data for each month of the year and each geographical area (the eight-hour ozone nonattainment area and Maricopa County). Each scenario was created using the County Domain/Scale and the Inventory Calculation Type. The specific MOVES2010b model RunSpec and RunSpec summaries are described in Appendix C.

5.2.2 MOVES2010b local input data

Compared with MOBILE6.2, MOVES2010b requires a more detailed level of local data, including fuel data, I/M program, meteorological data, vehicle population, source type age distribution, annual VMT, monthly/daily/hourly VMT fractions, road type distribution, average speed distribution, ramp fraction, and Alternative Vehicle and Fuel Technologies (AVFT) strategy.

5.2.2.1 Fuel data

Regarding the fuel local input data, MOVES2010b provides two MOVES tables, which are [fuelsupply] and [fuelformulation]. The fuel data for each month were derived from the 2011 fuel inspection results in Maricopa County provided by the Arizona Department of Weights and Measures. The 2011 fuel inspection results reflected the committed control measure – California Phase 2 Reformulated Gasoline with (1) 3.5% Oxygen Content from November 1 through March 31 (MAG, 2003) and (2) 7 psi from May 1 through September 30 (MAG, 2009). The fuel data for Maricopa County were also applied to the eight-hour ozone nonattainment area. The specific MOVES tables for fuel data are presented in Appendix C.

5.2.2.2 I/M programs

MOVES2010b has an [IMCoverage] table for I/M programs; this table was prepared using MOBILE6.2 input. This table reflects the actual proportions of vehicles subject to the specified levels of inspection. The term "I/M vehicles" denotes vehicles which are required to undergo an emission test and/or inspection under the Vehicle Inspection/Maintenance Program. It is important to note that participation in the I/M program is required for all vehicles registered in Area A, with the exception of certain model years and vehicle classes. However, it is assumed that 91.6 percent of the vehicles operating within the eight-hour ozone nonattainment area and Maricopa County participate in the I/M program and the remaining 8.4 percent do not participate in the program. These percentages reflect the control measures "Tougher Enforcement of Vehicle Registration and Emissions Test Compliance" and "Expansion of Area A Boundaries," described in the MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan for the

Maricopa Nonattainment Area (MAG, 2009). This percentage is directly applied to the Compliance Factor in the [IMCoverage] table. The same I/M programs were applied for the eight-hour ozone nonattainment area and Maricopa County. The specific MOVES table for I/M programs is presented in Appendix C.

5.2.2.3 Meteorological data

MOVES2010b requires hourly temperature and relative humidity data by specific month of the year. Meteorological data for the Phoenix Sky Harbor International Airport in 2011 were obtained from the National Climatic Data Center (*http://www.ncdc.noaa.gov/*). The same hourly average temperature and relative humidity data for each month were applied for the eight-hour ozone nonattainment area and Maricopa County. The specific MOVES table [ZoneMonthHour] for meteorological data is presented in Appendix C.

5.2.2.4 Vehicle population

In order to capture start, evaporative, and extended idle emissions, MOVES2010b introduced a new mobile source emission category called off-network emissions. In MOVES2010b, these off-network emissions are directly determined by population of vehicles in an area. The vehicle population in Maricopa County was obtained from the July 2011 vehicle registration data provided by ADOT. The vehicle population data were allocated to the 28 MOBILE6.2 vehicle types based on MOBILE6.2 VMT fractions for 2011. Then, the vehicle population data allocated to the 28 MOBILE6.2 vehicle types were assigned to the 13 MOVES source types using the match-up table (Table A.1) in EPA's technical guidance (EPA, 2012c). The vehicle population in the eight-hour ozone nonattainment area was estimated by applying the population ratio of the two geographical areas to the vehicle population in Maricopa County. The specific MOVES table [SourceTypeYear] for vehicle population is presented in Appendix C.

5.2.2.5 Source type age distribution

MOVES2010b categorizes vehicles according to vehicle classes and model years. The source type age distribution was prepared using EPA's data converter that takes the registration distribution input file created for MOBILE6.2 and converts it to the appropriate MOVES age distribution input table [SourceTypeAgeDistribution]. The same source type age distribution was applied for the eight-hour ozone nonattainment area and Maricopa County. The specific MOVES table for source type age distribution is presented in Appendix C.

5.2.2.6 Annual VMT

The 2011 daily VMTs by facility type were used to estimate onroad exhaust and evaporative emissions. The 2011 VMT distributions by facility type for the eight-hour ozone nonattainment area and Maricopa County were obtained from the 2011 Maricopa County Estimates of Daily Vehicle Travel by Highway Functional Classification provided by ADOT. The 2011 VMT distributions were multiplied by the 2011 HPMS VMT for the eight-hour ozone nonattainment area and Maricopa County. The resultant VMT estimates by facility type for the eight-hour ozone nonattainment area and Maricopa County are shown in Table 5.2–1.
Since MOVES2010b requires annual VMTs by HPMS vehicle type as a local input, the daily VMTs by HPMS vehicle type were derived from the 2011 traffic assignment data provided by

the MAG transportation modeling group in May 2011 and the daily VMTs by facility type and the estimated percentages of daily vehicle travel by vehicle type and highway functional classification provided by ADOT. Then, the daily VMTs by HPMS vehicle type were multiplied by 365 days to obtain the annual VMTs by HPMS vehicle type. The specific MOVES table [HPMSvTypeYear] for annual VMT is presented in Appendix C.

Table 5.2–1. 2011 daily VMT by facility type (annual average daily traffic).

	Facility Type	8-hr ozone NAA (thousand miles/day)	Maricopa County (thousand miles/day)
Rural	Interstate	1,833	3,247
	Other Principal Arterial	897	1,589
	Minor Arterial	166	293
	Major Collector	734	1,301
	Minor Collector	95	168
	Local	149	264
Urban	Interstate	10,906	11,182
	Other Freeway/Expressway	19,263	19,750
	Other Principal Arterial	21,474	22,017
	Minor Arterial	13,767	14,115
	Collector	4,680	4,799
	Local	9,910	10,160
Total:		**83,874**	**88,885**

5.2.2.7 Road type distribution

MOVES2010b requires the distribution of VMTs by road type as a local input. The road type VMT distribution by HPMS vehicle type was derived from the 2011 traffic assignment data and the daily VMTs by HPMS vehicle type mentioned in the previous section. As suggested in EPA's technical guidance (US EPA, 2010), the same road type distribution by HPMS vehicle type was used for all MOVES source types within an HPMS vehicle class. The specific MOVES table [RoadTypeDistribution] for road type distribution is presented in Appendix C.

5.2.2.8 VMT fraction

Since VMT varies by month, day of week, and hour, MOVES2010b requires month/day/hour VMT fractions as a local input in order to derive hourly VMT for each weekday/weekend and month from the annual VMT. The month/day/hour VMT fractions were developed from data recorded by continuous traffic counters on freeways (ADOT Freeway Management System) and arterials (Phoenix Automatic Traffic Recorders) during the year 2007. The specific MOVES tables [MonthVMTFraction], [DayVMTFraction], and [HourVMTFraction] for VMT fractions are presented in Appendix C.

5.2.2.9 Average speed distribution

In MOVES2010b, vehicle power, speed, and acceleration have a significant effect on vehicle emissions for all pollutants. MOVES2010b estimates those emission effects by assigning activity to operating mode distributions, which are determined by the distribution of vehicle hours traveled (VHT) by average speed. As recommended in EPA's technical guidance (US EPA, 2010), estimates of local average speeds were developed by post-processing the output from the 2011 traffic assignment data provided by the MAG transportation modeling group in May 2011. To develop the average speed distribution, VHTs in sixteen speed bins were accumulated separately for each hour of the day, source type, and road type in Maricopa County. Then, the average speed distribution was calculated by normalizing VHTs in sixteen speed bins for each hour of the day, source type, and road type. The same methodology was applied to develop the speed estimates for the eight-hour ozone nonattainment area. The specific MOVES table [AvgSpeedDistribution] for the average speed distribution is presented in Appendix C.

5.2.2.10 Ramp fraction

MOVES2010b requires the ramp fraction, which represents the percent of VHT on ramps, on both rural restricted roads (road type 2) and urban restricted roads (road type 4). The fraction of VHT on ramps was derived by dividing the total VHTs on ramps by the total VHTs for each restricted road type. Those VHTs were obtained from the 2011 traffic assignment data provided by the MAG transportation modeling group in May 2011. The specific MOVES table [RoadType] for ramp fractions is presented in Appendix C.

5.2.2.11 AVFT strategy

MOVES2010b allows users to modify the fuel engine fraction using different fuels and technologies in each model year in order to reflect the local situation. The fleet information for transit buses for model years 1997 through 2011 was provided by Valley Metro and used to prepare the AVFT input file. Since the fleet data are available only for specific model years, MOVES2010b default values were obtained from the [fuelEngFraction] table in the MOVES default database and used for the rest of the model years. The specific MOVES table [AVFT] for AVFT strategy is presented in Appendix C.

5.2.2.12 Stage II refueling control programs

As an option, MOVES2010b allows to apply Stage refueling emission control programs. Since 1994, the Stage II refueling program has been implemented in Area A as one of committed control measures (MAG, 2009). The program efficiency of 46 percent for the refueling displacement vapor losses and the refueling spillage losses are assumed for LDGVs, LDGTs, and HDGVs (Yantorno, 2007). The same program efficiency was applied to the eight-hour ozone nonattainment area and Maricopa County. The specific MOVES table [CountyYear] for Stage II refueling control programs is presented in Appendix C.

5.2.3 MOVES2010b outputs

MOVES2010b was executed with the RunSpec files described in Appendix C to obtain exhaust and evaporative emissions for VOC, NO_x, and CO. These values were obtained for the following categories by month:

- Vehicle classes: light duty gasoline vehicles (LDGV), light duty gasoline trucks 1 and 2 (LDGT1), light duty gasoline trucks 3 and 4 (LDGT2), heavy duty gasoline vehicles 2B thru 8B and gasoline buses (HDGV), motorcycles (MC), light duty diesel vehicles (LDDV), light duty diesel trucks 1 thru 4 (LDDT), heavy duty diesel vehicles class 2B (2BHDDV), heavy duty diesel vehicles classes 3, 4, and 5 (LHDDV), heavy duty diesel vehicles classes 6 and 7 (MHDDV), heavy duty diesel vehicles classes 8A and 8B (HHDDV), and heavy duty diesel buses (BUSES)
- Facility types: rural interstate, rural principal arterial, rural minor arterial, rural major collector, rural minor collector, rural local, urban interstate, urban freeway/expressway, urban principal arterial, urban minor arterial, urban collector, urban local, and off-network, which was newly added in MOVES2010b
- Days: weekdays and weekend days

5.2.4 MOVES2010b emission estimates

MOVES2010b was used to generate onroad emissions by vehicle class, facility type, weekdays/ weekend days, and month. By specifying the output time aggregate level as month, the model produces monthly emissions including weekday and weekend emissions for a given month. The annual emissions were calculated by aggregating monthly onroad emissions derived by MOVES2010b. The ozone season-day emissions were calculated by dividing the three-month peak ozone season emissions from July through September by 92 days.

Tables 5.2–2 and 5.2–3 show the calculated annual and ozone season-day VOC, NO_x, and CO emissions by facility type and vehicle class in the eight-hour ozone nonattainment area and Maricopa County, respectively.

Table 5.2–2. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in the eight-hour ozone NAA.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
			VOC	NO_x	CO	VOC	NO_x	CO
Rural Interstate	LDGV	2201001110	28.13	110.70	758.49	163.3	604.9	5,232.5
	LDGT1	2201020110	51.89	243.02	1,356.15	303.6	1,314.9	9,185.7
	LDGT2	2201040110	26.73	125.19	698.62	156.4	677.4	4,732.0
	HDGV	2201070110	13.02	72.48	319.37	74.6	369.0	1,921.9
	MC	2201080110	6.40	4.22	69.24	34.8	21.0	368.5
	LDDV	2230001110	0.05	0.84	0.40	0.3	4.6	2.7
	LDDT	2230060110	1.62	13.96	8.85	9.2	77.5	60.3
	2BHDDV	2230071110	0.71	6.18	3.89	4.0	34.4	26.5
	LHDDV	2230072110	3.85	32.92	20.87	21.8	182.4	141.9
	MHDDV	2230073110	10.86	164.12	45.16	57.2	807.2	237.2
	HHDDV	2230074110	23.31	570.60	116.92	123.1	2,806.7	614.3
	BUSES	2230075110	1.20	23.68	6.14	6.3	116.5	32.3
Rural Principal Arterial	LDGV	2201001130	20.73	70.04	387.68	119.5	403.2	2,614.6
	LDGT1	2201020130	18.86	76.50	363.07	109.6	434.4	2,408.3
	LDGT2	2201040130	9.72	39.41	187.04	56.5	223.8	1,240.7
	HDGV	2201070130	3.53	17.03	71.63	20.3	90.3	435.2
	MC	2201080130	11.93	6.20	105.39	64.6	31.0	561.0
	LDDV	2230001130	0.04	0.63	0.26	0.2	3.7	1.7
	LDDT	2230060130	0.66	5.13	3.60	3.7	29.9	24.0
	2BHDDV	2230071130	0.29	2.28	1.58	1.6	13.3	10.6
	LHDDV	2230072130	1.57	12.04	8.49	8.8	70.1	56.7
	MHDDV	2230073130	2.27	27.40	8.99	11.9	135.0	47.2
	HHDDV	2230074130	3.98	80.40	19.42	21.0	396.0	102.0
	BUSES	2230075130	0.40	6.97	1.97	2.1	34.3	10.3
Rural Minor Arterial	LDGV	2201001150	20.14	68.06	376.72	116.1	391.8	2,540.7
	LDGT1	2201020150	18.33	74.33	352.81	106.5	422.1	2,340.3
	LDGT2	2201040150	9.44	38.29	181.75	54.9	217.4	1,205.6
	HDGV	2201070150	3.43	16.55	69.61	19.7	87.8	422.9
	MC	2201080150	11.59	6.03	102.42	62.8	30.1	545.1
	LDDV	2230001150	0.04	0.61	0.26	0.2	3.6	1.7
	LDDT	2230060150	0.64	4.98	3.49	3.6	29.0	23.4
	2BHDDV	2230071150	0.28	2.21	1.54	1.6	12.9	10.3
	LHDDV	2230072150	1.53	11.70	8.25	8.6	68.1	55.1
	MHDDV	2230073150	2.20	26.63	8.73	11.6	131.1	45.9
	HHDDV	2230074150	3.87	78.12	18.87	20.4	384.8	99.1
	BUSES	2230075150	0.39	6.77	1.91	2.1	33.4	10.0
Rural Major Collector	LDGV	2201001170	3.75	12.69	70.22	21.6	73.0	473.5
	LDGT1	2201020170	3.42	13.86	65.76	19.9	78.7	436.2
	LDGT2	2201040170	1.76	7.14	33.88	10.2	40.5	224.7
	HDGV	2201070170	0.64	3.08	12.97	3.7	16.4	78.8
	MC	2201080170	2.16	1.12	19.09	11.7	5.6	101.6
	LDDV	2230001170	0.01	0.11	0.05	0.0	0.7	0.3
	LDDT	2230060170	0.12	0.93	0.65	0.7	5.4	4.4
	2BHDDV	2230071170	0.05	0.41	0.29	0.3	2.4	1.9
	LHDDV	2230072170	0.28	2.18	1.54	1.6	12.7	10.3
	MHDDV	2230073170	0.41	4.96	1.63	2.2	24.4	8.5
	HHDDV	2230074170	0.72	14.56	3.52	3.8	71.7	18.5
	BUSES	2230075170	0.07	1.26	0.36	0.4	6.2	1.9

Table 5.2–2. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in the eight-hour ozone NAA (continued).

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
Rural Minor Collector	LDGV	2201001190	0.87	2.94	16.26	5.0	16.9	109.6
	LDGT1	2201020190	0.79	3.21	15.22	4.6	18.2	101.0
	LDGT2	2201040190	0.41	1.65	7.84	2.4	9.4	52.0
	HDGV	2201070190	0.15	0.71	3.00	0.9	3.8	18.2
	MC	2201080190	0.50	0.26	4.42	2.7	1.3	23.5
	LDDV	2230001190	0.00	0.03	0.01	0.0	0.2	0.1
	LDDT	2230060190	0.03	0.21	0.15	0.2	1.3	1.0
	2BHDDV	2230071190	0.01	0.10	0.07	0.1	0.6	0.4
	LHDDV	2230072190	0.07	0.50	0.36	0.4	2.9	2.4
	MHDDV	2230073190	0.10	1.15	0.38	0.5	5.7	2.0
	HHDDV	2230074190	0.17	3.37	0.81	0.9	16.6	4.3
	BUSES	2230075190	0.02	0.29	0.08	0.1	1.4	0.4
Rural Local	LDGV	2201001210	9.08	30.68	169.82	52.3	176.6	1,145.3
	LDGT1	2201020210	8.26	33.51	159.04	48.0	190.3	1,055.0
	LDGT2	2201040210	4.26	17.26	81.93	24.7	98.0	543.5
	HDGV	2201070210	1.55	7.46	31.38	8.9	39.6	190.6
	MC	2201080210	5.22	2.72	46.17	28.3	13.6	245.7
	LDDV	2230001210	0.02	0.27	0.12	0.1	1.6	0.8
	LDDT	2230060210	0.29	2.25	1.58	1.6	13.1	10.5
	2BHDDV	2230071210	0.13	1.00	0.69	0.7	5.8	4.6
	LHDDV	2230072210	0.69	5.27	3.72	3.9	30.7	24.8
	MHDDV	2230073210	0.99	12.00	3.94	5.2	59.1	20.7
	HHDDV	2230074210	1.74	35.22	8.51	9.2	173.5	44.7
	BUSES	2230075210	0.18	3.05	0.86	0.9	15.0	4.5
Urban Interstate	LDGV	2201001230	315.59	1,122.85	8,542.12	1,828.0	6,198.7	58,613.4
	LDGT1	2201020230	389.33	1,602.91	9,784.95	2,271.6	8,744.6	65,893.5
	LDGT2	2201040230	200.56	825.74	5,040.73	1,170.2	4,504.8	33,945.1
	HDGV	2201070230	125.37	594.77	2,799.95	712.5	3,011.8	16,433.1
	MC	2201080230	128.88	73.37	1,238.82	698.9	365.4	6,593.8
	LDDV	2230001230	0.54	8.81	4.59	3.0	49.4	30.9
	LDDT	2230060230	13.00	102.99	71.45	73.3	575.8	483.3
	2BHDDV	2230071230	5.68	45.66	31.36	32.0	255.6	212.6
	LHDDV	2230072230	31.01	242.58	169.13	174.7	1,354.0	1,141.6
	MHDDV	2230073230	93.83	1,316.73	378.86	494.4	6,475.6	1,990.4
	HHDDV	2230074230	173.92	3,747.08	854.68	918.0	18,429.4	4,490.3
	BUSES	2230075230	14.35	272.67	73.30	75.6	1,341.1	385.1
Urban Freeway And Express-way	LDGV	2201001250	331.11	1,178.07	8,962.22	1,917.9	6,503.5	61,496.0
	LDGT1	2201020250	408.48	1,681.74	10,266.18	2,383.3	9,174.7	69,134.0
	LDGT2	2201040250	210.43	866.35	5,288.63	1,227.8	4,726.3	35,614.5
	HDGV	2201070250	131.53	624.02	2,937.66	747.5	3,160.0	17,241.3
	MC	2201080250	135.22	76.98	1,299.75	733.2	383.3	6,918.1
	LDDV	2230001250	0.56	9.25	4.82	3.2	51.9	32.4
	LDDT	2230060250	13.64	108.06	74.96	76.9	604.1	507.1
	2BHDDV	2230071250	5.96	47.91	32.90	33.6	268.2	223.0
	LHDDV	2230072250	32.53	254.51	177.45	183.3	1,420.6	1,197.8
	MHDDV	2230073250	98.44	1,381.48	397.49	518.7	6,794.1	2,088.3
	HHDDV	2230074250	182.48	3,931.36	896.71	963.2	19,335.8	4,711.2
	BUSES	2230075250	15.05	286.08	76.90	79.3	1,407.1	404.0

Table 5.2–2. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in the eight-hour ozone NAA (continued).

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
Urban Principal Arterial	LDGV	2201001270	867.65	2,461.71	14,822.61	4,980.2	14,626.5	98,722.0
	LDGT1	2201020270	723.35	2,268.85	11,877.79	4,187.4	13,305.9	77,666.8
	LDGT2	2201040270	372.63	1,168.80	6,118.85	2,157.1	6,854.6	40,010.1
	HDGV	2201070270	159.42	526.27	2,610.59	907.1	2,833.3	15,528.2
	MC	2201080270	364.35	120.97	2,387.52	1,968.4	603.7	12,707.9
	LDDV	2230001270	1.49	24.89	10.67	8.3	150.4	69.4
	LDDT	2230060270	25.26	203.10	142.81	141.2	1,229.5	939.0
	2BHDDV	2230071270	11.03	90.29	62.60	61.7	547.5	412.4
	LHDDV	2230072270	60.30	478.09	338.58	336.9	2,889.2	2,221.8
	MHDDV	2230073270	99.13	1,116.86	362.02	522.0	5,499.7	1,901.7
	HHDDV	2230074270	167.56	2,988.26	778.64	883.9	14,715.7	4,090.3
	BUSES	2230075270	14.31	229.46	66.76	75.4	1,130.0	350.7
Urban Minor Arterial	LDGV	2201001290	441.02	1,251.27	7,534.27	2,531.4	7,434.6	50,180.0
	LDGT1	2201020290	367.67	1,153.25	6,037.43	2,128.4	6,763.4	39,477.6
	LDGT2	2201040290	189.41	594.10	3,110.19	1,096.5	3,484.2	20,337.0
	HDGV	2201070290	81.03	267.50	1,326.95	461.1	1,440.2	7,892.9
	MC	2201080290	185.20	61.49	1,213.57	1,000.5	306.8	6,459.4
	LDDV	2230001290	0.76	12.65	5.42	4.2	76.4	35.3
	LDDT	2230060290	12.84	103.24	72.59	71.8	625.0	477.3
	2BHDDV	2230071290	5.61	45.89	31.82	31.4	278.3	209.6
	LHDDV	2230072290	30.65	243.01	172.10	171.2	1,468.6	1,129.3
	MHDDV	2230073290	50.39	567.70	184.01	265.3	2,795.5	966.6
	HHDDV	2230074290	85.17	1,518.92	395.78	449.3	7,479.9	2,079.1
	BUSES	2230075290	7.27	116.63	33.93	38.3	574.4	178.3
Urban Collector	LDGV	2201001310	86.13	244.37	1,471.39	494.4	1,451.9	9,799.8
	LDGT1	2201020310	71.80	225.22	1,179.07	415.7	1,320.8	7,709.7
	LDGT2	2201040310	36.99	116.02	607.40	214.1	680.4	3,971.7
	HDGV	2201070310	15.82	52.24	259.14	90.0	281.3	1,541.4
	MC	2201080310	36.17	12.01	237.00	195.4	59.9	1,261.5
	LDDV	2230001310	0.15	2.47	1.06	0.8	14.9	6.9
	LDDT	2230060310	2.51	20.16	14.18	14.0	122.1	93.2
	2BHDDV	2230071310	1.10	8.96	6.21	6.1	54.4	40.9
	LHDDV	2230072310	5.99	47.46	33.61	33.4	286.8	220.5
	MHDDV	2230073310	9.84	110.87	35.94	51.8	545.9	188.8
	HHDDV	2230074310	16.63	296.63	77.29	87.7	1,460.8	406.0
	BUSES	2230075310	1.42	22.78	6.63	7.5	112.2	34.8
Urban Local	LDGV	2201001330	415.75	1,179.56	7,102.48	2,386.3	7,008.5	47,304.1
	LDGT1	2201020330	346.60	1,087.15	5,691.42	2,006.4	6,375.7	37,215.2
	LDGT2	2201040330	178.55	560.05	2,931.94	1,033.6	3,284.5	19,171.4
	HDGV	2201070330	76.39	252.17	1,250.90	434.7	1,357.6	7,440.6
	MC	2201080330	174.58	57.96	1,144.02	943.2	289.2	6,089.2
	LDDV	2230001330	0.71	11.93	5.11	4.0	72.0	33.3
	LDDT	2230060330	12.11	97.32	68.43	67.7	589.1	449.9
	2BHDDV	2230071330	5.29	43.26	30.00	29.6	262.4	197.6
	LHDDV	2230072330	28.89	229.09	162.23	161.4	1,384.4	1,064.6
	MHDDV	2230073330	47.50	535.16	173.46	250.1	2,635.3	911.2
	HHDDV	2230074330	80.29	1,431.87	373.10	423.5	7,051.3	1,960.0
	BUSES	2230075330	6.86	109.95	31.99	36.1	541.4	168.1

Table 5.2–2. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in the eight-hour ozone NAA (continued).

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
Off-Network	LDGV	220100100	9,402.26	4,424.20	43,163.97	61,052.9	23,759.3	183,525.8
	LDGT1	220102000	2,588.87	1,468.89	19,360.70	16,455.7	7,981.9	96,124.0
	LDGT2	220104000	1,333.66	756.70	9,973.69	8,477.2	4,111.9	49,518.4
	HDGV	220107000	372.55	217.03	4,052.96	2,338.4	1,182.2	20,958.3
	MC	220108000	547.02	2.43	83.60	4,271.9	9.8	208.1
	LDDV	223000100	6.48	27.63	25.05	22.4	120.8	131.4
	LDDT	223006000	3.32	26.59	16.91	7.6	120.8	87.9
	2BHDDV	223007100	1.42	11.66	7.35	3.2	52.9	38.2
	LHDDV	223007200	7.79	62.35	39.03	17.8	283.1	202.6
	MHDDV	223007300	24.50	144.11	189.20	112.6	621.4	1,016.4
	HHDDV	223007400	418.93	2,672.32	1,119.58	2,179.6	12,161.2	5,908.3
	BUSES	223007500	1.63	4.45	96.15	0.1	0.0	522.5

Table 5.2–3. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in Maricopa County.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
Rural Interstate	LDGV	2201001110	41.81	166.74	1,147.40	242.9	911.2	7,919.6
	LDGT1	2201020110	100.56	475.25	2,658.13	588.5	2,571.6	18,011.7
	LDGT2	2201040110	51.80	244.83	1,369.34	303.2	1,324.8	9,278.8
	HDGV	2201070110	21.52	118.92	538.20	123.8	610.0	3,301.0
	MC	2201080110	11.22	7.49	122.76	61.0	37.3	653.4
	LDDV	2230001110	0.07	1.25	0.60	0.4	6.9	4.1
	LDDT	2230060110	3.14	27.11	17.13	17.7	150.4	116.7
	2BHDDV	2230071110	1.37	12.00	7.53	7.8	66.7	51.4
	LHDDV	2230072110	7.47	63.90	40.44	42.2	354.2	275.0
	MHDDV	2230073110	17.23	281.49	73.31	90.8	1,384.5	385.2
	HHDDV	2230074110	45.10	1,129.87	228.30	238.2	5,557.7	1,199.4
	BUSES	2230075110	1.71	34.23	8.79	9.0	168.4	46.2
Rural Principal Arterial	LDGV	2201001130	33.65	113.61	629.45	193.9	654.0	4,244.8
	LDGT1	2201020130	36.88	149.19	708.92	214.4	847.2	4,701.6
	LDGT2	2201040130	19.00	76.86	365.20	110.4	436.4	2,422.1
	HDGV	2201070130	6.69	31.89	135.07	38.5	169.7	824.3
	MC	2201080130	21.15	10.98	186.63	114.5	54.8	993.4
	LDDV	2230001130	0.06	1.02	0.43	0.3	5.9	2.8
	LDDT	2230060130	1.30	10.05	7.05	7.3	58.6	47.1
	2BHDDV	2230071130	0.57	4.46	3.10	3.2	26.1	20.7
	LHDDV	2230072130	3.08	23.59	16.65	17.3	137.3	111.1
	MHDDV	2230073130	4.17	51.42	16.61	22.0	253.2	87.3
	HHDDV	2230074130	7.84	159.49	38.37	41.4	785.5	201.6
	BUSES	2230075130	0.72	12.48	3.53	3.8	61.5	18.5
Rural Minor Arterial	LDGV	2201001150	32.70	110.40	611.65	188.5	635.5	4,124.9
	LDGT1	2201020150	35.84	144.97	688.88	208.3	823.2	4,568.7
	LDGT2	2201040150	18.46	74.68	354.88	107.3	424.1	2,353.6
	HDGV	2201070150	6.50	30.98	131.25	37.4	164.9	801.0
	MC	2201080150	20.55	10.67	181.35	111.3	53.2	965.3
	LDDV	2230001150	0.06	0.99	0.42	0.3	5.8	2.8
	LDDT	2230060150	1.26	9.76	6.85	7.1	56.9	45.8
	2BHDDV	2230071150	0.55	4.34	3.01	3.1	25.3	20.2
	LHDDV	2230072150	2.99	22.92	16.18	16.8	133.4	107.9
	MHDDV	2230073150	4.05	49.96	16.14	21.3	246.1	84.8
	HHDDV	2230074150	7.62	154.98	37.28	40.2	763.3	195.9
	BUSES	2230075150	0.70	12.13	3.43	3.7	59.8	18.0
Rural Major Collector	LDGV	2201001170	6.09	20.58	114.00	35.1	118.4	768.8
	LDGT1	2201020170	6.68	27.02	128.40	38.8	153.4	851.6
	LDGT2	2201040170	3.44	13.92	66.14	20.0	79.0	438.7
	HDGV	2201070170	1.21	5.78	24.46	7.0	30.7	149.3
	MC	2201080170	3.83	1.99	33.80	20.7	9.9	179.9
	LDDV	2230001170	0.01	0.18	0.08	0.1	1.1	0.5
	LDDT	2230060170	0.23	1.82	1.28	1.3	10.6	8.5
	2BHDDV	2230071170	0.10	0.81	0.56	0.6	4.7	3.8
	LHDDV	2230072170	0.56	4.27	3.01	3.1	24.9	20.1
	MHDDV	2230073170	0.76	9.31	3.01	4.0	45.9	15.8
	HHDDV	2230074170	1.42	28.89	6.95	7.5	142.3	36.5
	BUSES	2230075170	0.13	2.26	0.64	0.7	11.1	3.4

Table 5.2–3. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in Maricopa County (continued).

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
Rural Minor Collector	LDGV	2201001190	1.41	4.76	26.39	8.1	27.4	178.0
	LDGT1	2201020190	1.55	6.26	29.73	9.0	35.5	197.1
	LDGT2	2201040190	0.80	3.22	15.31	4.6	18.3	101.6
	HDGV	2201070190	0.28	1.34	5.66	1.6	7.1	34.6
	MC	2201080190	0.89	0.46	7.83	4.8	2.3	41.7
	LDDV	2230001190	0.00	0.04	0.02	0.0	0.2	0.1
	LDDT	2230060190	0.05	0.42	0.30	0.3	2.5	2.0
	2BHDDV	2230071190	0.02	0.19	0.13	0.1	1.1	0.9
	LHDDV	2230072190	0.13	0.99	0.70	0.7	5.8	4.7
	MHDDV	2230073190	0.17	2.16	0.70	0.9	10.6	3.7
	HHDDV	2230074190	0.33	6.69	1.61	1.7	32.9	8.5
	BUSES	2230075190	0.03	0.52	0.15	0.2	2.6	0.8
Rural Local	LDGV	2201001210	14.74	49.77	275.73	85.0	286.5	1,859.5
	LDGT1	2201020210	16.15	65.35	310.54	93.9	371.1	2,059.6
	LDGT2	2201040210	8.32	33.67	159.98	48.4	191.2	1,061.0
	HDGV	2201070210	2.93	13.97	59.17	16.8	74.3	361.1
	MC	2201080210	9.27	4.81	81.75	50.2	24.0	435.1
	LDDV	2230001210	0.03	0.45	0.19	0.1	2.6	1.2
	LDDT	2230060210	0.57	4.40	3.09	3.2	25.7	20.6
	2BHDDV	2230071210	0.25	1.96	1.36	1.4	11.4	9.1
	LHDDV	2230072210	1.35	10.33	7.29	7.6	60.1	48.7
	MHDDV	2230073210	1.83	22.52	7.28	9.6	110.9	38.2
	HHDDV	2230074210	3.43	69.87	16.81	18.1	344.1	88.3
	BUSES	2230075210	0.31	5.47	1.55	1.7	26.9	8.1
Urban Interstate	LDGV	2201001230	321.75	1,147.02	8,736.08	1,863.8	6,328.9	59,952.7
	LDGT1	2201020230	398.95	1,645.13	10,050.63	2,327.9	8,971.4	67,690.5
	LDGT2	2201040230	205.52	847.49	5,177.59	1,199.2	4,621.6	34,870.8
	HDGV	2201070230	129.18	613.34	2,887.04	734.1	3,105.0	16,939.0
	MC	2201080230	131.85	75.30	1,270.33	715.0	375.0	6,761.5
	LDDV	2230001230	0.55	8.99	4.69	3.1	50.4	31.5
	LDDT	2230060230	13.33	105.63	73.26	75.1	590.3	495.6
	2BHDDV	2230071230	5.82	46.83	32.15	32.9	262.1	218.0
	LHDDV	2230072230	31.79	248.83	173.43	179.1	1,388.4	1,170.7
	MHDDV	2230073230	96.93	1,361.53	391.49	510.7	6,696.0	2,056.8
	HHDDV	2230074230	179.94	3,879.33	884.45	949.8	19,079.9	4,646.8
	BUSES	2230075230	14.81	281.59	75.68	78.0	1,385.0	397.6
Urban Freeway and Express-way	LDGV	2201001250	337.58	1,203.43	9,165.73	1,955.5	6,640.2	62,901.2
	LDGT1	2201020250	418.57	1,726.04	10,544.93	2,442.3	9,412.6	71,019.7
	LDGT2	2201040250	215.63	889.17	5,432.23	1,258.2	4,848.9	36,585.8
	HDGV	2201070250	135.53	643.51	3,029.03	770.2	3,257.7	17,772.0
	MC	2201080250	138.33	79.00	1,332.81	750.1	393.4	7,094.0
	LDDV	2230001250	0.58	9.43	4.92	3.2	52.9	33.1
	LDDT	2230060250	13.98	110.83	76.86	78.8	619.4	519.9
	2BHDDV	2230071250	6.11	49.13	33.73	34.5	275.0	228.7
	LHDDV	2230072250	33.36	261.06	181.96	187.9	1,456.7	1,228.3
	MHDDV	2230073250	101.70	1,428.49	410.75	535.8	7,025.3	2,158.0
	HHDDV	2230074250	188.78	4,070.12	927.95	996.5	20,018.3	4,875.3
	BUSES	2230075250	15.54	295.43	79.40	81.9	1,453.1	417.2

Table 5.2–3. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in Maricopa County (continued).

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
Urban Principal Arterial	LDGV	2201001270	887.40	2,518.28	15,177.93	5,093.7	14,946.0	101,100.4
	LDGT1	2201020270	740.73	2,323.35	12,173.14	4,288.1	13,611.0	79,607.5
	LDGT2	2201040270	381.59	1,196.87	6,271.01	2,209.0	7,011.7	41,009.9
	HDGV	2201070270	163.87	541.20	2,685.49	932.4	2,910.9	15,968.7
	MC	2201080270	372.91	123.95	2,445.17	2,014.6	618.5	13,014.7
	LDDV	2230001270	1.53	25.46	10.92	8.5	153.6	71.0
	LDDT	2230060270	25.87	207.85	146.31	144.6	1,256.8	962.1
	2BHDDV	2230071270	11.30	92.40	64.13	63.2	559.6	422.5
	LHDDV	2230072270	61.76	489.28	346.88	345.0	2,953.3	2,276.6
	MHDDV	2230073270	102.21	1,151.68	373.34	538.2	5,671.2	1,961.2
	HHDDV	2230074270	172.44	3,077.56	801.69	909.6	15,155.6	4,211.4
	BUSES	2230075270	14.77	236.81	68.89	77.8	1,166.2	361.9
Urban Minor Arterial	LDGV	2201001290	451.06	1,280.03	7,714.88	2,589.1	7,597.0	51,389.0
	LDGT1	2201020290	376.51	1,180.95	6,187.56	2,179.6	6,918.4	40,464.2
	LDGT2	2201040290	193.96	608.37	3,187.53	1,122.8	3,564.0	20,845.2
	HDGV	2201070290	83.30	275.09	1,365.02	473.9	1,479.6	8,116.9
	MC	2201080290	189.55	63.00	1,242.87	1,024.0	314.4	6,615.3
	LDDV	2230001290	0.78	12.94	5.55	4.3	78.1	36.1
	LDDT	2230060290	13.15	105.65	74.37	73.5	638.8	489.0
	2BHDDV	2230071290	5.74	46.97	32.60	32.1	284.5	214.8
	LHDDV	2230072290	31.39	248.70	176.32	175.4	1,501.2	1,157.2
	MHDDV	2230073290	51.95	585.39	189.77	273.6	2,882.6	996.9
	HHDDV	2230074290	87.65	1,564.31	407.50	462.3	7,703.5	2,140.7
	BUSES	2230075290	7.51	120.37	35.02	39.5	592.8	184.0
Urban Collector	LDGV	2201001310	88.09	249.98	1,506.66	505.6	1,483.6	10,035.9
	LDGT1	2201020310	73.53	230.63	1,208.39	425.7	1,351.1	7,902.4
	LDGT2	2201040310	37.88	118.81	622.50	219.3	696.0	4,070.9
	HDGV	2201070310	16.27	53.72	266.58	92.6	289.0	1,585.2
	MC	2201080310	37.02	12.30	242.72	200.0	61.4	1,291.9
	LDDV	2230001310	0.15	2.53	1.08	0.8	15.2	7.1
	LDDT	2230060310	2.57	20.63	14.52	14.4	124.8	95.5
	2BHDDV	2230071310	1.12	9.17	6.37	6.3	55.6	41.9
	LHDDV	2230072310	6.13	48.57	34.43	34.3	293.2	226.0
	MHDDV	2230073310	10.15	114.32	37.06	53.4	563.0	194.7
	HHDDV	2230074310	17.12	305.50	79.58	90.3	1,504.4	418.1
	BUSES	2230075310	1.47	23.51	6.84	7.7	115.8	35.9
Urban Local	LDGV	2201001330	425.21	1,206.67	7,272.74	2,440.7	7,161.6	48,443.8
	LDGT1	2201020330	354.93	1,113.27	5,832.94	2,054.7	6,521.9	38,145.1
	LDGT2	2201040330	182.84	573.50	3,004.85	1,058.5	3,359.8	19,650.5
	HDGV	2201070330	78.52	259.32	1,286.79	446.8	1,394.8	7,651.6
	MC	2201080330	178.68	59.39	1,171.64	965.3	296.4	6,236.2
	LDDV	2230001330	0.73	12.20	5.23	4.1	73.6	34.0
	LDDT	2230060330	12.40	99.59	70.11	69.3	602.2	461.0
	2BHDDV	2230071330	5.41	44.27	30.73	30.3	268.2	202.5
	LHDDV	2230072330	29.59	234.45	166.21	165.3	1,415.1	1,090.9
	MHDDV	2230073330	48.97	551.84	178.89	257.9	2,717.4	939.8
	HHDDV	2230074330	82.63	1,474.66	384.14	435.8	7,262.0	2,018.0
	BUSES	2230075330	7.08	113.47	33.01	37.3	558.8	173.4

Table 5.2–3. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in Maricopa County (continued).

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
	LDGV	2201001000	9,343.57	4,398.52	42,913.45	60,666.2	23,621.4	182,460.8
	LDGT1	2201020000	2,565.00	1,457.16	19,206.53	16,298.8	7,918.2	95,359.0
	LDGT2	2201040000	1,321.36	750.66	9,894.27	8,396.3	4,079.0	49,124.2
	HDGV	2201070000	369.74	215.64	4,033.93	2,320.0	1,174.6	20,862.9
	MC	2201080000	539.75	2.40	82.65	4,215.5	9.7	205.7
Off-Network	LDDV	2230001000	6.44	27.47	24.90	22.3	120.1	130.6
	LDDT	2230060000	3.29	26.39	16.79	7.6	119.8	87.2
	2BHDDV	2230071000	1.41	11.57	7.30	3.2	52.5	37.9
	LHDDV	2230072000	7.74	61.88	38.74	17.6	281.0	201.1
	MHDDV	2230073000	26.03	153.86	192.53	120.6	666.0	1,033.9
	HHDDV	2230074000	448.68	2,863.21	1,186.93	2,336.0	13,033.7	6,262.1
	BUSES	2230075000	1.62	4.42	95.35	0.1	0.0	518.1

5.3 Summary of ozone precursor emissions from onroad mobile sources

Tables 5.3–1 and 5.3–2 show the annual and ozone season-day onroad mobile source emissions by facility type in the eight-hour ozone nonattainment area and Maricopa County, respectively.

Table 5.3–1. Annual and ozone season-day onroad mobile source emissions by facility type in the eight-hour ozone NAA.

		Annual emissions (tons/year)			Season-day emissions (lbs/day)		
	Facility Type	VOC	NOx	CO	VOC	NOx	CO
Rural	Interstate	167.77	1,367.91	3,404.10	954.6	7,016.5	22,555.8
	Principal Arterial	73.98	344.03	1,159.12	419.8	1,865.0	7,512.3
	Minor Arterial	71.88	334.28	1,126.36	408.1	1,812.1	7,300.1
	Major Collector	13.39	62.30	209.96	76.1	337.7	1,360.6
	Minor Collector	3.12	14.42	48.60	17.8	78.3	314.9
	Local	32.41	150.69	507.76	183.8	816.9	3,290.7
Urban	Interstate	1,492.06	9,956.16	28,989.94	8,452.2	51,306.2	190,213.1
	Freeway/Expressway	1,565.43	10,445.81	30,415.67	8,867.9	53,829.6	199,567.7
	Principal Arterial	2,866.48	11,677.55	39,579.44	16,229.6	64,386.0	254,620.3
	Minor Arterial	1,457.02	5,935.65	20,118.06	8,249.4	32,727.3	129,422.4
	Collector	284.55	1,159.19	3,928.92	1,610.9	6,391.4	25,275.2
	Local	1,373.52	5,595.47	18,965.08	7,776.6	30,851.4	122,005.2
Off-network		14,708.43	9,818.36	78,128.19	94,939.4	50,405.3	358,241.9
Total		**24,110.04**	**56,861.82**	**226,581.20**	**148,186.2**	**301,823.7**	**1,321,680.2**

Table 5.3–2. Annual and ozone season-day onroad mobile source emissions by facility type in Maricopa County.

		Annual emissions (tons/year)			Season-day emissions (lbs/day)		
	Facility Type	VOC	NOx	CO	VOC	NOx	CO
Rural	Interstate	303.00	2,563.08	6,211.93	1,725.5	13,143.7	41,242.5
	Principal Arterial	135.11	645.04	2,111.01	767.0	3,490.2	13,675.3
	Minor Arterial	131.28	626.78	2,051.32	745.3	3,391.5	13,288.9
	Major Collector	24.46	116.83	382.33	138.9	632.0	2,476.9
	Minor Collector	5.66	27.05	88.53	32.0	146.3	573.7
	Local	59.18	282.57	924.74	336.0	1,528.8	5,990.5
Urban	Interstate	1,530.42	10,261.01	29,756.82	8,668.7	52,854.0	195,231.5
	Freeway/Expressway	1,605.69	10,765.64	31,220.30	9,094.9	55,453.5	204,833.2
	Principal Arterial	2,936.38	11,984.69	40,564.90	16,624.7	66,014.4	260,967.9
	Minor Arterial	1,492.55	6,091.77	20,618.99	8,450.1	33,554.9	132,649.3
	Collector	291.50	1,189.67	4,026.73	1,650.4	6,553.1	25,905.5
	Local	1,406.99	5,742.63	19,437.28	7,966.0	31,631.8	125,046.8
Off-network		14,634.63	9,973.18	77,693.37	94,404.2	51,076.0	356,283.5
Total		**24,556.85**	**60,269.94**	**235,088.25**	**150,603.7**	**319,470.2**	**1,378,165.5**

Tables 5.3–3 and 5.3–4 present the same emissions by vehicle class in the eight-hour ozone nonattainment area and Maricopa County, respectively.

Table 5.3–3. Annual and ozone season-day onroad mobile source emissions by vehicle class in the eight-hour ozone NAA.

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Vehicle Class	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
LDGV	11,942.21	12,157.14	93,378.25	75,668.9	68,649.4	521,757.3
LDGT1	4,997.65	9,932.44	66,509.59	30,440.7	56,125.6	408,747.3
LDGT2	2,574.55	5,116.70	34,262.49	15,681.6	28,913.2	210,566.7
HDGV	984.43	2,651.31	15,746.11	5,819.4	13,873.3	90,103.4
MC	1,609.22	425.76	7,951.01	10,016.4	2,120.7	42,083.4
LDDV	10.85	100.12	57.82	46.7	550.2	346.9
LDDT	86.04	688.92	479.65	471.5	4,022.6	3,161.3
2BHDDV	37.56	305.81	210.30	205.9	1,788.7	1,388.6
LHDDV	205.15	1,621.70	1,135.36	1,123.8	9,453.6	7,469.4
MHDDV	440.46	5,409.17	1,789.81	2,303.5	26,530.0	9,424.9
HHDDV	1,158.77	17,368.71	4,663.83	6,083.6	84,483.4	24,528.1
BUSES	63.15	1,084.04	396.98	324.2	5,313.0	2,102.9
Total	**24,110.04**	**56,861.82**	**226,581.20**	**148,186.2**	**301,823.7**	**1,321,680.2**

Table 5.3–4. Annual and ozone season-day onroad mobile source emissions by vehicle class in Maricopa County.

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Vehicle Class	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
LDGV	11,985.06	12,469.79	95,292.09	75,868.1	70,411.7	535,379.4
LDGT1	5,125.88	10,544.57	69,728.72	31,170.0	59,506.6	430,578.7
LDGT2	2,640.60	5,432.05	35,920.83	16,057.2	30,654.8	221,813.1
HDGV	1,015.54	2,804.70	16,447.69	5,995.1	14,668.3	94,367.6
MC	1,655.00	451.74	8,402.31	10,247.0	2,250.3	44,488.1
LDDV	10.99	102.95	59.03	47.5	566.4	354.9
LDDT	91.14	730.13	507.92	500.2	4,256.8	3,351.0
2BHDDV	39.77	324.10	222.70	218.7	1,892.8	1,472.4
LHDDV	217.34	1,718.77	1,202.24	1,192.3	10,004.6	7,918.3
MHDDV	466.15	5,763.97	1,890.88	2,438.8	28,272.7	9,956.3
HHDDV	1,242.98	18,784.48	5,001.56	6,527.4	91,383.2	26,302.6
BUSES	66.40	1,142.69	412.28	341.4	5,602.0	2,183.1
Total	**24,556.85**	**60,269.94**	**235,088.25**	**150,603.7**	**319,470.2**	**1,378,165.5**

Table 5.3–5 summarizes annual and ozone season-day emissions for VOC, NO_x, and CO from all onroad mobile sources in the eight-hour ozone nonattainment area and Maricopa County in 2011.

Table 5.3–5. Annual and ozone season-day emissions from all onroad mobile sources in the eight-hour ozone NAA and Maricopa County.

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
	VOC	**NOx**	**CO**	**VOC**	**NOx**	**CO**
8-hr ozone NAA	24,110.04	56,861.82	226,581.20	148,186.2	301,823.7	1,321,680.2
Maricopa County	24,556.85	60,269.94	235,088.25	150,603.7	319,470.2	1,378,165.5

5.4 Quality assurance process

5.4.1 VMT estimates

Normal quality assurance procedures, including automated and manual consistency checks, were conducted by MAG in developing the 2011 TransCAD traffic assignment network used to generate the VMT data. The VMT estimates using the MAG travel demand model have been validated by the MAG transportation modeling group.

5.4.2 Emission estimates

The quality assurance process performed on the MOVES2010b analyses included accuracy, completeness, and reasonableness checks. For accuracy and completeness, all calculations were checked by an independent reviewer. Any errors found were corrected and the corrections were then rechecked by the reviewer.

5.4.3 Draft emissions inventory for ozone precursors

The draft onroad mobile source portion of the 2011 periodic emissions inventory for ozone precursors was reviewed using published EPA quality review guidelines for base year emissions inventories (EPA, 1992b). The procedure review (Levels I, II, and III) included checks for completeness, consistency, and the correct use of appropriate procedures.

5.5 References

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6. Biogenic Sources

6.1 Introduction

Biogenic emissions have been estimated for the 2011 Periodic Emissions Inventory for ozone precursors in Maricopa County (9,223 square miles) and the eight-hour ozone nonattainment area (NAA) (5,025 square miles). The Model of Emissions of Gases and Aerosols from Nature (MEGAN) has been used to estimate the biogenic emissions. MEGAN is a state-of-the-art biogenic emissions model developed by the National Center for Atmospheric Research (NCAR). Some important corrections and improvements were made in the latest version of MEGAN2.1 (Guenther et al, 2012; Jiang et al, 2011) compared to previous versions (Guenther, 2006a, 2006b, and 2007; Guenther et al, 2006). The most important change is that higher temporal and spatial resolution of land use and land cover data for MEGAN input has become available. MEGAN, with the vegetation data released in 2011, was applied to compute biogenic emissions in Maricopa County and the eight-hour ozone nonattainment area. Estimated emissions for volatile organic compounds (VOC), carbon monoxide (CO), and nitrogen oxides (NO_x) are included in this biogenic emissions inventory. The MEGAN runs were executed by the Maricopa Association of Governments. The contact person for the MEGAN emission estimates is Feng Liu (602-254-6300).

6.2 Modeling domain

As a numerical model, the MEGAN inputs and outputs are given in user-defined two-dimensional grid cells. To develop biogenic emissions for the 2011 Periodic Emissions Inventory for ozone precursors, the 4-km modeling domain that covers the entire area of Maricopa County were employed. The target area is the eight-hour ozone nonattainment area within the County. The definition of the domain in the Lambert Conformal Conic Projection (LCP) coordinate system is presented in Table 6.2–1. Since MEGAN estimates biogenic emissions for the entire modeling domain rather than specific areas, additional input files, masking areas covered by the eight-hour ozone nonattainment area and Maricopa County, were developed by applying Geographic Information Systems (GIS) to calculate emissions for those two target areas. In order to represent the target area, the masking file assigns 1.0 for the grid cells fully covered by the target area, a fractional value for grid cells partially covered by the target area, and 0.0 for grid cells outside the target area. As shown in Figure 6.3–1, biogenic emissions for the eight-hour ozone nonattainment area and Maricopa County were extracted from MEGAN runs for the masked grid cells in the 4-km modeling domain.

Table 6.2–1. Two modeling domains defined in the LCP coordinate system.

Grid Horizontal Resolution	Grid Size	LCP Range (km)	Target Area
4-km	65 by 65	(–131.4713, –129.4593) to (127.9845, 131.1945)	Eight-hour ozone NAA and Maricopa County

6.3 Input data

To calculate biogenic emissions using MEGAN, the following gridded input files for land cover and meteorological data were prepared:

1. EFMAP_LAI file: This file provides emission factors (EF) for 20 MEGAN species including NO_x, CO and VOC, and 8-day average leaf index (LAI) for year 2011in each grid cell.
2. PFTF file: This input file gives percentage of four plant function types (PFT) including broadleaf trees (BT), needle leaf trees (NT), grass and crops (HB) and shrubs (SB) for each model domain grid location.
3. METCRO2D file: This file contains meteorological parameters including temperature, short wave radiation, wind speed, humidity and soil moisture for each grid.

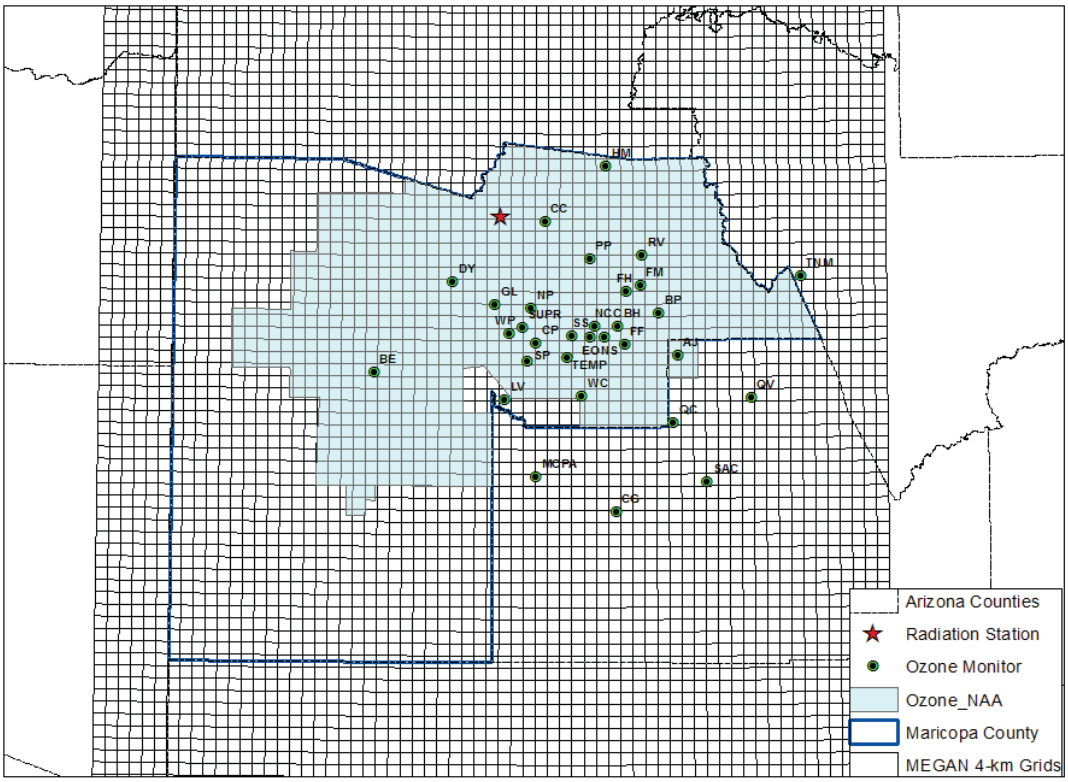

Figure 6.3–1. The masked grid cells in the 4-km modeling domain.

6.3.1 Land cover data

The land cover data, including the 8-day averaged LAI input files for North America for years 2003 to 2011 based on NASA MODIS data, monthly mean PFT, and EF, are provided by the EFMAP_LAI and PFTF files. These input data were derived from the MEGAN land cover database available at the resolution of 30 seconds latitude by 30 seconds longitude (1x1 km^2) in netCDF format (*http://acd.ucar.edu/~guenther/MEGAN/MEGAN.htm*).

6.3.2 Weather data

The weather data used by MEGAN are temperature, downward short wave radiation, wind speed, humidity and soil moisture. The Measurement and Instrumentation Data Center (MIDC) collects irradiance and meteorological data from nation-wide stations. One of those stations is located in northern Phoenix (33.83°N, 112.17°W, see red star in Figure 6.3–1) and is operated by the National Renewable Energy Laboratory (NREL). The archived hourly temperature, wind speed, humidity and radiation data from this site are available to the public. Monthly mean

diurnal cycles of the weather parameters were calculated based on hourly data for the year 2011, and a netCDF file representing 24-hour data for each month was prepared for MEGAN inputs. Biogenic emissions of VOC, NO_x, and CO are first governed by temperature and then highly dependent on downward short wave radiation. Figure 6.3–2 shows monthly mean (left panel) and annual mean diurnal cycle (right panel) of temperature. Figure 6.3–3 illustrates monthly averaged and annual mean diurnal cycle of short wave radiation. The maximum monthly temperature was recorded in August, while the highest radiation was observed in June. The maximum monthly temperature appeared two months later than the highest radiation. The peak hourly temperature was observed around 4:00 – 6:00 pm and lagged three hours behind the peak radiation. The delay is due to the fact that heating of the air occurs not from the sun's rays, but from heating of the earth and infrared radiation leaving the ground in the form of heat. As a result, maximum seasonal emission rates appear in the summer. The highest hourly emission rates take place in the afternoon because the emission rates are positively related to both temperature and short wave radiation (Guenther et al., 2006, 2012). The maximum monthly VOC, NO_x, and CO biogenic emission rates would be expected to occur in the same month as the maximum temperature.

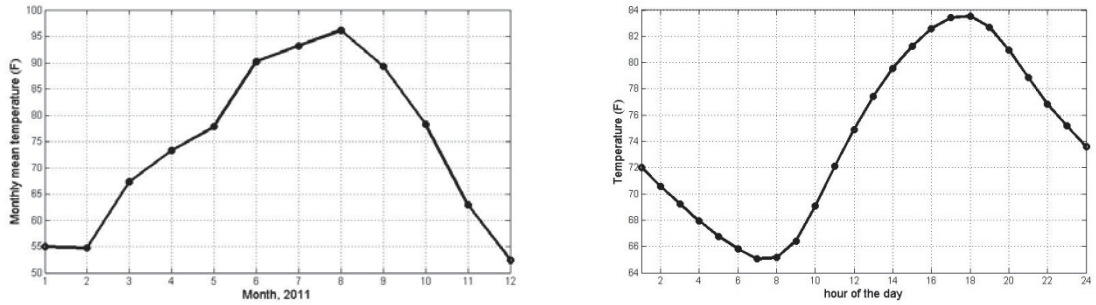

Figure 6.3–2. Monthly averaged temperature (left panel) and annual mean diurnal cycle of temperature (right panel) in 2011.

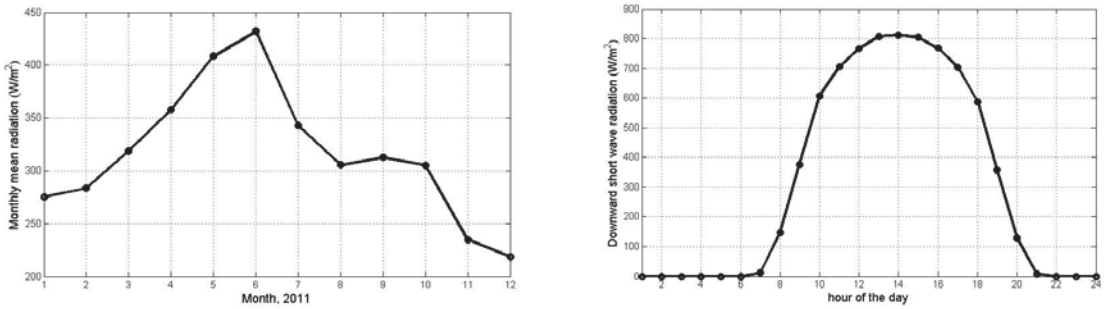

Figure 6.3–3. Monthly averaged radiation (left panel) and annual mean diurnal cycle of radiation (right panel) in 2011.

6.4 Emission estimation

MEGAN runs for the modeling domain provide hourly emission outputs for the year 2011. Figure 6.4–1 illustrates isoprene (ISOP), a major contributor to VOCs, and NO_x emission rates simulated by MEGAN at 17:00 MST in August, 2011. The high ISOP emissions occur in northeastern portion. The high NO_x emissions appear at the central part of Maricopa County and southeastern portion. Daily mean emissions for each month in 2011 are derived by using the hourly outputs for each month. In addition, monthly total emissions were obtained by multiplying the daily mean emissions for each month by the number of days in the month. The

daily mean emissions for the 12 months in 2011 are shown in Tables 6.4–1 and 6.4–2 for the eight-hour ozone nonattainment area and Maricopa County, respectively.

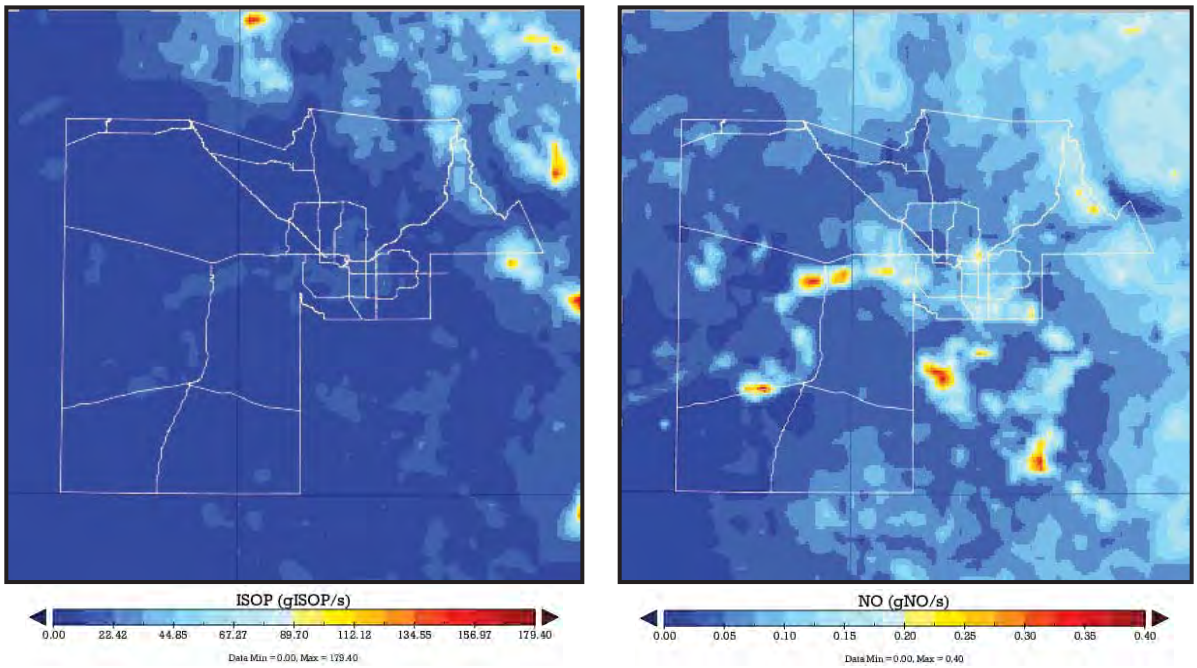

Figure 6.4–1. Estimated emission rates of ISOP (left panel) and NO_x (right panel) at 17:00 MST, August 2011 by MEGAN model.

Table 6.4–1. Daily mean biogenic emissions for each month in the eight-hour ozone NAA.

	VOC		NO_x		CO	
Month	**kg/day**	**lbs/day**	**kg/day**	**lbs/day**	**kg/day**	**lbs/day**
January	15,264.7	33,652.9	210.5	464.1	2,950.2	6,504.1
February	35,341.7	77,915.0	351.6	775.1	5,262.4	11,601.6
March	73,407.4	161,835.4	796.7	1,756.4	10,665.2	23,512.7
April	97,461.1	214,864.7	910.5	2,007.3	11,966.6	26,381.8
May	139,906.1	308,439.8	1,113.0	2,453.7	14,937.6	32,931.7
June	313,026.5	690,104.5	2,308.4	5,089.1	27,998.8	61,726.7
July	314,669.0	693,725.6	2,855.0	6,294.2	29,982.6	66,100.2
August	326,736.8	720,330.5	3,415.3	7,529.4	32,557.0	71,775.8
September	208,257.6	459,128.9	2,209.6	4,871.3	22,623.7	49,876.7
October	86,989.6	191,779.0	994.4	2,192.3	11,389.6	25,109.7
November	20,395.5	44,964.3	309.9	683.2	3,687.5	8,129.5
December	11,230.4	24,758.8	171.8	378.8	2,295.1	5,059.8

Table 6.4–2. Daily mean biogenic emissions for each month in Maricopa County.

	VOC		NO_x		CO	
Month	**kg/day**	**lbs/day**	**kg/day**	**lbs/day**	**kg/day**	**lbs/day**
January	23,123.3	50,978.1	316.3	697.3	5,654.4	12,465.8
February	53,015.2	116,878.4	524.0	1,155.2	9,971.5	21,983.4
March	104,165.5	229,645.3	1,152.6	2,541.0	19,383.1	42,732.4
April	139,181.0	306,841.2	1,330.8	2,933.9	22,591.4	49,805.5
May	200,913.3	442,937.5	1,641.2	3,618.2	28,869.2	63,645.6
June	451,990.3	996,466.9	3,432.5	7,567.4	55,292.2	121,898.3
July	451,204.3	994,734.0	4,207.9	9,276.8	58,566.5	129,116.9
August	467,398.8	1,030,436.7	5,031.7	11,093.0	63,445.8	139,873.9
September	300,464.1	662,409.2	3,278.2	7,227.2	44,256.1	97,567.9
October	129,711.0	285,963.5	1,506.4	3,321.0	23,713.3	52,278.8
November	30,063.3	66,278.2	462.5	1,019.6	7,101.2	15,655.4
December	16,413.2	36,184.9	252.8	557.3	4,255.2	9,381.1

Monthly mean emissions for Maricopa County and the eight-hour ozone nonattainment area are illustrated in Figure 6.4–2. Monthly emission values for the eight-hour ozone nonattainment area and Maricopa County are presented in Tables 6.4–3 and 6.4–4, respectively. It can be seen that the maximum monthly VOC, NO_x, and CO emissions took place in August, because monthly mean temperatures reached the maximum levels in this month.

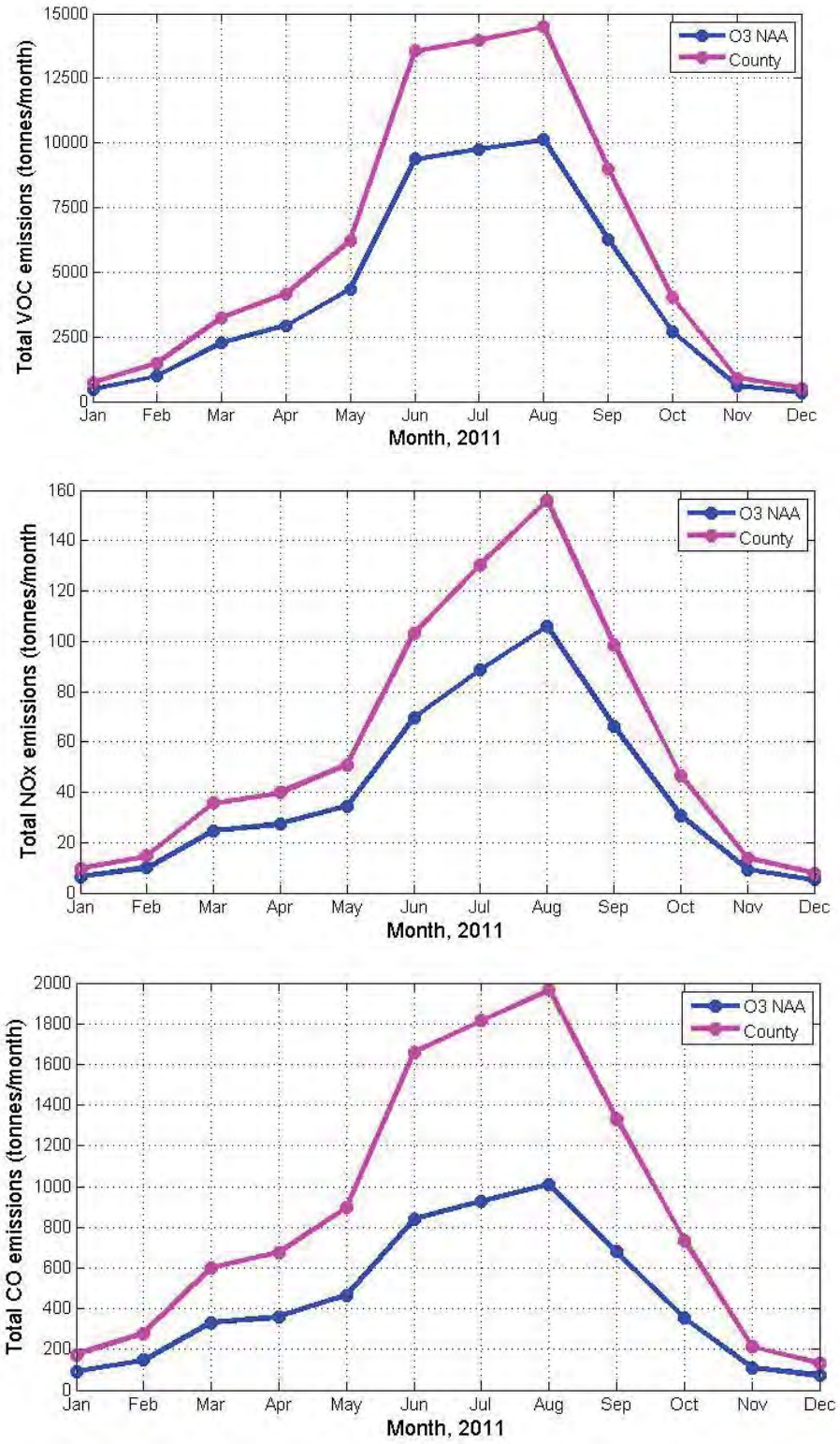

Figure 6.4–2. Monthly emissions of VOC (top), NO_x (middle) and CO (bottom) in Maricopa County (pink solid line, abbreviated as "County") and the eight-hour ozone NAA (blue solid line, abbreviated as "O3 NAA").

Table 6.4–3. Monthly biogenic emissions in the eight-hour ozone NAA.

	VOC		NO_x		CO	
Month	**Metric tons**	**Short tons**	**Metric tons**	**Short tons**	**Metric tons**	**Short tons**
January	473.21	521.62	6.53	7.19	91.46	100.81
February	989.57	1,090.81	9.84	10.85	147.35	162.42
March	2,275.63	2,508.45	24.70	27.22	330.62	364.45
April	2,923.83	3,222.97	27.32	30.11	359.00	395.73
May	4,337.09	4,780.82	34.50	38.03	463.07	510.44
June	9,390.80	10,351.57	69.25	76.34	839.96	925.90
July	9,754.74	10,752.75	88.51	97.56	929.46	1,024.55
August	10,128.84	11,165.12	105.87	116.71	1,009.27	1,112.53
September	6,247.73	6,886.93	66.29	73.07	678.71	748.15
October	2,696.68	2,972.57	30.83	33.98	353.08	389.20
November	611.87	674.46	9.30	10.25	110.63	121.94
December	348.14	383.76	5.33	5.87	71.15	78.43

Table 6.4–4. Monthly biogenic emissions in Maricopa County.

	VOC		NO_x		CO	
Month	**Metric tons**	**Short tons**	**Metric tons**	**Short tons**	**Metric tons**	**Short tons**
January	716.82	790.16	9.81	10.81	175.29	193.22
February	1,484.43	1,636.30	14.67	16.17	279.20	307.77
March	3,229.13	3,559.50	35.73	39.39	600.88	662.35
April	4,175.43	4,602.62	39.92	44.01	677.74	747.08
May	6,228.31	6,865.53	50.88	56.08	894.95	986.51
June	13,559.71	14,947.00	102.98	113.51	1,658.77	1,828.47
July	13,987.33	15,418.38	130.44	143.79	1,815.56	2,001.31
August	14,489.36	15,971.77	155.98	171.94	1,966.82	2,168.05
September	9,013.92	9,936.14	98.35	108.41	1,327.68	1,463.52
October	4,021.04	4,432.43	46.70	51.48	735.11	810.32
November	901.90	994.17	13.88	15.29	213.04	234.83
December	508.81	560.87	7.84	8.64	131.91	145.41

6.5 Summary of biogenic source emissions

Ozone season daily emissions for Maricopa County and the eight-hour ozone nonattainment area in 2011 are shown in Table 6.5–1. Annual emissions for Maricopa County and the eight-hour ozone nonattainment area in 2011 are summarized in Table 6.5–2. Emissions of VOC, NO_x, and CO all decreased in 2011 compared to MEGAN results for PEI 2008. Due to the incorporation of land cover data that are more characteristic of plants located in the desert southwest, as well as improvements to the MEGAN model, the 2011 data shown in Tables 6.5–1 and 6.5–2 represent a substantial improvement over previous biogenic emission estimates for Maricopa County and the eight-hour ozone NAA.

Table 6.5–1. Season-day biogenic emissions.

	VOC		NO_x		CO	
Area	**kg/day**	**lbs/day**	**kg/day**	**lbs/day**	**kg/day**	**lbs/day**
Maricopa County	406,355.7	895,860.0	4,172.6	9,199.0	55,422.8	122,186.2
8-hr ozone NAA	283,221.1	624,395.0	2,826.6	6,231.7	28,387.8	62,584.2

Table 6.5–2. Annual biogenic emissions.

	VOC		NO_x		CO	
Area	**tonnes*/yr**	**tons*/yr**	**tonnes/yr**	**tons/yr**	**tonnes/yr**	**tons/yr**
Maricopa County	72,316.20	79,714.87	707.17	779.52	10,476.94	11,548.84
8-hr ozone NAA	50,178.11	55,311.84	478.25	527.18	5,383.74	5,934.55

* "Tonne" denotes metric ton, and "ton" denotes short (or English) ton

6.6 References

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Appendix A. Instructions for Reporting 2011 Annual Air Pollution Emissions

Maricopa County
Air Quality Department

INSTRUCTIONS

FOR REPORTING 2011

ANNUAL AIR POLLUTION EMISSIONS

February 2012

Emissions Inventory Unit
1001 North Central Avenue, Suite 125
Phoenix, Arizona 85004
Phone: (602) 506-6790
Fax: (602) 506-6179
Email: ***EmisInv@mail.maricopa.gov***

Copies of this document, related forms,
and other reference materials are available online at our web site:
http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

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WHAT'S NEW FOR 2011?

Reporting forms:

- Emission factors for PM-10 for several processes typically found at sand and gravel facilities and/or concrete batch plants, have been revised. The new values are lower than the previous EPA default emission factors, and reflect the more stringent moisture-content requirements required by Maricopa County Rule 316 (Nonmetallic Mineral Processing).

- Some **preprinted information** on your report may be different from last year's version. Please review the enclosed forms carefully, and verify all preprinted information.

- Many of our reporting forms **have changed** in past years. If you develop your own forms, or a computerized reproduction of our forms, the forms used ***MUST*** conform to the current information requirements and **FORMAT** as supplied on our preprinted forms. "Homemade" reporting forms that vary significantly from the preprinted forms sent to you will ***not*** be accepted.

- **Please VERIFY THOROUGHLY that the information you provide on all reporting forms match the information presented on the preprinted forms from MCAQD.**

Miscellaneous:

- **Non-operational facilities**: Any facility that has been issued an air quality permit, but that did NOT operate at any time during 2011, must still respond in writing to this request for annual emissions information, as a condition of its air quality permit. Please provide ALL information requested on both the "Business Form" and the "Data Certification Form", and submit these forms, along with a letter certifying that there were no operations at the facility during calendar year 2011, by the due date shown on the Business Form.
- **Emissions fees for Title V facilities:** In accordance with Maricopa County Air Pollution Control Rule 280 (Fees), the 2011 annual emission fee for Title V sources is $39.83/ton. **NOTE:** Only emissions from Title V sources (those whose air quality permit numbers have a **"V"** prefix) are subject to this annual emissions fee.

I. INTRODUCTION

An annual emissions inventory is a document submitted by a business that: (1) lists all processes emitting reportable air pollutants and (2) provides details about each of those processes. Submitting the emissions inventory report is ***required*** as a condition of your Maricopa County Air Quality Permit. A separate emissions report is required for each business location with its own air quality permit.

Follow these steps to complete your 2011 Maricopa County emissions inventory:

STEP 1: Determine which forms are needed for your business. There are eight different forms available, but not all are required for every type of business. For most permitted sources, the packet you received from us contains the necessary preprinted forms based on your site's most recent emissions inventory.

1. **Business Form**: Contains general contact information about the permitted site. This form is required for all businesses.
2. **Stack Form**: Only required if your business location annually emits over 10 tons of a single pollutant (CO, VOC, NO_x, PM_{10}, or SO_x). A "stack" is defined as a stack, pipe, vent or opening through which a significant percentage of emissions (from one or more processes) are released into the atmosphere. See the "Stack Form Instructions" on page 9 for specific requirements.
3. **Control Device Form**: Required only if there is one or more emission control devices used at the business location.
4. **General Process Form** and
5. **Evaporative Process Form**: } Either or both will be required for all businesses.
6. **Off-Site Recycling/Disposal Form**: Required if you want to claim off-site recycling or disposal.
7. **Emission Factor Calculations**: Required as attachment for each process for which you calculated your own emission factors.
8. **Data Certification Form or Data Certification/Fee Calculation Form**: Only sources with a **Title V** (permit number would start with **"V"**) permit are required to pay a fee for their emissions and need to use the Data Certification/Fee Calculation Form. All other sources use the Data Certification Form.

STEP 2: Complete the applicable forms. Verify all preprinted information, and make corrections where necessary. When making corrections, strike out the preprinted data and write in corrections beside it. Please make all changes readily noticeable. Detailed information on how to complete the most common forms is included in this document. The packet you received also contains information about other resources (workshops, one-on-one assistance, etc.) available to help you in completing the necessary forms.

STEP 3: Make a copy of your completed emissions inventory report. Make sure to KEEP COPIES of all forms submitted and copies of all records and calculations used in completing the forms. Air pollution control regulations require that you keep all documentation for at least FIVE YEARS at the location where pollution is being emitted.

STEP 4: Make sure the Data Certification Form (or Data Certification/Fee Calculation Form for Title V sources) is ***signed*** by a company representative. ***Include your air quality permit number on all correspondence and applicable checks submitted with your report.*** Return the ***original***, signed copy of your annual emission report, with payment for any applicable emission fees to:

Maricopa County Air Quality Department
Emissions Inventory Unit
1001 North Central Avenue, Suite 125
Phoenix, AZ 85004

II. REPORTING REQUIREMENTS

POLLUTANTS TO BE REPORTED:
Your emissions inventory must include your business's emissions of the following air pollutants:

CO	=	Carbon monoxide
NO_x	=	Nitrogen oxides
PM_{10}	=	Particulate matter less than 10 microns
SO_x	=	Sulfur oxides
VOC	=	Volatile organic compounds *
HAP&NON	=	Hazardous Air Pollutant (HAP) that is also NOT a volatile organic compound (VOC)**
NH_x	=	Ammonia and ammonium compounds
Pb	=	Lead

* A ***volatile organic compound (VOC)*** is defined as any compound of carbon that participates in atmospheric photochemical reactions. This definition ***excludes***: carbon monoxide, carbon dioxide, acetone, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, as well as certain other organic compounds. (See Maricopa County Air Pollution Control Rule 100, Sections 200.69 and 200.110 for a full definition.)

EPA has re-designated the chemical **t-butyl acetate (CAS Number 540-88-5)** as a VOC for record-keeping requirements and emissions reporting, but not for emission limitations or content requirements. County Rule 100, Section 200.69b states:

"The following compound(s) are VOC for purposes of all recordkeeping, emissions reporting, photochemical dispersion modeling and inventory requirements which apply to VOC and shall be uniquely identified in emission reports, but are not VOC for purposes of VOC emissions limitations or VOC content requirements: t-butyl acetate (540-88-5)."

Therefore, if your facility uses t-butyl acetate, it is necessary to report t-butyl acetate as a separate material on the evaporative process form, not as part of a grouped material (e.g., solvents, thinners, activators, etc.). T-butyl acetate will continue to be identified as a VOC on your emission report and count towards any applicable emission fees.

** ***HAP&NON:*** Usage of certain materials that are: (1) a Hazardous Air Pollutant (HAP) **and** (2) **not** also a VOC (that is, not also an ozone precursor) should also be reported if:
(a) your site is subject to a Federal MACT (Maximum Achievable Control Technology) standard ***or***
(b) your air quality permit contains specific quantitative limits for HAP emissions.

The most common materials categorized as "HAP&NON" include:

- methylene chloride (dichloromethane)
- perchloroethylene
- 111-trichloroethane (111-TCA or methyl chloroform)
- hydrochloric acid
- hydrofluoric acid

NOTE: HAPs that are also considered volatile organic compounds are reported as VOC.

EMISSION CALCULATION METHOD HIERARCHY:

When preparing emission information for your report, the most accurate method for calculating **actual** emissions must be used. The hierarchy listed below outlines the preferred methods for calculating emission estimates (taken from County Rule 280, Section 305.1).

(1) Whenever available, emissions estimates should be calculated from continuous emissions monitors certified under 40 CFR Part 75, Subpart C, or data quality assured pursuant to Appendix F of 40 CFR, Part 60.

(2) When sufficient data obtained using the methods described in paragraph 1 is not available, emissions estimates should be calculated from source performance tests conducted pursuant to Rule 270 in Maricopa County's Air Pollution Control Rules and Regulations.

(3) When sufficient data obtained using the methods described in paragraphs 1 or 2 is not available, emissions estimates should be calculated from material balance using engineering knowledge of the process.

(4) When sufficient data obtained using the methods described in paragraphs 1 through 3 is not available, emissions estimates shall be calculated using emissions factors from EPA Publication No. AP-42 "Compilation of Air Pollutant Emission Factors," Volume I: Stationary Point and Area Sources.

(5) When sufficient data obtained using the methods described in paragraphs 1 through 4 is not available, emissions estimates should be calculated by equivalent methods supported by back-up documentation that will substantiate the chosen method.

III. CONFIDENTIALITY OF DATA SUBMITTED

Information submitted in your annual emissions reports must be made available to the public unless it meets certain criteria of Arizona State Statutes and Maricopa County Rules. Applicable excerpts concerning confidentiality of data are reproduced below.

ARS § 49-487 D. ...the following information shall be available to the public:…

2. The chemical constituents, concentrations and amounts of any emission of any air contaminant. ...

MARICOPA COUNTY AIR POLLUTION CONTROL RULES AND REGULATIONS, Rule 100:

§ **200.107 TRADE SECRETS -** Information to which all of the following apply:

a. A person has taken reasonable measures to protect from disclosure and the person intends to continue to take such measures.

b. The information is not, and has not been, reasonably obtainable without the person's consent by other persons, other than governmental bodies, by use of legitimate means, other than discovery based on a showing of special need in a judicial or quasi-judicial proceeding.

c. No statute, including ARS §49-487, specifically requires disclosure of the information to the public.

d. The person has satisfactorily shown that disclosure of the information is likely to cause substantial harm to the business's competitive position.

§ **402 CONFIDENTIALITY OF INFORMATION:**

402.2 Any records, reports or information obtained from any person under these rules shall be available to the public ... unless a person:

a. Precisely identifies the information in the permit(s), records, or reports which is considered confidential.

b. Provides sufficient supporting information to allow the Control Officer to evaluate whether such information satisfies the requirements related to trade secrets as defined in Section 200.107 of this rule.

For emissions inventory information to be deemed confidential, the following steps must be followed:

- Specific data which you request be held confidential must be identified by marking an "X" in the corresponding gray confidentiality box(es) on the relevant report forms.
- Provide a written explanation which gives factual information satisfactorily describing why releasing this information could cause substantial harm to the business's competitive position.
- Use the gray-shaded boxes on the reporting forms to indicate which data are to be held confidential. Do NOT stamp "Confidential", highlight data, or otherwise mark the page.
  No data can be held confidential without proper justification.

IV. HELPFUL HINTS AND INFORMATION

Be sure to verify all preprinted information on forms. If any information is incorrect or blank, please provide correct information. Making a change on the Business Form will **NOT** transfer the permit ownership or location. You must contact the Department's Small Business Assistance Program at (602) 506-5102 or the Engineering & Permitting Division at (602) 506-6094 to accomplish this.

WHAT IS A PROCESS? A ***process*** is a business activity at your location that emits one or more of the pollutants listed on page 3, and has only ***one*** material type as input and ***one*** operating schedule. For each applicable process at your business, you must assign a unique Process ID number to differentiate each process.

PROCESSES AND MATERIALS THAT DO ***NOT*** HAVE TO BE REPORTED:

- Welding.
- Acetone usage.
- Fuel use for forklifts or other vehicles. (NOTE: Fuel use in ***non-vehicle*** engines ***is*** reportable.)
- Soil remediation activities. (Note: Other periodic reporting requirements may exist; consult your permit.)
- Storage emissions from fuels or organic chemicals in any tank with a capacity of 250 gallons or less.
- Storage emissions of diesel and Jet A fuel in underground tanks of any size.
- Storage emissions of diesel and Jet A fuel in aboveground tanks, with throughput < 4,000,000 gal/yr.
- Routine pesticide usage, housekeeping cleaners, and routine maintenance painting at your facility.

Please group all similar equipment and materials together before applying the following limitations:

- Internal combustion engines (e.g., emergency generators) or external combustion equipment (e.g., boilers and heaters) that operated less than 100 hrs. and burned less than 200 gals. diesel or gas, or less than 100,000 cubic feet of natural gas.
- Materials with usage of less than 15 gallons or 100 pounds per year.

GROUPING MATERIALS AND/OR EQUIPMENT UNDER ONE PROCESS ID:
You can group together under one process ID:

- All internal combustion engines ***less than 600 hp*** if they burn the same fuel and have similar operating schedules.
- All external combustion equipment (boilers, heaters) with a capacity of ***less than 10,000,000 Btu*** per hour if they burn the same fuel and have similar operating schedules.
- All similar evaporative materials with similar emission factors that have similar operating schedules and process descriptions. For example, group low-VOC red paint, green paint and white paint together as one material: "Paint: Low-VOC." Do ***not*** group dissimilar materials together, such as thinners and paints. Attach documentation (see example, p. 20) showing how the grouped emission factor was determined.
- All underground tanks with the same fuel and same type of vapor recovery system.

ASSIGNING IDENTIFICATION NUMBERS (IDs):
Unique IDs are required for the following report elements: Stacks, Control Devices and Processes. For processes, that means a process ID number may be used only once on each General Process form and for each material reported on the Evaporative Process Forms.

These numbers are usually assigned by the person who prepares the original report. If you are adding a new item to a preprinted report, assign a number not already in use. Once an ID number is assigned, continue using the same number for that item each year. If that item is no longer reportable, mark it with 'DELETE' and return the preprinted form with a brief explanation. Do not use that ID number again.

INDUSTRY-SPECIFIC INSTRUCTIONS: Additional help sheets, detailed examples, and special instructions are available for a number of specific processes or industries listed below. To get copies of any of these documents, please call (602) 506-6790, or visit our web site at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

- Bakeries
- Concrete Batch Plants
- Fuel Storage and Handling
- Incinerators and Crematories
- Lg. Aboveground Storage Tanks
- Natural Gas Boilers/Heaters
- Polyester Resin
- Printing Plants
- Roofing Asphalt
- Sand and Gravel Plants
- Using EPA's TANKS 4.09d Program
- Vehicle Refinishing
- Vehicle Travel on Unpaved Roads
- Woodworking

COMMONLY USED CONVERSION FACTORS:

1 gram/liter	=	0.00834 lbs/gal	1 foot	=	0.0001894 mile
1 liter	=	0.2642 gallon (US)	1 square foot	=	0.000022957 acre
1 therm	=	0.0000952 MMCF	1 pound	=	0.0005 ton

NOTE: MM = 1,000,000 Example: MMCF = 1,000,000 cubic feet
M = 1,000 Example: MGAL = 1,000 gallons

ADDITIONAL RESOURCES AND ASSISTANCE:
The Maricopa County Emissions Inventory web site at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx contains additional reference materials, such as:

- blank copies of most emissions reporting forms.
- an updated list of emission factors for a large number of industrial processes, including SCC codes.
- a list of Tier Codes for industrial processes.
- detailed help sheets for a number of specific industries or processes.

To receive any of the above materials by fax or mail, or for additional information or assistance in how to calculate and report your emissions, please call us at (602) 506-6790.

V. INSTRUCTIONS AND EXAMPLES FOR COMPLETING EMISSIONS REPORTING FORMS

Business Form Instructions

Verify all preprinted information, and make corrections where necessary. When making corrections, strike out the preprinted data and write in corrections beside it. Please make all changes readily noticeable.

NOTE: Making a change on the Business Form will **NOT** transfer the permit ownership or location. You must contact the Department's Small Business Assistance Program at (602) 506-5102 or the Engineering & Permitting Division at (602) 506-6094 to accomplish this.

Data fields:

6 Number of employees: This should be the annual average number of full-time equivalent (FTE) employee positions ***at this business location***.

9 NAICS Code: This 5- or 6-digit North American Industrial Classification System (NAICS) code has been introduced to replace the 4-digit Standard Industrial Classification (SIC) codes. Please list the primary and secondary NAICS codes for your business, if known. (Consult our website, at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx, for a link to a full list of NAICS codes.)

10 Preparer of the Inventory (primary contact for technical questions concerning this report): This should be the person who knows the most about the data in the report. If this person has an e-mail address used for business purposes, please provide it.

11 Who should receive the Annual Emissions Inventory Form next year?: This should be a person who is directly employed with the business. This person should not be a consultant for the business.

Stack Form Instructions

A "stack" is defined as a **stationary** stack, pipe, vent or opening through which a significant percentage of emissions (from one or more processes) are released into the atmosphere (with or without a control device).

NOTE: Stack information is required only if your business location annually emits over 10 tons of any one individual pollutant. If so, you must complete a Stack Form for:

- each stack connected to a control device.
- any stack that discharges annually more than 5 tons of combined pollutant emissions (such as a paint booth exhaust).

EXAMPLE Stack Form Information:

1	2	3	4	5a OR 5b		6a OR 6b & 6c			7
Stack ID	Stack Type Code*	Stack Height**	Exit Gas Temperature	Velocity feet/sec	Flow Rate acfm	Diameter inside inch	Length / Width inside inch		Stack Name/Description. Include lat/long coordinates of stack (in decimal degrees)
1	W	30 ft	90 °F		20,000	36			paint booth Lat: N33.5277 Long: W112.2626
2	V	14 ft	200 °F		19,186	40			thermal oxidizer, Bldg. 2 Lat:N33.5259 Long:W112.2613

* Stack Type Codes: **V** = Vertical unobstructed; **H** = Horizontal unobstructed; **D** = Downward unobstructed; **G** = Gooseneck; **W** = Obstructed vertical (e.g. weather cap)

** Stack height is calculated relative to the surrounding terrain. For instance, the stack height of a 10-foot stack on top of a 20-foot tall building is 30 feet.

Data fields:

1 Stack ID: (See "Assigning Identification Numbers" on page 6.) A number (up to three digits, numeric only) which identifies a specific stack. It is suggested you start with 1, then 2, etc.

4 Exit Gas Temperature: Should represent average operating conditions, in degrees Fahrenheit. ***DO NOT*** report "ambient".

5a Exit Gas Velocity: ***OR*** 5b Gas Flow Rate:
Provide ***EITHER*** the exit velocity (in feet per second) ***OR*** the flow rate of gas (in actual cubic feet per minute) exiting the stack during normal operations. Preprinted information provides both.

6a Inside Stack Diameter: For round stacks, provide Inside Stack ***Diameter*** in inches.
OR
6b & 6c Inside Stack Length and Width: For square or rectangular stacks, provide inside ***Length and inside Width*** in inches.

7 Stack Name/Description and Lat/Long Coordinates: Provide a brief text description of the stack along with the latitude and longitude coordinates of the stack (in decimal degrees).

Control Device Form Instructions

EXAMPLE Control Device Form Information

1	2	3	4	5	6
Control ID	Installation/ Reconstruction* Date	Size or Rated Capacity**	Control Type Code	Control Device Name/Description	Stack ID
1	***05/09/98***	***25,000.0*** cfm	***021***	***Thermal oxidizer***	***2***
4	***03/10/97***	cfm	***153***	***Watering with water trucks***	

Data fields:

1 Control ID: (See "Assigning Identification Numbers" on page 6.) A unique number (up to three digits) that you assign to identify a specific control device.

2 Installation/Reconstruction Date: The completion date (given in *mm/dd/yy* format) of installation or the most recent reconstruction of the identified control device. This is not a date on which routine repair or maintenance was done. "Reconstruction" means any component of the control device was replaced and the cost (fixed capital) of the new component(s) was more than half of what it would have cost to purchase or construct a new control device.

3 Size or Rated Capacity: Report the air or water flow rate in ***cubic feet per minute***. Some devices (e.g., water trucks for dust control) will not include a value in this field.

4 Control Type Code: A 3-digit code designating the type of control device. A complete list of all EPA control device codes can be found on the Web at: http://www.maricopa.gov/aq/divisions/ planning_analysis/emissions inventory/Default.aspx or call (602) 506-6790 for assistance.

6 Stack ID: Not all businesses require a Stack ID. This is required if the Stack Form is used for your site (see page 9) ***and*** the control device is vented through that identified stack. This is the ID number shown in column 1 of the Stack Form. The Stack ID can be entered on this form after the Stack Form has been filled out.

General Process Form Instructions

The General Process Form is used to record data on all emissions-producing processes except evaporative processes. A "***general process***" is normally characterized by the burning or handling of a material. One form reports all the pollutants for one process. For example, several pollutants are produced by burning fuel, and PM_{10} is emitted by processing rock products, processing materials such as wood or cotton, and driving on unpaved areas.

Data fields: (See sample forms on pages 13 and 14.)

1 Process ID: A number (up to three digits) that is preprinted or you assign. (See "Assigning Identification Numbers" on page 6.) This Process ID number can not be used for any other process at this location.

2 Process Type/Description: Brief details on the type of activity that is occurring.

3 Stack ID(s): The stack ID number(s) shown in column 1 of the Stack Form that identify the stack(s) which vent pollution created by this process. Not all businesses are required to report stacks. This is only required if the Stack Form is required for your site (see page 9) ***and*** the process has a stack.

4 Process Tier Code and
5 SCC Code:

If these codes are not preprinted on your form, please consult the section "Other Resources" on our web site, or call (602) 506-6790.

6 Seasonal Throughput Percent: Enter the percent of total annual operating time that occurred per season, rounded to the nearest percent. For example, "Dec-Feb 30% " means 30% of total annual activity occurred in January, February and December 2011. The total for all four seasons must equal 100%.

7 Normal Operating Schedule and
8 Typical Hours of Operation:

These reflect the normal daily, weekly, and annual operating parameters of ***this process*** during 2011.

9 Emissions Based on: Provide the ***name*** of the material used, fuel used, product produced, or whatever was measured for the purpose of calculating emissions, such as "natural gas", "hours of operation," "vehicle miles traveled," or "acres."

10 Used, Produced or Existing: Indicate whether calculated emissions are based on a material type or fuel *used* (an input, such as "paint" or "natural gas"), or an *output* (such as "sawdust produced" or "finished product"). Use "Existing" if the parameter reported on line 9 is not directly used or produced in the process (such as "vehicle miles traveled" or "acres").

11 Annual Amount: The annual amount (a number) of material that was used, fuel combusted, product produced, hours of operation, vehicle miles traveled, or acres.

12 Fuel Sulfur Content (in percent): For processes that involve the combustion of oil or diesel fuels, report the sulfur content of the fuel as a decimal value. Example: 0.05 % (= 500 ppm)

13 Unit of Measure: Units of the material used, fuel used or product produced shown on line 9. For example: gallons, pounds, tons, therms, acres, vehicle miles traveled, units produced.

14 Unit Conversion Factor: You must provide this if you use an emission factor with an emission factor unit (see item 17 below) that is ***not*** the same as the unit of measure (from line 13). This is the standard number you would multiply your amount (line 11) by to convert it to the units of the emission factor. See page 7 for a list of commonly used conversion factors.

General Process Form Instructions (continued)

15 Pollutant: See page 3 for a list of pollutants that need to be reported.

16 Emission Factor (EF): The number to be multiplied by the annual amount (line 11) to determine how much of the pollutant was emitted. If you calculate your own emission factor or change the preprinted emission factor, you must provide details of your calculations in an attachment.

17 Emission Factor (EF) Units: Enter the appropriate Emission Factor Units in pounds (lb) per unit; e.g., lb/ton, lb/MMCF, lb/gal.

18 Controlled Emission Factor (EF)? YES or NO: Indicate "YES" if: 1) you have your own emission factor from testing **and** included the control device efficiency within the factor, or 2) the emission factor used is clearly identified as a controlled emission factor. A "YES" response requires the use of Formula A (see #25 below). Indicate "NO" if: 1) there is no emission control device, or 2) the emission factor represents emission rates **before** controls. A "NO" response requires the use of Formula B (see #25 below).

19 Calculation Method: Enter the number code (listed at the bottom of the General Process Form) which best describes the method you used to obtain this emission factor. Code 5, "AP-42/FIRE Method or Emission Factor" means that the factor comes from EPA documents or software. ***NOTE:*** If you have continuous emissions monitors (CEM) data or conducted a source test that was required and approved by the County for a specific process or piece of equipment, you ***must*** use the emission data from the CEM or the test results. Report "1" in this column for CEM data or "4" for performance test data.

20 through 24: Leave blank if there is no control device.

20 Capture % Efficiency: The percent of the pollutant that is captured and sent to the primary control device in this process. Be sure to list capture efficiency separately for ***each*** pollutant affected.

21 Primary Control Device ID: If this pollutant is being controlled in this process, enter the Control Device ID number which represents the first control device affecting the pollutant.

22 Secondary Control Device ID: If this pollutant is being controlled sequentially by 2 devices, enter the Control Device ID number which represents the second control device; otherwise leave this field blank.

23 Control Device(s) % Efficiency: Enter the total control efficiency of the control device(s). Be sure to list control device efficiency separately for ***each*** pollutant affected. If you report control device efficiency, you must ***also*** show capture efficiency in column 20.

24 Efficiency Reference Code: Enter the code (1 through 6) that best describes how you determined the ***control device efficiency***. A list of possible codes is included at the bottom of the form.

25 Estimated Actual Emissions (in pounds/year): You may round the calculated emissions values to the nearest pound. Calculate as follows:

A. *Emissions with no controls* or *controls are reflected in the emission factor:*
Column 25 = line 11 × line 14 × column 16

B. *Emissions after control:*
Column 25 = line 11 × line 14 × column 16 × (1 – [column 20 × column 23])

Use the decimal equivalent for columns 20 and 23. Example: 96.123% = 0.96123

General Process Form **2011**

EXAMPLE: Internal Combustion

Permit number(s) V99999

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process ID 80

2- Process Type/Description: 3 ENGINES FOR CRUSHING (EACH LESS THAN 600 HP)

3- Stack ID(s) *(only if required on Stack Form)* _____ _____ _____ _____ _____

4- Process TIER Code: 020599 FUEL COMB. INDUSTRIAL: INTERNAL COMBUSTION

5- SCC Code 20200102 *(8 digit number)* IND:DIESEL-RECIPROCATING

6- Seasonal Throughput Percent: Dec-Feb 25 % Mar-May 25 % Jun-Aug 25 % Sep-Nov 25 %

7- Normal Operating Schedule: Hours/Day 8 Days/Week 5 Hours/Year 2080 Weeks/Year 52

8- Typical Hours of Operation: *(military time)* Start 0700 End 1530

9- Emissions based on *(name of material or other parameter, e.g. "rock", "diesel", "vehicle miles traveled")* DIESEL

10- [X] Used (input) or [ ] Produced (output) or [ ] Existing (e.g. VMT, acres)

11- Annual Amount: *(a number)* 16,250 12- Fuel Sulfur Content (in percent) 0.05 %

13- Unit of Measure: *(for example: tons, gallons, million cu ft, acres, units produced, etc.)* GALLONS

14- Unit Conversion Factor *(if needed to convert Unit of Measure to correlate with emission factor units)* 0.001

	Emission Factor (EF) Information				Control Device Information					
15	16	17	18	19	20	21	22	23	24	25
Pollutant	Emission Factor (EF) (number)	Emission Factor Unit (lb per)	Controlled EF? Yes or No	Calculation Method Code*	Capture % Efficiency	Primary Control Device ID	Secondary Control Device ID	Control Device(s) % Efficiency	Efficiency Reference Code**	Estimated Actual Emissions
CO	130	M GALS	N	5						2,113 lbs
NOx	604	M GALS	N	5						9,815 lbs
PM-10	42.5	M GALS	N	5						691 lbs
SOx	39.7	M GALS	N	5						645 lbs
VOC	49.3	M GALS	N	5						801 lbs

*** Calculation Method Codes:**

1 = Continuous Emissions Monitoring Measurements
2 = Best Guess / Engineering Judgment
3 = Material Balance
4 = Source Test Measurements (Stack Test)
5 = AP-42 / FIRE Method or Emission Factor
6 = State or Local Agency Emission Factor
7 = Manufacturer Specifications
8 = Site-Specific Emission Factor
9 = Vendor Emission Factor
10 = Trade Group Emission Factor

**** Control Efficiency Reference Codes:**

1 = Tested efficiency / EPA reference method
2 = Tested efficiency / other source test method
3 = Design value from manufacturer
4 = Best guess / engineering estimate
5 = Calculated based on material balance
6 = Estimated, based on a published value

General Process Form **2011**

EXAMPLE: Unpaved Road Travel

Permit number(s) V99999

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process ID 28

2- Process Type/Description: UNPAVED ROAD TRAVEL: HEAVY-DUTY TRUCKS @ 15 MPH

3- Stack ID(s) *(only if required on Stack Form)* _____ _____ _____ _____ _____

4- Process TIER Code: 140799 MISCELLANEOUS: FUGITIVE DUST

5- SCC Code 30502504 *(8 digit number)* SAND/GRAVEL: HAULING

6- Seasonal Throughput Percent: Dec-Feb 25 % Mar-May 25 % Jun-Aug 25 % Sep-Nov 25 %

7- Normal Operating Schedule: Hours/Day 8 Days/Week 5 Hours/Year 2080 Weeks/Year 52

8- Typical Hours of Operation: *(military time)* Start 0700 End 1530

9- Emissions based on *(name of material or other parameter, e.g. "rock", "diesel", "vehicle miles traveled")* VEHICLE MILES TRAVELED (VMT)

10- ☐ Used (input) or ☐ Produced (output) or ☒ Existing (e.g. VMT, acres)

11- Annual Amount: *(a number)* 7,500 12- Fuel Sulfur Content (in percent) _____ %

13- Unit of Measure: *(for example: tons, gallons, million cu ft, acres, units produced, etc.)* VMT

14- Unit Conversion Factor *(if needed to convert Unit of Measure to correlate with emission factor units)* _____

	Emission Factor (EF) Information				Control Device Information					
15	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Pollutant	Emission Factor (EF) (number)	Emission Factor Unit (lb per)	Controlled EF? Yes or No	Calculation Method Code*	Capture % Efficiency	Primary Control Device ID	Secondary Control Device ID	Control Device(s) % Efficiency	Efficiency Reference Code**	Estimated Actual Emissions
PM-10	3.2	VMT	N	6	100	4		90	6	2400 lbs
										lbs
										lbs
										lbs
										lbs
										lbs

NOTE: Emissions in col. 25 are calculated as follows: (line 11 × col. 16) × (1 – [col. 20 × col. 23])

*** Calculation Method Codes:**
- **1** = Continuous Emissions Monitoring Measurements
- **2** = Best Guess / Engineering Judgment
- **3** = Material Balance
- **4** = Source Test Measurements (Stack Test)
- **5** = AP-42 / FIRE Method or Emission Factor
- **6** = State or Local Agency Emission Factor
- **7** = Manufacturer Specifications
- **8** = Site-Specific Emission Factor
- **9** = Vendor Emission Factor
- **10** = Trade Group Emission Factor

**** Control Efficiency Reference Codes**
- **1** = Tested efficiency / EPA reference method
- **2** = Tested efficiency / other source test method
- **3** = Design value from manufacturer
- **4** = Best guess / engineering estimate
- **5** = Calculated based on material balance
- **6** = Estimated, based on a published value

Evaporative Process Form Instructions

The Evaporative Process Form is used to report all emissions produced by evaporation. Examples include: cleaning with solvents, painting and other coatings, printing, using resin, evaporation of fuels from storage tanks, ammonia use, etc. All other processes should be shown on the General Process Form.

One Evaporative Process Form may be used to report numerous materials, with each material given a separate process ID number, as long as the information on lines 1–5 apply to all items on that form. Use a separate form for each group of materials that has a different Process Type/Description (shown on line 1), different Tier Code (line 2) or different operating schedule (lines 3, 4, or 5).

Data fields: (See sample forms on pages 17 and 18.)

1 Process Type/Description: Brief details of the activity in which the listed materials were used.

2 Process Tier Code: If this 6-digit code is not preprinted on your form, please refer to the Tier Code list at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx or call (602) 506-6790.

3 Seasonal Throughput Percent: Enter the percent of total annual operating time that occurred per season (rounded to the nearest percent). For example, "Dec-Feb 30% " means 30% of the total annual activity occurred during January, February and December 2011. The total for all four seasons must equal 100%.

4 Normal Operating Schedule and
5 Typical Hours of Operation: These represent the usual number of hours, time of day and weeks per year when ***this process*** occurred during the calendar year.

6 Process ID: A number (up to three digits) that represents this specific material (process). Each process on one form must have the same tier code and operating schedule as that shown in the top portion of the form. This Process ID number can ***not*** be used for any other process at this business location. See page 6 of these instructions for more explanation of ID numbers and for exclusions and guidance on grouping materials.

7 Stack ID(s): The stack ID number(s) shown in column 1 of the Stack Form that identify the stack(s) which vent pollution created by this process. Not all businesses are required to report stacks. This is only required if the Stack Form is required for your site (see page 9) ***and*** the process has a stack.

8 Material Type: Provide the name of the material used in this process. Give the chemical name for pure chemicals or a name that reflects its use (paint, ink, etc.), rather than just a brand name or code number. Examples of materials include: paint, thinner, degreasing solvent (plus its common name), ink, fountain solution, ammonia, alcohol, ETO (ethylene oxide), gasoline (in a storage tank).

9 Annual Material Usage/Input: Amount of this material used during the year. In most cases, the amount purchased is suitable. Write in "lbs" or "gal" (pounds or gallons).

10 Pollutant: The only pollutants reported on this form are VOC, HAP&NON and NH_X (see definitions on page 3). When one process (or material) has more than one of these pollutants, list each pollutant on a separate line, using the same process ID number.

Evaporative Process Form (continued)

11 Emission Factor (EF): An emission factor is a number used to calculate the pounds of pollutant emitted based on the quantity of material used in a process. Emission factors can be obtained from your supplier (usually provided on a Material Safety Data Sheet or environmental data sheet), and must correspond with the material units reported in column 9. If the material unit is "gal," then the emission factor must be in pounds of pollutant per gallon. If the material unit is "lb," then the emission factor must be in pounds of pollutant per pound of material.

Verify (and correct, where necessary) all preprinted emission factors, as the composition of materials used may have changed since your last report. A "lb/gal" emission factor is almost always less than 8 and never greater than 14. A "lb/lb" emission factor is never larger than 1.0.

12 Pounds of pollutant sent off-site: Required only if you wish to take credit for reduced emissions because waste of this material is sent off-site for recycling or disposal. Only waste generated during the report year may be claimed. The Off-Site Recycling/Disposal Form ***must*** be completed if you wish to claim a credit. The number of pounds reported in column 12 ***must*** equal the number of pounds reported on the Off-Site Recycling/Disposal Form(s) for the same Process ID number.

13 and 14: Leave these fields blank if there is no control device present.

13 Capture % Efficiency: The percent of the pollutant from this process that is captured and sent to the control device.

14 Control ID: If this pollutant is being controlled in this process, enter the Control Device ID number from column 1 of the Control Device Form.

Control % Efficiency: Enter the percent of this pollutant that is controlled by this control device.

Code: Select the Control Efficiency Reference Code from the list at the bottom of the form.

15 Estimated Emissions (lbs/yr): Estimated pounds of the pollutant emitted during the year, after off-site recycling/disposal and controls if applicable. **Credit will not be given for off-site recycling/disposal unless it is shown on the Off-Site Recycling/Disposal Form.** Round to the nearest pound. If the answer is 0, give a decimal answer to the first significant digit. Column 15 is calculated as follows:

Emissions without off-site recycling/disposal or controls:
Column 15 = column 9 × column 11

Emissions with off-site recycling/disposal:
Column 15 = (column 9 × column 11) – column 12

*Emissions with off-site recycling/disposal **and** controls:*
Column 15 = ([column 9 × column 11] – column 12) × (1 – [column 13 × column 14])

Use the decimal equivalent for columns 13 and 14. Example: 96.123% = 0.96123

EXAMPLE: Coating and Painting

Evaporative Process Form 2011

Permit number(s) V99999

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process Type/Description: *Coating metal parts*

2- Process TIER Code: *080415* SOLVENT USE: SURFACE COATING - MISC METAL PARTS

3- Seasonal Throughput Percent: Dec-Feb *25* % Mar-May *25* % Jun-Aug *25* % Sep-Nov *25* %

4- Normal Operating Schedule: Hours/Day *8* Days/Week *5* Hours/Year *2080* Weeks/Year *52*

5- Typical Hours of Operation *(military time)* Start *0800* End *1700*

6	7	8	9		10	11		12	13	14			15
Process ID	Stack ID(s)	Material Type	Annual Usage Input	lb or gal	VOC, HAP&NON or NHx	Emission Factor	EF Units (lbs per)	Pounds of pollutant* sent off site	Capture Efficiency %	Control ID	Control Efficiency %	Control Efficiency Code**	Estimated Emissions (lbs/yr)
800	*1*	*Lacquer 6455-06*	*95*	*gl*	*VOC*	*4.7*	*gal*		%		%		*447*
801	*1*	*lacq thinner*	*120*	*gl*	*VOC*	*7.1*	*gal*		%		%		*852*
802	*1*	*Paint red 4039-03*	*940*	*gl*	*VOC*	*4.2*	*gal*		%		%		*3,948*
803	*1*	*Toro-Red Paint*	*707*	*gl*	*VOC*	*7.0*	*gal*		%		%		*4,949*
803	*1*	*Toro-Red Paint*	*707*	*gl*	*HAP&NON*	*0.5*	*gal*		%		%		*354*
804	*1*	*powder paint 8730-11*	*20,200*	*lb*	*VOC*	*0.001*	*lb*		%		%		*20*

Note: Do NOT change preprinted Process ID numbers. See page 6 of these instructions for information on how to delete materials that are no longer used, or to assign Process ID numbers for new materials.

* If you have off-site recycling/disposal of any of the materials listed above, you must complete an Off-site Recycling/Disposal Form to receive credit for reduced emissions.

NOTE: Emissions in col. 15 are calculated as follows: **([col. 9 × col. 11] – col. 12) × (1 – [col. 13 × col. 14])**

**** Control Efficiency Reference Codes**

1 = Tested efficiency / EPA reference method
2 = Tested efficiency / other source test method
3 = Design value from manufacturer
4 = Best guess / engineering estimate
5 = Calculated based on material balance
6 = Estimated, based on a published value.

EXAMPLE: Cleaning solvent (with recycling)

Evaporative Process Form 2011

Permit number(s) **V99999**

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process Type/Description: **CLEANING METAL PARTS**

2- Process TIER Code: **080103** **SOLVENT USE: DEGREASING - COLD CLEANING**

3- Seasonal Throughput Percent: Dec-Feb **25** % Mar-May **25** % Jun-Aug **25** % Sep-Nov **25** %

4- Normal Operating Schedule: Hours/Day **8** Days/Week **5** Hours/Year **2080** Weeks/Year **52**

5- Typical Hours of Operation *(military time)* Start **1300** End **1700**

6	7	8	9		10	11		12	13	14			15
Process ID	Stack ID(s)	Material Type	Annual Usage Input	lb or gal	VOC, HAP&NON or NHx	Emission Factor	EF Units (lbs per)	Pounds of pollutant* sent off site	Capture Efficiency %	Control ID	Control Efficiency %	Control Efficiency Code**	Estimated Emissions (lbs/yr)
3	**2**	**SANITIZER**	**716**	**lb**	**VOC**	**1.0**	**lb**		**95** %	**1**	**80** %	**3**	**172**
6		**GUN CLEANER**	**180**	**gl**	**VOC**	**7.2**	**gl**	**569**	%		%		**727**
7		**XYZ STRIPPER**	**1300**	**gl**	**VOC**	**3.3**	**gl**	**1,884**	%		%		**2,406**
8		**CLEANING SOLVENTS**	**358**	**gl**	**VOC**	**6.4**	**gl**	**1,006**	%		%		**1,285**
9		**MEGASOLVE**	**2258**	**gl**	**VOC**	**6.8**	**gl**	**6,741**	%		%		**8,613**
									%		%		

Note: Do NOT change preprinted Process ID numbers. See page 6 of these instructions for information on how to delete materials that are no longer used, or to assign Process ID numbers for new materials.

* If you have off-site recycling/disposal of any of the materials listed above, you must complete an Off-site Recycling/Disposal Form to receive credit for reduced emissions.

NOTE: This example shows the case where 2,400 of the original 4,096 gallons of materials #6 through 9 were captured for off-site recycling, and the pollutant content of the waste material was estimated to be 75% of the original. The pounds of pollutant sent off-site shown in column 12 is calculated on the example Off-Site Recycling/Disposal Form on the next page.

EXAMPLE

Off-Site Recycling/Disposal Form 2011

Permit number(s) ***V99999***

NOTE: If you need blank copies of this form, call the Emissions Inventory Unit at (602) 506-6790 or consult our web page at http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

Provide one off-site recycling/disposal form for each waste stream at your business location. A waste stream is the waste from one or more processes mixed together to make one waste product before it is taken off site for recycling, disposal or combustion.

1) Assign a unique two-digit ID number to identify the waste stream that will be described below. ***01***
(Start with ID# 01 for first waste stream. Make copies of a blank Off-Site Recycling/Disposal form and use 02 for second, etc.)

2) What was the quantity of this waste stream in 2011? 2,400 *Check one:* ☐ pounds ☒ gallons
Indicate whether this quantity is reported in pounds or gallons. Keep waste disposal company manifests as proof that this amount of waste was taken off-site.

3) What was the **average** pollutant content of the waste stream? NOTE: Report in the same units (pounds or gallons) as used in line 2.

VOC ***4.25*** lbs/unit HAP&NON _____ lbs/ unit NHx _____ lbs/ unit

NOTE: Waste normally has less pollutant content than the new product. Some of the pollutant evaporates during the use of the product, and there is usually dirt, water or other contaminants in the waste stream. The estimated pollutant content of the waste is usually between 50% and 95% of the new product. This example estimates an average VOC content (on line 3) to be 75% of the original VOC content of 5.67 lbs/gal., to account for evaporation and contaminants. See page 20 to calculate a weighted average.

4) Calculate the **total** annual pollutant content of the waste in this waste stream.
(volume of waste, from Line 2) × (pollutant content, from Line 3) = Total pollutants in waste stream, in lbs/yr.

VOC ***10,200*** lbs/yr HAP&NON _____ lbs/yr NHx _____ lbs/yr

5) List the process ID numbers of the processes contributing to this waste stream. Also estimate the pounds of pollutant that each process contributed to this waste stream.

NOTE: In this example, the amount each process material contributed to total pollutants in the waste stream (Line 4) is based on the percentage, by weight, of each material that contributed to the waste stream (e.g., Process ID #6 contributed 5.6%, therefore 5.6% × 10,200 lbs/yr = 569 lbs. See example on page 20).

NOTE: Column totals in the table below must equal the total for each pollutant type reported on line 4. The quantities you report below for each pollutant and process must also be reported in column 12 on the Evaporative Process Form.

Process ID	Annual VOC (lbs)	Annual HAP&NON (lbs)	Annual NHx (lbs)
6 Contributed about	***569*** lbs	lbs	lbs
7 Contributed about	***1,884*** lbs	lbs	lbs
8 Contributed about	***1,006*** lbs	lbs	lbs
9 Contributed about	***6,741*** lbs	lbs	lbs

EXAMPLE: Documentation of Emission Factor Calculations

Identify the process ID number(s) and pollutant(s). Show calculations made to obtain the emission factors used for the process(es). Include references to data sources used, including the document name, date published, page numbers, etc.

Emission Factor Calculation

Process ID ***201*** Permit number ***V99999***

Emission factors derived from source test performed 12/2/00 by XYZ Engineering Company (copy of summary tables also attached).

Outlet (after controls):
CO = 0.43 lb/hr × 1 hr/60 min × 1 min/77.9 cu. ft × 1,000,000 cu. ft/MMCF
= 92.0 lb/MMCF

NOx = 0.09 lb/hr × 1 hr/60 min × 1 min/77.9 cu. ft × 1,000,000 cu. ft/MMCF
= 19.3 lb/MMCF

Weighted average sample calculation

NOTE: The example below shows how the weighted average of the materials going into the waste stream is calculated. A weighted-average emission factor has been calculated by listing usage amounts and emission factors for each material, summing each column, and then dividing the total emissions by the total gallons used.

In this example: 23,231 lbs ÷ 4,096 gal = 5.67 lb/gal average VOC content. This emission factor is then used to calculate the average pollutant content in the Off-site Recycling/Disposal Form example.

This process can also be used to find the weighted average emission factor for similar materials if you are reporting them together as a single line item on the Evaporative Process form. Refer to the explanation of "grouping" on page 6.

Process ID #	Material Type	2011 Usage	Units	VOC (lbs/unit)	VOC Emissions (= Usage × VOC content)	Percent contributed to waste stream
6	gun cleaner	180	gal	7.2	1,296 lbs.	5.6 %
7	xyz stripper	1,300	gal	3.3	4,290 lbs.	18.5 %
8	cleaning solvent	358	gal	6.4	2,291 lbs.	9.9 %
9	MEGASOLVE	2,258	gal	6.8	15,354 lbs.	66.1 %
	Totals:	4,096	**gal**		**23,231 lbs.**	100.0 %

Average VOC content:	***23,231 lbs. / 4,096 gals***	=	***5.67 lb/gal***

EXAMPLE (for all sources except Title V sources)

Data Certification Form 2011

Permit number ***999999***

For EACH pollutant listed, total up all emissions recorded on your General Process and Evaporative Process Forms. Enter these numbers in column 1, "Totals from Process Forms." Report any emissions from accidental releases in column 2.
Add the figures in each row across, and enter the result in column 3, "Total Emissions".

NOTE: "Accidental Releases" reported in column 2 should include all excess emissions reported to the Department under Rule 140, Section 500.

Summary of 2011 Annual Emissions:	(1) Totals from Process Forms	(2) + Accidental Releases	(3) = TOTAL 2011 Emissions
CO	***2,113***	***0***	***2,113***
NH_x	***0***	***0***	***0***
Lead	***0***	***0***	***0***
HAP&NON	***354***	***0***	***354***
VOC	***24,220***	***0***	***24,220***
NO_x	***9,815***	***0***	***9,815***
SO_x	***645***	***0***	***645***
PM_{10}	***3,091***	***0***	***3,091***

NOTE: Review specific requirements for data confidentiality on page 5. We cannot hold any data confidential without the required documentation.

TO COMPLETE YOUR EMISSIONS INVENTORY REPORT:

- Complete the Confidentiality Statement below.
- Sign and date this form below where indicated.
- Send the **original** copy of your completed forms to: Maricopa County Air Quality Dept., Emissions Inventory Unit,1001 North Central Avenue, Suite 125, Phoenix, AZ 85004.
- Keep a copy of all forms for your records.

CONFIDENTIALITY STATEMENT:

This annual emissions report contains requests to keep some data confidential. ☐ YES ☒ NO
If you check "YES", you must submit documentation and meet certain requirements before your data can be deemed confidential. See enclosed instructions for further details.

NOTE: The Data Certification form must be signed by a responsible company official.

CERTIFICATION STATEMENT:

I declare under penalty of perjury that the data (e.g. inputs, emission factors, controls, and annual emissions) presented herein represents the best available information and is true, accurate and complete to the best of my knowledge.

Signature of owner/business officer | Date of signature | Telephone number

Type or print full name of owner/business officer | Type or print full title

How to calculate an emission fee (for Title V sources only):

1. For each pollutant listed on the "Data Certification/Fee Calculation" form, total up all emissions recorded on your General Process and Evaporative Process Forms. Enter these numbers in column 1, "Totals from Process Forms."

NOTE: While most processes that generate PM_{10} should be reported on line 5 of the Data Certification/Fee Calculation form, "[f]ugitive emissions of PM_{10} from activities other than crushing, belt transfers, screening, or stacking" (County Rule 280, § 305.2d) are NOT subject to annual emission fees. The most common occurrences of these PM_{10}-producing activities that are NON-billable are listed below:

SCC codes and description of PM_{10}-producing processes that are NOT subject to emission fees

SCC	Major Category	Subcategory	Facility / Process Type	Process Description
30200814	Industrial Processes	Food and Agriculture	Feed Manufacture	Storage
30400737	Industrial Processes	Secondary Metal Production	Steel Foundries	Raw Material Silo
30500120	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Storage Bins: Ferric Chloride
30500121	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Storage Bins: Mineral Stabilizer
30500134	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Blown Saturant Storage
30500135	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Blown Coating Storage
30500141	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Granules Storage
30500143	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Mineral Dust Storage
30500203	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Piles
30500212	Industrial Processes	Mineral Products	Asphalt Concrete	Heated Asphalt Storage Tanks
30500213	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Silo
30500290	Industrial Processes	Mineral Products	Asphalt Concrete	Haul Roads: General
30500303	Industrial Processes	Mineral Products	Brick Manufacture	Storage of Raw Materials
30500608	Industrial Processes	Mineral Products	Cement Manufacturing (Dry Process)	Raw Material Piles
30500708	Industrial Processes	Mineral Products	Cement Manufacturing (Wet Process)	Raw Material Piles
30501710	Industrial Processes	Mineral Products	Mineral Wool	Storage of Oils and Binders
30502007	Industrial Processes	Mineral Products	Stone Quarrying - Processing	Open Storage
30502011	Industrial Processes	Mineral Products	Stone Quarrying - Processing	Hauling
30502504	Industrial Processes	Mineral Products	Construction Sand and Gravel	Hauling
30502507	Industrial Processes	Mineral Products	Construction Sand and Gravel	Storage Piles
30502760	Industrial Processes	Mineral Products	Industrial Sand and Gravel	Sand Handling, Transfer, & Storage
30531090	Industrial Processes	Mineral Products	Coal Mining, Cleaning, Material Handling	Haul Roads: General
30532007	Industrial Processes	Mineral Products	Stone Quarrying - Processing	Open Storage
30704002	Industrial Processes	Pulp and Paper & Wood Pdts.	Bulk Handling and Storage - Wood/Bark	Stockpiles
31100199	Industrial Processes	Building Construction	Construction: Building Contractors	Other Not Classified
31100299	Industrial Processes	Building Construction	Demolitions/Special Trade Contracts	Other Construction/Demolition
50100401	Waste Disposal	Solid Waste Disposal	Landfill Dump	Unpaved Road Traffic
50100402	Waste Disposal	Solid Waste Disposal	Landfill Dump	Fugitive Emissions
50100403	Waste Disposal	Solid Waste Disposal	Landfill Dump	Area Method
50100404	Waste Disposal	Solid Waste Disposal	Landfill Dump	Trench Method
50100405	Waste Disposal	Solid Waste Disposal	Landfill Dump	Ramp Method

2. Report any accidental releases in column 2. Add columns 1 and 2 together for each pollutant, and enter the sum in column 3. Sum lines 1 through 5 together, and enter the total on line 6.

3. Divide your facility's total billable emissions (on line 6) by 2000 to convert pounds into tons. **Round to the nearest ton.** Enter this value on line 7. Multiply this number by **$39.83**, and enter the result on line 8. This is your 2011 emission fee.

EXAMPLE (for Title V sources only)

Data Certification/Fee Calculation Form 2011

Permit number ***V99999***

For EACH pollutant listed, total up all emissions recorded on your General Process and Evaporative Process Forms. Enter these numbers in column 1, "Totals from Process Forms." Report any emissions from accidental releases in column 2.
Add the figures in each row across, and enter the result in column 3, "Total Emissions".
Carefully follow the instructions on lines 6 through 8 to calculate any emission fee owed.

NOTE: "Accidental Releases" reported in column 2 should include all excess emissions reported to the Department under Rule 140, Section 500.

	Summary of 2011 Annual Emissions:	(1) Totals from Process Forms	(2) + Accidental Releases	(3) = TOTAL 2011 Emissions
	CO	***2,113***	***0***	***2,113***
	NH_x	***0***	***0***	***0***
	Lead	***0***	***0***	***0***
	PM_{10} (non-billable; see page 22)	***2,400***	***0***	***2,400***
	Emissions fees are based on your emissions of the following pollutants ONLY:			
1	HAP&NON	***354***	***0***	***354***
2	VOC	***24,220***	***0***	***24,220***
3	NO_x	***9,815***	***0***	***9,815***
4	SO_x	***645***	***0***	***645***
5	PM_{10} (billable; see page 22)	***691***	***0***	***691***
6	**Add "TOTAL" column from lines 1 through 5 ONLY:**			***35,725*** lbs.
7	Divide the total on line 6 by 2000 (pounds per ton) to get tons, and round the number to the nearest ton. (Drop any decimal of .499 or less. Increase to the next whole number any decimal of .500 or more.) Enter the resulting WHOLE NUMBER here.			***18*** TONS
8	Multiply line 7 (a WHOLE number) by **$ 39.83**. This is your **2011 ANNUAL EMISSION FEE**.			$ ***716.94***

NOTE: Review specific requirements for data confidentiality on page 5. We cannot hold any data confidential without the required documentation.

TO COMPLETE YOUR EMISSIONS INVENTORY REPORT:

- Include a check (made payable to Maricopa County Air Quality Department) for the amount calculated on line 8 above.
- Complete the Confidentiality Statement below.
- Sign and date this form below where indicated.
- Send the **Original** copy of your completed forms along with any emission fee due to: Maricopa County Air Quality Department, Emissions Inventory Unit,1001 North Central Avenue, Suite 125, Phoenix, AZ 85004.
- Keep a copy of all forms for your records.

CONFIDENTIALITY STATEMENT:

This annual emissions report contains requests to keep some data confidential. ☐ YES ☒ NO
If you check "YES", you must submit documentation and meet certain requirements before your data can be deemed confidential. See enclosed instructions for further details.

NOTE: The Data Certification form must be signed by a responsible company official.

CERTIFICATION STATEMENT:

I declare under penalty of perjury that the data (e.g. inputs, emission factors, controls, and annual emissions) presented herein represents the best available information and is true, accurate and complete to the best of my knowledge.

Signature of owner/business officer | Date of signature | Telephone number

Type or print full name of owner/business officer | Type or print full title

Appendix B. Rule Effectiveness (RE) Studies

1. Introduction

Rule effectiveness (RE) studies are designed to assess the success of regulatory rules at controlling their targeted emissions. It is acknowledged that facilities and source categories subject to control techniques and devices mandated by rules do not always achieve 100% compliance with those requirements. Given this reality, the US EPA recommends the use of rule effectiveness studies to improve the quality of emission estimates presented in emission inventories.

Once an RE rate has been calculated, its value is applied to relevant sources at an individual process level, thus adjusting (i.e., increasing) emission estimates to reflect a lower degree of control efficiency. The formulas below illustrate how inclusion of rule effectiveness can significantly affect the resulting emission estimates:

Emissions before the application of rule effectiveness:

Uncontrolled Emissions	×	[1 – (Control Efficiency)]	=	Emissions with Control
100 tons	×	**[1 – (0.90)]**	=	**10.0 tons**

Emissions including the application of rule effectiveness:

Uncontrolled Emissions	×	[1 – (Control Efficiency × RE)]	=	Emissions with Control
100 tons	×	**[1 – (0.90 × 0.83)]**	=	**25.3 tons**

In general, the RE rate is applied to all processes where a control device or control technique is in use. There are however some limitations to this blanket rule, as expressed in US EPA's most recent guidance:

> *…not all emission estimates involving use of a control device or technique need to be adjusted to account for RE…For example, a state or local agency may conclude that a control device that operates in conjunction with a continuous emissions monitor, or is equipped with an automatic shutdown device, may provide a sufficient level of assurance that intended emission reductions will be achieved, and therefore an adjustment for rule effectiveness is not necessary. Another example would be in instances where a direct determination of emissions, such as via a mass balance calculation, can be made.* (US EPA, 2005)

Another complication in any attempt to apply a blanket RE percentage rate occurs where control device efficiencies are extremely high. Some categories of control devices routinely operate at efficiencies of 99% or greater (e.g., baghouses, thermal oxidizers). For these activities, even small adjustments through the application of RE can cause a dramatic increase in reported emissions. As an example, a process with a control device of 99.9% efficiency may report controlled emissions of 10 tons. If an RE rate of 85% were applied to this process, the adjusted emissions would total 1,508.5 tons (an increase of nearly 15,000%). In these types of instances, the department evaluated the affected processes on a case-by-case basis to determine the appropriateness of applying an RE adjustment.

2. Calculating Rule Effectiveness Rates for Title V Facilities and Non-Title V Facilities

The observed compliance rate in some cases, such as multi-source Title V and non-Title V facilities, can be better described as a rate at which inspection staff issue violations. Inspection staff has a range of experience and training which influences their proficiency in issuing appropriate violations. There may be instances when a rule violation goes unnoticed by staff, or conversely a violation may be issued in error. Even when a compliance rate has a high statistical measure of accuracy, it can fail to reflect a number of programmatic measures that affect overall rule effectiveness; measures like the strength of rule language, departmental enforcement and penalty actions, inspector training programs, educational and public outreach efforts, etc. This reality is reflected in earlier US EPA guidance:

> *A percentage effectiveness rating is not enough to describe the compliance effectiveness of a rule for a source category. An SSCD [Stationary Source Compliance Division] study should attempt to link the rating to a regulatory agency's overall effort. The study should address the factors that affect the percentage effectiveness rating such as the compliance rate of the sources in a category, inspection frequency and thoroughness, the language of the rule (i.e., whether or not it has loopholes), and the reporting and recordkeeping by the regulatory agency. Evaluating these factors will provide a more complete evaluation of the effectiveness of a rule.* (US EPA, 1994)

In order to incorporate all the salient factors described above, a matrix was created to produce a final RE rate. US EPA's latest guidance (2005) provides a listing of factors that can impact rule effectiveness rates (e.g., inspector training, frequency of inspections, media outreach, enforcement policies, recordkeeping requirements, etc.), grouped into major categories such as most important factors, important factors and other factors. The department used these suggested factors as the basis for developing the RE matrices contained in Tables B–2 and B–3.

In brief, the compliance rate developed from inspection data accounts for 70% of the overall RE rate, while all other factors account for the remaining 30%. Each factor is scored individually, based upon the department's success in implementing that factor. As an example, the score for the factor "Compliance History" is the compliance rate developed from the study period inspection data, while the score for "Enforcement Penalties" is based upon the department's timely response to, and settlement of, observed violations associated with the subject rule or source category. The complete matrices for each applicable rule or source category for which rule effectiveness was addressed, are contained in Tables B–2 and B–3.

The following sections describe in further detail the data and methods used in the development of the remaining RE factors for Title V and non-Title V permitted facilities; results are summarized in Table B–1 below.

Table B–1. Rule effectiveness rate, by source category analyzed.

Source Category	Compliance Rate	Rule Effectiveness (RE) Rate
Title V Facilities	90.45% *	91.81%
Non-Title V Facilities	85.92% *	87.81%

** Compliance rates for both Title V and Non-Title V facilities are based upon 2010-2011 inspection data, and reflect compliance self-monitoring recordkeeping practice, in addition to violation data.*

For the remaining emission processes that include a control device or technique that limits ozone formation, separate multi-rule RE rates have been calculated for permitted Title V and non-Title V facilities. Factor-based matrices have been utilized to develop RE rates for Title V and non-Title V facilities. Compliance rates for these sources are based upon two full years of data (2010 through 2011), as compliance information for these sources tends to be more detailed (as reflected in the matrix). The compliance rate for these facilities also includes data on self-monitoring recordkeeping practices in addition to inspection data. The combined scores of the monitoring data and inspection data divided by the 70% of the overall RE rate comprise the 'compliance rate' section of the RE calculation matrix. The combined compliance rate for Title V facilities is 90.45% and 85.92% for non-Title V facilities, resulting in RE rates of 91.81% and 87.81% for Title V and non-Title V facilities, respectively, as shown in Tables B–2 and B–3 below.

3 References

US EPA, 1994. Rule Effectiveness Guidance: Integration of Inventory, Compliance and Assessment Applications. EPA Rep. 452/R-94-001, January 1994.

US EPA, 2005. Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations. EPA Rep. 454/R-05-001, November 2005.

Table B–2. Rule Effectiveness Matrix for Title V Facilities

A. Most important factors (2 criteria, each assigned weighting of 35% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring	94%	100%	97%	Source specific monitoring used for compliance purposes, and monitoring records filed with regulatory agency at least every 4 months.	35%	90%	**31.5%**
	87%	93%	90%	Source specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency every 6 to 9 months.			
	81%	86%	84%	Source specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency each year.			
	70%	80%	75%	General guidance exists for source specific enhanced monitoring, and monitoring records required but aren't submitted to regulatory agency.			
		< 70%	35%	No requirements for any type of monitoring.			
Compliance History	94%	100%	97%	The facility has been in compliance for the past eight quarters.	35%	12 of 21 facilities	**19.4%**
	87%	93%	90%	The facility is believed to have been in compliance for the past eight quarters, although inspection frequency is such that this can't be positively confirmed.			
	81%	86%	84%	On schedule; the facility is meeting its compliance schedule.			
	70%	80%	75%	In Violation; facility is in violation of emissions and/or procedural requirements.		7 of 21 facilities	**11.3%**
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.		2 of 21 facilities	**1.2%**
						Sum:	**31.8%**

Overall Compliance Rate for Title V facilities: **90.45%**

B. Other important factors (4 criteria, each assigned weighting of 3% of total):

Type of Inspection	94%	100%	97%	Inspections involve compliance test methods with a high degree of accuracy, such as stack testing or other types of precise emissions measurement.	3%	97%	**2.9%**
	87%	93%	90%	Inspections involve detailed review of process parameters & inspection of control equipment.			
	81%	86%	84%	Inspections involve review of process and inspection of control equipment.			
	70%	80%	75%	Inspections generally consist of only a records review.			
		< 70%	35%	Inspections most likely consist of visual inspection (e.g., opacity), or drive by.			
Operation & Maintenance	94%	100%	97%	Control equipment operators follow and sign daily O&M instructions.	3%	90%	**2.7%**
	87%	93%	90%	Control equipment operators follow daily O&M instructions.			
	81%	86%	84%	Control equipment operators follow daily or weekly O&M instructions.			
	70%	80%	75%	O&M requirements exist, but on no specific schedule.			
		< 70%	35%	No specific O&M requirements.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Unannounced Inspections	94%	100%	97%	Routinely conducted.	3%	97%	**2.9%**
	87%	93%	90%	Sometimes done.			
	81%	86%	84%	Done, but infrequently.			
	70%	80%	75%	Rarely done.			
		< 70%	35%	Never done.			

Enforcement Penalties	94%	100%	97%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.	3%	97%	**2.91%**
	87%	93%	90%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	81%	86%	84%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	70%	80%	75%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
		< 70%	35%	Agency does not have sufficient authority to impose punitive measures towards violators.			

C. Other factors (9 criteria, each assigned weighting of 2% of total):

Compliance Certifications	94%	100%	97%	Source subject to Title V or other type of compliance certification.	2%	97%	**1.94%**
	87%	93%	90%	Source subject to Title V or other type of compliance certification.			
	81%	86%	84%	Source not subject to any type of compliance certification.			
	70%	80%	75%	Source not subject to any type of compliance certification.			
		< 70%	35%	Source not subject to any type of compliance certification.			

Inspection Frequency	94%	100%	97%	Source(s) are inspected once every 2 years or more frequently.	2%	97%	**1.94%**
	87%	93%	90%	Source(s) are inspected once every 3 years or more frequently.			
	81%	86%	84%	Source(s) are inspected once every 5 years or more frequently.			
	70%	80%	75%	Inspection of source(s) infrequent; > every 5 years.			
		< 70%	35%	Inspections rarely, if ever, performed.			

EPA HPV Enforcement	94%	100%	97%	Agency has sufficient resources to implement EPA's 12/22/98 HPV policy.	2%	97%	**1.94%**
	87%	93%	90%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	81%	86%	84%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	70%	80%	75%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy more often than not.			
		< 70%	35%	Resource constraints prohibit agency from implementing EPA's 12/22/98 HPV policy in most instances.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Operator Training	94%	100%	97%	Control equipment operators complete a formal training program on use of the equipment, and such program is kept up to date and has been reviewed by the regulatory agency.			
	87%	93%	90%	Control equipment operators complete formal training program, and such program is kept up to date and available for review by the regulatory agency upon request.			
	81%	86%	84%	Control equipment operators complete some amount of formal training.	2%	84%	**1.68%**
	70%	0.8	75%	Control equipment operators receive only on the job training.			
		< 70%	35%	Control equipment operators receive no specific training.			
Media Publicity	94%	100%	97%	Media publicity of enforcement actions.	2%	97%	**1.94%**
	87%	93%	90%	Media publicity of enforcement actions.			
	81%	86%	84%	Media publicity of enforcement actions.			
	70%	80%	75%	Media publicity of enforcement actions.			
		< 70%	35%	No media publicity of enforcement actions.			
Regulatory Workshops	94%	100%	97%	Regulatory workshops are available annually, and/or the implementing agency mails regulatory information packages each year.	2%	97%	**1.94%**
	87%	93%	90%	Regulatory workshops are available every 1-2 years, and/or the implementing agency mails regulatory information packages every 1-2 years.			
	81%	86%	84%	Regulatory workshops are available every 2-3 years, and/or the implementing agency mails regulatory information packages once every 2-3 years.			
	70%	80%	75%	Regulatory workshop not routinely available, but implementing agency mails regulatory information packages out about once every 2-3 years.			
		< 70%	35%	Regulatory workshops not routinely available. Implementing agency mails regulatory information packages infrequently, if ever.			
Inspector Training	94%	100%	97%	Inspectors must undergo 2 weeks of comprehensive basic training, and 1 to 2 weeks of source specific training, and such training is updated each year.			
	87%	93%	90%	Inspectors must undergo 1 to 2 weeks of basic training and 1 week of source specific training and such training is updated every 1-2 years.	2%	90%	**1.80%**
	81%	86%	84%	Inspectors must undergo 1 to 2 weeks of basic training and 3 to 5 days of source specific training, and such training is updated every 1-2 years.			
	70%	80%	75%	Inspectors must undergo 1 to 2 weeks of basic training and 1 to 3 days of source specific training, and such training is updated every 1-2 years.			
		< 70%	35%	Inspectors must undergo less than 5 days of basic training less than 3 days of source specific training, and such training is updated only every 2 years or less frequently.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Testing Guidelines	94%	100%	97%	Specific guidelines and schedule for testing and test methods exist.	2%	97%	**1.94%**
	87%	93%	90%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	81%	86%	84%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	70%	80%	75%	Specific guidelines on testing and test methods, but no schedule for testing.			
		< 70%	35%	Only general guidance on testing, or no mention of testing requirements.			

Follow-up Inspections	94%	100%	97%	Follow-up inspections always or almost always conducted (90 % of the time or more).	2%	97%	**1.94%**
	87%	93%	90%	Follow-up inspections usually conducted (approximately 75% of the time).			
	81%	86%	84%	Follow-up inspections sometimes conducted (approximately 50% of the time).			
	70%	80%	75%	Follow-up inspections infrequently conducted (approximately 25% of the time).			
		< 70%	35%	Follow-up inspections rarely or never conducted (10% of the time or less)			

Overall rule effectiveness score for Title V facilities: 91.81%

Table B–3. Rule Effectiveness Matrix for Non-Title V Facilities

A. Most important factors (2 criteria, each assigned weighting of 35% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring	94%	100%	97%	Source specific monitoring used for compliance purposes, and monitoring records filed with regulatory agency at least every 4 months.			
	87%	93%	90%	Source specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency every 6 to 9 months.			
	81%	86%	84%	Source specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency each year.			
	70%	80%	75%	General guidance exists for source specific enhanced monitoring, and monitoring records required but aren't submitted to regulatory agency.	35%	75%	**26.3%**
		< 70%	35%	No requirements for any type of monitoring.			
Compliance History	94%	100%	97%	The facility has been in compliance for the past eight quarters.	35%	191 of 268 facilities	**24.2%**
	87%	93%	90%	The facility is believed to have been in compliance for the past eight quarters, although inspection frequency is such that this can't be positively confirmed.		19 of 268 facilities	**2.2%**
	81%	86%	84%	On schedule; the facility is meeting its compliance schedule.			
	70%	80%	75%	In Violation; facility is in violation of emissions and/or procedural requirements.		77 of 268 facilities	**7.5%**
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.		0 of 268 facilities	**0.0%**
						Sum:	**33.9%**

Overall Compliance Rate for Non-Title V facilities: **85.92%**

B. Other important factors (4 criteria, each assigned weighting of 3% of total):

Type of Inspection	94%	100%	97%	Inspections involve compliance test methods with a high degree of accuracy, such as stack testing or other types of precise emissions measurement.			
	87%	93%	90%	Inspections involve detailed review of process parameters & inspection of control equipment.	3%	90%	**2.7%**
	81%	86%	84%	Inspections involve review of process and inspection of control equipment.			
	70%	80%	75%	Inspections generally consist of only a records review.			
		< 70%	35%	Inspections most likely consist of visual inspection (e.g., opacity), or drive by.			
Operation & Maintenance	94%	100%	97%	Control equipment operators follow and sign daily O&M instructions.			
	87%	93%	90%	Control equipment operators follow daily O&M instructions.	3%	90%	**2.7%**
	81%	86%	84%	Control equipment operators follow daily or weekly O&M instructions.			
	70%	80%	75%	O&M requirements exist, but on no specific schedule.			
		< 70%	35%	No specific O&M requirements.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Unannounced Inspections	94%	100%	97%	Routinely conducted.	3%	97%	**2.91%**
	87%	93%	90%	Sometimes done.			
	81%	86%	84%	Done, but infrequently.			
	70%	80%	75%	Rarely done.			
		< 70%	35%	Never done.			

Enforcement Penalties	94%	100%	97%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.	3%	97%	**2.91%**
	87%	93%	90%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	81%	86%	84%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	70%	80%	75%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
		< 70%	35%	Agency does not have sufficient authority to impose punitive measures towards violators.			

C. Other factors (9 criteria, each assigned weighting of 2% of total):

Compliance Certifications	94%	100%	97%	Source subject to Title V or other type of compliance certification.			
	87%	93%	90%	Source subject to Title V or other type of compliance certification.			
	81%	86%	84%	Source not subject to any type of compliance certification.			
	70%	80%	75%	Source not subject to any type of compliance certification.	2%	75%	**1.5%**
		< 70%	35%	Source not subject to any type of compliance certification.			

Inspection Frequency	94%	100%	97%	Source(s) are inspected once every 2 years or more frequently.	2%	97%	**1.94%**
	87%	93%	90%	Source(s) inspected every 3 years or more frequently.			
	81%	86%	84%	Source(s) inspected every 5 years or more frequently.			
	70%	80%	75%	Inspection of source(s) infrequent; > every 5 years.			
		< 70%	35%	Inspections rarely, if ever, performed.			

EPA HPV Enforcement	94%	100%	97%	Agency has sufficient resources to implement EPA's 12/22/98 HPV policy.	2%	97%	**1.94%**
	87%	93%	90%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	81%	86%	84%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	70%	80%	75%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy more often than not.			
		< 70%	35%	Resource constraints prohibit agency from implementing EPA's 12/22/98 HPV policy in most instances.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score(= weight × value)
Operator Training	94%	100%	97%	Control equipment operators complete a formal training program on use of the equipment; the program is kept up to date and has been reviewed by the regulatory agency.			
	87%	93%	90%	Control equipment operators complete formal training program, and such program is kept up to date and available for review by the regulatory agency upon request.			
	81%	86%	84%	Control equipment operators complete some amount of formal training.			
	70%	0.8	75%	Control equipment operators receive only on the job training.	2%	75%	**1.50%**
		< 70%	35%	Control equipment operators receive no specific training.			
Media Publicity	94%	100%	97%	Media publicity of enforcement actions.	2%	97%	**1.94%**
	87%	93%	90%	Media publicity of enforcement actions.			
	81%	86%	84%	Media publicity of enforcement actions.			
	70%	80%	75%	Media publicity of enforcement actions.			
		< 70%	35%	No media publicity of enforcement actions.			
Regulatory Workshops	94%	100%	97%	Regulatory workshops are available annually, and/or the implementing agency mails regulatory information packages each year.	2%	97%	**1.94%**
	87%	93%	90%	Regulatory workshops are available every 1-2 years, and/or the implementing agency mails regulatory information packages every 1-2 years.			
	81%	86%	84%	Regulatory workshops are available every 2-3 years, and/or the implementing agency mails regulatory information packages once every 2-3 years.			
	70%	80%	75%	Regulatory workshop not routinely available, but implementing agency mails regulatory information packages out about once every 2-3 years.			
		< 70%	35%	Regulatory workshops not routinely available. The implementing agency mails regulatory information packages infrequently, if ever.			
Inspector Training	94%	100%	97%	Inspectors must undergo 2 weeks of comprehen-sive basic training, and 1 to 2 weeks of source specific training, and such training is updated each year.			
	87%	93%	90%	Inspectors must undergo 1 to 2 weeks of basic training and 1 week of source specific training and such training is updated every 1-2 years.	2%	90%	**1.80%**
	81%	86%	84%	Inspectors must undergo 1 to 2 weeks of basic training and 3 to 5 days of source specific training, and such training is updated every 1-2 years.			
	70%	80%	75%	Inspectors must undergo 1 to 2 weeks of basic training and 1 to 3 days of source specific training, and such training is updated every 1-2 years.			
		< 70%	35%	Inspectors must undergo less than 5 days of basic training less than 3 days of source specific training, and such training is updated only every 2 years or less frequently.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score(= weight × value)
Testing Guidelines	94%	100%	97%	Specific guidelines and schedule for testing and test methods exist.	2%	97%	**1.94%**
	87%	93%	90%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	81%	86%	84%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	70%	80%	75%	Specific guidelines on testing and test methods, but no schedule for testing.			
		< 70%	35%	Only general guidance on testing, or no mention of testing requirements.			

Follow-up Inspections	94%	100%	97%	Follow-up inspections always or almost always conducted (90 % of the time or more).	2%	97%	**1.94%**
	87%	93%	90%	Follow-up inspections usually conducted (approximately 75% of the time).			
	81%	86%	84%	Follow-up inspections sometimes conducted (approximately 50% of the time).			
	70%	80%	75%	Follow-up inspections infrequently conducted (approximately 25% of the time).			
		< 70%	35%	Follow-up inspections rarely or never conducted (10% of the time or less)			

Overall rule effectiveness score for non-Title V facilities: **87.81%**

Appendix C. MOVES2010b Local Input Data and RunSpecs

In order to calculate the 2011 annual and ozone season-day onroad source emissions, MOVES2010b was executed using local input data for each month of the year and each geographical area (the eight-hour ozone NAA and Maricopa County).

A portion of the MOVES2010b RunSpec Summary, RunSpec, and local input data for Maricopa County are provided in this appendix as an example.

MOVES2010b RunSpec Summary (Maricopa County, December 2011)

* Output Database Server Name: [using default]

* Scale:
  Domain/Scale: County
  Calculation Type: Inventory

* Time Spans:
  Time Aggregation Level: Hour
  Years: 2011
  Months: December
  Days: Weekend & Weekdays
  Hours: Start Hour 00:00 - 00:59 | End Hour 23:00 - 23:59

* Geographic Bounds:
  Region: County
  Selections: ARIZONA - Maricopa County
  Domain Input Database: pei_mc_2011_may2011_m2010b_in_v1

* Vehicles/Equipment
  On Road Vehicle Equipment:
    Diesel Fuel - Combination Long-haul Truck
    Diesel Fuel - Combination Short-haul Truck
    Diesel Fuel - Intercity Bus
    Diesel Fuel - Light Commercial Truck
    Diesel Fuel - Motor Home
    Diesel Fuel - Motorcycle
    Diesel Fuel - Passenger Car
    Diesel Fuel - Passenger Truck
    Diesel Fuel - Refuse Truck
    Diesel Fuel - School Bus
    Diesel Fuel - Single Unit Long-haul Truck
    Diesel Fuel - Single Unit Short-haul Truck
    Diesel Fuel - Transit Bus
    Gasoline - Combination Long-haul Truck
    Gasoline - Combination Short-haul Truck
    Gasoline - Intercity Bus
    Gasoline - Light Commercial Truck
    Gasoline - Motor Home
    Gasoline - Motorcycle
    Gasoline - Passenger Car
    Gasoline - Passenger Truck
    Gasoline - Refuse Truck
    Gasoline - School Bus
    Gasoline - Single Unit Long-haul Truck
    Gasoline - Single Unit Short-haul Truck
    Gasoline - Transit Bus
    Compressed natural Gas (CNG) - Combination Long-haul Truck
    Compressed natural Gas (CNG) - Combination Short-haul Truck
    Compressed natural Gas (CNG) - Intercity Bus
    Compressed natural Gas (CNG) - Light Commercial Truck
    Compressed natural Gas (CNG) - Motor Home
    Compressed natural Gas (CNG) - Motorcycle
    Compressed natural Gas (CNG) - Passenger Car
    Compressed natural Gas (CNG) - Passenger Truck
    Compressed natural Gas (CNG) - Refuse Truck
    Compressed natural Gas (CNG) - School Bus
    Compressed natural Gas (CNG) - Single Unit Long-haul Truck
    Compressed natural Gas (CNG) - Single Unit Short-haul Truck
    Compressed natural Gas (CNG) - Transit Bus

* Road Type
  Off-Network
  Rural Restricted Access
  Rural Unrestricted Access
  Urban Restricted Access
  Urban Unrestricted Access

* Pollutants and Processes
  Total Gaseous Hydrocarbons - Running Exhaust
  Total Gaseous Hydrocarbons - Start Exhaust
  Total Gaseous Hydrocarbons - Evap Permeation
  Total Gaseous Hydrocarbons - Evap Fuel Vapor Venting
  Total Gaseous Hydrocarbons - Evap Fuel Leaks
  Total Gaseous Hydrocarbons - Crankcase Running Exhaust
  Total Gaseous Hydrocarbons - Crankcase Start Exhaust
  Total Gaseous Hydrocarbons - Crankcase Extended Idle Exhaust
  Total Gaseous Hydrocarbons - Refueling Displacement Vapor Loss
  Total Gaseous Hydrocarbons - Refueling Spillage Loss
  Total Gaseous Hydrocarbons - Extended Idle Exhaust
  Carbon Monoxide (CO) - Running Exhaust
  Carbon Monoxide (CO) - Start Exhaust
  Carbon Monoxide (CO) - Crankcase Running Exhaust
  Carbon Monoxide (CO) - Crankcase Start Exhaust
  Carbon Monoxide (CO) - Crankcase Extended Idle Exhaust
  Carbon Monoxide (CO) - Extended Idle Exhaust
  Oxides of Nitrogen (NOx) - Running Exhaust
  Oxides of Nitrogen (NOx) - Start Exhaust
  Oxides of Nitrogen (NOx) - Crankcase Running Exhaust
  Oxides of Nitrogen (NOx) - Crankcase Start Exhaust
  Oxides of Nitrogen (NOx) - Crankcase Extended Idle Exhaust
  Oxides of Nitrogen (NOx) - Extended Idle Exhaust
  Methane (CH4) - Running Exhaust
  Methane (CH4) - Start Exhaust
  Methane (CH4) - Crankcase Running Exhaust
  Methane (CH4) - Crankcase Start Exhaust
  Methane (CH4) - Crankcase Extended Idle Exhaust
  Methane (CH4) - Refueling Displacement Vapor Loss
  Methane (CH4) - Refueling Spillage Loss
  Methane (CH4) - Extended Idle Exhaust
  Non-Methane Hydrocarbons - Running Exhaust
  Non-Methane Hydrocarbons - Start Exhaust
  Non-Methane Hydrocarbons - Evap Permeation
  Non-Methane Hydrocarbons - Evap Fuel Vapor Venting
  Non-Methane Hydrocarbons - Evap Fuel Leaks
  Non-Methane Hydrocarbons - Crankcase Running Exhaust
  Non-Methane Hydrocarbons - Crankcase Start Exhaust
  Non-Methane Hydrocarbons - Crankcase Extended Idle Exhaust
  Non-Methane Hydrocarbons - Refueling Displacement Vapor Loss
  Non-Methane Hydrocarbons - Refueling Spillage Loss
  Non-Methane Hydrocarbons - Extended Idle Exhaust
  Non-Methane Organic Gases - Running Exhaust
  Non-Methane Organic Gases - Start Exhaust
  Non-Methane Organic Gases - Evap Permeation
  Non-Methane Organic Gases - Evap Fuel Vapor Venting
  Non-Methane Organic Gases - Evap Fuel Leaks
  Non-Methane Organic Gases - Crankcase Running Exhaust
  Non-Methane Organic Gases - Crankcase Start Exhaust
  Non-Methane Organic Gases - Crankcase Extended Idle Exhaust
  Non-Methane Organic Gases - Refueling Displacement Vapor Loss
  Non-Methane Organic Gases - Refueling Spillage Loss
  Non-Methane Organic Gases - Extended Idle Exhaust
  Total Organic Gases - Running Exhaust
  Total Organic Gases - Start Exhaust
  Total Organic Gases - Evap Permeation
  Total Organic Gases - Evap Fuel Vapor Venting
  Total Organic Gases - Evap Fuel Leaks
  Total Organic Gases - Crankcase Running Exhaust
  Total Organic Gases - Crankcase Start Exhaust
  Total Organic Gases - Crankcase Extended Idle Exhaust
  Total Organic Gases - Refueling Displacement Vapor Loss
  Total Organic Gases - Refueling Spillage Loss
  Total Organic Gases - Extended Idle Exhaust
  Volatile Organic Compounds - Running Exhaust
  Volatile Organic Compounds - Start Exhaust
  Volatile Organic Compounds - Evap Permeation
  Volatile Organic Compounds - Evap Fuel Vapor Venting
  Volatile Organic Compounds - Evap Fuel Leaks
  Volatile Organic Compounds - Crankcase Running Exhaust

Volatile Organic Compounds - Crankcase Start Exhaust
Volatile Organic Compounds - Crankcase Extended Idle Exhaust
Volatile Organic Compounds - Refueling Displacement Vapor Loss
Volatile Organic Compounds - Refueling Spillage Loss
Volatile Organic Compounds - Extended Idle Exhaust

* Manage Input Data Sets
Selections: / StageII_Input / Stage II Refueling Input

* Output
General Output:
Output Database: pei_mc_2011_may2011_m2010b_out_v1
Units: Mass Units (Grams) | Energy Units (Joules) | Distance Units (Miles)
Activity: Distance Traveled | Source Hours | Source Hours Idling | Source Hours Operating | Source Hours Parked | Population | Starts
Output Emissions Detail:
Always: Time (Month) | Location (NATION) | Pollutant
For All Vehicle/Equipment Categories: Fuel Type | Emission Process
On Road: SCC

MOVES2010b RunSpec (Maricopa County, December 2011)

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Truck"/>
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Truck"/>
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Truck"/>
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Car"/>
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Truck"/>
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Commercial Truck"/>
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Bus"/>
      <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="42" sourcetypename="Transit
Bus"/>
      <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="43" sourcetypename="School
Bus"/>
      <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="51" sourcetypename="Refuse
Truck"/>
      <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="52" sourcetypename="Single Unit
Short-haul Truck"/>
      <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="53" sourcetypename="Single Unit
Long-haul Truck"/>
      <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="54" sourcetypename="Motor
Home"/>
      <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="61" sourcetypename="Combination
Short-haul Truck"/>
      <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="62" sourcetypename="Combination
Long-haul Truck"/>
   </onroadvehicleselections>
   <offroadvehicleselections>
   </offroadvehicleselections>
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      <roadtype roadtypeid="2" roadtypename="Rural Restricted Access"/>
      <roadtype roadtypeid="3" roadtypename="Rural Unrestricted Access"/>
      <roadtype roadtypeid="4" roadtypename="Urban Restricted Access"/>
      <roadtype roadtypeid="5" roadtypename="Urban Unrestricted Access"/>
   </roadtypes>
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      <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="1" processname="Running
Exhaust"/>

      <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="2" processname="Start
Exhaust"/>

      <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="11" processname="Evap
Permeation"/>

      <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="12" processname="Evap Fuel
```

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Vapor Venting"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="13" processname="Evap Fuel
Leaks"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="15" processname="Crankcase
Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="16" processname="Crankcase
Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="18" processname="Refueling
Displacement Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="19" processname="Refueling
Spillage Loss"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="90" processname="Extended
Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="1" processname="Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="2" processname="Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="15" processname="Crankcase Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="16" processname="Crankcase Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="90" processname="Extended Idle
Exhaust"/>

     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="1" processname="Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="2" processname="Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="15" processname="Crankcase
Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="16" processname="Crankcase
Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="90" processname="Extended Idle
Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="1" processname="Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="2" processname="Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="15" processname="Crankcase Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="16" processname="Crankcase Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="17" processname="Crankcase Extended Idle
Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="18" processname="Refueling Displacement
Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="19" processname="Refueling Spillage
Loss"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="90" processname="Extended Idle Exhaust"/>

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Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="2" processname="Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="11" processname="Evap
Permeation"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="12" processname="Evap Fuel
Vapor Venting"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="13" processname="Evap Fuel
Leaks"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="15" processname="Crankcase
Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="16" processname="Crankcase
Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>
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     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="18" processname="Refueling
Displacement Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="19" processname="Refueling
Spillage Loss"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="90" processname="Extended
Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="1" processname="Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="2" processname="Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="11" processname="Evap
Permeation"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="12" processname="Evap Fuel
Vapor Venting"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="13" processname="Evap Fuel
Leaks"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="15" processname="Crankcase
Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="16" processname="Crankcase
Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="18" processname="Refueling
Displacement Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="19" processname="Refueling
Spillage Loss"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="90" processname="Extended
Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="1" processname="Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="2" processname="Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="11" processname="Evap
Permeation"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="12" processname="Evap Fuel Vapor
Venting"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="13" processname="Evap Fuel
Leaks"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="15" processname="Crankcase Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="16" processname="Crankcase Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="18" processname="Refueling
Displacement Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="19" processname="Refueling
Spillage Loss"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="90" processname="Extended Idle
Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="1" processname="Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="2" processname="Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="11" processname="Evap
Permeation"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="12" processname="Evap Fuel
Vapor Venting"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="13" processname="Evap Fuel
Leaks"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="15" processname="Crankcase
Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="16" processname="Crankcase
Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="18" processname="Refueling
Displacement Vapor Loss"/>
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    <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="19" processname="Refueling
Spillage Loss"/>

    <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="90" processname="Extended
Idle Exhaust"/>

  </pollutantprocessassociations>
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  <databaseselection servername="" databasename="StageII_Input" description="Stage II Refueling Input"/>
  </databaseselections>
  <internalcontrolstrategies>
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classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontrolstrategies.rateofprogress.RateOfProgressStrategy"><![CDATA
[
useParameters                No
]]></internalcontrolstrategy>
  </internalcontrolstrategies>
  <inputdatabase servername="" databasename="" description=""/>
  <uncertaintyparameters uncertaintymodeenabled="false" numberofrunspersimulation="0" numberofsimulations="0"/>
  <geographicoutputdetail description="LINK"/>
  <outputemissionsbreakdownselection>
    <modelyear selected="false"/>
    <fueltype selected="true"/>
    <emissionprocess selected="true"/>
    <onroadoffroad selected="true"/>
    <roadtype selected="true"/>
    <sourceusetype selected="false"/>
    <movesvehicletype selected="false"/>
    <onroadscc selected="true"/>
    <offroadscc selected="false"/>
    <estimateuncertainty selected="false" numberOfIterations="2" keepSampledData="false" keepIterations="false"/>
    <sector selected="false"/>
    <engtechid selected="false"/>
    <hpclass selected="false"/>
  </outputemissionsbreakdownselection>
  <outputdatabase servername="" databasename="pei_mc_2011_may2011_m2010b_out_v1" description=""/>
  <outputtimestep value="Month"/>
  <outputvmtdata value="true"/>
  <outputsho value="true"/>
  <outputsh value="true"/>
  <outputshp value="true"/>
  <outputshidling value="true"/>
  <outputstarts value="true"/>
  <outputpopulation value="true"/>
  <scaleinputdatabase servername="localhost" databasename="pei_mc_2011_may2011_m2010b_in_v1" description=""/>
  <pmsize value="0"/>
  <outputfactors>
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    <distancefactors selected="true" units="Miles"/>
    <massfactors selected="true" units="Grams" energyunits="Joules"/>
  </outputfactors>
  <savedata>
  </savedata>
  <donotexecute>
  </donotexecute>
  <generatordatabase shouldsave="false" servername="" databasename="" description=""/>
    <donotperformfinalaggregation selected="false"/>
  <lookuptableflags scenarioid="pei_mc_2011_may2011_m2010b_in_v1" truncateoutput="true" truncateactivity="true"/>
</runspec>
```

MOVES2010b Local Input Data (Maricopa County, December 2011)

[FuelFormulation]

Fuel Formulation	Fuel Subtype	RVP	Sulfur Level	ETOH Volume	MTBE Volume	ETBE Volume	TAME Volume	Aromatic Content	Olefin Content	Benzene Content	e200	e300	volToWtPercentOxy	BioDiesel Ester	Cetane Index	PAH Content	T50	T90
11100	12	8.02	20.2	10.	0	0.00194	0.05179	19.6	9.2	1.2	47.9	88.0	2.1717	0	0	0	197.721	309.431
11101	12	8.81	15.4	10.	0	0	0	17.5	6.5	0.9	53.3	90.7	3.7575	0	0	0	185.333	295.25
11102	13	8.79	14.7	10.	0	0	0	20.1	9.1	0.9	54.6	89.4	3.1457	0	0	0	177.636	302.727
11103	12	10.7	15.0	10.	0	0	0	31.9	14.	1.9	54.0	86.0	3.5900	0	0	0	170	317
11104	14	6.94	24.6	10.	0	0.00428	0.11395	19.6	9.9	0.9	42.7	86.7	0.7805	0	0	0	212.908	315.856
11105	12	8.02	26.0	10.	0	0	0	19.9	6.8	0.8	46.0	90.0	3.7400	0	0	0	210	297
11106	11	6.54	22.0	10.	0	0	0	17.6	10.	0.7	45.0	85.5	0.0000	0	0	0	209	320
11107	14	6.80	23.3	10.	0	0	0.36666	21.4	10.	1.2	44.3	86.0	0.1000	0	0	0	212	322
11108	11	6.64	27.2	10.	0	0.02142	0.08571	19.9	11.	0.8	39.0	86.3	0.0171	0	0	0	217	319
11109	14	6.69	24.5	10.	0	0	0.11739	19.2	10.	0.7	39.3	85.8	0.0454	0	0	0	216.543	321.282
11110	13	8.16	19.3	10.	0	0	0	17.0	8.5	0.9	47.8	88.3	2.6418	0	0	0	195.941	310.647
11111	13	8.49	18.7	10.	0	0	0	15.2	6.4	0.8	51.5	90.1	3.2706	0	0	0	191.117	300.294
11112	12	8.53	16.3	10.	0	0	0	16.0	6.4	3.7	51.6	90.3	3.5806	0	0	0	190.363	298.545
21100	12	8.02	20.2	0.0	0	0.00194	0.05179	19.6	9.2	1.2	47.9	88.0	2.1717	0	0	0	197.721	309.431
21101	12	8.81	15.4	0.0	0	0	0	17.5	6.5	0.9	53.3	90.7	3.7575	0	0	0	185.333	295.25
21102	13	8.79	14.7	0.0	0	0	0	20.1	9.1	0.9	54.6	89.4	3.1457	0	0	0	177.636	302.727
21103	12	10.7	15.0	0.0	0	0	0	31.9	14.	1.9	54.0	86.0	3.5900	0	0	0	170	317
21104	14	6.94	24.6	0.0	0	0.00428	0.11395	19.6	9.9	0.9	42.7	86.7	0.7805	0	0	0	212.908	315.856
21105	12	8.02	26.0	0.0	0	0	0	19.9	6.8	0.8	46.0	90.0	3.7400	0	0	0	210	297
21106	11	6.54	22.0	0.0	0	0	0	17.6	10.	0.7	45.0	85.5	0.0000	0	0	0	209	320
21107	14	6.80	23.3	0.0	0	0	0.36666	21.4	10.	1.2	44.3	86.0	0.1000	0	0	0	212	322
21108	11	6.64	27.2	0.0	0	0.02142	0.08571	19.9	11.	0.8	39.0	86.3	0.0171	0	0	0	217	319
21109	14	6.69	24.5	0.0	0	0	0.11739	19.2	10.	0.7	39.3	85.8	0.0454	0	0	0	216.543	321.282
21110	13	8.16	19.3	0.0	0	0	0	17.0	8.5	0.9	47.8	88.3	2.6418	0	0	0	195.941	310.647
21111	13	8.49	18.7	0.0	0	0	0	15.2	6.4	0.8	51.5	90.1	3.2706	0	0	0	191.117	300.294
21112	12	8.53	16.3	0.0	0	0	0	16.0	6.4	3.7	51.6	90.3	3.5806	0	0	0	190.363	298.545
31000	20	0	5.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31001	20	0	5.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31002	20	0	5.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31003	20	0	5.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31004	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31005	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31006	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31007	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31008	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31009	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31010	20	0	5.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31011	20	0	7.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31012	20	0	5.60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[HPMSvTypeYear]

HPMSVtypeID	yearID	VMTGrowthFactor	HPMSBaseYearVMT	baseYearOffNetVMT
10	2011	0	623037600.1	0
20	2011	0	15806675171	0
30	2011	0	12967244959	0
40	2011	0	118381498.4	0
50	2011	0	1281267928	0
60	2011	0	1646318085	0

[SourceTypeYear]

yearID	sourceTypeID	sourceTypePopulation
2011	11	75309
2011	21	2044983
2011	31	440595.7
2011	32	172099
2011	41	1172.42
2011	42	718.58
2011	43	7592.578
2011	51	585.7895
2011	52	21663.06
2011	53	1344.71
2011	54	3344.705
2011	61	9859.552
2011	62	8092.895

[FuelSupply]

countyID	fuelYearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV
4013	2011	1	21101	0.05	0.5
4013	2011	1	11101	0.95	0.5
4013	2011	1	31001	1	0.5
4013	2011	1	30	1	0.5
4013	2011	2	21102	0.05	0.5
4013	2011	2	11102	0.95	0.5
4013	2011	2	31002	1	0.5
4013	2011	2	30	1	0.5
4013	2011	3	21103	0.05	0.5
4013	2011	3	11103	0.95	0.5
4013	2011	3	31003	1	0.5
4013	2011	3	30	1	0.5
4013	2011	4	21104	0.05	0.5
4013	2011	4	11104	0.95	0.5
4013	2011	4	31004	1	0.5
4013	2011	4	30	1	0.5
4013	2011	5	21105	0.05	0.5
4013	2011	5	11105	0.95	0.5
4013	2011	5	31005	1	0.5
4013	2011	5	30	1	0.5
4013	2011	6	21106	0.05	0.5
4013	2011	6	11106	0.95	0.5
4013	2011	6	31006	1	0.5
4013	2011	6	30	1	0.5
4013	2011	7	21107	0.05	0.5
4013	2011	7	11107	0.95	0.5
4013	2011	7	31007	1	0.5
4013	2011	7	30	1	0.5
4013	2011	8	21108	0.05	0.5
4013	2011	8	11108	0.95	0.5
4013	2011	8	31008	1	0.5
4013	2011	8	30	1	0.5
4013	2011	9	21109	0.05	0.5
4013	2011	9	11109	0.95	0.5
4013	2011	9	31009	1	0.5
4013	2011	9	30	1	0.5
4013	2011	10	21110	0.05	0.5
4013	2011	10	11110	0.95	0.5
4013	2011	10	31010	1	0.5
4013	2011	10	30	1	0.5
4013	2011	11	21111	0.05	0.5
4013	2011	11	11111	0.95	0.5
4013	2011	11	31011	1	0.5
4013	2011	11	30	1	0.5
4013	2011	12	21112	0.05	0.5
4013	2011	12	11112	0.95	0.5
4013	2011	12	31012	1	0.5
4013	2011	12	30	1	0.5

[ZoneMonthHour]

monthID	zoneID	HourID	temperature	relHumidity
12	40130	1	48	62
12	40130	2	47	65
12	40130	3	47	64
12	40130	4	47	64
12	40130	5	46	66
12	40130	6	46	66
12	40130	7	45	68
12	40130	8	46	67
12	40130	9	48	62
12	40130	10	52	54
12	40130	11	55	48
12	40130	12	57	43
12	40130	13	59	40
12	40130	14	60	38
12	40130	15	61	36
12	40130	16	62	35
12	40130	17	61	37
12	40130	18	58	42
12	40130	19	56	47
12	40130	20	54	51
12	40130	21	53	52
12	40130	22	52	56
12	40130	23	50	59
12	40130	24	49	60
12	40130	1	48	62

[SourceTypeAgeDistribution]

SourceTypeID	YearID	AgeID	AgeFraction
11	2011	0	0.029892
11	2011	1	0.036417
11	2011	2	0.083781
11	2011	3	0.101569
11	2011	4	0.116094
11	2011	5	0.105884
11	2011	6	0.08115
11	2011	7	0.058941
11	2011	8	0.067783
11	2011	9	0.054942
11	2011	10	0.046522
11	2011	11	0.038838
11	2011	12	0.031681
11	2011	13	0.023471
11	2011	14	0.018524
11	2011	15	0.017472
11	2011	16	0.014525
11	2011	17	0.011157
11	2011	18	0.010525
11	2011	19	0.007262
11	2011	20	0.005157
11	2011	21	0.005263
11	2011	22	0.005052
11	2011	23	0.004631
11	2011	24	0.004245
11	2011	25	0.003891
11	2011	26	0.003567
11	2011	27	0.00327
11	2011	28	0.002997
11	2011	29	0.002748
11	2011	30	0.002748
21	2011	0	0.043696
21	2011	1	0.053295
21	2011	2	0.042596
21	2011	3	0.068793
21	2011	4	0.083192
21	2011	5	0.080592
21	2011	6	0.077392
21	2011	7	0.070493
21	2011	8	0.065393
21	2011	9	0.061294
21	2011	10	0.056294
21	2011	11	0.051995
21	2011	12	0.043696
21	2011	13	0.034097
21	2011	14	0.029997
21	2011	15	0.022198
21	2011	16	0.021098
21	2011	17	0.015798
21	2011	18	0.012199
21	2011	19	0.009499
21	2011	20	0.008099
21	2011	21	0.006399
21	2011	22	0.005299
21	2011	23	0.004
21	2011	24	0.003019
21	2011	25	0.002278
21	2011	26	0.001719
21	2011	27	0.001298
21	2011	28	0.000979
21	2011	29	0.000739
21	2011	30	0.022565
31	2011	0	0.040367
31	2011	1	0.036952
31	2011	2	0.023272
31	2011	3	0.060977
31	2011	4	0.080902
31	2011	5	0.086168
31	2011	6	0.070426
31	2011	7	0.071799
31	2011	8	0.060662
31	2011	9	0.054761
31	2011	10	0.061661
31	2011	11	0.055069
31	2011	12	0.041776
31	2011	13	0.034756
31	2011	14	0.036143
31	2011	15	0.02573
31	2011	16	0.02484
31	2011	17	0.022254
31	2011	18	0.014775
31	2011	19	0.010328
31	2011	20	0.008996
31	2011	21	0.007982
31	2011	22	0.008785
31	2011	23	0.006661
31	2011	24	0.005076
31	2011	25	0.003888
31	2011	26	0.003002
31	2011	27	0.002329
31	2011	28	0.001818
31	2011	29	0.001418
31	2011	30	0.036429
32	2011	0	0.043709
32	2011	1	0.037275
32	2011	2	0.024506
32	2011	3	0.063116
32	2011	4	0.086828
32	2011	5	0.091952
32	2011	6	0.071425
32	2011	7	0.069687
32	2011	8	0.057689
32	2011	9	0.051358
32	2011	10	0.058053
32	2011	11	0.055657
32	2011	12	0.041337
32	2011	13	0.03425
32	2011	14	0.036441
32	2011	15	0.02487
32	2011	16	0.023712
32	2011	17	0.02089
32	2011	18	0.013959
32	2011	19	0.009727
32	2011	20	0.008543
32	2011	21	0.007639
32	2011	22	0.00826
32	2011	23	0.006259
32	2011	24	0.004777
32	2011	25	0.00368
32	2011	26	0.002847
32	2011	27	0.002226
32	2011	28	0.001755
32	2011	29	0.001411
32	2011	30	0.036162
41	2011	0	0.038296
41	2011	1	0.015698
41	2011	2	0.027397
41	2011	3	0.064494
41	2011	4	0.149585
41	2011	5	0.139386
41	2011	6	0.09579
41	2011	7	0.060294
41	2011	8	0.043396
41	2011	9	0.034397
41	2011	10	0.044396
41	2011	11	0.055294
41	2011	12	0.052495
41	2011	13	0.028097
41	2011	14	0.027297
41	2011	15	0.025797
41	2011	16	0.024298
41	2011	17	0.014999
41	2011	18	0.009599
41	2011	19	0.007199
41	2011	20	0.006299
41	2011	21	0.009299
41	2011	22	0.006299
41	2011	23	0.0048
41	2011	24	0.003657
41	2011	25	0.002786
41	2011	26	0.002123
41	2011	27	0.001617
41	2011	28	0.001232
41	2011	29	0.000939
41	2011	30	0.002744
42	2011	0	0.038296
42	2011	1	0.015698
42	2011	2	0.027397
42	2011	3	0.064494
42	2011	4	0.149585
42	2011	5	0.139386
42	2011	6	0.09579
42	2011	7	0.060294
42	2011	8	0.043396
42	2011	9	0.034397
42	2011	10	0.044396
42	2011	11	0.055294
42	2011	12	0.052495
42	2011	13	0.028097
42	2011	14	0.027297
42	2011	15	0.025797
42	2011	16	0.024298
42	2011	17	0.014999
42	2011	18	0.009599
42	2011	19	0.007199
42	2011	20	0.006299
42	2011	21	0.009299
42	2011	22	0.006299
42	2011	23	0.0048
42	2011	24	0.003657
42	2011	25	0.002786
42	2011	26	0.002123
42	2011	27	0.001617
42	2011	28	0.001232
42	2011	29	0.000939
42	2011	30	0.002744
43	2011	0	0.075389
43	2011	1	0.040094
43	2011	2	0.037195
43	2011	3	0.085088
43	2011	4	0.147379
43	2011	5	0.151778
43	2011	6	0.083488
43	2011	7	0.051493
43	2011	8	0.030696
43	2011	9	0.020197
43	2011	10	0.024996
43	2011	11	0.063691
43	2011	12	0.038794
43	2011	13	0.030796
43	2011	14	0.041094
43	2011	15	0.017397
43	2011	16	0.013008
43	2011	17	0.00801
43	2011	18	0.005722
43	2011	19	0.003933
43	2011	20	0.004121
43	2011	21	0.004475
43	2011	22	0.003412
43	2011	23	0.002644
43	2011	24	0.002026
43	2011	25	0.001526
43	2011	26	0.001172
43	2011	27	0.000893
43	2011	28	0.000686
43	2011	29	0.000527
43	2011	30	0.008281
51	2011	0	0.075401
51	2011	1	0.0401
51	2011	2	0.0372
51	2011	3	0.085101
51	2011	4	0.147402
51	2011	5	0.151802
51	2011	6	0.083501
51	2011	7	0.051501
51	2011	8	0.0307
51	2011	9	0.0202
51	2011	10	0.025
51	2011	11	0.063701
51	2011	12	0.0388
51	2011	13	0.0308
51	2011	14	0.0411
51	2011	15	0.0174
51	2011	16	0.013199
51	2011	17	0.008099
51	2011	18	0.0059
51	2011	19	0.003999
51	2011	20	0.004199
51	2011	21	0.004499
51	2011	22	0.003399
51	2011	23	0.002599
51	2011	24	0.001988
51	2011	25	0.00152
51	2011	26	0.001162
51	2011	27	0.000889
51	2011	28	0.00068
51	2011	29	0.00052
51	2011	30	0.007638
52	2011	0	0.066214
52	2011	1	0.039334
52	2011	2	0.03318
52	2011	3	0.078132
52	2011	4	0.128378
52	2011	5	0.132775
52	2011	6	0.079084

Source TypeID	YearID	AgeID	AgeFraction
52	2011	7	0.056074
52	2011	8	0.038042
52	2011	9	0.02878
52	2011	10	0.034102
52	2011	11	0.060507
52	2011	12	0.038954
52	2011	13	0.031317
52	2011	14	0.039113
52	2011	15	0.019306
52	2011	16	0.016191
52	2011	17	0.011791
52	2011	18	0.008363
52	2011	19	0.005691
52	2011	20	0.005513
52	2011	21	0.005414
52	2011	22	0.004802
52	2011	23	0.003655
52	2011	24	0.00283
52	2011	25	0.002259
52	2011	26	0.00176
52	2011	27	0.001429
52	2011	28	0.001176
52	2011	29	0.001073
52	2011	30	0.02476
53	2011	0	0.074869
53	2011	1	0.040084
53	2011	2	0.036613
53	2011	3	0.08406
53	2011	4	0.144792
53	2011	5	0.148968
53	2011	6	0.082261
53	2011	7	0.050975
53	2011	8	0.030557
53	2011	9	0.02016
53	2011	10	0.024955
53	2011	11	0.062595
53	2011	12	0.038177
53	2011	13	0.030303
53	2011	14	0.040308
53	2011	15	0.017217
53	2011	16	0.013996
53	2011	17	0.008668
53	2011	18	0.006817
53	2011	19	0.004401
53	2011	20	0.004658
53	2011	21	0.004706
53	2011	22	0.003492
53	2011	23	0.002575
53	2011	24	0.002017
53	2011	25	0.001726
53	2011	26	0.001332

Source TypeID	YearID	AgeID	AgeFraction
53	2011	27	0.001106
53	2011	28	0.000916
53	2011	29	0.000861
53	2011	30	0.015836
54	2011	0	0.075419
54	2011	1	0.04011
54	2011	2	0.037209
54	2011	3	0.085122
54	2011	4	0.147438
54	2011	5	0.151839
54	2011	6	0.083521
54	2011	7	0.051513
54	2011	8	0.030708
54	2011	9	0.020205
54	2011	10	0.025006
54	2011	11	0.063716
54	2011	12	0.03881
54	2011	13	0.030808
54	2011	14	0.04111
54	2011	15	0.017404
54	2011	16	0.012531
54	2011	17	0.007698
54	2011	18	0.005268
54	2011	19	0.003727
54	2011	20	0.003917
54	2011	21	0.004384
54	2011	22	0.003365
54	2011	23	0.002681
54	2011	24	0.002082
54	2011	25	0.001515
54	2011	26	0.00117
54	2011	27	0.000884
54	2011	28	0.000678
54	2011	29	0.000526
54	2011	30	0.009633
61	2011	0	0.075521
61	2011	1	0.040164
61	2011	2	0.03726
61	2011	3	0.085237
61	2011	4	0.147637
61	2011	5	0.152044
61	2011	6	0.083634
61	2011	7	0.051583
61	2011	8	0.030749
61	2011	9	0.020232
61	2011	10	0.02504
61	2011	11	0.063802
61	2011	12	0.038862
61	2011	13	0.030849
61	2011	14	0.041166
61	2011	15	0.017428

Source TypeID	YearID	AgeID	AgeFraction
61	2011	16	0.013144
61	2011	17	0.00788
61	2011	18	0.005826
61	2011	19	0.003897
61	2011	20	0.004157
61	2011	21	0.004432
61	2011	22	0.003239
61	2011	23	0.002455
61	2011	24	0.001916
61	2011	25	0.001465
61	2011	26	0.001114
61	2011	27	0.000846
61	2011	28	0.00063
61	2011	29	0.000485
61	2011	30	0.007306
62	2011	0	0.075452
62	2011	1	0.040127
62	2011	2	0.037225
62	2011	3	0.085158
62	2011	4	0.147501
62	2011	5	0.151904
62	2011	6	0.083557
62	2011	7	0.051535
62	2011	8	0.030721
62	2011	9	0.020214
62	2011	10	0.025017
62	2011	11	0.063744
62	2011	12	0.038827
62	2011	13	0.030821
62	2011	14	0.041128
62	2011	15	0.017412
62	2011	16	0.013178
62	2011	17	0.008015
62	2011	18	0.005871
62	2011	19	0.003959
62	2011	20	0.00418
62	2011	21	0.00447
62	2011	22	0.003336
62	2011	23	0.00254
62	2011	24	0.001955
62	2011	25	0.001495
62	2011	26	0.001141
62	2011	27	0.00087
62	2011	28	0.000659
62	2011	29	0.000505
62	2011	30	0.007485

[IMCoverage]

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
101	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
101	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
101	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
101	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
101	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
101	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
101	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
101	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
101	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
101	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
102	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
102	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
102	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
102	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
102	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
102	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
102	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
102	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
102	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
102	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
112	4	4013	2011	21	1	8	1996	2005	2	43	N	95.8845
112	4	4013	2011	21	1	9	1981	1995	1	44	N	95.8845
112	4	4013	2011	31	1	8	1996	2005	2	43	N	95.8845
112	4	4013	2011	31	1	9	1981	1995	1	44	N	95.8845
112	4	4013	2011	32	1	8	1996	2005	2	43	N	95.8845
112	4	4013	2011	32	1	9	1981	1995	1	44	N	95.8845
112	4	4013	2011	52	1	7	1967	2005	1	41	N	95.8845
113	4	4013	2011	21	1	8	1996	2005	2	43	N	95.8845
113	4	4013	2011	21	1	9	1981	1995	1	44	N	95.8845
113	4	4013	2011	31	1	8	1996	2005	2	43	N	95.8845
113	4	4013	2011	31	1	9	1981	1995	1	44	N	95.8845
113	4	4013	2011	32	1	8	1996	2005	2	43	N	95.8845
113	4	4013	2011	32	1	9	1981	1995	1	44	N	95.8845
113	4	4013	2011	52	1	7	1967	2005	1	41	N	95.8845
201	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
201	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
201	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
201	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
201	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
201	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
201	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
201	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
201	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
201	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
202	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
202	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
202	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
202	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
202	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
202	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
202	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
202	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
202	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
202	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
301	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
301	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
301	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
301	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
301	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
301	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
301	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
301	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
301	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
301	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
302	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
302	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
302	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
302	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
302	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
302	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
302	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
302	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
302	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
302	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
101	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
101	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
101	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
101	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
101	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
101	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
101	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
101	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
101	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
101	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
102	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
102	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
102	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
102	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
102	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
102	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
102	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
102	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
102	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
102	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
112	4	4013	2011	21	1	108	1996	2007	2	43	Y	83.814
112	4	4013	2011	21	1	109	1981	1995	2	44	Y	64.12
112	4	4013	2011	31	1	108	1996	2007	2	43	Y	83.814
112	4	4013	2011	31	1	109	1981	1995	2	44	Y	64.12
112	4	4013	2011	32	1	108	1996	2007	2	43	Y	83.814
112	4	4013	2011	32	1	109	1981	1995	2	44	Y	64.12
112	4	4013	2011	52	1	107	1981	2007	1	41	Y	86.2872
113	4	4013	2011	21	1	108	1996	2007	2	43	Y	83.814
113	4	4013	2011	21	1	109	1981	1995	2	44	Y	64.12
113	4	4013	2011	31	1	108	1996	2007	2	43	Y	83.814
113	4	4013	2011	31	1	109	1981	1995	2	44	Y	64.12
113	4	4013	2011	32	1	108	1996	2007	2	43	Y	83.814
113	4	4013	2011	32	1	109	1981	1995	2	44	Y	64.12
113	4	4013	2011	52	1	107	1981	2007	1	41	Y	86.2872
201	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
201	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
201	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
201	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
201	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
201	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
201	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
201	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
201	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
201	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
202	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
202	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
202	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
202	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
202	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
202	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
202	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
202	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
202	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
202	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
301	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
301	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
301	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
301	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
301	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
301	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
301	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
301	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
301	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
301	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
302	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
302	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
302	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
302	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
302	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
302	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
302	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
302	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
302	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
302	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032

[RoadType]

roadTypeID	rampFraction
2	0.054636
4	0.111569

[RoadTypeDistribution]

sourceTypeID	roadTypeID	roadTypeVMTFraction
11	1	0
11	2	0.013318
11	3	0.05643
11	4	0.290786
11	5	0.639467
21	1	0
21	2	0.021036
21	3	0.039609
21	4	0.296909
21	5	0.642446
31	1	0
31	2	0.050257
31	3	0.044142
31	4	0.371289
31	5	0.534312
32	1	0
32	2	0.050257
32	3	0.044142
32	4	0.371289
32	5	0.534312
41	1	0
41	2	0.030808
41	3	0.032603
41	4	0.500175
41	5	0.436415
42	1	0
42	2	0.030808
42	3	0.032603
42	4	0.500175
42	5	0.436415
43	1	0
43	2	0.030808
43	3	0.032603
43	4	0.500175
43	5	0.436415
51	1	0
51	2	0.043408
51	3	0.027296
51	4	0.52444
51	5	0.404856
52	1	0
52	2	0.043408
52	3	0.027296
52	4	0.52444
52	5	0.404856
53	1	0
53	2	0.043408
53	3	0.027296
53	4	0.52444
53	5	0.404856
54	1	0
54	2	0.043408
54	3	0.027296
54	4	0.52444
54	5	0.404856
61	1	0
61	2	0.081128
61	3	0.02854
61	4	0.528464
61	5	0.361868
62	1	0
62	2	0.081128
62	3	0.02854
62	4	0.528464
62	5	0.361868

[MonthVMTFraction]

sourceTypeID	isLeapYear	monthID	monthVMTFraction
11	N	12	0.083229
21	N	12	0.083229
31	N	12	0.083229
32	N	12	0.083229
41	N	12	0.083229
42	N	12	0.083229
43	N	12	0.083229
51	N	12	0.083229
52	N	12	0.083229
53	N	12	0.083229
54	N	12	0.083229
61	N	12	0.083229
62	N	12	0.083229

[DayVMTFraction]

Source TypeID	Month ID	Road TypeID	dayID	Day VMTFraction
11	12	1	5	0.767488
21	12	1	5	0.767488
31	12	1	5	0.767488
32	12	1	5	0.767488
41	12	1	5	0.767488
42	12	1	5	0.767488
43	12	1	5	0.767488
51	12	1	5	0.767488
52	12	1	5	0.767488
53	12	1	5	0.767488
54	12	1	5	0.767488
61	12	1	5	0.767488
62	12	1	5	0.767488
11	12	2	5	0.768458
21	12	2	5	0.768458
31	12	2	5	0.768458
32	12	2	5	0.768458
41	12	2	5	0.768458
42	12	2	5	0.768458
43	12	2	5	0.768458
51	12	2	5	0.768458
52	12	2	5	0.768458
53	12	2	5	0.768458
54	12	2	5	0.768458
61	12	2	5	0.768458
62	12	2	5	0.768458
11	12	3	5	0.766507
21	12	3	5	0.766507
31	12	3	5	0.766507
32	12	3	5	0.766507
41	12	3	5	0.766507
42	12	3	5	0.766507
43	12	3	5	0.766507
51	12	3	5	0.766507
52	12	3	5	0.766507
53	12	3	5	0.766507
54	12	3	5	0.766507
61	12	3	5	0.766507
62	12	3	5	0.766507
11	12	4	5	0.768458
21	12	4	5	0.768458
31	12	4	5	0.768458
32	12	4	5	0.768458
41	12	4	5	0.768458
42	12	4	5	0.768458
43	12	4	5	0.768458
51	12	4	5	0.768458
52	12	4	5	0.768458
53	12	4	5	0.768458
54	12	4	5	0.768458
61	12	4	5	0.768458
62	12	4	5	0.768458
11	12	5	5	0.766507
21	12	5	5	0.766507
31	12	5	5	0.766507
32	12	5	5	0.766507
41	12	5	5	0.766507
42	12	5	5	0.766507
43	12	5	5	0.766507
51	12	5	5	0.766507
52	12	5	5	0.766507
53	12	5	5	0.766507
54	12	5	5	0.766507
61	12	5	5	0.766507
62	12	5	5	0.766507
11	12	1	2	0.232512
21	12	1	2	0.232512
31	12	1	2	0.232512
32	12	1	2	0.232512
41	12	1	2	0.232512
42	12	1	2	0.232512
43	12	1	2	0.232512
51	12	1	2	0.232512
52	12	1	2	0.232512
53	12	1	2	0.232512
54	12	1	2	0.232512
61	12	1	2	0.232512
62	12	1	2	0.232512
11	12	2	2	0.231542
21	12	2	2	0.231542
31	12	2	2	0.231542
32	12	2	2	0.231542
41	12	2	2	0.231542
42	12	2	2	0.231542
43	12	2	2	0.231542
51	12	2	2	0.231542
52	12	2	2	0.231542
53	12	2	2	0.231542
54	12	2	2	0.231542
61	12	2	2	0.231542
62	12	2	2	0.231542
11	12	3	2	0.233493
21	12	3	2	0.233493
31	12	3	2	0.233493
32	12	3	2	0.233493
41	12	3	2	0.233493
42	12	3	2	0.233493
43	12	3	2	0.233493
51	12	3	2	0.233493
52	12	3	2	0.233493
53	12	3	2	0.233493
54	12	3	2	0.233493
61	12	3	2	0.233493
62	12	3	2	0.233493
11	12	4	2	0.231542
21	12	4	2	0.231542
31	12	4	2	0.231542
32	12	4	2	0.231542
41	12	4	2	0.231542
42	12	4	2	0.231542
43	12	4	2	0.231542
51	12	4	2	0.231542
52	12	4	2	0.231542
53	12	4	2	0.231542
54	12	4	2	0.231542
61	12	4	2	0.231542
62	12	4	2	0.231542
11	12	5	2	0.233493
21	12	5	2	0.233493
31	12	5	2	0.233493
32	12	5	2	0.233493
41	12	5	2	0.233493
42	12	5	2	0.233493
43	12	5	2	0.233493
51	12	5	2	0.233493
52	12	5	2	0.233493
53	12	5	2	0.233493
54	12	5	2	0.233493
61	12	5	2	0.233493
62	12	5	2	0.233493

[HourVMTFraction] (SourceTypeID 21: Passenger Car)

Source TypeID	Road TypeID	dayID	hourID	hourVMT Fraction
21	1	5	1	0.007957
21	1	5	2	0.005448
21	1	5	3	0.004973
21	1	5	4	0.006014
21	1	5	5	0.013468
21	1	5	6	0.034281
21	1	5	7	0.054676
21	1	5	8	0.06466
21	1	5	9	0.060292
21	1	5	10	0.052697
21	1	5	11	0.050973
21	1	5	12	0.054873
21	1	5	13	0.057626
21	1	5	14	0.059009
21	1	5	15	0.064762
21	1	5	16	0.06924
21	1	5	17	0.070039
21	1	5	18	0.07009
21	1	5	19	0.05904
21	1	5	20	0.04192
21	1	5	21	0.033428
21	1	5	22	0.029157
21	1	5	23	0.02144
21	1	5	24	0.013936
21	2	5	1	0.009807
21	2	5	2	0.006923
21	2	5	3	0.00651
21	2	5	4	0.007961
21	2	5	5	0.017302
21	2	5	6	0.042783
21	2	5	7	0.060321
21	2	5	8	0.059377
21	2	5	9	0.057361
21	2	5	10	0.055026
21	2	5	11	0.052104
21	2	5	12	0.05478
21	2	5	13	0.05683
21	2	5	14	0.059985
21	2	5	15	0.065538
21	2	5	16	0.065523
21	2	5	17	0.061668
21	2	5	18	0.059173
21	2	5	19	0.054281
21	2	5	20	0.040837
21	2	5	21	0.033031
21	2	5	22	0.030836
21	2	5	23	0.024921
21	2	5	24	0.017121
21	3	5	1	0.006081
21	3	5	2	0.003952
21	3	5	3	0.003413
21	3	5	4	0.004039
21	3	5	5	0.009578
21	3	5	6	0.025656
21	3	5	7	0.04895
21	3	5	8	0.07002
21	3	5	9	0.063264
21	3	5	10	0.050335
21	3	5	11	0.049826
21	3	5	12	0.054967
21	3	5	13	0.058433
21	3	5	14	0.058019
21	3	5	15	0.063976
21	3	5	16	0.073011
21	3	5	17	0.07853
21	3	5	18	0.081166
21	3	5	19	0.063868
21	3	5	20	0.043018
21	3	5	21	0.033831
21	3	5	22	0.027454
21	3	5	23	0.017909
21	3	5	24	0.010705
21	4	5	1	0.009807
21	4	5	2	0.006923
21	4	5	3	0.00651
21	4	5	4	0.007961
21	4	5	5	0.017302
21	4	5	6	0.042783
21	4	5	7	0.060321
21	4	5	8	0.059377
21	4	5	9	0.057361
21	4	5	10	0.055026
21	4	5	11	0.052104
21	4	5	12	0.05478
21	4	5	13	0.05683
21	4	5	14	0.059985
21	4	5	15	0.065538
21	4	5	16	0.065523
21	4	5	17	0.061668
21	4	5	18	0.059173
21	4	5	19	0.054281
21	4	5	20	0.040837
21	4	5	21	0.033031
21	4	5	22	0.030836
21	4	5	23	0.024921
21	4	5	24	0.017121
21	5	5	1	0.006081
21	5	5	2	0.003952
21	5	5	3	0.003413
21	5	5	4	0.004039
21	5	5	5	0.009578
21	5	5	6	0.025656
21	5	5	7	0.04895
21	5	5	8	0.07002
21	5	5	9	0.063264
21	5	5	10	0.050335
21	5	5	11	0.049826
21	5	5	12	0.054967
21	5	5	13	0.058433
21	5	5	14	0.058019
21	5	5	15	0.063976
21	5	5	16	0.073011
21	5	5	17	0.07853
21	5	5	18	0.081166
21	5	5	19	0.063868
21	5	5	20	0.043018
21	5	5	21	0.033831
21	5	5	22	0.027454
21	5	5	23	0.017909
21	5	5	24	0.010705
21	1	2	1	0.020872
21	1	2	2	0.014804
21	1	2	3	0.013016
21	1	2	4	0.010079
21	1	2	5	0.011715
21	1	2	6	0.018691
21	1	2	7	0.027033
21	1	2	8	0.033174
21	1	2	9	0.040089
21	1	2	10	0.048519
21	1	2	11	0.05524
21	1	2	12	0.060009
21	1	2	13	0.064796
21	1	2	14	0.06555
21	1	2	15	0.064719
21	1	2	16	0.064355
21	1	2	17	0.064852
21	1	2	18	0.064713
21	1	2	19	0.061678
21	1	2	20	0.050477
21	1	2	21	0.043519
21	1	2	22	0.040777
21	1	2	23	0.035718
21	1	2	24	0.025605
21	2	2	1	0.020431
21	2	2	2	0.014508
21	2	2	3	0.012577
21	2	2	4	0.009828
21	2	2	5	0.011013
21	2	2	6	0.01751
21	2	2	7	0.025995
21	2	2	8	0.031456
21	2	2	9	0.038799
21	2	2	10	0.047714
21	2	2	11	0.054712
21	2	2	12	0.060251
21	2	2	13	0.065575
21	2	2	14	0.066506
21	2	2	15	0.065746
21	2	2	16	0.065312
21	2	2	17	0.065948
21	2	2	18	0.066767
21	2	2	19	0.064137
21	2	2	20	0.050196
21	2	2	21	0.042573
21	2	2	22	0.040589
21	2	2	23	0.036012
21	2	2	24	0.025845
21	3	2	1	0.021315
21	3	2	2	0.015101
21	3	2	3	0.013457
21	3	2	4	0.010331
21	3	2	5	0.01242
21	3	2	6	0.019876
21	3	2	7	0.028075
21	3	2	8	0.034899
21	3	2	9	0.041383
21	3	2	10	0.049326
21	3	2	11	0.05577
21	3	2	12	0.059766
21	3	2	13	0.064014
21	3	2	14	0.064591
21	3	2	15	0.063689
21	3	2	16	0.063394
21	3	2	17	0.063753
21	3	2	18	0.062652
21	3	2	19	0.05921
21	3	2	20	0.050759
21	3	2	21	0.044469
21	3	2	22	0.040966
21	3	2	23	0.035423
21	3	2	24	0.025364
21	4	2	1	0.020431
21	4	2	2	0.014508
21	4	2	3	0.012577
21	4	2	4	0.009828
21	4	2	5	0.011013
21	4	2	6	0.01751
21	4	2	7	0.025995
21	4	2	8	0.031456
21	4	2	9	0.038799
21	4	2	10	0.047714
21	4	2	11	0.054712
21	4	2	12	0.060251
21	4	2	13	0.065575
21	4	2	14	0.066506
21	4	2	15	0.065746
21	4	2	16	0.065312
21	4	2	17	0.065948
21	4	2	18	0.066767
21	4	2	19	0.064137
21	4	2	20	0.050196
21	4	2	21	0.042573
21	4	2	22	0.040589
21	4	2	23	0.036012
21	4	2	24	0.025845
21	5	2	1	0.021315
21	5	2	2	0.015101
21	5	2	3	0.013457
21	5	2	4	0.010331
21	5	2	5	0.01242
21	5	2	6	0.019876
21	5	2	7	0.028075
21	5	2	8	0.034899
21	5	2	9	0.041383
21	5	2	10	0.049326
21	5	2	11	0.05577
21	5	2	12	0.059766
21	5	2	13	0.064014
21	5	2	14	0.064591
21	5	2	15	0.063689
21	5	2	16	0.063394
21	5	2	17	0.063753
21	5	2	18	0.062652
21	5	2	19	0.05921
21	5	2	20	0.050759
21	5	2	21	0.044469
21	5	2	22	0.040966
21	5	2	23	0.035423
21	5	2	24	0.025364

[AvgSpeedDistribution] (SourceTypeID 21: Passenger Car and RoadTypeID 2: Rural Restricted Access)

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	15	1	2.51E-05
21	2	15	2	0
21	2	15	3	0
21	2	15	4	0
21	2	15	5	0
21	2	15	6	0

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	15	7	0.019619
21	2	15	8	0.097646
21	2	15	9	0.131977
21	2	15	10	0.203234
21	2	15	11	0.087838
21	2	15	12	0.07357
21	2	15	13	0.039194
21	2	15	14	0.083438
21	2	15	15	0.102646
21	2	15	16	0.160812
21	2	25	1	2.51E-05
21	2	25	2	0
21	2	25	3	0
21	2	25	4	0
21	2	25	5	0
21	2	25	6	0
21	2	25	7	0.019619
21	2	25	8	0.097646
21	2	25	9	0.131977
21	2	25	10	0.203234
21	2	25	11	0.087838
21	2	25	12	0.07357
21	2	25	13	0.039194
21	2	25	14	0.083438
21	2	25	15	0.102646
21	2	25	16	0.160812
21	2	35	1	2.51E-05
21	2	35	2	0
21	2	35	3	0
21	2	35	4	0
21	2	35	5	0
21	2	35	6	0
21	2	35	7	0.019619
21	2	35	8	0.097646
21	2	35	9	0.131977
21	2	35	10	0.203234
21	2	35	11	0.087838
21	2	35	12	0.07357
21	2	35	13	0.039194
21	2	35	14	0.083438
21	2	35	15	0.102646
21	2	35	16	0.160812
21	2	45	1	2.51E-05
21	2	45	2	0
21	2	45	3	0
21	2	45	4	0
21	2	45	5	0
21	2	45	6	0
21	2	45	7	0.019619
21	2	45	8	0.097646
21	2	45	9	0.131977
21	2	45	10	0.203234
21	2	45	11	0.087838
21	2	45	12	0.07357
21	2	45	13	0.039194
21	2	45	14	0.083438
21	2	45	15	0.102646
21	2	45	16	0.160812
21	2	55	1	2.51E-05
21	2	55	2	0
21	2	55	3	0
21	2	55	4	0
21	2	55	5	0
21	2	55	6	0
21	2	55	7	0.019619
21	2	55	8	0.097646
21	2	55	9	0.131977
21	2	55	10	0.203234
21	2	55	11	0.087838
21	2	55	12	0.07357
21	2	55	13	0.039194
21	2	55	14	0.083438
21	2	55	15	0.102646
21	2	55	16	0.160812
21	2	65	1	2.51E-05
21	2	65	2	0
21	2	65	3	0
21	2	65	4	0
21	2	65	5	0
21	2	65	6	0
21	2	65	7	0.019619
21	2	65	8	0.097646
21	2	65	9	0.131977
21	2	65	10	0.203234
21	2	65	11	0.087838
21	2	65	12	0.07357
21	2	65	13	0.039194
21	2	65	14	0.083438
21	2	65	15	0.102646
21	2	65	16	0.160812
21	2	75	1	1.98E-05
21	2	75	2	0
21	2	75	3	0
21	2	75	4	0
21	2	75	5	0
21	2	75	6	0
21	2	75	7	0
21	2	75	8	0
21	2	75	9	0
21	2	75	10	0.057069
21	2	75	11	0.140623
21	2	75	12	0.248507
21	2	75	13	0.169045
21	2	75	14	0.075169
21	2	75	15	0.111641
21	2	75	16	0.197927
21	2	85	1	1.98E-05
21	2	85	2	0
21	2	85	3	0
21	2	85	4	0
21	2	85	5	0
21	2	85	6	0
21	2	85	7	0
21	2	85	8	0
21	2	85	9	0
21	2	85	10	0.057069
21	2	85	11	0.140623
21	2	85	12	0.248507
21	2	85	13	0.169045
21	2	85	14	0.075169
21	2	85	15	0.111641
21	2	85	16	0.197927
21	2	95	1	1.98E-05
21	2	95	2	0
21	2	95	3	0
21	2	95	4	0
21	2	95	5	0
21	2	95	6	0
21	2	95	7	0
21	2	95	8	0
21	2	95	9	0
21	2	95	10	0.057069
21	2	95	11	0.140623
21	2	95	12	0.248507
21	2	95	13	0.169045
21	2	95	14	0.075169
21	2	95	15	0.111641
21	2	95	16	0.197927
21	2	105	1	1.78E-05
21	2	105	2	0
21	2	105	3	0
21	2	105	4	0
21	2	105	5	0
21	2	105	6	0
21	2	105	7	0
21	2	105	8	0
21	2	105	9	0
21	2	105	10	0.059729
21	2	105	11	0.129919
21	2	105	12	0.24385
21	2	105	13	0.049713
21	2	105	14	0.140357
21	2	105	15	0.191024
21	2	105	16	0.18539
21	2	115	1	1.78E-05
21	2	115	2	0
21	2	115	3	0
21	2	115	4	0
21	2	115	5	0
21	2	115	6	0
21	2	115	7	0
21	2	115	8	0
21	2	115	9	0
21	2	115	10	0.059729
21	2	115	11	0.129919
21	2	115	12	0.24385
21	2	115	13	0.049713
21	2	115	14	0.140357
21	2	115	15	0.191024
21	2	115	16	0.18539
21	2	125	1	1.78E-05
21	2	125	2	0
21	2	125	3	0
21	2	125	4	0
21	2	125	5	0
21	2	125	6	0
21	2	125	7	0
21	2	125	8	0
21	2	125	9	0
21	2	125	10	0.059729
21	2	125	11	0.129919
21	2	125	12	0.24385
21	2	125	13	0.049713
21	2	125	14	0.140357
21	2	125	15	0.191024
21	2	125	16	0.18539
21	2	135	1	1.78E-05
21	2	135	2	0
21	2	135	3	0
21	2	135	4	0
21	2	135	5	0
21	2	135	6	0
21	2	135	7	0
21	2	135	8	0
21	2	135	9	0
21	2	135	10	0.059729
21	2	135	11	0.129919
21	2	135	12	0.24385
21	2	135	13	0.049713
21	2	135	14	0.140357
21	2	135	15	0.191024
21	2	135	16	0.18539
21	2	145	1	1.78E-05
21	2	145	2	0
21	2	145	3	0
21	2	145	4	0
21	2	145	5	0
21	2	145	6	0
21	2	145	7	0
21	2	145	8	0
21	2	145	9	0
21	2	145	10	0.059729
21	2	145	11	0.129919
21	2	145	12	0.24385
21	2	145	13	0.049713
21	2	145	14	0.140357
21	2	145	15	0.191024
21	2	145	16	0.18539
21	2	155	1	1.78E-05
21	2	155	2	0
21	2	155	3	0
21	2	155	4	0
21	2	155	5	0
21	2	155	6	0
21	2	155	7	0
21	2	155	8	0
21	2	155	9	0
21	2	155	10	0.059729
21	2	155	11	0.129919
21	2	155	12	0.24385
21	2	155	13	0.049713
21	2	155	14	0.140357
21	2	155	15	0.191024
21	2	155	16	0.18539
21	2	165	1	1.69E-05
21	2	165	2	0
21	2	165	3	0
21	2	165	4	0
21	2	165	5	0
21	2	165	6	0
21	2	165	7	0
21	2	165	8	0
21	2	165	9	0
21	2	165	10	0
21	2	165	11	0
21	2	165	12	0.000288
21	2	165	13	0.094046
21	2	165	14	0.274366
21	2	165	15	0.241766
21	2	165	16	0.389518
21	2	175	1	1.69E-05
21	2	175	2	0
21	2	175	3	0
21	2	175	4	0
21	2	175	5	0
21	2	175	6	0
21	2	175	7	0
21	2	175	8	0
21	2	175	9	0
21	2	175	10	0
21	2	175	11	0

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	175	12	0.000288
21	2	175	13	0.094046
21	2	175	14	0.274366
21	2	175	15	0.241766
21	2	175	16	0.389518
21	2	185	1	1.69E-05
21	2	185	2	0
21	2	185	3	0
21	2	185	4	0
21	2	185	5	0
21	2	185	6	0
21	2	185	7	0
21	2	185	8	0
21	2	185	9	0
21	2	185	10	0
21	2	185	11	0
21	2	185	12	0.000288
21	2	185	13	0.094046
21	2	185	14	0.274366
21	2	185	15	0.241766
21	2	185	16	0.389518
21	2	195	1	2.51E-05
21	2	195	2	0
21	2	195	3	0
21	2	195	4	0
21	2	195	5	0
21	2	195	6	0
21	2	195	7	0.019619
21	2	195	8	0.097646
21	2	195	9	0.131977
21	2	195	10	0.203234
21	2	195	11	0.087838
21	2	195	12	0.07357
21	2	195	13	0.039194
21	2	195	14	0.083438
21	2	195	15	0.102646
21	2	195	16	0.160812
21	2	205	1	2.51E-05
21	2	205	2	0
21	2	205	3	0
21	2	205	4	0
21	2	205	5	0
21	2	205	6	0
21	2	205	7	0.019619
21	2	205	8	0.097646
21	2	205	9	0.131977
21	2	205	10	0.203234
21	2	205	11	0.087838
21	2	205	12	0.07357
21	2	205	13	0.039194
21	2	205	14	0.083438
21	2	205	15	0.102646
21	2	205	16	0.160812
21	2	215	1	2.51E-05
21	2	215	2	0
21	2	215	3	0
21	2	215	4	0
21	2	215	5	0
21	2	215	6	0
21	2	215	7	0.019619
21	2	215	8	0.097646
21	2	215	9	0.131977
21	2	215	10	0.203234
21	2	215	11	0.087838
21	2	215	12	0.07357
21	2	215	13	0.039194
21	2	215	14	0.083438
21	2	215	15	0.102646
21	2	215	16	0.160812
21	2	225	1	2.51E-05
21	2	225	2	0
21	2	225	3	0
21	2	225	4	0
21	2	225	5	0
21	2	225	6	0
21	2	225	7	0.019619
21	2	225	8	0.097646
21	2	225	9	0.131977
21	2	225	10	0.203234
21	2	225	11	0.087838
21	2	225	12	0.07357
21	2	225	13	0.039194
21	2	225	14	0.083438
21	2	225	15	0.102646
21	2	225	16	0.160812
21	2	235	1	2.51E-05
21	2	235	2	0
21	2	235	3	0
21	2	235	4	0
21	2	235	5	0
21	2	235	6	0
21	2	235	7	0.019619
21	2	235	8	0.097646
21	2	235	9	0.131977
21	2	235	10	0.203234
21	2	235	11	0.087838
21	2	235	12	0.07357
21	2	235	13	0.039194
21	2	235	14	0.083438
21	2	235	15	0.102646
21	2	235	16	0.160812
21	2	245	1	2.51E-05
21	2	245	2	0
21	2	245	3	0
21	2	245	4	0
21	2	245	5	0
21	2	245	6	0
21	2	245	7	0.019619
21	2	245	8	0.097646
21	2	245	9	0.131977
21	2	245	10	0.203234
21	2	245	11	0.087838
21	2	245	12	0.07357
21	2	245	13	0.039194
21	2	245	14	0.083438
21	2	245	15	0.102646
21	2	245	16	0.160812
21	2	12	1	2.51E-05
21	2	12	2	0
21	2	12	3	0
21	2	12	4	0
21	2	12	5	0
21	2	12	6	0
21	2	12	7	0.019619
21	2	12	8	0.097646
21	2	12	9	0.131977
21	2	12	10	0.203234
21	2	12	11	0.087838
21	2	12	12	0.07357
21	2	12	13	0.039194
21	2	12	14	0.083438
21	2	12	15	0.102646
21	2	12	16	0.160812
21	2	22	1	2.51E-05
21	2	22	2	0
21	2	22	3	0
21	2	22	4	0
21	2	22	5	0
21	2	22	6	0
21	2	22	7	0.019619
21	2	22	8	0.097646
21	2	22	9	0.131977
21	2	22	10	0.203234
21	2	22	11	0.087838
21	2	22	12	0.07357
21	2	22	13	0.039194
21	2	22	14	0.083438
21	2	22	15	0.102646
21	2	22	16	0.160812
21	2	32	1	2.51E-05
21	2	32	2	0
21	2	32	3	0
21	2	32	4	0
21	2	32	5	0
21	2	32	6	0
21	2	32	7	0.019619
21	2	32	8	0.097646
21	2	32	9	0.131977
21	2	32	10	0.203234
21	2	32	11	0.087838
21	2	32	12	0.07357
21	2	32	13	0.039194
21	2	32	14	0.083438
21	2	32	15	0.102646
21	2	32	16	0.160812
21	2	42	1	2.51E-05
21	2	42	2	0
21	2	42	3	0
21	2	42	4	0
21	2	42	5	0
21	2	42	6	0
21	2	42	7	0.019619
21	2	42	8	0.097646
21	2	42	9	0.131977
21	2	42	10	0.203234
21	2	42	11	0.087838
21	2	42	12	0.07357
21	2	42	13	0.039194
21	2	42	14	0.083438
21	2	42	15	0.102646
21	2	42	16	0.160812
21	2	52	1	2.51E-05
21	2	52	2	0
21	2	52	3	0
21	2	52	4	0
21	2	52	5	0
21	2	52	6	0
21	2	52	7	0.019619
21	2	52	8	0.097646
21	2	52	9	0.131977
21	2	52	10	0.203234
21	2	52	11	0.087838
21	2	52	12	0.07357
21	2	52	13	0.039194
21	2	52	14	0.083438
21	2	52	15	0.102646
21	2	52	16	0.160812
21	2	62	1	2.51E-05
21	2	62	2	0
21	2	62	3	0
21	2	62	4	0
21	2	62	5	0
21	2	62	6	0
21	2	62	7	0.019619
21	2	62	8	0.097646
21	2	62	9	0.131977
21	2	62	10	0.203234
21	2	62	11	0.087838
21	2	62	12	0.07357
21	2	62	13	0.039194
21	2	62	14	0.083438
21	2	62	15	0.102646
21	2	62	16	0.160812
21	2	72	1	2.51E-05
21	2	72	2	0
21	2	72	3	0
21	2	72	4	0
21	2	72	5	0
21	2	72	6	0
21	2	72	7	0.019619
21	2	72	8	0.097646
21	2	72	9	0.131977
21	2	72	10	0.203234
21	2	72	11	0.087838
21	2	72	12	0.07357
21	2	72	13	0.039194
21	2	72	14	0.083438
21	2	72	15	0.102646
21	2	72	16	0.160812
21	2	82	1	2.51E-05
21	2	82	2	0
21	2	82	3	0
21	2	82	4	0
21	2	82	5	0
21	2	82	6	0
21	2	82	7	0.019619
21	2	82	8	0.097646
21	2	82	9	0.131977
21	2	82	10	0.203234
21	2	82	11	0.087838
21	2	82	12	0.07357
21	2	82	13	0.039194
21	2	82	14	0.083438
21	2	82	15	0.102646
21	2	82	16	0.160812
21	2	92	1	2.51E-05
21	2	92	2	0
21	2	92	3	0
21	2	92	4	0
21	2	92	5	0
21	2	92	6	0
21	2	92	7	0.019619
21	2	92	8	0.097646
21	2	92	9	0.131977
21	2	92	10	0.203234
21	2	92	11	0.087838
21	2	92	12	0.07357
21	2	92	13	0.039194
21	2	92	14	0.083438
21	2	92	15	0.102646
21	2	92	16	0.160812

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	102	1	2.51E-05
21	2	102	2	0
21	2	102	3	0
21	2	102	4	0
21	2	102	5	0
21	2	102	6	0
21	2	102	7	0.019619
21	2	102	8	0.097646
21	2	102	9	0.131977
21	2	102	10	0.203234
21	2	102	11	0.087838
21	2	102	12	0.07357
21	2	102	13	0.039194
21	2	102	14	0.083438
21	2	102	15	0.102646
21	2	102	16	0.160812
21	2	112	1	2.51E-05
21	2	112	2	0
21	2	112	3	0
21	2	112	4	0
21	2	112	5	0
21	2	112	6	0
21	2	112	7	0.019619
21	2	112	8	0.097646
21	2	112	9	0.131977
21	2	112	10	0.203234
21	2	112	11	0.087838
21	2	112	12	0.07357
21	2	112	13	0.039194
21	2	112	14	0.083438
21	2	112	15	0.102646
21	2	112	16	0.160812
21	2	122	1	2.51E-05
21	2	122	2	0
21	2	122	3	0
21	2	122	4	0
21	2	122	5	0
21	2	122	6	0
21	2	122	7	0.019619
21	2	122	8	0.097646
21	2	122	9	0.131977
21	2	122	10	0.203234
21	2	122	11	0.087838
21	2	122	12	0.07357
21	2	122	13	0.039194
21	2	122	14	0.083438
21	2	122	15	0.102646
21	2	122	16	0.160812
21	2	132	1	2.51E-05
21	2	132	2	0
21	2	132	3	0
21	2	132	4	0
21	2	132	5	0
21	2	132	6	0
21	2	132	7	0.019619
21	2	132	8	0.097646
21	2	132	9	0.131977
21	2	132	10	0.203234
21	2	132	11	0.087838
21	2	132	12	0.07357
21	2	132	13	0.039194
21	2	132	14	0.083438
21	2	132	15	0.102646
21	2	132	16	0.160812
21	2	142	1	2.51E-05
21	2	142	2	0
21	2	142	3	0
21	2	142	4	0
21	2	142	5	0
21	2	142	6	0
21	2	142	7	0.019619
21	2	142	8	0.097646
21	2	142	9	0.131977
21	2	142	10	0.203234
21	2	142	11	0.087838
21	2	142	12	0.07357
21	2	142	13	0.039194
21	2	142	14	0.083438
21	2	142	15	0.102646
21	2	142	16	0.160812
21	2	152	1	2.51E-05
21	2	152	2	0
21	2	152	3	0
21	2	152	4	0
21	2	152	5	0

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	152	6	0
21	2	152	7	0.019619
21	2	152	8	0.097646
21	2	152	9	0.131977
21	2	152	10	0.203234
21	2	152	11	0.087838
21	2	152	12	0.07357
21	2	152	13	0.039194
21	2	152	14	0.083438
21	2	152	15	0.102646
21	2	152	16	0.160812
21	2	162	1	2.51E-05
21	2	162	2	0
21	2	162	3	0
21	2	162	4	0
21	2	162	5	0
21	2	162	6	0
21	2	162	7	0.019619
21	2	162	8	0.097646
21	2	162	9	0.131977
21	2	162	10	0.203234
21	2	162	11	0.087838
21	2	162	12	0.07357
21	2	162	13	0.039194
21	2	162	14	0.083438
21	2	162	15	0.102646
21	2	162	16	0.160812
21	2	172	1	2.51E-05
21	2	172	2	0
21	2	172	3	0
21	2	172	4	0
21	2	172	5	0
21	2	172	6	0
21	2	172	7	0.019619
21	2	172	8	0.097646
21	2	172	9	0.131977
21	2	172	10	0.203234
21	2	172	11	0.087838
21	2	172	12	0.07357
21	2	172	13	0.039194
21	2	172	14	0.083438
21	2	172	15	0.102646
21	2	172	16	0.160812
21	2	182	1	2.51E-05
21	2	182	2	0
21	2	182	3	0
21	2	182	4	0
21	2	182	5	0
21	2	182	6	0
21	2	182	7	0.019619
21	2	182	8	0.097646
21	2	182	9	0.131977
21	2	182	10	0.203234
21	2	182	11	0.087838
21	2	182	12	0.07357
21	2	182	13	0.039194
21	2	182	14	0.083438
21	2	182	15	0.102646
21	2	182	16	0.160812
21	2	192	1	2.51E-05
21	2	192	2	0
21	2	192	3	0
21	2	192	4	0
21	2	192	5	0
21	2	192	6	0
21	2	192	7	0.019619
21	2	192	8	0.097646
21	2	192	9	0.131977
21	2	192	10	0.203234
21	2	192	11	0.087838
21	2	192	12	0.07357
21	2	192	13	0.039194
21	2	192	14	0.083438
21	2	192	15	0.102646
21	2	192	16	0.160812
21	2	202	1	2.51E-05
21	2	202	2	0
21	2	202	3	0
21	2	202	4	0
21	2	202	5	0
21	2	202	6	0
21	2	202	7	0.019619
21	2	202	8	0.097646
21	2	202	9	0.131977
21	2	202	10	0.203234

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	202	11	0.087838
21	2	202	12	0.07357
21	2	202	13	0.039194
21	2	202	14	0.083438
21	2	202	15	0.102646
21	2	202	16	0.160812
21	2	212	1	2.51E-05
21	2	212	2	0
21	2	212	3	0
21	2	212	4	0
21	2	212	5	0
21	2	212	6	0
21	2	212	7	0.019619
21	2	212	8	0.097646
21	2	212	9	0.131977
21	2	212	10	0.203234
21	2	212	11	0.087838
21	2	212	12	0.07357
21	2	212	13	0.039194
21	2	212	14	0.083438
21	2	212	15	0.102646
21	2	212	16	0.160812
21	2	222	1	2.51E-05
21	2	222	2	0
21	2	222	3	0
21	2	222	4	0
21	2	222	5	0
21	2	222	6	0
21	2	222	7	0.019619
21	2	222	8	0.097646
21	2	222	9	0.131977
21	2	222	10	0.203234
21	2	222	11	0.087838
21	2	222	12	0.07357
21	2	222	13	0.039194
21	2	222	14	0.083438
21	2	222	15	0.102646
21	2	222	16	0.160812
21	2	232	1	2.51E-05
21	2	232	2	0
21	2	232	3	0
21	2	232	4	0
21	2	232	5	0
21	2	232	6	0
21	2	232	7	0.019619
21	2	232	8	0.097646
21	2	232	9	0.131977
21	2	232	10	0.203234
21	2	232	11	0.087838
21	2	232	12	0.07357
21	2	232	13	0.039194
21	2	232	14	0.083438
21	2	232	15	0.102646
21	2	232	16	0.160812
21	2	242	1	2.51E-05
21	2	242	2	0
21	2	242	3	0
21	2	242	4	0
21	2	242	5	0
21	2	242	6	0
21	2	242	7	0.019619
21	2	242	8	0.097646
21	2	242	9	0.131977
21	2	242	10	0.203234
21	2	242	11	0.087838
21	2	242	12	0.07357
21	2	242	13	0.039194
21	2	242	14	0.083438
21	2	242	15	0.102646
21	2	242	16	0.160812

[AVFT] (SourceTypeID 42: Transit Bus)

Source TypeID	Model YearID	Fuel TypeID	Eng TechID	fuelEng Fraction
42	1960	2	1	1
42	1961	2	1	1
42	1962	2	1	1
42	1963	2	1	1
42	1964	2	1	1
42	1965	2	1	1
42	1966	2	1	1
42	1967	2	1	1
42	1968	2	1	1
42	1969	2	1	1
42	1970	2	1	1
42	1971	2	1	1
42	1972	2	1	1
42	1973	2	1	1
42	1974	2	1	1
42	1975	2	1	1
42	1976	2	1	1
42	1977	2	1	1
42	1978	2	1	1
42	1979	2	1	1
42	1980	2	1	1
42	1981	2	1	1
42	1982	2	1	1
42	1983	2	1	1
42	1984	2	1	1
42	1985	2	1	1
42	1986	2	1	1
42	1987	2	1	1
42	1988	2	1	1
42	1989	2	1	1
42	1990	2	1	0.993
42	1990	3	1	0.007
42	1991	2	1	0.982
42	1991	3	1	0.018
42	1992	1	1	0.01
42	1992	2	1	0.944
42	1992	3	1	0.046
42	1993	1	1	0.01
42	1993	2	1	0.914
42	1993	3	1	0.076
42	1994	1	1	0.01
42	1994	2	1	0.905
42	1994	3	1	0.085
42	1995	1	1	0.01
42	1995	2	1	0.837
42	1995	3	1	0.153
42	1996	1	1	0.01
42	1996	2	1	0.892
42	1996	3	1	0.098
42	1997	1	1	0
42	1997	2	1	1
42	1997	3	1	0
42	1998	1	1	0
42	1998	2	1	0
42	1998	3	1	1
42	1999	1	1	0
42	1999	2	1	0
42	1999	3	1	1
42	2000	1	1	0
42	2000	2	1	0
42	2000	3	1	1
42	2001	1	1	0
42	2001	2	1	0
42	2001	3	1	1
42	2002	1	1	0
42	2002	2	1	0
42	2002	3	1	1
42	2003	1	1	0
42	2003	2	1	0.08
42	2003	3	1	0.92
42	2004	1	1	0
42	2004	2	1	0.397059
42	2004	3	1	0.602941
42	2005	1	1	0
42	2005	2	1	1
42	2005	3	1	0
42	2006	1	1	0.089744
42	2006	2	1	0.128205
42	2006	3	1	0.782051
42	2007	1	1	0.149533
42	2007	2	1	0.850467
42	2007	3	1	0
42	2008	1	1	0
42	2008	2	1	0.479592
42	2008	3	1	0.520408
42	2009	1	1	0.121212
42	2009	2	1	0.030303
42	2009	3	1	0.848485
42	2010	1	1	0
42	2010	2	1	1
42	2010	3	1	0
42	2011	1	1	0
42	2011	2	1	1
42	2011	3	1	0
42	2012	1	1	0
42	2012	2	1	1
42	2012	3	1	0
42	2013	1	1	0
42	2013	2	1	1
42	2013	3	1	0
42	2014	1	1	0
42	2014	2	1	1
42	2014	3	1	0
42	2015	1	1	0
42	2015	2	1	1
42	2015	3	1	0
42	2016	1	1	0
42	2016	2	1	1
42	2016	3	1	0
42	2017	1	1	0
42	2017	2	1	1
42	2017	3	1	0
42	2018	1	1	0
42	2018	2	1	1
42	2018	3	1	0
42	2019	1	1	0
42	2019	2	1	1
42	2019	3	1	0
42	2020	1	1	0
42	2020	2	1	1
42	2020	3	1	0
42	2021	1	1	0
42	2021	2	1	1
42	2021	3	1	0
42	2022	1	1	0
42	2022	2	1	1
42	2022	3	1	0
42	2023	1	1	0
42	2023	2	1	1
42	2023	3	1	0
42	2024	1	1	0
42	2024	2	1	1
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42	2025	2	1	1
42	2025	3	1	0
42	2026	1	1	0
42	2026	2	1	1
42	2026	3	1	0
42	2027	1	1	0
42	2027	2	1	1
42	2027	3	1	0
42	2028	1	1	0
42	2028	2	1	1
42	2028	3	1	0
42	2029	1	1	0
42	2029	2	1	1
42	2029	3	1	0
42	2030	1	1	0
42	2030	2	1	1
42	2030	3	1	0
42	2031	1	1	0
42	2031	2	1	1
42	2031	3	1	0
42	2032	1	1	0
42	2032	2	1	1
42	2032	3	1	0
42	2033	1	1	0
42	2033	2	1	1
42	2033	3	1	0
42	2034	1	1	0
42	2034	2	1	1
42	2034	3	1	0
42	2035	1	1	0
42	2035	2	1	1
42	2035	3	1	0
42	2036	1	1	0
42	2036	2	1	1
42	2036	3	1	0
42	2037	1	1	0
42	2037	2	1	1
42	2037	3	1	0
42	2038	1	1	0
42	2038	2	1	1
42	2038	3	1	0
42	2039	1	1	0
42	2039	2	1	1
42	2039	3	1	0
42	2040	1	1	0
42	2040	2	1	1
42	2040	3	1	0
42	2041	1	1	0
42	2041	2	1	1
42	2041	3	1	0
42	2042	1	1	0
42	2042	2	1	1
42	2042	3	1	0
42	2043	1	1	0
42	2043	2	1	1
42	2043	3	1	0
42	2044	1	1	0
42	2044	2	1	1
42	2044	3	1	0
42	2045	1	1	0
42	2045	2	1	1
42	2045	3	1	0
42	2046	1	1	0
42	2046	2	1	1
42	2046	3	1	0
42	2047	1	1	0
42	2047	2	1	1
42	2047	3	1	0
42	2048	1	1	0
42	2048	2	1	1
42	2048	3	1	0
42	2049	1	1	0
42	2049	2	1	1
42	2049	3	1	0
42	2050	1	1	0
42	2050	2	1	1
42	2050	3	1	0

[CountyYear]

countyID	yearID	refuelingVaporProgramAdjust	refuelingSpillProgramAdjust
4013	1999	0.46	0.46
4013	2000	0.46	0.46
4013	2001	0.46	0.46
4013	2002	0.46	0.46
4013	2003	0.46	0.46
4013	2004	0.46	0.46
4013	2005	0.46	0.46
4013	2006	0.46	0.46
4013	2007	0.46	0.46
4013	2008	0.46	0.46
4013	2009	0.46	0.46
4013	2010	0.46	0.46
4013	2011	0.46	0.46
4013	2012	0.46	0.46
4013	2013	0.46	0.46
4013	2014	0.46	0.46
4013	2015	0.46	0.46
4013	2016	0.46	0.46
4013	2017	0.46	0.46
4013	2018	0.46	0.46
4013	2019	0.46	0.46
4013	2020	0.46	0.46
4013	2021	0.46	0.46
4013	2022	0.46	0.46
4013	2023	0.46	0.46
4013	2024	0.46	0.46
4013	2025	0.46	0.46
4013	2026	0.46	0.46
4013	2027	0.46	0.46
4013	2028	0.46	0.46
4013	2029	0.46	0.46
4013	2030	0.46	0.46
4013	2031	0.46	0.46
4013	2032	0.46	0.46
4013	2033	0.46	0.46
4013	2034	0.46	0.46
4013	2035	0.46	0.46
4013	2036	0.46	0.46
4013	2037	0.46	0.46
4013	2038	0.46	0.46
4013	2039	0.46	0.46
4013	2040	0.46	0.46
4013	2041	0.46	0.46
4013	2042	0.46	0.46
4013	2043	0.46	0.46
4013	2044	0.46	0.46
4013	2045	0.46	0.46
4013	2046	0.46	0.46
4013	2047	0.46	0.46
4013	2048	0.46	0.46
4013	2049	0.46	0.46
4013	2050	0.46	0.46

NEWS

for immediate release

MARICOPA COUNTY
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1001 North Central Avenue
Phoenix, AZ 85004
Ph 602-506-6713
www.maricopa.gov

Emissions Inventory Public Review Draft Released

PHOENIX, January 22, 2014 – The Maricopa County Air Quality Department (MCAQD) today released its draft **2011 Periodic Emissions Inventory for Ozone Precursors**. The inventory includes emission estimates for volatile organic compounds (VOC), nitrogen oxides (NO_x) and carbon monoxide (CO). Emissions are calculated for both Maricopa County and the eight-hour ozone nonattainment area. Annual totals as well as season-day emissions are provided for all source categories.

The emissions inventory report will now undergo a 30-day public review period. The document is available in electronic format (PDF files) on the department's website at:
http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

The main body of the report consists of six chapters:

Chapter 1: Introduction	(overview and summary of all source categories)
Chapter 2: Point sources	(large manufacturing facilities, power plants, etc.)
Chapter 3: Area sources	(widespread similar sources, such as fuel combustion, fires, etc.)
Chapter 4: Nonroad mobile sources	(aircraft, locomotives, lawn mowers, tractors, etc.)
Chapter 5: Onroad mobile sources	(cars, trucks, other vehicles, etc.)
Chapter 6: Biogenic sources	(crops, indigenous vegetation, landscaping, etc.)

MCAQD will hold a public workshop to discuss the draft emissions inventory report on Friday, February 14, 2014. The workshop will begin at 2:00 PM in the fifth-floor classroom (Suite 560) at the department's offices at 1001 N. Central Ave. in Phoenix.

**All visitors to the MCAQD office located at 1001 N. Central Ave. will need to check-in at the reception area in suite 125 and then proceed to the 5th floor classroom.*

The department is also accepting written comments on the draft report through the close of business on Friday, February 21, 2014. Written comments may be submitted (via US mail or email) to:

Maricopa County Air Quality Department
Emissions Inventory Unit
1001 N. Central Ave. Suite 595
Phoenix, AZ 85004
E-mail: EmisInv@mail.maricopa.gov

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About Maricopa County Air Quality Department

The Maricopa County Air Quality Department is a regulatory agency whose goal is to ensure federal clean air standards are achieved and maintained for the residents and visitors of Maricopa County. The department is governed by the Maricopa County Board of Supervisors and follows air quality standards set forth by the federal Clean Air Act.

Calendar

<	February 2014					>
S	M	T	W	T	F	S
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	1
2	3	4	5	6	7	8

Public Workshop

Air Quality Department, Bob Huhn, PIO

The Maricopa County Air Quality Department is holding a public workshop to discuss the draft 2011 Periodic Emissions Inventory for Ozone Precursors, published in January 2014.

The inventory includes emissions estimates for volatile organic compounds (VOC), nitrogen oxides (NOx) and carbon monoxide (CO). Emissions are calculated for both Maricopa County and the eight-hour ozone nonattainment area. Annual totals as well as season-day emissions are provided for all source categories.

The emissions inventory report will undergo a 30-day public review period. The document is available in electronic format (PDF files) on the department's website (see link below).

The department is accepting written comments on the draft emissions inventory report through the close of business on Friday, February 21, 2014.

The public workshop is an informal meeting for all interested parties, is free of charge, and requires no advance registration or RSVP.

*All visitors to the MCAQD offices at 1001 N. Central Ave, Phoenix, AZ are kindly requested to check in at the reception area in Suite 125.

Date: 2/14/2014
Time: 2:00 PM
Registration Required: No
Fee: None

More Info: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/reports/Default.aspx
Contact: Bob Downing
Emissions Inventory Unit Manager
602-506-6790
bdowning@mail.maricopa.gov
Location: Maricopa County Air Quality Department

Address:
1001 N. Central Ave. Suite 125
Phoenix, AZ 85004

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Maricopa County
Air Quality Department

2011 Periodic Emissions Inventory for Ozone Precursors

for the
Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area

ADDENDUM

August 2015

2011 Periodic Emissions Inventory for Ozone Precursors

ADDENDUM

August 2015

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2011 Periodic Emissions Inventory for Ozone Precursors

ADDENDUM

August 2015

1. Background and Introduction

This addendum serves as a supplement to the 2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area, published in February 2014, and included as part of the *MAG 2014 Eight-Hour Ozone Plan – Submittal of Marginal Area Requirements for the Maricopa Nonattainment Area* submitted to EPA in June 2014. This document has been developed by the Maricopa County Air Quality Department (MCAQD) for three purposes:

- It adds a facility to the list of available Emission Reduction Credits (ERCs) in the Arizona Emissions Bank.
- In response to inquiries from EPA staff, it provides a "recasting" of the emissions calculations to develop an ozone season-day inventory reflecting the June–August 2011 period (vs. July–September addressed in the original Periodic Emissions Inventory [PEI] report).
- It provides further details on facility-specific emissions levels from County-permitted sources that are reflected in the original PEI report as area-source (nonpoint) emissions in Chapter 3.

Each of the above points is discussed in further detail below. Where applicable, the changes that affect (annual and/or season-day) emissions estimates for a particular source category are provided in summary tables. This Addendum concludes with a detailed table summarizing emissions for the eight-hour ozone nonattainment area (NAA), revised to reflect the two analyses described above.

Note that shaded cells in the tables below indicate emissions values that have been revised from the original PEI report. Where applicable, table and page numbers from the originally published 2011 Periodic Emissions Inventory document published in February 2014 are noted parenthetically in the table captions.

2. Availability of Additional Emission Reduction Credits (ERCs)

Since the original publication of the 2011 Periodic Emissions Inventory for Ozone Precursors in February 2014, additional emissions reduction credits (ERCs) have been added to the Arizona Emissions Bank. Penn Racquet Sports, a sports-ball manufacturing facility located within the eight-hour ozone nonattainment area, closed permanently in 2009, and its ERCs have been added to the Arizona Emissions Bank. Table A1 below lists the currently available emission reduction credits, while Table A2 provides updated annual and ozone season-day emissions estimates for the eight-hour ozone nonattainment area.

These newly available ERCs have also been incorporated into the base-year and future-year emissions inventories used by the Maricopa Association of Governments (MAG) for the modeling exercises conducted in developing the moderate-area ozone State Implementation Plan (SIP).

Table A1. Emission reduction credits as of December 31, 2011. (cf. original Table 2.5–1, p. 14)

Facility/ Current Owner	Reduction Date	Emission reduction credits (tons/yr) VOC	NO_x	CO
Freescale Semiconductor, Inc.	3/1/2004	17.1	9.8	15.3
Grey K Envl Fund LP	12/11/2006	80.0		
Woodstuff Manufacturing	11/30/2007	17.6		
Penn Racquet Sports Inc.	3/06/2009	98.33	4.34	
TOTAL:		**213.03**	**14.14**	**15.3**

As in the original 2011 PEI report, season-day emissions from ERCs have been estimated by dividing annual totals by 365, as these are presumed equally distributed throughout the year. Table A2 provides a summary of point source emissions for the eight-hour ozone nonattainment area, including emission reduction credits.

Table A2. Revised annual and season-day point source emissions for the eight-hour ozone nonattainment area, including emission reduction credits.

	Annual (tons/yr)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Point Sources	653.84	1,744.32	1,063.18	4,279.8	15,353.4	9,632.0
Emission Reduction Credits	213.03	14.14	15.30	1,167.3	77.5	83.8
Totals:	**866.87**	**1,758.46**	**1,078.48**	**5,447.1**	**15,430.9**	**9,715.8**

3. "Recasting" the 2011 Ozone Season-day Inventory for the Eight-Hour Ozone Nonattainment Area

3.1 Identifying an Alternative Time Period for the 2011 Ozone Season

For this exercise, MCAQD and MAG revisited the 2011 Periodic Emissions Inventory (PEI) originally prepared in 2014, to investigate if there were any significant differences in ozone season-day emissions when considering an ozone season different from the July–September period defined in the original 2011 PEI. To identify an alternative period deemed more representative of the actual ozone season, calendar year 2011 data on average and maximum Air Quality Index (AQI) values, as well as information on the incidence of ozone exceedances, were analyzed. The base data is shown below in Table A3.

Table A3. Average and maximum AQI values, and frequency of ozone exceedances in 2011, by month.

Month	Average Daily AQI Value	Maximum AQI Value	Number of Exceedances
February	42	49	0
March	48	61	0
April	63	100	0
May	70	122	2
June	85	142	9
July	69	122	2
August	70	122	4
September	60	119	1
October	44	64	0

From the above information, three-month rolling averages were calculated for each parameter, in order to identify the most representative three-month period for the ozone season. Results are shown in Table A4; maximum values in each column are shown in **bold.**

Table A4. Three-month rolling averages of monthly AQI and exceedance data for 2011.

Three-month period	Average Daily AQI Value	Maximum AQI Value	Average Number of Exceedances	Percentage of All 2011 Exceedances
February–April	51.09	70.00	0.0	0%
March–May	60.36	94.33	0.67	11%
April–June	72.52	121.33	3.67	61%
May–July	74.39	**128.67**	4.33	72%
June–August	**74.44**	**128.67**	**5.0**	**83%**
July–September	66.10	121.00	2.33	39%
August–October	57.94	101.67	1.67	28%

The above table indicates that the rolling three-month average for each of the parameters analyzed reaches its maximum value for the June through August time period. Thus, this time period is considered representative of the 2011 ozone season for the Phoenix area, and used in this "recasting" exercise to assess the impact of redefining the ozone season on overall emissions in the 2011 PEI.

3.2 Recalculating the 2011 Ozone Season-day Inventory

Each source category contained in the original 2011 ozone precursor emissions inventory was reviewed, and season-day emissions re-calculated where needed, depending on the methodology used to derive the original emissions estimates for that source category. The derivation of the "recast" emissions values for each source category type are described in more detail below. At the end of this section, Table A16 presents a comparison of season-day emissions for each source category, including the values contained in the original 2011 PEI report (for the July–September period), as well as the "recast" emissions reflecting the three-month period covering June through August.

3.2.1 Point and Area Sources

When analyzing season-day emissions calculations for the recasting exercise, each point and nonpoint (area) source type could be classified into one of the following categories:

- Sources whose emissions were derived from **actual activity data** for the June–August time period; thus whose emissions remain unchanged. All reported point source activity falls into this classification, as did those area source categories (e.g., bakeries, graphic arts) which had been estimated directly based on data from individual facility surveys, which were then "grown" by overall employment for that sector.

- Sources whose activity (and thus emissions) were assumed to be **evenly distributed throughout the year**, thus whose emissions remain unchanged. Examples include commercial cooking and consumer solvent use.

- Some emission categories (e.g., residential combustion of wood, LPG, and kerosene) were **assumed to have no summertime activity** (at any time between May and September), thus ozone season-day emissions for these source categories remained zero.

- Several source categories were estimated using published EPA guidance and recommended "seasonal activity factors" to derive season-day emissions from annual estimates; thus overall emissions estimates remained the same.

- One category, prescribed fires, had no reported activity in either June or September, thus the reported emissions for the ozone season (reflecting burns conducted in July and August) remained the same.

For the remaining categories, adjustments were made to recalculate the ozone-season emissions for the June–August period. For the following area source categories, monthly data was used to estimate season-day emissions in both the original PEI report, as well as this Addendum:

- Agricultural pesticides
- Gas stations Stage I: Submerged fill
- Gas stations Stage I: Bal. submerged fill
- Underground tanks: Breathing/emptying
- Truck: gasoline (tank trucks in transit)
- Accidental releases
- Wildfires

3.2.2 Nonroad Mobile Sources

3.2.2.1 Source Categories Calculated Using the NONROAD Model

Annual and monthly emissions for nonroad mobile source categories except locomotives, aircraft, airport ground support equipment (GSE) and auxiliary power units (APU), were developed using NONROAD2008a for the 2011 PEI report. For this Addendum, monthly nonroad mobile source emissions for June, July, and August 2011 were extracted from the NONROAD2008a outputs which had been generated for the original 2011 PEI. Table A5 below provides monthly emissions within the eight-hour ozone nonattainment area for each major nonroad source category calculated by the model. Season-day emissions were then calculated using activity allocation factors (as described in Section 4.1 of the original 2011 Ozone Precursor PEI report). Lawn and garden equipment total emissions were calculated by summing the residential and commercial lawn and garden equipment categories. Season-day emissions for the period of June through August 2011 are provided in Table A6.

Table A5. Monthly nonroad mobile source emissions in the eight-hour ozone nonattainment area for the period June–August, 2011 (in tons/month).

	VOC			NOx			CO		
Nonroad Source Category	**June**	**July**	**August**	**June**	**July**	**August**	**June**	**July**	**August**
Agricultural Equipment	2.58	2.63	2.61	21.84	21.83	21.83	20.46	20.45	20.50
Commercial Equipment	186.38	198.89	192.66	108.13	107.74	107.24	2,643.99	2,640.97	2,652.57
Construction /mining Equipment	180.11	182.14	180.91	1,211.17	1,211.08	1,210.96	1,380.06	1,377.79	1,379.73
Industrial Equipment	28.68	28.81	28.69	152.37	152.34	152.30	598.34	598.26	598.63
Lawn & Garden (Residential)	382.25	419.43	411.33	31.24	30.82	30.27	3,277.43	3,272.49	3,286.46
Lawn & Garden (Commercial)	180.11	181.47	180.97	56.86	56.55	56.13	2,932.22	2,924.99	2,934.99
Logging Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pleasure Craft	78.61	82.85	83.82	14.97	15.01	14.97	203.49	201.52	200.94
Railroad Equipment	0.17	0.18	0.17	0.72	0.72	0.72	1.44	1.44	1.44
Recreational Equipment	85.10	87.32	86.58	3.35	3.32	3.28	366.35	365.14	366.14

Table A6. Ozone season-day emissions from nonroad mobile sources in the eight-hour ozone nonattainment area for the period June–August, 2011.

	Season-day Emissions (lbs/day)		
Nonroad Source Category	**VOC**	**NOx**	**CO**
Agricultural Equipment	200.6	1,679.5	1,574.6
Commercial Equipment	14,818.6	8,284.7	203,526.4
Construction and Mining Equipment	13,927.2	93,159.3	106,091.9
Industrial Equipment	2,209.9	11,718.2	46,031.6
Lawn and Garden Equipment (Total)	54,825.3	7,329.9	552,709.8
Logging Equipment	0.0	0.0	0.0
Pleasure Craft	13,207.4	2,420.5	32,628.3
Railway Maintenance Equipment	14.5	59.7	119.5
Recreational Equipment	8,855.0	339.9	37,525.9

3.2.2.2 Aircraft, Ground Support Equipment, and Auxiliary Power Units

Emissions from aircraft, ground support equipment (GSE), and auxiliary power units (APUs) for the period of June through August 2011 were calculated by applying adjustment factors to the emission estimates prepared for the original 2011 PEI report, covering the period of July through September 2011. These adjustment factors for airports have been developed by dividing the number of operations for the June–August timeframe, by the number of operations within the July–September period covered by the initial model calculations, for each of four aircraft categories (air carrier, air taxi, general aviation, and military). Monthly airport operational data were obtained from the Federal Aviation Administration (FAA) Air Traffic Activity Data System (ATADS) database for the year 2011, and from MAG 2009 airport survey data. The total operations for airports for the two periods are presented in Table A7. The season-day emissions for aircrafts, GSE, and APUs for the eight-hour ozone nonattainment area for the period of June through August 2011 developed using the adjustment factors are provided in Table A8.

Table A7. Total operations for two three-month time periods in 2011 (June–August, and July–September) for airports within the eight-hour ozone nonattainment area.

	Count of Total Operations Over a Three-Month Period, by Aircraft Category							
	Air Carrier		Air Taxi		General Aviation		Military	
Airport	**Jun-Aug**	**Jul-Sep**	**Jun-Aug**	**Jul-Sep**	**Jun-Aug**	**Jul-Sep**	**Jun-Aug**	**Jul-Sep**
Buckeye Municipal	0	0	0	0	12,421	12,008	0	0
Chandler Municipal	0	6	532	553	36,210	37,001	389	388
Falcon Field	0	3	696	656	48,426	47,073	547	629
Gila Bend Municipal	0	0	0	0	833	806	0	0
Glendale Municipal	0	0	240	220	19,613	20,904	14	8
Luke Air Force Base	0	0	0	0	0	0	21,082	20,794
Phoenix Deer Valley	0	0	828	796	77,787	84,991	24	61
Phoenix Goodyear	29	29	83	65	33,302	33,437	1,611	1,944
Phoenix Sky Harbor	95,534	92,717	16,326	16,484	4,398	4,536	585	505
Phoenix-Mesa Gateway	2,082	1,974	2,317	2,196	31,047	31,686	1,198	1,326
Pleasant Valley	0	0	0	0	1,503	1,503	0	0
Scottsdale	0	0	2,459	2,584	27,027	28,111	107	139
Sky Ranch at Carefree	0	0	0	0	448	432	0	0
Stellar Airpark	0	0	0	0	9,153	8,849	0	0

Table A8. Ozone season-day emissions from aircraft, ground support equipment, and auxiliary power units in the eight-hour ozone nonattainment area for the period June–August, 2011.

	Ozone Season-day Emissions (lbs/day)		
Nonroad Source Category	**VOC**	**NOx**	**CO**
Aircraft	8,355.4	12,789.2	63,737.5
GSE & APU	590.0	2,155.7	17,236.5

3.2.3 Onroad Mobile Sources

MOVES2010b was used to generate monthly onroad mobile source emissions for vehicle classes, facility types, weekdays and weekend for the 2011 Periodic Emissions Inventory (PEI) for ozone precursors. Monthly onroad mobile source emissions in the eight-hour ozone nonattainment area for June through August were obtained from the MOVES2010b output database developed for the original 2011 PEI; results are shown in Table A9 below. To calculate the average daily emissions for the period, the three-month total onroad emissions were divided by 92 (the total number of days in the three-month period) as shown in Table A10.

Table A9. Monthly emissions from onroad mobile sources in the eight-hour ozone nonattainment area for the period June–August, 2011.

	Onroad Mobile Source Emissions (lbs/month)		
	VOC	**NOx**	**CO**
June	4,283,659.6	10,160,425.4	38,461,716.3
July	4,528,226.8	9,006,439.8	39,909,804.7
August	4,739,641.7	9,267,486.0	42,238,005.8
Total	**13,551,528.1**	**28,434,351.2**	**120,609,526.8**

Table A10. Average season-day emissions from onroad mobile sources in the eight-hour ozone nonattainment area for the period June–August, 2011.

	Average Season-day Emissions (lbs/day)		
Source Category	**VOC**	**NOx**	**CO**
Onroad Mobile Sources	147,299.2	309,069.0	1,310,973.1

3.2.4 Biogenic Sources

Daily mean biogenic emissions for June, July, and August 2011 were obtained from Table 6.4–1 in the 2011 ozone precursor PEI report (and reproduced below in Table A11). The three-month daily means were then averaged to derive season-day biogenic emissions values, as shown in Table A12.

Table A11. Daily mean emissions from biogenic sources in the eight-hour ozone nonattainment area for the period June–August, 2011.

	Daily Mean Biogenic Emissions (lbs/day)		
	VOC	**NOx**	**CO**
June	690,104.5	5,089.1	61,726.7
July	693,725.6	6,294.2	66,100.2
August	720,330.5	7,529.4	71,775.8

Table A12. Average season-day emissions from biogenic sources in the eight-hour ozone nonattainment area for the period June–August, 2011.

	Average Season-day Emissions (lbs/day)		
Source Category	**VOC**	**NOx**	**CO**
Biogenic Sources	701,386.9	6,304.2	66,534.2

3.3 Summary of the "Recasting" Exercise Using a June–August Ozone Season

The tables below compare the original ozone season-day emissions inventory for the eight-hour ozone nonattainment area, with the revised season-day totals that incorporate the revised season-day emissions calculations described in Section 3.2 above. Table A13 compares overall season-day emissions for the eight-hour nonattainment area, broken out by major source category.

Table A13. Comparison of ozone season-day emissions in the eight-hour ozone nonattainment area from the original 2011 PEI report vs. the "recast" inventory, by major source category.

	Ozone Season-day Emissions (lbs/day)					
	As In Original PEI Report (July–September ozone season)			"Recast" Inventory (June–August ozone season)		
Source Category	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Point Sources	4,908	15,407	9,716	4,908	15,407	9,715
Nonpoint (Area) Sources	227,857	31,820	292,321	228,322	32,043	302,710
Nonroad Mobile Sources	111,797	141,444	1,025,618	117,279	144,874	1,061,973
Onroad Mobile Sources	148,186	301,824	1,321,680	147,299	309,069	1,310,973
Biogenic Sources	624,395	6,232	62,584	701,387	6,304	66,534
Total, all source categories	**1,117,143**	**496,727**	**2,711,919**	**1,199,195**	**507,698**	**2,751,955**

The two tables below summarize the changes in emissions that result from redefining the ozone season as the June–August time period. Table A14 presents the absolute emission changes (both increases and decreases), while Table A15 presents these changes in percentage terms. Both tables indicate that the net change in anthropogenic emissions that results from a revised definition of an "ozone season" to June–August is insignificant (i.e., slightly less than 1% of the overall inventory). Finally, Table A16 presents a detailed, line-item comparison of the season-day inventory presented in the original PEI report, vs the recast version incorporating the revised emissions calculated described above.

Table A14. Absolute change in ozone season-day emissions in the eight-hour ozone nonattainment area between the original 2011 PEI report (reflecting a July–September ozone season) and the "recast" inventory (reflecting June–August), by major source category.

	Change in Season-day Emissions (lbs/day)		
Source Category	**VOC**	**NOx**	**CO**
Point Sources	0	0	0
Nonpoint (Area) Sources	+465	+223	+10,389
Nonroad Mobile Sources	+5,482	+3,431	+36,404
Onroad Mobile Sources	–887	+7,245	–10,707
Biogenic Sources	+76,992	+73	+3,950
Net change, all source categories	+82,052	+10,971	+40,037
Net change, anthropogenic sources only (excluding wildfires and biogenic sources)	**+4,571**	**+10,676**	**+25,697**

Table A15. Percentage change in ozone season-day emissions in the eight-hour ozone nonattainment area between the original 2011 PEI report (reflecting a July–September ozone season) and the "recast" inventory (reflecting June–August), by major source category.

	Change in Season-day Emissions (%)		
Source Category	**VOC**	**NOx**	**CO**
Point Sources	0.00%	0.00%	0.00%
Nonpoint (Area) Sources	+0.20%	+0.70%	+3.55%
Nonroad Mobile Sources	+4.90%	+2.43%	+3.55%
Onroad Mobile Sources	–0.60%	+2.40%	–0.81%
Biogenic Sources	+12.33%	+1.16%	+6.31%
Net change, all source categories	+7.34%	+2.21%	+1.48%
Net change, anthropogenic sources only (excluding wildfires and biogenic sources)	**+0.41%**	**+2.15%**	**+0.95%**

Table A16. Ozone season-day emissions from all source categories in the eight-hour ozone nonattainment area, comparing the original 2011 PEI report (reflecting a July–September ozone season) and the "recast" inventory (reflecting June–August), by major source category. Shaded cells indicate revised emission values.

	Original PEI (July–Sept., in lbs/day)			"Recast" ozone season (June–August, in lbs/day)		
Source Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
POINT SOURCES[1]	4,279.8	15,353.4	9,632.0	4,279.8	15,353.4	9,632.0
Emission Reduction Credits[2] (unchanged)	628.5	53.7	83.8	628.5	53.7	83.8
Total, All Point Sources:	**4,908.3**	**15,407.1**	**9,715.8**	**4,908.3**	**15,407.1**	**9,715.8**
AREA SOURCES:						
Fuel combustion:						
Industrial distillate oil: Boilers[2]	3.9	388.5	97.1	3.9	388.5	97.1
Industrial distillate oil: Engines[2]	0.0	11,733.0	2,525.3	0.0	11,733.0	2,525.3
Industrial natural gas[1]	216.9	4,285.3	2,669.3	216.9	4,285.3	2,669.3
Comm./inst. distillate oil: Boilers[2]	0.0	0.8	0.2	0.0	0.8	0.2
Comm./inst. distillate oil: Engines[2]	0.0	23.7	5.1	0.0	23.7	5.1
Comm./inst. natural gas[1]	251.7	4,992.0	3,061.7	251.7	4,992.0	3,061.7
Residential distillate oil[3]	0	0	0	0	0	0
Residential natural gas[1]	120.5	2,060.1	876.7	120.5	2,060.1	876.7
Residential LPG[3]	0	0	0	0	0	0
Residential wood combustion[3]	0	0	0	0	0	0
Residential kerosene[3]	0	0	0	0	0	0
All Fuel Combustion:	**593.0**	**23,483.5**	**9,235.4**	**593.0**	**23,483.5**	**9,235.4**
Industrial processes:						
Chemical manufacturing[1]	596.5			596.5		
Commercial cooking[2]	829.8		2,181.7	829.8		2,181.7
Bakeries[1]	545.4			545.4		
Secondary metal production[1]	306.4	107.9	697.4	306.4	107.9	697.4
Rubber/plastic product manufacturing[1]	14,110.1			14,110.1		
Electrical equipment manufacturing[1]	746.2	135.8	16.4	746.2	135.8	16.4
Industrial processes, NEC[1]	318.0	1,245.8	525.2	318.0	1,245.8	525.2
All Industrial Processes:	**17,452.4**	**1,489.5**	**3,420.8**	**17,452.4**	**1,489.5**	**3,420.8**
Solvent use:						
Architectural coatings[4]	30,973.1			30,973.1		
Auto refinishing[2]	10,211.8			10,211.8		
Traffic markings[4]	1,737.5			1,737.5		
Factory finished wood[1]	1,390.7			1,390.7		
Wood furniture[1]	3,419.9			3,419.9		
Aircraft surface coating[1]	473.1			473.1		
Miscellaneous surface coating[1]	2,440.0			2,440.0		
Degreasing[1]	1,445.1			1,445.1		
Dry cleaning[2]	180.1			180.1		
Graphics arts[1]	2,216.1			2,216.1		
Miscellaneous industrial solvent use[1]	5,104.6			5,104.6		
Consumer and commercial products[2]	96,468.5			96,468.5		
Cutback asphalt[2]	4,309.9			4,309.9		
Emulsified asphalt[2]	4,465.8			4,465.8		
Roofing asphalt[2]	23.7			23.7		
Agricultural pesticides	1,697.5			1,697.3		
All Solvent Use:	**166,557.4**			**166,557.2**		

[1] = No change; season-day emissions are based on June–August activity data reported by sources.
[2] = No change; activity is assumed evenly distributed throughout the year.
[3] = No change; no activity assumed to occur between May and September.
[4] = No change; season-day emissions were estimated using EPA guidance and seasonal activity factor.
[5] = No change; no activity reported in June or September.
[6] = No change; activity is accounted for as part of mobile source emission calculations.

Table A16 (continued). Ozone season-day emissions from all source categories in the eight-hour ozone non-attainment area, comparing the original 2011 PEI report (reflecting a July–September ozone season) and the "recast" inventory (reflecting June–August), by major source category. Shaded cells indicate revised emission values.

	Original PEI (July–Sept., in lbs/day)			"Recast" ozone season (June–August, in lbs/day)		
Source Category	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Storage/transport:						
Residential portable gas cans[2]	16,311.4			16,311.4		
Commercial portable gas cans[2]	3,136.7			3,136.7		
Bulk plants[1]	659.3			659.3		
Gas stations Stage I: Submerged fill	528.7			526.9		
Gas stations Stage I: Bal. submerged fill	1,426.8			1,421.9		
Gas stations Stage II[6]	0			0		
Underground tanks: Breathing/emptying	4,138.6			4,124.4		
Airports: aviation gasoline Stage I[2]	1,887.2			1,887.2		
Airports: aviation gasoline Stage II[2]	97.9			97.9		
Truck: gasoline (tank trucks in transit)	315.8			314.7		
Pipeline gasoline[2]	94.5			94.5		
Volatile organic liquids storage/transport[1]	169.3			169.3		
All Storage/Transport:	**28,766.2**			**28,744.2**		
Waste treatment/disposal:						
On-site incineration[1]	1.1	21.4	5.3	1.1	21.4	5.3
Open burning: Land clearing debris[2]	9.1	4.1	86.4	9.1	4.1	86.4
Landfills[1]	200.7	167.4	596.4	200.7	167.4	596.4
Publicly owned treatment works[4]	583.7			583.7		
Leaking underground storage tanks[2]	32.3			32.3		
Other waste[1]	10.9	122.8	431.4	10.9	122.8	431.4
All Waste Treatment/Disposal:	**837.8**	**315.6**	**1,119.6**	**837.8**	**315.6**	**1,119.6**
Misc. area sources:						
Agricultural field burning[2]	470.2	209.0	4,440.7	470.2	209.0	4,440.7
Structure fires[4]	73.3	9.3	399.7	73.3	9.3	399.7
Aircraft engine testing[1]	26.1	259.3	91.2	26.1	259.3	91.2
Vehicle fires[2]	51.4	6.4	200.8	51.4	6.4	200.8
Crematories[1]	50.9	88.1	17.2	50.9	88.1	17.2
Accidental releases	2.1	0.0	0.0	0.6	0.0	0.0
Hospitals[1]	52.9			52.9		
Wildfires	12,794.0	5,832.6	271,872.2	13,282.9	6,055.4	282,261.6
Prescribed fires[5]	129.2	127.1	1,523.2	129.2	127.1	1,523.2
All Misc. Area Sources:	**13,650**	**6,532**	**278,545**	**14,137.4**	**6,754.7**	**288,934.4**
ALL AREA SOURCES:	**227,856.8**	**31,820.5**	**292,320.7**	**228,322.0**	**32,043.4**	**302,710.1**
NONROAD MOBILE SOURCES:						
Agricultural equipment	192.5	1,615.1	1,510.9	200.6	1,679.5	1,574.6
Airport GSE & APUs	584.5	2,128.9	17,071.7	590.0	2,155.5	17,236.7
Commercial equipment	14,474.7	8,299.0	202,531.2	14,818.6	8,284.7	203,526.4
Construction & mining equipment	13,534.5	90,774.0	103,125.0	13,927.2	93,159.3	106,091.9
Industrial equipment	2,203.1	11,712.9	45,940.4	2,209.9	11,718.2	46,031.6
Lawn and garden equipment	52,584.9	7,078.4	529,218.9	54,825.3	7,329.9	552,709.8
Pleasure craft	11,527.0	1,996.8	26,738.3	13,207.4	2,420.5	32,628.3
Railway maintenance equipment	14.4	59.7	119.1	14.5	59.7	119.5
Recreational equipment	8,020.9	306.0	33,528.7	8,855.0	339.9	37,525.9
Aircraft	8,385.8	12,535.3	64,993.6	8,355.4	12,789.2	63,737.5
Locomotives[2]	274.8	4,937.7	839.9	274.8	4,937.7	839.9
ALL NONROAD MOBILE SOURCES:	**111,797.1**	**141,443.8**	**1,025,617.7**	**117,278.7**	**144,874.4**	**1,062,022.0**
ONROAD MOBILE SOURCES:	**148,186.2**	**301,823.7**	**1,321,680.2**	**147,299.2**	**309,069.0**	**1,310,973.1**
BIOGENIC SOURCES:	**624,395.0**	**6,231.7**	**62,584.2**	**701,386.9**	**6,304.2**	**66,534.2**
TOTAL, ALL SOURCE CATEGORIES:	**1,117,143.4**	**496,726.7**	**2,711,918.6**	**1,199,195.0**	**507,698.0**	**2,751,955.2**

4. Emissions from Facilities Treated as Area Sources in the 2011 Periodic Emissions Inventory

Table A17 below lists those sources whose 2011 emissions were included in the area source categories of the 2011 Periodic Emissions Inventory (PEI) report for Ozone Precursors, originally published in February 2014.

Table A17. 2011 emissions (in tons/yr) from permitted facilities whose emissions are reflected in area source categories.

ID	Business Name	Address	City	VOC	NOx	CO
1074	23RD AVE WASTEWATER TREATMENT PLANT	2470 S 22ND AVE	PHOENIX	0.24	2.62	25.73
1303	ABLE ENGINEERING & COMPONENT SERVICES	2920 E CHAMBERS ST	PHOENIX	1.29	0.07	0.06
1387	ABLE STEEL FABRICATORS	4150 E QUARTZ CIR	MESA	2.06		
103646	ABSS MANUFACTURING CO INC	3935 W ADAMS ST	PHOENIX	1.21		
73117	ACE ASPHALT OF ARIZONA INC	3030 S 7TH ST	PHOENIX	0.75		
4005	AEROTEC INTERNATIONAL INC	3007 E CHAMBERS ST	PHOENIX	0.27	0.20	0.01
969	AF LORTS MANUFACTURING COMPANY INC	15836 W EDDIE ALBERT WAY	GOODYEAR	16.48		
74939	AFFORDABLE POWDER COATING	2111 W FILLMORE ST	PHOENIX	0.01	0.09	0.08
34139	ALL WOOD TREASURES CO	2063 E CEDAR ST	TEMPE	7.80		
35541	ALLIED TUBE AND CONDUIT	2525 N 27TH AVE	PHOENIX	14.52	0.08	0.07
4369	AM FORM U-HAUL	4650 W PASADENA AVE	GLENDALE	0.01		
4397	AMBER STEEL FABRICATION, INC	11331 E GERMANN RD	CHANDLER	13.17		
128418	AMERICAN AEROSPACE TECHNICAL CASTINGS	2950 W CATALINA DR	PHOENIX	0.08	0.21	0.18
1412	AMERICAN AIRLINES INC	3400 E SKY HARBOR BLVD	PHOENIX	0.05	0.65	0.14
1243	AMERICAN FIBERGLASS	2533 W CYPRESS ST	PHOENIX	2.35		
131366	AMERICAN METALS COMPANY, INC	740 W BROADWAY RD	MESA	0.13	1.64	0.35
1195	AMERICAN MONUMENT CO	2337 W VAN BUREN ST	PHOENIX	0.09		
54414	AMERICAN SAND & ROCK	PORTABLE		0.15	1.83	0.39
42432	AMERIPRIDE LINEN & APPAREL SERVICE	6025 W VAN BUREN ST	PHOENIX	0.06	1.11	0.94
199	AMERON INTL-WATER TRANSMISSION GROUP	2325 S 7TH ST	PHOENIX	1.73	0.19	0.10
129545	AMES DIVERSIFIED SERVICES	3015 W CLARENDON AVE	PHOENIX	0.03	1.39	0.08
78183	AMKOR TECHNOLOGY INC	1900 S PRICE RD	CHANDLER	0.02	0.27	0.08
130799	ANASAZI DOOR	5650 S 67TH AVE	LAVEEN	0.16		
31637	ANDERSON CLAYTON CORP	25500 W SOUTHERN AVE	BUCKEYE	0.01	0.39	0.07
79726	ANGELICA TEXTILE SERVICES	4410 W MOHAVE ST	PHOENIX	0.16	2.80	1.41
41	ANIMAL CREMATION SERVICES	5646 W BETHANY HOME RD	GLENDALE	0.02	1.14	0.06
92785	APEX BLOCK	1901 W FILLMORE ST	PHOENIX	0.01		
83379	APS BIOGROUP	601 S 54TH AVE	PHOENIX	0.02	0.37	0.31
78943	AQC PAINTING	6947 W SOUTHERN AVE	LAVEEN	0.32		
84	ARIZONA BRAKE & CLUTCH SUPPLY INC	2211 N BLACK CANYON HWY	PHOENIX	1.05	0.01	0.01
35372	ARIZONA CUSTOM CABINETS INC	8729 N 78TH AVE	PEORIA	2.88		
3938	ARIZONA GALVANIZING INC	15775 W ELWOOD ST	GOODYEAR	0.14	2.56	2.15
130470	ARIZONA LANDFILL LLC	2750 S 11TH AVE	PHOENIX	0.65	13.51	2.07
131021	ARIZONA NUTRITIONAL SUPPLEMENTS LLC	210 S BECK AVE	CHANDLER	12.07		
69409	ARIZONA POLYMER FLOORING INC	7731 N 68TH AVE	GLENDALE	5.96		
4364	ARIZONA STATE UNIVERSITY	1551 S RURAL RD	TEMPE	2.29	8.99	4.09
128851	ARMOR DESIGN LLC	2500 N 24TH ST	PHOENIX	0.02	0.00	0.00
36340	ARMORWORKS LLC	305 N 54TH ST	CHANDLER	2.17		
30112	ASM AMERICA INC	3440 E UNIVERSITY DR	PHOENIX	0.13	0.15	0.03

Table A17 (continued). 2011 emissions (in tons/yr) from permitted facilities whose emissions are reflected in area source categories.

ID	Business Name	Address	City	VOC	NOx	CO
36898	ASPC-LEWIS	26700 S HWY 85	BUCKEYE	2.37	14.29	10.31
4109	ASSOCIATED CONSTRUCTION ENTERPRISES INC	3645 N 40TH AVE	PHOENIX	0.30		
4328	ASU MACROTECHNOLOGY WORKS	7700 S RIVER PKWY	TEMPE	1.06	2.79	1.12
1502	ATLAS ROOFING CORPORATION	40 S 45TH AVE	PHOENIX	6.07	0.49	2.02
2656	AVIATION DEPT - PHOENIX SKY HARBOR	3400 E SKY HARBOR BLVD	PHOENIX	0.50	3.48	1.01
50422	BAE SYSTEMS AEROSPACE AND DEFENSE GROUP	7822 S 46TH ST	PHOENIX	9.24	0.83	0.69
1449	BAKER COMMODITIES	3602 W ELWOOD ST	PHOENIX	13.87	2.47	0.00
31585	BANK OF AMERICA	2500 W FRYE RD	CHANDLER	0.11	6.02	0.91
781	BANNER GOOD SAMARITAN MEDICAL CENTER	1111 E MCDOWELL RD	PHOENIX	0.56	8.23	5.29
29946	BANNER THUNDERBIRD MEDICAL CENTER	5555 W THUNDERBIRD RD	GLENDALE	1.36	6.57	1.75
126319	BELLA BEAMS & ARCHITECTURAL PRODUCTS INC	825 N 73RD AVE	PHOENIX	0.39		
65354	BERGMANN GROUP	3730 E SOUTHERN AVE	PHOENIX	0.00	0.06	0.05
961	BIG SURF WATERPARK	1500 N MCCLINTOCK DR	TEMPE	0.32	7.83	1.10
74058	BILTMORE SHUTTERS INC	1138 W WATKINS ST	PHOENIX	5.22		
1192	BINGHAM OF ARIZONA	2327 E JONES AVE	PHOENIX	0.14		
128814	BIOTECH RESEARCH LABS INC	3809 E WATKINS ST	PHOENIX	1.08	1.53	1.28
115733	BOLT'S METALLIZING, INC	222 S 37TH ST	PHOENIX	0.86		
34872	BONDED LOGIC	24053 S ARIZONA AVE	CHANDLER	0.00	2.12	0.35
226	BORAL ROOFING LLC	1832 S 51ST AVE	PHOENIX	2.24	0.27	0.23
688	BREWER COTE OF ARIZONA	5226 W MISSOURI AVE	GLENDALE	0.00	0.02	0.00
59	BROWN & BROWN CHEVROLET	145 E MAIN ST	MESA	3.84	0.29	0.24
3528	BROWN EVANS DIST - B/P #1	306 S COUNTRY CLUB DR	MESA	6.71		
458	BRYANT INDUSTRIES INC	788 W ILLINI ST	PHOENIX	3.77		
130047	BUESING CORPORATION	11520 E GERMANN RD	CHANDLER	0.24	2.99	0.64
217	BUILDING PRODUCTS CO	4850 W BUCKEYE RD	PHOENIX	1.02	1.40	4.81
2854	BUNGER STEEL INC	8112 W BUCKEYE RD	PHOENIX	0.60		
56105	BURDETTE CABINET CO INC	3941 N HIGLEY RD	MESA	8.91		
1218	BUTTERFIELD STATION FACILITY	40404 S 99TH AVE	MOBILE	5.82	17.73	23.58
46123	CABINETS BY SUZI INC	2801 N 37TH AVE	PHOENIX	1.16		
131634	CAFE VALLEY, INC	7000 W BUCKEYE RD	PHOENIX	5.81	2.03	1.71
3307	CALJET	5119 W MONROE ST	PHOENIX	32.44		
3442	CALJET	125 N 53RD AVE	PHOENIX	30.15	0.01	0.08
108199	CALJET OF AMERICA LLC	57 N 57TH AVE	PHOENIX	8.82		
120006	CALPORTLAND	PORTABLE #1		0.00	0.04	0.03
129582	CALPORTLAND	23742 N CENTRAL AVE	PHOENIX	0.00	0.06	0.06
131966	CALPORTLAND	4830 S 43RD AVE	PHOENIX	0.01	0.25	0.21
109360	CALPORTLAND COMPANY	7505 S 143RD AVE	GOODYEAR	0.00	0.04	0.03
3296	CALVERT OIL CO	214 E ARIZONA EASTERN AVE	BUCKEYE	10.33		
291	CAPITAL LUMBER COMPANY	11 N 45TH AVE	PHOENIX	0.38		
177	CAPITOL ENGINEERING CO	724 E SOUTHERN PACIFIC DR	PHOENIX	0.31		
284	CARL T HAYDEN VA MEDICAL CENTER	650 E INDIAN SCHOOL RD	PHOENIX	0.83	4.58	2.09
776	CASE SANDBLASTING INC	1018 S 27TH AVE	PHOENIX	1.00		
1317	CAVCO INDUSTRIES INC	2602 S 35TH AVE	PHOENIX	0.00		
1318	CAVCO INDUSTRIES INC	1366 S LITCHFIELD RD	GOODYEAR	9.91		
1316	CAVCO INDUSTRIES LLC/DURANGO PLANT	2502 W DURANGO ST	PHOENIX	3.19		
260	CEMEX - 19TH AVE PLANT	3640 S 19TH AVE	PHOENIX	2.50	9.56	29.27
98591	CEMEX - 7TH STREET PLANT	PORTABLE #4	PHOENIX	0.00	0.07	0.02
98492	CEMEX - BUCKEYE PLANT	22625 W BELOAT RD	BUCKEYE	0.00	0.01	0.00
63	CEMEX - EL MIRAGE PLANT	8635 N EL MIRAGE RD	EL MIRAGE	0.00	0.04	0.01
129625	CEMEX - TABLE MESA SITE	TABLE MESA RD	PHOENIX	0.00	0.03	0.01

Table A17 (continued). 2011 emissions (in tons/yr) from permitted facilities whose emissions are reflected in area source categories.

ID	Business Name	Address	City	VOC	NOx	CO
1266	CEMEX - WEST PLANT	11701 W INDIAN SCHOOL RD	PHOENIX	0.00	0.00	
4009	CEMEX ENTERPRISES, LLC	327 S 27TH AVE	PHOENIX	0.01	0.09	0.08
16	CEM-TEC CORPORATION	3745 S 7TH AVE	PHOENIX	1.17	0.10	0.08
27947	CENTRAL ARIZONA WATER CONSERVATION DIST	23636 N 7TH ST	PHOENIX	0.99	0.64	0.14
1310	CENTURY GRAPHICS LLC	2960 GRAND AVE	PHOENIX	8.44	0.33	0.28
823	CHEMRESEARCH CO INC	1130 W HILTON AVE	PHOENIX	4.57	0.36	0.31
3976	CHOLLA CUSTOM CABINETS INC	1727 E DEER VALLEY DR	PHOENIX	2.04	0.01	0.00
261	CHROMALLOY ARIZONA	5161 W POLK ST	PHOENIX	0.04	0.68	0.57
127623	CINTAS CORPORATION	2425 W NEVADA ST	CHANDLER	1.85	0.71	0.59
61573	CIRCLE H SAND & ROCK	6400 S EL MIRAGE RD	TOLLESON	0.19	2.37	0.51
3441	CIRCLE K TERMINAL LLC	5333 W VAN BUREN ST	PHOENIX	36.16		
35819	CITY OF CHANDLER LANDFILL	3850 S MCQUEEN RD	CHANDLER	0.15	1.53	0.07
3403	CITY OF PHOENIX 19TH AVE LANDFILL	1701 W LOWER BUCKEYE RD	PHOENIX	0.04	0.70	0.30
29919	CITY OF PHOENIX 27TH AVE LANDFILL	2800 S 27TH AVE	PHOENIX	0.12	1.50	2.61
43818	CLASSIC PARTY RENTALS	3103 E BROADWAY RD	PHOENIX	0.89		
1075	CITY OF PHOENIX 91ST AVE WWTP	5615 S 91ST AVE	TOLLESON	2.97	19.08	9.16
49636	COFFMAN SPECIALTIES INC	PORTABLE 1		0.33	4.10	0.88
926	COMPOSITES ONE LLC	2701 W VIRGINIA AVE	PHOENIX	0.08		
113723	CONTRACTORS LANDFILL & RECYCLING	2425 N CENTER ST	MESA	0.14	1.72	0.37
130397	COOLING TOWER PRODUCTS	415 E GRANT ST	PHOENIX	0.56		
34473	COPLIN MFG INC	7505 W WASHINGTON ST	TOLLESON	2.91		
1054	COPPERSTATE CABINET CO INC	1932 W NORTH LN	PHOENIX	6.08		
31570	COPPERSTATE RUBBER OF ARIZONA	750 S 59TH AVE	PHOENIX	8.17	0.35	0.30
399	CORESLAB STRUCTURES (ARIZ) INC	5026 S 43RD AVE	PHOENIX	2.30		
225	CORNING GILBERT INC	5310 W CAMELBACK RD	GLENDALE	0.72		
227	CORROSION ENGINEERING INC	145 S NINA CIR	MESA	14.98	0.43	0.36
1198	COURIER GRAPHICS CORP	2621 S 37TH ST	PHOENIX	8.80	0.30	0.25
289	COURTHOUSE AG HOLDINGS LLC	51040 W VALLEY RD	AGUILA	1.74	0.01	0.01
65	CRAFCO INC	6975 W CRAFCO WAY	CHANDLER	1.74	0.32	0.23
4368	CRAFTSMEN IN WOOD MFG	5441 W HADLEY ST	PHOENIX	4.81	0.04	0.03
1407	CRANE CO. SIGNAL TECHNOLOGY	340 N ROOSEVELT AVE	CHANDLER	0.37	0.24	0.20
100059	CRM OF AMERICA (NEW AIR)	11400 E PECOS RD	MESA	0.19	0.18	0.15
131179	CSE OPERATING I, LLC	29115 W BROADWAY RD	BUCKEYE	0.00	0.44	0.05
130790	CUSTOM FAB INC	3065 S 43RD AVE	PHOENIX	3.74	0.25	0.21
131444	CUSTOM LANDSCAPE MATERIALS "BELMONT"		WICKENBURG	0.08	1.00	0.21
131392	CUSTOM LANDSCAPE MATERIALS "BIG HORN"	AGUILA RD MILE POST 12	AGUILA	0.18	2.20	0.47
87	DECA CREMATION SERVICES INC	2237 S 15TH ST	PHOENIX	0.01	0.76	0.04
45027	DEER VALLEY TRANSFER STATION	2120 W ADOBE DR	PHOENIX	0.01	0.06	0.01
1342	DEL RIO LANDFILL	1150 E ELWOOD ST	PHOENIX	0.23	0.10	0.02
696	DESERT FIRE INDUSTRIES INC	720 W ILLINI ST	PHOENIX	1.02	1.29	1.08
47179	DESERT MILLWORK INC	1702 W ROOSEVELT ST	PHOENIX	0.94		
50725	DESERT POWDER COATING	4409 S 35TH AVE	PHOENIX	5.42	0.27	0.23
51073	DIGITAL REALTY TRUST CHANDLER, LLC	2121 S PRICE RD	CHANDLER	0.54	6.75	4.92
440	DI-MATRIX PRECISION MANUFACTURING	5225 S 31ST PL	PHOENIX	23.67		
130195	DIRT 101 OPERATIONS LLC	11748 W GLENDALE AVE	GLENDALE	0.12	1.45	0.31
130	DOLPHIN INC	740 S 59TH AVE	PHOENIX	0.87	0.81	0.68
127094	DOUBLETREE PAPER MILL LLC	31201 W THAYER RD	GILA BEND	5.76	4.66	12.62
299	DPC ENTERPRISES INC GP	4909 W PASADENA AVE	GLENDALE	1.60		
971	DUCOMMUN LABARGE TECHNOLOGIES INC	1601 E BROADWAY RD	PHOENIX	1.51	0.12	0.10
51062	DURANGO CORRECTIONAL FACILITY	3225 W DURANGO ST	PHOENIX	0.14	2.12	1.19

Table A17 (continued). 2011 emissions (in tons/yr) from permitted facilities whose emissions are reflected in area source categories.

ID	Business Name	Address	City	VOC	NOx	CO
36595	D-VELCO AVIATION SERVICES	300 S 23RD ST	PHOENIX	0.37	0.06	0.05
48771	EAGLE ROOFING PRODUCTS	4602 W ELWOOD ST	PHOENIX	1.01	0.22	0.19
35018	EARL'S FIBERGLASS INC	128 W MARICOPA FWY	PHOENIX	6.56		
3305	EARTHGRAINS BAKING COMPANIES INC	738 W VAN BUREN ST	PHOENIX	14.74	2.11	1.77
1286	EASTERN PRODUCTS FOUNDRY	2810 E ILLINI ST	PHOENIX	0.04	0.05	0.04
26	EMPIRE MACHINERY CO	1725 S COUNTRY CLUB DR	MESA	8.90	32.42	19.53
62367	EMPIRE POWER SYSTEMS	840 N 43RD AVE	PHOENIX	0.11		
130260	ENTRUSTED PET LLC	2237 S 15TH ST	PHOENIX	0.00	0.17	0.01
87202	ENVIRONMENTAL MANAGEMENT SYSTEMS INC	2132 S 5TH AVE	PHOENIX	0.00	0.02	0.00
55952	ERGON ASPHALT PRODUCTS INC	6940 W CHANDLER BLVD	CHANDLER	0.11	0.27	0.22
114747	ERICKSON FRAMING AZ LLC	250 N BECK AVE	CHANDLER	0.07		
1505	EXECUTIVE DOOR COMPANY	3939 W CLARENDON AVE	PHOENIX	0.36		
1488	FARMER'S GIN INC	8400 S TURNER RD	BUCKEYE	0.03	0.89	0.15
59426	FEDERAL EXPRESS-PHXR	3002 E OLD TOWER RD	PHOENIX	0.48	1.01	0.22
224	FERTIZONA	17102 W OLIVE AVE	WADDELL	0.28		
925	FERTIZONA BUCKEYE LLC	26705 W BASELINE RD	BUCKEYE	0.69		
132090	FINE WOODS MFG INC	4817 S 35TH ST	PHOENIX	0.39		
131222	FINECRAFT CUSTOM WOODWORKS LLC	5230 W LUKE AVE	GLENDALE	2.34		
107758	FIREBIRD FIBERGLASS PRODUCTS INC	6010 N 53RD DR	GLENDALE	6.47		
128991	FISHER SAND & GRAVEL	PORTABLE #3		0.86	8.65	7.98
63471	FISHER SAND & GRAVEL CO	PORTABLE #1		0.03	0.36	0.08
85509	FISHER SAND & GRAVEL COMPANY	PORTABLE #2		0.08	0.97	0.21
1087	FLEX FOAM DIVISION	617 N 21ST AVE	PHOENIX	2.92	0.23	0.20
27728	FLIPCHIP INTERNATIONAL LLC	3701 E UNIVERSITY DR	PHOENIX	21.28	0.50	0.42
1375	FOREST DESIGNS	3230 E ROESER RD	PHOENIX	4.42		
881	FREESCALE SEMICONDUCTOR INC	1300 N ALMA SCHOOL RD	CHANDLER	20.51	13.51	13.06
4206	FUJI FILM ELECTRONIC MATERIALS USA	6550 S MOUNTAIN RD	MESA	1.88	1.51	1.27
64450	FUTUREWELD CO INC	3518 E WOOD ST	PHOENIX	0.02		
36258	G & K SERVICES	4804 W ROOSEVELT ST	PHOENIX	3.76	0.91	0.76
1118	GANNON & SCOTT	2113 E SKY HARBOR CIR S	PHOENIX	0.06	2.90	0.67
41751	GCR TIRE CENTERS	2815 N 32ND AVE	PHOENIX	0.33		
994	GEMINI COMPANY INC	1711 E JACKSON ST	PHOENIX	1.25		
902	GENERAL DYNAMICS C4 SYSTEMS	8201 E MCDOWELL RD	SCOTTSDALE	3.27	4.79	1.60
4173	GLENDALE MUN SANITARY LANDFILL/FLD OPER	11480 W GLENDALE AVE	GLENDALE	0.24	14.83	82.80
73110	GLENN WEINBERGER TOPSOIL INC	39500 S 99TH AVE	MARICOPA Co	0.01	0.13	0.03
561	GLENWOOD CUSTOM CABINETS, LLC	44 E PIONEER ST	PHOENIX	2.21		
46711	GLOBAL ORGANICS INC	26305 S 295TH AVE	BUCKEYE	0.00	0.03	0.03
123080	GODADDY.COM, LLC	1402 E BUCKEYE RD	PHOENIX	0.14	3.96	0.74
1418	GOODRICH CORPORATION	3414 S 5TH ST	PHOENIX	26.71	0.36	0.16
131758	GOODRICH LIGHTING SYSTEMS	3445 S 5TH ST	PHOENIX	0.02	0.00	0.00
1374	GOODRICH TURBOMACHINERY PRODUCTS	323 S BRACKEN LN	CHANDLER	2.61	0.15	0.12
62288	GREEN WASTE RECYCLING	6840 S 35TH AVE	PHOENIX	0.09	3.02	0.69
1182	GREENWOOD MEMORY LAWN MORTUARY	2300 W VAN BUREN ST	PHOENIX	0.02	0.83	0.05
141	GRO-WELL BRANDS INC	2807 S 27TH AVE	PHOENIX	0.26		
56900	GRO-WELL BRANDS INC	3060 S 27TH AVE	PHOENIX	0.54	6.56	1.41
4498	HANSON AGGREGATES LLC	33500 W INDIAN SCHOOL RD	TONOPAH	0.03	0.39	0.08
699	HANSON AGGREGATES OF ARIZONA INC	4002 S 51ST AVE	PHOENIX	2.47	3.19	3.54
67317	HANSON PIPE & PRECAST INC	12600 W NORTHERN AVE	EL MIRAGE	0.01	0.13	0.11
112836	HASSAYAMPA PLANT #32	31908 W CAMELBACK RD	BUCKEYE	0.00	0.02	0.00
131334	HELIAE DEVELOPMENT LLC	614 E GERMANN RD	GILBERT	0.69		

Table A17 (continued). 2011 emissions (in tons/yr) from permitted facilities whose emissions are reflected in area source categories.

ID	Business Name	Address	City	VOC	NOx	CO
31565	HENRY PRODUCTS INC	302 S 23RD AVE	PHOENIX	10.77	0.44	0.37
1320	HERAEUS MATERIALS TECHNOLOGY NORTH AMERI	301 N ROOSEVELT AVE	CHANDLER	2.93	0.10	0.02
590	HOLLY ASPHALT COMPANY	7110 W NORTHERN AVE	GLENDALE	5.12	6.56	5.51
3536	HOLSUM BAKERY INC	2322 W LINCOLN ST	PHOENIX	25.02	4.04	3.39
39213	HOLSUM OF TOLLESON LLC	9600 W BUCKEYE RD	TOLLESON	21.89	2.51	2.11
76313	HONEYWELL ELECTRONIC CHEMICAL LLC	6760 W CHICAGO ST	CHANDLER	0.00		
1059	HONEYWELL ENGINES SYS & SERVICE PHX R&O	1944 E SKY HARBOR CIR	PHOENIX	13.58	1.67	3.01
355	HONEYWELL-ENGINES SYSTEMS & SERVICES	111 S 34TH ST	PHOENIX	26.84	45.90	15.35
403	HYDRO ALUMINUM NORTH AMERICA INC	249 S 51ST AVE	PHOENIX	33.53	10.99	8.42
168	HYDRO CONDUIT CORP	1011 S 43RD AVE	PHOENIX	0.01	0.02	0.01
131198	IMPERIAL WOODWORKING LLC	4012 W TURNEY AVE	PHOENIX	0.77		
354	IMSAMET OF ARIZONA	3829 S ESTRELLA PKWY	GOODYEAR	8.00	5.60	52.80
352	INCIDE TECHNOLOGIES INC	50 N 41ST AVE	PHOENIX	0.00	0.05	0.04
4033	INDUSTRIAL POWDER COATING INC	3736 S 7TH AVE	PHOENIX	0.00	0.03	0.02
777	INSULFOAM	3401 W COCOPAH ST	PHOENIX	35.39	0.72	0.60
31617	INTEL CORP CHANDLER CAMPUS (FAB 6)	5000 W CHANDLER BLVD	CHANDLER	5.35	7.92	5.89
89885	INTERCO PRINT	4501 W POLK ST	PHOENIX	0.94	0.16	0.13
4444	INTERNATIONAL RECTIFIER (EPI SERVICES)	550 W JUANITA AVE	MESA	0.56	0.16	0.03
131226	INTERSAN MANUFACTURING	1746 W FILLMORE ST	PHOENIX	0.15		
130265	IO PHOENIX ONE, LLC	615 N 48TH ST	PHOENIX	0.37	6.74	0.55
40471	IRONWOOD CUSTOM FINISHING	1822 E MADISON ST	PHOENIX	3.90		
983	ISOLA GROUP S A R L	165 S PRICE RD	CHANDLER	19.09	15.04	2.97
77985	ITC MFG	110 S 41ST AVE	PHOENIX	0.04	0.68	0.57
29975	J & A OAK INC	2452 W SHERMAN ST	PHOENIX	1.60		
732	JABIL	615 S RIVER DR	TEMPE	4.84		
121	JACKS TIRE & OIL	5925 W MONROE ST	PHOENIX	0.89	0.05	0.04
101	JBS TOLLESON INC	651 S 91ST AVE	TOLLESON	13.15	15.00	12.60
1027	JPCI SERVICES	PORTABLE		3.16	1.42	0.31
101303	KARCHER NORTH AMERICA	325 S PRICE RD	CHANDLER	0.10		
130981	KELLER ELECTRICAL INDUSTRIES INC	1881 E UNIVERSITY DR	PHOENIX	0.55	0.10	0.08
725	KILAUEA CRUSHERS INC	HWY 74	WICKENBURG	2.04	25.57	5.51
114904	KILAUEA CRUSHERS INC	16402 S TUTHILL RD	BUCKEYE	0.04	0.47	0.10
128509	KILAUEA CRUSHERS INC	HWY 85	BUCKEYE	0.09	1.12	0.24
811	KROPF WOODWORKING INC	11035 N 22ND AVE	PHOENIX	1.17		
341	L & M LAMINATES & MARBLE	813 E UNIVERSITY DR	PHOENIX	3.70		
857	L-3 COMMUNICATIONS CORPORATION	1215 S 52ND ST	TEMPE	10.65	0.16	0.03
48255	LADY WOODRUFF CABINETRY INC	4812 S 43RD AVE	PHOENIX	0.03		
817	LANE AWARD MFG INC	1118 S CENTRAL AVE	PHOENIX	0.45		
30357	LARON INC	3550 S 16TH ST	PHOENIX	0.59	0.04	0.04
96886	LEGENDS FURNITURE	10300 W BUCKEYE RD	TOLLESON	34.27		
130111	LIFEPLAN CREMATORY INC	1216 N 17TH AVE	PHOENIX	0.70	0.35	1.17
744	M E GLOBAL INC	5857 S KYRENE RD	TEMPE	25.91	12.49	49.13
1248	MAAX SPAS INDUSTRIES CORP	25605 S ARIZONA AVE	CHANDLER	37.94		
31261	MADISON GRANITE SUPPLIES	29925 N NORTH VALLEY PKWY	PHOENIX	2.09	24.38	7.17
113181	MAGELLAN AEROSPACE TURBINE SERVICES LLC	5170 W BETHANY HOME RD	GLENDALE	0.99		
131855	MARICOPA COUNTY SOLID WASTE DEPARTMENT	40135 N HWY 60	MORRISTOWN	0.30		
353	MARLAM INDUSTRIES INC	834 E HAMMOND LN	PHOENIX	10.30	0.01	0.01
61268	MASTER BLOCK	12620 W BUTLER DR	EL MIRAGE	0.00	0.03	0.02
1200	MEDTRONIC - TEMPE	2343 W MEDTRONIC WAY	TEMPE	5.62	0.56	0.47
128760	MERIDIAN OPTICAL	3711 E ATLANTA AVE	PHOENIX	1.13		

Table A17 (continued). 2011 emissions (in tons/yr) from permitted facilities whose emissions are reflected in area source categories.

ID	Business Name	Address	City	VOC	NOx	CO
82244	MESA COMMUNITY COLLEGE MORTUARY SCI PROG	7440 E TAHOE AVE	MESA	0.00	0.00	
3326	MESA FULLY FORMED LLC	1111 S SIRRINE ST	MESA	6.45		
4105	MESA INDUSTRIES INC	230 N 48TH AVE	PHOENIX	0.17		
1414	MESA MATERIALS INC	3410 N HIGLEY RD	MESA	0.18	0.50	1.21
1415	MESA MATERIALS INC	7845 W BROADWAY RD	PHOENIX	1.27	3.84	11.64
29474	METAL MANAGEMENT ARIZONA LLC	3640 S 35TH AVE	PHOENIX	0.27		
192	MEYER & LUNDAHL MANUFACTURING CO	2345 W LINCOLN ST	PHOENIX	6.56		
1203	MICROCHIP TECHNOLOGY INC	2355 W CHANDLER BLVD	CHANDLER	1.18	0.61	0.41
1875	MICROCHIP TECHNOLOGY INC	1200 S 52ND ST	TEMPE	11.95	11.22	7.05
53593	MICROSEMI CORP	3601 E UNIVERSITY DR	PHOENIX	1.65		
1277	MISSION UNIFORM & LINEN SERVICE	2652 S 16TH ST	PHOENIX	0.13	2.31	1.94
131880	MMI TANK & INDUSTRIAL SERVICE	3240 S 37TH AVE	PHOENIX	0.38		
882	MORTON SALT, INC	13000 W GLENDALE AVE	GLENDALE	0.67	9.10	2.58
128379	MURPHY WALL PRODUCTS INTERNATIONAL INC	228 E ARIZONA EASTERN AVE	BUCKEYE	0.00		
146	MWM CORPORATION	5650 W BUCKEYE RD	PHOENIX	1.12		
648	NAMMO TALLEY INC	4111 N HIGLEY RD	MESA	4.22		0.01
852	NATIONAL COUNTERTOPS & CABINETS	1202 W WATKINS ST	PHOENIX	1.84		
34197	NATIONAL GYPSUM COMPANY	1414 E HADLEY ST	PHOENIX	7.84	11.34	15.71
114015	NATIONAL SPECIALTY AGGREGATES LLC	4310 S 80TH ST	MESA	0.00	0.02	0.00
910	NELTEC INC	1420 W 12TH PL	TEMPE	5.78	7.58	1.53
812	NEOTERIC LTD	11035 N 23RD DR	PHOENIX	0.76		
3758	NK ASPHALT PARTNERS	131 S 57TH AVE	PHOENIX	1.66	1.12	0.94
128912	NORTH GATEWAY TRANSFER STATION	30205 N BLACK CANYON HWY	PHOENIX	0.01	0.08	0.02
620	NORTHWEST WATER RECLAMATION PLANT	960 N RIVERVIEW	MESA	0.09	4.49	44.55
131646	NRC, LLC	2003 W MCDOWELL RD	PHOENIX	0.04		
56506	OAK CREEK FURNITURE INC	5355 N 51ST AVE	GLENDALE	1.52		
3953	OAKCRAFT INC	7733 W OLIVE AVE	PEORIA	34.54	0.07	0.06
27925	OASIS BEDROOM COMPANY	2022 N 22ND AVE	PHOENIX	5.55		
53	OLDCASTLE PRECAST INC	411 E FRYE RD	CHANDLER	2.23	1.77	0.38
302	OLSON PRECAST OF ARIZONA INC	3045 S 35TH AVE	PHOENIX	0.00	0.00	0.00
4147	OPT CO	PORTABLE		0.74	9.08	1.95
98	PALO VERDE NUCLEAR GENERATING STATION	5801 S WINTERSBURG RD	TONOPAH	11.72	64.44	16.53
428	PALOMA GIN PROPERTIES LLC	57525 S POTATOE RD	GILA BEND	0.00	0.05	0.04
130656	PALOMA READY MIX & MATERIALS LLC	PORTABLE #1		0.00	0.05	0.01
733	PAN GLO SERVICES LLC	2401 W SHERMAN ST	PHOENIX	16.90	0.49	0.41
57852	PARADISE WASTE SRVS TRANSFER FACILITY	4845 W LOWER BUCKEYE RD	PHOENIX	1.21	0.01	0.51
1055	PARAMOUNT PETROLEUM CORP OF AZ INC	1935 W MCDOWELL RD	PHOENIX	4.12	7.95	6.68
419	PARKER HANNIFIN CORP	7777 N GLEN HARBOR BLVD	GLENDALE	17.30		
1398	PATRICIAN MARBLE CO	3333 W OSBORN RD	PHOENIX	2.11		
93102	PATRICK INDUSTRIES	601 S 54TH AVE	PHOENIX	0.15		
4241	PEPSI CO	409 S 104TH AVE	TOLLESON	5.71	8.50	14.10
61	PERMA-FINISH INC	74 N 45TH AVE	PHOENIX	0.06	0.24	0.21
29244	PET & ANIMAL LOVERS SERVICE (PALS)	3629 N 40TH AVE	PHOENIX	0.03	1.78	0.10
1014	PHOENIX BRICK YARD	1814 S 7TH AVE	PHOENIX	0.53	2.46	8.30
69	PHOENIX HEAT TREATING INC	2405 W MOHAVE RD	PHOENIX	1.38	1.49	1.26
1472	PHOENIX MANUFACTURING INC	3655 E ROESER RD	PHOENIX	2.31	0.89	0.75
1491	PHOENIX METALCRAFT INC	3845 N 29TH AVE	PHOENIX	3.74		
562	PHOENIX NEWSPAPERS INC	22600 N 19TH AVE	PHOENIX	1.54	0.43	0.10
130009	PHOENIX SAN-MAN INC	10423 S APACHE RD	BUCKEYE	0.17	5.88	1.35
1154	PING INC	2201 W DESERT COVE AVE	PHOENIX	8.46	0.18	0.15

Table A17 (continued). 2011 emissions (in tons/yr) from permitted facilities whose emissions are reflected in area source categories.

ID	Business Name	Address	City	VOC	NOx	CO
23	PIONEER ROOFING CO	9221 N 15TH AVE	PHOENIX	0.91		
73263	PMA PHOTOMETALS OF ARIZONA INC	3040 N 27TH AVE	PHOENIX	2.14	0.11	0.09
128007	PRECISION ELECTRIC CO INC	1822 E JACKSON ST	PHOENIX	0.40	0.00	0.00
4007	PRECISION TRUCK PAINTING & REPAIR INC	2212 N 27TH AVE	PHOENIX	6.18		
116742	PREFERRED PACKAGING & CONTAINER	3330 W COCOPAH ST	PHOENIX	4.29	0.09	0.07
148	PRESTO CASTING CO	5440 W MISSOURI AVE	GLENDALE	10.25	1.07	0.80
108860	PRISMA GRAPHIC CORPORATION	2937 E BROADWAY RD	PHOENIX	9.28	0.21	0.18
75998	PRO PETROLEUM PHOENIX TERMINAL	408 S 43RD AVE	PHOENIX	0.99	2.37	2.07
60889	PURCELLS WESTERN STATES TIRE	420 S 35TH AVE	PHOENIX	6.20	0.12	0.10
131158	PURE EARTH ENERGY RESOURCES LLC	1980 W COMMERCE AVE	GILBERT	0.20		
1335	QUALITY BLOCK INC	3035 S 35TH AVE	PHOENIX	0.02	0.32	0.27
90599	QUEEN CREEK LANDFILL	20224 E RIGGS RD	QUEEN CRK	3.81		
437	QUIKRETE COMPANIES-ARIZONA	26807 W BASELINE RD	BUCKEYE	0.04	1.17	0.16
131898	QUIKTRIP DISTRIBUTION - PHOENIX	8501 W LATHAM ST	TOLLESON	1.38	7.21	5.53
44182	QUINCY JOIST COMPANY	22253 W SOUTHERN AVE	BUCKEYE	3.17		
1493	R J RUFF CO	3883 W LOWER BUCKEYE RD	PHOENIX	0.03		
87807	R&D SALES INC	6200 W DOBBINS RD	LAVEEN	0.09	1.07	0.23
131682	RAILJET LAND, LLC	5601 W VAN BUREN ST	PHOENIX	2.69		
840	RECONSERVE OF ARIZONA, INC	1704 W BROADWAY RD	PHOENIX	0.05	0.93	0.78
2206	RED EAGLE ENTERPRISES INC	12946 W SANTA FE DR	SURPRISE	0.01	0.11	0.09
537	RED MOUNTAIN MINING INC	4520 N POWER RD	MESA	0.41	5.06	1.09
54	REDBURN TIRE CO	3801 W CLARENDON AVE	PHOENIX	1.19		
126322	RELIANCE CUSTOM CABINETS	825 N 73RD AVE	PHOENIX	0.84		
300	REUTER EQUIPMENT CO	3816 W LOWER BUCKEYE RD	PHOENIX	1.33		
122515	RIO SALADO LANDFILL	2802 S 7TH AVE	PHOENIX	0.10	0.38	0.09
44356	RITCHIE BROS AUCTIONEERS (AMERICA) INC	5410 W LOWER BUCKEYE RD	PHOENIX	0.37	0.04	0.03
4318	RIVER RANCH PLANT #40	5159 N EL MIRAGE RD	LITCHFLD PK	0.07	0.03	0.00
36084	ROCK SOLID INC	11550 W NORTHERN AVE	PEORIA	0.39	4.72	1.02
758	ROGERS CORP - CMD	100 N DOBSON RD	CHANDLER	0.86	0.40	0.34
759	ROGERS CORP/ADVANCED CIRCUIT MATERIALS	100 S ROOSEVELT AVE	CHANDLER	14.37	1.50	4.37
4174	ROGERS CORPORATION	2225 W CHANDLER BLVD	CHANDLER	1.72	0.01	0.01
130171	ROYDEN CONSTRUCTION CO.	3423 S 51ST AVE	PHOENIX	0.00	0.02	0.00
132153	SAINT GOBAIN SOLAR GLASS FACILITY	17300 W BROADWAY RD	GOODYEAR	1.37	0.02	0.00
132005	SALT RIVER MATERIALS GROUP	6204 W SOUTHERN AVE	LAVEEN	0.00	0.06	0.01
86686	SAN TAN TRANSFER STATION	4040 S 80TH ST	MESA	0.02	0.23	0.05
42617	SASCO/SOUTHERN ARIZONA STUD COMPANY	5415 W MOHAVE ST	PHOENIX	0.30		
772	SCHAUMAPLAST PRECISION FOAM MOLDING LP	101 S 30TH ST	PHOENIX	5.74	0.45	0.38
4072	SCHREIBER FOODS INC	2122 S HARDY DR	TEMPE	1.73	5.07	15.92
255	SCHUFF STEEL CO	619 N COOPER RD	GILBERT	1.97		
266	SCHUFF STEEL CO	420 S 19TH AVE	PHOENIX	7.31	5.23	1.13
246	SCHULT HOMES	231 N APACHE RD	BUCKEYE	10.77		
120518	SEALMASTER AZ	2020 W MCDOWELL RD	PHOENIX	0.72	0.53	0.38
1332	SEMIRAY INSPECTION SERVICES	3027 E WASHINGTON ST	PHOENIX	0.45		
1351	SERENITY MORTUARY SERV INC	2514 S 6TH AVE	PHOENIX	0.02	1.31	0.07
1036	SERVICE BRASS FOUNDRY	2501 W JACKSON ST	PHOENIX	0.03	0.04	0.03
1169	SHAMROCK FOODS CO	2228 N BLACK CANYON HWY	PHOENIX	0.49	8.92	7.49
130996	SHUTTERZ INC	6655 W FRYE RD	CHANDLER	1.14		
4050	SIGNATURE BREADS INC	1120 W FAIRMONT DR	TEMPE	5.19	0.38	0.32
57976	SIGNETIX INC	2611 S 7TH ST	PHOENIX	2.33	0.59	0.49
27933	SKUNK CREEK LANDFILL	3165 W HAPPY VALLEY RD	PHOENIX	0.77	4.47	1.99

Table A17 (continued). 2011 emissions (in tons/yr) from permitted facilities whose emissions are reflected in area source categories.

ID	Business Name	Address	City	VOC	NOx	CO
4176	SKY HARBOR TRANSFER STATION	2425 S 40TH ST	PHOENIX	1.26		
131809	SKY PILOT VERTICAL WIND TUNNEL LLC	PORTABLE		0.00	0.02	0.01
39980	S-L SNACKS AZ, LLC	1200 N BULLARD AVE	GOODYEAR	17.82	5.99	5.03
1213	SMITH PRECAST	2410 W BROADWAY RD	PHOENIX	0.01		
129	SODEXO COMMERCIAL LINEN EXCHANGE	4445 S 36TH ST	PHOENIX	0.28	5.17	4.34
131686	SOLAR & RENEWABLES MANAGEMENT, LLC	29505 W SOUTHERN AVE	BUCKEYE	0.00	0.15	0.02
89313	SOLVENT RECY-CLEAN	1850 W BROADWAY RD	PHOENIX	0.51	0.02	0.00
129028	SONORAN DOORS INC	21002 N 19TH AVE	PHOENIX	1.25		
4086	SOUTH BAY CIRCUITS INC	6409 W COMMONWEALTH PL	CHANDLER	2.90		
2108	SOUTHWEST AIRLINES CO	4153 E SKY HARBOR BLVD	PHOENIX	6.75	0.25	0.05
131861	SOUTHWEST ARCHITECTURAL CASTINGS	5343 W MOHAVE ST	PHOENIX	0.17		
838	SOUTHWEST POWDER COATING INC	116 N 59TH AVE	PHOENIX	0.02	0.17	0.14
612	SOUTHWEST PRODUCTS CORP	5143 W ROOSEVELT ST	PHOENIX	1.46		
854	SOUTHWEST REFINING CORP	1205 W HILTON AVE	PHOENIX	0.00	0.01	0.01
31643	SOUTHWEST REGIONAL LANDFILL	24427 S HWY 85	BUCKEYE	0.56	7.17	1.46
130102	SOUTHWEST ROCK PRODUCTS	6500 N 115TH AVE	GLENDALE	0.12	1.51	0.33
130199	SPECIALTY TEXTILE SERVICES	720 W BUCHANAN ST	PHOENIX	0.19	3.49	2.93
136	SPECIALTY VERMICULITE CORP.	4220 W GLENROSA AVE	PHOENIX	0.92	0.10	0.09
122	SPELLMAN HARDWOODS INC	4645 N 43RD AVE	PHOENIX	0.08		
80437	SR 85 LANDFILL PUBLIC WORKS DEPT	28633 W PATTERSON RD	BUCKEYE	0.07	2.80	0.18
582	STONE CREEK INC	4221 E RAYMOND ST	PHOENIX	29.32		
388	STOROPACK INC	77 N 45TH AVE	PHOENIX	3.08	0.08	0.07
131720	STP PERFORMANCE COATING LLC	406 E PIONEER ST	PHOENIX	7.32		
1214	SULZER EMS INC	2412 W DURANGO ST	PHOENIX	2.00	0.01	0.01
4400	SUMCO SOUTHWEST CORPORATION	19801 N TATUM BLVD	PHOENIX	7.52	11.31	2.32
71801	SUMIKA ELECTRONIC MATERIALS INC	3832 E WATKINS ST	PHOENIX	0.15	0.28	0.06
378	SUN LAND MATERIALS	6950 W SOUTHERN AVE	LAVEEN	0.37	4.53	0.98
130187	SUN VALLEY OAK	801 S 25TH AVE	PHOENIX	1.58		
31	SUNLAND MEMORIAL PARK/MORT/CREM CTR	15826 N DEL WEBB BLVD	SUN CITY	0.00	0.24	0.01
42102	SUNTRON CORPORATION	2401 W GRANDVIEW RD	PHOENIX	4.90		
41431	SUPER RADIATOR COILS LTD	2610 S 21ST ST	PHOENIX	0.02	0.33	0.27
165	SUPERLITE BLOCK	301 E BASELINE RD	GILBERT	0.00	0.06	0.05
392	SUPERLITE BLOCK	1639 E DEER VALLEY RD	PHOENIX	0.00	0.05	0.01
3691	SUPREME OIL CO	2110 GRAND AVE	PHOENIX	3.05		
121397	SVP MFG INC	702 N 21ST AVE	PHOENIX	0.90		
131377	SWIM PLATFORMS INC	3220 S 38TH ST	PHOENIX	5.52		
1109	TEMPE CAMPUS SPV, LLC	2100 E ELLIOT RD	TEMPE	0.33	1.19	0.84
1102	TEVA PHARMACEUTICALS USA, INC	2050 S 35TH AVE	PHOENIX	0.45	1.07	0.90
249	THE BOEING COMPANY	5000 E MCDOWELL RD	MESA	18.26	1.69	1.76
1216	THE COOKSON COMPANY INC	2417 S 50TH AVE	PHOENIX	2.05	0.27	0.22
122552	THE SHERWIN-WILLIAMS COMPANY 4380	1515 E HADLEY ST	PHOENIX	1.00		
4386	THERMO FLUIDS INC	4301 W JEFFERSON ST	PHOENIX	0.14	0.41	0.10
552	THORNWOOD FURNITURE MFG	5125 E MADISON ST	PHOENIX	62.84	0.11	0.57
3806	TODDS A DIV OF HJ HEINZ	610 S 56TH AVE	PHOENIX	0.02	0.38	0.32
56	TPAC A DIVISION OF KIEWIT WESTERN CO	3052 S 19TH AVE	PHOENIX	0.00	0.00	0.00
37546	TRENWYTH INDUSTRIES	4626 N 42ND AVE	PHOENIX	4.04	0.74	0.62
129453	TRICOM COATINGS, INC	2639 N 31ST AVE	PHOENIX	1.94		
1510	TRIUMPH AIR REPAIR	4010 S 43RD PL	PHOENIX	1.46	1.79	0.18
1122	TRIUMPH MANUFACTURING LLC	2130 S INDUSTRIAL PARK AVE	TEMPE	2.59		
1261	TROY CORPORATION	113 S 47TH AVE	PHOENIX	0.13	0.05	0.01

Table A17 (continued). 2011 emissions (in tons/yr) from permitted facilities whose emissions are reflected in area source categories.

ID	Business Name	Address	City	VOC	NOx	CO
30173	TRUCK WORKS	3216 W SHERMAN ST	PHOENIX	5.17		
819	TRW VEHICLE SAFETY SYSTEMS INC	11202 E GERMANN RD	MESA	2.11	0.25	0.31
39309	UNION DISTRIBUTING COMPANY	622 S 56TH AVE	PHOENIX	4.45		
234	UNITED DAIRYMEN OF ARIZONA	2008 S HARDY DR	TEMPE	2.52	28.07	31.70
63962	UPPER CRUST BAKERY	3655 W WASHINGTON ST	PHOENIX	7.97	1.09	0.92
1504	US AIRWAYS	4000 E SKY HARBOR BLVD	PHOENIX	1.25		
131506	USAA (UNITED SERVICES AUTOMOBILE ASSOC)	ONE N NORTERRA DR	PHOENIX	0.02	0.55	0.13
28393	UTC AEROSPACE SYSTEMS	1007 E UNIVERSITY DR	PHOENIX	3.04		
827	VALLEY INDUSTRIAL PAINTING	1131 W WATKINS ST	PHOENIX	11.85	0.44	0.37
30171	VEOLIA TRANSPORTATION PHOENIX	2225 W LOWER BUCKEYE RD	PHOENIX	0.92	0.19	0.16
194	VEOLIA TRANSPORTATION SERVICES, INC	2010 W DESERT COVE AVE	PHOENIX	1.21	0.11	0.09
187	VERCO DECKING INC	4340 N 42ND AVE	PHOENIX	0.53	0.15	0.12
130178	VULCAN MATERIALS CO DBA CAL-MAT COMPANY	3205 S 24TH ST	PHOENIX	0.10	1.21	0.26
2	VULCAN MATERIALS CO-WESTERN DIVISION	14521 N 115TH AVE	EL MIRAGE	0.20	8.02	16.30
90	VULCAN MATERIALS CO-WESTERN DIVISION	4830 S 43RD AVE	PHOENIX	3.45	5.85	1.38
4022	WALKER POWER SYSTEMS INC	1301 E JACKSON ST	PHOENIX	1.46	0.11	0.02
130002	WASTE MGMT 7TH AVE TRANSFER & LANDFILL	3000 S 7TH AVE	PHOENIX	0.58	7.29	1.60
113519	WASTE MGMT PHX HAUL CONTAINER SHOP	2441 S 40TH ST	PHOENIX	10.38		
1149	WEAVER QUALITY SHUTTERS INC	218 S 15TH ST	PHOENIX	1.55		
125450	WESTERN AGGREGATES PLANT #41	31805 W SOUTHERN AVE	BUCKEYE	0.15	10.67	2.36
1475	WESTERN BLOCK CO INC	4021 S 19TH AVE	PHOENIX	0.02	0.30	0.25
4131	WESTERN DIGITAL PROPERTIES	1000 E BELL RD	PHOENIX	1.85	1.65	1.66
36676	WESTERN MILLING	310 S 24TH AVE	PHOENIX	0.00	0.05	0.01
1240	WESTERN MILLWORK INC	2525 W CORONADO RD	PHOENIX	4.03		
130574	WESTERN MILLWORK INC	2940 W WILLETTA ST	PHOENIX	0.85		
1339	WESTERN REFINING COMPANY LP	3050 S 19TH AVE	PHOENIX	0.18	2.32	1.95
2703	WESTERN STATES PETROLEUM	450 S 15TH AVE	PHOENIX	13.30		
91589	WHITE TANKS TRANSFER STATION	18605 W MCDOWELL RD	GOODYEAR	0.03	0.29	0.06
398	WICKENBURG FACILITY	44605 GRAND AVE	WICKENBURG	0.06	0.58	0.12
515	WINGFOOT COMMERCIAL TIRE SYSTEMS LLC	3007 N 31ST AVE	PHOENIX	0.36		
128707	WOOD UNLIMITED INC (AIR)	9801 N LITCHFIELD RD	EL MIRAGE	1.22	15.31	3.30
1382	WOODCASE FINE CABINETRY INC	3255 W OSBORN RD	PHOENIX	13.60		
35359	WOODESIGN A CORPORATION	3234 E CORONA AVE	PHOENIX	0.62		

5. Summary of All Revisions to the 2011 Periodic Emissions Inventory for Ozone Precursors

Table A18 below reflects all revisions made (to both annual and season-day emission calculations) resulting from the two sets of changes described in this Addendum, namely: (1) the inclusion of additional Emission Reduction Credits and (2) the "recasting" of ozone season-day emissions to reflect the three-month period from June–August 2011 (vs. July–September in the original publication).

Table A18. Revised annual and season-day emissions from all sources in the eight-hour ozone nonattainment area. (cf. Table 1.6–9, pp. 9–10). Shaded cells indicate revised values vs. the original 2011 PEI report.

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
POINT SOURCES:	653.84	1,744.32	1,063.18	4,279.8	15,353.4	9,632.0
Emission Reduction Credits	213.03	14.14	15.30	1,167.3	77.5	83.8
Total, All Point Sources:	**866.87**	**1,758.46**	**1,078.48**	**5,447.1**	**15,430.9**	**9,715.8**
AREA SOURCES:						
Fuel combustion:						
Industrial distillate oil: Boilers	0.61	60.61	15.15	3.9	388.5	97.1
Industrial distillate oil: Engines	0.00	1,830.35	393.95	0.0	11,733.0	2,525.3
Industrial natural gas	36.83	727.80	453.34	216.9	4,285.3	2,669.3
Comm./inst. distillate oil: Boilers	0.00	0.12	0.03	0.0	0.8	0.2
Comm./inst. distillate oil: Engines	0.00	3.70	0.80	0.0	23.7	5.1
Comm./inst. natural gas	54.42	1,079.44	662.05	251.7	4,992.0	3,061.7
Residential distillate oil	0.01	0.35	0.10	0.0	0.0	0.0
Residential natural gas	50.20	857.96	365.09	120.5	2,060.1	876.7
Residential LPG	2.02	51.93	14.73	0.0	0.0	0.0
Residential wood combustion	515.53	58.38	2,993.75	0.0	0.0	0.0
Residential kerosene	0.00	0.03	0.01	0.0	0.0	0.0
All Fuel Combustion:	**659.63**	**4,670.68**	**4,898.99**	**593.0**	**23,483.5**	**9,235.4**
Industrial processes:						
Chemical manufacturing	77.09			596.5		
Commercial cooking	151.03		397.07	829.8		2,181.7
Bakeries	77.85			545.4		
Secondary metal production	41.01	15.02	98.36	306.4	107.9	697.4
Rubber/plastic product manufacturing	1,759.15			14,110.1		
Electrical equipment manufacturing	122.80	23.47	2.98	746.2	135.8	16.4
Industrial processes, NEC	47.55	224.92	91.84	318.0	1,245.8	525.2
All Industrial Processes:	**2,276.48**	**263.41**	**590.27**	**17,452.4**	**1,489.5**	**3,420.8**
Solvent use:						
Architectural coatings	5,033.13			30,973.1		
Auto refinishing	1,327.53			10,211.8		
Traffic markings	171.12			1,737.5		
Factory finished wood	137.12			1,390.7		
Wood furniture	414.77			3,419.9		
Aircraft surface coating	65.84			473.1		
Miscellaneous surface coating	315.02			2,440.0		
Degreasing	216.62			1,445.1		
Dry cleaning	23.42			180.1		
Graphics arts	289.73			2,216.1		
Miscellaneous industrial solvent use	718.75			5,104.6		
Consumer and commercial products	17,605.51			96,468.5		
Cutback asphalt	788.72			4,309.9		
Emulsified asphalt	817.24			4,465.8		
Roofing asphalt	3.08			23.7		
Agricultural pesticides	212.18			1,697.3		
All Solvent Use:	**28,139.77**			**166,557.2**		

Table A18 (continued). Revised annual and season-day emissions from all sources in the eight-hour ozone nonattainment area.

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Storage/transport:						
Residential portable gas cans	2,968.67			16,311.4		
Commercial portable gas cans	570.89			3,136.7		
Bulk plants	120.91			659.3		
Gas stations Stage I: Submerged fill	85.08			526.9		
Gas stations Stage I: Bal. submerged fill	229.60			1,421.9		
Gas stations Stage II	0.00			0.0		
Underground tanks: Breathing/emptying	777.00			4,124.4		
Airports: aviation gasoline Stage I	344.41			1,887.2		
Airports: aviation gasoline Stage II	17.87			97.9		
Truck: gasoline (tank trucks in transit)	50.82			314.7		
Pipeline gasoline	17.32			94.5		
Volatile organic liquids storage/transport	28.80			169.3		
All Storage/Transport:	**5,211.35**			**28,744.2**		
Waste treatment/disposal:						
On-site incineration	0.17	3.31	0.79	1.1	21.4	5.3
Open burning: Land clearing debris	0.30	0.13	2.81	9.1	4.1	86.4
Landfills	36.59	30.40	108.55	200.7	167.4	596.4
Publicly owned treatment works	75.88			583.7		
Leaking underground storage tanks	1.05			32.3		
Other waste	2.12	22.19	77.93	10.9	122.8	431.4
All Waste Treatment/Disposal:	116.10	56.04	190.06	837.8	315.6	1,119.6
Miscellaneous area sources:						
Agricultural field burning	15.28	6.79	144.32	470.2	209.0	4,440.7
Structure fires	14.95	1.90	81.55	73.3	9.3	399.7
Aircraft engine testing	4.72	46.36	16.16	26.1	259.3	91.2
Vehicle fires	9.38	1.17	36.64	51.4	6.4	200.8
Crematories	1.18	11.14	2.22	50.9	88.1	17.2
Accidental releases	0.45	0.00	0.00	0.6	0.0	0.0
Hospitals	8.66			52.9		
Wildfires	206.08	93.95	4,379.28	13,282.9	6,055.4	282,261.6
Prescribed fires	0.39	0.38	4.54	129.2	127.1	1,523.2
All Miscellaneous Area Sources:	261.09	161.70	4,664.71	14,137.4	6,754.7	288,934.4
ALL AREA SOURCES:	36,664.42	5,151.83	10,344.03	228,322.0	32,043.4	302,710.1
NONROAD MOBILE SOURCES:						
Agricultural equipment	22.52	193.22	177.56	200.6	1,679.5	1,574.6
Airport GSE (+APU)	111.43	404.49	3,259.08	590.0	2,155.7	17,236.5
Commercial equipment	1,916.15	1,355.57	30,094.46	14,818.6	8,284.7	203,526.4
Construction & mining equipment	1,941.80	13,349.23	14,855.32	13,927.2	93,159.3	106,091.9
Industrial equipment	339.78	1,831.45	7,110.33	2,209.9	11,718.2	46,031.6
Lawn and garden equipment	4,970.15	876.55	55,425.05	54,825.3	7,329.9	552,709.8
Pleasure craft	530.39	96.56	1,249.66	13,207.4	2,420.5	32,628.3
Railway maintenance equipment	1.96	8.64	16.67	14.5	59.7	119.5
Recreational equipment	684.30	29.78	2,871.27	8,855.0	339.9	37,525.9
Aircraft	1,705.43	2,585.98	11,719.36	8,355.4	12,789.2	63,737.5
Locomotives	50.15	901.12	153.29	274.8	4,937.7	839.9
ALL NONROAD MOBILE SOURCES:	12,274.06	21,632.59	126,932.05	117,278.7	144,874.4	1,062,022.0
ONROAD MOBILE SOURCES:	24,110.04	56,861.82	226,581.20	147,299.2	309,069.0	1,310,973.1
BIOGENIC SOURCES:	55,311.84	527.18	5,934.55	701,386.9	6,304.2	66,534.2
TOTAL, ALL SOURCE CATEGORIES:	**129,277.24**	**85,931.88**	**370,870.31**	**1,199,733.8**	**507,721.8**	**2,751,955.2**

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APPENDICES

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APPENDICES

APPENDIX A

Exhibit 1: 2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. February 2014. Addendum August 2015.

Exhibit 2: 2014 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. September 2016.

APPENDIX B

Exhibit 1: Technical Support Document in Support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments.

Exhibit 2: State of Arizona Fifty-Second Legislature Senate Bill 1255 and Final Revised Fact Sheet for Senate Bill 1255.

APPENDIX C

Exhibit 1: Public Hearing Process Documentation.

Exhibit 2: Certification of Adoption and MAG Authority for Regional Air Quality Planning.

APPENDIX A

APPENDIX A

EXHIBIT 2:

2014 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. September 2016.

Maricopa County
Air Quality Department

2014 Periodic Emissions Inventory for Ozone Precursors

for the
Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area

September 2016

2014 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County 8-hour Ozone Nonattainment Area

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1. Introduction

1.1 Overview

This 2014 periodic emissions inventory for ozone precursors has been developed to meet requirements set forth in Title I of the Clean Air Act Amendments of 1990 (CAAA), which requires the development of a baseline emissions inventory and periodic revisions for areas that fail to meet the National Ambient Air Quality Standards (NAAQS). A portion of Maricopa County is classified as nonattainment for the 8-hour ozone standard.

This inventory includes emission estimates for three ozone precursors: volatile organic compounds (VOCs), carbon monoxide (CO) and nitrogen oxides (NO_x). VOC is defined by Maricopa County's Rule 100 as "any organic compound which participates in atmospheric photochemical reactions, except the non-precursor organic compounds". The inventory provides emission estimates from point, area, nonroad mobile, onroad mobile, and biogenic sources. Note that totals shown in tables may not equal the sum of individual values due to independent rounding.

1.2 Agencies responsible for the emissions inventory

Maricopa County Air Quality Department (MCAQD) has primary responsibility for preparing and submitting the 2014 Periodic Emissions Inventory for Ozone Precursors for Maricopa County. Point, area, and some nonroad mobile source emission estimates were prepared by MCAQD. The Maricopa Association of Governments (MAG) prepared the emission estimates for onroad mobile, biogenic, and the majority of nonroad mobile sources. Table 1.2–1 lists those responsible for inventory preparation and quality assurance/quality control activities, which are described in the respective chapters.

Table 1.2–1. Chapter authors and quality assurance/quality control (QA/QC) contacts.

Chapter	Author(s)	QA/QC contact person(s)
2. Point sources	Bob Downing, MCAQD 602-506-6790	Eric Raisanen, MCAQD 602-506-6790 Matt Poppen, MAG 602-254-6300
3. Area (nonpoint) sources	Eric Raisanen, Tom Ekren and Dena Konopka, MCAQD 602-506-6790	Bob Downing, MCAQD 602-506-6790 Matt Poppen, MAG 602-254-6300
4. Nonroad mobile sources	Taejoo Shin, MAG 602-254-6300 Bob Downing, MCAQD 602-506-6790	Bob Downing, MCAQD 602-506-6790 Matt Poppen, MAG 602-254-6300
5. Onroad mobile sources	Taejoo Shin, MAG 602-254-6300	Matt Poppen, MAG 602-254-6300
6. Biogenic sources	Taejoo Shin, MAG 602-254-6300	Matt Poppen, MAG 602-254-6300

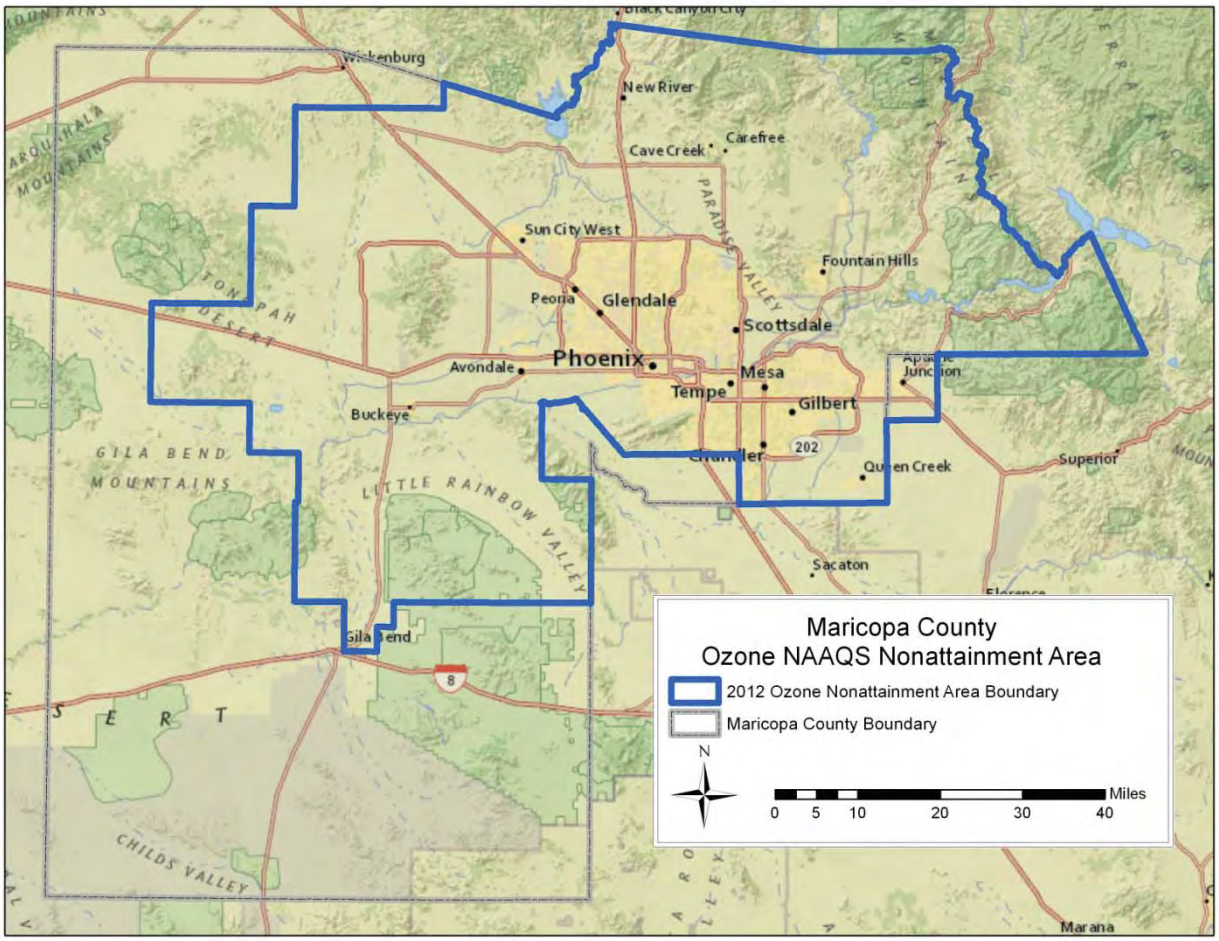
1.3 Temporal scope

Both annual and ozone season-day emissions were estimated for the year 2014, for both Maricopa County and the 8-hour ozone nonattainment area (NAA). The 3-month peak ozone season for the Maricopa County nonattainment area has been defined as the June–August timeframe, which encompasses the period during which the region experiences the highest monitored ozone concentrations, the highest average Air Quality Index (AQI) values, and the most frequent exceedances of the 8-hour ozone NAAQS.

1.4 Geographic scope

This inventory includes emission estimates for Maricopa County and for the Maricopa County 8-hour ozone nonattainment area. Maricopa County encompasses approximately 9,223 square miles of land area, while the Maricopa County 8-hour ozone nonattainment area is approximately 5,018 square miles or about 54 percent of the Maricopa County land area.[1] A portion of the southeastern boundary of the 8-hour ozone nonattainment area includes areas of Pinal County totaling 48 square miles or 0.96% of the nonattainment area. A map of Maricopa County and the 8-hour ozone nonattainment area is provided in Figure 1.4–1.

Figure 1.4–1. Map of Maricopa County and the 8-hour ozone nonattainment area.



1. In May 2012, EPA designated a new 8-hour ozone nonattainment area based on the 2008 8-hour ozone NAAQS (***77 FR 30088***, May 12, 2012). The previous 8-hour ozone nonattainment area was based on the 1997 8-hour ozone NAAQS. The 2012 nonattainment area boundary was used for the 2011 and this 2014 inventory, as it is expected to be used as a base-year inventory for a future State Implementation Plan.

1.5 Overview of local demographic and land-use data

Many of the emissions estimates generated in this report were calculated using demographic and land-use data provided by the Maricopa Association of Governments (MAG). These data were used to apportion and/or scale Maricopa County emissions estimates to the nonattainment area and vice versa. (For example, county-level emissions from residential natural gas usage in Maricopa County were apportioned to the nonattainment area using the ratio of total population in each area). Detailed explanations of how emission estimates were apportioned or scaled are presented in each of the following chapters, along with the data sources used.

1.5.1 Demographic profile

The demographic data provided by MAG included population, employment data, and single family/multi-family splits for calendar year 2014, for both Maricopa County and the 8-hour ozone nonattainment area. Table 1.5–1 provides an overview of the key demographic data used in this report. As noted throughout the text, these data are frequently used to derive estimates of activity or emissions within the 8-hour ozone nonattainment area from county-level calculations. It is important to note, however, that the nonattainment area includes a portion of Pinal County, AZ as shown in Figure 1.4–1. Thus in some cases (e.g., those source categories calculated based on total population), the multiplier used to derive nonattainment area estimates from County-level values may be greater than 1, and thus the resulting NAA emission totals are larger than the County-level estimates from which they are derived.

Table 1.5–1. Demographic profile of Maricopa County and the 8-hour ozone NAA.

Demographic variable	Maricopa County	8-hr ozone NAA	NAA% relative to County
1. Population:			
Resident population	4,008,651	4,040,182	100.79%
Non-resident population	319,784	324,968	101.62%
Total population:	**4,328,435**	**4,365,150**	**100.85%**
2. Employment:			
–Retail employment *	385,678	385,426	99.93%
–Office employment *	462,139	461,824	99.93%
–Public employment *	132,436	133,352	100.69%
–Other employment *	181,060	179,924	99.37%
All commercial/institutional employment:	***1,161,313***	***1,160,526***	***99.93%***
Industrial employment	334,326	331,137	99.37%
Construction	24,808	24,583	99.09%
Work at home	101,244	101,653	100.40%
Non site-based	128,193	128,068	99.90%
Total employment:	**1,749,884**	**1,746,474**	**99.81%**
3. Household split:			
Single-family	77%	77%	
Multi-family	23%	23%	
Total households:	**100%**	**100%**	

* These four categories comprise the "commercial/institutional" employment sector.

1.5.2 Land-use data

The land-use data used in this report have been developed by the Maricopa Association of Governments (MAG), which provided 2014 land-use data. Table 1.5–2 presents a listing of the land use categories used, and the acreages of each land-use type within Maricopa County and the 8-hour ozone nonattainment area.

Table 1.5–2. Land use categories used to apportion emissions.

Land use category	Acreage within Maricopa County	Acreage within 8-hour ozone NAA	% relative to County
General/active open space/golf course (e.g., parks)	212,662	213,795	100.53%
Passive/restricted open space, washes	2,602,364	1,175,442	45.17%
Lakes	12,286	12,286	100.00%
Agriculture	267,894	157,478	58.78%
Vacant (e.g., developable land)	2,053,015	918,426	44.74%

1.6 Emissions overview by source category

1.6.1 Point sources

The point source category includes those stationary sources that emit a significant amount of pollution into the air such as power plants, petroleum product storage and transfer facilities, and large industrial facilities. MCAQD utilizes the US EPA's Annual Emissions Reporting Requirements (AERR) rule to define which stationary sources are listed as point sources. A detailed definition of a point source can be found in Section 2.1 of Chapter 2.

Table 1.6–1 summarizes annual and season-day emissions from point sources (including emission reduction credits) in Maricopa County and the 8-hour ozone nonattainment area, respectively. Since all facilities identified as point sources are located within the 8-hour ozone nonattainment area, the emission values for the two areas are equal. A detailed breakdown of emissions calculations for all point sources is contained in Chapter 2.

Table 1.6–1. Annual and season-day emissions from point sources in Maricopa County and the 8-hour ozone nonattainment area (including emission reduction credits).

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	1,041.8	1,647.6	1,375.1	6,281	14,074	12,163
8-hr ozone NAA	1,041.8	1,647.6	1,375.1	6,281	14,074	12,163

1.6.2 Area (nonpoint) sources

Area sources are facilities or activities whose individual emissions do not qualify them as point sources. Area sources represent numerous facilities or activities that individually release small amounts of a given pollutant, but collectively they can release significant amounts of a pollutant. Emissions from stationary sources that were not identified as point sources in this report have

been included in the area source inventory. Examples of area source categories include residential wood burning, commercial cooking, waste incineration and wildfires.

Tables 1.6–2 and 1.6–3 summarize annual and season-day emissions of the chief area source categories, for Maricopa County and the 8-hour ozone nonattainment area, respectively. A detailed breakdown of emissions calculations for each area source category is contained in Chapter 3.

Table 1.6–2. Annual and season-day emissions from area sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel combustion	1,679.8	4,931.9	10,710.0	1,806	30,016	14,997
Industrial processes	1,723.9	531.6	1,619.1	12,484	3,095	11,160
Solvent use	29,522.2	0.0	0.0	172,914	0	0
Storage/transport	3,594.9	0.0	0.0	19,734	0	0
Waste treatmt/disposal	124.0	41.5	225.6	881	249	1,596
Misc. area sources	132.1	128.1	3,060.5	736	800	17,410
All area sources:	**36,777.0**	**5,633.2**	**15,615.2**	**208,555**	**34,160**	**45,163**

Table 1.6–3. Annual and season-day emissions from area sources in the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel combustion	1,689.7	4,916.2	10,769.1	1,783	29,505	14,839
Industrial processes	1,715.6	531.6	1,624.3	12,412	3,100	11,127
Solvent use	29,510.2	0.0	0.0	172,431	0	0
Storage/transport	3,592.9	0.0	0.0	19,718	0	0
Waste treatmt/disposal	196.6	40.5	76.9	1,499	226	421
Misc. area sources	132.8	128.5	3,079.4	761	828	17,859
All area sources:	**36,837.9**	**5,616.9**	**15,549.7**	**208,605**	**33,660**	**44,246**

1.6.3 Nonroad mobile sources

Nonroad mobile sources include off-highway vehicles and engines that move or are moved within a 12-month period. Tables 1.6–4 and 1.6–5 summarize annual and season-day emissions from nonroad mobile sources, for Maricopa County and the 8-hour ozone nonattainment area, respectively. A detailed breakdown of emissions calculations for each source category is contained in Chapter 4.

Table 1.6–4. Annual and season-day emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural equipment	5.7	286.9	262.2	49	2,473	2,311
Airport GSE (+APU)	77.3	293.7	2,211.4	409	1,575	11,710
Commercial equipment	1,144.0	1,175.6	29,670.3	7,851	7,198	198,568
Construction & mining	454.4	10,495.7	12,531.9	3,203	72,485	88,728
Industrial equipment	115.1	1,263.3	3,956.0	733	7,645	25,053
Lawn & garden	2,937.5	589.9	44,389.3	25,208	4,194	403,992
Pleasure craft	382.3	98.3	1,154.8	7,477	2,428	29,686
Railway maintenance	0.3	7.7	15.2	2	53	108
Recreational equipment	1,271.8	62.4	6,501.1	15,408	713	84,058
Aircraft	1,761.8	2,391.1	10,688.0	9,284	12,603	57,583
Locomotives	137.5	2,478.3	421.8	754	13,580	2,311
All nonroad sources:	**8,287.7**	**19,143.1**	**111,801.8**	**70,378**	**124,946**	**904,107**

Table 1.6–5. Annual and season-day emissions from nonroad mobile sources in the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural equipment	3.3	168.7	154.1	29	1,454	1,358
Airport GSE (+APU)	76.1	290.5	2,174.9	404	1,559	11,526
Commercial equipment	1,134.9	1,166.2	29,432.3	7,788	7,140	196,975
Construction & mining	450.3	10,400.5	12,418.3	3,174	71,827	87,923
Industrial equipment	114.1	1,253.1	3,924.2	727	7,584	24,852
Lawn & garden	2,962.4	594.9	44,765.8	25,422	4,229	407,419
Pleasure craft	382.3	98.3	1,154.8	7,477	2,428	29,686
Railway maintenance	0.3	7.8	15.3	2	53	109
Recreational equipment	572.0	28.1	2,924.0	6,930	321	37,807
Aircraft	1,719.2	2,384.3	10,494.4	9,080	12,571	56,545
Locomotives	91.0	1,621.2	265.3	498	8,883	1,454
All nonroad sources:	**7,505.9**	**18,013.6**	**107,723.4**	**61,531**	**118,049**	**855,654**

1.6.4 Onroad mobile sources

Emissions from onroad mobile sources were calculated for Maricopa County and the 8-hour ozone nonattainment area. A detailed description of emissions calculations is contained in Chapter 5. Table 1.6–6 summarizes annual and season-day emissions from onroad mobile sources in Maricopa County and the 8-hour ozone nonattainment area, respectively.

Table 1.6–6. Annual and season-day emissions from onroad mobile sources in Maricopa County and the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	19,308.7	34,219.1	210,239.1	118,683	182,273	1,279,788
8-hr ozone NAA	19,162.5	32,380.6	209,281.7	117,999	172,963	1,273,697

1.6.5 Biogenic sources

The biogenic source category includes emissions from all vegetation (e.g., crops, indigenous vegetation, landscaping, etc.) in Maricopa County and the 8-hour ozone nonattainment area. Emissions were estimated using the Model of Emissions of Gases and Aerosols from Nature (MEGAN). MEGAN is a state-of-the-art biogenic emissions model developed by the National Center for Atmospheric Research (NCAR). Some corrections and improvements were made in the latest version of MEGAN2.1. MEGAN2.1 was used to compute biogenic emissions in Maricopa County and the 8-hour ozone nonattainment area. Annual and season-day emissions from biogenic sources are shown in Table 1.6–7 for Maricopa County and the 8-hour ozone nonattainment area.

Table 1.6–7. Annual and season-day emissions from biogenic sources in Maricopa County and the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	187,065.9	987.9	23,099.4	2,380,298	11,235	300,222
8-hr ozone NAA	102,301.8	587.2	13,154.5	1,321,018	6,768	173,438

1.6.6 Summary of all source categories

Tables 1.6–8 and 1.6–9 provide summary totals of annual and season-day emissions from all emission sources in Maricopa County and the 8-hour ozone nonattainment area, respectively.

Table 1.6–8. Annual and season-day emissions from all source categories in Maricopa County.

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
POINT SOURCES:	702.3	1,604.6	1,360.8	4,421	13,839	12,084
Emission reduction credits (ERCs)	266.1	14.1	14.3	1,458	77	78
Potential ERCs	73.3	28.8		402	158	
ALL POINT SOURCES:	**1,041.8**	**1,647.6**	**1,375.1**	**6,281**	**14,074**	**12,163**
AREA (NONPOINT) SOURCES:						
Fuel combustion:						
Industrial distillate oil: boilers	1.0	96.1	24.0	6	616	154
Industrial distillate oil: engines	134.5	1,934.4	416.3	862	12,400	2,669
Industrial natural gas	40.7	740.1	621.7	261	4,744	3,985
Industrial liquefied petroleum gas	1.9	52.1	29.2	12	334	187
Comm./inst. distillate oil: boilers	0.0	2.8	0.7	0	18	4
Comm./inst. distillate oil: engines	0.3	4.4	1.0	2	28	6
Comm./inst. natural gas	62.0	1,126.8	946.5	397	7,223	6,068
Residential distillate oil	0.0	0.3	0.1	0	3	1
Residential natural gas	45.5	777.0	330.7	249	4,258	1,812
Residential LPG	1.6	41.5	11.8	15	391	111
Residential wood combustion	1,392.2	156.3	8,328.1	0	0	0
All Fuel Combustion:	**1,679.8**	**4,931.9**	**10,710.0**	**1,806**	**30,016**	**14,997**

Table 1.6–8. Annual and season-day emissions from all source categories in Maricopa County (continued).

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Industrial Processes:						
Chemical manufacturing	69.1			535		
Commercial cooking	233.5		666.3	1,279		3,651
Bakeries	112.4			661		
Secondary metal production	65.9	55.1	671.6	467	482	5,936
Rubber/plastic product manufacturing	928.8			7,763		
Fabricated metal product mfg.	19.2			92		
Electrical equipment manufacturing	223.6	24.3	7.5	1,280	135	41
Industrial processes, NEC	71.4	452.2	273.7	407	2,478	1,532
All Industrial Processes:	**1,723.9**	**531.6**	**1,619.1**	**12,484**	**3,095**	**11,160**
Solvent Use:						
Architectural coatings	5,215.8			31,748		
Auto refinishing	958.3			5,251		
Traffic markings	441.0			4,478		
Factory finished wood	193.6			1,616		
Wood furniture	666.4			1,052		
Metal furniture: SIC 25	59.8			3,622		
Paper: SIC 26	51.3			325		
Metal cans: SIC 341	183.2			279		
Machinery and equipment: SIC 35	58.2			996		
Large appliances: SIC 363	35.5			316		
Electronic/other electrical: SIC 36	4.2			193		
Motor vehicles: SIC 371	183.0			23		
Aircraft surface coating	65.8			473		
Marine: SIC 373	3.5			358		
Railroad: SIC 374	5.1			19		
Miscellaneous surface coating	160.9			1,309		
Industrial maintenance coatings	301.0			875		
Other special-purpose coatings	12.0			1,636		
Degreasing	291.9			1,923		
Dry cleaning	10.3			79		
Graphics arts	297.4			2,308		
Miscellaneous industrial solvent use	201.1			1,443		
Personal care products	4,013.2			21,990		
Household products	4,414.5			24,189		
Automotive aftermarket products	2,729.0			14,950		
Coatings and related products	1,906.3			10,445		
Adhesives and sealants	1,143.8			6,257		
FIFRA-regulated products	3,571.7			19,571		
Miscellaneous products, NEC	140.5			770		
Cutback asphalt	1,004.8			21,844		
Emulsified asphalt	828.2			18,004		
Agricultural pesticides	371.0			2,033		
All Solvent Use:	**29,522.2**			**172,914**		

Table 1.6–8. Annual and season-day emissions from all source categories in Maricopa County (continued).

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Storage/Transport:						
Residential portable gas cans	443.1			2,428		
Commercial portable gas cans	382.0			2,093		
Bulk terminals	91.0			493		
Bulk plants	36.2			229		
Gas stations Stage I:submerged fill	369.9			2,027		
Gas stations Stage I:bal. submerged fill	646.9			3,545		
Underground tank breathing/emptying	764.8			4,191		
Airports: aviation gasoline Stage I	673.6			3,691		
Airports: aviation gasoline Stage II	33.3			182		
Truck: gasoline (tank trucks in transit)	50.0			274		
Pipeline gasoline	66.2			363		
Volatile organic liquids storage/transpt	37.8			218		
All Storage/Transport:	**3,594.9**			**19,734**		
Waste Treatment/Disposal:						
On-site incineration	0.2	3.0	0.7	1	19	5
Open burning	18.2	8.1	172.2	140	62	1,325
Landfills	36.6	9.9	14.6	158	54	80
Publicly owned treatment works	58.9			453		
Leaking underground storage tanks	2.5			75		
Other waste	7.7	20.6	38.1	54	113	186
All Waste Treatment/Disposal:	**124.0**	**41.5**	**225.6**	**881**	**249**	**1,596**
Miscellaneous Area Sources:						
Backyard barbeques	52.8	60.5	2,819.9	289	332	15,451
Structure fires	15.5	2.0	84.5	76	11	414
Aircraft engine testing	4.6	45.5	16.9	27	260	98
Vehicle fires	10.6	1.3	41.2	58	7	226
Crematories, human	0.4	10.7	0.6	3	77	5
Crematories, animal	0.1	5.6	0.3	1	49	3
Accidental releases	10.1	0.2	0.4	2	0	0
Hospitals	33.4			201		
Wildfires	4.5	2.0	94.8	29	13	606
Prescribed fires	0.2	0.2	1.8	51	51	607
All Miscellaneous Area Sources:	**132.1**	**128.1**	**3,060.5**	**736**	**800**	**17,410**
ALL AREA SOURCES:	**36,777.0**	**5,633.2**	**15,615.2**	**208,555**	**34,160**	**45,163**

Table 1.6–8. Annual and season-day emissions from all source categories in Maricopa County (continued).

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
NONROAD MOBILE SOURCES:						
Agricultural equipment	5.7	286.9	262.2	49	2,473	2,311
Airport GSE (+APU)	77.3	293.7	2,211.4	409	1,575	11,710
Commercial equipment	1,144.0	1,175.6	29,670.3	7,851	7,198	198,568
Construction & mining equipment	454.4	10,495.7	12,531.9	3,203	72,485	88,728
Industrial equipment	115.1	1,263.3	3,956.0	733	7,645	25,053
Lawn and garden equipment	2,937.5	589.9	44,389.3	25,208	4,194	403,992
Pleasure craft	382.3	98.3	1,154.8	7,477	2,428	29,686
Railway maintenance equipment	0.3	7.7	15.2	2	53	108
Recreational equipment	1,271.8	62.4	6,501.1	15,408	713	84,058
Aircraft	1,761.8	2,391.1	10,688.0	9,284	12,603	57,583
Locomotives	137.5	2,478.3	421.8	754	13,580	2,311
ALL NONROAD MOBILE:	**8,287.7**	**19,143.1**	**111,801.8**	**70,378**	**124,946**	**904,107**
ALL ONROAD MOBILE:	**19,308.7**	**34,219.1**	**210,239.1**	**118,683**	**182,273**	**1,279,788**
ALL BIOGENIC SOURCES:	**187,065.9**	**987.9**	**23,099.4**	**2,380,298**	**11,235**	**300,222**
TOTAL, ALL SOURCE CATEGORIES:	**252,480.9**	**61,630.9**	**362,130.7**	**2,784,194**	**366,687**	**2,541,442**

Table 1.6–9. Annual and season-day emissions from all sources in the 8-hour ozone NAA.

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
POINT SOURCES:	702.3	1,604.6	1,360.8	4,421	13,839	12,084
Emission Reduction Credits (ERCs)	266.1	14.1	14.3	1,458	77	78
Potential ERCs	73.3	28.8		402	158	
ALL POINT SOURCES:	**1,041.8**	**1,647.6**	**1,375.1**	**6,281**	**14,074**	**12,163**
AREA (NONPOINT) SOURCES:						
Fuel combustion:						
Industrial distillate oil: boilers	1.0	95.3	23.8	6	611	153
Industrial distillate oil: engines	133.4	1,918.9	413.0	855	12,301	2,647
Industrial natural gas	40.4	734.2	616.7	259	4,706	3,953
Industrial liquefied petroleum gas	1.9	51.7	29.0	12	332	186
Comm./inst. distillate oil: boilers	0.0	2.8	0.7	0	18	4
Comm./inst. distillate oil: engines	0.3	4.4	1.0	2	28	6
Comm./inst. natural gas	61.9	1,126.0	945.9	397	7,218	6,063
Residential distillate oil	0.0	0.3	0.1	0	0	0
Residential natural gas	45.8	783.2	333.3	251	4,291	1,826
Residential LPG	1.6	41.8	11.8	0	0	0
Residential wood combustion	1,403.2	157.6	8,393.8	0	0	0
All Fuel Combustion:	**1,689.7**	**4,916.2**	**10,769.1**	**1,783**	**29,505**	**14,839**
Industrial processes:						
Chemical manufacturing	68.6			531		
Commercial cooking	235.3		671.5	1,289		3,680
Bakeries	111.5			656		
Secondary metal production	65.9	55.1	671.6	467	482	5,936

Table 1.6–9. Annual and season-day emissions from all sources in the 8-hr ozone NAA (continued).

Section	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Industrial processes (continued):						
Rubber/plastic product manufacturing	921.4			7,701		
Fabricated metal product mfg.	19.0			91		
Electrical equipment manufacturing	223.6	24.3	7.5	1,280	140	42
Industrial processes, NEC	70.3	452.2	273.7	397	2,478	1,470
All Industrial Processes:	**1,715.6**	**531.6**	**1,624.3**	**12,412**	**3,100**	**11,127**
Solvent use:						
Architectural coatings	5,260.0			32,017		
Auto refinishing	950.6			5,209		
Traffic markings	437.5			4,442		
Factory finished wood	192.1			1,603		
Wood furniture	661.1			5,085		
Metal furniture: SIC 25	59.3			456		
Paper: SIC 26	50.8			391		
Metal cans: SIC 341	181.8			1,398		
Machinery and equipment: SIC 35	57.7			444		
Large appliances: SIC 363	35.2			271		
Electronic/other electrical: SIC 36	4.2			32		
Motor vehicles: SIC 371	181.5			1,396		
Aircraft surface coating	65.8			473		
Marine: SIC 373	3.4			26		
Railroad: SIC 374	5.1			39		
Miscellaneous surface coating	159.6			1,299		
Industrial maintenance coatings	298.6			2,297		
Other special-purpose coatings	11.9			92		
Degreasing	289.5			1,908		
Dry cleaning	10.4			80		
Graphics arts	295.1			1,908		
Miscellaneous industrial solvent use	199.5			1,431		
Personal care products	4,047.3			22,177		
Household products	4,452.0			24,395		
Automotive aftermarket products	2,752.1			15,080		
Coatings and related products	1,922.5			10,534		
Adhesives and sealants	1,153.5			6,320		
FIFRA-regulated products	3,602.1			19,737		
Miscellaneous products, NEC	141.7			776		
Cutback asphalt	992.3			5,437		
Emulsified asphalt	817.9			4,482		
Agricultural pesticides	218.1			1,195		
All Solvent Use:	**29,510.2**			**172,431**		
Storage/transport:						
Residential portable gas cans	446.6			2,447		
Commercial portable gas cans	385.1			2,110		
Bulk terminals	91.0			493		
Bulk plants	36.2			229		
Gas stations Stage I:submerged fill	369.9			2,027		
Gas stations Stage I:bal. submerged fill	646.9			3,545		
Underground tank breathing/emptying	764.8			4,191		

Table 1.6–9. Annual and season-day emissions from all sources in the 8-hr ozone nonattainment area (continued).

	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
Section	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Storage/transport (cont'd):						
Airports: aviation gasoline Stage I	667.5			3,658		
Airports: aviation gasoline Stage II	33.0			181		
Truck: gasoline (tank trucks in transit)	50.0			274		
Pipeline gasoline	66.2			363		
Volatile organic liquids storage/transpt	35.7			201		
All Storage/Transport:	**3,592.9**			**19,718**		
Waste treatment/disposal:						
On-site incineration	0.1	2.9	0.7	1	19	5
Open burning	90.4	4.3	9.6	695	33	74
Landfills	36.6	12.7	28.5	217	70	157
Publicly owned treatment works	59.3			456		
Leaking underground storage tanks	2.5			75		
Other waste	7.7	20.6	38.1	54	105	186
All Waste Treatment/Disposal:	**196.6**	**40.5**	**76.9**	**1,499**	**226**	**421**
Misc. area sources:						
Backyard barbeques	53.2	61.0	2,842.1	291	334	15,573
Structure fires	15.6	2.0	85.2	77	10	418
Aircraft engine testing	4.6	45.5	16.9	27	260	98
Vehicle fires	10.6	1.3	41.6	58	7	228
Crematories, human	0.4	10.7	0.6	3	73	4
Crematories, animal	0.1	5.6	0.3	1	49	3
Accidental releases	10.1	0.2	0.4	2	16	0
Hospitals	33.7			202		
Wildfires	4.3	1.9	90.4	37	17	792
Prescribed fires	0.2	0.2	1.8	63	62	743
All Miscellaneous Area Sources:	**132.8**	**128.5**	**3,079.4**	**761**	**828**	**17,859**
ALL AREA SOURCES:	**36,837.9**	**5,616.9**	**15,549.7**	**208,605**	**33,660**	**44,246**
NONROAD MOBILE SOURCES:						
Agricultural equipment	3.3	168.7	154.1	29	1,454	1,358
Airport GSE (+APU)	76.1	290.5	2,174.9	404	1,559	11,526
Commercial equipment	1,134.9	1,166.2	29,432.3	7,788	7,140	196,975
Construction & mining equipment	450.3	10,400.5	12,418.3	3,174	71,827	87,923
Industrial equipment	114.1	1,253.1	3,924.2	727	7,584	24,852
Lawn and garden equipment	2,962.4	594.9	44,765.8	25,422	4,229	407,419
Pleasure craft	382.3	98.3	1,154.8	7,477	2,428	29,686
Railway maintenance equipment	0.3	7.8	15.3	2	53	109
Recreational equipment	572.0	28.1	2,924.0	6,930	321	37,807
Aircraft	1,719.2	2,384.3	10,494.4	9,080	12,571	56,545
Locomotives	91.0	1,621.2	265.3	498	8,883	1,454
ALL NONROAD MOBILE:	**7,505.9**	**18,013.6**	**107,723.4**	**61,531**	**118,049**	**855,654**
ALL ONROAD MOBILE:	**19,162.5**	**32,380.6**	**209,281.7**	**117,999**	**172,963**	**1,273,697**
BIOGENIC SOURCES:	**102,301.8**	**587.2**	**13,154.5**	**1,321,018**	**6,768**	**173,438**
TOTAL, ALL SOURCE CATEGORIES:	**166,849.8**	**58,245.8**	**347,084.4**	**1,715,433**	**345,514**	**2,359,198**

2. Point Sources

2.1 Introduction and scope

This inventory of ozone precursors (VOC, NO_x, and CO) is one of two 2014 emissions inventory reports being prepared to meet US EPA reporting requirements. This inventory has been developed concurrently with a similar inventory for PM_{10} and related pollutants ($PM_{2.5}$, NO_x, SO_x, and NH_3) as part of Maricopa County's requirements under the respective State Implementation Plans (SIPs).

In addition to preparing a periodic emissions inventory for the 8-hour ozone nonattainment area (NAA) as a commitment under the current 8-hour ozone SIP, the federal Air Emission Reporting Requirements (AERR; US EPA, 2015) rule requires that state and local agencies prepare emissions estimates on a county basis, and submit data electronically to the US EPA for inclusion in the National Emissions Inventory (NEI) for calendar year 2014.

2.2 Identifying point sources

In order to provide consistency among various inventories, it was decided to standardize the definition of a "point source" by adopting the designation of point sources as outlined in the *Federal Register* notice for the original AERR:

> *We are basing the requirement for point source format reporting on whether the source is major under 40 CFR part 70 for the pollutants for which reporting is required, i.e., CO, VOC, NO_x, SO_2, $PM_{2.5}$, PM_{10}, lead and NH_3 but without regard to emissions of HAPs… [T]his approach will result in a more stable universe of reporting point sources, which in turn will facilitate elimination of overlaps and gaps in estimating point source emissions, as compared to nonpoint source emissions. Under this requirement, states will know well in advance of the start of the inventory year which sources will need to be reported.* (US EPA, 2008)

This chapter contains several tables that provide information on emissions from large stationary point sources. Table 2.2–1 provides an alphabetical listing of all point sources and their location. Table 2.4–1 shows the annual and ozone season-day emissions of VOC, NO_x and CO for those point sources that reported emissions of one or more of these pollutants in 2014. Table 2.5–1 lists emission reduction credits for the area, while Table 2.7–1 summarizes point source emission totals for both Maricopa County and the 8-hour ozone nonattainment area. Note that the totals shown in tables may not equal the sum of individual values due to independent rounding.

The Maricopa County Air Quality Department (MCAQD) identified point sources within the county through its electronic permit system database, EMS, and the 2014 annual emissions reports submitted to the department. A total of 19 stationary sources were identified as point sources using the definition described in Section 2.1 above. While the Arizona Department of Environmental Quality (ADEQ) retains permitting authority for a limited number of industrial source categories in Maricopa County, no ADEQ-permitted facilities are considered point sources, and are addressed instead as area sources.

Table 2.2–1 contains an alphabetical listing of all point sources, including a unique business identification number, NAICS industry classification code, business name, and physical address.

Table 2.2–1. Name and location of all point sources in Maricopa County.

ID #	NAICS	Business name	Address	City	ZIP
3313	221112	APS West Phoenix Power Plant	4606 W Hadley St	Phoenix	85043
43063	221112	Arlington Valley LLC	39027 W Elliot Rd	Arlington	85322
1218	562212	Butterfield Station Facility	40404 S 99th Ave	Mobile	85239
127771	331111	CMC Steel Fabricators Inc.	11444 E Germann Rd	Mesa	85212
44439	221112	Gila River Power Station	1250 E Watermelon	Gila Bend	85337
4173	562212	Glendale Mun Sanitary Landfill	11480 W Glendale Av	Glendale	85301
44186	221112	Mesquite Generating Station	37625 W Elliot Rd	Arlington	85322
43530	221112	New Harquahala Generating Co.	2530 N 491st Ave	Tonopah	85354
20706	32614	New Wincup Holdings Inc.	7980 W Buckeye Rd	Phoenix	85043
1879	562212	Northwest Regional Landfill	19401 W Deer Valley	Surprise	85387
1331	337122	Oak Canyon Manufacturing Inc.	3021 N 29th Dr.	Phoenix	85017
52382	221112	Ocotillo Power Plant	1500 E University Dr.	Tempe	85281
42956	221112	Redhawk Generating Facility	11600 S 363rd Ave	Arlington	85322
303	332431	Rexam Beverage Can Company	211 N 51st Ave	Phoenix	85043
3315	221112	Santan Generating Station	1005 S Val Vista Rd	Gilbert	85296
4175	424710	SFPP LP Phoenix Terminal	49 N 53rd Ave	Phoenix	85043
3316	221112	SRP Agua Fria Generating Station	7302 W Northern Av	Glendale	85303
3317	221112	SRP Kyrene Generating Station	7005 S Kyrene Rd	Tempe	85283
1210	337122	Trendwood Inc.	2402 S 15th Ave	Phoenix	85007

Note: All facilities listed above are also located within the 8-hour ozone nonattainment area.

2.3 Procedures for estimating emissions from point sources

Annual and season-day emission estimates were calculated from annual source emissions reports, MCAQD investigation reports, permit files and logs, or telephone contacts with sources. For most of the sources, material balance methods were used for determining emissions. Emissions were estimated using the emission factors from source tests, AP–42, engineering calculations, or manufacturers' specifications.

MCAQD distributes annual emissions survey forms to most facilities for which MCAQD has issued an operating permit, including all Title V and synthetic minor facilities. All facilities are required to report detailed information on stacks, control devices, operating schedules, and process-level information concerning their annual activities. Detailed instructions accompany the emissions reporting forms, and include examples and explanations on how to complete the annual emissions reporting forms that facilities must submit to MCAQD. (See Appendix A for a copy of the instructions accompanying the annual emissions inventory forms.)

After a facility has submitted an annual emissions report to MCAQD, emissions inventory staff check all reports for missing and questionable data, and check the accuracy and reasonableness of all emissions calculations with AP–42, the Factor Information and REtrieval (*webFIRE*) software, and other EPA documentation. Control efficiencies are determined by source tests when available, or by AP–42 factors, engineering calculations, or manufacturers' specifications. MCAQD has conducted annual emissions surveys for permitted facilities since 1988, and the department's database system, EMS, contains numerous automated quality assurance/quality control checks for data input and processing.

2.3.1 Application of rule effectiveness

Rule effectiveness ("RE") reflects the actual ability of a regulatory program to achieve the emission reductions required by regulation. The concept of applying rule effectiveness in a SIP emissions inventory has evolved from the observation that regulatory programs may be less than 100 percent effective for some source categories. Rule effectiveness is applied to those sources affected by a regulation and for which emissions are determined by means of emission factors and control efficiency estimates.

MCAQD has estimated rule effectiveness for a variety of emissions sources and source categories. For processes that claimed emissions reductions through the use of a control device, rule effectiveness was quantified separately for Title V and non-Title V sources. Overall RE values of 90.44% (for Title V processes) and 89.00% (for non-Title V processes) were calculated, and applied to 2014 process-level emissions information where applicable. Appendix B provides further details on the methods and data used in computing these rule effectiveness rates.

2.4 Detailed overview of point source emissions

Table 2.4–1 provides a summary of annual and season-day emissions from all 19 facilities that have been categorized as point sources (all of which are located within the 8-hour ozone nonattainment area). Sources for which rule effectiveness has been applied are noted. Emissions values of "0.0" and "0" for annual and season-day emissions denote quantities below the level of significance (0.05 tons/yr and 0.5 lbs/day, respectively).

Table 2.4–1. Annual and season-day emissions from point sources, by facility.

			Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
ID #	**Business name**		**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
3313	APS West Phoenix Power Plant	*	17.9	441.5	81.5	136	3,200	684
43063	Arlington Valley LLC	*	12.7	75.8	33.5	138	825	366
1218	Butterfield Station Facility	*	5.0	16.7	25.3	28	103	141
127771	CMC Steel Fabricators Inc.	*	25.5	42.7	561.0	243	405	5,377
44439	Gila River Power Station	*	12.6	216.3	68.5	109	1,900	614
4173	Glendale Mun. Sanitary Landfill	*	2.3	13.0	74.5	4	71	409
44186	Mesquite Power Operations LLC		22.1	190.5	56.8	151	1,362	428
43530	New Harquahala Gen Co.		4.5	38.8	28.1	79	707	521
20706	New Wincup Holdings Inc.		156.5	11.4	2.6	860	66	15
1879	Northwest Regional Landfill	*	48.5	21.1	96.4	89	116	530
1331	Oak Canyon Inc.		100.6			774		
52382	Ocotillo Power Plant		4.5	76.4	13.0	32	609	103
42956	Redhawk Generating Facility		6.0	153.5	156.8	48	1,072	1,104
303	Rexam Beverage Can Co.	*	117.3	4.8	4.1	670	25	21
3315	Santan Generating Station		7.9	211.8	100.5	71	2,174	937
4175	SFPP LP Phoenix Terminal	*	114.2	3.6	8.2	627	23	48
3316	SRP Agua Fria Generating Stn.		2.0	44.6	29.5	38	765	581
3317	SRP Kyrene Generating Station		1.6	42.0	20.4	11	415	204
1210	Trendwood Inc.	*	40.6			313		
	Totals:		**702.3**	**1,604.6**	**1,360.8**	**4,421**	**13,839**	**12,084**

* = Facility for which rule effectiveness has been applied to one or more reported processes.

2.5 Emission reduction credits (ERCs)

A major source or major modification planned in a nonattainment area must obtain emissions reductions as a condition for approval. These emissions reductions, generally obtained from existing sources located in the vicinity of a proposed source, must offset the increased emissions from the new source or modification. The obvious purpose of acquiring offsetting emissions decreases is to allow an area to move towards attainment of the national ambient air quality standards while still allowing some industrial growth.

In order for these emission reductions to be available in the future for offsetting, they must: (1) be explicitly included and quantified as growth in projection-year inventories required in rate of progress plans or attainment demonstrations that were based on 1990 actual inventories, and (2) meet the requirements outlined in MCAQD Rule 240 (renamed "Federal Major New Source Review [NSR]" in early 2016). Table 2.5–1 provides a list of emission reduction credits for VOC, NO_x, and CO.

Table 2.5–1. Available Emissions Reduction Credits (ERCs) as of December 31, 2014.

		Emission reduction credits (tons/yr)		
Facility name	**Reduction date**	**VOC**	**NO_x**	**CO**
Freescale Semiconductor, Inc.	3/1/2004	17.1	9.8	14.3
Intel Corporation	3/4/2005	178.33		
Madison 51, LLC (Thornwood)	10/8/2012	53.1		
Penn Racquet Sports Inc.	3/6/2009		4.34	
Woodstuff Manufacturing Inc.	11/30/2007	17.6		
Totals:		**266.13**	**14.14**	**14.3**

A number of facilities have been identified as potential sources of ERCs for NO_x or VOC, in addition to those listed in Table 2.5–1. The companies listed in Table 2.5–2 below are permitted facilities that have permanently closed since 2011, and whose annual emissions history indicates that the facility is a potential source of the source of additional ERCs. This list is provided here in order to maintain the availability of these emissions in this periodic inventory in the event that sufficient documentation can be secured to confirm the emissions reductions.

Table 2.5–2. Potential sources of emission reduction credits for VOC or NO_x.

Permit no.	Facility name	City, ZIP	Potential ERCs (tons/yr) VOC	Potential ERCs (tons/yr) NO_x
100087	Di-Matrix Precision Manufacturing	Phoenix, 85040	17.4	
110178	Saint Gobain Solar Glass Facility	Goodyear, 85338	9.9	
020005	Jabil	Tempe, 85281	8.5	
010233	All Pro Industrial Finishes	Tempe, 85281	8.4	
150049	Artisan Natural Stone Products LLP	Phoenix, 85034	7.8	
010240	Wells Cargo Inc./Haulmark Industries Inc.	Phoenix, 85043	6.0	
110195	Crown Custom Millwork LLC	Phoenix, 85085	5.0	
990152	Wickenburg Oil Company LLC	Wickenburg, 85390	4.2	
020189	American Case & Pedestal Mfg. Co.	Phoenix, 85009	4.0	
990254	Benchmark Electronics Phoenix, Inc.	Phoenix, 85023	2.1	
090003	Phoenix San-Man Inc.	Buckeye, 85326		9.9
010143	Gro-Well Brands Inc.	Phoenix, 85009		8.3
970349	Cemex – Central Ave. Plant	Phoenix, 85041		7.5
090298	Phoenix Brick Yard	Phoenix, 85007		3.1
	Totals:		**73.3**	**28.8**

2.6 Quality assurance/quality control procedures

2.6.1 Emission survey preparation and data collection

The MCAQD's Emissions Inventory (EI) Unit annually collects point source criteria pollutant emission data from sources in the county. MCAQD annually reviews EPA guidance, documents from the Emissions Inventory Improvement Program (EIIP), and other source materials to ensure that the most current emission factors and emission calculation methods are used for each year's survey. Each January, the EI Unit prepares a pre-populated hard copy of the preceding year's submissions and mails reporting forms to permitted sources, along with detailed instructions for completing the forms. (A copy of these instructions is included as Appendix A). The EI Unit asks sources to verify and update the data. The EI Unit also holds numerous workshops each spring to assist businesses in completing EI forms. The general data flow for data collection and inventory preparation is shown in Figure 2.6–1.

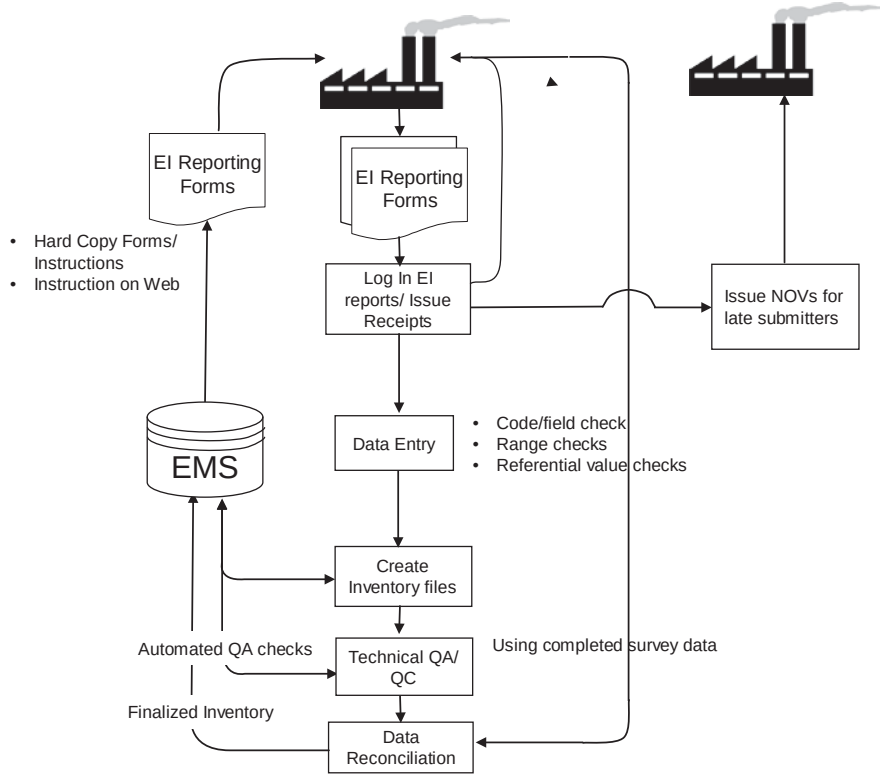


Figure 2.6–1. Data flow for annual point source emissions inventory reporting.

2.6.2 Submission processing

Submitted EI reports are logged in as they are received, and receipts are issued for any emissions fees paid. The data are input "as received" into the department's data base. During data entry, a variety of automated quality control (QC) checks are performed, including:

- pull-down menus to minimize data entry errors (e.g., city, pollutant, emission factor unit, etc.)
- mandatory data field requirement checks (e.g., a warning screen appears if a user tries to save an emission record with a missing emission factor).
- range checks (e.g., were valid SCC, Tier, SIC, and NAICS codes entered?)
- referential value checks (e.g., emission factor units, annual throughput units)
- automatic formatting of date, time, telephone number fields, etc.

Automated quality assurance (QA) checks on the report that has been entered include the following:

- comparing reported emission factors to SCC reference lists,
- comparing reported emission factors to material name reference list,
- checking the report for completeness of required data, and
- checking the report for calculation errors. This includes annual throughput, emission factors, unit conversion factors (e.g., therms to MMCF), capture efficiency, primary / secondary control device efficiency, and any offsite recycling credits claimed.

When data entry is complete, an electronic version of the original data is preserved separately to document changes made during the technical review and QA/QC process. When errors are flagged, the businesses are contacted and correct information is obtained and input to EMS. Outstanding reporting issues are documented. Confidential business information (CBI) is identified by a checkbox on the form, and these data elements are flagged during data entry and are not transmitted to EPA.

To prepare the inventory for submittal to the National Emissions Inventory (NEI), the EI Unit has developed a series of MS-Access queries to extract data from EMS; and to append or convert codes, units of measure, etc., in order to create staging tables that adhere to the EPA's Consolidated Emissions Reporting Schema (CERS). These tables are then converted to XML files using EPA's Bridge conversion tool for submittal to the EPA's Emissions Inventory System (EIS).

2.6.3 Analysis of annual point source emissions data for this inventory

Air quality planning staff checked inventory accuracy and reasonableness, and assured that all point sources had been identified and that the methodology applied to calculate emissions was appropriate and that the calculations were correct. Other reasonableness checks were conducted by recalculating emissions using methods other than those used to make the initial emissions calculations and then comparing results. Quality assurance checks were conducted by checking all emissions reports submitted to MCAQD for the year 2014 for missing and questionable data and by checking the accuracy and reasonableness of all emissions calculations made for such reports. Notes concerning follow-up calls and corrections to calculations were documented on each 2014 annual emissions report.

2.7 Summary of all point source emissions

Table 2.7–1 below summarizes annual and season-day emissions from all point sources, including the existing and potential emission reduction credits listed above in Tables 2.5–1 and 2.5–2 respectively, for both Maricopa County and the 8-hour ozone nonattainment area.

Table 2.7–1. Annual and season-day point source emissions (including all emission reduction credits).

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1,041.8	1,647.6	1,375.1	6,281	14,074	12,163
8-hr ozone NAA	1,041.8	1,647.6	1,375.1	6,281	14,074	12,163

2.8 References

US EPA, 2008. Air Emissions Reporting Requirements. 73 Fed. Reg. 76539 (Dec. 17, 2008). *https://federalregister.gov/a/E8-29737*

US EPA, 2015. Revisions to the Air Emissions Reporting Requirements: Revisions to Lead (Pb) Reporting Threshold and Clarifications to Technical Reporting Details. 80 Fed. Reg. 8787 (Feb. 19, 2015). *https://federalregister.gov/a/2015-03470*

3. Area (Nonpoint) Sources

3.1 Scope and methodology

This chapter considers all stationary sources which are too small or too numerous to be treated as point sources. A variety of US EPA guidance materials were evaluated to identify area source categories meriting inclusion in this inventory, including the 2014 National Emissions Inventory (NEI) website (US EPA, 2016); documentation of the development of the previous NEI in 2011 (US EPA, 2015); and the document "Introduction to Area Source Inventory Development" (US EPA, 2001a). In addition, permit and emissions data in the MCAQD's Environmental Management System (EMS) database were analyzed to identify critical point and area source categories. Some source categories were deemed "insignificant" because there are no large production facilities and/or very few small sources, and thus emissions from these categories were not quantified.

For nearly all area source categories, emissions were calculated in one of the following ways:

- For those source categories with detailed emissions data available from most or all of the significant sources in the category (e.g., aircraft engine testing), annual and season-day emissions were calculated based on detailed process-level and operational data provided by these sources.
- Emissions estimates for some categories were developed by conducting surveys on local usage (e.g., natural gas consumption) or derived from state-wide data (e.g., fuel oil use).
- For those source categories in which some representative facilities submit annual emissions reports (e.g., bakeries), these detailed data were used to develop a per-employee emission factor, which was then used along with County-level employment data from the US Census to "scale up" those emissions reported from the subset of surveyed facilities, to reflect emissions from the entire source category.
- For a small number of particularly ubiquitous or diverse categories (e.g., consumer solvent use), emissions estimated using published or recommended per-capita (or per-employee) emission factors.
- Emissions estimates for some categories were obtained from County-level emissions estimates developed by US EPA for use in the 2014 National Emissions Inventory, or by using related emissions estimation tools developed by US EPA (e.g., residential wood combustion).

The specific emissions estimation method(s) used for each source category, including the derivation and application of rule effectiveness, are described in greater detail in the respective sections. Emissions estimates for several source categories were conducted by staff from the consulting firm ERG (www.erg.com) under a contract with MCAQD.

3.2 Fuel combustion

3.2.1 Industrial fuel combustion

3.2.1.1 Industrial distillate oil

Annual emissions from industrial distillate oil combustion were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). US EPA developed separate estimates for emissions from external combustion sources (boilers) and internal combustion engines, for each county nationwide. Annual emissions for the 8-hour ozone nonattainment area were estimated by apportioning Maricopa

County's emissions to the nonattainment area, using the ratio of industrial employment (99.20%) as a surrogate. See Section 1.5.1 for a discussion of the employment data used. Annual emissions for Maricopa County and 8-hour ozone nonattainment area are presented in Table 3.2–1.

Table 3.2–1. Annual emissions (tons/yr) from area-source industrial distillate oil combustion.

	Maricopa County			8-hr ozone nonattainment area		
Equipment type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Boilers	1.0	96.1	24.0	1.0	95.3	23.8
Engines	134.5	1,934.4	416.3	133.4	1,918.9	413.0
Totals:	**135.5**	**2,030.5**	**440.3**	**134.4**	**2,014.2**	**436.8**

To calculate season-day emissions, it was assumed that industrial combustion of distillate oil occurs six days per week, and is relatively uniform throughout the year. Thus annual emissions were divided by 312 (= 6 days/week × 52 weeks/year) to derive emissions for an ozone season day. Season-day emissions for Maricopa County and the 8-hour ozone nonattainment area are presented in Table 3.2–2.

Table 3.2–2. Season-day emissions (lbs/day) from area-source industrial distillate oil combustion.

	Maricopa County			8-hr ozone nonattainment area		
Equipment type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Boilers	6	616	154	6	611	153
Engines	862	12,400	2,669	855	12,301	2,647
Totals:	**868**	**13,016**	**2,823**	**861**	**12,912**	**2,800**

3.2.1.2 Industrial natural gas

Annual emissions from industrial natural gas combustion were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). To calculate season-day emissions, it was assumed that industrial natural gas combustion occurs six days per week, and is relatively uniform throughout the year. Thus annual emissions were divided by 312 (= 6 days/week × 52 weeks/year) to derive emissions for an ozone season day.

Emissions for the 8-hour ozone nonattainment area were estimated by apportioning County-level emissions to the nonattainment area, using the ratio of industrial employment (99.20%) as a surrogate. See Section 1.5.1 for a discussion of the employment data used. Annual and season-day emissions for Maricopa County and the 8-hour ozone NAA are shown in Table 3.2–3.

Table 3.2–3. Annual and season-day emissions from area-source industrial natural gas combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	40.7	740.1	621.7	261	4,744	3,985
8-hr ozone nonattainment area	40.4	734.2	616.7	259	4,706	3,953

3.2.1.3 Industrial liquefied petroleum gas (LPG)

Annual emissions from industrial LPG combustion were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). To calculate season-day emissions, it was assumed that industrial LPG combustion occurs six days per week, and is relatively uniform throughout the year. Thus annual emissions were divided by 312 (= 6 days/week × 52 weeks/year) to derive emissions for an ozone season day.

Emissions for the 8-hour ozone nonattainment area were estimated by apportioning County-level emissions to the nonattainment area, using the ratio of industrial employment (99.20%) as a surrogate. See Section 1.5.1 for a discussion of the employment data used. Annual and season-day emissions for Maricopa County and the 8-hour ozone NAA are shown in Table 3.2–4.

Table 3.2–4. Annual and season-day emissions from area-source industrial LPG combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1.9	52.1	29.2	12	334	187
8-hr ozone nonattainment area	1.9	51.7	29.0	12	332	186

3.2.2 Commercial/institutional fuel combustion

3.2.2.1 Commercial/institutional distillate oil

Annual emissions from commercial/institutional distillate oil combustion were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). US EPA develops separate estimates for emissions from external combustion sources (boilers) and internal combustion engines, for each county nationwide.

Annual emissions for the 8-hour ozone nonattainment area were estimated by apportioning Maricopa County's emissions to the nonattainment area, using the ratio of commercial/ institutional employment (99.93%) as a surrogate. See Section 1.5.1 for a discussion of the employment data used. Annual emissions for Maricopa County and 8-hour ozone nonattainment area are presented in Table 3.2–5.

Table 3.2–5. Annual emissions (tons/yr) from area-source commercial/institutional distillate oil combustion.

	Maricopa County			8-hr ozone nonattainment area		
Equipment type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Boilers	0.0	2.8	0.7	0.0	2.8	0.7
Engines	0.3	4.4	1.0	0.3	4.4	1.0
Totals:	**0.3**	**7.2**	**1.7**	**0.3**	**7.2**	**1.7**

To calculate season-day emissions, it was assumed that industrial combustion of distillate oil occurs six days per week, and is relatively uniform throughout the year. Thus annual emissions were divided by 312 (= 6 days/week × 52 weeks/year) to derive emissions for an ozone season day. Season-day emissions for Maricopa County and the 8-hour ozone nonattainment area are presented in Table 3.2–6.

Table 3.2–6. Season-day emissions (lbs/day) from area-source commercial/institutional distillate oil combustion.

	Maricopa County			8-hr ozone nonattainment area		
Equipment type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Boilers	0	18	4	0	18	4
Engines	2	28	6	2	28	6
Totals:	**2**	**46**	**10**	**2**	**46**	**10**

3.2.2.2 Commercial/institutional natural gas

Annual emissions from commercial/institutional natural gas combustion were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). To calculate ozone season-day emissions, it was assumed that commercial/institutional natural gas combustion occurs six days per week, and is relatively uniform throughout the year. Thus annual emissions were divided by 312 (= 6 days/week × 52 weeks/year) to derive emissions for an ozone season day.

Emissions for the 8-hour ozone nonattainment area were estimated by apportioning County-level emissions to the nonattainment area, using the ratio of commercial/institutional employment (99.93%) as a surrogate. See Section 1.5.1 for a discussion of the employment data used. Annual and season-day emissions for Maricopa County and the 8-hour ozone nonattainment area are presented in Table 3.2–7.

Table 3.2–7. Annual and season-day emissions from area-source commercial/institutional natural gas combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	62.0	1,126.8	946.5	397	7,223	6,068
8-hr ozone nonattainment area	61.9	1,126.0	945.9	397	7,218	6,063

3.2.3 Residential fuel combustion

3.2.3.1 Residential distillate oil

Annual emissions from residential distillate oil combustion were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). The 2014 NEI utilized 2013 state-level fuel consumption data from Energy Information Administration's (EIA) State Energy Data System (SEDS) (EIA, 2016). State-level emissions were calculated using the EIA data and allocated to the counties based on state-level and county-level data on number of housing units using a specific type of fuel for residential heating from the U.S. Census Bureau. ERG reviewed potential sources of activity data for 2014

to update the emission estimates for Maricopa County. Fuel consumption data for 2014 are available from EIA's SEDS, but the 2014 residential distillate fuel consumption data for Arizona were unchanged from the 2013 data that were used in the 2014 NEI.

Ozone season-day emissions would normally be calculated by dividing ozone season emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65 °F). However, data obtained from National Oceanic and Atmospheric Administration (NOAA, 2016) indicated that there were no heating degree days reported during the 2014 ozone season (June–August). Therefore, ozone season-day emissions from residential distillate oil combustion are assumed to be zero.

Annual and season-day emissions within the 8-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of total resident population in the nonattainment area to the total resident population in the county (100.79%). See Section 1.5.1 for a discussion of the population data used. The resulting annual and season-day emissions estimates are presented in Table 3.2–8.

Table 3.2–8. Annual and season-day emissions from residential distillate oil combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.0	0.3	0.1	0	3	1
8-hr ozone nonattainment area	0.0	0.3	0.1	0	0	0

3.2.3.2 Residential natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information regarding the volume of natural gas sold in 2014, by user category, within the county. Annual emissions from residential natural gas combustion were calculated by multiplying residential natural gas sales in 2014 (16,532.9 MMCF) by EPA-recommended emission factors from WebFIRE (US EPA, 2015).

Ozone season-day emissions were calculated by first summing monthly reported natural gas usage during the ozone season months (June–August; 1,979.5 MMCF) to derive a total ozone season emissions value. Activity for this source category was assumed to occur evenly, both on a weekly and annual basis. Total ozone-season emissions were thus divided by the total days (92) during the ozone season to derive season-day emissions.

Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying county-level emissions by the ratio of total resident population in the nonattainment area to the total resident population in the county (100.79%). See Section 1.5.1 for a discussion of the population data used. Table 3.2–9 below summarizes annual and ozone season-day emissions from residential natural gas combustion for both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.2–9. Annual and season-day emissions from residential natural gas combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	45.5	777.0	330.7	118	2,023	861
8-hr ozone nonattainment area	45.8	783.2	333.3	119	2,038	867

3.2.3.3 Residential liquefied petroleum gas (LPG)

Annual emissions from residential LPG combustion were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). The 2014 NEI utilized 2013 state-level fuel consumption data from Energy Information Administration's (EIA) State Energy Data System (SEDS). ERG reviewed potential sources of activity data for 2014 to update the emission estimates for Maricopa County. Fuel consumption data for 2014 are available from EIA's SEDS (EIA 2016) and indicate 1,004,000 barrels of LPG consumed in the residential sector in Arizona. State-level emissions were then allocated to Maricopa County based on the ratio of housing units that utilize LPG at the county-level to state-level. Data used in the 2014 NEI indicate that approximately 15% of all households using LPG in the state of Arizona are located in Maricopa County.

Ozone season emissions would normally be calculated by applying the ratio of heating degree days (HDD) in the ozone season (June-August) to total annual HDD. However, data obtained from National Oceanic and Atmospheric Administration (NOAA, 2016) indicated that there were no heating degree days reported during the 2014 ozone season (June–August). Thus, ozone season-day emissions from residential LPG combustion are assumed to be zero.

Annual and season-day emissions within the 8-hour ozone nonattainment area were calculated by multiplying county-level emission estimates by the nonattainment-area/county ratio of total resident population (100.79%). See Section 1.5.1 for a discussion of the population data used. Table 3.2–10 summarizes annual and ozone season-day emissions from residential LPG combustion for both the county and the 8-hour ozone nonattainment area.

Table 3.2–10. Annual and season-day emissions from residential LPG combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1.6	41.5	11.8	15	391	111
8-hr ozone nonattainment area	1.6	41.8	11.8	0	0	0

3.2.3.4 Residential kerosene

County-level emission estimates that were developed for use in US EPA's 2014 National Emissions Inventory (NEI) were obtained and reviewed (US EPA, 2016). The 2014 NEI utilized 2013 state-level fuel consumption data from Energy Information Administration's (EIA) State Energy Data System (SEDS) (EIA, 2016). The 2013 fuel consumption data for Arizona indicated no kerosene consumption in the residential sector; therefore, the 2014 NEI emission estimates for Arizona and Maricopa County were also zero.

ERG reviewed available activity data sources for 2014 at the state-level and county-level. Review of Arizona data downloaded from SEDS for 2014 (EIA 2016) indicated zero consumption of kerosene in the residential sector for the entire state of Arizona (and Maricopa County). Since the available activity data indicates that there is no kerosene consumption in the residential sector for Arizona, the emissions from this source category are considered to be zero.

3.2.3.5 Residential wood combustion

Annual emissions from residential wood combustion were derived from the county-level estimates prepared by EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). County-level annual emissions by appliance type are shown in Table 3.2–11.

Table 3.2–11. Annual emissions from residential wood combustion (RWC) in Maricopa County, by appliance type (from EPA's RWC emissions-estimation tool).

		Annual emissions (tons/yr)		
SCC	**Appliance type**	**VOC**	**NO_x**	**CO**
2104008210	Woodstove: fireplace inserts; non-EPA certified	143.5	19.7	1,130.9
2104008220	–Fireplace inserts; EPA certified; non-catalytic	198.4	10.5	864.2
2104008230	–Fireplace inserts; EPA certified; catalytic	29.4	5.6	345.3
2104008310	–Freestanding, non-EPA certified	10.9	1.5	75.8
2104008320	–Freestanding, EPA certified, non-catalytic	592.0	31.3	2,578.0
2104008330	–Freestanding, EPA certified, catalytic	166.2	31.6	1,950.3
2104008400	–Pellet-fired, general	138.5	18.5	964.0
2104008610	Hydronic heater: outdoor	10.4	18.0	75.3
2104008700	Outdoor wood burning device, NEC	4.0	0.6	31.5
2104009000	Residential firelog	98.9	19.2	312.6
Totals:		**1,392.2**	**156.3**	**8,328.1**

Ozone season-day emissions would normally be calculated by dividing ozone season emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65 °F). However, data obtained from National Oceanic and Atmospheric Administration (NOAA, 2016) indicated that there were no heating degree days reported during the 2014 ozone season (June–August). Therefore, ozone season-day emissions from residential wood combustion are assumed to be zero.

Annual and season-day emissions within the 8-hour ozone nonattainment area were calculated by multiplying county-level emissions totals by the ratio of total population in the nonattainment area to the total population in the county (100.79%). See Section 1.5.1 for a further discussion of the population data used. Table 3.2–12 summarizes annual and season-day emissions from residential wood combustion for both the county and the 8-hour ozone nonattainment area.

Table 3.2–12. Annual and season-day emissions from residential wood combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1,392.2	156.3	8,328.1	0	0	0
8-hr ozone nonattainment area	1,403.2	157.6	8,393.8	0	0	0

3.3 Industrial processes

3.3.1 Chemical manufacturing

Historically, emissions from chemical manufacturing were calculated for the periodic emissions inventory by the "scaling up" method as described elsewhere in this report. However, the sample size for the 2014 periodic emissions inventory was not large enough to calculate an accurate and reliable result. Therefore, data from the 2011 periodic emissions inventory (MCAQD, 2014) were grown to 2014 based on industrial employment levels for those two years.

Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage industrial employment within the nonattainment area. See Section 1.5.1 for a discussion of the employment data used. Table 3.3–1 summarizes annual and season-day emissions from chemical manufacturing in both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.3–1. Annual and season-day VOC emissions from area-source chemical manufacturing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	69.1	535
8-hr ozone nonattainment area	68.6	531

3.3.2 Food and kindred products

3.3.2.1 Commercial cooking

Emissions from commercial cooking were estimated for five types of commercial cooking equipment using county-level estimates prepared for use in U.S. EPA's 2014 National Emissions Inventory (NEI) data and documentation (U.S. EPA, 2016). The 2014 NEI estimates were developed using 2013 activity data from the U.S. Census Bureau. The equipment types for which emissions were estimated included: chain-driven charbroilers, under-fired charbroilers, deep-fat fryers, flat griddles, and clamshell griddles.

Maricopa County population data for 2013 and 2014 were obtained from the Arizona Department of Administration (ADOA, 2016). The population data indicated population growth of 1.6% from 2013 to 2014. This growth factor was then applied to the county-level estimates from the 2014 NEI to develop emission estimates for Maricopa County for 2014. The 2014 NEI estimates for the commercial cooking source category did not include NO_x.

Commercial cooking activity is assumed to occur uniformly throughout the year. Therefore, average season-day emissions were developed by dividing the annual emissions by 365 (i.e., ozone season-day emissions are the same as average season-day emissions). The results are shown in Table 3.3–2.

Table 3.3–2. Annual and season-day emissions from commercial cooking equipment in Maricopa County.

	Annual emissions (tons/yr)		Ozone season-day emissions (lbs/day)	
Equipment type	**VOC**	**CO**	**VOC**	**CO**
Chain-driven charbroilers	44.3	148.1	243	811
Under-fired charbroilers	146.3	478.4	801	2,622
Deep-fat fryers	22.9		125	
Flat griddles	19.3	39.8	106	218
Clamshell griddles	0.8		4	
Totals:	**233.5**	**666.3**	**1,279**	**3,651**

Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the county totals by the ratio of total resident population in the nonattainment area to the total resident population in the county (100.79%). See Section 1.5.1 for a discussion of the population data used. Table 3.3–3 summarizes the annual and season-day emissions from commercial cooking for the 8-hour ozone nonattainment area.

Table 3.3–3. Annual and season-day emissions from commercial cooking equipment in the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)		Ozone season-day emissions (lbs/day)	
Equipment type	**VOC**	**CO**	**VOC**	**CO**
Chain-driven charbroilers	44.7	149.2	245	818
Under-fired charbroilers	147.4	482.2	808	2,642
Deep-fat fryers	23.0		126	
Flat griddles	19.4	40.1	106	220
Clamshell griddles	0.8		4	
Totals:	**235.3**	**671.5**	**1,289**	**3,680**

3.3.2.2 Bakeries

Emissions from area-source bakeries were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources and County-level employment data from the US Census Bureau (2013) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2013 employment were used. (Where employment estimates were provided as a range of values, the midpoint was used.) CBP estimates for Maricopa County employment in NAICS codes 311812 and 31183 (Commercial Bakeries and Tortilla Manufacturing) to total 2,401 persons. There were no point sources in this category, thus all emissions from this source category are reported as area sources. Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed season-day emissions instead of annual totals.

Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county. Results are summarized in Table 3.3–4. See section 1.5.1 for a discussion of the employment data used.

Table 3.3–4. Annual and season-day VOC emissions from area-source bakeries.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	112.4	661
8-hr ozone nonattainment area	111.5	656

3.3.3 Secondary metal production

Annual and season-day emissions from secondary metal production facilities were derived from annual emissions reports from permitted sources. As this category consists primarily of foundries, it was assumed that there were no significant unpermitted sources within Maricopa County. Since all facilities considered in this section are located within the 8-hour ozone nonattainment area, total emission values for the county and the nonattainment area from secondary metal production are equal. Annual and season-day emissions are shown in Table 3.3–5.

Table 3.3–5. Annual and season-day emissions from area-source secondary metal production.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	65.9	55.1	671.6	467	482	5,936
8-hr ozone nonattainment area	65.9	55.1	671.6	467	482	5,936

3.3.4 Rubber and plastic product manufacturing

Emissions from area-source rubber and plastic product manufacturing facilities were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2013) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category. The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2013 employment were used. Where CBP employment estimates were presented as a range, the midpoint values were chosen for these calculations. Table 3.3–6 lists the NAICS codes and employment data used to calculate emissions from rubber and plastic product manufacturing facilities.

Table 3.3–6. County employment for rubber and plastic product manufacturing, by NAICS code.

NAICS	NAICS description	Employment
325211	Plastics material and resin manufacturing	199
326199	All other plastic product manufacturing	2,120
326212	Tire retreading	61
326299	All other rubber product manufacturing	140
332313	Plate work manufacturing	85
336413	Other aircraft parts and aux. equipment manufacturing	1,257
339113	Surgical appliance and supplies manufacturing	372
339115	Ophthalmic goods manufacturing	90
42313	Tire and tube merchant wholesalers	397
42393	Recyclable material merchant wholesalers	1,558
44131	Automotive parts and accessories stores	3,613
44132	Tire dealers	2,455
Total:		**12,347**

Some facilities in this category have been categorized as point sources, and thus their emissions are accounted for in Chapter 2. To avoid double-counting, reported total employment at individual point sources is subtracted from estimated County employment levels.
Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed season-day emissions instead of annual totals. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county. See Section 1.5.1 for a discussion of the employment data used. Table 3.3–7 below summarizes annual and season-day emissions from area source rubber and plastic product manufacturing.

Table 3.3–7. Annual and season-day VOC emissions from area-source rubber and plastic product manufacturing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	928.8	7,763
8-hr ozone nonattainment area	921.4	7,701

3.3.5 Fabricated metal products manufacturing

Emissions from fabricated metal products manufacturing were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources and county-level employment data from the US Census Bureau (2013) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2013 employment were used. CBP employment data for NAICS code 332 (fabricated metal products manufacturing) indicated that there were 14,662 employees in this industry in Maricopa County.

Since there were no point sources in this category, an area-source employment estimate of 14,662 was used to "scale up" emissions reported from those facilities surveyed in 2014.

Season-day emissions are calculated in the same method as annual emissions, only using surveyed season-day emissions instead of annual totals. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of industrial employment within the nonattainment area. See Section 1.5.1 for a discussion of the employment data used. Table 3.3–8 summarizes annual and season-day emissions from fabricated metal products manufacturing in both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.3–8. Annual and season day VOC emissions from area-source fabricated metal products manufacturing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	19.2	92
8-hr ozone nonattainment area	19.0	91

3.3.6 Electrical equipment manufacturing

Annual and season-day emissions from electric equipment manufacturing were derived from annual emissions reports submitted by permitted sources. It was assumed that there were no significant unpermitted sources within Maricopa County and all electrical equipment manufacturing permitted sources are reported here as area-sources.

As all facilities addressed in this source category are located within the 8-hour ozone nonattainment area, emission totals for both areas are equal. Annual and season-day emissions are shown in Table 3.3–9.

Table 3.3–9. Annual and season-day emissions from area-source electric equipment manufacturing.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	223.6	24.3	7.5	1,280	135	41
8-hr ozone nonattainment area	223.6	24.3	7.5	1,280	140	42

3.3.7 Industrial processes not elsewhere classified

Annual area-source emissions from other industrial processes not elsewhere classified (NEC) were derived primarily from annual emissions reports from permitted facilities. Other industrial processes include a wide array of industrial activities that are often specific to the permitted facility that reported the process. For this reason, it is assumed there are no significant emissions from other industrial processes, other than those reported by permitted facilities on their annual emissions reports. Ozone season-day emissions were calculated based on operating schedule information provided by individual facilities through MCAQD's annual emissions reporting

program. Emissions estimates for the 8-hour ozone nonattainment area were derived using data on the location of the facilities that report other industrial processes.

In addition, emissions from ADEQ-permitted sources are included in this category due to a lack of specificity regarding the nature of the reported emissions. As a conservative estimate, all of these emissions were assumed to occur within the 8-hour ozone nonattainment area. Estimates of total emissions from this source category are presented in Table 3.3–10.

Table 3.3–10. Annual and season-day emissions from industrial processes not elsewhere classified.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	71.4	452.2	273.7	407	2,478	1,532
8-hr ozone nonattainment area	70.3	452.2	273.7	397	2,478	1,470

3.4 Solvent use

3.4.1 Surface coating

3.4.1.1 Architectural coatings

VOC emissions from architectural coatings were calculated using a per-capita emission factor developed and used by EPA for the 2008 NEI (US EPA, Date. 2008 NEI Version 3 Technical Support Documentation, supporting Data and Summaries). Because Maricopa County Rule 335 contains an emission limit for coatings, the "controlled" VOC emission factor (2.41 lbs/person) was used.

Annual VOC emissions for architectural coating for both Maricopa County and the 8-hour ozone nonattainment area were calculated by multiplying the per-capita emission factor by the county and nonattainment area population values. See Section 1.5.1 for a discussion of the population data used.

Ozone season-day emissions were developed using default assumptions from EIIP (US EPA, 1995a). The seasonal factor for ozone season architectural coating activity was assumed to be 28 percent of annual activity. In addition, it was assumed that coating use may take place 7 days a week during the ozone season. Thus, season-day emissions were calculated by multiplying annual VOC emissions by the seasonal factor and then dividing the results by 92 days per season. Table 3.4–1 presents the assumptions used as well as annual and season-day VOC emissions from architectural coatings for Maricopa County and the 8-hour ozone nonattainment area.

Table 3.4–1. Annual and season-day VOC emissions from architectural coating.

Geographic area	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Maricopa County	5,215.8	31,748
8-hr ozone nonattainment area	5,260.0	32,017

3.4.1.2 Auto refinishing

Annual emissions from auto refinishing were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). Activity for this source category is assumed to occur uniformly throughout the year and take place 7 days per week. Thus, season-day emissions were estimated by dividing annual emissions by 365 days/year. Annual and season-day emissions for the 8-hour ozone nonattainment area were derived by applying the ratio of industrial employment in the nonattainment area and Maricopa County (99.20%). (See Section 1.5.1 for a discussion of the employment data used). Emissions for both Maricopa County and the nonattainment area are shown in Table 3.4–2.

Table 3.4–2. Annual and season-day VOC emissions from auto refinishing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	958.3	5,251
8-hr ozone nonattainment area	950.6	5,209

3.4.1.3 Traffic markings

Annual emissions from traffic markings were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). Ozone season-day emissions during the ozone season for Maricopa County and the 8-hour ozone nonattainment area were calculated assuming 33 percent of annual activity occurred during the ozone season (13 weeks per year) and a typical activity level of 5 days per week (US EPA, 1997). Annual and season-day emissions in the 8-hour ozone nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations (99.20%). (See Section 1.5.1 for a discussion of employment data used).

Table 3.4–3. Annual and season-day VOC emissions from traffic markings.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	441.0	4,478
8-hr ozone nonattainment area	437.5	4,442

3.4.1.4 Factory-finished wood

Emissions from factory-finished wood coating were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2013) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2013 employment were used. Where CBP employment estimates were presented as a range, the midpoint value was chosen for these calculations. Table 3.4–4 shows the NAICS codes and employment data used to calculate emissions from factory-finished wood surface coating.

Table 3.4–4. County employment for factory-finished wood coating, by NAICS code.

NAICS	NAICS description (and employment range)	Employment
321911	Wood window & door manufacturing	283
321918	Other millwork	129
337212	Custom architectural woodwork & millwork mfg.	591
337215	Showcase, partition, shelving & locker manufacturing	233
337920	Blind & shade manufacturing (100–249)	175
Total:		**1,411**

Since there were no point sources in this category, the area-source employment estimate was used to "scale up" emissions reported from those facilities surveyed in 2014.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed season-day emissions instead of annual totals. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.20%). See Section 1.5.1 for a discussion of the employment data used. Table 3.4–5 summarizes annual and season-day VOC emissions from factory-finished wood surface coating in both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.4–5. Annual and season-day VOC emissions from area-source factory-finished wood surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	193.6	1,616
8-hr ozone nonattainment area	192.1	1,603

3.4.1.5 Industrial surface coating

Annual emissions from industrial surface coating were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016).

Industrial surface coating is assumed to occur uniformly throughout the year, therefore, it was assumed that 25% of annual activity occurs during the ozone season, and that activity occurs 7 days/week. Thus, season-day emissions were estimated by multiplying annual emissions by 25% then dividing the result by 92 days. Annual and season-day emissions in the 8-hour ozone nonattainment area were calculated by applying the ratio of industrial employment in the non-attainment area to county-level emission calculations (99.20%). (See Section 1.5.1 for a discussion of the employment data used). Results are shown in Table 3.4–6 below.

Table 3.4–6. Annual and season-day VOC emissions from industrial surface coating.

	Maricopa County		8-hour ozone NAA	
Product category	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Wood furniture	666.4	1,052	661.1	1,044
Metal furniture: SIC 25	59.8	3,622	59.3	3,593
Paper: SIC 26	51.3	325	50.8	322
Metal cans: SIC 341	183.2	279	181.8	276
Machinery and equipment: SIC 35	58.2	996	57.7	988
Large appliances: SIC 363	35.5	316	35.2	314
Electronic & other electrical: SIC 36	4.2	193	4.2	191
Motor vehicles: SIC 371	183.0	23	181.5	23
Marine: SIC 373	3.5	358	3.4	355
Railroad: SIC 374	5.1	19	5.1	19

3.4.1.6 Aircraft surface coating

Emissions from aircraft surface coating facilities were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2013) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2013 employment were used. CBP employment data for NAICS code 3364 (Aerospace Product and Parts Manufacturing) indicated that there were 12,272 employees in this industry in Maricopa County. Since there were no point sources in this category, an area-source employment estimate of 12,272 was used to "scale up" emissions reported from those facilities surveyed in 2014.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed season-day emissions instead of annual totals. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–7 summarizes annual and season-day emissions from aircraft surface coating in both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.4–7. Annual and season-day VOC emissions from area-source aircraft surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	65.8	473
8-hr ozone nonattainment area	65.8	473

3.4.1.7 Miscellaneous surface coating

Area-source VOC emissions from miscellaneous surface coating were estimated by a "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions and employment data from Maricopa County permitted facilities to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category

The typical "scale-up" methodology was revised slightly for this source category for a number of reasons. First, miscellaneous surface coating activity occurs, at some level, across an exceptionally broad spectrum of industries, both industrial and commercial/institutional. Additionally, annual emissions reports may be inconsistent in how activities are reported, and it is uncertain if all relevant activities are categorized as "miscellaneous surface coating" vs. some other category (e.g., manufacturing). Estimating total emissions from miscellaneous surface coating based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no miscellaneous surface coating activities) would therefore be misleading and lead to an over-estimate of area-source emissions from this source category. Instead, the list of Standard Industrial Classification (SIC) codes used by facilities that reported miscellaneous surface coating activities was conservatively assumed to represent the "universe" of businesses that could possibly have significant miscellaneous surface coating activity. To avoid double-counting, employment at point sources was subtracted from total employment within these SIC categories.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed season-day emissions instead of annual totals. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.2%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–8 summarizes annual and season-day VOC emissions from area-source miscellaneous surface coating in both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.4–8. Annual and season-day VOC emissions from miscellaneous surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	201.1	1,443
8-hr ozone nonattainment area	159.6	1,299

3.4.2 Degreasing

Area-source VOC emissions from degreasing were estimated by a "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions and employment data from Maricopa County permitted facilities to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The typical "scale-up" methodology was revised slightly for this source category for a number of reasons. First, degreasing activity occurs at some level across a wide spectrum of industries, both industrial and commercial/ institutional. Additionally, annual emissions reports may be inconsistent in how activities are reported and it is uncertain if all relevant activities are categorized as "degreasing" vs. some other category (e.g., manufacturing). Estimating total emissions from degreasing based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no degreasing activities) would therefore be misleading and lead to an overestimate of area-source emissions from this source category.

Instead, the list of SIC codes used by businesses that reported degreasing activities was conservatively assumed to represent the "universe" of businesses that could possibly have significant degreasing activity. To avoid double-counting, employment at point sources was subtracted from total employment within these SIC.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed season-day emissions instead of annual totals. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of industrial employment within the nonattainment area. See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–9 summarizes annual and season-day emissions from area-source degreasing in both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.4–9. Annual and season-day VOC emissions from area-source degreasing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	291.9	1,923
8-hr ozone nonattainment area	289.5	1,908

3.4.3 Dry cleaning

Annual emissions from dry cleaning facilities were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). Based on operating schedule information provided in the facilities' historic annual emissions reports, it is assumed that operations occur evenly throughout the year, 5 days per week, thus season-day emissions were derived by dividing the annual total emissions by 260 (= 5 days/week × 52 weeks/yr).

Annual and season-day emissions estimates for the 8-hour ozone nonattainment area were calculated by multiplying county-level emissions by the ratio of Maricopa County population to nonattainment area population. See Section 1.5.1 for a discussion of the population data used. Table 3.4–10 summarizes the annual and season-day VOC emissions from dry cleaning.

Table 3.4–10. Annual and season-day VOC emissions from dry cleaning.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	10.3	79
8-hr ozone nonattainment area	10.4	80

3.4.4 Graphic arts

Emissions from graphic arts were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2013) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP), covering employment in 2013, were used. The CBP employment data for NAICS code 32311 (printing) indicated that there were 3,265 employees in this industry in Maricopa County. Since there were no point sources in this category, an area-source employment estimate of 3,265 was used to "scale up" emissions reported from those facilities surveyed in 2014.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed season-day emissions instead of annual totals. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.2%). See Section 1.5.1 for a discussion of the employment data used. Table 3.4–11 summarizes annual and season-day emissions from graphic arts in both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.4–11. Annual and season-day VOC emissions from area-source graphic arts sources.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	297.4	2,308
8-hr ozone nonattainment area	295.1	1,908

3.4.5 Miscellaneous industrial solvent use

Area-source VOC emissions from miscellaneous industrial solvent use were estimated by a "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions and employment data from Maricopa County permitted facilities to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The typical "scale-up" methodology was revised slightly for this source category for a number of reasons. First, miscellaneous industrial solvent use occurs at some level across a wide spectrum of industries. Additionally, annual emissions reports may be inconsistent in how activities are reported, and it is uncertain if all relevant activities are categorized as "miscellaneous industrial solvent use" vs. some other category (e.g., manufacturing of a specific product). Estimating total emissions from miscellaneous industrial solvent use based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no solvent use activities) would therefore be misleading and lead to an significant under- or overestimates of area-source emissions from this source category.

Instead, the list of SIC codes used by businesses that reported miscellaneous industrial solvent use activities was conservatively assumed to represent the "universe" of businesses that could possibly have significant miscellaneous industrial solvent use activity. To avoid double-counting, employment at facilities treated as point sources (and addressed in Chapter 2) was subtracted from total employment within these SICs.

Ozone season-day emissions were calculated in the same method as annual emissions, using surveyed season-day emissions instead of annual totals. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county. See Section 1.5.1 for a discussion of the employment data used. Table 3.4–12 summarizes annual and season-day VOC emissions from area-source miscellaneous industrial solvent use in both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.4–12. Annual and season-day VOC emissions from area-source miscellaneous industrial solvent use.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	201.1	1,443
8-hr ozone nonattainment area	199.5	1,431

3.4.6 Consumer and commercial products

Annual emissions from consumer and commercial products were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016). Consumer and commercial products include the following seven product categories: personal care products, household products, automotive aftermarket products, adhesives and sealants, products regulated under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), coatings and related products, and miscellaneous products. Emissions from consumer and commercial products were assumed to occur uniformly throughout the year, and occurs 7 days per week. Thus season-day emissions were estimated by dividing annual emissions by 365.

Emissions in the 8-hour ozone nonattainment were based on County-level emissions estimates, and then applying the ratio of total resident population in the nonattainment area to that of Maricopa County (100.85%). See Section 1.5.1 of this report for a discussion of the population data used. Results are shown in Table 3.4–13.

Table 3.4–13. Annual and season-day VOC emissions from consumer and commercial products.

	Maricopa County		8-hour ozone NAA	
Product category	Annual emissions (tons/yr)	Season-day emissions (lbs/day)	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Personal care	4,013.2	21,990	4,047.3	22,177
Household	4,414.5	24,189	4,452.0	24,395
Automotive aftermarket	2,729.0	14,953	2,752.1	15,080
Coatings and related	1,906.3	10,445	1,922.5	10,534
Adhesives/sealants	1,143.8	6,267	1,153.5	6,320
FIFRA-regulated	3,571.7	19,571	3,602.1	19,737
Miscellaneous	140.5	770	141.7	776
Totals:	**17,918.8**	**98,185**	**18,071.1**	**99,020**

3.4.7 Asphalt application

Asphalt is applied to pave, seal, and repair surfaces such as roads, parking lots, drives, walk-ways, roofs, and airport runways. Asphalt application emissions were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016).

Ozone season-day emissions were calculated by multiplying annual emissions for the ozone-season (June–August) then dividing by 92 days. As a conservative assumption, annual and season-day emissions for the 8-hour ozone nonattainment area are assumed to be equal to Maricopa County emissions.

Table 3.4–14. Annual and season-day VOC emissions from asphalt use, by type.

	Maricopa County		Eight-hour ozone NAA	
Asphalt type	Annual emissions (tons/yr)	Season-day emissions (lbs/day)	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Cutback	1,004.8	21,844	992.3	21,572
Emulsified	828.2	18,004	817.9	17,780

3.4.8 Agricultural pesticides

Annual emissions from agricultural pesticide usage within Maricopa County were obtained directly from the county-level emission estimates developed for use in the US Environmental Protection Agency's 2014 National Emissions Inventory (NEI) data and documentation (US EPA, 2016). US EPA estimated that 371.0 tons of VOCs were emitted from agricultural pesticide usage in Maricopa County in 2014.

The 2014 NEI used activity data obtained from USGS for 2012 (i.e., county-level pesticide usage for 2012). The 2014 NEI data indicated that approximately 1,589,288 lbs of active ingredient in agricultural pesticides were applied in Maricopa County in 2012. Due to a lack of available data

on temporal resolution, ozone season-day emissions for Maricopa County were calculated by dividing annual emissions by 365 days as activity is assumed to occur uniformly throughout the year.

Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of agricultural land acreage in the nonattainment area to the agricultural land acreage in Maricopa County (58.8%). See Section 1.5.2 for a discussion of the land-use data used to allocate emissions to the 8-hour ozone nonattainment area. Table 3.4–15 presents the annual and ozone season-day VOC estimates for Maricopa County and the 8-hour ozone nonattainment area.

Table 3.4–15. Annual and season-day VOC emissions from agricultural pesticide application.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	371.0	2,033
8-hr ozone nonattainment area	218.1	1,195

3.5 Storage and transport

3.5.1 Portable fuel containers

Annual Maricopa County emissions from area source portable fuel containers (PFCs) were initially obtained from the county-level emission estimates developed for use in the U.S. Environmental Protection Agency's 2014 National Emissions Inventory (NEI) (US EPA, 2016). These calculations identify a total of seven mechanisms by which emissions can be generated from PFCs:

- Emissions associated with filling PFCs at the gas pump:
  - Displacement of the vapor within the PFCs, and
  - Spillage of gasoline while filling the PFCs
- Emissions associated with transporting PFCs:
  - Spillage of gasoline during transport
- Emissions (adjusted for changes in ambient temperature) associated with storage of the gasoline in PFCs:
  - Emissions due to evaporation (i.e., diurnal emissions), and
  - Emissions due to permeation.

Two additional sources of emissions associated with using PFCs to refuel pieces of nonroad equipment are considered by the NONROAD model (described in Chapter 4) and thus not addressed here:

- Displacement of the vapor within nonroad equipment, and
- Spillage of gasoline while filling nonroad equipment.

During review of the 2014 NEI documentation for the portable fuel containers source category, it was identified that the state-level emissions were allocated to counties based on the ratio of county fuel consumption to state fuel consumption. ERG reviewed potential data sources and identified recent county-level motor gasoline sales data available through the Arizona Department of Transportation (ADOT, 2016). These data are developed for every fiscal year (July 1

through June 30) starting from 1990 to present (2015 is the most recent year for which data are available). Using these data, the state-level emissions were re-allocated to the counties. The ADOT motor gasoline fuel sales data indicated that approximately 59.1% of Arizona state motor gasoline sales occurred in Maricopa County.

Ozone season-day emissions for the county were calculated by dividing annual emissions by 365 days as activity is assumed to occur uniformly throughout the year. Annual and ozone season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the county totals by the ratio of total resident population in the nonattainment area to total resident population in the county. See Section 1.5.1 for a discussion of the population data used. Table 3.5–1 presents the annual and season-day VOC estimates for Maricopa County and for the 8-hour ozone nonattainment area.

Table 3.5–1. Annual and season-day VOC emissions from portable fuel containers (PFCs).

	Maricopa County		8-hour ozone NAA	
Emissions source	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Residential PFCs:				
Permeation	99.0	542	99.7	546
Evaporation/diurnal	111.0	608	111.9	613
Spillage during transport	192.6	1,055	194.1	1,064
Vapor displacement in PFCs	34.9	191	35.2	193
Spillage at pump	5.6	31	5.7	31
Subtotal, residential PFCs	**443.1**	**2,428**	**446.6**	**2,447**
Commercial PFCs:				
Permeation	4.3	24	4.4	24
Evaporation/diurnal	3.5	19	3.6	20
Spillage during transport	262.7	1,440	264.8	1,451
Vapor displacement in PFCs	100.6	551	101.4	556
Spillage at pump	10.8	59	10.9	60
Displacement during refueling of nonroad equipment*				
Spillage during refueling of nonroad equipment*				
Subtotal, commercial PFCs	**382.0**	**2,093**	**385.1**	**2,110**
Totals:	**825.2**	**4,522**	**831.7**	**4,557**

*These activities are included in the MOVES2014a model emissions calculations, described in Chapter 4.

3.5.2 Bulk plants

Emissions from this source category were calculated from annual emissions inventory reports from all bulk plants located within the county. It is assumed that there are no unpermitted bulk plants in Maricopa County. Bulk plants are characterized as having a throughput below 7.2 MMgal/year. Ozone season-day emissions were calculated based on operating schedule

information provided in the facilities' annual emissions reports. Since all facilities considered in this section are located within the 8-hour ozone nonattainment area, total emission values for the county and the 8-hour ozone nonattainment area are equal.

Table 3.5–2. Annual and season-day VOC emissions from bulk plants.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	36.2	229
8-hr ozone nonattainment area	36.2	229

3.5.3 Bulk terminals

Emissions from this source category were calculated from annual emissions inventory reports from all bulk terminals located within the county. Bulk terminals are characterized as having a throughput above 7.2 MMgal/year. It is assumed that there are no unpermitted bulk terminals in Maricopa County. To avoid double-counting, emissions from bulk terminals that were treated as point sources (totaling 118.8 tons/yr) are reported in Chapter 2. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities annual emissions reports. Since all facilities considered in this section are located within the 8-hour ozone nonattainment area, total emission values for the county and the 8-hour ozone nonattainment area are equal.

Table 3.5–3. Annual and season-day VOC emissions from bulk terminals.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	91.0	493
8-hr ozone nonattainment area	91.0	493

3.5.4 Gasoline service stations

Stage I emissions from gasoline distribution emissions can be characterized as "Stage I" emissions, which are generated when gasoline vapors are displaced from storage tanks during unloading of gasoline from tank trucks at service stations. Stage II emissions are the refueling emissions that occur during the transfer of gasoline from storage tanks at service stations to vehicle fuel tanks (i.e., vehicle refueling and spillage emissions). The MOVES2010b model that was used to calculate onroad emissions includes estimation of these Stage II emissions. Therefore, these emissions are addressed in Chapter 5 as part of the onroad mobile sources emissions and are not addressed here as an area source.

Stage I VOC emissions from gasoline service station unloading were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016).

Ozone season-day emissions were calculated by multiplying annual emissions for the ozone-season (June–August) then dividing by 92 days. As a conservative assumption, annual and season-day emissions for the 8-hour ozone nonattainment area are assumed to be equal to

Maricopa County emissions. Table 3.5–4 summarizes Stage I annual and season-day emissions in Maricopa County and the 8-hour ozone nonattainment area.

Table 3.5–4. Annual and season-day VOC emissions from gas service stations (Stage I), by fill type.

	Maricopa County		8-hour ozone NAA	
Fill type	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Submerged filling	369.9	8,041	369.9	8,041
Balanced submerged filling	646.9	14,063	646.9	14,063
Totals:	**1,016.8**	**22,104**	**1,016.8**	**22,104**

3.5.5 Gasoline stations underground tanks, breathing/emptying

Breathing losses are the expulsion of vapor from a tank vapor space that has expanded or contracted because of daily changes in temperature and barometric pressure; these emissions occur in the absence of any liquid level change in the tank. Emptying losses occur when the air that is drawn into the tank during liquid removal saturates with hydrocarbon vapor and expands, thus exceeding the fixed capacity of the vapor space and overflowing through the pressure vacuum valve.

Gasoline stations underground tanks, breathing/emptying emissions from gasoline service station unloading were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016).

Ozone season-day emissions were calculated by multiplying annual emissions for the ozone-season (June–August) then dividing by 92 days. As a conservative assumption, annual and season-day emissions for the 8-hour ozone nonattainment area are assumed to be equal to Maricopa County emissions.

Table 3.5–5. Annual and season-day VOC emissions from gasoline service stations underground tank, breathing and emptying.

Geographic area	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Maricopa County	764.8	16,327
8-hr ozone nonattainment area	764.8	16,327

3.5.6 Aviation gasoline

Aviation gasoline is used by small reciprocating, piston-engine aircraft in civil aviation. Commercial and military aviation rarely use aviation gasoline. Aviation gasoline is shipped to airports and is filled into bulk terminals, and then into tanker trucks. The displacement of vapors during the transfer of gasoline from tank trucks to storage tanks, and vice versa falls under the definition of Stage I. Stage II involves the transfer of fuel from the tanker trucks into general aviation aircraft.

Annual emissions from aviation gasoline Stage I and Stage II were initially obtained from the U.S. Environmental Protection Agency's county-level emissions estimates prepared for use in the 2014 National Emissions Inventory (US EPA, 2016). Table 3.5–6 shows US EPA 2014 estimated VOC emissions from aviation gasoline for Maricopa County. During review of the 2014 NEI documentation, it was observed that aviation gasoline consumption data used in EPA's estimates for the NEI had been obtained from U.S. Energy Information Administration's (EIA) State Energy Data System (SEDS). These data included state-level aviation gasoline consumption for 2013 (i.e., aviation gasoline consumption for Arizona was 139,000 bbls).

ERG identified updated state-level aviation gasoline consumption data for 2014 from EIA's SEDS (EIA, 2015). ERG modified EPA's calculation spreadsheet for aviation gasoline Stage I and Stage II source categories using the updated EIA data for 2014 (i.e., aviation gasoline consumption for Arizona was 206,000 bbls). Due to a lack of available data on temporal resolution, daily emissions were assumed to be equal throughout the year and were calculated by dividing annual emissions by 365 days/year. Annual and season-day VOC emissions estimates for aviation gasoline Stage I and Stage II sources in Maricopa County are presented in Table 3.5–6.

Table 3.5–6. Annual and season-day VOC emissions from aviation gasoline for Maricopa County.

Fueling stage	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Aviation Gasoline Stage I	673.6	3,691
Aviation Gasoline Stage II	33.3	182

Annual and season-day emission in the 8-hour ozone nonattainment area were calculated by multiplying county totals by the percentage of general aviation operations that occurred within the nonattainment area in 2014 (99.1%). (See Table 4.11–1 of this report for general aviation aircraft operational data used.) Annual and season-day emissions from aviation gasoline for both Maricopa County and the 8-hour ozone nonattainment area are presented in Table 3.5–7.

Table 3.5–7. Annual and season-day VOC emissions from aviation gasoline (avgas).

	Maricopa County		Eight-hour ozone NAA	
Emissions source	Annual emissions (tons/yr)	Season-day emissions (lbs/day)	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Avgas Stage I	673.6	3,691	667.5	3,658
Avgas Stage II	33.3	182	33.0	181
Totals:	**706.9**	**3,873**	**700.5**	**3,839**

3.5.7 Gasoline tank trucks in transit

Emissions from tank trucks in transit occur when gasoline vapor evaporates from (1) loaded tank trucks during transportation of gasoline from bulk terminals/plants to service stations, and (2) empty tank trucks returning from service stations to bulk terminals/plants. Annual VOC

emissions from gasoline trucks in transit were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016).

Ozone season-day emissions were calculated by multiplying annual emissions for the ozone-season (June–August) then dividing by 92 days. As a conservative assumption, annual and season-day emissions for the 8-hour ozone nonattainment area are assumed to be equal to Maricopa County emissions. Results are shown in Table 3.5–8.

Table 3.5–8. Annual and season-day VOC emissions from gasoline trucks in transit.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	50.0	1,087
8-hr ozone nonattainment area	50.0	1,087

3.5.8 Pipeline gasoline

Pipeline emissions result from the valves and pumps found at pipeline pumping stations and from the valves, pumps, and storage tanks at pipeline breakout stations. Annual VOC emissions from gasoline pipelines were derived from the county-level estimates prepared by US EPA for use in the National Emissions Inventory (NEI) for 2014 (US EPA, 2016).

Ozone season-day emissions were calculated by multiplying annual emissions for the ozone-season (June–August) then dividing by 92 days. As a conservative assumption, annual and season-day emissions for the 8-hour ozone nonattainment area are assumed to be equal to Maricopa County emissions.

Table 3.5–9. Annual and season-day VOC emissions from pipeline gasoline.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	66.2	1,439
8-hr ozone nonattainment area	66.2	1,439

3.5.9 Volatile organic liquid (VOL) storage and transport

Emissions from this source category were calculated by summing reported VOC emissions from volatile organic liquid storage/transfer emissions inventory reports. It is assumed that there are no significant unpermitted volatile organic liquid storage/transfer facilities in Maricopa County. To avoid double-counting, emissions from those facilities treated as point sources (totaling 2.5 tons/yr) are addressed in Chapter 2. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities annual emissions reports.

Table 3.5–10. Annual and season-day VOC emissions from volatile organic liquid storage and transport.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	37.8	218
8-hr ozone nonattainment area	35.7	201

3.6 Waste treatment and disposal

3.6.1 On-site incineration

This section includes emissions from on-site industrial incinerators, primarily burn-off ovens used to reclaim electric wire or other materials. Emissions from human and animal crematories are addressed in Section 3.7.5.

Historically, emissions from on-site incinerator were determined from annual emissions inventory reports. It was assumed that all incinerators were surveyed and emissions accounted for, since all permitted incinerators received surveys in 2011, but not 2014. Thus, data from the 2011 periodic emissions inventory (MCAQD, 2014) were grown to 2014 based on industrial employment rates.

Annual and season-day emissions estimates for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage industrial employment within the nonattainment area. See Section 1.5.1 for a discussion of the employment data used. Results are shown in Table 3.6–1.

Table 3.6–1. Annual and season-day emissions from on-site incineration.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	0.2	3.0	0.7	1	19	5
8-hr ozone nonattainment area	0.1	2.9	0.7	1	19	5

3.6.2 Open burning

Emissions from controlled open burning are regulated by Maricopa County Rule 314 (Open Outdoor Fires and Indoor Fireplaces at Commercial and Institutional Establishments), which requires a burn permit for open burning in Maricopa County. Burn permits are issued primarily for purposes of agricultural ditch bank and fence row burning, tumbleweed burning, land clearance, and firefighting training. MCAQD's burn permit data base was used to identify all burn permits issued in 2014. A total of 43 open burn permits were issued during the year. The quantity and reported activity for the open burn permits (except for firefighting burn permits) are shown in Table 3.6–2.

Table 3.6–2. Maricopa County burn permit activity in 2014.

Permit subtype	Permits issued	Total reported activity	Activity unit of measure
Ditchbank & fence row	23	617,007	Linear feet
Land clearance	13	240	Acres
Firefighting instruction	5	12	Structures

Activity data for all categories were converted to tons of material burned using fuel loading factor for "weeds, unspecified" from AP-42 (US EPA, 1992). Activity data were multiplied by the 3.2 tons/acre fuel loading factor to derive the total mass of material burned. Annual emissions were then calculated by multiplying the amount of material burned by the AP-42 emission factors for "weeds, unspecified".

The reported dates of activity from all open burn permits issued were reviewed in order to estimate the total open burn activity occurring during the June–August ozone season. To estimate season-day emissions, it was assumed that activity in all categories listed above normally occurs, on average, 5 days per week. Thus, season-day emissions were calculated by dividing total ozone-season emissions by 65 (=5 days/week × 13 weeks/ozone season).

MCAQD's records of citizen complaints received during 2014 regarding suspected open or illegal outside burning were reviewed to assess the potential extent of unpermitted open burning activity. Emissions estimates from permitted burn activity were multiplied by a factor of 2.87 to account for unpermitted outdoor burning.

Annual and season-day emissions for the nonattainment area were calculated by multiplying the percentage of vacant land use located in the 8-hour ozone nonattainment area (44.74%) by the Maricopa County emissions estimates. See Section 1.5.2 for a discussion of the land-use data used. Table 3.6–3 summarizes 2014 annual and season-day emissions from open burning, for both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.6–3. Annual and season-day emissions from open burning.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	18.2	8.1	172.2	140	62	1,325
8-hr ozone nonattainment area	90.4	4.3	9.6	695	33	74

3.6.3 Landfills

Emissions from municipal solid waste (MSW) landfills come from uncontrolled landfill gas emissions as well as from combustion from control measures, such as a flare. Total emissions were calculated from annual emissions inventory reports from all landfills located within the county. Butterfield Station Facility, Glendale Municipal Sanitary Landfill and Northwest Regional Landfill were considered as point sources; all other MSW landfills (including the Apache Junction landfill, located in the Pinal County portion of the 8-hour ozone nonattainment area) are reported here as an area-source category.

Geographic data on the location of each landfill was used to identify whether each landfill was located inside or outside of the 8-hour ozone nonattainment area. Annual and season-day emissions for Maricopa County and the nonattainment area are summarized in Table 3.6–4.

Table 3.6–4. Annual and season-day emissions from landfills.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	36.6	9.9	14.6	158	54	80
8-hr ozone nonattainment area	36.6	12.7	28.5	217	70	157

3.6.4 Publicly owned treatment works

Annual emissions from publicly owned treatment works (POTWs) in Maricopa County were obtained from the US Environmental Protection Agency's 2014 National Emissions Inventory (US EPA, 2012c). EPA estimated 58.9 tons of VOC were emitted from POTWs in Maricopa County in 2014. There were no point sources in this category that needed to be subtracted. Ozone season-day emissions were calculated by multiplying annual emissions by a 35% season adjustment factor and then dividing by 91 days per season (US EPA, 2001a).

Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of total population in the nonattainment area to the total population in the county (100.85%). See Section 1.5.1 for a discussion of the population data used. Resulting emissions estimates are shown in Table 3.6–5 below.

Table 3.6–5. Annual and season-day VOC emissions from publicly owned treatment works.

Geographic area	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Maricopa County	58.9	453
8-hr ozone nonattainment area	59.3	456

3.6.5 Leaking underground storage tanks

Leaking underground storage tanks (LUST) are normally not considered a quantifiable source of air emissions until excavation and remediation efforts begin. The majority of air emissions from LUST site remediation occur during the initial site activity, which is typically removal of the tank. Emissions from soil occur as the tank is being removed and when soil is deposited on the ground before treatment and disposal occur (US EPA, 2001c).

A default emission rate of 28 lbs/day per remediation event was used to estimate VOC emissions from LUST remediation (US EPA, 2001c). Data obtained from the Leaking Underground Storage Tank Section of the Arizona Department of Environmental Quality indicated that 35 leaking underground storage tanks opened in Maricopa County in 2014 (N. Giuntoli, pers. commun., July 7, 2016). As data was not available on the numbers of tanks or date of remediation that occurred in 2014, it was conservatively assumed that all 35 tanks were remediated

during the 2014 ozone season. It was also assumed that an initial site action (tank and soil removal) for an average LUST remediation lasts five days.

Ozone season-day emissions were calculated by dividing annual values by 65 (5 days/week × 13 weeks/ozone season). As precise data was not available on the location of each tank, it was conservatively assumed that assumed that all 35 LUST occurrences were located within the 8-hour ozone nonattainment area. Thus, both annual and season-day emissions within the NAA are equal to the Maricopa County totals. Results are shown in Table 3.6–6 below.

Table 3.6–6. Annual and season-day VOC emissions from remediation of leaking underground storage tanks.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	2.5	75
8-hr ozone nonattainment area	2.5	75

3.6.6 Other waste

Annual area-source emissions from other industrial waste disposal were derived from annual emissions reports from permitted facilities. Other industrial waste disposal processes include a wide array of industrial activities that are often specific to the permitted facility that reported the process. For this reason, it is assumed there are no significant emissions from this category, other than those reported by permitted facilities on their annual emissions reports. Ozone season-day emissions were calculated based on operating schedule information provided by the facilities in their annual emissions reports.

Since all surveyed facilities for this area source category are located inside the 8-hour ozone nonattainment area, emissions for Maricopa County and the 8-hour ozone nonattainment area are equal. Table 3.6–7 summarizes annual and season-day emissions estimates.

Table 3.6–7. Annual and season-day emissions from other waste.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	7.7	20.6	38.1	54	113	186
8-hr ozone nonattainment area	7.7	20.6	38.1	54	105	186

3.7 Miscellaneous area sources

3.7.1 Backyard barbeques

Annual emission estimates from backyard barbeques (i.e., residential charcoal grilling) for Maricopa County in 2014 were taken directly from the county-level estimates prepared for use in US EPA's 2014 National Emissions Inventory (NEI) data and documentation (US EPA, 2016).

ERG downloaded and reviewed the Temporal Allocation Factor File (TAFF) that is available with US EPA's 2011 Air Emissions Modeling Platform (version 6.2). The temporal allocation

data (US EPA, 2015) indicates equal allocation across the year for residential charcoal grilling source category (SCC 2810025000). Based on this information, ERG calculated ozone season-day emissions by dividing the 2014 annual emissions by 365.

Maricopa County emissions were then allocated to the 8-hour ozone nonattainment area by multiplying the county totals to the ratio of total resident population in the 8-hour ozone nonattainment area to the total resident population in Maricopa County (100.79%). See Section 1.5.1 for a discussion of the population data used. Table 3.7–1 presents a summary of annual and season-day emissions for Maricopa County and the 8-hour ozone nonattainment area.

Table 3.7–1. Annual and season-day emissions from backyard barbeques.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	52.8	60.5	2,819.9	289	332	15,451
8-hr ozone nonattainment area	53.2	61.0	2,842.1	291	334	15,573

3.7.2 Structure fires

Emissions from structure fires in Maricopa County were estimated based on 2011 data, which were projected to 2014, based on county population growth over the 2011–2014 period (4.81%). Annual emissions for the 8-hour ozone nonattainment area were derived by multiplying annual county emissions by the percentage of total population within the nonattainment area (100.85%). See Section 1.5.1 for a discussion of the population data used.

In the absence of sufficient data on the temporal distribution of structure fires in 2014, activity for this source category was assumed to occur evenly throughout the year. Thus, ozone season-day emissions were derived by dividing annual emissions by 365 days/year. The results are shown in Table 3.7−2 below.

Table 3.7–2. Annual and season-day emissions from structure fires.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	15.5	2.0	84.5	76	11	414
8-hr ozone nonattainment area	15.6	2.0	85.2	77	10	418

3.7.3 Aircraft engine testing

Annual emissions from engine testing facilities were derived from annual emissions reports from permitted sources that were not considered point sources in this inventory. It was assumed that there were no significant unpermitted sources within Maricopa County. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities' annual emissions reports.

Since all facilities considered in this section are located within the 8-hour ozone nonattainment area, total emission values for the county and the nonattainment area are equal. Results are shown in Table 3.7–3.

Table 3.7–3. Annual and season-day emissions from aircraft engine testing.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	4.6	45.5	16.9	27	260	98
8-hr ozone nonattainment area	4.6	45.5	16.9	27	260	98

3.7.4 Vehicle fires

Emissions from vehicle fires in Maricopa County were estimated based on 2011 data, which were grown to 2014 based on county population growth over the 2011–2014 period (4.81%). Annual emissions for the 8-hour ozone nonattainment area were derived by multiplying annual county emissions by the percentage of total population within the nonattainment area (100.85%). See Section 1.5.1 for a discussion of the population data used.

It was assumed that vehicle fires occur evenly throughout the year. Thus, ozone season-day emissions were derived by dividing the Maricopa County and nonattainment area annual emissions by 365 days/year. The results are shown in Table 3.7−4 below.

Table 3.7–4. Annual and season-day emissions from vehicle fires.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	10.6	1.3	41.2	58	7	226
8-hr ozone nonattainment area	10.6	1.3	41.6	58	7	228

3.7.5 Crematories

Annual and season-day emissions from human and animal crematories were derived from annual emissions reports submitted by permitted sources. It was assumed that there were no significant unpermitted sources within Maricopa County. There were no point sources in this category.

Ozone season-day emissions were calculated based on reported activity data (days per week) for each individual process, and then summed. Table 3.7–5 summarizes annual emissions from crematories in both Maricopa County and the 8-hour ozone nonattainment area and season day emissions in Table 3.7.6.

Table 3.7–5. Annual emissions (tons/yr) from crematories.

	Maricopa County			8-hr ozone nonattainment area		
Type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Human	0.4	10.7	0.6	0.4	10.7	0.6
Animal	0.1	5.6	0.3	0.1	5.6	0.3

Table 3.7–6. Season-day emissions (lbs/day) from crematories.

	Maricopa County			8-hr ozone nonattainment area		
Type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Human	3	77	5	3	73	4
Animal	1	49	3	1	49	3

3.7.6 Accidental releases

As part of its air quality permit compliance program, MCAQD keeps an "upset log" for each calendar year that records excess emissions and accidental releases at permitted facilities. Annual emissions inventory reports also provide for recording of accidental releases. Data from these two sources were reviewed to estimate emissions from all accidental releases in 2014.

Ozone season-day emissions were calculated based on the whether the reported release occurred during the ozone season. Emissions within the 8-hour ozone nonattainment area are calculated based on locations of facilities that reported releases. Results are shown in Table 3.7–7.

Table 3.7–7. Annual and season-day emissions from accidental releases.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	10.1	0.2	0.4	2	0	0
8-hr ozone nonattainment area	10.1	0.2	0.4	2	16	0

3.7.7 Hospitals

Emissions from hospitals were calculated by the "scaling up" method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources and county-level employment data from the US Census Bureau (2013) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category. The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2013 employment were used. CBP employment data for NAICS code 662110 (general medical and surgical hospitals) indicated 54,653 employees in this industry in Maricopa County.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed season-day emissions instead of annual totals. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of population in the nonattainment area to population in the county. See Section 1.5.1 for a discussion of the employment data used. Table 3.7–8 summarizes annual and season-day emissions from hospitals in both Maricopa County and the 8-hour ozone nonattainment area.

Table 3.7–8. Annual and season-day VOC emissions from hospitals.

Geographic area	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Maricopa County	33.4	201
8-hr ozone nonattainment area	33.7	202

3.7.8 Wildfires

Data on the incidence of wildfires in Maricopa County in 2014 were obtained from the Arizona State Forestry Division (ASFD, 2015). ASFD provides for the prevention and suppression of wildfires on state trust land and private lands located outside of incorporated communities. The wildfire data provided includes wildfires that occur outside of local fire districts and municipalities on State, private, and U.S. Bureau of Land Management (BLM) land. The ASFD supplied data on 1,299 reported wildfire incidents in Maricopa County, encompassing 146 acres. In supplying this data, the Forestry Division noted a significant increase in the number of fires reported compared with prior years, due to a new State Forestry requirement that the local government fire departments and districts now report their fires to State Forestry.

In addition, data from Incident Status Summary reports (ICS-209) on the US Forest Service's website Monitoring Trends in Burn Severity (MTBS) website (USFS, 2016) were reviewed in order to identify any additional wildfires that may have occurred outside of ASFD jurisdiction. No additional wildfires within the area of interest were identified.

Estimates of the material burned were derived by multiplying the acres burned for each category by an assigned fuel loading factor. Since there was insufficient information concerning the land use or vegetation types for each reported fire, a fuel loading factor of 4.5 tons/acre (reflecting e.g., "agriculture" or "sagebrush" categories), was used as a conservative estimate.

Latitude and longitude data were used to determine the number of acres burned inside of the nonattainment area. Table 3.7–9 shows the number of wildfires and acreage burned for Maricopa County and the 8-hour ozone nonattainment area, as well as the estimated total material burned.

Table 3.7–9. Wildfire incidence, acreage burned, and material burned in 2014.

Geographic area	No. of fires	Acreage burned	Fuel loading factor (tons/acre)	Material burned (tons/yr)
Maricopa County	1,299	145.8	4.5	656.1
8-hr ozone nonattainment area	1,286	139.1	4.5	626.0

Annual emissions from wildfires for each geographic area were calculated by multiplying the material burned for each area by the emission factors obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emissions Inventory (WGA/WRAP, 2005). Ozone season-day emissions were estimated by multiplying the material burned during ozone season by the appropriate emission factor and dividing the result by the number of ozone season burn days. In 2014, wildfire activity was reported on a total of 87 separate days during the June–August ozone season. Table 3.7–10 shows annual and season-day emissions from wildfires in Maricopa County and the nonattainment area.

Table 3.7–10. Annual and season-day emissions from wildfires.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	4.5	2.0	94.8	29	13	606
8-hr ozone nonattainment area	4.3	1.9	90.4	37	17	792

3.7.9 Prescribed fires

Emissions from prescribed fires were estimated using data obtained from the Arizona Department of Environmental Quality (ADEQ, 2015), which reported that a total of six (6) prescribed fires occurred in Maricopa County during 2014, only one of which was located within the 8-hour ozone nonattainment area. Because all 2014 prescribed fires were piled fuels, material burned was derived by multiplying the number of acres burned by tons of piles per acre for each fire. Table 3.7–11 shows the data provided by the ADEQ, the amount of material burned for each fire, whether the fire occurred within the nonattainment area and during the ozone season.

Table 3.7–11. Prescribed fires in Maricopa County during 2014.

Date	**Burn location**	**Tons/ acre**	**Acres burned**	**Material burned (tons)**	**Within 8-hr NAA?**	**During ozone season?**
02/27/2014	T3N,R8E,S33	1	5	5	Y	N
03/03/2014	T3N,R11E,S2	2	3	6	Y	N
03/14/2014	T3N,R8E,S33	1	10	10	Y	N
07/21/2014	T2N,R9E,S4	1	10	10	Y	Y
09/02/2014	T6N,R10E,S10	2	4	8	Y	N
10/01/2014	T3N,R11E,S2	2	5	10	Y	N
Totals:			**37**	**49**		

To estimate emissions, emission factors for "piled fuels" the Western Regional Air Partnership's (WRAP) 2002 Fire Emissions Inventory (WGA/WRAP, 2005) were used. Annual emissions from prescribed fires in Maricopa County were derived by multiplying material burned by the emission factor then dividing by 2,000 lbs/ton.

The prescribed fire data provided by ADEQ indicated that all six of the reported prescribed fires were within the 8-hour ozone nonattainment area; thus annual emissions for both areas are equal. Only one of the six prescribed fires occurred during the June–August ozone season. As it was assumed that each prescribed fire lasted one day, all emissions from this fire were assumed to be generated on a single ozone season-day. Table 3.7–12 shows the annual and season-day from prescribed fires.

Table 3.7–12. Annual and season-day emissions from prescribed fires.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.2	0.2	1.8	51	51	607
8-hr ozone nonattainment area	0.2	0.2	1.8	63	62	743

3.8 Quality assurance/quality control procedures

Quality assurance and quality control (QA/QC) activities for the area source emissions inventory were designed to create a comprehensive, accurate, representative and comparable inventory of area source emissions for Maricopa County and the nonattainment area. During each step of creating, building and reviewing the area source emissions inventory, quality checks and assurances were performed to establish confidence in the inventory structure and data.

Area source categories were identified for inclusion in the inventory based on the latest Emissions Inventory Improvement Program (EIIP) guidance available. In addition, recent EPA activities to develop county-level emissions estimates for newly created source categories (such as portable fuel containers) or refined source classification codes were also reviewed, and incorporated where relevant. Prior-year inventories for the region were also examined to identify possible additional categories for inclusion in the present inventory. The list of area source categories developed based on these guidance documents was modified to fit the characteristics of Maricopa County, with some area source categories determined to be insignificant (e.g., emissions from industrial coal combustion, oil and natural gas production, and snowmobile use).

Data for area source emission calculations were gathered from a wide universe of resources. Whenever applicable, local surveyed data (such as annual emissions report) was used as this data best reflects activity in the county and the nonattainment area. When local data was not available, state data from state agencies (e.g., Arizona Department of Transportation [ADOT]) and regional bodies (such as the Western Regional Air Partnership, WRAP) were used. National-level data (such as those from the US Census Bureau) was used when no local, state or regional data was available. In addition, the most recent EIIP guidance for area sources was consulted for direction in determining the most relevant data source for use in emissions calculations.

Emissions calculations for area sources were performed by three air quality planners and one unit manager. All area source emission estimates were calculated in spreadsheets to ensure the calculations could be verified and reproduced. Whenever possible or available, the "preferred method" described in the most recent EIIP guidance documents for area sources was used to calculate emissions. Emissions were estimated using emission factors from EIIP guidance, AP-42, and local source testing. Local seasonal and activity data were used when available, with EPA and EIIP guidance used when no local seasonal or activity data existed. All calculations were evaluated to ensure that emissions from point sources were not being double-counted and to determine if rule effectiveness applied.

Once area source emission estimates had been produced, several quality control checks were performed to substantiate the calculations. Most area source calculations were peer-reviewed by two other planners, with all area sources being reviewed by at least one other planner. Peer

review ensured that all emission calculations were reasonable and could be reproduced. Sensitivity analyses and computational method checks were performed on area sources when emissions seemed to be outside the expected ranges. When errors were found, the appropriate changes were made by the author of the calculations to ensure consistency of the emissions calculations. The peer-reviewed emissions estimates were combined into a draft area source chapter. This draft chapter was read through in its entirety by the unit manager and the three air quality planners for final review, with any identified errors corrected by the author of the section.

The draft version of the area source chapter was sent to the Arizona Department of Environmental Quality, the Arizona Department of Transportation, and the Maricopa Association of Governments for a quality assurance review. These agencies provided comments which were addressed and incorporated into the final area source chapter. The QA/QC activities described here have produced high levels of confidence in the area source emissions estimates detailed in this chapter, and represent the best efforts of the inventory preparers.

3.9 Summary of all area source emissions

Tables 3.9–1 and 3.9–2 summarize the total annual and average season-day emissions from all area sources addressed in this chapter, for both Maricopa County and the 8-hour ozone NAA, respectively.

Table 3.9–1. Annual and season-day emissions from all area sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel combustion:						
Industrial distillate oil: boilers	1.0	96.1	24.0	6	616	154
Industrial distillate oil: engines	134.5	1,934.4	416.3	862	12,400	2,669
Industrial natural gas	40.7	740.1	621.7	261	4,744	3,985
Industrial LPG	1.9	52.1	29.2	12	334	187
Comm./inst. distillate oil: boilers	0.0	2.8	0.7	0	18	4
Comm./inst. distillate oil: engines	0.3	4.4	1.0	2	28	6
Comm./inst. natural gas	62.0	1,126.8	946.5	397	7,223	6,068
Residential distillate oil	0.0	0.3	0.1	0	3	1
Residential natural gas	45.5	777.0	330.7	118	2,023	861
Residential LPG	1.6	41.5	11.8	15	391	111
Residential wood combustion	1,392.2	156.3	8,328.1	0.0	0.0	0.0
All Fuel Combustion:	**1,679.8**	**4,931.9**	**10,710.0**	**1,675**	**27,781**	**14,046**
Industrial processes:						
Chemical manufacturing	69.1			535		
Commercial cooking	233.5		666.3	1,279		3,651
Bakeries	112.4			661		
Secondary metal production	65.9	55.1	671.6	467	482	5,936
Rubber/plastic product manufacturing	928.8			7,763		
Fabricated metal product manufacturing	19.2			92		
Electrical equipment manufacturing	223.6	24.3	7.5	1,280	135	41
Industrial processes, NEC	71.4	452.2	273.7	407	2,478	1,532
All Industrial Processes:	**987.3**	**531.6**	**1,619.1**	**12,484**	**3,095**	**11,160**
Solvent use:						
Architectural coatings	5,215.8			31,748		
Auto refinishing	958.3			5,251		
Traffic markings	441.0			4,478		
Factory finished wood	193.6			1,616		
Wood furniture	666.4			5,126		
Metal furniture: SIC 25	59.8			460		
Paper: SIC 26	51.3			394		
Metal cans: SIC 341	183.2			1,410		
Machinery and equipment: SIC 35	58.2			448		
Large appliances: SIC 363	35.5			273		
Electronic/other elec.: SIC 36–363	4.2			32		
Motor vehicles: SIC 371	183.0			1,407		
Aircraft surface coating	65.8			473		
Marine: SIC 373	3.5			27		
Railroad: SIC 374	5.1			39		
Miscellaneous surface coating	160.9			1,309		
Industrial maintenance coatings	301.0			2,315		
Other special purpose coatings	12.0			93		
Degreasing	291.9			1,923		
Dry cleaning	10.3			79		
Graphics arts	297.4			2,308		
Misc. industrial solvent use	201.1			1,443		
Personal care products	4,013.2			21,990		
Household products	4,414.5			24,189		

Table 3.9–1. Annual and season-day emissions from all area sources in Maricopa County (continued).

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Solvent use (continued):						
Automotive aftermarket products	2,729.0			14,950		
Coatings and related products	1,906.3			10,445		
Adhesives and sealants	1,143.8			6,257		
FIFRA-regulated products	3,571.7			19,571		
Miscellaneous products, NEC	140.5			770		
Cutback asphalt	1,004.8			21,844		
Emulsified asphalt	828.2			18,004		
Agricultural pesticides	371.0			2,033		
All Solvent Use:	**29,522.2**			**172,914**		
Storage/transport:						
Residential portable gas cans	443.1			2,428		
Commercial portable gas cans	382.0			2,093		
Bulk terminals	91.0			493		
Bulk plants	36.2			229		
Gas stations Stage I: Submerged fill	369.9			2,027		
Gas stations Stage I: Bal. submerged fill	646.9			3,545		
Underground tanks: Breathing/emptying	764.8			4,191		
Airports: aviation gasoline Stage I	673.6			3,691		
Airports: aviation gasoline Stage II	33.3			182		
Truck: gasoline (tank trucks in transit)	50.0			274		
Pipeline gasoline	66.2			363		
Volatile organic liquids storage/transport	37.8			218		
All Storage/Transport:	**3,594.9**			**19,734**		
Waste treatment/disposal:						
On-site incineration	0.2	3.0	0.7	1	19	5
Open burning	18.2	8.1	172.2	140	62	1,325
Landfills	36.6	9.9	14.6	158	54	80
Publicly owned treatment works	58.9			453		
Leaking underground storage tanks	2.5			75		
Other waste	7.7	20.6	38.1	54	113	186
All Waste Treatment/Disposal:	**124.0**	**41.5**	**225.6**	**881**	**249**	**1,596**
Miscellaneous area sources:						
Backyard barbeques	52.8	60.5	2,819.9	289	332	15,451
Structure fires	15.5	2.0	84.5	76	11	414
Aircraft engine testing	4.6	45.5	16.9	27	260	98
Vehicle fires	10.6	1.3	41.2	58	7	226
Crematories, human	0.4	10.7	0.6	3	77	5
Crematories, animal	0.1	5.6	0.3	1	49	3
Accidental releases	10.1	0.2	0.4	2	0	0
Hospitals	33.4			201		
Wildfires	4.5	2.0	94.8	29	13	606
Prescribed fires	0.2	0.2	1.8	51	51	607
All Miscellaneous Area Sources:	**132.1**	**128.1**	**3,060.5**	**736**	**800**	**17,410**
Total, All Area Sources:	**36,040.4**	**5,633.2**	**15,615.2**	**208,424**	**31,925**	**44,212**

Table 3.9–2. Annual and season-day emissions from all area sources in the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Fuel combustion:						
Industrial distillate oil: Boilers	1.0	95.3	23.8	6	611	153
Industrial distillate oil: Engines	133.4	1,918.9	413.0	855	12,301	2,647
Industrial natural gas	40.4	734.2	616.7	259	4,706	3,953
Industrial LPG	1.9	51.7	29.0	12	332	186
Comm./inst. distillate oil: Boilers	0.0	2.8	0.7	0	18	4
Comm./inst. distillate oil: Engines	0.3	4.4	1.0	2	28	6
Comm./inst. natural gas	61.9	1,126.0	945.9	397.0	7,218.2	6,063.3
Residential distillate oil	0.0	0.3	0.1	0	0	0
Residential natural gas	45.8	783.2	333.3	119	2,038	867
Residential LPG	1.6	41.8	11.8	0	0	0
Residential wood combustion	1,403.2	157.6	8,393.8	0.0	0.0	0.0
All Fuel Combustion:	**1,689.7**	**4,916.2**	**10,769.1**	**1,651**	**27,252**	**13,881**
Industrial processes:						
Chemical manufacturing	1.0			531		
Commercial cooking	235.3		671.5	1,289		3,680
Bakeries	111.5			656		
Secondary metal production	65.9	55.1	671.6	467	482	5,936
Rubber/plastic product manufacturing	928.8			7,701		
Fabricated metal product manufacturing	19.0			91		
Electrical equipment manufacturing	223.6	24.3	7.5	1,280	140	42
Industrial processes, NEC	70.3	452.2	273.7	397	2,478	1,470
All Industrial Processes:	**917.3**	**531.6**	**1,624.3**	**12,412**	**3,100**	**11,127**
Solvent use:						
Architectural coatings	5,260.0			32,017		
Auto refinishing	950.6			5,209		
Traffic markings	437.5			4,442		
Factory finished wood	192.1			1,603		
Wood furniture	661.1			5,085		
Metal furniture: SIC 25	59.3			456		
Paper: SIC 26	50.8			391		
Metal cans: SIC 341	181.8			1,398		
Machinery and equipment: SIC 35	57.7			444		
Large appliances: SIC 363	35.2			271		
Electronic/other electrical: SIC 36-363	4.2			32		
Motor vehicles: SIC 371	181.5			1,396		
Aircraft surface coating	65.8			473		
Marine: SIC 373	3.4			26		
Railroad: SIC 374	5.1			39		
Miscellaneous surface coating	159.6			1,299		
Industrial maintenance coatings	298.6			2,297		
Other special purpose coatings	11.9			92		
Degreasing	289.5			1,908		
Dry cleaning	10.4			80		
Graphics arts	295.1			1,908		
Miscellaneous industrial solvent use	199.5			1,431		
Personal care products	4,047.3			22,177		
Household products	4,452.0			24,395		
Automotive aftermarket products	2,752.1			15,080		
Coatings and related products	1,922.5			10,534		
Adhesives and sealants	1,153.5			6,320		
FIFRA-regulated products	3,602.1			19,737		

Table 3.9–2. Annual and season-day emissions from all area sources in the 8-hour ozone nonattainment area (continued).

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Source Category	**VOC**	**NOx**	**CO**	**VOC**	**NOx**	**CO**
Solvent use (continued):						
Miscellaneous products, NEC	141.7			776		
Cutback asphalt	992.3			21,572		
Emulsified asphalt	817.9			17,780		
Agricultural pesticides	218.1			1,195		
All Solvent Use:	**29,510.2**			**172,431**		
Storage/transport:						
Residential portable gas cans	446.6			2,447		
Commercial portable gas cans	385.1			2,110		
Bulk terminals	91.0			493		
Bulk plants	36.2			229		
Gas stations Stage I: submerged fill	369.9			2,027		
Gas stations Stage I: bal. submerged fill	646.9			3,545		
Underground tanks: breathing/emptying	764.8			4,191		
Airports: aviation gasoline Stage I	667.5			3,658		
Airports: aviation gasoline Stage II	33.0			181		
Truck: gasoline (tank trucks in transit)	50.0			274		
Pipeline gasoline	66.2			363		
Volatile organic liquids storage/transport	35.7			201		
All Storage/Transport:	**3,592.9**			**19,718**		
Waste treatment/disposal:						
On-site incineration	0.1	2.9	0.7	1	19	5
Open burning	90.4	4.3	9.6	695	33	74
Landfills	36.6	12.7	28.5	217	70	157
Publicly owned treatment works	59.3			456		
Leaking underground storage tanks	2.5			75		
Other waste	7.7	20.6	38.1	54	105	186
All Waste Treatment/Disposal:	**196.6**	**40.5**	**76.9**	**1,499**	**226**	**421**
Misc. area sources:						
Backyard barbeques	53.2	61.0	2,842.1	291	334	15,573
Structure fires	15.6	2.0	85.2	77	10	418
Aircraft engine testing	4.6	45.5	16.9	27	260	98
Vehicle fires	10.6	1.3	41.6	58	7	228
Crematories, human	0.4	10.7	0.6	3	73	4
Crematories, animal	0.1	5.6	0.3	1	49	3
Accidental releases	10.1	0.2	0.4	2	16	0
Hospitals	33.7			202		
Wildfires	4.3	1.9	90.4	37	17	792
Prescribed fires	0.2	0.2	1.8	63	62	743
All Misc. Area Sources	**132.8**	**128.5**	**3,079.4**	**761**	**828**	**17,859**
ALL AREA SOURCES:	**36,039.6**	**5,616.9**	**15,549.7**	**208,473**	**31,407**	**43,287**

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4. Nonroad Mobile Sources

4.1 Introduction

Nonroad mobile sources are defined as those that move or are moved within a 12-month period and are not licensed or certified as highway vehicles. Nonroad mobile sources are vehicles and engines that fall under the following categories:

- Agricultural equipment, such as tractors, combines and balers;
- Airport ground support equipment, such as baggage tugs and terminal tractors;
- Commercial equipment, such as generators and pumps;
- Industrial equipment, such as forklifts and sweepers;
- Construction and mining equipment, such as graders, back hoes and trenchers;
- Lawn and garden equipment, such as leaf blowers and lawn mowers;
- Logging equipment (not present in Maricopa County);
- Pleasure craft, such as power boats and personal watercraft;
- Railway maintenance equipment, such as rail straighteners;
- Recreational equipment, such as all-terrain vehicles and off-road motorcycles;
- Underground mining and oil field equipment (not present in Maricopa County);
- Aircraft, such as jet- and piston-engine planes; and
- Locomotives, such as switching and line-haul trains.

EPA released MOVES2014a in November 2015 as a replacement for its prior NONROAD2008 model. EPA announced that it would no longer support NONROAD2008, and instead recommended using MOVES2014a to model nonroad mobile source emissions. The MOVES2014a model allows for the use of consistent fuel and meteorology inputs for both onroad and nonroad mobile sources. While the same NONROAD2008 core code is still utilized, the inputs and outputs are controlled with MySQL databases that are more efficient to maintain. Procedures for updating local activity and population data have also improved and now require less run time. An update to the VOC emission calculation was implemented in the post-processing stage of MOVES2014a, resulting in different (generally lower) emissions calculations for VOC compared to values previously calculated with NONROAD2008.

Emission calculations for most nonroad mobile source categories except aircraft, airport ground support equipment (GSE) and locomotives were derived using the MOVES2014a model. Aircraft and airport GSE emission estimates were made using the Federal Aviation Administration's EDMS (Emissions Dispersion Modeling System) model, ver. 5.1.4. Locomotive emission calculations were derived from surveys of the three railroad companies that have operations in the county (Burlington Northern Santa Fe, Union Pacific and Amtrak).

County-specific temperature and fuel-related inputs are required to run the MOVES2014a model. The prior NONROAD2008 model required manual user input of monthly temperatures (minimum, maximum and average); Reid Vapor Pressure (RVP); gasoline and diesel sulfur content; and information on local gasoline ethanol blends (volume percentage, market share percentage and total oxygen weight percentage).

For the MOVES2014a model, hourly observed temperature data for a typical day in each month were obtained from Phoenix Sky Harbor Airport. Fuel data were provided by the Arizona

Department of Weights and Measures, and are identical to the fuel data used in modeling onroad mobile emissions. Stage II Vapor Recovery program effectiveness for 2014 (66.1%) was used to replace the default value in the model.

EPA recommends adjusting default model input files (such as equipment population and activity levels) where local data are available, as the default values in the model are derived from national averages. For commercial lawn and garden equipment, model defaults were adjusted based on 2003 survey results of the commercial lawn and garden industry performed by ENVIRON as part of an inventory developed to study the impact of visibility-impairing pollutants (ENVIRON et al., 2003). Survey results show that for most categories of lawn and garden equipment, populations in Maricopa County are significantly lower than EPA default values, while the average annual hours of operation for most equipment types are slightly higher than EPA's values. Using these local data results in a considerable decrease in emissions from this category, compared with earlier results using EPA default inputs.

Ozone season-day emissions were estimated based on a 3-month average of the typical weekday, or typical weekend, emissions in each ozone season month (June – August) as generated by the MOVES2014a model. To be conservative, the typical day with the highest emissions (weekday or weekend) was selected to represent ozone season-day emissions for each nonroad emissions category. For example, typical daily emissions from agricultural equipment are highest on weekdays as compared to weekends. As such, weekday emissions are selected to be representative of ozone season-day emissions for agricultural equipment. (Other categories, such as recreational equipment, have higher emissions on weekends as compared to weekdays).

Annual emissions are first calculated by multiplying the month-specific MOVES2014a model typical weekday and weekend emissions by the number of weekdays and weekends in each month. The product of the weekday and weekend emissions in each month is then summed to produce month-specific emissions. Lastly, monthly emissions are summed to produce annual emissions.

Spatial allocation factors were developed to apportion Maricopa County-level annual and ozone season-day nonroad emissions to the 8-hour ozone nonattainment area. The approaches used are described in each section of this chapter.

4.2 Agricultural equipment

Annual and season-day emissions from agricultural equipment in Maricopa County were calculated using EPA's MOVES2014a model, as discussed above. Annual and season-day emissions for the 8-hour ozone nonattainment area were calculated based on the Emission Inventory Guidance for Implementation of Ozone [and Particulate Matter] National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations (US EPA, 2014) and Geographical Allocation (GA) guidance (US EPA, 2002) which recommends using the ratio of agricultural land inside the nonattainment area (157,478 acres) to agricultural land within the county (267,894 acres). See Section 1.5.2 for a discussion of the land-use data used. The resulting annual and season-day emissions are presented in Table 4.2–1.

Table 4.2–1. Annual and season-day emissions from agricultural equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	5.7	286.9	262.2	49	2,473	2,311
8-hr ozone NAA	3.3	168.7	154.1	29	1,454	1,358

4.3 Airport ground support equipment

Annual and season-day emissions from airport ground support equipment (GSE) and auxiliary power units (APUs) were calculated using the Emissions Dispersion Modeling System (EDMS, v. 5.1.4) from the U.S. Federal Aviation Administration (FAA). Activity data on 2014 aircraft operations and GSE use for eight major airports were obtained from FAA's Operations and Performance Data System and MAG's 2014 survey data. In addition, 2014 activity data for six small general-aviation airports were obtained from FAA's 2015 Terminal Area Forecast (TAF) dataset and MAG's 2009 and 2014 survey data. (Further details concerning the modeling input data and results are described in Section 4.11, Aircraft).Emissions from GSE and APUs at Luke Air Force Base (AFB) for the year 2014 are grouped together with aircraft emissions at Luke AFB in Section 4.11. The resulting annual and season-day emissions are shown in Tables 4.3–1 and 4.3–2, respectively.

Table 4.3–1. Annual emissions (tons/year) from airport ground support equipment (GSE) and auxiliary power units (APUs).

	Maricopa County			8-hr. ozone nonattainment area		
Equipment type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
GSE	70.8	211.1	2,116.7	69.7	208.1	2,081.7
APUs	6.4	82.7	94.7	6.4	82.4	93.2
Totals:	**77.3**	**293.7**	**2,211.4**	**76.1**	**290.5**	**2,174.9**

Table 4.3–2. Season-day emissions (lbs/day) from airport GSE and APUs.

	Maricopa County			8-hr. ozone nonattainment area		
Equipment type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
GSE	374	1,121	11,194	369	1,106	11,018
APUs	35	454	516	35	453	508
Totals:	**409**	**1,575**	**11,710**	**404**	**1,559**	**11,526**

4.4 Commercial equipment

Annual and season-day emissions from commercial equipment in Maricopa County were calculated using EPA's MOVES2014a model, as described in Section 4.1. Annual and season-day emissions for the 8-hour ozone nonattainment area for this category were derived by applying the ratio of industrial employment in the nonattainment area to Maricopa County-level employment, as data on the number of wholesale establishments recommended by EPA guidance (US EPA, 2002) was not available. See Section 1.5.1 for a discussion of the industrial employment data used. The resulting annual and season-day emissions are shown in Table 4.4–1 below.

Table 4.4–1. Annual and season-day emissions from commercial equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1,144.0	1,175.6	29,670.3	7,851	7,198	198,568
8-hr ozone NAA	1,134.9	1,166.2	29,432.3	7,788	7,140	196,975

4.5 Construction and mining equipment

Annual and season-day emissions from construction and mining equipment in Maricopa County were calculated using EPA's MOVES2014a model as described in Section 4.1. Annual and season-day emissions for the 8-hour ozone nonattainment area for this category were derived by applying the ratio of construction employment in the nonattainment area to Maricopa County-level employment as a conservative estimate, as the EPA-recommended allocation factor (the total dollar value of all construction) was unavailable (US EPA, 2002). See Section 1.5.1 for a discussion of the employment data used. The resulting annual and season-day emissions are presented in Table 4.5–1.

Table 4.5–1. Annual and season-day emissions from construction and mining equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	454.4	10,495.7	12,531.9	3,203	72,485	88,728
8-hr ozone NAA	450.3	10,400.5	12,418.3	3,174	71,827	87,923

4.6 Industrial equipment

Annual and season-day emissions from industrial equipment in Maricopa County were calculated using EPA's MOVES2014a model, as described in Section 4.1. Annual and season-day emissions for the 8-hour ozone nonattainment area for this category were derived by applying the ratio of industrial employment in the nonattainment area to Maricopa County-level employment as a conservative estimate, as the number of employees in manufacturing recommended by EPA guidance (US EPA, 2002) was unavailable. See Section 1.5.1 for a discussion of the industrial employment data used. The resulting annual and season-day emissions estimates are shown in Table 4.6–1 below.

Table 4.6–1. Annual and season-day emissions from industrial equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	115.1	1,263.3	3,956.0	733	7,645	25,053
8-hr ozone NAA	114.1	1,253.1	3,924.2	727	7,584	24,852

4.7 Lawn and garden equipment

Annual and season-day emissions from lawn and garden equipment in Maricopa County were calculated using EPA's MOVES2014a model, as described in Section 4.1. These results reflect equipment population and usage estimates from survey work done in early 2003 for the Arizona

Department of Environmental Quality (discussed further in Section 4.1). Annual and season-day emissions for the 8-hour ozone nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County-level population, since housing units was not available, as recommended by EPA guidance (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used. The resulting annual and season-day emissions estimates are shown in Table 4.7–1 below.

Table 4.7–1. Annual and season-day emissions from lawn and garden equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	2,937.5	589.9	44,389.3	25,208	4,194	403,992
8-hr ozone NAA	2,962.4	594.9	44,765.8	25,422	4,229	407,419

4.8 Pleasure craft

Annual and season-day emissions from pleasure craft equipment in Maricopa County were calculated using EPA's MOVES2014a model, as described in Section 4.1. Annual and season-day emissions for the 8-hour ozone nonattainment area for this category were derived by applying the ratio of water surface area in the nonattainment area to Maricopa County-level water surface area, as recommended by EPA guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land-use data used. The resulting annual and season-day emissions estimates are shown in Table 4.8–1 below.

Table 4.8–1. Annual and season-day emissions from pleasure craft equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	382.3	98.3	1,154.8	7,477	2,428	29,686
8-hr ozone NAA	382.3	98.3	1,154.8	7,477	2,428	29,686

4.9 Railway maintenance equipment

Annual and season-day emissions from railway maintenance equipment in Maricopa County were calculated using EPA's MOVES2014a model, as described in Section 4.1. Annual and season-day emissions for the 8-hour ozone nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County-level population, as recommended by EPA guidance (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used. The resulting annual and season-day emissions are shown in Table 4.9–1 below.

Table 4.9–1. Annual and season-day emissions from railway maintenance equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.3	7.7	15.2	2	53	108
8-hr ozone NAA	0.3	7.8	15.3	2	53	109

4.10 Recreational equipment

Annual emissions from recreational equipment in Maricopa County were calculated using EPA's MOVES2014a model, as described in Section 4.1. Annual and season-day emissions for the 8-hour ozone nonattainment area were derived by applying the ratio of passive open space and vacant land use within the nonattainment area to Maricopa County-level land use, as recommended by EPA guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land use data used. The resulting annual and season-day emissions are shown in Table 4.10–1 below.

Table 4.10–1. Annual and season-day emissions from recreational equipment.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1,271.8	62.4	6,501.1	15,408	713	84,058
8-hr ozone NAA	572.0	28.1	2,924.0	6,930	321	37,807

4.11 Aircraft

Emissions from aircraft at the airports in Maricopa County were estimated using the Federal Aviation Administration's Emissions and Dispersion Model (EDMS, v. 5.1.4). The FAA EDMS model combines atmospheric mixing heights and aircraft-specific activity data with default emissions factors in order to estimate annual emissions inventories for a specific airport. The model calculates emissions of sulfur oxides (SO_x), oxides of nitrogen (NO_x), particulate matter (only for certain categories of airframes and engines), carbon monoxide (CO), and hydrocarbons (HC). The model also estimate emissions from ground support equipment (GSE) and auxiliary power units (APUs), using either default profiles or user-specified information about these components. The emissions from GSE and APUs at all airports other than Luke Air Force Base have been addressed and reported in Section 4.3 above.

One required meteorological input for EDMS is atmospheric mixing height, which is defined as the height (or depth) above ground where relatively vigorous vertical mixing occurs due to convection. To calculate the time-varying mixing height, the latest version of the EPA AERMOD Meteorological Preprocessor (AERMET version 15181) was employed. Both the 2014 hourly surface meteorological data and the 2014 one-minute Automated Surface Observing System (ASOS) wind data from the National Weather Service (NWS) station at Phoenix Sky Harbor were used (NCDC, 2015). Upper-air data for all of 2014 for the Tucson station (#23160) were obtained from the National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory Radiosonde Database (ESRL, 2015). Ultimately, a single mixing height dataset in 2014 is used for all airports other than Luke Air Force Base.

Aircraft emissions have been estimated for four aircraft categories:

- Air carriers (abbreviated "AC"): Larger commercial aircraft with at least 60 seats or 18,000 lbs payload capacity, used for scheduled service to transport passengers and/or freight;
- Air taxis ("AT"): Smaller commercial turbine- or piston-powered aircraft with less than 60 seats or 18,000 lbs payload capacity;
- General aviation ("GA"): Aircraft used on an unscheduled basis for recreational flying, personal transportation, and other activities, including business travel; and
- Military ("ML"): Aircraft used to support military operations.

Within each of these four main categories, many combinations of specific aircraft and engines are modeled and aggregated by EDMS to produce overall emissions for each of the four categories.

Three databases from the Federal Aviation Administration (FAA) provide annual aircraft activity, aircraft type fleet mix, and hourly/weekly/monthly operational profiles for the eight major airports in the 8-hour ozone nonattainment area (Chandler Municipal, Falcon Field, Glendale Municipal, Phoenix Deer Valley, Phoenix Goodyear, Phoenix-Mesa Gateway, Phoenix Sky Harbor, and Scottsdale airports). The three FAA databases are:

- Operational Network (OPSNET) database (FAA, 2015a),
- Enhanced Traffic Management System Counts (ETMSC) database, and
- Aviation System Performance Metrics (ASPM) database (FAA, 2015b).

In addition, the Traffic Flow Management System Counts (TFMSC) database provides taxi-in and taxi-out time for Phoenix Sky Harbor Airport, while MAG's survey of year 2014 data quantifies touch-and-go operations from Phoenix Deer Valley Airport and Phoenix Goodyear Airport.

To supplement the FAA's database for the eight major airports, another three datasets were used for the six small general-aviation airports:

- FAA's Terminal Area Forecast (TAF) database (FAA, 2015c) for year 2014 activity data at Gila Bend Municipal and Wickenburg Municipal airports;
- MAG's survey of 2014 activity at Buckeye Municipal Airport; and
- MAG's survey of 2008 data on aircraft activity (landing and take-off,or LTOs) in Pleasant Valley, Sky Ranch at Carefree, and Stellar Airpark airports.

Data for the year 2008 for the remaining three small general-aviation airports are assumed to be representative of 2014 activity, since updated aircraft activity data for these airports were not available. Table 4.11–1 below summarizes the activity level for each aircraft category for each airport included in the modeling, and indicates the data sources for each airport's activity (reported number of operations) and fleet mix.

The following section describes how activity and emissions were estimated for a representative airport, Chandler Municipal (CHD). The FAA's Operational Network (OPSNET) database provided 2014 activity by aircraft type category, as listed in Table 4.11–1. While OPSNET reported a total of 215,589 general aviation operations at this airport in 2014, further information on the aircraft types for this activity was needed so that the FAA's Enhanced Traffic Management System Counts (ETMSC) database was used to "grow" available aircraft-specific operational data as described below.

The ETMSC database on general aviation activity at Chandler Municipal Airport (CHD) in 2014 comprises 86 different aircraft types, totaling 3,063 operations. The aircraft-specific activity data were ranked in the decreasing order. Activity data for the predominant aircraft was then grown to represent all general aviation activity. This process for the general aviation activity at Chandler Municipal Airport is depicted in Table 4.11–2.

The processes of ranking reported activity and growing this subset of data typically resulted in 10 to 30 aircraft types for each airport/aircraft class combination, representing 85 to 100% of all reported activity.

Table 4.11–1. Annual airport operations (by aircraft category) and related data sources.

Airport	Code	Operations data source[1]	Fleet mix data source[2]	Aircraft type[3]	2014 operations
Buckeye Municipal	BXK	Survey response	generic GA profile	GA	37,114
Chandler Municipal	CHD	FAA/OPSNET	FAA/ETMSC	AT	1,852
				GA	215,589
				ML	108
Falcon Field	FFZ	FAA/OPSNET	FAA/ETMSC	AC	18
				AT	38,805
				GA	194,557
				ML	3,043
Gila Bend Municipal	E63	FAA/TAF	generic GA profile	GA	3,550
Glendale Municipal	GEU	FAA/OPSNET	FAA/ETMSC	AT	882
				GA	64,033
				ML	138
Luke Air Force Base	LUF	[Aircraft emissions in 2014 were estimates through scaling based on the numbers of F-16s and F-35s]			
Phoenix Deer Valley	DVT	FAA/OPSNET, Survey response	Survey response, FAA/ETMSC	AC	15
				AT	5,368
				GA	334,024 *
				ML	86
Phoenix Goodyear	GYR	FAA/OPSNET, Survey response	Survey response, FAA/ETMSC	AC	234
				AT	3,930
				GA	75,354 *
				ML	3,998
Phoenix-Mesa Gateway (formerly Williams Gateway)	IWA	FAA/OPSNET	FAA/ETMSC	AC	10,134
				AT	22,867
				GA	186,488
				ML	8,879
Phoenix Sky Harbor	PHX	FAA/OPSNET	FAA/ETMSC	AC	352,732
				AT	54,599
				GA	20,579
				ML	2,551
Pleasant Valley	P48	Survey Response	generic GA profile	GA	6,010
Scottsdale	SDL	FAA/OPSNET	FAA/ETMSC	AC	76
				AT	15,518
				GA	133,540
				ML	1,285
Sky Ranch/Carefree	18AZ	Survey response	generic GA profile	GA	3,030
Stellar Airpark	P19	airnav.com	generic GA profile	GA	39,056
Wickenburg Mun.	E25	FAA/TAF	generic GA profile	GA	36,030

1. **FAA/OPSNET:** Federal Aviation Administration's Operations Network (database); aspm.faa.gov.
   FAA/TAF:. FAA's Terminal Area Forecast; taf.faa.gov
2. **FAA/ETMSC:** FAA's Enhanced Traffic Management System Counts (database); aspm.faa.gov.
3. **AC:** Air Commercial; **AT:** Air Taxi; **GA:** General Aviation; **ML:** Military

* The number of operations includes touch-and-go operations reported by airport.

Table 4.11–2. Aircraft-specific activity growth for EDMS modeling input for Chandler Municipal airport.

Rank	Aircraft type	ETMSC-reported operations	% total reported operations	Cumulative percent	Operations grown for EDMS modeling
1	P28A: Piper Cherokee	490	16.00%	16.00%	40,568
2	BE20: Beech 200 Super King	177	5.78%	21.78%	14,654
3	C172: Cessna Skyhawk 172/Cutlass	168	5.48%	27.26%	13,909
4	BE58: Beech 58	162	5.29%	32.55%	13,412
5	C25C: Cessna Citation CJ4	152	4.96%	37.51%	12,584
6	R22: Robinson R-22 Mariner	135	4.41%	41.92%	11,177
7	C182: Cessna Skylane 182	131	4.28%	46.20%	10,846
8	C560: Cessna Citation V/Ultra	119	3.89%	50.08%	9,852
9	BE36: Beech Bonanza 36	104	3.40%	53.48%	8,610
10	P46T: Piper Malibu Meridian	89	2.91%	56.38%	7,368
11	C510: Cessna Citation Mustang	84	2.74%	59.13%	6,955
12	AC90: Gulfstream Commander	79	2.58%	61.70%	6,541
13	SR22: Cirrus SR 22	79	2.58%	64.28%	6,541
14	PC12: Pilatus PC-12	78	2.55%	66.83%	6,458
15	BE33: Beech Bonanza 33	73	2.38%	69.21%	6,044
16	PA46: Piper Malibu	70	2.29%	71.50%	5,795
17	BE35: Beech Bonanza 35	68	2.22%	73.72%	5,630
18	C525: Cessna CitationJet/CJ1	58	1.89%	75.61%	4,802
19	PA28: Piper Cherokee	42	1.37%	76.98%	3,477
20	M20P: Mooney M-20C Ranger	38	1.24%	78.22%	3,146
21	BE9L: Beech King Air 90	37	1.21%	79.43%	3,063
22	M20T: Turbo Mooney M20K	37	1.21%	80.64%	3,063
23	PA44: Piper Seminole	36	1.18%	81.82%	2,981
24	C340: Cessna 340	34	1.11%	82.93%	2,815
25	C210: Cessna 210 Centurion	32	1.04%	83.97%	2,649
26	DA40: Diamond Star DA40	32	1.04%	85.01%	2,649
⋮	⋮	⋮	⋮	⋮	
86	H25B: BAe HS125/7-800/Hawker	2	< 0.1%	100.00%	(n/a)
	Total:	**3,063**			**215,589**

Aircraft emissions at Luke Air Force Base (AFB) are based upon three types of aircraft: F-16, F-35, and "transient" aircraft, and also includes emissions from associated ground support equipment (GSE). F-16 aircraft emissions and associated GSE emissions were scaled using a ratio of the number of F-16s in 2014 to the number of F-16s in 2008 (Weston, 2010). Emissions from F-35 aircraft and their associated GSE were scaled using a ratio of the number of F-35 aircraft in 2014 to the future total number (144) of F-35 aircraft in the L6 scenario emissions as obtained from the base's 2012 environmental impact statement report (USAF, 2012). "Transient" aircraft emissions in 2014 were assumed to be the same as those in 2008 based on discussions with Luke AFB personnel. Emissions from F-16 aircraft, F-35 aircraft, "transient" aircraft, and GSE were all summed into the single "ML" category for Luke Air Force Base.

Tables 4.11–3 and 4.11–4 present total annual and season-day emissions by airport and aircraft type for airports inside and outside the 8-hour ozone nonattainment area, respectively. Ozone

season-day emissions are calculated by summing monthly emissions in the ozone season (June–August), and then dividing the sum by the number of days in the ozone season (92).

Table 4.11–3. Annual and season-day emissions for airports in the 8-hour ozone nonattainment area, by airport and aircraft type.

		Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Facility	**Type***	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Buckeye Municipal	GA	4.1	1.7	176.7	21	8	951
Chandler Municipal	AT	6.6	1.2	7.3	40	7	45
	GA	142.3	24.1	1,351.0	726	117	7,480
	ML	0.0	0.0	1.4	0	0	8
	Total	**149.0**	**25.3**	**1,359.7**	**766**	**124**	**7,533**
Falcon Field	AC	0.0	0.0	0.4	0	0	1
	AT	136.7	27.9	171.89	1,019	205	1,294
	GA	146.7	24.7	1,198.0	547	84	5,001
	ML	3.0	0.8	15.2	16	4	86
	Total	**286.4**	**53.4**	**1,385.5**	**1,583**	**292**	**6,382**
Gila Bend Municipal	GA	**0.4**	**0.2**	**16.8**	**2**	**1**	**89**
Glendale Municipal	AT	2.9	0.9	3.9	8	2	11
	GA	95.5	11.5	489.3	414	46	2,277
	ML	0.1	0.0	0.7	1	0	7
	Total	**98.5**	**12.4**	**494.0**	**424**	**49**	**2,295**
Luke AF Base	ML	**101.0**	**244.8**	**456.6**	**777**	**1,883**	**3,513**
Phoenix Deer Valley	AC	0.0	0.0	0.1	0	0	1
	AT	10.8	5.6	18.1	48	24	81
	GA	115.9	49.0	2,021.5	608	251	11,863
	ML	0.0	0.0	0.4	0	0	3
	Total	**126.8**	**54.6**	**2,040.1**	**656**	**275**	**11,948**
Phoenix Goodyear	AC	0.3	0.7	1.5	1	2	4
	AT	13.9	3.8	19.2	79	20	109
	GA	28.7	39.1	507.7	137	184	2,704
	ML	5.6	23.5	20.3	24	95	87
	Total	**48.6**	**67.1**	**548.8**	**240**	**301**	**2,905**
Phoenix Sky Harbor Intl	AC	258.5	1,567.1	1,483.7	1,407	7,939	8,005
	AT	22.3	109.2	124.2	120	554	673
	GA	30.0	9.3	114.4	138	40	561
	ML	3.9	29.01	24.1	17	113	102
	Total	**314.7**	**1,714.6**	**1,746.4**	**1,682**	**8,645**	**9,341**
Phoenix-Mesa Gateway	AC	5.4	39.04	42.9	29	201	231
	AT	104.5	13.13	119.4	600	74	694
	GA	186.8	47.80	1,073.2	839	193	5,224
	ML	23.5	17.30	75.8	153	102	495
	Total	**320.1**	**117.27**	**1,311.3**	**1,621**	**570**	**6,643**
Pleasant Valley	GA	**0.1**	**0.38**	**1.1**	**1**	**2**	**56**
Scottsdale	AC	0.1	0.07	0.3	0	0	0
	AT	47.3	13.10	65.4	187	50	261
	GA	211.3	76.64	641.5	1,066	359	3,338
	ML	1.3	0.49	9.5	6	2	47
	Total	**260.0**	**90.30**	**716.7**	**1,259**	**410**	**3,646**
Skyranch at Carefree	GA	**1.7**	**0.3**	**16.3**	**10**	**2**	**116**
Stellar Airpark	GA	**8.0**	**2.3**	**224.5**	**40**	**10**	**1,178**
8–hr ozone NAA totals:		**1,719.2**	**2,384.3**	**10,494.4**	**9,080**	**12,571**	**56,545**

***Type**: 'AC' = Air Commercial; 'AT' = Air Taxi; 'GA" = General Aviation; 'ML' = Military

Table 4.11–4. Annual and season-day emissions for airports outside the 8-hour ozone nonattainment area, by airport and aircraft type.

		Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Facility	**Type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Wickenburg Municipal	GA	42.6	6.8	193.6	204	32	1,038
County totals:		**1,761.8**	**2,391.1**	**10,688.0**	**9,284**	**12,603**	**57,583**

4.12 Locomotives

Annual emissions from locomotives were calculated based on diesel fuel usage data provided by Burlington Northern/Santa Fe Railway (BNSF), Union Pacific Railway (UP) and Amtrak. Railway operations from these companies fall into three categories: Class I haul lines, passenger trains, and yard/switching operations. Annual emissions were calculated by multiplying diesel fuel usage by emission factors published by US EPA (2009). Ozone season-day emissions were calculated by dividing annual totals by 365 days per year, as locomotive activity is assumed to be uniform throughout the year. The resulting annual and season-day emissions from each of the categories in Maricopa County are presented in Table 4.12–1.

Table 4.12–1. Annual and season-day emissions from locomotives in Maricopa County.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Locomotive type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Class I haul line	115.7	2,126.8	389.5	634	11,654	2,134
Yard/switch ops.	20.7	329.7	28.8	113	1,807	158
Passenger trains	1.1	21.8	3.5	6	119	19
Totals:	**137.5**	**2,478.3**	**421.8**	**754**	**13,580**	**2,311**

To calculate emissions within the 8-hour ozone nonattainment area, County-level emissions were multiplied by the percentage of track miles inside the nonattainment area, determined by GIS mapping. The resulting annual and season-day emissions are shown in Table 4.12–2.

Table 4.12–2. Annual and season-day emissions from locomotives in the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Locomotive type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Class I haul line	70.2	1,289.9	236.2	385	7,068	1,294
Yard/switch ops.	20.7	329.7	28.8	113	1,807	158
Passenger trains	0.1	1.5	0.2	0	8	1
Totals:	**91.0**	**1,621.2**	**265.3**	**498**	**8,883**	**1,454**

4.13 Quality assurance procedures

Established procedures were used to check, and correct when necessary, the nonroad mobile sources emissions estimates. All model input and output files, and Excel spreadsheets used to calculate the emissions, were checked by personnel who were not involved in the development of the modeling inputs/outputs and spreadsheets under review. In addition, the emissions estimates were reviewed for reasonableness by external agency staff.

4.14 Summary of all nonroad mobile source emissions

Table 4.14–1 summarizes annual and season-day emissions of VOC, NO_x, and CO from nonroad mobile sources in Maricopa County. Table 4.14–2 shows annual and season-day emissions for these pollutants for the 8-hour ozone nonattainment area.

Table 4.14–1. Annual and season-day emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural	5.7	286.9	262.2	49	2,473	2,311
Airport GSE+APUs	77.3	293.7	2,211.4	409	1,575	11,710
Commercial	1,144.0	1,175.6	29,670.3	7,851	7,198	198,568
Construction & mining	454.4	10,495.7	12,531.9	3,203	72,485	88,728
Industrial	115.1	1,263.3	3,956.0	733	7,645	25,053
Lawn & garden	2,937.5	589.9	44,389.3	25,208	4,194	403,992
Pleasure craft	382.3	98.3	1,154.8	7,477	2,428	29,686
Railway maintenance	0.3	7.7	15.2	2	53	108
Recreational	1,271.8	62.4	6,501.1	15,408	713	84,058
Aircraft	1,761.8	2,391.1	10,688.0	9,284	12,603	57,583
Locomotives	137.5	2,478.3	421.8	754	13,580	2,311
Total:	**8,287.7**	**19,143.1**	**111,801.8**	**70,378**	**124,946**	**904,107**

Table 4.14–2. Annual and season-day emissions from nonroad mobile sources in the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural	3.3	168.7	154.1	29	1,454	1,358
Airport GSE+APUs	76.1	290.5	2,174.9	404	1,559	11,526
Commercial	1,134.9	1,166.2	29,432.3	7,788	7,140	196,975
Construction & mining	450.3	10,400.5	12,418.3	3,174	71,827	87,923
Industrial	114.1	1,253.1	3,924.2	727	7,584	24,852
Lawn & garden	2,962.4	594.9	44,765.8	25,422	4,229	407,419
Pleasure craft	382.3	98.3	1,154.8	7,477	2,428	29,686
Railway maintenance	0.3	7.8	15.3	2	53	109
Recreational	572.0	28.1	2,924.0	6,930	321	37,807
Aircraft	1,719.2	2,384.3	10,494.4	9,080	12,571	56,545
Locomotives	91.0	1,621.2	265.3	498	8,883	1,454
Totals:	**7,505.9**	**18,013.6**	**107,723.4**	**61,531**	**118,049**	**855,654**

4.15 References

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5. Onroad Mobile Sources

5.1 Introduction

Onroad mobile source emissions for ozone precursors, such as volatile organic compounds (VOCs), oxides of nitrogen (NO_x), and carbon monoxide (CO), have been calculated for the 8-hour ozone nonattainment area (NAA) and Maricopa County for the 2014 Periodic Emissions Inventory (PEI).

Motor Vehicle Emission Simulator (MOVES2014a) is the latest model developed by the U.S. Environmental Protection Agency (EPA) for the purpose of estimating onroad and off-network motor vehicle emission factors.

The MOVES2014a inputs were developed using local data from multiple sources such as the Arizona Department of Transportation (ADOT), the Arizona Department of Weights and Measures (ADWM), the Maricopa Association of Governments (MAG) Transportation Division, and the National Climatic Data Center (NCDC).

The main references for preparing the onroad mobile source portion of the 2014 emissions inventory were:

- Emission Inventory Requirements for Ozone State Implementation Plans (US EPA, 1991);
- Procedures for Emission Inventory Preparation Volume IV: Mobile Sources (US EPA, 1992a);
- Quality Review Guidelines for 1990 Base Year Emission Inventories (US EPA, 1992b);
- Emissions Inventory Guidance for Implementation of Ozone [and Particulate Matter] National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations (US EPA, 2014a);
- Policy Guidance on the Use of MOVES2014 for State Implementation Plan Development, Transportation Conformity, and Other Purposes (US EPA, 2014b);
- MOVES2014a User Guide (US EPA, 2015a);
- MOVES2014a User Interface Reference Manual (US EPA, 2015b);
- MOVES2014a Software Design Reference Manual (US EPA, 2015c); and
- MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity (US EPA, 2015d);

5.2 Onroad emissions

Onroad exhaust, evaporative, refueling, and extended idling emissions were estimated by MOVES2014a.

5.2.1 MOVES2014a model

Onroad mobile source emissions were calculated using the EPA state-of-the-art emissions modeling tool, MOVES2014a. MOVES2014a is intended for official use to estimate national, state, and county level inventories of criteria air pollutants from highway vehicles. The user of MOVES2014a is allowed to specify vehicle types, time periods, geographical areas, pollutants,

vehicle operating characteristics, and road types for a particular scenario to be modeled by creating a Run Specification (RunSpec).

In order to calculate vehicle emissions for the calendar year 2014, MOVES2014a was executed using local input data for each geographical area (Maricopa County and the 8-hour ozone nonattainment area). Each scenario was created using the county scale setting and the inventory calculation type. The specific MOVES2014a model RunSpec and RunSpec summaries are described in Appendix C.

5.2.2 Local input data used with the MOVES2014a model

MOVES2014a requires local data such as the presence of inspection and maintenance (I/M) programs, meteorological data, vehicle populations, source type age distribution, annual vehicle miles traveled (VMT), monthly/daily/hourly fractions, road type distribution, average speed distribution, ramp fraction, fuel data, and alternative vehicle and fuel technologies (AVFT).

5.2.2.1 Fuel data

Regarding the fuel local input data, MOVES2014a provides three MOVES tables, which are [fuelsupply], [fuelformulation], and [fuelusagefraction]. The fuel data for each month were derived from the 2014 fuel inspection results in Maricopa County provided by ADWM. The fuel data for Maricopa County were also applied to the 8-hour ozone nonattainment area. The specific MOVES tables for fuel data are presented in Appendix C.

5.2.2.2 I/M programs

MOVES2014a has an [IMCoverage] table for I/M programs, which reflects the actual proportions of vehicles subject to the specified levels of inspection. The term "I/M vehicles" denotes vehicles which are required to undergo an emission test and/or inspection under the Vehicle Inspection/Maintenance Program. It is important to note that participation in the I/M program is required for all vehicles registered in the Area A, with the exception of certain model years and vehicle classes. However, it is assumed that 91.6 percent of the vehicles operating within the 8-hour ozone nonattainment area and Maricopa County participate in the I/M program, while and the remaining 8.4 percent do not participate in the program. These percentages reflect the control measures "Tougher Enforcement of Vehicle Registration and Emissions Test Compliance" and "Expansion of Area A Boundaries," described in the MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa Nonattainment Area (MAG, 2009). This percentage is directly applied to the Compliance Factor in the [IMCoverage] table. The same I/M programs were applied for Maricopa County and the 8-hour ozone nonattainment area. The specific MOVES table for I/M programs is presented in Appendix C.

5.2.2.3 Meteorological data

MOVES2014a requires hourly temperature and relative humidity data by specific month of the year. Meteorological data for the Phoenix Sky Harbor International Airport in 2014 were obtained from the National Climatic Data Center (http://www.ncdc.noaa.gov/IPS/lcd/lcd.html). The same hourly average temperature and relative humidity data for each month were applied for

Maricopa County and the 8-hour ozone nonattainment area. The specific MOVES table [ZoneMonthHour] for meteorological data is presented in Appendix C.

5.2.2.4 Vehicle population

In MOVES2014a, off-network emissions including start, evaporative, and extended idle emissions are directly determined by population of vehicles in an area. The vehicle population in Maricopa County was obtained from the July 2014 vehicle registration data provided by ADOT. The vehicle population data were allocated to the 13 MOVES source types based on MOVES default vehicle population fractions for Maricopa County in 2014. The vehicle population in the 8-hour ozone nonattainment area was estimated by applying the population ratio of the two geographical areas to the vehicle population in Maricopa County. The population ratio for 2014 was derived from the MAG socioeconomic data, which are 4,022,310 people for the 8-hour ozone nonattainment area and 3,989,980 people for Maricopa County. The specific MOVES table [SourceTypeYear] for vehicle population is presented in Appendix C.

5.2.2.5 Source type age distribution

MOVES2014a categorizes vehicles according to vehicle classes and model years. The source type age distribution input table was prepared using EPA MOVES data converter and the vehicle registration data from ADOT. The same source type age distribution was applied for Maricopa County and the 8-hour ozone nonattainment area. The specific MOVES table [SourceTypeAgeDistribution] for source type age distribution is presented in Appendix C.

5.2.2.6 Annual VMT

The 2014 annual VMTs were used to estimate onroad exhaust and evaporative emissions. The 2014 annual average daily VMTs by HPMS vehicle type for Maricopa County and the 8-hour ozone nonattainment area were derived from the 2014 traffic assignment data provided by the MAG Transportation Modeling Group in July 2015. The annual average daily VMTs were multiplied by 365 days to obtain the annual VMTs. The specific MOVES table [HPMSvTypeYear] for annual VMT is presented in Appendix C.

5.2.2.7 Road type distribution

MOVES2014a requires the distribution of VMTs by road type as a local input. The road type VMT distribution by HPMS vehicle type was derived with the 2014 traffic assignment data and the MOVES default VMT fractions for the HPMS vehicle types. MOVES source types belonging to the same HPMS vehicle class applied the same road type distribution assigned for the HPMS vehicle class. The specific MOVES table [RoadTypeDistribution] for road type distribution is presented in Appendix C.

5.2.2.8 VMT fraction

Since VMT varies by month, day of week, and hour, MOVES2014a requires month/day/hour VMT fractions as a local input in order to derive hourly VMT for each weekday/weekend and month from the annual VMT. The month/day/hour VMT fractions were developed from data

recorded by continuous traffic counters on freeways (ADOT Freeway Management System) and arterials (Phoenix Automatic Traffic Recorders) in 2007. The specific MOVES tables [MonthVMTFraction], [DayVMTFraction], and [HourVMTFraction] for VMT fractions are presented in Appendix C.

5.2.2.9 Average speed distribution

In MOVES2014a, vehicle power, speed, and acceleration have a significant effect on vehicle emissions for all pollutants. MOVES2014a estimates those emission effects by assigning activity to operating mode distributions, which are determined by the distribution of vehicle hours traveled (VHT) in sixteen speed bins. Local estimates of average speed were developed by post-processing the output from the 2014 traffic assignment data. To develop the average speed distribution, VHTs in sixteen speed bins were accumulated separately for each hour of the day, source type, and road type in Maricopa County. Then, the average speed distribution was calculated by normalizing VHTs in sixteen speed bins for each hour of the day, source type, and road type. The same methodology was applied to develop the speed estimates for the 8-hour ozone nonattainment area. The specific MOVES table [AvgSpeedDistribution] for the average speed distribution is presented in Appendix C.

5.2.2.10 Ramp fraction

MOVES2014a requires the ramp fraction, which represents the percent of vehicle hours traveled (VHT) on ramps, on both rural restricted roads (road type 2) and urban restricted roads (road type 4). The fraction of VHT on ramps was derived by dividing the total VHTs on ramps by the total VHTs for each restricted road type. Those VHTs were obtained from the 2014 traffic assignment. The specific MOVES table [RoadType] for ramp fractions is shown in Appendix C.

5.2.2.11 Alternative vehicle and fuel technologies (AVFT) strategy

MOVES2014a allows users to modify the fuel engine fraction using different fuels and technologies in each model year in order to reflect the local situation. The fleet information for transit buses was provided by Valley Metro and used to prepare the AVFT input. Since the fleet data are available only for specific model years, MOVES2014a default values were obtained from the [fuelEngFraction] table in the MOVES default database and used for the rest of the model years. The specific MOVES table [AVFT] for AVFT strategy is shown in Appendix C.

5.2.2.12 Stage II refueling control programs

To account for the impact of Stage II refueling control programs on refueling losses, MOVES2014a requires the control efficiency for the local area. The control efficiency for the refueling displacement vapor losses in 2014 were provided by Arizona Department of Weights and Measures. The same program efficiency of 66.1% was applied to Maricopa County and the 8-hour ozone nonattainment area. The specific MOVES table [CountyYear] for Stage II refueling control programs is presented in Appendix C.

5.2.3 MOVES2014a outputs

MOVES2014a was executed with the RunSpec files described in Appendix C to obtain exhaust and evaporative emissions for VOC, NO_x, and CO. These values were obtained for the following categories:

- Source types: motorcycle, passenger car, passenger truck, light commercial truck, intercity bus, transit bus, school bus, refuse truck, single unit short-haul truck, single unit long-haul truck, motor home, combination short-haul truck, and combination long-haul truck.
- Road types: off-network, rural restricted access, rural unrestricted access, urban restricted access, and urban unrestricted access.

5.2.4 MOVES2014a emission estimates

MOVES2014a was used to generate onroad emissions by vehicle class, facility type, weekday/ weekend day, and month. By specifying the output time aggregate level as month, MOVES2014a produces monthly emissions including weekday and weekend emissions for a given month. The annual emissions were calculated by aggregating monthly onroad emissions derived by MOVES2014a. The ozone season-day emissions were calculated by dividing the three-month peak ozone season emissions from June through August by 92 days.

Tables 5.2–1 and 5.2–2 show the calculated annual and ozone season-day VOC, NO_x, and CO emissions by road and vehicle type in Maricopa County and the 8-hour ozone nonattainment area, respectively.

Table 5.2–1. Annual and season-day onroad mobile source emissions in Maricopa County, by road and vehicle type.

Road type	Source type	Annual emissions (tons/year)			Ozone season-day emissions (lbs/day)		
		VOC	NOx	CO	VOC	NOx	CO
Off-Network	Motorcycle	347.4	2.9	84.1	2,490	13	375
	Passenger car	8,583.4	3,947.7	35,951.9	55,043	21,035	182,111
	Passenger truck	3,321.3	1,785.2	21,645.3	20,733	9,605	114,641
	Light commercial truck	836.9	494.5	6,136.9	5,158	2,665	32,609
	Intercity bus	0.0	0.1	1.5	0	0	8
	Transit bus	0.1	0.0	12.1	0	0	66
	School bus	4.8	2.3	206.5	23	13	1,126
	Refuse truck	0.3	0.1	10.9	1	1	60
	Single unit short-haul truck	93.1	88.0	2,416.2	530	479	13,113
	Single unit long-haul truck	2.7	2.3	84.6	15	13	459
	Motor home	12.6	4.9	256.5	90	26	1,396
	Combination short-haul truck	1.1	0.0	56.6	0	0	310
	Combination long-haul truck	374.7	2,030.6	891.3	1,966	10,215	4,701
Rural Restricted Access	Motorcycle	4.9	4.8	73.1	27	24	382
	Passenger car	51.8	225.5	2,150.5	300	1,255	14,357
	Passenger truck	31.7	154.9	1,104.4	183	856	7,277
	Light commercial truck	7.8	40.1	259.9	45	222	1,714
	Intercity bus	0.7	15.3	3.0	4	77	16
	Transit bus	1.8	24.2	19.7	10	125	104
	School bus	3.4	37.8	18.6	18	190	98
	Refuse truck	0.7	15.4	4.2	4	78	22
	Single unit short-haul truck	16.9	153.0	196.5	92	776	1,040
	Single unit long-haul truck	1.0	8.2	10.6	5	42	56
	Motor home	0.9	5.7	16.8	5	29	89
	Combination short-haul truck	19.1	431.8	80.5	102	2,177	424
	Combination long-haul truck	48.4	1,172.9	214.6	257	5,913	1,129
Rural Unrestricted Access	Motorcycle	21.6	12.8	213.8	121	64	1,117
	Passenger car	165.5	502.1	4,399.3	955	2,804	29,206
	Passenger truck	95.8	324.1	2,208.6	551	1,796	14,436
	Light commercial truck	25.3	90.1	561.2	146	502	3,673
	Intercity bus	0.4	6.8	1.8	2	34	9
	Transit bus	1.0	9.1	7.8	5	47	41
	School bus	2.0	13.9	8.1	10	70	43
	Refuse truck	1.2	19.1	6.8	7	96	36
	Single unit short-haul truck	31.1	204.3	296.7	168	1,036	1,570
	Single unit long-haul truck	1.7	11.1	15.6	9	56	82
	Motor home	1.4	6.5	20.2	8	33	107
	Combination short-haul truck	6.6	109.2	27.1	35	551	142
	Combination long-haul truck	16.2	300.8	70.6	86	1,518	371

Table 5.2–1. Annual and ozone season-day onroad mobile source emissions in Maricopa County, by road and source type (continued).

Road type	Source type	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
		VOC	NOx	CO	VOC	NOx	CO
Urban Restricted Access	Motorcycle	63.0	54.0	833.5	351	267	4,354
	Passenger car	812.3	3,150.3	35,925.7	4,693	17,530	239,761
	Passenger truck	478.6	2,102.2	17,539.1	2,765	11,618	115,526
	Light commercial truck	118.9	543.9	3,991.9	686	3,015	26,314
	Intercity bus	2.3	43.8	9.7	12	221	51
	Transit bus	6.2	71.7	61.1	33	370	321
	School bus	12.0	112.9	61.9	64	569	328
	Refuse truck	8.5	156.1	48.2	45	787	254
	Single unit short-haul truck	219.9	1,776.2	2,519.3	1,199	9,008	13,341
	Single unit long-haul truck	12.5	97.7	136.9	68	496	725
	Motor home	11.5	62.0	203.2	65	315	1,078
	Combination short-haul truck	41.7	811.4	173.5	222	4,091	913
	Combination long-haul truck	103.7	2,205.7	457.9	551	11,120	2,410
Urban Unrestricted Access	Motorcycle	173.9	72.7	1,374.4	976	360	7,181
	Passenger car	1,580.9	4,131.7	39,802.3	9,115	23,151	263,742
	Passenger truck	904.0	2,578.9	19,594.4	5,197	14,339	127,747
	Light commercial truck	242.3	732.6	4,993.0	1,392	4,111	32,588
	Intercity bus	2.7	37.6	10.7	14	190	56
	Transit bus	5.7	39.6	34.3	30	204	180
	School bus	11.2	68.3	38.0	60	345	201
	Refuse truck	8.7	123.1	46.1	47	621	243
	Single unit short-haul truck	232.4	1,347.8	2,015.6	1,261	6,830	10,666
	Single unit long-haul truck	12.7	73.1	102.6	69	371	543
	Motor home	11.0	40.1	136.3	61	203	723
	Combination short-haul truck	27.9	412.3	106.9	148	2,081	563
	Combination long-haul truck	67.1	1,115.5	278.7	356	5,629	1,466
Summary, all vehicle types:							
	Motorcycle	610.8	147.2	2,578.9	3,965	728	13,409
	Passenger car	11,193.9	11,957.3	118,229.7	70,106	65,775	729,177
	Passenger truck	4,831.4	6,945.3	62,091.8	29,429	38,214	379,627
	Light commercial truck	1,231.2	1,901.2	15,942.9	7,427	10,515	96,898
	Intercity bus	6.1	103.6	26.7	32	522	140
	Transit bus	14.8	144.6	135.0	78	746	712
	School bus	33.4	235.2	333.1	175	1,187	1,796
	Refuse truck	19.4	313.8	116.2	104	1,583	615
	Single unit short-haul truck	593.4	3,569.3	7,444.3	3,250	18,129	39,730
	Single unit long-haul truck	30.6	192.4	350.3	166	978	1,865
	Motor home	37.4	119.2	633.0	229	606	3,393
	Combination short-haul truck	96.4	1,764.7	444.6	507	8,900	2,352
	Combination long-haul truck	610.1	6,825.5	1,913.1	3,216	34,395	10,077
	Totals:	**19,308.7**	**34,219.1**	**210,239.1**	**118,683**	**182,273**	**1,279,788**

Table 5.2–2. Annual and ozone season-day onroad mobile source emissions in the 8-hour ozone nonattainment area, by road and source type.

Road type	Source type	Annual emissions (tons/year)			Season-day emissions (lbs/day)		
		VOC	NOx	CO	VOC	NOx	CO
Off-Network	Motorcycle	351.4	3.0	85.0	2,519	13	380
	Passenger car	8,638.8	3,972.5	36,177.6	55,399	21,167	183,254
	Passenger truck	3,345.1	1,797.8	21,797.8	20,883	9,673	115,449
	Light commercial truck	842.9	498.0	6,180.3	5,195	2,684	32,839
	Intercity bus	0.0	0.1	1.5	0	0	8
	Transit bus	0.1	0.0	12.2	0	0	67
	School bus	4.8	2.3	208.4	23	13	1,136
	Refuse truck	0.3	0.1	11.1	1	1	60
	Single unit short-haul truck	94.1	88.9	2,442.0	536	484	13,253
	Single unit long-haul truck	2.8	2.3	85.5	16	13	464
	Motor home	12.7	4.9	258.8	90	27	1,408
	Combination short-haul truck	1.1	0.0	57.4	0	0	314
	Combination long-haul truck	214.0	1,157.7	533.0	1,121	5,824	2,816
Rural Restricted Access	Motorcycle	3.6	3.5	53.0	20	17	277
	Passenger car	37.6	164.2	1,590.6	217	914	10,620
	Passenger truck	23.0	112.8	814.3	133	623	5,366
	Light commercial truck	5.6	29.1	191.2	33	161	1,261
	Intercity bus	0.4	8.8	1.7	2	44	9
	Transit bus	1.0	13.9	11.3	5	71	60
	School bus	1.9	21.7	10.7	10	109	56
	Refuse truck	0.4	9.2	2.5	2	46	13
	Single unit short-haul truck	10.0	91.8	117.9	55	466	624
	Single unit long-haul truck	0.6	4.9	6.3	3	25	34
	Motor home	0.5	3.4	10.1	3	17	54
	Combination short-haul truck	10.9	246.5	45.8	58	1,243	241
	Combination long-haul truck	27.6	669.7	122.1	146	3,376	642
Rural Unrestricted Access	Motorcycle	19.6	11.7	194.3	110	58	1,015
	Passenger car	149.5	452.9	3,974.1	862	2,529	26,384
	Passenger truck	86.5	292.4	1,995.3	498	1,620	13,043
	Light commercial truck	22.9	81.3	507.0	132	453	3,318
	Intercity bus	0.4	5.5	1.4	2	28	7
	Transit bus	0.8	7.4	6.3	4	38	33
	School bus	1.6	11.2	6.5	8	57	34
	Refuse truck	1.1	16.4	5.8	6	83	31
	Single unit short-haul truck	26.6	175.0	254.3	144	888	1,345
	Single unit long-haul truck	1.5	9.5	13.3	8	48	71
	Motor home	1.2	5.5	17.3	7	28	92
	Combination short-haul truck	5.3	87.8	21.7	28	443	114
	Combination long-haul truck	13.0	242.2	56.8	69	1,222	299

Table 5.2–2. Annual and ozone season-day onroad mobile source emissions in the 8-hour ozone nonattainment area, by road and source type (continued).

Road type	Source type	Annual emissions (tons/year) VOC	NOx	CO	Season-day emissions (lbs/day) VOC	NOx	CO
Urban Restricted Access	Motorcycle	63.3	54.2	837.6	353	268	4,376
	Passenger car	816.7	3,168.2	36,195.1	4,719	17,629	241,560
	Passenger truck	481.5	2,115.5	17,677.4	2,782	11,692	116,437
	Light commercial truck	119.6	547.2	4,022.1	690	3,033	26,513
	Intercity bus	2.3	43.9	9.7	12	221	51
	Transit bus	6.3	71.8	61.2	33	370	322
	School bus	12.0	113.2	62.0	64	571	328
	Refuse truck	8.5	157.2	48.6	46	793	256
	Single unit short-haul truck	220.8	1,784.0	2,530.7	1,204	9,048	13,401
	Single unit long-haul truck	12.5	98.1	137.6	69	498	728
	Motor home	11.6	62.2	203.9	65	316	1,082
	Combination short-haul truck	41.7	812.2	173.6	222	4,095	914
	Combination long-haul truck	103.9	2,208.8	458.5	552	11,136	2,412
Urban Unrestricted Access	Motorcycle	175.1	73.3	1,384.5	982	363	7,234
	Passenger car	1,590.7	4,159.3	40,053.3	9,172	23,305	265,408
	Passenger truck	910.4	2,598.5	19,735.2	5,233	14,447	128,667
	Light commercial truck	244.1	738.1	5,029.0	1,402	4,142	32,824
	Intercity bus	2.7	37.7	10.7	14	190	56
	Transit bus	5.7	39.7	34.4	30	205	181
	School bus	11.3	68.5	38.1	60	346	201
	Refuse truck	8.8	124.0	46.4	47	626	245
	Single unit short-haul truck	233.3	1,353.1	2,023.5	1,266	6,857	10,708
	Single unit long-haul truck	12.7	73.4	103.0	69	372	545
	Motor home	11.0	40.2	136.6	61	204	725
	Combination short-haul truck	27.9	413.4	107.2	148	2,086	564
	Combination long-haul truck	67.3	1,119.1	279.6	357	5,647	1,471
Summary, all road types:							
	Motorcycle	613.0	145.7	2,554.4	3,984	719	13,282
	Passenger car	11,233.3	11,917.1	117,990.7	70,369	65,544	727,226
	Passenger truck	4,846.5	6,917.0	62,020.0	29,529	38,055	378,962
	Light commercial truck	1,235.1	1,893.7	15,929.6	7,452	10,473	96,755
	Intercity bus	5.8	96.0	25.0	30	483	131
	Transit bus	13.9	132.8	125.4	72	684	663
	School bus	31.6	216.9	325.7	165	1,096	1,755
	Refuse truck	19.1	306.9	114.4	102	1,549	605
	Single unit short-haul truck	584.8	3,492.8	7,368.4	3,205	17,743	39,331
	Single unit long-haul truck	30.1	188.2	345.7	165	956	1,842
	Motor home	37.0	116.2	626.7	226	592	3,361
	Combination short-haul truck	86.9	1,559.9	405.7	456	7,867	2,147
	Combination long-haul truck	425.8	5,397.5	1,450.0	2,245	27,205	7,640
	Totals:	**19,162.9**	**32,380.6**	**209,281.7**	**117,999**	**172,963**	**1,273,697**

5.3 Quality assurance process

5.3.1 VMT estimates

Normal quality assurance procedures, including automated and manual consistency checks, were conducted by MAG in developing the 2014 TransCAD traffic assignment network used to generate the VMT data. The VMT estimates using the MAG travel demand model have been validated by the MAG transportation modeling group.

5.3.2 Emission estimates

The quality assurance process performed on the MOVES2014a analyses included accuracy, completeness, and reasonableness checks. For accuracy and completeness, all calculations were checked by an independent reviewer. Any errors found were corrected and the corrections were then rechecked by the reviewer.

5.3.3 Draft emissions inventory for ozone precursors

The draft onroad mobile source portion of the 2014 periodic emissions inventory for ozone precursors was reviewed using published EPA quality review guidelines for base year emission inventories (US EPA, 1992b). The procedure review (Levels I, II, and III) included checks for completeness, consistency, and the correct use of appropriate procedures.

5.4 Summary of all onroad mobile source emissions

Tables 5.4–1 and 5.4–2 summarize annual and season-day onroad mobile source emissions, by road type, for Maricopa County and the 8-hour ozone nonattainment area, respectively.

Table 5.4–1. Annual and ozone season-day onroad mobile source emissions in Maricopa County, by road type.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Road type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Off-network	13,578.2	8,358.6	67,754.4	86,049	44,064	350,974
Rural restricted access	189.0	2,289.5	4,152.3	1,051	11,762	26,707
Rural unrestricted access	369.8	1,609.9	7,837.3	2,104	8,607	50,833
Urban restricted access	1,891.1	11,187.9	61,961.9	10,754	59,405	405,375
Urban unrestricted access	3,280.6	10,773.3	68,533.2	18,726	58,434	445,899
Totals:	**19,308.7**	**34,219.1**	**210,239.1**	**118,683**	**182,273**	**1,279,788**

Table 5.4–2. Annual and ozone season-day onroad mobile source emissions in the 8-hour ozone nonattainment area, by road type.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Road type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Off-network	13,508.0	7,527.6	67,850.7	85,782	39,898	351,449
Rural restricted access	123.1	1,379.5	2,977.5	688	7,113	19,256
Rural unrestricted access	329.9	1,398.8	7,054.2	1,878	7,494	45,785
Urban restricted access	1,900.6	11,236.5	62,417.8	10,809	59,669	408,380
Urban unrestricted access	3,301.0	10,838.3	68,981.5	18,842	58,790	448,827
Totals:	**19,162.5**	**32,380.6**	**209,281.7**	**117,999**	**172,963**	**1,273,697**

Likewise, Tables 5.4–3 and 5.4–4 also summarize annual and season-day emissions from onroad mobile sources, by vehicle type.

Table 5.4–3. Annual and ozone season-day onroad mobile source emissions in Maricopa County, by vehicle type.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Vehicle type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Motorcycle	610.7	147.3	2,578.9	3,965	726	13,410
Passenger car	11,194.1	11,957.3	118,229.7	70,106	65,775	729,177
Passenger truck	4,831.3	6,945.3	62,091.7	29,429	38,214	379,627
Light commercial truck	1,231.2	1,901.2	15,942.8	7,427	10,514	96,897
Intercity bus	6.1	103.6	26.6	32	523	140
Transit bus	14.8	144.6	134.9	78	745	712
School bus	33.3	235.2	333.1	175	1,187	1,795
Refuse truck	19.4	313.7	116.2	104	1,583	615
Single unit short-haul truck	593.3	3,569.3	7,444.3	3,251	18,129	39,730
Single unit long-haul truck	30.5	192.4	350.2	167	977	1,865
Motor home	37.4	119.1	633.1	228	606	3,393
Combination short-haul truck	96.4	1,764.7	444.6	507	8,899	2,351
Combination long-haul truck	610.1	6,825.6	1,913.2	3,216	34,395	10,077
Totals:	**19,308.7**	**34,219.1**	**210,239.1**	**118,683**	**182,273**	**1,279,788**

Table 5.4–4. Annual and ozone season-day onroad mobile source emissions in the 8-hour ozone nonattainment area, by vehicle type.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Vehicle type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Motorcycle	612.9	145.6	2,554.4	3,983	718	13,281
Passenger car	11,233.3	11,917.0	117,990.7	70,369	65,544	727,225
Passenger truck	4,846.5	6,916.9	62,020.0	29,529	38,055	378,962
Light commercial truck	1,235.1	1,893.8	15,929.7	7,452	10,473	96,755
Intercity bus	5.8	95.9	25.0	30	484	132
Transit bus	13.8	132.8	125.3	73	684	662
School bus	31.6	217.0	325.8	165	1,095	1,756
Refuse truck	19.1	306.9	114.3	102	1,549	605
Single unit short-haul truck	584.8	3,492.9	7,368.4	3,205	17,742	39,332
Single unit long-haul truck	30.0	188.3	345.7	165	956	1,841
Motor home	37.0	116.2	626.7	226	591	3,360
Combination short-haul truck	86.9	1,560.0	405.7	456	7,867	2,147
Combination long-haul truck	425.7	5,397.5	1,450.0	2,245	27,205	7,640
Totals:	**19,162.5**	**32,380.6**	**209,281.7**	**117,999**	**172,963**	**1,273,697**

Table 5.4–5 summarizes the annual and ozone season-day emissions for VOC, NO_x, and CO from all onroad mobile sources in Maricopa County and the 8-hour ozone nonattainment area in 2014.

Table 5.4–5. Annual and ozone season-day emissions from all onroad mobile sources in Maricopa County and the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	19,308.7	34,219.1	210,239.1	118,683	182,273	1,279,788
8-hr ozone NAA	19,162.5	32,380.6	209,281.7	117,999	172,963	1,273,697

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6. Biogenic Sources

6.1 Introduction

Biogenic emissions have been estimated for the 2014 Periodic Emissions Inventory (PEI) for ozone precursors in Maricopa County and the 8-hour ozone nonattainment area (NAA) using the Model of Emissions of Gases and Aerosols from Nature (MEGAN). MEGAN is a state-of-the-art biogenic emissions model developed by the National Center for Atmospheric Research (NCAR). Some important corrections and improvements were made in the latest version of MEGAN2.1 (Jiang et al., 2011; Guenther et al., 2012) compared to its previous versions (Guenther, 2006a, 2006b, and 2007; Guenther et al., 2006). Volatile organic compounds (VOC), carbon monoxide (CO), and nitrogen oxides (NO_x) emissions are reported in the ozone precursor emission inventory.

In an effort to improve biogenic emission estimates, the methodology used to calculate biogenic emissions for the 2014 PEI has been updated from the methodology in the 2011 PEI. In the 2014 PEI, Weather Research and Forecasting Model (WRF) meteorology input data were generated using reanalysis data based on observational data from multiple weather stations. WRF data are hour-by-hour for the entire year of 2014 and spatially gridded using a 4km × 4km resolution with 56 × 44 grid cells. The 365 day-specific gridded biogenic emissions at each grid cell were calculated by MEGAN based on WRF meteorology data. These gridded emissions were summed together to calculate monthly and annual total emissions.

In contrast, meteorology data measured at the Southwest Solar Research Park were applied to all grid cells of the modeling domain in the 2011 PEI. The biogenic emissions were estimated for one representative day of each month using the monthly average diurnal cycle of the meteorological data at the site. The daily emissions were then multiplied by the number of days for each month to calculate the monthly total emissions. The monthly total emissions were summed together for annual emissions.

The methodology used in the 2011 PEI limited a realistic representation of the natural meteorological variability, and thereby reduced the overall biogenic emission magnitudes. Since daily biogenic emissions have a large range of temporal and spatial variability depending on the day-to-day weather conditions, the use of more dynamic values provided by the WRF meteorology resulted in a large increase in the monthly and annual biogenic emissions in the 2014 PEI.

For example, daily biogenic VOC emissions in June 2014 ranged from 905 to 1,369 tons per day in Maricopa County using day-to-day gridded WRF meteorology and totaled 36,382 tons for the entire month of June in the 2014 PEI. The biogenic VOC emissions for a representative day in June 2011 in the 2011 PEI were estimated at 498 tons per day in Maricopa County using monthly average meteorology data applied to all grid cells, and were multiplied by 30 days to estimate a total of 14,947 tons for the entire month of June. Since the 2011 PEI depended on the time- and space-averaged meteorological assumptions, the emissions total for a typical day was effectively smoothed to a value lower than the day-to-day range achievable with the more representative gridded data available to the 2014 PEI. As a result, the monthly and annual VOC emissions in the 2014 PEI are approximately two times larger than those in the 2011 PEI.

6.2 Modeling domain

MEGAN inputs and outputs are based on the user-defined two-dimensional grid cells. A 4-km grid modeling domain covering the entire area of Maricopa County and portions of neighboring counties are employed to develop biogenic emissions with MEGAN. The target areas for the development of biogenic emissions are the 8-hour ozone nonattainment area and Maricopa County within the 4-km domain. The modeling domain is defined with a Lambert Conformal Conic Projection (LCP) coordinate system presented in Table 6.2–1. Additional input files that mask areas covered by the 8-hour ozone nonattainment area and Maricopa County are developed by using Geographic Information Systems (GIS) software to calculate emissions for those two target areas. The masking file assigns 1.0 for the grid cells fully covered by the target area, a fractional value for grid cells partially covered by the target area (e.g., boundaries of Maricopa County or the 8-hour ozone nonattainment area), and 0.0 for grid cells outside the target area. As shown in Figure 6.2–1, biogenic emissions for the nonattainment area and Maricopa County are extracted from MEGAN simulations using the masked grid cells in the 4-km modeling domain.

Table 6.2–1. The modeling domain defined in the LCP coordinate system.

Grid horizontal resolution	Grid size	LCP range (km)	Target area
4 km	56 × 44	(32.4989, –113.3869) to (34.07317, –111.0435)	8-hour ozone NAA and Maricopa County

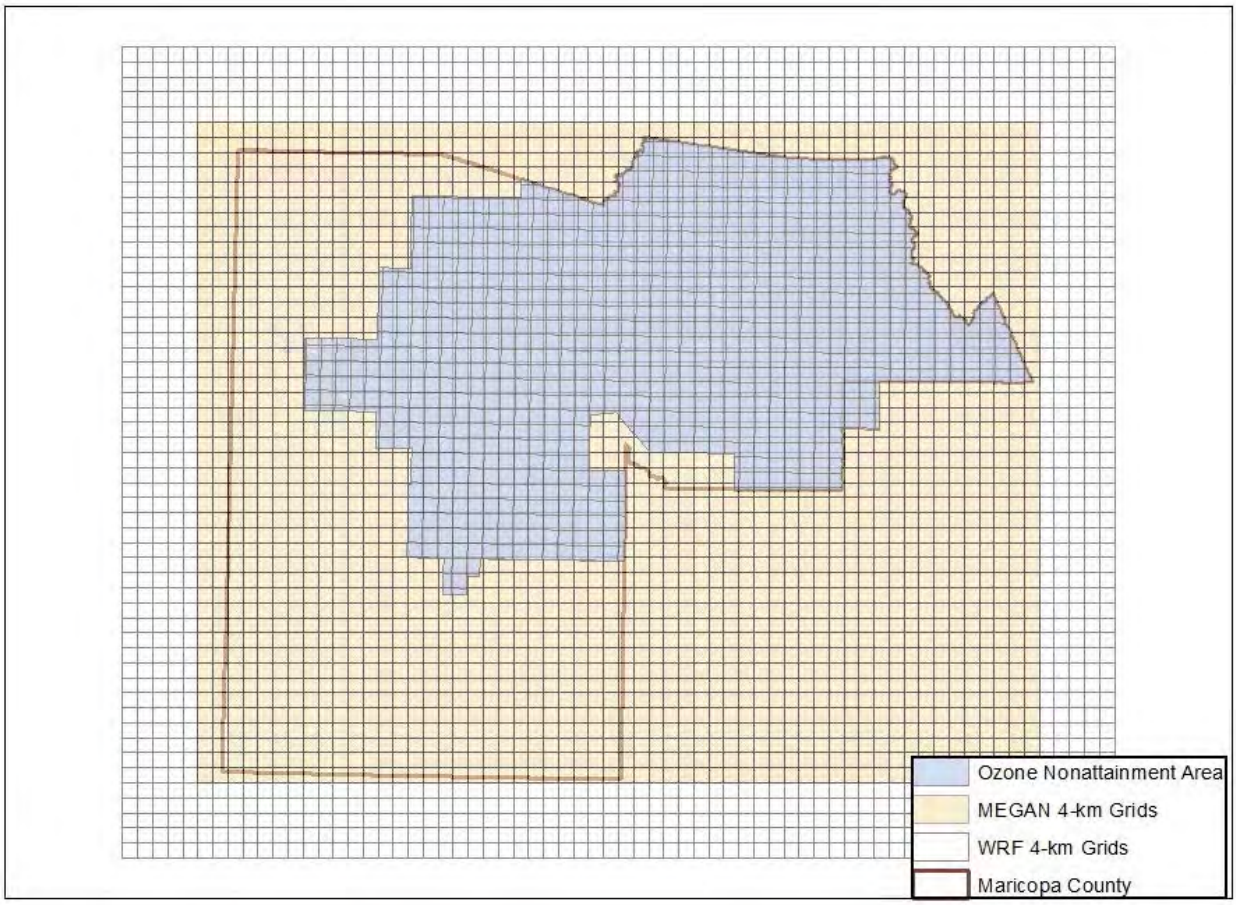

Figure 6.2–1. The masked grid cells in the 4-km modeling domain.

6.3 Input data

MEGAN requires that both land cover data and meteorological data be prepared as inputs to calculate biogenic emissions.

6.3.1 Land cover data

Land cover datasets released with MEGAN v2.1 include eight-day average leaf area index (LAI), percentages of 16 plant functional types (PFT), and emission factors (EF). The LAI data are based on a resolution of 30 arc-seconds (approximately 1 km) dataset from the North America Leaf Index (version 2011); the PFT data are 30 arc-seconds resolution from the North America Plant Functional Type (version 2011); and the EF data are from a 30 arc-seconds resolution global emission factor dataset.

6.3.2 Meteorological data

Meteorological data are obtained from WRF version 3.7 model runs after processing by the Meteorology-Chemistry Interface Processor (MCIP). The output of MCIP is then used as input to MET2MEG, a component program of MEGAN to generate meteorological input data for the biogenic emission model. The MET2MEG outputs include photosynthetically active radiation (PAR) at the surface, air temperature at 2 meters above surface, air pressure, humidity, wind speed, top-layer soil moisture and temperature, and accumulated precipitation for each hour.

Biogenic emissions of VOC and CO are mainly affected by temperature and solar radiation. Isoprene (a specific VOC) emissions are also dependent upon soil moisture. NOx emissions from soils depend upon soil temperature and water-filled pore space, which are determined by soil types and precipitation. Wind speed and humidity influence leaf temperature. Figure 6.3–1 shows daily mean air temperature, PAR, wind speed, air pressure, water vapor mixing ratio, 24-hour accumulated precipitation, and surface soil moisture and temperature. The highest daily mean temperature was recorded in July, while the maximum daily average PAR was observed in June, indicating the peak daily mean temperature occurred one month after the highest radiation.

In order to examine the reliability of WRF model results, temperature, the water vapor mixing ratio, wind speed, and solar radiation were validated using hourly observational datasets from the National Weather Service (NWS; DS472.0) and the Arizona Meteorological Network (AZMET) stations. There are 12 NWS stations and 13 AZMET stations within the 4-km grid modeling domain. The model validation results are illustrated in Figure 6.3–2. The temperature and water vapor mixing ratio are well replicated with coefficients of determination (R^2) of 0.97 and 0.89, respectively. The positive bias of solar radiation indicates the overestimation of PAR and solar radiation by WRF, likely due to inaccurately modeled cloud data.

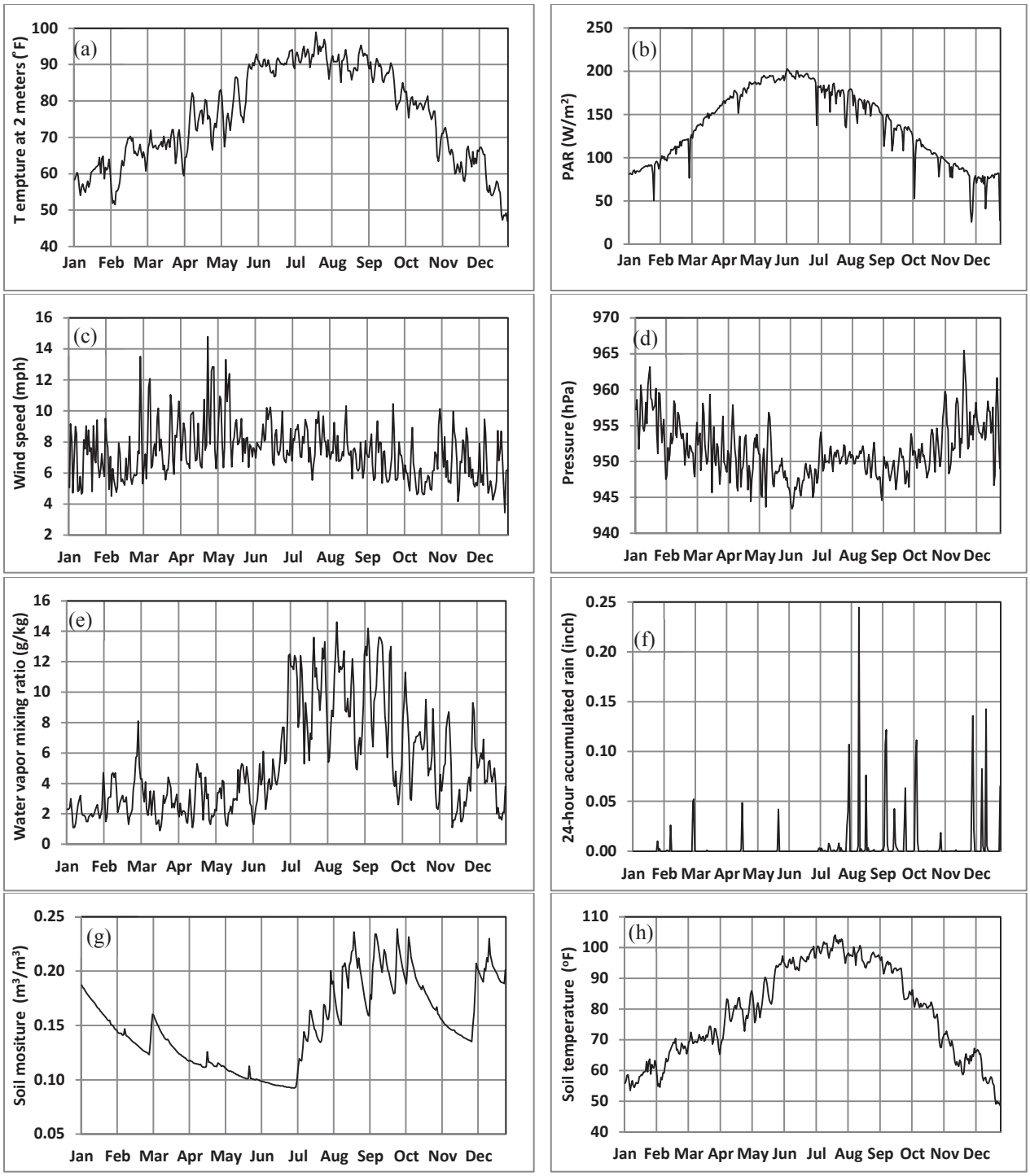

Figure 6.3–1. Daily averages of meteorological variables derived from WRF simulations for 2014. (a) air temperature at 2-m height, (b) PAR, (c) wind speed, (d) air pressure, (e) water vapor mixing ratio, (f) 24-hour accumulated precipitation, (g) soil moisture, and (h) soil temperature.

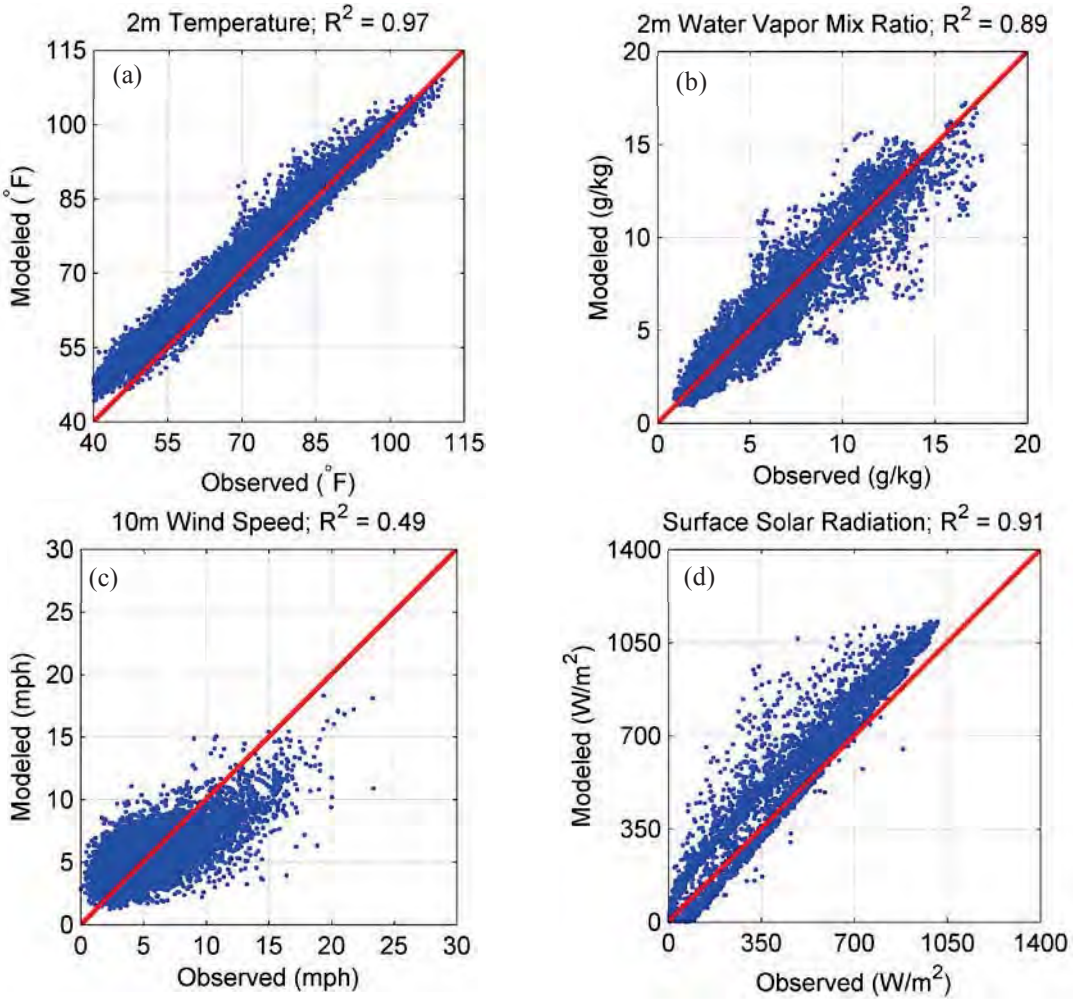

Figure 6.3–2. Validation results of WRF model simulations using hourly observational data from NWS and AZMET: (a) air temperature at 2-m height, (b) water vapor mixing ratio, (c) wind speed, and (d) surface solar radiation. Results are based on paired hourly modeled and observed data for all of 2014. R^2 = coefficient of determination.

6.4 Emission estimation

Daily average emissions for each month in 2014 are provided in Table 6.4–1 for the 8-hour ozone nonattainment area and Maricopa County. Daily average emissions in 2014 (left panel) and diurnal emission cycles (right panel) of ozone precursors (VOC, NO_x, and CO) for Maricopa County and the 8-hour ozone nonattainment area are illustrated in Figure 6.4–1. Monthly biogenic emissions for the 8-hour ozone nonattainment area and Maricopa County are presented in Table 6.4–2. The maximum emissions occurred the ozone season (June–August), as temperature and solar radiation reached their highest levels during these summer months.

Table 6.4–1. Average daily biogenic emissions (lbs/day) for Maricopa County and the 8-hour ozone nonattainment area, by month.

	Maricopa County			8-hour ozone NAA		
Month	**VOC**	**NO_X**	**CO**	**VOC**	**NO_X**	**CO**
January	123,683	1,068	11,735	66,808	621	6,544
February	284,837	2,147	29,906	152,442	1,248	16,531
March	445,427	3,021	52,792	246,449	1,816	30,112
April	664,032	3,905	84,399	358,515	2,311	47,388
May	1,327,969	6,425	169,625	741,132	3,900	97,962
June	2,425,520	10,360	309,840	1,338,130	6,243	178,099
July	2,715,657	12,531	342,128	1,541,904	7,637	201,635
August	1,999,716	10,813	248,697	1,083,019	6,425	140,580
September	1,388,472	8,297	168,139	716,631	4,811	91,042
October	606,096	4,021	68,960	310,059	2,230	36,916
November	173,151	1,166	17,788	90,108	655	9,592
December	91,809	954	7,886	50,424	558	4,398

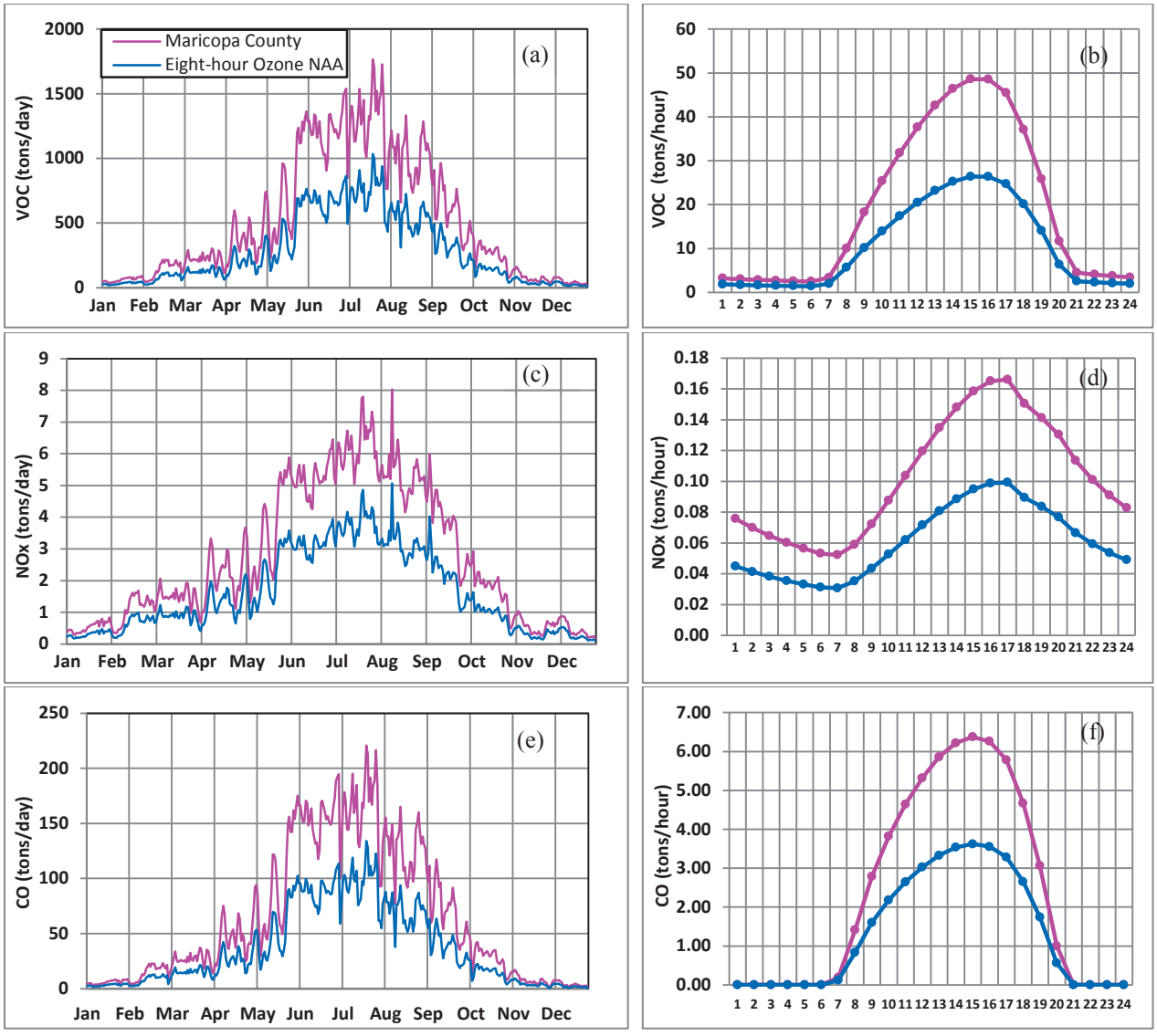

Figure 6.4–1. Average daily biogenic emissions, by month (left) and annual diurnal emission cycle (right) of VOC (top), NO_x (center), and CO (bottom), for both Maricopa County (pink line) and the 8-hour ozone nonattainment area (blue line).

Table 6.4–2. Biogenic emissions (tons/month) for Maricopa County in 2014 for Maricopa County and the 8-hour ozone nonattainment area, by month.

	Maricopa County			8-hour ozone NAA		
Month	**VOC**	**NO_X**	**CO**	**VOC**	**NO_X**	**CO**
January	1,917.1	16.6	181.9	1,035.5	9.6	101.4
February	3,987.7	30.1	418.7	2,134.2	17.5	231.4
March	6,904.1	46.8	818.3	3,820.0	28.1	466.7
April	9,960.5	58.6	1,266.0	5,377.7	34.7	710.8
May	20,583.5	99.6	2,629.2	11,487.5	60.4	1,518.4
June	36,382.8	155.4	4,647.6	20,072.0	93.7	2,671.5
July	42,092.7	194.2	5,303.0	23,899.5	118.4	3,125.3
August	30,995.6	167.6	3,854.8	16,786.8	99.6	2,179.0
September	20,827.1	124.5	2,522.1	10,749.5	72.2	1,365.6
October	9,394.5	62.3	1,068.9	4,805.9	34.6	572.2
November	2,597.3	17.5	266.8	1,351.6	9.8	143.9
December	1,423.1	14.8	122.2	781.6	8.6	68.2
Totals:	**187,065.9**	**987.9**	**23,099.4**	**102,301.8**	**587.2**	**13,154.5**

6.5 Summary of all biogenic source emissions

Annual and ozone season-day (June–August) emissions from biogenic sources for both Maricopa County and the 8-hour ozone nonattainment area are provided in Table 6.5–1.

Table 6.5–1. Annual and season-day biogenic emissions for Maricopa County and the 8-hour ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	187,065.9	987.9	23,099.4	2,380,298	11,235	300,222
8-hr ozone NAA	102,301.8	587.2	13,154.5	1,321,018	6,768	173,438

6.6 References

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Guenther, A., 2006b. User's Guide to the Model of Emissions of Gases and Aerosols from Nature (MEGAN) Version MEGAN-VBA-2.0.

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Guenther, A., T. Karl, P. Harley, C. Wiedinmyer, P. I. Palmer, and C. Geron, 2006. Estimates of global terrestrial isoprene emissions using MEGAN (Model of Emissions of Gases and Aerosols from Nature), *Atmos. Chem. Phys*., 6, 1–30.

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Jiang, X., A. Guenther, T. Duhl, and T. Sakulyanontvittaya, 2011. MEGAN version 2.10 User's Guide. NCAR Earth Systems Laboratory, Atmosperhic Chemistry Division. www.acom.ucar.edu/webt/MEGAN/MEGAN2.1_User_Guide_05-07-2012.pdf

Appendix A. Instructions for Reporting 2014 Annual Air Pollution Emissions

Maricopa County
Air Quality Department

INSTRUCTIONS

FOR REPORTING 2014

ANNUAL AIR POLLUTION EMISSIONS

revised
January 2015

Emissions Inventory Unit
1001 North Central Avenue, Suite 125
Phoenix, Arizona 85004

Phone: (602) 506-6790
Fax: (602) 506-6179
Email: *EmisInv@mail.maricopa.gov*

Copies of this document, related forms,
and other reference materials are available online at our web site:
http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

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APPENDIX. List of Valid Control Device Codes for 2014

WHAT'S NEW FOR 2014?

Emission factors, codes, etc.:

- U.S. EPA has revised (i.e., retired, replaced, and/or combined) many **Control Device Codes**. If you report control devices please verify the current "Control Type Code" (col. 4 on the Control Device Form) to ensure that your control equipment has been properly (re)assigned. For your convenience, we have included a complete 2-page list of all currently valid Control Device Codes as an appendix to this document.

- We have standardized the reporting of several types of **PM_{10}-generating processes** that use watering to reduce emissions (e.g., unpaved road travel, stockpiles, and certain activities at sand/gravel operations and concrete batch plants). For those processes that use an emission factor that already incorporates this control measure (i.e., **"Controlled EF?"** is "**Y**" in Col. 18 on the General Process Form), values for capture and control efficiencies are no longer pre-printed, to avoid double-counting the emission reductions achieved by watering.

- The PM_{10} emission factor for **certain crematory processes** has been updated (from 0.8 lb/ton to 5.92 lb/ton) to reflect current EPA guidance, and to be consistent with the values that MCAQD uses to establish emission limits when issuing permits.

Reporting forms:

- Some **preprinted information** on your report may be different from last year's version. Please review the enclosed forms carefully, and **VERIFY THOROUGHLY that the information you provide on all reporting forms match the information presented on the preprinted forms from MCAQD.**

- Many of our reporting forms have changed in past years. If you develop your own forms, or a computerized reproduction of our forms, the forms used ***must*** conform to the current information requirements and **FORMAT** as supplied on our preprinted forms. "Homemade" reporting forms that vary significantly from the preprinted forms sent to you will ***not*** be accepted.

Miscellaneous:

- **Non-operational facilities**: Any facility that has been issued an air quality permit, but that did NOT operate at any time during 2014, must still respond in writing to this request for annual emissions information, as a condition of its air quality permit. Please provide ALL information requested on both the "Business Form" and the "Data Certification Form", and submit these forms, along with a letter certifying that there were no operations at the facility during calendar year 2014, by the due date shown on the Business Form.
- **Emissions fees for Title V facilities:** In accordance with Maricopa County Air Pollution Control Rule 280 (Fees), the 2014 annual emission fee for Title V sources is $42.21/ton. **NOTE:** Only emissions from Title V sources (those whose air quality permit numbers have a **"V"** prefix) are subject to this annual emissions fee.

I. INTRODUCTION

An annual emissions inventory is a document submitted by a business that: (1) lists all processes emitting reportable air pollutants and (2) provides details about each of those processes. Submitting the emissions inventory report is ***required*** as a condition of your Maricopa County Air Quality Permit. A separate emissions report is required for each business location with its own air quality permit.

Follow these steps to complete your 2014 Maricopa County emissions inventory:

STEP 1: Determine which forms are needed for your business. There are eight different forms available, but not all are required for every type of business. For most permitted sources, the packet you received from us contains the necessary preprinted forms based on your site's most recent emissions inventory.

1. **Business Form**: Contains general contact information about the permitted site. This form is required for all businesses.
2. **Stack Form**: Only required if your business location annually emits over 10 tons of a single pollutant (CO, VOC, NO_x, PM_{10}, or SO_x). A "stack" is defined as a stack, pipe, vent or opening through which a significant percentage of emissions (from one or more processes) are released into the atmosphere. See the "Stack Form Instructions" on page 9 for specific requirements.
3. **Control Device Form**: Required only if there is one or more emission control devices used at the business location.
4. **General Process Form** and
5. **Evaporative Process Form**: } Either or both will be required for all businesses.
6. **Off-Site Recycling/Disposal Form**: Required if you want to claim off-site recycling or disposal.
7. **Emission Factor Calculations**: Required as attachment for each process for which you calculated your own emission factors.
8. **Data Certification Form or Data Certification/Fee Calculation Form**: Only those major sources with a **Title V** permit are required to pay annual emissions fees, and thus need to use the Data Certification/Fee Calculation Form. All other sources use the Data Certification Form.

STEP 2: Complete the applicable forms. Verify all preprinted information, and make corrections where necessary. When making corrections, strike out the preprinted data and write in corrections beside it. Please make all changes readily noticeable. Detailed information on how to complete the most common forms is included in this document. The packet you received also contains information about other resources (workshops, one-on-one assistance, etc.) available to help you in completing the necessary forms.

STEP 3: Make a copy of your completed emissions inventory report. Make sure to KEEP COPIES of all forms submitted and copies of all records and calculations used in completing the forms. Air pollution control regulations require that you keep all documentation for at least FIVE YEARS at the location where pollution is being emitted.

STEP 4: Make sure the Data Certification Form (or Data Certification/Fee Calculation Form for Title V sources) is ***signed*** by a company representative. ***Include your air quality permit number on all correspondence and applicable checks submitted with your report.*** Return the ***original***, signed copy of your annual emission report, with payment for any applicable emission fees to:

Maricopa County Air Quality Department
Emissions Inventory Unit
1001 North Central Avenue, Suite 125
Phoenix, AZ 85004

II. REPORTING REQUIREMENTS

POLLUTANTS TO BE REPORTED:
Your emissions inventory must include your business's emissions of the following air pollutants:

CO	=	Carbon monoxide
NO_x	=	Nitrogen oxides
PM_{10}	=	Particulate matter less than 10 microns
SO_x	=	Sulfur oxides
VOC	=	Volatile organic compounds *
HAP&NON	=	Hazardous Air Pollutant (HAP) that is also NOT a volatile organic compound (VOC)**
NH_x	=	Ammonia and ammonium compounds
Pb	=	Lead

* A ***volatile organic compound (VOC)*** is defined as any compound of carbon that participates in atmospheric photochemical reactions. This definition ***excludes***: carbon monoxide, carbon dioxide, acetone, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, as well as certain other organic compounds. (See Maricopa County Air Pollution Control Rule 100, Sections 200.69 and 200.110 for a full definition.)

EPA has re-designated the chemical **t-butyl acetate (CAS Number 540-88-5)** as a VOC for record-keeping requirements and emissions reporting, but not for emission limitations or content requirements. County Rule 100, Section 200.69b states:

"The following compound(s) are VOC for purposes of all recordkeeping, emissions reporting, photochemical dispersion modeling and inventory requirements which apply to VOC and shall be uniquely identified in emission reports, but are not VOC for purposes of VOC emissions limitations or VOC content requirements: t-butyl acetate (540-88-5)."

Therefore, if your facility uses t-butyl acetate, it is necessary to report t-butyl acetate as a separate material on the evaporative process form, not as part of a grouped material (e.g., solvents, thinners, activators, etc.). T-butyl acetate will continue to be identified as a VOC on your emission report and count towards any applicable emission fees.

** ***HAP&NON:*** Usage of certain materials that are: (1) a Hazardous Air Pollutant (HAP) **and** (2) **not** also a VOC (that is, not also an ozone precursor) should also be reported if:
(a) your site is subject to a Federal MACT (Maximum Achievable Control Technology) standard ***or***
(b) your air quality permit contains specific quantitative limits for HAP emissions.

The most common materials categorized as "HAP&NON" include:

- methylene chloride (dichloromethane)
- perchloroethylene
- 111-trichloroethane (111-TCA or methyl chloroform)
- hydrochloric acid
- hydrofluoric acid

NOTE: HAPs that are also considered volatile organic compounds are reported as VOC.

EMISSION CALCULATION METHOD HIERARCHY:

When preparing emission information for your report, the most accurate method for calculating **actual** emissions must be used. The hierarchy listed below outlines the preferred methods for calculating emission estimates (taken from County Rule 280, Section 305.1).

(1) Whenever available, emissions estimates should be calculated from continuous emissions monitors certified under 40 CFR Part 75, Subpart C, or data quality assured pursuant to Appendix F of 40 CFR, Part 60.

(2) When sufficient data obtained using the methods described in paragraph 1 is not available, emissions estimates should be calculated from source performance tests conducted pursuant to Rule 270 in Maricopa County's Air Pollution Control Rules and Regulations.

(3) When sufficient data obtained using the methods described in paragraphs 1 or 2 is not available, emissions estimates should be calculated from material balance using engineering knowledge of the process.

(4) When sufficient data obtained using the methods described in paragraphs 1 through 3 is not available, emissions estimates shall be calculated using emissions factors from EPA Publication No. AP-42 "Compilation of Air Pollutant Emission Factors," Volume I: Stationary Point and Area Sources.

(5) When sufficient data obtained using the methods described in paragraphs 1 through 4 is not available, emissions estimates should be calculated by equivalent methods supported by back-up documentation that will substantiate the chosen method.

III. CONFIDENTIALITY OF DATA SUBMITTED

Information submitted in your annual emissions reports must be made available to the public unless it meets certain criteria described in Arizona Revised Statutes and Maricopa County Rules. Applicable excerpts concerning confidentiality of data are reproduced below.

A.R.S. § 49-487 D. ...the following information shall be available to the public:…

2. The chemical constituents, concentrations and amounts of any emission of any air contaminant. ...

MARICOPA COUNTY AIR POLLUTION CONTROL RULES AND REGULATIONS, Rule 100:

§ **200.107 TRADE SECRETS -** Information to which all of the following apply:

a. A person has taken reasonable measures to protect from disclosure and the person intends to continue to take such measures.

b. The information is not, and has not been, reasonably obtainable without the person's consent by other persons, other than governmental bodies, by use of legitimate means, other than discovery based on a showing of special need in a judicial or quasi-judicial proceeding.

c. No statute, including ARS §49-487, specifically requires disclosure of the information to the public.

d. The person has satisfactorily shown that disclosure of the information is likely to cause substantial harm to the business's competitive position.

§ **402 CONFIDENTIALITY OF INFORMATION:**

402.2 Any records, reports or information obtained from any person under these rules shall be available to the public ... unless a person:

a. Precisely identifies the information in the permit(s), records, or reports which is considered confidential.

b. Provides sufficient supporting information to allow the Control Officer to evaluate whether such information satisfies the requirements related to trade secrets as defined in Section 200.107 of this rule.

For emissions inventory information to be deemed confidential, the following steps must be followed:

- Specific data which you request be held confidential must be identified by marking an "X" in the corresponding gray confidentiality box(es) on the relevant report forms.
- Provide a written explanation which gives factual information satisfactorily describing why releasing this information could cause substantial harm to the business's competitive position.
- Use the gray-shaded boxes on the reporting forms to indicate which data are to be held confidential. Do NOT stamp "Confidential", highlight data, or otherwise mark the page.

NOTE: No data can be held confidential without proper justification. We will reply in writing to all requests for confidentiality, detailing which individual data elements for each process have been deemed confidential.

IV. HELPFUL HINTS AND INFORMATION

Be sure to verify all preprinted information on forms. If any information is incorrect or blank, please provide correct information. Making a change on the Business Form will **NOT** transfer the permit ownership or location. You must contact the Department's Business Assistance Program at (602) 506-5102 or the Engineering & Permitting Division at (602) 506-6094 to accomplish this.

WHAT IS A PROCESS? A ***process*** is a business activity at your location that emits one or more of the pollutants listed on page 3, and has only ***one*** material type as input and ***one*** operating schedule. For each applicable process at your business, you must assign a unique Process ID number to differentiate each process.

PROCESSES AND MATERIALS THAT DO ***NOT*** HAVE TO BE REPORTED:

- Welding.
- Acetone usage.
- Fuel use for forklifts or other vehicles. (Note: Fuel use in ***non-vehicle*** engines ***is*** reportable.)
- Soil remediation activities. (Note: Other periodic reporting requirements may exist; consult your permit.)
- Storage emissions from fuels or organic chemicals in any tank with a capacity of 250 gallons or less.
- Storage emissions of diesel and Jet A fuel in underground tanks of any size.
- Storage emissions of diesel and Jet A fuel in aboveground tanks, with throughput < 4,000,000 gal/yr.
- Routine pesticide usage, housekeeping cleaners, and routine maintenance painting at your facility.

Please group all similar equipment and materials together before applying the following limitations:

- Internal combustion engines (e.g., emergency generators) or external combustion equipment (e.g., boilers and heaters) that operated less than 100 hrs. and burned less than 200 gals. diesel or gas, or less than 100,000 cubic feet of natural gas.
- Materials with usage of less than 15 gallons or 100 pounds per year.

GROUPING MATERIALS AND/OR EQUIPMENT UNDER ONE PROCESS ID:
You can group together under one process ID:

- All internal combustion engines ***less than 600 hp*** if they burn the same fuel and have similar operating schedules.
- All external combustion equipment (boilers, heaters) with a capacity of ***less than 10,000,000 Btu*** per hour if they burn the same fuel and have similar operating schedules.
- All similar evaporative materials with similar emission factors that have similar operating schedules and process descriptions. For example, group low-VOC red paint, green paint and white paint together as one material: "Paint: Low-VOC." Do ***not*** group dissimilar materials together, such as thinners and paints. Attach documentation (see example, p. 20) showing how the grouped emission factor was determined.
- All underground tanks with the same fuel and same type of vapor recovery system.

ASSIGNING IDENTIFICATION NUMBERS (IDs):
Unique IDs are required for the following report elements: Stacks, Control Devices and Processes. For processes, that means a process ID number may be used only once on each General Process form and for each material reported on the Evaporative Process Forms.

These numbers are usually assigned by the person who prepares the original report. If you are adding a new item to a preprinted report, assign a number not already in use. Once an ID number is assigned, continue using the same number for that item each year. If that item is no longer reportable, mark it with 'DELETE' and return the preprinted form with a brief explanation. Do not use that ID number again.

INDUSTRY-SPECIFIC INSTRUCTIONS: Additional help sheets, detailed examples, and special instructions are available for a number of specific processes or industries listed below. To get copies of any of these documents, please call (602) 506-6790, or visit our web site at:
http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

- Bakeries
- Concrete Batch Plants
- Fuel Storage and Handling
- Incinerators and Crematories
- Lg. Aboveground Storage Tanks
- Natural Gas Boilers/Heaters
- Polyester Resin
- Printing Plants
- Roofing Asphalt
- Sand and Gravel Plants
- Using EPA's TANKS 4.09d Program
- Vehicle Refinishing
- Vehicle Travel on Unpaved Roads
- Woodworking

COMMONLY USED CONVERSION FACTORS:

1 gram/liter	=	0.00834 lbs/gal	1 foot	=	0.0001894 mile
1 liter	=	0.2642 gallon (US)	1 square foot	=	0.000022957 acre
1 therm	=	0.0000952 MMCF	1 pound	=	0.0005 ton

NOTE: MM = 1,000,000 Example: MMCF = 1,000,000 cubic feet
M = 1,000 Example: MGAL = 1,000 gallons

ADDITIONAL RESOURCES AND ASSISTANCE:
The Maricopa County Emissions Inventory web site at:
http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx
contains additional reference materials, such as:

- blank copies of most emissions reporting forms.
- an updated list of emission factors for a large number of industrial processes, including SCC codes.
- a list of Tier Codes for industrial processes.
- detailed help sheets for a number of specific industries or processes.

To receive any of the above materials by fax or mail, or for additional information or assistance in how to calculate and report your emissions, please call us at (602) 506-6790 or email at EmisInv@mail.maricopa.gov.

V. INSTRUCTIONS AND EXAMPLES FOR COMPLETING EMISSIONS REPORTING FORMS

Business Form Instructions

Verify all preprinted information, and make corrections where necessary. When making corrections, strike out the preprinted data and write in corrections beside it. Please make all changes readily noticeable.

NOTE: Making a change on the Business Form will **NOT** transfer the permit ownership or location. You must contact the Department's Business Assistance Program at (602) 506-5102 or the Engineering & Permitting Division at (602) 506-6094 to accomplish this.

Data fields:

6 Number of employees: This should be the annual average number of full-time equivalent (FTE) employee positions ***at this business location***.

9 NAICS Code: This 5- or 6-digit North American Industrial Classification System (NAICS) code has been introduced to replace the 4-digit Standard Industrial Classification (SIC) codes. Please list the primary and secondary NAICS codes for your business, if known. (Consult our website, at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx, for a link to a full list of NAICS codes.)

10 Preparer of the Inventory (primary contact for technical questions concerning this report): This should be the person who knows the most about the data in the report. If this person has an e-mail address used for business purposes, please provide it.

11 Who should receive the Annual Emissions Inventory Form next year?: This should be a person who is directly employed with the business. This person should not be a consultant for the business.

Stack Form Instructions

A "stack" is defined as a **stationary** stack, pipe, vent or opening through which a significant percentage of emissions (from one or more processes) are released into the atmosphere (with or without a control device).

NOTE: Stack information is required only if your business location annually emits over 10 tons of any one individual pollutant. If so, you must complete a Stack Form for:

- each stack connected to a control device.
- any stack that discharges annually more than 5 tons of combined pollutant emissions (such as a paint booth exhaust).

EXAMPLE Stack Form Information:

1	2	3	4	5a OR 5b		6a OR 6b & 6c			7
Stack ID	Stack Type Code*	Stack Height**	Exit Gas Temperature	Velocity feet/sec	Flow Rate acfm	Diameter inside inch	Length / Width inside inch		Stack Name/Description. Include lat/long coordinates of stack (in decimal degrees)
1	***W***	***30*** ft	***90*** ^{o}F		***20,000***	***36***			***paint booth Lat: N33.5277 Long: W112.2626***
2	***V***	***14*** ft	***200*** ^{o}F		***19,186***	***40***			***thermal oxidizer, Bldg. 2 Lat:N33.5259 Long:W112.2613***

* Stack Type Codes: **V** = Vertical unobstructed; **H** = Horizontal unobstructed; **D** = Downward unobstructed; **G** = Gooseneck; **W** = Obstructed vertical (e.g. weather cap)

** Stack height is calculated relative to the surrounding terrain. For instance, the stack height of a 10-foot stack on top of a 20-foot tall building is 30 feet.

Data fields:

1 Stack ID: (See "Assigning Identification Numbers" on page 6.) A number (up to three digits, numeric only) which identifies a specific stack. It is suggested you start with 1, then 2, etc.

4 Exit Gas Temperature: Should represent average operating conditions, in degrees Fahrenheit. ***DO NOT*** report "ambient".

5a Exit Gas Velocity: ***OR*** 5b Gas Flow Rate:
Provide ***EITHER*** the exit velocity (in feet per second) ***OR*** the flow rate of gas (in actual cubic feet per minute) exiting the stack during normal operations. Preprinted information provides both.

6a Inside Stack Diameter: For round stacks, provide Inside Stack ***Diameter*** in inches.
OR
6b & 6c Inside Stack Length and Width: For square or rectangular stacks, provide inside ***Length and inside Width*** in inches.

7 Stack Name/Description and Lat/Long Coordinates: Provide a brief text description of the stack along with the latitude and longitude coordinates of the stack (in decimal degrees).

Control Device Form Instructions

EXAMPLE Control Device Form Information

1	2	3	4	5	6
Control ID	Installation/ Reconstruction* Date	Size or Rated Capacity**	Control Type Code	Control Device Name/Description	Stack ID
1	***05/09/98***	***25,000.0*** cfm	***021***	***Thermal oxidizer***	***2***
4	***03/10/97***	cfm	***217***	***Watering with water trucks***	

Data fields:

1 Control ID: (See "Assigning Identification Numbers" on page 6.) A unique number (up to three digits) that you assign to identify a specific control device.

2 Installation/Reconstruction Date: The completion date (given in *mm/dd/yy* format) of installation or the most recent reconstruction of the identified control device. This is not a date on which routine repair or maintenance was done. "Reconstruction" means any component of the control device was replaced and the cost (fixed capital) of the new component(s) was more than half of what it would have cost to purchase or construct a new control device.

3 Size or Rated Capacity: Report the air or water flow rate in ***cubic feet per minute***. Some devices (e.g., water trucks for dust control) will not include a value in this field.

4 Control Type Code: A 3-digit code designating the type of control device. A complete list of all EPA control device codes can be found on the Web at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions inventory/Default.aspx or call (602) 506-6790 for assistance.

6 Stack ID: Not all businesses require a Stack ID. This is required if the Stack Form is used for your site (see page 9) ***and*** the control device is vented through that identified stack. This is the ID number shown in column 1 of the Stack Form. The Stack ID can be entered on this form after the Stack Form has been filled out.

General Process Form Instructions

The General Process Form is used to record data on all emissions-producing processes except evaporative processes. A "***general process***" is normally characterized by the burning or handling of a material. One form reports all the pollutants for one process. For example, several pollutants are produced by burning fuel, and PM_{10} is emitted by processing rock products, processing materials such as wood or cotton, and driving on unpaved areas.

Data fields: (See sample forms on pages 13 and 14.)

1 Process ID: A number (up to three digits) that is preprinted or you assign. (See "Assigning Identification Numbers" on page 6.) This Process ID number is unique and can not be used for any other process at this location.

2 Process Type/Description: Brief details on the type of activity that is occurring.

3 Stack ID(s): The stack ID number(s) shown in column 1 of the Stack Form that identify the stack(s) which vent pollution created by this process. Not all businesses are required to report stacks. This is only required if the Stack Form is required for your site (see page 9) ***and*** the process has a stack.

4 Process Tier Code and
5 SCC Code:

If these codes are not preprinted on your form, please consult the section "Other Resources" on our web site, or call (602) 506-6790.

6 Seasonal Throughput Percent: Enter the percent of total annual operating time that occurred per season, rounded to the nearest percent. For example, "Dec-Feb 30% " means 30% of total annual activity occurred in January, February and December 2014. The total for all four seasons must equal 100%.

7 Normal Operating Schedule and
8 Typical Hours of Operation:

These reflect the normal daily, weekly, and annual operating parameters of ***this process*** during 2014.

9 Emissions Based on: Provide the ***name*** of the material used, fuel used, product produced, or whatever was measured for the purpose of calculating emissions, such as "natural gas", "hours of operation," "vehicle miles traveled," or "acres."

10 Used, Produced or Existing: Indicate whether calculated emissions are based on a material type or fuel *used* (an input, such as "paint" or "natural gas"), or an *output* (such as "sawdust produced" or "finished product"). Use "Existing" if the parameter reported on line 9 is not directly used or produced in the process (such as "vehicle miles traveled" or "acres").

11 Annual Amount: The annual amount (a number) of material that was used, fuel combusted, product produced, hours of operation, vehicle miles traveled, or acres.

12 Fuel Sulfur Content (in percent): For processes that involve the combustion of oil or diesel fuels, report the sulfur content of the fuel as a decimal value. Example: 0.05 % (= 500 ppm)

13 Unit of Measure: Units of the material used, fuel used or product produced shown on line 9. For example: gallons, pounds, tons, therms, acres, vehicle miles traveled, units produced.

14 Unit Conversion Factor: You must provide this if you use an emission factor with an emission factor unit (see item 17 below) that is ***not*** the same as the unit of measure (from line 13). This is the standard number you would multiply your amount (line 11) by to convert it to the units of the emission factor. See page 7 for a list of commonly used conversion factors.

General Process Form Instructions (continued)

15 Pollutant: See page 3 for a list of pollutants that need to be reported.

16 Emission Factor (EF): The number to be multiplied by the annual amount (line 11) to determine how much of the pollutant was emitted. If you calculate your own emission factor or change the preprinted emission factor, you must provide details of your calculations in an attachment.

17 Emission Factor (EF) Units: Enter the appropriate Emission Factor Units in pounds (lb) per unit; e.g., lb/ton, lb/MMCF, lb/gal.

18 Controlled Emission Factor (EF)? YES or NO: Indicate "YES" if: 1) you have your own emission factor from testing **and** included the control device efficiency within the factor, or 2) the emission factor used is clearly identified as a controlled emission factor. A "YES" response requires the use of Formula A (see #25 below). Indicate "NO" if: 1) there is no emission control device, or 2) the emission factor represents emission rates **before** controls. A "NO" response requires the use of Formula B (see #25 below).

19 Calculation Method: Enter the number code (listed at the bottom of the General Process Form) which best describes the method you used to obtain this emission factor. Code 5, "AP-42/FIRE Method or Emission Factor" means that the factor comes from EPA documents or software. ***NOTE:*** If you have continuous emissions monitors (CEM) data or conducted a source test that was required and approved by the County for a specific process or piece of equipment, you ***must*** use the emission data from the CEM or the test results. Report "1" in this column for CEM data or "4" for performance test data.

20 through 24: Leave blank if there is no control device.

20 Capture % Efficiency: The percent of the pollutant that is captured and sent to the primary control device in this process. Be sure to list capture efficiency separately for ***each*** pollutant affected.

21 Primary Control Device ID: If this pollutant is being controlled in this process, enter the Control Device ID number which represents the first control device affecting the pollutant.

22 Secondary Control Device ID: If this pollutant is being controlled sequentially by 2 devices, enter the Control Device ID number which represents the second control device; otherwise leave this field blank.

23 Control Device(s) % Efficiency: Enter the total control efficiency of the control device(s). Be sure to list control device efficiency separately for ***each*** pollutant affected. If you report control device efficiency, you must ***also*** show capture efficiency in column 20.

24 Efficiency Reference Code: Enter the code (1 through 6) that best describes how you determined the ***control device efficiency***. A list of possible codes is included at the bottom of the form.

25 Estimated Actual Emissions (in pounds/year): You may round the calculated emissions values to the nearest pound. Calculate as follows:

A. *Emissions with no controls* or *controls are reflected in the emission factor:*
Column 25 = line 11 × line 14 × column 16

B. *Emissions after control:*
Column 25 = line 11 × line 14 × column 16 × (1 – [column 20 × column 23])

Use the decimal equivalent for columns 20 and 23. Example: 96.123% = 0.96123

General Process Form **2014**

EXAMPLE: Internal Combustion

Permit number(s) V99999

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process ID 80

2- Process Type/Description: 3 ENGINES FOR CRUSHING (EACH LESS THAN 600 HP)

3- Stack ID(s) *(only if required on Stack Form)* _____ _____ _____ _____ _____

4- Process TIER Code: 020599 FUEL COMB. INDUSTRIAL: INTERNAL COMBUSTION

5- SCC Code 20200102 *(8 digit number)* IND:DIESEL-RECIPROCATING

6- Seasonal Throughput Percent: Dec-Feb 20 % Mar-May 25 % Jun-Aug 30 % Sep-Nov 25 %

7- Normal Operating Schedule: Hours/Day 8 Days/Week 5 Hours/Year 2080 Weeks/Year 52

8- Typical Hours of Operation: *(military time)* Start 0700 End 1530

9- Emissions based on *(name of material or other parameter, e.g. "rock", "diesel", "vehicle miles traveled")* DIESEL

10- [X] Used (input) or [ ] Produced (output) or [ ] Existing (e.g. VMT, acres)

11- Annual Amount: *(a number)* 16,250 12- Fuel Sulfur Content (in percent) 0.05 %

13- Unit of Measure: *(for example: tons, gallons, million cu ft, acres, units produced, etc.)* GALLONS

14- Unit Conversion Factor *(if needed to convert Unit of Measure to correlate with emission factor units)* 0.001

	Emission Factor (EF) Information				Control Device Information					
15	16	17	18	19	20	21	22	23	24	25
Pollutant	Emission Factor (EF) (number)	Emission Factor Unit (lb per)	Controlled EF? Yes or No	Calculation Method Code*	Capture % Efficiency	Primary Control Device ID	Secondary Control Device ID	Control Device(s) % Efficiency	Efficiency Reference Code**	Estimated Actual Emissions
CO	130	M GALS	N	5						2,113 lbs
NOx	604	M GALS	N	5						9,815 lbs
PM-10	42.5	M GALS	N	5						691 lbs
SOx	39.7	M GALS	N	5						645 lbs
VOC	49.3	M GALS	N	5						801 lbs

*** Calculation Method Codes:**

1 = Continuous Emissions Monitoring Measurements
2 = Best Guess / Engineering Judgment
3 = Material Balance
4 = Source Test Measurements (Stack Test)
5 = AP-42 / FIRE Method or Emission Factor
6 = State or Local Agency Emission Factor
7 = Manufacturer Specifications
8 = Site-Specific Emission Factor
9 = Vendor Emission Factor
10 = Trade Group Emission Factor

**** Control Efficiency Reference Codes:**

1 = Tested efficiency / EPA reference method
2 = Tested efficiency / other source test method
3 = Design value from manufacturer
4 = Best guess / engineering estimate
5 = Calculated based on material balance
6 = Estimated, based on a published value

General Process Form **2014**

EXAMPLE: Unpaved Road Travel

Permit number(s) V99999

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process ID 28

2- Process Type/Description: UNPAVED ROAD TRAVEL: HEAVY-DUTY TRUCKS @ 15 MPH

3- Stack ID(s) *(only if required on Stack Form)* _____ _____ _____ _____ _____

4- Process TIER Code: 140799 MISCELLANEOUS: FUGITIVE DUST

5- SCC Code 30502504 *(8 digit number)* SAND/GRAVEL: HAULING

6- Seasonal Throughput Percent: Dec-Feb 25 % Mar-May 25 % Jun-Aug 25 % Sep-Nov 25 %

7- Normal Operating Schedule: Hours/Day 8 Days/Week 5 Hours/Year 2080 Weeks/Year 52

8- Typical Hours of Operation: *(military time)* Start 0700 End 1530

9- Emissions based on *(name of material or other parameter, e.g. "rock", "diesel", "vehicle miles traveled")* VEHICLE MILES TRAVELED (VMT)

10- ☐ Used (input) or ☐ Produced (output) or ☒ Existing (e.g. VMT, acres)

11- Annual Amount: *(a number)* 7,500 12- Fuel Sulfur Content (in percent) _____ %

13- Unit of Measure: *(for example: tons, gallons, million cu ft, acres, units produced, etc.)* VMT

14- Unit Conversion Factor *(if needed to convert Unit of Measure to correlate with emission factor units)* _____

	Emission Factor (EF) Information					Control Device Information					
15	**16**		**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Pollutant	Emission Factor (EF) (number)		Emission Factor Unit (lb per)	Controlled EF? Yes or No	Calculation Method Code*	Capture % Efficiency	Primary Control Device ID	Secondary Control Device ID	Control Device(s) % Efficiency	Efficiency Reference Code**	Estimated Actual Emissions
PM-10	3.2		VMT	N	6	100	4		90	6	2400 lbs
											lbs
											lbs
											lbs
											lbs
											lbs

NOTE: Emissions in col. 25 are calculated as follows: (line 11 × col. 16) × (1 – [col. 20 × col. 23])

*** Calculation Method Codes:**
- **1** = Continuous Emissions Monitoring Measurements
- **2** = Best Guess / Engineering Judgment
- **3** = Material Balance
- **4** = Source Test Measurements (Stack Test)
- **5** = AP-42 / FIRE Method or Emission Factor
- **6** = State or Local Agency Emission Factor
- **7** = Manufacturer Specifications
- **8** = Site-Specific Emission Factor
- **9** = Vendor Emission Factor
- **10** = Trade Group Emission Factor

**** Control Efficiency Reference Codes**
- **1** = Tested efficiency / EPA reference method
- **2** = Tested efficiency / other source test method
- **3** = Design value from manufacturer
- **4** = Best guess / engineering estimate
- **5** = Calculated based on material balance
- **6** = Estimated, based on a published value

Evaporative Process Form Instructions

The Evaporative Process Form is used to report all emissions produced by evaporation. Examples include: cleaning with solvents, painting and other coatings, printing, using resin, evaporation of fuels from storage tanks, ammonia use, etc. All other processes should be shown on the General Process Form.

One Evaporative Process Form may be used to report numerous materials, with each material given a separate process ID number, as long as the information on lines 1–5 apply to all items on that form. Use a separate form for each group of materials that has a different Process Type/Description (shown on line 1), different Tier Code (line 2) or different operating schedule (lines 3, 4, or 5).

Data fields: (See sample forms on pages 17 and 18.)

1 Process Type/Description: Brief details of the activity in which the listed materials were used.

2 Process Tier Code: If this 6-digit code is not preprinted on your form, please refer to the Tier Code list at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx or call (602) 506-6790.

3 Seasonal Throughput Percent: Enter the percent of total annual operating time that occurred per season (rounded to the nearest percent). For example, "Dec-Feb 30% " means 30% of the total annual activity occurred during January, February and December 2014. The total for all four seasons must equal 100%.

4 Normal Operating Schedule and
5 Typical Hours of Operation: These represent the usual number of hours, time of day and weeks per year when ***this process*** occurred during the calendar year.

6 Process ID: A number (up to three digits) that represents this specific material (process). Each process on one form must have the same tier code and operating schedule as that shown in the top portion of the form. This Process ID number are unique and can ***not*** be used for any other process at this business location. See page 6 of these instructions for more explanation of ID numbers and for exclusions and guidance on grouping materials.

7 Stack ID(s): The stack ID number(s) shown in column 1 of the Stack Form that identify the stack(s) which vent pollution created by this process. Not all businesses are required to report stacks. This is only required if the Stack Form is required for your site (see page 9) ***and*** the process has a stack.

8 Material Type: Provide the information on the type of the material used in this process. Give the chemical name for pure chemicals or a name that reflects its use (paint, ink, etc.), rather than just a brand name or code number. Examples of materials include: paint, thinner, degreasing solvent (plus its common name), ink, fountain solution, ammonia, alcohol, ETO (ethylene oxide), gasoline (in a storage tank).

9 Annual Material Usage/Input: Amount of this material used during the year. In most cases, the amount purchased is suitable. Write in "lbs" or "gal" (pounds or gallons).

10 Pollutant: The only pollutants reported on this form are VOC, HAP&NON and NH_X (see definitions on page 3). When one process (or material) has more than one of these pollutants, list each pollutant on a separate line, using the same process ID number.

Evaporative Process Form (continued)

11 Emission Factor (EF): An emission factor is a number used to calculate the pounds of pollutant emitted based on the quantity of material used in a process. Emission factors can be obtained from your supplier (usually provided on a Material Safety Data Sheet or environmental data sheet), and must correspond with the material units reported in column 9. If the material unit is "gal," then the emission factor must be in pounds of pollutant per gallon. If the material unit is "lb," then the emission factor must be in pounds of pollutant per pound of material.

Verify (and correct, where necessary) all preprinted emission factors, as the composition of materials used may have changed since your last report. A "lb/gal" emission factor is almost always less than 8 and never greater than 14. A "lb/lb" emission factor is never larger than 1.0.

12 Pounds of pollutant sent off-site: Required only if you wish to take credit for reduced emissions because waste of this material is sent off-site for recycling or disposal. Only waste generated during the report year may be claimed. The Off-Site Recycling/Disposal Form ***must*** be completed if you wish to claim a credit. The number of pounds reported in column 12 ***must*** equal the number of pounds reported on the Off-Site Recycling/Disposal Form(s) for the same Process ID number.

13 and 14: Leave these fields blank if there is no control device present.

13 Capture % Efficiency: The percent of the pollutant from this process that is captured and sent to the control device.

14 Control ID: If this pollutant is being controlled in this process, enter the Control Device ID number from column 1 of the Control Device Form.

Control % Efficiency: Enter the percent of this pollutant that is controlled by this control device.

Code: Select the Control Efficiency Reference Code from the list at the bottom of the form.

15 Estimated Emissions (lbs/yr): Estimated pounds of the pollutant emitted during the year, after off-site recycling/disposal and controls if applicable. **Credit will not be given for off-site recycling/disposal unless it is shown on the Off-Site Recycling/Disposal Form.** Round to the nearest pound. If the answer is 0, give a decimal answer to the first significant digit. Column 15 is calculated as follows:

Emissions without off-site recycling/disposal or controls:
Column 15 = column 9 × column 11

Emissions with off-site recycling/disposal:
Column 15 = (column 9 × column 11) – column 12

*Emissions with off-site recycling/disposal **and** controls:*
Column 15 = ([column 9 × column 11] – column 12) × (1 – [column 13 × column 14])

Use the decimal equivalent for columns 13 and 14. Example: 96.123% = 0.96123

EXAMPLE: Coating and Painting

Evaporative Process Form 2014

Permit number(s) V99999

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process Type/Description: *Coating metal parts*

2- Process TIER Code: *080415* **SOLVENT USE: SURFACE COATING - MISC METAL PARTS**

3- Seasonal Throughput Percent: Dec-Feb *25* % Mar-May *25* % Jun-Aug *25* % Sep-Nov *25* %

4- Normal Operating Schedule: Hours/Day *8* Days/Week *5* Hours/Year *2080* Weeks/Year *52*

5- Typical Hours of Operation *(military time)* Start *0800* End *1700*

6	7	8	9		10	11		12	13	14			15
Process ID	Stack ID(s)	Material Type	Annual Usage Input	lb or gal	VOC, HAP&NON or NHx	Emission Factor	EF Units (lbs per)	Pounds of pollutant* sent off site	Capture Efficiency %	Control ID	Control Efficiency %	Control Efficiency Code**	Estimated Emissions (lbs/yr)
800	*1*	*Lacquer 6455-06*	*95*	*gl*	*VOC*	*4.7*	*gal*		%		%		*447*
801	*1*	*lacq thinner*	*120*	*gl*	*VOC*	*7.1*	*gal*		%		%		*852*
802	*1*	*Paint red 4039-03*	*940*	*gl*	*VOC*	*4.2*	*gal*		%		%		*3,948*
803	*1*	*Toro-Red Paint*	*707*	*gl*	*VOC*	*7.0*	*gal*		%		%		*4,949*
803	*1*	*Toro-Red Paint*	*707*	*gl*	*HAP&NON*	*0.5*	*gal*		%		%		*354*
804	*1*	*powder paint 8730-11*	*20,200*	*lb*	*VOC*	*0.001*	*lb*		%		%		*20*

Note: Do NOT change preprinted Process ID numbers. See page 6 of these instructions for information on how to delete materials that are no longer used, or to assign Process ID numbers for new materials.

* If you have off-site recycling/disposal of any of the materials listed above, you must complete an Off-site Recycling/Disposal Form to receive credit for reduced emissions.

NOTE: Emissions in col. 15 are calculated as follows: **([col. 9 × col. 11] – col. 12) × (1 – [col. 13 × col. 14])**

**** Control Efficiency Reference Codes**

1 = Tested efficiency / EPA reference method
2 = Tested efficiency / other source test method
3 = Design value from manufacturer
4 = Best guess / engineering estimate
5 = Calculated based on material balance
6 = Estimated, based on a published value.

EXAMPLE: Cleaning solvent (with recycling)

Evaporative Process Form 2014

Permit number(s) **V99999**

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process Type/Description: **CLEANING METAL PARTS**

2- Process TIER Code: ***080103*** **SOLVENT USE: DEGREASING - COLD CLEANING**

3- Seasonal Throughput Percent: Dec-Feb ***25*** % Mar-May ***25*** % Jun-Aug ***25*** % Sep-Nov ***25*** %

4- Normal Operating Schedule: Hours/Day ***8*** Days/Week ***5*** Hours/Year ***2080*** Weeks/Year ***52***

5- Typical Hours of Operation *(military time)* Start ***1300*** End ***1700***

6	7	8	9		10	11		12	13	14			15
Process ID	Stack ID(s)	Material Type	Annual Usage Input	lb or gal	VOC, HAP&NON or NHx	Emission Factor	EF Units (lbs per)	Pounds of pollutant* sent off site	Capture Efficiency %	Control ID	Control Efficiency %	Control Efficiency Code**	Estimated Emissions (lbs/yr)
3	***2***	***SANITIZER***	***716***	***lb***	***VOC***	***1.0***	***lb***		***95*** %	***1***	***80*** %	***3***	***172***
6		***GUN CLEANER***	***180***	***gl***	***VOC***	***7.2***	***gl***	***569***	%		%		***727***
7		***XYZ STRIPPER***	***1300***	***gl***	***VOC***	***3.3***	***gl***	***1,884***	%		%		***2,406***
8		***CLEANING SOLVENTS***	***358***	***gl***	***VOC***	***6.4***	***gl***	***1,006***	%		%		***1,285***
9		***MEGASOLVE***	***2258***	***gl***	***VOC***	***6.8***	***gl***	***6,741***	%		%		***8,613***
									%		%		

Note: Do NOT change preprinted Process ID numbers. See page 6 of these instructions for information on how to delete materials that are no longer used, or to assign Process ID numbers for new materials.

* If you have off-site recycling/disposal of any of the materials listed above, you must complete an Off-site Recycling/Disposal Form to receive credit for reduced emissions.

NOTE: This example shows the case where 2,400 of the original 4,096 gallons of materials #6 through 9 were captured for off-site recycling, and the pollutant content of the waste material was estimated to be 75% of the original. The pounds of pollutant sent off-site shown in column 12 is calculated on the example Off-Site Recycling/Disposal Form on the next page.

EXAMPLE

Off-Site Recycling/Disposal Form 2014

Permit number(s) ***V99999***

NOTE: If you need blank copies of this form, call the Emissions Inventory Unit at (602) 506-6790 or consult our web page at http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

Provide one off-site recycling/disposal form for each waste stream at your business location. A waste stream is the waste from one or more processes mixed together to make one waste product before it is taken off site for recycling, disposal or combustion.

1) Assign a unique two-digit ID number to identify the waste stream that will be described below. ***01***
(Start with ID# 01 for first waste stream. Make copies of a blank Off-Site Recycling/Disposal form and use 02 for second, etc.)

2) What was the quantity of this waste stream in 2014? 2,400 *Check one:* ☐ pounds ☒ gallons
Indicate whether this quantity is reported in pounds or gallons. Keep waste disposal company manifests as proof that this amount of waste was taken off-site.

3) What was the **average** pollutant content of the waste stream? NOTE: Report in the same units (pounds or gallons) as used in line 2.

VOC ***4.25*** lbs/unit HAP&NON _____ lbs/ unit NHx _____ lbs/ unit

NOTE: Waste normally has less pollutant content than the new product. Some of the pollutant evaporates during the use of the product, and there is usually dirt, water or other contaminants in the waste stream. The estimated pollutant content of the waste is usually between 50% and 95% of the new product. This example estimates an average VOC content (on line 3) to be 75% of the original VOC content of 5.67 lbs/gal., to account for evaporation and contaminants. See page 20 to calculate a weighted average.

4) Calculate the **total** annual pollutant content of the waste in this waste stream.
(volume of waste, from Line 2) × (pollutant content, from Line 3) = Total pollutants in waste stream, in lbs/yr.

VOC ***10,200*** lbs/yr HAP&NON _____ lbs/yr NHx _____ lbs/yr

5) List the process ID numbers of the processes contributing to this waste stream. Also estimate the pounds of pollutant that each process contributed to this waste stream.

NOTE: In this example, the amount each process material contributed to total pollutants in the waste stream (Line 4) is based on the percentage, by weight, of each material that contributed to the waste stream (e.g., Process ID #6 contributed 5.6%, therefore 5.6% × 10,200 lbs/yr = 569 lbs. See example on page 20).

NOTE: Column totals in the table below must equal the total for each pollutant type reported on line 4. The quantities you report below for each pollutant and process must also be reported in column 12 on the Evaporative Process Form.

Process ID		Annual VOC (lbs)		Annual HAP&NON (lbs)	Annual NHx (lbs)
6	Contributed about	***569***	lbs	lbs	lbs
7	Contributed about	***1,884***	lbs	lbs	lbs
8	Contributed about	***1,006***	lbs	lbs	lbs
9	Contributed about	***6,741***	lbs	lbs	lbs

EXAMPLE: Documentation of Emission Factor Calculations

Identify the process ID number(s) and pollutant(s). Show calculations made to obtain the emission factors used for the process(es). Include references to data sources used, including the document name, date published, page numbers, etc.

Emission Factor Calculation

Process ID ***201*** Permit number ***V99999***

Emission factors derived from source test performed 12/2/00 by XYZ Engineering Company (copy of summary tables also attached).

Outlet (after controls):
CO = 0.43 lb/hr × 1 hr/60 min × 1 min/77.9 cu. ft × 1,000,000 cu. ft/MMCF
= 92.0 lb/MMCF

NOx = 0.09 lb/hr × 1 hr/60 min × 1 min/77.9 cu. ft × 1,000,000 cu. ft/MMCF
= 19.3 lb/MMCF

Weighted average sample calculation

NOTE: The example below shows how the weighted average of the materials going into the waste stream is calculated. A weighted-average emission factor has been calculated by listing usage amounts and emission factors for each material, summing each column, and then dividing the total emissions by the total gallons used.

In this example: 23,231 lbs ÷ 4,096 gal = 5.67 lb/gal average VOC content. This emission factor is then used to calculate the average pollutant content in the Off-site Recycling/Disposal Form example.

This process can also be used to find the weighted average emission factor for similar materials if you are reporting them together as a single line item on the Evaporative Process form. Refer to the explanation of "grouping" on page 6.

Process ID #	Material Type	2014 Usage	Units	VOC (lbs/unit)	VOC Emissions (= Usage × VOC content)	Percent contributed to waste stream
6	gun cleaner	180	gal	7.2	1,296 lbs.	5.6 %
7	xyz stripper	1,300	gal	3.3	4,290 lbs.	18.5 %
8	cleaning solvent	358	gal	6.4	2,291 lbs.	9.9 %
9	MEGASOLVE	2,258	gal	6.8	15,354 lbs.	66.1 %
	Totals:	4,096	**gal**		**23,231 lbs.**	100.0 %

Average VOC content:	***23,231 lbs. / 4,096 gals***	=	***5.67 lb/gal***

EXAMPLE (for all sources except Title V sources)

Data Certification Form 2014

Permit number ***999999***

For EACH pollutant listed, total up all emissions recorded on your General Process and Evaporative Process Forms. Enter these numbers in column 1, "Totals from Process Forms." Report any emissions from accidental releases in column 2.
Add the figures in each row across, and enter the result in column 3, "Total Emissions".

NOTE: "Accidental Releases" reported in column 2 should include all excess emissions reported to the Department under Rule 140, Section 500.

Summary of 2014 Annual Emissions:	(1) Totals from Process Forms	(2) + Accidental Releases	(3) = TOTAL 2014 Emissions
CO	***2,113***	***0***	***2,113***
NH_x	***0***	***0***	***0***
Lead	***0***	***0***	***0***
HAP&NON	***354***	***0***	***354***
VOC	***24,220***	***0***	***24,220***
NO_x	***9,815***	***0***	***9,815***
SO_x	***645***	***0***	***645***
PM_{10}	***3,091***	***0***	***3,091***

NOTE: Review specific requirements for data confidentiality on page 5. We cannot hold any data confidential without the required documentation.

TO COMPLETE YOUR EMISSIONS INVENTORY REPORT:

- Complete the Confidentiality Statement below.
- Sign and date this form below where indicated.
- Send the **original** copy of your completed forms to: Maricopa County Air Quality Dept., Emissions Inventory Unit,1001 North Central Avenue, Suite 125, Phoenix, AZ 85004.
- Keep a copy of all forms for your records.

CONFIDENTIALITY STATEMENT:

This annual emissions report contains requests to keep some data confidential. ☐ YES ☒ NO
If you check "YES", you must submit documentation and meet certain requirements before your data can be deemed confidential. See enclosed instructions for further details.

NOTE: The Data Certification form must be signed by a responsible company official.

CERTIFICATION STATEMENT:

I declare under penalty of perjury that the data (e.g. inputs, emission factors, controls, and annual emissions) presented herein represents the best available information and is true, accurate and complete to the best of my knowledge.

Signature of owner/business officer | Date of signature | Telephone number

Type or print full name of owner/business officer | Type or print full title

How to calculate an emission fee (for Title V sources only):

1. For each pollutant listed on the "Data Certification/Fee Calculation" form, total up all emissions recorded on your General Process and Evaporative Process Forms. Enter these numbers in column 1, "Totals from Process Forms."

NOTE: While most processes that generate PM_{10} should be reported on line 5 of the Data Certification/Fee Calculation form, "[f]ugitive emissions of PM_{10} from activities other than crushing, belt transfers, screening, or stacking" (County Rule 280, § 305.2d) are NOT subject to annual emission fees. The most common occurrences of these PM_{10}-producing activities that are NON-billable are listed below:

SCC codes and description of PM_{10}-producing processes that are NOT subject to emission fees

SCC	Major Category	Subcategory	Facility / Process Type	Process Description
30200814	Industrial Processes	Food and Agriculture	Feed Manufacture	Storage
30300834	Industrial Processes	Primary Metal Production	Iron Production	Paved Road Travel
30400737	Industrial Processes	Secondary Metal Production	Steel Foundries	Raw Material Silo
30500120	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Storage Bins: Ferric Chloride
30500121	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Storage Bins: Mineral Stabilizer
30500134	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Blown Saturant Storage
30500135	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Blown Coating Storage
30500141	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Granules Storage
30500143	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Mineral Dust Storage
30500203	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Piles
30500212	Industrial Processes	Mineral Products	Asphalt Concrete	Heated Asphalt Storage Tanks
30500213	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Silo
30500290	Industrial Processes	Mineral Products	Asphalt Concrete	Haul Roads: General
30500303	Industrial Processes	Mineral Products	Brick Manufacture	Storage of Raw Materials
30500608	Industrial Processes	Mineral Products	Cement Manufacturing (Dry Process)	Raw Material Piles
30500708	Industrial Processes	Mineral Products	Cement Manufacturing (Wet Process)	Raw Material Piles
30501710	Industrial Processes	Mineral Products	Mineral Wool	Storage of Oils and Binders
30502007	Industrial Processes	Mineral Products	Stone Quarrying - Processing	Open Storage
30502012	Industrial Processes	Mineral Products	Stone Quarrying - Processing	Hauling
30502504	Industrial Processes	Mineral Products	Construction Sand and Gravel	Hauling
30502507	Industrial Processes	Mineral Products	Construction Sand and Gravel	Storage Piles
30502760	Industrial Processes	Mineral Products	Industrial Sand and Gravel	Sand Handling, Transfer, & Storage
30531090	Industrial Processes	Mineral Products	Coal Mining, Cleaning, Material Handling	Haul Roads: General
30532007	Industrial Processes	Mineral Products	Stone Quarrying - Processing	Open Storage
30704002	Industrial Processes	Pulp and Paper & Wood Pdts.	Bulk Handling and Storage - Wood/Bark	Stockpiles
31100199	Industrial Processes	Building Construction	Construction: Building Contractors	Other Not Classified
31100299	Industrial Processes	Building Construction	Demolitions/Special Trade Contracts	Other Construction/Demolition
50100401	Waste Disposal	Solid Waste Disposal	Landfill Dump	Unpaved Road Traffic
50100402	Waste Disposal	Solid Waste Disposal	Landfill Dump	Fugitive Emissions
50100403	Waste Disposal	Solid Waste Disposal	Landfill Dump	Area Method
50100404	Waste Disposal	Solid Waste Disposal	Landfill Dump	Trench Method
50100405	Waste Disposal	Solid Waste Disposal	Landfill Dump	Ramp Method

2. Report any accidental releases in column 2. Add columns 1 and 2 together for each pollutant, and enter the sum in column 3. Sum lines 1 through 5 together, and enter the total on line 6.

3. Divide your facility's total billable emissions (on line 6) by 2000 to convert pounds into tons. **Round to the nearest ton.** Enter this value on line 7. Multiply this number by **$42.21**, and enter the result on line 8. This is your 2014 emission fee.

EXAMPLE (for Title V sources only)

Data Certification/Fee Calculation Form 2014

Permit number ***V99999***

For EACH pollutant listed, total up all emissions recorded on your General Process and Evaporative Process Forms. Enter these numbers in column 1, "Totals from Process Forms." Report any emissions from accidental releases in column 2.
Add the figures in each row across, and enter the result in column 3, "Total Emissions".
Carefully follow the instructions on lines 6 through 8 to calculate any emission fee owed.

NOTE: "Accidental Releases" reported in column 2 should include all excess emissions reported to the Department under Rule 140, Section 500.

	Summary of 2014 Annual Emissions:	(1) Totals from Process Forms	(2) + Accidental Releases	(3) = TOTAL 2014 Emissions
	CO	***2,113***	***0***	***2,113***
	NH_x	***0***	***0***	***0***
	Lead	***0***	***0***	***0***
	PM_{10} (non-billable; see page 22)	***2,400***	***0***	***2,400***
	Emissions fees are based on your emissions of the following pollutants ONLY:			
1	HAP&NON	***354***	***0***	***354***
2	VOC	***24,220***	***0***	***24,220***
3	NO_x	***9,815***	***0***	***9,815***
4	SO_x	***645***	***0***	***645***
5	PM_{10} (billable; see page 22)	***691***	***0***	***691***
6	**Add "TOTAL" column from lines 1 through 5 ONLY:**			***35,725*** lbs.
7	Divide the total on line 6 by 2000 (pounds per ton) to get tons, and round the number to the nearest ton. (Drop any decimal of .499 or less. Increase to the next whole number any decimal of .500 or more.) Enter the resulting WHOLE NUMBER here.			***18*** TONS
8	Multiply line 7 (a WHOLE number) by **$ 42.21**. This is your **2014 ANNUAL EMISSION FEE**.			$ ***759.78***

NOTE: Review specific requirements for data confidentiality on page 5. We cannot hold any data confidential without the required documentation.

TO COMPLETE YOUR EMISSIONS INVENTORY REPORT:

- Include a check (made payable to Maricopa County Air Quality Department) for the amount calculated on line 8 above.
- Complete the Confidentiality Statement below.
- Sign and date this form below where indicated.
- Send the **Original** copy of your completed forms along with any emission fee due to: Maricopa County Air Quality Department, Emissions Inventory Unit,1001 North Central Avenue, Suite 125, Phoenix, AZ 85004.
- Keep a copy of all forms for your records.

CONFIDENTIALITY STATEMENT:

This annual emissions report contains requests to keep some data confidential. ☐ YES ☒ NO
If you check "YES", you must submit documentation and meet certain requirements before your data can be deemed confidential. See enclosed instructions for further details.

NOTE: The Data Certification form must be signed by a responsible company official.

CERTIFICATION STATEMENT:

I declare under penalty of perjury that the data (e.g. inputs, emission factors, controls, and annual emissions) presented herein represents the best available information and is true, accurate and complete to the best of my knowledge.

Signature of owner/business officer | Date of signature | Telephone number

Type or print full name of owner/business officer | Type or print full title

Appendix B. Rule Effectiveness (RE) Studies

1. Introduction

Rule effectiveness (RE) studies are designed to assess the success of regulatory rules at controlling their targeted emissions. It is acknowledged that facilities and source categories subject to control techniques and devices mandated by rules do not always achieve 100% compliance with those requirements. Given this reality, the US EPA recommends the use of rule effectiveness studies to improve the quality of emission estimates presented in emission inventories.

Once an RE rate has been calculated, its value is applied to relevant sources at an individual process level, thus adjusting (i.e., increasing) emission estimates to reflect a lower degree of control efficiency. The following example illustrates how the application of rule effectiveness can significantly affect the resulting emission estimates. The calculations below reflect a process whose reported emissions are controlled via a control device with a nominal 90% control efficiency (CE). In the second equation, an RE rate of 83% is applied to the controlled process.

A. Emissions <u>before</u> the application of rule effectiveness:

Uncontrolled emissions × [1 – (*CE*)] = *Emissions after control*

100 tons × [1 – (0.90)] = **10.0 tons**

B. Emissions <u>including</u> the application of an 83% rule effectiveness (RE):

Uncontrolled emissions × [1 – (*CE* × ***RE***)] = *Emissions after control* ***<u>and</u>*** *RE*

100 tons × [1 – (0.90 × **0.83)**] = **25.3 tons**

In general, the RE rate is applied to all processes where a control device or control technique is in use. There are, however, some limitations to this blanket rule, as expressed in US EPA's most recent guidance:

> *…not all emission estimates involving use of a control device or technique need to be adjusted to account for RE…For example, a state or local agency may conclude that a control device that operates in conjunction with a continuous emissions monitor, or is equipped with an automatic shutdown device, may provide a sufficient level of assurance that intended emission reductions will be achieved, and therefore an adjustment for rule effectiveness is not necessary. Another example would be in instances where a direct determination of emissions, such as via a mass balance calculation, can be made.* (US EPA, 2005)

Another complication in any attempt to apply a blanket RE percentage rate occurs where control device efficiencies are extremely high. Some categories of control devices routinely operate at efficiencies of 99% or greater (e.g., baghouses, thermal oxidizers). For these activities, even small adjustments through the application of RE can cause a dramatic, and unrealistic, increase in reported emissions. As an example, a process with a control device of 99.9% efficiency may report controlled emissions of 10 tons. If an RE rate of 85% were applied to this process, the adjusted emissions would total 1,508.5 tons (an increase of nearly 15,000%). In these types of instances, the department evaluated the affected processes on a case-by-case basis to determine the appropriateness of applying an RE adjustment.

2. Calculating Rule Effectiveness Rates for Title V and Non-Title V Facilities

The observed compliance rate in some cases, such as multi-source Title V and non-Title V facilities, can be better described as a rate at which inspection staff issue violations. Inspection staff has a range of experience and training which influences their proficiency in issuing appropriate violations. There may be instances when a rule violation goes unnoticed by staff, or conversely a violation may be issued in error. Even when a compliance rate has a high statistical measure of accuracy, it can fail to reflect a number of programmatic measures that affect overall rule effectiveness; measures like the strength of rule language, departmental enforcement and penalty actions, inspector training programs, educational and public outreach efforts, etc. This reality is reflected in earlier US EPA guidance:

> *A percentage effectiveness rating is not enough to describe the compliance effectiveness of a rule for a source category. An SSCD [Stationary Source Compliance Division] study should attempt to link the rating to a regulatory agency's overall effort. The study should address the factors that affect the percentage effectiveness rating such as the compliance rate of the sources in a category, inspection frequency and thoroughness, the language of the rule (i.e., whether or not it has loopholes), and the reporting and recordkeeping by the regulatory agency. Evaluating these factors will provide a more complete evaluation of the effectiveness of a rule.* (US EPA, 1994)

In order to incorporate all the salient factors described above, a matrix was created to produce a final RE rate. US EPA's latest guidance (2005) provides a listing of factors that can impact rule effectiveness rates (e.g., inspector training, frequency of inspections, media outreach, enforcement policies, recordkeeping requirements, etc.), grouped into major categories such as most important factors, important factors and other factors. The department used these suggested factors as the basis for developing the RE matrices contained in Tables B–2 and B–3.

In brief, the compliance rate developed from inspection data accounts for 70% of the overall RE rate, while all other factors account for the remaining 30%. Each factor is scored individually, based upon the department's success in implementing that factor. As an example, the score for the factor "Compliance History" is the compliance rate developed from the study period inspection data, while the score for "Enforcement Penalties" is based upon the department's timely response to, and settlement of, observed violations associated with the subject rule or source category. The complete matrices for each applicable rule or source category for which rule effectiveness was addressed, are contained in Tables B–2 and B–3.

The data and methods used to develop RE rates for Title V and non-Title V permitted facilities are described below. The resulting rule effectiveness values for 2014 are summarized in Table B–1 below.

Table B–1. Rates of compliance and rule effectiveness for 2014, by permit category.

Source category	Compliance rate *	Rule Effectiveness (RE) rate
Title V facilities	88.45%	90.44%
Non-Title V facilities	85.94%	89.00%

** Compliance rates for both Title V and Non-Title V facilities are based upon 2013–14 inspection data, and reflect compliance self-monitoring recordkeeping practices, in addition to violation data.*

For the remaining emission processes that include a control device or technique that limits ozone formation, separate multi-rule RE rates have been calculated for permitted Title V and non-Title V facilities. Factor-based matrices have been utilized to develop RE rates for Title V and non-Title V facilities. Compliance rates for both Title V and non-Title V facilities are based on two full years of data (2013 and 2014), since compliance information for these sources tends to be more detailed (as reflected in the matrix). The compliance rate for these facilities also includes data on self-monitoring recordkeeping practices in addition to inspection data. The combined scores of the monitoring data and inspection data divided by the 70% of the overall RE rate comprise the "compliance rate" portion of the RE calculation matrix, as shown in Tables B–2 and B–3 below.

3. References

US EPA, 1992. Guidelines for Estimating and Applying Rule Effectiveness for Ozone/CO State Implementation Plan Base Year Inventories. EPA Rep. 452/R-92-010, November 1992.

US EPA, 1994. Rule Effectiveness Guidance: Integration of Inventory, Compliance and Assessment Applications. EPA Rep. 452/R-94-001, January 1994.

US EPA, 2005. Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations. EPA Rep. 454/R-05-001, November 2005.

Table B–2. Rule Effectiveness Matrix for Title V Facilities

A. Most important factors (2 criteria, each assigned weighting of 35% of total):

Factor	Range		Midpoint value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring	94%	100%	97%	Source-specific monitoring used for compliance purposes, and monitoring records filed with regulatory agency at least every 4 months.			
	87%	93%	90%	Source-specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency every 6–9 months.	35%	90%	**31.50%**
	81%	86%	84%	Source-specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency each year.			
	70%	80%	75%	General guidance exists for source-specific enhanced monitoring, and monitoring records required but aren't submitted to regulatory agency.			
		< 70%	35%	No requirements for any type of monitoring.			
Compliance History	94%	100%	97%	The facility has been in compliance for the past eight quarters.	35%	8 of 16 facilities	**16.98%**
	87%	93%	90%	The facility is believed to have been in compliance for the past eight quarters, although inspection frequency is such that this can't be positively confirmed.			
	81%	86%	84%	On schedule; the facility is meeting its compliance schedule.			
	70%	80%	75%	In Violation; facility is in violation of emissions and/or procedural requirements.		8 of 16 facilities	**13.13%**
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.			

Overall compliance rate for Title V facilities: 88.45%

B. Other important factors (4 criteria, each assigned weighting of 3% of total):

Type of Inspection	94%	100%	97%	Inspections involve compliance test methods with a high degree of accuracy, such as stack testing or other types of precise emissions measurement.	3%	97%	**2.91%**
	87%	93%	90%	Inspections involve detailed review of process parameters & inspection of control equipment.			
	81%	86%	84%	Inspections involve review of process and inspection of control equipment.			
	70%	80%	75%	Inspections generally consist of only a records review.			
		< 70%	35%	Inspections most likely consist of visual inspection (e.g., opacity), or drive by.			
Operation & Maintenance	94%	100%	97%	Control equipment operators follow and sign daily O&M instructions.	3%	97%	**2.91%**
	87%	93%	90%	Control equipment operators follow daily O&M instructions.			
	81%	86%	84%	Control equipment operators follow daily or weekly O&M instructions.			
	70%	80%	75%	O&M requirements exist, but on no specific schedule.			
		< 70%	35%	No specific O&M requirements.			

Table B–2. Rule Effectiveness Matrix for Title V Facilities (continued)

Factor	Range		Midpoint value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Unannounced Inspections	94%	100%	97%	Routinely conducted.	3%	97%	**2.91%**
	87%	93%	90%	Sometimes done.			
	81%	86%	84%	Done, but infrequently.			
	70%	80%	75%	Rarely done.			
		< 70%	35%	Never done.			

Enforcement Penalties	94%	100%	97%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.	3%	97%	**2.91%**
	87%	93%	90%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	81%	86%	84%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	70%	80%	75%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
		< 70%	35%	Agency does not have sufficient authority to impose punitive measures towards violators.			

C. Other factors (9 criteria, each assigned weighting of 2% of total):

Compliance Certifications	94%	100%	97%	Source subject to Title V or other type of compliance certification.	2%	97%	**1.94%**
	87%	93%	90%	Source subject to Title V or other type of compliance certification.			
	81%	86%	84%	Source not subject to any type of compliance certification.			
	70%	80%	75%	Source not subject to any type of compliance certification.			
		< 70%	35%	Source not subject to any type of compliance certification.			

Inspection Frequency	94%	100%	97%	Source(s) are inspected once every 2 years or more frequently.	2%	97%	**1.94%**
	87%	93%	90%	Source(s) are inspected once every 3 years or more frequently.			
	81%	86%	84%	Source(s) are inspected once every 5 years or more frequently.			
	70%	80%	75%	Inspection of source(s) infrequent; > every 5 years.			
		< 70%	35%	Inspections rarely, if ever, performed.			

Table B–2. Rule Effectiveness Matrix for Title V Facilities (continued)

Factor	Range		Midpoint value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
EPA HPV Enforcement	94%	100%	97%	Agency has sufficient resources to implement EPA's 12/22/98 HPV policy.	2%	97%	**1.94%**
	87%	93%	90%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	81%	86%	84%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	70%	80%	75%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy more often than not.			
		< 70%	35%	Resource constraints prohibit agency from implementing EPA's 12/22/98 HPV policy in most instances.			
Operator Training	94%	100%	97%	Control equipment operators complete a formal training program on use of the equipment, and such program is kept up to date and has been reviewed by the regulatory agency.			
	87%	93%	90%	Control equipment operators complete formal training program, and such program is kept up to date and available for review by the regulatory agency upon request.			
	81%	86%	84%	Control equipment operators complete some amount of formal training.	2%	84%	**1.68%**
	70%	0.8	75%	Control equipment operators receive only on the job training.			
		< 70%	35%	Control equipment operators receive no specific training.			
Media Publicity	94%	100%	97%	Media publicity of enforcement actions.	2%	97%	**1.94%**
	87%	93%	90%	Media publicity of enforcement actions.			
	81%	86%	84%	Media publicity of enforcement actions.			
	70%	80%	75%	Media publicity of enforcement actions.			
		< 70%	35%	No media publicity of enforcement actions.			
Regulatory Workshops	94%	100%	97%	Regulatory workshops are available annually, and/or the implementing agency mails regulatory information packages each year.	2%	97%	**1.94%**
	87%	93%	90%	Regulatory workshops are available every 1–2 years, and/or the implementing agency mails regulatory information packages every 1–2 years.			
	81%	86%	84%	Regulatory workshops are available every 2–3 years, and/or the implementing agency mails regulatory information packages once every 2–3 years.			
	70%	80%	75%	Regulatory workshop not routinely available, but implementing agency mails regulatory information packages out about once every 2–3 years.			
		< 70%	35%	Regulatory workshops not routinely available. Implementing agency mails regulatory information packages infrequently, if ever.			

Table B–2. Rule Effectiveness Matrix for Title V Facilities (continued)

Factor	Range		Midpoint value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Inspector Training	94%	100%	97%	Inspectors must undergo 2 weeks of comprehensive basic training, and 1–2 weeks of source-specific training, and such training is updated each year.	2%	97%	**1.94%**
	87%	93%	90%	Inspectors must undergo 1–2 weeks of basic training and 1 week of source-specific training and such training is updated every 1–2 years.			
	81%	86%	84%	Inspectors must undergo 1–2 weeks of basic training and 3–5 days of source-specific training, and such training is updated every 1–2 years.			
	70%	80%	75%	Inspectors must undergo 1–2 weeks of basic training and 1 to 3 days of source-specific training, and such training is updated every 1–2 years.			
		< 70%	35%	Inspectors must undergo less than 5 days of basic training less than 3 days of source-specific training, and such training is updated only every 2 years or less frequently.			
Testing Guidelines	94%	100%	97%	Specific guidelines and schedule for testing and test methods exist.	2%	97%	**1.94%**
	87%	93%	90%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	81%	86%	84%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	70%	80%	75%	Specific guidelines on testing and test methods, but no schedule for testing.			
		< 70%	35%	Only general guidance on testing, or no mention of testing requirements.			
Follow-up Inspections	94%	100%	97%	Follow-up inspections always or almost always conducted (90 % of the time or more).	2%	97%	**1.94%**
	87%	93%	90%	Follow-up inspections usually conducted (approximately 75% of the time).			
	81%	86%	84%	Follow-up inspections sometimes conducted (approximately 50% of the time).			
	70%	80%	75%	Follow-up inspections infrequently conducted (approximately 25% of the time).			
		< 70%	35%	Follow-up inspections rarely or never conducted (10% of the time or less)			

Overall rule effectiveness score for Title V facilities: **90.44%**

Table B–3. Rule Effectiveness Matrix for Non-Title V Facilities

A. Most important factors (2 criteria, each assigned weighting of 35% of total):

Factor	Range		Midpoint value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring	94%	100%	97%	Source-specific monitoring used for compliance purposes, and monitoring records filed with regulatory agency at least every 4 months.			
	87%	93%	90%	Source-specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency every 6–9 months.			
	81%	86%	84%	Source-specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency each year.			
	70%	80%	75%	General guidance exists for source-specific enhanced monitoring, and monitoring records required but aren't submitted to regulatory agency.	35%	75%	**26.25%**
		< 70%	35%	No requirements for any type of monitoring.			
Compliance History	94%	100%	97%	The facility has been in compliance for the past eight quarters.	35%	82 of 137 facilities	**20.32%**
	87%	93%	90%	The facility is believed to have been in compliance for the past eight quarters, although inspection frequency is such that this can't be positively confirmed.		2 of 137 facilities	**0.46%**
	81%	86%	84%	On schedule; the facility is meeting its compliance schedule.			
	70%	80%	75%	In Violation; facility is in violation of emissions and/or procedural requirements.		57 of 137 facilities	**13.13%**
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.			

Overall compliance rate for Non-Title V facilities: 85.94%

B. Other important factors (4 criteria, each assigned weighting of 3% of total):

Type of Inspection	94%	100%	97%	Inspections involve compliance test methods with a high degree of accuracy, such as stack testing or other types of precise emissions measurement.	3%	97%	**2.91%**
	87%	93%	90%	Inspections involve detailed review of process parameters & inspection of control equipment.			
	81%	86%	84%	Inspections involve review of process and inspection of control equipment.			
	70%	80%	75%	Inspections generally consist of only a records review.			
		< 70%	35%	Inspections most likely consist of visual inspection (e.g., opacity), or drive by.			
Operation & Maintenance	94%	100%	97%	Control equipment operators follow and sign daily O&M instructions.	3%	97%	**2.91%**
	87%	93%	90%	Control equipment operators follow daily O&M instructions.			
	81%	86%	84%	Control equipment operators follow daily or weekly O&M instructions.			
	70%	80%	75%	O&M requirements exist, but on no specific schedule.			
		< 70%	35%	No specific O&M requirements.			

Table B–3. Rule Effectiveness Matrix for Non-Title V Facilities (continued)

Factor	Range		Midpoint value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Unannounced Inspections	94%	100%	97%	Routinely conducted.	3%	97%	**2.91%**
	87%	93%	90%	Sometimes done.			
	81%	86%	84%	Done, but infrequently.			
	70%	80%	75%	Rarely done.			
		< 70%	35%	Never done.			
Enforcement Penalties	94%	100%	97%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.	3%	97%	**2.91%**
	87%	93%	90%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	81%	86%	84%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	70%	80%	75%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
		< 70%	35%	Agency does not have sufficient authority to impose punitive measures towards violators.			

C. Other factors (9 criteria, each assigned weighting of 2% of total):

Compliance Certifications	94%	100%	97%	Source subject to Title V or other type of compliance certification.	2%	97%	**1.94%**
	87%	93%	90%	Source subject to Title V or other type of compliance certification.			
	81%	86%	84%	Source not subject to any type of compliance certification.			
	70%	80%	75%	Source not subject to any type of compliance certification.			
		< 70%	35%	Source not subject to any type of compliance certification.			
Inspection Frequency	94%	100%	97%	Source(s) are inspected once every 2 years or more frequently.	2%	97%	**1.94%**
	87%	93%	90%	Source(s) inspected every 3 years or more frequently.			
	81%	86%	84%	Source(s) inspected every 5 years or more frequently.			
	70%	80%	75%	Inspection of source(s) infrequent; > every 5 years.			
		< 70%	35%	Inspections rarely, if ever, performed.			

Table B–3. Rule Effectiveness Matrix for Non-Title V Facilities (continued)

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
EPA HPV Enforcement	94%	100%	97%	Agency has sufficient resources to implement EPA's 12/22/98 HPV policy.	2%	97%	**1.94%**
	87%	93%	90%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	81%	86%	84%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	70%	80%	75%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy more often than not.			
		< 70%	35%	Resource constraints prohibit agency from implementing EPA's 12/22/98 HPV policy in most instances.			
Operator Training	94%	100%	97%	Control equipment operators complete a formal training program on use of the equipment; the program is kept up to date and has been reviewed by the regulatory agency.			
	87%	93%	90%	Control equipment operators complete formal training program, and such program is kept up to date and available for review by the regulatory agency upon request.			
	81%	86%	84%	Control equipment operators complete some amount of formal training.	2%	84%	**1.68%**
	70%	0.8	75%	Control equipment operators receive only on the job training.			
		< 70%	35%	Control equipment operators receive no specific training.			
Media Publicity	94%	100%	97%	Media publicity of enforcement actions.	2%	97%	**1.94%**
	87%	93%	90%	Media publicity of enforcement actions.			
	81%	86%	84%	Media publicity of enforcement actions.			
	70%	80%	75%	Media publicity of enforcement actions.			
		< 70%	35%	No media publicity of enforcement actions.			
Regulatory Workshops	94%	100%	97%	Regulatory workshops are available annually, and/or the implementing agency mails regulatory information packages each year.	2%	97%	**1.94%**
	87%	93%	90%	Regulatory workshops are available every 1–2 years, and/or the implementing agency mails regulatory information packages every 1–2 years.			
	81%	86%	84%	Regulatory workshops are available every 2–3 years, and/or the implementing agency mails regulatory information packages once every 2–3 years.			
	70%	80%	75%	Regulatory workshop not routinely available, but implementing agency mails regulatory information packages out about once every 2–3 years.			
		< 70%	35%	Regulatory workshops not routinely available. The implementing agency mails regulatory information packages infrequently, if ever.			

Table B–3. Rule Effectiveness Matrix for Non-Title V Facilities (continued)

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score(= weight × value)
Inspector Training	94%	100%	97%	Inspectors must undergo 2 weeks of comprehensive basic training, and 1–2 weeks of source-specific training, and such training is updated each year.	2%	97%	**1.94%**
	87%	93%	90%	Inspectors must undergo 1–2 weeks of basic training and 1 week of source-specific training and such training is updated every 1–2 years.			
	81%	86%	84%	Inspectors must undergo 1–2 weeks of basic training and 3–5 days of source-specific training, and such training is updated every 1–2 years.			
	70%	80%	75%	Inspectors must undergo 1–2 weeks of basic training and 1 to 3 days of source-specific training, and such training is updated every 1–2 years.			
		< 70%	35%	Inspectors must undergo less than 5 days of basic training less than 3 days of source-specific training, and such training is updated only every 2 years or less frequently.			
Testing Guidelines	94%	100%	97%	Specific guidelines and schedule for testing and test methods exist.	2%	97%	**1.94%**
	87%	93%	90%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	81%	86%	84%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	70%	80%	75%	Specific guidelines on testing and test methods, but no schedule for testing.			
		< 70%	35%	Only general guidance on testing, or no mention of testing requirements.			
Follow-up Inspections	94%	100%	97%	Follow-up inspections always or almost always conducted (90 % of the time or more).	2%	97%	**1.94%**
	87%	93%	90%	Follow-up inspections usually conducted (approximately 75% of the time).			
	81%	86%	84%	Follow-up inspections sometimes conducted (approximately 50% of the time).			
	70%	80%	75%	Follow-up inspections infrequently conducted (approximately 25% of the time).			
		< 70%	35%	Follow-up inspections rarely or never conducted (10% of the time or less)			

Overall rule effectiveness score for non-Title V facilities: **89.00%**

Appendix C. MOVES2014a Local Input Data and RunSpecs

To calculate 2014 annual and typical daily emissions from onroad sources, MOVES2014a was executed using local input data for each month of the year and each geographic area analyzed (Maricopa County and the 8-hour ozone nonattainment area).

A portion of the MOVES2014a RunSpec Summary, RunSpec, and local input data for Maricopa County are provided in this appendix as an example.

MOVES2014a RunSpec Summary (Maricopa County)

* Output Database Server Name: [using default]

* Scale:
  - Domain/Scale: County
  - Calculation Type: Inventory

* Time Spans:
  - Time Aggregation Level: Hour
  - Years: 2014
  - Months: January - December
  - Days: Weekend & Weekdays
  - Hours: Start Hour 00:00 - 00:59 | End Hour 23:00 - 23:59

* Geographic Bounds:
  - Region: County
  - Selections: ARIZONA - Maricopa County
  - Domain Input Database: c04013y2014_20151118

* Vehicles/Equipment
  - On Road Vehicle Equipment:
    - Compressed natural Gas (CNG) - Transit Bus
    - Diesel Fuel - Combination Long-haul Truck
    - Diesel Fuel - Combination Short-haul Truck
    - Diesel Fuel - Intercity Bus
    - Diesel Fuel - Light Commercial Truck
    - Diesel Fuel - Motor Home
    - Diesel Fuel - Passenger Car
    - Diesel Fuel - Passenger Truck
    - Diesel Fuel - Refuse Truck
    - Diesel Fuel - School Bus
    - Diesel Fuel - Single Unit Long-haul Truck
    - Diesel Fuel - Single Unit Short-haul Truck
    - Diesel Fuel - Transit Bus
    - Electricity - Light Commercial Truck
    - Electricity - Passenger Car
    - Electricity - Passenger Truck
    - Ethanol (E-85) - Light Commercial Truck
    - Ethanol (E-85) - Passenger Car
    - Ethanol (E-85) - Passenger Truck
    - Gasoline - Combination Short-haul Truck
    - Gasoline - Light Commercial Truck
    - Gasoline - Motor Home
    - Gasoline - Motorcycle
    - Gasoline - Passenger Car
    - Gasoline - Passenger Truck
    - Gasoline - Refuse Truck
    - Gasoline - School Bus
    - Gasoline - Single Unit Long-haul Truck
    - Gasoline - Single Unit Short-haul Truck
    - Gasoline - Transit Bus

* Road Type
  - Off-Network
  - Rural Restricted Access
  - Rural Unrestricted Access
  - Urban Restricted Access
  - Urban Unrestricted Access

* Pollutants and Processes
  - Total Gaseous Hydrocarbons - Running Exhaust
  - Total Gaseous Hydrocarbons - Start Exhaust
  - Total Gaseous Hydrocarbons - Evap Permeation
  - Total Gaseous Hydrocarbons - Evap Fuel Vapor Venting
  - Total Gaseous Hydrocarbons - Evap Fuel Leaks
  - Total Gaseous Hydrocarbons - Crankcase Running Exhaust
  - Total Gaseous Hydrocarbons - Crankcase Start Exhaust
  - Total Gaseous Hydrocarbons - Crankcase Extended Idle Exhaust
  - Total Gaseous Hydrocarbons - Refueling Displacement Vapor Loss
  - Total Gaseous Hydrocarbons - Refueling Spillage Loss
  - Total Gaseous Hydrocarbons - Extended Idle Exhaust
  - Total Gaseous Hydrocarbons - Auxiliary Power Exhaust
  - Carbon Monoxide (CO) - Running Exhaust
  - Carbon Monoxide (CO) - Start Exhaust
  - Carbon Monoxide (CO) - Crankcase Running Exhaust
  - Carbon Monoxide (CO) - Crankcase Start Exhaust
  - Carbon Monoxide (CO) - Crankcase Extended Idle Exhaust
  - Carbon Monoxide (CO) - Extended Idle Exhaust
  - Carbon Monoxide (CO) - Auxiliary Power Exhaust
  - Oxides of Nitrogen (NOx) - Running Exhaust
  - Oxides of Nitrogen (NOx) - Start Exhaust
  - Oxides of Nitrogen (NOx) - Crankcase Running Exhaust
  - Oxides of Nitrogen (NOx) - Crankcase Start Exhaust
  - Oxides of Nitrogen (NOx) - Crankcase Extended Idle Exhaust
  - Oxides of Nitrogen (NOx) - Extended Idle Exhaust
  - Oxides of Nitrogen (NOx) - Auxiliary Power Exhaust
  - Methane (CH4) - Running Exhaust
  - Methane (CH4) - Start Exhaust
  - Methane (CH4) - Crankcase Running Exhaust
  - Methane (CH4) - Crankcase Start Exhaust
  - Methane (CH4) - Crankcase Extended Idle Exhaust
  - Methane (CH4) - Extended Idle Exhaust
  - Methane (CH4) - Auxiliary Power Exhaust
  - Non-Methane Hydrocarbons - Running Exhaust
  - Non-Methane Hydrocarbons - Start Exhaust
  - Non-Methane Hydrocarbons - Evap Permeation
  - Non-Methane Hydrocarbons - Evap Fuel Vapor Venting
  - Non-Methane Hydrocarbons - Evap Fuel Leaks
  - Non-Methane Hydrocarbons - Crankcase Running Exhaust
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  - Non-Methane Hydrocarbons - Refueling Displacement Vapor Loss
  - Non-Methane Hydrocarbons - Refueling Spillage Loss
  - Non-Methane Hydrocarbons - Extended Idle Exhaust
  - Non-Methane Hydrocarbons - Auxiliary Power Exhaust
  - Non-Methane Organic Gases - Running Exhaust
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  - Non-Methane Organic Gases - Evap Fuel Vapor Venting
  - Non-Methane Organic Gases - Evap Fuel Leaks
  - Non-Methane Organic Gases - Crankcase Running Exhaust
  - Non-Methane Organic Gases - Crankcase Start Exhaust
  - Non-Methane Organic Gases - Crankcase Extended Idle Exhaust

Non-Methane Organic Gases - Refueling Displacement Vapor Loss
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Non-Methane Organic Gases - Extended Idle Exhaust
Non-Methane Organic Gases - Auxiliary Power Exhaust
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Total Organic Gases - Start Exhaust
Total Organic Gases - Evap Permeation
Total Organic Gases - Evap Fuel Vapor Venting
Total Organic Gases - Evap Fuel Leaks
Total Organic Gases - Crankcase Running Exhaust
Total Organic Gases - Crankcase Start Exhaust
Total Organic Gases - Crankcase Extended Idle Exhaust
Total Organic Gases - Refueling Displacement Vapor Loss
Total Organic Gases - Refueling Spillage Loss
Total Organic Gases - Extended Idle Exhaust
Total Organic Gases - Auxiliary Power Exhaust
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Volatile Organic Compounds - Start Exhaust
Volatile Organic Compounds - Evap Permeation
Volatile Organic Compounds - Evap Fuel Vapor Venting
Volatile Organic Compounds - Evap Fuel Leaks
Volatile Organic Compounds - Crankcase Running Exhaust
Volatile Organic Compounds - Crankcase Start Exhaust
Volatile Organic Compounds - Crankcase Extended Idle Exhaust
Volatile Organic Compounds - Refueling Displacement Vapor Loss
Volatile Organic Compounds - Refueling Spillage Loss
Volatile Organic Compounds - Extended Idle Exhaust
Volatile Organic Compounds - Auxiliary Power Exhaust

* Manage Input Data Sets
  Selections: / StageII_Input / Stage II Refueling Input

* Output
  General Output:
    Output Database: c04013y2014_20151118_out
    Units: Mass Units (Grams) | Energy Units (Joules) | Distance Units (Miles)
    Activity: Distance Traveled | Source Hours | Source Hours Idling | Source Hours Operating | Source Hours Parked | Population | Starts
  Output Emissions Detail:
    Always: Time (Month) | Location (COUNTY) | Pollutant
    For All Vehicle/Equipment Categories: Fuel Type | Emission Process
    On Road: SCC

MOVES2014a RunSpec (Maricopa County)

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Extended Idle Exhaust"/>
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Displacement Vapor Loss"/>
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Spillage Loss"/>
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Idle Exhaust"/>
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Power Exhaust"/>
   </pollutantprocessassociations>
   <databaseselections>
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classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontrolstrategies.rateofprogress.RateOfProgressStrategy"><![CDATA
[
useParameters                No

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   <geographicoutputdetail description="COUNTY"/>
   <outputemissionsbreakdownselection>
     <modelyear selected="false"/>
     <fueltype selected="true"/>
     <emissionprocess selected="true"/>
     <onroadoffroad selected="true"/>
     <roadtype selected="true"/>
     <sourceusetype selected="true"/>
     <movesvehicletype selected="true"/>
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     <estimateuncertainty selected="false" numberOfIterations="2" keepSampledData="false" keepIterations="false"/>
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     <engtechid selected="false"/>
     <hpclass selected="false"/>
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   <outputtimestep value="Month"/>
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   <outputsho value="true"/>
   <outputsh value="true"/>
   <outputshp value="true"/>
   <outputshidling value="true"/>
   <outputstarts value="true"/>
   <outputpopulation value="true"/>
   <scaleinputdatabase servername="localhost" databasename="c04013y2014_20151118" description=""/>
   <pmsize value="0"/>
   <outputfactors>
     <timefactors selected="true" units="Months"/>
     <distancefactors selected="true" units="Miles"/>
     <massfactors selected="true" units="Grams" energyunits="Joules"/>
   </outputfactors>
   <savedata>

   </savedata>

   <donotexecute>

   </donotexecute>

   <generatordatabase shouldsave="false" servername="" databasename="" description=""/>
     <donotperformfinalaggregation selected="false"/>
   <lookuptableflags scenarioid="c04013y2014_20151118" truncateoutput="true" truncateactivity="true" truncatebaserates="true"/>
</runspec>
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MOVES2014a Local Input Data (Maricopa County)

[HPMSvTypeYear]

HPMSVtypeID	yearID	HPMSBaseYearVMT
10	2014	183,419,188
25	2014	30,173,627,159
40	2014	78,456,880
50	2014	1,183,539,915
60	2014	971,500,384

[SourceTypeYear]

yearID	sourceTypeID	sourceTypePopulation
2014	11	90,699
2014	21	2,221,072
2014	31	531,215
2014	32	132,419
2014	41	238
2014	42	888
2014	43	7,962
2014	51	1,049
2014	52	37,271
2014	53	1,567
2014	54	9,785
2014	61	6,503
2014	62	7,070

[FuelFormulation]

Fuel Formulation ID	Fuel Subtype ID	RVP	Sulfur Level	ETOH Volume	MTBE Volume	ETBE Volume	TAME Volume	Aromatic Content	Olefin Content	Benzene Content	e200	e300	BioDiesel Ester	Cetane Index	PAH Content	T50	T90
10	10	6.9	30	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	218	329
20	20	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	30	0	7.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	51	7.7	11	85	0	0	0	0	0	0	49.9	89.5	0	0	0	200	300
90	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	10	8.7	338	0	0	0	0	26.4	11.9	1.64	50	83	0	0	0	199.816	329.40
97	10	6.6	150	0	11.758	0	0	24	11	0.8	52	84	0	0	0	195.735	324.86
98	10	6.9	30	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	218	329
99	10	6.9	90	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	218	329
3190	12	6.83	18.5	10.0	0	0	0	21.964	4.8161	0.53	44.256	88.711	0	0	0	211.53	303.44
3191	12	8.61708	14.8	10.3	0	0	0	21.894	4.6848	0.53	46.808	89.670	0	0	0	206.33	299.09
3192	12	7.885	19	10.1	0	0	0	21.917	4.9097	0.53	45.779	89.313	0	0	0	208.42	300.71
25005	21	0	15	0	0	0	0	0	0	0	0	0	5	0	0	0	0
27001	51	10.5	8	74	0	0	0	0	0	0	49.9	89.5	0	0	0	200	300
27002	51	7.7	8	74	0	0	0	0	0	0	49.9	89.5	0	0	0	200	300
28001	30	0	7.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[FuelUsageFraction]

countyID	fuelYearID	modelYearGroupID	sourceBinFuelTypeID	fuelSupplyFuelTypeID	usageFraction
4013	2014	0	1	1	1
4013	2014	0	2	2	1
4013	2014	0	3	3	1
4013	2014	0	5	1	0.982134
4013	2014	0	5	5	0.017866
4013	2014	0	9	9	1

[FuelSupply]

fuelRegionID	fuelYearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV
1570011000	2014	5	3190	1	0.5
1570011000	2014	6	3190	1	0.5
1570011000	2014	7	3190	1	0.5
1570011000	2014	8	3190	1	0.5
1570011000	2014	9	3190	1	0.5
1570011000	2014	1	3191	1	0.5
1570011000	2014	2	3191	1	0.5
1570011000	2014	3	3191	1	0.5
1570011000	2014	11	3191	1	0.5
1570011000	2014	12	3191	1	0.5
1570011000	2014	4	3192	1	0.5
1570011000	2014	10	3192	1	0.5
1570011000	2014	1	25005	1	0.5
1570011000	2014	2	25005	1	0.5
1570011000	2014	3	25005	1	0.5
1570011000	2014	4	25005	1	0.5
1570011000	2014	5	25005	1	0.5
1570011000	2014	6	25005	1	0.5
1570011000	2014	7	25005	1	0.5
1570011000	2014	8	25005	1	0.5
1570011000	2014	9	25005	1	0.5
1570011000	2014	10	25005	1	0.5
1570011000	2014	11	25005	1	0.5
1570011000	2014	12	25005	1	0.5
1570011000	2014	1	27001	1	0.5
1570011000	2014	2	27001	1	0.5
1570011000	2014	3	27001	1	0.5
1570011000	2014	11	27001	1	0.5
1570011000	2014	12	27001	1	0.5
1570011000	2014	4	27002	1	0.5
1570011000	2014	5	27002	1	0.5
1570011000	2014	6	27002	1	0.5
1570011000	2014	7	27002	1	0.5
1570011000	2014	8	27002	1	0.5
1570011000	2014	9	27002	1	0.5
1570011000	2014	10	27002	1	0.5
1570011000	2014	1	28001	1	0.5
1570011000	2014	2	28001	1	0.5
1570011000	2014	3	28001	1	0.5
1570011000	2014	4	28001	1	0.5
1570011000	2014	5	28001	1	0.5
1570011000	2014	6	28001	1	0.5
1570011000	2014	7	28001	1	0.5
1570011000	2014	8	28001	1	0.5
1570011000	2014	9	28001	1	0.5
1570011000	2014	10	28001	1	0.5
1570011000	2014	11	28001	1	0.5
1570011000	2014	12	28001	1	0.5
1570011000	2014	1	90	1	0.5
1570011000	2014	2	90	1	0.5
1570011000	2014	3	90	1	0.5
1570011000	2014	4	90	1	0.5
1570011000	2014	5	90	1	0.5
1570011000	2014	6	90	1	0.5
1570011000	2014	7	90	1	0.5
1570011000	2014	8	90	1	0.5
1570011000	2014	9	90	1	0.5
1570011000	2014	10	90	1	0.5
1570011000	2014	11	90	1	0.5
1570011000	2014	12	90	1	0.5

[ZoneMonthHour]

monthID	zoneID	HourID	temperature	relHumidity
1	40130	1	53	41
1	40130	2	52	43
1	40130	3	51	44
1	40130	4	51	44
1	40130	5	50	46
1	40130	6	49	47
1	40130	7	49	46
1	40130	8	49	46
1	40130	9	52	39
1	40130	10	57	31
1	40130	11	62	25
1	40130	12	66	21
1	40130	13	68	18
1	40130	14	70	16
1	40130	15	71	15
1	40130	16	72	15
1	40130	17	71	16
1	40130	18	69	18

monthID	zoneID	HourID	temperature	relHumidity
1	40130	19	65	22
1	40130	20	63	26
1	40130	21	61	28
1	40130	22	58	33
1	40130	23	56	36
1	40130	24	55	39
2	40130	1	59	35
2	40130	2	58	38
2	40130	3	57	39
2	40130	4	56	40
2	40130	5	55	41
2	40130	6	54	42
2	40130	7	54	43
2	40130	8	54	43
2	40130	9	58	37
2	40130	10	62	31
2	40130	11	67	26
2	40130	12	70	23

monthID	zoneID	HourID	temperature	relHumidity
2	40130	13	72	21
2	40130	14	74	19
2	40130	15	75	18
2	40130	16	75	18
2	40130	17	75	18
2	40130	18	74	18
2	40130	19	72	20
2	40130	20	69	23
2	40130	21	67	26
2	40130	22	65	29
2	40130	23	63	32
2	40130	24	61	34
3	40130	1	65	34
3	40130	2	64	35
3	40130	3	62	37
3	40130	4	61	40
3	40130	5	59	43
3	40130	6	59	44

monthID	zoneID	HourID	temperature	relHumidity
3	40130	7	58	44
3	40130	8	61	41
3	40130	9	64	34
3	40130	10	68	29
3	40130	11	71	25
3	40130	12	74	22
3	40130	13	77	19
3	40130	14	78	17
3	40130	15	79	16
3	40130	16	80	16
3	40130	17	80	16
3	40130	18	78	17
3	40130	19	76	19
3	40130	20	74	21
3	40130	21	72	23
3	40130	22	70	24
3	40130	23	68	27
3	40130	24	66	30
4	40130	1	72	19
4	40130	2	70	20
4	40130	3	68	23
4	40130	4	66	25
4	40130	5	65	26
4	40130	6	64	27
4	40130	7	64	27
4	40130	8	67	24
4	40130	9	72	20
4	40130	10	75	18
4	40130	11	78	15
4	40130	12	81	13
4	40130	13	83	11
4	40130	14	84	10
4	40130	15	85	10
4	40130	16	86	10
4	40130	17	86	10
4	40130	18	85	10
4	40130	19	83	10
4	40130	20	81	12
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4	40130	22	77	15
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5	40130	19	92	9
5	40130	20	90	10
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5	40130	22	85	12
5	40130	23	84	13
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6	40130	2	88	15
6	40130	3	85	18
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6	40130	5	82	20
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7	40130	2	91	34
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7	40130	4	89	37
7	40130	5	88	37
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7	40130	9	93	31
7	40130	10	95	28
7	40130	11	98	25
7	40130	12	100	22
7	40130	13	102	20
7	40130	14	104	19
7	40130	15	105	18
7	40130	16	105	17
7	40130	17	105	17
7	40130	18	104	19
7	40130	19	102	21
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7	40130	23	95	29
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8	40130	6	83	50
8	40130	7	83	50
8	40130	8	85	47
8	40130	9	88	42
8	40130	10	91	37
8	40130	11	93	34
8	40130	12	95	30
8	40130	13	97	29
8	40130	14	99	26
8	40130	15	100	24
8	40130	16	100	23
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8	40130	18	99	26
8	40130	19	97	26
8	40130	20	96	27
8	40130	21	93	31
8	40130	22	91	36
8	40130	23	90	37
8	40130	24	89	39
9	40130	1	85	44
9	40130	2	84	47
9	40130	3	83	50
9	40130	4	82	52
9	40130	5	81	54
9	40130	6	80	56
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9	40130	10	89	38
9	40130	11	92	34
9	40130	12	94	32
9	40130	13	95	31
9	40130	14	96	29
9	40130	15	96	30
9	40130	16	96	30
9	40130	17	96	29
9	40130	18	95	29
9	40130	19	94	30
9	40130	20	92	34
9	40130	21	90	38
9	40130	22	88	40
9	40130	23	88	40
9	40130	24	86	44
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10	40130	5	70	50
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10	40130	7	70	50
10	40130	8	73	46
10	40130	9	76	40
10	40130	10	80	35
10	40130	11	83	31
10	40130	12	85	28
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10	40130	14	89	24
10	40130	15	90	22
10	40130	16	90	21
10	40130	17	89	22
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10	40130	21	80	36
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10	40130	24	75	43
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11	40130	14	76	19
11	40130	15	77	18
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11	40130	18	73	20
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11	40130	20	68	27
11	40130	21	67	31
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12	40130	5	50	72
12	40130	6	50	72
12	40130	7	50	72
12	40130	8	50	72
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12	40130	10	56	55
12	40130	11	60	49
12	40130	12	62	43
12	40130	13	64	40
12	40130	14	65	38
12	40130	15	66	36
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12	40130	18	63	44
12	40130	19	61	48
12	40130	20	58	55
12	40130	21	58	55
12	40130	22	57	57
12	40130	23	55	61
12	40130	24	54	63

[SourceTypeAgeDistribution]

Source TypeID	YearID	AgeID	AgeFraction
11	2014	0	0.038851
11	2014	1	0.067568
11	2014	2	0.058699
11	2014	3	0.042019
11	2014	4	0.030300
11	2014	5	0.065139
11	2014	6	0.067779
11	2014	7	0.085198
11	2014	8	0.082981
11	2014	9	0.069257
11	2014	10	0.051098
11	2014	11	0.058594
11	2014	12	0.047297
11	2014	13	0.040646
11	2014	14	0.033995
11	2014	15	0.028188
11	2014	16	0.020165
11	2014	17	0.015836
11	2014	18	0.014886
11	2014	19	0.012352
11	2014	20	0.009713
11	2014	21	0.009185
11	2014	22	0.006651
11	2014	23	0.004962
11	2014	24	0.004540
11	2014	25	0.004540
11	2014	26	0.004540
11	2014	27	0.005068
11	2014	28	0.007285
11	2014	29	0.006334
11	2014	30	0.006334
21	2014	0	0.050100
21	2014	1	0.076900
21	2014	2	0.064800
21	2014	3	0.052400
21	2014	4	0.047600
21	2014	5	0.037500
21	2014	6	0.059700
21	2014	7	0.068800
21	2014	8	0.068900
21	2014	9	0.063700
21	2014	10	0.058600
21	2014	11	0.052300
21	2014	12	0.048500
21	2014	13	0.042500
21	2014	14	0.039500
21	2014	15	0.031400
21	2014	16	0.024400
21	2014	17	0.020300
21	2014	18	0.014700
21	2014	19	0.013100
21	2014	20	0.009600
21	2014	21	0.007300
21	2014	22	0.005500
21	2014	23	0.004800
21	2014	24	0.003900
21	2014	25	0.003100
21	2014	26	0.002500
21	2014	27	0.002200
21	2014	28	0.001800
21	2014	29	0.001500
21	2014	30	0.022100
31	2014	0	0.081695
31	2014	1	0.055524
31	2014	2	0.040539
31	2014	3	0.038378
31	2014	4	0.026072
31	2014	5	0.019801
31	2014	6	0.051019
31	2014	7	0.065069
31	2014	8	0.072258
31	2014	9	0.059254
31	2014	10	0.062216
31	2014	11	0.051430
31	2014	12	0.047464
31	2014	13	0.051500
31	2014	14	0.045435
31	2014	15	0.034062
31	2014	16	0.027786
31	2014	17	0.027765
31	2014	18	0.019702
31	2014	19	0.019161
31	2014	20	0.016728
31	2014	21	0.011136
31	2014	22	0.007571
31	2014	23	0.006589
31	2014	24	0.005906
31	2014	25	0.006023
31	2014	26	0.004523
31	2014	27	0.003103
31	2014	28	0.004077
31	2014	29	0.003106
31	2014	30	0.035108
32	2014	0	0.086135
32	2014	1	0.057941
32	2014	2	0.043586
32	2014	3	0.039447
32	2014	4	0.026124
32	2014	5	0.020848
32	2014	6	0.052503
32	2014	7	0.069230
32	2014	8	0.076084
32	2014	9	0.059563
32	2014	10	0.059391
32	2014	11	0.048796
32	2014	12	0.044650
32	2014	13	0.048787
32	2014	14	0.045632
32	2014	15	0.033340
32	2014	16	0.026629
32	2014	17	0.026523
32	2014	18	0.018772
32	2014	19	0.018280
32	2014	20	0.015767
32	2014	21	0.010524
32	2014	22	0.007161
32	2014	23	0.006290
32	2014	24	0.005669
32	2014	25	0.005703
32	2014	26	0.004298
32	2014	27	0.002944
32	2014	28	0.003834
32	2014	29	0.002913
32	2014	30	0.032635
41	2014	0	0.072300
41	2014	1	0.059200
41	2014	2	0.063100
41	2014	3	0.040900
41	2014	4	0.017800
41	2014	5	0.026300
41	2014	6	0.053200
41	2014	7	0.112200
41	2014	8	0.107200
41	2014	9	0.073800
41	2014	10	0.050800
41	2014	11	0.036000
41	2014	12	0.027200
41	2014	13	0.038000
41	2014	14	0.046600
41	2014	15	0.042000
41	2014	16	0.022600
41	2014	17	0.021700
41	2014	18	0.018500
41	2014	19	0.018700
41	2014	20	0.011200
41	2014	21	0.007400
41	2014	22	0.005400
41	2014	23	0.004700
41	2014	24	0.006300
41	2014	25	0.004100
41	2014	26	0.003200
41	2014	27	0.002500
41	2014	28	0.002000
41	2014	29	0.001300
41	2014	30	0.003800
42	2014	0	0.072300
42	2014	1	0.059200
42	2014	2	0.063100
42	2014	3	0.040900
42	2014	4	0.017800
42	2014	5	0.026300
42	2014	6	0.053200
42	2014	7	0.112200
42	2014	8	0.107200
42	2014	9	0.073800
42	2014	10	0.050800
42	2014	11	0.036000
42	2014	12	0.027200
42	2014	13	0.038000
42	2014	14	0.046600
42	2014	15	0.042000
42	2014	16	0.022600
42	2014	17	0.021700
42	2014	18	0.018500
42	2014	19	0.018700
42	2014	20	0.011200
42	2014	21	0.007400
42	2014	22	0.005400
42	2014	23	0.004700
42	2014	24	0.006300
42	2014	25	0.004100
42	2014	26	0.003200
42	2014	27	0.002500
42	2014	28	0.002000
42	2014	29	0.001300
42	2014	30	0.003800
43	2014	0	0.126012
43	2014	1	0.081608
43	2014	2	0.075807
43	2014	3	0.050205
43	2014	4	0.026602
43	2014	5	0.032103
43	2014	6	0.068206
43	2014	7	0.114311
43	2014	8	0.118011
43	2014	9	0.063606
43	2014	10	0.030203
43	2014	11	0.021602
43	2014	12	0.015701
43	2014	13	0.020802
43	2014	14	0.048605
43	2014	15	0.026302
43	2014	16	0.014801
43	2014	17	0.013801
43	2014	18	0.009201
43	2014	19	0.009201
43	2014	20	0.005801
43	2014	21	0.004100
43	2014	22	0.002900
43	2014	23	0.003200
43	2014	24	0.003200
43	2014	25	0.002300
43	2014	26	0.001900
43	2014	27	0.001300
43	2014	28	0.001300
43	2014	29	0.000900
43	2014	30	0.006407
51	2014	0	0.126000
51	2014	1	0.081600
51	2014	2	0.075800
51	2014	3	0.050200
51	2014	4	0.026600
51	2014	5	0.032100
51	2014	6	0.068200
51	2014	7	0.114300
51	2014	8	0.118000
51	2014	9	0.063600
51	2014	10	0.030200
51	2014	11	0.021600
51	2014	12	0.015700
51	2014	13	0.020800
51	2014	14	0.048600
51	2014	15	0.026300
51	2014	16	0.014800
51	2014	17	0.013800
51	2014	18	0.009200
51	2014	19	0.009200
51	2014	20	0.005800
51	2014	21	0.004100
51	2014	22	0.002900
51	2014	23	0.003200
51	2014	24	0.003200
51	2014	25	0.002300
51	2014	26	0.001900
51	2014	27	0.001300
51	2014	28	0.001300
51	2014	29	0.000900
51	2014	30	0.006500
52	2014	0	0.116089
52	2014	1	0.074980
52	2014	2	0.065956
52	2014	3	0.047090
52	2014	4	0.026475
52	2014	5	0.028604
52	2014	6	0.063398

Source TypeID	YearID	AgeID	AgeFraction
52	2014	7	0.100180
52	2014	8	0.104724
52	2014	9	0.062119
52	2014	10	0.038902
52	2014	11	0.029700
52	2014	12	0.024288
52	2014	13	0.029128
52	2014	14	0.047409
52	2014	15	0.028261
52	2014	16	0.018284
52	2014	17	0.017559
52	2014	18	0.012040
52	2014	19	0.011898
52	2014	20	0.008784
52	2014	21	0.006045
52	2014	22	0.004177
52	2014	23	0.004124
52	2014	24	0.003943
52	2014	25	0.003346
52	2014	26	0.002635
52	2014	27	0.001793
52	2014	28	0.002062
52	2014	29	0.001505
52	2014	30	0.014500
53	2014	0	0.127928
53	2014	1	0.081924
53	2014	2	0.075332
53	2014	3	0.050230
53	2014	4	0.026607
53	2014	5	0.031870
53	2014	6	0.067955
53	2014	7	0.113257
53	2014	8	0.116866
53	2014	9	0.063248
53	2014	10	0.030347
53	2014	11	0.021731
53	2014	12	0.015805
53	2014	13	0.020928
53	2014	14	0.048227
53	2014	15	0.026176
53	2014	16	0.014812
53	2014	17	0.013827
53	2014	18	0.009234
53	2014	19	0.009236
53	2014	20	0.005866
53	2014	21	0.004166
53	2014	22	0.002929
53	2014	23	0.003218
53	2014	24	0.003220
53	2014	25	0.002353
53	2014	26	0.001935

Source TypeID	YearID	AgeID	AgeFraction
53	2014	27	0.001312
53	2014	28	0.001321
53	2014	29	0.000916
53	2014	30	0.007224
54	2014	0	0.126042
54	2014	1	0.081627
54	2014	2	0.075825
54	2014	3	0.050217
54	2014	4	0.026609
54	2014	5	0.032111
54	2014	6	0.068223
54	2014	7	0.114338
54	2014	8	0.118039
54	2014	9	0.063621
54	2014	10	0.030210
54	2014	11	0.021607
54	2014	12	0.015705
54	2014	13	0.020807
54	2014	14	0.048616
54	2014	15	0.026309
54	2014	16	0.014805
54	2014	17	0.013805
54	2014	18	0.009203
54	2014	19	0.009203
54	2014	20	0.005802
54	2014	21	0.004101
54	2014	22	0.002901
54	2014	23	0.003201
54	2014	24	0.003201
54	2014	25	0.002301
54	2014	26	0.001901
54	2014	27	0.001300
54	2014	28	0.001300
54	2014	29	0.000900
54	2014	30	0.006171
61	2014	0	0.126005
61	2014	1	0.081603
61	2014	2	0.075803
61	2014	3	0.050202
61	2014	4	0.026601
61	2014	5	0.032101
61	2014	6	0.068203
61	2014	7	0.114304
61	2014	8	0.118004
61	2014	9	0.063602
61	2014	10	0.030201
61	2014	11	0.021601
61	2014	12	0.015701
61	2014	13	0.020801
61	2014	14	0.048602
61	2014	15	0.026301

Source TypeID	YearID	AgeID	AgeFraction
61	2014	16	0.014801
61	2014	17	0.013801
61	2014	18	0.009200
61	2014	19	0.009200
61	2014	20	0.005800
61	2014	21	0.004100
61	2014	22	0.002900
61	2014	23	0.003200
61	2014	24	0.003200
61	2014	25	0.002300
61	2014	26	0.001900
61	2014	27	0.001300
61	2014	28	0.001300
61	2014	29	0.000900
61	2014	30	0.006462
62	2014	0	0.126002
62	2014	1	0.081601
62	2014	2	0.075801
62	2014	3	0.050201
62	2014	4	0.026600
62	2014	5	0.032100
62	2014	6	0.068201
62	2014	7	0.114302
62	2014	8	0.118002
62	2014	9	0.063601
62	2014	10	0.030200
62	2014	11	0.021600
62	2014	12	0.015700
62	2014	13	0.020800
62	2014	14	0.048601
62	2014	15	0.026300
62	2014	16	0.014800
62	2014	17	0.013800
62	2014	18	0.009200
62	2014	19	0.009200
62	2014	20	0.005800
62	2014	21	0.004100
62	2014	22	0.002900
62	2014	23	0.003200
62	2014	24	0.003200
62	2014	25	0.002300
62	2014	26	0.001900
62	2014	27	0.001300
62	2014	28	0.001300
62	2014	29	0.000900
62	2014	30	0.006485

[IMCoverage]

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
101	4	4013	2014	21	1	103	1967	1980	1	13	N	57.6164
101	4	4013	2014	21	1	106	1981	1995	2	31	N	64.12
101	4	4013	2014	21	1	110	1996	2010	2	51	N	90.0428
101	4	4013	2014	31	1	103	1967	1980	1	13	N	57.6164
101	4	4013	2014	31	1	106	1981	1995	2	31	N	64.12
101	4	4013	2014	31	1	110	1996	2010	2	51	N	90.0428
101	4	4013	2014	32	1	103	1967	1980	1	13	N	57.6164
101	4	4013	2014	32	1	106	1981	1995	2	31	N	64.12
101	4	4013	2014	32	1	110	1996	2010	2	51	N	90.0428
101	4	4013	2014	52	1	103	1967	2010	1	13	N	87.2032
102	4	4013	2014	21	1	103	1967	1980	1	13	N	57.6164
102	4	4013	2014	21	1	106	1981	1995	2	31	N	64.12
102	4	4013	2014	21	1	110	1996	2010	2	51	N	90.0428
102	4	4013	2014	31	1	103	1967	1980	1	13	N	57.6164
102	4	4013	2014	31	1	106	1981	1995	2	31	N	64.12
102	4	4013	2014	31	1	110	1996	2010	2	51	N	90.0428
102	4	4013	2014	32	1	103	1967	1980	1	13	N	57.6164
102	4	4013	2014	32	1	106	1981	1995	2	31	N	64.12
102	4	4013	2014	32	1	110	1996	2010	2	51	N	90.0428
102	4	4013	2014	52	1	103	1967	2010	1	13	N	87.2032
112	4	4013	2014	21	1	108	1996	2010	2	43	N	83.814
112	4	4013	2014	21	1	109	1981	1995	2	44	N	64.12
112	4	4013	2014	31	1	108	1996	2010	2	43	N	83.814
112	4	4013	2014	31	1	109	1981	1995	2	44	N	64.12
112	4	4013	2014	32	1	108	1996	2010	2	43	N	83.814
112	4	4013	2014	32	1	109	1981	1995	2	44	N	64.12
112	4	4013	2014	52	1	107	1981	2010	1	41	N	86.2872
201	4	4013	2014	21	1	103	1967	1980	1	13	N	57.6164
201	4	4013	2014	21	1	106	1981	1995	2	31	N	64.12
201	4	4013	2014	21	1	110	1996	2010	2	51	N	90.0428
201	4	4013	2014	31	1	103	1967	1980	1	13	N	57.6164
201	4	4013	2014	31	1	106	1981	1995	2	31	N	64.12
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201	4	4013	2014	32	1	110	1996	2010	2	51	N	90.0428
201	4	4013	2014	52	1	103	1967	2010	1	13	N	87.2032
202	4	4013	2014	21	1	103	1967	1980	1	13	N	57.6164
202	4	4013	2014	21	1	106	1981	1995	2	31	N	64.12
202	4	4013	2014	21	1	110	1996	2010	2	51	N	90.0428
202	4	4013	2014	31	1	103	1967	1980	1	13	N	57.6164
202	4	4013	2014	31	1	106	1981	1995	2	31	N	64.12
202	4	4013	2014	31	1	110	1996	2010	2	51	N	90.0428
202	4	4013	2014	32	1	103	1967	1980	1	13	N	57.6164
202	4	4013	2014	32	1	106	1981	1995	2	31	N	64.12
202	4	4013	2014	32	1	110	1996	2010	2	51	N	90.0428
202	4	4013	2014	52	1	103	1967	2010	1	13	N	87.2032
301	4	4013	2014	21	1	103	1967	1980	1	13	N	57.6164
301	4	4013	2014	21	1	106	1981	1995	2	31	N	64.12
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301	4	4013	2014	31	1	103	1967	1980	1	13	N	57.6164
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301	4	4013	2014	31	1	110	1996	2010	2	51	N	90.0428
301	4	4013	2014	32	1	103	1967	1980	1	13	N	57.6164
301	4	4013	2014	32	1	106	1981	1995	2	31	N	64.12
301	4	4013	2014	32	1	110	1996	2010	2	51	N	90.0428
301	4	4013	2014	52	1	103	1967	2010	1	13	N	87.2032
302	4	4013	2014	21	1	103	1967	1980	1	13	N	57.6164
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302	4	4013	2014	21	1	110	1996	2010	2	51	N	90.0428
302	4	4013	2014	31	1	103	1967	1980	1	13	N	57.6164
302	4	4013	2014	31	1	106	1981	1995	2	31	N	64.12
302	4	4013	2014	31	1	110	1996	2010	2	51	N	90.0428
302	4	4013	2014	32	1	103	1967	1980	1	13	N	57.6164
302	4	4013	2014	32	1	106	1981	1995	2	31	N	64.12
302	4	4013	2014	32	1	110	1996	2010	2	51	N	90.0428
302	4	4013	2014	52	1	103	1967	2010	1	13	N	87.2032
101	4	4013	2014	21	5	303	1967	1980	1	13	N	57.6164
101	4	4013	2014	21	5	306	1981	1995	2	31	N	64.12
101	4	4013	2014	21	5	310	1996	2010	2	51	N	90.0428
101	4	4013	2014	31	5	303	1967	1980	1	13	N	57.6164
101	4	4013	2014	31	5	306	1981	1995	2	31	N	64.12
101	4	4013	2014	31	5	310	1996	2010	2	51	N	90.0428
101	4	4013	2014	32	5	303	1967	1980	1	13	N	57.6164
101	4	4013	2014	32	5	306	1981	1995	2	31	N	64.12
101	4	4013	2014	32	5	310	1996	2010	2	51	N	90.0428
101	4	4013	2014	52	5	303	1967	2010	1	13	N	87.2032
102	4	4013	2014	21	5	303	1967	1980	1	13	N	57.6164
102	4	4013	2014	21	5	306	1981	1995	2	31	N	64.12
102	4	4013	2014	21	5	310	1996	2010	2	51	N	90.0428
102	4	4013	2014	31	5	303	1967	1980	1	13	N	57.6164
102	4	4013	2014	31	5	306	1981	1995	2	31	N	64.12
102	4	4013	2014	31	5	310	1996	2010	2	51	N	90.0428
102	4	4013	2014	32	5	303	1967	1980	1	13	N	57.6164
102	4	4013	2014	32	5	306	1981	1995	2	31	N	64.12
102	4	4013	2014	32	5	310	1996	2010	2	51	N	90.0428
102	4	4013	2014	52	5	303	1967	2010	1	13	N	87.2032
112	4	4013	2014	21	5	308	1996	2010	2	43	N	83.814
112	4	4013	2014	21	5	309	1981	1995	2	44	N	64.12
112	4	4013	2014	31	5	308	1996	2010	2	43	N	83.814
112	4	4013	2014	31	5	309	1981	1995	2	44	N	64.12

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
112	4	4013	2014	32	5	308	1996	2010	2	43	N	83.814
112	4	4013	2014	32	5	309	1981	1995	2	44	N	64.12
112	4	4013	2014	52	5	307	1981	2010	1	41	N	86.2872
201	4	4013	2014	21	5	303	1967	1980	1	13	N	57.6164
201	4	4013	2014	21	5	306	1981	1995	2	31	N	64.12
201	4	4013	2014	21	5	310	1996	2010	2	51	N	90.0428
201	4	4013	2014	31	5	303	1967	1980	1	13	N	57.6164
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201	4	4013	2014	31	5	310	1996	2010	2	51	N	90.0428
201	4	4013	2014	32	5	303	1967	1980	1	13	N	57.6164
201	4	4013	2014	32	5	306	1981	1995	2	31	N	64.12
201	4	4013	2014	32	5	310	1996	2010	2	51	N	90.0428
201	4	4013	2014	52	5	303	1967	2010	1	13	N	87.2032
202	4	4013	2014	21	5	303	1967	1980	1	13	N	57.6164
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202	4	4013	2014	21	5	310	1996	2010	2	51	N	90.0428
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202	4	4013	2014	31	5	310	1996	2010	2	51	N	90.0428
202	4	4013	2014	32	5	303	1967	1980	1	13	N	57.6164
202	4	4013	2014	32	5	306	1981	1995	2	31	N	64.12
202	4	4013	2014	32	5	310	1996	2010	2	51	N	90.0428
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302	4	4013	2014	32	5	310	1996	2010	2	51	N	90.0428
302	4	4013	2014	52	5	303	1967	2010	1	13	N	87.2032
101	4	4013	2014	21	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	21	1	6	1981	1995	2	31	Y	63.6192
101	4	4013	2014	21	1	10	1996	2010	2	51	Y	83.1594
101	4	4013	2014	31	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	31	1	6	1981	1995	2	31	Y	63.6192
101	4	4013	2014	31	1	10	1996	2010	2	51	Y	78.1699
101	4	4013	2014	32	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	32	1	6	1981	1995	2	31	Y	63.6192
101	4	4013	2014	32	1	10	1996	2010	2	51	Y	73.1802
101	4	4013	2014	41	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	42	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	43	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	51	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	52	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	53	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	54	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	61	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	62	1	3	1967	1980	1	13	Y	57.2079
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102	4	4013	2014	21	1	10	1996	2010	2	51	Y	83.1594
102	4	4013	2014	31	1	3	1967	1980	1	13	Y	57.2079
102	4	4013	2014	31	1	6	1981	1995	2	31	Y	63.6192
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102	4	4013	2014	32	1	6	1981	1995	2	31	Y	63.6192
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102	4	4013	2014	61	1	3	1967	1980	1	13	Y	57.2079
102	4	4013	2014	62	1	3	1967	1980	1	13	Y	57.2079
112	4	4013	2014	21	1	8	1996	2010	2	45	Y	89.3396
112	4	4013	2014	21	1	9	1981	1995	2	44	Y	63.6192
112	4	4013	2014	21	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	31	1	8	1996	2010	2	45	Y	83.9792
112	4	4013	2014	31	1	9	1981	1995	2	44	Y	59.8021
112	4	4013	2014	31	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	32	1	8	1996	2010	2	45	Y	78.6188
112	4	4013	2014	32	1	9	1981	1995	2	44	Y	55.9849
112	4	4013	2014	32	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	41	1	7	1981	2010	1	41	Y	85.6133
112	4	4013	2014	41	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	42	1	7	1981	2010	1	41	Y	85.6133
112	4	4013	2014	42	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	43	1	7	1981	2010	1	41	Y	85.6133

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
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112	4	4013	2014	51	1	7	1981	2010	1	41	Y	85.6133
112	4	4013	2014	51	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	52	1	7	1981	2010	1	41	Y	85.6133
112	4	4013	2014	52	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	53	1	7	1981	2010	1	41	Y	85.6133
112	4	4013	2014	53	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	54	1	7	1981	2010	1	41	Y	85.6133
112	4	4013	2014	54	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	61	1	7	1981	2010	1	41	Y	85.6133
112	4	4013	2014	61	1	11	1967	1980	1	41	Y	86.7668
112	4	4013	2014	62	1	7	1981	2010	1	41	Y	85.6133
112	4	4013	2014	62	1	11	1967	1980	1	41	Y	86.7668
113	4	4013	2014	21	1	8	1996	2010	2	45	Y	89.3396
113	4	4013	2014	21	1	9	1981	1995	2	44	Y	63.6192
113	4	4013	2014	21	1	11	1967	1980	1	41	Y	86.7668
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113	4	4013	2014	32	1	8	1996	2010	2	45	Y	78.6188
113	4	4013	2014	32	1	9	1981	1995	2	44	Y	55.9849
113	4	4013	2014	32	1	11	1967	1980	1	41	Y	86.7668
113	4	4013	2014	41	1	7	1981	2010	1	41	Y	85.6133
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113	4	4013	2014	52	1	7	1981	2010	1	41	Y	85.6133
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113	4	4013	2014	62	1	7	1981	2010	1	41	Y	85.6133
113	4	4013	2014	62	1	11	1967	1980	1	41	Y	86.7668
201	4	4013	2014	21	1	3	1967	1980	1	13	Y	57.2079
201	4	4013	2014	21	1	6	1981	1995	2	31	Y	63.6192
201	4	4013	2014	21	1	10	1996	2010	2	51	Y	83.1594
201	4	4013	2014	31	1	3	1967	1980	1	13	Y	57.2079
201	4	4013	2014	31	1	6	1981	1995	2	31	Y	63.6192
201	4	4013	2014	31	1	10	1996	2010	2	51	Y	78.1699
201	4	4013	2014	32	1	3	1967	1980	1	13	Y	57.2079
201	4	4013	2014	32	1	6	1981	1995	2	31	Y	63.6192
201	4	4013	2014	32	1	10	1996	2010	2	51	Y	73.1802
201	4	4013	2014	41	1	3	1967	1980	1	13	Y	57.2079
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201	4	4013	2014	62	1	3	1967	1980	1	13	Y	57.2079
202	4	4013	2014	21	1	3	1967	1980	1	13	Y	57.2079
202	4	4013	2014	21	1	6	1981	1995	2	31	Y	63.6192
202	4	4013	2014	21	1	10	1996	2010	2	51	Y	83.1594
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202	4	4013	2014	31	1	6	1981	1995	2	31	Y	63.6192
202	4	4013	2014	31	1	10	1996	2010	2	51	Y	78.1699
202	4	4013	2014	32	1	3	1967	1980	1	13	Y	57.2079
202	4	4013	2014	32	1	6	1981	1995	2	31	Y	63.6192
202	4	4013	2014	32	1	10	1996	2010	2	51	Y	73.1802
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202	4	4013	2014	51	1	3	1967	1980	1	13	Y	57.2079
202	4	4013	2014	52	1	3	1967	1980	1	13	Y	57.2079
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301	4	4013	2014	52	1	3	1967	1980	1	13	Y	57.2079
301	4	4013	2014	53	1	3	1967	1980	1	13	Y	57.2079
301	4	4013	2014	54	1	3	1967	1980	1	13	Y	57.2079
301	4	4013	2014	61	1	3	1967	1980	1	13	Y	57.2079

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
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302	4	4013	2014	21	1	3	1967	1980	1	13	Y	57.2079
302	4	4013	2014	21	1	6	1981	1995	2	31	Y	63.6192
302	4	4013	2014	21	1	10	1996	2010	2	51	Y	83.1594
302	4	4013	2014	31	1	3	1967	1980	1	13	Y	57.2079
302	4	4013	2014	31	1	6	1981	1995	2	31	Y	63.6192
302	4	4013	2014	31	1	10	1996	2010	2	51	Y	78.1699
302	4	4013	2014	32	1	3	1967	1980	1	13	Y	57.2079
302	4	4013	2014	32	1	6	1981	1995	2	31	Y	63.6192
302	4	4013	2014	32	1	10	1996	2010	2	51	Y	73.1802
302	4	4013	2014	41	1	3	1967	1980	1	13	Y	57.2079
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302	4	4013	2014	62	1	3	1967	1980	1	13	Y	57.2079
101	4	4013	2014	41	1	4	1981	2010	2	13	Y	86.5221
101	4	4013	2014	42	1	4	1981	2010	2	13	Y	86.5221
101	4	4013	2014	43	1	4	1981	2010	2	13	Y	86.5221
101	4	4013	2014	51	1	4	1981	2010	2	13	Y	86.5221
101	4	4013	2014	52	1	4	1981	2010	2	13	Y	86.5221
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202	4	4013	2014	51	1	4	1981	2010	2	13	Y	86.5221
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101	4	4013	2014	21	5	506	1981	1995	2	31	Y	63.6192
101	4	4013	2014	21	5	510	1996	2010	2	51	Y	83.1594
101	4	4013	2014	31	5	503	1967	1980	1	13	Y	57.2079
101	4	4013	2014	31	5	506	1981	1995	2	31	Y	63.6192
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polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
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102	4	4013	2014	31	5	506	1981	1995	2	31	Y	63.6192
102	4	4013	2014	31	5	510	1996	2010	2	51	Y	78.1699
102	4	4013	2014	32	5	503	1967	1980	1	13	Y	57.2079
102	4	4013	2014	32	5	506	1981	1995	2	31	Y	63.6192
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102	4	4013	2014	41	5	503	1967	1980	1	13	Y	57.2079
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102	4	4013	2014	62	5	503	1967	1980	1	13	Y	57.2079
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112	4	4013	2014	21	5	509	1981	1995	2	44	Y	63.6192
112	4	4013	2014	21	5	511	1967	1980	1	41	Y	86.7668
112	4	4013	2014	31	5	508	1996	2010	2	45	Y	83.9792
112	4	4013	2014	31	5	509	1981	1995	2	44	Y	59.8021
112	4	4013	2014	31	5	511	1967	1980	1	41	Y	86.7668
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112	4	4013	2014	41	5	507	1981	2010	1	41	Y	85.6133
112	4	4013	2014	41	5	511	1967	1980	1	41	Y	86.7668
112	4	4013	2014	42	5	507	1981	2010	1	41	Y	85.6133
112	4	4013	2014	42	5	511	1967	1980	1	41	Y	86.7668
112	4	4013	2014	43	5	507	1981	2010	1	41	Y	85.6133
112	4	4013	2014	43	5	511	1967	1980	1	41	Y	86.7668
112	4	4013	2014	51	5	507	1981	2010	1	41	Y	85.6133
112	4	4013	2014	51	5	511	1967	1980	1	41	Y	86.7668
112	4	4013	2014	52	5	507	1981	2010	1	41	Y	85.6133
112	4	4013	2014	52	5	511	1967	1980	1	41	Y	86.7668
112	4	4013	2014	53	5	507	1981	2010	1	41	Y	85.6133
112	4	4013	2014	53	5	511	1967	1980	1	41	Y	86.7668
112	4	4013	2014	54	5	507	1981	2010	1	41	Y	85.6133
112	4	4013	2014	54	5	511	1967	1980	1	41	Y	86.7668
112	4	4013	2014	61	5	507	1981	2010	1	41	Y	85.6133
112	4	4013	2014	61	5	511	1967	1980	1	41	Y	86.7668
112	4	4013	2014	62	5	507	1981	2010	1	41	Y	85.6133
112	4	4013	2014	62	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	21	5	508	1996	2010	2	45	Y	89.3396
113	4	4013	2014	21	5	509	1981	1995	2	44	Y	63.6192
113	4	4013	2014	21	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	31	5	508	1996	2010	2	45	Y	83.9792
113	4	4013	2014	31	5	509	1981	1995	2	44	Y	59.8021
113	4	4013	2014	31	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	32	5	508	1996	2010	2	45	Y	78.6188
113	4	4013	2014	32	5	509	1981	1995	2	44	Y	55.9849
113	4	4013	2014	32	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	41	5	507	1981	2010	1	41	Y	85.6133
113	4	4013	2014	41	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	42	5	507	1981	2010	1	41	Y	85.6133
113	4	4013	2014	42	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	43	5	507	1981	2010	1	41	Y	85.6133
113	4	4013	2014	43	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	51	5	507	1981	2010	1	41	Y	85.6133
113	4	4013	2014	51	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	52	5	507	1981	2010	1	41	Y	85.6133
113	4	4013	2014	52	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	53	5	507	1981	2010	1	41	Y	85.6133
113	4	4013	2014	53	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	54	5	507	1981	2010	1	41	Y	85.6133
113	4	4013	2014	54	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	61	5	507	1981	2010	1	41	Y	85.6133
113	4	4013	2014	61	5	511	1967	1980	1	41	Y	86.7668
113	4	4013	2014	62	5	507	1981	2010	1	41	Y	85.6133
113	4	4013	2014	62	5	511	1967	1980	1	41	Y	86.7668
201	4	4013	2014	21	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	21	5	506	1981	1995	2	31	Y	63.6192
201	4	4013	2014	21	5	510	1996	2010	2	51	Y	83.1594
201	4	4013	2014	31	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	31	5	506	1981	1995	2	31	Y	63.6192
201	4	4013	2014	31	5	510	1996	2010	2	51	Y	78.1699
201	4	4013	2014	32	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	32	5	506	1981	1995	2	31	Y	63.6192
201	4	4013	2014	32	5	510	1996	2010	2	51	Y	73.1802
201	4	4013	2014	41	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	42	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	43	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	51	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	52	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	53	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	54	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	61	5	503	1967	1980	1	13	Y	57.2079
201	4	4013	2014	62	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	21	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	21	5	506	1981	1995	2	31	Y	63.6192
202	4	4013	2014	21	5	510	1996	2010	2	51	Y	83.1594
202	4	4013	2014	31	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	31	5	506	1981	1995	2	31	Y	63.6192

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
202	4	4013	2014	31	5	510	1996	2010	2	51	Y	78.1699
202	4	4013	2014	32	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	32	5	506	1981	1995	2	31	Y	63.6192
202	4	4013	2014	32	5	510	1996	2010	2	51	Y	73.1802
202	4	4013	2014	41	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	42	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	43	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	51	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	52	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	53	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	54	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	61	5	503	1967	1980	1	13	Y	57.2079
202	4	4013	2014	62	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	21	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	21	5	506	1981	1995	2	31	Y	63.6192
301	4	4013	2014	21	5	510	1996	2010	2	51	Y	83.1594
301	4	4013	2014	31	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	31	5	506	1981	1995	2	31	Y	63.6192
301	4	4013	2014	31	5	510	1996	2010	2	51	Y	78.1699
301	4	4013	2014	32	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	32	5	506	1981	1995	2	31	Y	63.6192
301	4	4013	2014	32	5	510	1996	2010	2	51	Y	73.1802
301	4	4013	2014	41	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	42	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	43	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	51	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	52	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	53	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	54	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	61	5	503	1967	1980	1	13	Y	57.2079
301	4	4013	2014	62	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	21	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	21	5	506	1981	1995	2	31	Y	63.6192
302	4	4013	2014	21	5	510	1996	2010	2	51	Y	83.1594
302	4	4013	2014	31	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	31	5	506	1981	1995	2	31	Y	63.6192
302	4	4013	2014	31	5	510	1996	2010	2	51	Y	78.1699
302	4	4013	2014	32	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	32	5	506	1981	1995	2	31	Y	63.6192
302	4	4013	2014	32	5	510	1996	2010	2	51	Y	73.1802
302	4	4013	2014	41	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	42	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	43	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	51	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	52	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	53	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	54	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	61	5	503	1967	1980	1	13	Y	57.2079
302	4	4013	2014	62	5	503	1967	1980	1	13	Y	57.2079
101	4	4013	2014	41	5	504	1981	2010	2	13	Y	86.5221
101	4	4013	2014	42	5	504	1981	2010	2	13	Y	86.5221
101	4	4013	2014	43	5	504	1981	2010	2	13	Y	86.5221
101	4	4013	2014	51	5	504	1981	2010	2	13	Y	86.5221
101	4	4013	2014	52	5	504	1981	2010	2	13	Y	86.5221
101	4	4013	2014	53	5	504	1981	2010	2	13	Y	86.5221
101	4	4013	2014	54	5	504	1981	2010	2	13	Y	86.5221
101	4	4013	2014	61	5	504	1981	2010	2	13	Y	86.5221
101	4	4013	2014	62	5	504	1981	2010	2	13	Y	86.5221
102	4	4013	2014	41	5	504	1981	2010	2	13	Y	86.5221
102	4	4013	2014	42	5	504	1981	2010	2	13	Y	86.5221
102	4	4013	2014	43	5	504	1981	2010	2	13	Y	86.5221
102	4	4013	2014	51	5	504	1981	2010	2	13	Y	86.5221
102	4	4013	2014	52	5	504	1981	2010	2	13	Y	86.5221
102	4	4013	2014	53	5	504	1981	2010	2	13	Y	86.5221
102	4	4013	2014	54	5	504	1981	2010	2	13	Y	86.5221
102	4	4013	2014	61	5	504	1981	2010	2	13	Y	86.5221
102	4	4013	2014	62	5	504	1981	2010	2	13	Y	86.5221
201	4	4013	2014	41	5	504	1981	2010	2	13	Y	86.5221
201	4	4013	2014	42	5	504	1981	2010	2	13	Y	86.5221
201	4	4013	2014	43	5	504	1981	2010	2	13	Y	86.5221
201	4	4013	2014	51	5	504	1981	2010	2	13	Y	86.5221
201	4	4013	2014	52	5	504	1981	2010	2	13	Y	86.5221
201	4	4013	2014	53	5	504	1981	2010	2	13	Y	86.5221
201	4	4013	2014	54	5	504	1981	2010	2	13	Y	86.5221
201	4	4013	2014	61	5	504	1981	2010	2	13	Y	86.5221
201	4	4013	2014	62	5	504	1981	2010	2	13	Y	86.5221
202	4	4013	2014	41	5	504	1981	2010	2	13	Y	86.5221
202	4	4013	2014	42	5	504	1981	2010	2	13	Y	86.5221
202	4	4013	2014	43	5	504	1981	2010	2	13	Y	86.5221
202	4	4013	2014	51	5	504	1981	2010	2	13	Y	86.5221
202	4	4013	2014	52	5	504	1981	2010	2	13	Y	86.5221
202	4	4013	2014	53	5	504	1981	2010	2	13	Y	86.5221
202	4	4013	2014	54	5	504	1981	2010	2	13	Y	86.5221
202	4	4013	2014	61	5	504	1981	2010	2	13	Y	86.5221
202	4	4013	2014	62	5	504	1981	2010	2	13	Y	86.5221
301	4	4013	2014	41	5	504	1981	2010	2	13	Y	86.5221
301	4	4013	2014	42	5	504	1981	2010	2	13	Y	86.5221
301	4	4013	2014	43	5	504	1981	2010	2	13	Y	86.5221
301	4	4013	2014	51	5	504	1981	2010	2	13	Y	86.5221
301	4	4013	2014	52	5	504	1981	2010	2	13	Y	86.5221
301	4	4013	2014	53	5	504	1981	2010	2	13	Y	86.5221
301	4	4013	2014	54	5	504	1981	2010	2	13	Y	86.5221
301	4	4013	2014	61	5	504	1981	2010	2	13	Y	86.5221

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
301	4	4013	2014	62	5	504	1981	2010	2	13	Y	86.5221
302	4	4013	2014	41	5	504	1981	2010	2	13	Y	86.5221
302	4	4013	2014	42	5	504	1981	2010	2	13	Y	86.5221
302	4	4013	2014	43	5	504	1981	2010	2	13	Y	86.5221
302	4	4013	2014	51	5	504	1981	2010	2	13	Y	86.5221
302	4	4013	2014	52	5	504	1981	2010	2	13	Y	86.5221
302	4	4013	2014	53	5	504	1981	2010	2	13	Y	86.5221
302	4	4013	2014	54	5	504	1981	2010	2	13	Y	86.5221
302	4	4013	2014	61	5	504	1981	2010	2	13	Y	86.5221
302	4	4013	2014	62	5	504	1981	2010	2	13	Y	86.5221

[RoadType]

roadTypeID	rampFraction
2	0.071069
4	0.132624

[RoadTypeDistribution]

sourceTypeID	roadTypeID	roadTypeVMTFraction
11	1	0.00000
11	2	0.02599
11	3	0.08524
11	4	0.30636
11	5	0.58240
21	1	0.00000
21	2	0.02645
21	3	0.06762
21	4	0.37328
21	5	0.53265
31	1	0.00000
31	2	0.02645
31	3	0.06762
31	4	0.37328
31	5	0.53265
32	1	0.00000
32	2	0.02645
32	3	0.06762
32	4	0.37328
32	5	0.53265
41	1	0.00000
41	2	0.15058
41	3	0.07218
41	4	0.44269
41	5	0.33456
42	1	0.00000
42	2	0.15058
42	3	0.07218
42	4	0.44269
42	5	0.33456
43	1	0.00000
43	2	0.15058
43	3	0.07218
43	4	0.44269
43	5	0.33456
51	1	0.00000
51	2	0.05298
51	3	0.06458
51	4	0.53405
51	5	0.34840
52	1	0.00000
52	2	0.05298
52	3	0.06458
52	4	0.53405
52	5	0.34840
53	1	0.00000
53	2	0.05298
53	3	0.06458
53	4	0.53405
53	5	0.34840
54	1	0.00000
54	2	0.05298
54	3	0.06458
54	4	0.53405
54	5	0.34840
61	1	0.00000
61	2	0.25094
61	3	0.06567
61	4	0.48229
61	5	0.20111
62	1	0.00000
62	2	0.25094
62	3	0.06567
62	4	0.48229
62	5	0.20111

[MonthVMTFraction]

sourceTypeID	monthID	monthVMTFraction
11	1	0.083175
21	1	0.083175
31	1	0.083175
32	1	0.083175
41	1	0.083175
42	1	0.083175
43	1	0.083175
51	1	0.083175
52	1	0.083175
53	1	0.083175
54	1	0.083175
61	1	0.083175
62	1	0.083175
11	2	0.085878
21	2	0.085878
31	2	0.085878
32	2	0.085878
41	2	0.085878
42	2	0.085878
43	2	0.085878
51	2	0.085878
52	2	0.085878
53	2	0.085878
54	2	0.085878
61	2	0.085878
62	2	0.085878
11	3	0.086154
21	3	0.086154
31	3	0.086154
32	3	0.086154
41	3	0.086154
42	3	0.086154
43	3	0.086154
51	3	0.086154
52	3	0.086154
53	3	0.086154
54	3	0.086154
61	3	0.086154
62	3	0.086154
11	4	0.085796
21	4	0.085796
31	4	0.085796
32	4	0.085796
41	4	0.085796
42	4	0.085796
43	4	0.085796
51	4	0.085796
52	4	0.085796
53	4	0.085796
54	4	0.085796
61	4	0.085796
62	4	0.085796
11	5	0.084240
21	5	0.084240
31	5	0.084240
32	5	0.084240
41	5	0.084240
42	5	0.084240
43	5	0.084240
51	5	0.084240
52	5	0.084240
53	5	0.084240
54	5	0.084240
61	5	0.084240
62	5	0.084240
11	6	0.082456
21	6	0.082456
31	6	0.082456
32	6	0.082456
41	6	0.082456
42	6	0.082456
43	6	0.082456
51	6	0.082456
52	6	0.082456
53	6	0.082456
54	6	0.082456
61	6	0.082456
62	6	0.082456
11	7	0.078756
21	7	0.078756
31	7	0.078756
32	7	0.078756
41	7	0.078756
42	7	0.078756
43	7	0.078756
51	7	0.078756
52	7	0.078756
53	7	0.078756
54	7	0.078756
61	7	0.078756
62	7	0.078756
11	8	0.080695
21	8	0.080695
31	8	0.080695
32	8	0.080695
41	8	0.080695
42	8	0.080695
43	8	0.080695
51	8	0.080695
52	8	0.080695
53	8	0.080695
54	8	0.080695
61	8	0.080695
62	8	0.080695
11	9	0.082213
21	9	0.082213
31	9	0.082213
32	9	0.082213
41	9	0.082213
42	9	0.082213
43	9	0.082213
51	9	0.082213
52	9	0.082213
53	9	0.082213
54	9	0.082213
61	9	0.082213
62	9	0.082213
11	10	0.083410
21	10	0.083410
31	10	0.083410
32	10	0.083410
41	10	0.083410
42	10	0.083410
43	10	0.083410
51	10	0.083410
52	10	0.083410
53	10	0.083410
54	10	0.083410
61	10	0.083410
62	10	0.083410
11	11	0.083996
21	11	0.083996
31	11	0.083996
32	11	0.083996
41	11	0.083996
42	11	0.083996
43	11	0.083996
51	11	0.083996
52	11	0.083996
53	11	0.083996
54	11	0.083996
61	11	0.083996
62	11	0.083996
11	12	0.083232
21	12	0.083232
31	12	0.083232
32	12	0.083232
41	12	0.083232
42	12	0.083232
43	12	0.083232
51	12	0.083232
52	12	0.083232
53	12	0.083232
54	12	0.083232
61	12	0.083232
62	12	0.083232

[DayVMTFraction] (July 2014)

Source TypeID	Month ID	Road TypeID	dayID	Day VMTFraction
11	7	1	5	0.780932
21	7	1	5	0.780932
31	7	1	5	0.780932
32	7	1	5	0.780932
41	7	1	5	0.780932
42	7	1	5	0.780932
43	7	1	5	0.780932
51	7	1	5	0.780932
52	7	1	5	0.780932
53	7	1	5	0.780932
54	7	1	5	0.780932
61	7	1	5	0.780932
62	7	1	5	0.780932
11	7	2	5	0.783228
21	7	2	5	0.783228
31	7	2	5	0.783228
32	7	2	5	0.783228
41	7	2	5	0.783228
42	7	2	5	0.783228
43	7	2	5	0.783228
51	7	2	5	0.783228
52	7	2	5	0.783228
53	7	2	5	0.783228
54	7	2	5	0.783228
61	7	2	5	0.783228
62	7	2	5	0.783228
11	7	3	5	0.778523
21	7	3	5	0.778523
31	7	3	5	0.778523
32	7	3	5	0.778523
41	7	3	5	0.778523
42	7	3	5	0.778523
43	7	3	5	0.778523
51	7	3	5	0.778523
52	7	3	5	0.778523
53	7	3	5	0.778523
54	7	3	5	0.778523
61	7	3	5	0.778523
62	7	3	5	0.778523
11	7	4	5	0.783228
21	7	4	5	0.783228
31	7	4	5	0.783228
32	7	4	5	0.783228
41	7	4	5	0.783228
42	7	4	5	0.783228
43	7	4	5	0.783228
51	7	4	5	0.783228
52	7	4	5	0.783228
53	7	4	5	0.783228
54	7	4	5	0.783228
61	7	4	5	0.783228
62	7	4	5	0.783228
11	7	5	5	0.778523
21	7	5	5	0.778523
31	7	5	5	0.778523
32	7	5	5	0.778523
41	7	5	5	0.778523
42	7	5	5	0.778523
43	7	5	5	0.778523
51	7	5	5	0.778523
52	7	5	5	0.778523
53	7	5	5	0.778523
54	7	5	5	0.778523
61	7	5	5	0.778523
62	7	5	5	0.778523
11	7	1	2	0.219068
21	7	1	2	0.219068
31	7	1	2	0.219068
32	7	1	2	0.219068
41	7	1	2	0.219068
42	7	1	2	0.219068
43	7	1	2	0.219068
51	7	1	2	0.219068
52	7	1	2	0.219068
53	7	1	2	0.219068
54	7	1	2	0.219068
61	7	1	2	0.219068
62	7	1	2	0.219068
11	7	2	2	0.216772
21	7	2	2	0.216772
31	7	2	2	0.216772
32	7	2	2	0.216772
41	7	2	2	0.216772
42	7	2	2	0.216772
43	7	2	2	0.216772
51	7	2	2	0.216772
52	7	2	2	0.216772
53	7	2	2	0.216772
54	7	2	2	0.216772
61	7	2	2	0.216772
62	7	2	2	0.216772
11	7	3	2	0.221477
21	7	3	2	0.221477
31	7	3	2	0.221477
32	7	3	2	0.221477
41	7	3	2	0.221477
42	7	3	2	0.221477
43	7	3	2	0.221477
51	7	3	2	0.221477
52	7	3	2	0.221477
53	7	3	2	0.221477
54	7	3	2	0.221477
61	7	3	2	0.221477
62	7	3	2	0.221477
11	7	4	2	0.216772
21	7	4	2	0.216772
31	7	4	2	0.216772
32	7	4	2	0.216772
41	7	4	2	0.216772
42	7	4	2	0.216772
43	7	4	2	0.216772
51	7	4	2	0.216772
52	7	4	2	0.216772
53	7	4	2	0.216772
54	7	4	2	0.216772
61	7	4	2	0.216772
62	7	4	2	0.216772
11	7	5	2	0.221477
21	7	5	2	0.221477
31	7	5	2	0.221477
32	7	5	2	0.221477
41	7	5	2	0.221477
42	7	5	2	0.221477
43	7	5	2	0.221477
51	7	5	2	0.221477
52	7	5	2	0.221477
53	7	5	2	0.221477
54	7	5	2	0.221477
61	7	5	2	0.221477
62	7	5	2	0.221477

[HourVMTFraction] (SourceTypeID 21: Passenger Car)

Source TypeID	Road TypeID	dayID	hourID	hourVMT Fraction
21	1	2	1	0.0216
21	1	2	2	0.0156
21	1	2	3	0.0139
21	1	2	4	0.0110
21	1	2	5	0.0142
21	1	2	6	0.0215
21	1	2	7	0.0289
21	1	2	8	0.0354
21	1	2	9	0.0413
21	1	2	10	0.0489
21	1	2	11	0.0551
21	1	2	12	0.0592
21	1	2	13	0.0634
21	1	2	14	0.0639
21	1	2	15	0.0627
21	1	2	16	0.0623
21	1	2	17	0.0627
21	1	2	18	0.0613
21	1	2	19	0.0581
21	1	2	20	0.0505
21	1	2	21	0.0453
21	1	2	22	0.0417
21	1	2	23	0.0356
21	1	2	24	0.0257
21	1	5	1	0.0080
21	1	5	2	0.0055
21	1	5	3	0.0052
21	1	5	4	0.0077
21	1	5	5	0.0223
21	1	5	6	0.0376
21	1	5	7	0.0536
21	1	5	8	0.0654
21	1	5	9	0.0602
21	1	5	10	0.0518
21	1	5	11	0.0501
21	1	5	12	0.0534
21	1	5	13	0.0565
21	1	5	14	0.0595
21	1	5	15	0.0637
21	1	5	16	0.0670
21	1	5	17	0.0688
21	1	5	18	0.0691
21	1	5	19	0.0568
21	1	5	20	0.0408
21	1	5	21	0.0334
21	1	5	22	0.0288
21	1	5	23	0.0211
21	1	5	24	0.0137
21	2	2	1	0.0219
21	2	2	2	0.0162
21	2	2	3	0.0144
21	2	2	4	0.0116
21	2	2	5	0.0159
21	2	2	6	0.0231
21	2	2	7	0.0297
21	2	2	8	0.0358
21	2	2	9	0.0413
21	2	2	10	0.0484
21	2	2	11	0.0545
21	2	2	12	0.0587
21	2	2	13	0.0628
21	2	2	14	0.0632
21	2	2	15	0.0618
21	2	2	16	0.0613
21	2	2	17	0.0617
21	2	2	18	0.0600
21	2	2	19	0.0571
21	2	2	20	0.0503
21	2	2	21	0.0461
21	2	2	22	0.0423
21	2	2	23	0.0358
21	2	2	24	0.0260
21	2	5	1	0.0097
21	2	5	2	0.0069
21	2	5	3	0.0069
21	2	5	4	0.0110
21	2	5	5	0.0339
21	2	5	6	0.0484
21	2	5	7	0.0579
21	2	5	8	0.0612
21	2	5	9	0.0573
21	2	5	10	0.0531
21	2	5	11	0.0504
21	2	5	12	0.0520
21	2	5	13	0.0548
21	2	5	14	0.0609
21	2	5	15	0.0635
21	2	5	16	0.0615
21	2	5	17	0.0599
21	2	5	18	0.0581
21	2	5	19	0.0503
21	2	5	20	0.0387
21	2	5	21	0.0331
21	2	5	22	0.0299
21	2	5	23	0.0239
21	2	5	24	0.0165
21	3	2	1	0.0213
21	3	2	2	0.0151
21	3	2	3	0.0135
21	3	2	4	0.0103
21	3	2	5	0.0124
21	3	2	6	0.0199
21	3	2	7	0.0281
21	3	2	8	0.0349
21	3	2	9	0.0414
21	3	2	10	0.0493
21	3	2	11	0.0558
21	3	2	12	0.0598
21	3	2	13	0.0640
21	3	2	14	0.0646
21	3	2	15	0.0637
21	3	2	16	0.0634
21	3	2	17	0.0638
21	3	2	18	0.0627
21	3	2	19	0.0592
21	3	2	20	0.0508
21	3	2	21	0.0445
21	3	2	22	0.0410
21	3	2	23	0.0354
21	3	2	24	0.0254
21	3	5	1	0.0061
21	3	5	2	0.0040
21	3	5	3	0.0034
21	3	5	4	0.0040
21	3	5	5	0.0096
21	3	5	6	0.0257
21	3	5	7	0.0489
21	3	5	8	0.0700
21	3	5	9	0.0633
21	3	5	10	0.0503
21	3	5	11	0.0498
21	3	5	12	0.0550
21	3	5	13	0.0584
21	3	5	14	0.0580
21	3	5	15	0.0640
21	3	5	16	0.0730
21	3	5	17	0.0785
21	3	5	18	0.0812
21	3	5	19	0.0639
21	3	5	20	0.0430
21	3	5	21	0.0338
21	3	5	22	0.0275
21	3	5	23	0.0179
21	3	5	24	0.0107
21	4	2	1	0.0219
21	4	2	2	0.0162
21	4	2	3	0.0144
21	4	2	4	0.0116
21	4	2	5	0.0159
21	4	2	6	0.0231
21	4	2	7	0.0297
21	4	2	8	0.0358
21	4	2	9	0.0413
21	4	2	10	0.0484
21	4	2	11	0.0545
21	4	2	12	0.0587
21	4	2	13	0.0628
21	4	2	14	0.0632
21	4	2	15	0.0618
21	4	2	16	0.0613
21	4	2	17	0.0617
21	4	2	18	0.0600
21	4	2	19	0.0571
21	4	2	20	0.0503
21	4	2	21	0.0461
21	4	2	22	0.0423
21	4	2	23	0.0358
21	4	2	24	0.0260
21	4	5	1	0.0097
21	4	5	2	0.0069
21	4	5	3	0.0069
21	4	5	4	0.0110
21	4	5	5	0.0339
21	4	5	6	0.0484
21	4	5	7	0.0579
21	4	5	8	0.0612
21	4	5	9	0.0573
21	4	5	10	0.0531
21	4	5	11	0.0504
21	4	5	12	0.0520
21	4	5	13	0.0548
21	4	5	14	0.0609
21	4	5	15	0.0635
21	4	5	16	0.0615
21	4	5	17	0.0599
21	4	5	18	0.0581
21	4	5	19	0.0503
21	4	5	20	0.0387
21	4	5	21	0.0331
21	4	5	22	0.0299
21	4	5	23	0.0239
21	4	5	24	0.0165
21	5	2	1	0.0213
21	5	2	2	0.0151
21	5	2	3	0.0135
21	5	2	4	0.0103
21	5	2	5	0.0124
21	5	2	6	0.0199
21	5	2	7	0.0281
21	5	2	8	0.0349
21	5	2	9	0.0414
21	5	2	10	0.0493
21	5	2	11	0.0558
21	5	2	12	0.0598
21	5	2	13	0.0640
21	5	2	14	0.0646
21	5	2	15	0.0637
21	5	2	16	0.0634
21	5	2	17	0.0638
21	5	2	18	0.0627
21	5	2	19	0.0592
21	5	2	20	0.0508
21	5	2	21	0.0445
21	5	2	22	0.0410
21	5	2	23	0.0354
21	5	2	24	0.0254
21	5	5	1	0.0061
21	5	5	2	0.0040
21	5	5	3	0.0034
21	5	5	4	0.0040
21	5	5	5	0.0096
21	5	5	6	0.0257
21	5	5	7	0.0489
21	5	5	8	0.0700
21	5	5	9	0.0633
21	5	5	10	0.0503
21	5	5	11	0.0498
21	5	5	12	0.0550
21	5	5	13	0.0584
21	5	5	14	0.0580
21	5	5	15	0.0640
21	5	5	16	0.0730
21	5	5	17	0.0785
21	5	5	18	0.0812
21	5	5	19	0.0639
21	5	5	20	0.0430
21	5	5	21	0.0338
21	5	5	22	0.0275
21	5	5	23	0.0179
21	5	5	24	0.0107

[AvgSpeedDistribution] (SourceTypeID 21: Passenger Car and RoadTypeID 2: Rural Restricted Access)

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	15	1	0.00000
21	2	15	2	0.00000
21	2	15	3	0.00000
21	2	15	4	0.00000
21	2	15	5	0.00000
21	2	15	6	0.00000
21	2	15	7	0.00000
21	2	15	8	0.00000
21	2	15	9	0.00000
21	2	15	10	0.00000
21	2	15	11	0.00000
21	2	15	12	0.00000
21	2	15	13	0.00000
21	2	15	14	0.04740
21	2	15	15	0.95259
21	2	15	16	0.00000
21	2	25	1	0.00000
21	2	25	2	0.00000
21	2	25	3	0.00000
21	2	25	4	0.00000
21	2	25	5	0.00000
21	2	25	6	0.00000
21	2	25	7	0.00000
21	2	25	8	0.00000
21	2	25	9	0.00000
21	2	25	10	0.00000
21	2	25	11	0.00000
21	2	25	12	0.00000
21	2	25	13	0.00000
21	2	25	14	0.04740
21	2	25	15	0.95259
21	2	25	16	0.00000
21	2	35	1	0.00000
21	2	35	2	0.00000
21	2	35	3	0.00000
21	2	35	4	0.00000
21	2	35	5	0.00000
21	2	35	6	0.00000
21	2	35	7	0.00000
21	2	35	8	0.00000
21	2	35	9	0.00000
21	2	35	10	0.00000
21	2	35	11	0.00000
21	2	35	12	0.00000
21	2	35	13	0.00000
21	2	35	14	0.04740
21	2	35	15	0.95259
21	2	35	16	0.00000
21	2	45	1	0.00000
21	2	45	2	0.00000
21	2	45	3	0.00000
21	2	45	4	0.00000
21	2	45	5	0.00000
21	2	45	6	0.00000
21	2	45	7	0.00000
21	2	45	8	0.00000
21	2	45	9	0.00000
21	2	45	10	0.00000
21	2	45	11	0.00000
21	2	45	12	0.00000
21	2	45	13	0.00000
21	2	45	14	0.04740
21	2	45	15	0.95259
21	2	45	16	0.00000
21	2	55	1	0.00000
21	2	55	2	0.00000
21	2	55	3	0.00000
21	2	55	4	0.00000
21	2	55	5	0.00000
21	2	55	6	0.00000
21	2	55	7	0.00000
21	2	55	8	0.00000
21	2	55	9	0.00000
21	2	55	10	0.00000
21	2	55	11	0.00000
21	2	55	12	0.00000
21	2	55	13	0.00000
21	2	55	14	0.04740
21	2	55	15	0.95259
21	2	55	16	0.00000
21	2	65	1	0.00000
21	2	65	2	0.00000
21	2	65	3	0.00000
21	2	65	4	0.00000
21	2	65	5	0.00000
21	2	65	6	0.00000
21	2	65	7	0.00000
21	2	65	8	0.00000
21	2	65	9	0.00000
21	2	65	10	0.00000
21	2	65	11	0.00000
21	2	65	12	0.00000
21	2	65	13	0.00000
21	2	65	14	0.04740
21	2	65	15	0.95259
21	2	65	16	0.00000
21	2	75	1	0.00000
21	2	75	2	0.00000
21	2	75	3	0.00000
21	2	75	4	0.00000
21	2	75	5	0.00000
21	2	75	6	0.00000
21	2	75	7	0.00000
21	2	75	8	0.02627
21	2	75	9	0.00000
21	2	75	10	0.00000
21	2	75	11	0.05723
21	2	75	12	0.02975
21	2	75	13	0.10615
21	2	75	14	0.20489
21	2	75	15	0.56656
21	2	75	16	0.00915
21	2	85	1	0.00000
21	2	85	2	0.00000
21	2	85	3	0.00000
21	2	85	4	0.00000
21	2	85	5	0.00000
21	2	85	6	0.00000
21	2	85	7	0.00000
21	2	85	8	0.02627
21	2	85	9	0.00000
21	2	85	10	0.00000
21	2	85	11	0.05723
21	2	85	12	0.02975
21	2	85	13	0.10615
21	2	85	14	0.20489
21	2	85	15	0.56656
21	2	85	16	0.00915
21	2	95	1	0.00000
21	2	95	2	0.00000
21	2	95	3	0.00000
21	2	95	4	0.00000
21	2	95	5	0.00000
21	2	95	6	0.00000
21	2	95	7	0.00000
21	2	95	8	0.02627
21	2	95	9	0.00000
21	2	95	10	0.00000
21	2	95	11	0.05723
21	2	95	12	0.02975
21	2	95	13	0.10615
21	2	95	14	0.20489
21	2	95	15	0.56656
21	2	95	16	0.00915
21	2	105	1	0.00000
21	2	105	2	0.00000
21	2	105	3	0.00000
21	2	105	4	0.00000
21	2	105	5	0.00000
21	2	105	6	0.00000
21	2	105	7	0.00000
21	2	105	8	0.00000
21	2	105	9	0.00000
21	2	105	10	0.00000
21	2	105	11	0.00000
21	2	105	12	0.00000
21	2	105	13	0.00849
21	2	105	14	0.04656
21	2	105	15	0.94495
21	2	105	16	0.00000
21	2	115	1	0.00000
21	2	115	2	0.00000
21	2	115	3	0.00000
21	2	115	4	0.00000
21	2	115	5	0.00000
21	2	115	6	0.00000
21	2	115	7	0.00000
21	2	115	8	0.00000
21	2	115	9	0.00000
21	2	115	10	0.00000
21	2	115	11	0.00000
21	2	115	12	0.00000
21	2	115	13	0.00849
21	2	115	14	0.04656
21	2	115	15	0.94495
21	2	115	16	0.00000
21	2	125	1	0.00000
21	2	125	2	0.00000
21	2	125	3	0.00000
21	2	125	4	0.00000
21	2	125	5	0.00000
21	2	125	6	0.00000
21	2	125	7	0.00000
21	2	125	8	0.00000
21	2	125	9	0.00000
21	2	125	10	0.00000
21	2	125	11	0.00000
21	2	125	12	0.00000
21	2	125	13	0.00849
21	2	125	14	0.04656
21	2	125	15	0.94495
21	2	125	16	0.00000
21	2	135	1	0.00000
21	2	135	2	0.00000
21	2	135	3	0.00000
21	2	135	4	0.00000
21	2	135	5	0.00000
21	2	135	6	0.00000
21	2	135	7	0.00000
21	2	135	8	0.00000
21	2	135	9	0.00000
21	2	135	10	0.00000
21	2	135	11	0.00000
21	2	135	12	0.00000
21	2	135	13	0.00849
21	2	135	14	0.04656
21	2	135	15	0.94495
21	2	135	16	0.00000
21	2	145	1	0.00000
21	2	145	2	0.00000
21	2	145	3	0.00000
21	2	145	4	0.00000
21	2	145	5	0.00000
21	2	145	6	0.00000
21	2	145	7	0.00000
21	2	145	8	0.00000
21	2	145	9	0.00000
21	2	145	10	0.00000
21	2	145	11	0.00000
21	2	145	12	0.00000
21	2	145	13	0.00849
21	2	145	14	0.04656
21	2	145	15	0.94495
21	2	145	16	0.00000
21	2	155	1	0.00000
21	2	155	2	0.00000
21	2	155	3	0.00000
21	2	155	4	0.00000
21	2	155	5	0.00000
21	2	155	6	0.00000
21	2	155	7	0.00000
21	2	155	8	0.00000
21	2	155	9	0.01914
21	2	155	10	0.00000
21	2	155	11	0.00000
21	2	155	12	0.05332
21	2	155	13	0.08409
21	2	155	14	0.22279
21	2	155	15	0.61647
21	2	155	16	0.00419
21	2	165	1	0.00000
21	2	165	2	0.00000
21	2	165	3	0.00000
21	2	165	4	0.00000
21	2	165	5	0.00000
21	2	165	6	0.00000
21	2	165	7	0.00000
21	2	165	8	0.00000
21	2	165	9	0.01914
21	2	165	10	0.00000
21	2	165	11	0.00000
21	2	165	12	0.05332
21	2	165	13	0.08409
21	2	165	14	0.22279
21	2	165	15	0.61647

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	165	16	0.00419
21	2	175	1	0.00000
21	2	175	2	0.00000
21	2	175	3	0.00000
21	2	175	4	0.00000
21	2	175	5	0.00000
21	2	175	6	0.00000
21	2	175	7	0.00000
21	2	175	8	0.00000
21	2	175	9	0.01914
21	2	175	10	0.00000
21	2	175	11	0.00000
21	2	175	12	0.05332
21	2	175	13	0.08409
21	2	175	14	0.22279
21	2	175	15	0.61647
21	2	175	16	0.00419
21	2	185	1	0.00000
21	2	185	2	0.00000
21	2	185	3	0.00000
21	2	185	4	0.00000
21	2	185	5	0.00000
21	2	185	6	0.00000
21	2	185	7	0.00000
21	2	185	8	0.00000
21	2	185	9	0.01914
21	2	185	10	0.00000
21	2	185	11	0.00000
21	2	185	12	0.05332
21	2	185	13	0.08409
21	2	185	14	0.22279
21	2	185	15	0.61647
21	2	185	16	0.00419
21	2	195	1	0.00000
21	2	195	2	0.00000
21	2	195	3	0.00000
21	2	195	4	0.00000
21	2	195	5	0.00000
21	2	195	6	0.00000
21	2	195	7	0.00000
21	2	195	8	0.00000
21	2	195	9	0.00000
21	2	195	10	0.00000
21	2	195	11	0.00000
21	2	195	12	0.00000
21	2	195	13	0.00000
21	2	195	14	0.04740
21	2	195	15	0.95259
21	2	195	16	0.00000
21	2	205	1	0.00000
21	2	205	2	0.00000
21	2	205	3	0.00000
21	2	205	4	0.00000
21	2	205	5	0.00000
21	2	205	6	0.00000
21	2	205	7	0.00000
21	2	205	8	0.00000
21	2	205	9	0.00000
21	2	205	10	0.00000
21	2	205	11	0.00000
21	2	205	12	0.00000
21	2	205	13	0.00000
21	2	205	14	0.04740
21	2	205	15	0.95259
21	2	205	16	0.00000
21	2	215	1	0.00000
21	2	215	2	0.00000
21	2	215	3	0.00000
21	2	215	4	0.00000
21	2	215	5	0.00000
21	2	215	6	0.00000
21	2	215	7	0.00000
21	2	215	8	0.00000
21	2	215	9	0.00000
21	2	215	10	0.00000
21	2	215	11	0.00000
21	2	215	12	0.00000
21	2	215	13	0.00000
21	2	215	14	0.04740
21	2	215	15	0.95259
21	2	215	16	0.00000
21	2	225	1	0.00000
21	2	225	2	0.00000
21	2	225	3	0.00000
21	2	225	4	0.00000
21	2	225	5	0.00000
21	2	225	6	0.00000

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	225	7	0.00000
21	2	225	8	0.00000
21	2	225	9	0.00000
21	2	225	10	0.00000
21	2	225	11	0.00000
21	2	225	12	0.00000
21	2	225	13	0.00000
21	2	225	14	0.04740
21	2	225	15	0.95259
21	2	225	16	0.00000
21	2	235	1	0.00000
21	2	235	2	0.00000
21	2	235	3	0.00000
21	2	235	4	0.00000
21	2	235	5	0.00000
21	2	235	6	0.00000
21	2	235	7	0.00000
21	2	235	8	0.00000
21	2	235	9	0.00000
21	2	235	10	0.00000
21	2	235	11	0.00000
21	2	235	12	0.00000
21	2	235	13	0.00000
21	2	235	14	0.04740
21	2	235	15	0.95259
21	2	235	16	0.00000
21	2	245	1	0.00000
21	2	245	2	0.00000
21	2	245	3	0.00000
21	2	245	4	0.00000
21	2	245	5	0.00000
21	2	245	6	0.00000
21	2	245	7	0.00000
21	2	245	8	0.00000
21	2	245	9	0.00000
21	2	245	10	0.00000
21	2	245	11	0.00000
21	2	245	12	0.00000
21	2	245	13	0.00000
21	2	245	14	0.04740
21	2	245	15	0.95259
21	2	245	16	0.00000
21	2	12	1	0.00000
21	2	12	2	0.00000
21	2	12	3	0.00000
21	2	12	4	0.00000
21	2	12	5	0.00000
21	2	12	6	0.00000
21	2	12	7	0.00000
21	2	12	8	0.00000
21	2	12	9	0.00000
21	2	12	10	0.00000
21	2	12	11	0.00000
21	2	12	12	0.00000
21	2	12	13	0.00000
21	2	12	14	0.04740
21	2	12	15	0.95259
21	2	12	16	0.00000
21	2	22	1	0.00000
21	2	22	2	0.00000
21	2	22	3	0.00000
21	2	22	4	0.00000
21	2	22	5	0.00000
21	2	22	6	0.00000
21	2	22	7	0.00000
21	2	22	8	0.00000
21	2	22	9	0.00000
21	2	22	10	0.00000
21	2	22	11	0.00000
21	2	22	12	0.00000
21	2	22	13	0.00000
21	2	22	14	0.04740
21	2	22	15	0.95259
21	2	22	16	0.00000
21	2	32	1	0.00000
21	2	32	2	0.00000
21	2	32	3	0.00000
21	2	32	4	0.00000
21	2	32	5	0.00000
21	2	32	6	0.00000
21	2	32	7	0.00000
21	2	32	8	0.00000
21	2	32	9	0.00000
21	2	32	10	0.00000
21	2	32	11	0.00000
21	2	32	12	0.00000
21	2	32	13	0.00000

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	32	14	0.04740
21	2	32	15	0.95259
21	2	32	16	0.00000
21	2	42	1	0.00000
21	2	42	2	0.00000
21	2	42	3	0.00000
21	2	42	4	0.00000
21	2	42	5	0.00000
21	2	42	6	0.00000
21	2	42	7	0.00000
21	2	42	8	0.00000
21	2	42	9	0.00000
21	2	42	10	0.00000
21	2	42	11	0.00000
21	2	42	12	0.00000
21	2	42	13	0.00000
21	2	42	14	0.04740
21	2	42	15	0.95259
21	2	42	16	0.00000
21	2	52	1	0.00000
21	2	52	2	0.00000
21	2	52	3	0.00000
21	2	52	4	0.00000
21	2	52	5	0.00000
21	2	52	6	0.00000
21	2	52	7	0.00000
21	2	52	8	0.00000
21	2	52	9	0.00000
21	2	52	10	0.00000
21	2	52	11	0.00000
21	2	52	12	0.00000
21	2	52	13	0.00000
21	2	52	14	0.04740
21	2	52	15	0.95259
21	2	52	16	0.00000
21	2	62	1	0.00000
21	2	62	2	0.00000
21	2	62	3	0.00000
21	2	62	4	0.00000
21	2	62	5	0.00000
21	2	62	6	0.00000
21	2	62	7	0.00000
21	2	62	8	0.00000
21	2	62	9	0.00000
21	2	62	10	0.00000
21	2	62	11	0.00000
21	2	62	12	0.00000
21	2	62	13	0.00000
21	2	62	14	0.04740
21	2	62	15	0.95259
21	2	62	16	0.00000
21	2	72	1	0.00000
21	2	72	2	0.00000
21	2	72	3	0.00000
21	2	72	4	0.00000
21	2	72	5	0.00000
21	2	72	6	0.00000
21	2	72	7	0.00000
21	2	72	8	0.02627
21	2	72	9	0.00000
21	2	72	10	0.00000
21	2	72	11	0.05723
21	2	72	12	0.02975
21	2	72	13	0.10615
21	2	72	14	0.20489
21	2	72	15	0.56656
21	2	72	16	0.00915
21	2	82	1	0.00000
21	2	82	2	0.00000
21	2	82	3	0.00000
21	2	82	4	0.00000
21	2	82	5	0.00000
21	2	82	6	0.00000
21	2	82	7	0.00000
21	2	82	8	0.02627
21	2	82	9	0.00000
21	2	82	10	0.00000
21	2	82	11	0.05723
21	2	82	12	0.02975
21	2	82	13	0.10615
21	2	82	14	0.20489
21	2	82	15	0.56656
21	2	82	16	0.00915
21	2	92	1	0.00000
21	2	92	2	0.00000
21	2	92	3	0.00000
21	2	92	4	0.00000

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	92	5	0.00000
21	2	92	6	0.00000
21	2	92	7	0.00000
21	2	92	8	0.02627
21	2	92	9	0.00000
21	2	92	10	0.00000
21	2	92	11	0.05723
21	2	92	12	0.02975
21	2	92	13	0.10615
21	2	92	14	0.20489
21	2	92	15	0.56656
21	2	92	16	0.00915
21	2	102	1	0.00000
21	2	102	2	0.00000
21	2	102	3	0.00000
21	2	102	4	0.00000
21	2	102	5	0.00000
21	2	102	6	0.00000
21	2	102	7	0.00000
21	2	102	8	0.00000
21	2	102	9	0.00000
21	2	102	10	0.00000
21	2	102	11	0.00000
21	2	102	12	0.00000
21	2	102	13	0.00849
21	2	102	14	0.04656
21	2	102	15	0.94495
21	2	102	16	0.00000
21	2	112	1	0.00000
21	2	112	2	0.00000
21	2	112	3	0.00000
21	2	112	4	0.00000
21	2	112	5	0.00000
21	2	112	6	0.00000
21	2	112	7	0.00000
21	2	112	8	0.00000
21	2	112	9	0.00000
21	2	112	10	0.00000
21	2	112	11	0.00000
21	2	112	12	0.00000
21	2	112	13	0.00849
21	2	112	14	0.04656
21	2	112	15	0.94495
21	2	112	16	0.00000
21	2	122	1	0.00000
21	2	122	2	0.00000
21	2	122	3	0.00000
21	2	122	4	0.00000
21	2	122	5	0.00000
21	2	122	6	0.00000
21	2	122	7	0.00000
21	2	122	8	0.00000
21	2	122	9	0.00000
21	2	122	10	0.00000
21	2	122	11	0.00000
21	2	122	12	0.00000
21	2	122	13	0.00849
21	2	122	14	0.04656
21	2	122	15	0.94495
21	2	122	16	0.00000
21	2	132	1	0.00000
21	2	132	2	0.00000
21	2	132	3	0.00000
21	2	132	4	0.00000
21	2	132	5	0.00000
21	2	132	6	0.00000
21	2	132	7	0.00000
21	2	132	8	0.00000
21	2	132	9	0.00000
21	2	132	10	0.00000
21	2	132	11	0.00000
21	2	132	12	0.00000
21	2	132	13	0.00849
21	2	132	14	0.04656
21	2	132	15	0.94495
21	2	132	16	0.00000
21	2	142	1	0.00000
21	2	142	2	0.00000
21	2	142	3	0.00000
21	2	142	4	0.00000
21	2	142	5	0.00000
21	2	142	6	0.00000
21	2	142	7	0.00000
21	2	142	8	0.00000
21	2	142	9	0.00000
21	2	142	10	0.00000
21	2	142	11	0.00000
21	2	142	12	0.00000
21	2	142	13	0.00849
21	2	142	14	0.04656
21	2	142	15	0.94495
21	2	142	16	0.00000
21	2	152	1	0.00000
21	2	152	2	0.00000
21	2	152	3	0.00000
21	2	152	4	0.00000
21	2	152	5	0.00000
21	2	152	6	0.00000
21	2	152	7	0.00000
21	2	152	8	0.00000
21	2	152	9	0.01914
21	2	152	10	0.00000
21	2	152	11	0.00000
21	2	152	12	0.05332
21	2	152	13	0.08409
21	2	152	14	0.22279
21	2	152	15	0.61647
21	2	152	16	0.00419
21	2	162	1	0.00000
21	2	162	2	0.00000
21	2	162	3	0.00000
21	2	162	4	0.00000
21	2	162	5	0.00000
21	2	162	6	0.00000
21	2	162	7	0.00000
21	2	162	8	0.00000
21	2	162	9	0.01914
21	2	162	10	0.00000
21	2	162	11	0.00000
21	2	162	12	0.05332
21	2	162	13	0.08409
21	2	162	14	0.22279
21	2	162	15	0.61647
21	2	162	16	0.00419
21	2	172	1	0.00000
21	2	172	2	0.00000
21	2	172	3	0.00000
21	2	172	4	0.00000
21	2	172	5	0.00000
21	2	172	6	0.00000
21	2	172	7	0.00000
21	2	172	8	0.00000
21	2	172	9	0.01914
21	2	172	10	0.00000
21	2	172	11	0.00000
21	2	172	12	0.05332
21	2	172	13	0.08409
21	2	172	14	0.22279
21	2	172	15	0.61647
21	2	172	16	0.00419
21	2	182	1	0.00000
21	2	182	2	0.00000
21	2	182	3	0.00000
21	2	182	4	0.00000
21	2	182	5	0.00000
21	2	182	6	0.00000
21	2	182	7	0.00000
21	2	182	8	0.00000
21	2	182	9	0.01914
21	2	182	10	0.00000
21	2	182	11	0.00000
21	2	182	12	0.05332
21	2	182	13	0.08409
21	2	182	14	0.22279
21	2	182	15	0.61647
21	2	182	16	0.00419
21	2	192	1	0.00000
21	2	192	2	0.00000
21	2	192	3	0.00000
21	2	192	4	0.00000
21	2	192	5	0.00000
21	2	192	6	0.00000
21	2	192	7	0.00000
21	2	192	8	0.00000
21	2	192	9	0.00000
21	2	192	10	0.00000
21	2	192	11	0.00000
21	2	192	12	0.00000
21	2	192	13	0.00000
21	2	192	14	0.04740
21	2	192	15	0.95259
21	2	192	16	0.00000
21	2	202	1	0.00000
21	2	202	2	0.00000
21	2	202	3	0.00000
21	2	202	4	0.00000
21	2	202	5	0.00000
21	2	202	6	0.00000
21	2	202	7	0.00000
21	2	202	8	0.00000
21	2	202	9	0.00000
21	2	202	10	0.00000
21	2	202	11	0.00000
21	2	202	12	0.00000
21	2	202	13	0.00000
21	2	202	14	0.04740
21	2	202	15	0.95259
21	2	202	16	0.00000
21	2	212	1	0.00000
21	2	212	2	0.00000
21	2	212	3	0.00000
21	2	212	4	0.00000
21	2	212	5	0.00000
21	2	212	6	0.00000
21	2	212	7	0.00000
21	2	212	8	0.00000
21	2	212	9	0.00000
21	2	212	10	0.00000
21	2	212	11	0.00000
21	2	212	12	0.00000
21	2	212	13	0.00000
21	2	212	14	0.04740
21	2	212	15	0.95259
21	2	212	16	0.00000
21	2	222	1	0.00000
21	2	222	2	0.00000
21	2	222	3	0.00000
21	2	222	4	0.00000
21	2	222	5	0.00000
21	2	222	6	0.00000
21	2	222	7	0.00000
21	2	222	8	0.00000
21	2	222	9	0.00000
21	2	222	10	0.00000
21	2	222	11	0.00000
21	2	222	12	0.00000
21	2	222	13	0.00000
21	2	222	14	0.04740
21	2	222	15	0.95259
21	2	222	16	0.00000
21	2	232	1	0.00000
21	2	232	2	0.00000
21	2	232	3	0.00000
21	2	232	4	0.00000
21	2	232	5	0.00000
21	2	232	6	0.00000
21	2	232	7	0.00000
21	2	232	8	0.00000
21	2	232	9	0.00000
21	2	232	10	0.00000
21	2	232	11	0.00000
21	2	232	12	0.00000
21	2	232	13	0.00000
21	2	232	14	0.04740
21	2	232	15	0.95259
21	2	232	16	0.00000
21	2	242	1	0.00000
21	2	242	2	0.00000
21	2	242	3	0.00000
21	2	242	4	0.00000
21	2	242	5	0.00000
21	2	242	6	0.00000
21	2	242	7	0.00000
21	2	242	8	0.00000
21	2	242	9	0.00000
21	2	242	10	0.00000
21	2	242	11	0.00000
21	2	242	12	0.00000
21	2	242	13	0.00000
21	2	242	14	0.04740
21	2	242	15	0.95259
21	2	242	16	0.00000

[AVFT] (SourceTypeID 42: Transit Bus)

Source TypeID	Model YearID	Fuel TypeID	Eng TechID	fuelEng Fraction
42	1960	1	1	0.009615
42	1960	2	1	0.990385
42	1960	3	1	0.000000
42	1961	1	1	0.009615
42	1961	2	1	0.990385
42	1961	3	1	0.000000
42	1962	1	1	0.009615
42	1962	2	1	0.990385
42	1962	3	1	0.000000
42	1963	1	1	0.009615
42	1963	2	1	0.990385
42	1963	3	1	0.000000
42	1964	1	1	0.009615
42	1964	2	1	0.990385
42	1964	3	1	0.000000
42	1965	1	1	0.009615
42	1965	2	1	0.990385
42	1965	3	1	0.000000
42	1966	1	1	0.009615
42	1966	2	1	0.990385
42	1966	3	1	0.000000
42	1967	1	1	0.009615
42	1967	2	1	0.990385
42	1967	3	1	0.000000
42	1968	1	1	0.009615
42	1968	2	1	0.990385
42	1968	3	1	0.000000
42	1969	1	1	0.009615
42	1969	2	1	0.990385
42	1969	3	1	0.000000
42	1970	1	1	0.009615
42	1970	2	1	0.990385
42	1970	3	1	0.000000
42	1971	1	1	0.009615
42	1971	2	1	0.990385
42	1971	3	1	0.000000
42	1972	1	1	0.009615
42	1972	2	1	0.990385
42	1972	3	1	0.000000
42	1973	1	1	0.009615
42	1973	2	1	0.990385
42	1973	3	1	0.000000
42	1974	1	1	0.009615
42	1974	2	1	0.990385
42	1974	3	1	0.000000
42	1975	1	1	0.009615
42	1975	2	1	0.990385
42	1975	3	1	0.000000
42	1976	1	1	0.009615
42	1976	2	1	0.990385
42	1976	3	1	0.000000
42	1977	1	1	0.009615
42	1977	2	1	0.990385
42	1977	3	1	0.000000
42	1978	1	1	0.009615
42	1978	2	1	0.990385
42	1978	3	1	0.000000
42	1979	1	1	0.009615
42	1979	2	1	0.990385
42	1979	3	1	0.000000
42	1980	1	1	0.009615
42	1980	2	1	0.990385
42	1980	3	1	0.000000
42	1981	1	1	0.008696
42	1981	2	1	0.991304
42	1981	3	1	0.000000
42	1982	1	1	0.011321
42	1982	2	1	0.988679
42	1982	3	1	0.000000
42	1983	1	1	0.008081
42	1983	2	1	0.991919
42	1983	3	1	0.000000
42	1984	1	1	0.009671
42	1984	2	1	0.990329
42	1984	3	1	0.000000
42	1985	1	1	0.010448
42	1985	2	1	0.989552
42	1985	3	1	0.000000
42	1986	1	1	0.010243
42	1986	2	1	0.989757
42	1986	3	1	0.000000
42	1987	1	1	0.009825
42	1987	2	1	0.990175
42	1987	3	1	0.000000
42	1988	1	1	0.009990
42	1988	2	1	0.990010
42	1988	3	1	0.000000
42	1989	1	1	0.009441
42	1989	2	1	0.990559
42	1989	3	1	0.000000
42	1990	1	1	0.010174
42	1990	2	1	0.982645
42	1990	3	1	0.007181
42	1991	1	1	0.009632
42	1991	2	1	0.971979
42	1991	3	1	0.018389
42	1992	1	1	0.009752
42	1992	2	1	0.944149
42	1992	3	1	0.046099
42	1993	1	1	0.009238
42	1993	2	1	0.914550
42	1993	3	1	0.076212
42	1994	1	1	0.010211
42	1994	2	1	0.904914
42	1994	3	1	0.084876
42	1995	1	1	0.010022
42	1995	2	1	0.836860
42	1995	3	1	0.153118
42	1996	1	1	0.009941
42	1996	2	1	0.892002
42	1996	3	1	0.098057
42	1997	1	1	0.000000
42	1997	2	1	1.000000
42	1997	3	1	0.000000
42	1998	1	1	0.000000
42	1998	2	1	0.000000
42	1998	3	1	1.000000
42	1999	1	1	0.000000
42	1999	2	1	0.000000
42	1999	3	1	1.000000
42	2000	1	1	0.000000
42	2000	2	1	0.000000
42	2000	3	1	1.000000
42	2001	1	1	0.000000
42	2001	2	1	0.000000
42	2001	3	1	1.000000
42	2002	1	1	0.000000
42	2002	2	1	0.000000
42	2002	3	1	1.000000
42	2003	1	1	0.000000
42	2003	2	1	0.000000
42	2003	3	1	1.000000
42	2004	1	1	0.000000
42	2004	2	1	0.327869
42	2004	3	1	0.672131
42	2005	1	1	0.000000
42	2005	2	1	1.000000
42	2005	3	1	0.000000
42	2006	1	1	0.000000
42	2006	2	1	0.075758
42	2006	3	1	0.924242
42	2007	1	1	0.000000
42	2007	2	1	1.000000
42	2007	3	1	0.000000
42	2008	1	1	0.000000
42	2008	2	1	0.385542
42	2008	3	1	0.614458
42	2009	1	1	0.108108
42	2009	2	1	0.135135
42	2009	3	1	0.756757
42	2010	1	1	0.000000
42	2010	2	1	1.000000
42	2010	3	1	0.000000
42	2011	1	1	0.000000
42	2011	2	1	0.048780
42	2011	2	11	0.414634
42	2011	3	1	0.536585
42	2012	1	1	0.000000
42	2012	2	1	0.000000
42	2012	3	1	1.000000
42	2013	1	1	0.045455
42	2013	2	1	0.054545
42	2013	2	11	0.118182
42	2013	3	1	0.781818
42	2014	1	1	0.010417
42	2014	2	1	0.114583
42	2014	3	1	0.875000
42	2015	1	1	0.024619
42	2015	2	1	0.817351
42	2015	3	1	0.158030
42	2016	1	1	0.024619
42	2016	2	1	0.817351
42	2016	3	1	0.158030
42	2017	1	1	0.024619
42	2017	2	1	0.817351
42	2017	3	1	0.158030
42	2018	1	1	0.024619
42	2018	2	1	0.817351
42	2018	3	1	0.158030
42	2019	1	1	0.024619
42	2019	2	1	0.817351
42	2019	3	1	0.158030
42	2020	1	1	0.024619
42	2020	2	1	0.817351
42	2020	3	1	0.158030
42	2021	1	1	0.024619
42	2021	2	1	0.817351
42	2021	3	1	0.158030
42	2022	1	1	0.024619
42	2022	2	1	0.817351
42	2022	3	1	0.158030
42	2023	1	1	0.024619
42	2023	2	1	0.817351
42	2023	3	1	0.158030
42	2024	1	1	0.024619
42	2024	2	1	0.817351
42	2024	3	1	0.158030
42	2025	1	1	0.024619
42	2025	2	1	0.817351
42	2025	3	1	0.158030
42	2026	1	1	0.024619
42	2026	2	1	0.817351
42	2026	3	1	0.158030
42	2027	1	1	0.024619
42	2027	2	1	0.817351
42	2027	3	1	0.158030
42	2028	1	1	0.024619
42	2028	2	1	0.817351
42	2028	3	1	0.158030
42	2029	1	1	0.024619
42	2029	2	1	0.817351
42	2029	3	1	0.158030
42	2030	1	1	0.024619
42	2030	2	1	0.817351
42	2030	3	1	0.158030
42	2031	1	1	0.024619
42	2031	2	1	0.817351
42	2031	3	1	0.158030
42	2032	1	1	0.024619
42	2032	2	1	0.817351
42	2032	3	1	0.158030
42	2033	1	1	0.024619
42	2033	2	1	0.817351
42	2033	3	1	0.158030
42	2034	1	1	0.024619
42	2034	2	1	0.817351
42	2034	3	1	0.158030
42	2035	1	1	0.024619
42	2035	2	1	0.817351
42	2035	3	1	0.158030
42	2036	1	1	0.024619
42	2036	2	1	0.817351
42	2036	3	1	0.158030
42	2037	1	1	0.024619
42	2037	2	1	0.817351
42	2037	3	1	0.158030
42	2038	1	1	0.024619
42	2038	2	1	0.817351
42	2038	3	1	0.158030
42	2039	1	1	0.024619
42	2039	2	1	0.817351
42	2039	3	1	0.158030
42	2040	1	1	0.024619
42	2040	2	1	0.817351
42	2040	3	1	0.158030
42	2041	1	1	0.024619
42	2041	2	1	0.817351
42	2041	3	1	0.158030
42	2042	1	1	0.024619
42	2042	2	1	0.817351
42	2042	3	1	0.158030
42	2043	1	1	0.024619
42	2043	2	1	0.817351
42	2043	3	1	0.158030
42	2044	1	1	0.024619
42	2044	2	1	0.817351
42	2044	3	1	0.158030
42	2045	1	1	0.024619
42	2045	2	1	0.817351
42	2045	3	1	0.158030
42	2046	1	1	0.024619
42	2046	2	1	0.817351
42	2046	3	1	0.158030
42	2047	1	1	0.024619
42	2047	2	1	0.817351
42	2047	3	1	0.158030
42	2048	1	1	0.024619

Source TypeID	Model YearID	Fuel TypeID	Eng TechID	fuelEng Fraction
42	2048	2	1	0.817351
42	2048	3	1	0.158030
42	2049	1	1	0.024619
42	2049	2	1	0.817351

Source TypeID	Model YearID	Fuel TypeID	Eng TechID	fuelEng Fraction
42	2049	3	1	0.158030
42	2050	1	1	0.024619
42	2050	2	1	0.817351
42	2050	3	1	0.158030

[CountyYear]

countyID	yearID	refuelingVaporProgramAdjust	refuelingSpillProgramAdjust
4013	2014	0.661	0.000

Appendix D. Emissions from Facilities Treated as Area Sources in the 2014 Periodic Emissions Inventory for Ozone Precursors

The table below lists those facilities whose reported 2014 emissions have been included in the area source categories of this 2014 Periodic Emissions Inventory for Ozone Precursors.

Table D-1. Emissions (tons/yr) from facilities whose emissions are reflected in area source categories in the 2014 Periodic Emissions Inventory.

ID	Business name	Street address and city	VOC	NO_x	CO
1074	23RD AVE WASTEWATER TREATMENT PLANT	2470 S 22ND AVE, PHOENIX	0.3	2.8	29.8
133843	A LEGACY FUNERAL HOME LLC	1722 N BANNING #101, MESA	0.0	0.2	0.0
132976	ABEL FUNERAL SERVICES INC	1544 W GRANT ST, PHOENIX	0.0	1.1	0.1
1387	ABLE STEEL FABRICATORS	4150 E QUARTZ CIR, MESA	3.7		
130432	ADVANCED LINING SOLUTIONS INC	1903 S 11TH AVE, PHOENIX	0.2		
72104	AEROTURBINE	1658 S LITCHFIELD RD, GOODYEAR	5.3		
969	AF LORTS MANUFACTURING COMPANY INC	15836 W EDDIE ALBERT WAY, GOODYEAR	21.4		
125823	AFFORDABLE CREMATION & BURIAL CHAPEL	1130 S HORNE, MESA	0.0	0.0	0.0
3291	AIRLINE TRAINING CTR AZ INC	1658 S LITCHFIELD RD, GOODYEAR	2.3		
133089	ALL IN ONE TRUCK REPAIR INC	5703 W DOBBINS RD, PHOENIX	0.4		
107220	ALL PETS GREAT AND SMALL	1110 S HORNE ST #103, MESA	0.0	0.6	0.0
90012	ALL STATE CREMATORY	1110 S HORNE #108, MESA	0.0	1.5	0.1
34139	ALL WOOD TREASURES CO	2063 E CEDAR ST, TEMPE	9.1		
131474	ALLIED PACKAGING CORPORATION	5640 S 16TH ST, PHOENIX	5.2	0.2	0.1
35541	ALLIED TUBE AND CONDUIT	2525 N 27TH AVE, PHOENIX	30.8	0.1	0.1
4397	AMBER STEEL FABRICATION, INC	11331 E GERMANN RD, CHANDLER	9.8		
27925	AMERICAN CASE & PEDESTAL MFG CO	2022 N 22ND AVE, PHOENIX	2.7		
132483	AMERICAN FENCE & SECURITY CO INC	2737 W VIRGINIA AVE, PHOENIX	6.1		
54414	AMERICAN SAND & ROCK	PORTABLE	0.1	1.7	0.4
42432	AMERIPRIDE LINEN & APPAREL SERVICE	6025 W VAN BUREN ST, PHOENIX	0.8	1.3	1.1
199	AMERON WATER TRANSMISSION GROUP, LLC	2325 S 7TH ST, PHOENIX	1.7	0.1	0.1
129545	AMES DIVERSIFIED SERVICES	3015 W CLARENDON AVE, PHOENIX	0.0	1.8	0.1
133188	ANIMAL CREMATION SERVICES	5348 W BETHANY HOME RD, GLENDALE	0.0	0.6	0.0
129550	ARIZONA AIRCRAFT PAINTING LLC	4911 E FALCON DR, MESA	1.0		
84	ARIZONA BRAKE & CLUTCH SUPPLY INC	2211 N BLACK CANYON HWY, PHOENIX	0.1	0.0	0.0
3938	ARIZONA GALVANIZING INC	15775 W ELWOOD ST, GOODYEAR	0.2	4.4	3.7
130470	ARIZONA LANDFILL LLC	2750 S 11TH AVE, PHOENIX	0.5	10.8	1.7
131021	ARIZONA NUTRITIONAL SUPPLEMENTS LLC	210 S BECK AVE, CHANDLER	7.8		
69409	ARIZONA POLYMER FLOORING INC	7731 N 68TH AVE, GLENDALE	5.2		
4364	ARIZONA STATE UNIVERSITY	1551 S RURAL RD, TEMPE	2.4	13.5	7.2
134108	ARMORWORKS ENTERPRISES LLC	901 E MADISON ST, PHOENIX	0.1		
341	ARTISAN NATURAL STONE PRODUCTS LLP	813 E UNIVERSITY DR, PHOENIX	2.9		
30112	ASM AMERICA INC	3440 E UNIVERSITY DR, PHOENIX	0.1		
36898	ASPC-LEWIS	26700 S HWY 85, BUCKEYE	6.5	9.6	4.9
4328	ASU MACROTECHNOLOGY WORKS	7700 S RIVER PKWY, TEMPE	1.3	3.0	1.1
1502	ATLAS ROOFING CORPORATION	40 S 45TH AVE, PHOENIX	5.7	0.5	2.0
2656	AVIATION DEPT - PHOENIX SKY HARBOR	3400 E SKY HARBOR BLVD, PHOENIX	0.5	3.2	1.0
50422	BAE SYSTEMS AEROSPACE & DEFENSE GROUP	7822 S 46TH ST, PHOENIX	5.4	0.0	0.0

ID	Business name	Street address and city	VOC	NO_X	CO
1449	BAKER COMMODITIES	3602 W ELWOOD ST, PHOENIX	3.8	2.1	
31585	BANK OF AMERICA	2500 W FRYE RD, CHANDLER	0.1	3.4	0.5
781	BANNER GOOD SAMARITAN MEDICAL CENTER	1111 E MCDOWELL RD, PHOENIX	0.5	7.6	5.1
29946	BANNER THUNDERBIRD MEDICAL CENTER	5555 W THUNDERBIRD RD, GLENDALE	1.5	3.3	1.0
129595	BARREL O' FUN SNACK FOOD SOUTHWEST	7330 W SHERMAN ST, PHOENIX	0.3	6.1	5.1
110901	BAY FOAM PRODUCTS INC	2240 W PEORIA AVE, PHOENIX	0.0	0.3	0.1
42102	BENCHMARK ELECTRONICS PHOENIX, INC	2401 W GRANDVIEW RD, PHOENIX	2.4		
607	BEST FUNERAL SERVICES INC	9380 W PEORIA AVE, PEORIA	0.0	0.6	0.0
961	BIG SURF WATERPARK	1500 N MCCLINTOCK DR, TEMPE	0.1	2.6	0.4
74058	BILTMORE SHUTTERS INC	1138 W WATKINS ST, PHOENIX	3.9		
3305	BIMBO BAKERIES USA, INC	738 W VAN BUREN ST, PHOENIX	13.0	1.8	1.5
226	BORAL ROOFING LLC	1832 S 51ST AVE, PHOENIX	2.9	0.3	0.2
80207	BROKEN ARROW CONSTRUCTION	PORTABLE #1, MESA	0.1		
56105	BURDETTE CABINET CO INC	3941 N HIGLEY RD, MESA	10.0		
131634	CAFE VALLEY INC	7000 W BUCKEYE RD, PHOENIX	16.5	3.2	2.7
131208	CALGON CARBON CORPORATION	521 S BUTTERFIELD TR, GILA BEND	0.2	2.5	7.0
3442	CALJET	125 N 53RD AVE, PHOENIX	38.3	0.1	0.3
108199	CALJET OF AMERICA LLC	57 N 57TH AVE, PHOENIX	6.8		
131966	CALPORTLAND	4830 S 43RD AVE, PHOENIX	0.0	0.4	0.3
133365	CALPORTLAND	3410 E VIRGINIA ST, MESA	0.0	0.0	0.0
3296	CALVERT OIL CO	214 E ARIZONA EASTERN AVE, BUCKEYE	8.5		
898	CAMINO DEL SOL FUNERAL CHAPEL	13738 W CAMINO DEL SOL, SUN CITY WEST	0.0	0.2	0.0
44182	CANAM STEEL CORPORATION	22253 W SOUTHERN AVE, BUCKEYE	2.1		
130156	CASE FURNITURE & DESIGN, LLC	1502 E HADLEY ST #100, PHOENIX	3.4		
776	CASE SANDBLASTING INC	1018 S 27TH AVE, PHOENIX	1.9		
1318	CAVCO INDUSTRIES INC	1366 S LITCHFIELD RD #6, GOODYEAR	12.2		
1316	CAVCO INDUSTRIES LLC/DURANGO PLANT	2502 W DURANGO ST, PHOENIX	11.1		
260	CEMEX - 19TH AVE PLANT	3640 S 19TH AVE, PHOENIX	0.7	3.4	15.7
98591	CEMEX - 7TH STREET PLANT	PORTABLE #4, PHOENIX	0.0	0.1	0.0
98492	CEMEX - BUCKEYE PLANT	22625 W BELOAT RD, BUCKEYE	0.0	0.0	0.0
63	CEMEX - EL MIRAGE PLANT	8635 N EL MIRAGE RD, EL MIRAGE	0.0	0.1	0.0
213	CEMEX - GLENDALE PLANT	11920 W GLENDALE AVE, GLENDALE	2.1	1.8	10.7
1266	CEMEX - WEST PLANT	11701 W INDIAN SCHOOL RD, PHOENIX	0.7	8.7	1.9
579	CEMEX - WEST VALLEY PLANT	11550 W NORTHERN AVE, GLENDALE	0.5	6.4	1.4
1310	CENTURY GRAPHICS LLC	2960 GRAND AVE, PHOENIX	6.3	0.3	0.2
823	CHEMRESEARCH CO INC	1130 W HILTON AVE, PHOENIX	3.1	0.4	0.3
127623	CINTAS CORPORATION	2425 W NEVADA ST, CHANDLER	0.8	0.8	0.7
61573	CIRCLE H SAND & ROCK	6400 S EL MIRAGE RD, TOLLESON	0.3	4.1	0.9
3441	CIRCLE K TERMINAL LLC	5333 W VAN BUREN ST, PHOENIX	40.2		
3403	CITY OF PHOENIX 19TH AVE LANDFILL	1701 W LOWER BUCKEYE RD, PHOENIX	0.6	0.4	0.8
29919	CITY OF PHOENIX 27TH AVE LANDFILL	2800 S 27TH AVE, PHOENIX	1.4	1.2	2.1
1075	CO PHX 91ST AVE WWTP	5615 S 91ST AVE #1, TOLLESON	2.9	19.8	9.0
105317	COMMON MARKET EQUIPMENT EAST	26700 S HWY 85, BUCKEYE	2.3		
113723	CONTRACTORS LANDFILL & RECYCLING	2425 N CENTER ST, MESA	0.7	8.8	1.9
31570	COPPER STATE RUBBER OF ARIZONA	750 S 59TH AVE, PHOENIX	8.6	0.5	0.4
1054	COPPERSTATE CABINET CO INC	1932 W NORTH LN, PHOENIX	5.8		
399	CORESLAB STRUCTURES (ARIZ) INC	5026 S 43RD AVE, PHOENIX	9.6		
227	CORROSION ENGINEERING INC	145 S NINA CIR, MESA	21.5	0.4	0.4

ID	Business name	Street address and city	VOC	NO_X	CO
128232	COSTCO GASOLINE #1028	7525 E HAMPTON RD, MESA	10.6		
43917	COSTCO GASOLINE #490	19001 N 27TH AVE, PHOENIX	14.9		
43916	COSTCO GASOLINE #665	1646 W MONTEBELLO AVE, PHOENIX	10.4		
106288	COSTCO GASOLINE #738	2454 E BEARDSLEY RD, PHOENIX	12.9		
129936	COSTCO GASOLINE FACILITY NO 1058	4550 E CACTUS RD PV MALL, PHOENIX	14.6		
127537	COSTCO GASOLINE LOC 827 (AIR)	3801 N 33RD AVE, PHOENIX	4.7		
104505	COSTCO WHOLESALE	2887 S MARKET ST, GILBERT	13.7		
4339	COSTCO WHOLESALE #427	15255 N HAYDEN RD, SCOTTSDALE	15.1		
16027	COSTCO WHOLESALE #436	1445 W ELLIOT RD, TEMPE	12.6		
18490	COSTCO WHOLESALE #465	4502 E OAK ST, PHOENIX	12.4		
41080	COSTCO WHOLESALE #481	1415 N ARIZONA AVE, GILBERT	12.7		
51068	COSTCO WHOLESALE #674	17550 N 79TH AVE, GLENDALE	15.6		
60765	COSTCO WHOLESALE #691	10000 W MCDOWELL RD, AVONDALE	11.6		
99731	COSTCO WHOLESALE #736	595 S GALLERIA WAY, CHANDLER	14.1		
1198	COURIER GRAPHICS CORP	2621 S 37TH ST, PHOENIX	8.6	0.4	0.4
289	COURTHOUSE AG HOLDINGS LLC	51040 W VALLEY RD, AGUILA	2.1	0.0	0.0
132333	COYOTE TIRE RETREADING, INC	1802 N 23RD AVE, PHOENIX	0.1	0.1	0.1
4368	CRAFTSMEN IN WOOD MFG	5441 W HADLEY ST, PHOENIX	6.3	0.0	0.0
1407	CRANE ELECTRONICS, INC	340 N ROOSEVELT AVE, CHANDLER	0.3	0.1	0.1
100059	CRM OF AMERICA (NEW AIR)	11400 E PECOS RD, MESA	0.2	0.3	0.1
129	CROTHALL LAUNDRY SERVICES	4445 S 36TH ST, PHOENIX	0.2	4.2	3.5
134012	CROWN CUSTOM MILLWORK, LLC	2740 W DEER VALLEY RD, PHOENIX	9.6		
131179	CSE OPERATING I, LLC	29115 W BROADWAY RD, BUCKEYE		0.1	0.0
134236	CURTISS WRIGHT CONTROLS	1150 N FIESTA BLVD, GILBERT	0.4		
130790	CUSTOM FAB INC	3065 S 43RD AVE, PHOENIX	6.0	0.6	0.5
87	DECA CREMATION SERVICES INC	2237 S 15TH ST, PHOENIX	0.0	0.7	0.0
45027	DEER VALLEY TRANSFER STATION	2120 W ADOBE DR, PHOENIX	0.0	0.1	0.0
1342	DEL RIO LANDFILL	1150 E ELWOOD ST, PHOENIX	0.1	0.0	0.0
50725	DESERT POWDER COATING	4409 S 35TH AVE, PHOENIX	0.8	0.3	0.3
51073	DIGITAL REALTY TRUST CHANDLER, LLC	2121 S PRICE RD, CHANDLER	0.8	12.5	5.5
36	DON SANDERSON FORD INC	6400 N 51ST AVE, GLENDALE	3.8		
127094	DOUBLETREE PAPER MILL LLC	31201 W THAYER RD, GILA BEND	6.0	4.0	10.4
299	DPC ENTERPRISES INC GP	4909 W PASADENA AVE, GLENDALE	1.6		
51062	DURANGO CORRECTIONAL FACILITY	3225 W DURANGO ST, PHOENIX	0.1	0.9	0.6
48771	EAGLE ROOFING PRODUCTS	4602 W ELWOOD ST, PHOENIX	1.4	2.3	1.9
35018	EARL'S FIBERGLASS INC	128 W MARICOPA FWY, PHOENIX	4.6		
1383	EAST VALLEY CREMATORY	9642 E APACHE TR, MESA	0.0	0.2	0.0
109938	EBAY INC	4010 N 3RD ST, PHOENIX	0.7	49.2	2.8
26	EMPIRE MACHINERY CO	1725 S COUNTRY CLUB DR, MESA	2.3	8.9	2.2
130260	ENTRUSTED PETS, INC	2237 S 15TH ST, PHOENIX	0.0	0.1	0.0
1505	EXECUTIVE DOOR COMPANY	3939 W CLARENDON AVE, PHOENIX	0.3		
1488	FARMER'S GIN INC	8400 S TURNER RD, BUCKEYE	0.0	0.3	0.0
59426	FEDERAL EXPRESS-PHXR	3002 E OLD TOWER RD #100, PHOENIX	0.4	0.8	0.2
132911	FINECRAFT CUSTOM WOODWORKS LLC	5775 N 51ST AVE, GLENDALE	2.5		
107758	FIREBIRD PRODUCTS, LLC	6010 N 53RD DR, GLENDALE	8.4		
128991	FISHER SAND & GRAVEL	PORTABLE #3	2.7	12.1	9.8
85509	FISHER SAND & GRAVEL COMPANY	PORTABLE #2	1.3	15.4	3.3
1087	FLEX FOAM DIVISION	617 N 21ST AVE, PHOENIX	1.8	0.2	0.2

ID	Business name	Street address and city	VOC	NO_x	CO
27728	FLIPCHIP INTERNATIONAL LLC	3701 E UNIVERSITY DR, PHOENIX	17.4	0.4	0.4
1375	FOREST DESIGNS	3230 E ROESER RD #10, PHOENIX	3.9		
4206	FUJI FILM ELECTRONIC MATERIALS USA	6550 S MOUNTAIN RD, MESA	3.2	1.5	1.2
36258	G & K SERVICES	4804 W ROOSEVELT ST, PHOENIX	5.3	1.0	0.8
132482	G & L POWERS INC	1483 W HARVARD ST, GILBERT	0.5		
41751	GCR TIRE CENTERS	2815 N 32ND AVE, PHOENIX	0.3		
902	GENERAL DYNAMICS C4 SYSTEMS	8201 E MCDOWELL RD, SCOTTSDALE	3.1	1.4	0.7
73110	GLENN WEINBERGER TOPSOIL INC	39500 S 99TH AVE, MOBILE	0.0	0.2	0.0
2411	GLENROSA SERVICE CENTER	4019 W GLENROSA AVE, PHOENIX	0.3		
1418	GOODRICH CORPORATION	3414 S 5TH ST, PHOENIX	15.0	0.0	0.0
515	GOODYEAR COMMERCIAL TIRE SERVICE CTR	3007 N 31ST AVE, PHOENIX	0.7		
131841	GRANITE EXPRESS	, MORRISTOWN	0.5	6.3	1.3
10	GREEN ACRES MORTUARIES & CEMETERIES	401 N HAYDEN RD, SCOTTSDALE	0.0	0.0	0.0
1182	GREENWOOD MEMORY LAWN MORTUARY	2300 W VAN BUREN ST, PHOENIX	0.0	0.9	0.1
141	GRO-WELL BRANDS INC	2807 S 27TH AVE, PHOENIX	0.2		
28393	HAMILTON SUNDSTRAND/UTC AEROSPACE SYS	1007 E UNIVERSITY DR, PHOENIX	1.2		
699	HANSON AGGREGATES OF ARIZONA INC	4002 S 51ST AVE, PHOENIX	2.9	3.6	4.1
131334	HELIAE DEVELOPMENT LLC	614 E GERMANN RD, GILBERT	4.9	0.2	0.0
31565	HENRY PRODUCTS INC	302 S 23RD AVE, PHOENIX	10.9	0.4	0.4
129711	HERITAGE CREMATORY	12525 NW GRAND AVE, EL MIRAGE	0.0	0.4	0.0
3536	HOLSUM BAKERY INC	2322 W LINCOLN ST, PHOENIX	25.6	3.6	3.1
39213	HOLSUM OF TOLLESON LLC	9600 W BUCKEYE RD, TOLLESON	23.3	2.9	2.4
1059	HONEYWELL ENGINES SYS & SERVICE PHX R&O	1944 E SKY HARBOR CIR, PHOENIX	12.2	1.4	2.6
355	HONEYWELL INTERNATIONAL INC	111 S 34TH ST, PHOENIX	32.9	42.0	13.7
247	HONEYWELL INTERNATIONAL INC (TEMPE, AZ)	1300 W WARNER RD, TEMPE	7.4	3.3	2.3
348	HONEYWELL PHOENIX AVIONICS DEER VALLEY	21111 N 19TH AVE, PHOENIX	2.6	1.4	0.6
131198	IMPERIAL WOODWORKING LLC	4012 W TURNEY AVE #6, PHOENIX	1.9		
354	IMSAMET OF ARIZONA	3829 S ESTRELLA PKWY, GOODYEAR	10.4	6.4	63.9
4444	INFINEON TECHNOLOGIES EPI SERVICES INC	550 W JUANITA AVE, MESA	0.6	0.1	0.0
777	INSULFOAM	3401 W COCOPAH ST, PHOENIX	29.4	0.6	0.5
31617	INTEL CORP CHANDLER CAMPUS (FAB 6)	5000 W CHANDLER BLVD, CHANDLER	8.1	14.5	7.8
3966	INTEL CORP-OCOTILLO CAMPUS	4500 S DOBSON RD, CHANDLER	91.2	27.0	37.5
89885	INTERCO PRINT	4501 W POLK ST, PHOENIX	1.5	0.2	0.2
130597	INTERNATIONAL FLORA TECHNOLOGIES	28633 W PATTERSON RD, BUCKEYE	21.5	0.1	0.1
43832	INTERNATIONAL PAPER	660 S 83RD AVE, TOLLESON	6.9	0.9	2.3
131226	INTERSAN MANUFACTURING	1746 W FILLMORE ST, PHOENIX	0.1		
130265	IO PHOENIX ONE, LLC	615 N 48TH ST, PHOENIX	0.4	7.6	0.7
40471	IRONWOOD CUSTOM FINISHING	1822 E MADISON ST, PHOENIX	6.1		
983	ISOLA GROUP S A R L	165 S PRICE RD, CHANDLER	11.8	10.6	3.2
732	JABIL	615 S RIVER DR, TEMPE	1.0		
121	JACKS TIRE & OIL	5925 W MONROE ST, PHOENIX	0.3	0.0	0.0
121873	JAMES EDWARD FURNITURE	1555 E JACKSON ST, PHOENIX	4.7		
101	JBS TOLLESON INC	651 S 91ST AVE, TOLLESON	11.5	12.4	5.2
25823	JOY GLOBAL - SURFACE MINING	112 W IRON AVE, MESA	1.3	0.0	0.0
1027	JPCI SERVICES	PORTABLE	6.0	3.3	0.7
130981	KELLER ELECTRICAL INDUSTRIES INC	1881 E UNIVERSITY DR, PHOENIX	0.6	0.1	0.1
114904	KILAUEA CRUSHERS INC	16402 S TUTHILL RD, BUCKEYE	0.1	1.0	0.2
128509	KILAUEA CRUSHERS INC	SR 85 & BUCKEYE HILLS DR, BUCKEYE	0.1	0.8	0.2

ID	Business name	Street address and city	VOC	NO_X	CO
857	L-3 COMMUNICATIONS CORPORATION	1215 S 52ND ST, TEMPE	15.2	0.3	0.1
121236	LANDMARK AVIATION	14600 N AIRPORT DR, SCOTTSDALE	0.4		
30357	LARON INC	3550 S 16TH ST, PHOENIX	0.6	0.1	0.1
96886	LEGENDS FURNITURE	10300 W BUCKEYE RD, TOLLESON	55.7		
131339	LGS AZ, LLC DBA LOOK TRAILERS	8230 N EL MIRAGE RD, EL MIRAGE	16.1		
130111	LIFEPLAN CREMATORY INC	1216 N 17TH AVE, PHOENIX	0.0	0.7	0.0
39914	LOVE'S COUNTRY STORE #296	820 W PIMA RD, GILA BEND	13.3		
3300	LUKE AFB - 56TH FIGHTER WING	14002 W MARAUDER ST, GLENDALE	13.9	7.7	3.5
744	M E GLOBAL INC	5857 S KYRENE RD, TEMPE	22.3	11.5	49.5
1248	MAAX SPAS INDUSTRIES CORP	25605 S ARIZONA AVE, CHANDLER	50.0		
31261	MADISON GRANITE SUPPLIES	29925 N NORTH VALLEY PKWY, PHOENIX	0.5	25.9	4.0
148	MAGELLAN AEROSPACE, GLENDALE INC	5440 W MISSOURI AVE, GLENDALE	10.4	1.0	0.8
353	MARLAM INDUSTRIES INC	834 E HAMMOND LN, PHOENIX	14.9	0.0	0.0
15445	MAYO CLINIC ARIZONA	13400 E SHEA BLVD, SCOTTSDALE	4.1	2.6	2.1
1200	MEDTRONIC - TEMPE	2343 W MEDTRONIC WAY, TEMPE	5.1	0.5	0.4
244	MELCHER MISSION CHAPEL AND CREMATORY	6625 E MAIN ST, MESA	0.0	0.8	0.0
596	MELDRUM MORTUARY & CREMATORY	52 N MACDONALD, MESA	0.0	0.1	0.0
128760	MERIDIAN OPTICAL	3711 E ATLANTA AVE, PHOENIX	0.8		
82244	MESA COMMUNITY COLLEGE MORTUARY SCI	7440 E TAHOE AVE, MESA	0.0	0.0	0.0
3326	MESA FULLY FORMED LLC	1111 S SIRRINE ST, MESA	8.1		
1203	MICROCHIP TECHNOLOGY INC	2355 W CHANDLER BLVD, CHANDLER	0.4	0.9	0.5
1875	MICROCHIP TECHNOLOGY INC	1200 S 52ND ST, TEMPE	10.8	11.6	6.4
53593	MICROSEMI CORP	3601 E UNIVERSITY DR, PHOENIX	2.1		
3724	MISSION FOODS-TEMPE	5860 S ASH AVE, TEMPE	2.7	2.8	2.4
882	MORTON SALT, INC	13000 W GLENDALE AVE, GLENDALE	0.6	8.0	2.3
264	MOUNTAIN VIEW FUNERAL HOME & CEMETERY	7900 E MAIN ST, MESA	0.2	0.1	0.0
132523	MOUNTAINVIEW CUSTOM CABINETS	23306 N 15TH AVE, PHOENIX	6.9		
128379	MURPHY WALL PRODUCTS INTERNATIONAL INC	228 E ARIZONA EASTERN AVE, BUCKEYE	0.0		
121682	MUSKET CORPORATION	816 N 19TH AVE, PHOENIX	0.0	0.0	0.0
34197	NATIONAL GYPSUM COMPANY	1414 E HADLEY ST, PHOENIX	8.3	9.8	13.8
114015	NATIONAL SPECIALTY AGGREGATES LLC	4310 S 80TH ST, MESA	0.0	0.0	0.0
910	NELTEC INC	1420 W 12TH PL, TEMPE	9.4	3.6	1.3
128696	NIELS ANDERSEN SCULPTURES LLC	2630 E MOHAWK LN SUITE 124, PHOENIX	0.7		
590	NK ASPHALT PARTNERS	7110 W NORTHERN AVE, GLENDALE	3.7	5.9	5.0
129677	NO WASTE GRINDINGS	PORTABLE #1, PHOENIX	0.5	6.2	1.3
620	NORTHWEST WATER RECLAMATION PLANT	960 N RIVERVIEW, MESA	1.3	3.5	3.1
881	NXP SEMICONDUCTORS	1300 N ALMA SCHOOL RD, CHANDLER	34.4	12.9	15.0
56506	OAK CREEK FURNITURE INC	5355 N 51ST AVE #7, GLENDALE	1.6		
3953	OAKCRAFT INC	7733 W OLIVE AVE, PEORIA	45.0	0.1	0.1
31637	OLAM COTTON	25500 W SOUTHERN AVE, BUCKEYE	0.0	0.1	0.0
53	OLDCASTLE PRECAST INC	411 E FRYE RD, CHANDLER	5.1	1.9	0.4
4147	OPT CO	PORTABLE	0.5	6.1	1.3
101348	ORBITAL SCIENCES CORPORATION	1721 W ELLIOT RD, GILBERT	0.4	0.5	0.4
528	PACKAGING CORPORATION OF AMERICA INC	441 S 53RD AVE, PHOENIX	2.6	1.5	1.3
98	PALO VERDE NUCLEAR GENERATING STATION	5801 S WINTERSBURG RD, TONOPAH	11.0	48.7	12.8
428	PALOMA GIN PROPERTIES LLC	57525 S POTATOE RD, GILA BEND	0.0	0.1	0.1
130656	PALOMA READY MIX & MATERIALS LLC	PORTABLE #1, (blank)	0.0	0.4	0.1
733	PAN GLO SERVICES LLC	2401 W SHERMAN ST, PHOENIX	17.7	0.5	0.4

ID	Business name	Street address and city	VOC	NO_X	CO
4004	PAN JIT	2502 W HUNTINGTON DR, TEMPE	2.0	0.0	0.0
49047	PARADISE MEMORIAL CREMATORY	9300 E SHEA BLVD BLDG C, SCOTTSDALE	0.0	1.2	0.1
1055	PARAMOUNT PETROLEUM CORP OF AZ INC	1935 W MCDOWELL RD, PHOENIX	5.1	9.3	7.8
419	PARKER HANNIFIN CORP	7777 N GLEN HARBOR BLVD, GLENDALE	22.3		
1398	PATRICIAN MARBLE CO	3333 W OSBORN RD, PHOENIX	2.3		
4241	PEPSICO	409 S 104TH AVE, TOLLESON	3.7	10.0	16.6
29244	PET & ANIMAL LOVERS SERVICE (PALS)	3629 N 40TH AVE, PHOENIX	0.0	2.5	0.1
69	PHOENIX HEAT TREATING INC	2405 W MOHAVE RD, PHOENIX	3.7	1.9	1.6
1491	PHOENIX METALCRAFT INC	3845 N 29TH AVE, PHOENIX	3.5		
27946	PHOENIX-MESA GATEWAY AIRPORT AUTHORITY	5835 S SOSSAMAN RD, MESA	3.7	0.2	0.2
1154	PING INC	2201 W DESERT COVE AVE, PHOENIX	8.8	0.1	0.1
132990	PRECISE METAL PRODUCTS	4534 N 44TH AVE, PHOENIX	0.6		
4007	PRECISION TRUCK PAINTING & REPAIR INC	2212 N 27TH AVE, PHOENIX	2.6		
116742	PREFERRED PACKAGING & CONTAINER	3330 W COCOPAH ST #1, PHOENIX	4.4	0.1	0.1
108860	PRISMA GRAPHIC CORPORATION	2937 E BROADWAY RD, PHOENIX	9.4	0.2	0.1
75998	PRO PETROLEUM PHOENIX TERMINAL	408 S 43RD AVE, PHOENIX	2.3	0.0	0.0
60889	PURCELLS WESTERN STATES TIRE	420 S 35TH AVE, PHOENIX	6.2	0.1	0.1
1335	QUALITY BLOCK INC	3035 S 35TH AVE, PHOENIX	0.0	0.4	0.3
3307	QUIKJET LLC	5119 W MONROE ST, PHOENIX	25.5		
131898	QUIKTRIP DISTRIBUTION - PHOENIX	8501 W LATHAM ST, TOLLESON	1.8	1.1	0.6
537	RED MOUNTAIN MINING INC	4520 N POWER RD, MESA	0.5	6.2	1.3
54	REDBURN TIRE CO	3801 W CLARENDON AVE, PHOENIX	1.1		
131795	REDSTONE INDUSTRIES, INC	13770 W PEORIA AVE, SURPRISE	2.9		
128324	REGENCY MORTUARY SERVICES INC	9850 W THUNDERBIRD RD, SUN CITY	0.0	0.1	0.0
44356	RITCHIE BROS AUCTIONEERS (AMERICA) INC	5410 W LOWER BUCKEYE RD, PHOENIX	0.5	0.0	0.0
4318	RIVER RANCH PLANT #40	5159 N EL MIRAGE RD, LITCHFIELD PK	0.1	0.1	0.0
131080	ROBERTSON FUEL SYSTEMS LLC	800 W CARVER RD #101, TEMPE	2.4	0.1	0.1
133058	ROCK SOLID INC	11500 W BEARDSLEY RD, SUN CITY	0.0	0.0	0.0
133589	ROCK SOLID INC	6204 W SOUTHERN AVE, PHOENIX	0.0	0.0	0.0
759	ROGERS CORP/ADVANCED CIRCUIT MATERIALS	100 S ROOSEVELT AVE, CHANDLER	15.3	6.5	2.9
4174	ROGERS CORPORATION	2225 W CHANDLER BLVD, CHANDLER	0.0	0.3	0.1
4543	ROHRER CORPORATION	159 W 1ST AVE, MESA	8.6		
29474	SA RECYCLING LLC	3640 S 35TH AVE, PHOENIX	0.1		
132784	SAM'S CLUB #6605	1225 N GILBERT RD, GILBERT	7.8	0.1	0.0
403	SAPA EXTRUSIONS NORTH AMERICA, LLC	249 S 51ST AVE, PHOENIX	21.6	10.9	9.9
132227	SCHAUMAPLAST PRECISION FOAM MOLDING LP	21 N 39TH AVE, PHOENIX	9.8	0.5	0.4
4072	SCHREIBER FOODS INC	2122 S HARDY DR, TEMPE	1.4	4.2	12.8
266	SCHUFF STEEL CO	420 S 19TH AVE, PHOENIX	18.2	9.3	2.0
246	SCHULT HOMES	231 N APACHE RD, BUCKEYE	11.9		
39309	SENERGY PETROLEUM LLC	622 S 56TH AVE, PHOENIX	2.5		
3528	SENERGY PETROLEUM, LLC	306 S COUNTRY CLUB DR, MESA	9.6		
1351	SERENITY MORTUARY SERV INC	2514 S 6TH AVE, PHOENIX	0.0	1.3	0.1
1169	SHAMROCK FOODS CO	2228 N BLACK CANYON HWY, PHOENIX	0.6	10.8	9.1
4050	SIGNATURE BREADS INC	1120 W FAIRMONT DR STE #6-12, TEMPE	4.5	0.3	0.3
27933	SKUNK CREEK LANDFILL	3165 W HAPPY VALLEY RD, PHOENIX	3.5	3.6	3.4
39980	S-L SNACKS AZ, LLC	1200 N BULLARD AVE, GOODYEAR	11.5	6.3	5.3
131682	SOLJET, LLC	5601 W VAN BUREN ST, PHOENIX	2.2	0.1	0.1
4086	SOUTH BAY CIRCUITS INC	6409 W COMMONWEALTH PL, CHANDLER	2.6		

ID	Business name	Street address and city	VOC	NO_X	CO
2108	SOUTHWEST AIRLINES CO	4153 E SKY HARBOR BLVD, PHOENIX	4.3	0.3	0.1
131861	SOUTHWEST ARCHITECTURAL CASTINGS	5343 W MOHAVE ST, PHOENIX	0.2		
52776	SOUTHWEST BAKING COMPANY	9604 W BUCKEYE RD, TOLLESON	0.0	0.0	0.0
31643	SOUTHWEST REGIONAL LANDFILL	24427 S HWY 85, BUCKEYE	0.7	8.2	1.7
2110	SPECIAL DEVICES INC	3431 N RESEDA CIR, MESA	11.9		0.0
80437	SR 85 LANDFILL	28633 W PATTERSON RD, BUCKEYE	4.7	4.0	8.2
582	STONE CREEK INC	4221 E RAYMOND ST #102, PHOENIX	15.2		
388	STOROPACK INC	77 N 45TH AVE #2, PHOENIX	2.5	0.1	0.1
131720	STP PERFORMANCE COATING LLC	406 E PIONEER ST, PHOENIX	0.6	0.1	0.1
827	STP PERFORMANCE COATING, LLC	1131 W WATKINS ST, PHOENIX	2.0	0.5	0.4
1214	SULZER EMS INC	2412 W DURANGO ST, PHOENIX	1.4	0.0	0.0
4400	SUMCO SOUTHWEST CORPORATION	19801 N TATUM BLVD, PHOENIX	9.0	13.9	6.0
71801	SUMIKA ELECTRONIC MATERIALS INC	3832 E WATKINS ST, PHOENIX	0.2	0.3	0.1
31	SUNLAND MEMORIAL PARK/MORT/CREM CTR	15826 N DEL WEBB BLVD, SUN CITY	0.0	0.0	0.0
41431	SUPER RADIATOR COILS LTD	2610 S 21ST ST, PHOENIX	0.0	0.3	0.3
37546	SUPERLITE BLOCK	4626 N 42ND AVE, PHOENIX	2.0	1.1	0.9
39376	SWIFT TRANSPORTATION CO INC	2200 S 75TH AVE, PHOENIX	3.5		
131377	SWIM PLATFORMS INC	3220 S 38TH ST, PHOENIX	6.0		
131453	SYSCO ARIZONA INC	611 S 80TH AVE, TOLLESON	0.0	1.0	0.2
249	THE BOEING COMPANY	5000 E MCDOWELL RD, MESA	26.9	2.1	1.8
133082	TRANSWESTERN PIPELINE COMPANY, LLC	W TABLE MESA RD, NEW RIVER	1.1	1.7	3.2
1122	TRIUMPH MANUFACTURING LLC	2130 S INDUSTRIAL PARK AVE, TEMPE	1.9		
819	TRW VEHICLE SAFETY SYSTEMS INC	11202 E GERMANN RD, MESA	2.8	0.3	0.4
234	UNITED DAIRYMEN OF ARIZONA	2008 S HARDY DR, TEMPE	2.4	27.0	38.2
132907	UNITED METAL PRODUCTS, INC	1920 E ENCANTO DR, TEMPE	2.8	0.6	0.5
63962	UPPER CRUST BAKERY	3655 W WASHINGTON ST, PHOENIX	9.4	1.7	1.4
131506	USAA (UNITED SERVICES AUTOMOBILE ASSOC)	1 N NORTERRA DR, PHOENIX	0.0	1.4	0.2
187	VERCO DECKING INC	4340 N 42ND AVE, PHOENIX	0.5	0.1	0.1
1415	VULCAN MATERIALS CO	7845 W BROADWAY RD, PHOENIX	6.9	12.2	27.5
132528	VULCAN MATERIALS COMPANY	3410 E VIRGINIA ST, MESA	1.6	3.0	2.2
2	VULCAN MATERIALS CO-WESTERN DIVISION	14521 N 115TH AVE, EL MIRAGE	0.8	3.0	36.4
90	VULCAN MATERIALS CO-WESTERN DIVISION	4830 S 43RD AVE, PHOENIX	0.8	4.6	3.8
131642	W L GORE ASSOCIATES, INC	32340 N NORTH VALLEY PKWY, PHOENIX	2.7	0.8	1.0
130002	WASTE MGMT 7TH AVE TRANSFER & LANDFILL	3000 S 7TH AVE, PHOENIX	0.3	3.9	0.9
113519	WASTE MGMT PHX HAUL CONTAINER SHOP	2441 S 40TH ST, PHOENIX	1.6		
134014	WASTEBUILT SOUTHWEST LLC	4020 S 15TH AVE, PHOENIX	4.9		
1149	WEAVER QUALITY SHUTTERS INC	218 S 15TH ST, PHOENIX	2.4		
131585	WEST COAST SAND AND GRAVEL	13333 W SOUTHERN AVE, AVONDALE	0.9	10.5	2.3
1240	WESTERN MILLWORK INC	2525 W CORONADO RD, PHOENIX	3.9		
1339	WESTERN REFINING TERMINALS, LLC	3050 S 19TH AVE, PHOENIX	0.3	1.2	0.6
2703	WESTERN STATES PETROLEUM	450 S 15TH AVE, PHOENIX	11.5		
820	WESTSIDE CREMATORY	11211 W MICHIGAN AVE, YOUNGTOWN	0.0	0.4	0.0
121588	WICKENBURG FUNERAL HOMES INC	187 N ADAMS ST, WICKENBURG	0.0	0.1	0.0
128707	WOOD UNLIMITED INC (AIR)	9801 N LITCHFIELD RD, EL MIRAGE	1.8	9.1	5.0
1382	WOODCASE FINE CABINETRY INC	3255 W OSBORN RD, PHOENIX	26.3		

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

APPENDICES

VOLUME THREE

DECEMBER 2016

MARICOPA ASSOCIATION of GOVERNMENTS

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APPENDICES

APPENDIX A

Exhibit 1: 2011 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. February 2014. Addendum August 2015.

Exhibit 2: 2014 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. September 2016.

APPENDIX B

Exhibit 1: Technical Support Document in Support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments.

Exhibit 2: State of Arizona Fifty-Second Legislature Senate Bill 1255 and Final Revised Fact Sheet for Senate Bill 1255.

APPENDIX C

Exhibit 1: Public Hearing Process Documentation.

Exhibit 2: Certification of Adoption and MAG Authority for Regional Air Quality Planning.

APPENDIX B

APPENDIX B

EXHIBIT 1:

Technical Support Document in Support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments.

TECHNICAL SUPPORT DOCUMENT

IN SUPPORT OF

THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR

THE MARICOPA NONATTAINMENT AREA

DECEMBER 2016

Maricopa Association of Governments
302 North 1st Avenue, Suite 300
Phoenix, Arizona 85003

MARICOPA ASSOCIATION of GOVERNMENTS

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ACRONYMS AND ABBREVIATIONS

Acronyms

AC	Air Commercial
ADOT	Arizona Department of Transportation
ADEQ	Arizona Department of Environmental Quality
ADWM	Arizona Department of Weights and Measures
APM	Aviation Performance Metrics
APU	Auxiliary Power Unit
AQMP	Air Quality Modeling Platform
AQS	Air Quality System
ARW	Advanced Research WRF
ASOS	Automated Surface Observing System
AT	Air Taxi
ATADS	Air Traffic Activity Data System
AVFT	Alternative Vehicle and Fuel Technologies
BC	Boundary Condition
CAA	Clean Air Act
CAMx	Comprehensive Air Quality Model with Extensions
CBG	Cleaner Burning Gasoline
CEMS	Continuous Emission Monitoring System
CPA	Chemical Process Analysis
CSAPR	Cross-State Air Pollution Rule
DDM	Decoupled Direct Method
$DEASCO_3$	Deterministic & Empirical Assessment of Smoke's Contribution to Ozone
DV	Design Value
DVB	Base Year Design Value
DVF	Future Year Design Value
EDMS	Emissions and Dispersion Modeling System
EF	Emission Factor
EGU	Electric Generating Units
EKMA	Empirical Kinetic Modeling Approach
EPA	U.S. Environmental Protection Agency
ERG	Eastern Research Group
ESRL	Earth System Research Laboratory
ETMSC	Enhanced Traffic Management System Counts
FAA	Federal Aviation Administration
FINN	Fire Inventory from NCAR
FMYN	Fort McDowell Yavapai Nation
FR	Federal Register
GA	General Aviation
GCIP	GEWEX Continental-Scale International Project
GEOS	Goddard Earth Observing System Model
GEWEX	Global Energy and Water Cycle Experiment
GIS	Geographic Information Systems

GRIC	Gila River Indian Community of Gila River Indian Reservation
GSE	Ground Support Equipment
HDDM	High-order Decoupled Direct Method
HPA	High Pollution Advisory
I/M	Inspection and Maintenance
ICBC	Initial and Boundary Conditions
ISHD	Integrated Surface Hourly Database
LAI	Leaf Area Index
LCP	Lambert Conformal Projection
LSM	Land Surface Model
LTO	Landing and Takeoff
MAG	Maricopa Association of Governments
MATS	Model Attainment Test Software
MCAQD	Maricopa County Air Quality Department
MCIP	Meteorology-Chemistry Interface Processor
MEGAN	Model of Emissions of Gases and Aerosols from Nature
ML	Military
MOVES	Motor Vehicle Emission Simulator
MOZART	Model for Ozone and Related Chemical Tracers
MPO	Metropolitan Planning Organization
MR	Mixing Ratio
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NCDC	National Climatic Data Center
NCEP	National Centers for Environmental Information
NEI	National Emissions Inventory
OSAT	Ozone Source Apportionment Technology
PAMS	Photochemical Assessment Monitoring Stations
PCAQCD	Pinal County Air Quality Control District
PEI	Periodic Emissions Inventory
PFC	Portable Fuel Containers
PFT	Plant Function Type
PTE	Potential To Emit
RFP	Reasonable Further Progress
RMSE	Root Mean Square Errors
RRF	Relative Response Factor
RRTM	Rapid Radiative Transfer Model
RVP	Reid Vapor Pressure
SCC	Standard Classification Codes
SIP	State Implementation Plan
SMOKE	Sparse Matrix Operator Kernel Emissions
SRPMIC	Salt River Pima-Maricopa Indian Community of Salt River Reservation
TAF	Terminal Area Forecast
TDM	Travel Demand Model

TOMS	Total Ozone Mapping Spectrometer
USB	US Background
VHT	Vehicle Hours Traveled
VMT	Vehicle Miles Traveled
WOE	Weight Of Evidence
WPS	WRF Preprocessing System
WRAP	Western Regional Air Partnership
WRF	Weather Research and Forecasting

Abbreviations

g	gram
CO	Carbon Monoxide
H_2O_2	Hydrogen Peroxide
HNO_3	Nitric Acid
hPa	hectopascal
m	meter
mph	miles per hour
NOx	Oxides of Nitrogen
O_3	Ozone
P	Production Rate
ppb	parts per billion
ppm	parts per million
T	Temperature
TNMOC	Total Non-Methane Organic Compounds
VOC	Volatile Organic Compounds
WD	Wind Direction
WS	Wind Speed

I. INTRODUCTION

The Maricopa eight-hour ozone nonattainment area has not yet attained the 2008 eight-hour ozone standard of 0.075 parts per million (ppm). The area is currently classified as a Moderate Area under the Clean Air Act. The attainment date for Moderate Areas is July 20, 2018. A Moderate Area Plan is due by January 1, 2017. The MAG 2017 Eight-Hour Ozone Moderate Area Plan has been prepared to meet the requirements in Section 182(b) of the Clean Air Act.

As the designated Regional Air Quality Planning Agency, the Maricopa Association of Governments (MAG) conducted modeling for emissions and air quality, and prepared the air quality plans including attainment demonstrations. This Technical Support Document (TSD) presents the analyses of the ground-level eight-hour ozone concentrations for an area encompassing the Maricopa eight-hour ozone nonattainment area and the modeled attainment demonstration of the 2008 ozone standard.

I-1. Background

On May 21, 2012, the U.S. Environmental Protection Agency (EPA) published a final rule classifying the Maricopa eight-hour ozone nonattainment area as a Marginal Area for the 2008 ozone National Ambient Air Quality Standard (NAAQS) of 0.075 parts per million (ppm). The Maricopa eight-hour ozone nonattainment area includes a 5,017 square mile area located predominantly in Maricopa County and Apache Junction in Pinal County. EPA published a final rule on March 6, 2015, which revised the attainment date for Marginal area from December 31, 2015 to July 20, 2015.

On June 27, 2014, the MAG 2014 Eight-Hour Ozone Plan-Submittal of Marginal Area Requirements for the Maricopa Nonattainment Area was transmitted to EPA. For Marginal Areas, EPA assumed that the areas would be in attainment within three years of designation without any additional control measures. Marginal Areas were not required to submit an attainment demonstration; reasonably available control technologies and measures, reasonable further progress demonstration, and contingency measures. On October 16, 2015, EPA published a final notice to take direct final action to approve the MAG 2014 Eight-Hour Ozone Plan-Submittal of Marginal Area Requirements for the Maricopa eight-hour ozone nonattainment area.

Since the Maricopa eight-hour ozone nonattainment area did not attain the 2008 ozone standard by July 20, 2015, the nonattainment area was subsequently reclassified from a Marginal Area to a Moderate Area by EPA on May 4, 2016. The attainment date for the Moderate Area is July 20, 2018. EPA requires that all control measures necessary to demonstrate attainment be implemented prior to the start of ozone season preceding the attainment year. Thus, the modeled attainment demonstration in this TSD verifies that the existing and implemented federal state and local control measures in the Maricopa eight-hour ozone nonattainment area provide the emission reductions needed to attain the 2008 ozone standard by the end of the ozone season in 2017.

MAG developed the draft ozone modeling protocol, in support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area, and submitted it to EPA and the Air Quality Planning Team for review and comments on November 20, 2015. The draft modeling protocol in Appendix A presented details of the technical approaches and modeling assumptions that would be used in the modeled attainment demonstration for the 2008 ozone standard in the Maricopa eight-hour ozone nonattainment area. No comments were provided on the draft modeling protocol by the deadline of December 17, 2015.

The primary objective of this TSD is to demonstrate that the Maricopa eight-hour ozone nonattainment area will attain the 2008 ozone standard by the end of the 2017 ozone season. The secondary objective is to develop the 2017 conformity budget for onroad mobile source emissions using the most recent version of the EPA Motor Vehicle Emission Simulator (MOVES) model, MOVES2014a.

I-2. Overview of Modeling Analysis

Ozone (O_3) is a pale blue gas with a distinctively pungent smell. It is a secondary air pollutant which is generated by chemical reactions between volatile organic compounds (VOC) and oxides of nitrogen (NOx) in the presence of sunlight. Ozone is harmful to the human respiratory system, especially for children, the elderly, and people of all ages who have lung diseases such as asthma. Elevated local ozone concentrations are typically generated with local and transported ozone and precursor emissions from anthropogenic and biogenic sources under strong sunlight of the summer ozone season.

This modeling analysis evaluated the effects of emission growth and emission control strategies on future eight-hour ozone concentrations in the Maricopa eight-hour ozone nonattainment area. The results of the modeling analysis provide a quantitative assessment of the potential for compliance with the federal ozone standard and also the basis for the development of the attainment plan.

For the eight-hour ozone modeling analysis, the Comprehensive Air Quality Model with Extensions (CAMx) was used to simulate ozone concentrations during the ozone season of May 1 through September 30 for the 2011 base year and the 2017 future year. The meteorological input data for CAMx were generated by the Weather Research and Forecasting (WRF) model. Point and area source emissions inventories were developed based on the data provided by the Maricopa County Air Quality Department (MCAQD) and the Pinal County Air Quality Control District (PCAQCD). Onroad and nonroad mobile source emissions were developed using the Motor Vehicle Emission Simulator (MOVES2014a). The Emissions and Dispersion Modeling System (EDMS) was used to develop emissions from aircraft, Ground Support Equipment (GSE), and Auxiliary Power Units (APU) at airports. The Model of Emissions of Gases and Aerosols from Nature (MEGAN) was used to develop biogenic source emissions. The Sparse Matrix Operator Kernel Emissions (SMOKE) model was used to develop hourly gridded and chemically speciated emissions, and to merge anthropogenic and biogenic source emissions. Figure I-1 illustrates the MAG air quality modeling system that was used in this modeling analysis.

The WRF and CAMx model performances were evaluated with weather and ozone observation data in 2011. Input data and modeling configurations of physical and chemical solvers for the WRF and CAMx were revised or changed until the model performances satisfied the EPA recommended statistical criteria.

The peak design value for the 2017 attainment year based on the CAMx modeling results in this study was predicted at 75.6 parts per billion (ppb) at North Phoenix, which is lower than the cutpoint of 75.9 ppb (or 0.0759 ppm) for the attainment demonstration. The supplemental analyses in support of the attainment demonstration results are provided in Section VI and Appendix II. Based on the results from the attainment demonstration and the weight-of-evidence (WOE) discussed in the supplemental analyses, it is concluded that the Maricopa eight-hour ozone nonattainment area will meet the 2008 ozone standard by the end of ozone season in 2017.

This plan established the 2017 conformity budgets of 45.7 metric tons per day for VOC and 62.7 metric tons per day for NOx for onroad mobile source emissions in the Maricopa eight-hour ozone nonattainment area. The budgets were developed using the average daily onroad motor vehicle emissions for the period of May 1 through September 30, 2017, which were used in the attainment demonstration for the 2008 ozone standard. The new 2017 VOC and NOx emissions budgets will be used in the regional transportation conformity analyses that begin after the budgets have been found to be adequate or are approved by EPA. In subsequent conformity analyses, onroad mobile source emissions for conformity horizon years cannot exceed the 2017 VOC and NOx onroad emissions budgets.

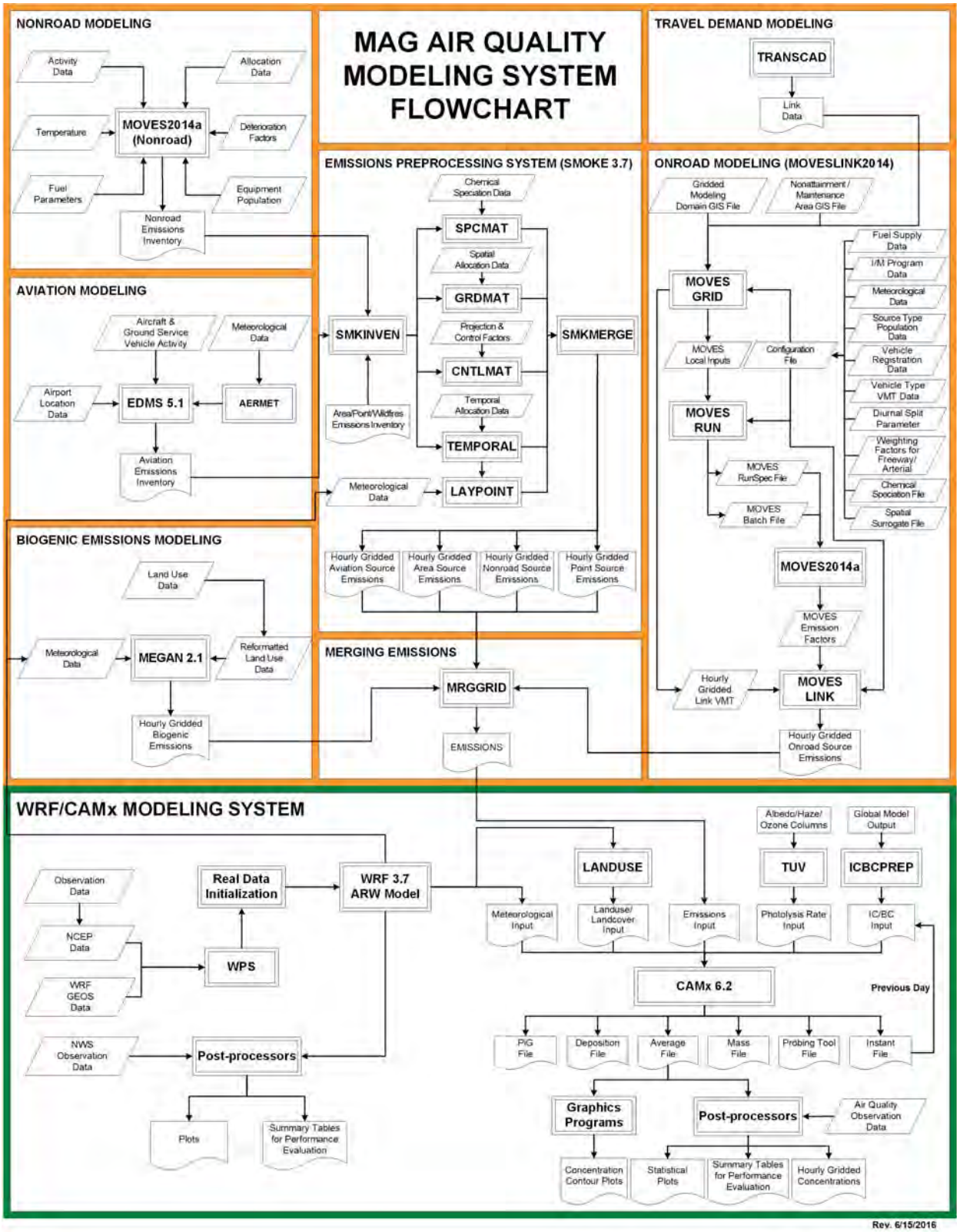


Figure I-1. MAG air quality modeling system flow chart

I-3. Data Access Procedure

All modeling input and output files were saved in a dedicated hard drive, and will be provided on a request basis since the files used in the modeling analysis require an extensive data storage space (e.g., more than 5 terabytes). A summary of the input and output files, and the structures of files used in the air quality modeling are provided in Appendix C. The input and output files are grouped by model, and the file summary provides a sequential outline of the overall air quality modeling chain.

The job file list indicates the names of the job control files which were used to run each model or program. Each job control file is the executable file which was used to run the particular air quality model. Note that since some emission models were not run by job file (i.e., MOVES2014a), no job files are listed. Also, some air quality models have very simple job files (e.g., MOVESLINK2014) whose purpose is calling a large control file. Since these job files are very simple, a sample job file was provided in Appendix G. These sample job files may be changed easily to call a different control file. All input and output files are organized by program or model in separate directories.

I-4. Structure of Document

Section I of this technical support document provides the background, objectives, and access procedure for modeling input and output data of this modeling study. Section II describes horizontal and vertical structures of the modeling domains, and criteria of the ozone episode selection. Section III presents the descriptions of the preparation of emissions and meteorological input data for the attainment demonstration. Section IV describes the WRF and CAMx model performance evaluation methodologies and results. Section V provides the attainment demonstration for the monitors and the unmonitored area in the Maricopa eight-hour ozone nonattainment area, the proposed conformity budgets in 2017, the Reasonable Further Progress (RFP) 15 percent reduction in VOC anthropogenic emissions, and the descriptions of ozone control and contingency measures. Section VI is dedicated to the supplemental and weight of evidence analyses which support the model attainment demonstration in Section V. Section VII provides conclusions that were found from the modeled attainment demonstrations and the supplemental and weight of evidence analyses.

II. MODELING DOMAIN AND OZONE EPISODE SELECTION

II-1. Modeling Domain

Selection of the modeling domains takes into account the Maricopa eight-hour ozone nonattainment area boundaries, the distribution of major emissions sources, the locations of the meteorological and air quality monitoring sites, and the prevailing winds associated with elevated ozone concentrations, as well as regional air pollutant transport. Figure II-1 shows the spatial relationship among the master (36 km grid resolution), first-nested (12 km grid resolution), and second-nested (4 km grid resolution) CAMx and WRF modeling domains. Figure II-2 illustrates the inner modeling domain of 4-by-4 km grid cells that covers the Maricopa eight-hour ozone nonattainment area, Maricopa County, and portions of Pinal, Gila, and Yavapai Counties.

Since ozone concentrations in the Maricopa eight-hour ozone nonattainment area can be substantially influenced by transported ozone and precursor emissions from upwind sources of the Maricopa eight-hour ozone nonattainment area (EPA, 2015a), the master 36 km grid modeling domain (36 km modeling domain) covers the 48 contiguous United States along with the southern portion of Canada and the northern portion of Mexico. The extensive coverage of the master modeling domains of CAMx and WRF was designed to capture the characteristics of long-range transport of ozone and precursor emissions to the Maricopa eight-hour ozone nonattainment area. The 36 km modeling domain was used to generate initial and boundary conditions for the 12 km grid modeling domain (12 km modeling domain). The 12 km modeling domain was used to provide boundary and initial condition data for the core 4 km grid modeling domain (4 km modeling domain). The CAMx modeled attainment demonstration was performed with the 4 km modeling domain.

In accordance with the EPA modeling guidance (EPA, 2014a), the meteorological modeling domains were developed to be larger than the air quality modeling domains to minimize complications associated with air mass recirculation and to minimize boundary influences. The map projection parameters and domain sizes for both WRF and CAMx modeling domains are provided in Tables II-1 and II-2, respectively. The CAMx inner 4 km modeling domain encompasses the entire Maricopa eight-hour ozone nonattainment area, consisting of 56 grid cells in the west-east direction and 44 grid cells in the south-north direction. The domain covers an area of approximate 15,222 square miles.

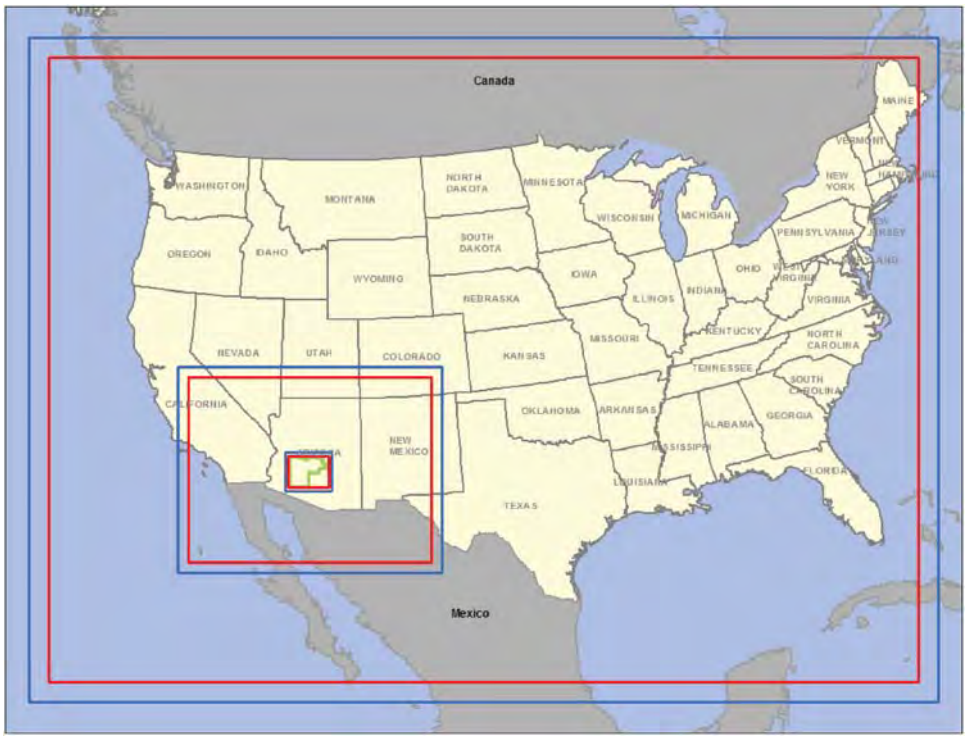


Figure II-1. CAMx air quality modeling domains (red: 36/12/4 km) and WRF meteorological modeling domains (blue: 36/12/4 km)

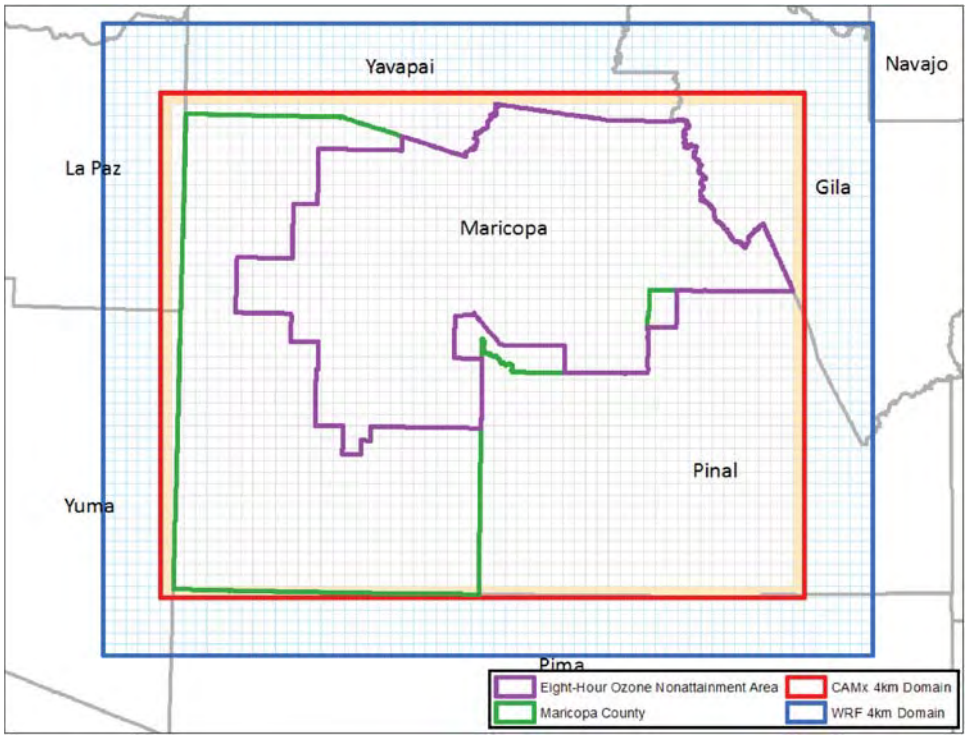


Figure II-2. The inner CAMx modeling domain (red) and WRF modeling domain (blue)

Table II-1. Map projection parameters for the 36/12/4 km modeling domains

Parameter	Value
Projection	Lambert-Conformal Projection (LCP)
1st True Latitude	33 degrees N
2nd True Latitude	45 degrees N
Central Longitude	111 degrees W
Central Latitude	33.355 degrees N

Table II-2. WRF and CAMx modeling domain configurations

WRF Modeling Domains		
Grid Resolution	Grid Size	LCP Range (km)
36 km x 36 km	141 by 103	(-1,674.000, -1,290.252) to (3,402.000, 2,417.748)
12 km x 12 km	123 by 96	(-846.000, -570.252) to (630.000, 581.748)
4 km x 4 km	66 by 54	(-246.000, -114.252) to (18.000, 101.748)
CAMx Modeling Domains		
Grid Resolution	Grid Size	LCP Range (km)
36 km x 36 km	135 by 97	(-1,566.000, -1,182.252) to (3,294.000, 2,309.748)
12 km x 12 km	113 by 86	(-786.000, -510.252) to (570.000, 521.748)
4 km x 4 km	56 by 44	(-226.000, -94.252) to (-2.000, 81.748)

II-2. Vertical Layer Structure

The vertical layer resolution and coordinates for WRF and CAMx modeling are based on the sigma coordinate system. The sigma coordinate system uses the terrain-following hydrostatic pressure vertical coordinate ranging from 1 at the surface to 0 at the upper boundary of the modeling domain. The 23 vertical layer configuration was used for both CAMx and WRF modeling. The upper boundary was based on the reference pressure of 50.0 hectopascal (hPa). The numbers of approximate pressures and heights of vertical layers for the CAMx and WRF modeling are presented in Table II-3. The three modeling domains have the same vertical layer structures.

Table II-3. Approximate pressures and heights of WRF and CAMx vertical layers

Layer No.	Vertical Layer Pressure (hPa)	Vertical Layer Height (m)
1	933	20
2	929	60
3	925	100
4	921	140
5	914	201
6	906	282
7	898	364
8	889	446
9	877	571
10	860	740
11	843	911
12	826	1,085
13	801	1,352
14	764	1,764
15	713	2,341
16	663	2,945
17	622	3,479
18	580	4,042
19	538	4,638
20	496	5,271
21	392	7,192
22	225	11,339
23	121	14,949

II-3. Ozone Episode Selection

The EPA modeling guidance (EPA, 2014a) suggests the consideration of the following criteria in selecting the ozone modeling episode: 1) The most recently compiled and quality-assured national emissions inventory databases should be available for the modeling episode, 2) a sufficient number of days should be available so that the modeled attainment test applied at each monitor is based on the ten highest modeled days, 3) the modeling episode should ensure that the modeling system appropriately characterizes low pollution periods, development of elevated periods, and transition back to low pollution

periods through synoptic cycles, and 4) the modeling episode should cover a variety of meteorological conditions conducive to elevated ozone concentrations.

Since the EPA National Emissions Inventory (NEI) for the year 2011 was the most recently compiled and quality-assured national emissions inventory, the year 2011 was selected as the base year for the development of the baseline emissions inventory and baseline design values. The baseline design values of monitors in 2011 were developed using ozone observations at monitors during the five-year period of 2009 - 2013. Since the full ozone season from May 1 through September 30 provided a sufficient amount of days (i.e., 153 days) for the development of the ten highest modeled days for ozone concentrations, covered a variety of meteorological conditions, and characterized high-low and transitional conditions of ozone concentrations in the Maricopa eight-hour ozone nonattainment area, the period of May 1 through September 30 in 2011 was selected as the modeling episode for the attainment demonstration. For the attainment demonstration, the initial three days of the modeling episode were used as the model spin-up period to minimize the impact of fluctuations in the initial condition data. Thus, modeling results from the spin-up period of May 1 - 3 were not used for the modeled attainment demonstration.

III. AIR QUALITY MODEL INPUT PREPARATION

III-1. Base and Future Year Emissions Inventory

The anthropogenic emissions inventory for 2011 and 2017 for the 12 km and 36 km modeling domains were obtained from the EPA 2011 Air Quality Modeling Platform (AQMP) version 6.2 (EPA, 2015b). This inventory includes point, area, nonroad, and onroad sources emissions for individual states and counties within the contiguous U.S.. The anthropogenic emissions inventory from the southern portion of Canada and the northern portion of Mexico in the 12 km and 36 km modeling domains were provided by Eastern Research Group (ERG), Inc. on August 31, 2015. The details of the Mexico and Canada data and ERG's modeling assumptions are available in Appendix A.

Biogenic emissions for the 12 km and 36 km modeling domains were calculated with the same modeling approaches used for the 4 km modeling domain (see Section III-1-5). Wildfires and prescribed burning within the 12 km and 36 km modeling domains that fall within the U.S. territory were provided by AQMP v6.2. The data for the southern portion of Canada and the northern portion of Mexico were obtained from the Western Regional Air Partnership (WRAP) Deterministic & Empirical Assessment of Smoke's Contribution to Ozone ($DEASCO_3$) project. $DEASCO_3$ data were pre-processed for the SMOKE emissions processing. The base year and the attainment year biogenic and wildfire emissions were assumed to be constant between 2011 and 2017.

The following subsections describe the methodologies used in the development of daily emissions inventory for the 4 km modeling domain. The daily emissions inventory for the five-month modeling episode for the years 2011 and 2017 are provided in Appendix E.

III-1-1. Point Source Emissions

Point sources include major stationary sources that emit a significant amount of air pollutants. A point source is required to report emissions if it qualifies as a major source as defined by 40 CFR Part 70. For this emissions inventory, point sources in the modeling domain were divided into Electric Generating Units (EGU) and non-EGU. EGU is referred to as power plant, while non-EGU includes all other major stationary sources, such as landfills, petroleum storage, transfer facilities, and large industrial installations.

The SMOKE model was used to process stack parameters (i.e. height, width, temperature, and exit velocity) of point sources and to separate elevated point source emissions from the ground-level point source emissions based on the plume rise above 20 meters. For Maricopa County, the annual EGU emissions were processed using monthly, weekly, and daily temporal profiles to develop hourly emissions for a specific day of week for a specific month. The temporal profiles were developed using the 2011 Continuous Emission Monitoring System (CEMS) data for EGUs in Maricopa County. Details on temporal allocation processes can be found in Section III-2-3.

For the EGU emissions in 2017 for Maricopa County, the maximum emissions over the 10-year period of 2005 through 2014 was assumed for individual power plants, as provided by MCAQD (MCAQD, 2015). The new Buckeye Generation Center is expected to start operating in 2017. Since prior emissions data for this new power plant were not available, the Potential to Emit (PTE) emissions were assumed for this power plant in 2017. EGU emissions for Maricopa County in 2011 and 2017 are provided in Table III-1.

Table III-1. EGU emissions for Maricopa County in 2011 and 2017 (unit: metric tons/day)

	2011			2017*		
Facility Name	VOC	NOx	CO	VOC	NOx	CO
APS West Phoenix Power Plant	0.07	1.89	0.19	0.09	2.09	0.25
Arlington Valley LLC	0.00	0.27	0.17	0.10	0.54	0.41
Buckeye Generation Center LLC	0.00	0.00	0.00	0.06	0.22	0.28
Gila River Power Station	0.04	0.81	0.23	0.12	2.18	0.36
Mesquite Generating Station	0.06	0.52	0.06	0.08	0.66	0.15
New Harquahala Generating Co	0.08	0.11	0.18	0.12	0.43	0.28
Ocotillo Power Plant	0.02	0.49	0.09	0.03	0.94	0.17
Redhawk Generating Facility	0.01	0.37	0.40	0.02	0.45	0.42
Santan Generating Station	0.04	1.28	0.75	0.21	1.56	0.88
SRP Agua Fria Generating Station	0.01	0.86	0.22	0.05	4.07	0.83
SRP Kyrene Generating Station	0.01	0.11	0.03	0.03	0.26	0.13

* MCAQD provided projected power plant emissions in 2017 (Downing, 2015).

Maricopa County non-EGU point source emissions for the base year were based on ozone season day emissions reported in the Addendum for the 2011 Periodic Emissions Inventory (PEI) for ozone precursors (MCAQD, 2015). Growth factors for non-EGU from 2011 to 2017 were derived from socioeconomic and census data (e.g. population, employment, agricultural area, gasoline consumption, etc.) for Maricopa County, as shown in Table III-2. These growth factors were applied to the base year non-EGU point source emissions to obtain the 2017 future year emissions. Non-EGU emissions for Maricopa County in 2011 and 2017 are provided in Table III-3.

Table III-2. Growth factors for non-EGU point and area sources in Maricopa County

Growth Index	2011	2017	Growth Factor
Agricultural Acres	275,050	268,346	0.98
Airport Operations (operations/year)*	1,718,536	1,805,295	1.05
Gasoline Consumption (gallons/day)	4,308,054	3,901,057	0.91
Industrial Employment	336,654	393,824	1.17
Locomotive Diesel Usage (gallons/year)	8,273,092	6,097,290	0.74
Number of Aircrafts at Luke AFB	136	132	0.97
Population	3,843,373	4,239,606	1.10
Roadway Lane Miles	22,551	23,137	1.03

* Total airport operations from the eight major airports in Maricopa County based on a fiscal year calendar.

Table III-3. Non-EGU emissions for Maricopa County in 2011 and 2017 (unit: metric tons/day)

Facility Name	Growth Index	2011			2017		
		VOC	NOx	CO	VOC	NOx	CO
CMC Steel Fabricators Inc	Industrial Employment	0.10	0.14	1.99	0.12	0.17	2.32
Luke AFB - 56th Fighter Wing	Number of Aircrafts	0.02	0.02	0.01	0.02	0.02	0.01
New WinCup Holdings Inc	Industrial Employment	0.31	0.03	0.01	0.36	0.03	0.01
Northwest Regional Landfill	Total Population	0.01	0.02	0.01	0.01	0.03	0.02
Oak Canyon Manufacturing Inc	Industrial Employment	0.22	0.00	0.00	0.26	0.00	0.00
Rexam Beverage Can Company	Industrial Employment	0.22	0.01	0.01	0.26	0.01	0.01
SFPP LP Phoenix Terminal	Industrial Employment	0.25	0.02	0.02	0.30	0.02	0.03
Trendwood Inc	Industrial Employment	0.45	0.00	0.00	0.52	0.00	0.00
Offset Emission Credit	(no change)	0.53	0.04	0.04	0.53	0.04	0.04

For Pinal County, annual EGU and non-EGU point source emissions for the 2011 base year were provided by PCAQCD. EGU and non-EGU emissions for Pinal County in 2011 and 2017 are provided in Tables III-4 and III-5. The growth factor for non-EGU point sources was derived from the ratio of industrial employment in 2011 and 2017 for Pinal County, as shown in Table III-6. The growth factors for EGU point sources were derived from the 2011 and 2017 EGU point source emissions data in the AQMP v6.2. Those growth factors were applied to the base year point source emissions to project the 2017 future year emissions. The 2017 emissions for the Coolidge Generation Station were not available in the AQMP v6.2. PCAQCD provided a growth factor of 20% for this power plant (DiBiase, 2015).

Table III-4. EGU emissions for Pinal County in 2011 and 2017 (unit: metric tons/day)

Facility Name	2011			2017*		
	VOC	NOx	CO	VOC	NOx	CO
Coolidge Generating Station	0.00	0.02	0.01	0.00	0.02	0.01
Desert Basin Generating Station	0.02	0.08	0.87	0.02	0.09	0.67
Saguaro Power Plant	0.00	0.01	0.00	0.01	0.00	0.00
Sundance Power Plant	0.01	0.06	0.02	0.01	0.06	0.02

* PCAQCD provided projected power plant emissions in 2017 (DiBiase, 2015).

Table III-5. Non-EGU emissions for Pinal County in 2011 and 2017 (unit: metric tons/day)

Facility Name*	Growth Index	2011			2017		
		VOC	NOx	CO	VOC	NOx	CO
Arizona Environmental Container Corporation	Industrial Employment	0.02	0.00	0.00	0.02	0.00	0.00
Casa Grande Compressor Station	Industrial Employment	0.00	0.03	0.01	0.00	0.03	0.01
Casa Grande Plant	Industrial Employment	0.15	0.00	0.00	0.15	0.00	0.00
Frito-Lay Inc	Industrial Employment	0.01	0.07	0.09	0.01	0.07	0.09
Hexcel Corporation	Industrial Employment	0.32	0.03	0.02	0.31	0.03	0.02
Republic Plastics, LP	Industrial Employment	0.32	0.00	0.00	0.30	0.00	0.00

* Non-EGU point sources located outside the 4 km modeling domain were excluded.

Table III-6. Growth factors for non-EGU point and area sources in Pinal County

Growth Index	2011	2017	Growth Factor
Agricultural Acres	449,368	447,425	1.00
Airport Operations (operations/year)	175,528	260,812	1.49
Gasoline Consumption (gallons/day)	417,529	378,125	0.91
Industrial Employment	8,111	7,752	0.96
Population	384,221	444,680	1.16
Roadway Lane Miles	6,368	6,508	1.02

III-1-2. Area Source Emissions

Area sources includes the stationary sources which are too small or too numerous to be treated as point sources. Area source emissions for Maricopa County in 2011 were obtained from ozone season average daily emissions reported in the Addendum for the 2011 PEI for ozone precursors. The ozone season average daily emissions for the period of June through August were assumed constant throughout the five-month period of the modeling episode.

Ozone season day emissions for area sources in 2011 were projected to the 2017 future year emissions using growth factors for Maricopa County shown in Table III-2. The growth factors applied to individual area source categories in Maricopa County are provided in Table D-5, Appendix D.

The Maricopa County 2011 PEI for ozone precursors indicated that most area sources operated seven days per week, while eight area source categories were reported to operate six days per week and five area source categories were reported to operate five days per week. Emissions from the area sources operating seven days per week were equally distributed to seven days regardless of weekdays and weekends. For the eight area source categories reported to operate six days per week, Saturday was treated as a weekday for emissions and zero emissions were assigned to Sunday. For the five area source categories reported to operate five days per week, emissions were distributed to the five weekdays and zero emissions were assigned to Saturday and Sunday.

For Pinal County, area source emissions for the 2011 base year were obtained primarily from the AQMP v6.2 since the Pinal County 2011 PEI for ozone precursors was not available. The AQMP v6.2 emissions inventory, however, overestimated emissions for land clearing debris, architectural coatings, landfills, and crematories in Pinal County. PCAQCD provided correct emissions for these area source categories. The growth factors shown in Table III-6 were applied to project the 2017 future year area source emissions for Pinal

County. The growth factors that were applied to individual area source categories for Pinal County are provided in Table D-6, Appendix D.

The portable fuel container (PFC) rules were applied to ten area source categories for residential and industrial uses. The 2011 controlled emissions for those PFC area sources were obtained from the EPA 2011 NEI v2 for Maricopa and Pinal Counties. EPA provided annual emissions for the ten PFC area sources for the years 2015 and 2020 for Maricopa and Pinal Counties (September 23, 2013, Rich Cook, EPA). The 2017 annual PFC emissions for both counties were obtained by interpolating the EPA 2015 and 2020 emissions data. Table III-7 presents the PFC emissions by Standard Classification Code (SCC) for Maricopa and Pinal Counties in 2011 and 2017. Area source emissions for Maricopa and Pinal Counties in 2011 and 2017 are provided in Table III-8.

Table III-7. Portable fuel container VOC emissions in 2011 and 2017 (unit: metric tons/day)

No.	SCC	Description	Maricopa County		Pinal County	
			2011	2017	2011	2017
1	2501011011	Residential Permeation	2.21	0.14	0.08	0.01
2	2501011012	Residential Evaporation	4.31	0.28	0.16	0.01
3	2501011013	Residential Spill in Transport	0.56	0.55	0.02	0.02
4	2501011014	Residential Vapor Displacement	0.21	0.21	0.01	0.01
5	2501011015	Residential Spill at Pump	0.02	0.02	0.00	0.00
6	2501012011	Commercial Permeation	0.07	0.00	0.00	0.00
7	2501012012	Commercial Evaporation	0.14	0.01	0.00	0.00
8	2501012013	Commercial Spill in Transport	0.77	0.75	0.03	0.03
9	2501012014	Commercial Vapor Displacement	0.40	0.41	0.01	0.01
10	2501012015	Commercial Spill at Pump	0.03	0.04	0.00	0.00
Total			8.72	2.41	0.31	0.09

Table III-8. Ozone season average daily area source emissions for Maricopa and Pinal Counties in 2011 and 2017 (unit: metric tons/day)

County	2011			2017		
	VOC	NOx	CO	VOC	NOx	CO
Maricopa County	97.79	11.83	10.06	99.46	13.56	10.83
Pinal County	8.32	0.28	1.49	8.67	0.32	1.72

III-1-3. Nonroad Mobile Source Emissions

Nonroad mobile sources include off-highway recreational vehicles and pleasure craft, locomotives, aircraft and airport support vehicles, and equipment from commercial industrial, agricultural, lawn maintenance and construction activities.

The nonroad emissions inventory was developed for the 4 km modeling domain using MOVES2014a. There were no emissions from logging equipment or underground mining/oil field equipment in Maricopa and Pinal Counties. Locomotive emissions were obtained from the AQMP v6.2. Airport ground support equipment, aircraft, and auxiliary power unit emissions were developed with the Federal Aviation Administration (FAA)'s Emission and Dispersion Modeling System (EDMS) model.

MOVES2014a Nonroad Equipment Emissions

Base year meteorology inputs (daily minimum, maximum and average temperature and relative humidity), which were obtained from the National Climate Data Center (NCDC) for the Sky Harbor International Airport station, were used for Maricopa and Pinal Counties. Local fuel properties including oxygen content, sulfur content, Reid Vapor Pressure (RVP), and ethanol blend percentage were provided by the Arizona Department of Weights and Measures. The MOVES2014a fuel wizard was used to pre-process this data to supply monthly county-specific values to the model. For the 2017 future year modeling, the MOVES2014a default fuel parameters for 2017 were used for the EPA Tier 3 Fuel Standards.

For the local commercial lawn and garden industry, ENVIRON performed a survey as a part of the Cap and Trade Oversight Committee work (ENVIRON, 2003). Survey results showed that equipment populations for most categories of this sector in Maricopa County were significantly lower than EPA default values, while the average annual hours of operation for most equipment in this sector were slightly higher than EPA defaults. Thus, equipment population numbers and activity levels for commercial lawn and garden equipment were adjusted based on the ENVIRON's survey results. The information for these updates were reflected in the MOVES2014a input database. Default population and activity data were used in MOVES2014a for all other categories in Maricopa County. MOVES2014a nonroad emissions for Pinal County were developed using the MOVES2014 default data for Pinal County.

MOVES2014a was simulated for each modeling episode day in 2011 using unique day-specific meteorology. Care was taken to properly define each date as weekend or weekday relative to the 2011 calendar. In the case of holidays (Memorial Day, Independence Day, and Labor Day), these holidays were manually set with weekend profiles to best approximate altered activity. The 2017 future year emissions inventory was obtained by running MOVES2014a with the 2017 fuel inputs and the 2011 meteorology based on the 2011 calendar.

Within the 4km modeling domain, some nonroad sources were located outside Maricopa and Pinal Counties, such as pleasure craft emissions on the Roosevelt Lake in Gila County and Lake Pleasant in Yavapai County. These nonroad mobile source emissions were taken from the AQMP v6.2 for 2011 and 2017. MOVES2014a nonroad mobile source emissions for Maricopa and Pinal Counties in 2011 and 2017 are provided in Tables III-9 and III-10.

Table III-9. Ozone season average daily nonroad mobile source emissions for Maricopa County in 2011 and 2017 from MOVES2014a (unit: metric tons/day)

	2011			2017		
Sector	VOC	NOx	CO	VOC	NOx	CO
Recreational Equipment	4.72	0.19	21.43	3.44	0.18	21.82
Construction Equipment	1.42	33.44	38.14	1.16	20.73	29.11
Industrial Equipment	0.61	4.46	17.26	0.15	2.35	5.87
Lawn and Garden Equipment	12.67	2.13	156.41	8.64	1.60	148.23
Agriculture Equipment	0.02	1.04	0.98	0.01	0.76	0.74
Commercial Equipment	4.28	3.18	78.20	2.85	2.48	78.49
Pleasure Craft	1.89	0.35	4.86	1.12	0.36	4.15
Railroad Equipment	0.00	0.02	0.04	0.00	0.01	0.03
Total	25.61	44.81	317.32	17.37	28.47	288.44

Table III-10. Ozone season average daily nonroad mobile source emissions for Pinal County in 2011 and 2017 from MOVES2014a (unit: metric tons/day)

	2011			2017		
Sector	VOC	NOx	CO	VOC	NOx	CO
Recreational Equipment	2.39	0.06	8.04	1.73	0.07	7.33
Construction Equipment	0.12	2.82	3.42	0.10	1.75	2.45
Industrial Equipment	0.01	0.13	0.42	0.00	0.08	0.14
Lawn and Garden Equipment	1.08	0.17	15.06	0.75	0.13	12.60
Agriculture Equipment	0.02	0.93	0.92	0.01	0.68	0.66
Commercial Equipment	0.08	0.05	1.64	0.05	0.04	1.47
Pleasure Craft	0.41	0.07	1.21	0.25	0.08	0.91
Railroad Equipment	0.00	0.01	0.03	0.00	0.01	0.02
Total	4.11	4.24	30.74	2.89	2.90	25.58

Airport Emissions

Airport emissions include emissions from aircraft, auxiliary power units (APU), and ground support equipment (GSE). A total of 21 airports are located within the 4 km modeling domain, as shown in Figure III-1. Airport emissions in Maricopa and Pinal Counties were developed using the EDMS v5.1.4, with the exception of Luke Air Force Base (AFB). Luke AFB emissions were scaled using the F-16 and F-35 aircraft data provided by the facility.

The names, locations, and annual operations for the 21 airports within the 4 km modeling domain are provided in Table III-11. Operational landing and takeoff (LTO) cycles, aircraft fleet mix, and operational temporal profiles by aircraft for each airport were developed for the EDMS model runs for four aircraft categories: Air Commercial (AC), Air Taxi (AT), General Aviation (GA), and Military (ML).

Day-specific LTO for the first eight major airports in Table III-11 were retrieved from the Airport Operations database in the FAA Air Traffic Activity Data System (ATADS). The other six airports except Luke AFB were based upon the monthly LTO data from the MAG 2009 and 2014 survey data.

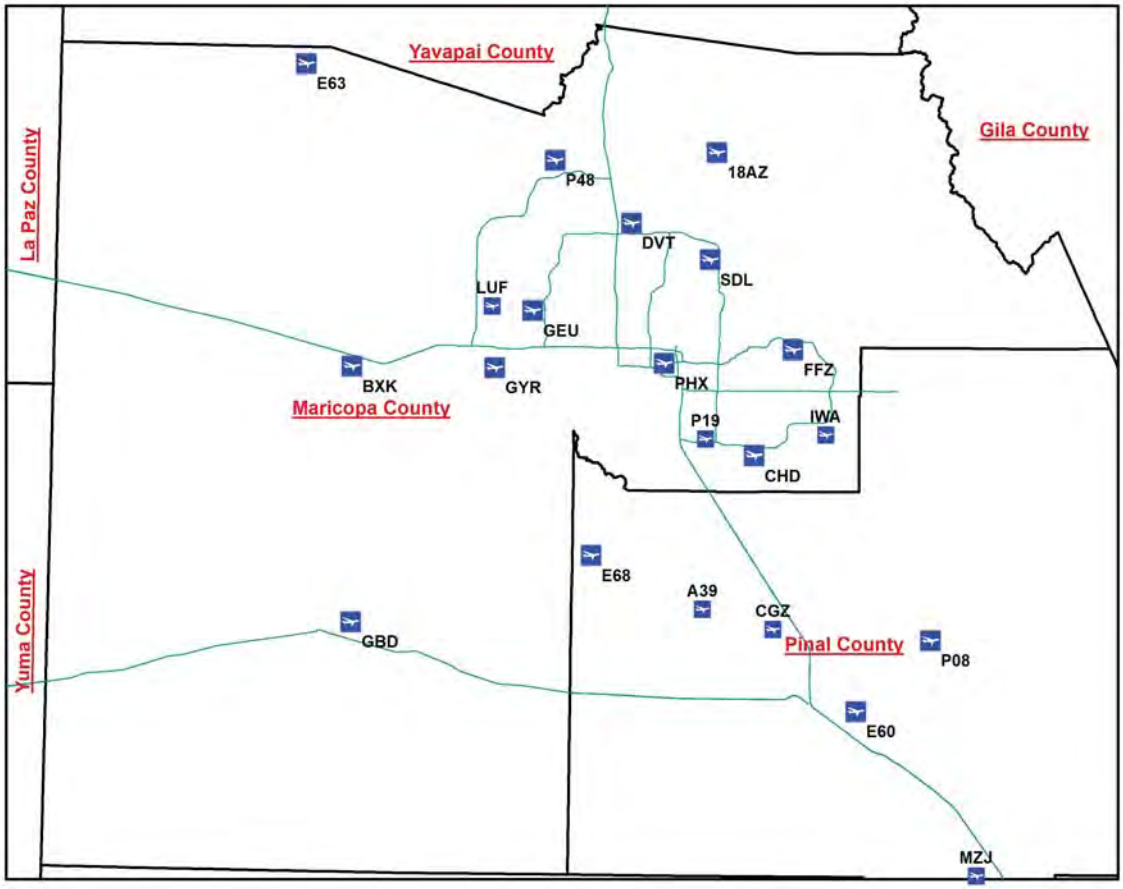


Figure III-1. Map of 21 airports located within the 4 km modeling domain

Aircraft fleet mix accounting for the operation distribution of aircraft types was developed using data from the FAA Enhanced Traffic Management Counts (ETMSC). Monthly and weekly temporal profiles for each airport were developed from day-specific LTO for each aircraft category. Hourly temporal profiles were created using the operation data from the FAA Aviation Performance Metrics (APM).

To develop hourly mixing heights, surface meteorological data for Phoenix Sky Harbor International Airport and upper air data for the Tucson monitor were obtained from the NCDC Integrated Surface Hourly Database (ISHD), 1-minute Automated Surface Observing System (ASOS), and the Earth System Research Laboratory (ESLR) radiosonde database. The surface and upper air meteorological data were combined using the EPA AERMET v15181 and AERSURFACE v13016 models for the EDMS modeling for airports.

The 2017 airport emissions inventory for Maricopa County was developed using the 2017 LTO projections from the FAA Terminal Area Forecast (TAF) (FAA, 2015) for the first eight major airports in Table III-11. LTO cycles for the other airports in Maricopa County were assumed to be unchanged from 2011 since they were small or had no operation projections in 2017.

The Luke AFB emissions for the 2011 base year were developed by scaling the 2008 emissions (Weston, 2010) with the numbers of F-16 aircraft in 2008 and 2011, which were provided by Luke AFB. Luke AFB also provided the number of F-16 and F-35 aircrafts for the 2017 future year. The ratio of F-16 aircrafts between the 2011 base year and the 2017 future year was applied to project the Luke AFB F-16 aircraft emissions for the 2017 future year. The emissions from a single F-35 aircraft at the Luke AFB were derived from L6 scenario in the 2012 environmental impact statement (USAF, 2012). The Luke AFB F-35 aircraft emissions for the 2017 future year were calculated by multiplying the emissions per F-35 aircraft and numbers of F-35 in 2017. The Luke AFB emissions for the 2017 future year were developed by adding the F-16 aircraft emissions in 2017 to the F-35 aircraft emissions in 2017.

Aircraft operation data for six airports in Pinal County within the 4 km modeling domain were obtained from the MAG airport survey, the FAA TAF database, and the AirNav.com website. Fleet mix data for airports in Pinal County were based on averages of fleet mix data for general aviation and military categories of municipal airports in Maricopa County. Mixing height data for Pinal County were extracted from the National Weather Service (NWS) for the Casa Grande Airport. Average daily emissions by airport in 2011 and 2017 are provided in Table III-12.

Table III-11. Annual operations for airports in the 4 km modeling domain in 2011 and 2017

No.	Airport Name	Code	County	Latitude	Longitude	Operations	
						2011	2017
1	Chandler Municipal Airport	CHD	Maricopa	33.269	-111.811	161,589	233,855
2	Deer Valley Airport	DVT	Maricopa	33.688	-112.083	317,443	317,247
3	Falcon Field Airport	FFZ	Maricopa	33.461	-111.728	220,080	275,171
4	Glendale Municipal Airport	GEU	Maricopa	33.527	-112.295	87,124	59,130
5	Phoenix Goodyear Airport	GYR	Maricopa	33.423	-112.376	138,606	76,282
6	Phoenix-Mesa Gateway Airport	IWA	Maricopa	33.308	-111.655	171,200	221,259
7	Phoenix Sky Harbor Airport	PHX	Maricopa	33.434	-112.008	461,989	458,242
8	Scottsdale Airport	SDL	Maricopa	33.623	-111.911	141,640	148,813
9	Buckeye Municipal Airport	BXK	Maricopa	33.420	-112.686	53,070	53,070
10	Gila Bend Municipal Airport	GBD	Maricopa	32.958	-112.678	3,536	3,536
11	Pleasant Valley Airport	P48	Maricopa	33.801	-112.251	6,010	6,010
12	Sky Ranch at Carefree Airport	18AZ	Maricopa	33.818	-111.898	3,030	3,030
13	Stellar Airpark	P19	Maricopa	33.299	-111.916	39,056	39,056
14	Luke Air Force Base*	LUF	Maricopa	33.535	-112.383	n/a	n/a
15	Wickenburg Municipal Airport	E63	Maricopa	33.969	-112.799	12,000	12,000
16	Ak-Chin Regional Airport**	A39	Pinal	32.991	-111.919	1,095	36,500
17	Arizona Soaring	E68	Pinal	33.084	-112.161	20,075	20,075
18	Casa Grande Municipal Airport	CGZ	Pinal	32.955	-111.767	119,680	119,680
19	Coolidge Municipal Airport	P08	Pinal	32.936	-111.427	4,250	4,250
20	Eloy Municipal Airport	E60	Pinal	32.807	-111.587	19,800	23,450
21	Pinal Airpark	MZJ	Pinal	32.510	-111.325	10,628	56,857

* Emissions were scaled by numbers of aircrafts in 2011 and 2017.

** Operational data at the Ak-Chin Regional Airport were collected through a phone conversation with airport manager Tim Costello on 10/27/2015.

Table III-12. Summary of average daily airport emissions for the 4 km modeling domain (unit: metric tons/day)

		VOC		NOx		CO	
No.	Airport	2011	2017	2011	2017	2011	2017
1	Chandler Municipal Airport	0.220	0.301	0.057	0.054	2.652	3.582
2	Deer Valley Airport	0.227	0.236	0.093	0.085	3.511	3.421
3	Falcon Field Airport	0.251	0.411	0.099	0.133	3.860	4.436
4	Glendale Municipal Airport	0.222	0.147	0.064	0.032	1.527	0.921
5	Phoenix Goodyear Airport	0.191	0.110	0.119	0.079	2.492	1.303
6	Phoenix-Mesa Gateway Airport	0.670	0.924	0.264	0.301	2.883	3.279
7	Phoenix Sky Harbor Airport	1.180	1.073	4.674	4.467	9.981	7.013
8	Scottsdale Airport	0.594	0.618	0.212	0.188	1.926	1.706
9	Buckeye Municipal Airport	0.016	0.014	0.015	0.009	0.701	0.646
10	Gila Bend Municipal Airport	0.001	0.001	0.001	0.001	0.047	0.043
11	Pleasant Valley Airport	0.000	0.000	0.002	0.001	0.003	0.003
12	Sky Ranch at Carefree Airport	0.003	0.003	0.001	0.001	0.033	0.030
13	Stellar Airpark	0.021	0.019	0.012	0.007	0.607	0.566
14	Luke Air Force Base	0.365	0.229	0.792	0.698	1.449	1.382
15	Wickenburg Municipal Airport	0.034	0.033	0.009	0.007	0.201	0.180
16	Ak-Chin Regional Airport	0.004	0.126	0.001	0.024	0.014	0.415
17	Arizona Soaring	0.070	0.069	0.017	0.013	0.263	0.228
18	Casa Grande Municipal Airport	0.420	0.413	0.104	0.083	1.582	1.368
19	Coolidge Municipal Airport	0.015	0.015	0.004	0.003	0.057	0.049
20	Eloy Municipal Airport	0.070	0.081	0.017	0.016	0.261	0.267
21	Pinal Airpark	0.042	0.268	0.044	0.527	0.202	1.491
Total		4.616	5.091	6.601	6.729	34.252	32.329

Locomotive Emissions

Locomotive and rail yard emissions for the 2011 base year in Maricopa and Pinal Counties were obtained from the Maricopa County 2011 PEI and the AQMP v6.2, respectively. The growth factor of 0.74 for the locomotive emissions between 2011 and 2017 was derived from locomotive diesel usages in Maricopa County. The locomotive diesel usage of 6,097,290 gallons/year in 2017 was extrapolated using the locomotive diesel usages of 9,360,993 gallons/year in 2008 and 8,273,092 gallons/year in 2011. The same growth factor applied for locomotive emissions for Maricopa County was assumed for Pinal County. Locomotive emissions for Maricopa and Pinal Counties in 2011 and 2017 are provided in Table III-13. Nonroad mobile source emissions for the Maricopa eight-hour

ozone nonattainment area and the 4 km modeling domain in 2011 and 2017 are provided in Table III-14.

Table III-13. Ozone season average daily locomotive emissions for Maricopa and Pinal Counties in 2011 and 2017 (unit: metric tons/day)

County	2011			2017		
	VOC	NOx	CO	VOC	NOx	CO
Maricopa County	0.19	3.49	0.61	0.14	2.58	0.45
Pinal County	0.17	3.42	0.49	0.13	2.52	0.36

Table III-14. Ozone season average daily nonroad mobile source emissions for the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain in 2011 and 2017 (unit: metric tons/day)

Area	2011			2017		
	VOC	NOx	CO	VOC	NOx	CO
Eight-hour ozone NA	27.89	53.58	343.58	20.26	36.26	310.41
4 km modeling domain	36.60	62.78	387.21	26.89	43.49	350.04

III-1-4. Onroad Mobile Source Emissions

MOVES2014a is the latest onroad and off-network emissions model developed by EPA. The MOVES2014a and MAG MOVESLINK2014 were used to develop onroad emissions inventory for the 4 km modeling domain. The MAG MOVESLINK2014 tool prepares MOVES2014a input, executes MOVES2014a, and processes onroad network and off-network emission factors extracted from MOVES2014a and link-level traffic data from the TransCAD Travel Demand Model (TDM). This tool was developed using the Python programming language and Geographic Information Systems (GIS) technology.

To calculate onroad exhaust, evaporative, refueling, and extended idling emissions for the selected years, MOVES2014a is executed using local input data for each day of the modeling episode. MOVES modeling scenarios were created using the county scale setting with the inventory and emissions rate options for all road types including off-network.

MOVES2014a requires local input data such as Inspection and Maintenance (I/M) programs, meteorological data, vehicle population, source type age distribution, annual vehicle miles traveled (VMT), monthly/daily/hourly fractions, road type distribution, average speed distribution, ramp fraction, fuel parameter data, and Alternative Vehicle and Fuel Technologies (AVFT). These MOVES2014a local inputs were developed using local data from multiple sources such as the Arizona Department of Transportation (ADOT), the Arizona Department of Weights and Measures (ADWM), the MAG Transportation Division,

and the National Climatic Data Center (NCDC). The specific MOVES2014a model RunSpec and input data are provided in Appendix G.

Since the modeling area contains a subarea (i.e., Area A) where control measures such as I/M programs and fuel programs were enforced, MOVES2014a were run separately for the subarea and outside the subarea. The Area A boundary was defined in Arizona Senate Bill 1427 (SB 1427), and expanded in Arizona House Bill 2538 (HB 2538). The air quality measures described in HB 2538 were implemented in the Area A. The Area A boundary (HB 2538) covers portions of Maricopa, Pinal, and Yavapai Counties. Onroad vehicles registered and operating in the Area A are subject to the vehicle emissions inspection programs and the Cleaner Burning Gasoline (CBG) fuel requirements. The 4 km modeling domain covers the Area A. Input data for Area A and outside Area A were separately prepared.

I/M Programs

MOVES2014a has an [IMCoverage] table for I/M programs, which reflects the actual proportions of vehicles subject to the specified levels of inspection. The term "I/M vehicles" denotes vehicles which are required to undergo an emission test and/or inspection under the Vehicle Inspection/Maintenance Programs. The participation in the I/M programs is required for all vehicles registered in the Area A, with the exception of certain model years and vehicle classes. However, it is assumed that 91.6 percent of the vehicles operating within the Area A participate in the I/M programs and the remaining 8.4 percent do not participate in the program. These percentages reflect the control measures "Tougher Enforcement of Vehicle Registration and Emissions Test Compliance" and "Expansion of Area A Boundaries," described in the MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa Nonattainment Area (MAG, 2009). This percentage is directly applied to the Compliance Factor in the [IMCoverage] table. The same I/M programs were applied for the Maricopa eight-hour ozone nonattainment area.

Meteorological Data

MOVES2014a requires hourly temperature and relative humidity data by a specific month of the year. Meteorological data for the Phoenix Sky Harbor International Airport in 2011 were obtained from NCDC for the selected episode days in 2011. The same hourly average temperature and relative humidity data were used in the base and future year modeling.

Vehicle Population

In MOVES2014a, off-network emissions including start, evaporative, and extended idle emissions were determined by the population of vehicles in an area. The vehicle population in Maricopa and Pinal Counties was obtained from the July 2011 vehicle registration data provided by ADOT. The vehicle population data were allocated to the 13 MOVES source types based upon MOVES default vehicle population fractions for Maricopa and Pinal

Counties in 2011. The vehicle population in a subarea was estimated by multiplying the ratio of the population of a specific geographical subarea to the population of Maricopa County or Pinal County by the vehicle population in Maricopa County or Pinal County. The population ratio for 2011 was derived from the MAG socioeconomic data. For the 2017 future year modeling, the vehicle registration data for the year 2015 were adjusted by applying the ratio of the future year source type population to the 2015 source type population.

Source Type Age Distribution

MOVES2014a categorizes vehicles by vehicle class and model year. The source type age distribution input table was prepared using the EPA MOVES data converter and the vehicle registration data from ADOT. For the 2017 future year modeling, the source type age distribution was projected by using the EPA Age Distribution Projection Tool.

Annual Vehicle Miles Traveled (VMT)

The annual average daily VMT data were derived from the TDM provided by the MAG Transportation Division in April 2015. The outputs from the TDM were clipped using GIS to calculate VMT in the 4 km modeling domain. The 2011 and 2017 VMT for the 4 km modeling domain are provided in Table III-15. The annual average daily VMT were multiplied by 365 days to obtain the annual VMT.

Table III-15. 2011 and 2017 average daily VMT for subareas (unit: miles/day)

Area	2011	2017
Area A	85,936,496	95,576,055
Outside Area A	8,159,403	9,392,622
4 km modeling domain	94,095,899	104,968,677

Road Type Distribution

MOVES2014a requires the distribution of VMT by road type as a local input. For each modeling year, the VMT distribution of road types was derived using the 2011 and 2017 traffic assignment data provided by the MAG Transportation Division.

VMT Fraction

Since the TDM network assignments provide average weekday VMT, the average weekday VMT were adjusted using month, day, and hour VMT fractions in order to derive hourly VMT for each weekday/weekend and month from the annual VMT. The month/day/hour VMT fractions were developed from data recorded by continuous traffic counters on freeways (ADOT Freeway Management System) and arterials (Phoenix Automatic Traffic Recorders) in 2007. The same month, day, and hour VMT fractions were applied to the 2011 and 2017 average weekday VMTs from the 2011 and 2017 network assignments.

Average Speed Distribution

For the inventory option, MOVES2014a estimated emission effects from vehicle power, speed, and acceleration on arterials and freeways by assigning activity to operating mode distributions, which were determined by the distribution of vehicle hours traveled (VHT) in sixteen speed bins. In this study, link-specific emissions were calculated for arterials and freeways using link-specific VMT and the MOVES emission rates for link-specific speed. As a MOVES2014a input requirement, the average speed distributions of arterials and freeways for each modeling year were developed by post-processing the outputs from the TDM network assignment data provided by the MAG Transportation Division. To develop the average speed distribution, VHT in sixteen speed bins were separately accumulated for each hour of the day, source type, and road type. The average speed distribution was calculated by normalizing VHT in sixteen speed bins for each hour of the day, source type, and road type.

Ramp Fraction

MOVES2014a requires the ramp fraction which represents the percent of VHT on ramps on both rural and urban freeways. The fraction of VHT on ramps was derived by dividing the total VHT on ramps by the total VHT for each restricted road type. Those VHT for each modeling year were obtained from the traffic assignment data provided by the MAG Transportation Division.

Fuel Data

Regarding the fuel input data, MOVES2014a provides three MOVES tables, which are [fuelsupply], [fuelformulation], and [fuelusagefraction]. Using the MOVES Fuel Wizard, the fuel parameters extracted from the ADWM 2011 fuel inspection data in Maricopa and Pinal Counties were used in the 2011 base year modeling. For the 2017 future year modeling, the MOVES2014a default fuel parameters for 2017 were used for the EPA Tier 3 Fuel Standards.

AVFT strategy

MOVES2014a allows users to modify the default fuel engine fractions for local vehicles using different fuels and technologies by vehicle model year. The fleet data for diesel and natural gas transit buses were provided by Valley Metro. The data were used to update the AVFT input for diesel and natural gas transit buses. Since the local fleet data for transit buses using alternative fuels were available only for some model years, MOVES2014a default values extracted from the MOVES [fuelEngFraction] table were used for the rest of the vehicle model years.

Onroad mobile source emissions for the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain in 2011 and 2017 are provided in Tables III-16 and III-17.

Table III-16. Ozone season average daily onroad mobile source emissions for the Maricopa eight-hour ozone nonattainment area in 2011 and 2017 (unit: metric tons/day)

Road Type	2011			2017		
	VOC	NOx	CO	VOC	NOx	CO
Off-Network	48.01	24.31	187.98	33.81	18.13	133.85
Rural Restricted Access	1.25	15.68	28.54	0.53	7.55	16.33
Rural Unrestricted Access	2.41	9.81	51.04	0.99	4.35	29.86
Urban Restricted Access	6.01	33.9	188.95	3.01	17.13	150.7
Urban Unrestricted Access	13.28	33.45	219.46	7.31	15.53	162.24
Total	70.96	117.15	675.97	45.65	62.69	492.98

Table III-17. Ozone season average daily onroad mobile source emissions for the 4 km modeling domain in 2011 and 2017 (unit: metric tons/day)

RoadType	2011			2017		
	VOC	NOx	CO	VOC	NOx	CO
Off-Network	53.25	30.01	208.10	38.00	23.38	147.44
Rural Restricted Access	1.39	19.36	31.60	0.60	9.74	17.99
Rural Unrestricted Access	2.67	12.11	56.50	1.11	5.61	32.89
Urban Restricted Access	6.67	41.85	209.18	3.38	22.09	166.00
Urban Unrestricted Access	14.73	41.30	242.95	8.22	20.03	178.72
Total	78.71	144.63	748.33	51.31	80.85	543.04

III-1-5. Biogenic Source Emissions

Biogenic emissions inventory for the three modeling domains was prepared using the latest Model of Emissions of Gases and Aerosols from Nature (MEGAN) version 2.10, which incorporates the extensive biogenic chemical species of ozone precursors (Guenther et al., 2012). The MEGAN v2.10 is the state-of-the-art biogenic emissions model developed by the National Center for Atmospheric Research (NCAR). MEGAN was used to generate gridded hourly emissions of VOC, NOx, and CO for the modeling domains for the period of May 1 through September 30, 2011. Chemical species of the Carbon Bond Model version 6 (CB6) chemical mechanism were used for the MEGAN biogenic emissions modeling. The hourly gridded emissions from the model were post-processed and merged with anthropogenic emissions by SMOKE for the CAMx air quality modeling.

MEGAN used the 2011 gridded meteorological data generated by WRF and pre-processed by the Meteorology-Chemistry Interface Processor (MCIP). The MCIP is an interface tool between WRF and MEGAN that converts WRF meteorology to MEGAN. The WRF gridded meteorological data include solar radiation, surface temperature, wind speed, humidity, soil moisture, and accumulated rainfall. MEGAN requires gridded 8-day average leaf area index (LAI), plant function type (PFT) for 16 plant categories, and emission factors (EF) for 20 MEGAN plant species. These gridded inputs were derived from the North America Leaf

Index version 2011, the North America Plant Functional Type version 2011, and the MEGAN global emission factor in 30 arc-second (approximately 1 km) spatial resolution.

The MEGAN default land cover data for North America were used in the 36 km, 12 km, and 4 km modeling domains. The MEGAN default land use data for the 4 km modeling domain were compared with the MAG study results, which were based on satellite and ground observations for local land use and biogenic emissions (MAG, 2006). For broadleaf deciduous temperate tree and needle leaf evergreen temperate tree, which had discrepancy on the vegetation distribution, the MEGAN default vegetation data were updated with the local data for the 4 km modeling domain. Figure III-2 illustrates the MEGAN biogenic daily emissions of VOC, NOx, and CO in the 4 km modeling domain during ozone season from May 1 through September 30, 2011. The base year and the attainment year biogenic emissions were assumed to be constant between 2011 and 2017. Biogenic source emissions for the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain in 2011 and 2017 are provided in Table III-18.

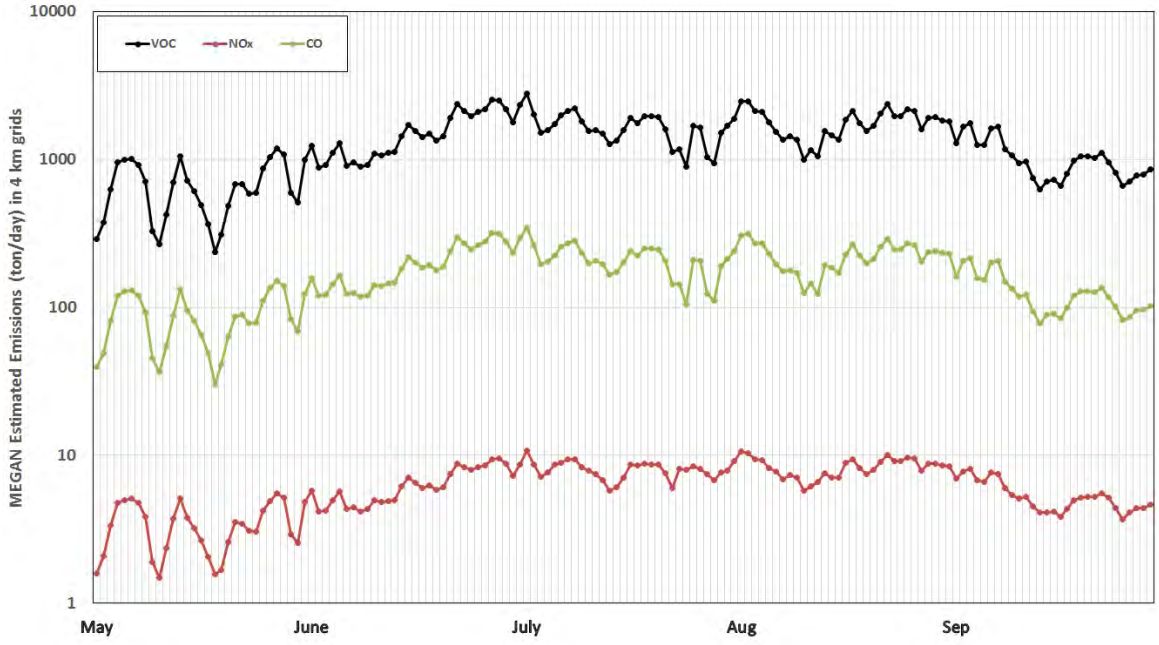


Figure III-2. Total daily biogenic emissions of VOC , NOx, and CO for the 4 km modeling domain from May 1 through September 30, 2011

Table III-18. Ozone season average daily biogenic source emissions for the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain (unit: metric tons/day)

	2011			2017		
Area	VOC	NOx	CO	VOC	NOx	CO
Maricopa eight-hour ozone NA	487.52	2.37	63.46	487.52	2.37	63.46
4 km modeling domain	1,336.57	6.32	169.62	1,336.57	6.32	169.62

III-1-6. Wildfires and Prescribed Burning

Emissions from wildfires and prescribed burning extracted from AQMP v6.2 were located by geographic coordinates (point locations) and had daily ozone precursor emissions and such parameters as burned acres and fuel load. Agricultural burning and other open burning emissions were processed as area sources. EPA used the SmartFire 2/Blue system to develop wildfire and prescribed burning emissions. SMOKE was used to process the wildfire and prescribed burning emissions as point sources for the CAMx air quality modeling. The base year and the attainment year wildfire emissions were assumed to be constant between 2011 and 2017. Wildfire emissions for the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain in 2011 are provided in Table III-19. The day-specific wildfire emissions are provided in Table D-7, Appendix D.

Table III-19. Ozone season average daily wildfire emissions for the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain (unit: metric tons/day)

Area	2011			2017		
	VOC	NOx	CO	VOC	NOx	CO
Maricopa eight-hour ozone NA	70.36	7.57	294.03	70.36	7.57	294.03
4 km modeling domain	499.00	57.18	2,080.97	499.00	57.18	2,080.97

III-2. Emissions Preprocessing

Emissions inventory data described in Section III-1 should be pre-processed for use in air quality model. The SMOKE modeling system transforms the emissions inventories from their original spatial and temporal resolutions into the hourly gridded and chemically speciated emissions required by the CAMx air quality model. The spatial resolution for the emissions inventory varies by emission source and area. Temporal resolutions of emissions vary depending upon emissions source categories. Hourly, daily, monthly, or annual total emissions were typically provided.

The SMOKE modeling system read emission inventories and applied spatial and temporal allocations, and chemical speciation for emissions. The MOVES2014a/ MOVESLINK2014 was used to develop chemically speciated and hourly gridded onroad emissions. MEGAN also calculated speciated and hourly gridded biogenic emissions without using SMOKE.

Anthropogenic and biogenic emissions including wildfires were merged using SMOKE to provide a combined emissions input file for CAMx model runs. The ground-level point source emissions were separated from the elevated point source emissions using the SMOKE model.

III-2-1. Spatial Allocation

Anthropogenic emissions except point, onroad mobile, and airport emission sources were reported as county-level emissions. These emissions were spatially allocated to grid cells for photochemical air quality modeling. For instance, gridded agricultural are were used as the spatial surrogate to assign county-level agricultural pesticide emissions to grid cells with the SMOKE modeling system.

The EPA Spatial Allocator v4.2 was used to develop spatial surrogates that were inputs to the SMOKE modeling system. Three components were used for developing spatial surrogates. The first component was a weighted shapefile, such as shapefiles for roadways, population density, or golf courses for each county. The second component was a county/province/municipal boundary shapefile. The last component was the grid or polygon configuration for the modeling domains.

A total of 21 spatial surrogates were developed for Maricopa and Pinal Counties by using MAG GIS shapefiles. For Maricopa County, the MAG GIS shapefiles include 2010 census data, 2011 MAG regional traffic data, 2012 MAG land use and land cover, and 2011 Maricopa County employment data. The recent local landuse and employment data for Pinal County were used in developing spatial surrogates for gridded emissions in Pinal County. Table III-20 presents 21 spatial surrogates and surrogate codes for Maricopa and Pinal Counties in the 4 km modeling domain. Spatial surrogates for SCCs are given in Table D-10, Appendix D. Development of spatial surrogates for both the 12 km and 36 km modeling domains covering the southern portion of Canada, the northern portion of Mexico, and the U.S. were based on the shapefiles and technical support document provided in the AQMP v6.2.

Emission density plots in Figures III-3 through III-8 were developed using gridded emissions from the SMOKE model runs. Since emissions density plots provide the spatial distribution of emissions for the emission source sectors, they were used to review the accuracy or appropriateness of spatial distributions of the gridded emissions for quality assurance and quality checking purposes. Point source emissions were spatially distributed to grid cells according to source specific geographic latitude and longitude data. Area and nonroad sources were gridded using the aforementioned spatial surrogates. Onroad and biogenic source emissions were provided as the grid-level emissions that were developed by the MAG MOVESLINK2014 and MEGAN models. Wildfire emissions were spatially distributed based on the emission levels of grid cells.

Table III-20. Spatial surrogates and codes used in gridding emissions in Maricopa and Pinal Counties

No.	Surrogate	Surrogate Code
1	Population	100
2	Construction	141
3	Total Road Miles	240
4	Total Railroad Density	261
5	Agriculture	309
6	Water	350
7	Open Land	401
8	Commercial Land	500
9	Aircraft Engine Manufacturers	504
10	Industrial Land	505
11	Commercial plus Industrial	510
12	Commercial plus Institutional Land	515
13	Residential	531
14	Residential + Commercial + Industrial + Institutional + Government	535
15	Auto refinish	544
16	Hospital	560
17	Fuel Dispensing Facility	601
18	Golf Courses	850
19	Wastewater Treatment Facilities	870
20	Landfills	871
21	Crematories	872

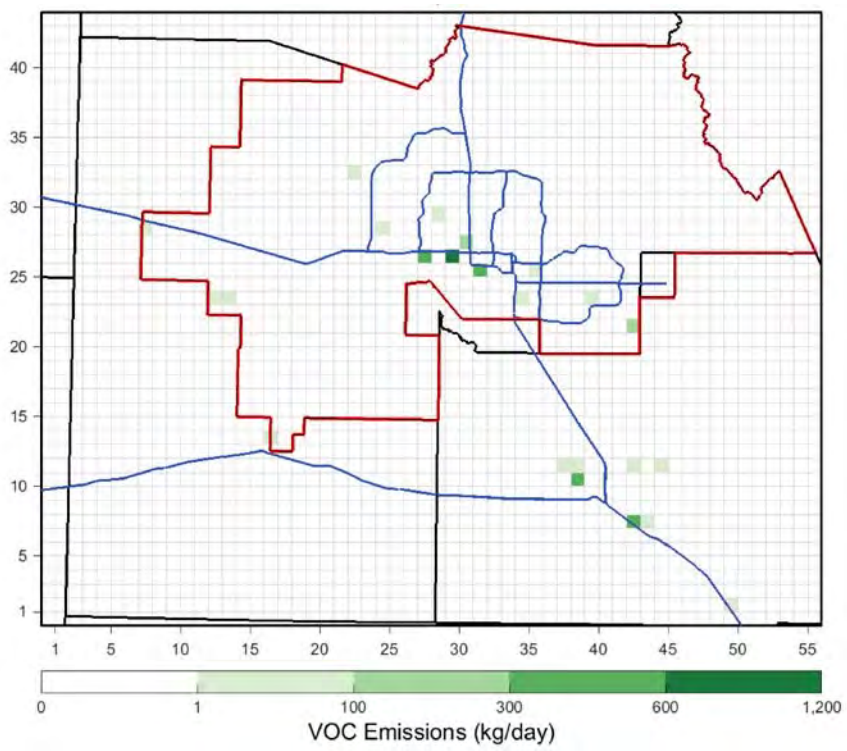


Figure III-3 (a). Point source daily VOC emissions for a typical weekday in 2011

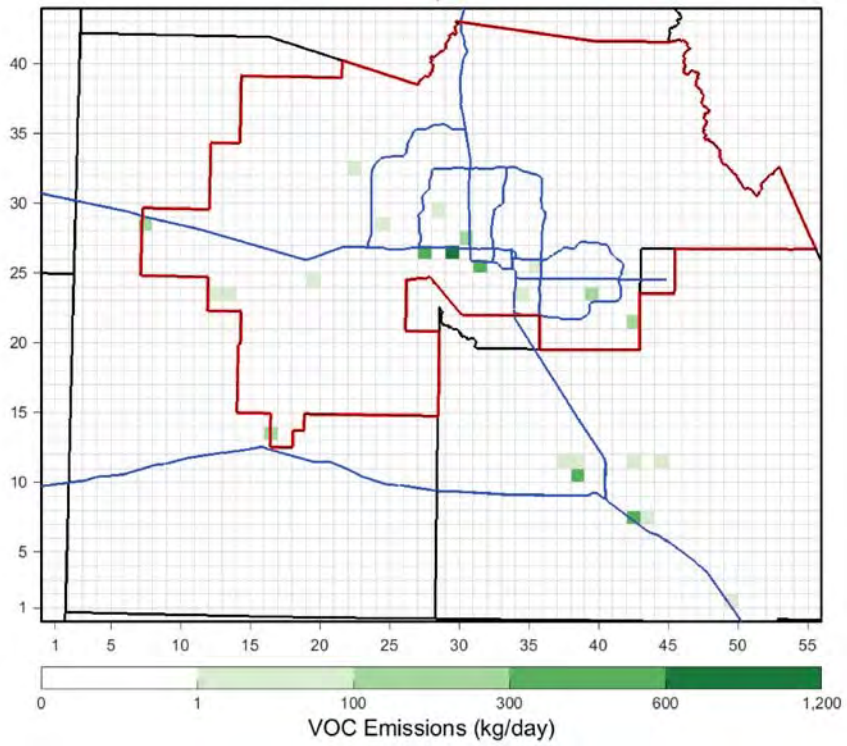


Figure III-3 (b). Point source daily VOC emissions for a typical weekday in 2017

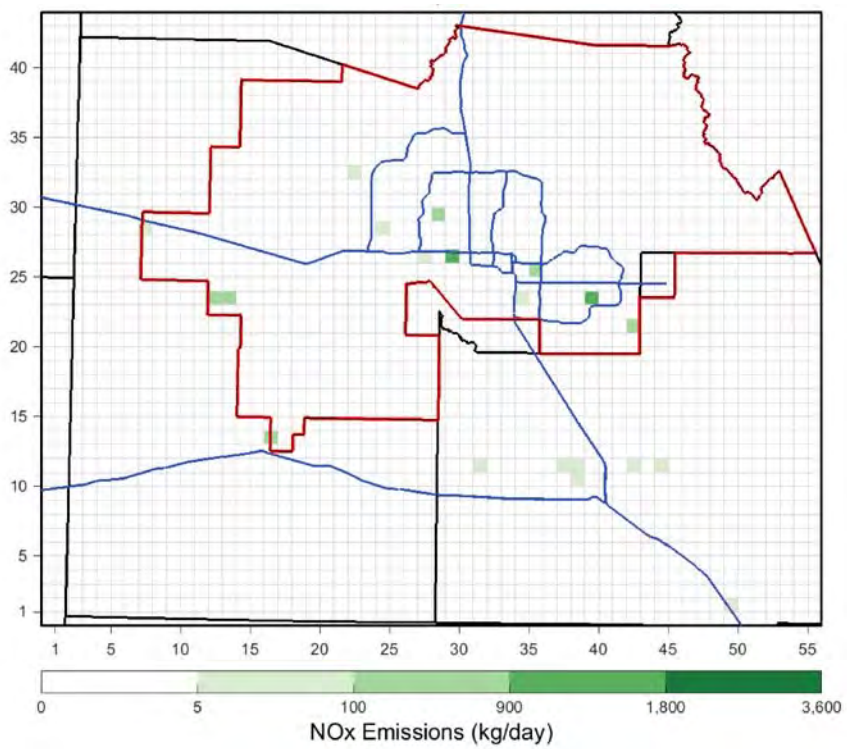


Figure III-3 (c). Point source daily NOx emissions for a typical weekday in 2011

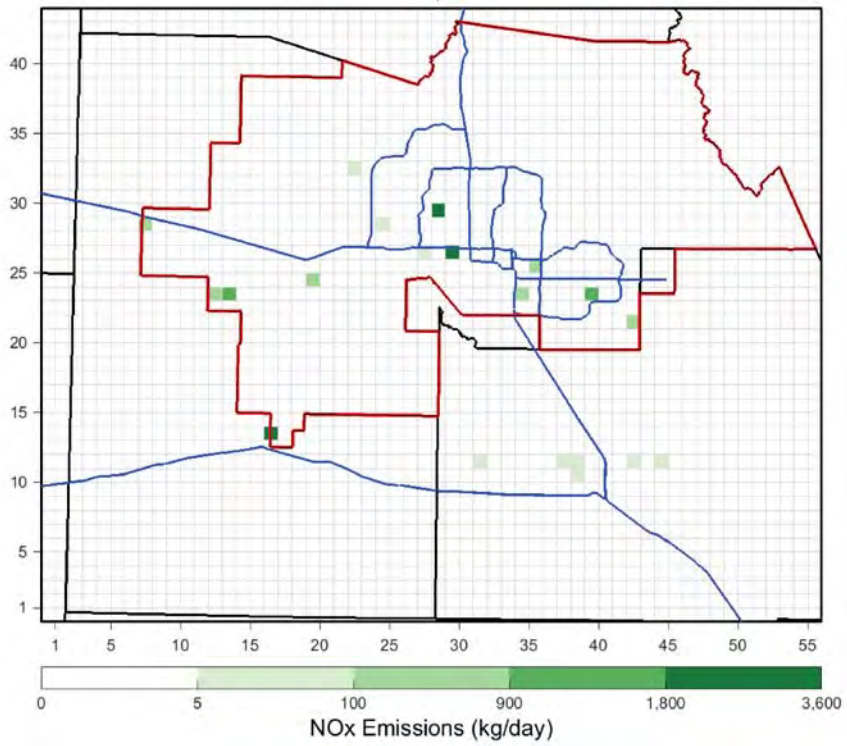


Figure III-3 (d). Point source daily NOx emissions for a typical weekday in 2017

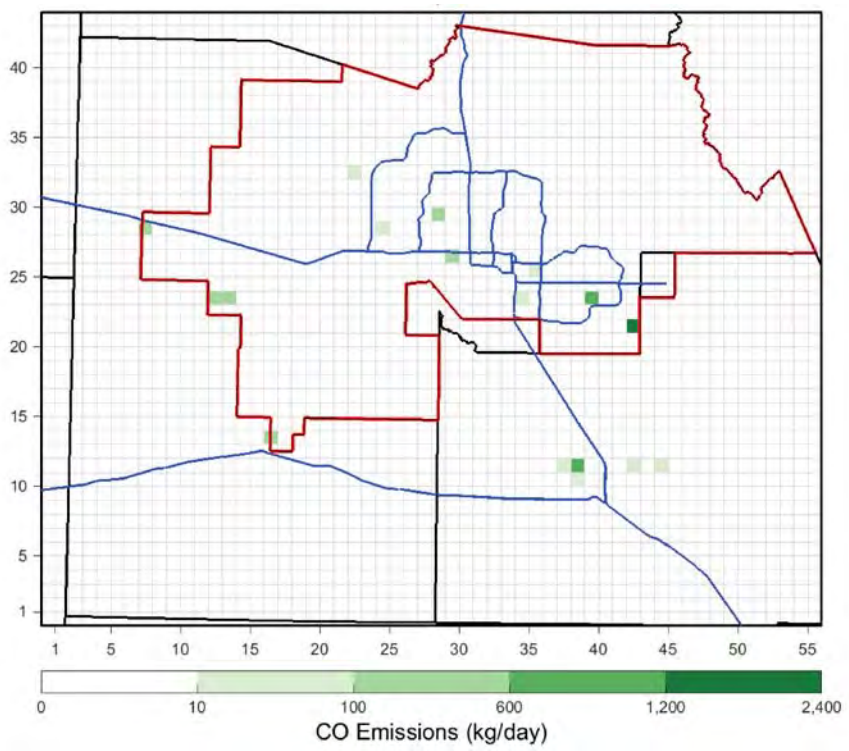


Figure III-3 (e). Point source daily CO emissions for a typical weekday in 2011

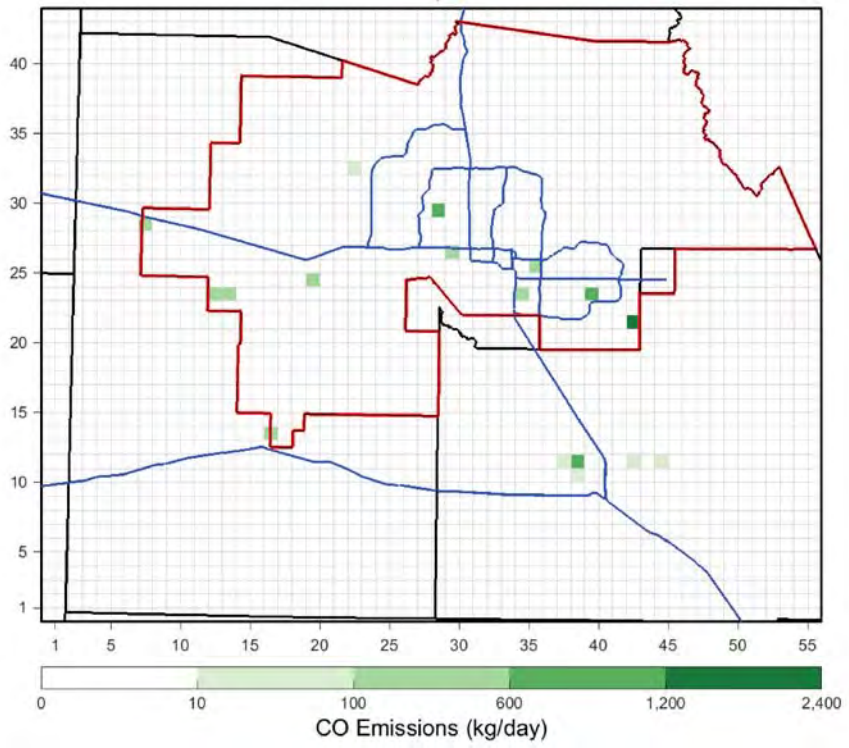


Figure III-3 (f). Point source daily CO emissions for a typical weekday in 2017

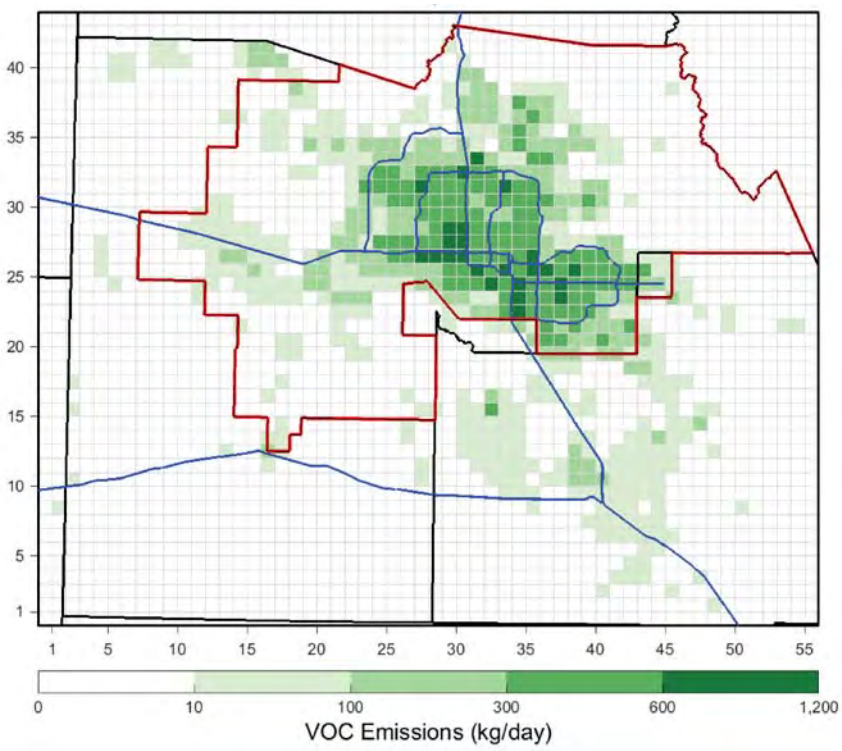


Figure III-4 (a). Area source daily VOC emissions for a typical weekday in 2011

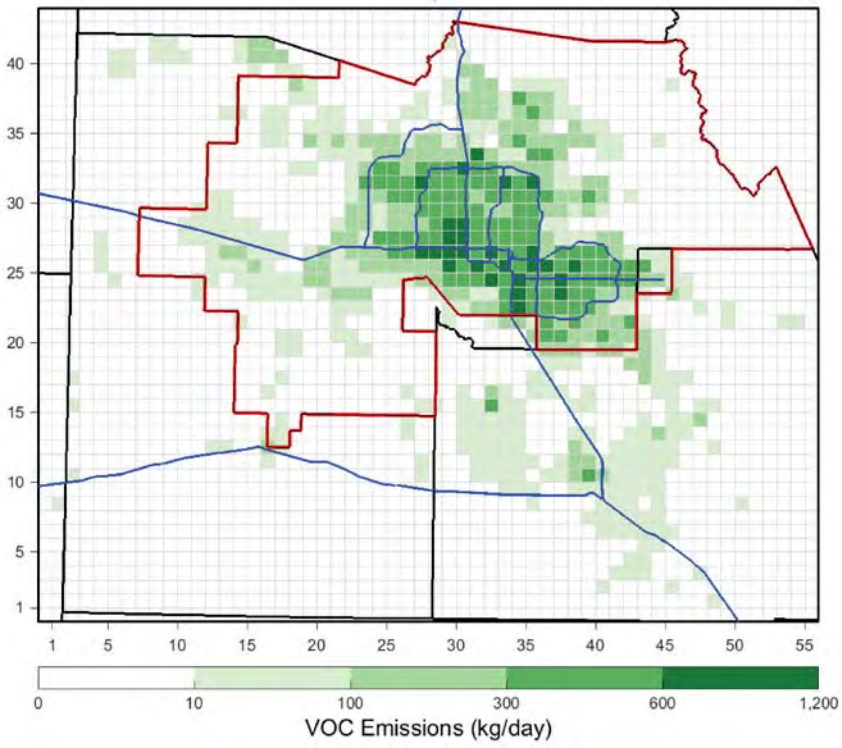


Figure III-4 (b). Area source daily VOC emissions for a typical weekday in 2017

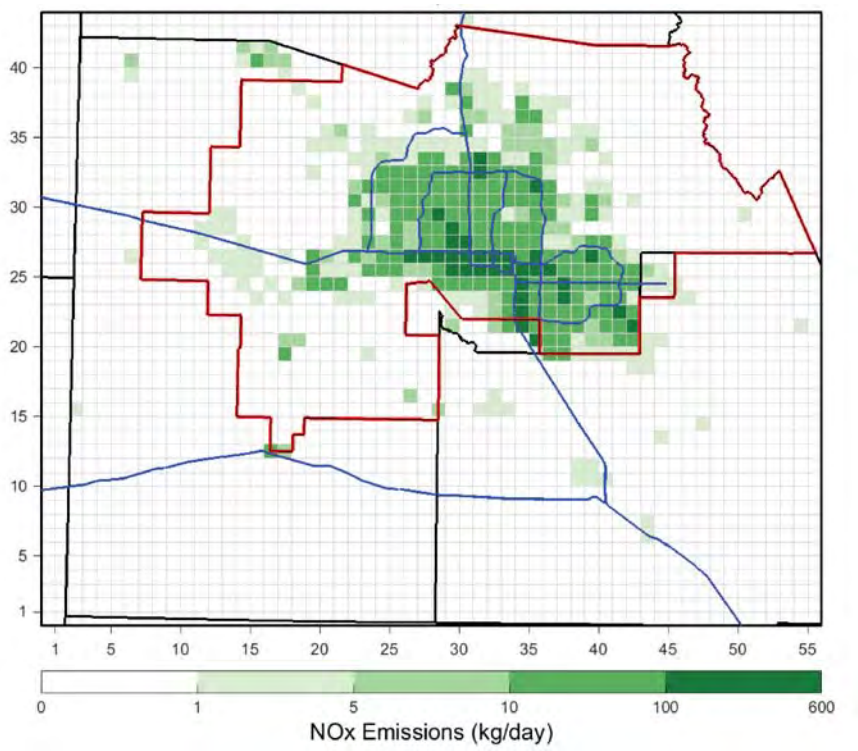


Figure III-4 (c). Area source daily NOx emissions for a typical weekday in 2011

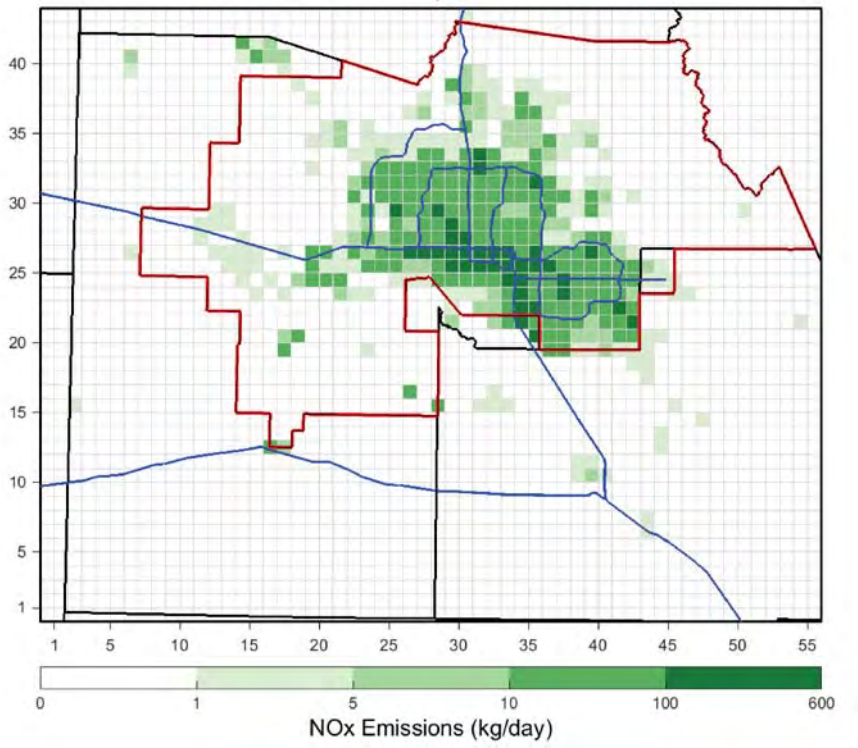


Figure III-4 (d). Area source daily NOx emissions for a typical weekday in 2017

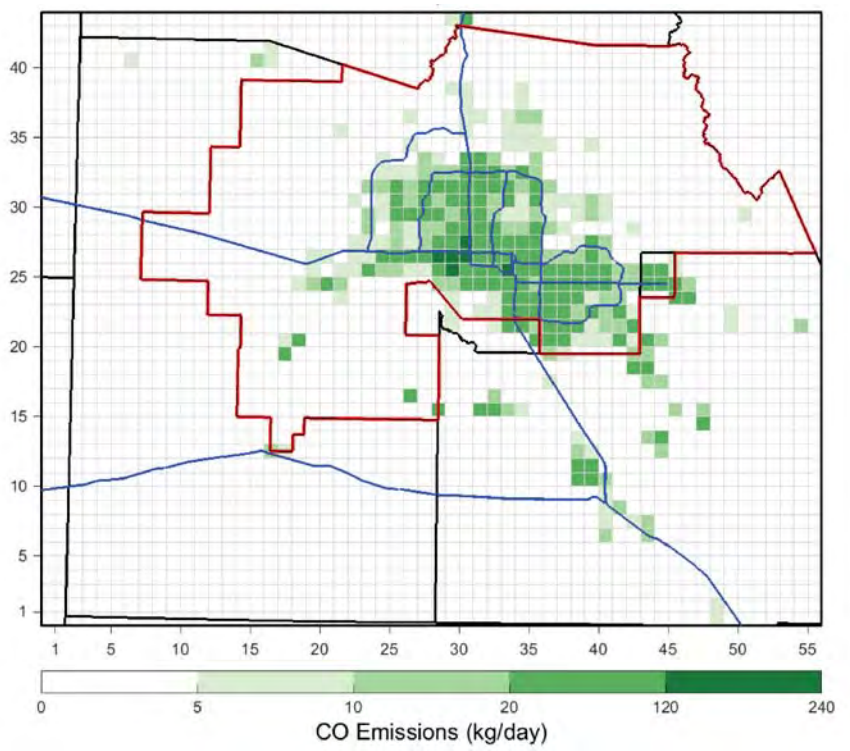


Figure III-4 (e). Area source daily CO emissions for a typical weekday in 2011

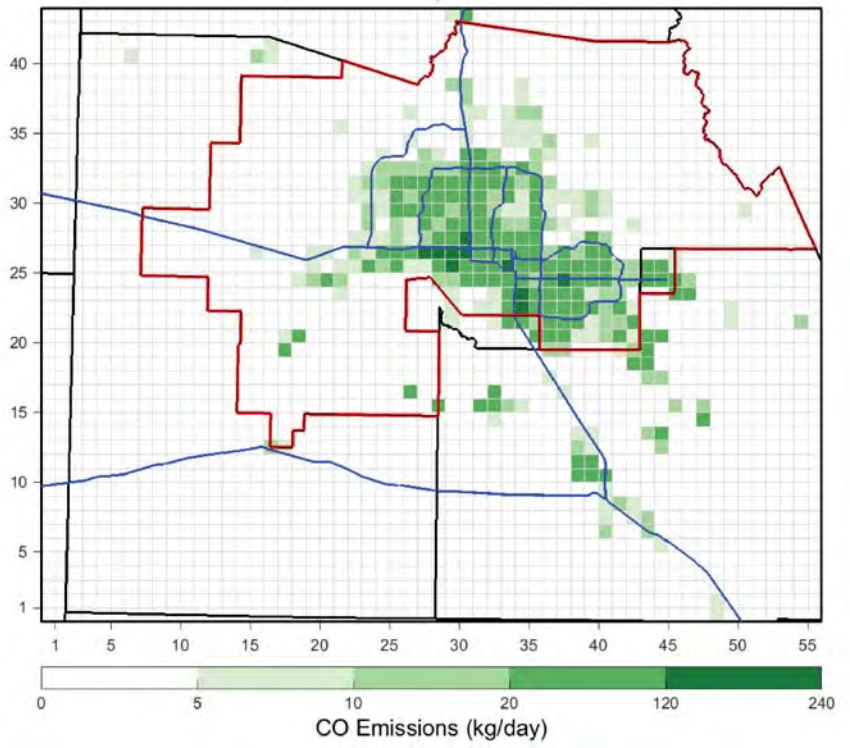


Figure III-4 (f). Area source daily CO emissions for a typical weekday in 2017

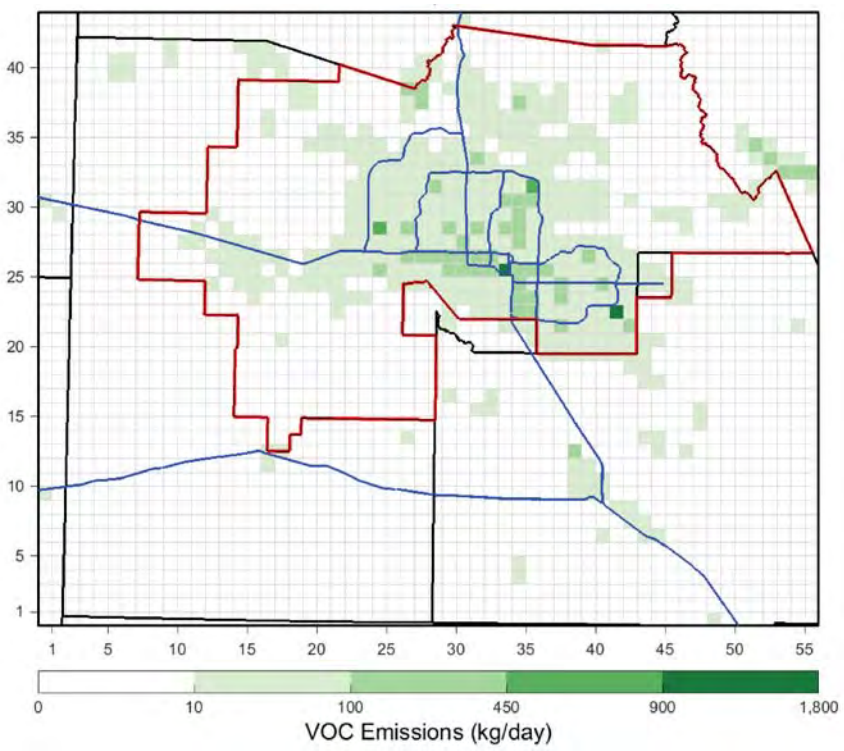


Figure III-5 (a). Nonroad source daily VOC emissions for a typical weekday in 2011

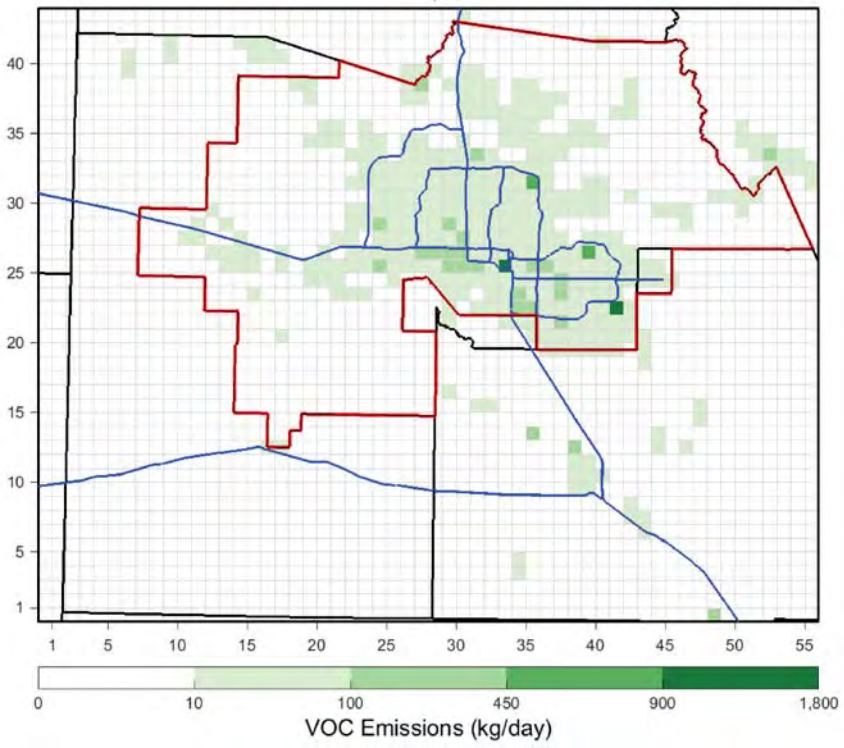


Figure III-5 (b). Nonroad source daily VOC emissions for a typical weekday in 2017

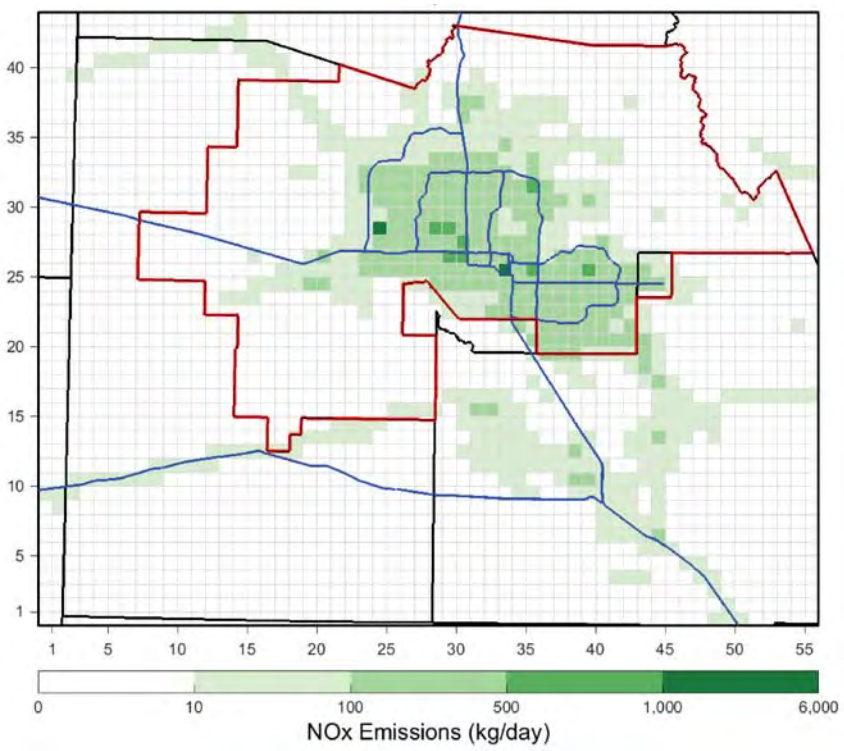


Figure III-5 (c). Nonroad source daily NOx emissions for a typical weekday in 2011

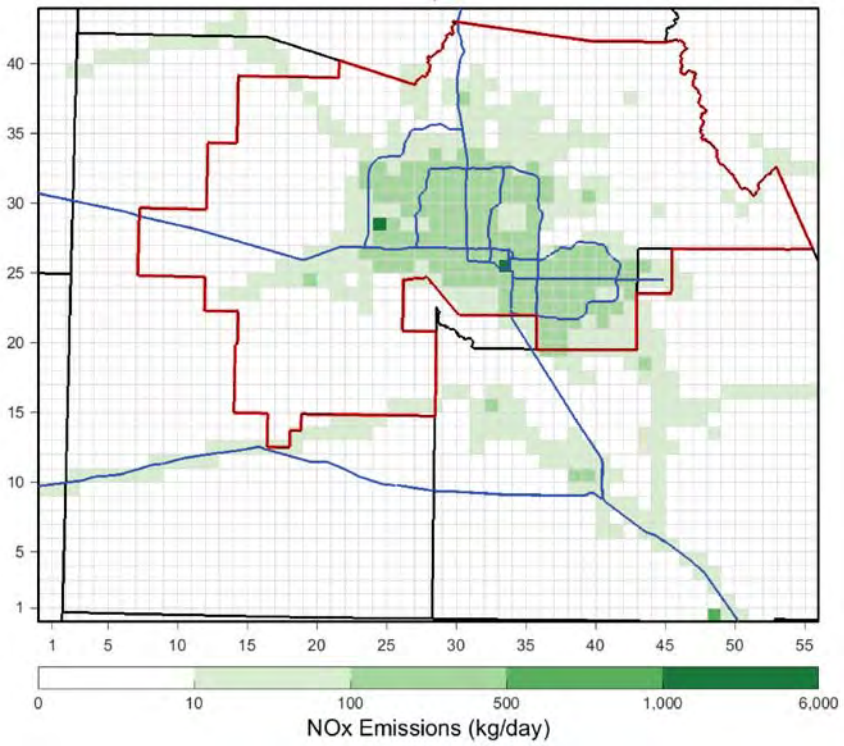


Figure III-5 (d). Nonroad source daily NOx emissions for a typical weekday in 2017

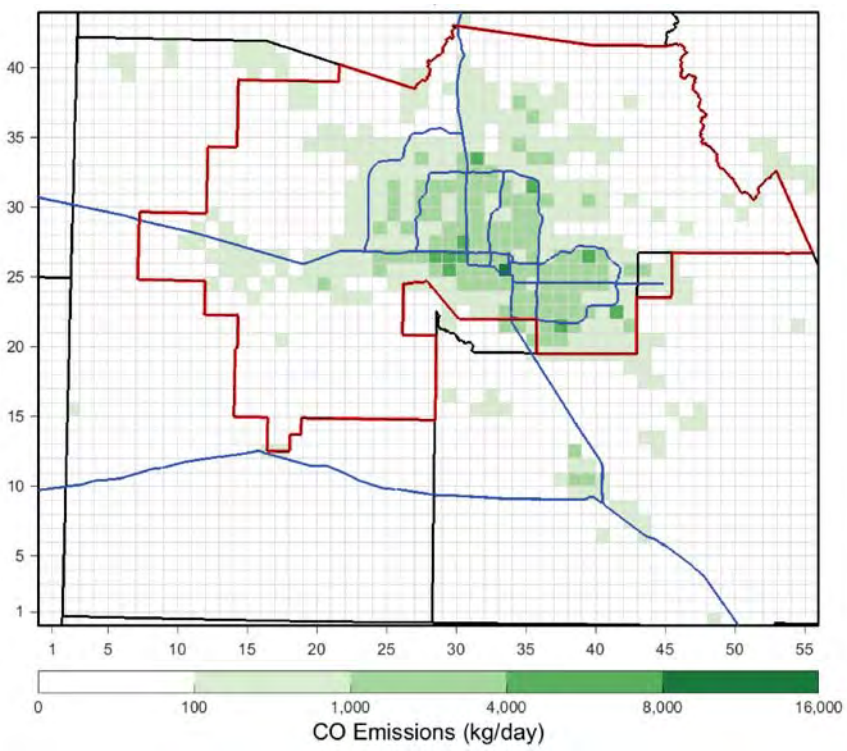


Figure III-5 (e). Nonroad source daily CO emissions for a typical weekday in 2011

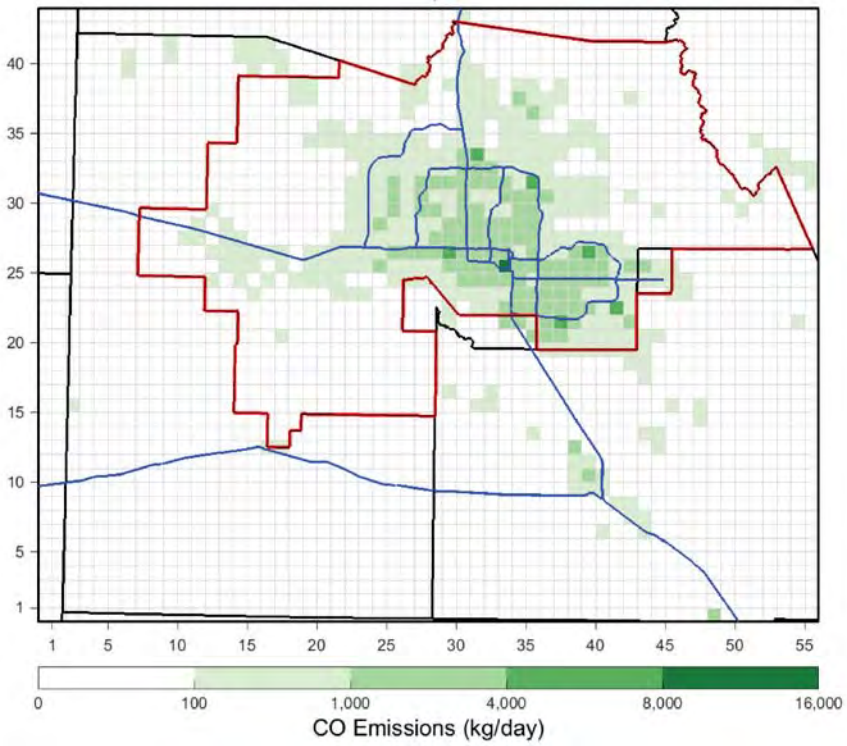


Figure III-5 (f). Nonroad source daily CO emissions for a typical weekday in 2017

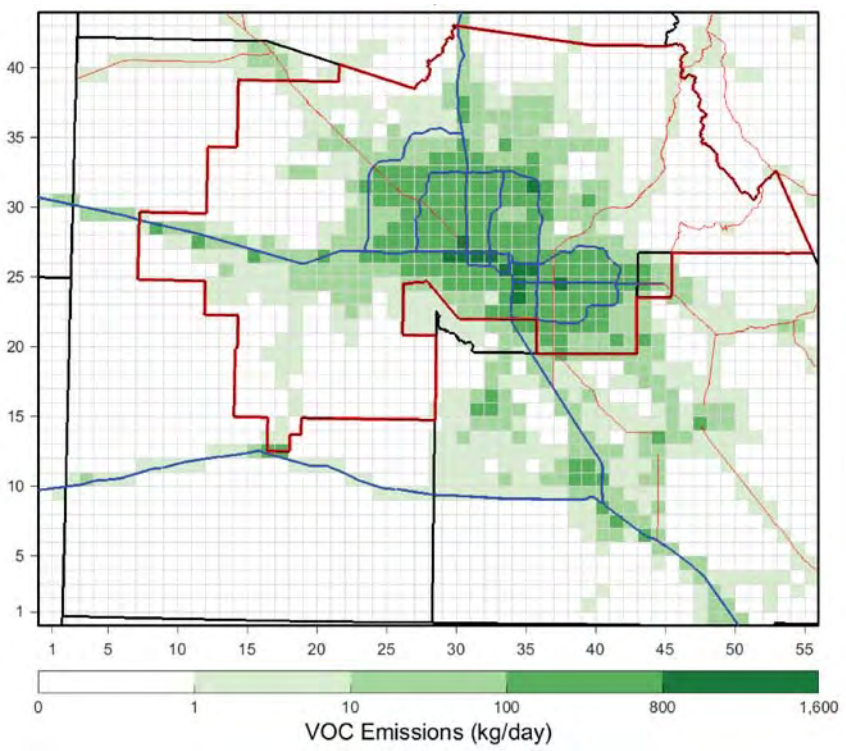


Figure III-6 (a). Onroad source daily VOC emissions for a typical weekday in 2011

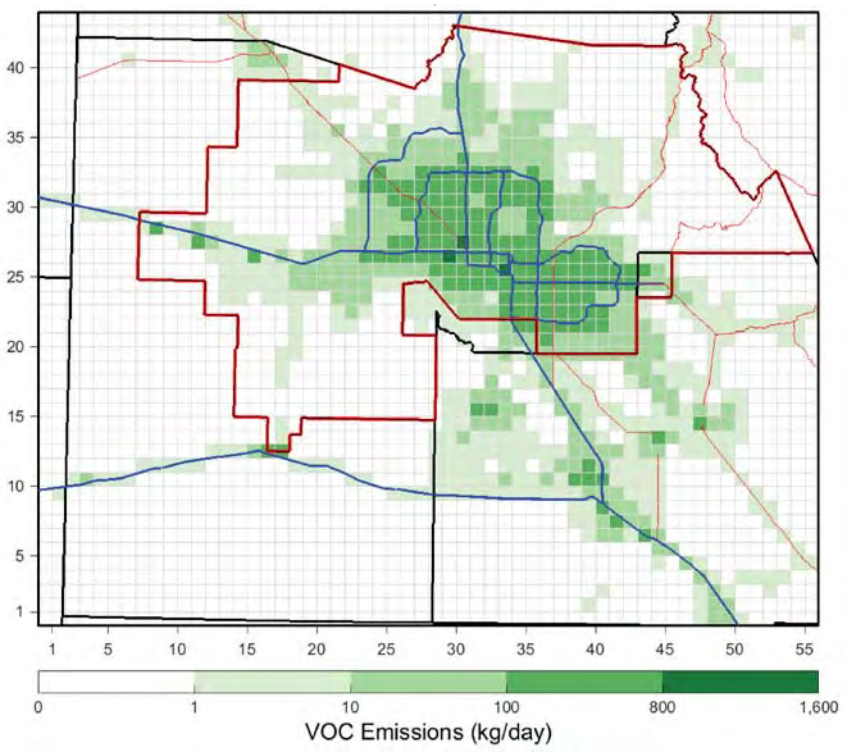


Figure III-6 (b). Onroad source daily VOC emissions for a typical weekday in 2017

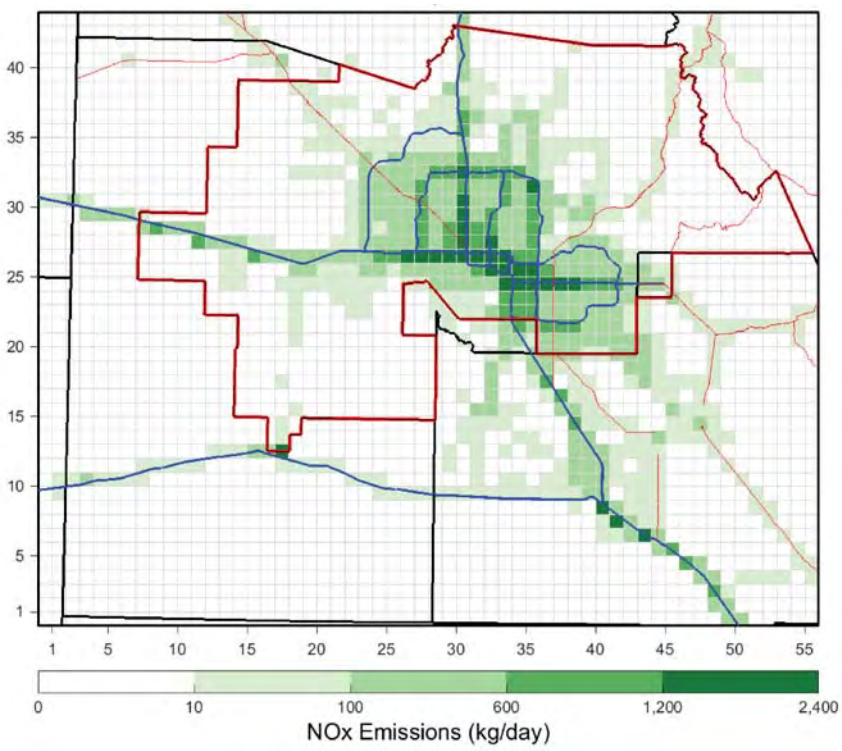


Figure III-6 (c). Onroad source daily NOx emissions for a typical weekday in 2011

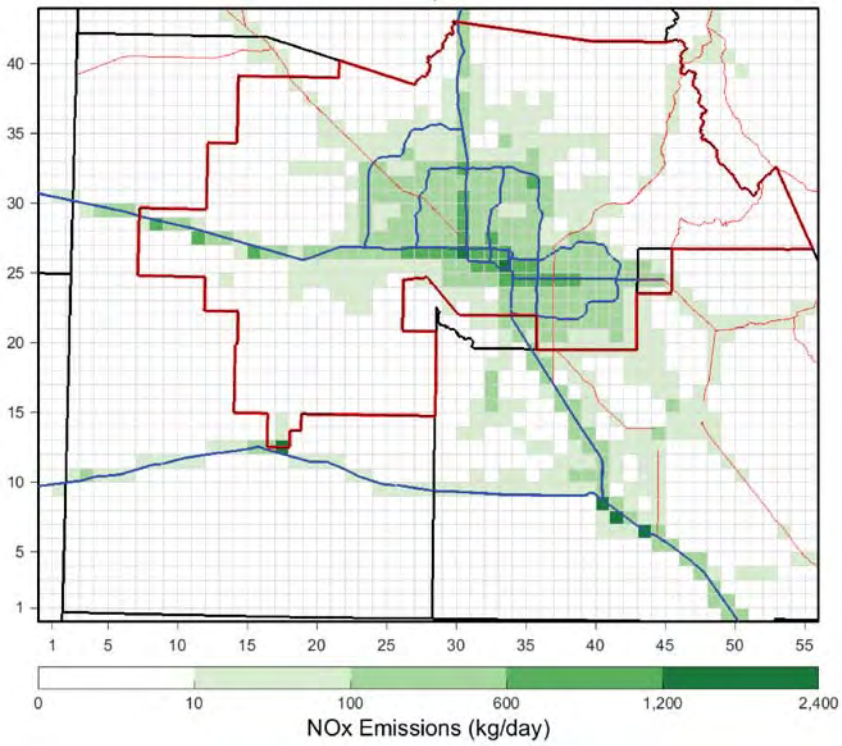


Figure III-6 (d). Onroad source daily NOx emissions for a typical weekday in 2017

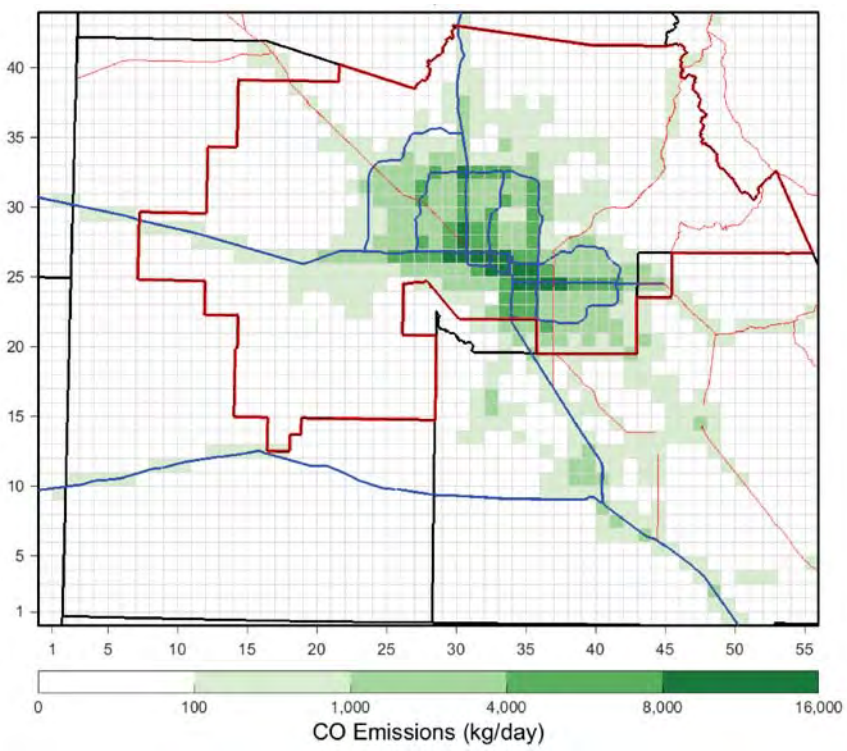


Figure III-6 (e). Onroad source daily CO emissions for a typical weekday in 2011

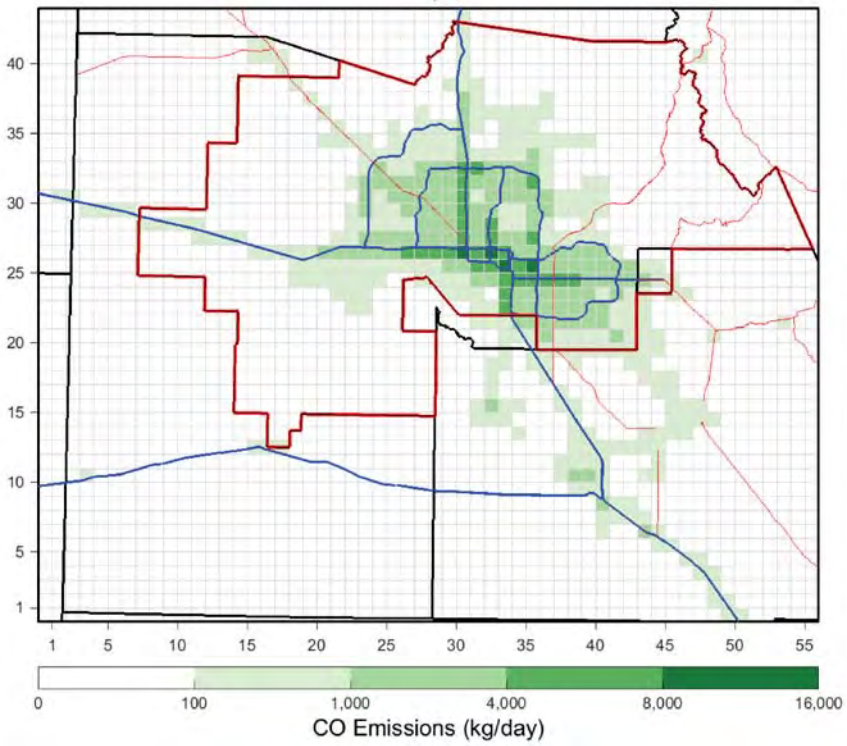


Figure III-6 (f). Onroad source daily CO emissions for a typical weekday in 2017

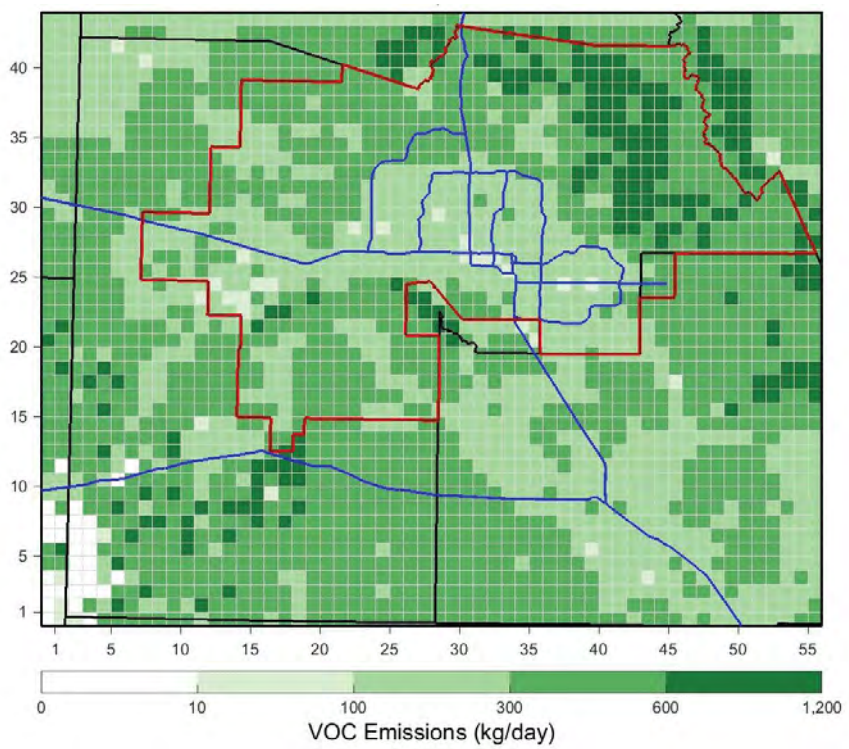


Figure III-7 (a). Biogenic source daily VOC emissions for a typical weekday in 2011

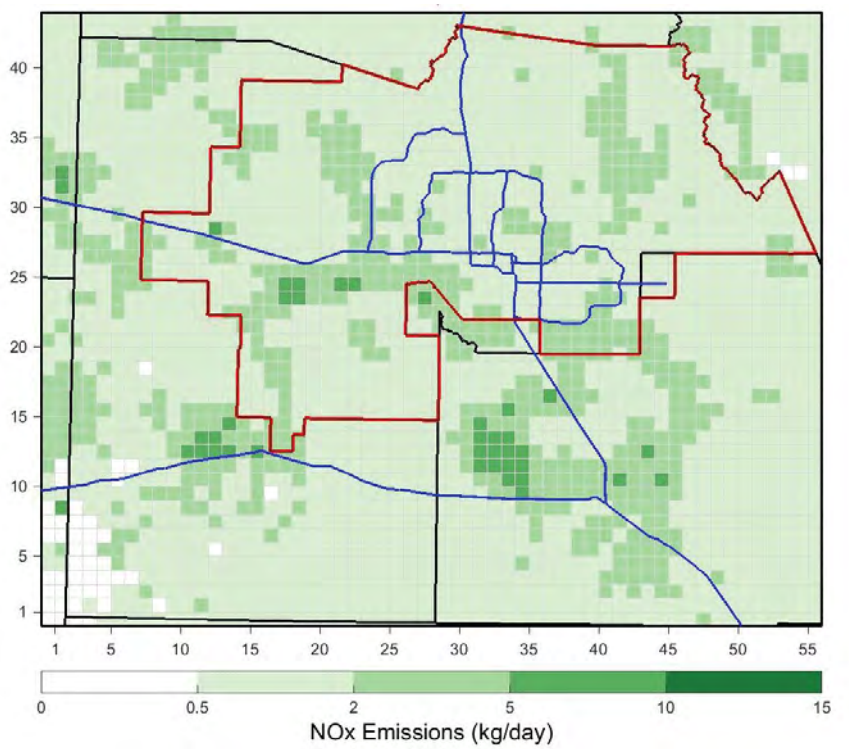


Figure III-7 (b). Biogenic source daily NOx emissions for a typical weekday in 2011

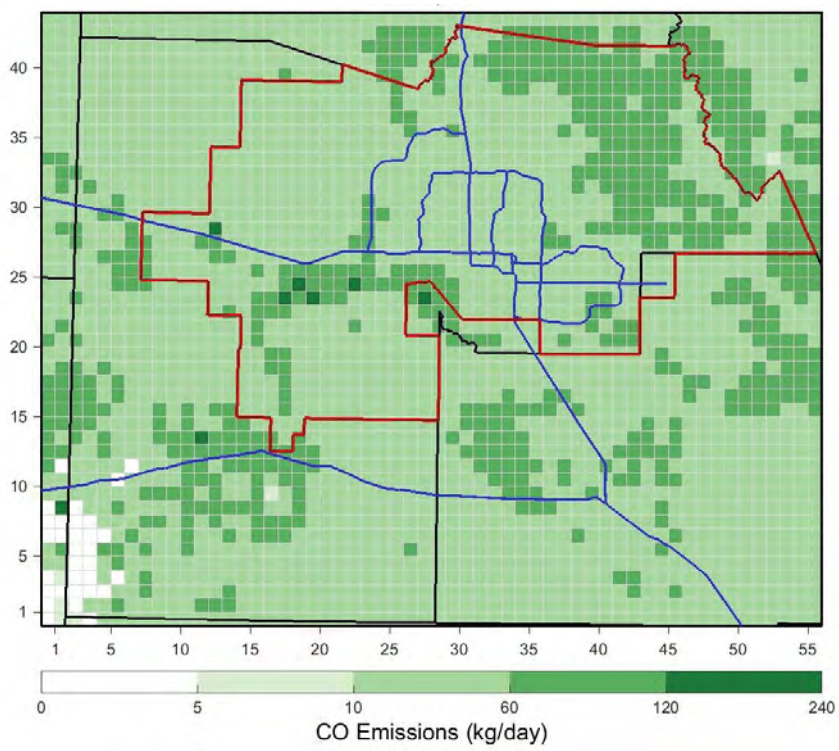


Figure III-7 (c). Biogenic source daily CO emissions for a typical weekday in 2011

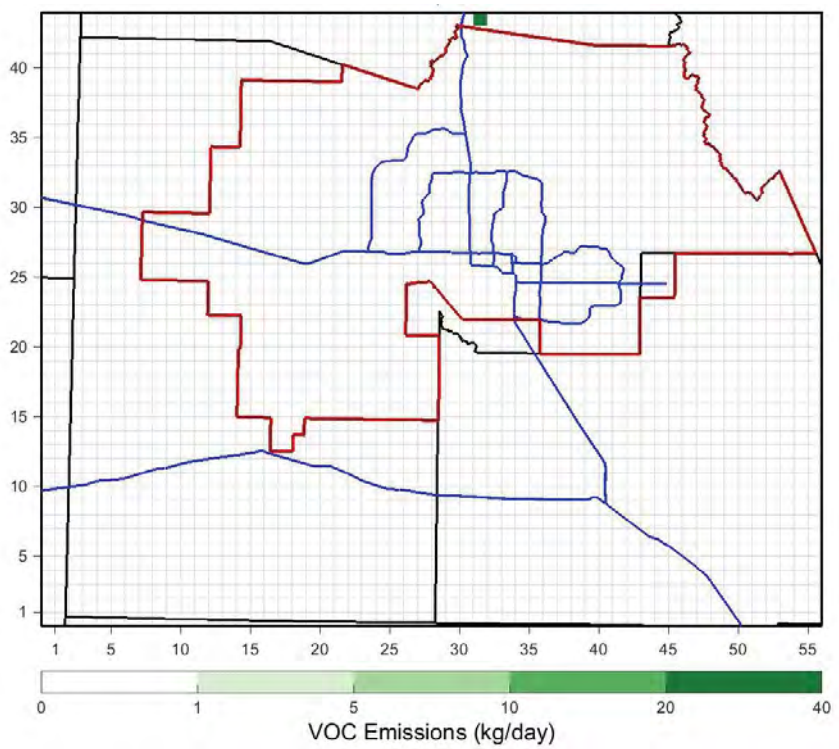


Figure III-8 (a). Wildfire source daily VOC emissions for a typical weekday in 2011

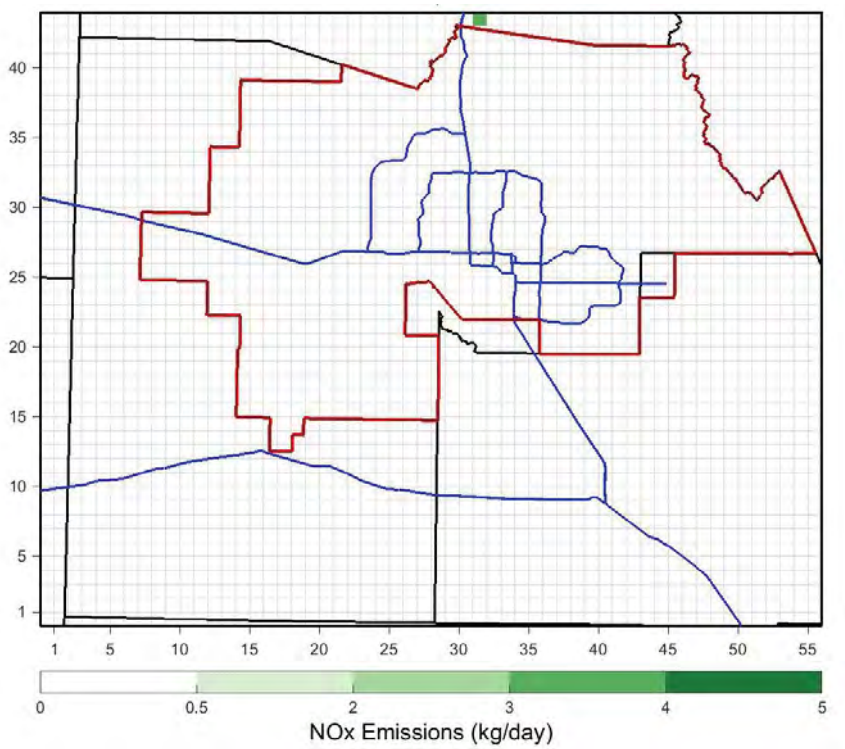


Figure III-8 (b). Wildfire source daily NOx emissions for a typical weekday in 2011

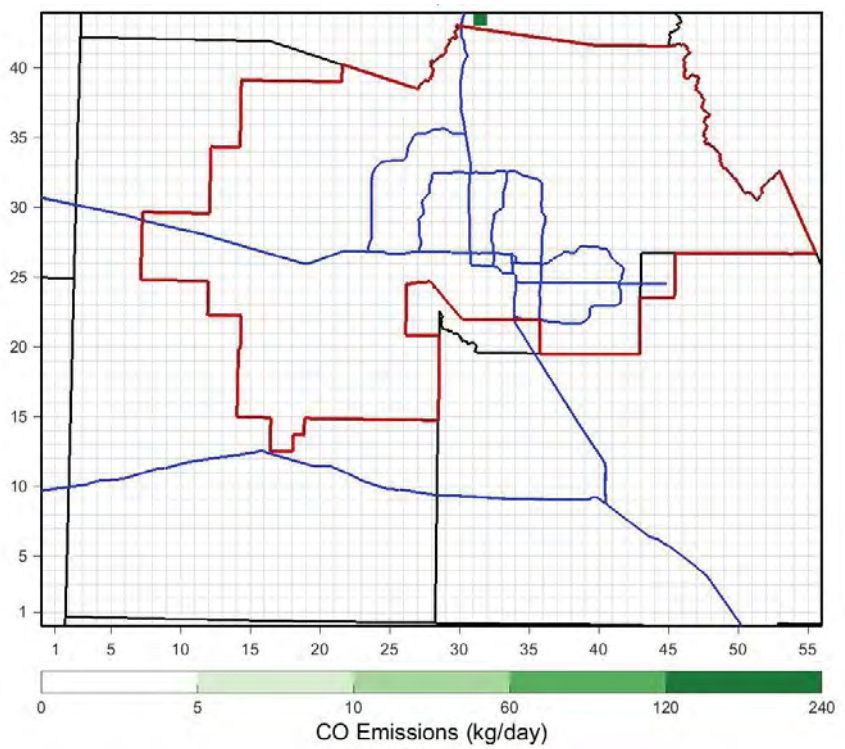


Figure III-8 (c). Wildfire source daily CO emissions for a typical weekday in 2011

III-2-2. Chemical Speciation

The CAMx modeling analysis was based upon the most up-to-date chemical mechanism, CB6 version 2 (CB6r2), to characterize photochemical reactions of ozone precursor emissions. This version of chemical mechanism had updated chemistry of isoprene and aromatic hydrocarbons and NOx recycling from the degradation of organic nitrates. The chemical mechanism contained 137 model species and 216 chemical reactions to simulate atmospheric photochemical reactions (ENVIRON, 2014). The SMOKE modeling system was used to convert ozone precursor emissions (i.e., VOC and NOx) into the model species emissions for ozone chemistry according to chemical speciation profiles for emission source categories. The latest SMOKE CB6 speciation profiles were used to perform the chemical speciation process for the CAMx modeling.

III-2-3. Temporal Allocation

Emissions inventories were provided at various temporal levels. (i.e., hourly, daily, monthly, and annual). Table III-21 shows time resolutions of all emission inventory data for the CAMx 4 km modeling domain. Temporal allocation distributed aggregated annual emissions to monthly, daily, and hourly emissions. This process was typically done by applying temporal profiles to the inventories in this order: monthly, day of the week, and hourly. These temporal profiles might differ by county, sector, or season.

Table III-21. Raw emission inventories for the 4 km modeling domain at different temporal levels

Category	Maricopa County	Pinal County	Other Counties
Point (EGU)	Annual	Annual	N/A
Point (Non-EGU)	Daily	Annual	Annual
Area	Daily	Annual	Annual
Nonroad (Airport)	Hourly	Hourly	N/A
Nonroad (Other)	Daily	Daily	Monthly
Onroad	Hourly	Hourly	Hourly
Biogenic	Hourly	Hourly	Hourly
Wildfires	Daily	Daily	Daily

Since the default temporal profiles for EGU point sources from AQMP v6.2 did not appropriately represent the temporal changes of emissions in the 4 km modeling domain, the EGU temporal profiles were developed using the EPA hourly CEMS data from the AQMP v6.2 for both Maricopa and Pinal Counties.

The 2011 hourly CEMS data for EGU sources in Maricopa and Pinal Counties were used to develop monthly profiles for Maricopa and Pinal Counties. The weekday/weekend and daily temporal profiles for the counties were developed based on hourly CEMS data for the summer ozone season from May 1 to September 30, 2011. The temporal profiles were normalized to keep the mass balance of input and output emissions. Figure III-9 shows the normalized monthly, weekly, and daily temporal profiles for the EGU point source emissions for both counties.

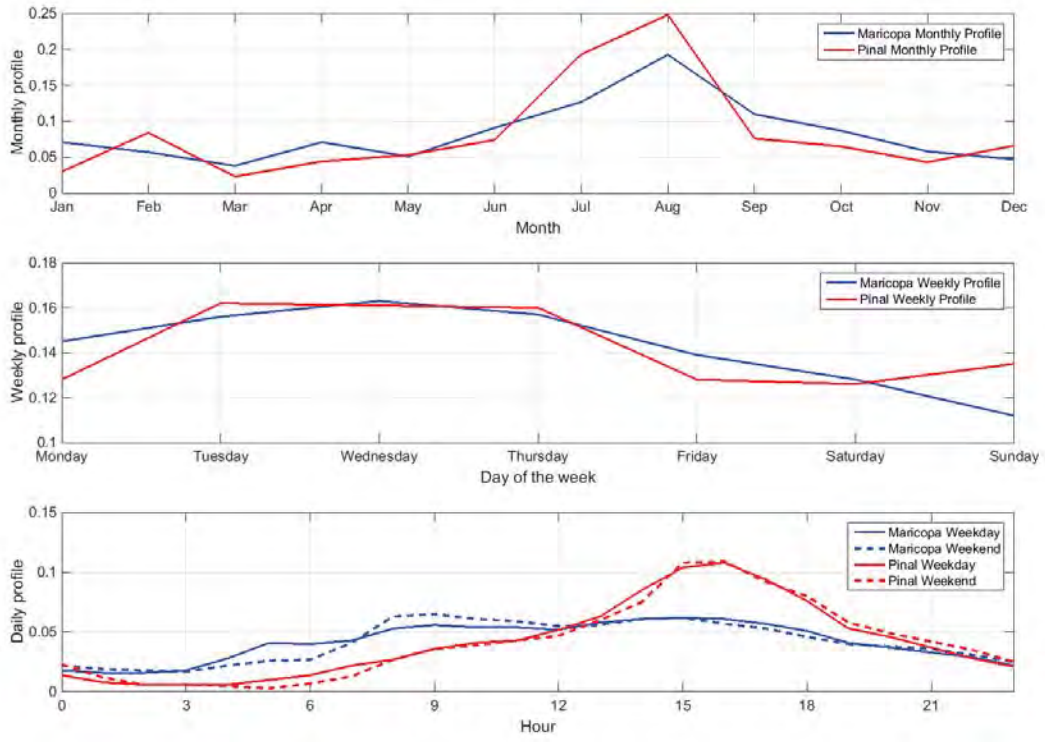
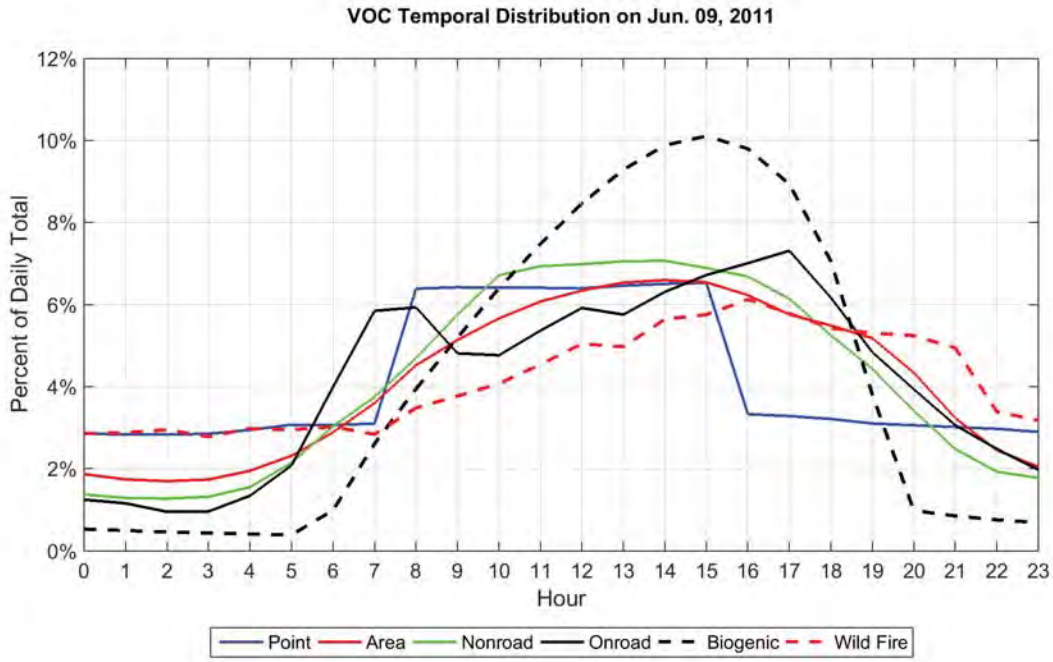


Figure III-9. Normalized monthly, weekly, and daily temporal profiles for EGU point source emissions in Maricopa and Pinal Counties

For non-EGU point sources in Maricopa County, summer ozone season average daily emissions were temporally distributed using the EPA hourly profiles from the AQMP v6.2. Pinal County non-EGU annual emissions were processed to develop hourly emissions using the EPA monthly, weekly, and diurnal temporal profiles. For the temporal allocation of area source in Maricopa County and nonroad sources (except airports) in Maricopa and Pinal Counties, the EPA temporal profiles were used to develop day-specific hourly emissions by the SCC. Figure III-10 shows the diurnal distributions of point, area, nonroad, onroad, biogenic, and wildfire emissions for a typical weekday in 2011 and 2017.



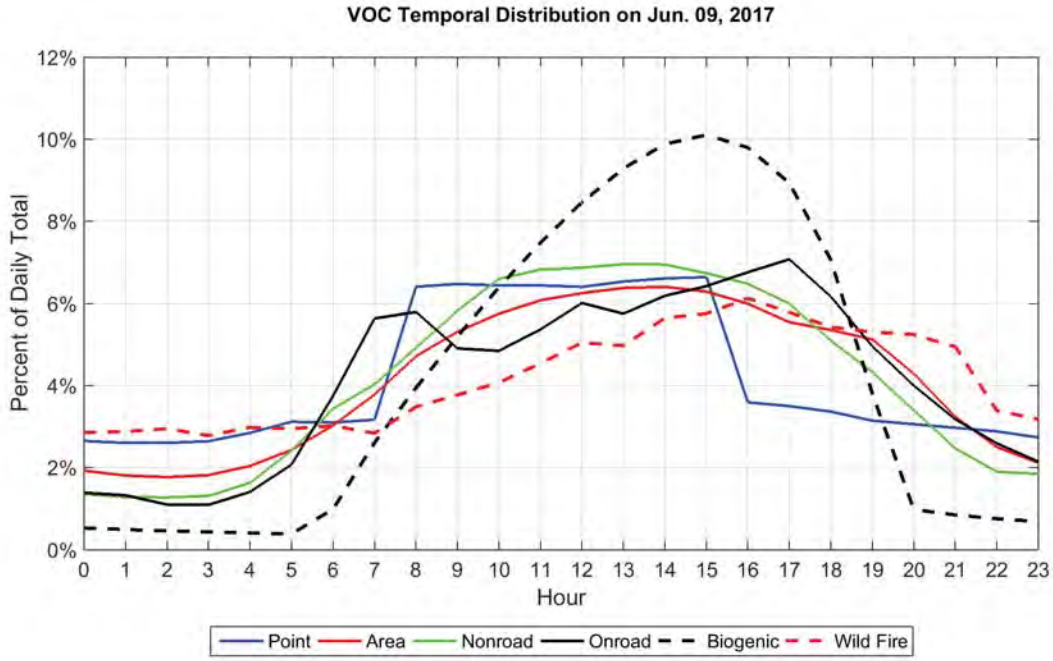


Figure III-10 (a). Temporal profiles for VOC on a typical weekday in 2011 and 2017

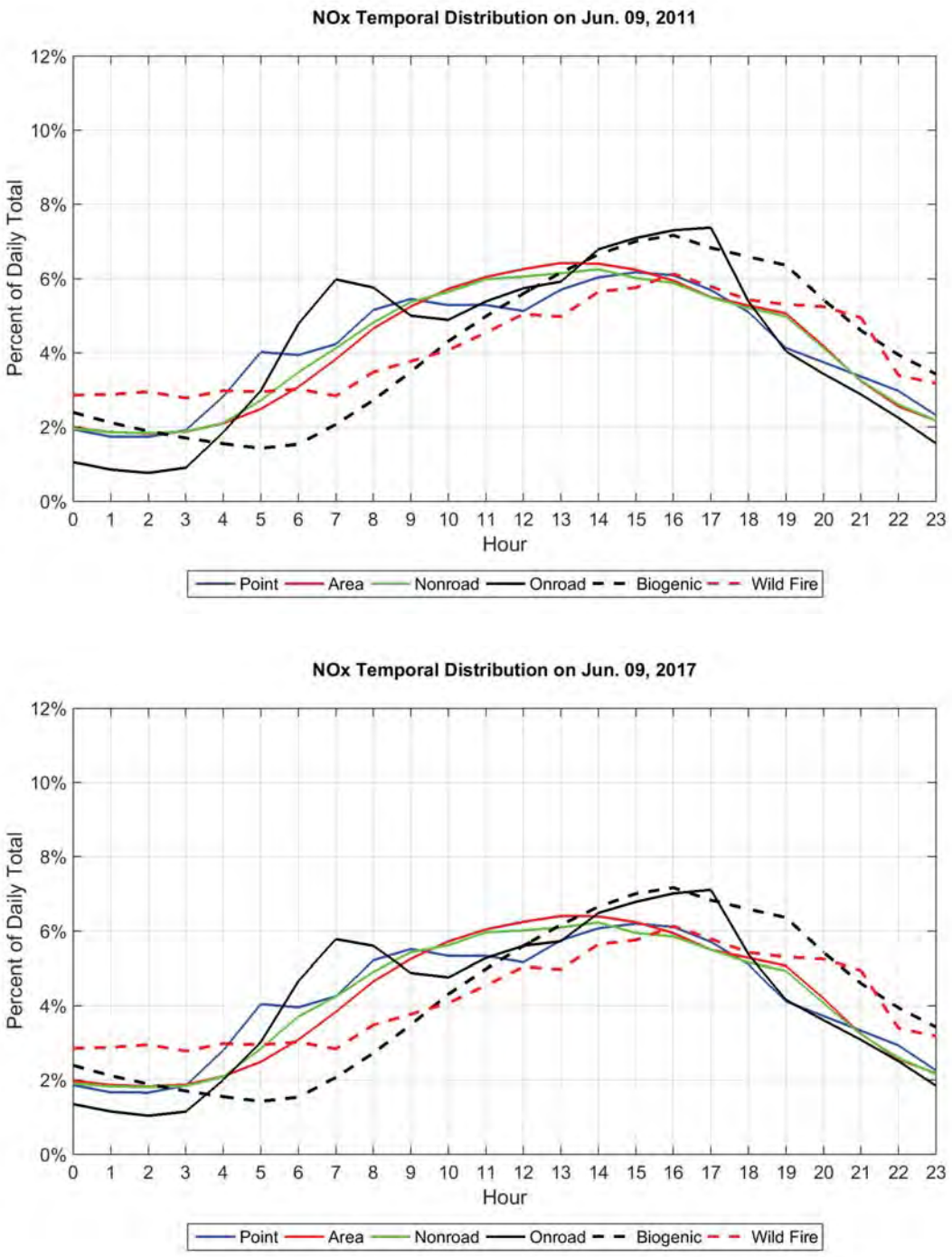
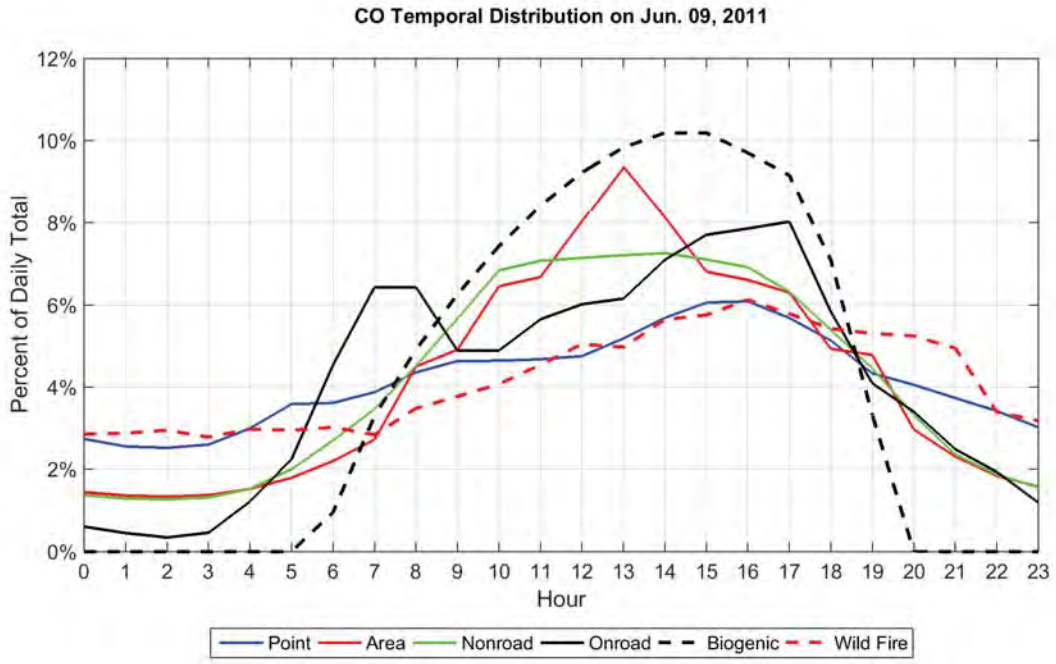


Figure III-10 (b). Temporal profiles for NOx on a typical weekday in 2011 and 2017



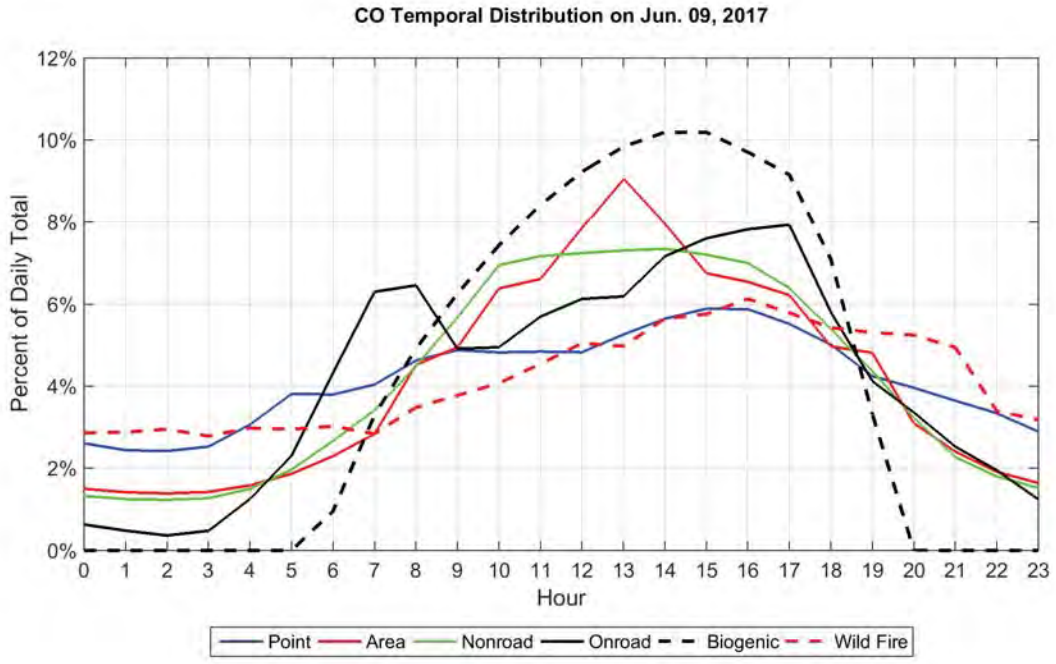


Figure III-10 (c). Temporal profiles for CO on a typical weekday in 2011 and 2017

III-3. Emissions Summaries

The ozone season daily average emissions in the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain are provided for the years 2011 and 2017 in Tables III-22 and III-23. Wildfire emissions are excluded from the ozone season average daily emissions for the five month period because wildfires occurred on specific days in 2011 and assumed to be constant between 2011 and 2017. Pie charts showing the 2011 and 2017 VOC, NOx, and CO by source are presented for the Maricopa eight-hour ozone nonattainment area in Figure III-11 and the 4 km modeling domain in Figure III-12. The daily emissions of anthropogenic and biogenic sources during May - September in 2011 and 2017 are presented in Appendix E.

Table III-22. Ozone season average daily emissions during May - September in 2011 and 2017 in the Maricopa eight-hour ozone nonattainment area (unit: metric tons/day)

	2011			2017		
Category	VOC	NOx	CO	VOC	NOx	CO
Point	2.47	7.02	4.41	3.32	13.75	6.75
Area	94.46	10.96	7.71	96.05	12.59	8.50
Nonroad Mobile	27.89	53.58	343.58	20.26	36.26	310.41
Onroad Mobile	70.96	117.15	675.97	45.65	62.69	492.98
Biogenic	487.52	2.37	63.46	487.52	2.37	63.46
Total	683.30	191.08	1,095.13	652.80	127.66	882.10

Table III-23. Ozone season average daily emissions during May - September in 2011 and 2017 in the 4 km modeling domain (unit: metric tons/day)

	2011			2017		
Category	VOC	NOx	CO	VOC	NOx	CO
Point	3.33	7.40	5.95	4.16	14.16	7.98
Area	103.79	11.16	10.09	105.54	12.81	11.02
Nonroad Mobile	36.60	62.78	387.21	26.89	43.49	350.04
Onroad Mobile	78.71	144.63	748.33	51.31	80.85	543.04
Biogenic	1,336.57	6.32	169.62	1,336.57	6.32	169.62
Total	1,559.00	232.29	1,321.20	1,524.47	157.63	1,081.70

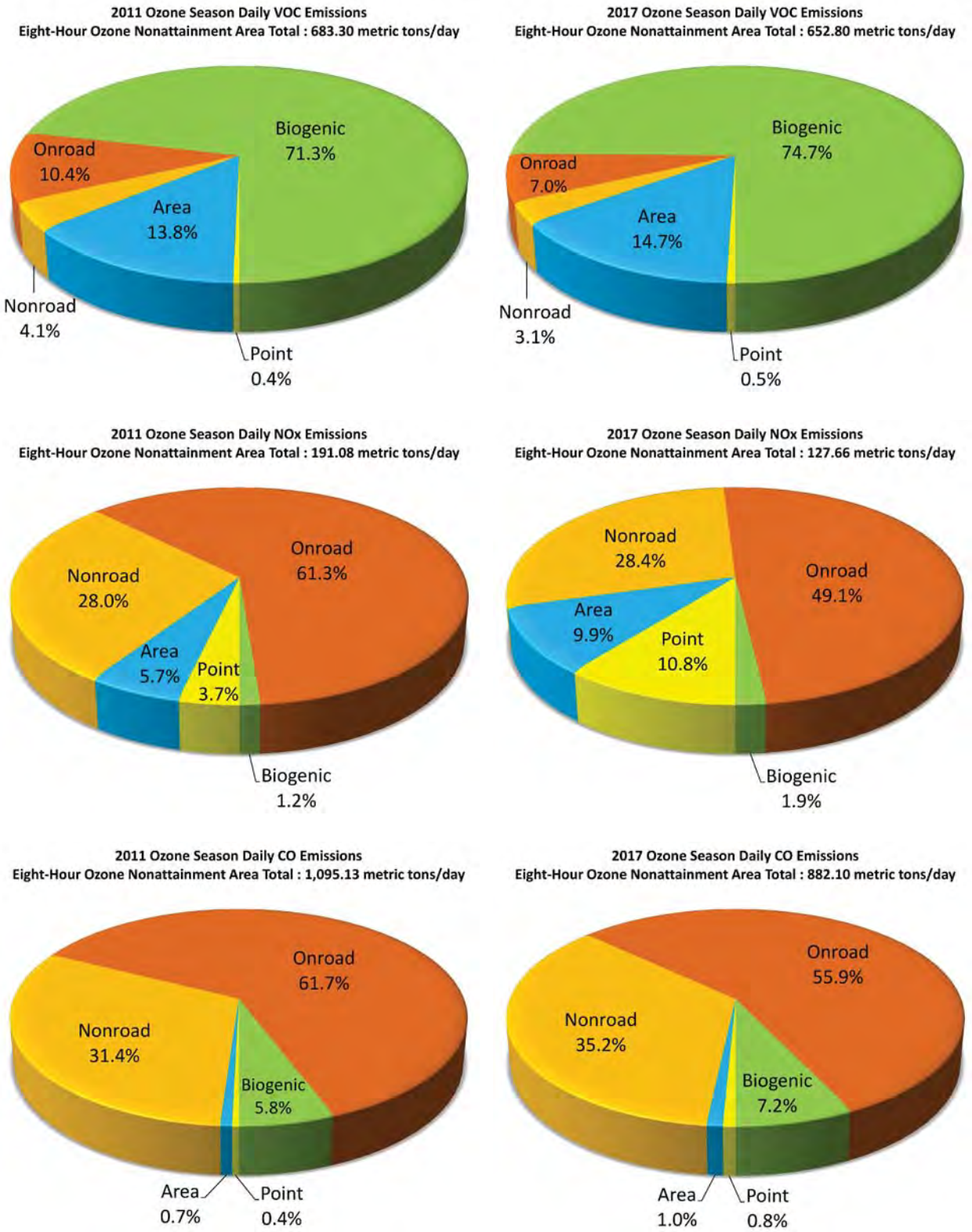


Figure III-11. Pie charts for ozone season average daily VOC, NOx, and CO emissions in 2011 and 2017 in the Maricopa eight-hour ozone nonattainment area

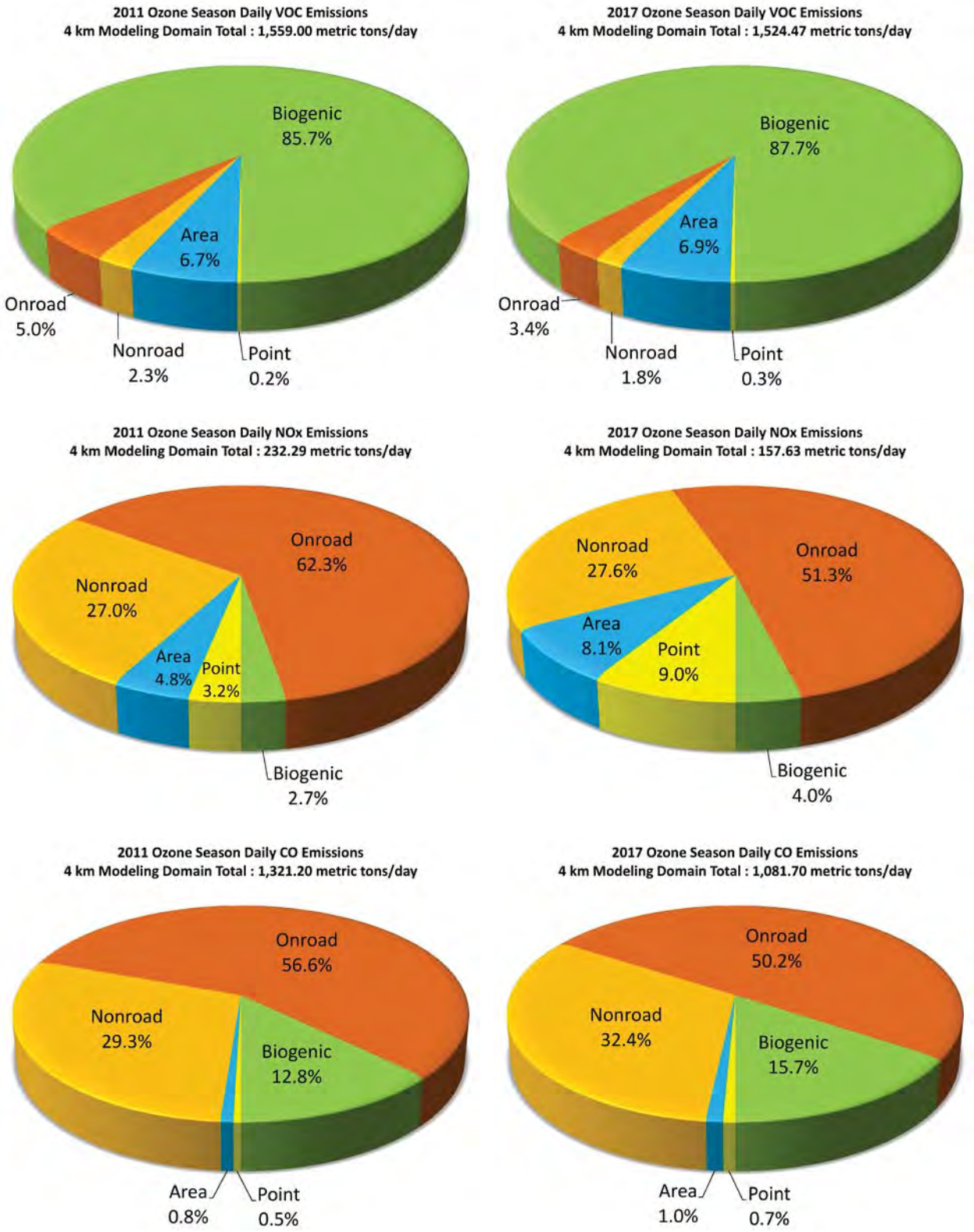


Figure III-12. Pie charts for ozone season average daily VOC, NOx, and CO emissions in 2011 and 2017 in the 4 km modeling domain

III-4. WRF Meteorology

III-4-1. Model Configuration

Version 3.7 of the Weather Research and Forecasting (WRF) model with the Advanced Research WRF (ARW) dynamic solver was used to generate the meteorology simulations for the 2011 ozone season. The model was configured with three two-way nested domains of 36/12/4 km horizontal resolution (Figure II-1). The innermost domain contains Maricopa County and the Maricopa eight-hour ozone nonattainment area. A total number of 23 vertical sigma layers were used (see Section II-2), with the first 11 layers below 1 km to better resolve the boundary layer in which most of the influences on surface ozone are confined. Selected physics options included the new YSU scheme for planetary boundary layer physics; the Noah Land Surface Model (LSM) for surface physics; Single-Moment 5-class (WSM5) microphysics scheme for cloud processes over 36 km grids, and the Thompson Microphysics scheme for cloud in 12 km and 4 km modeling domains; new Multi-scale Kain-Fritsch cumulus parameterization utilizing the moisture-advection trigger for both 36 km and 12 km modeling domains; the Rapid Radiative Transfer Model (RRTM) for long wave radiation transfer, and the Goddard scheme for short wave radiation.

The simulation was initialized using the National Centers for Environmental Information (NCEP) GEWEX Continental-Scale International Project (GCIP) 40 km Eta Data (ds609.2) obtained from the Computational & Information Systems Laboratory (CISL) at the National Center for Atmospheric Research (NCAR). Analysis nudging for temperature, wind, and moisture was applied above the boundary layer only for coarse domains. Land use and land cover data were based on National Land Cover Database 2011 data.

The entire simulation was stitched from many shorter runs to enhance accuracy and form a continuous data set. Each individual simulation started at 12:00 UTC and lasted for a segment of 1.5 days (36 hours). The first 12-hour period for each simulation was considered as the model spin-up. A one hour interval was set for the time stamps in the output files.

III-4-2. Post Processing

The Meteorology-Chemistry Interface Processor (MCIP v4.2) was used to process WRF output files into MEGAN and SMOKE-ready file formats. The WRFCAMx (v4.3) was used to directly convert WRF output files into UAM-format. MCIP and WRFCAMx are designed to maintain dynamic consistency between the meteorological model and the chemical transport model as much as possible. The CAMx uses a smaller modeling domain than WRF because WRF simulations in the cells near the boundary may not be adequate for use in air quality simulation by CAMx. The MCIP and WRFCAMx accommodated the WRF domains into the smaller domains needed for SMOKE and CAMx runs.

III-5. Initial and Boundary Conditions

Meteorological Initial and Boundary Conditions

The initial and boundary conditions (ICBC) for the 36 km meteorological modeling domain were prepared by the WRF Preprocessing System (WPS) using the ds609.2 data downloaded from NCAR's Research Data Archive. WPS output provides ICBC data at a standard 3-hour interval for WRF simulation. The ICBC for nested domains are dynamically provided every hour by the parent domain during the model simulation. That is, the 36 km parent modeling domain serves as the ICBC for the 12 km modeling domain, and the 12 km modeling domain serves as the ICBC for the 4 km modeling domain.

Photochemical Initial and Boundary Conditions

ICBC based on global chemical transport model simulations are required to provide information about background concentrations, long-range transport, and stratospheric ozone influences for nested photochemical model simulations. The Model for Ozone and Related Chemical Tracers, version 4 (MOZART-4) outputs were used to define ICBCs for the MAG photochemical modeling. MOZART-4 is driven by meteorological fields from the National Aeronautics and Space Administration (NASA) Goddard Earth Observing System Model, version 5 (GEOS-5) (Emmons et al., 2010). It uses global anthropogenic emissions based on an international inventory and fire emissions from the Fire Inventory from NCAR (FINN) version 1.0 (Wiedinmyer et al., 2011). The MOZART-4 model has a global coverage with a resolution of 1.9 x 2.5 degree and 56 vertical levels.

The CAMx pre-processor was used to interpolate the MOZART-4 output from its native resolution and coordinate system to a Lambert Conformal Projection coordinate system in the CAMx vertical layer structure. Additionally, the MOZART chemical species were mapped to the CB6 chemical species used in CAMx as shown in Table III-24. For one-way offline air quality modeling with nested domains, ICBC for the 36 km modeling domain were provided by MOZART, and the inner nest domains received their ICBC from the CAMx simulations.

III-6. Ozone Column Data

The CAMx photochemical mechanism requires ozone column and clear-sky photolysis rate data. Day-specific ozone column data for ozone episode days in 2011 were obtained from the Total Ozone Mapping Spectrometer (TOMS) data measured by the satellite-based Ozone Monitoring Instrument. The o3map preprocessor was used to process ozone column data for CAMx. The CAMx Tropospheric Ultraviolet Visible radiative transfer model uses TOMS ozone column data to calculate clear-sky photolysis rates and to adjust the clear-sky photolysis rates in presence of cloud and aerosols. The photolysis rates for CAMx were prepared using tuv4.8.camx6.00 preprocessor.

Table III-24. Mapping of the MOZART chemical species to the CB6 chemical mechanism

CMAQ Species	Equivalent MOZART Species
NO	NO
NO2	NO2
O3	O3
H2O2	H2O2
NO3	NO3
N2O5	N2O5
HNO3	HNO3
PNA	HO2NO2
PAN	PAN
PANX	MPAN
NTR	ONIT
INTR	ONITR + ISOPNO3
CO	CO
PAR	C3H6 + BIGENE + 5 BIGALK + 2 HYAC + HYDRALD + 3 MEK + 0.333 TOLUENE + 2 ONIT
OLE	C3H6 + 0.5 BIGENE + HYDRALD
IOLE	0.5 BIGENE
FORM	CH2O
ALD2	CH3CHO
ALDX	HYDRALD
GLYD	GLYALD
MGLY	CH3COCHO
ETHA	C2H6
ETH	C2H4
ETHY	C2H2
PRPA	C3H8
ACET	CH3COCH3
ETOH	C2H5OH
MEOH	CH3OH
MEPX	CH3OOH
FACD	HCOOH
AACD	CH3COOH
PACD	CH3COOOH
KET	HYAC + MEK + ONIT
ISOP	ISOP
ISPD	MACR + MVK
TERP	C10H16
TOL	0.333 TOLUENE
XYL	0.333 TOLUENE
CRES	CRESOL
OPEN	BIGALD
SO2	SO2 + DMS
NH3	NH3
MECN	CH3CN
HCN	HCN
TOLA	0.333 TOLUENE
XYLA	0.333 TOLUENE
ISP	ISOP
TRP	C10H16
PSO4	SO4
PNO3	NH4NO3
PNH4	NH4
SOA5	0.4 SOA
SOA6	0.4 SOA
POA	0.0655 OC1 + 0.0655 OC2
PEC	0.12 CB1 + 0.12 CB2
FCRS	1.35 DUST1 + 1.35 DUST2
CCRS	1.35 DUST3 + 1.35 DUST4
NA	SA1 + 0.834 SA2
PCL	SA1 + 0.834 SA2

IV. MODEL PERFORMANCE EVALUATION

Model performance evaluations for the WRF meteorological and CAMx air quality models were conducted according to the EPA guidance (EPA, 2014a). The purpose of the model performance evaluation is to assess if the model accurately replicates meteorological observations and ambient ozone concentrations for the 2011 base year. The uses of the models for the future air quality modeling analysis may be justified through the model performance evaluation. The twelve statistical metrics provided in Table IV-1 were used for the model performance evaluation, as was recommended by EPA. The statistical metrics were typically assessed by comparing modeled values with observed values for the ozone season in 2011.

Table IV-1. Quantitative statistical performance measures for evaluating models

Metric Name	Definition
Number of Pairs	N
Average Observed Value	$\overline{O} = \frac{1}{N}\sum O_i$
Average Modeled Value	$\overline{M} = \frac{1}{N}\sum M_i$
Mean Bias (MB)	$MB = \frac{1}{N}\sum (M_i - O_i)$
Mean Error (ME)	$ME = \frac{1}{N}\sum \lvert M_i - O_i \rvert$
Root Mean Square Error (RMSE)	$RMSE = \sqrt{\frac{\sum (M_i - O_i)^2}{N}}$
Fractional Bias (FB)	$FB = 100\% \times \frac{2}{N}\sum \frac{(M_i - O_i)}{(M_i + O_i)}$
Fractional Error (FE)	$FE = 100\% \times \frac{2}{N}\sum \frac{\lvert M_i - O_i \rvert}{(M_i + O_i)}$
Normalized Mean Bias (NMB)	$NMB = 100\% \times \frac{\sum (M_i - O_i)}{\sum O_i}$
Normalized Mean Error (NME)	$NME = 100\% \times \frac{\sum \lvert M_i - O_i \rvert}{\sum O_i}$
Coefficient of Determination (R^2)	$R^2 = \left(\frac{\sum \left((M_i - \overline{M}) \times (O_i - \overline{O}) \right)}{\sqrt{\left(\sum (M_i - \overline{M})^2 \times \sum (O_i - \overline{O})^2 \right)}} \right)^2$
Index of Agreement (IOA)	$IA = 1 - \frac{\sum (O_i - M_i)^2}{\sum \left(\lvert M_i - \overline{O} \rvert + \lvert O_i - \overline{O} \rvert \right)^2}$

IV-1. WRF Model Performance Evaluation

Temperatures, water vapor mixing ratios, and wind speeds and directions modeled by the WRF were assessed using the observed meteorological data for the modeling episode in 2011. Use of such meteorological modeling data with the good model performance assures more confidence and robustness of the CAMx air quality modeling results. The WRF meteorological model performance evaluation was conducted for the 4 km modeling domain. For the performance evaluation, temperature and water mixing ratio measured at 2 meters above ground, and wind speed and direction measured at 10 meters above ground were extracted from the U.S. and Canada Surface Hourly Observation data set in the National Center for Atmospheric Research (NCAR) Data Archive ds472.0 (NCAR, 1987). The data set provided meteorological observations at 13 weather stations in the 4 km modeling domain. Locations of the weather stations are provided in Figure IV-1.

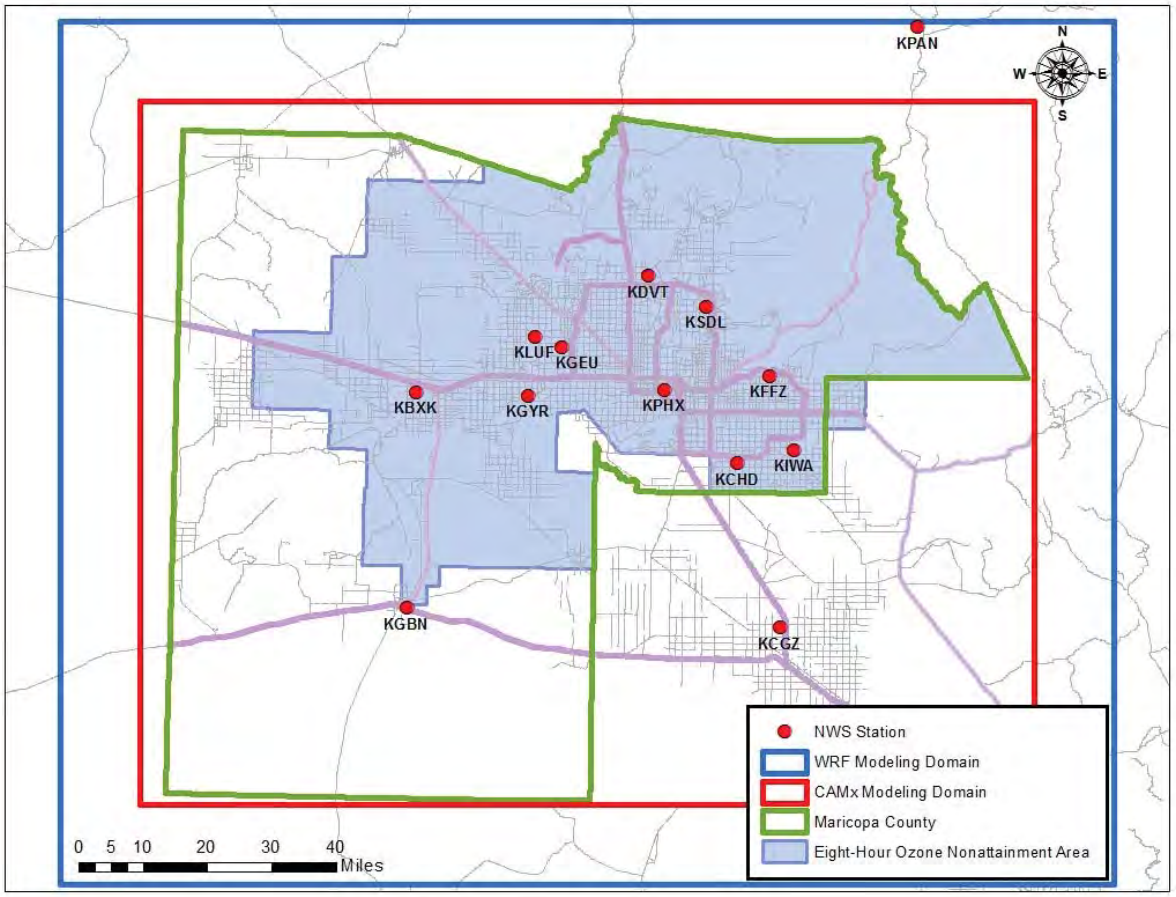


Figure IV-1. The locations of 13 weather stations within the 4 km modeling domain used for the WRF meteorological performance evaluation

Modeled and observed temperature, water vapor mixing ratio, and wind fields (wind speeds and directions) were paired and compared in time and space. The statistical metrics for the WRF meteorology are provided in Table IV-2. The WRF modeled values for diurnal surface temperatures and day-time peak temperatures were generally accurate. The modeled water vapor mixing ratio provided a small bias for the entire modeling period. The good WRF model performance was provided in modeling the monsoon season. The modeled wind speeds had a small bias over the typical diurnal cycle. Since accurate modeling for wind directions is challenging, the statistical metrics for wind directions indicated a poor model performance, as shown in Table IV-2.

Table IV-2. Model performance statistics for meteorological parameters during ozone season in 2011

Metric Name	Temperature (°F)	Mixing Ratio (g/kg)	Wind Speed (mph)	Wind Direction (°)
Number of Pairs	3,649	3,646	3,649	3,649
Average Modeled Value	88.1	6.6	6.2	208
Average Observed Value	87.3	6.7	6.6	158
Mean Bias	0.8	-0.1	-0.3	49.4
Mean Error	2.2	0.9	1.9	57.2
Normalized Mean Bias (%)	0.9	-1.8	-5.0	31.2
Normalized Mean Error (%)	2.5	12.8	29.1	36.1
Root Mean Square Error	3.0	1.1	2.5	74.2
Coefficient of Determination	0.94	0.90	0.48	0.31
Index of Agreement	0.98	0.97	0.78	0.66

The coefficient of determination (R^2) provides the measure of accuracy for the modeled values, and ranges from zero to one. Zero indicates the poorest accuracy and one is the best accuracy. The coefficients of determination for temperature and water vapor mixing ratio were 0.94 and 0.90, respectively. The modeled temperatures and water vapor mixing ratios are in good agreement with measurements. Biases for the two meteorological parameters were very small. The coefficients of determination for wind speed and direction are low because resolving wind speeds and directions with WRF is difficult due to the complex terrains of the Phoenix Valley because the wind fields are very sensitive to terrain features. The Root Mean Square Errors (RMSE) for wind directions could vary in the range of 60-80 degrees for the various topographies (Jimenez, et al., 2013). The results are consistent with the findings of the MAG WRF model performance.

A scatter plot provides information that the observed and modeled values are in good agreement if the data are clustered around the line of best fit, the modeled values are

overestimated if above the best-fit-line or underestimated if under the best-fit-line. The scatter plots in Figure IV-2 presented the good agreement between observed and modeled values for temperature and water vapor mixing ratio, the overestimation for lower wind speeds and the underestimation for higher wind speeds, and the significant overestimation for wind directions of south-east sectors.

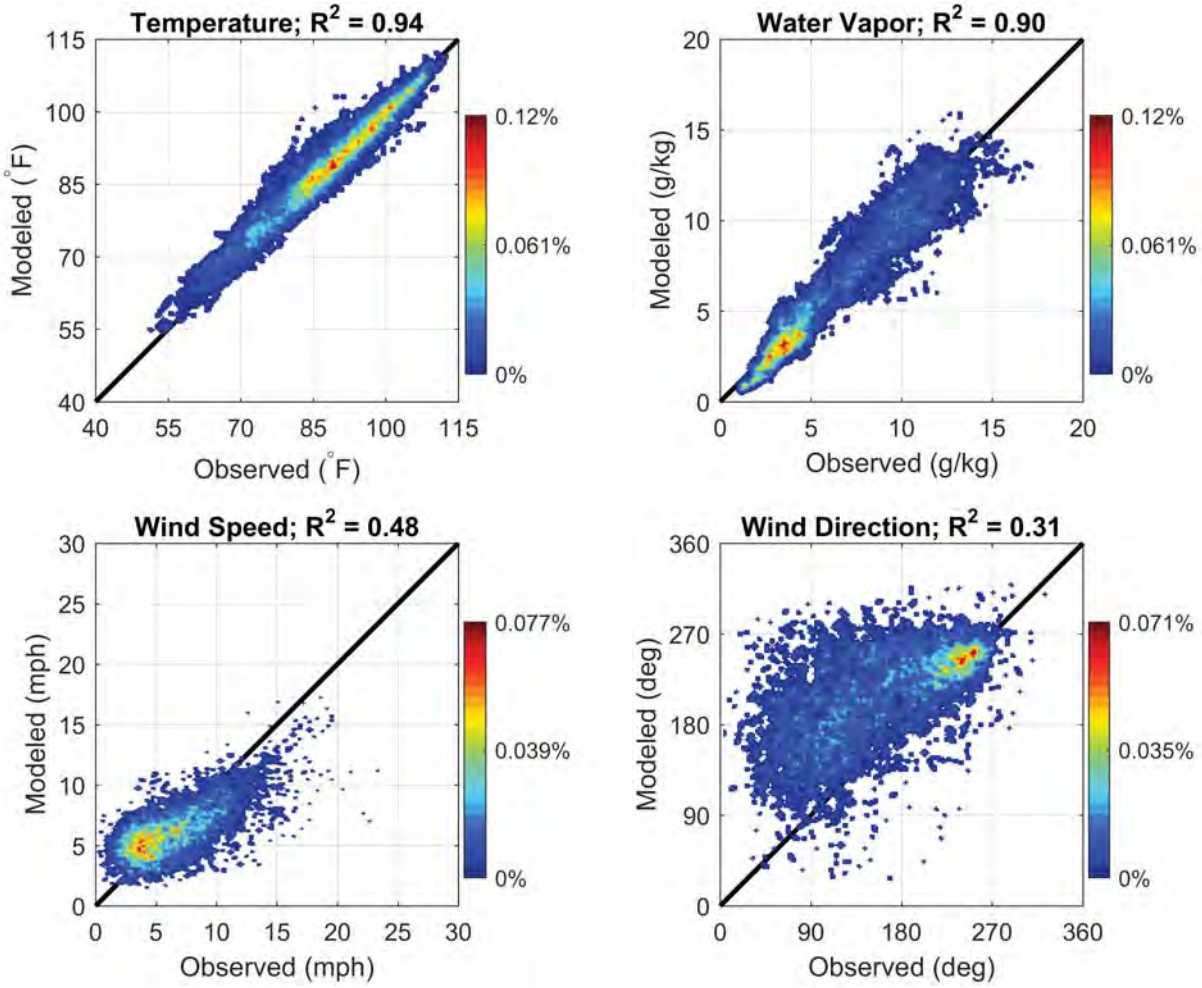


Figure IV-2. Scatter plots between modeled and observed temperature, water vapor mixing ratio, wind speed and wind direction during 2011 ozone season from May 1 through September 30

A Taylor diagram (Taylor, 2001) is also used to provide a statistical summary of how well modeled and observed values match each other in terms of their correlation and the ratio of their variances. In the Taylor diagram, the distance between modeled and observed values reflects the model simulation skills (Taylor, 2001). Figure IV-3 shows that WRF has the best skill in simulating the water vapor mixing ratio among all four variables because the point of standard deviation of water vapor mixing ratio lies closest to the reference arc line representing observations or zero mean error. The second best is temperature and

then followed by wind speed and wind direction. The temporal and spatial patterns of modeled temperature are regarded as the best agreement with observations because its correlation coefficient is the highest among four variables. Model performance for wind direction is poor because of the larger errors and biases with the lower correlation coefficient.

A soccer plot in Figure IV-4 provides normalized mean error and bias. Biases for temperature, mixing ratio, and wind speed are close to zero and are within the inner goal or first target box. Wind direction approaches to the second target box for bias and error. The literature review for the WRF model performance indicated that the MAG WRF model performance was comparable to the benchmark proposed by ENVIRON (Emery et al., 2001). The MAG WRF model performance for water vapor mixing ratio was improved by using the new cumulus physics and fractional cloud cover in the latest version of the WRF model. The MAG WRF model performance was also comparable to or even better than the EPA 2011 WRF simulations over North America (EPA, 2014b). The index of agreement for temperature and vapor mixing ratio provided better model performance in the MAG WRF simulations than the recent WRF sensitivity study results (Xie et al., 2012).

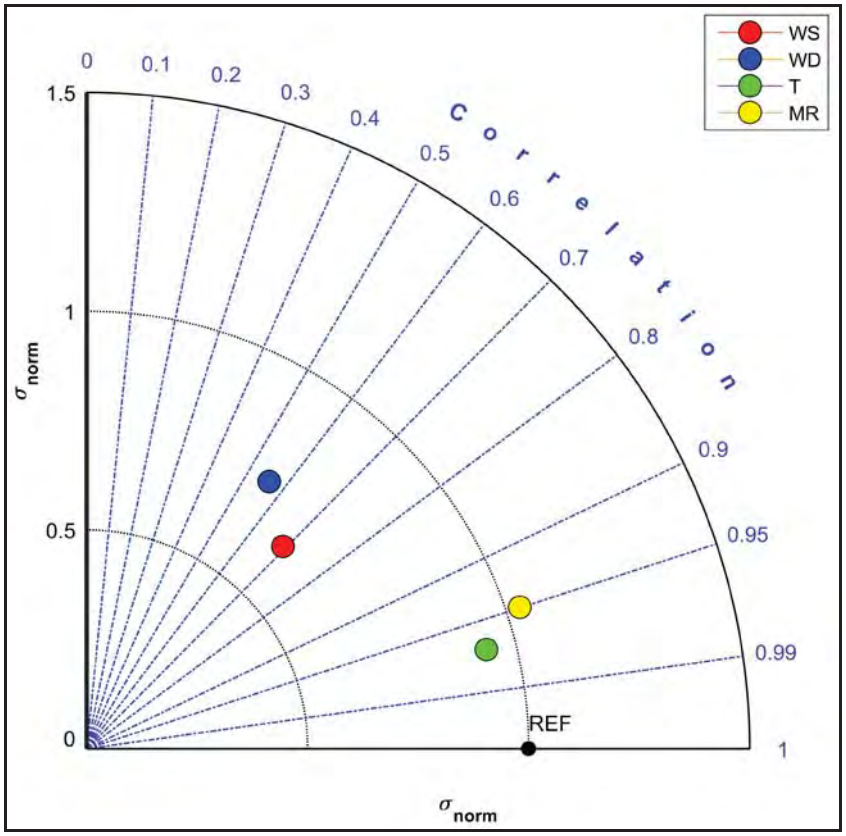


Figure IV-3. Taylor diagram showing the performance of WRF to simulate temperature (T), water vapor mixing ratio (MR), wind speed (WS), and wind direction (WD) over the 4 km modeling domain (REF denotes reference based on observations.)

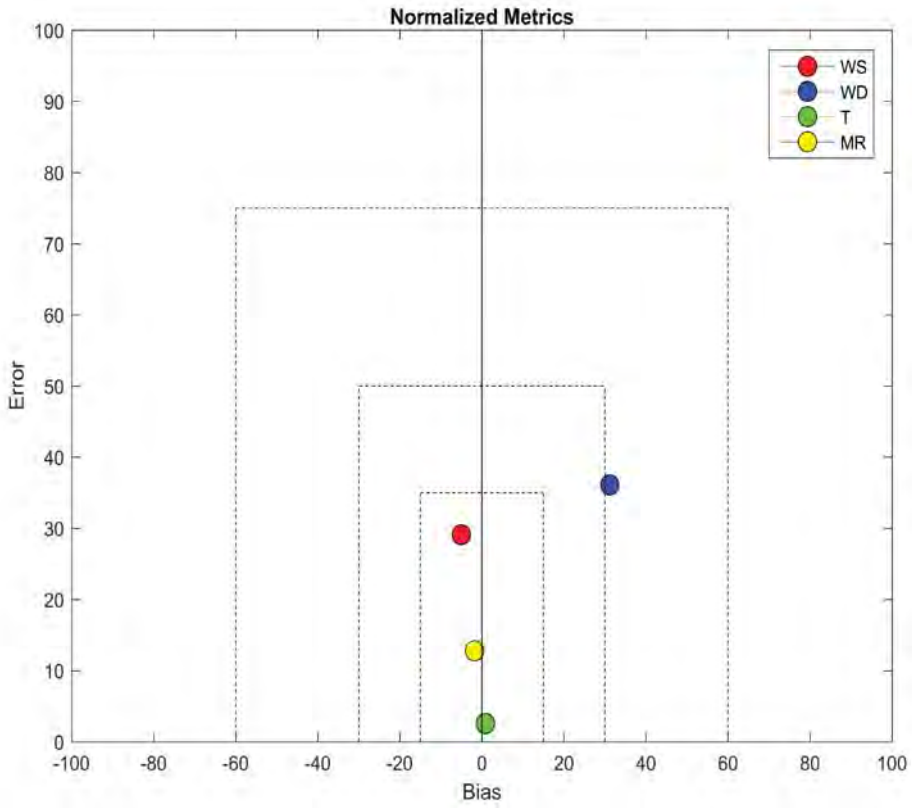


Figure IV-4. Soccer plot showing the performance of WRF to simulate surface temperature (T), water vapor mixing ratio (MR), wind speed (WS), and wind direction (WD) over the 4 km modeling domain

IV-2. CAMx Model Performance Evaluation

For the CAMx model performance evaluation, operational evaluation was conducted to assess how accurately the CAMx model replicates observed ozone concentrations for the 2011 base year. Statistical metrics, time series plots, scatter plots, maps of mean error and bias for monitors, and box plots were provided for the operational evaluation. The operational evaluation for the CAMx model may identify limitations and uncertainties in the model and model inputs that may require further improvements.

For the statistical performance evaluation, the observed and modeled ozone values in 2011 were evaluated for the statistical metrics provided in Table IV-1. Two numeric goals were used to determine if the CAMx model performed within the desirable statistical goals. The goal for normalized mean bias (NMB) is within ±15%, and the goal for the normalized mean error (NME) is less than 35%. The Index of Agreement is the standardized measure of the degree of model prediction error, and varies between zero and one. A value of zero indicates the poorest agreement between modeled and observed values, and one is the

perfect match.

Normalized mean biases and errors for one-hour and peak eight-hour ozone modeled values, and eight-hour ozone modeled values paired with eight-hour observed ozone values greater than 60 ppb for the five-month modeling period of May-September, 2011 were well within the goals, as shown in Tables IV-3, IV-4, and IV-5. All normalized mean biases for one-hour and peak eight-hour modeled ozone values, eight-hour modeled ozone values paired with eight-hour observed ozone values greater than 60 ppb in July, however, were over ±15% goal, which indicates that the CAMx model systematically underestimated ozone values in July. The Index of Agreement showed that one-hour and peak eight-hour modeled ozone values are overall in good agreement between modeled and observed values, but eight-hour ozone modeled values paired with eight-hour observed ozone values greater than 60 ppb did not match as well with observed values.

The percent of modeled days that meet the statistical goals for NME and NMB for all modeled ozone values and modeled values paired with observed ozone values greater than 60 ppb are provided in Table IV-6. Table IV-6 presented that more than 80% of the modeled days satisfied the goal for NME while roughly 60% of the modeled days met the goal for NMB.

Table IV-3. Statistical metrics by month for one-hour ozone modeled values for monitors

Metric	May	Jun	Jul	Aug	Sep	May-Sep
Number of Pairs (#)	20,435	19,810	20,137	20,098	19,686	100,166
Average Observed Value (ppb)	45.5	43.8	41.0	41.2	37.2	41.8
Average Modeled Value (ppb)	48.4	42.4	32.4	37.7	40.5	40.3
Mean Bias (ppb)	3.2	-1.1	-8.2	-3.0	3.7	-1.5
Mean Error (ppb)	12.3	10.3	12.0	11.1	12.0	11.5
Root Mean Square Error (ppb)	15.8	13.6	15.6	14.4	15.1	14.9
Fractional Bias (%)	1.6	-10.7	-28.8	-16.6	-5.1	-11.9
Fractional Error (%)	33.7	36.8	41.8	38.1	46.9	39.4
Normalized Mean Bias (%)	6.4	-3.3	-20.9	-8.4	8.7	-3.5
Normalized Mean Error (%)	26.8	23.4	29.5	26.9	31.7	27.5
Coefficient of Determination (R^2)	0.40	0.58	0.46	0.52	0.55	0.49
Index of Agreement	0.77	0.87	0.77	0.83	0.83	0.82

Table IV-4. Statistical metrics by month for eight-hour ozone modeled values for monitors

Metric	May	Jun	Jul	Aug	Sep	May-Sep
Number of Pairs (#)	851	829	839	840	808	4,167
Average Observed Value (ppb)	58.8	61.7	55.6	56.3	53.2	57.1
Average Modeled Value (ppb)	63.4	60.4	46.2	56.3	69.6	57.2
Mean Bias (ppb)	4.7	-1.1	-9.0	0.4	6.7	0.0
Mean Error (ppb)	9.3	6.4	10.9	9.2	10.2	9.2
Root Mean Square Error (ppb)	11.2	8.0	14.3	11.2	11.9	11.5
Fractional Bias (%)	6.6	-2.0	-19.0	-1.6	10.2	-1.2
Fractional Error (%)	15.0	10.5	22.1	16.2	17.9	16.3
Normalized Mean Bias (%)	7.8	-2.1	-16.9	-0.1	12.0	0.0
Normalized Mean Error (%)	15.7	10.4	19.9	16.1	18.9	16.0
Coefficient of Determination (R^2)	0.34	0.38	0.26	0.40	0.29	0.29
Index of Agreement	0.69	0.78	0.64	0.75	0.62	0.71

Table IV-5. Statistical metrics by month for eight-hour ozone modeled values paired with eight-hour observed ozone values greater than 60 ppb for monitors

Metric	May	Jun	Jul	Aug	Sep	May-Sep
Number of Pairs (#)	348	452	345	337	145	1,627
Average Observed Value (ppb)	66.2	68.6	65.6	66.2	64.7	66.7
Average Modeled Value (ppb)	70.9	64.5	51.5	66.1	68.9	63.8
Mean Bias (ppb)	4.8	-3.9	-13.8	0.0	4.2	-2.9
Mean Error (ppb)	10.4	6.9	15.7	11.0	9.0	10.5
Root Mean Square Error (ppb)	11.8	8.6	18.7	13.4	10.6	13.1
Fractional Bias (%)	5.9	-6.4	-26.1	-1.9	5.7	-6.2
Fractional Error (%)	15.0	10.4	28.6	16.8	13.2	16.7
Normalized Mean Bias (%)	7.0	-6.0	-21.5	-0.2	6.4	-4.5
Normalized Mean Error (%)	15.7	10.0	24.1	16.6	13.8	13.8
Coefficient of Determination (R^2)	0.02	0.14	0.00	0.01	0.01	0.03
Index of Agreement	0.38	0.57	0.22	0.33	0.28	0.37

Table IV-6. Percent of modeled days that meet the statistical goals for all modeled ozone values and ozone modeled values paired with observed ozone values above 60 ppb

Subset	Percent of Days with Normalized Mean Error less than 35%		Percent of Days with Normalized Mean Bias between +/- 15%	
	All Values	> 60 ppb	All Values	> 60 ppb
Eight-hour O_3	95%	97%	58%	68%
One-hour O_3	84%	93%	58%	64%

Time series plots of daily peak eight-hour ozone modeled values plotted over observations for each monitoring site are given in Figure IV-5. A time series plot of the network average daily peak eight-hour ozone values over the observed values is provided in Figure IV-6. Time series plots indicated that the CAMx model tended to underestimate the observed values in July and overestimate in August.

A scatter plot of daily peak eight-hour ozone modeled and observed values for all monitors are provided in Figure IV-7. The plot indicates that the CAMx modeled ozone values generally clustered around the best-fit-line, and have a slightly larger bias at higher ozone values above 60 ppb than at lower ozone values.

Figures IV-8 and 9 illustrated the spatial distributions of mean errors and mean biases of monitors for the daily peak eight-hour ozone modeled values. The mean errors for the West Phoenix and West Chandler monitors were the highest, those for all other monitors are relatively uniform in the range of 8-10 ppb. The mean biases of monitors in Figure IV-9 are relatively lower in the Phoenix urban core area and higher outside the urban core area.

The MAG CAMx model performance was compared against other modeling studies in Figure IV-10. Figure IV-10 presents the statistical metrics for the MAG CAMx modeled ozone values (with a red ‘x' within a box) overlaid over the documented results of numerous other modeling studies (Simon et al., 2012 and Appel et al., 2011). The box-and whisker plots in Figure IV-10 indicate that the bold center line in the box shows the median value from the survey of other modeling studies, the box outlines the 25th and 75th percentile values, and the whiskers extend to 1.5 times the interquartile range. The amount of studies used in each distribution is shown as "n" above the box-and-whisker. This comparison demonstrates that the metrics derived from the MAG CAMx modeled values are within or close to the distribution of the range of other published modeling studies. The MAG CAMx results were better than the median of the study sample sets for one-hour and eight-hour daily peak values for multiple metrics such as MB, NMB, RMSE, and ME.

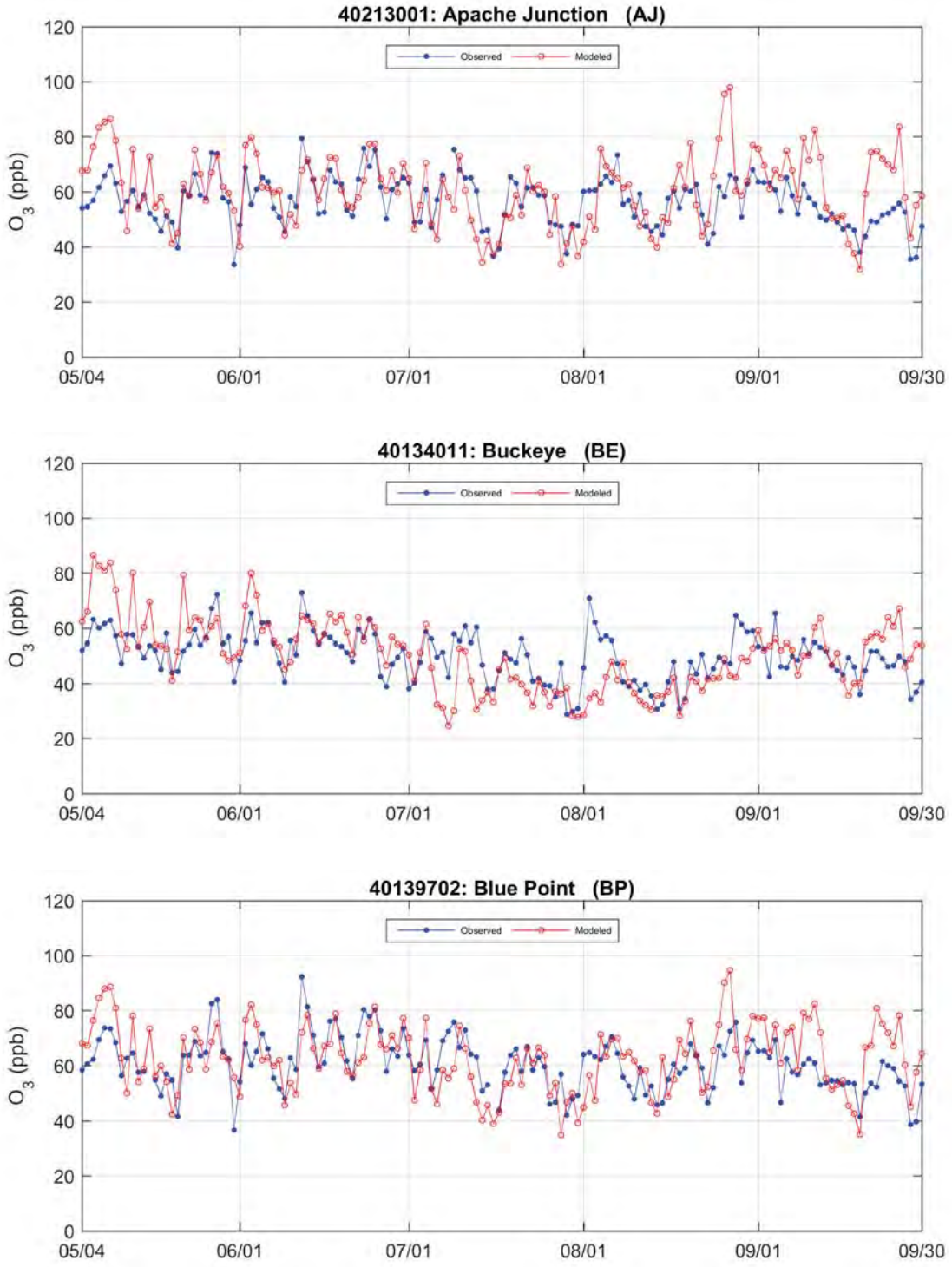
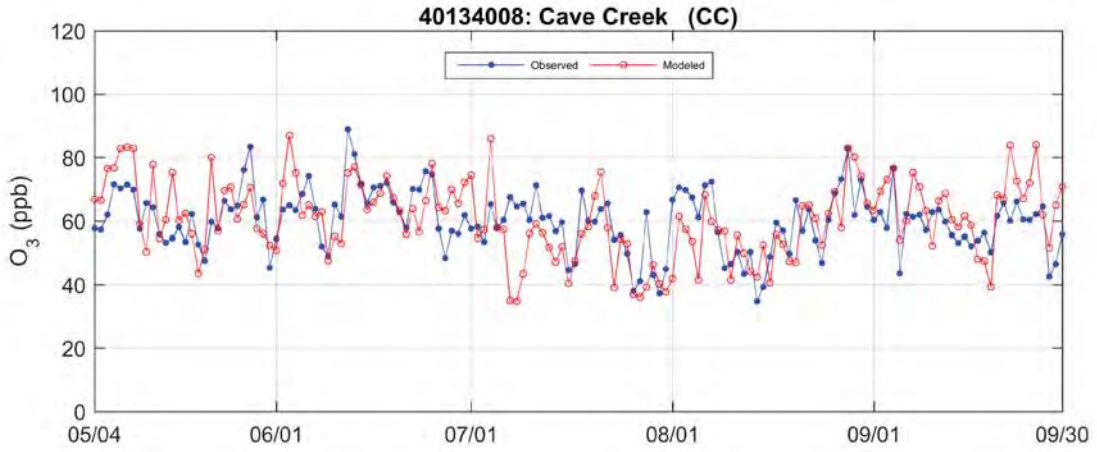
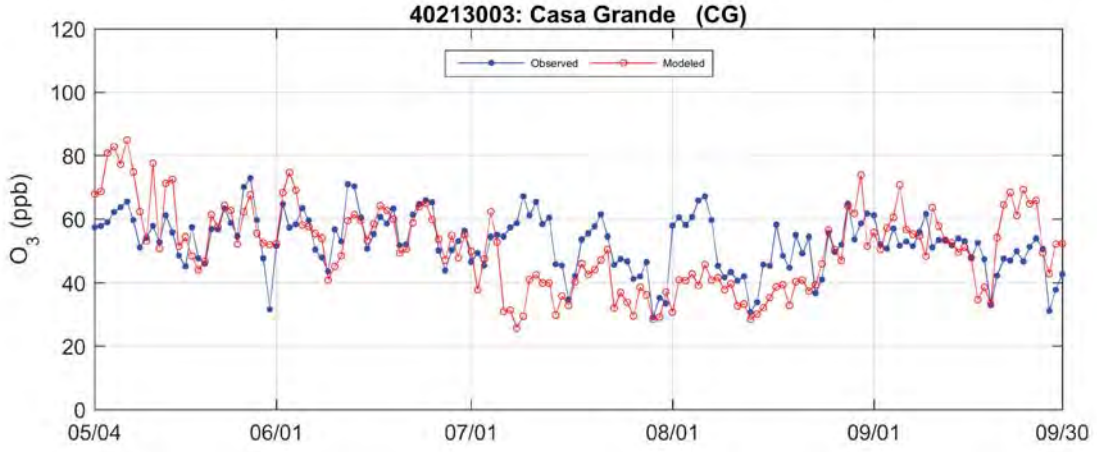
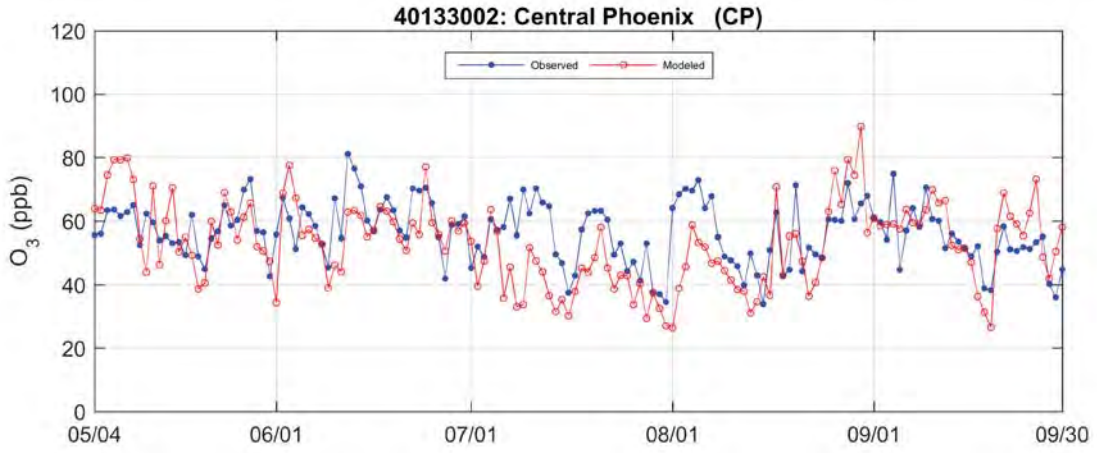


Figure IV-5. Time series plots of daily peak eight-hour ozone modeled values over observed ozone values for monitors







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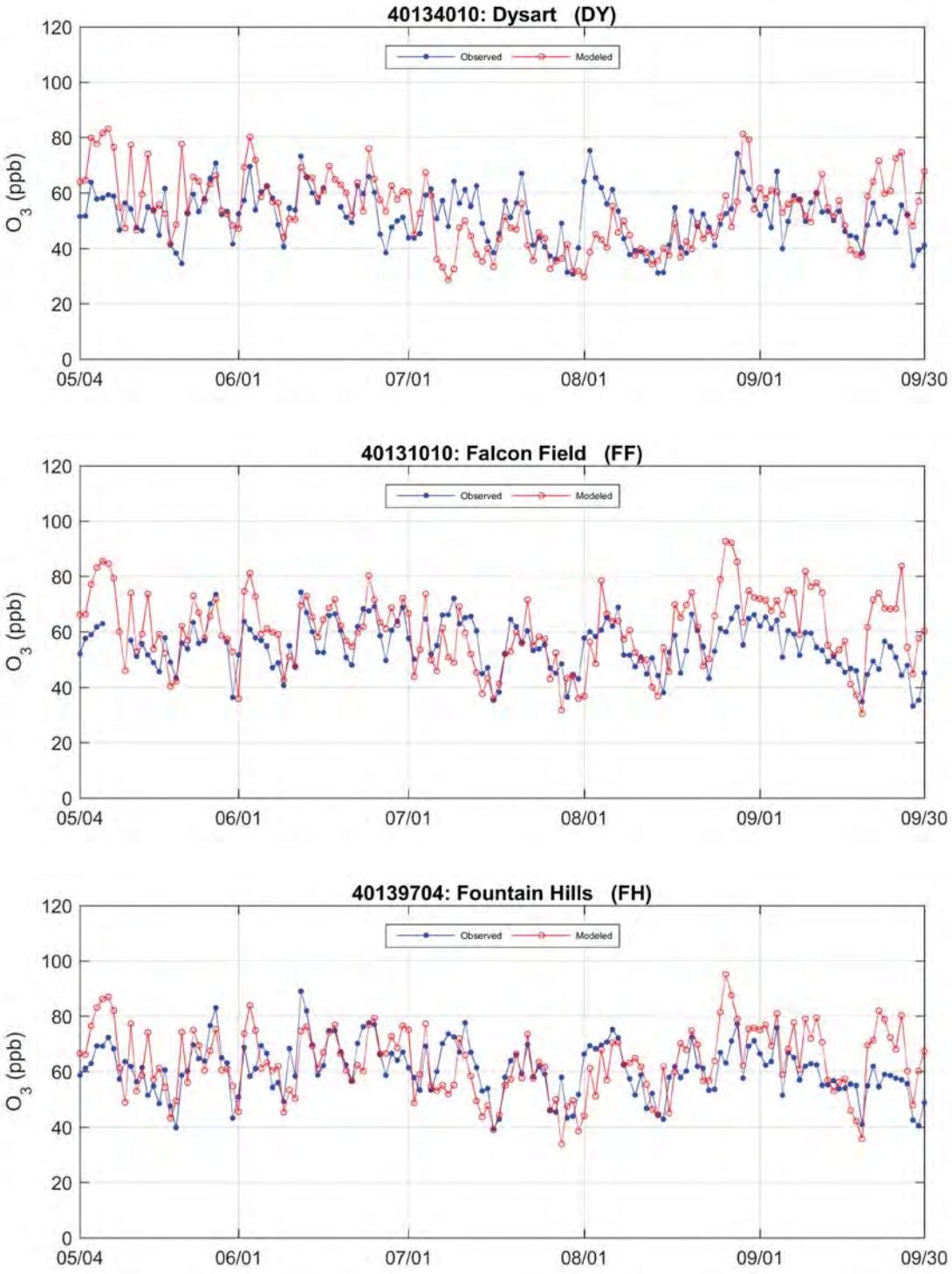

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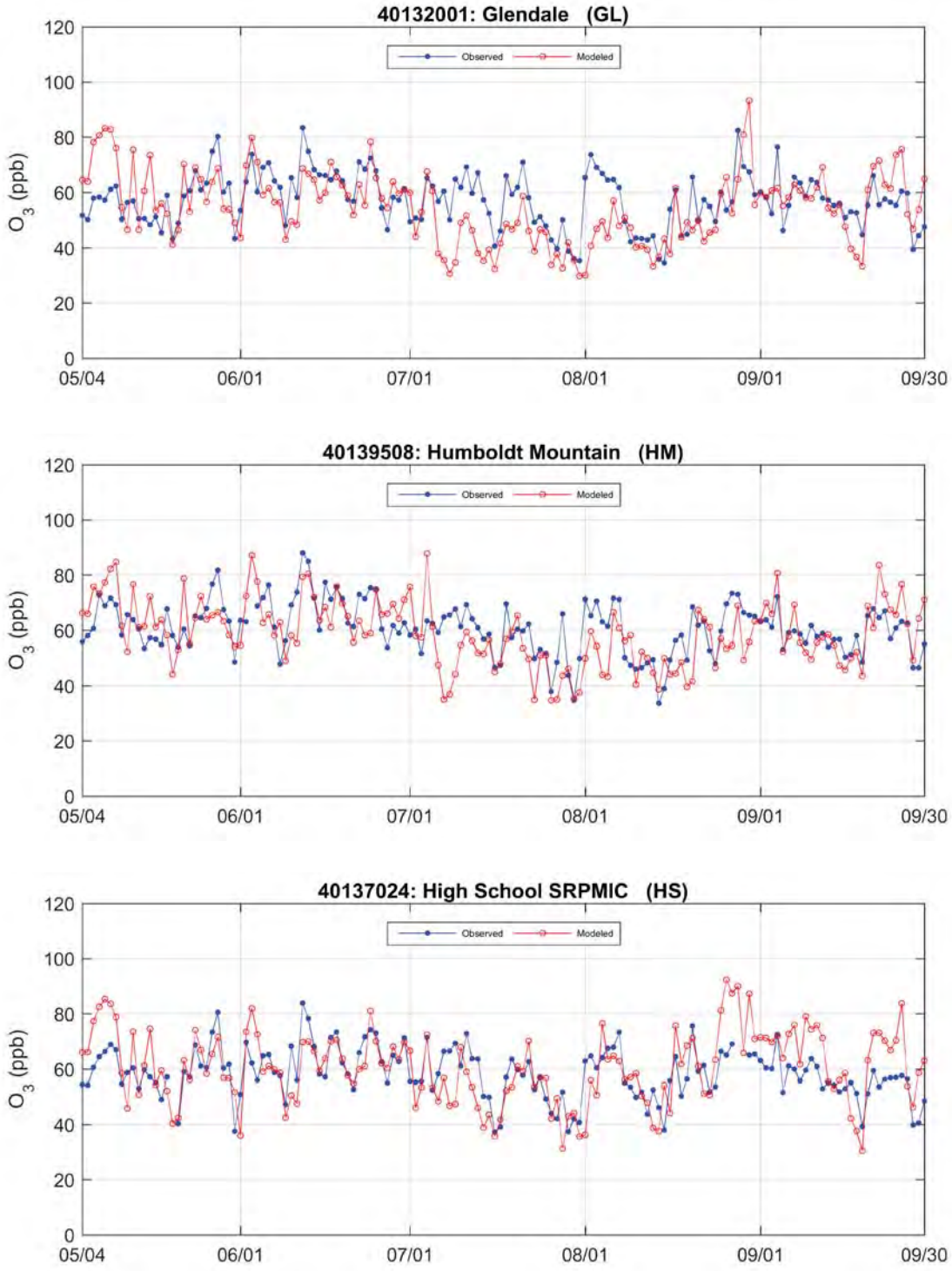

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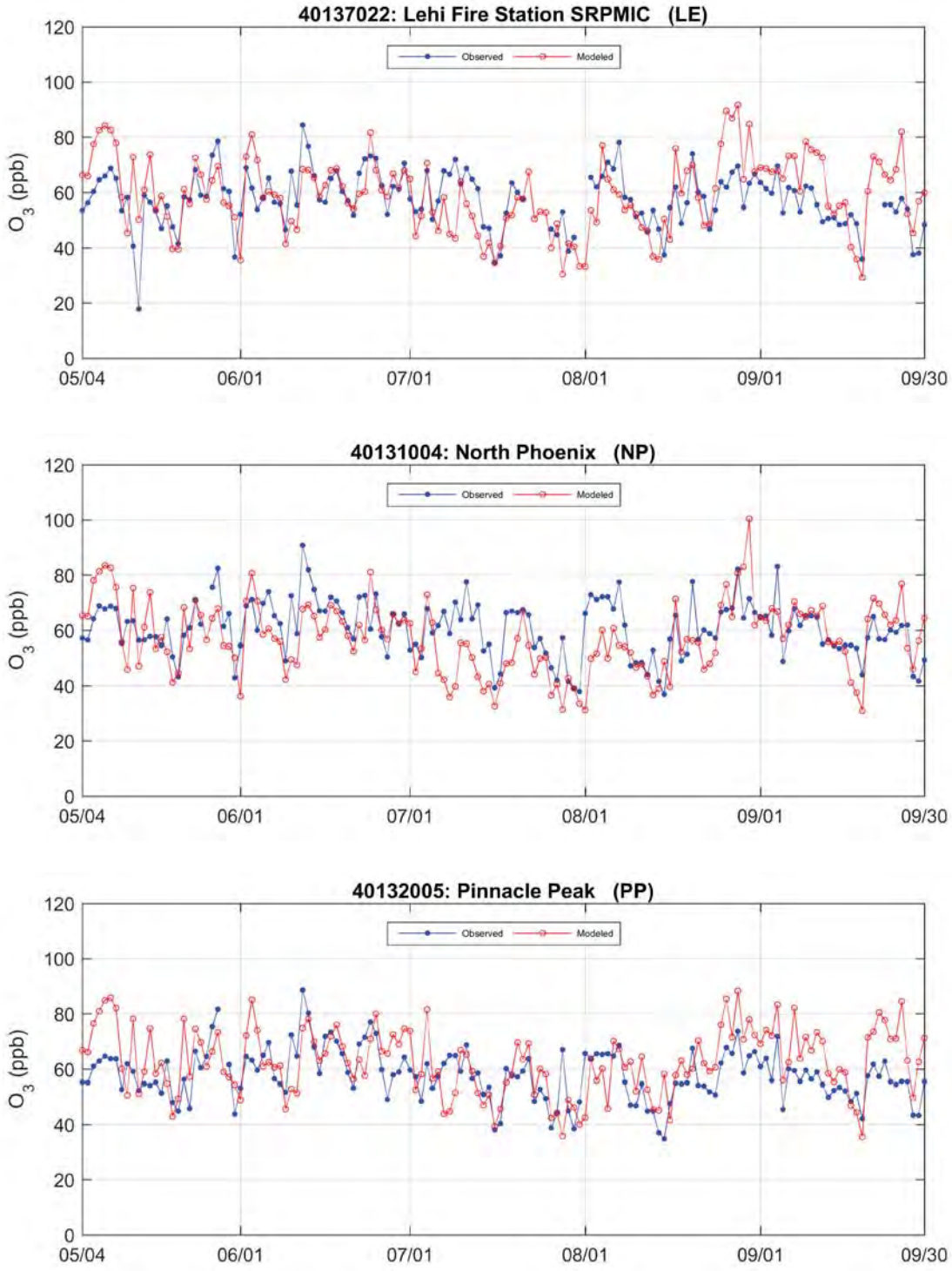

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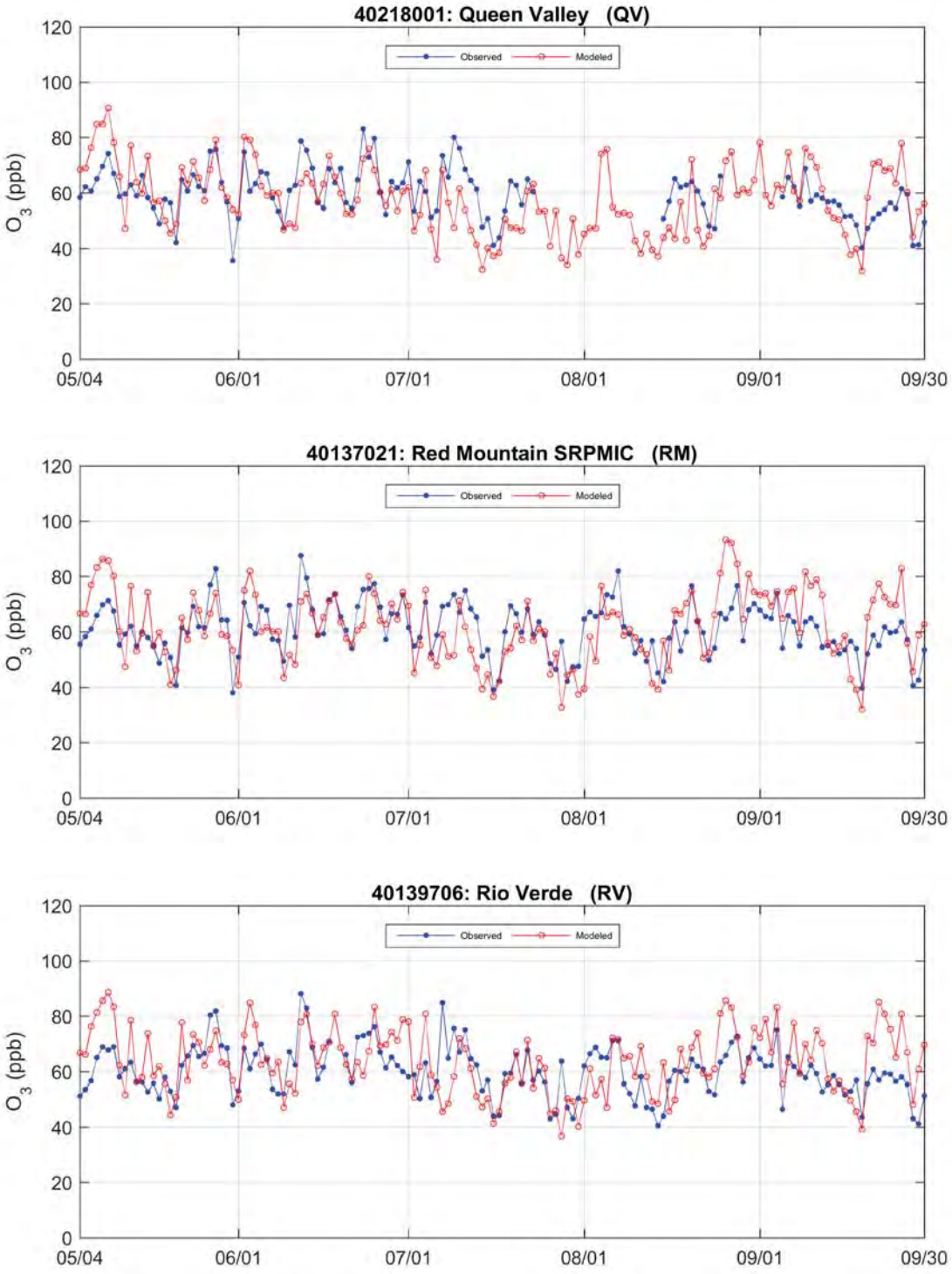

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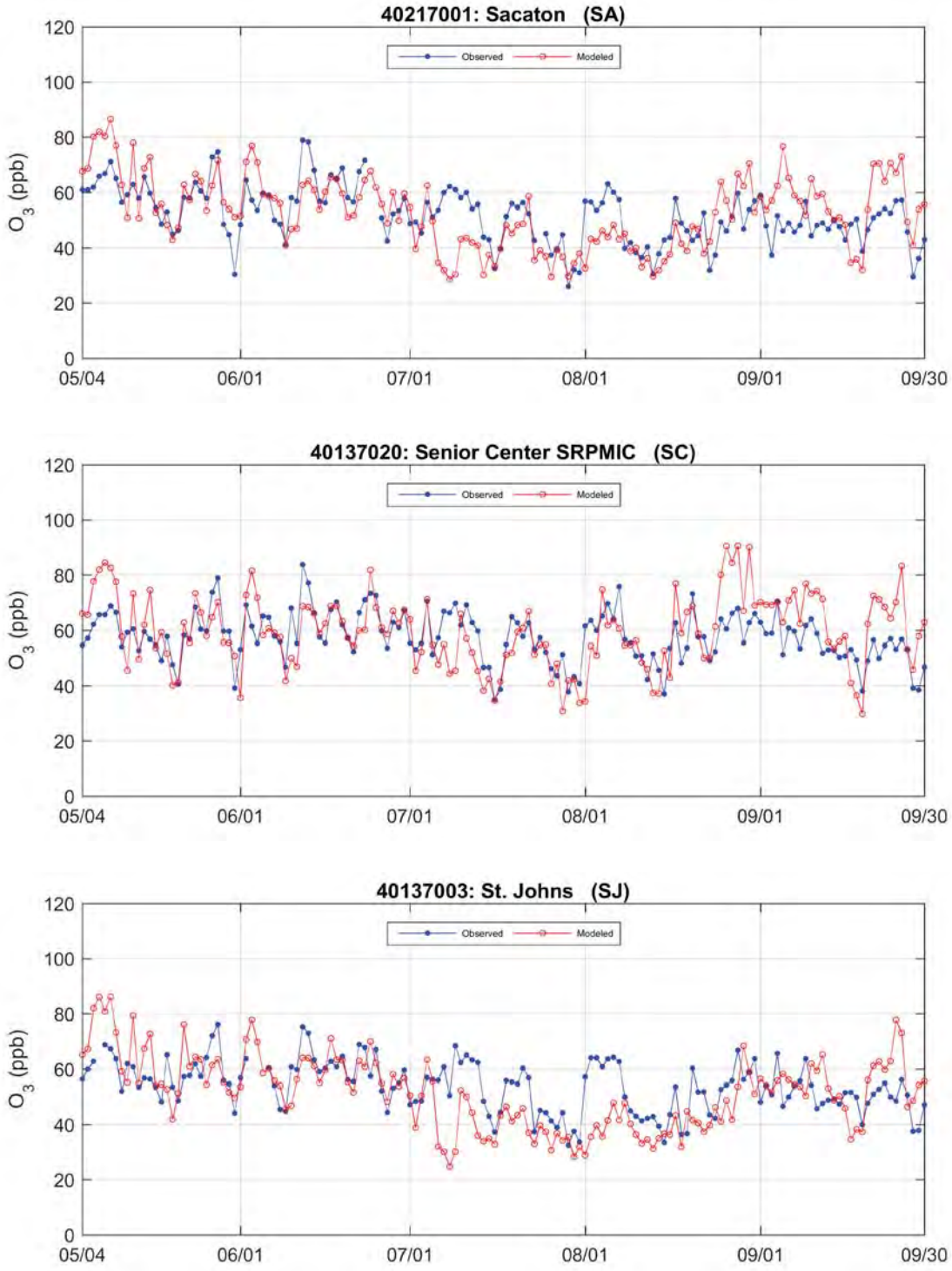

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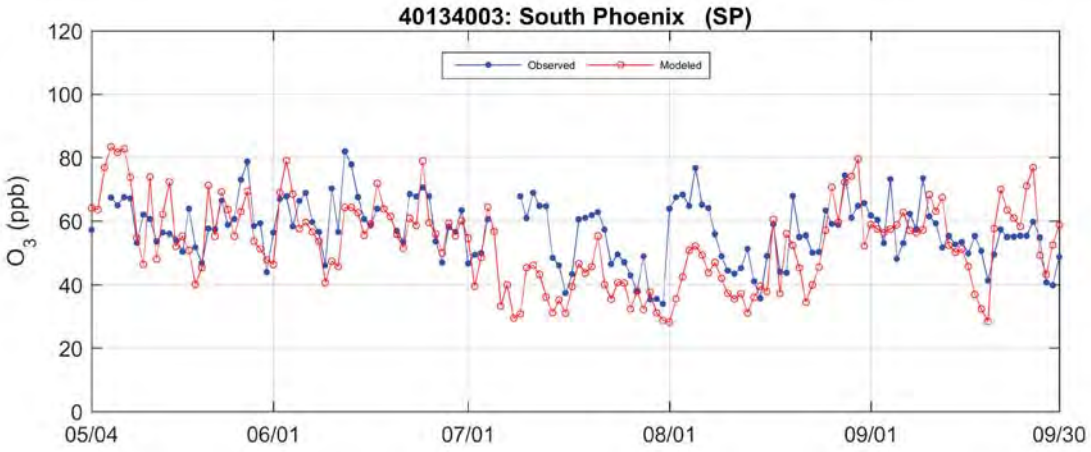

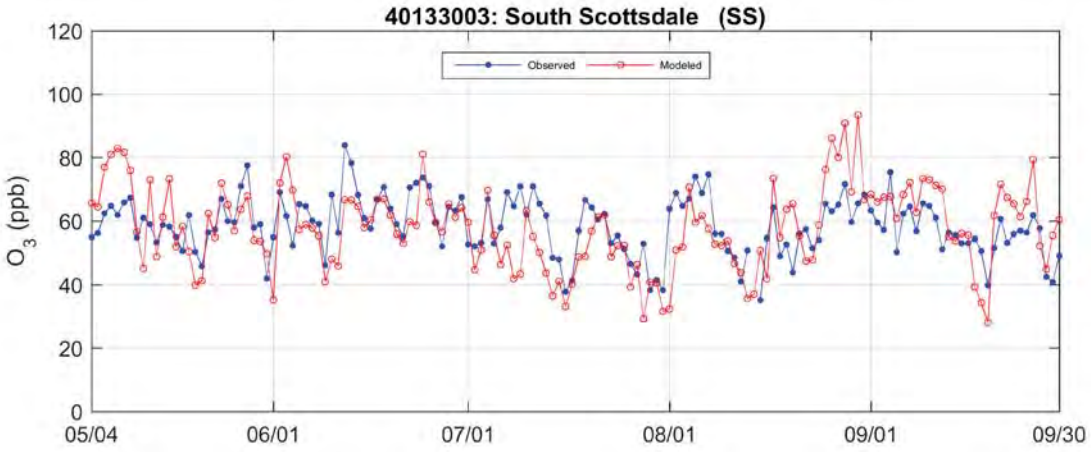

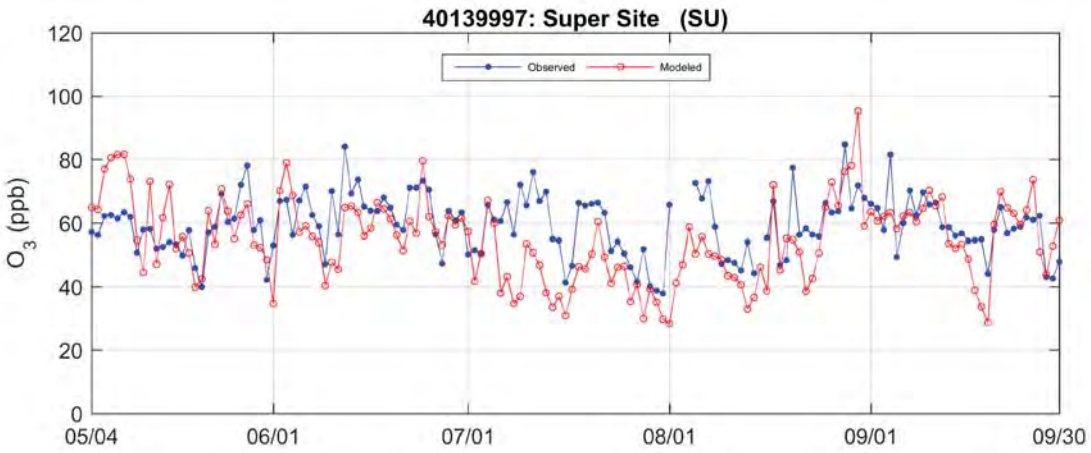

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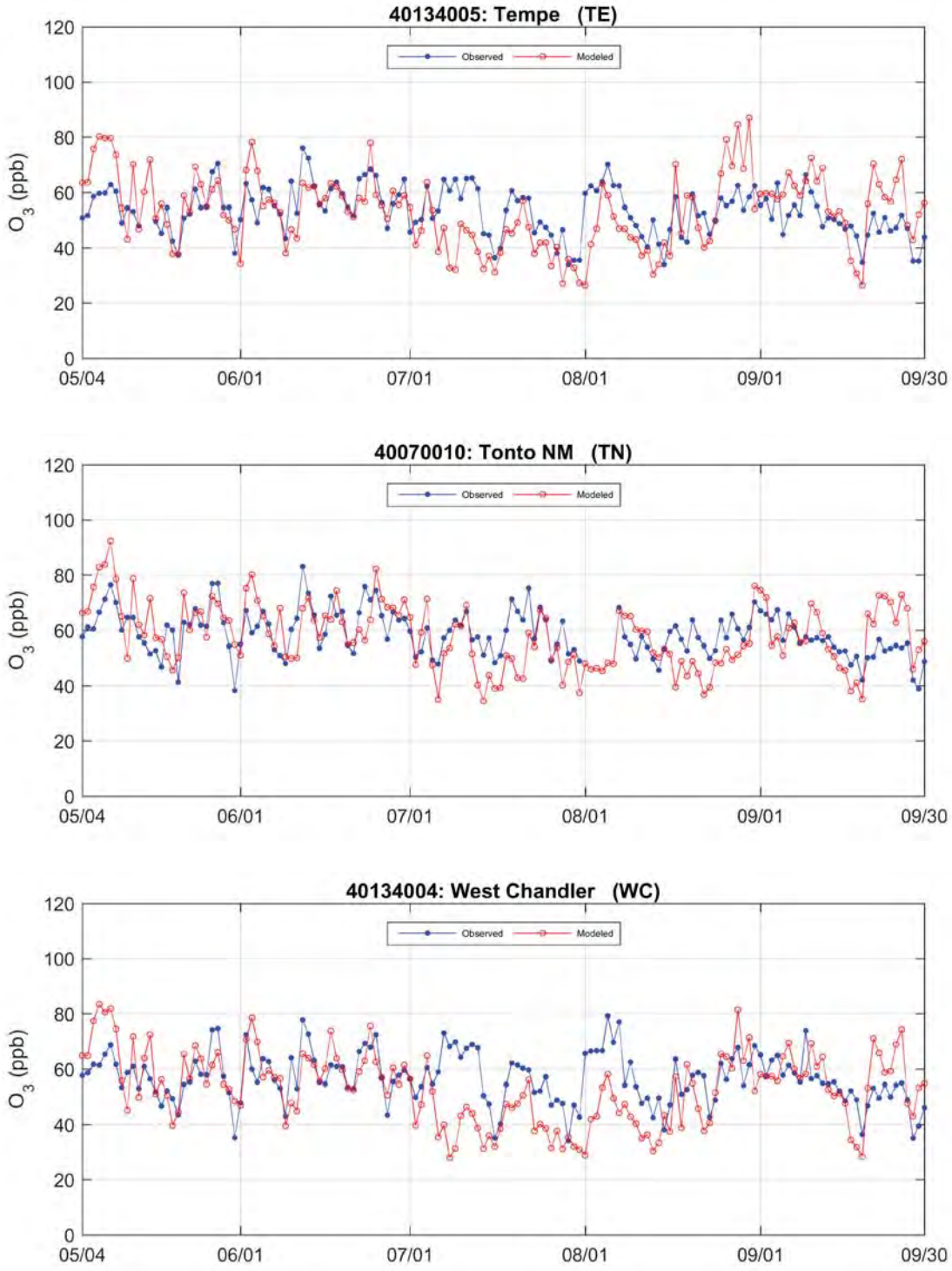

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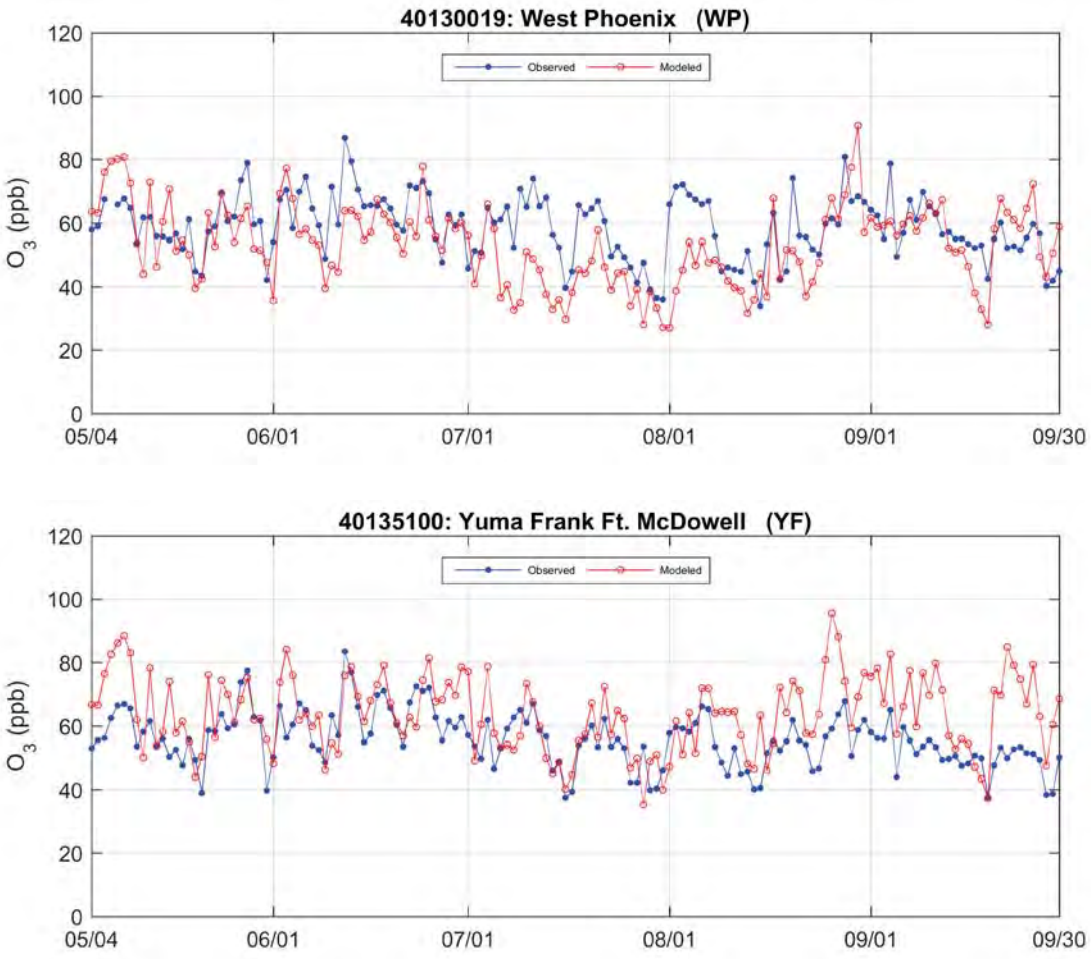

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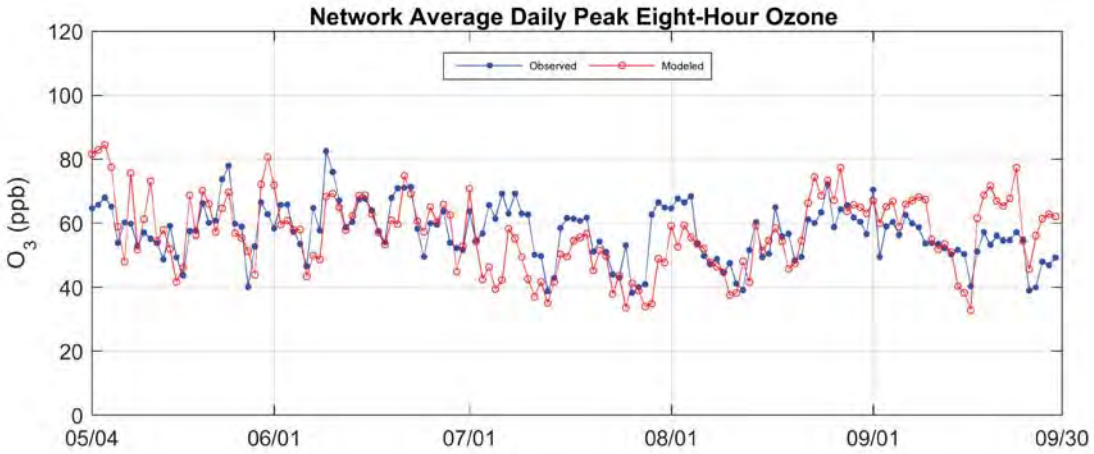


Figure IV-6. Time series of eight-hour daily peak ozone averaged over the network for observed and modeled concentrations for the base year simulation period

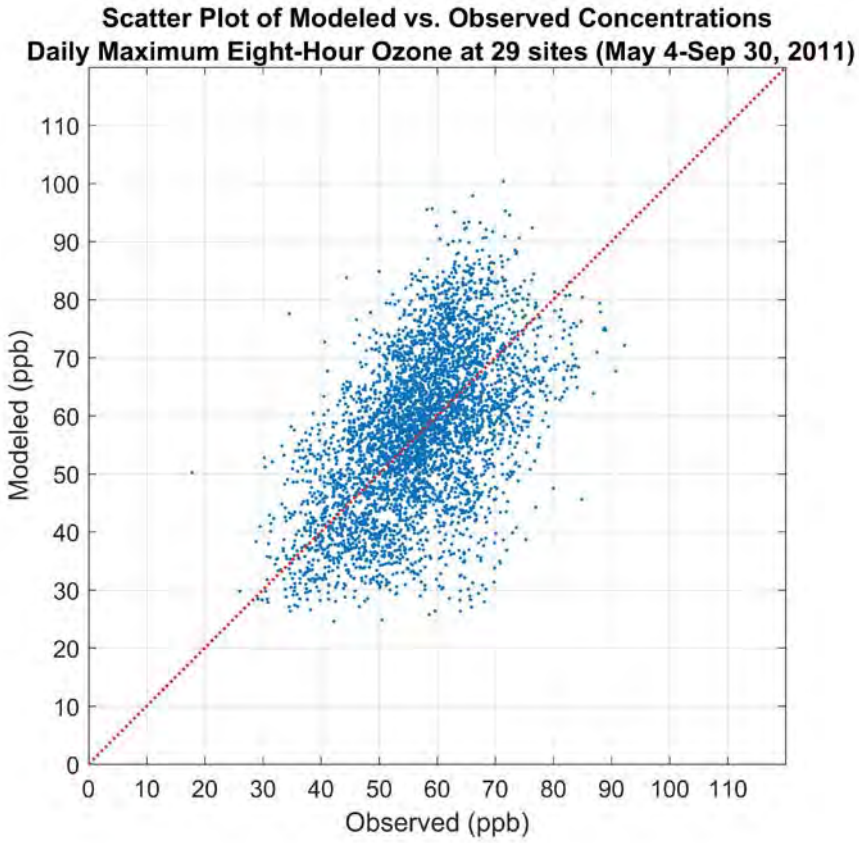


Figure IV-7. Scatter plot of daily peak eight-hour ozone observed and modeled concentrations for monitors

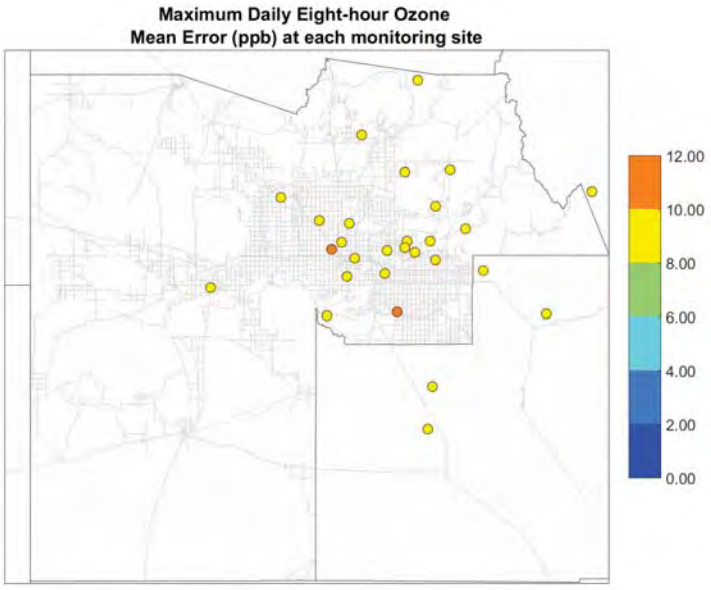


Figure IV-8. Spatial distribution of mean errors of monitors for daily peak eight-hour ozone values

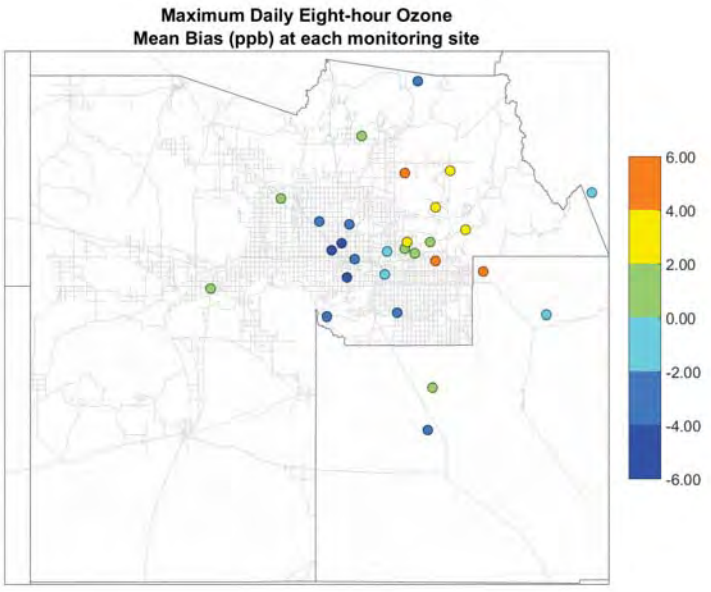


Figure IV-9. Spatial distribution of mean biases of monitors for daily peak eight-hour ozone values

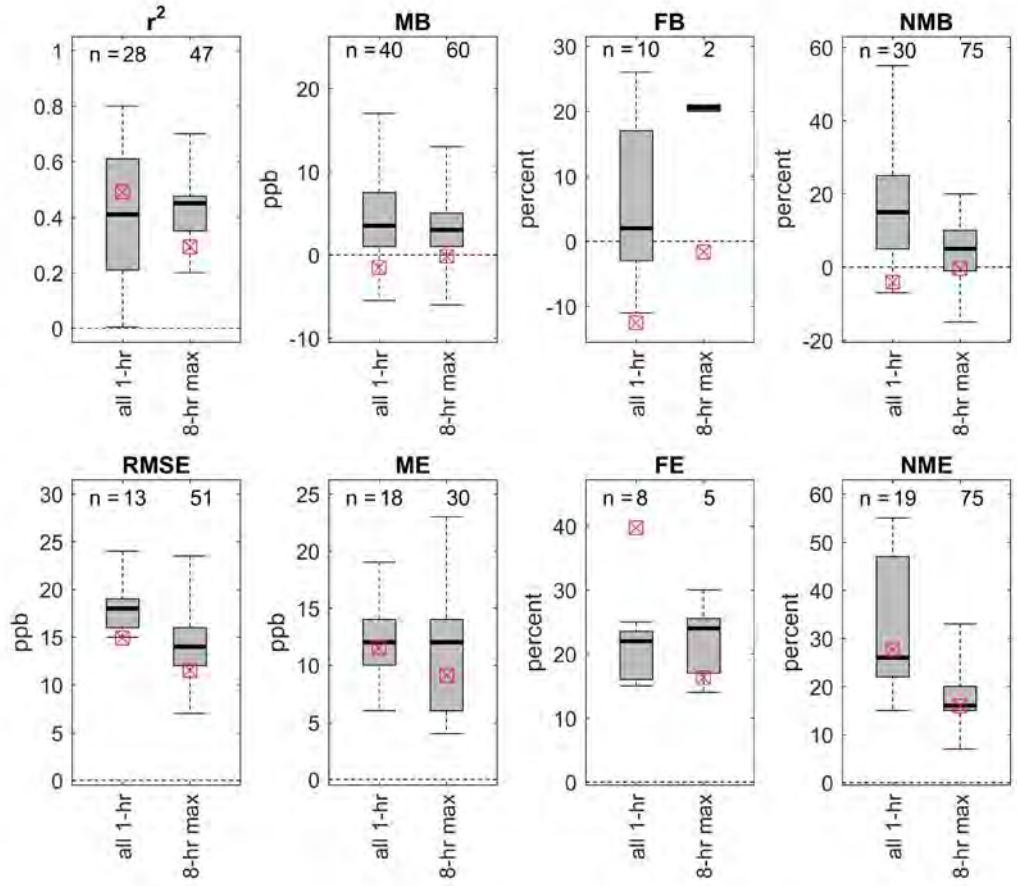


Figure IV-10. Comparison of the MAG CAMx model performance (the red box with a check mark) with other air quality model performance studies (Simon et al., 2012)

The operational model performance evaluation for the model episode days indicates that the CAMx model replicated ozone concentrations well, except for a few periods of under-predictions in July and over-prediction in August. However, these do not significantly affect the results of the attainment test presented in Section V of this document because the attainment test depends upon the base year design values for monitors and Relative Response Factors.

V. ATTAINMENT DEMONSTRATION

V-1. Monitoring Site Attainment Tests

Following the procedures described in the EPA guidance for the attainment demonstration (EPA, 2014a), the modeled ozone values from the CAMx 2011 and 2017 simulations were used to project the 2011 base year design values (DVB) to the 2017 future design values (DVF) for monitors. The 2011 base year design values for individual monitors were based on ozone observations for the five-year period of 2009 through 2013: the five-year weighted average of three design values for 2009-2011, 2010-2012, and 2011-2013. The DVB at each monitoring site was projected to the 2017 future design value with Relative Response Factor (RRF), which was facilitated by the EPA Model Attainment Test Software (MATS) v2.6.1 program. Equation 1 below describes the process in the simplified form.

$$(DVF)_i = (RRF)_i (DVB)_i \quad (1)$$

where:

$(DVB)_i$ = Baseline design value monitored at monitoring site i (unit: ppb)
$(RRF)_i$ = Relative response factor for monitoring site i (unitless)
$(DVF)_i$ = Estimated design value for the future year at monitoring site i (unit: ppb)

The RRF for each monitoring site is the ratio of the CAMx 2017 future year ozone prediction to the CAMx 2011 base year ozone prediction. The RRF for a monitor is based on the average of the maximum ozone predictions in the 3x3 grid cells surrounding the monitor for the highest 10 modeled days in the CAMx 2011 base year simulation and the average of the CAMx 2017 ozone predictions on the same grid cells of the maximum ozone predictions for the highest ten modeled days in the CAMx 2011 base year simulation.

The 2017 design values for monitors were compared to the 2008 ozone NAAQS for the attainment test. The sites with 2017 design values that do not exceed the NAAQS are projected to be attainment in 2017. Since ozone design values are truncated to integer values in determining compliance with the NAAQS, a design value of 75.9 ppb is truncated to 75 ppb which is considered attainment, whereas design values at or above 76.0 ppb are considered nonattainment.

Table V-1 presented the three-year average design values of monitors, which are the three-year average of the annual fourth-highest daily maximum eight-hour average ozone concentrations, and the five-year weighted baseline design values (DVB) of monitors for the 2011 base year. The maximum DVB for the 2011 base year was estimated at 79.7 ppb at the North Phoenix monitoring site.

Table V-1. Three-year average design values and five-year weighted baseline design values (DVB) for monitors for the 2011 base year (unit: ppb)

Site Name	Site Abbr.	AIRS	2009-2011	2010-2012	2011-2013	DVB*
West Phoenix	WP	040130019	73	78	79	76.7
North Phoenix	NP	040131004	77	81	81	79.7
Falcon Field	FF	040131010	68	69	72	69.7
Glendale	GL	040132001	72	76	76	74.7
Pinnacle Peak	PP	040132005	74	77	77	76.0
Central Phoenix	CP	040133002	71	74	75	73.3
South Scottsdale	SS	040133003	74	77	76	75.7
South Phoenix	SP	040134003	72	76	76	74.7
West Chandler	WC	040134004	72	74	72	72.7
Tempe	TE	040134005	68	70	71	69.7
Cave Creek	CC	040134008	75	77	77	76.3
Dysart	DY	040134010	70	71	72	71.0
Buckeye	BE	040134011	64	66	65	65.0
Fort McDowell/Yuma Frank	YF	040135100	69	70	72	70.3
Senior Center	SC	040137020	72	74	75	73.7
Red Mountain	RM	040137021	76	77	77	76.7
Lehi	LE	040137022	72	73	75	73.3
High School	HS	040137024	72	74	74	73.3
Humboldt Mountain	HM	040139508	71	75	76	74.0
Blue Point	BP	040139702	72	75	77	74.7
Fountain Hills	FH	040139704	73	76	74	74.3
Rio Verde	RV	040139706	73	74	75	74.0
Super Site	SU	040139997	75	76	77	76.0
Apache Junction	AJ	040213001	72	74	73	73.0

* The EPA Guidance (EPA, 2014a) recommended that the tenths of design value in ppb be used in all documentation and be truncated to integer value for the future design value in ppb to compare to the NAAQS.

Ozone design values for the 2011 base year and the 2017 future year and RRF for each monitoring site in the Maricopa eight-hour ozone nonattainment area are provided in Table V-2. All monitoring sites have RRFs less than one, which indicates that the CAMx ozone predictions in the future year are lower than those for the base year. The maximum 2017 future design value of 75.6 ppb at the North Phoenix site was calculated as follows:

79.7 ppb	x	0.9487	=	75.6 ppb
(DVB_{2011})		(RRF_{NP})		(DVB_{2017})

Significant figures to the right of the decimal point in the future design values were truncated as the final future design value for the attainment test. The peak predicted future design value for monitors is 75 ppb, as shown in Table V-2. The range of the 2017 future design values for monitors in the Maricopa eight-hour ozone nonattainment area are 63 - 75 ppb. Eight monitors in the Maricopa eight-hour ozone nonattainment area were predicted above 70 ppb and below 75 ppb, which are mostly located in the Phoenix urban core area. Since all these future design values are less than or equal to 75 ppb, the Maricopa eight-hour ozone nonattainment area has successfully passed the model attainment test for the 2008 ozone standard for the 2017 attainment year.

Table V-2. 2011 and 2017 design values for monitors in the Maricopa eight-hour ozone nonattainment area

Site Name	Site Abbr.	AIRS	2011 Base Year Design Value (ppb)	RRF	2017 Future Year Design Value (ppb)
West Phoenix	WP	040130019	76.7	0.9561	73.3
North Phoenix	NP	040131004	79.7	0.9487	**75.6**
Falcon Field	FF	040131010	69.7	0.9318	64.9
Glendale	GL	040132001	74.7	0.9633	71.9
Pinnacle Peak	PP	040132005	76.0	0.9232	70.1
Central Phoenix	CP	040133002	73.3	0.9518	69.7
South Scottsdale	SS	040133003	75.7	0.9463	71.6
South Phoenix	SP	040134003	74.7	0.9580	71.5
West Chandler	WC	040134004	72.7	0.9602	69.8
Tempe	TE	040134005	69.7	0.9721	67.7
Cave Creek	CC	040134008	76.3	0.9391	71.6
Dysart	DY	040134010	71.0	0.9597	68.1
Buckeye	BE	040134011	65.0	0.9754	63.4
Fort McDowell/Yuma Frank	YF	040135100	70.3	0.9309	65.4
Senior Center	SC	040137020	73.7	0.9454	69.6
Red Mountain	RM	040137021	76.7	0.9343	71.6
Lehi	LE	040137022	73.3	0.9470	69.4
High School	HS	040137024	73.3	0.9403	68.9
Humboldt Mountain	HM	040139508	74.0	0.9438	69.8
Blue Point	BP	040139702	74.7	0.9383	70.0
Fountain Hills	FH	040139704	74.3	0.9351	69.4
Rio Verde	RV	040139706	74.0	0.9243	68.3
Super Site	SU	040139997	76.0	0.9590	72.8
Apache Junction	AJ	040213001	73.0	0.9314	67.9

V-2. Unmonitored Area Analysis

Since high ozone concentrations can occur in unmonitored areas, the unmonitored area analysis was conducted to investigate ozone concentrations in unmonitored areas in the 4 km modeling domain. This analysis may identify the areas where future year design values are greater than the 2008 ozone standard. The EPA guidance (EPA, 2014a) recommends the following procedures:

- Interpolates base year design values, which are also used in the attainment test, to develop spatial fields using the inverse distance weights.
- Adjusts the spatial fields using gridded model output.
- Calculates gridded RRF, which are derived by gridded modeled outputs for base and future years.
- Creates future year spatial fields by applying the gridded RRF to the base year gradient adjusted spatial fields.

The EPA MATS v2.6.1 was coded by following the above procedures, and used to conduct the unmonitored analysis. The EPA MATS model predicted all values in the grid cells of the Maricopa eight-hour ozone nonattainment area below the 2008 ozone standard. The maximum design value of 75.5 ppb was predicted in a grid cell in unmonitored area located northwest of the Supersite. The contour plot of the unmonitored area analysis results is illustrated in Figure V-1.

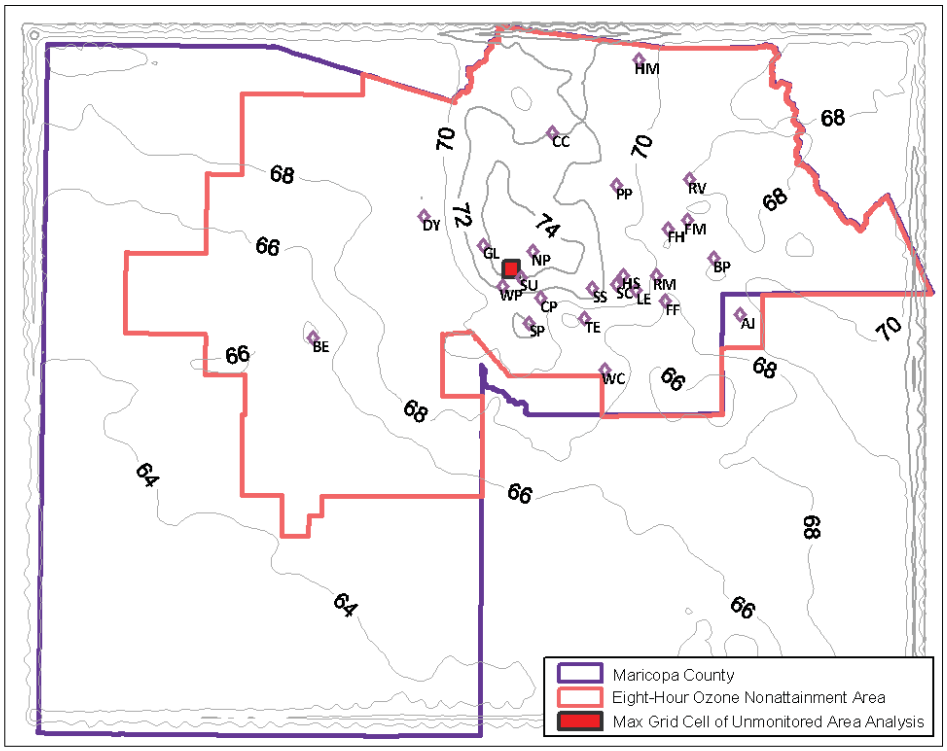


Figure V-1. Contour plot of the future design values for unmonitored area

V-3. Onroad Emissions Budget for Conformity

In accordance with the 1990 Clean Air Act (CAA) Amendments, transportation conformity requirements are intended to ensure that transportation activities do not result in air quality degradation. Section 176 of the CAA requires that transportation plans, programs, and projects conform to applicable air quality plans before the transportation action is approved by a Metropolitan Planning Organization (MPO). The designated MPO for Maricopa County is the Maricopa Association of Governments.

Section 176(c) of the CAA provides the framework for ensuring that Federal actions conform to air quality plans under section 110. Conformity to an implementation plan means that proposed activities should not: (1) cause or contribute to any new violation of any standard in any area, (2) increase the frequency or severity of any existing violation of any standard in any area, or (3) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

EPA transportation conformity regulations establish criteria involving comparison of projected transportation plan emissions with the motor vehicle emissions assumed in applicable air quality plans. These regulations define the term “motor vehicle emissions budget” as meaning “the portion of the total allowable emissions defined in a revision of the applicable implementation plan (or in an implementation plan revision which was endorsed by the Governor or his or her designee) for a certain date for the purpose of meeting reasonable further progress milestones or attainment demonstrations, for any criteria pollutants or its precursors, allocated by the applicable implementation plan to highway and transit vehicles.”

On June 13, 2012, EPA published the final rule approving the MAG 2007 Eight-Hour Ozone Plan, including the 2008 emissions budgets for VOC of 67.9 metric tons per day and NOx of 138.2 metric tons per day, effective July 13, 2012. On September 17, 2014, EPA published a final rule approving the MAG 2009 Eight-Hour Ozone Maintenance Plan, including the 2025 emissions budget for VOC of 43.8 metric tons per day and NOx of 101.8 metric tons per day, effective October 17, 2014.

The MAG 2017 Moderate Area Ozone Plan establishes 2017 conformity budgets based on 2017 onroad mobile source VOC and NOx emissions in the Maricopa eight-hour ozone nonattainment area that were used to model attainment of the 2008 ozone standard of 0.075 ppm. The 2017 conformity budgets are represented by the onroad VOC and NOx emissions on average daily emissions of May 1 through September 30. The methodology used in estimating onroad mobile source emissions in 2017 is discussed in Section III-1-4. As shown in Table V-3, the average daily onroad motor vehicle emissions in the Maricopa eight-hour ozone nonattainment area for the period of May through September are 45.7 metric tons per day for VOC and 62.7 metric tons per day for NOx. These represent the 2017 emissions budgets that will be used in future transportation conformity analyses that begin after these emissions budgets have been found to be adequate or are approved by EPA as part of this plan. In subsequent conformity analyses, onroad mobile source

emissions for conformity horizon years of 2017 and beyond should not exceed the 2017 VOC and NOx emissions budgets.

Table V-3. Average daily anthropogenic emissions of May 1 through September 30 in the Maricopa eight-hour ozone nonattainment area (unit: metric tons/day)

Emission Source	VOC			NOx			CO		
	2011	2017	Emission Reduction (2017-2011)	2011	2017	Emission Reduction (2017-2011)	2011	2017	Emission Reduction (2017-2011)
Point	2.47	3.32	+0.85	7.02	13.75	+6.73	4.41	6.75	+2.34
Area	94.46	96.05	+1.59	10.96	12.59	+1.63	7.71	8.50	+0.79
Nonroad	27.89	20.26	-7.63	53.58	36.26	-17.32	343.58	310.41	-33.17
Onroad	70.96	45.65	-25.31	117.15	62.69	-54.46	675.97	492.98	-182.99
Total	195.78	165.28	-30.50	188.71	125.29	-63.42	1,031.67	818.64	-213.03

V-4. Reasonable Further Progress - 15 Percent Rate of Progress Demonstration

In accordance with Clean Air Act Section 182(b)(1), the nonattainment area that is classified as Moderate for the 2008 ozone standard must submit a Rate of Progress (ROP) plan to provide for a 15 percent reduction in VOC emissions across the nonattainment area over a six-year period from the base year anthropogenic emissions, the years 2012 through 2017. For the purpose of meeting the 15 percent ROP requirements in the Maricopa eight-hour ozone nonattainment area, the base year 2011 average daily anthropogenic VOC emissions for the period of May 1 through September 30 in the nonattainment area were reduced by at least 15 percent by 2017. The 2017 ROP 15 percent reduction target of 166.41 metric tons per day is calculated by multiplying the 2011 average daily anthropogenic VOC emissions of 195.78 metric tons per day (Table V-3) by 85% (100% - 15%) as follows:

195.78 metric tons per day x (100% - 15%) = 166.41 metric tons per day

The 2017 average daily anthropogenic VOC emissions of 165.28 metric tons per day is less than the 2017 ROP 15 percent reduction target of 166.41 metric tons per day. Therefore, the 2017 average daily anthropogenic VOC emissions in the Maricopa eight-hour ozone nonattainment area satisfy the CAA Section 182(b)(1) reasonable further progress and 15 percent ROP plan requirements.

V-5. Ozone Control Measures Used for Numeric Credit

Chapter Five of the MAG 2017 Eight-Hour Ozone Moderate Area Plan includes a table of the 93 existing federal, state and local ozone control measures. The 93 existing ozone control measures have been approved by EPA in prior regional air quality plans or in separate EPA actions. The continuous implementation of these existing control measures in the nonattainment area assists in the attainment of the 2008 ozone standard in 2017. Only a subset of these control measures has quantifiable emission reduction benefits that were used to demonstrate attainment and meet contingency measure requirements. The federal, state, and local control measures used in demonstrating attainment of the 2008 ozone standard are as follows:

1. Summer Fuel Reformulation: California Phase 2 and Federal Phase II Reformulated Gasoline with 7 psi from May 1 through September 30
2. Phased-In Emission Test Cutpoints
3. One-time Waiver from Vehicle Emissions Test
4. Tougher Enforcement of Vehicle Registration and Emissions Test Compliance
5. Expansion of Area A Boundaries
6. Gross Polluter Option for I/M Program Waivers
7. Coordinated Traffic Signal Systems
8. Develop Intelligent Transportation Systems
9. Federal Tier 2 and Tier 3 Motor Vehicle Emissions and Fuel Standards
10. Federal Phase 1 and 2 Light-Duty and Heavy-Duty Phase 1 Greenhouse Gas Rules
11. Federal Nonroad Equipment Standards
12. Federal Heavy Duty Diesel Vehicle Emissions Standards
13. Federal Portable Fuel Container Rules

The emissions reduction benefits of ozone control measures 1 through 12 are included in the onroad and nonroad emissions inventories that were developed by MOVES2014a. The aggregated emission reductions from these measures are used in modeling attainment in this plan. Measures 1 through 6, 9, 11, and 12 are reflected in the fuel parameters (e.g., RVP, gasoline and diesel sulfur contents, oxygen contents, etc.), vehicle registration data, and I/M programs for the MOVES2014a onroad and nonroad modeling. Measures 7 and 8 are incorporated into transportation network assignments of the Travel Demand Model (TDM), which were developed by the MAG Transportation Division. Onroad and nonroad mobile source emissions factors in MOVES2014a reflect the benefits of measures 9, 11, and 12 through the onroad and nonroad engine and fuel standards. Measure 10 contributes ozone precursor emissions reductions by way of improved fuel efficiency.

The MOVES2014a and SMOKE models estimated aggregated emissions reductions of 25.3 metric tons per day of VOC and 54.5 metric tons per day of NOx for onroad mobile sources in the Maricopa eight-hour ozone nonattainment area. Aggregated nonroad mobile source emissions reductions of 7.6 metric tons per day of VOC and 17.3 metric tons per day of NOx were estimated in the Maricopa eight-hour ozone nonattainment area. The benefits of measure 13, the federal portable fuel container rules, were provided by EPA for

Maricopa and Pinal Counties. The 2011 controlled emissions for the portable fuel containers were obtained from the EPA 2011 National Emissions Inventory (NEI). The 2017 emission reduction benefits were interpolated using the EPA 2015 and 2020 emissions benefits for the portable fuel container rules. Measure 13 provided 6.2 metric tons per day of VOC emission reduction benefit in the Maricopa eight-hour ozone nonattainment area in 2017. The attainment demonstration in this plan was primarily dependent upon the emissions benefits of the tighter federal standards for new onroad and nonroad engines and fuel requirements, and the continuing fleet turnover in the nonattainment area.

In addition to the ozone control measures used for numeric credit in the attainment demonstration, numerous other control measures, as shown in the Chapter Five of this plan, have been implemented in the Maricopa eight-hour ozone nonattainment area. These measures have been approved by EPA in prior regional air quality plans or separate EPA action and contribute to improve air quality, but cannot be quantified. As a result, the measures were not used as numeric credit for the attainment demonstration. As an example, the Arizona Department of Environmental Quality (ADEQ) issues an ozone High Pollution Advisory (HPA) when ozone is likely to exceed the NAAQS and pose health risks. When the HPA is issued, notices are sent to employers participating in trip reduction programs. At that time, employers activate HPA plans to help reduce air pollutants. The HPA plans may include commuting on public transportation, carpooling, vanpooling, and teleworking. The general public is also encouraged to take actions during an HPA such as limiting engine idling, refueling after dark, and limiting uses of gas-powered garden equipment and charcoal BBQs. The emissions reductions attributable to an HPA are not easily quantified, and thus are not used in the attainment demonstration. Many of the 93 existing control measures, such as the HPA program, were not used as numeric credit in the CAMx model attainment demonstration. These measures, while not quantified, improve air quality and contribute to the attainment of the 2008 ozone standard in 2017.

V-6. Contingency Provisions

Section 172(c)(9) of the Clean Air Act requires that the State Implementation Plans provide for the implementation of contingency measures without any further rulemaking action if the Moderate area fails to attain or to meet the standard by the attainment date. Since EPA allows early implementation of contingency measures (EPA, 1993), existing measures that have already been implemented may be contingency measures if they are not needed to show attainment and do not hasten attainment. EPA also allows federal measures to be contingency measures if they are not needed for attainment (EPA, 2005).

EPA requires that contingency measures represent one-year's worth of progress, amounting to reductions of 3 percent of the 2011 base year VOC and/or NOx emissions for the Maricopa eight-hour ozone nonattainment area. These reductions would be achieved in 2018 in the Maricopa eight-hour ozone nonattainment area while the state is revising its plans for the area if the area failed to meet the ozone standard by the required attainment date, July 20, 2018.

For the MAG 2017 Eight-Hour Ozone Moderate Area Plan, the existing control measures provide enough continuing emission reduction benefits in 2018 to meet the contingency measure requirements. The VOC and NOx emissions reductions of the contingency measures in 2018 for the Maricopa eight-hour ozone nonattainment area are provided in Table V-4. Details on the development of the 2018 emissions inventory for the Maricopa eight-hour ozone nonattainment area are included in Appendix F. Average daily anthropogenic VOC emissions of the modeling episode from May 1 through September 30 in the Maricopa eight-hour ozone nonattainment area are 165.28 metric tons per day in 2017 and 164.08 metric tons per day in 2018. The difference of total anthropogenic VOC emissions between 2017 and 2018 is 1.20 metric tons per day. The one year VOC emissions reduction between 2017 and 2018 amounts to a 0.61 percent reduction from the 2011 base year emissions. In the same way, the NOx emissions reduction between 2017 and 2018 is estimated to be a 3.25 percent reduction from the 2011 base year emissions. The combined VOC and NOx emissions reduction of 3.86 percent in the Maricopa eight-hour ozone nonattainment area meets the 3 percent emission reduction requirements of contingency measures.

Table V-4. Average daily anthropogenic VOC and NOx emissions reductions in 2018 for contingency measure requirements (unit: metric tons/day)

Emission Source	VOC					NOx				
	2011	2017	2018	Emission Reduction (2018-2017)	2018 Reduction from 2011	2011	2017	2018	Emission Reduction (2018-2017)	2018 Reduction from 2011
Point	2.47	3.32	3.39	+0.07	2.83%	7.02	13.75	13.76	+0.01	0.14%
Area	94.46	96.05	97.88	+1.83	1.94%	10.96	12.59	12.98	+0.39	3.56%
Nonroad	27.89	20.26	20.07	-0.19	-0.68%	53.58	36.26	34.36	-1.90	-3.55%
Onroad	70.96	45.65	42.74	-2.91	-4.10%	117.15	62.69	58.05	-4.64	-3.96%
Total	195.78	165.28	164.08	-1.20	-0.61%	188.71	125.29	119.15	-6.14	-3.25%
Combined VOC and NOx Emissions Reduction Percent in 2018: 3.86%										

VI. SUPPLEMENTAL ANALYSES

The EPA modeling guidance (EPA, 2014a) requires the supplemental analysis or the Weight-of-Evidence (WOE) analysis to show that the attainment can be reached in the future with some margin of safety, especially when projected future design values are close to the 2008 ozone standard. The purpose of this section is to provide the supplemental analyses to support the results from the CAMx model attainment demonstration in Section V. MAG had contracted with RAMBOLL ENVIRON for technical assistance on the WOE analyses. The WOE analysis report provided by RAMBOLL ENVIRON is included in Appendix B.

VI-1. Ambient Air Quality Trends

Trend analyses for the ambient ozone concentrations are useful to evaluate progress towards attainment of the 2008 ozone standard based on the historical air quality measurements.

The one-hour ozone monitoring data for the Maricopa eight-hour ozone nonattainment area were obtained from the EPA Air Quality System (AQS), which contains air pollution data collected by federal, state, local, and tribal agencies. Figure VI-1 and Table VI-1 illustrate the locations of the ozone monitoring sites used for the ambient ozone trend analysis.

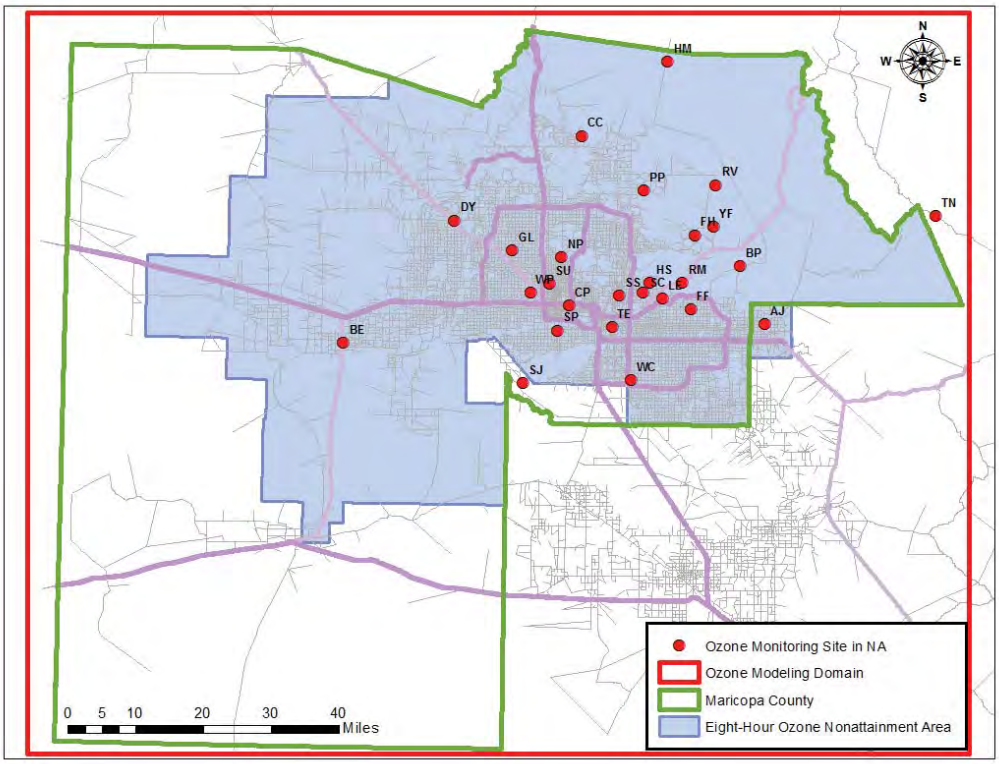


Figure VI-1. Locations of ozone monitoring sites for the ambient ozone trend analysis

Table VI-1. Ozone monitoring sites used for the ambient ozone trend analysis

AIRSID	Site Name	Site Abbr	Agency	Street Address	Latitude	Longitude
40070010	Tonto NM	TN	ADEQ	South of SR88	33.6547	-111.1074
40130019	West Phoenix	WP	MCAQD	3847 W Earll Dr, Phoenix	33.4839	-112.1426
40131004	North Phoenix	NP	MCAQD	601 E Butler Dr & 6th St, Phoenix	33.5603	-112.0663
40131010	Falcon Field	FF	MCAQD	4530 E McKellips Rd, Mesa	33.4522	-111.7333
40132001	Glendale	GL	MCAQD	6000 W Olive Ave, Glendale	33.5745	-112.1920
40132005	Pinnacle Peak	PP	MCAQD	25000 N Windy Walk, Scottsdale	33.7063	-111.8556
40133002	Central Phoenix	CP	MCAQD	1645 E Roosevelt St, Phoenix	33.4579	-112.0460
40133003	South Scottsdale	SS	MCAQD	2857 N Miller Rd, Scottsdale	33.4797	-111.9172
40134003	South Phoenix	SP	MCAQD	33 W Tamarisk Ave, Phoenix	33.4032	-112.0753
40134004	West Chandler	WC	MCAQD	275 S Ellis, Chandler	33.2990	-111.8843
40134005	Tempe	TE	MCAQD	1525 S College Ave, Tempe	33.4124	-111.9347
40134008	Cave Creek	CC	MCAQD	37019 N Lava Ln, Cave Creek	33.8217	-112.0174
40134010	Dysart	DY	MCAQD	16825 N Dysart, Surprise	33.6371	-112.3418
40134011	Buckeye	BE	MCAQD	26453 W MC85, Buckeye	33.3701	-112.6207
40135100	Fort McDowell/ Yuma Frank	YF	FMYN	18791 Yuma Frank Rd, Fort McDowell	33.6292	-111.6769
40137003	St Johns	SJ	GRIC	4208 W Pecos, Laveen	33.2902	-112.1606
40137020	Senior Center	SC	SRPMIC	10844 E Osborn Rd, Scottsdale	33.4882	-111.8557
40137021	Red Mountain	RM	SRPMIC	15115 Beeline Highway, Scottsdale	33.5080	-111.7553
40137022	Lehi	LE	SRPMIC	3250 N Stapley Dr, Mesa	33.4746	-111.8058
40137024	High School	HS	SRPMIC	4827 N Country Club Dr, Scottsdale	33.5081	-111.8385
40139508	Humboldt Mountain	HM	MCAQD	7 Springs Rd, Tonto National Forest	33.9828	-111.7987
40139702	Blue Point	BP	MCAQD	Usery Pass Rd, Blue Point	33.5455	-111.6093
40139704	Fountain Hills	FH	MCAQD	16426 E Palisades Blvd, Fountain Hills	33.6110	-111.7253
40139706	Rio Verde	RV	MCAQD	25608 N Forest Rd, Rio Verde	33.7188	-111.6718
40139997	Super Site	SU	ADEQ	4530 N 17th Ave, Phoenix	33.5038	-112.0958
40213001	Apache Junction	AJ	PCAQCD	305 E Superstition Blvd, Apache Junction	33.4214	-111.5436

Note: The air pollution control agencies maintaining the ozone monitoring sites in this table include Arizona Department of Environmental Quality (ADEQ), MCAQD, PCAQCD, the Salt River Pima-Maricopa Indian Community of Salt River Reservation (SRPMIC), the Gila River Indian Community Gila River Indian Reservation (GRIC), and Fort McDowell Yavapai Nation (FMYN).

The numbers of annual exceeding days for the 2008 eight-hour ozone standard in the Maricopa eight-hour ozone nonattainment area from 2000 to 2015 are given in Figure VI-2. The numbers of the annual exceeding days have steadily decreased from seventy-two in 2000 to nineteen in 2011 and seven in 2015. Exceedances of the 2008 eight-hour ozone standard in the Maricopa eight-hour ozone nonattainment area over this period occurred mostly in May (24%) and June (23%) followed by August (22%) and July (20%). In 2015, the numbers of days exceeding the 2008 ozone standard were five days in June and two days in August.

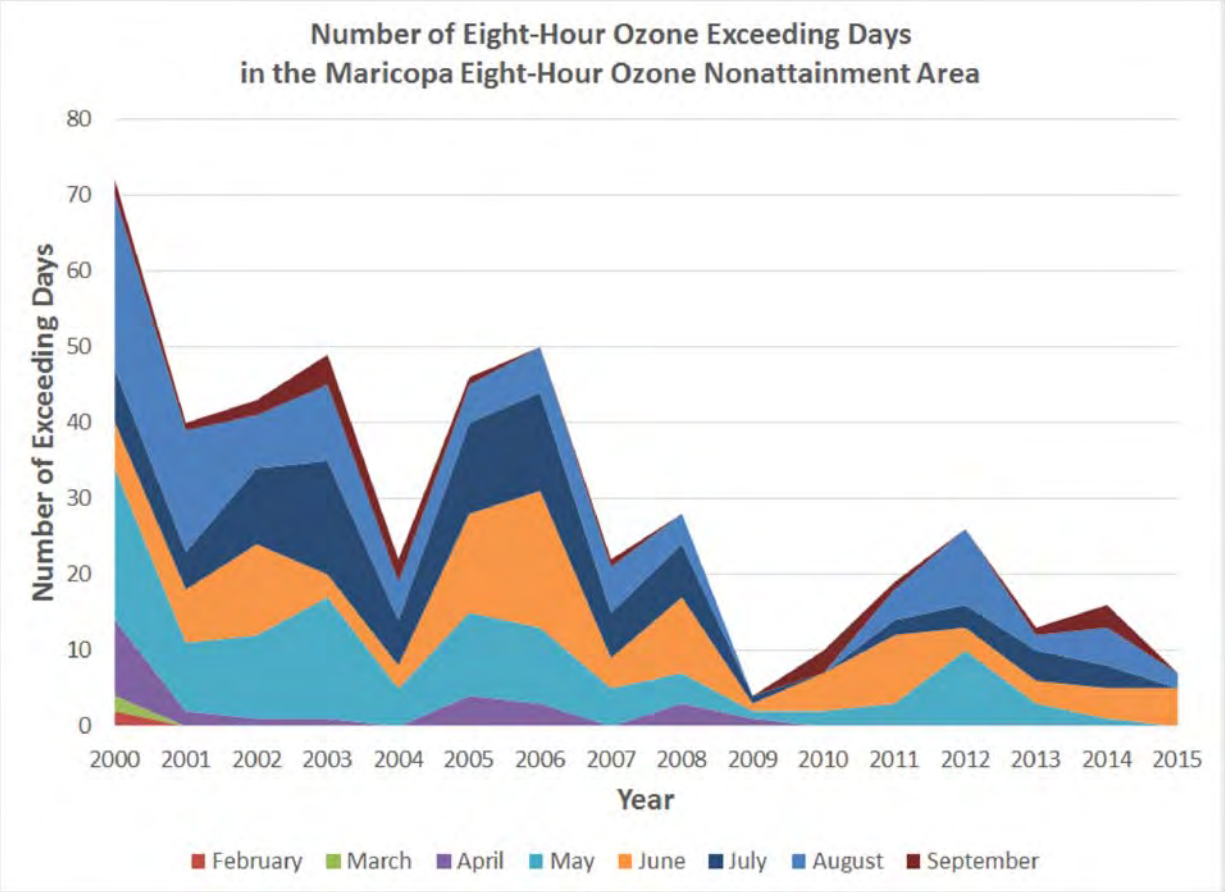


Figure VI-2. Trends in the numbers of eight-hour ozone exceeding days over 2000 - 2015 in the Maricopa eight-hour ozone nonattainment area

The ozone design value (DV) is defined as the three-year average of the annual fourth highest daily maximum eight-hour ozone concentration. Monitoring sites for the historical peak eight-hour ozone DVs in the Maricopa eight-hour ozone nonattainment area from 2002 to 2015 are presented in Table VI-2. The peak eight-hour ozone DVs decreased from 85 ppb to 77 ppb, and the monitoring site for the peak eight-hour ozone DV was shifted from Humboldt Mountain to North Phoenix.

Table VI-2. Monitoring sites with the historical peak eight-hour ozone DVs in the Maricopa eight-hour ozone nonattainment area

Average Period	Peak Eight-Hour Ozone DV	Peak DV Sites
2000 - 2002	85 ppb	North Phoenix (04-013-1004) Pinnacle Peak (04-013-2005) Humboldt Mountain (04-013-9508)
2001 - 2003	87 ppb	Humboldt Mountain (04-013-9508)
2002 - 2004	85 ppb	Humboldt Mountain (04-013-9508)
2003 - 2005	84 ppb	Humboldt Mountain (04-013-9508)
2004 - 2006	86 ppb	Red Mountain (04-013-7021)
2005 - 2007	83 ppb	Red Mountain (04-013-7021) Rio Verde (04-013-9706)
2006 - 2008	81 ppb	North Phoenix (04-013-1004)
2007 - 2009	76 ppb	North Phoenix (04-013-1004) Red Mountain (04-013-7021)
2008 - 2010	77 ppb	North Phoenix (04-013-1004)
2009 - 2011	77 ppb	North Phoenix (04-013-1004)
2010 - 2012	81 ppb	North Phoenix (04-013-1004)
2011 - 2013	81 ppb	North Phoenix (04-013-1004)
2012 - 2014	80 ppb	North Phoenix (04-013-1004)
2013 - 2015	77 ppb	North Phoenix (04-013-1004) Pinnacle Peak (04-013-2005) Supersite (04-013-9997)

*Design Value for this period excludes the June 20, 2015 ozone wildfire exceptional event.

Figure VI-3 presents the eight-hour ozone DV at the five sites that contributed to the peak eight-hour ozone DV for the time period of 2000 - 2015. The monitoring sites were grouped in the following three groups: (1) Central urban sites (blue line), (2) rural urban fringe sites (green lines), and (3) rural sites (orange lines). The downward trend in the eight-hour ozone DVs for the rural sites (Humboldt Mountain and Rio Verde) are apparently more prominent than the other two groups.

The mean, minimum, and maximum values of the annual fourth highest eight-hour ozone concentration for monitoring sites over 2000-2015 are provided in Figure VI-4. The maximum, minimum, and mean annual fourth highest eight-hour ozone concentrations in the Maricopa eight-hour ozone nonattainment area had decreasing trends during 2000-2009, but started increasing after reaching at the lowest level in 2009, and returned to the decreasing trends from 2012.

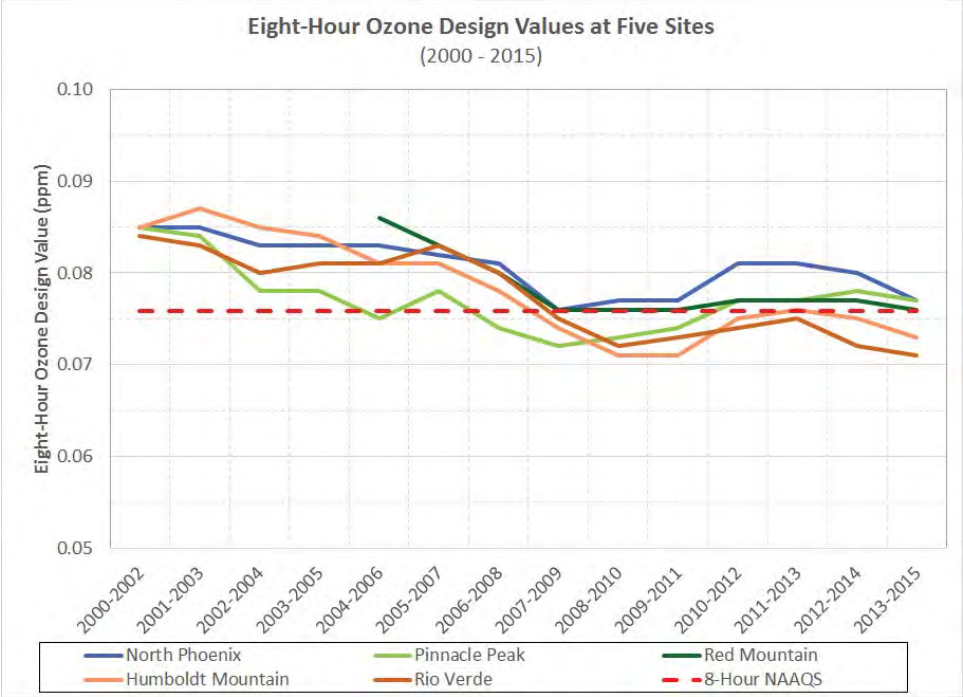


Figure VI-3. Annual eight-hour ozone DVs at the five monitoring sites contributing to the peak eight-hour ozone DV in Table VI-2 (Urban site: blue, rural urban fringe sites: green, and rural sites: orange)

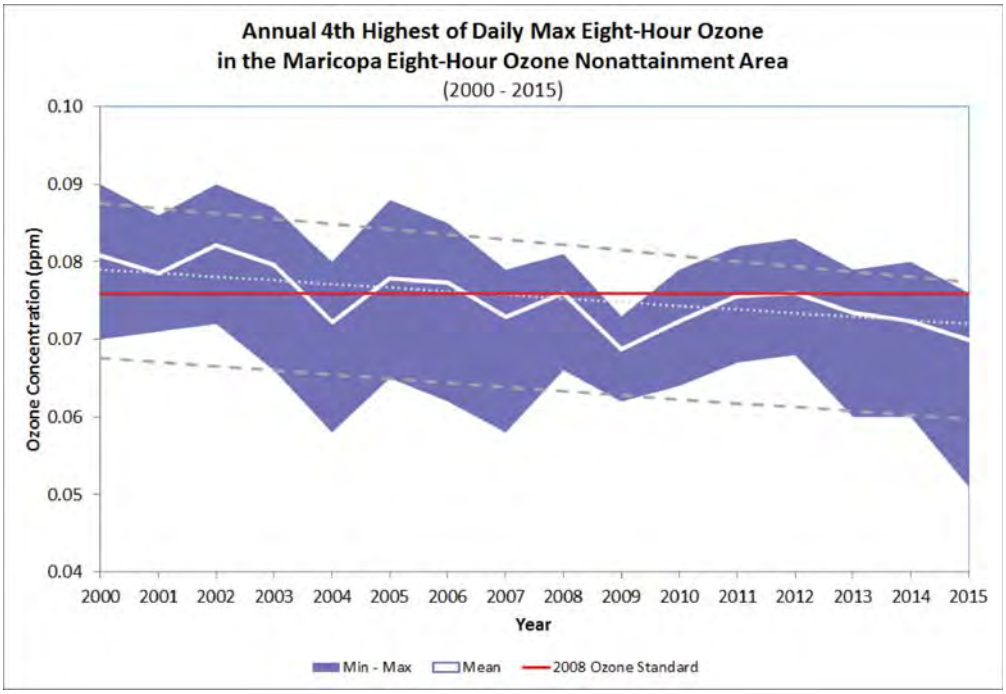


Figure VI-4. Trends in the annual peak fourth highest eight-hour ozone concentrations during 2000-2015 in the Maricopa eight-hour ozone nonattainment area

VI-2. Trends in Ambient Ozone Precursors

This section provides trends in the ambient ozone precursors to support the ambient ozone trends in Section VI-1. As a station of the EPA Photochemical Assessment Monitoring Stations (PAMS) network, the Supersite monitor in Phoenix has collected the ambient concentrations of ozone precursors (NOx, CO, and hydrocarbons) dating back to at least 1999 and current through 2015. The monitoring data at Supersite were downloaded from the EPA AQS system and averaged into annual values from all available observations in the summer ozone season (May 1 to September 30) of each year.

Figure VI-5 shows the NOx trend during the ozone season from 1999 to 2015 at the Supersite monitor. A regression line is shown for the trend, and indicates a general reduction in ambient NOx concentrations on the order of 1.6 ppb/year. This is consistent with the analysis performed in the MAG Eight-Hour Ozone Maintenance Plan (MAG, 2009), which reported on the observations between 1999 - 2007. The updated data indicates the trend has persisted downward in the years that followed. This translates to a 30-40% reduction over the period of 1999-2015.

The trend in ambient CO concentrations at the Supersite is given in Figure VI-6. The regression line indicates a general reduction in ambient CO concentrations on the order of 40.9 ppb per year. This translates in a reduction of 55-65% over 1999 - 2015.

PAMS monitors collect Total Non-Methane Organic Compounds (TNMOC), which will be used herein interchangeably with Volatile Organic Compounds (VOC) for trend analyses purposes. The trend in TNMOC at the Phoenix Supersite is given in Figure VI-7. Despite a lack of summer sampling in years 2000, 2003 and 2007, the regression line indicates a general reduction in ambient concentrations on the order of 11.6 ppbC/year (measured on the basis of number of carbon atoms). This translates to a reduction of 55-65% from 1999 to 2015. Figures VI-8 and VI-9 show the individually measured VOC species of acetaldehyde and formaldehyde, respectively. Both are considered as important anthropogenic tracer species, and the regression line of each trends in similar general direction as the other precursors. Acetaldehyde concentrations had a reduction of approximate 0.05 ppb/year, translating to a 20-30% decrease since 1999. Formaldehyde concentrations had a reduction of approximate 0.4 ppb/year, translating to a 70-80% decrease since 1999.

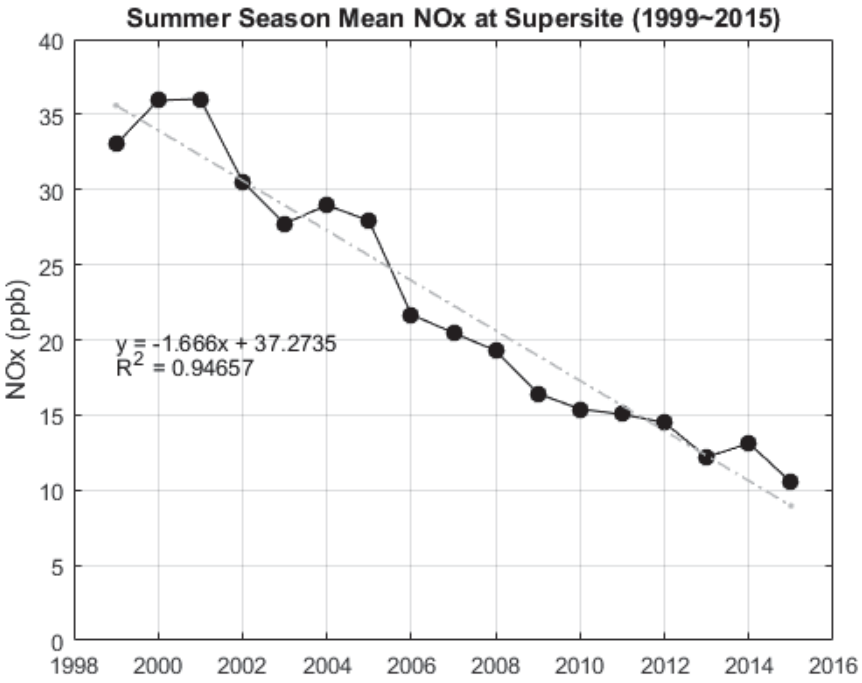


Figure VI-5. Trend with the fitted regression line in NOx concentrations averaged over each ozone season at Supersite from 1999 to 2015

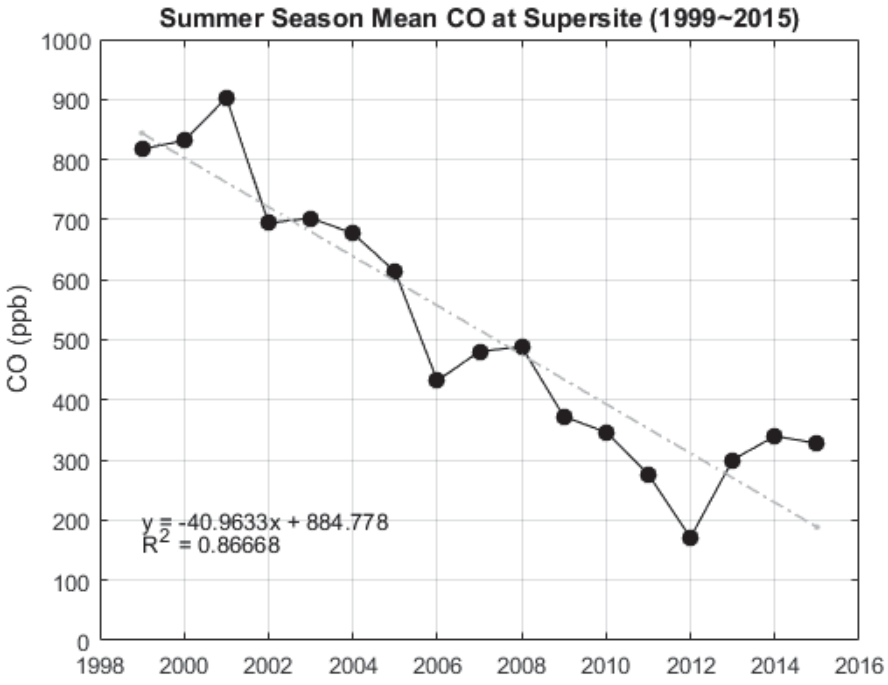


Figure VI-6. Trend with the fitted regression line in CO concentrations averaged over each ozone season at Supersite from 1999 to 2015

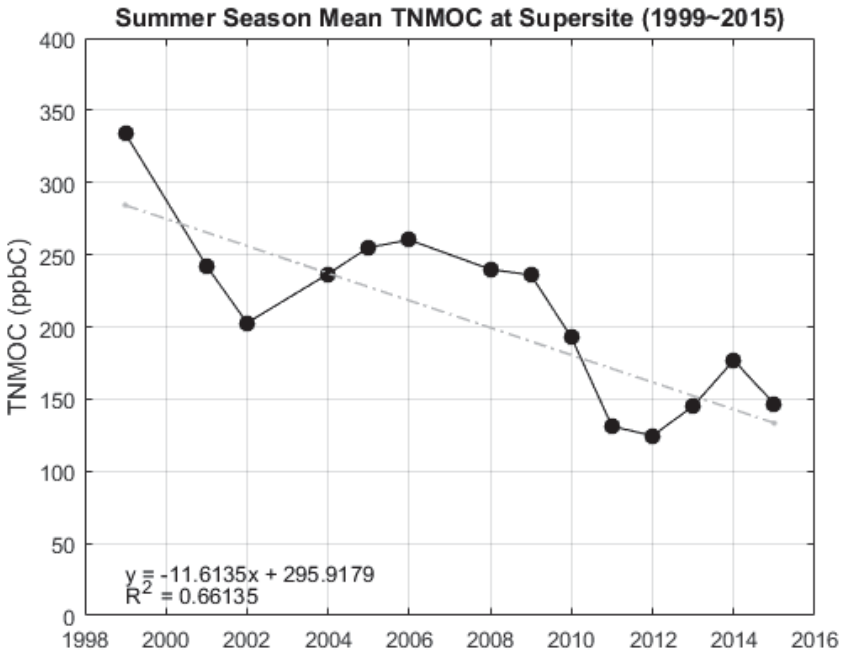


Figure VI-7. Trend with the fitted regression line in TNMOC concentrations averaged over each ozone season at Supersite from 1999 to 2015

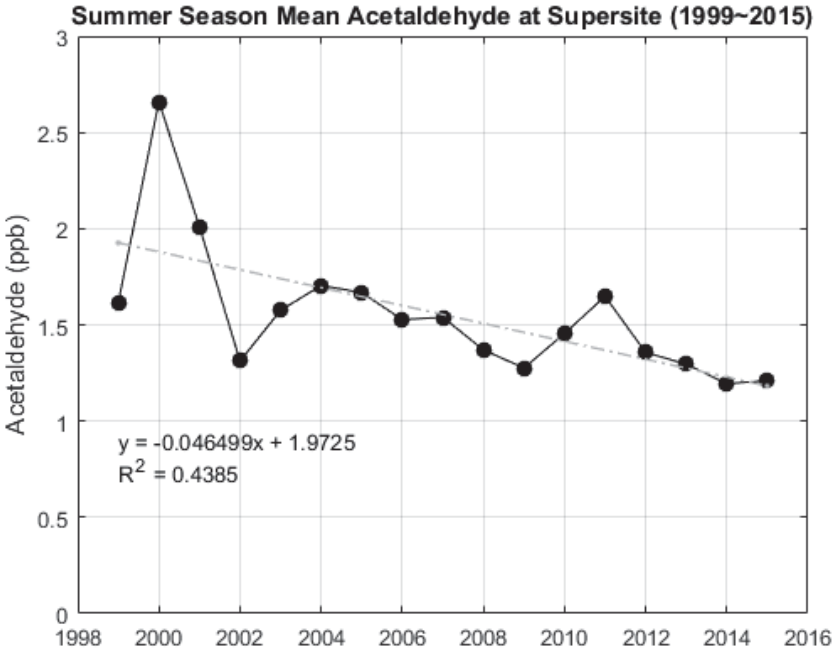


Figure VI-8. Trend with the fitted regression line in acetaldehyde concentrations averaged over each ozone season at Supersite from 1999 to 2015

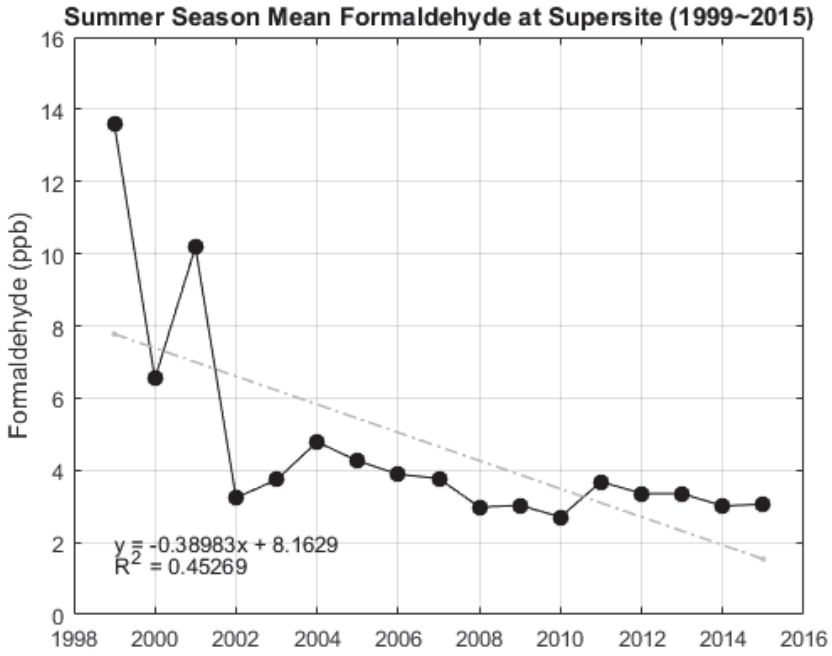


Figure VI-9. Trend with the fitted regression line in formaldehyde concentrations averaged over each ozone season at Supersite from 1999 to 2015

VI-3. Absolute Model Forecasts

To supplement the attainment test results, absolute model forecasts are used to demonstrate substantial reductions in absolute model concentrations from the base year to the future year. The following metrics were used in estimating the magnitude, frequency, and relative amount of nonattainment:

- Percent change in the total amount of ozone greater than 75 ppb
- Percent change in the number of grid cells greater than 75 ppb
- Percent change in the grid cell hours (days) greater than 75 ppb
- Percent change in the maximum modeled eight-hour ozone concentration

Table VI-3 presents the above metrics for the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain for the May - September episode. It is shown that the predicted eight-hour ozone concentration change between the base and future years is substantial in terms of the magnitude, frequency, and relative amount of nonattainment. This is valid for both the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain.

Table VI-3. Absolute modeling metrics for entire episode

Metrics	Eight-Hour Ozone Nonattainment Area			Modeling Domain (4 km)		
	Base Year (2011)	Future Year (2017)	Percent Change	Base Year (2011)	Future Year (2017)	Percent Change
Total Concentration	4,008.46 ppm	2,354.92 ppm	-41.3%	7,801.45 ppm	4,771.22 ppm	-38.8%
Number of Grid	49,941 cells	29,654 cells	-40.6%	97,208 cells	59,969 cells	-38.3%
Grid Cell Hours	346 hours	191 hours	-44.8%	397 hours	213 hours	-46.3%
Maximum Ozone Modeled	100.23 ppb	89.24 ppb	-11.0%	100.23 ppb	90.06 ppb	-10.1%

VI-4. Process Analysis

To assess which ozone precursor (e.g., VOC or NOx) limits ozone production in the Maricopa eight-hour ozone nonattainment area, the CAMx Chemical Process Analysis (CPA) was demonstrated for the base and future years. This analysis provides detailed chemically meaningful attributes over groups of reactions in the chemical mechanism for a selected area. One result of CPA is the classification of NOx-limited and VOC-limited areas. An understanding of such areas is key to assessing the impact of control measures to the complex, nonlinear response of ozone concentrations. If the responses are quantified correctly, the attainment test may have more physical justification.

To classify the NOx-limited and VOC-limited areas, the production rates (P) of hydrogen peroxide (H_2O_2) and nitric acid (HNO_3) are derived using CAMx. The ratio of this two is the indicator which can be used to classify ozone formation as being NOx-limited when $P(H_2O_2)/P(HNO_3)$ is greater than 0.35 and VOC-limited when the ratio is below 0.35 (Sillman, 1995).

Figure VI-10 illustrates the CPA results for four time periods, which were averaged over the entire episode days in 2011 and 2017. Warm (red) and cool (blue) colors in Figure VI-10 denote VOC-limited and NOx-limited conditions, respectively. The 4 km modeling domain is in a VOC-limited condition at night time because of no biogenic emissions from the photosynthesis of plants. It gradually turns to a NOx-limited as sunlight induces biogenic VOC emissions. Finally, it becomes NOx-limited at the PM peak with the exception of the urban core, which has abundant anthropogenic NOx emissions. Figure VI-10 also visualizes a distinct transition of the Phoenix urban core from VOC-limited conditions in 2011 to NOx-limited conditions in 2017. This transition usually occurs when NOx emissions decrease or VOC emissions increase in a given area. According to the emissions inventory in Section III, both NOx and VOC emissions in the Maricopa eight-hour ozone nonattainment area decrease between 2011 and 2017. This result indicates substantial

NOx reduction, primarily contributed by onroad mobile source, which caused the Phoenix urban core area to shift from being VOC-limited towards NOx-limited. According to the Empirical Kinetic Modeling Approach (EKMA) diagrams (EPA, 1981), NOx reductions are generally less effective at bringing ozone levels down under the VOC-limited condition, and can even increase ozone levels. NOx reductions, however, are effective in an area within NOx-limited condition or even in an area in a transitional regime between VOC-limited and NOx-limited conditions. While the Phoenix urban core area is in the transitional regime, outside of the Phoenix urban core area is consistently NOx-limited. This indicates that NOx emission controls may be more effective strategy to reduce ozone levels in the Maricopa eight-hour ozone nonattainment area.

The CPA results for 2011 and 2017 were also compared month by month. Figure VI-11 shows a seasonal variation of the VOC-limited area, which is largest in June and smallest in July. The transition from VOC-limited to NOx-limited in the Phoenix urban core area consistently appears for all months. This results indicate that NOx emission controls would be more efficient in reducing ozone than VOC emission controls in 2017.

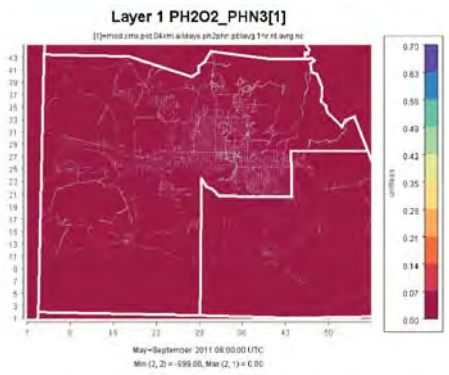
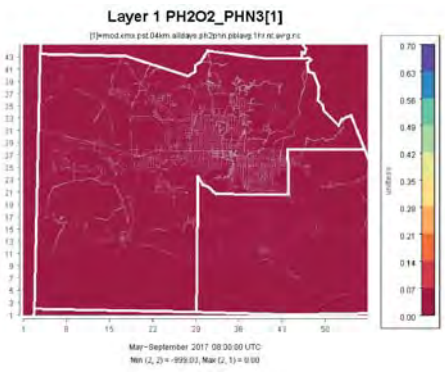
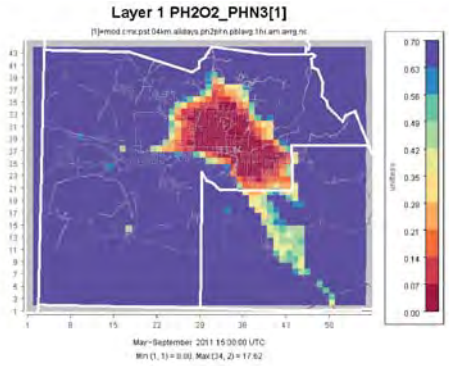
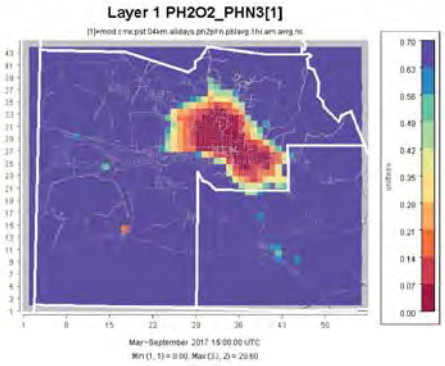
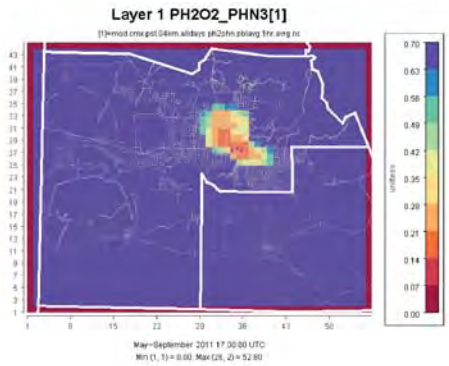
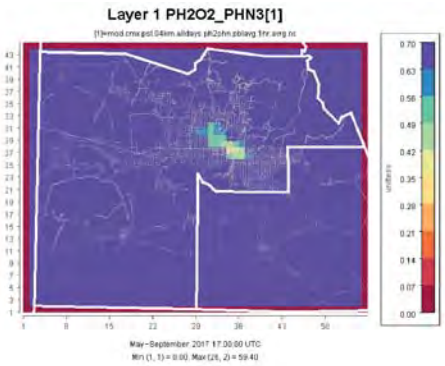
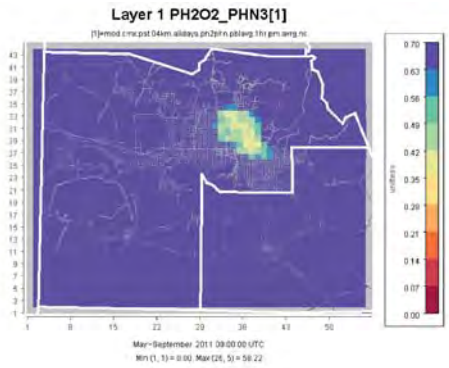
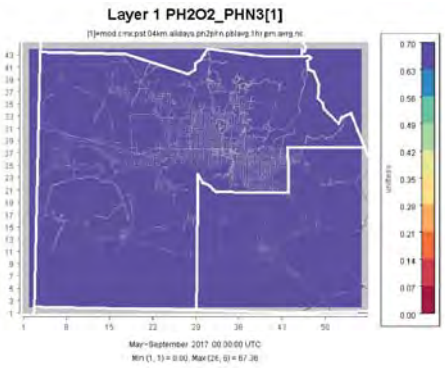
Time	2011	2017
Night Time (1:00 am)		
AM Peak (8:00 am)		
Mid-Day (12:00 pm)		
PM Peak (5:00 pm)		

Figure VI-10. Process analysis results by time of day (episode average)

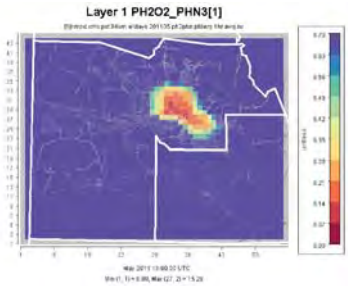
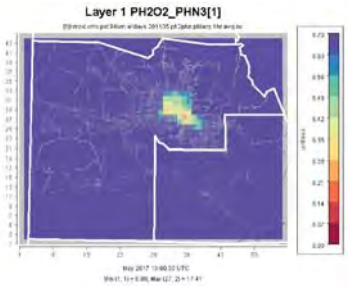
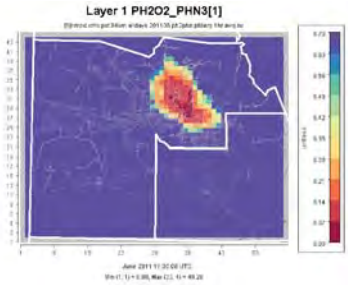
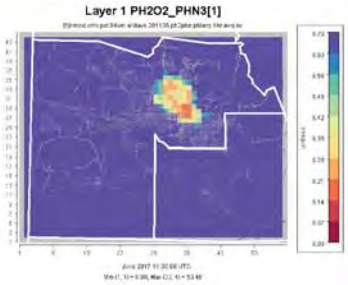
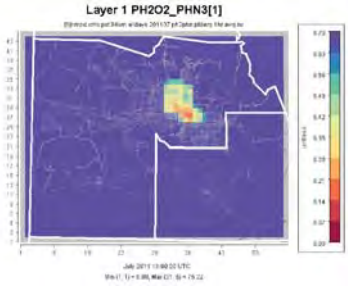
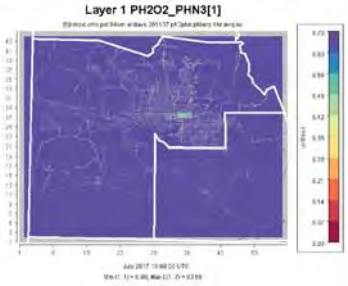
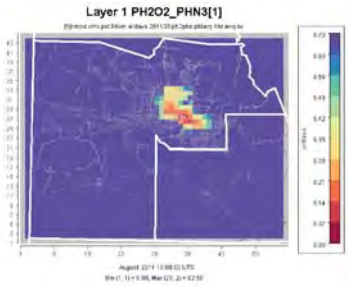
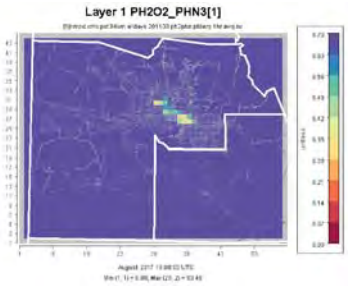
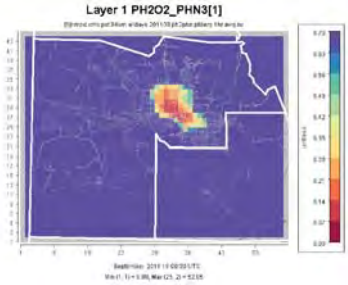
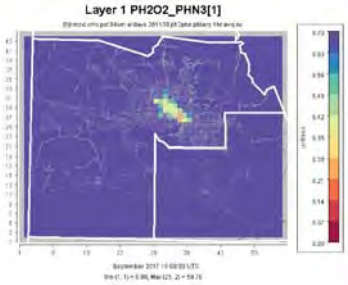
Month	2011	2017
May		
June		
July		
August		
September		

Figure VI-11. Process analysis results (monthly average at noon)

VI-5. Zero-Out Emissions Analysis

Transported ozone from upwind areas may significantly affect local ozone concentration. Zero-out anthropogenic emissions analysis was conducted to evaluate the impact of transported anthropogenic emissions on ozone concentrations in the Maricopa eight-hour ozone nonattainment area. The analysis is based on the underlying assumption that upwind anthropogenic emissions were perfectly controlled. To quantify the contribution of 2017 anthropogenic emissions from all upwind source regions to ozone concentrations in the Maricopa eight-hour ozone nonattainment area, the CAMx runs were implemented with regionally zeroed-out anthropogenic emissions. The zero-out regions include Arizona and the neighboring states of Arizona (California, Nevada, Utah, Colorado, New Mexico, and Texas), groups of states (East, Midwest, and Northwest states groups), U.S., and Mexico as shown in Figure VI-12.

The US background (USB) contribution to the Maricopa eight-hour ozone nonattainment area was quantified in this analysis. The USB is defined by EPA as all global natural sources of ozone and all anthropogenic sources from outside the U.S.

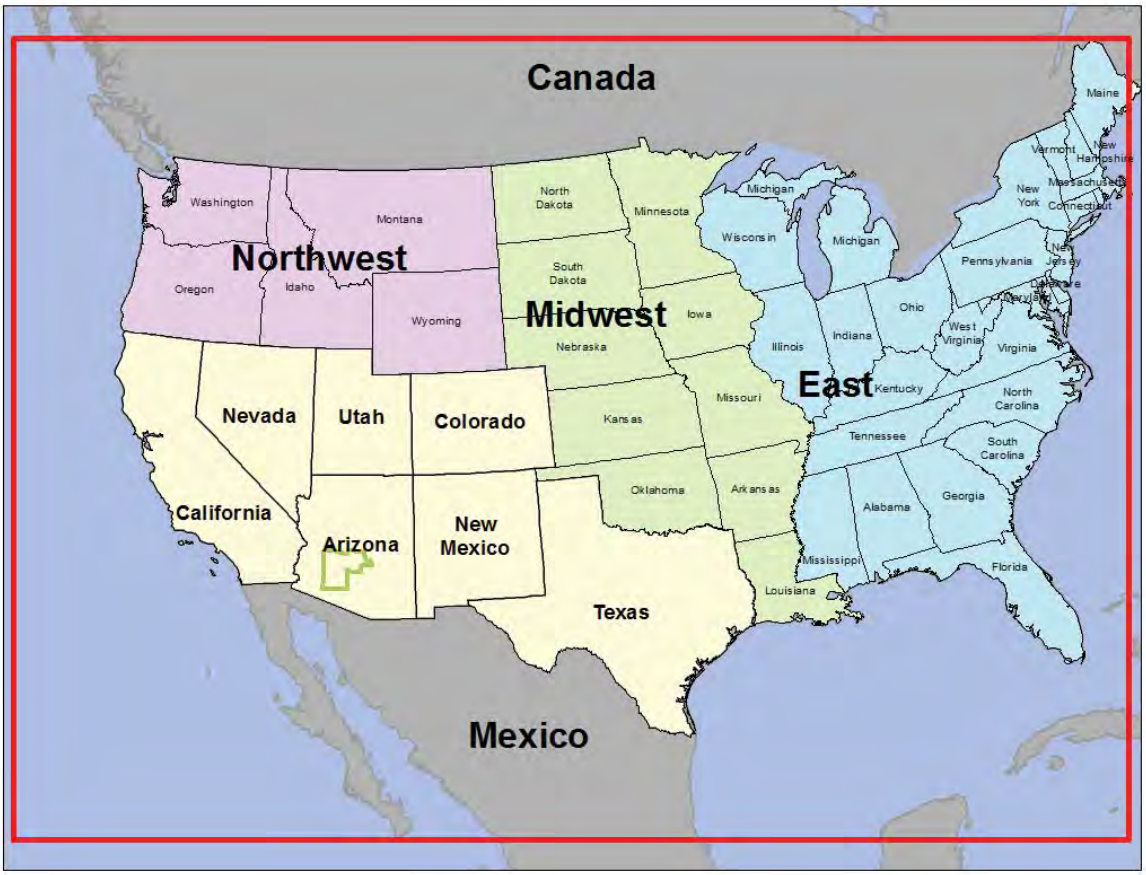


Figure VI-12. Regions for the CAMx zero-out analysis

The CAMx runs were performed using zero-out anthropogenic emissions for the regions for the 2017 attainment year. For the zero-out analysis, future design values (DVF) for monitoring sites in the Maricopa eight-hour ozone nonattainment area were calculated based on the ten highest ozone prediction days for the five-month modeling period and each month of the modeling period. To evaluate the contributions of the zero-out anthropogenic emissions of the regions to the North Phoenix site, on which the peak ozone design value was predicted in 2017, the DVF derived from the zero-out anthropogenic emissions for each region was subtracted from the 2017 DVF developed for the attainment demonstration by using the 2017 emissions inventory. Table VI-4 provides the ozone contributions of each region to the DVF at the North Phoenix site.

For the five-month modeling episode, he USB contributed up to 47.3 ppb (63%) and in-state Arizona sources up to 24.4 ppb (32%) to the DVF at the North Phoenix site, as shown in Table VI-4. The contributions of anthropogenic emissions from California, Mexico, and Texas are also provided in Table VI-4. Mexico contributed 1.9 ppb (3%) to ozone concentrations at North Phoenix, California contributed 1.3 ppb (2%), and Texas contributed 0.9 ppb (1%). Table VI-4 revealed that the transported anthropogenic emissions contribution to ozone concentrations at the North Phoenix site remarkably varied from month-to-month due to different meteorological conditions. The contribution of USB was the highest in May (87% or 68.1 ppb) and the lowest in August (51% or 36.9 ppb). California contributed to the peak 2017 DVF with the highest impact up to 4.5 ppb in June, Mexico contributed with the highest impact up to 7.1 ppb in July, and Texas contributed by greater than 1 ppb in August and September.

Table VI-4. Contributions of regional anthropogenic emissions and USB to DVF at the North Phoenix site (unit: ppb)

Region	May	Jun	Jul	Aug	Sep	May-Sep
Arizona	5.9	15.4	20.8	30.7	22.4	24.4
California	2.4	4.5	1.8	1.1	3.1	1.3
Colorado	0.0	0.2	0.3	0.4	0.3	0.3
New Mexico	0.1	0.3	0.5	0.6	0.5	0.5
Nevada	0.5	0.3	0.3	0.3	0.4	0.4
Texas	0.1	0.2	0.9	1.6	1.1	0.9
Utah	0.2	0.3	0.3	0.3	0.5	0.4
East	0.0	0.0	0.2	0.2	0.2	0.1
Midwest	0.0	0.0	0.2	0.4	0.3	0.2
Northwest	0.6	0.4	0.0	0.1	0.3	0.2
Mexico	0.6	3.2	7.1	4.5	3.5	1.9
USB	68.1	56.8	48.4	36.9	46.4	47.3

VI-6. Decoupled Direct Method

The decoupled direct method (DDM) is an alternative and improved methodology for evaluating model sensitivity, which can be used as further evidence that the attainment demonstration yields reasonable results. The method can be used to characterize the potential uncertainties in the predicted future year emissions and ozone concentrations. The CAMx model provides an option for the high-order DDM (HDDM) to calculate second-order sensitivity coefficients along with first-order sensitivity coefficients with respect to predicted ozone concentrations to pollutant sources such as boundary conditions and anthropogenic emissions. The CAMx HDDM includes options for varying emission inputs to the CAMx model; scaling emissions by a factor; additively increasing emissions by a constant amount everywhere; or zeroing-out emissions by source category and geographic region. The CAMx HDDM was used to evaluate the sensitivity of the CAMx ozone predictions to emission changes in 2017.

The maximum eight-hour ozone DVFs in 2017 for 0%, 5%, 10%, 15%, and 20% reductions of anthropogenic VOC and NOx emissions in the 4 km modeling domain are given in Table VI-5. It reveals that the reduction of NOx is more effective in ozone reduction than the VOC reduction, and an ozone reduction of 1 ppb requires more than a 10% reduction in the 2017 anthropogenic VOC and NOx emissions in the 4 km modeling domain.

Table VI-5. Sensitivity of maximum eight-hour ozone DVF in 2017 to reductions of anthropogenic VOC and/or NOx emissions in the 4 km modeling domain (unit: ppb)

	% Reduction				
Pollutant	0%	5%	10%	15%	20%
VOC	75.6	75.4	75.3	75.2	75.1
NOx	75.6	75.2	74.8	74.3	73.9
VOC & NOx	75.6	75.1	74.6	74.2	73.8

Table VI-6 presents the sensitivity of the maximum eight-hour ozone DVF in 2017 to increases of anthropogenic VOC and/or NOx emissions in the 4 km modeling domain. Increases of anthropogenic VOC emissions up to 15%, NOx emissions up to 5%, and VOC and NOx emissions less than 5% from the 2017 emissions inventory still resulted in the attainment of the 2008 ozone standard. The results indicate that the 2017 anthropogenic emissions used in the attainment demonstration provides an approximate 5% of the safety margin for anthropogenic VOC and NOx emissions for the attainment of the 2008 ozone standard.

Table VI-6. Sensitivity of maximum eight-hour ozone DVF in 2017 to increase of anthropogenic VOC and/or NOx emissions in the 4 km modeling domain (unit: ppb)

	% Increase				
Pollutant	0%	5%	10%	15%	20%
VOC	75.6	75.7	75.8	75.9	76.0
NOx	75.6	75.9	76.2	76.4	76.7
VOC & NOx	75.6	76.0	76.5	77.0	77.5

VI-7. Source Apportionment Technology

Photochemical model source apportionment is a probing tool to estimate the contribution of multiple source areas, categories, and pollutant types to ozone formation. In this analysis, the contribution to future design values from emission sources in the 4 km modeling domain was evaluated using the CAMx Ozone Source Apportionment Technology (OSAT) tool. Emissions in the 2017 future year were used in applying the OSAT tool to evaluate the contribution of emission sources to ozone.

The impacts of point, area, onroad, and nonroad emission sources in the 4 km modeling domain on the North Phoenix site were evaluated by the OSAT analysis since the highest future design value was predicted at the North Phoenix site in Section V-1. The contribution of point, area, onroad, and nonroad emission sources in the 4 km modeling domain to ozone at North Phoenix are provided in Table VI-7. Onroad mobile source contribution was the highest, and then followed by area source, nonroad mobile source, and point source contribution. Since onroad mobile sources are the major contributor to NOx emissions in the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain, as shown in Tables III-8 and 9, onroad mobile source emission controls are the most efficient in further reducing ozone concentrations in the Maricopa eight-hour ozone nonattainment area.

Table VI-7. Percent contributions of anthropogenic emission source sector in the 4 km modeling domain to high ozone at the North Phoenix site

Emissions Source	May	June	July	August	September
Onroad	45.9%	52.8%	51.2%	58.3%	45.2%
Area	32.1%	20.0%	22.4%	11.6%	32.5%
Nonroad	16.8%	22.4%	20.2%	17.1%	16.1%
Point	5.2%	4.8%	6.2%	13.0%	6.2%

VI-8. Uncertainty of the Projected 2017 Emissions for Electric Generating Units

The projected 2017 emissions for Electric Generating Units (EGU) that were used in the CAMx model attainment demonstration for the Maricopa eight-hour ozone nonattainment area were developed based on the maximum EGU emissions over 2005-2014. The assumption of the ten-year maximum emissions for EGU, however, may be over-estimated for the 2017 EGU emissions. EGU emissions may not grow so rapidly during such a short period of 2011-2017 due to EGU NOx controls and fuel conversions from coal to natural gas. EPA's national power plant emission trends affirm that the nationwide NOx emissions of power plants substantially decreased over 1990 - 2015 even though the capacity of electricity increased over 1990 - 2005 and slightly decreased during the recent five years, as shown in Figure VI-13 (EPA, 2016). As shown in Figures VI-14 and VI-15, the ten-year

maximum emissions of most power plants for 2017 are generally higher than the annual VOC and NOx emissions for the period of 2011-2014. Consequently, the maximum 2017 future design value of 75.6 ppb based on the ten-year maximum EGU emissions were likely to be overestimated.

Thus, an alternative no-growth assumption for the EGU emissions was tested for the attainment of the 2008 ozone standard. The same 2011 EGU emissions are assumed for the 2017 EGU emissions for the attainment test. The alternative approach has lowered the future design values up to 0.6 ppb. The maximum 2017 design value was predicted at 75.0 ppb, as shown in Table VI-8. The no-growth assumption for the 2017 EGU emissions provides a significant safety margin for the modeled attainment of the 2008 ozone standard.

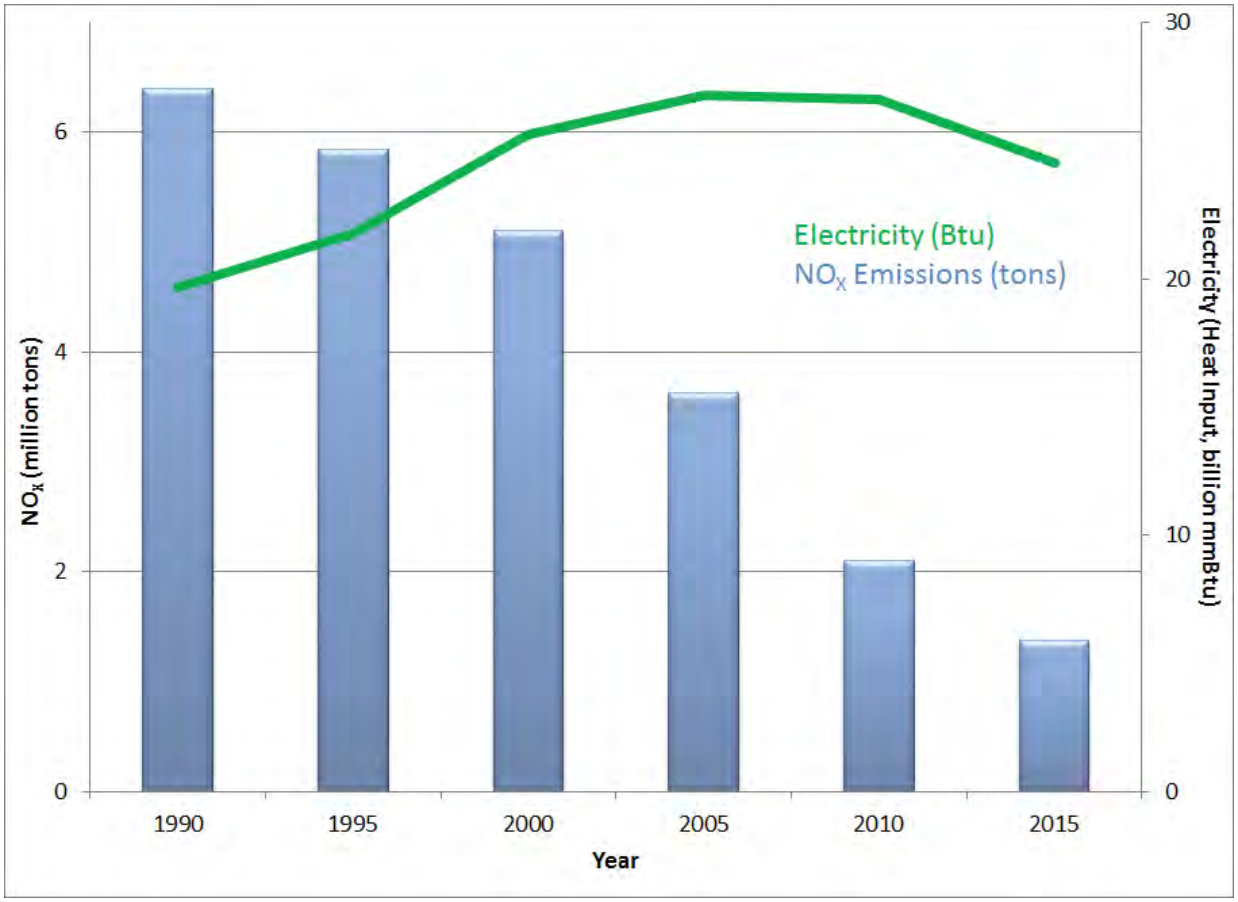


Figure VI-13. EPA national trends of NOx emissions and electricity generation capacity of power plants since 1990

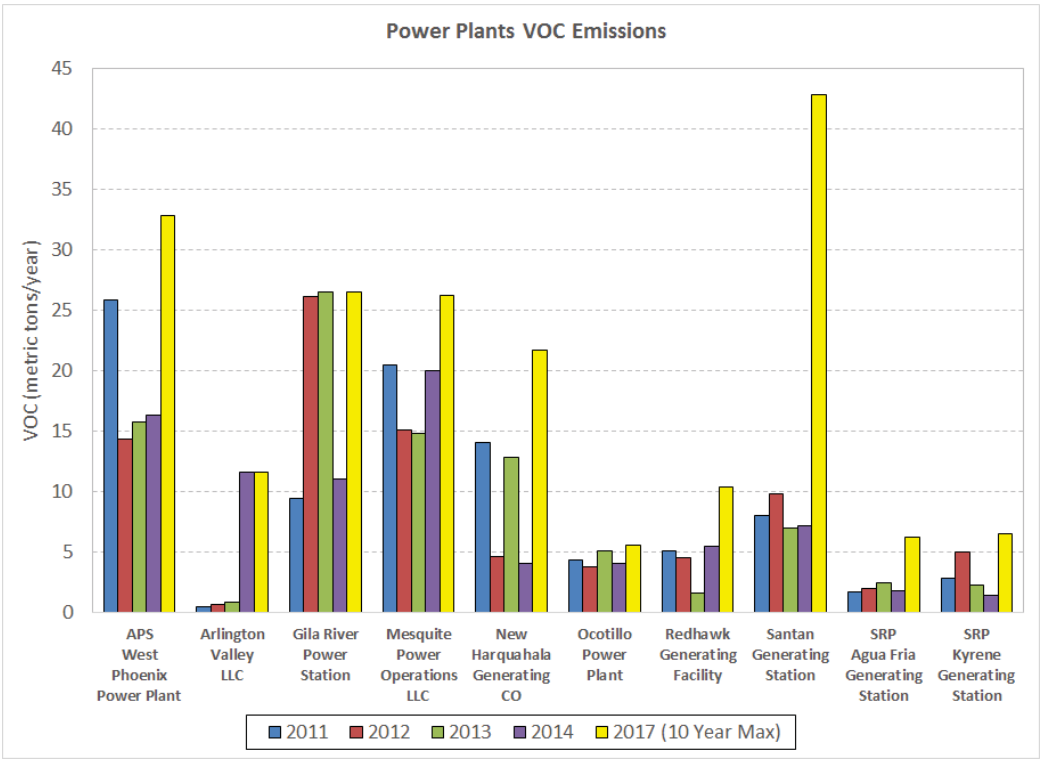


Figure VI-14. VOC emissions of power plants in Maricopa County

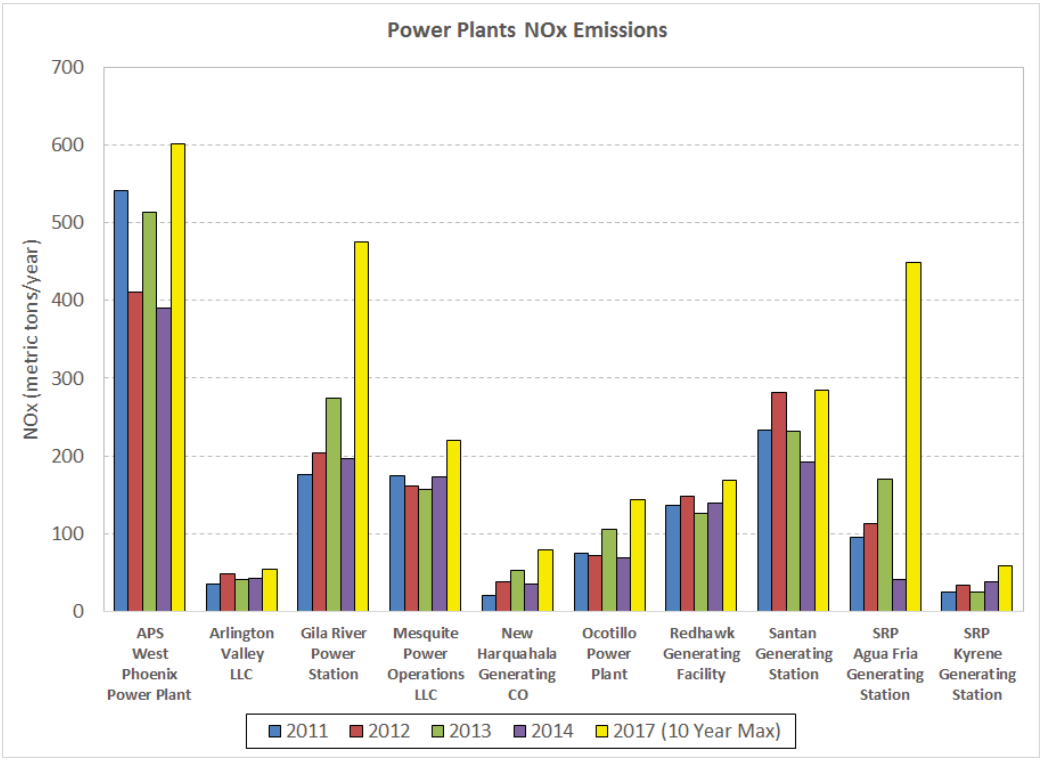


Figure VI-15. NOx emissions of power plants in Maricopa County

Table VI-8. 2017 future design values (DVF) based on the 10-year maximum EGU emissions and the 2011 EGU emissions for 2017 (unit: ppb)

Site Name	AIRS	DVF Based on the 10-Year Max EGU Emissions	DVF Based on the 2011 EGU Emissions	DVF Difference
West Phoenix	040130019	73.3	73.0	0.3
North Phoenix	040131004	**75.6**	**75.0**	**0.6**
Falcon Field	040131010	64.9	64.4	0.5
Glendale	040132001	71.9	71.6	0.3
Pinnacle Peak	040132005	70.1	69.7	0.4
Central Phoenix	040133002	69.7	69.4	0.3
South Scottsdale	040133003	71.6	71.1	0.5
South Phoenix	040134003	71.5	71.3	0.2
West Chandler	040134004	69.8	69.7	0.1
Tempe	040134005	67.7	67.5	0.2
Cave Creek	040134008	71.6	71.3	0.3
Dysart	040134010	68.1	67.8	0.3
Buckeye	040134011	63.4	63.3	0.1
Fort McDowell/Yuma Frank	040135100	65.4	65.1	0.3
Senior Center	040137020	69.6	69.2	0.4
Red Mountain	040137021	71.6	71.1	0.5
Lehi	040137022	69.4	69.0	0.4
High School	040137024	68.9	68.5	0.4
Humboldt Mountain	040139508	69.8	69.6	0.2
Blue Point	040139702	70.0	69.7	0.3
Fountain Hills	040139704	69.4	69.0	0.4
Rio Verde	040139706	68.3	67.9	0.4
Super Site	040139997	72.8	72.4	0.4
Apache Junction	040213001	67.9	67.7	0.2

VII. CONCLUSIONS

The CAMx modeling, as discussed in the previous sections, demonstrated that the Maricopa eight-hour ozone nonattainment area would attain the 2008 ozone standard by the end of ozone season in 2017. The CAMx model attainment demonstration was performed based on the five-year weighted 2011 base year design values for monitors which included the worst ozone episodes induced by the unfavorable meteorology in 2011 and 2012 during the span of 2002-2015. The CAMx modeling predicted the 2017 maximum design value of 0.0756 ppm (or 75.6 ppb) at the North Phoenix monitor. The unmonitored area analysis with CAMx and MATS predicted the 2017 maximum design value of 0.0755 ppm (75.5 ppb) in the unmonitored area of the 4 km modeling domain. The 2017 maximum design value in the unmonitored area was located northwest of the Supersite monitor. The future design values in ppm were truncated to three significant digits for comparison with the 2008 ozone standard of 0.075 ppm (or 75 ppb) for the model attainment demonstration. Since both the truncated 2017 maximum design values for the monitors and the unmonitored area in the 4 km modeling domain are 0.075 ppm and equal to the 2008 ozone standard, the Maricopa eight-hour ozone nonattainment area satisfies the EPA attainment test requirements for the 2008 ozone standard.

To support the CAMx model attainment demonstration for the monitors and the unmonitored area in the Maricopa eight-hour ozone nonattainment area, the supplemental analyses were provided in Section VI and Appendix B. The purpose of the supplemental analyses or Weight-of-Evidence (WOE) analyses is to provide additional evidence that attainment will be reached in the future with some margin of safety, especially when the projected future design value is close to the 2008 ozone standard.

In one of the WOE analyses for the MAG CAMx attainment demonstration, which was discussed in Appendix B, the EPA modeling analysis performed for the proposed Cross-State Air Pollution Rule (CSAPR) for the 2008 ozone standard showed that the peak 2017 five-year weighted design value in Maricopa county is 75.0 ppb at the North Phoenix site and the design values for all other sites are below 73.0 ppb. The EPA modeling analysis affirmed that the Maricopa eight-hour ozone nonattainment area would be in attainment of the 2008 ozone standard in 2017.

The analyses for ambient ozone trends over 2010-2015 pointed out that the annual 4th highest daily maximum eight-hour ozone concentrations in the Maricopa eight-hour ozone nonattainment area have been generally decreasing except for the bump-ups in 2011 and 2012 because of abnormally less cloud coverage in 2011-2012, an unusually large number of high-temperature days in 2012, and more potential impacts from wildfire emissions in 2012 than in 2008-2011. The ambient ozone precursor trends at Supersite demonstrated consistency with the decreasing ozone trends in the area. Ambient NOx concentrations at Supersite show a strong downward trend since 1999. Summer season mean NOx in 2015 has been reduced to one third of the 1999 level. Concentrations of VOC have declined at Supersite during 1999-2010, slightly increased in 2011, and then re-established the decreasing trend in 2012. VOC concentrations have declined by more than half during the

1999-2015 period.

The projected 2017 emissions may contain potential uncertainties due to the incomplete data and assumptions used in the anthropogenic emissions projections. The CAMx decoupled direct method (DDM) was used to evaluate the impact of the uncertainties in the projected 2017 anthropogenic emissions on the model attainment demonstration in Section VI-6. Increases of anthropogenic VOC emissions up to 15%, NOx emissions up to 5%, and both VOC and NOx emissions less than 5% in the Maricopa eight-hour ozone nonattainment area from the 2017 emissions inventory provided a margin of safety for the attainment of the 2008 ozone standard. The CAMx DDM results also indicated less sensitivity of ozone concentrations to changes in VOC emissions than changes in NOx emissions.

The projected 2017 emissions for Electric Generating Units (EGU) that were used in the CAMx model attainment demonstration for the Maricopa eight-hour ozone nonattainment area were based on the maximum EGU emissions over 2005-2014. The assumption of the ten-year maximum emissions for EGU might be too conservative for the 2017 EGU emissions since the EPA power plant emission trends show that the nationwide NOx, SO_2, and CO_2 emissions have substantially decreased over 1990-2015 (EPA, 2016). For this reason, an alternative assumption of the no-growth EGU emissions between 2011 and 2017 was tested for the attainment of the 2008 ozone standard. The maximum 2017 design value was predicted at 75.0 ppb and lowered by as much as 0.6 ppb with constant EGU emissions between 2011 and 2017. The alternative approach provided a higher margin of safety for the attainment of the 2008 ozone standard.

The background ozone analyses verified the extensive background contributions of transported international ozone and precursor emissions from anthropogenic and biogenic sources to local ozone, and indicated that background ozone in the Maricopa eight-hour ozone nonattainment area is rising in response to increasing non-US emissions. It was also found that non-US ozone and precursor emissions (i.e., MOZART boundary data for the 36 km modeling domain) contributed to the 2017 future design values for the monitors up to 47.3 ppb based on the top ten high ozone prediction days for the May-September period. Anthropogenic emissions from Mexico contributed up to 7.1 ppb in July, and anthropogenic emissions from California contributed up to 7.3 ppb in June for the 2017 future design values for the monitors in the Maricopa eight-hour ozone nonattainment area. The background ozone analyses confirmed that the uncontrollable background ozone and precursor emissions significantly influenced ozone concentrations in the Maricopa eight-hour ozone nonattainment area. Ambient ozone controls in the western region may have become less effective and more difficult and burdensome due to the continual rise of transported non-US ozone and precursor emissions.

The model attainment demonstration for the monitors and the unmonitored area, affirmed by the supplemental and weight of evidence analyses, supports the conclusion that the Maricopa eight-hour ozone nonattainment area will attain the 2008 ozone standard by the attainment date of July 20, 2018.

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MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

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VOLUME FOUR

DECEMBER 2016

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MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

APPENDICES

DECEMBER 2016

MARICOPA ASSOCIATION of GOVERNMENTS

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

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Exhibit 2: 2014 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. September 2016.

APPENDIX B

Exhibit 1: Technical Support Document in Support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments.

Exhibit 2: State of Arizona Fifty-Second Legislature Senate Bill 1255 and Final Revised Fact Sheet for Senate Bill 1255.

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Exhibit 1: Public Hearing Process Documentation.

Exhibit 2: Certification of Adoption and MAG Authority for Regional Air Quality Planning.

APPENDIX B

APPENDIX B

EXHIBIT 1:

Appendices to the:

Technical Support Document in Support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments.

APPENDICES

APPENDIX A

MODELING PROTOCOL

OZONE MODELING PROTOCOL
IN SUPPORT OF
THE MAG 2017 MODERATE AREA PLAN FOR
THE MARICOPA EIGHT-HOUR OZONE NONATTAINMENT AREA
(2008 OZONE STANDARD)

Maricopa Association of Governments

November 2015

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ACRONYMS

ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWM	Arizona Department of Weights and Measures
APCA	Anthropogenic precursor culpability assessment
APM	Aviation performance metrics
APU	Auxiliary power unit
AQMP	Air Quality Modeling Platform
AQTAC	Air Quality Technical Advisory Committee
ASOS	Automated Surface Observing System
ATADS	Air Traffic Activity Data System
AVFT	Alternative vehicle and fuel technologies
CAA	Clean Air Act
CAMx	Comprehensive Air Quality Model with eXtensions
CART	Classification and regression tree
CB6	Carbon bond version 6
CEMS	Continuous Emissions Monitoring System
CFR	Code of Federal Regulations
CISL	Computational Information Systems Laboratory
CMAQ	Community Multiscale Air Quality Model
CPA	Chemical process analysis
DDM	Decoupled direct method
DEASCO3	Deterministic and Empirical Assessment of Smoke's Contribution to Ozone
DOT	Department of Transportation
EDMS	Emissions and Dispersion Modeling System
EGU	Electric Generating Unit
EPA	Environmental Protection Agency
ERG	Eastern Research Group
ESRL	Earth System Research Laboratory
ETMSC	Enhanced Traffic Management System Counts
FAA	Federal Aviation Administration
FR	Federal Register
GIS	Geographic Information System
GSE	Ground support equipment
HPMS	Highway Performance Monitoring System
I/M	Inspection and maintenance
ICAO	International Civil Aviation Organization
ICBC	Initial and boundary conditions
ISHD	Integrated Surface Hourly Database
LAI	Leaf area index
LCP	Lambert Conformal Projection
LTO	Landing and takeoff
MAG	Maricopa Association of Governments

MATS	Modeled Attainment Test Software
MCAQD	Maricopa County Air Quality Department
MCIP	Meteorology-Chemistry Interface Processor
MEGAN	Model of Emissions of Gases and Aerosols from Nature
MOVES	Motor Vehicle Emission Simulator
MOZART	Model for Ozone and Related Chemical Tracers
NAAQS	National Ambient Air Quality Standards
NCAR	National Center for Atmospheric Research
NCDC	National Climatic Data Center
NEI	National Emissions Inventory
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen oxides
NWS	National Weather Service
OSAT	Ozone source apportionment technology
PCAQCD	Pinal County Air Quality Control District
PEI	Periodic Emissions Inventory
PFT	Plant functional types
PTE	Potential to Emit
RRF	Relative response factor
RRTM	Rapid Radiative Transfer Model
RVP	Reid vapor pressure
SA	Spatial Allocator
SCC	Source classification code
SMOKE	Sparse Matrix Operator Kernel Emissions
TAF	Terminal Area Forecast
TDM	Travel demand model
TOMS	Total Ozone Mapping Spectrometer
TSD	Technical support document
TUV	Tropospheric Ultraviolet Visible
UTC	Universal Time Coordinate
VHT	Vehicle hours traveled
VMT	Vehicle miles traveled
VOC	Volatile organic compounds
WPS	WRF Preprocessing System
WRAP	Western Regional Air Partnership
WRF	Weather Research and Forecasting Model

1.0 OVERVIEW OF MODELING STUDY

1.1 Background

Under the 1990 Clean Air Act (CAA), the Maricopa eight-hour ozone nonattainment area was classified as a Marginal area for the 2008 ozone National Ambient Air Quality Standard (NAAQS) of 0.075 parts per million (ppm). The Maricopa eight-hour ozone nonattainment area includes the 5,018 square mile area located predominantly in Maricopa County with a portion of Pinal County (i.e., the city of Apache Junction). The effective date of the Marginal area designation was July 20, 2012. Since the Marginal area has up to 3 years from the effective date of the designation for the attainment of the 2008 ozone NAAQS, the attainment date was set to July 20, 2015.

The Maricopa Association of Governments (MAG) prepared the MAG 2014 Eight-Hour Ozone Plan. In compliance with the CAA requirements for the Marginal nonattainment area for ozone, the plan included an Emissions Statement, the 2011 Periodic Emissions Inventory, Pre-1990 Reasonably Available Control Technology Corrections, Nonattainment Area Preconstruction Permit Program, New Source Review, Emission Offset Requirements, Pre-1990 Corrections to Previously Required Vehicle Inspection and Maintenance Programs, and Transportation Conformity Requirements Compliance. Since the modeled attainment demonstration is not required for Marginal areas under the CAA, the plan did not include the attainment demonstration for the 2008 ozone standard. The plan was submitted to the U.S. Environmental Protection Agency (EPA) in June 2014. EPA approved most elements of the plan except for the New Source Review on September 25, 2015.

Since the area did not achieve the 2008 ozone standard by the required deadline of July 20, 2015, the Maricopa eight-hour ozone nonattainment area was subsequently proposed by EPA to be reclassified as a Moderate area on August 27, 2015 (FR, 2015). The deadline for Moderate areas to attain the 2008 ozone standard is July 20, 2018. Since EPA requires a modeled attainment demonstration if an area is classified as a Moderate area for the 2008 ozone standard, MAG has prepared this modeling protocol for the attainment demonstration for the 2008 ozone standard. For the attainment demonstration, EPA requires that all control measures necessary to demonstrate attainment be implemented prior to the start of the ozone season preceding the attainment year. Thus, the modeled attainment demonstration in this study verifies that all implemented federal and local control measures provide enough emission reductions needed to attain the 2008 ozone standard by the end of the ozone season in 2017.

The objectives of this study are to determine whether the Maricopa eight-hour ozone nonattainment area will attain the 2008 ozone standard by the end of the 2017 ozone season and to establish the 2017 conformity budget for onroad mobile source emissions using the most recent version of the EPA Motor Vehicle Emission Simulator (MOVES) model, MOVES2014a (released by EPA on November 4, 2015).

1.2 Purpose of Modeling Protocol

The modeling protocol is based upon the Draft EPA 2014 modeling guidance (EPA, 2014)

and describes modeling methodologies and assumptions which will be used in the modeled attainment demonstration for the 2008 ozone standard. The protocol is viewed as a set of general guidelines that provide focus, consistency, and a basis for consensus for all parties involved in this analysis. This modeling protocol will be reviewed and approved by members of the Air Quality Planning Team prior to commencement of modeling. This team includes staff representatives from MAG, the Arizona Department of Environmental Quality (ADEQ), the Arizona Department of Transportation (ADOT), and the Maricopa County Air Quality Department (MCAQD). Representatives of other agencies, including EPA and the U.S. Department of Transportation (DOT), will be consulted on technical matters, as needed.

2.0 CONCEPTUAL MODEL

The summer ozone season in the Maricopa eight-hour ozone nonattainment area has several meteorological factors that influence elevated ozone concentrations throughout the ozone season: early summer westerly transport of upwind air pollutants; a synoptic weather pattern featuring a high pressure over the northeastern portion of Arizona and a low pressure centered in the southwestern portion of Arizona; daytime local temperatures above 100°F; local emissions coinciding with valley-wide stagnant winds. The spatial distribution of elevated ozone concentrations in the region depends on surface winds that exhibit diurnal valley breezes and directional changes due to surrounding topography.

The conceptual model is developed for the Maricopa eight-hour ozone nonattainment area as follows:

1. Ozone concentrations are elevated during the summer due to intense photochemical reactions associated with increased solar radiation, local stagnation or long range transport of natural and anthropogenic ozone precursor emissions, and synoptic and mesoscale atmospheric dynamics.
2. Anthropogenic emissions are generally repetitive throughout the summer, but biogenic emissions substantially fluctuate depending on the weather conditions. Elevated ozone is created by combinations of these meteorological conditions and ozone precursor emissions generated from anthropogenic and biogenic sources.
3. The interaction of upwind transported and local emissions under various weather conditions characterizes elevated ozone concentrations in the region.

A detailed conceptual model for the Maricopa eight-hour ozone nonattainment area is provided in Appendix A.

3.0 EPISODE SELECTION

The EPA modeling guidance (EPA, 2007 and 2014) suggests the consideration of the following criteria in selecting the modeling episode or modeling time period: 1) The most recently compiled and quality-assured national emissions inventory databases should be

available for the modeling episode, 2) a sufficient number of days should be available so that the modeled attainment test applied at each monitor is based on the ten highest modeled days, 3) the modeling episode must ensure that the modeling system appropriately characterizes low pollution periods, development of elevated periods, and transition back to low pollution periods through synoptic cycles, and 4) the modeling episode should cover a variety of meteorological conditions conducive to elevated ozone concentrations.

Since the EPA National Emissions Inventory (NEI) for the year 2011 is the most recently compiled and quality-assured national emissions inventory, the year 2011 is selected as the base year for the development of the baseline emissions inventory and baseline design values. The baseline design values in 2011 are developed using ozone observations at monitors during the five-year period of 2009 - 2013. Since the full ozone season from May 1 through September 30 provides a sufficient amount of days (i.e., 153 days) for the development of the ten highest modeled days for ozone concentrations, covers a variety of meteorological conditions, and characterizes high-low and transitional conditions of ozone concentrations in the Maricopa eight-hour ozone nonattainment area, the period of May 1 through September 30 in 2011 is selected for the modeling episode in this study. For the modeled attainment demonstration, the initial three days of the modeling episode will be used as the model spin-up period to minimize the impact of fluctuations in the initial condition data. The modeling results from the spin-up period of May 1-3 will not be used for the modeled attainment demonstration.

4.0 MODEL SELECTION

A variety of emissions, meteorology, and air quality models are needed to perform a full attainment demonstration. The models used in this study meet the EPA guidance requirements of having prior peer reviews, appropriate theoretical bases, good performance in previous studies, and available documentation. The most commonly used photochemical air quality models for ozone attainment demonstration are the Comprehensive Air Quality Model with Extensions (CAMx) and Community Multiscale Air Quality Model (CMAQ). The CAMx model provides useful tools of the Ozone Source Apportionment Technology (OSAT) and Decoupled Direct Method (DDM) which have been used in many photochemical modeling applications to evaluate the contributions of pollutants, source categories, and source regions to local ozone concentrations as well as emissions sensitivities. Since the CAMx OSAT and DDM tools have been well tested and successfully applied to many photochemical modeling applications, the CAMx model is selected for the modeled attainment demonstration for the 2008 ozone standard and the supplemental analyses to develop nitrogen oxides (NOx) and/or volatile organic compounds (VOC) emission reduction strategies and to identify which pollutants, source categories, and source region should be controlled. The latest CAMx version 6.2 is used in the study. Figure 4-1 illustrates the MAG air quality modeling system flowchart with CAMx as the core model. Onroad mobile source emissions are generated by the MOVES2014a and MAG MOVESLINK2014 models. MOVESLINK2014 is a MAG developed program that estimates hourly gridded emissions using the Travel Demand

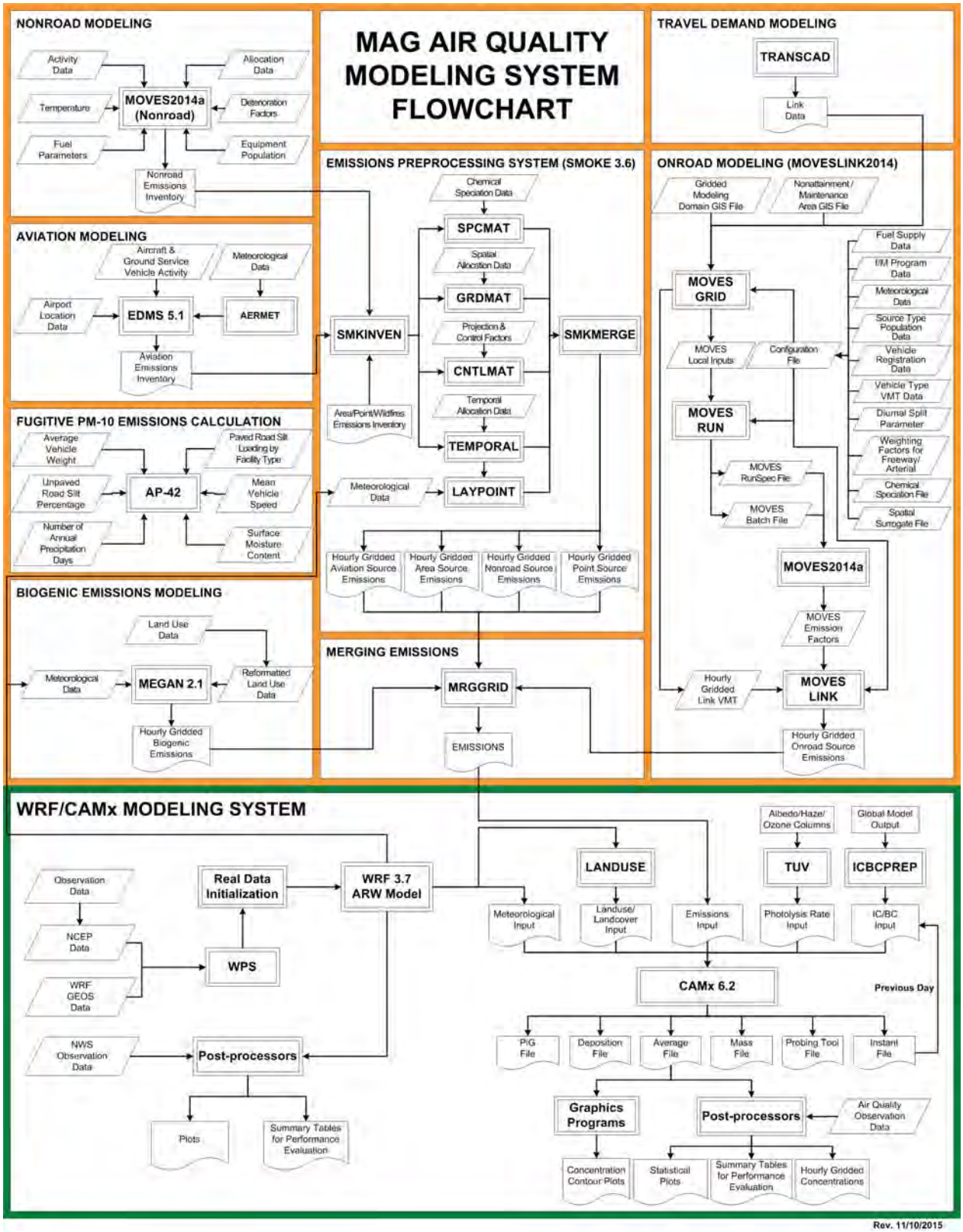

Figure 4-1 MAG air quality modeling system flowchart

Model (e.g., TransCAD) outputs for the photochemical air quality modeling analysis. Nonroad mobile source emissions are developed using the MOVES2014a model and the Federal Aviation Administration (FAA) Emissions and Dispersion Modeling System (EDMS) model. Biogenic source emissions are computed using the Model of Emissions of Gases and Aerosols from Nature (MEGAN) version 2.1. The Weather Research and Forecasting Model (WRF) version 3.7 is used to develop meteorological input data for CAMx. The Sparse Matrix Operator Kernel Emissions (SMOKE) version 3.7 is used to develop emissions input data for CAMx. More detailed discussions on the preparation of the emissions inventory and meteorological inputs are provided in Section 6.0.

5.0 MODELING DOMAIN SELECTION

5.1 Horizontal Domain

Selection of the modeling domains takes into account the Maricopa eight-hour ozone nonattainment area boundaries, the distribution of major emissions sources, the location of the meteorological and air quality monitoring sites, and the prevailing winds associated with elevated ozone concentrations, as well as regional air pollutant transport. Figure 5-1 shows the spatial relationship among the master (36 km grid resolution), first-nested (12 km grid resolution), and second-nested (4 km grid resolution) CAMx and WRF modeling domains. Figure 5-2 illustrates the inner modeling domain comprised of 4-by-4 km grid cells that covers the Maricopa eight-hour ozone nonattainment area, Maricopa County, and portions of Pinal, Gila, and Yavapai Counties.

Since ozone concentrations in the Maricopa eight-hour ozone nonattainment area can be substantially influenced by transported ozone and ozone precursor emissions from outside the Maricopa eight-hour ozone nonattainment area (EPA, 2015b), the master 36 km grid modeling domain (36 km domain) covers the 48 contiguous U.S. States along with the southern portion of Canada and the northern portion of Mexico. The extensive coverage of the master modeling domain of CAMx and WRF is designed to capture the characteristics of long-range transport of ozone and ozone precursor emissions to the Maricopa eight-hour ozone nonattainment area. The 36 km domain will be used to generate initial and boundary conditions for the 12 km grid modeling domain (12 km domain). The 12 km domain will be used to provide boundary and initial condition data for the core 4 km grid modeling domain (4 km domain). The CAMx modeled attainment demonstration will be performed with the 4 km domain.

In accordance with EPA guidance, the WRF modeling domains are developed to be larger than the CAMx modeling domains to simulate ozone concentrations around the boundaries of the CAMx modeling domains. The modeling domain configurations are provided in Table 5-1. The CAMx inner 4 km domain encompasses the entire Maricopa eight-hour ozone nonattainment area, consisting of 56 grid cells in the west-east direction and 44 grid cells in the south-north direction. The origin of the modeling domain (the southwest corner of the inner domain) is located at 226.004 km easting and -165.879 km northing in Lambert Conformal Projection (LCP). The domain has an area of approximate 15,222 square miles.

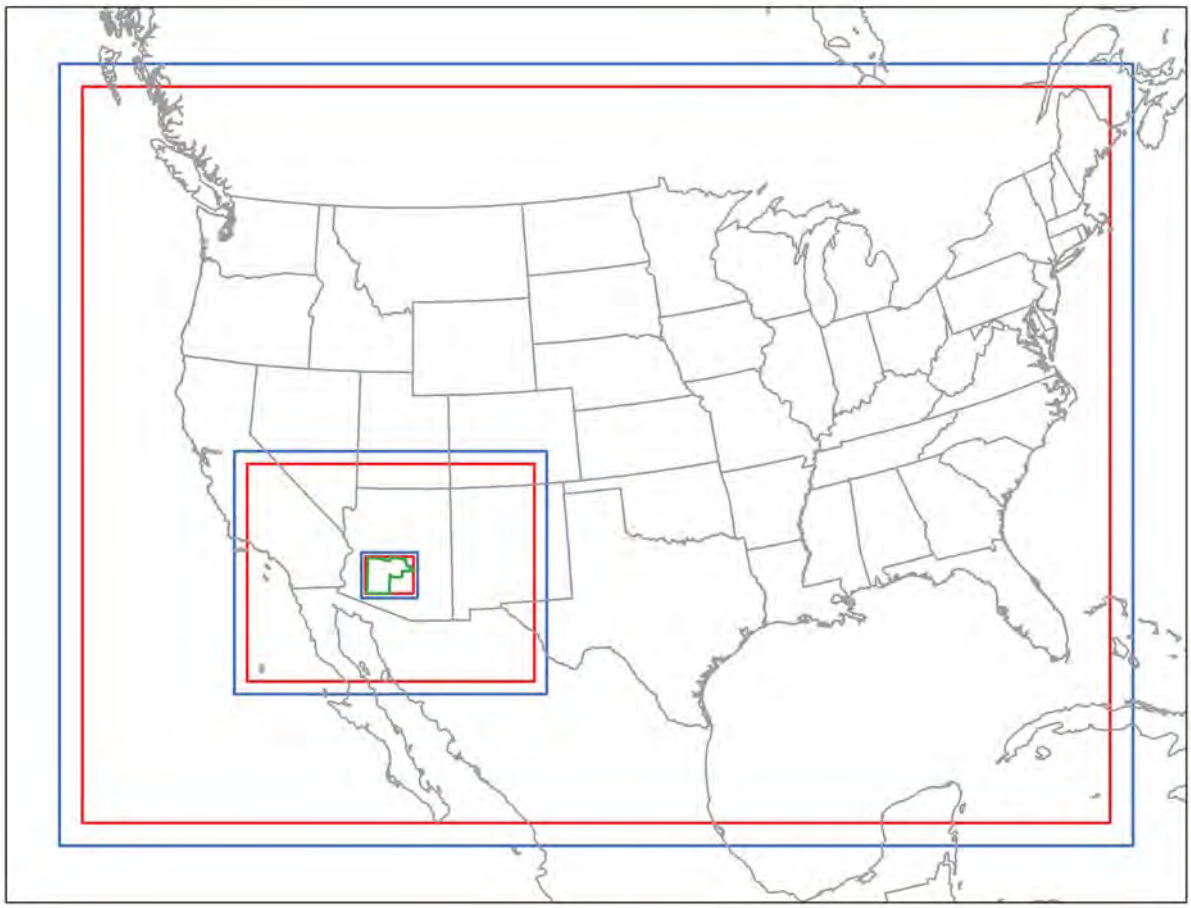

Figure 5-1 CAMx photochemical modeling domains (red: 36/12/4 km) and WRF meteorological modeling domains (blue: 36/12/4 km)

Table 5-1 WRF and CAMx modeling domains

WRF Modeling Domains		
Grid Resolution	**Grid Size**	**LCP Range (km)**
36 km x 36 km	141 by 103	(-1,674.004, -1,361.879) to (3,401.996, 2,346.121)
12 km x 12 km	123 by 96	(-846.004, -641.879) to (629.996, 510.121)
4 km x 4 km	66 by 54	(-246.004, -185.879) to (17.996, 30.121)
CAMx Modeling Domains		
Grid Resolution	**Grid Size**	**LCP Range (km)**
36 km x 36 km	135 by 97	(-1,566.004, -1,253.879) to (3,293.996, 2,238.121)
12 km x 12 km	113 by 86	(-786.004, -581.879) to (569.996, 450.121)
4 km x 4 km	56 by 44	(-226.004, -165.879) to (-2.004, 10.121)

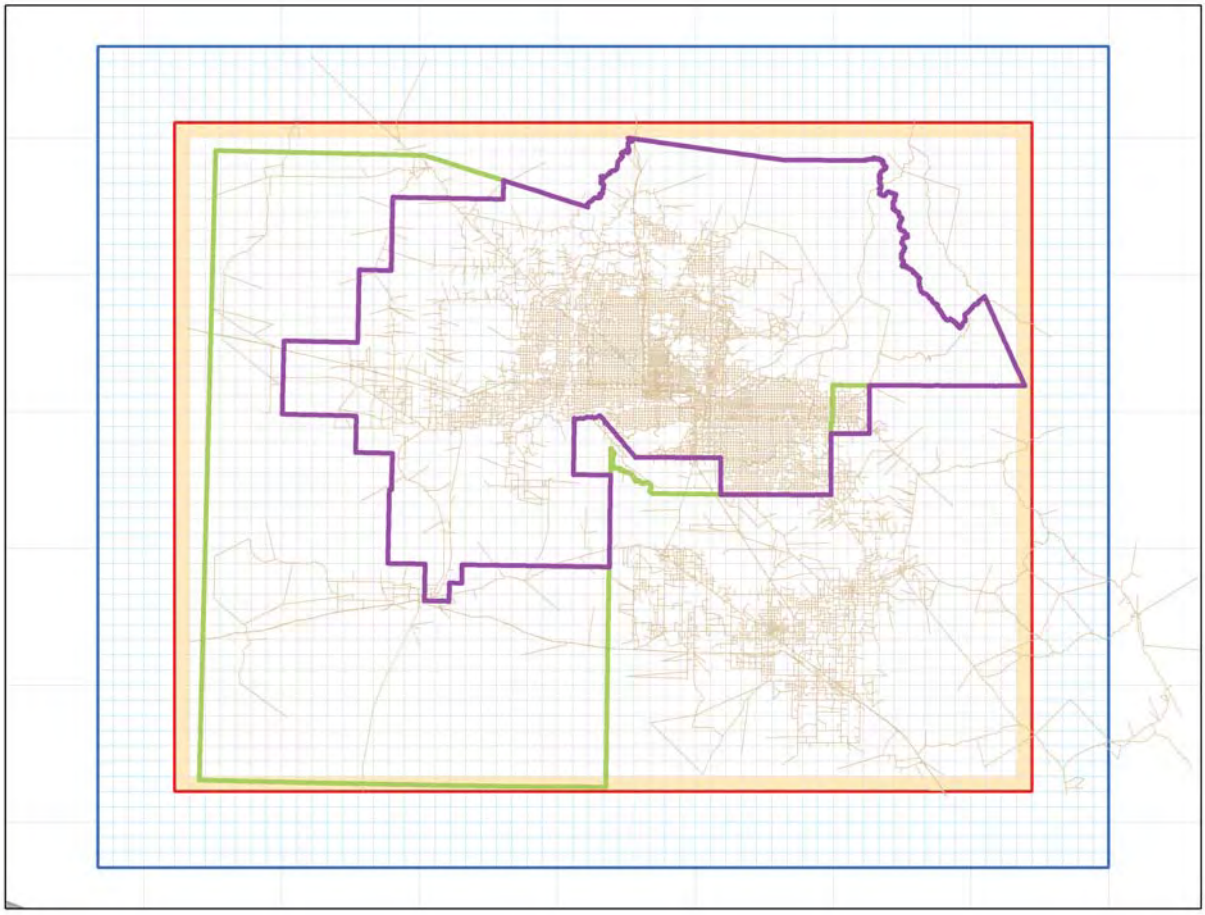

Figure 5-2 The inner-most CAMx modeling domain (red) and WRF modeling domain (blue), along with the Maricopa County boundary (green) and the Maricopa eight-hour ozone nonattainment area (purple)

The domain is large enough to contain potential emission sources within Maricopa and Pinal Counties which are likely to contribute to elevated ozone concentrations in the Maricopa eight-hour ozone nonattainment area.

5.2 Vertical Layer Configuration

The vertical layer resolution and coordinates for WRF and CAMx modeling are based on the sigma coordinate system. The sigma coordinate system uses the terrain-following hydrostatic pressure vertical coordinates ranging from 1 at the surface to 0 at the upper top boundary of the modeling domain. The 23 vertical layers configuration is used for both CAMx and WRF modeling. The upper top boundary is based on the reference pressure of 50.0 hPa. The numbers of approximate pressures and heights of vertical layers for the CAMx and WRF modeling are presented in Table 5-2.

The vertical depth and vertical layer structures of the 12 km and 4 km domains are consistent with those of the 36 km domain.

Table 5-2 Pressures and heights of WRF and CAMx vertical layers

Layer No.	Vertical Layer Pressure (hPa)	Vertical Layer Height (m)
1	933	20
2	929	60
3	925	100
4	921	140
5	914	201
6	906	282
7	898	364
8	889	446
9	877	571
10	860	740
11	843	911
12	826	1,085
13	801	1,352
14	764	1,764
15	713	2,341
16	663	2,945
17	622	3,479
18	580	4,042
19	538	4,638
20	496	5,271
21	392	7,192
22	225	11,339
23	121	14,949

6.0 MODEL INPUTS

6.1 Meteorological Modeling Inputs

6.1.1 WRF Model Configuration

WRF is an off-line dynamic grid model that simulates winds, vertical mixing, temperature, humidity, and solar radiation. The physical schemes used in the WRF model runs are as follows:

- New YSU planetary boundary layer physics,
- Noah LSM surface physics,
- WSM5 cloud mircophysics,
- Thompson cloud microphysics,
- New Multi-scale Kain-Fritsch cumulus parameterization,
- Rapid Radiative Transfer Model (RRTM) for longwave radiation, and
- Goddard scheme for shortwave radiation.

The simulation starting time is 12:00 Universal Time Coordinate (UTC) and the model is reinitialized after each segment run of 1.5 days (36 hours). All 153 consecutive 36-hour simulations are stitched together to form a full ozone season simulation. The first 12 hours of each segment are considered as the spin-up period for the segment run and disregarded after re-initialization, creating a continuous and more accurate representation of the seasonal meteorology. The standard data assimilation approach (grid analysis nudging) is applied to all modeling domains.

6.1.2 WRF Input Data Preparation Procedures

The operational NCEP Eta 212 grid (40 km) archived data (ds609.2) are obtained from the National Center for Atmospheric Research (NCAR) Computational Information Systems Laboratory (CISL) and used as input to the WRF modeling. A customized shell program is used to read and rename input files being processed by the WRF Preprocessing System (WPS). The procedures of the WPS to prepare input to WRF for real-data simulations include 1) defining coarse parent domain and fine nested domains, 2) computing latitude, longitude, map scale factors, and Coriolis parameters at every grid point, 3) interpolating time-invariant terrestrial data to simulation grids, and 4) transferring time-variant data at a standard 3-hour interval.

6.1.3 Meteorological Initial and Boundary Conditions

The meteorological initial conditions for the modeling domains and the lateral boundary conditions for the 36 km domain are generated by the program real.exe based on WPS data. Lateral boundary conditions for the two nested modeling domains are dynamically provided every hour by their parent modeling domains during the WRF simulations. WRF runs for the 36 km domain provide the boundary condition for the 12 km domain and likewise WRF runs for the 12 km domain provide the boundary condition for the 4 km

domain.

6.1.4 WRF Output Data for Meteorological Inputs to Air Quality Models

The Meteorology-Chemistry Interface Processor (MCIP) processes WRF outputs for the CAMx-ready data sets. MCIP is designed to maintain dynamic consistency between the meteorological model and the chemical transport model. MCIP v4.2 reads WRF ouputs for the grid cells of the air quality modeling domain and converts the WRF model outputs to meteorological input format for CAMx, MEGAN, and SMOKE.

6.2 Emission Inputs

Anthropogenic and biogenic source emissions inventories in 2011 and 2017 for the period of May 1 through September 30 are developed for Maricopa and Pinal Counties for the 4 km domain, and the U.S. and portions of Mexico and Canada for the 12 km and 36 km domains for this modeling analysis. The U.S. anthropogenic emissions inventory for the 12 km and 36 km domains are obtained from the EPA 2011 Air Quality Modeling Platform version 6.2 (AQMP v6.2) (EPA, 2015a). The anthropogenic emissions inventory development for the northern portion of Mexico and the southern portion of Canada was contracted with Eastern Research Group (ERG), Inc. ERG provided the 2011 and 2017 anthropogenic emissions in Mexico and Canada on August 31, 2015. The details on the 2011 and 2017 Mexico and Canada emissions inventories are available in Appendix E.

Biogenic emissions in 2011 are developed using MEGAN for the 4 km, 12 km, and 36 km domains. Wildfire emissions in the U.S. are obtained from the EPA 2011 AQMP v6.2 and wildfire emissions in Mexico and Canada are obtained from the Western Regional Air Partnership (WRAP) Deterministic & Empirical Assessment of Smoke's Contribution to Ozone (DEASCO3) project data. Biogenic source emissions including wildfire emissions are assumed to be constant between 2011 and 2017.

The following sub-sections focus on the emissions inventory development for the 4 km domain.

6.2.1 Point Source Emissions

Point sources include major stationary sources that emit a significant amount of air pollutants (i.e., VOC, NOx, CO, SO_2, PM-10, PM-2.5, lead, and NH_3) into the air. Point sources are required to report emissions if they meet the major source definition under 40 CFR Part 70. To develop the emissions inventory for this modeling analysis, point sources are subcategorized into Electric Generating Units (EGU) and non-EGU. EGU refer to power plants. Non-EGU include major stationary sources (except power plants) such as petroleum product storage and transfer facilities, large industrial facilities, and landfills.

EGU and non-EGU point source emissions for Maricopa County in 2011 are based on ozone season day emissions for the period of June through August reported in the Addendum (August 2015) for the 2011 Periodic Emissions Inventory (PEI) for ozone precursors. EGU emissions in 2017 provided by MCAQD are based on the maximum emissions over the 10-year period of 2005 through 2014 for individual EGU (MCAQD, 2015). The new Buckeye Generation Center is planned for operation in 2017 and the

Potential to Emit (PTE) emissions are assumed for the power plant emissions in 2017. Non-EGU emissions in 2011 are projected to 2017 by applying growth factors that are developed using the socioeconomic data, census data, and appropriate growth indicators (e.g., population, employment, agricultural area, gasoline consumption, etc.) between 2011 and 2017, as shown in Table 6-1.

Table 6-1 Growth indices and growth factors for non-EGU point and area sources in Maricopa County

Growth Index	2011	2017	Growth Factor
Agricultural Acres	275,050	268,346	0.98
Airport Operations (operations/year)	1,718,536	1,805,295	1.05
Gasoline Consumption (gallons/day)	4,308,054	3,901,057	0.91
Industrial Employment	336,654	393,824	1.17
Locomotive Diesel Usage (gallons/year)	8,273,092	6,097,290	0.74
Number of Aircrafts in Luke AFB	136	132	0.97
Population	3,843,373	4,239,606	1.10
Roadway Lane Miles	22,551	23,137	1.03

Pinal County EGU and non-EGU emissions in 2011 are provided by the Pinal County Air Quality Control District (PCAQCD) and projected to 2017 emissions by applying growth factors. The growth factors for individual EGU are developed using Pinal County EGU emissions growths extracted from the 2011 and 2017 base case emissions inventories of the EPA 2011 AQMP v6.2. The growth factors for non-EGU are developed using the industrial employment growth between 2011 and 2017. The industrial growth index and growth factor are presented in Table 6-2. PCAQCD provided 2017 emissions for the Coolidge Generation Station by applying a 20% growth to the 2011 emissions because the emissions for the Coolidge Generating Station are left off the 2017 base case emissions inventory of the EPA 2011 AQMP v6.2 (PCAQCD, 2015).

6.2.2 Area Source Emissions

Area sources are defined as all stationary sources which are too small or too numerous to be treated as point sources. Area source emissions for Maricopa County in 2011 are obtained from ozone season day emissions for the period of June through August reported in the Addendum for the 2011 PEI for ozone precursors. The ozone season day emissions are expanded for the development of ozone season day specific emissions for the five

Table 6-2 Growth indices and growth factors for non-EGU point and area sources in Pinal County

Growth Index	2011	2017	Growth Factor
Agricultural Acres	449,368	447,425	1.00
Airport Operations (operations/year)	176,724	262,008	1.48
Gasoline Consumption (gallons/day)	417,529	378,125	0.91
Industrial Employment	8,111	7,752	0.96
Locomotive Diesel Usage (gallons/year)*	8,273,092	6,097,290	0.74
Population	384,221	444,680	1.16
Roadway Lane Miles	6,368	6,508	1.02

* The locomotive diesel usage and projection for Maricopa County are assumed for Pinal County.

months modeling period of this study. Area source ozone season day emissions in 2011 are projected to emissions in 2017 by applying growth factors which were developed based on the growth indices between 2011 and 2017. The growth indices and growth factors developed for Maricopa County are provided in Table 6-1. The growth factors applied to individual area source categories in Maricopa County are presented in Table C-1 in Appendix C.

Area source emissions in Pinal County for the base year 2011 are obtained primarily from the EPA 2011 AQMP v6.2 because the Pinal County 2011 PEI for ozone precursors is not available. Since the EPA 2011 AQMP v6.2 emissions inventory overestimated emissions for land clearing debris, architectural coatings, landfills, and crematories in Pinal County, corrected emissions for these categories are provided by PCAQCD. The growth factors in Table 6-2 are applied to project Pinal County area source emissions in 2011 to those in 2017. The growth indices and factors applied to individual area source categories in Pinal County are presented in Table C-2 in Appendix C.

6.2.3 Onroad Mobile Source Emissions

EPA released MOVES2014a on November 4, 2015. Because EPA recommends use of the model for new State Implementation Plan (SIP) development, onroad emissions for the 4 km domain will be calculated using MOVES2014a and MAG MOVESLINK2014 for this study. MOVESLINK2014 is a tool designed to process road network and off-network emissions factors from MOVES2014a and link data from the TransCAD Travel Demand Model (TDM) to develop the onroad emissions inventory for regional transportation conformity and photochemical air quality modeling analyses. This tool is developed by

MAG using the Python programming language and Geographic Information Systems (GIS) technology. MOVESLINK2014 reads link-level activity data from the MAG TransCAD traffic assignment, prepares MOVES2014a input data, executes MOVES2014a, and post-processes MOVES2014a outputs.

To calculate vehicle emissions for the selected years, MOVES2014a is executed using local input data for each day of the modeling episode. MOVES modeling scenarios are created using the County Domain/Scale option with the Inventory and Emissions Rates Calculation Type for all road types including off-network.

MOVES2014a requires local data such as Inspection and Maintenance (I/M) programs, meteorological data, vehicle population, source type age distribution, annual vehicle miles traveled (VMT), monthly/daily/hourly fractions, road type distribution, average speed distribution, ramp fraction, fuel data, and Alternative Vehicle and Fuel Technologies (AVFT). According to EPA guidance (EPA, 2015c), local input data are prepared as follows:

- I/M programs: The I/M programs data were provided by the ADEQ.
- Meteorological data: As a representative of local meteorological conditions, meteorological data measured at the Phoenix Sky Harbor International Airport are obtained from the National Climatic Data Center (NCDC) for the selected episode days in 2011. The same data are applied to the base and future year modeling.
- Vehicle population: Vehicle registration data in Maricopa County for the base year of 2011 are obtained from ADOT and assigned to vehicle populations for the 13 MOVES source types. For the future year modeling, the vehicle registration data for the current year 2015 are adjusted by applying the ratio of the future year source type population to the current year source type population.
- Source type age distribution: The EPA MOVES data converter is used to generate the MOVES age distribution input based on the vehicle registration data from ADOT.
- Annual VMT: The annual VMT data by the Highway Performance Monitoring System (HPMS) vehicle type are derived with the MOVES default VMT fractions for the HPMS vehicle types and the traffic assignment data provided by the MAG Transportation Division.
- Road type distribution: The road type distribution by HPMS vehicle type is derived with the MOVES default VMT fractions for the HPMS vehicle types from the traffic assignment data provided by the MAG Transportation Division.
- VMT fraction: The month/day/hour VMT fractions are developed from traffic count data recorded by continuous traffic counters on freeways (ADOT Freeway Management System) and arterials (Phoenix Automatic Traffic Recorders) in 2007.
- Average speed distribution: Estimates of local average speeds are derived from the traffic assignment data provided by the MAG Transportation Division.

- Ramp fraction: The ramp fraction represents the percent of vehicle hours traveled (VHT) on freeway ramps on both rural and urban restricted roads. The VHT for the ozone modeling domain is obtained from the traffic assignment data provided by the MAG Transportation Division.
- Fuel data: Using the MOVES Fuel Wizard, the MOVES2014a default fuel parameters by month are replaced with the Maricopa and Pinal Counties fuel inspection data provided by the Arizona Department of Weights and Measures (ADWM) for the year 2011. For the future year modeling, the MOVES2014a defaults for the 2017 fuel parameters are used.
- AVFT strategy: The AVFT input for transit buses is updated using the bus fleet information by fuel type provided by Valley Metro.

Based on these inputs, draft onroad emissions have been developed using the MOVES2014 model, as provided in Appendices B and F. The draft onroad emissions will be revised using the MOVES2014a model for the modeled attainment demonstrations and the 15% VOC reduction compliance of the Reasonable Further Progress (RFP).

6.2.4 Nonroad Mobile Source Emissions

Nonroad Equipment Emissions

EPA incorporated its NONROAD2008 model into MOVES2014 in July 2014. Since the nonroad portion of MOVES2014 is identical to the NONROAD2008 model, either the standalone NONROAD2008 or its incorporation into MOVES2014 is allowed for development of nonroad emissions inventories for SIP submissions or other official modeling purposes. On November 4, 2015, EPA released MOVES2014a (EPA, 2015c) and recommended that MOVES2014a be used for nonroad emissions modeling for all new SIP development. EPA justified use of MOVES2014a because it provides slightly different nonroad emissions results due to the new features of nonroad emissions output processes and the updated fuel input files. EPA pointed out that the NONROAD2008 model might no longer work with current operating systems and will no longer be technically supported by EPA. For these reasons, MOVES2014a will be used to estimate ozone precursor emissions for all nonroad mobile sources in Maricopa and Pinal Counties, except for locomotives, aircraft and airport ground support equipment. However, draft nonroad equipment emissions in 2011 and 2017 are calculated using the NONROAD2008 model default populations and activities for Maricopa and Pinal Counties, as are presented in Appendices B and F. The draft nonroad emissions will be revised using MOVES2014a for this study.

Nonroad emissions categories include agricultural equipment, commercial equipment, construction and mining equipment, industrial equipment, lawn and garden equipment (commercial and residential), pleasure craft, railroad equipment and recreational equipment. Logging equipment are assumed to be zero for Maricopa County and Pinal County. MOVES2014a runs are based on the population and activity defaults of the model for Maricopa and Pinal Counties. For commercial lawn and garden equipment, MAG uses locally collected data from a survey of activity and population for these equipment in

Maricopa County (ENVIRON, 2003).

Monthly fuel data in 2011 for Maricopa and Pinal Counties are provided by ADWM. The fuel data include oxygen content, ethanol blend volume percentage and market share, and Reid Vapor Pressure (RVP). Daily minimum and maximum, and average temperatures measured at Sky Harbor International Airport in 2011 are used for MOVES2014a nonroad modeling. Additionally, the model is run with different default profiles depending on the day of the week (EPA, 1999), resulting in unique day-of-week totals depending on the base year 2011 calendar day. Daily emissions for the entire ozone season is constructed, substituting emissions for holidays (Memorial Day, Independence Day, and Labor Day) with the weekend emissions. Locomotive emissions in 2011 are obtained from the Maricopa County 2011 PEI for ozone precursors and the EPA 2011 AQMP v6.2 for Pinal County. Locomotive emissions in 2017 account for the projected locomotive diesel fuel consumptions in 2017.

Airport Emissions

Most airport emissions in Maricopa and Pinal Counties are developed with EDMS version 5.1.4. This model is designed to calculate VOC, NOx, CO, particulate matter, and other gaseous pollutant emissions for aircraft, auxiliary power units (APU), and ground support equipment (GSE). EDMS features up-to-date aircraft engine emission factors from the International Civil Aviation Organization (ICAO) Engine Exhaust Emissions Data Bank.

As shown in Table 6-3, there are 22 airports located in Maricopa and Pinal Counties within the 4 km domain.

To calculate aircraft, APU, and GSE emissions for airports in Maricopa County, EDMS requires the following four inputs:

- Number of landing and takeoff (LTO) cycles: The number of LTO cycles is prepared for four aircraft categories: Air Commercial (AC), Air Taxi (AT), General Aviation (GA), and Military (ML). The day-specific LTO data from the first eight airports in Table 6-3 are retrieved directly from the Airport Operations database in the FAA Air Traffic Activity Data System (ATADS). The monthly LTO data for the other airports, except Luke Air Force Base (AFB), are obtained from MAG 2009 and 2014 airport survey data.
- Aircraft fleet mix: Aircraft fleet mix accounts for the operation distribution of aircraft types. The fleet mix data are developed using FAA Enhanced Traffic Management System Counts (ETMSC) data.
- Operational temporal profiles for aircraft types: The monthly and weekly profiles are developed using the day-specific LTO data for the aircraft categories for individual airports. The hourly profile is created using operation data from the FAA Aviation Performance Metrics (APM) data.
- Mixing height: Based on the Phoenix Sky Harbor Airport surface meteorological data and the Tucson upper air data, the time-varying mixing heights are calculated using EPA AERMET (version 15181) and AERSURFACE (version 13016) models.

Surface and upper air meteorological data are obtained from the NCDC Integrated Surface Hourly Database (ISHD), 1-minute Automated Surface Observing System (ASOS) wind data, and the Earth System Research Laboratory (ESRL) Radiosonde Database.

Table 6-3 Operations for airports in the 4 km domain in 2011 and 2017

No.	Airport Name	Code	County	Latitude	Longitude	2011	2017
1	Chandler Municipal Airport	CHD	Maricopa	33.269	-111.811	161,589	233,855
2	Deer Valley Airport	DVT	Maricopa	33.688	-112.083	317,443	317,247
3	Falcon Field Airport	FFZ	Maricopa	33.461	-111.728	220,080	275,171
4	Glendale Municipal Airport	GEU	Maricopa	33.527	-112.295	87,124	59,130
5	Phoenix Goodyear Airport	GYR	Maricopa	33.423	-112.376	138,606	76,282
6	Phoenix-Mesa Gateway Airport	IWA	Maricopa	33.308	-111.655	171,200	221,259
7	Phoenix Sky Harbor Airport	PHX	Maricopa	33.434	-112.008	461,989	458,242
8	Scottsdale Airport	SDL	Maricopa	33.623	-111.911	141,640	148,813
9	Buckeye Municipal Airport	BXK	Maricopa	33.420	-112.686	53,070	53,070
10	Gila Bend Municipal Airport	GBD	Maricopa	32.958	-112.678	3,536	3,536
11	Pleasant Valley Airport	P48	Maricopa	33.801	-112.251	6,010	6,010
12	Sky Ranch at Carefree Airport	18AZ	Maricopa	33.818	-111.898	3,030	3,030
13	Stellar Airpark	P19	Maricopa	33.299	-111.916	39,056	39,056
14	Luke Air Force Base*	LUF	Maricopa	33.535	-112.383	n/a	n/a
15	Wickenburg Municipal Airport	E63	Maricopa	33.969	-112.799	12,000	12,000
16	Ak-Chin Regional Airport**	A39	Pinal	32.991	-111.919	1,095	36,500
17	Arizona Soaring	E68	Pinal	33.084	-112.161	20,075	20,075
18	Casa Grande Municipal Airport	CGZ	Pinal	32.955	-111.767	119,680	119,680
19	Coolidge Municipal Airport	P08	Pinal	32.936	-111.427	4,250	4,250
20	Eloy Municipal Airport	E60	Pinal	32.807	-111.587	19,800	23,450
21	Kearny Airport	E67	Pinal	33.047	-110.909	1,196	1,196
22	Pinal Airpark	MZJ	Pinal	32.510	-111.325	10,628	56,857

* Emissions are scaled by numbers of aircrafts in 2011 and 2017.

** Operational data at Ak-Chin Regional Airport were collected through a phone conversation with airport manager Tim Costello on 10/27/2015.

The Luke Air Force Base (AFB) emissions in 2011 are developed by scaling the 2008 emissions (Weston, 2010) with the numbers of F-16 aircraft data in 2008 and 2011. The Luke AFB provided the numbers of F-16 aircraft in 2011, and F-16 and F-35 aircraft in 2017. The Luke AFB F-16 emissions in 2011 are projected to 2017 using the ratio of the

number of F-16 aircraft in 2017 to one in 2011. The Luke AFB aircraft and GSE emissions for the future 144 F-35 aircraft of the L6 scenario are obtained from the 2012 environmental impact statement report (USAF, 2012). The Luke AFB emissions in 2017 are calculated by multiplying the ratio of the 60 F-35 aircraft in 2017 to the 144 F-35 aircraft to the L6 scenario emissions and adding F-16 aircraft emissions in 2017.

For the 2017 airport emission calculations for Maricopa County, the latest LTO predictions from the FAA Terminal Area Forecast (TAF) (FAA, 2015) are used for the first eight airports in Table 6-3, while the LTO cycles for other airports are assumed to be the same as those in 2011 since those airports are small and have no operation projections for the future year.

For the seven airports in Pinal County within the 4 km domain, airport operations in 2011 and 2017 are obtained from three sources: (1) MAG airport survey, (2) FAA TAF database, and (3) AirNav.com website. The emissions at the Pinal Airpark in 2017 are scaled by applying the ratio of operations between 2011 and 2017 to the 2011 emissions from the EPA 2011 AQMP v6.2. The aircraft fleet mix data for airports in Pinal County are based on average fleet mix data of the municipal airports in Maricopa County for general aviation and military cateogries. To calculate hourly mixing heights, surface meteorological data at the National Weather Service (NWS) Casa Grande Airport station are extracted from NCDC ISHD.

6.2.5 Biogenic Source Emissions

Biogenic emissions include VOC, NOx, and CO emitted by vegetation and soil. MEGAN version 2.10 (Guenther, 2012) is used to estimate biogenic emissions.

Meteorological data for MEGAN runs are obtained from WRF model outputs. The WRF simulations are postprocessed by MCIP. The output of MCIP is used as input to MET2MEG, which is a component program of MEGAN to generate meteorological input data for MEGAN. The MET2MEG outputs include photosynthetically active radiation at the surface, temperature at 2 meters above the surface, pressure, humidity, wind speed, soil moisture and temperature, and precipitation.

Eight-day average leaf area index (LAI) and percentages of 16 plant functional types (PFT) are used to characterize vegetation coverage and tree distribution in the modeling domains. The LAI data are based on 30 arc-seconds (approximate 1 km) North America Leaf Index (version 2011); the PFT data are 30 arc-seconds North America Plant Functional Type (version 2011); the emissions factors are 30 arc-seconds global emission factors.

6.3 Emissions Preprocessing

Emissions inventory data must be pre-processed for use of the CAMx modeling analysis. The SMOKE modeling system is used to develop gridded, chemically speciated, and hourly emissions for the CAMx modeling. The anthropogenic and biogenic emissions are merged into one emissions input file for CAMx. The SMOKE model is also used to separate elevated point source emissions from the ground level point source emissions using the WRF mixing heights.

Temporal Allocation of Emissions

Emissions inventories are provided at various temporal levels (i.e., season day emissions or annual emissions). SMOKE develops day-specific hourly emissions using temporal profiles.

Since the temporal profiles for EGU point sources in the 4 km domain are inappropriate, EGU temporal profiles are developed using the EPA Continuous Emissions Monitoring System (CEMS) data from the EPA 2011 AQMP v6.2. For non-EGU point sources in Maricopa County, ozone season average day emissions are temporally adjusted using the EPA hourly profile from the EPA 2011 AQMP v6.2. Pinal County non-EGU annual emissions are processed to develop hourly emissions using the EPA monthly, weekly, and diurnal temporal profiles.

For the temporal allocation of area and nonroad sources, the EPA temporal profiles are used for day-specific hourly emissions by Source Classification Code (SCC).

Spatial Allocation of Emissions

Most anthropogenic emissions, except point sources, are reported as county-level. These emissions are to be spatially allocated to grid cells for photochemical air quality modeling. For example, gridded agricultural land use is used to spatially distribute agricultural pesticide emissions.

The EPA Spatial Allocator (SA) v4.2 is used in generating geo-referenced spatial surrogates that are inputs to the SMOKE modeling system.

Three components are required for developing spatial surrogates as follows:

1. Weight shapefile: The geospatial dataset is used for allocating (or weighting) county-level emissions to grid cells. The dataset includes shapefiles for roadways, population density, or golf courses.
2. Data shapefile: The geospatial dataset includes county and municipal boundary layers.
3. Output grid or polygon: The geospatial dataset includes grids or polygons configuration for the modeling domains.

A total of 22 spatial surrogates are developed for Maricopa and Pinal Counties by using MAG GIS shapefiles for the region. For Maricopa County, the MAG GIS shapefiles include 2010 census data, 2011 MAG regional traffic data, 2012 MAG land use and land cover, and 2011 Maricopa County employment data. The recent local landuse and employment data for Pinal County are used in developing spatial surrogates for grid emissions in the area. These spatial surrogates applied to Source Classification Codes (SCC) are listed in Appendix D.

Chemical Speciation

The CAMx modeling in this study uses the most up-to-date chemical mechanism, Carbon Bond Version 6 revision 2 (CB6r2), as photochemical reactions of ozone precursor

emissions. This version of chemical mechanism has updated chemistry of isoprene and aromatic hydrocarbons and NOx recycling from the degradation of organic nitrates. The chemical mechanism contains 137 model species and 216 chemical reactions to simulate atmospheric photochemical reactions (ENVIRON, 2014). The SMOKE modeling system is used for the chemical speciation process, which converts ozone precursor emissions (i.e., VOC and NOx) to the model species emissions for ozone chemistry according to chemical speciation profiles for emission source categories. The SMOKE CB6 speciation profile is used to perform the chemical speciation process for the CAMx modeling.

6.4 Ozone Column Data

The CAMx photochemical mechanism requires ozone column and clear-sky photolysis rate data. Day-specific ozone column data are obtained from the Total Ozone Mapping Spectrometer (TOMS) satellite platform. The CAMx Tropospheric Ultraviolet Visible (TUV) radiative transfer model uses TOMS ozone column data to calculate clear-sky photolysis rates and to adjust the clear-sky photolysis rates in presence of cloud and aerosols.

6.5 Observed Ozone Data

Observed ozone concentrations collected from the air quality monitoring sites in Table 6-4 will be used in evaluating the CAMx model performance and developing the baseline design values for the monitoring sites. The locations of the monitoring sites are provided in Figure 6-1.

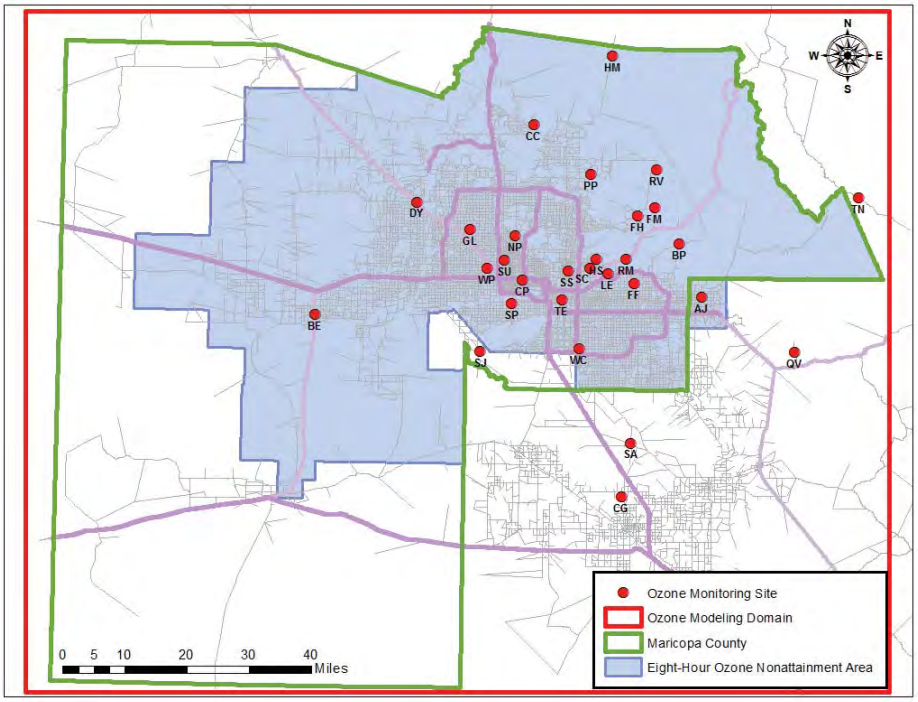

Figure 6-1 Locations of ozone monitoring sites within and near the Maricopa eight-hour ozone nonattainment area

Table 6-4 Ozone monitoring sites in the 4 km domain

AIRSID	Site Name	Site Abbr	County	Street Address	Latitude	Longitude
40070010	Tonto NM	TN	Gila	South of SR88	33.6547	-111.1074
40130019	West Phoenix	WP	Maricopa	3847 W Earll Dr, Phoenix	33.4839	-112.1426
40131004	North Phoenix	NP	Maricopa	601 E Butler Dr & 6th St, Phoenix	33.5603	-112.0663
40131010	Falcon Field	FF	Maricopa	4530 E McKellips Rd, Mesa	33.4522	-111.7333
40132001	Glendale	GL	Maricopa	6000 W Olive Ave, Glendale	33.5745	-112.1920
40132005	Pinnacle Peak	PP	Maricopa	25000 N Windy Walk, Scottsdale	33.7063	-111.8556
40133002	Central Phoenix	CP	Maricopa	1645 E Roosevelt St, Phoenix	33.4579	-112.0460
40133003	South Scottsdale	SS	Maricopa	2857 N Miller Rd, Scottsdale	33.4797	-111.9172
40134003	South Phoenix	SP	Maricopa	33 W Tamarisk Ave, Phoenix	33.4032	-112.0753
40134004	West Chandler	WC	Maricopa	275 S Ellis, Chandler	33.2990	-111.8843
40134005	Tempe	TE	Maricopa	1525 S College Ave, Tempe	33.4124	-111.9347
40134008	Cave Creek	CC	Maricopa	37019 N Lava Ln, Cave Creek	33.8217	-112.0174
40134010	Dysart	DY	Maricopa	16825 N Dysart, Surprise	33.6371	-112.3418
40134011	Buckeye	BE	Maricopa	26453 W MC85, Buckeye	33.3701	-112.6207
40135100	Fort McDowell/Yuma Frank	FM	Maricopa	18791 Yuma Frank Rd, Fort McDowell	33.6292	-111.6769
40137003	St Johns	SJ	Maricopa	4208 W Pecos, Laveen	33.2902	-112.1606
40137020	Senior Center	SC	Maricopa	10844 E Osborn Rd, Scottsdale	33.4882	-111.8557
40137021	Red Mountain	RM	Maricopa	15115 Beeline Highway, Scottsdale	33.5080	-111.7553
40137022	Lehi	LE	Maricopa	3250 N Stapley Dr, Mesa	33.4746	-111.8058
40137024	High School	HS	Maricopa	4827 N Country Club Dr, Scottsdale	33.5081	-111.8385
40139508	Humboldt Mountain	HM	Maricopa	7 Springs Rd, Tonto National Forest	33.9828	-111.7987
40139702	Blue Point	BP	Maricopa	Usery Pass Rd, Blue Point	33.5455	-111.6093
40139704	Fountain Hills	FH	Maricopa	16426 E Palisades Blvd, Fountain Hills	33.6110	-111.7253
40139706	Rio Verde	RV	Maricopa	25608 N Forest Rd, Rio Verde	33.7188	-111.6718
40139997	Super Site	SU	Maricopa	4530 N 17th Ave, Phoenix	33.5038	-112.0958
40213001	Apache Junction	AJ	Pinal	305 E Superstition Blvd, Apache Junction	33.4214	-111.5436
40213003	Casa Grande	CG	Pinal	660 W Aero Dr, Casa Grande	32.9544	-111.7623
40217001	Sacaton	SA	Pinal	35 Pima St, Sacaton	33.0801	-111.7400
40218001	Queen Valley	QV	Pinal	10 S Queen Ann, Queen Valley	33.2935	-111.2856

6.6 Photochemical Modeling Configuration

CAMx requires a namelist control file specifying input files and model configuration such as model clock control, map projection parameters, modeling grid parameters, model options, and output specifications. Table 6-5 summarizes the CAMx model configuration in this study.

Table 6-5 CAMx model configuration

Science Options	Configuration	Details
Model	CAMx v6.2	Newer version will be used if available at time of modeling
Horizontal Grid	36/12/4 km	Geographic dimensions of each cell
- 36 km domain	135 x 97 cells	36 km one-way grid nesting
- 12 km domain	113 x 86 cells	12/4 km two-way grid nesting
- 4 km domain	56 x 44 cells	12/4 km two-way grid nesting
Vertical Grid	23 vertical layers	Layer 1 (~20 m), Model top (~15 km)
Grid Interaction	36 km: one-way grid nesting 12/4 km: two-way grid nesting	Nested domain depends on outer domain for boundary and initial conditions
Initial Conditions	3-day spin-up	Smoothing out unrealistic fluctuations at start of simulation
Boundary Conditions	36 km: extracted from global chemistry model 12 km: extracted from the 36 km domain results	MOZART global chemistry model
Emissions Processing	SMOKE MOVESLINK2014 for 4 km domain	MOVESLINK2014 for 4 km onroad emissions
Gas Phase Chemistry	Carbon Bond 6, revision 2 (CB6r2)	Latest chemical reactions
Meteorological Processor	WRFCAMx v4.3	Compatible with CAMx v6.2
Horizontal Diffusion	Explicit simultaneous 2-D solver	K-theory 1st order closure
Vertical Diffusion	Kv (CMAQ method)	K-theory 1st order closure
Dry Deposition	Resistance model for gases	Zhang 2003
Wet Deposition	Scavenging model for gases and aerosols	Seinfeld and Pandis 1998
Gas Phase Chemistry Solver	Euler Backward Iterative (EBI) Solver	Most efficient solver in CAMx
Vertical Advection Scheme	Implicit backward-Euler hybrid centered/upstream solver	Eulerian continuity equation
Horizontal Advection Scheme	Piecewise Parabolic Method (PPM) scheme	Eulerian continuity equation

The CAMx configuration is set up to perform one-way grid nesting on the 36 km domain and two-way grid nesting on the 12 km and 4 km domains. Initial and boundary conditions (ICBC) for the 36 km domain are extracted from the MOZART global chemistry model using MOZART2CAMx pre-processor. ICBC for the 12 km domain are extracted from three dimensional outputs of CAMx simulations for the 36 km domain using the CAMx pre-processor BNDEXTR, and ICBC for the 4 km domain are obtained from CAMx outputs for

the 12 km domain.

For the sensitivity or source apportionment modeling, CAMx will be set up to perform two-way nesting on the three domains to evaluate contribution of ozone and its precursor emissions from upwind states, Mexico, and Canada to the Maricopa eight-hour ozone nonattainment area.

The meteorological fields developed by WRF are processed for CAMx using WRFCAMx pre-processor. The O3MAP pre-processor is used to prepare albedo/haze/ozone column inputs for CAMx from TOMS data. The photolysis inputs are prepared using TUV pre-processor.

6.7 Quality Assurance

The purpose of quality assurance is to establish that good model performance is the result of valid model inputs and assumptions, not the result of compensating errors in input data.

Prior to conducting modeling analysis, individual air quality, meteorological, and emissions data will be examined for consistency and obvious errors. Both spatial and temporal characteristics of the data will be also evaluated. Examples of quality assurance processes include;

- Air Quality - Observational data will be checked for out-of-range values.
- Meteorology - WRF modeled surface and elevated wind vectors and temperature fields will be plotted. The plotted wind vectors and temperature fields will be compared with monitoring station data and weather maps for consistent patterns. The runtime log files from MCIP and WRFCAMx programs will be examined for errors or warnings.
- Emissions - Inventories are tabulated, plotted, and reviewed for the quality assurance. The quality assurance procedures will include documentation of major assumptions, careful accounting of emissions totals throughout the emissions inventory development process, verification of spatial distribution of emissions against known emissions source locations and strengths, identification of missing or unreasonable values, and examination of inputs and outputs of the SMOKE model to assure no errors or unexpected warnings.

7.0 MODEL PERFORMANCE EVALUATION

MAG will adhere to EPA modeling guidance to assess relevant variables paired in time and space for all recommended statistical metrics for performance evaluation of WRF meteorology simulations and CAMx ozone simulations. The MATLAB program is used to evaluate the WRF and CAMx model performances. The mode performance evaluations are performed on a site-by-site and/or network aggregate basis, for any duration or frequency of interest. A list of these metrics is provided in Table 7-1.

Table 7-1 Statistical metrics used in model performance evaluation

Metric Name	Definition
Mean Bias	$\mathrm{MB} = \frac{1}{N}\sum(M_i - O_I)$
Mean Error	$\mathrm{ME} = \frac{1}{N}\sum\lvert M_i - O_i\rvert$
Root Mean Square Error	$\mathrm{RMSE} = \sqrt{\frac{\sum(M_i-O_i)^2}{N}}$
Fractional Bias	$\mathrm{FB} = 100\% \times \frac{2}{N}\sum\frac{(M_i-O_i)}{(M_i+O_i)}$
Fractional Error	$\mathrm{FE} = 100\% \times \frac{2}{N}\sum\frac{\lvert M_i-O_i\rvert}{(M_i+O_i)}$
Normalized Mean Bias	$NMB = 100\% \times \frac{\sum(M_i-O_i)}{\sum O_i}$
Normalized Mean Error	$NME = 100\% \times \frac{\sum\lvert M_i-O_i\rvert}{\sum O_i}$
Correlation Coefficient	$R^2 = \left(\frac{\sum_1^N\left((M_i-\overline{M})\times(O_i-\overline{O})\right)}{\sqrt{\sum_1^N(M_i-\overline{M})^2\sum_1^N(O_i-\overline{O})^2}}\right)^2$
Index of Agreement	$IoA = 1 - \frac{\sum(O_i-M_i)^2}{\sum(\lvert M_i-\overline{O}\rvert+\lvert O_i-\overline{O}\rvert)^2}$

Performance evaluation of the meteorological simulations will focus on four key meteorological variables: temperature, water vapor mixing ratio, wind speed, and wind direction. The standard NCAR/NOAA/NWS U.S. and Canada hourly surface observational database (DS472.0) will serve as the primary data set for WRF validation and performance evaluation. The DS472.0 dataset covers the entire region encompassed by the WRF domain. Alternative monitoring networks (e.g. AZMET) may be considered for validation of solar radiation at the Earth's surface. However, since measurement heights of some of these networks are non-standard, it would be more difficult to consistently compare model results with observations.

EPA guidance recommends operational and phenomenological evaluations for the model performance. Correlation coefficient, mean bias, mean error bias, root mean square error and index of agreement will be computed for each variable to satisfy the operational performance evaluation. Hourly time series plots, paired scatter-density plots, summary plots of scatter-density, diurnal box-and-whisker plots, soccer goal diagrams, and Taylor diagrams will be generated.

To satisfy the phenomenological evaluation, emphasis will be put on validation of the simulated valley breeze. Wind roses will be created for modeled and observed wind information as well as 2-D maps of wind fields overlaid on topography. If available, observed radiosonde data will be evaluated against simulated vertical profiles to assess boundary layer heights, inversion locations and wind shear.

In addition to the metrics used in meteorological performance evaluation, the CAMx model performance will be evaluated according to the following statistical metrics:

- Normalized bias test: The metric provides a measure of the ability of the model to replicate observed patterns during the times of day when available monitoring and modeled data are most likely to represent similar spatial scales. The EPA recommended range for the metric is ±15%.
- Gross error of all pairs above 60 ppb: In conjunction with bias, this metric provides overall assessment of base case performance and may be used as a reference to other modeling applications. Gross error may be interpreted as precision. EPA recommended range for the metric is ±35%.

In general, the performance metrics that fall within or below these ranges will be considered acceptable. Furthermore, the CAMx model performance evaluation may include additional numerical and graphical measures to assure the good model performance in the study.

8.0 OZONE ATTAINMENT DEMONSTRATION

8.1 Future Year Selection

EPA modeling guidance indicates that emissions reductions needed for attainment must be implemented no later than the beginning of the ozone season immediately preceding the area's attainment date. Since the attainment deadline for the moderate area is July 20, 2018, the attainment year for the modeled attainment demonstration is 2017. The modeled attainment demonstration will be performed for the full ozone season of May 1 through September 30 in 2017.

8.2 Eight-Hour Ozone Attainment Demonstration Procedures

The modeled attainment demonstration will be performed according to the methodologies and procedures provided in EPA guidance (EPA, 2014). The modeled attainment demonstration procedures are summarized as follows:

- Develop the 2011 baseline design values for monitors in the Maricopa eight-hour ozone nonattainment area. In accordance with the EPA guidance (EPA, 2007 and 2014), the 2011 baseline design value for each monitoring site is developed by averaging three design values derived from annual 4^{th} high daily maximum ozone concentrations for the five year period of 2009 - 2013: The first design value is the average of annual 4^{th} high daily maximum ozone concentrations for the period of 2009 - 2011, the second design value is the average of annual 4^{th} high daily maximum ozone concentrations for the period of 2010 - 2012, and the third design value is the average of annual 4^{th} high daily maximum ozone concentrations for the period of 2011 - 2013.
- Run CAMx model for the 2011 base year ozone concentrations at monitors in the Maricopa eight-hour ozone nonattainment area.
- Run CAMx model for the 2017 attainment year ozone concentrations at monitors in the Maricopa eight-hour ozone nonattainment area.
- Develop Relative Response Factors (RRFs) using the modeled 2011 base year and 2017 attainment year ozone concentrations at 3 by 3 grid cells around monitoring sites.
- Develop the 2017 design values at monitors by adjusting the 2011 baseline design values by RRFs. The following equation describes the procedure:

  $$DVF_i = DVB_i \times RRF_i$$

  where $_i$ is a monitoring site, DVF is Future Design Value (i.e., 2017 DV), and DVB is Baseline Design Value (i.e., 2011 DV).
- Attainment demonstration is successful if the 2017 design values for all monitors are lower than the ozone standard. If the 2017 design values are greater than the ozone standard, the 2017 emissions inventory will be revised for further emissions control measures.

8.3 Future Year Air Quality Simulations

Since EPA does not recommend the effect of long-term climate change in the attainment demonstration if the interval between base year and future year is less than 20 years (EPA, 2014), the meteorological conditions in 2011 are assumed for the attainment year 2017 for this study. All CAMx modeling inputs for the year 2017 such as photolysis rates, land use, and modeling configurations will be identical to those for the 2011 base year except for anthropogenic emissions. Therefore, the variation of ozone concentrations in the future year in this study will be a result of the change in anthropogenic emissions between the base year and future year.

Because the Maricopa eight-hour ozone nonattainment area will continue to implement the committed control measures in the MAG 2009 Ozone Maintenance Plan (MAG, 2009), the numeric credits for the committed control measures will be used in demonstrating attainment of the ozone standard in 2017. Furthermore, the federal control measures such as portable fuel container rules, Tier 3 motor vehicle emissions and fuel standards, heavy-duty engine and vehicle standards, light-duty and heavy-duty greenhouse gas rules, renewable fuel standard program, diesel recreational marine standards, small spark ignition (SI) & SI recreational marine final rule, and ICAO aircraft engine emissions standards are included in calculating area, onroad, and nonroad source emissions for the attainment demonstration. The benefits of federal and local emission control measures are embedded in the emissions inventory via the models' onroad and nonroad emissions factors for new onroad and nonroad engines, fuel requirement inputs, and fleet turnover.

8.4 Unmonitored Areas Attainment Test

The unmonitored area analysis is intended to identify areas or locations outside of the existing monitoring network where the modeling analysis indicates potential high ozone concentrations are exceeding the ozone standard. EPA recommends gradient adjusted spatial fields to get more accurate ozone estimates for unmonitored areas. Gradient adjusted spatial fields are created by the combination of interpolated spatial fields of ambient data and gridded modeled outputs. To implement gradient adjusted spatial fields, base year design values must first be interpolated to develop ambient spatial fields. Then, the spatial fields will be adjusted using base year gridded model output gradients. Finally, model derived RRFs for grids will be applied to the gradient adjusted spatial fields to create future year fields. The future year gradient adjusted spatial fields will be evaluated to determine if any predicted values in the grid cells are above the ozone standard. If violations in the unmonitored area through the analysis occur, the EPA regional office will be consulted to determine how the results of unmonitored area analysis should be used.

EPA Modeled Attainment Test Software (MATS) will be used to conduct this analysis.

9.0 SUPPLEMENTAL ANALYSES

EPA requires supplemental analyses to support the modeled attainment demonstration results since the modeling analyses may contain some uncertain modeling elements such as emission projections, meteorological input data, and science formulation adopted in models. Additionally, future design values that are very close to the ozone standard require a set of corroboratory analyses as the weight of evidence (EPA, 2014). The supplemental analyses will be performed to confirm the conclusions from the modeled attainment demonstration for the 2008 ozone NAAQS. These supplemental analyses are discussed below.

Absolute Model Forecasts

Absolute model forecast results may be useful in assessing general progress towards attainment from the baseline emissions inventory to the future emissions inventory. Absolute model forecast analysis compares the future year modeled ozone concentrations to the base year modeled ozone concentrations, and calculates the frequency, magnitude, and relative amount of ozone reductions. Metrics for the absolute model forecast analysis are as follows:

- Percent change in total amount of modeled ozone concentrations greater than or equal to 76 ppb in the nonattainment area;
- Percent change in number of grid cells greater than or equal to 76 ppb in the nonattainment area;
- Percent change in grid cell-hours greater than or equal to 76 ppb in the nonattainment area; and
- Percent change in maximum modeled eight-hour ozone concentrations in the nonattainment area.

Chemical Process Analysis

To assess which ozone precursor (e.g., VOC or NOx) will limit ozone production, the CAMx Chemical Process Analysis (CPA) will be used. This analysis provides detailed reaction rate information over groups of reactions in the chemical mechanism for a selected area. This makes it possible to quantify chemically meaningful attributes such as ozone and oxidant production/loss rates, radical initiation rates, radical propagation efficiencies, radical termination rates, hydrocarbon chaining lengths, formaldehyde production rates, and odd-nitrogen (NOy) reaction rates. This analysis will be used to determine the VOC-limited or NOx-limited area and to develop more appropriate, effective emission control strategies for the attainment of the 2008 ozone standard.

Ozone Source Apportionment Analysis

To confirm and explain the results of the CAMx modeling, other corroboratory analyses may include the CAMx Ozone Source Apportionment Technology/Anthropogenic Precursor Culpability Assessment (OSAT/APCA). These analyses will identify and quantify the contributions of multiple upwind source areas, emissions source categories, and individual

ozone precursors to local ozone concentrations.

Decoupled Direct Method

The decoupled direct method (DDM) will be used for the sensitivity analysis of emission sources. The DDM will be implemented in the evaluation of first order sensitivity coefficients with respect to predicted ozone concentrations to pollutant sources such as initial conditions, boundary conditions, top concentrations, and anthropogenic emissions. The sensitivity analysis includes an option for varying emission inputs to the CAMx model, such as scaling emissions by a factor, additively increasing emissions by a constant amount, or zeroing-out emissions by source category and geographic region.

Trends in Ambient Air Quality

Progress towards attainment of the ozone standard will be evaluated based on measured historical trends of air quality and emissions. If available, air quality trends will be established using ozone concentrations meteorologically adjusted with available techniques such as statistical modeling, filtering, probability distribution, and Classification and Regression Tree (CART) analysis.

10.0 MANAGEMENT STRUCTURE AND COMMITTEES

MAG has responsibilities for regional involvement in a number of planning issues, and has established an extensive mechanism for ensuring coordinated policy direction from elected officials, coordinated management and technical input, and advice from the appropriate agency staff, as well as direct citizen input. Figure 10-1 displays the MAG Policy Structure and Figure 10-2 presents the MAG Committee Structure. All policy committees and formal technical committees follow the Arizona open meeting law which requires, among other requirements, the posting of meeting notices and agendas at least 24 hours prior to any meeting.

The MAG Regional Council is the governing body of MAG. It is composed of elected officials from each member agency, two ex officio members representing the Arizona State Transportation Board, and a representative from the Citizens Transportation Oversight Committee. This composition of elected officials is a reflection of citizen input at the local government level. The MAG Regional Council agenda includes a call to the audience, providing the opportunity for public comments at each monthly meeting. MAG holds at least one formal public meeting prior to the adoption of any new or updated nonattainment area plan. Formal public meetings are advertised locally at least 30 days prior to the meeting date and documentation is available for public review during this 30-day period. Draft documents are distributed to appropriate federal, state, and local agencies for review and comment during this period. Comments received are analyzed with a staff response for consideration by the MAG Air Quality Technical Advisory Committee and MAG Regional Council before taking approval action. Documentation of the comments and responses are

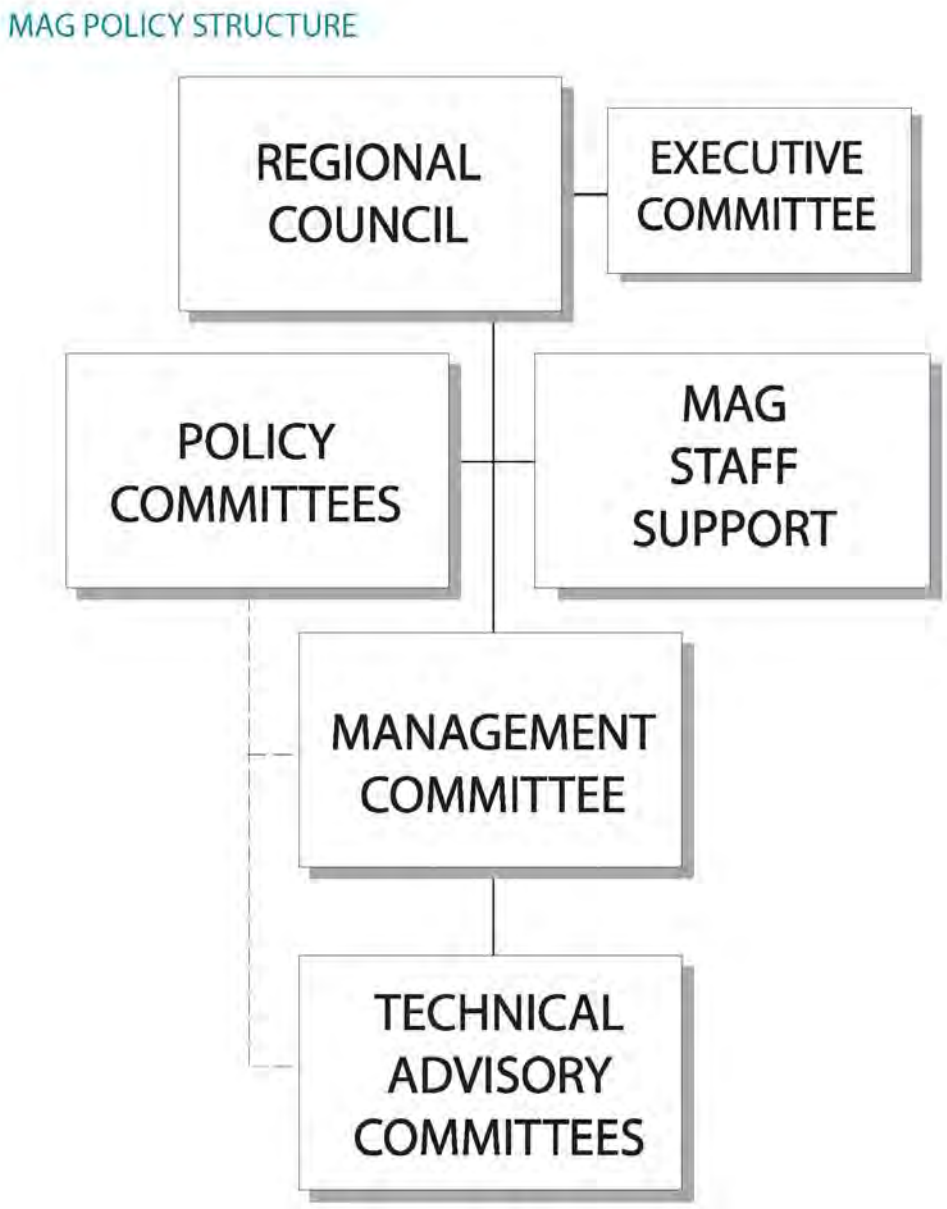

Figure 10-1 MAG policy structure

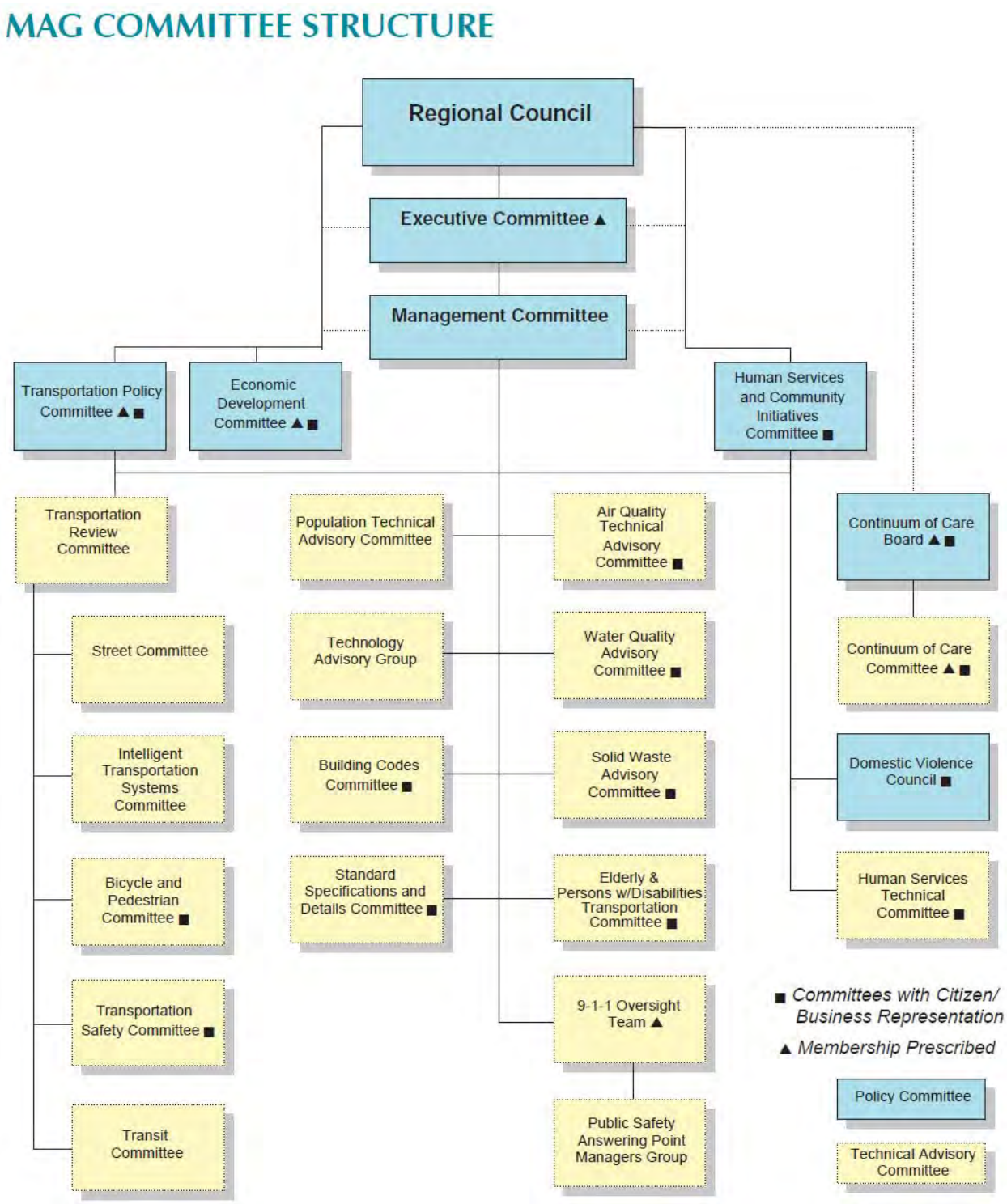

Figure 10-2 MAG committee structure

incorporated into the plan document.

Due to the technical complexity of many MAG programs, committees consisting of professional experts are often needed to assist in program development. The Air Quality Technical Advisory Committee is composed of representatives from eight MAG member agencies, citizens, environmental interests, health interests, automobile industry, fuel industry, utilities, public transit, trucking industry, rock products industry, construction firms, housing industry, architecture, agriculture, industry, business, parties to the Air Quality Memorandum of Agreement, and various State and Federal agencies. The role of the Technical Advisory Committee is to review and comment on technical information generated during the planning process and make recommendations to the MAG Management Committee.

11.0 PARTICIPATING ORGANIZATIONS

Technical oversight for this project will be provided by the Air Quality Planning Team. This team includes staff representatives from MAG, ADEQ, ADOT, and MCAQD. The Air Quality Planning Team will meet as necessary during the ozone modeling effort. Periodic reports on the status and progress of various phases of the modeling work will be presented at these meetings, and technical issues will be discussed and resolved.

12.0 PROCEDURAL REQUIREMENTS

The following items will be delivered in draft form to the EPA regional office for review and comments during the modeling study. MAG will also provide draft versions of these items to the Air Quality Planning Team for review and comments.

- The modeling protocol
- The Technical Support Document which addresses the entire modeled attainment demonstration and the supplemental analyses as the weight of evidence, and which also includes the narrative descriptions on WRF and CAMx input preparation, model performance evaluation, and modeling applications.

13.0 SCHEDULE

The ozone modeling analysis for the Maricopa eight-hour ozone nonattainment area will include the following tasks. The schedule for the tasks are presented in Table 13-1.

1. Prepare a modeling protocol document (this document) describing the historical background, modeling domain, modeling period, and procedures to be followed in the attainment modeling analysis. (Completion Date: November 2015)
2. Develop meteorology and biogenic source emissions for the base year 2011 using WRF and biogenic emissions models. (Completion Date: November 2015)

3. Evaluate WRF model performance using EPA recommended model evaluation methodologies. (Completion Date: December 2015)
4. Develop hourly gridded and chemically speciated point, area, onroad, and nonroad source emissions inventory for the years 2011 and 2017 using SMOKE modeling system. (Completion Date: January 2016)
5. Develop 2011 and 2017 initial and boundary condition data for CAMx modeling. (Completion Date: January 2016)
6. Evaluate CAMx model performance using statistical and graphical assessment methodologies. (Completion Date: February 2016)
7. Perform attainment modeling demonstration for the 2008 ozone standard. (Completion Date: March 2016)
8. Perform the supplemental modeling analysis including the evaluation of historical eight-hour ozone trends, the decoupled direct method for sensitivity analysis, chemical component analysis, and application of source apportionment technology. (Completion Date: May 2016)
9. Develop Technical Support Document (TSD). (Completion Date: July 2016)
10. Provide the draft TSD for Air Quality Planning Team review. (Completion Date: August 2016)
11. Release the Plan and draft TSD for public review. (Completion Date: September 2016)
12. Submit the Plan and draft TSD for public hearing. (Completion Date: October 2016)
13. Submit the Plan and TSD to Air Quality Technical Advisory Committee, Management Committee, and Regional Council for approval. (Completion Date: December 2016)
14. Submit the Plan and TSD to EPA. (Completion Date: December 2016)

Table 13-1 Schedule for the eight-hour ozone modeling demonstration for the Maricopa eight-hour ozone nonattainment area

Ozone Modeling Task List	2015						2016											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Submit modeling protocol document to EPA																		
Develop WRF meteorology and biogenic source emissions in the U.S., Mexico, and Canada																		
Evaluate WRF model performance																		
Develop point, area, onroad, and nonroad source emissions inventory for 4 km, 12 km, 36 km modeling domains in 2011 and 2017																		
Develop 2011 and 2017 initial and boundary condition data																		
Evaluate CAMx model performance																		
Perform attainment modeling demonstration																		
Perform supplemental modeling analysis																		
Develop TSD																		
Provide draft TSD for Air Quality Planning Team review																		
Provide draft plan document for public review																		
Public hearing & AQTAC Recommendation																		
Management Committee																		
Regional Council Action																		
Submit to EPA																		

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APPENDIX A

CONCEPTUAL MODEL

Ozone concentrations during the summer ozone season in the Maricopa eight-hour ozone nonattainment area are influenced by several factors: westerly transport of upwind pollutants; a favorable synoptic weather pattern featuring high pressure over the northeastern portion of the state, a low pressure center in the southwest portion, and daytime local temperatures above 100°F; and local emissions that are coincident with valley-wide stagnant and weak winds. The spatial distribution of high ozone concentrations depends on a diurnal valley breeze and directional change in winds induced by surrounding topography. Examination of the entire summer season shows how meteorological variability has strong influence on ozone formation in the nonattainment area.

Poor air quality in the area due to elevated ozone is rarely localized to a single monitor and often occurs at many monitors on the same day. The Phoenix metropolitan area includes several major cities and is the core of the nonattainment area. Networks of freeways and arterial roads and several significant point sources exist in the urban core. The edges of the nonattainment area are considered suburban or rural and monitoring sites in these zones are typically in more remote or mountainous locations. Ozone can advect downwind of the urban core to surrounding rural and suburban sites and these regions can have different profiles than those in the urban core. The coupling of the urban and downwind sites depends greatly on how the daily weather conditions interact with local emissions.

The photochemical reaction processes are essential for ozone formation. The desert yields sufficient solar radiation and high surface temperatures that promote efficient photochemical reactions of nitrogen oxides (NOx) and volatile organic carbons (VOC) to form ground level ozone. Transported ozone (international, interstate, stratospheric) can also influence local ozone levels, especially in the late spring and early summer when the transport pathways are conducive to elevated ozone. Biogenic emissions are the largest VOC source mostly from forests and agricultural area. These emissions mix with significant urban anthropogenic VOC sources. The major source of NOx is motor vehicle exhaust, but point sources such as electric generating units are also important emission sources for NOx emissions. Wildfires may be considered as temporary point sources whose short-lived plumes can disperse ozone precursors from very distant downwind locations. Several upwind wildfires during the 2011 summer ozone season influenced elevated ozone episodes.

Elevated ozone in the Maricopa eight-hour ozone nonattainment area can be influenced by long range transport or be created under local weather and emissions. The area is often downwind from source regions in Southern California and Northern Mexico. It is also aligned with the Rocky Mountains where early summer stratospheric ozone intrusions have been documented (Lin, et al., 2012, 2015; Yates, et al., 2013). Cold front storm systems associated with a southerly deviation of the late spring jet stream are conducive to these types of long range and vertical transport (Hsu, et al., 2005; Liang et al., 2004; Gettelman and Sobel, 2000). Under more localized conditions, most elevated ozone episodes occur under a distinct mesoscale meteorological pattern with a pronounced valley breeze or general stagnation. Many of the urban ozone monitors in the area are located within a basin surrounded by mountain ranges, and differential solar heating of surrounding topography often creates a thermal circulation known as the valley breeze. Under weak

large scale summer weather patterns, local winds flow calmly to the southwest late at night and into morning and then strengthen towards the northeast in the afternoon hours. Although a variety of large scale weather patterns occur in the desert southwest, favorable patterns for elevated ozone often recur throughout summer. These patterns create high temperatures, upper level winds from the south and/or west, sinking air from higher altitudes, and a sustained valley breeze circulation at the surface.

Each monitoring site within the nonattainment area exhibits a diurnal pattern in ozone levels, but the timing and magnitude depend on locations. Urban sites exhibit a more pronounced diurnal cycle in ozone, with the maximum occurring in late afternoon before sunset and the minimum just prior to sunrise. Ozone can be consumed by titration from locally generated NOx in the urban core and also removed by dry deposition during night. In contrast, maximum ozone concentrations have been measured hours later at downwind rural sites. Most anthropogenic precursors are emitted from the urban core and follow a diurnal pattern related to traffic patterns that peak twice daily with the AM and PM rush hours. Anthropogenic emissions also vary by day of week, with most sources exhibiting lower emissions on the weekends due to fewer industrial, commercial and traffic activities. Naturally occurring VOC levels vary over the course of the ozone season, and biogenic emissions highly depend on meteorology (i.e. sunlight, temperature, and relative humidity).

The Maricopa eight-hour ozone nonattainment area presently contains monitors with ozone design values over the 2008 NAAQS of 0.075 ppm, yet ozone trends have leveled off after they peaked in 2012. In the span of 2000-2009, design values decreased but increased between 2009 and 2012 (ENVIRON, 2013). EPA promulgated the 0.08 ppm of NAAQS for ozone in 1997, lowering the value to 0.075 ppm in 2008. In that span, Maricopa County has decreasing trends in ozone design values until the minimum in 2009. The number of exceedance days and total number of individual exceedances are shown for the years of 2005 - 2014 in Table A-1. Both quantities decreased sharply from more than 123 to 9 total exceedances between 2005 and 2009. Both the number of exceedance days and total exceedances in 2009 reached the minimum (four exceedance days and nine total exceedances). A number of studies indicate that the meteorology could play a key role in this lower-ozone period in 2009. However, both quantities increased between 2010 and 2012, but the years of 2013 and 2014 have demonstrated another decreasing trend.

Ozone concentrations can vary by month in the ozone season. A month-by-month analysis is possible with an observational record starting in 2005. The numbers of ozone exceedance days (with at least one exceeding monitor, relative to the 2008 ozone standard) per month are provided in Table A-1 and total exceedances per month are provided in Table A-2. A small percentage of exceedance days and total exceedances occurred before May while a much larger fraction occurred in May. The largest proportion of exceedance days and total exceedances occurred in June, followed by July and August. Only a small fraction of exceedances occurred in September. More than 80% of exceedances occurred in the period of the three months from May to July.

Table A-1 Eight-hour ozone exceedance days by month for ozone monitors in the Maricopa nonattainment area for the 2008 ozone standard (0.075 ppm)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
April	4	0	0	2	1	0	0	2	0	0	9
May	8	7	5	2	1	2	2	10	3	1	41
June	12	17	4	8	1	5	9	3	3	4	66
July	12	12	5	7	1	0	2	3	4	3	49
August	4	6	6	3	0	0	4	10	2	0	35
September	1	0	1	0	0	3	1	0	1	3	10

Table A-2 Eight-hour ozone exceedances by month for ozone monitors in the Maricopa nonattainment area for the 2008 ozone standard (0.075 ppm)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
April	11	0	0	5	1	0	0	2	0	0	19
May	21	21	16	19	4	4	17	45	11	1	159
June	33	80	7	34	2	30	39	5	7	29	266
July	47	71	11	21	2	0	4	18	27	6	207
August	10	10	24	7	0	0	12	37	3	0	103
September	1	0	1	0	0	3	5	0	4	10	24

Six sites in the Maricopa eight-hour ozone nonattainment area (West Phoenix, North Phoenix, Pinnacle Peak, Cave Creek, Red Mountain, and Super Site) were in violation of the 2008 NAAQS ozone standard (0.075 ppm) by the start of 2014. The annual 4th high concentration for each site in each year in time span of 2009-2013 is listed in Table A-3.

On average, May has relatively lower temperatures, less sunlight and stronger ventilating westerly winds, all of which typically limit ozone production. But during this time transport from Southern California and Mexico can be enhanced by cold fronts and stratospheric intrusions from late spring low pressure systems. The episode of May 24-25, 2011 was likely influenced by stratospheric intrusion, and lead to six exceeding sites on the first day and thirteen the following day. Back trajectories and weather map analyses for those days reveal westerly long-range transport. Cold fronts and associated westerly transport can recur several times before the monsoonal high pressure system begins to dominate in the region.

June is usually much warmer than May. Early in the month the air is dry prior to development of the southwestern monsoon pattern. Afternoons can be extremely hot (T > 110 °F) and dry (RH < 10%), and have the longest exposure to sunlight near the summer solstice. In June 2011, the season's highest single-day eight-hour maximum ozone concentration was recorded (0.092 ppm at Blue Point on June 9). This was also the day with the most exceeding sites in the network (14 sites). June of 2011 had the most days (nine) with at least one exceedance in the network, and the most overall exceedances (39)

than any other month in that year. By the end of the month, the monsoonal high pressure pattern begins to dominate.

Table A-3 Annual 4th high eight-hour ozone concentrations (in ppb) for the five-year period used to calculate the 2011 baseline design value (DVB)

AIRS Code	Site Name	Site Abbr	2009	2010	2011	2012	2013	DVB**
04-007-0010	Tonto NM	TN	72	70	76	78	72	73
04-013-0019	West Phoenix*	WP	68	75	78	83	76	76
04-013-1004	North Phoenix*	NP	72	79	82	83	79	79
04-013-1010	Falcon Field	FF	65	70	70	69	77	69
04-013-2001	Glendale	GL	68	74	76	78	74	74
04-013-2005	Pinnacle Peak*	PP	70	77	77	79	77	76
04-013-3002	Central Phoenix	CP	69	72	73	77	75	73
04-013-3003	South Scottsdale	SS	72	76	75	80	74	75
04-013-4003	South Phoenix	SP	67	74	76	78	75	74
04-013-4004	West Chandler	WC	70	74	74	74	70	72
04-013-4005	Tempe	TE	67	68	70	73	71	69
04-013-4008	Cave Creek*	CC	70	74	81	78	72	76
04-013-4010	Dysart	DY	69	71	70	73	74	71
04-013-4011	Buckeye	BE	62	64	67	68	60	65
04-013-5100	Fort McDowell/Yuma Frank	FM	68	66	73	73	71	70
04-013-7003	St Johns	SJ	64	74	72	72	68	70
04-013-7020	Senior Center	SC	70	73	75	76	74	73
04-013-7021	Red Mountain*	RM	72	77	79	77	75	76
04-013-7022	Lehi	LE	70	70	76	75	75	73
04-013-7024	High School	HS	69	73	75	74	74	73
04-013-9508	Humboldt Mountain	HM	67	70	77	79	73	74
04-013-9702	Blue Point	BP	69	68	81	77	75	74
04-013-9704	Fountain Hills	FH	69	74	77	77	70	74
04-013-9706	Rio Verde	RV	68	71	81	72	73	74
04-013-9997	Super Site*	SU	73	76	78	76	79	76
04-021-3001	Apache Junction	AJ	69	73	75	76	69	73

* Sites that were in violation of the 2008 NAAQS eight-hour ozone standard at the start of 2014.

** DVB is calculated as the average of three consecutive design values for 2009-2011, 2010-2012, and 2011-2013.

July and August have extremely high daytime temperatures and are influenced much more by the regional monsoon pattern. A large scale upper level high pressure feature usually aligns over the Four Corners area and pumps moist, unstable air from the southeast. While the synoptic pattern can persist for several weeks, sudden changes in mesoscale weather during this time make ozone formation more complicated. Under monsoonal steering winds, small scale thunderstorms thrive under these favorable dynamics. Days are typically more humid and can exhibit short lived severe weather (intense rain, strong winds and windblown dust). The high pressure often controls the local flow in between thunderstorm events. Stagnant winds can last long enough to combine with the extreme heat to trap pollutants and create the highest ozone of the season. Additionally, peak biogenic VOC emissions occur in August that might enhance ozone formation. In 2011, July had two days with exceeding sites (four exceeding sites total) and August had four days (12 exceeding sites total).

Elevated ozone in September can occur during the transition from humid unstable conditions to drier autumn-like conditions after the monsoon has dissipated. Elevated ozone is less severe and infrequent due to declining sunlight, a shift back to larger scale westerly wind systems, and decreasing biogenic VOC emissions. In 2011, only one day (September 1) had any exceedances in that month, which occurred at only some of the urban sites (Cave Creek, Glendale, North Phoenix, Supersite, and West Phoenix).

Because source regions of transported pollutants can vary throughout the season, the NOAA Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) Model (Draxler et al., 2015) was used to investigate the geographic origins of air masses. MAG used the model with the locations of each monitor for starting location (100m above the surface) to trace backwards the trajectories of the winds. Analyses of 24-hour back trajectories for every day of the 2011 ozone season reveal instances of interstate transport arriving from all directions as shown in Figure A-1. On the days of widespread exceedances (13 sites on May 25; 16 sites on June 9), air masses originated from Southern California. Of the 18 days with at least a single exceedance in the network, 14 exhibited the pattern of 24-hour back trajectories traveling over the southwestern corner of Arizona and nearby boundaries. Each type of air mass was created by unique synoptic and mesoscale conditions. To better understand how the ozone design value responds to control measures, MAG determined all types of transport conditions should be tested. By simulating the entire summer season, the simulations may capture the wide range of meteorological patterns that contribute to elevated ozone.

The influences of lightning and stratospheric ozone in the proposed attainment test may require further investigation. Lightning and stratospheric intrusions are often credited as natural sources of elevated ozone. Current air quality models are unable to accurately simulate the process of NOx emission by lightning strikes or the influence of stratospheric intrusions. Several western states (CDPHE, 2011; WDEQ, 2013) have demonstrated how stratospheric intrusions extend far enough down to the earth's surface in spring to cause exceptional events of the ozone NAAQS. The initial and boundary conditions at the top of the CAMx model are derived from the MOZART global model, which is unable to provide

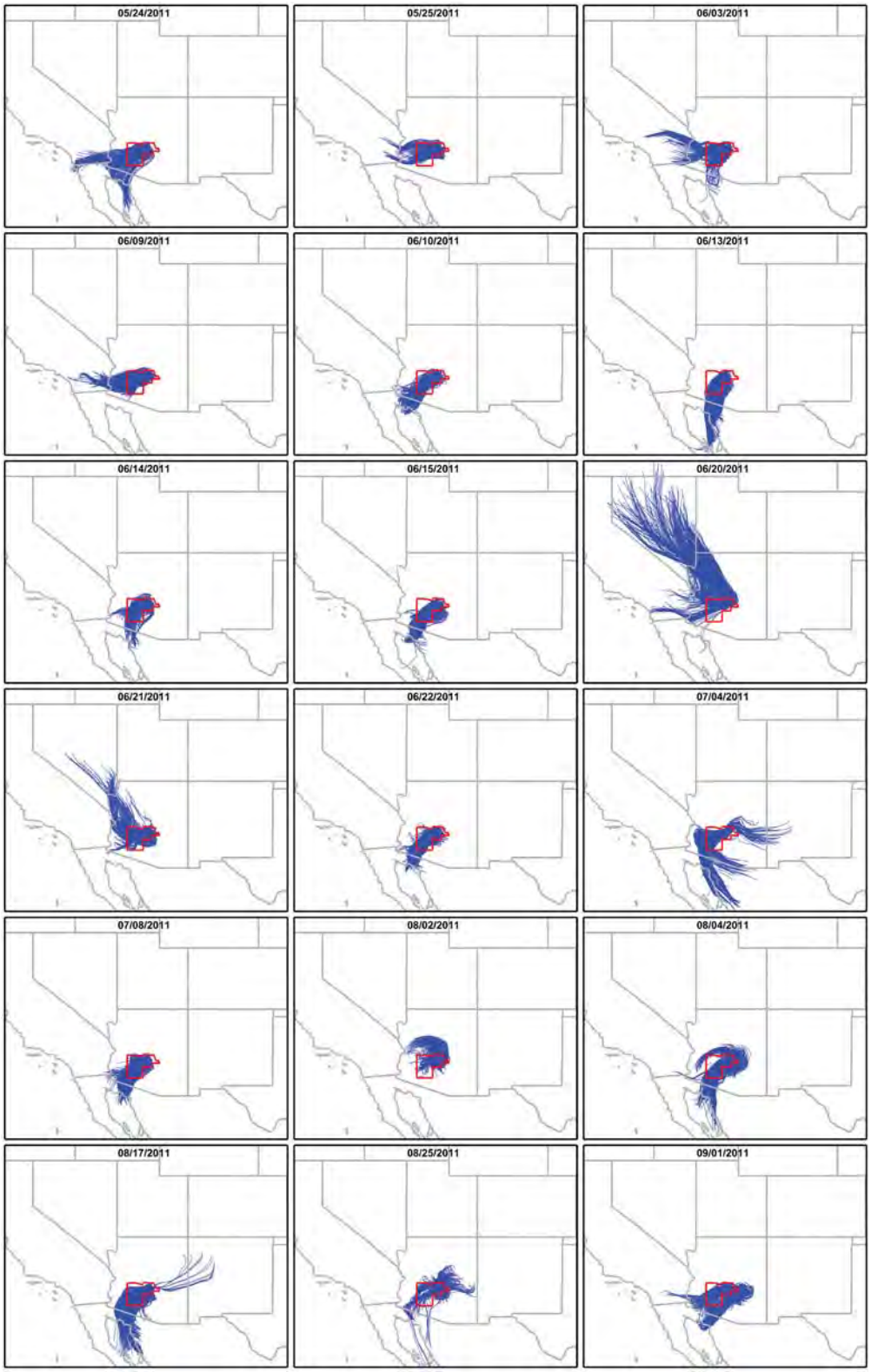

Figure A-1 Daily maps of 24-hour HYSPLIT back trajectories for each day in the 2011 ozone season with at least one exceeding monitoring site

the sufficient information about exchange between the stratosphere and troposphere. This makes calculations of transport from aloft less easy within the photochemical model.

Natural emissions can also originate from lightning. In the desert southwest, lightning is most frequent during the monsoon season. The onset of highest lightning frequency overlaps largely with the summer ozone season in the nonattainment area. Individual monsoon storms can create hundreds of lightning strikes in their short life times. It is estimated that a single flash can contribute up to 500 moles of NOx at levels of the atmosphere that otherwise have minimal concentrations of precursors (DeCaria et al., 2005). As an elevated source several thousands of feet above the surface, the lifetime of lighting NOx is much longer than surface emitted NOx. Therefore the impact on ozone chemistry of these individual sources is more widespread in higher altitudes and larger areas than the single point source which created them. A temporary influx of lightning-created NOx may result in higher concentrations that exceed the NAAQS (Allen et al., 2012). Photochemical models either lack lightning processes completely, or are too immature in development to be reliable.

In summary, this conceptual description highlights the following key elements:

(1) Ozone concentrations are elevated during the summer due to intense photochemical reactions associated with increased solar radiation, long range transport, natural and anthropogenic emissions, and synoptic and mesoscale atmospheric dynamics.

(2) Anthropogenic emissions are fairly consistent throughout the summer, but biogenic emissions substantially fluctuate depending on the weather conditions. Elevated ozone is created by combination of these meteorological conditions and ozone precursor emissions generated from anthropogenic and biogenic sources.

(3) The interaction of upwind transported and local emissions under various weather conditions characterizes elevated ozone concentrations in the region.

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APPENDIX B

DRAFT EMISSIONS INVENTORY

Point Source

Table B-1 2011 and 2017 Electric Generating Units (EGU) emissions in Maricopa County

Maricopa County EGU	2011 (metric tons/year)			2017 (metric tons/year)*		
	VOC	NOx	CO	VOC	NOx	CO
Arlington Valley LLC	0.5	35.1	21.9	11.6	68.8	52.8
Gila River Power Station	9.4	176.2	48.5	26.5	475.8	77.0
Mesquite Generating Station	20.4	174.6	20.9	26.2	220.5	51.5
Agua Fria Generating Station	1.7	95.2	23.2	6.2	449.1	88.4
West Phoenix Power Plant	25.8	541.2	73.4	32.8	600.6	94.5
Ocotillo Power Plant	4.4	75.3	14.1	5.6	143.8	26.7
Redhawk Generating Facility	5.1	136.8	153.2	10.4	168.6	159.2
Kyrene Generating Station	2.9	25.2	7.7	6.5	58.2	28.9
New Harquahala	14.1	21.1	32.0	21.7	80.0	50.2
Santan Generating Station	8.0	233.9	136.3	42.8	284.7	160.3
Buckeye Generation Center LLC**	0.0	0.0	0.0	22.5	87.0	111.8

* MCAQD provided projected power plant emissions in 2017 (e-mail from Bob Downing on July 10, 2015).

** Buckeye Generation Center LLC is planned to be operating in 2017 and the PTE emissions for the facilities are assumed for the year 2017.

Table B-2 2011 and 2017 EGU emissions in Pinal County

Pinal County EGU	2011 (metric tons/year)			2017 (metric tons/year)*		
	VOC	NOx	CO	VOC	NOx	CO
Saguaro Power Plant	0.8	4.4	1.6	4.3	1.3	0.3
Desert Basin Generating Station	5.7	27.9	316.8	6.1	34.5	245.8
Coolidge Generation Station	0.6	7.0	4.1	0.7	8.4	4.9
Sundance Power Plant	2.2	20.3	7.1	2.2	20.3	7.1

* PCAQCD provided projected power plant emissions in 2017 (e-mail from Scott DiBiase on June 10, 2015).

Table B-3 2011 and 2017 point source (non-EGU) emissions in Maricopa County

Maricopa County	Growth Index	2011 (metric tons/year)			2017 (metric tons/year)		
		VOC	NOx	CO	VOC	NOx	CO
CMC Steel Fabricators	Industrial Employment	21.4	30.9	413.6	25.1	36.1	483.9
Luke AFB - 56th Fighter Wing	Number of Aircrafts	7.3	9.1	4.9	7.1	8.8	4.7
New Wincup Holdings Inc	Industrial Employment	114.3	10.7	1.9	133.7	12.6	2.2
Oak Canyon Manufacturing Inc	Industrial Employment	57.0	0.0	0.0	66.7	0.0	0.0
REXAM Beverage Can Company	Industrial Employment	90.3	4.0	3.3	105.6	4.6	3.9
SFPP LP Phoenix Terminal	Industrial Employment	91.8	4.4	5.0	107.4	5.2	5.9
Northwest Regional Landfill	Total Population	2.2	8.8	4.7	2.5	9.7	5.2
Trendwood Inc	Industrial Employment	116.7	0.0	0.0	136.5	0.0	0.0
OFFSET Emission Credit	(no change)	203.2	13.3	13.9	203.2	13.3	13.9

Table B-4 2011 and 2017 point source (non-EGU) emissions in Pinal County

Pinal County	Growth Index	2011 (metric tons/year)			2017 (metric tons/year)		
		VOC	NOx	CO	VOC	NOx	CO
Ray Complex	Industrial Employment	10.3	190.5	736.9	9.8	182.1	704.3
Casa Grande Compressor Station	Industrial Employment	0.1	10.8	2.2	0.1	10.3	2.1
Oracle Compressor Station	Industrial Employment	0.4	89.8	0.2	0.4	85.8	0.2
Hexcel Corporation	Industrial Employment	118.4	10.7	9.0	113.2	10.2	8.6
Frito-Lay	Industrial Employment	3.5	25.3	34.2	3.3	24.2	32.7
Arizona Environmental Container Corp	Industrial Employment	6.8	0.0	0.0	6.5	0.0	0.0
Prowall Building Products Casa Grande Plant	Industrial Employment	55.6	0.3	0.3	53.1	0.3	0.3
Republic Plastic Eloy Foam Manfacturing Plant	Industrial Employment	116.0	0.0	0.0	110.9	0.0	0.0

Area Source

Table B-5 2011 and 2017 ozone season daily average area source emissions in Maricopa County

No.	SCC	Description	2011 (lbs/day)			2017 (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
1	2102004001	Industrial distillate oil: Boilers	3.9	390.2	97.5	4.6	456.5	114.1
2	2102004002	Industrial distillate oil: Engines	0.0	11,783.7	2,536.2	0.0	13,784.8	2,966.9
3	2102006000	Industrial natural gas	217.8	4,303.8	2,680.8	254.8	5,034.7	3,136.1
4	2103004001	Commercial/institutional distillate oil: Boilers	0.0	0.8	0.2	0.0	0.9	0.2
5	2103004002	Commercial/institutional distillate oil: Engines	0.0	23.8	5.1	0.0	26.3	5.7
6	2103006000	Commercial/institutional natural gas	252.0	4,998.0	3,065.4	277.9	5,513.2	3,381.4
7	2104006000	Residential natural gas	119.6	2,044.2	869.9	131.9	2,254.9	959.5
8	2301000000	Chemical manufacturing	599.0	0.0	0.0	700.8	0.0	0.0
9	2302002100	Commercial cooking - Conveyorized charbroiling	136.8	0.0	481.6	150.9	0.0	531.2
10	2302002200	Commercial cooking - Underfired charbroiling	470.6	0.0	1,531.6	519.1	0.0	1,689.5
11	2302003000	Commercial cooking - Deep fat frying	143.0	0.0	0.0	157.8	0.0	0.0
12	2302003100	Commercial cooking - Flat griddle frying	67.4	0.0	143.9	74.4	0.0	158.8
13	2302003200	Commercial cooking - Clamshell griddle frying	2.6	0.0	0.0	2.9	0.0	0.0
14	2302050000	Bakeries	547.8	0.0	0.0	604.2	0.0	0.0
15	2304000000	Secondary metal production	306.4	107.9	697.4	358.5	126.2	815.9
16	2308000000	Rubber/Plastic product mfg.	14,171.0	0.0	0.0	15,632.0	0.0	0.0
17	2312000000	Machinery (electrical)	746.2	135.8	16.4	872.9	158.9	19.2
18	2399000000	Industrial processes, not elsewhere classified (NEC)	325.6	1,245.8	525.2	380.9	1,457.4	614.4
19	2401001000	Architectural coatings	30,622.9	0.0	0.0	33,780.0	0.0	0.0
20	2401005000	Auto refinishing	10,255.9	0.0	0.0	11,313.2	0.0	0.0
21	2401008000	Traffic markings	1,823.6	0.0	0.0	1,871.0	0.0	0.0
22	2401015000	Factory finished wood	1,396.7	0.0	0.0	1,540.7	0.0	0.0
23	2401020000	Wood furniture	3,434.7	0.0	0.0	3,788.8	0.0	0.0
24	2401075000	Aircraft surface coatings	473.1	0.0	0.0	497.0	0.0	0.0

No.	SCC	Description	2011 (lbs/day)			2017 (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
25	2401090000	Miscellaneous surface coatings	2,450.5	0.0	0.0	2,703.2	0.0	0.0
26	2415000000	Degreasing	1,451.4	0.0	0.0	1,601.0	0.0	0.0
27	2420000000	Dry cleaning	178.1	0.0	0.0	196.4	0.0	0.0
28	2425000000	Graphics arts	2,225.7	0.0	0.0	2,455.1	0.0	0.0
29	2440000000	Misc. Ind. Solvent use	5,126.6	0.0	0.0	5,997.2	0.0	0.0
30	2460100000	Personal care products	21,496.8	0.0	0.0	23,713.0	0.0	0.0
31	2460200000	Household products	20,365.4	0.0	0.0	22,464.9	0.0	0.0
32	2460400000	Automotive aftermarket products	15,387.2	0.0	0.0	16,973.5	0.0	0.0
33	2460500000	Coatings and related products	10,748.4	0.0	0.0	11,856.5	0.0	0.0
34	2460600000	Adhesives and sealants	6,449.0	0.0	0.0	7,113.9	0.0	0.0
35	2460800000	FIFRA related products	20,139.1	0.0	0.0	22,215.3	0.0	0.0
36	2460900000	Miscellaneous products, NEC	792.0	0.0	0.0	873.6	0.0	0.0
37	2461021000	Cutback Asphalt	4,567.4	0.0	0.0	4,686.1	0.0	0.0
38	2461022000	Emulsified Asphalt	4,732.6	0.0	0.0	4,855.6	0.0	0.0
39	2461023000	Roofing Asphalt	23.4	0.0	0.0	25.9	0.0	0.0
40	2461850000	Agricultural Pesticides	2,903.4	0.0	0.0	2,832.7	0.0	0.0
41	2501011011	Residential Permeation	4,861.7	0.0	0.0	311.4	0.0	0.0
42	2501011012	Residential Evaporation	9,492.2	0.0	0.0	608.0	0.0	0.0
43	2501011013	Residential Spill in Transport	1,238.6	0.0	0.0	1,214.2	0.0	0.0
44	2501011014	Residential Vapor Displacement	454.1	0.0	0.0	472.1	0.0	0.0
45	2501011015	Residential Spill at Pump	36.1	0.0	0.0	40.6	0.0	0.0
46	2501012011	Commercial Permeation	155.3	0.0	0.0	9.9	0.0	0.0
47	2501012012	Commercial Evaporation	303.2	0.0	0.0	19.4	0.0	0.0
48	2501012013	Commercial Spill in Transport	1,689.6	0.0	0.0	1,656.3	0.0	0.0
49	2501012014	Commercial Vapor Displacement	875.1	0.0	0.0	909.8	0.0	0.0
50	2501012015	Commercial Spill at Pump	69.5	0.0	0.0	78.2	0.0	0.0

No.	SCC	Description	2011 (lbs/day)			2017 (lbs/day)		
			VOC	NOx	CO	VOC	NOx	CO
51	2501055120	Bulk plants	659.3	0.0	0.0	597.1	0.0	0.0
52	2501060051	Gasoline Service Stations Stage 1: Submerged Filling	528.7	0.0	0.0	478.8	0.0	0.0
53	2501060053	Gasoline Service Stations Stage 1: Balanced Submerged Filling	1,426.8	0.0	0.0	1,292.0	0.0	0.0
54	2501060201	Gasoline Service Stations Underground Tank: Breathing and Emptying	4,138.6	0.0	0.0	3,747.6	0.0	0.0
55	2501080050	Airports : Aviation Gasoline Stage 1: Total	1,904.5	0.0	0.0	1,724.6	0.0	0.0
56	2501080100	Airports : Aviation Gasoline Stage 2: Total	98.8	0.0	0.0	89.5	0.0	0.0
57	2505030120	Truck: Gasoline (Tank Trucks in Transit)	315.8	0.0	0.0	285.9	0.0	0.0
58	2505040120	Pipeline Gasoline	94.5	0.0	0.0	85.5	0.0	0.0
59	2510000000	Volatile organic liquid (VOL) storage and transport	182.7	0.0	0.0	201.5	0.0	0.0
60	2601000000	Onsite incineration	1.1	21.4	5.3	1.2	23.6	5.9
61	2610000500	Land clearing debris	20.5	9.1	193.8	22.6	10.1	213.8
62	2620000000	Landfills	200.7	167.4	596.4	221.4	184.7	657.9
63	2630020000	Publicly owned treatment works	577.1	0.0	0.0	636.6	0.0	0.0
64	2650000000	Other waste	10.9	122.8	431.4	12.0	135.5	475.9
65	2660000000	Leaking underground storage tanks	32.3	0.0	0.0	29.3	0.0	0.0
66	2801500000	Agricultural Field burning (ditchbank & fence row)	804.2	357.4	7,595.5	784.6	348.7	7,410.4
67	2810030000	Structure Fires	72.4	9.2	395.2	72.4	9.2	395.2
68	2810040000	Aircraft engine testing	26.1	259.3	91.2	27.4	272.4	95.8
69	2810050000	Vehicle Fires	50.8	6.4	198.5	50.8	6.4	198.5
70	2810060100	Crematories	51.1	88.5	17.3	56.4	97.6	19.1
71	2830001000	Accidental releases	2.1	0.0	0.0	2.1	0.0	0.0
72	2850000000	Hospitals (Total: All Operations)	52.3	0.0	0.0	57.7	0.0	0.0

Table B-6 2011 and 2017 annual area source emissions in Pinal County

No.	SCC	Description	2011 (metric tons/year)			2017 (metric tons/year)		
			VOC	NOx	CO	VOC	NOx	CO
1	2103008000	Commercial/institutional wood	0.3	3.6	9.8	0.3	3.4	9.3
2	2104004000	Residential distillate oil	0.0	0.1	0.0	0.0	0.1	0.0
3	2104006000	Residential natural gas	3.1	53.1	22.6	3.6	61.5	26.2
4	2104007000	Residential liquefied petroleum gas (LPG)	0.8	20.4	11.4	0.9	23.6	13.2
5	2285002006	Locomotives Line Haul Class I	63.8	1,243.1	183.9	47.0	916.2	135.5
6	2285002007	Line Haul Locomotives: Class II / III Operations	5.1	131.6	13.0	3.8	97.0	9.6
7	2302002100	Commercial cooking - Conveyorized charbroiling	1.5	0.00	5.1	1.8	0.0	5.9
8	2302002200	Commercial cooking - Under-fired charbroiling	5.2	0.0	17.0	6.0	0.0	19.7
9	2302003000	Commercial cooking - Deep fat frying	0.8	0.0	0.0	0.9	0.0	0.0
10	2302003100	Commercial cooking - Flat griddle frying	0.7	0.0	1.4	0.8	0.0	1.7
11	2302003200	Commercial cooking - Clamshell griddle frying	0.0	0.0	0.0	0.0	0.0	0.0
12	2401001000	Architectural coatings	40.0	0.0	0.0	46.3	0.0	0.0
13	2401005000	Auto refinishing	20.7	0.0	0.0	24.0	0.0	0.0
14	2401008000	Traffic markings	0.7	0.0	0.0	0.7	0.0	0.0
15	2401015000	Factory finished wood	2.9	0.0	0.0	3.3	0.0	0.0
16	2401020000	Wood furniture	8.0	0.0	0.0	9.2	0.0	0.0
17	2401055000	Machinery and Equipment coatings	0.8	0.0	0.0	0.7	0.0	0.0
18	2401065000	Electronic and Other Electrical coatings	0.6	0.0	0.0	0.6	0.0	0.0
19	2401070000	Motor Vehicles coatings	5.9	0.0	0.0	6.8	0.0	0.0
20	2401075000	Aircraft surface coatings	0.1	0.0	0.0	0.1	0.0	0.0
21	2401090000	Miscellaneous surface coatings	0.4	0.0	0.0	0.5	0.0	0.0
22	2401100000	Surface Coating, Industrial Maintenance Coatings	28.2	0.0	0.0	26.9	0.0	0.0
23	2401200000	Surface Coating, Other Special Purpose Coatings	12.0	0.0	0.0	11.5	0.0	0.0
24	2415000000	Degreasing	37.7	0.0	0.0	43.7	0.0	0.0
25	2420000000	Dry cleaning	0.2	0.0	0.0	0.3	0.0	0.0
26	2460100000	Personal care products	357.0	0.0	0.0	413.2	0.0	0.0

No.	SCC	Description	2011 (metric tons/year)			2017 (metric tons/year)		
			VOC	NOx	CO	VOC	NOx	CO
27	2460200000	Household products	338.2	0.0	0.0	391.4	0.0	0.0
28	2460400000	Automotive aftermarket products	255.5	0.0	0.0	295.7	0.0	0.0
29	2460500000	Coatings and related products	178.5	0.0	0.0	206.6	0.0	0.0
30	2460600000	Adhesives and sealants	107.1	0.0	0.0	123.9	0.0	0.0
31	2460800000	FIFRA related products	334.4	0.0	0.0	387.1	0.0	0.0
32	2460900000	Miscellaneous products, NEC	13.2	0.0	0.0	15.2	0.0	0.0
33	2461021000	Cutback Asphalt	93.5	0.0	0.0	95.6	0.0	0.0
34	2461022000	Emulsified Asphalt	77.1	0.0	0.0	78.8	0.0	0.0
35	2461850000	Agricultural Pesticides	631.6	0.0	0.0	628.8	0.0	0.0
36	2501011011	Permeation	32.2	0.0	0.0	2.1	0.0	0.0
37	2501011012	Evaporation (includes Diurnal losses)	62.8	0.0	0.0	4.0	0.0	0.0
38	2501011013	Spillage During Transport	8.2	0.0	0.0	8.0	0.0	0.0
39	2501011014	Refilling at the Pump - Vapor Displacement	3.0	0.0	0.0	3.1	0.0	0.0
40	2501011015	Refilling at the Pump - Spillage	0.2	0.0	0.0	0.3	0.0	0.0
41	2501012011	Permeation	1.0	0.0	0.0	0.1	0.0	0.0
42	2501012012	Evaporation (includes Diurnal losses)	2.0	0.0	0.0	0.1	0.0	0.0
43	2501012013	Spillage During Transport	11.2	0.0	0.0	11.0	0.0	0.0
44	2501012014	Refilling at the Pump - Vapor Displacement	5.8	0.0	0.0	6.0	0.0	0.0
45	2501012015	Refilling at the Pump - Spillage	0.5	0.0	0.0	0.5	0.0	0.0
46	2501060051	Gasoline Service Stations Stage 1: Submerged Filling	346.3	0.0	0.0	313.6	0.0	0.0
47	2501060052	Gasoline Service Stations Stage 1: Splash Filling	79.8	0.0	0.0	72.2	0.0	0.0
48	2501060201	Gasoline Service Stations Underground Tank: Breathing and Emptying	83.8	0.0	0.0	75.8	0.0	0.0
49	2501080050	Airports : Aviation Gasoline Stage 1: Total	32.6	0.0	0.0	29.5	0.0	0.0
50	2501080100	Airports : Aviation Gasoline Stage 2: Total	1.7	0.0	0.0	1.5	0.0	0.0
51	2505030120	Truck: Gasoline (Tank Trucks in Transit)	5.5	0.0	0.0	5.0	0.0	0.0
52	2505040120	Pipeline Gasoline	2.0	0.0	0.0	1.8	0.0	0.0
53	2610000500	Land clearing debris	19.5	8.7	183.8	22.6	10.1	212.7

No.	SCC	Description	2011 (metric tons/year)			2017 (metric tons/year)		
			VOC	NOx	CO	VOC	NOx	CO
54	2610030000	Household waste	35.0	24.5	347.4	40.5	28.4	402.1
55	2620000000	Landfills	51.6	0.7	1.9	59.7	0.8	2.2
56	2630020000	Publicly owned treatment works	6.2	0.0	0.0	7.2	0.0	0.0
57	2810060100	Crematories	0.0	0.1	0.1	0.0	0.1	0.1

Onroad Source

Draft onroad mobile source emissions are calculated using MOVES2014.

Table B-7 Draft monthly onroad mobile source emissions for Maricopa County in 2011 and 2017

Month	2011 (metric tons/month)			2017 (metric tons/month)		
	VOC	NOx	CO	VOC	NOx	CO
May	1,900.3	3,697.9	18,644.0	1,267.7	2,053.8	13,795.1
June	2,113.7	3,771.7	20,249.7	1,393.2	2,042.7	15,044.4
July	2,207.6	3,414.5	20,641.3	1,453.3	1,840.0	15,337.6
August	2,322.8	3,542.3	22,061.8	1,523.8	1,920.9	16,432.2
September	2,082.9	3,532.5	20,050.9	1,371.3	1,915.4	14,872.2
Total	10,627.3	17,958.9	101,647.7	7,009.3	9,772.8	75,481.5

Table B-8 Draft monthly onroad mobile source emissions for the Maricopa eight-hour ozone nonattainment area in 2011 and 2017

Month	2011 (metric tons/month)			2017 (metric tons/month)		
	VOC	NOx	CO	VOC	NOx	CO
May	1,936.6	3,698.9	19,021.6	1,291.1	2,040.7	14,067.5
June	2,154.4	3,775.3	20,655.0	1,419.0	2,029.5	15,337.3
July	2,250.3	3,419.1	21,049.0	1,480.6	1,829.7	15,632.7
August	2,368.2	3,549.2	22,507.2	1,552.7	1,911.5	16,755.6
September	2,123.2	3,538.8	20,459.3	1,397.0	1,905.1	15,167.4
Total	10,832.7	17,981.3	103,692.1	7,140.4	9,716.5	76,960.5

Table B-9 Draft average daily onroad mobile source emissions for the period of May 1 through September 30 for Maricopa County in 2011 and 2017

2011 (metric tons/day)			2017 (metric tons/day)		
VOC	NOx	CO	VOC	NOx	CO
69.5	117.4	664.4	45.8	63.9	493.3

Table B-10 Draft average daily onroad mobile source emissions for the period of May 1 through September 30 for the Maricopa eight-hour ozone nonattainment area in 2011 and 2017

2011 (metric tons/day)			2017 (metric tons/day)		
VOC	NOx	CO	VOC	NOx	CO
70.8	117.5	677.7	46.7	63.5	503.0

Nonroad Source

Draft nonroad mobile source emissions are calculated using NONROAD2008a and EDMS models.

Table B-11 Draft monthly nonroad source emissions for Maricopa County in 2011 and 2017

Month	2011 (metric tons/month)			2017 (metric tons/month)		
	VOC	NOx	CO	VOC	NOx	CO
May	945.4	1,630.9	10,452.6	724.7	1,114.8	9,639.8
June	1,135.3	1,756.4	11,858.4	845.4	1,194.8	10,985.1
July	1,167.1	1,696.9	11,859.1	854.8	1,160.2	10,976.2
August	1,180.1	1,762.0	12,008.3	857.5	1,197.0	11,115.2
September	1,003.0	1,619.4	10,663.0	749.7	1,100.4	9,845.1
Total	5,430.9	8,465.6	56,841.4	4,032.1	5,767.2	52,561.4

Table B-12 Draft monthly nonroad source emissions for Pinal County in 2011 and 2017

Month	2011 (metric tons/month)			2017 (metric tons/month)		
	VOC	NOx	CO	VOC	NOx	CO
May	138.8	234.4	903.6	117.1	179.6	895.7
June	178.4	246.9	1,095.6	144.2	187.6	1,080.2
July	188.7	244.4	1,130.4	151.3	187.1	1,116.3
August	184.5	250.7	1,114.3	148.3	190.9	1,099.5
September	145.3	231.6	923.3	120.7	176.9	913.0
Total	835.7	1,208.0	5,167.3	681.6	922.2	5,104.7

Table B-13 Draft average daily nonroad source emissions for the period of May 1 through September 30 for Maricopa County in 2011 and 2017

2011 (metric tons/day)			2017 (metric tons/day)		
VOC	NOx	CO	VOC	NOx	CO
35.5	55.3	371.5	26.4	37.7	343.5

Table B-14 Draft average daily nonroad source emissions for the period of May 1 through September 30 for Pinal County in 2011 and 2017

2011 (metric tons/day)			2017 (metric tons/day)		
VOC	NOx	CO	VOC	NOx	CO
5.5	7.9	33.8	4.5	6.0	33.4

Biogenic Source

Table B-15 Monthly biogenic source emissions for Maricopa County in 2011 and 2017

Month	2011 (metric tons/month)			2017 (metric tons/month)		
	VOC	NOx	CO	VOC	NOx	CO
May	14,044.9	70.6	1,806.5	14,044.9	70.6	1,806.5
June	30,821.7	129.1	3,931.0	30,821.7	129.1	3,931.0
July	35,304.4	165.6	4,432.7	35,304.4	165.6	4,432.7
August	38,050.8	178.6	4,725.3	38,050.8	178.6	4,725.3
September	21,442.9	112.4	2,619.3	21,442.9	112.4	2,619.3
Total	139,664.7	656.3	17,514.8	139,664.7	656.3	17,514.8

Table B-16 Monthly biogenic source emissions for the Maricopa eight-hour ozone nonattainment area in 2011 and 2017

Month	2011 (metric tons/month)			2017 (metric tons/month)		
	VOC	NOx	CO	VOC	NOx	CO
May	7,981.0	43.0	1,059.9	7,981.0	43.0	1,059.9
June	17,351.5	78.3	2,301.7	17,351.5	78.3	2,301.7
July	20,178.2	101.4	2,630.9	20,178.2	101.4	2,630.9
August	20,971.5	107.1	2,720.0	20,971.5	107.1	2,720.0
September	11,364.1	64.3	1,455.5	11,364.1	64.3	1,455.5
Total	77,846.3	394.1	10,168.0	77,846.3	394.1	10,168.0

Table B-17 Average daily biogenic source emissions for the period of May 1 through September 30 for Maricopa County in 2011 and 2017

2011 (metric tons/day)			2017 (metric tons/day)		
VOC	NOx	CO	VOC	NOx	CO
912.3	4.3	114.4	912.3	4.3	114.4

Table B-18 Average daily biogenic source emissions for the period of May 1 through September 30 for the Maricopa eight-hour ozone nonattainment area in 2011 and 2017

2011 (metric tons/day)			2017 (metric tons/day)		
VOC	NOx	CO	VOC	NOx	CO
508.4	2.6	66.4	508.4	2.6	66.4

APPENDIX C

GROWTH FACTORS

Table C-1 Area source growth factors for Maricopa County

No.	SCC	Description	Growth Index	Growth Factor
1	2102004001	Industrial distillate oil: Boilers	Industrial Employment	1.17
2	2102004002	Industrial distillate oil: Engines	Industrial Employment	1.17
3	2102006000	Industrial natural gas	Industrial Employment	1.17
4	2103004001	Commercial/institutional distillate oil: Boilers	Population	1.10
5	2103004002	Commercial/institutional distillate oil: Engines	Population	1.10
6	2103006000	Commercial/institutional natural gas	Population	1.10
7	2104006000	Residential natural gas	Population	1.10
8	2301000000	Chemical manufacturing	Industrial Employment	1.17
9	2302002100	Commercial cooking - Conveyorized charbroiling	Population	1.10
10	2302002200	Commercial cooking - Underfired charbroiling	Population	1.10
11	2302003000	Commercial cooking - Deep fat frying	Population	1.10
12	2302003100	Commercial cooking - Flat griddle frying	Population	1.10
13	2302003200	Commercial cooking - Clamshell griddle frying	Population	1.10
14	2302050000	Bakeries	Population	1.10
15	2304000000	Secondary metal production	Industrial Employment	1.17
16	2308000000	Rubber/Plastic product mfg.	Population	1.10
17	2312000000	Machinery (electrical)	Industrial Employment	1.17
18	2399000000	Industrial processes, not elsewhere classified (NEC)	Industrial Employment	1.17
19	2401001000	Architectural coatings	Population	1.10
20	2401005000	Auto refinishing	Population	1.10
21	2401008000	Traffic markings	Roadway Lane Miles	1.03
22	2401015000	Factory finished wood	Population	1.10
23	2401020000	Wood furniture	Population	1.10
24	2401075000	Aircraft surface coatings	Airport Operations	1.05
25	2401090000	Miscellaneous surface coatings	Population	1.10
26	2415000000	Degreasing	Population	1.10
27	2420000000	Dry cleaning	Population	1.10
28	2425000000	Graphics arts	Population	1.10
29	2440000000	Miscellaneous Industrial Solvent use	Industrial Employment	1.17
30	2460100000	Personal care products	Population	1.10
31	2460200000	Household products	Population	1.10
32	2460400000	Automotive aftermarket products	Population	1.10
33	2460500000	Coatings and related products	Population	1.10
34	2460600000	Adhesives and sealants	Population	1.10
35	2460800000	FIFRA related products	Population	1.10
36	2460900000	Miscellaneous products, NEC	Population	1.10
37	2461021000	Cutback Asphalt	Roadway Lane Miles	1.03
38	2461022000	Emulsified Asphalt	Roadway Lane Miles	1.03
39	2461023000	Roofing Asphalt	Population	1.10
40	2461850000	Agricultural Pesticides	Agricultural Acres	0.98

No.	SCC	Description	Growth Index	Growth Factor
41	2501011011	Residential Permeation	Gas Can Rule	0.06
42	2501011012	Residential Evaporation	Gas Can Rule	0.06
43	2501011013	Residential Spill in Transport	Gas Can Rule	0.98
44	2501011014	Residential Vapor Displacement	Gas Can Rule	1.04
45	2501011015	Residential Spill at Pump	Gas Can Rule	1.12
46	2501012011	Commercial Permeation	Gas Can Rule	0.06
47	2501012012	Commercial Evaporation	Gas Can Rule	0.06
48	2501012013	Commercial Spill in Transport	Gas Can Rule	0.98
49	2501012014	Commercial Vapor Displacement	Gas Can Rule	1.04
50	2501012015	Commercial Spill at Pump	Gas Can Rule	1.12
51	2501055120	Bulk plants	Gasoline Consumption	0.91
52	2501060051	Gasoline Service Stations Stage 1: Submerged Filling	Gasoline Consumption	0.91
53	2501060053	Gasoline Service Stations Stage 1: Balanced Submerged Filling	Gasoline Consumption	0.91
54	2501060201	Gasoline Service Stations Underground Tank: Breathing and Emptying	Gasoline Consumption	0.91
55	2501080050	Airports : Aviation Gasoline Stage 1: Total	Gasoline Consumption	0.91
56	2501080100	Airports : Aviation Gasoline Stage 2: Total	Gasoline Consumption	0.91
57	2505030120	Truck: Gasoline (Tank Trucks in Transit)	Gasoline Consumption	0.91
58	2505040120	Pipeline Gasoline	Gasoline Consumption	0.91
59	2510000000	Volatile organic liquid (VOL) storage and transport	Population	1.10
60	2601000000	Onsite incineration	Population	1.10
61	2610000500	Land clearing debris	Population	1.10
62	2620000000	Landfills	Population	1.10
63	2630020000	Publicly owned treatment works	Population	1.10
64	2650000000	Other waste	Population	1.10
65	2660000000	Leaking underground storage tanks	Gasoline Consumption	0.91
66	2801500000	Agricultural Field burning (ditchbank & fence row)	Agricultural Acres	0.98
67	2810030000	Structure Fires	No Growth	1.00
68	2810040000	Aircraft engine testing	Airport Operations	1.05
69	2810050000	Vehicle Fires	No Growth	1.00
70	2810060100	Crematories	Population	1.10
71	2830001000	Accidental releases	No Growth	1.00
72	2850000000	Hospitals (Total: All Operations)	Population	1.10

Table C-2 Area source growth factors for Pinal County

No.	SCC	Description	Growth Index	Growth Factor
1	2103008000	Commercial/institutional wood	Industrial Employment	0.96
2	2104004000	Residential distillate oil	Population	1.16
3	2104006000	Residential natural gas	Population	1.16
4	2104007000	Residential liquefied petroleum gas (LPG)	Population	1.16
5	2285002006	Locomotives Line Haul Class I	Locomotive Diesel Usage	0.74
6	2285002007	Line Haul Locomotives: Class II / III Operations	Locomotive Diesel Usage	0.74
7	2302002100	Commercial cooking - Conveyorized charbroiling	Population	1.16
8	2302002200	Commercial cooking - Under-fired charbroiling	Population	1.16
9	2302003000	Commercial cooking - Deep fat frying	Population	1.16
10	2302003100	Commercial cooking - Flat griddle frying	Population	1.16
11	2302003200	Commercial cooking - Clamshell griddle frying	Population	1.16
12	2401001000	Architectural coatings	Population	1.16
13	2401005000	Auto refinishing	Population	1.16
14	2401008000	Traffic markings	Roadway Lane Miles	1.02
15	2401015000	Factory finished wood	Population	1.16
16	2401020000	Wood furniture	Population	1.16
17	2401055000	Machinery and Equipment coatings	Industrial Employment	0.96
18	2401065000	Electronic and Other Electrical coatings	Industrial Employment	0.96
19	2401070000	Motor Vehicles coatings	Population	1.16
20	2401075000	Aircraft surface coatings	Airport Operations	1.05
21	2401090000	Miscellaneous surface coatings	Population	1.16
22	2401100000	Surface Coating, Industrial Maintenance Coatings	Industrial Employment	0.96
23	2401200000	Surface Coating, Other Special Purpose Coatings	Industrial Employment	0.96
24	2415000000	Degreasing	Population	1.16
25	2420000000	Dry cleaning	Population	1.16
26	2460100000	Personal care products	Population	1.16
27	2460200000	Household products	Population	1.16
28	2460400000	Automotive aftermarket products	Population	1.16
29	2460500000	Coatings and related products	Population	1.16
30	2460600000	Adhesives and sealants	Population	1.16
31	2460800000	FIFRA related products	Population	1.16
32	2460900000	Miscellaneous products, NEC	Population	1.16
33	2461021000	Cutback Asphalt	Roadway Lane Miles	1.02
34	2461022000	Emulsified Asphalt	Roadway Lane Miles	1.02
35	2461850000	Agricultural Pesticides	Agricultural Acres	1.00
36	2501011011	Permeation	Gas Can Rule	0.06
37	2501011012	Evaporation (includes Diurnal losses)	Gas Can Rule	0.06
38	2501011013	Spillage During Transport	Gas Can Rule	0.98
39	2501011014	Refilling at the Pump - Vapor Displacement	Gas Can Rule	1.04
40	2501011015	Refilling at the Pump - Spillage	Gas Can Rule	1.12

No.	SCC	Description	Growth Index	Growth Factor
41	2501012011	Permeation	Gas Can Rule	0.06
42	2501012012	Evaporation (includes Diurnal losses)	Gas Can Rule	0.06
43	2501012013	Spillage During Transport	Gas Can Rule	0.98
44	2501012014	Refilling at the Pump - Vapor Displacement	Gas Can Rule	1.04
45	2501012015	Refilling at the Pump - Spillage	Gas Can Rule	1.12
46	2501060051	Gasoline Service Stations Stage 1: Submerged Filling	Gasoline Consumption	0.91
47	2501060052	Gasoline Service Stations Stage 1: Splash Filling	Gasoline Consumption	0.91
48	2501060201	Gasoline Service Stations Underground Tank: Breathing and Emptying	Gasoline Consumption	0.91
49	2501080050	Airports : Aviation Gasoline Stage 1: Total	Gasoline Consumption	0.91
50	2501080100	Airports : Aviation Gasoline Stage 2: Total	Gasoline Consumption	0.91
51	2505030120	Truck: Gasoline (Tank Trucks in Transit)	Gasoline Consumption	0.91
52	2505040120	Pipeline Gasoline	Gasoline Consumption	0.91
53	2610000500	Land clearing debris	Population	1.16
54	2610030000	Household waste	Population	1.16
55	2620000000	Landfills	Population	1.16
56	2630020000	Publicly owned treatment works	Population	1.16
57	2810060100	Crematories	Population	1.16

APPENDIX D

MAPPING OF SPATIAL SURROGATES

Table D-1 Configurations of Spatial Tools for generating 22 spatial surrogates in Maricopa County and Pinal County*

No.	Surrogate	Surrogate Code	Data Shapefile	Weight Attribute	Filter Function
1	Population	100	MAG_Maricopa_Pinal_2010Census_latlon	TOTAL_POP	
2	Construction	141	MAG_Residential_construction_completed_2011 [PINAL_Residential_completed_2011_ll]	SQFT	
3	Total Road Miles	240	MAG_2011_Traffic_data_latlon	LANE_LENGT	
4	NTAD Total Railroad Density	261	ARIZONA_RAILROAD_latlon	NONE	
5	Agriculture	309	MAG_landuse_2012_latlon [nlcd2011az_80s_250m_nos_v2_latlon]	NONE	LONG_DISPL = 1 [GRID_CODE = 81,82]
6	Water	350	Maricopa_only_lakes_latlon	NONE	
7	Open Land	401	MAG_landuse_2012_latlon [pophu_bg2010_AZ4]	NONE	LONG_DISPL = 15,16,28 [AREA_CODE = 2,3,4]
8	Commercial Land	500	MAG_landuse_2012_latlon [fema_bsf_2002bnd]	NONE	LONG_DISPL = 3,9,21,22 [COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9]
9	Aircraft Engine Manufacturers	504	Maricopa_2011_employers_latlon	EMPLOYEES	NAICS = 336412
10	Industrial Land	505	MAG_landuse_2012_latlon [fema_bsf_2002bnd]	NONE	LONG_DISPL = 10 [IND1+IND2+IND3+IND4+IND5+IND6]
11	Commercial plus Industrial	510	MAG_landuse_2012_latlon [fema_bsf_2002bnd]	NONE	LONG_DISPL = 3,9,10,21,22 [COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9+IND1+IND2+IND3+IND4+IND5+IND6]
12	Commercial plus Institutional Land	515	MAG_landuse_2012_latlon [fema_bsf_2002bnd]	NONE	LONG_DISPL = 3,9,20,21,22 [COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9+RES5+RES6+EDU1+EDU2+REL1]
13	Residential	531	MAG_landuse_2012_latlon [Pinal_2011_all_residential_norural_ll]	NONE	LONG_DISPL = 12,23,24,25 [None]
14	Residential + Commercial + Industrial + Institutional + Government	535	MAG_landuse_2012_latlon [Pinal_Resd_Comme_Indus_Insti_Goven]]	NONE	LONG_DISPL = 3,9,10,14,20,12,21,22,23,24,25 [None]

No.	Surrogate	Surrogate Code	Data Shapefile	Weight Attribute	Filter Function
15	Auto refinish	544	Maricopa_2011_employers_latlon [CAAG_2010_employment_II]	EMPLOYEES [JOBS2010]	NAICS = 811121 [NAICS_= 811121]
16	Hospital (COM6)	560	AZ_all_hospital_latlon	CAPACITY	
17	Fuel Dispensing Facility	601	XY_Fueling_Facilities_MC_and_PC_latlon	NONE	
18	Airport Points	710	MC_15_airports_latlon	GA_OPS	
19	Golf Courses	850	Maricopa_Pinal_golf_latlon	NONE	
20	Wastewater Treatment Facilities	870	MC_wastewater_treatment_latlon [CAAG_2010_employment_II]	Capacity [JOBS2010]	[NAICS = 221320]
21	Landfills	871	AZ_landfill_except_NW_latlon	NONE	
22	Crematories	872	Maricopa_2011_employers_latlon [CAAG_2010_employment_II]	EMPLOYEES [JOBS2010]	NAICS = 812220 [NAICS = 812220]

* All options for Pinal County are presented in the brackets.

Table D-2 Spatial surrogates used for area sources in the 4 km modeling domain

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
1	2102004001	Stationary Source Fuel Combustion	Industrial	Distillate Oil	All Boiler Types	505	Industrial Land
2	2102004002	Stationary Source Fuel Combustion	Industrial	Distillate Oil	All IC Engine Types	505	Industrial Land
3	2102006000	Stationary Source Fuel Combustion	Industrial	Natural Gas	Total: Boilers and IC Engines	505	Industrial Land
4	2103004001	Stationary Source Fuel Combustion	Commercial/Institutional	Distillate Oil	Boilers	515	Commercial plus Institutional Land
5	2103004002	Stationary Source Fuel Combustion	Commercial/Institutional	Distillate Oil	IC Engines	515	Commercial plus Institutional Land
6	2103006000	Stationary Source Fuel Combustion	Commercial/Institutional	Natural Gas	Total: Boilers and IC Engines	515	Commercial plus Institutional Land
7	2104001000	Stationary Source Fuel Combustion	Residential	Anthracite Coal	Total: All Combustor Types	531	Residential
8	2104002000	Stationary Source Fuel Combustion	Residential	Bituminous/Subbituminous Coal	Total: All Combustor Types	531	Residential
9	2104004000	Stationary Source Fuel Combustion	Residential	Distillate Oil	Total: All Combustor Types	531	Residential
10	2104006000	Stationary Source Fuel Combustion	Residential	Natural Gas	Total: All Combustor Types	531	Residential
11	2104007000	Stationary Source Fuel Combustion	Residential	Liquified Petroleum Gas (LPG)	Total: All Combustor Types	531	Residential
12	2104008100	Stationary Source Fuel Combustion	Residential	Wood	Fireplace: general	531	Residential
13	2104008210	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; non-EPA certified	531	Residential
14	2104008220	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; non-catalytic	531	Residential
15	2104008230	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; catalytic	531	Residential
16	2104008310	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, non-EPA certified	531	Residential
17	2104008320	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, non-catalytic	531	Residential
18	2104008330	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, catalytic	531	Residential
19	2104008400	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: pellet-fired, general (freestanding or FP insert)	531	Residential
20	2104008610	Stationary Source Fuel Combustion	Residential	Wood	Hydronic heater: outdoor	531	Residential

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
21	2104008700	Stationary Source Fuel Combustion	Residential	Wood	Outdoor wood burning device, NEC (fire-pits, chimeas, etc)	531	Residential
22	2104009000	Stationary Source Fuel Combustion	Residential	Firelog	Total: All Combustor Types	531	Residential
23	2104011000	Stationary Source Fuel Combustion	Residential	Kerosene	Total: All Heater Types	531	Residential
24	2301000000	Industrial Processes	Chemical Manufacturing: SIC 28	All Processes	Total	505	Industrial Land
25	2302002100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Conveyorized Charbroiling	500	Commercial Land
26	2302002200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Under-fired Charbroiling	500	Commercial Land
27	2302003000	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Deep Fat Fying	500	Commercial Land
28	2302003100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Flat Griddle Frying	500	Commercial Land
29	2302003200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Clamshell Griddle Frying	500	Commercial Land
30	2302050000	Industrial Processes	Food and Kindred Products: SIC 20	Bakery Products	Total	500	Commercial Land
31	2304000000	Industrial Processes	Secondary Metal Production: SIC 33	All Processes	Total	505	Industrial Land
32	2308000000	Industrial Processes	Rubber/Plastics: SIC 30	All Processes	Total	505	Industrial Land
33	2312000000	Industrial Processes	Machinery: SIC 35	All Processes	Total	505	Industrial Land
34	2399000000	Industrial Processes	Industrial Processes: NEC	Industrial Processes: NEC	Total	505	Industrial Land
35	2401001000	Solvent Utilization	Surface Coating	Architectural Coatings	Total: All Solvent Types	535	Residential + Commercial + Industrial + Institutional + Government
36	2401005000	Solvent Utilization	Surface Coating	Auto Refinishing: SIC 7532	Total: All Solvent Types	544	Auto refinish
37	2401008000	Solvent Utilization	Surface Coating	Traffic Markings	Total: All Solvent Types	240	Total Road Miles
38	2401015000	Solvent Utilization	Surface Coating	Factory Finished Wood: SIC 2426 thru 242	Total: All Solvent Types	505	Industrial Land
39	2401020000	Solvent Utilization	Surface Coating	Wood Furniture: SIC 25	Total: All Solvent Types	505	Industrial Land
40	2401075000	Solvent Utilization	Surface Coating	Aircraft: SIC 372	Total: All Solvent Types	505	Industrial Land
41	2401090000	Solvent Utilization	Surface Coating	Miscellaneous Manufacturing	Total: All Solvent Types	505	Industrial Land
42	2415000000	Solvent Utilization	Degreasing	All Processes/All Industries	Total: All Solvent Types	510	Commercial plus Industrial
43	2420000000	Solvent Utilization	Dry Cleaning	All Processes	Total: All Solvent Types	500	Commercial Land
44	2425000000	Solvent Utilization	Graphic Arts	All Processes	Total: All Solvent Types	500	Commercial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
45	2440000000	Solvent Utilization	Miscellaneous Industrial	All Processes	Total: All Solvent Types	500	Commercial Land
46	2460100000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Personal Care Products	Total: All Solvent Types	531	Residential
47	2460200000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Household Products	Total: All Solvent Types	531	Residential
48	2460400000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Automotive Aftermarket Products	Total: All Solvent Types	531	Residential
49	2460500000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Coatings and Related Products	Total: All Solvent Types	531	Residential
50	2460600000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Adhesives and Sealants	Total: All Solvent Types	531	Residential
51	2460800000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All FIFRA Related Products	Total: All Solvent Types	531	Residential
52	2460900000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	Miscellaneous Products (Not Otherwise Covered)	Total: All Solvent Types	531	Residential
53	2461021000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Cutback Asphalt	Total: All Solvent Types	240	Total Road Miles
54	2461022000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Emulsified Asphalt	Total: All Solvent Types	240	Total Road Miles
55	2461023000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Asphalt Roofing	Total: All Solvent Types	531	Residential
56	2461850000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	All Processes	309	Agriculture
57	2501011011	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Permeation	531	Residential
58	2501011012	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Evaporation (includes Diurnal losses)	531	Residential
59	2501011013	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Spillage During Transport	531	Residential
60	2501011014	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Refilling at the Pump - Vapor Displacement	601	Fuel Dispensing Facility

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
61	2501011015	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Refilling at the Pump - Spillage	601	Fuel Dispensing Facility
62	2501012011	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Permeation	500	Commercial Land
63	2501012012	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Evaporation (includes Diurnal losses)	500	Commercial Land
64	2501012013	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Spillage During Transport	500	Commercial Land
65	2501012014	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Refilling at the Pump - Vapor Displacement	601	Fuel Dispensing Facility
66	2501012015	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Refilling at the Pump - Spillage	601	Fuel Dispensing Facility
67	2501050120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Terminals: All Evaporative Losses	Gasoline	601	Fuel Dispensing Facility
68	2501055120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Plants: All Evaporative Losses	Gasoline	601	Fuel Dispensing Facility
69	2501060051	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Submerged Filling	601	Fuel Dispensing Facility
70	2501060053	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Balanced Submerged Filling	601	Fuel Dispensing Facility
71	2501060100	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Total	601	Fuel Dispensing Facility
72	2501060201	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Underground Tank: Breathing and Emptying	601	Fuel Dispensing Facility
73	2501080050	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 1: Total	710	Airport Points
74	2501080100	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 2: Total	710	Airport Points
75	2505030120	Storage and Transport	Petroleum and Petroleum Product Transport	Truck	Gasoline	240	Total Road Miles

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
76	2505040120	Storage and Transport	Petroleum and Petroleum Product Transport	Pipeline	Gasoline	240	Total Road Miles
77	2510000000	Storage and Transport	Organic Chemical Storage	All Storage Types: Breathing Loss	Total: All Products	505	Industrial Land
78	2601000000	Waste Disposal, Treatment, and Recovery	On-site Incineration	All Categories	Total	505	Industrial Land
79	2610000100	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Leaf Species Unspecified	531	Residential
80	2610000300	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Weed Species Unspecified (incl Grass)	531	Residential
81	2610000400	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Brush Species Unspecified	531	Residential
82	2610000500	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)	531	Residential
83	2620000000	Waste Disposal, Treatment, and Recovery	Landfills	All Categories	Total	871	Landfills
84	2630020000	Waste Disposal, Treatment, and Recovery	Wastewater Treatment	Public Owned	Total Processed	870	Wastewater Treatment Facilities
85	2650000000	Waste Disposal, Treatment, and Recovery	Scrap and Waste Materials	Scrap and Waste Materials	Total: All Processes	505	Industrial Land
86	2660000000	Waste Disposal, Treatment, and Recovery	Leaking Underground Storage Tanks	Leaking Underground Storage Tanks	Total: All Storage Types	505	Industrial Land
87	2801500000	Miscellaneous Area Sources	Agriculture Production - Crops	Agricultural Field Burning - whole field set on fire	Unspecified	309	Agriculture
88	2810030000	Miscellaneous Area Sources	Other Combustion	Structure Fires	Unspecified	535	Residential + Commercial + Industrial + Institutional + Government
89	2810040000	Miscellaneous Area Sources	Other Combustion	Aircraft/Rocket Engine Firing and Testing	Total	504	Aircraft Engine Manufacturers
90	2810050000	Miscellaneous Area Sources	Other Combustion	Motor Vehicle Fires	Unspecified	240	Total Road Miles
91	2810060100	Miscellaneous Area Sources	Other Combustion	Cremation	Humans	872	Crematories
92	2830001000	Miscellaneous Area Sources	Catastrophic/Accidental Releases	Industrial Accidents	Total	505	Industrial Land
93	2850000000	Miscellaneous Area Sources	Health Services	Hospitals	Total: All Operations	560	Hospital (COM6)
94	2260001010	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Recreational Equipment	Motorcycles: Off-road	401	Open Land
95	2260001020	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Recreational Equipment	Snowmobiles	401	Open Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
96	2260001030	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Recreational Equipment	All Terrain Vehicles	401	Open Land
97	2260001060	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Recreational Equipment	Specialty Vehicles/Carts	401	Open Land
98	2260002006	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Tampers/Rammers	141	Construction
99	2260002009	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Plate Compactors	141	Construction
100	2260002021	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Paving Equipment	141	Construction
101	2260002027	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Signal Boards/Light Plants	141	Construction
102	2260002039	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Concrete/Industrial Saws	141	Construction
103	2260002054	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Crushing/Processing Equipment	141	Construction
104	2260003030	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Industrial Equipment	Sweepers/Scrubbers	505	Industrial Land
105	2260003040	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land
106	2260004015	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Rotary Tillers < 6 HP (Residential)	531	Residential
107	2260004016	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Rotary Tillers < 6 HP (Commercial)	500	Commercial Land
108	2260004020	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Chain Saws < 6 HP (Residential)	531	Residential
109	2260004021	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Chain Saws < 6 HP (Commercial)	500	Commercial Land
110	2260004025	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Trimmers/Edgers/Brush Cutters (Residential)	531	Residential
111	2260004026	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Trimmers/Edgers/Brush Cutters (Commercial)	500	Commercial Land
112	2260004030	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Leafblowers/Vacuums (Residential)	531	Residential
113	2260004031	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Leafblowers/Vacuums (Commercial)	500	Commercial Land
114	2260004035	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Snowblowers (Residential)	531	Residential
115	2260004036	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Snowblowers (Commercial)	500	Commercial Land
116	2260004071	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Turf Equipment (Commercial)	500	Commercial Land
117	2260005035	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Agricultural Equipment	Sprayers	309	Agriculture

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
118	2260006005	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Commercial Equipment	Generator Sets	500	Commercial Land
119	2260006010	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Commercial Equipment	Pumps	500	Commercial Land
120	2260006015	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Commercial Equipment	Air Compressors	500	Commercial Land
121	2260006035	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Commercial Equipment	Hydro-power Units	500	Commercial Land
122	2265001010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Recreational Equipment	Motorcycles: Off-road	401	Open Land
123	2265001030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Recreational Equipment	All Terrain Vehicles	401	Open Land
124	2265001050	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Recreational Equipment	Golf Carts	850	Golf Courses
125	2265001060	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Recreational Equipment	Specialty Vehicles/Carts	401	Open Land
126	2265002003	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Pavers	141	Construction
127	2265002006	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Tampers/Rammers	141	Construction
128	2265002009	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Plate Compactors	141	Construction
129	2265002015	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Rollers	141	Construction
130	2265002021	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Paving Equipment	141	Construction
131	2265002024	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Surfacing Equipment	141	Construction
132	2265002027	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Signal Boards/Light Plants	141	Construction
133	2265002030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Trenchers	141	Construction
134	2265002033	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Bore/Drill Rigs	141	Construction
135	2265002039	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Concrete/Industrial Saws	141	Construction
136	2265002042	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Cement and Mortar Mixers	141	Construction
137	2265002045	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Cranes	141	Construction
138	2265002054	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Crushing/Processing Equipment	141	Construction
139	2265002057	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Rough Terrain Forklifts	141	Construction

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
140	2265002060	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Rubber Tire Loaders	141	Construction
141	2265002066	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Tractors/Loaders/Backhoes	141	Construction
142	2265002072	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Skid Steer Loaders	141	Construction
143	2265002078	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Dumpers/Tenders	141	Construction
144	2265002081	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Other Construction Equipment	141	Construction
145	2265003010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Aerial Lifts	505	Industrial Land
146	2265003020	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Forklifts	505	Industrial Land
147	2265003030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Sweepers/Scrubbers	505	Industrial Land
148	2265003040	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land
149	2265003050	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Other Material Handling Equipment	505	Industrial Land
150	2265003060	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	AC\Refrigeration	505	Industrial Land
151	2265003070	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Terminal Tractors	505	Industrial Land
152	2265004010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Lawn Mowers (Residential)	531	Residential
153	2265004011	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Lawn Mowers (Commercial)	500	Commercial Land
154	2265004015	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Rotary Tillers < 6 HP (Residential)	531	Residential
155	2265004016	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Rotary Tillers < 6 HP (Commercial)	500	Commercial Land
156	2265004025	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Trimmers/Edgers/Brush Cutters (Residential)	531	Residential
157	2265004026	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Trimmers/Edgers/Brush Cutters (Commercial)	500	Commercial Land
158	2265004030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Leafblowers/Vacuums (Residential)	531	Residential
159	2265004031	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Leafblowers/Vacuums (Commercial)	500	Commercial Land
160	2265004035	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Snowblowers (Residential)	531	Residential
161	2265004036	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Snowblowers (Commercial)	500	Commercial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
162	2265004040	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Rear Engine Riding Mowers (Residential)	531	Residential
163	2265004041	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Rear Engine Riding Mowers (Commercial)	500	Commercial Land
164	2265004046	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Front Mowers (Commercial)	500	Commercial Land
165	2265004051	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Shredders < 6 HP (Commercial)	531	Residential
166	2265004055	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Lawn and Garden Tractors (Residential)	500	Commercial Land
167	2265004056	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Lawn and Garden Tractors (Commercial)	500	Commercial Land
168	2265004066	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Chippers/Stump Grinders (Commercial)	500	Commercial Land
169	2265004071	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Turf Equipment (Commercial)	500	Commercial Land
170	2265004075	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Other Lawn and Garden Equipment (Residential)	531	Residential
171	2265004076	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Other Lawn and Garden Equipment (Commercial)	500	Commercial Land
172	2265005010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	2-Wheel Tractors	309	Agriculture
173	2265005015	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Agricultural Tractors	309	Agriculture
174	2265005020	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Combines	309	Agriculture
175	2265005025	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Balers	309	Agriculture
176	2265005030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Agricultural Mowers	309	Agriculture
177	2265005035	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Sprayers	309	Agriculture
178	2265005040	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Tillers : 6 HP	309	Agriculture
179	2265005045	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Swathers	309	Agriculture
180	2265005055	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Other Agricultural Equipment	309	Agriculture
181	2265005060	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Irrigation Sets	309	Agriculture
182	2265006005	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Generator Sets	500	Commercial Land
183	2265006010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Pumps	500	Commercial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
184	2265006015	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Air Compressors	500	Commercial Land
185	2265006025	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Welders	500	Commercial Land
186	2265006030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Pressure Washers	500	Commercial Land
187	2265006035	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Hydro-power Units	500	Commercial Land
188	2267001060	Mobile Sources	LPG	Recreational Equipment	Specialty Vehicles/Carts	401	Open Land
189	2267002003	Mobile Sources	LPG	Construction and Mining Equipment	Pavers	141	Construction
190	2267002015	Mobile Sources	LPG	Construction and Mining Equipment	Rollers	141	Construction
191	2267002021	Mobile Sources	LPG	Construction and Mining Equipment	Paving Equipment	141	Construction
192	2267002024	Mobile Sources	LPG	Construction and Mining Equipment	Surfacing Equipment	141	Construction
193	2267002030	Mobile Sources	LPG	Construction and Mining Equipment	Trenchers	141	Construction
194	2267002033	Mobile Sources	LPG	Construction and Mining Equipment	Bore/Drill Rigs	141	Construction
195	2267002039	Mobile Sources	LPG	Construction and Mining Equipment	Concrete/Industrial Saws	141	Construction
196	2267002045	Mobile Sources	LPG	Construction and Mining Equipment	Cranes	141	Construction
197	2267002054	Mobile Sources	LPG	Construction and Mining Equipment	Crushing/Processing Equipment	141	Construction
198	2267002057	Mobile Sources	LPG	Construction and Mining Equipment	Rough Terrain Forklifts	141	Construction
199	2267002060	Mobile Sources	LPG	Construction and Mining Equipment	Rubber Tire Loaders	141	Construction
200	2267002066	Mobile Sources	LPG	Construction and Mining Equipment	Tractors/Loaders/Backhoes	141	Construction
201	2267002072	Mobile Sources	LPG	Construction and Mining Equipment	Skid Steer Loaders	141	Construction
202	2267002081	Mobile Sources	LPG	Construction and Mining Equipment	Other Construction Equipment	141	Construction
203	2267003010	Mobile Sources	LPG	Industrial Equipment	Aerial Lifts	505	Industrial Land
204	2267003020	Mobile Sources	LPG	Industrial Equipment	Forklifts	505	Industrial Land
205	2267003030	Mobile Sources	LPG	Industrial Equipment	Sweepers/Scrubbers	505	Industrial Land
206	2267003040	Mobile Sources	LPG	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
207	2267003050	Mobile Sources	LPG	Industrial Equipment	Other Material Handling Equipment	505	Industrial Land
208	2267003070	Mobile Sources	LPG	Industrial Equipment	Terminal Tractors	505	Industrial Land
209	2267004066	Mobile Sources	LPG	Lawn and Garden Equipment	Chippers/Stump Grinders (Commercial)	500	Commercial Land
210	2267005055	Mobile Sources	LPG	Agricultural Equipment	Other Agricultural Equipment	309	Agriculture
211	2267005060	Mobile Sources	LPG	Agricultural Equipment	Irrigation Sets	309	Agriculture
212	2267006005	Mobile Sources	LPG	Commercial Equipment	Generator Sets	500	Commercial Land
213	2267006010	Mobile Sources	LPG	Commercial Equipment	Pumps	500	Commercial Land
214	2267006015	Mobile Sources	LPG	Commercial Equipment	Air Compressors	500	Commercial Land
215	2267006025	Mobile Sources	LPG	Commercial Equipment	Welders	500	Commercial Land
216	2267006030	Mobile Sources	LPG	Commercial Equipment	Pressure Washers	500	Commercial Land
217	2267006035	Mobile Sources	LPG	Commercial Equipment	Hydro-power Units	500	Commercial Land
218	2268002081	Mobile Sources	CNG	Construction and Mining Equipment	Other Construction Equipment	141	Construction
219	2268003020	Mobile Sources	CNG	Industrial Equipment	Forklifts	505	Industrial Land
220	2268003030	Mobile Sources	CNG	Industrial Equipment	Sweepers/Scrubbers	505	Industrial Land
221	2268003040	Mobile Sources	CNG	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land
222	2268003060	Mobile Sources	CNG	Industrial Equipment	AC\Refrigeration	505	Industrial Land
223	2268003070	Mobile Sources	CNG	Industrial Equipment	Terminal Tractors	505	Industrial Land
224	2268005055	Mobile Sources	CNG	Agricultural Equipment	Other Agricultural Equipment	309	Agriculture
225	2268005060	Mobile Sources	CNG	Agricultural Equipment	Irrigation Sets	309	Agriculture
226	2268006005	Mobile Sources	CNG	Commercial Equipment	Generator Sets	500	Commercial Land
227	2268006010	Mobile Sources	CNG	Commercial Equipment	Pumps	500	Commercial Land
228	2268006015	Mobile Sources	CNG	Commercial Equipment	Air Compressors	500	Commercial Land
229	2268006020	Mobile Sources	CNG	Commercial Equipment	Gas Compressors	500	Commercial Land
230	2268006035	Mobile Sources	CNG	Commercial Equipment	Hydro-power Units	500	Commercial Land
231	2270001060	Mobile Sources	Off-highway Vehicle Diesel	Recreational Equipment	Specialty Vehicles/Carts	500	Commercial Land
232	2270002003	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Pavers	141	Construction

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
233	2270002006	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Tampers/Rammers	141	Construction
234	2270002009	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Plate Compactors	141	Construction
235	2270002015	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Rollers	141	Construction
236	2270002018	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Scrapers	141	Construction
237	2270002021	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Paving Equipment	141	Construction
238	2270002024	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Surfacing Equipment	141	Construction
239	2270002027	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Signal Boards/Light Plants	141	Construction
240	2270002030	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Trenchers	141	Construction
241	2270002033	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Bore/Drill Rigs	141	Construction
242	2270002036	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Excavators	141	Construction
243	2270002039	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Concrete/Industrial Saws	141	Construction
244	2270002042	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Cement and Mortar Mixers	141	Construction
245	2270002045	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Cranes	141	Construction
246	2270002048	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Graders	141	Construction
247	2270002051	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Off-highway Trucks	141	Construction
248	2270002054	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Crushing/Processing Equipment	141	Construction
249	2270002057	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Rough Terrain Forklifts	141	Construction
250	2270002060	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Rubber Tire Loaders	141	Construction
251	2270002066	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Tractors/Loaders/Backhoes	141	Construction
252	2270002069	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Crawler Tractor/Dozers	141	Construction
253	2270002072	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Skid Steer Loaders	141	Construction
254	2270002075	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Off-highway Tractors	141	Construction

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
255	2270002078	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Dumpers/Tenders	141	Construction
256	2270002081	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Other Construction Equipment	141	Construction
257	2270003010	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Aerial Lifts	505	Industrial Land
258	2270003020	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Forklifts	505	Industrial Land
259	2270003030	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Sweepers/Scrubbers	505	Industrial Land
260	2270003040	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land
261	2270003050	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Other Material Handling Equipment	505	Industrial Land
262	2270003060	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	AC\Refrigeration	505	Industrial Land
263	2270003070	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Terminal Tractors	505	Industrial Land
264	2270004031	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Leafblowers/Vacuums (Commercial)	500	Commercial Land
265	2270004036	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Snowblowers (Commercial)	500	Commercial Land
266	2270004046	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Front Mowers (Commercial)	500	Commercial Land
267	2270004056	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Lawn and Garden Tractors (Commercial)	500	Commercial Land
268	2270004066	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Chippers/Stump Grinders (Commercial)	500	Commercial Land
269	2270004071	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Turf Equipment (Commercial)	500	Commercial Land
270	2270004076	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Other Lawn and Garden Equipment (Commercial)	500	Commercial Land
271	2270005010	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	2-Wheel Tractors	309	Agriculture
272	2270005015	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Agricultural Tractors	309	Agriculture
273	2270005020	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Combines	309	Agriculture
274	2270005025	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Balers	309	Agriculture
275	2270005030	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Agricultural Mowers	309	Agriculture
276	2270005035	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Sprayers	309	Agriculture

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
277	2270005040	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Tillers : 6 HP	309	Agriculture
278	2270005045	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Swathers	309	Agriculture
279	2270005055	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Other Agricultural Equipment	309	Agriculture
280	2270005060	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Irrigation Sets	309	Agriculture
281	2270006005	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Generator Sets	500	Commercial Land
282	2270006010	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Pumps	500	Commercial Land
283	2270006015	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Air Compressors	500	Commercial Land
284	2270006020	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Gas Compressors	500	Commercial Land
285	2270006025	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Welders	500	Commercial Land
286	2270006030	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Pressure Washers	500	Commercial Land
287	2270006035	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Hydro-power Units	500	Commercial Land
288	2282005010	Mobile Sources	Pleasure Craft	Gasoline 2-Stroke	Outboard	350	Water
289	2282005015	Mobile Sources	Pleasure Craft	Gasoline 2-Stroke	Personal Water Craft	350	Water
290	2282010005	Mobile Sources	Pleasure Craft	Gasoline 4-Stroke	Inboard/Sterndrive	350	Water
291	2282020005	Mobile Sources	Pleasure Craft	Diesel	Inboard/Sterndrive	350	Water
292	2282020010	Mobile Sources	Pleasure Craft	Diesel	Outboard	350	Water
293	2285002006	Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class I Operations	261	NTAD Total Railroad Density
294	2285002008	Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Passenger Trains (Amtrak)	261	NTAD Total Railroad Density
295	2285002010	Mobile Sources	Railroad Equipment	Diesel	Yard Locomotives	261	NTAD Total Railroad Density
296	2285002015	Mobile Sources	Railroad Equipment	Diesel	Railway Maintenance	261	NTAD Total Railroad Density
297	2285004015	Mobile Sources	Railroad Equipment	Gasoline, 4-Stroke	Railway Maintenance	261	NTAD Total Railroad Density
298	2285006015	Mobile Sources	Railroad Equipment	LPG	Railway Maintenance	261	NTAD Total Railroad Density

APPENDIX E

MEXICO AND CANADA EMISSIONS

TECHNICAL DOCUMENTATION FOR YEAR 2011 AND YEAR 2017 OZONE PRECURSOR EMISSION INVENTORIES FOR MEXICO AND CANADA

Final

Prepared for:

Maricopa Association of Governments
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Phoenix, AZ 85003

August 31, 2015

ERG No. 3923.00.002.004
MAG Contract No. 476-C
Task Order No. 002

TECHNICAL DOCUMENTATION FOR YEAR 2011 AND YEAR 2017 OZONE PRECURSOR EMISSION INVENTORIES FOR MEXICO AND CANADA

Final

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1.0 INTRODUCTION

In support of air quality modeling associated with the Maricopa County 8-hour ozone nonattainment area, the Maricopa Association of Governments (MAG) contracted with Eastern Research Group, Inc. (ERG) to develop Year 2011 and Year 2017 ozone precursor emissions inventories for the portions of Mexico and Canada that lie within the CMAQ 36-km modeling domain. The emissions inventory will be used by MAG to develop ozone boundary and initial condition data. This technical documentation report contains detailed documentation of the methodologies used to develop these emissions inventories.

2.0 INVENTORY SCOPE

The ozone modeling being conducted by MAG requires three different emission inventories for three different modeling domains:

- 4-km (covering primarily Maricopa County only)
- 12-km (including the Southwest and northwest portions of Mexico)
- 36-km (covering the entire U.S., southern portions of Canada, and northern portions of Mexico)

MAG will develop the emissions inventories for the 4-km domain in-house. ERG's scope of work focused on the 36-km domain, which also encompasses the 12-km domain. The 36-km domain is presented in Figure 2-1. The scope of the emissions inventory is as follows:

- Inventory year – 2011 and 2017 projected emissions (Mexico and Canada).
- Pollutant sources – Point, area, on-road mobile, and nonroad mobile source emissions. Biogenic and wildfire emissions will not be estimated or included.
- Pollutants – Ozone precursors: nitrogen oxides (NO_x), volatile organic compounds (VOC), and carbon monoxide (CO).
- Geographic domain and spatial resolution – Mexico and Canada emissions within the 36-km CAMx/CMAQ domain (as shown in Figure 2-1) resolved at the following resolution: Mexico – municipality (county-equivalent); and Canada – province (state-equivalent). Point source emissions were located using facility coordinates.
- Temporal resolution – Ozone season day (for May through September) emissions. For point, area, and nonroad mobile sources, emissions were estimated as average ozone season day emissions. For on-road motor vehicles, emissions were estimated as weekday and weekend day ozone season day emissions.

Figure 2-1. MAG 36-km domain.

3.0 DEVELOPMENT OF MEXICO EMISSIONS FOR 2011 AND 2017

ERG developed the 2011 and 2017 ozone precursor emission inventories for the portions of Mexico within the 36-km domain using the municipality-level emission files from the 2008 Mexico National Emissions Inventory (MNEI) (SEMARNAT, 2014). ERG previously used these municipality-level emission files from the 2008 MNEI in the development of Year 2018, 2025, and 2030 projected inventories for the entire country of Mexico for U.S. EPA (ERG, 2014). As part of the project for U.S. EPA, ERG conducted a number of preparatory steps before projecting emissions forward to the future years. Some additional preparatory steps were performed before developing the 2011 and 2017 inventories for MAG.

3.1 Preparatory Steps

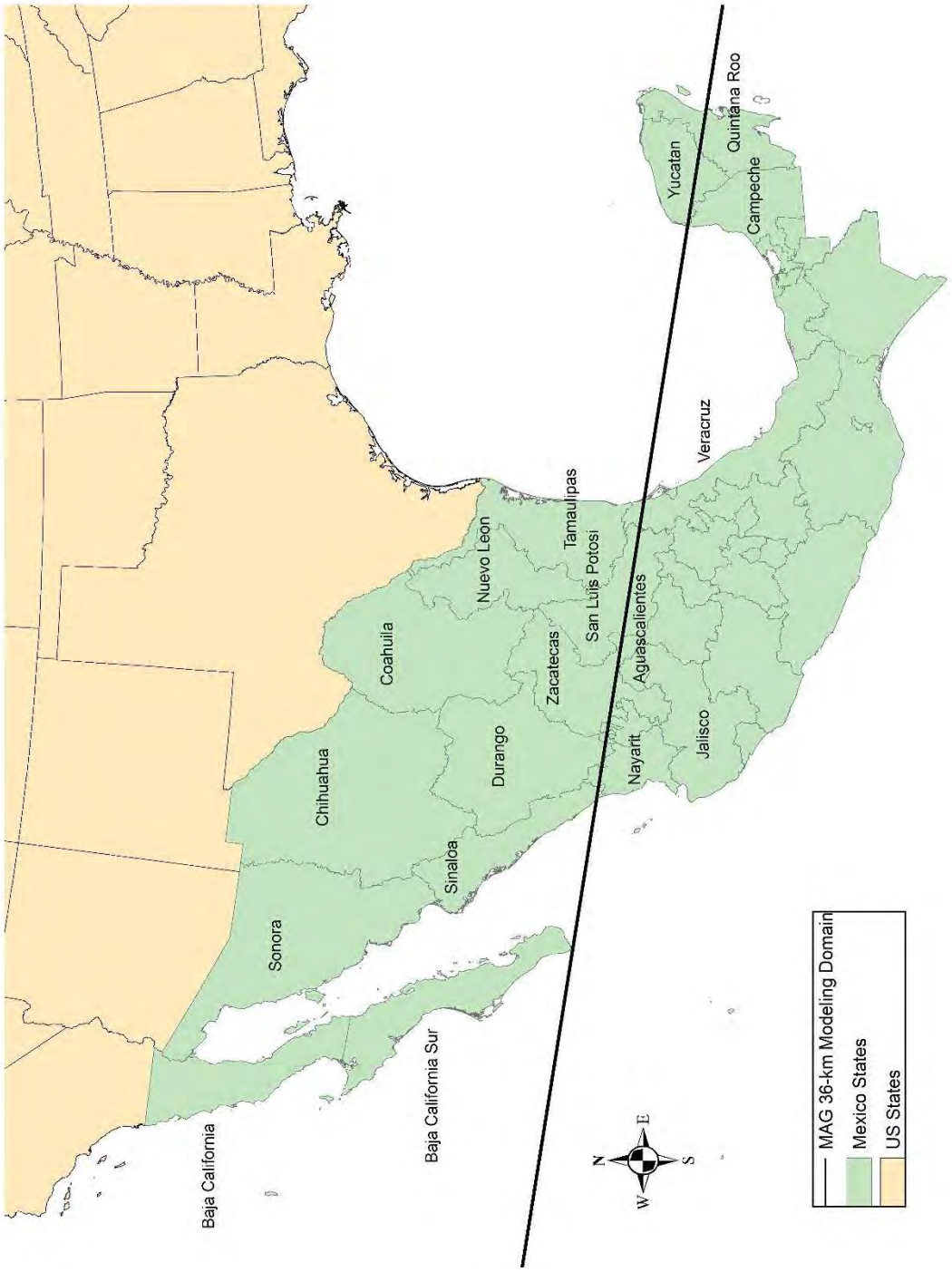
First, ERG excluded all non-ozone precursor emissions from the initial 2008 MNEI file; the remaining ozone precursor pollutants were nitrogen oxides (NO_x), volatile organic compounds (VOC), and carbon monoxide (CO). All emissions were then converted from metric tons to U.S. tons by multiplying by a factor of 1.1023. All point source stack parameters were also converted to the units of measure required by the FF10 file format (i.e., meters to feet, degrees Celsius to degrees Fahrenheit, etc.).

ERG then excluded all Mexico municipalities from the inventory file that were not located within the 36-km modeling domain. Mexico is comprised of 32 federal "entities" or jurisdictions (i.e., 31 states and the Federal District). A total of 18 states lie entirely or partially within the 36-km domain; a map showing these states is presented in Figure 3-1. Visual analysis of the 36-km domain using GIS indicated the following:

- Nine states (i.e., Baja California, Baja California Sur, Coahuila, Chihuahua, Durango, Nuevo León, Sinaloa, Sonora, and Tamaulipas) were located entirely within the modeling domain – all municipalities from these states were included in the inventory;
- Nine states (i.e., Aguascalientes, Campeche, Jalisco, Nayarit, Quintana Roo, San Luis Potosí, Veracruz, Yucatán, and Zacatecas) straddled the southern boundary of the modeling domain. Additional visual analysis of the individual municipalities in these states was used to determine whether or not to include each municipality in the inventory. If any portion of a particular municipality was located within the modeling domain, then that municipality was included in the inventory.

A detailed listing of the Mexican municipalities included in the inventory domain is provided in Appendix A.

Figure 3-1. Mexican States Within 36-km Modeling Domain



After identifying all municipalities located outside the 36-km modeling domain, ERG then removed the area source, on-road motor vehicle, and nonroad mobile source emission records for those municipalities from the 2008 MNEI file. ERG also removed all point source emission records with location coordinates located outside the 36-km modeling domain from the 2008 MNEI file. In conjunction with this, ERG also conducted some additional quality assurance (QA) of the point source coordinates located within the 36-km modeling domain. Specifically, ERG plotted point source coordinates on a state-by-state basis. As part of the U.S. EPA project cited earlier, ERG examined the geographic locations of all point sources in the entire country. As a result of this effort, ERG corrected the coordinates for over 100 point source facilities. Specific details regarding ERG's QA activities performed for the U.S. EPA project can be found in the final inventory documentation (ERG, 2014). Prior to developing the Year 2011 and Year 2017 projected inventories, ERG conducted some more intensive QA of the point source locations. Based on this QA, ERG identified and corrected an additional 23 point source facilities in the states of Coahuila (1 facility), Durango (20 facilities), and Tamaulipas (2 facilities). For each of these 23 point sources, the facility coordinates were revised to the urban locality coordinates for each municipality.

Area and nonroad source data were also quality assured for the U.S. EPA project; additional details can be found in the final inventory documentation submitted to U.S. EPA (ERG, 2014).

Finally, because 2011 and 2017 Mexico on-road motor vehicle emissions were estimated using the MOVES model (as described in Section 3.6), rather than estimated using surrogate projections, ERG removed all on-road motor vehicle emissions located within the 36-km modeling domain.

3.2 Projections Methodology

In general, ERG projected the 2011 Mexico emissions by multiplying the base year 2008 emissions by a projection factor as shown in the following equation:

$$E_{2011,s} = E_{2008,s} \times P_s$$

Where: $E_{2011,s}$ = projected future year emissions for 2011 for source *s*;
$E_{2008,s}$ = estimated base year emissions for 2008 for source *s*; and
P_s = projection factor for source *s*.

Similarly, ERG projected the 2017 Mexico emissions by multiplying the base year 2008 emissions by a projection factor as shown in the following equation:

$$E_{2017,s} = E_{2008,s} \times P_s$$

Where: $E_{2017,s}$ = projected future year emissions for 2017 for source *s*;
$E_{2008,s}$ = estimated base year emissions for 2008 for source *s*; and
P_s = projection factor for source *s*.

A projection factor greater than 1.0 represented increasing emissions, while a projection factor less than 1.0 represented decreasing emissions. A projection factor of 1.0 represented a situation of no growth (i.e., projected emissions were equal to base year emissions). The projection factors were based on "surrogates" for all sources except on-road motor vehicles, as explained below.

3.3 Point Sources

ERG used the following data sources as surrogates to develop point source projections for Mexico:

- Electricity generation sector:
  - Residual fuel oil usage (regional-level) (SENER, 2014a)
  - Distillate fuel oil usage (regional-level) (SENER, 2014a)
  - Natural gas usage (regional-level) (SENER, 2014b)
  - Petroleum coke usage (national-level) (SENER, 2014a)
  - Coal usage (national-level) (SENER, 2014c)
- Oil and natural gas sector:
  - Crude oil production (national-level) (SENER, 2014a)
  - Crude oil refining (regional-level) (SENER, 2014a)
  - Natural gas demand (regional-level) (SENER, 2014b)
- All other sectors:
  - Gross domestic product (GDP) (national-level) (PCIF, 2014)

The regional divisions used by SENER are defined as follows:

- Noroeste (Northwest) – Baja California, Baja California Sur, Sinaloa, and Sonora
- Noreste (Northeast) – Coahuila, Chihuahua, Durango, Nuevo León, and Tamaulipas
- Centro-Occidente (Central-West) – Aguascalientes, Jalisco, Nayarit, San Luis Potosí, Zacatecas (and excluded states of Colima, Guanajuato, Michoacán, and Querétaro)
- Centro (Central) – (excluded states of Distrito Federal, Hidalgo, México, Morelos, Puebla, and Tlaxcala)
- Sur-Sureste (South-Southeast) – Campeche, Quintana Roo, Veracruz, Yucatán (and excluded states of Chiapas, Guerrero, Oaxaca, and Tabasco)

The assignment of surrogates to point source SCIAN (*Sistema de Clasificación Industrial de América del Norte*) codes is provided in Appendix B; the projection factors developed from these surrogates are presented in Appendix C.

It should be noted that projection factors were applied to the reported emissions for existing point sources in the 2008 MNEI. No attempt was made to anticipate the location of future point sources (e.g., planned electricity generation projects, etc.). In addition, reductions from potential future control measures were not accounted for.

3.4 Area Sources

ERG used the following data sources as surrogates to develop area source projections for Mexico:

- Population data:
  - Census data (municipality-level) (INEGI, 2010)
  - Intracensal data (municipality-level) (INEGI, 2005)
  - Population projections (municipality-level) (CONAPO, 2012)
- Fuel usage:
  - Petroleum product usage (regional-level) (SENER, 2014a)
  - Natural gas and LPG usage (regional-level) (SENER, 2014b)
  - Residential wood usage (national-level) (SENER, 2014c)
- GDP estimates (national-level) (PCIF, 2014)
- Agricultural acreage (SAGARPA, 2014a):
  - Total (state-level)
  - Sugarcane (state-level)

- Cattle head counts (state-level) (SAGARPA, 2014b)

The assignment of surrogates to Mexico area source categories is provided in Appendix D. The population-based projection factors are presented in Appendix E, while all other area source projection factors are included in Appendix F.

Future year population projections were available from CONAPO for each of the 527 municipalities within the domain. However, in order to apply the 2017 population projections, an estimate of 2008 population was needed for each municipality. ERG derived 2008 population estimates using linear interpolation between the 2005 intracensal populations (INEGI, 2005) and the 2010 census populations (INEGI, 2010).

Agricultural acreage (both total and sugarcane) and livestock head count data were only available through 2014; the 2011 projection factors were based on historical data for 2011, while the 2017 projection factors were based upon the 15-year average from 2000 to 2014.

3.5 Nonroad Mobile Sources

Nonroad mobile sources in Mexico included commercial marine vessels, locomotives, aircraft, and nonroad equipment (i.e., airport ground support equipment, construction and mining equipment, and agricultural equipment). ERG used diesel and jet fuel (*turbosina*) usage statistics (SENER, 2014a) and agricultural acreage statistics (SAGARPA, 2014a) as surrogates for projecting emissions from nonroad mobile sources in Mexico. The assignment of surrogates to Mexico nonroad mobile source categories is provided in Appendix H, while the projection factors are included in Appendix I.

3.6 On-Road Motor Vehicles

Instead of using projection methodologies, Mexico on-road motor vehicle emissions were generated using a version of the U.S. EPA vehicle emissions model MOVES, updated to reflect conditions in those countries. MOVES2014 was the most recent version of the model available at the time of the analysis, and reflects U.S. EPA's latest estimate of vehicle emissions and default U.S. activity data (U.S. EPA, 2014c).

Generating the on-road motor vehicles emissions required determining the best approach for updating the model, culling data on vehicle fleet and activity data to replace U.S. defaults where possible, and reflecting significant differences in emission standards from the U.S. Updated MOVES databases were developed for Mexico to allow estimation of emissions in calendar years 2011 and 2017. Mexico emissions were generated at the municipality-level. Appendix O provides a detailed discussion of the MOVES adaption for both Mexico and Canada.

3.7 Results

A summary of the 2011 projected Mexico emissions for the ozone season (May through September) is presented in Table 3-1; a summary of the 2017 projected Mexico emissions for the ozone season (May through September) is presented in Table 3-2.

Table 3-1. Projected Mexico Emissions (tons) for the 2011 Ozone Season (May – September)

	NO_X (tons)	VOC (tons)	CO (tons)
Point	186,155	39,492	87,654
Area	83,061	325,747	180,181
Nonroad	54,659	7,114	33,753
Onroad	199,365	90,345	1,342,309
Total	**523,239**	**462,698**	**1,643,898**

Table 3-2. Projected Mexico Emissions (tons) for the 2017 Ozone Season (May – September)

	NO_X (tons)	VOC (tons)	CO (tons)
Point	182,152	48,181	116,239
Area	85,431	340,119	179,093
Nonroad	56,185	7,487	37,272
Onroad	171,100	61,506	995,242
Total	**494,867**	**457,293**	**1,327,845**

4.0 DEVELOPMENT OF CANADA EMISSIONS FOR 2011 AND 2017

ERG developed the 2011 and 2017 ozone precursor emission inventory using the Canada emissions contained within the emissions inventories from U.S. EPA's 2011 and 2018 Emissions Modeling Platforms (U.S. EPA, 2014a; U.S. EPA, 2014b). These emissions were based on a 2010 national emissions inventory provided by Environment Canada with a few point source updates addressing recent industrial plant closures. Although the Canada emissions

were contained in U.S. EPA's 2011 and 2018 Emissions Modeling Platform emissions inventories, these emissions had not been projected and still represented 2010 emissions.

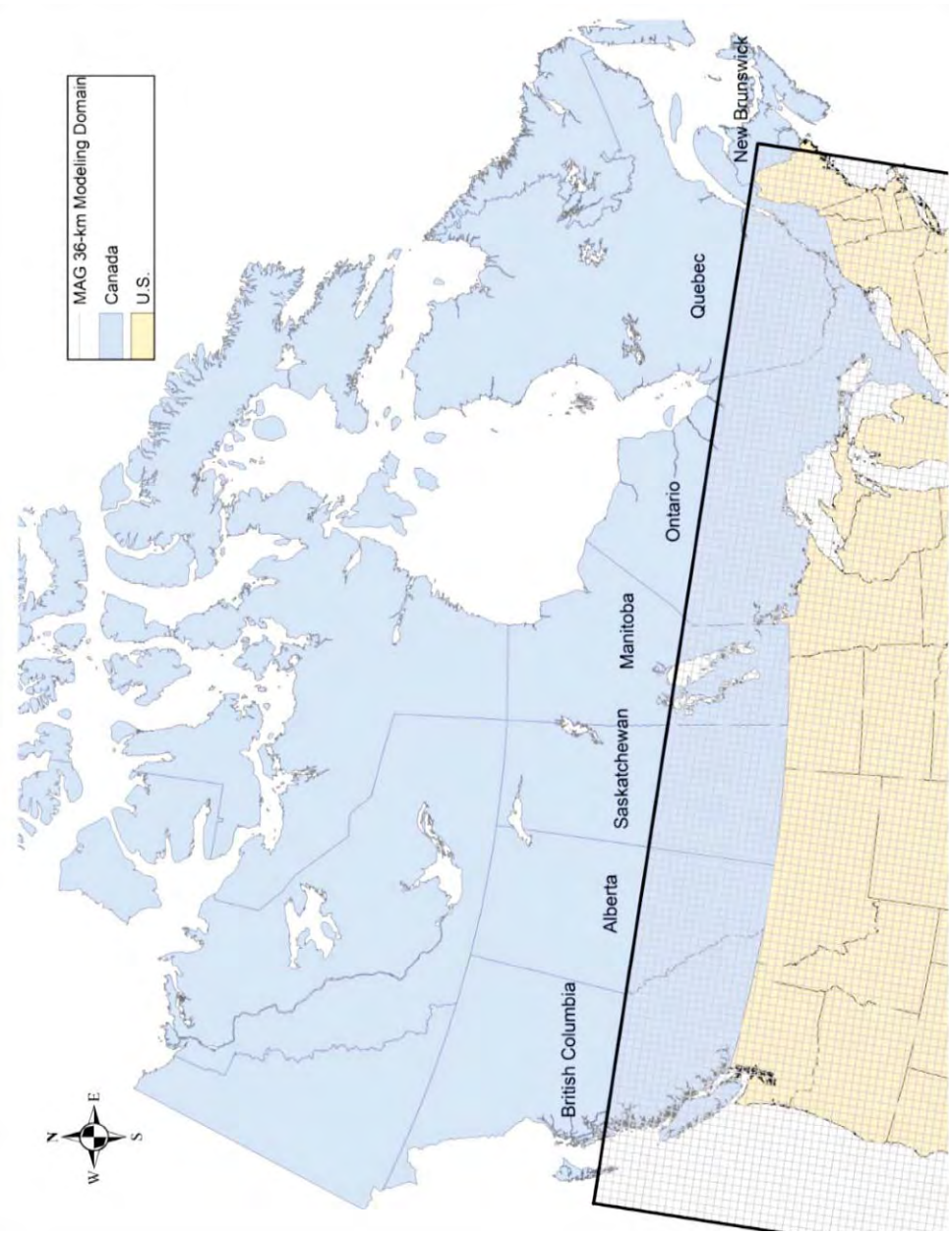
Because the 36-km domain did not include the entire country of Canada, ERG conducted a number of preparatory steps before projecting the 2010 Canada inventory to 2011 and 2017.

4.1 Preparatory Steps

First, ERG excluded all non-ozone precursor emissions from the initial 2010 inventory file; the remaining ozone precursor pollutants were NO_x, VOC, and CO.

The 36-km modeling domain included portions of seven Canadian provinces (i.e., British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Québec, and New Brunswick). A map showing these provinces is presented in Figure 4-1. ERG determined that U.S. EPA's processing of the 2010 Environment Canada inventory only included province-level emissions from area sources, on-road motor vehicles, and nonroad mobile sources and eliminated all other geographic data identifiers. Because of this elimination of geographic identifiers, U.S. EPA's version of the 2010 Environment Canada inventory contained multiple records for the same source categories. In order to resolve this duplication, ERG summed the source category-specific records to the province-level. It was assumed that all province-level emissions for area sources, on-road motor vehicles, and nonroad mobile sources were located within the 36-km modeling domain. This is a reasonable assumption because all major population centers in the seven provinces are located within the 36-km modeling domain.

Figure 4-1. Canadian Provinces Within 36-km Modeling Domain



ERG removed all point sources emission records with location coordinates located outside the 36-km modeling domain from the U.S. EPA version of the 2010 Environment Canada inventory. In addition, ERG removed all Category 3 (C3) marine vessel emissions (treated as point source releases in the inventory) located outside of the 36-km modeling domain. A map showing the Canadian point sources is presented in Figure 4-2.

Finally, because 2011 and 2017 on-road motor vehicle emissions were estimated using the MOVES model (as described in Section 3.6 and Appendix B), rather than estimated using surrogate projections, ERG removed all on-road motor vehicle emissions located within the 36-km modeling domain.

4.2 Projections Methodology

In general, ERG projected the 2011 and 2017 emissions by multiplying the base year 2010 emissions by a projection factor as shown in the following equation:

$$E_{2011,s} = E_{2010,s} \times P_s$$

Where: $E_{2011,s}$ = projected future year emissions for 2011 for source *s*;
$E_{2010,s}$ = estimated base year emissions for 2010 for source *s*; and
P_s = projection factor for source *s*.

Similarly, ERG projected the 2017 emissions by multiplying the base year 2010 emissions by a projection factor as shown in the following equation:

$$E_{2017,s} = E_{2010,s} \times P_s$$

Where: $E_{2017,s}$ = projected future year emissions for 2017 for source *s*;
$E_{2010,s}$ = estimated base year emissions for 2010 for source *s*; and
P_s = projection factor for source *s*.

The projection factors were based upon relevant activity surrogates.

4.3 Point Sources

ERG used the following data sources as surrogates to develop point source projections for Canada:

- Historical and projected energy production (NEB, 2013):
  - Crude oil (province-level)
  - Natural gas (province-level)
  - Coal (national-level)
- Historical and projected electricity generation (NEB, 2013):
  - Coal (province-level)
  - Heavy fuel oil (province-level)
  - Natural gas (province-level)
- GDP estimates (province-level) (SC, 2014a)

The assignment of surrogates to Canada point sources is provided in Appendix I. The point source projection factors are included in Appendix J.

Figure 4-2. Canadian Point Sources

4.4 Area Sources

ERG used the following data sources as surrogates to develop area source projections for Canada:

- Population data (province-level):
  - Historical data (SC, 2010)
  - Population projections (SC, 2014b)
- Historical and projected fuel demand (province-level) (NEB, 2013):
  - Coal (utility)
  - Refined petroleum product (RPP)/LPG (utility, residential)
  - Natural gas (utility, residential)
  - Gasoline (transportation)
  - Biomass (residential)
- GDP estimates (province-level) (SC, 2014a)

The assignment of surrogates to Canada area source categories is provided in Appendix K. The area source projection factors are included in Appendix L.

Future year population projections were based upon a growth scenario with medium growth following historical trends from 1981 to 2008 (i.e., Projection Scenario M1) (SC, 2014a). A projection factor of 1.0000 was assigned for a few categories for which a suitable basis for a projection factor could not be determined.

4.5 Nonroad Mobile Sources

Nonroad mobile sources in Canada included commercial marine vessels, locomotives, aircraft, as well as a wide range of nonroad equipment powered by gasoline, diesel, LPG, and compressed natural gas (CNG). ERG used fuel-specific demand projections for the transportation sector to generate projection factors (NEB, 2013). The assignment of surrogates to Canada nonroad mobile source categories is provided in Appendix M, while the projection factors are included in Appendix N.

4.6 On-Road Motor Vehicles

Instead of using projection methodologies, Canada on-road motor vehicle emissions were generated using a version of the U.S. EPA vehicle emissions model MOVES, updated to

reflect conditions in those countries. MOVES2014 was the most recent version of the model available at the time of the analysis, and reflects U.S. EPA's latest estimate of vehicle emissions and default U.S. activity data (U.S. EPA, 2014c).

Generating the on-road motor vehicles emissions required determining the best approach for updating the model, culling data on vehicle fleet and activity data to replace U.S. defaults where possible, and reflecting significant differences in emission standards from the U.S. Updated MOVES databases were developed for Canada to allow estimation of emissions in calendar years 2011 and 2017. Canada emissions were generated at the municipality-level. A detailed discussion of the MOVES adaption for both Canada and Mexico is provided in Appendix O.

4.7 Results

A summary of the 2011 projected Canada emissions for the ozone season (May through September) is presented in Table 4-1; a summary of the 2017 projected Canada emissions for the ozone season (May through September) is presented in Table 4-2.

Table 4-1. Projected Canada Emissions (tons) for the 2011 Ozone Season (May – September)

	NO_x (tons)	VOC (tons)	CO (tons)
Point	144,187	183,751	161,329
Area	46,753	406,986	467,853
Nonroad	210,615	115,611	1,217,920
Onroad	192,092	80,956	786,639
Total	**593,647**	**787,304**	**2,633,741**

Table 4-2. Projected Canada Emissions (tons) for the 2017 Ozone Season (May – September)

	NO_x (tons)	VOC (tons)	CO (tons)
Point	152,552	202,300	181,716
Area	53,279	435,425	509,983
Nonroad	253,046	111,369	1,211,405
Onroad	103,889	46,174	507,821
Total	**562,766**	**795,268**	**2,410,925**

5.0 DEVELOPMENT OF EMISSION DATA FILES

ERG developed the emission data files in U.S. EPA's FF10 (Flat File 2010) format. The FF10 format supports storing annual and monthly emissions in a single file. Additionally, FF10 files can also support daily and hourly point and nonpoint emission inventories. ERG developed FF10 files for all applicable source types (i.e., point sources, area sources, on-road motor vehicles, and nonroad mobile sources) to support daily ozone season emission inventories. ERG developed FF10 files, by source type for Mexico and Canada.

The ozone season was defined by MAG as consisting of the months May through September. Individual OSD files were developed for each month in U.S. tons per day. All emissions were converted to U.S. tons (i.e., short tons) and all stack parameters were converted to recommended FF10 units (e.g., feet, feet/second, degrees Fahrenheit, etc.). Additionally, ERG also developed annual FF10 files for the Mexico and Canada point source Inventories. This is due to the fact that the daily FF10 format for point sources does not include stack parameters and geographic coordinate information.

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Appendix A
Mexico Municipalities Included and Excluded from Inventory Domain

Mexico Municipalities Included and Excluded from Inventory Domain

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
01	Aguascalientes	01001	Aguascalientes		X
		01002	Asientos		X
		01003	Calvillo		X
		01004	Cosío	X	
		01005	Jesús María		X
		01006	Pabellón de Arteaga		X
		01007	Rincón de Romos		X
		01008	San José de Gracia		X
		01009	Tepezalá		X
		01010	El Llano		X
		01011	San Francisco de los Romo		X
02	Baja California	(All 5 municipalities)		X	
03	Baja California Sur	(All 5 municipalities)		X	
04	Campeche	04001	Calkiní	X	
		04002	Campeche		X
		04003	Carmen		X
		04004	Champotón		X
		04005	Hecelchakán		X
		04006	Hopelchén		X
		04007	Palizada		X
		04008	Tenabo		X
		04009	Escárcega		X
		04010	Calakmul		X
		04011	Candelaria		X
05	Coahuila	(All 38 municipalities)		X	
06	Colima	(All 10 municipalities)			X
07	Chiapas	(All 119 municipalities)			X
08	Chihuahua	(All 67 municipalities)		X	
09	Distrito Federal	(All 16 municipalities)			X
10	Durango	(All 39 municipalities)		X	
11	Guanajuato	(All 46 municipalities)			X
12	Guerrero	(All 81 municipalities)			X
13	Hidalgo	(All 84 municipalities)			X
14	Jalisco	14001	Acatic		X
		14002	Acatlán de Juárez		X
		14003	Ahualulco de Mercado		X
		14004	Amacueca		X
		14005	Amatitán		X
		14006	Ameca		X
		14007	San Juanito de Escobedo		X
		14008	Arandas		X
		14009	El Arenal		X
		14010	Atemajac de Brizuela		X
		14011	Atengo		X
		14012	Atenguillo		X
		14013	Atotonilco el Alto		X
		14014	Atoyac		X
		14015	Autlán de Navarro		X
		14016	Ayotlán		X
		14017	Ayutla		X
		14018	La Barca		X
		14019	Bolaños		X
		14020	Cabo Corrientes		X
		14021	Casimiro Castillo		X
		14022	Cihuatlán		X
		14023	Zapotlán el Grande		X
		14024	Cocula		X
		14025	Colotlán		X

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		14026	Concepción de Buenos Aires		X
		14027	Cuautitlán de García Barragán		X
		14028	Cuautla		X
		14029	Cuquío		X
		14030	Chapala		X
		14031	Chimaltitán		X
		14032	Chiquilistlán		X
		14033	Degollado		X
		14034	Ejutla		X
		14035	Encarnación de Díaz		X
		14036	Etzatlán		X
		14037	El Grullo		X
		14038	Guachinango		X
		14039	Guadalajara		X
		14040	Hostotipaquillo		X
		14041	Huejúcar		X
		14042	Huejuquilla el Alto	X	
		14043	La Huerta		X
		14044	Ixtlahuacán de los Membrillos		X
		14045	Ixtlahuacán del Río		X
		14046	Jalostotitlán		X
		14047	Jamay		X
		14048	Jesús María		X
		14049	Jilotlán de los Dolores		X
		14050	Jocotepec		X
		14051	Juanacatlán		X
		14052	Juchitlán		X
		14053	Lagos de Moreno		X
		14054	El Limón		X
		14055	Magdalena		X
		14056	Santa María del Oro		X
		14057	La Manzanilla de la Paz		X
		14058	Mascota		X
		14059	Mazamitla		X
		14060	Mexticacán		X
		14061	Mezquitic	X	
		14062	Mixtlán		X
		14063	Ocotlán		X
		14064	Ojuelos de Jalisco		X
		14065	Pihuamo		X
		14066	Poncitlán		X
		14067	Puerto Vallarta		X
		14068	Villa Purificación		X
		14069	Quitupan		X
		14070	El Salto		X
		14071	San Cristóbal de la Barranca		X
		14072	San Diego de Alejandría		X
		14073	San Juan de los Lagos		X
		14074	San Julián		X
		14075	San Marcos		X
		14076	San Martín de Bolaños		X
		14077	San Martín Hidalgo		X
		14078	San Miguel el Alto		X
		14079	Gómez Farías		X
		14080	San Sebastián del Oeste		X
		14081	Santa María de los Ángeles		X
		14082	Sayula		X
		14083	Tala		X
		14084	Talpa de Allende		X
		14085	Tamazula de Gordiano		X
		14086	Tapalpa		X

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		14087	Tecalitlán		X
		14088	Tecolotlán		X
		14089	Techaluta de Montenegro		X
		14090	Tenamaxtlán		X
		14091	Teocaltiche		X
		14092	Teocuitatlán de Corona		X
		14093	Tepatitlán de Morelos		X
		14094	Tequila		X
		14095	Teuchitlán		X
		14096	Tizapán el Alto		X
		14097	Tlajomulco de Zúñiga		X
		14098	Tlaquepaque		X
		14099	Tolimán		X
		14100	Tomatlán		X
		14101	Tonalá		X
		14102	Tonaya		X
		14103	Tonila		X
		14104	Totatiche		X
		14105	Tototlán		X
		14106	Tuxcacuesco		X
		14107	Tuxcueca		X
		14108	Tuxpan		X
		14109	Unión de San Antonio		X
		14110	Unión de Tula		X
		14111	Valle de Guadalupe		X
		14112	Valle de Juárez		X
		14113	San Gabriel		X
		14114	Villa Corona		X
		14115	Villa Guerrero		X
		14116	Villa Hidalgo		X
		14117	Cañadas de Obregón		X
		14118	Yahualica de González Gallo		X
		14119	Zacoalco de Torres		X
		14120	Zapopan		X
		14121	Zapotiltic		X
		14122	Zapotitlán de Vadillo		X
		14123	Zapotlán del Rey		X
		14124	Zapotlanejo		X
		14125	San Ignacio Cerro Gordo		X
15	México	(All 125 municipalities)			X
16	Michoacán	(All 113 municipalities)			X
17	Morelos	(All 33 municipalities)			X
18	Nayarit	18001	Acaponeta	X	
		18002	Ahuacatlán		X
		18003	Amatlán de Cañas		X
		18004	Compostela		X
		18005	Huajicori	X	
		18006	Ixtlán del Río		X
		18007	Jala		X
		18008	Xalisco		X
		18009	Del Nayar	X	
		18010	Rosamorada		X
		18011	Ruíz		X
		18012	San Blas		X
		18013	San Pedro Lagunillas		X
		18014	Santa María del Oro		X
		18015	Santiago Ixcuintla		X
		18016	Tecuala		X
		18017	Tepic		X
		18018	Tuxpan		X
		18019	La Yesca		X

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		18020	Bahía de Banderas		X
19	Nuevo León	(All 51 municipalities)		X	
20	Oaxaca	(All 570 municipalities)			X
21	Puebla	(All 217 municipalities)			X
22	Querétaro	(All 18 municipalities)			X
23	Quintana Roo	23001	Cozumel	X	
		23002	Felipe Carrillo Puerto	X	
		23003	Isla Mujeres	X	
		23004	Othón P. Blanco		X
		23005	Benito Juárez	X	
		23006	José María Morelos	X	
		23007	Lázaro Cárdenas	X	
		23008	Solidaridad	X	
		23009	Tulum	X	
		23010	Bacalar		X
24	San Luis Potosí	24001	Ahualulco	X	
		24002	Alaquines	X	
		24003	Aquismón		X
		24004	Armadillo de los Infante	X	
		24005	Cárdenas		X
		24006	Catorce	X	
		24007	Cedral	X	
		24008	Cerritos	X	
		24009	Cerro de San Pedro		X
		24010	Ciudad del Maíz	X	
		24011	Ciudad Fernández		X
		24012	Tancanhuitz		X
		24013	Ciudad Valles	X	
		24014	Coxcatlán		X
		24015	Charcas	X	
		24016	Ebano	X	
		24017	Guadalcázar	X	
		24018	Huehuetlán		X
		24019	Lagunillas		X
		24020	Matehuala	X	
		24021	Mexquitic de Carmona	X	
		24022	Moctezuma	X	
		24023	Rayón		X
		24024	Rioverde	X	
		24025	Salinas	X	
		24026	San Antonio		X
		24027	San Ciro de Acosta		X
		24028	San Luis Potosí	X	
		24029	San Martín Chalchicuautla		X
		24030	San Nicolás Tolentino	X	
		24031	Santa Catarina		X
		24032	Santa María del Río		X
		24033	Santo Domingo	X	
		24034	San Vicente Tancuayalab		X
		24035	Soledad de Graciano Sánchez	X	
		24036	Tamasopo	X	
		24037	Tamazunchale		X
		24038	Tampacán		X
		24039	Tampamolón Corona		X
		24040	Tamuín	X	
		24041	Tanlajás		X
		24042	Tanquián de Escobedo		X
		24043	Tierra Nueva		X
		24044	Vanegas	X	
		24045	Venado	X	
		24046	Villa de Arriaga		X

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		24047	Villa de Guadalupe	X	
		24048	Villa de la Paz	X	
		24049	Villa de Ramos	X	
		24050	Villa de Reyes		X
		24051	Villa Hidalgo	X	
		24052	Villa Juárez	X	
		24053	Axtla de Terrazas		X
		24054	Xilitla		X
		24055	Zaragoza		X
		24056	Villa de Arista	X	
		24057	Matlapa		X
		24058	El Naranjo	X	
25	Sinaloa		(All 18 municipalities)	X	
26	Sonora		(All 72 municipalities)	X	
27	Tabasco		(All 17 municipalities)		X
28	Tamaulipas		(All 43 municipalities)	X	
29	Tlaxcala		(All 60 municipalities)		X
30	Veracruz	30001	Acajete		X
		30002	Acatlán		X
		30003	Acayucan		X
		30004	Actopan		X
		30005	Acula		X
		30006	Acultzingo		X
		30007	Camarón de Tejeda		X
		30008	Alpatláhuac		X
		30009	Alto Lucero de Gutiérrez Barrios		X
		30010	Altotonga		X
		30011	Alvarado		X
		30012	Amatitlán		X
		30013	Naranjos Amatlán		X
		30014	Amatlán de los Reyes		X
		30015	Angel R. Cabada		X
		30016	La Antigua		X
		30017	Apazapan		X
		30018	Aquila		X
		30019	Astacinga		X
		30020	Atlahuilco		X
		30021	Atoyac		X
		30022	Atzacan		X
		30023	Atzalan		X
		30024	Tlaltetela		X
		30025	Ayahualulco		X
		30026	Banderilla		X
		30027	Benito Juárez		X
		30028	Boca del Río		X
		30029	Calcahualco		X
		30030	Camerino Z. Mendoza		X
		30031	Carrillo Puerto		X
		30032	Catemaco		X
		30033	Cazones de Herrera		X
		30034	Cerro Azul		X
		30035	Citlaltépetl		X
		30036	Coacoatzintla		X
		30037	Coahuitlán		X
		30038	Coatepec		X
		30039	Coatzacoalcos		X
		30040	Coatzintla		X
		30041	Coetzala		X
		30042	Colipa		X
		30043	Comapa		X
		30044	Córdoba		X

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		30045	Cosamaloapan de Carpio		X
		30046	Cosautlán de Carvajal		X
		30047	Coscomatepec		X
		30048	Cosoleacaque		X
		30049	Cotaxtla		X
		30050	Coxquihui		X
		30051	Coyutla		X
		30052	Cuichapa		X
		30053	Cuitláhuac		X
		30054	Chacaltianguis		X
		30055	Chalma		X
		30056	Chiconamel		X
		30057	Chiconquiaco		X
		30058	Chicontepec		X
		30059	Chinameca		X
		30060	Chinampa de Gorostiza		X
		30061	Las Choapas		X
		30062	Chocamán		X
		30063	Chontla		X
		30064	Chumatlán		X
		30065	Emiliano Zapata		X
		30066	Espinal		X
		30067	Filomeno Mata		X
		30068	Fortín		X
		30069	Gutiérrez Zamora		X
		30070	Hidalgotitlán		X
		30071	Huatusco		X
		30072	Huayacocotla		X
		30073	Hueyapan de Ocampo		X
		30074	Huiloapan de Cuauhtémoc		X
		30075	Ignacio de la Llave		X
		30076	Ilamatlán		X
		30077	Isla		X
		30078	Ixcatepec		X
		30079	Ixhuacán de los Reyes		X
		30080	Ixhuatlán del Café		X
		30081	Ixhuatlancillo		X
		30082	Ixhuatlán del Sureste		X
		30083	Ixhuatlán de Madero		X
		30084	Ixmatlahuacan		X
		30085	Ixtaczoquitlán		X
		30086	Jalacingo		X
		30087	Xalapa		X
		30088	Jalcomulco		X
		30089	Jáltipan		X
		30090	Jamapa		X
		30091	Jesús Carranza		X
		30092	Xico		X
		30093	Jilotepec		X
		30094	Juan Rodríguez Clara		X
		30095	Juchique de Ferrer		X
		30096	Landero y Coss		X
		30097	Lerdo de Tejada		X
		30098	Magdalena		X
		30099	Maltrata		X
		30100	Manlio Fabio Altamirano		X
		30101	Mariano Escobedo		X
		30102	Martínez de la Torre		X
		30103	Mecatlán		X
		30104	Mecayapan		X
		30105	Medellín		X

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		30106	Miahuatlán		X
		30107	Las Minas		X
		30108	Minatitlán		X
		30109	Misantla		X
		30110	Mixtla de Altamirano		X
		30111	Moloacán		X
		30112	Naolinco		X
		30113	Naranjal		X
		30114	Nautla		X
		30115	Nogales		X
		30116	Oluta		X
		30117	Omealca		X
		30118	Orizaba		X
		30119	Otatitlán		X
		30120	Oteapan		X
		30121	Ozuluama de Mascareñas	X	
		30122	Pajapan		X
		30123	Pánuco	X	
		30124	Papantla		X
		30125	Paso del Macho		X
		30126	Paso de Ovejas		X
		30127	La Perla		X
		30128	Perote		X
		30129	Platón Sánchez		X
		30130	Playa Vicente		X
		30131	Poza Rica de Hidalgo		X
		30132	Las Vigas de Ramírez		X
		30133	Pueblo Viejo	X	
		30134	Puente Nacional		X
		30135	Rafael Delgado		X
		30136	Rafael Lucio		X
		30137	Los Reyes		X
		30138	Río Blanco		X
		30139	Saltabarranca		X
		30140	San Andrés Tenejapan		X
		30141	San Andrés Tuxtla		X
		30142	San Juan Evangelista		X
		30143	Santiago Tuxtla		X
		30144	Sayula de Alemán		X
		30145	Soconusco		X
		30146	Sochiapa		X
		30147	Soledad Atzompa		X
		30148	Soledad de Doblado		X
		30149	Soteapan		X
		30150	Tamalín		X
		30151	Tamiahua		X
		30152	Tampico Alto	X	
		30153	Tancoco		X
		30154	Tantima		X
		30155	Tantoyuca		X
		30156	Tatatila		X
		30157	Castillo de Teayo		X
		30158	Tecolutla		X
		30159	Tehuipango		X
		30160	Álamo Temapache		X
		30161	Tempoal		X
		30162	Tenampa		X
		30163	Tenochtitlán		X
		30164	Teocelo		X
		30165	Tepatlaxco		X
		30166	Tepetlán		X

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		30167	Tepetzintla		X
		30168	Tequila		X
		30169	José Azueta		X
		30170	Texcatepec		X
		30171	Texhuacán		X
		30172	Texistepec		X
		30173	Tezonapa		X
		30174	Tierra Blanca		X
		30175	Tihuatlán		X
		30176	Tlacojalpan		X
		30177	Tlacolulan		X
		30178	Tlacotalpan		X
		30179	Tlacotepec de Mejía		X
		30180	Tlachichilco		X
		30181	Tlalixcoyan		X
		30182	Tlalnelhuayocan		X
		30183	Tlapacoyan		X
		30184	Tlaquilpa		X
		30185	Tlilapan		X
		30186	Tomatlán		X
		30187	Tonayán		X
		30188	Totutla		X
		30189	Tuxpan		X
		30190	Tuxtilla		X
		30191	Ursulo Galván		X
		30192	Vega de Alatorre		X
		30193	Veracruz		X
		30194	Villa Aldama		X
		30195	Xoxocotla		X
		30196	Yanga		X
		30197	Yecuatla		X
		30198	Zacualpan		X
		30199	Zaragoza		X
		30200	Zentla		X
		30201	Zongolica		X
		30202	Zontecomatlán de López y Fuentes		X
		30203	Zozocolco de Hidalgo		X
		30204	Agua Dulce		X
		30205	El Higo		X
		30206	Nanchital de Lázaro Cárdenas del Río		X
		30207	Tres Valles		X
		30208	Carlos A. Carrillo		X
		30209	Tatahuicapan de Juárez		X
		30210	Uxpanapa		X
		30211	San Rafael		X
		30212	Santiago Sochiapan		X
31	Yucatán	31001	Abalá	X	
		31002	Acanceh	X	
		31003	Akil		X
		31004	Baca	X	
		31005	Bokobá	X	
		31006	Buctzotz	X	
		31007	Cacalchén	X	
		31008	Calotmul	X	
		31009	Cansahcab	X	
		31010	Cantamayec	X	
		31011	Celestún	X	
		31012	Cenotillo	X	
		31013	Conkal	X	
		31014	Cuncunul	X	
		31015	Cuzamá	X	

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		31016	Chacsinkín		X
		31017	Chankom	X	
		31018	Chapab	X	
		31019	Chemax	X	
		31020	Chicxulub Pueblo	X	
		31021	Chichimilá	X	
		31022	Chikindzonot	X	
		31023	Chocholá	X	
		31024	Chumayel	X	
		31025	Dzán	X	
		31026	Dzemul	X	
		31027	Dzidzantún	X	
		31028	Dzilam de Bravo	X	
		31029	Dzilam González	X	
		31030	Dzitás	X	
		31031	Dzoncauich	X	
		31032	Espita	X	
		31033	Halachó	X	
		31034	Hocabá	X	
		31035	Hoctún	X	
		31036	Homún	X	
		31037	Huhí	X	
		31038	Hunucmá	X	
		31039	Ixil	X	
		31040	Izamal	X	
		31041	Kanasín	X	
		31042	Kantunil	X	
		31043	Kaua	X	
		31044	Kinchil	X	
		31045	Kopomá	X	
		31046	Mama	X	
		31047	Maní	X	
		31048	Maxcanú	X	
		31049	Mayapán	X	
		31050	Mérida	X	
		31051	Mocochá	X	
		31052	Motul	X	
		31053	Muna	X	
		31054	Muxupip	X	
		31055	Opichén	X	
		31056	Oxkutzcab		X
		31057	Panabá	X	
		31058	Peto	X	
		31059	Progreso	X	
		31060	Quintana Roo	X	
		31061	Río Lagartos	X	
		31062	Sacalum	X	
		31063	Samahil	X	
		31064	Sanahcat	X	
		31065	San Felipe	X	
		31066	Santa Elena		X
		31067	Seyé	X	
		31068	Sinanché	X	
		31069	Sotuta	X	
		31070	Sucilá	X	
		31071	Sudzal	X	
		31072	Suma	X	
		31073	Tahdziú	X	
		31074	Tahmek	X	
		31075	Teabo	X	
		31076	Tecoh	X	

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		31077	Tekal de Venegas	X	
		31078	Tekantó	X	
		31079	Tekax	X	
		31080	Tekit	X	
		31081	Tekom	X	
		31082	Telchac Pueblo	X	
		31083	Telchac Puerto	X	
		31084	Temax	X	
		31085	Temozón	X	
		31086	Tepakán	X	
		31087	Tetiz	X	
		31088	Teya	X	
		31089	Ticul	X	
		31090	Timucuy	X	
		31091	Tinum	X	
		31092	Tixcacalcupul	X	
		31093	Tixkokob	X	
		31094	Tixmehuac	X	
		31095	Tixpéhual	X	
		31096	Tizimín	X	
		31097	Tunkás	X	
		31098	Tzucacab		X
		31099	Uayma	X	
		31100	Ucú	X	
		31101	Umán	X	
		31102	Valladolid	X	
		31103	Xocchel	X	
		31104	Yaxcabá	X	
		31105	Yaxkukul	X	
		31106	Yobaín	X	
32	Zacatecas	32001	Apozol		X
		32002	Apulco		X
		32003	Atolinga		X
		32004	Benito Juárez		X
		32005	Calera	X	
		32006	Cañitas de Felipe Pescador	X	
		32007	Concepción del Oro	X	
		32008	Cuauhtémoc	X	
		32009	Chalchihuites	X	
		32010	Fresnillo	X	
		32011	Trinidad García de la Cadena		X
		32012	Genaro Codina	X	
		32013	General Enrique Estrada	X	
		32014	General Francisco R. Murguía	X	
		32015	El Plateado de Joaquín Amaro		X
		32016	General Pánfilo Natera	X	
		32017	Guadalupe	X	
		32018	Huanusco		X
		32019	Jalpa		X
		32020	Jerez	X	
		32021	Jiménez del Teul	X	
		32022	Juan Aldama	X	
		32023	Juchipila		X
		32024	Loreto		X
		32025	Luis Moya	X	
		32026	Mazapil	X	
		32027	Melchor Ocampo	X	
		32028	Mezquital del Oro		X
		32029	Miguel Auza	X	
		32030	Momax		X
		32031	Monte Escobedo	X	

State Code	State Name	Municipality Code	Municipality Name	Included	Excluded
		32032	Morelos	X	
		32033	Moyahua de Estrada		X
		32034	Nochistlán de Mejía		X
		32035	Noria de Ángeles	X	
		32036	Ojocaliente	X	
		32037	Pánuco	X	
		32038	Pinos	X	
		32039	Río Grande	X	
		32040	Sain Alto	X	
		32041	El Salvador	X	
		32042	Sombrerete	X	
		32043	Susticacán	X	
		32044	Tabasco		X
		32045	Tepechitlán		X
		32046	Tepetongo	X	
		32047	Teúl de González Ortega		X
		32048	Tlaltenango de Sánchez Román		X
		32049	Valparaíso	X	
		32050	Vetagrande	X	
		32051	Villa de Cos	X	
		32052	Villa García		X
		32053	Villa González Ortega	X	
		32054	Villa Hidalgo	X	
		32055	Villanueva	X	
		32056	Zacatecas	X	
		32057	Trancoso	X	
		32058	Santa María de la Paz		X

Appendix B
Mexico Point Source Surrogate Assignments

Mexico Point Source Surrogate Assignments

NAICS	SCC	NAICS Definition	Surrogate
32419	All	Other petroleum and coal products manufacturing	Crude Oil Refining
211110	All	Oil and gas extraction	Crude Oil Production
221110	10100401	Electric power generation, transmission and distribution	Electricity - Residual
221110	10100405	Electric power generation, transmission and distribution	Electricity - Residual
221110	10100501	Electric power generation, transmission and distribution	Electricity - Distillate
221110	10100601	Electric power generation, transmission and distribution	Electricity - Natural Gas
221110	10200221	Electric power generation, transmission and distribution	Electricity - Coal
221110	10200401	Electric power generation, transmission and distribution	Electricity - Residual
221110	10200501	Electric power generation, transmission and distribution	Electricity - Distillate
221110	10200601	Electric power generation, transmission and distribution	Electricity - Natural Gas
221110	10200802	Electric power generation, transmission and distribution	Electricity - Coke
221110	20100101	Electric power generation, transmission and distribution	Electricity - Distillate
221110	20100102	Electric power generation, transmission and distribution	Electricity - Distillate
221110	20100201	Electric power generation, transmission and distribution	Electricity - Natural Gas
221110	20200101	Electric power generation, transmission and distribution	Electricity - Distillate
221110	20200201	Electric power generation, transmission and distribution	Electricity - Natural Gas
221110	30300310	Electric power generation, transmission and distribution	Electricity - Coke
221110	30300312	Electric power generation, transmission and distribution	Electricity - Coke
324110	All	Petroleum refining	Crude Oil Refining
324120	All	Asphalt products manufacturing	Crude Oil Refining
324191	All	Lubricating oils and greases manufacturing	Crude Oil Refining
324199	All	Coke and other products derived from refined petroleum and coal, manufacturing	Crude Oil Refining
486110	All	Pipeline transportation of crude oil	Crude Oil Refining
486210	All	Pipeline transportation of natural gas	Natural Gas Pipelines
486910	All	Pipeline transportation of refined petroleum products	Crude Oil Refining
All Others	All		GDP

Appendix C
Mexico Point Source Projection Factors

Mexico Point Source Projection Factors

State Code	State	Surrogate	2011 Projection Factor	2017 Projection Factor
01	Aguascalientes	Electricity Generation - Residual	0.6668	0.0574
02	Baja California	Electricity Generation - Residual	1.2402	0.4023
03	Baja California Sur	Electricity Generation - Residual	1.2402	0.4023
04	Campeche	Electricity Generation - Residual	0.9611	0.7883
05	Coahuila	Electricity Generation - Residual	0.7445	0.7262
08	Chihuahua	Electricity Generation - Residual	0.7445	0.7262
10	Durango	Electricity Generation - Residual	0.7445	0.7262
14	Jalisco	Electricity Generation - Residual	0.6668	0.0574
18	Nayarit	Electricity Generation - Residual	0.6668	0.0574
19	Nuevo León	Electricity Generation - Residual	0.7445	0.7262
23	Quintana Roo	Electricity Generation - Residual	0.9611	0.7883
24	San Luis Potosí	Electricity Generation - Residual	0.6668	0.0574
25	Sinaloa	Electricity Generation - Residual	1.2402	0.4023
26	Sonora	Electricity Generation - Residual	1.2402	0.4023
28	Tamaulipas	Electricity Generation - Residual	0.7445	0.7262
30	Veracruz	Electricity Generation - Residual	0.9611	0.7883
31	Yucatán	Electricity Generation - Residual	0.9611	0.7883
32	Zacatecas	Electricity Generation - Residual	0.6668	0.0574
01	Aguascalientes	Electricity Generation - Distillate	0.9609	1.1542
02	Baja California	Electricity Generation - Distillate	2.0729	1.1144
03	Baja California Sur	Electricity Generation - Distillate	2.0729	1.1144
04	Campeche	Electricity Generation - Distillate	0.9669	1.9882
05	Coahuila	Electricity Generation - Distillate	2.0162	2.2799
08	Chihuahua	Electricity Generation - Distillate	2.0162	2.2799
10	Durango	Electricity Generation - Distillate	2.0162	2.2799
14	Jalisco	Electricity Generation - Distillate	0.9609	1.1542
18	Nayarit	Electricity Generation - Distillate	0.9609	1.1542
19	Nuevo León	Electricity Generation - Distillate	2.0162	2.2799
23	Quintana Roo	Electricity Generation - Distillate	0.9669	1.9882
24	San Luis Potosí	Electricity Generation - Distillate	0.9609	1.1542
25	Sinaloa	Electricity Generation - Distillate	2.0729	1.1144
26	Sonora	Electricity Generation - Distillate	2.0729	1.1144
28	Tamaulipas	Electricity Generation - Distillate	2.0162	2.2799
30	Veracruz	Electricity Generation - Distillate	0.9669	1.9882
31	Yucatán	Electricity Generation - Distillate	0.9669	1.9882
32	Zacatecas	Electricity Generation - Distillate	0.9609	1.1542
01	Aguascalientes	Electricity Generation - Natural Gas	1.0579	2.2552
02	Baja California	Electricity Generation - Natural Gas	0.9040	1.8247
03	Baja California Sur	Electricity Generation - Natural Gas	0.9040	1.8247
04	Campeche	Electricity Generation - Natural Gas	0.8641	0.9616
05	Coahuila	Electricity Generation - Natural Gas	1.2750	1.5928
08	Chihuahua	Electricity Generation - Natural Gas	1.2750	1.5928

State Code	State	Surrogate	2011 Projection Factor	2017 Projection Factor
10	Durango	Electricity Generation - Natural Gas	1.2750	1.5928
14	Jalisco	Electricity Generation - Natural Gas	1.0579	2.2552
18	Nayarit	Electricity Generation - Natural Gas	1.0579	2.2552
19	Nuevo León	Electricity Generation - Natural Gas	1.2750	1.5928
23	Quintana Roo	Electricity Generation - Natural Gas	0.8641	0.9616
24	San Luis Potosí	Electricity Generation - Natural Gas	1.0579	2.2552
25	Sinaloa	Electricity Generation - Natural Gas	0.9040	1.8247
26	Sonora	Electricity Generation - Natural Gas	0.9040	1.8247
28	Tamaulipas	Electricity Generation - Natural Gas	1.2750	1.5928
30	Veracruz	Electricity Generation - Natural Gas	0.8641	0.9616
31	Yucatán	Electricity Generation - Natural Gas	0.8641	0.9616
32	Zacatecas	Electricity Generation - Natural Gas	1.0579	2.2552
01	Aguascalientes	Electricity Generation - Coke	1.1886	1.4010
02	Baja California	Electricity Generation - Coke	1.1886	1.4010
03	Baja California Sur	Electricity Generation - Coke	1.1886	1.4010
04	Campeche	Electricity Generation - Coke	1.1886	1.4010
05	Coahuila	Electricity Generation - Coke	1.1886	1.4010
08	Chihuahua	Electricity Generation - Coke	1.1886	1.4010
10	Durango	Electricity Generation - Coke	1.1886	1.4010
14	Jalisco	Electricity Generation - Coke	1.1886	1.4010
18	Nayarit	Electricity Generation - Coke	1.1886	1.4010
19	Nuevo León	Electricity Generation - Coke	1.1886	1.4010
23	Quintana Roo	Electricity Generation - Coke	1.1886	1.4010
24	San Luis Potosí	Electricity Generation - Coke	1.1886	1.4010
25	Sinaloa	Electricity Generation - Coke	1.1886	1.4010
26	Sonora	Electricity Generation - Coke	1.1886	1.4010
28	Tamaulipas	Electricity Generation - Coke	1.1886	1.4010
30	Veracruz	Electricity Generation - Coke	1.1886	1.4010
31	Yucatán	Electricity Generation - Coke	1.1886	1.4010
32	Zacatecas	Electricity Generation - Coke	1.1886	1.4010
01	Aguascalientes	Electricity Generation - Coal	1.6135	1.4282
02	Baja California	Electricity Generation - Coal	1.6135	1.4282
03	Baja California Sur	Electricity Generation - Coal	1.6135	1.4282
04	Campeche	Electricity Generation - Coal	1.6135	1.4282
05	Coahuila	Electricity Generation - Coal	1.6135	1.4282
08	Chihuahua	Electricity Generation - Coal	1.6135	1.4282
10	Durango	Electricity Generation - Coal	1.6135	1.4282
14	Jalisco	Electricity Generation - Coal	1.6135	1.4282
18	Nayarit	Electricity Generation - Coal	1.6135	1.4282
19	Nuevo León	Electricity Generation - Coal	1.6135	1.4282
23	Quintana Roo	Electricity Generation - Coal	1.6135	1.4282
24	San Luis Potosí	Electricity Generation - Coal	1.6135	1.4282
25	Sinaloa	Electricity Generation - Coal	1.6135	1.4282
26	Sonora	Electricity Generation - Coal	1.6135	1.4282

State Code	State	Surrogate	2011 Projection Factor	2017 Projection Factor
28	Tamaulipas	Electricity Generation - Coal	1.6135	1.4282
30	Veracruz	Electricity Generation - Coal	1.6135	1.4282
31	Yucatán	Electricity Generation - Coal	1.6135	1.4282
32	Zacatecas	Electricity Generation - Coal	1.6135	1.4282
01	Aguascalientes	Refining	0.8836	0.9842
02	Baja California	Refining	1.0000	1.0000
03	Baja California Sur	Refining	1.0000	1.0000
04	Campeche	Refining	0.9737	1.1148
05	Coahuila	Refining	0.7464	1.1052
08	Chihuahua	Refining	0.7464	1.1052
10	Durango	Refining	0.7464	1.1052
14	Jalisco	Refining	0.8836	0.9842
18	Nayarit	Refining	0.8836	0.9842
19	Nuevo León	Refining	0.7464	1.1052
23	Quintana Roo	Refining	0.9737	1.1148
24	San Luis Potosí	Refining	0.8836	0.9842
25	Sinaloa	Refining	1.0000	1.0000
26	Sonora	Refining	1.0000	1.0000
28	Tamaulipas	Refining	0.7464	1.1052
30	Veracruz	Refining	0.9737	1.1148
31	Yucatán	Refining	0.9737	1.1148
32	Zacatecas	Refining	0.8836	0.9842
01	Aguascalientes	Crude Oil Production	0.9144	0.9491
02	Baja California	Crude Oil Production	0.9144	0.9491
03	Baja California Sur	Crude Oil Production	0.9144	0.9491
04	Campeche	Crude Oil Production	0.9144	0.9491
05	Coahuila	Crude Oil Production	0.9144	0.9491
08	Chihuahua	Crude Oil Production	0.9144	0.9491
10	Durango	Crude Oil Production	0.9144	0.9491
14	Jalisco	Crude Oil Production	0.9144	0.9491
18	Nayarit	Crude Oil Production	0.9144	0.9491
19	Nuevo León	Crude Oil Production	0.9144	0.9491
23	Quintana Roo	Crude Oil Production	0.9144	0.9491
24	San Luis Potosí	Crude Oil Production	0.9144	0.9491
25	Sinaloa	Crude Oil Production	0.9144	0.9491
26	Sonora	Crude Oil Production	0.9144	0.9491
28	Tamaulipas	Crude Oil Production	0.9144	0.9491
30	Veracruz	Crude Oil Production	0.9144	0.9491
31	Yucatán	Crude Oil Production	0.9144	0.9491
32	Zacatecas	Crude Oil Production	0.9144	0.9491
01	Aguascalientes	Natural Gas Pipelines	1.0339	1.8701
02	Baja California	Natural Gas Pipelines	0.9310	1.8186
03	Baja California Sur	Natural Gas Pipelines	0.9310	1.8186
04	Campeche	Natural Gas Pipelines	0.9602	1.2161

State Code	State	Surrogate	2011 Projection Factor	2017 Projection Factor
05	Coahuila	Natural Gas Pipelines	1.2276	1.6285
08	Chihuahua	Natural Gas Pipelines	1.2276	1.6285
10	Durango	Natural Gas Pipelines	1.2276	1.6285
14	Jalisco	Natural Gas Pipelines	1.0339	1.8701
18	Nayarit	Natural Gas Pipelines	1.0339	1.8701
19	Nuevo León	Natural Gas Pipelines	1.2276	1.6285
23	Quintana Roo	Natural Gas Pipelines	0.9602	1.2161
24	San Luis Potosí	Natural Gas Pipelines	1.0339	1.8701
25	Sinaloa	Natural Gas Pipelines	0.9310	1.8186
26	Sonora	Natural Gas Pipelines	0.9310	1.8186
28	Tamaulipas	Natural Gas Pipelines	1.2276	1.6285
30	Veracruz	Natural Gas Pipelines	0.9602	1.2161
31	Yucatán	Natural Gas Pipelines	0.9602	1.2161
32	Zacatecas	Natural Gas Pipelines	1.0339	1.8701
01	Aguascalientes	GDP	1.0419	1.2386
02	Baja California	GDP	1.0419	1.2386
03	Baja California Sur	GDP	1.0419	1.2386
04	Campeche	GDP	1.0419	1.2386
05	Coahuila	GDP	1.0419	1.2386
08	Chihuahua	GDP	1.0419	1.2386
10	Durango	GDP	1.0419	1.2386
14	Jalisco	GDP	1.0419	1.2386
18	Nayarit	GDP	1.0419	1.2386
19	Nuevo León	GDP	1.0419	1.2386
23	Quintana Roo	GDP	1.0419	1.2386
24	San Luis Potosí	GDP	1.0419	1.2386
25	Sinaloa	GDP	1.0419	1.2386
26	Sonora	GDP	1.0419	1.2386
28	Tamaulipas	GDP	1.0419	1.2386
30	Veracruz	GDP	1.0419	1.2386
31	Yucatán	GDP	1.0419	1.2386
32	Zacatecas	GDP	1.0419	1.2386

Appendix D
Mexico Area Source Surrogate Assignments

Mexico Area Source Surrogate Assignments

SCC	Source_Category	Surrogate
2102004000	Industrial fuel combustion - Diesel	Diesel - Industrial
2102007000	Industrial fuel combustion - LPG	LPG - Industrial
2103006000	Commercial fuel combustion - Natural Gas	Natural Gas - Commercial
2103007000	Commercial fuel combustion - LPG	LPG - Commercial
2104006000	Residential fuel combustion - Natural Gas	Natural Gas - Residential
2104007000	Residential Fuel Combustion - LPG	LPG - Residential
2104008001	Residential Fuel Combustion - Wood	Wood - Residential
2104011000	Residential Fuel Combustion - Kerosene	Population
2202420000	Bus Terminals	Gasoline - Transportation
2222222222	Border Crossings	Gasoline - Transportation
2302002000	Charbroiling	Population
2302050000	Bakeries	Population
2401001000	Architectural Surface Coatings	Population
2401005000	Autobody Refinishing	Population
2401008000	Traffic Markings	Unchanged
2401990000	Industrial Surface Coatings	GDP
2415000000	Degreasing	GDP
2420000055	Drycleaning	Population
2425000000	Graphic Arts	Population
2461020000	Asphalt Application	Unchanged
2461850000	Pesticides	Agricultural Acreage
2465000000	Consumer Solvent Use	Population
2501060000	Gasoline Distribution	Gasoline - Transportation
2630030000	Residential Wastewater, treated	Population
2630090000	Residential Wastewater, untreated	Population
2801500250	Agricultural Burning - Sugarcane	Sugarcane Acreage
2801520004	Agricultural Fuel Combustion - Diesel	Agricultural Acreage
2801520010	Agricultural Fuel Combustion - LPG	LPG - Agricultural
2801520020	Agricultural Fuel Combustion - Kerosene	Agricultural Acreage
2801700000	Fertilizer Application	Agricultural Acreage
2810030000	Structure Fires	Population
2850000010	Hospitals - Sterilization Operations	Population
3333333333	LPG Distribution	LPG - Overall

Appendix E
Mexico Population-Based Area Source Projection Factors

Mexico Population-Based Area Source Projection Factors

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
01004	Aguascalientes	Cosío	1.0597	1.1440
02001	Baja California	Ensenada	1.0913	1.2018
02002	Baja California	Mexicali	1.0732	1.1638
02003	Baja California	Tecate	1.0804	1.1755
02004	Baja California	Tijuana	1.0787	1.1823
02005	Baja California	Playas de Rosarito	1.1421	1.3011
03001	Baja California Sur	Comondú	1.0788	1.2241
03002	Baja California Sur	Mulegé	1.0855	1.2454
03003	Baja California Sur	La Paz	1.0994	1.2783
03008	Baja California Sur	Los Cabos	1.2320	1.5724
03009	Baja California Sur	Loreto	1.2179	1.5168
04001	Campeche	Calkiní	1.0567	1.1471
05001	Coahuila	Abasolo	1.0567	1.1089
05002	Coahuila	Acuña	1.0533	1.1305
05003	Coahuila	Allende	1.0769	1.1646
05004	Coahuila	Arteaga	1.0867	1.1741
05005	Coahuila	Candela	1.0480	1.0888
05006	Coahuila	Castaños	1.0568	1.1263
05007	Coahuila	Cuatro Ciénegas	1.0449	1.0974
05008	Coahuila	Escobedo	1.0358	1.0802
05009	Coahuila	Francisco I. Madero	1.0532	1.1229
05010	Coahuila	Frontera	1.0493	1.1152
05011	Coahuila	General Cepeda	1.0275	1.0598
05012	Coahuila	Guerrero	1.0650	1.1324
05013	Coahuila	Hidalgo	1.1158	1.2391
05014	Coahuila	Jiménez	1.0193	1.0561
05015	Coahuila	Juárez	1.0912	1.1922
05016	Coahuila	Lamadrid	1.0489	1.0865
05017	Coahuila	Matamoros	1.0488	1.1142
05018	Coahuila	Monclova	1.0545	1.1237
05019	Coahuila	Morelos	1.0809	1.1683
05020	Coahuila	Múzquiz	1.0454	1.1029
05021	Coahuila	Nadadores	1.0573	1.1195
05022	Coahuila	Nava	1.0506	1.1205
05023	Coahuila	Ocampo	1.0511	1.1116
05024	Coahuila	Parras	1.0196	1.0597
05025	Coahuila	Piedras Negras	1.0423	1.1051
05026	Coahuila	Progreso	1.0257	1.0648
05027	Coahuila	Ramos Arizpe	1.1685	1.3450
05028	Coahuila	Sabinas	1.0880	1.1837
05029	Coahuila	Sacramento	1.0736	1.1493

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
05030	Coahuila	Saltillo	1.0730	1.1630
05031	Coahuila	San Buenaventura	1.0798	1.1674
05032	Coahuila	San Juan de Sabinas	1.0318	1.0744
05033	Coahuila	San Pedro	1.0599	1.1272
05034	Coahuila	Sierra Mojada	1.1201	1.2497
05035	Coahuila	Torreón	1.0687	1.1529
05036	Coahuila	Viesca	1.0611	1.1303
05037	Coahuila	Villa Unión	1.0217	1.0551
05038	Coahuila	Zaragoza	1.0235	1.0623
08001	Chihuahua	Ahumada	1.0215	1.0483
08002	Chihuahua	Aldama	1.1029	1.1955
08003	Chihuahua	Allende	1.0485	1.0820
08004	Chihuahua	Aquiles Serdán	1.3365	1.6660
08005	Chihuahua	Ascensión	1.0707	1.1365
08006	Chihuahua	Bachíniva	1.0565	1.0887
08007	Chihuahua	Balleza	1.0779	1.1496
08008	Chihuahua	Batopilas	1.0725	1.1410
08009	Chihuahua	Bocoyna	1.0141	1.0478
08010	Chihuahua	Buenaventura	1.0834	1.1536
08011	Chihuahua	Camargo	1.0555	1.1091
08012	Chihuahua	Carichí	1.0579	1.1087
08013	Chihuahua	Casas Grandes	1.1681	1.3085
08014	Chihuahua	Coronado	1.1018	1.1802
08015	Chihuahua	Coyame del Sotol	1.1211	1.1968
08016	Chihuahua	La Cruz	1.1170	1.2099
08017	Chihuahua	Cuauhtémoc	1.1159	1.2263
08018	Chihuahua	Cusihuiriachi	1.1011	1.1734
08019	Chihuahua	Chihuahua	1.0845	1.1693
08020	Chihuahua	Chínipas	1.1017	1.1958
08021	Chihuahua	Delicias	1.0853	1.1653
08022	Chihuahua	Dr. Belisario Domínguez	1.1053	1.1375
08023	Chihuahua	Galeana	1.2921	1.5913
08024	Chihuahua	Santa Isabel	1.0579	1.0999
08025	Chihuahua	Gómez Farías	1.1120	1.1988
08026	Chihuahua	Gran Morelos	1.0614	1.0806
08027	Chihuahua	Guachochi	1.0770	1.1550
08028	Chihuahua	Guadalupe	0.8411	0.7586
08029	Chihuahua	Guadalupe y Calvo	1.0479	1.1026
08030	Chihuahua	Guazapares	1.0983	1.1862
08031	Chihuahua	Guerrero	1.0718	1.1326
08032	Chihuahua	Hidalgo del Parral	1.0593	1.1202
08033	Chihuahua	Huejotitán	1.0508	1.0826
08034	Chihuahua	Ignacio Zaragoza	1.0617	1.1017

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
08035	Chihuahua	Janos	1.1973	1.3739
08036	Chihuahua	Jiménez	1.0480	1.0934
08037	Chihuahua	Juárez	1.0433	1.0938
08038	Chihuahua	Julimes	1.0920	1.1511
08039	Chihuahua	López	1.0522	1.0771
08040	Chihuahua	Madera	0.9911	0.9944
08041	Chihuahua	Maguarichi	0.9809	0.9781
08042	Chihuahua	Manuel Benavides	1.0347	1.0406
08043	Chihuahua	Matachí	1.0243	1.0371
08044	Chihuahua	Matamoros	1.0646	1.1065
08045	Chihuahua	Meoqui	1.0693	1.1323
08046	Chihuahua	Morelos	1.1157	1.2284
08047	Chihuahua	Moris	1.0512	1.0920
08048	Chihuahua	Namiquipa	1.1048	1.1796
08049	Chihuahua	Nonoava	1.0412	1.0645
08050	Chihuahua	Nuevo Casas Grandes	1.0864	1.1695
08051	Chihuahua	Ocampo	1.1401	1.2694
08052	Chihuahua	Ojinaga	1.1619	1.2985
08053	Chihuahua	Praxedis G. Guerrero	0.7294	0.6153
08054	Chihuahua	Riva Palacio	1.0484	1.0881
08055	Chihuahua	Rosales	1.0658	1.1208
08056	Chihuahua	Rosario	1.0787	1.1232
08057	Chihuahua	San Francisco de Borja	1.0502	1.0536
08058	Chihuahua	San Francisco de Conchos	1.1006	1.1640
08059	Chihuahua	San Francisco del Oro	1.0302	1.0512
08060	Chihuahua	Santa Bárbara	1.0569	1.1046
08061	Chihuahua	Satevó	1.0096	1.0006
08062	Chihuahua	Saucillo	1.1090	1.2001
08063	Chihuahua	Temósachic	1.0286	1.0437
08064	Chihuahua	El Tule	1.0507	1.0770
08065	Chihuahua	Urique	1.0524	1.1054
08066	Chihuahua	Uruachi	1.0539	1.1139
08067	Chihuahua	Valle de Zaragoza	1.1309	1.2175
10001	Durango	Canatlán	1.0606	1.1161
10002	Durango	Canelas	1.0251	1.0548
10003	Durango	Coneto de Comonfort	1.0476	1.0920
10004	Durango	Cuencamé	1.0567	1.1060
10005	Durango	Durango	1.0817	1.1677
10006	Durango	General Simón Bolívar	1.0808	1.1482
10007	Durango	Gómez Palacio	1.0652	1.1335
10008	Durango	Guadalupe Victoria	1.0570	1.1139
10009	Durango	Guanaceví	1.0183	1.0390
10010	Durango	Hidalgo	1.0289	1.0500

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
10011	Durango	Indé	1.0703	1.1139
10012	Durango	Lerdo	1.0723	1.1457
10013	Durango	Mapimí	1.0716	1.1356
10014	Durango	Mezquital	1.0729	1.1371
10015	Durango	Nazas	1.0315	1.0579
10016	Durango	Nombre de Dios	1.0566	1.1036
10017	Durango	Ocampo	1.0451	1.0781
10018	Durango	El Oro	1.0635	1.1108
10019	Durango	Otáez	1.0974	1.1851
10020	Durango	Pánuco de Coronado	1.0240	1.0512
10021	Durango	Peñón Blanco	1.0543	1.0985
10022	Durango	Poanas	1.0560	1.1074
10023	Durango	Pueblo Nuevo	1.0440	1.0963
10024	Durango	Rodeo	1.0942	1.1729
10025	Durango	San Bernardo	0.9708	0.9368
10026	Durango	San Dimas	1.0324	1.0752
10027	Durango	San Juan de Guadalupe	1.0297	1.0583
10028	Durango	San Juan del Río	1.0852	1.1573
10029	Durango	San Luis del Cordero	1.0645	1.1136
10030	Durango	San Pedro del Gallo	1.1022	1.1830
10031	Durango	Santa Clara	1.0674	1.1233
10032	Durango	Santiago Papasquiaro	1.0683	1.1385
10033	Durango	Súchil	1.0081	1.0242
10034	Durango	Tamazula	1.0300	1.0659
10035	Durango	Tepehuanes	0.9781	0.9693
10036	Durango	Tlahualilo	1.0840	1.1548
10037	Durango	Topia	1.0633	1.1242
10038	Durango	Vicente Guerrero	1.0371	1.0801
10039	Durango	Nuevo Ideal	1.0614	1.1178
14042	Jalísco	Huejuquilla el Alto	1.0685	1.1386
14061	Jalísco	Mezquitic	1.0821	1.1626
18001	Nayarit	Acaponeta	1.0504	1.1294
18005	Nayarit	Huajicori	1.0601	1.1498
18009	Nayarit	Del Nayar	1.0784	1.1837
19001	Nuevo León	Abasolo	1.0228	1.0686
19002	Nuevo León	Agualeguas	0.9970	0.9972
19003	Nuevo León	Los Aldamas	0.9038	0.8363
19004	Nuevo León	Allende C446	1.0683	1.1502
19005	Nuevo León	Anáhuac	1.0277	1.0714
19006	Nuevo León	Apodaca	1.1383	1.2983
19007	Nuevo León	Aramberri	1.0383	1.0716
19008	Nuevo León	Bustamante	1.0814	1.1605
19009	Nuevo León	Cadereyta Jiménez	1.1037	1.2207

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
19010	Nuevo León	Carmen	1.4178	1.8191
19011	Nuevo León	Cerralvo	1.0017	1.0213
19012	Nuevo León	Ciénega de Flores	1.3136	1.6758
19013	Nuevo León	China	1.0242	1.0614
19014	Nuevo León	Dr. Arroyo	1.0447	1.0888
19015	Nuevo León	Dr. Coss	1.0395	1.0753
19016	Nuevo León	Dr. González	1.0540	1.1154
19017	Nuevo León	Galeana	1.0269	1.0627
19018	Nuevo León	García	1.4686	1.8695
19019	Nuevo León	San Pedro Garza García	1.0255	1.0933
19020	Nuevo León	General Bravo	1.0256	1.0584
19021	Nuevo León	General Escobedo	1.1141	1.2519
19022	Nuevo León	General Terán	1.0278	1.0561
19023	Nuevo León	General Treviño	0.9349	0.8980
19024	Nuevo León	General Zaragoza	1.0312	1.0755
19025	Nuevo León	General Zuazua	1.6976	2.2408
19026	Nuevo León	Guadalupe	1.0054	1.0440
19027	Nuevo León	Los Herreras	1.0562	1.0695
19028	Nuevo León	Higueras	1.0754	1.1561
19029	Nuevo León	Hualahuises	1.0376	1.0814
19030	Nuevo León	Iturbide	1.0147	1.0400
19031	Nuevo León	Juárez	1.3228	1.6760
19032	Nuevo León	Lampazos de Naranjo	1.1222	1.2417
19033	Nuevo León	Linares	1.0715	1.1564
19034	Nuevo León	Marín	1.0216	1.0715
19035	Nuevo León	Melchor Ocampo	0.9059	0.8589
19036	Nuevo León	Mier y Noriega	1.0136	1.0414
19037	Nuevo León	Mina	1.0199	1.0622
19038	Nuevo León	Montemorelos	1.0671	1.1473
19039	Nuevo León	Monterrey	1.0172	1.0616
19040	Nuevo León	Parás	1.0674	1.1240
19041	Nuevo León	Pesquería	1.3138	1.6867
19042	Nuevo León	Los Ramones	0.9303	0.8875
19043	Nuevo León	Rayones	1.0261	1.0575
19044	Nuevo León	Sabinas Hidalgo	1.0586	1.1327
19045	Nuevo León	Salinas Victoria	1.1017	1.2198
19046	Nuevo León	San Nicolás de los Garza	0.9785	0.9981
19047	Nuevo León	Hidalgo	1.0536	1.1282
19048	Nuevo León	Santa Catarina	1.0353	1.1032
19049	Nuevo León	Santiago	1.0520	1.1183
19050	Nuevo León	Vallecillo	1.0482	1.0860
19051	Nuevo León	Villaldama	1.0139	1.0323
23001	Quintana Roo	Cozumel	1.0751	1.2425

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
23002	Quintana Roo	Felipe Carrillo Puerto	1.1025	1.2902
23003	Quintana Roo	Isla Mujeres	1.1393	1.3722
23005	Quintana Roo	Benito Juárez	1.1105	1.3205
23006	Quintana Roo	José María Morelos	1.0811	1.2480
23007	Quintana Roo	Lázaro Cárdenas	1.0951	1.2722
23008	Quintana Roo	Solidaridad	1.2156	1.5593
23009	Quintana Roo	Tulum	1.1939	1.4613
24001	San Luis Potosí	Ahualulco	1.0507	1.1070
24002	San Luis Potosí	Alaquines	1.0353	1.0650
24004	San Luis Potosí	Armadillo de los Infante	1.0022	0.9989
24006	San Luis Potosí	Catorce	1.0412	1.0700
24007	San Luis Potosí	Cedral	1.0610	1.1258
24008	San Luis Potosí	Cerritos	1.0364	1.0652
24010	San Luis Potosí	Ciudad del Maíz	1.0364	1.0704
24013	San Luis Potosí	Ciudad Valles	1.0511	1.1126
24015	San Luis Potosí	Charcas	1.0381	1.0785
24016	San Luis Potosí	Ebano	1.0589	1.1193
24017	San Luis Potosí	Guadalcázar	1.0325	1.0535
24020	San Luis Potosí	Matehuala	1.0703	1.1470
24021	San Luis Potosí	Mexquitic de Carmona	1.0695	1.1503
24022	San Luis Potosí	Moctezuma	1.0425	1.0883
24024	San Luis Potosí	Rioverde	1.0510	1.1059
24025	San Luis Potosí	Salinas	1.0751	1.1525
24028	San Luis Potosí	San Luis Potosí	1.0467	1.1123
24030	San Luis Potosí	San Nicolás Tolentino	1.0019	0.9980
24033	San Luis Potosí	Santo Domingo	1.0442	1.0815
24035	San Luis Potosí	Soledad de Graciano Sánchez	1.1084	1.2287
24036	San Luis Potosí	Tamasopo	1.0500	1.0940
24040	San Luis Potosí	Tamuín	1.0517	1.1086
24044	San Luis Potosí	Vanegas	1.0704	1.1339
24045	San Luis Potosí	Venado	1.0296	1.0566
24047	San Luis Potosí	Villa de Guadalupe	1.0411	1.0661
24048	San Luis Potosí	Villa de la Paz	1.0546	1.1023
24049	San Luis Potosí	Villa de Ramos	1.0646	1.1298
24051	San Luis Potosí	Villa Hidalgo	1.0454	1.0829
24052	San Luis Potosí	Villa Juárez	1.0341	1.0505
24056	San Luis Potosí	Villa de Arista	1.0671	1.1381
24058	San Luis Potosí	El Naranjo	1.0720	1.1382
25001	Sinaloa	Ahome	1.0707	1.1352
25002	Sinaloa	Angostura	1.0608	1.1041
25003	Sinaloa	Badiraguato	0.9875	0.9852
25004	Sinaloa	Concordia	1.0590	1.1019
25005	Sinaloa	Cosalá	0.9905	0.9873

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
25006	Sinaloa	Culiacán	1.0771	1.1500
25007	Sinaloa	Choix	1.0473	1.0792
25008	Sinaloa	Elota	0.9822	0.9748
25009	Sinaloa	Escuinapa	1.0778	1.1411
25010	Sinaloa	El Fuerte	1.0578	1.1022
25011	Sinaloa	Guasave	1.0621	1.1153
25012	Sinaloa	Mazatlán	1.0785	1.1499
25013	Sinaloa	Mocorito	1.0475	1.0727
25014	Sinaloa	Rosario	1.0505	1.0883
25015	Sinaloa	Salvador Alvarado	1.0495	1.0950
25016	Sinaloa	San Ignacio	1.0068	1.0078
25017	Sinaloa	Sinaloa	1.0496	1.0843
25018	Sinaloa	Navolato	1.0290	1.0549
26001	Sonora	Aconchi	1.0609	1.1201
26002	Sonora	Agua Prieta	1.0890	1.1969
26003	Sonora	Alamos	1.0509	1.1040
26004	Sonora	Altar	1.0642	1.1439
26005	Sonora	Arivechi	1.0054	1.0132
26006	Sonora	Arizpe	1.0353	1.0659
26007	Sonora	Atil	0.9290	0.8855
26008	Sonora	Bacadéhuachi	1.0111	1.0076
26009	Sonora	Bacanora	1.0307	1.0325
26010	Sonora	Bacerac	1.0714	1.1500
26011	Sonora	Bacoachi	1.0916	1.1783
26012	Sonora	Bácum	1.0718	1.1489
26013	Sonora	Banámichi	1.0834	1.1438
26014	Sonora	Baviácora	1.0419	1.0701
26015	Sonora	Bavispe	1.0920	1.1639
26016	Sonora	Benjamín Hill	1.0190	1.0470
26017	Sonora	Caborca	1.1066	1.2239
26018	Sonora	Cajeme	1.0724	1.1590
26019	Sonora	Cananea	1.0352	1.0852
26020	Sonora	Carbó	1.1009	1.2100
26021	Sonora	La Colorada	0.9897	0.9712
26022	Sonora	Cucurpe	1.1247	1.2175
26023	Sonora	Cumpas	1.0749	1.1448
26024	Sonora	Divisaderos	1.1284	1.2465
26025	Sonora	Empalme	1.0597	1.1320
26026	Sonora	Etchojoa	1.0696	1.1469
26027	Sonora	Fronteras	1.1038	1.2139
26028	Sonora	Granados	1.1296	1.2310
26029	Sonora	Guaymas	1.0838	1.1781
26030	Sonora	Hermosillo	1.0874	1.1913

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
26031	Sonora	Huachinera	1.0732	1.1433
26032	Sonora	Huásabas	1.0740	1.1247
26033	Sonora	Huatabampo	1.0565	1.1217
26034	Sonora	Huépac	1.0800	1.1299
26035	Sonora	Imuris	1.1089	1.2293
26036	Sonora	Magdalena	1.1087	1.2259
26037	Sonora	Mazatán	1.0151	1.0206
26038	Sonora	Moctezuma	1.0667	1.1429
26039	Sonora	Naco	1.0566	1.1265
26040	Sonora	Nácori Chico	1.1084	1.2030
26041	Sonora	Nacozari de García	1.0594	1.1373
26042	Sonora	Navojoa	1.0716	1.1551
26043	Sonora	Nogales	1.0950	1.2053
26044	Sonora	Onavas	1.0277	1.0486
26045	Sonora	Opodepe	1.0694	1.1224
26046	Sonora	Oquitoa	1.0708	1.1388
26047	Sonora	Pitiquito	1.0445	1.1007
26048	Sonora	Puerto Peñasco	1.1609	1.3297
26049	Sonora	Quiriego	1.0685	1.1250
26050	Sonora	Rayón	1.0371	1.0471
26051	Sonora	Rosario	1.0273	1.0517
26052	Sonora	Sahuaripa	1.0418	1.0784
26053	Sonora	San Felipe de Jesús	1.1649	1.3024
26054	Sonora	San Javier	1.4124	1.8531
26055	Sonora	San Luis Río Colorado	1.0933	1.1965
26056	Sonora	San Miguel de Horcasitas	1.2072	1.4324
26057	Sonora	San Pedro de la Cueva	1.0888	1.1547
26058	Sonora	Santa Ana	1.0727	1.1553
26059	Sonora	Santa Cruz	1.0827	1.1669
26060	Sonora	Sáric	1.0601	1.1181
26061	Sonora	Soyopa	1.0538	1.0762
26062	Sonora	Suaqui Grande	1.0273	1.0361
26063	Sonora	Tepache	1.1020	1.1765
26064	Sonora	Trincheras	1.0377	1.0702
26065	Sonora	Tubutama	1.0121	1.0283
26066	Sonora	Ures	1.0696	1.1300
26067	Sonora	Villa Hidalgo	1.0803	1.1466
26068	Sonora	Villa Pesqueira	0.9682	0.9437
26069	Sonora	Yécora	1.0150	1.0449
26070	Sonora	General Plutarco Elías Calles	1.1494	1.3024
26071	Sonora	Benito Juárez	1.0624	1.1345
26072	Sonora	San Ignacio Río Muerto	1.0572	1.1244
28001	Tamaulipas	Abasolo	1.0293	1.0614

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
28002	Tamaulipas	Aldama	1.0561	1.1172
28003	Tamaulipas	Altamira	1.1708	1.3503
28004	Tamaulipas	Antiguo Morelos	1.0491	1.0980
28005	Tamaulipas	Burgos	0.9982	0.9965
28006	Tamaulipas	Bustamante	1.0419	1.0682
28007	Tamaulipas	Camargo	0.9270	0.8968
28008	Tamaulipas	Casas	1.0524	1.0927
28009	Tamaulipas	Ciudad Madero	1.0366	1.0869
28010	Tamaulipas	Cruillas	0.9526	0.9238
28011	Tamaulipas	Gómez Farías	1.0391	1.0787
28012	Tamaulipas	González	1.0523	1.1089
28013	Tamaulipas	Güémez	1.0658	1.1268
28014	Tamaulipas	Guerrero	1.1087	1.2410
28015	Tamaulipas	Gustavo Díaz Ordaz	1.0480	1.0971
28016	Tamaulipas	Hidalgo	1.0299	1.0564
28017	Tamaulipas	Jaumave	1.0590	1.1149
28018	Tamaulipas	Jiménez	1.0262	1.0581
28019	Tamaulipas	Llera	1.0173	1.0296
28020	Tamaulipas	Mainero	1.0445	1.0643
28021	Tamaulipas	El Mante	1.0399	1.0863
28022	Tamaulipas	Matamoros	1.0521	1.1219
28023	Tamaulipas	Méndez	0.9897	0.9895
28024	Tamaulipas	Mier	0.8484	0.7784
28025	Tamaulipas	Miguel Alemán	1.0887	1.1908
28026	Tamaulipas	Miquihuana	1.0346	1.0552
28027	Tamaulipas	Nuevo Laredo	1.0619	1.1378
28028	Tamaulipas	Nuevo Morelos	1.0761	1.1466
28029	Tamaulipas	Ocampo	1.0409	1.0729
28030	Tamaulipas	Padilla	1.0777	1.1469
28031	Tamaulipas	Palmillas	1.0764	1.1300
28032	Tamaulipas	Reynosa	1.1015	1.2177
28033	Tamaulipas	Río Bravo	1.0752	1.1556
28034	Tamaulipas	San Carlos	1.0218	1.0349
28035	Tamaulipas	San Fernando	1.0135	1.0433
28036	Tamaulipas	San Nicolás	1.0111	1.0363
28037	Tamaulipas	Soto la Marina	1.0662	1.1347
28038	Tamaulipas	Tampico	1.0123	1.0441
28039	Tamaulipas	Tula	1.0574	1.1100
28040	Tamaulipas	Valle Hermoso	1.0278	1.0679
28041	Tamaulipas	Victoria	1.0753	1.1633
28042	Tamaulipas	Villagrán	1.0079	1.0109
28043	Tamaulipas	Xicoténcatl	1.0463	1.0922
30121	Veracruz	Ozuluama de Mascareñas	1.0076	1.0096

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
30123	Veracruz	Pánuco	1.0451	1.0857
30133	Veracruz	Pueblo Viejo	1.0353	1.0717
30152	Veracruz	Tampico Alto	1.0188	1.0243
31001	Yucatán	Abalá	1.0505	1.1240
31002	Yucatán	Acanceh	1.0553	1.1427
31004	Yucatán	Baca	1.0469	1.1114
31005	Yucatán	Bokobá	1.0409	1.1077
31006	Yucatán	Buctzotz	1.0311	1.0838
31007	Yucatán	Cacalchén	1.0524	1.1286
31008	Yucatán	Calotmul	1.0512	1.1178
31009	Yucatán	Cansahcab	1.0107	1.0437
31010	Yucatán	Cantamayec	1.0439	1.1111
31011	Yucatán	Celestún	1.0655	1.1592
31012	Yucatán	Cenotillo	1.0391	1.0875
31013	Yucatán	Conkal	1.0558	1.1401
31014	Yucatán	Cuncunul	1.0440	1.1155
31015	Yucatán	Cuzamá	1.0366	1.1092
31017	Yucatán	Chankom	1.0286	1.0807
31018	Yucatán	Chapab	1.0396	1.1038
31019	Yucatán	Chemax	1.0695	1.1527
31020	Yucatán	Chicxulub Pueblo	1.0537	1.1279
31021	Yucatán	Chichimilá	1.0481	1.1131
31022	Yucatán	Chikindzonot	1.0245	1.0791
31023	Yucatán	Chocholá	1.0373	1.0933
31024	Yucatán	Chumayel	1.0563	1.1326
31025	Yucatán	Dzán	1.0608	1.1477
31026	Yucatán	Dzemul	1.0515	1.1164
31027	Yucatán	Dzidzantún	1.0126	1.0529
31028	Yucatán	Dzilam de Bravo	1.0655	1.1470
31029	Yucatán	Dzilam González	1.0189	1.0597
31030	Yucatán	Dzitás	1.0259	1.0705
31031	Yucatán	Dzoncauich	1.0095	1.0388
31032	Yucatán	Espita	1.0525	1.1251
31033	Yucatán	Halachó	1.0444	1.1189
31034	Yucatán	Hocabá	1.0360	1.0949
31035	Yucatán	Hoctún	1.0289	1.0828
31036	Yucatán	Homún	1.0396	1.1159
31037	Yucatán	Huhí	1.0574	1.1407
31038	Yucatán	Hunucmá	1.0668	1.1647
31039	Yucatán	Ixil	1.0465	1.1233
31040	Yucatán	Izamal	1.0526	1.1256
31041	Yucatán	Kanasín	1.2536	1.5503
31042	Yucatán	Kantunil	1.0287	1.0775

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
31043	Yucatán	Kaua	1.0556	1.1283
31044	Yucatán	Kinchil	1.0719	1.1668
31045	Yucatán	Kopomá	1.0733	1.1626
31046	Yucatán	Mama	1.0580	1.1513
31047	Yucatán	Maní	1.0599	1.1522
31048	Yucatán	Maxcanú	1.0389	1.1100
31049	Yucatán	Mayapán	1.0661	1.1564
31050	Yucatán	Mérida	1.0514	1.1335
31051	Yucatán	Mocochá	1.0447	1.1121
31052	Yucatán	Motul	1.0568	1.1378
31053	Yucatán	Muna	1.0419	1.1147
31054	Yucatán	Muxupip	1.0472	1.1313
31055	Yucatán	Opichén	1.0807	1.1868
31057	Yucatán	Panabá	1.0085	1.0469
31058	Yucatán	Peto	1.0568	1.1342
31059	Yucatán	Progreso	1.0643	1.1527
31060	Yucatán	Quintana Roo	1.0083	1.0513
31061	Yucatán	Río Lagartos	1.0454	1.1123
31062	Yucatán	Sacalum	1.0577	1.1422
31063	Yucatán	Samahil	1.0423	1.1182
31064	Yucatán	Sanahcat	1.0531	1.1251
31065	Yucatán	San Felipe	1.0089	1.0384
31067	Yucatán	Seyé	1.0310	1.0941
31068	Yucatán	Sinanché	1.0394	1.0918
31069	Yucatán	Sotuta	1.0372	1.0929
31070	Yucatán	Sucilá	1.0486	1.1087
31071	Yucatán	Sudzal	1.0573	1.1300
31072	Yucatán	Suma	1.0472	1.0977
31073	Yucatán	Tahdziú	1.0826	1.1718
31074	Yucatán	Tahmek	1.0317	1.0794
31075	Yucatán	Teabo	1.0723	1.1720
31076	Yucatán	Tecoh	1.0438	1.1185
31077	Yucatán	Tekal de Venegas	1.0478	1.1168
31078	Yucatán	Tekantó	0.9993	1.0266
31079	Yucatán	Tekax	1.0606	1.1488
31080	Yucatán	Tekit	1.0613	1.1576
31081	Yucatán	Tekom	1.0419	1.1060
31082	Yucatán	Telchac Pueblo	1.0390	1.0876
31083	Yucatán	Telchac Puerto	1.0512	1.1303
31084	Yucatán	Temax	1.0194	1.0601
31085	Yucatán	Temozón	1.0455	1.1184
31086	Yucatán	Tepakán	1.0478	1.1098
31087	Yucatán	Tetiz	1.0493	1.1377

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
31088	Yucatán	Teya	1.0224	1.0648
31089	Yucatán	Ticul	1.0486	1.1309
31090	Yucatán	Timucuy	1.0554	1.1444
31091	Yucatán	Tinum	1.0909	1.2018
31092	Yucatán	Tixcacalcupul	1.0546	1.1307
31093	Yucatán	Tixkokob	1.0511	1.1290
31094	Yucatán	Tixmehuac	1.0646	1.1362
31095	Yucatán	Tixpéhual	1.0595	1.1416
31096	Yucatán	Tizimín	1.0421	1.1102
31097	Yucatán	Tunkás	1.0196	1.0532
31099	Yucatán	Uayma	1.1438	1.2981
31100	Yucatán	Ucú	1.0875	1.2011
31101	Yucatán	Umán	0.9928	1.0337
31102	Yucatán	Valladolid	1.0569	1.1452
31103	Yucatán	Xocchel	1.0714	1.1656
31104	Yucatán	Yaxcabá	1.0455	1.1072
31105	Yucatán	Yaxkukul	1.0580	1.1391
31106	Yucatán	Yobaín	1.0339	1.0768
32005	Zacatecas	Calera	1.0628	1.1277
32006	Zacatecas	Cañitas de Felipe Pescador	1.0316	1.0585
32007	Zacatecas	Concepción del Oro	1.0482	1.0812
32008	Zacatecas	Cuauhtémoc	1.0386	1.0767
32009	Zacatecas	Chalchihuites	1.0104	1.0199
32010	Zacatecas	Fresnillo	1.0533	1.1073
32012	Zacatecas	Genaro Codina	1.0586	1.1086
32013	Zacatecas	General Enrique Estrada	1.0326	1.0643
32014	Zacatecas	General Francisco R. Murguía	1.0322	1.0594
32016	Zacatecas	General Pánfilo Natera	1.0298	1.0577
32017	Zacatecas	Guadalupe	1.1295	1.2607
32020	Zacatecas	Jerez	1.0593	1.1075
32021	Zacatecas	Jiménez del Teul	0.9721	0.9504
32022	Zacatecas	Juan Aldama	1.0676	1.1297
32025	Zacatecas	Luis Moya	1.0672	1.1249
32026	Zacatecas	Mazapil	1.0805	1.1375
32027	Zacatecas	Melchor Ocampo	1.0442	1.0769
32029	Zacatecas	Miguel Auza	1.0478	1.0941
32031	Zacatecas	Monte Escobedo	1.0108	1.0041
32032	Zacatecas	Morelos	1.0549	1.1119
32035	Zacatecas	Noria de Ángeles	1.1003	1.1862
32036	Zacatecas	Ojocaliente	1.0514	1.1019
32037	Zacatecas	Pánuco	1.0771	1.1470
32038	Zacatecas	Pinos	1.0377	1.0770
32039	Zacatecas	Río Grande	1.0554	1.1093

Municipality Code	State	Municipality	2011 Projection Factor	2017 Projection Factor
32040	Zacatecas	Sain Alto	1.0666	1.1229
32041	Zacatecas	El Salvador	0.9714	0.9387
32042	Zacatecas	Sombrerete	1.0360	1.0698
32043	Zacatecas	Susticacán	1.0621	1.1027
32046	Zacatecas	Tepetongo	1.0087	1.0000
32049	Zacatecas	Valparaíso	1.0193	1.0266
32050	Zacatecas	Vetagrande	1.0721	1.1421
32051	Zacatecas	Villa de Cos	1.0722	1.1333
32053	Zacatecas	Villa González Ortega	1.0541	1.1056
32054	Zacatecas	Villa Hidalgo	1.0477	1.0952
32055	Zacatecas	Villanueva	1.0203	1.0323
32056	Zacatecas	Zacatecas	1.0369	1.0828
32057	Zacatecas	Trancoso	1.0594	1.1195

Appendix F
Mexico Other Area Source Projection Factors

Mexico Other Area Source Projection Factors

Surrogate	Region/State	2011 Projection Factor	2017 Projection Factor
Diesel - Industrial	Noroeste	1.1731	1.3832
Diesel - Industrial	Noreste	1.3046	1.5567
Diesel - Industrial	Centro-Occidente	1.0605	1.3555
Diesel - Industrial	Centro	0.7877	0.6682
Diesel - Industrial	Sur-Sureste	1.0593	1.1525
LPG - Industrial	Noroeste	0.9115	0.8629
LPG - Industrial	Noreste	0.8894	1.0004
LPG - Industrial	Centro-Occidente	1.0910	0.9050
LPG - Industrial	Centro	0.9629	0.9564
LPG - Industrial	Sur-Sureste	1.1144	0.6111
LPG - Commercial	Noroeste	1.0813	1.0032
LPG - Commercial	Noreste	1.2390	1.0524
LPG - Commercial	Centro-Occidente	0.9632	0.9345
LPG - Commercial	Centro	1.0018	0.9610
LPG - Commercial	Sur-Sureste	1.1001	1.1202
LPG - Residential	Noroeste	0.9720	0.8921
LPG - Residential	Noreste	1.0043	0.8322
LPG - Residential	Centro-Occidente	0.9155	0.8019
LPG - Residential	Centro	0.9731	0.9235
LPG - Residential	Sur-Sureste	0.9264	0.8947
LPG - Agricultural	Noroeste	1.2726	1.2925
LPG - Agricultural	Noreste	0.9478	0.8965
LPG - Agricultural	Centro-Occidente	1.0041	0.8839
LPG - Agricultural	Centro	1.1394	0.7507
LPG - Agricultural	Sur-Sureste	1.1257	2.4565
LPG - Overall	Noroeste	0.9681	0.9596
LPG - Overall	Noreste	1.0190	1.0102
LPG - Overall	Centro-Occidente	0.9652	0.9225
LPG - Overall	Centro	0.9754	0.9628
LPG - Overall	Sur-Sureste	0.9749	0.9708
Natural Gas - Commercial	Noroeste	1.2795	1.3597
Natural Gas - Commercial	Noreste	0.9285	1.1272
Natural Gas - Commercial	Centro-Occidente	0.9645	1.6718
Natural Gas - Commercial	Centro	1.2092	1.3746
Natural Gas - Commercial	Sur-Sureste	1.0542	3.4710
Natural Gas - Residential	Noroeste	1.0113	1.2927
Natural Gas - Residential	Noreste	0.8776	1.0025
Natural Gas - Residential	Centro-Occidente	0.9251	1.1775
Natural Gas - Residential	Centro	1.0394	1.2833
Natural Gas - Residential	Sur-Sureste	0.9251	1.1775
Wood - Residential	National	0.9849	0.9567

Surrogate	Region/State	2011 Projection Factor	2017 Projection Factor
Gasoline - Transportation	Aguascalientes	1.0306	1.0920
Gasoline - Transportation	Baja California	0.9774	0.9905
Gasoline - Transportation	Baja California Sur	0.9774	0.9955
Gasoline - Transportation	Campeche	1.0740	1.2158
Gasoline - Transportation	Chihuahua	0.9261	0.9659
Gasoline - Transportation	Coahuila	0.9261	0.9679
Gasoline - Transportation	Durango	0.9261	0.9673
Gasoline - Transportation	Jalisco	1.0306	1.0915
Gasoline - Transportation	Nayarit	1.0306	1.0982
Gasoline - Transportation	Nuevo León	0.9261	0.9152
Gasoline - Transportation	Quintana Roo	1.0740	1.2180
Gasoline - Transportation	San Luis Potosí	1.0306	1.0888
Gasoline - Transportation	Sinaloa	0.9774	0.9908
Gasoline - Transportation	Sonora	0.9774	0.9901
Gasoline - Transportation	Tamaulipas	0.9261	0.9645
Gasoline - Transportation	Veracruz	1.0740	1.2190
Gasoline - Transportation	Yucatán	1.0740	1.2174
Gasoline - Transportation	Zacatecas	1.0306	1.0805
Agricultural Acreage	Aguascalientes	0.7595	0.9322
Agricultural Acreage	Baja California	0.9994	1.0166
Agricultural Acreage	Baja California Sur	1.1060	1.0451
Agricultural Acreage	Campeche	1.0126	1.0082
Agricultural Acreage	Coahuila	1.0285	1.0088
Agricultural Acreage	Chihuahua	0.9972	0.9995
Agricultural Acreage	Durango	0.9709	0.9918
Agricultural Acreage	Jalisco	1.0250	0.9934
Agricultural Acreage	Nayarit	1.0440	0.9746
Agricultural Acreage	Nuevo León	0.8403	1.0186
Agricultural Acreage	Quintana Roo	0.9633	1.0389
Agricultural Acreage	San Luis Potosí	0.8750	0.9992
Agricultural Acreage	Sinaloa	1.1980	0.9559
Agricultural Acreage	Sonora	1.0947	0.9775
Agricultural Acreage	Tamaulipas	1.0417	1.0150
Agricultural Acreage	Veracruz	0.9974	1.0049
Agricultural Acreage	Yucatán	0.9962	0.9834
Agricultural Acreage	Zacatecas	0.8896	0.9846
Sugar Cane Acreage	Aguascalientes	1.0485	0.9869
Sugar Cane Acreage	Baja California	1.0485	0.9869
Sugar Cane Acreage	Baja California Sur	1.0485	0.9869
Sugar Cane Acreage	Campeche	1.0869	0.9432
Sugar Cane Acreage	Coahuila	1.0485	0.9869
Sugar Cane Acreage	Chihuahua	1.0485	0.9869
Sugar Cane Acreage	Durango	1.0485	0.9869

Surrogate	Region/State	2011 Projection Factor	2017 Projection Factor
Sugar Cane Acreage	Jalisco	1.0004	1.0128
Sugar Cane Acreage	Nayarit	0.9753	0.8930
Sugar Cane Acreage	Nuevo León	1.0485	0.9869
Sugar Cane Acreage	Quintana Roo	1.0509	0.9624
Sugar Cane Acreage	San Luis Potosí	1.0254	0.9968
Sugar Cane Acreage	Sinaloa	0.6460	0.8858
Sugar Cane Acreage	Sonora	1.0485	0.9869
Sugar Cane Acreage	Tamaulipas	1.1425	0.9701
Sugar Cane Acreage	Veracruz	1.0462	0.9902
Sugar Cane Acreage	Yucatán	1.0485	0.9869
Sugar Cane Acreage	Zacatecas	1.0485	0.9869
GDP	National	1.0419	1.2386

Appendix G
Mexico Nonroad Mobile Source Surrogate Assignments

Mexico Nonroad Mobile Source Surrogate Assignments

SCC	SCC Description	Surrogate Assignment
2270002000	Construction Equipment	Diesel - Transportation
2270005000	Agricultural Equipment	Agricultural Acreage
2270008000	GSE	Turbosina
2275000000	Aircrafts	Turbosina
2280000000	Commercial Marine Vessels	Diesel - Marine
2285000000	Locomotives	Diesel - Locomotives

Appendix H
Mexico Nonroad Mobile Source Projection Factors

Mexico Nonroad Mobile Source Projection Factors

Surrogate	Region/State	2011 Projection Factor	2017 Projection Factor
Diesel - Transportation	Noroeste	0.9882	1.1695
Diesel - Transportation	Noreste	0.9569	1.0775
Diesel - Transportation	Centro-Occidente	1.0557	1.2836
Diesel - Transportation	Centro	0.9953	1.1407
Diesel - Transportation	Sur-Sureste	0.9467	1.0934
Diesel - Locomotive	Noroeste	1.1040	1.2836
Diesel - Locomotive	Noreste	1.1669	1.1443
Diesel - Locomotive	Centro-Occidente	1.0251	1.0813
Diesel - Locomotive	Centro	1.4398	1.8911
Diesel - Locomotive	Sur-Sureste	1.2948	1.5696
Diesel - Marine	Noroeste	0.8715	0.8256
Diesel - Marine	Noreste	0.9995	0.6016
Diesel - Marine	Centro-Occidente	1.0894	0.5056
Diesel - Marine	Centro	0.9076	0.8722
Diesel - Marine	Sur-Sureste	0.8572	1.1713
Turbosina	Aguascalientes	0.8642	1.1694
Turbosina	Baja California	8.7976	13.5509
Turbosina	Baja California Sur	1.0218	1.4820
Turbosina	Campeche	0.8642	1.1694
Turbosina	Coahuila	0.8642	1.1694
Turbosina	Chihuahua	0.8642	1.1694
Turbosina	Durango	0.8642	1.1694
Turbosina	Jalisco	0.8642	1.1694
Turbosina	Nayarit	0.8642	1.1694
Turbosina	Nuevo León	0.5379	0.6632
Turbosina	Quintana Roo	0.8642	1.1694
Turbosina	San Luis Potosí	0.8642	1.1694
Turbosina	Sinaloa	0.8642	1.1694
Turbosina	Sonora	0.4674	0.6414
Turbosina	Tamaulipas	4.8004	5.7475
Turbosina	Veracruz	0.3251	0.4259
Turbosina	Yucatán	0.5168	0.7542
Turbosina	Zacatecas	0.8642	1.1694
Agricultural Acreage	Aguascalientes	0.7595	0.9322
Agricultural Acreage	Baja California	0.9994	1.0166
Agricultural Acreage	Baja California Sur	1.1060	1.0451
Agricultural Acreage	Campeche	1.0126	1.0082
Agricultural Acreage	Coahuila	1.0285	1.0088
Agricultural Acreage	Chihuahua	0.9972	0.9995
Agricultural Acreage	Durango	0.9709	0.9918
Agricultural Acreage	Jalisco	1.0250	0.9934
Agricultural Acreage	Nayarit	1.0440	0.9746
Agricultural Acreage	Nuevo León	0.8403	1.0186

Surrogate	Region/State	2011 Projection Factor	2017 Projection Factor
Agricultural Acreage	Quintana Roo	0.9633	1.0389
Agricultural Acreage	San Luis Potosí	0.8750	0.9992
Agricultural Acreage	Sinaloa	1.1980	0.9559
Agricultural Acreage	Sonora	1.0947	0.9775
Agricultural Acreage	Tamaulipas	1.0417	1.0150
Agricultural Acreage	Veracruz	0.9974	1.0049
Agricultural Acreage	Yucatán	0.9962	0.9834
Agricultural Acreage	Zacatecas	0.8896	0.9846

Appendix I
Canada Point Source Surrogate Assignments

Canada Point Source Surrogate Assignments

NAICS	NAICS Description	SCC	SCC Description	Surrogate Assignment
212114	Coal Mining	2325000000	Mining &Quarrying /All Processes /Total	Coal Production
212116	Coal Mining	2325000000	Mining &Quarrying /All Processes /Total	Coal Production
211113	Oil and Gas Extraction	2102006000	Stationary Fuel Comb /Industrial /Natural Gas /Total: Boilers and IC Engines	Crude Oil Production
211113	Oil and Gas Extraction	2306000000	Petroleum Refining /All Processes /Total	Crude Oil Production
211113	Oil and Gas Extraction	2310000000	Oil & Gas Expl & Prod /All Processes /Total: All Processes	Crude Oil Production
211113	Oil and Gas Extraction	2310020600	Oil & Gas Expl & Prod /Natural Gas /Compressor Engines	Crude Oil Production
211114	Oil and Gas Extraction	2310000000	Oil & Gas Expl & Prod /All Processes /Total: All Processes	Crude Oil Production
221112	Fossil Fuel Electric Power Generation	2101001000	Stationary Fuel Comb /Electric Utility /Anthracite Coal /Total: All Boiler Types	Utility - Coal
221112	Fossil Fuel Electric Power Generation	2101006001	Stationary Fuel Comb /Electric Utility /Natural Gas /All Boiler Types	Utility - Natural Gas
221112	Fossil Fuel Electric Power Generation	2199006001	Stationary Fuel Comb /Total Area Source /Natural Gas /All Boiler Types	Utility - Natural Gas
221119	Other Electric Power Generation	2101006001	Stationary Fuel Comb /Electric Utility /Natural Gas /All Boiler Types	Utility - Natural Gas
486110	Pipeline Transportation of Crude Oil	2310000000	Oil & Gas Expl & Prod /All Processes /Total: All Processes	Crude Oil Production
486110	Pipeline Transportation of Crude Oil	2310020600	Oil & Gas Expl & Prod /Natural Gas /Compressor Engines	Crude Oil Production
486110	Pipeline Transportation of Crude Oil	31000123	Crude Oil Production /Well Casing Vents	Crude Oil Production
486110	Pipeline Transportation of Crude Oil	31000132	Crude Oil Production /Atmospheric Wash Tank (2nd Stage of Gas-Oil Separation): Flashing Loss	Crude Oil Production
486110	Pipeline Transportation of Crude Oil	31000160	Crude Oil Production /Flares	Crude Oil Production

NAICS	NAICS Description	SCC	SCC Description	Surrogate Assignment
486110	Pipeline Transportation of Crude Oil	40600132	Petrol Trans & Marketg /Tank Cars & Trucks /Crude Oil: Submerged Loading (Normal Service)	Crude Oil Production
221210	Natural Gas Distribution	2310020600	Oil & Gas Expl & Prod /Natural Gas /Compressor Engines	Natural Gas Production
486210	Pipeline Transportation of Natural Gas	2310020600	Oil & Gas Expl & Prod /Natural Gas /Compressor Engines	Natural Gas Production
486210	Pipeline Transportation of Natural Gas	31000220	Natural Gas Production /All Equipt Leak Fugitives (Valves, Flanges, Connections, Seals, Drains	Natural Gas Production
486210	Pipeline Transportation of Natural Gas	31000304	Natural Gas Proc Facilities /Glycol Dehydrators: Ethylene Glycol: General	Natural Gas Production
All others		All others		GDP

Appendix J
Canada Point Source Projection Factors

Canada Point Source Projection Factors

Province Code	Province Name	Surrogate	2011 Projection Factor	2017 Projection Factor
59000	British Columbia	Coal Production	0.9489	0.9382
48000	Alberta	Coal Production	0.9489	0.9382
47000	Saskatchewan	Coal Production	0.9489	0.9382
46000	Manitoba	Coal Production	0.9489	0.9382
24000	Québec	Coal Production	0.9489	0.9382
35000	Ontario	Coal Production	0.9489	0.9382
13000	New Brunswick	Coal Production	0.9489	0.9382
59000	British Columbia	Coal Production	0.9489	0.9382
48000	Alberta	Coal Production	0.9489	0.9382
47000	Saskatchewan	Coal Production	0.9489	0.9382
46000	Manitoba	Coal Production	0.9489	0.9382
24000	Québec	Coal Production	0.9489	0.9382
35000	Ontario	Coal Production	0.9489	0.9382
13000	New Brunswick	Coal Production	0.9489	0.9382
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250

Province Code	Province Name	Surrogate	2011 Projection Factor	2017 Projection Factor
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Utility - Coal	1.0000	1.0000
48000	Alberta	Utility - Coal	0.9838	0.8151
47000	Saskatchewan	Utility - Coal	0.9623	1.1225
46000	Manitoba	Utility - Coal	0.8462	5.0000
24000	Québec	Utility - Coal	1.0000	1.0000
35000	Ontario	Utility - Coal	0.3139	0.0000
13000	New Brunswick	Utility - Coal	1.1439	0.5119
59000	British Columbia	Utility - Natural Gas	0.3993	0.8356
48000	Alberta	Utility - Natural Gas	1.1290	1.9680
47000	Saskatchewan	Utility - Natural Gas	1.0763	1.8319
46000	Manitoba	Utility - Natural Gas	1.1042	0.0000
24000	Québec	Utility - Natural Gas	0.8927	15.7897
35000	Ontario	Utility - Natural Gas	1.3182	1.4176
13000	New Brunswick	Utility - Natural Gas	1.0451	0.4632
59000	British Columbia	Utility - Natural Gas	0.3993	0.8356
48000	Alberta	Utility - Natural Gas	1.1290	1.9680
47000	Saskatchewan	Utility - Natural Gas	1.0763	1.8319
46000	Manitoba	Utility - Natural Gas	1.1042	0.0000
24000	Québec	Utility - Natural Gas	0.8927	15.7897
35000	Ontario	Utility - Natural Gas	1.3182	1.4176
13000	New Brunswick	Utility - Natural Gas	1.0451	0.4632
59000	British Columbia	Utility - Natural Gas	0.3993	0.8356
48000	Alberta	Utility - Natural Gas	1.1290	1.9680
47000	Saskatchewan	Utility - Natural Gas	1.0763	1.8319
46000	Manitoba	Utility - Natural Gas	1.1042	0.0000
24000	Québec	Utility - Natural Gas	0.8927	15.7897
35000	Ontario	Utility - Natural Gas	1.3182	1.4176
13000	New Brunswick	Utility - Natural Gas	1.0451	0.4632
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000

Province Code	Province Name	Surrogate	2011 Projection Factor	2017 Projection Factor
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Crude Oil Production	0.9927	0.7938
48000	Alberta	Crude Oil Production	1.0714	1.6220
47000	Saskatchewan	Crude Oil Production	1.0462	1.2430
46000	Manitoba	Crude Oil Production	1.4615	2.4570
24000	Québec	Crude Oil Production	1.0000	1.0000
35000	Ontario	Crude Oil Production	0.9167	0.6250
13000	New Brunswick	Crude Oil Production	1.0000	1.0000
59000	British Columbia	Natural Gas Production	1.1893	1.2662
48000	Alberta	Natural Gas Production	0.9570	0.6437
47000	Saskatchewan	Natural Gas Production	0.9155	0.6338
46000	Manitoba	Natural Gas Production	1.0000	1.0000
24000	Québec	Natural Gas Production	1.0000	1.0000
35000	Ontario	Natural Gas Production	0.8000	0.6000
13000	New Brunswick	Natural Gas Production	1.0000	0.0000
59000	British Columbia	Natural Gas Production	1.1893	1.2662

Province Code	Province Name	Surrogate	2011 Projection Factor	2017 Projection Factor
48000	Alberta	Natural Gas Production	0.9570	0.6437
47000	Saskatchewan	Natural Gas Production	0.9155	0.6338
46000	Manitoba	Natural Gas Production	1.0000	1.0000
24000	Québec	Natural Gas Production	1.0000	1.0000
35000	Ontario	Natural Gas Production	0.8000	0.6000
13000	New Brunswick	Natural Gas Production	1.0000	0.0000
59000	British Columbia	Natural Gas Production	1.1893	1.2662
48000	Alberta	Natural Gas Production	0.9570	0.6437
47000	Saskatchewan	Natural Gas Production	0.9155	0.6338
46000	Manitoba	Natural Gas Production	1.0000	1.0000
24000	Québec	Natural Gas Production	1.0000	1.0000
35000	Ontario	Natural Gas Production	0.8000	0.6000
13000	New Brunswick	Natural Gas Production	1.0000	0.0000
59000	British Columbia	Natural Gas Production	1.1893	1.2662
48000	Alberta	Natural Gas Production	0.9570	0.6437
47000	Saskatchewan	Natural Gas Production	0.9155	0.6338
46000	Manitoba	Natural Gas Production	1.0000	1.0000
24000	Québec	Natural Gas Production	1.0000	1.0000
35000	Ontario	Natural Gas Production	0.8000	0.6000
13000	New Brunswick	Natural Gas Production	1.0000	0.0000
59000	British Columbia	GDP	1.0279	1.2104
48000	Alberta	GDP	1.0572	1.2270
47000	Saskatchewan	GDP	1.0581	1.2256
46000	Manitoba	GDP	1.0212	1.1863
24000	Québec	GDP	1.0200	1.1231
35000	Ontario	GDP	1.0261	1.1843
13000	New Brunswick	GDP	1.0057	1.0458

Appendix K
Canada Area Source Surrogate Assignments

Canada Area Source Surrogate Assignments

SCC	SCC Description	Surrogate Assignment
2101001000	Stationary Fuel Comb /Electric Utility /Anthracite Coal /Total: All Boiler Types	Utility - Coal
2101006001	Stationary Fuel Comb /Electric Utility /Natural Gas /All Boiler Types	Utility - Natural Gas
2101010000	Stationary Fuel Comb /Electric Utility /Process Gas /Total: All Boiler Types	Utility - RPP
2104000000	Stationary Fuel Comb /Residential /Wood /	Residential - Biomass
2104008001	Stationary Fuel Comb /Residential /Wood /Fireplaces: General	Residential - Biomass
2104008030	Stationary Fuel Comb /Residential /Wood /Catalytic Woodstoves: General	Residential - Biomass
2104008051	Stationary Fuel Comb /Residential /Wood /Non-catalytic Woodstoves: Non-EPA certified	Residential - Biomass
2104008060	Stationary Fuel Comb /Residential /Wood /	Residential - Biomass
2104008070	Stationary Fuel Comb /Residential /Wood /Outdoor Wood Burning Equipment	Residential - Biomass
2199006001	Stationary Fuel Comb /Total Area Source /Natural Gas /All Boiler Types	Residential - Natural Gas
2302050000	Food & Kindred Products /Bakery Products /Total	Population
2303020000	Primary Metal Production /Iron & Steel Foundries /Total	GDP
2306010000	Petroleum Refining /Asphalt Paving/Roofing Materials /Total	GDP
2307000000	Wood Products /All Processes /Total	GDP
2311020000	Construction: SIC 15 - 17 /Industrial/Commercial/Institutional /Total	GDP
2325000000	Mining &Quarrying /All Processes /Total	GDP
2401990000	Surface Coating /All Surface Coating Categories /Total: All Solvent Types	GDP
2420000000	Dry Cleaning /All Processes /Total: All Solvent Types	Population
2425000000	Graphic Arts /All Processes /Total: All Solvent Types	Population
2440000000	Misc Industrial /All Processes /Total: All Solvent Types	GDP
2501000000	Petrol & Petrol Product Storage /All Storage Types: Breathing Loss /Total: All Products	Transportation - Gasoline
2501000120	Petrol & Petrol Product Storage /All Storage Types: Breathing Loss /Gasoline	Transportation - Gasoline
2601000000	On-site Incineration /All Categories /Total	Assumed to be 1.0000
2601010000	On-site Incineration /Industrial /Total	Assumed to be 1.0000
2601020000	On-site Incineration /Commercial/Institutional /Total	Assumed to be 1.0000
2610000000	Open Burning /All Categories /Total	Population
2620000000	Landfills /All Categories /Total	Population
2810003000	Cigarette Smoke /Total	Population
2810030000	Structure Fires /Unspecified	Population
2810060100	Cremation /Humans	Population

Appendix L
Canada Area Source Projection Factors

Canada Area Source Projection Factors

Province Code	Province Name	Surrogate Assignment	2011 Projection Factor	2017 Projection Factor
59000	British Columbia	Utility - RPP	0.9846	0.9846
48000	Alberta	Utility - RPP	1.0000	3.1667
47000	Saskatchewan	Utility - RPP	0.5789	0.6316
46000	Manitoba	Utility - RPP	0.9333	1.0952
24000	Quebec	Utility - RPP	0.9501	0.6676
35000	Ontario	Utility - RPP	0.5584	1.7662
13000	New Brunswick	Utility - RPP	0.4588	0.0284
59000	British Columbia	Utility - Natural Gas	0.3993	0.8356
48000	Alberta	Utility - Natural Gas	1.1290	1.9680
47000	Saskatchewan	Utility - Natural Gas	1.0763	1.8319
46000	Manitoba	Utility - Natural Gas	1.1042	0.0000
24000	Quebec	Utility - Natural Gas	0.8927	15.7897
35000	Ontario	Utility - Natural Gas	1.3182	1.4176
13000	New Brunswick	Utility - Natural Gas	1.0451	0.4632
59000	British Columbia	Utility - Coal	1.0000	1.0000
48000	Alberta	Utility - Coal	0.9838	0.8151
47000	Saskatchewan	Utility - Coal	0.9623	1.1225
46000	Manitoba	Utility - Coal	0.8462	5.0000
24000	Quebec	Utility - Coal	1.0000	1.0000
35000	Ontario	Utility - Coal	0.3139	0.0000
13000	New Brunswick	Utility - Coal	1.1439	0.5119
59000	British Columbia	Transportation - Gasoline	1.0304	0.9193
48000	Alberta	Transportation - Gasoline	1.0862	1.1729
47000	Saskatchewan	Transportation - Gasoline	1.0440	0.9327
46000	Manitoba	Transportation - Gasoline	0.9851	0.8763
24000	Quebec	Transportation - Gasoline	1.0112	0.8955
35000	Ontario	Transportation - Gasoline	0.9841	0.9381
13000	New Brunswick	Transportation - Gasoline	1.1926	1.0567

Province Code	Province Name	Surrogate Assignment	2011 Projection Factor	2017 Projection Factor
59000	British Columbia	Residential - Natural Gas	1.2470	1.3199
48000	Alberta	Residential - Natural Gas	1.0606	1.2011
47000	Saskatchewan	Residential - Natural Gas	0.9611	1.0167
46000	Manitoba	Residential - Natural Gas	1.0860	1.1613
24000	Quebec	Residential - Natural Gas	1.1717	1.2273
35000	Ontario	Residential - Natural Gas	1.1193	1.2194
13000	New Brunswick	Residential - Natural Gas	1.2000	1.6000
59000	British Columbia	Residential - Biomass	1.1333	1.2444
48000	Alberta	Residential - Biomass	1.2000	1.2000
47000	Saskatchewan	Residential - Biomass	1.0000	1.0909
46000	Manitoba	Residential - Biomass	1.0500	1.2000
24000	Quebec	Residential - Biomass	1.0472	1.0751
35000	Ontario	Residential - Biomass	1.0711	1.1564
13000	New Brunswick	Residential - Biomass	1.0714	1.0714
59000	British Columbia	Population	1.0159	1.1112
48000	Alberta	Population	1.0137	1.0956
47000	Saskatchewan	Population	1.0059	1.0437
46000	Manitoba	Population	1.0104	1.0747
24000	Quebec	Population	1.0083	1.0558
35000	Ontario	Population	1.0133	1.0929
13000	New Brunswick	Population	1.0044	1.0299
59000	British Columbia	GDP	1.0279	1.2104
48000	Alberta	GDP	1.0572	1.2270
47000	Saskatchewan	GDP	1.0581	1.2256
46000	Manitoba	GDP	1.0212	1.1863
24000	Quebec	GDP	1.0200	1.1231
35000	Ontario	GDP	1.0261	1.1843
13000	New Brunswick	GDP	1.0057	1.0458

Appendix M
Canada Nonroad Mobile Source Surrogate Assignments

Canada Nonroad Mobile Source Surrogate Assignments

SCC	SCC Description	Surrogate Assignment
2260001010	Off-highway Gasoline, 2-Stroke /Recreational Equipt /Motorcycles: Off-road	Transportation - Gasoline
2260001020	Off-highway Gasoline, 2-Stroke /Recreational Equipt /Snowmobiles	Transportation - Gasoline
2260001030	Off-highway Gasoline, 2-Stroke /Recreational Equipt /All Terrain Vehicles	Transportation - Gasoline
2260001060	Off-highway Gasoline, 2-Stroke /Recreational Equipt /Specialty Vehicles/Carts	Transportation - Gasoline
2260001061	Off-highway Gasoline, 2-Stroke /Recreational Equipt /	Transportation - Gasoline
2260001062	Off-highway Gasoline, 2-Stroke /Recreational Equipt /	Transportation - Gasoline
2260002006	Off-highway Gasoline, 2-Stroke /Construction & Mining Equipt /Tampers/Rammers	Transportation - Gasoline
2260002009	Off-highway Gasoline, 2-Stroke /Construction & Mining Equipt /Plate Compactors	Transportation - Gasoline
2260002021	Off-highway Gasoline, 2-Stroke /Construction & Mining Equipt /Paving Equipt	Transportation - Gasoline
2260002033	Off-highway Gasoline, 2-Stroke /Construction & Mining Equipt /Bore/Drill Rigs	Transportation - Gasoline
2260002039	Off-highway Gasoline, 2-Stroke /Construction & Mining Equipt /Concrete/Industrial Saws	Transportation - Gasoline
2260003030	Off-highway Gasoline, 2-Stroke /Industrial Equipt /Sweepers/Scrubbers	Transportation - Gasoline
2260004010	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Lawn Mowers (Residential)	Transportation - Gasoline
2260004011	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Lawn Mowers (Commercial)	Transportation - Gasoline
2260004015	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Rotary Tillers < 6 HP (Residential)	Transportation - Gasoline
2260004016	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Rotary Tillers < 6 HP (Commercial)	Transportation - Gasoline
2260004020	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Chain Saws < 6 HP (Residential)	Transportation - Gasoline
2260004021	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Chain Saws < 6 HP (Commercial)	Transportation - Gasoline
2260004025	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Trimmers/Edgers/Brush Cutters (Residential)	Transportation - Gasoline
2260004026	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Trimmers/Edgers/Brush Cutters (Commercial)	Transportation - Gasoline
2260004030	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Leafblowers/Vacuums (Residential)	Transportation - Gasoline
2260004031	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Leafblowers/Vacuums (Commercial)	Transportation - Gasoline

SCC	SCC Description	Surrogate Assignment
2260004035	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Snowblowers (Residential)	Transportation - Gasoline
2260004036	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Snowblowers (Commercial)	Transportation - Gasoline
2260004051	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Shredders < 6 HP (Commercial)	Transportation - Gasoline
2260004075	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Other Lawn & Garden Equipt (Residential)	Transportation - Gasoline
2260004076	Off-highway Gasoline, 2-Stroke /Lawn & Garden Equipt /Other Lawn & Garden Equipt (Commercial)	Transportation - Gasoline
2260005010	Off-highway Gasoline, 2-Stroke /Agricultural Equipt /2-Wheel Tractors	Transportation - Gasoline
2260005030	Off-highway Gasoline, 2-Stroke /Agricultural Equipt /Agricultural Mowers	Transportation - Gasoline
2260005035	Off-highway Gasoline, 2-Stroke /Agricultural Equipt /Sprayers	Transportation - Gasoline
2260005040	Off-highway Gasoline, 2-Stroke /Agricultural Equipt /Tillers : 6 HP	Transportation - Gasoline
2260006005	Off-highway Gasoline, 2-Stroke /Commercial Equipt /Generator Sets	Transportation - Gasoline
2260006010	Off-highway Gasoline, 2-Stroke /Commercial Equipt /Pumps	Transportation - Gasoline
2260006025	Off-highway Gasoline, 2-Stroke /Commercial Equipt /Welders	Transportation - Gasoline
2260006030	Off-highway Gasoline, 2-Stroke /Commercial Equipt /Pressure Washers	Transportation - Gasoline
2260006035	Off-highway Gasoline, 2-Stroke /Commercial Equipt /Hydro-power Units	Transportation - Gasoline
2260007005	Off-highway Gasoline, 2-Stroke /Logging Equipt /Chain Saws : 6 HP	Transportation - Gasoline
2260007010	Off-highway Gasoline, 2-Stroke /Logging Equipt /Shredders : 6 HP	Transportation - Gasoline
2265001010	Off-highway Gasoline, 4-Stroke /Recreational Equipt /Motorcycles: Off-road	Transportation - Gasoline
2265001020	Off-highway Gasoline, 4-Stroke /Recreational Equipt /Snowmobiles	Transportation - Gasoline
2265001030	Off-highway Gasoline, 4-Stroke /Recreational Equipt /All Terrain Vehicles	Transportation - Gasoline
2265001050	Off-highway Gasoline, 4-Stroke /Recreational Equipt /Golf Carts	Transportation - Gasoline
2265001060	Off-highway Gasoline, 4-Stroke /Recreational Equipt /Specialty Vehicles/Carts	Transportation - Gasoline
2265001061	Off-highway Gasoline, 4-Stroke /Recreational Equipt /	Transportation - Gasoline
2265001062	Off-highway Gasoline, 4-Stroke /Recreational Equipt /	Transportation - Gasoline

SCC	SCC Description	Surrogate Assignment
2265002003	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Pavers	Transportation - Gasoline
2265002006	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Tampers/Rammers	Transportation - Gasoline
2265002009	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Plate Compactors	Transportation - Gasoline
2265002012	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Concrete Pavers	Transportation - Gasoline
2265002015	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Rollers	Transportation - Gasoline
2265002021	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Paving Equipt	Transportation - Gasoline
2265002022	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /	Transportation - Gasoline
2265002024	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Surfacing Equipt	Transportation - Gasoline
2265002025	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /	Transportation - Gasoline
2265002030	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Trenchers	Transportation - Gasoline
2265002033	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Bore/Drill Rigs	Transportation - Gasoline
2265002036	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Excavators	Transportation - Gasoline
2265002039	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Concrete/Industrial Saws	Transportation - Gasoline
2265002042	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Cement & Mortar Mixers	Transportation - Gasoline
2265002045	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Cranes	Transportation - Gasoline
2265002046	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /	Transportation - Gasoline
2265002054	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Crushing/Processing Equipt	Transportation - Gasoline
2265002057	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Rough Terrain Forklifts	Transportation - Gasoline
2265002060	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Rubber Tire Loaders	Transportation - Gasoline
2265002066	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Tractors/Loaders/Backhoes	Transportation - Gasoline
2265002069	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Crawler Tractor/Dozers	Transportation - Gasoline
2265002072	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Skid Steer Loaders	Transportation - Gasoline
2265002078	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Dumpers/Tenders	Transportation - Gasoline

SCC	SCC Description	Surrogate Assignment
2265002081	Off-highway Gasoline, 4-Stroke /Construction & Mining Equipt /Other Construction Equipt	Transportation - Gasoline
2265003010	Off-highway Gasoline, 4-Stroke /Industrial Equipt /Aerial Lifts	Transportation - Gasoline
2265003011	Off-highway Gasoline, 4-Stroke /Industrial Equipt /	Transportation - Gasoline
2265003020	Off-highway Gasoline, 4-Stroke /Industrial Equipt /Forklifts	Transportation - Gasoline
2265003021	Off-highway Gasoline, 4-Stroke /Industrial Equipt /	Transportation - Gasoline
2265003030	Off-highway Gasoline, 4-Stroke /Industrial Equipt /Sweepers/Scrubbers	Transportation - Gasoline
2265003031	Off-highway Gasoline, 4-Stroke /Industrial Equipt /	Transportation - Gasoline
2265003040	Off-highway Gasoline, 4-Stroke /Industrial Equipt /Other General Industrial Equipt	Transportation - Gasoline
2265003060	Off-highway Gasoline, 4-Stroke /Industrial Equipt /AC\Refrigeration	Transportation - Gasoline
2265003061	Off-highway Gasoline, 4-Stroke /Industrial Equipt /	Transportation - Gasoline
2265003070	Off-highway Gasoline, 4-Stroke /Industrial Equipt /Terminal Tractors	Transportation - Gasoline
2265003071	Off-highway Gasoline, 4-Stroke /Industrial Equipt /	Transportation - Gasoline
2265004010	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Lawn Mowers (Residential)	Transportation - Gasoline
2265004011	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Lawn Mowers (Commercial)	Transportation - Gasoline
2265004015	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Rotary Tillers < 6 HP (Residential)	Transportation - Gasoline
2265004016	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Rotary Tillers < 6 HP (Commercial)	Transportation - Gasoline
2265004025	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Trimmers/Edgers/Brush Cutters (Residential)	Transportation - Gasoline
2265004026	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Trimmers/Edgers/Brush Cutters (Commercial)	Transportation - Gasoline
2265004031	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Leafblowers/Vacuums (Commercial)	Transportation - Gasoline
2265004035	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Snowblowers (Residential)	Transportation - Gasoline
2265004036	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Snowblowers (Commercial)	Transportation - Gasoline
2265004040	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Rear Engine Riding Mowers (Residential)	Transportation - Gasoline
2265004041	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Rear Engine Riding Mowers (Commercial)	Transportation - Gasoline

SCC	SCC Description	Surrogate Assignment
2265004046	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Front Mowers (Commercial)	Transportation - Gasoline
2265004051	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Shredders < 6 HP (Commercial)	Transportation - Gasoline
2265004055	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Lawn & Garden Tractors (Residential)	Transportation - Gasoline
2265004056	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Lawn & Garden Tractors (Commercial)	Transportation - Gasoline
2265004061	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Wood Splitters (Commercial)	Transportation - Gasoline
2265004066	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Chippers/Stump Grinders (Commercial)	Transportation - Gasoline
2265004071	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Turf Equipt (Commercial)	Transportation - Gasoline
2265004075	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Other Lawn & Garden Equipt (Residential)	Transportation - Gasoline
2265004076	Off-highway Gasoline, 4-Stroke /Lawn & Garden Equipt /Other Lawn & Garden Equipt (Commercial)	Transportation - Gasoline
2265005010	Off-highway Gasoline, 4-Stroke /Agricultural Equipt /2-Wheel Tractors	Transportation - Gasoline
2265005025	Off-highway Gasoline, 4-Stroke /Agricultural Equipt /Balers	Transportation - Gasoline
2265005030	Off-highway Gasoline, 4-Stroke /Agricultural Equipt /Agricultural Mowers	Transportation - Gasoline
2265005035	Off-highway Gasoline, 4-Stroke /Agricultural Equipt /Sprayers	Transportation - Gasoline
2265005040	Off-highway Gasoline, 4-Stroke /Agricultural Equipt /Tillers : 6 HP	Transportation - Gasoline
2265005055	Off-highway Gasoline, 4-Stroke /Agricultural Equipt /Other Agricultural Equipt	Transportation - Gasoline
2265005060	Off-highway Gasoline, 4-Stroke /Agricultural Equipt /Irrigation Sets	Transportation - Gasoline
2265006005	Off-highway Gasoline, 4-Stroke /Commercial Equipt /Generator Sets	Transportation - Gasoline
2265006010	Off-highway Gasoline, 4-Stroke /Commercial Equipt /Pumps	Transportation - Gasoline
2265006015	Off-highway Gasoline, 4-Stroke /Commercial Equipt /Air Compressors	Transportation - Gasoline
2265006025	Off-highway Gasoline, 4-Stroke /Commercial Equipt /Welders	Transportation - Gasoline
2265006030	Off-highway Gasoline, 4-Stroke /Commercial Equipt /Pressure Washers	Transportation - Gasoline
2265006035	Off-highway Gasoline, 4-Stroke /Commercial Equipt /Hydro-power Units	Transportation - Gasoline
2265007010	Off-highway Gasoline, 4-Stroke /Logging Equipt /Shredders : 6 HP	Transportation - Gasoline

SCC	SCC Description	Surrogate Assignment
2265007015	Off-highway Gasoline, 4-Stroke /Logging Equipt /Forest Equipt - Feller/Bunch/Skidder	Transportation - Gasoline
2265010010	Off-highway Gasoline, 4-Stroke /Industrial Equipt /Other Oil Field Equipt	Transportation - Gasoline
2267001060	Off-highway LPG /Recreational Equipt /Specialty Vehicles/Carts	Transportation - LPG
2267001061	Off-highway LPG /Recreational Equipt /	Transportation - LPG
2267002039	Off-highway LPG /Construction & Mining Equipt /Concrete/Industrial Saws	Transportation - LPG
2267002045	Off-highway LPG /Construction & Mining Equipt /Cranes	Transportation - LPG
2267002057	Off-highway LPG /Construction & Mining Equipt /Rough Terrain Forklifts	Transportation - LPG
2267002060	Off-highway LPG /Construction & Mining Equipt /Rubber Tire Loaders	Transportation - LPG
2267003010	Off-highway LPG /Industrial Equipt /Aerial Lifts	Transportation - LPG
2267003020	Off-highway LPG /Industrial Equipt /Forklifts	Transportation - LPG
2267003030	Off-highway LPG /Industrial Equipt /Sweepers/Scrubbers	Transportation - LPG
2267003070	Off-highway LPG /Industrial Equipt /Terminal Tractors	Transportation - LPG
2267004031	Off-highway LPG /Lawn & Garden Equipt /Leafblowers/Vacuums (Commercial)	Transportation - LPG
2267004040	Off-highway LPG /Lawn & Garden Equipt /Rear Engine Riding Mowers (Residential)	Transportation - LPG
2267006005	Off-highway LPG /Commercial Equipt /Generator Sets	Transportation - LPG
2267006025	Off-highway LPG /Commercial Equipt /Welders	Transportation - LPG
2268003030	Off-highway CNG /Industrial Equipt /Sweepers/Scrubbers	Transportation - Natural Gas
2268003070	Off-highway CNG /Industrial Equipt /Terminal Tractors	Transportation - Natural Gas
2268005060	Off-highway CNG /Agricultural Equipt /Irrigation Sets	Transportation - Natural Gas
2268006005	Off-highway CNG /Commercial Equipt /Generator Sets	Transportation - Natural Gas
2268010010	Off-highway CNG /Industrial Equipt /Other Oil Field Equipt	Transportation - Natural Gas
2270001030	Off-highway Diesel /Recreational Equipt /All Terrain Vehicles	Transportation - Diesel
2270001060	Off-highway Diesel /Recreational Equipt /Specialty Vehicles/Carts	Transportation - Diesel
2270001061	Off-highway Diesel /Recreational Equipt /	Transportation - Diesel
2270001062	Off-highway Diesel /Recreational Equipt /	Transportation - Diesel
2270002003	Off-highway Diesel /Construction & Mining Equipt /Pavers	Transportation - Diesel
2270002006	Off-highway Diesel /Construction & Mining Equipt /Tampers/Rammers	Transportation - Diesel
2270002009	Off-highway Diesel /Construction & Mining Equipt /Plate Compactors	Transportation - Diesel

SCC	SCC Description	Surrogate Assignment
2270002012	Off-highway Diesel /Construction & Mining Equipt /Concrete Pavers	Transportation - Diesel
2270002015	Off-highway Diesel /Construction & Mining Equipt /Rollers	Transportation - Diesel
2270002018	Off-highway Diesel /Construction & Mining Equipt /Scrapers	Transportation - Diesel
2270002021	Off-highway Diesel /Construction & Mining Equipt /Paving Equipt	Transportation - Diesel
2270002022	Off-highway Diesel /Construction & Mining Equipt /	Transportation - Diesel
2270002024	Off-highway Diesel /Construction & Mining Equipt /Surfacing Equipt	Transportation - Diesel
2270002027	Off-highway Diesel /Construction & Mining Equipt /Signal Boards/Light Plants	Transportation - Diesel
2270002030	Off-highway Diesel /Construction & Mining Equipt /Trenchers	Transportation - Diesel
2270002033	Off-highway Diesel /Construction & Mining Equipt /Bore/Drill Rigs	Transportation - Diesel
2270002036	Off-highway Diesel /Construction & Mining Equipt /Excavators	Transportation - Diesel
2270002039	Off-highway Diesel /Construction & Mining Equipt /Concrete/Industrial Saws	Transportation - Diesel
2270002042	Off-highway Diesel /Construction & Mining Equipt /Cement & Mortar Mixers	Transportation - Diesel
2270002045	Off-highway Diesel /Construction & Mining Equipt /Cranes	Transportation - Diesel
2270002048	Off-highway Diesel /Construction & Mining Equipt /Graders	Transportation - Diesel
2270002051	Off-highway Diesel /Construction & Mining Equipt /Off-highway Trucks	Transportation - Diesel
2270002054	Off-highway Diesel /Construction & Mining Equipt /Crushing/Processing Equipt	Transportation - Diesel
2270002057	Off-highway Diesel /Construction & Mining Equipt /Rough Terrain Forklifts	Transportation - Diesel
2270002060	Off-highway Diesel /Construction & Mining Equipt /Rubber Tire Loaders	Transportation - Diesel
2270002066	Off-highway Diesel /Construction & Mining Equipt /Tractors/Loaders/Backhoes	Transportation - Diesel
2270002069	Off-highway Diesel /Construction & Mining Equipt /Crawler Tractor/Dozers	Transportation - Diesel
2270002072	Off-highway Diesel /Construction & Mining Equipt /Skid Steer Loaders	Transportation - Diesel
2270002075	Off-highway Diesel /Construction & Mining Equipt /Off-highway Tractors	Transportation - Diesel
2270002078	Off-highway Diesel /Construction & Mining Equipt /Dumpers/Tenders	Transportation - Diesel
2270002081	Off-highway Diesel /Construction & Mining Equipt /Other Construction Equipt	Transportation - Diesel
2270003010	Off-highway Diesel /Industrial Equipt /Aerial Lifts	Transportation - Diesel
2270003020	Off-highway Diesel /Industrial Equipt /Forklifts	Transportation - Diesel

SCC	SCC Description	Surrogate Assignment
2270003030	Off-highway Diesel /Industrial Equipt /Sweepers/Scrubbers	Transportation - Diesel
2270003040	Off-highway Diesel /Industrial Equipt /Other General Industrial Equipt	Transportation - Diesel
2270003041	Off-highway Diesel /Industrial Equipt /	Transportation - Diesel
2270003042	Off-highway Diesel /Industrial Equipt /	Transportation - Diesel
2270003060	Off-highway Diesel /Industrial Equipt /AC\Refrigeration	Transportation - Diesel
2270003061	Off-highway Diesel /Industrial Equipt /	Transportation - Diesel
2270003070	Off-highway Diesel /Industrial Equipt /Terminal Tractors	Transportation - Diesel
2270004040	Off-highway Diesel /Lawn & Garden Equipt /Rear Engine Riding Mowers (Residential)	Transportation - Diesel
2270004041	Off-highway Diesel /Lawn & Garden Equipt /Rear Engine Riding Mowers (Commercial)	Transportation - Diesel
2270004046	Off-highway Diesel /Lawn & Garden Equipt /Front Mowers (Commercial)	Transportation - Diesel
2270004055	Off-highway Diesel /Lawn & Garden Equipt /Lawn & Garden Tractors (Residential)	Transportation - Diesel
2270004056	Off-highway Diesel /Lawn & Garden Equipt /Lawn & Garden Tractors (Commercial)	Transportation - Diesel
2270004061	Off-highway Diesel /Lawn & Garden Equipt /Wood Splitters (Commercial)	Transportation - Diesel
2270004066	Off-highway Diesel /Lawn & Garden Equipt /Chippers/Stump Grinders (Commercial)	Transportation - Diesel
2270004071	Off-highway Diesel /Lawn & Garden Equipt /Turf Equipt (Commercial)	Transportation - Diesel
2270004075	Off-highway Diesel /Lawn & Garden Equipt /Other Lawn & Garden Equipt (Residential)	Transportation - Diesel
2270004076	Off-highway Diesel /Lawn & Garden Equipt /Other Lawn & Garden Equipt (Commercial)	Transportation - Diesel
2270005010	Off-highway Diesel /Agricultural Equipt /2-Wheel Tractors	Transportation - Diesel
2270005015	Off-highway Diesel /Agricultural Equipt /Agricultural Tractors	Transportation - Diesel
2270005020	Off-highway Diesel /Agricultural Equipt /Combines	Transportation - Diesel
2270005025	Off-highway Diesel /Agricultural Equipt /Balers	Transportation - Diesel
2270005035	Off-highway Diesel /Agricultural Equipt /Sprayers	Transportation - Diesel
2270005040	Off-highway Diesel /Agricultural Equipt /Tillers : 6 HP	Transportation - Diesel
2270005045	Off-highway Diesel /Agricultural Equipt /Swathers	Transportation - Diesel
2270005055	Off-highway Diesel /Agricultural Equipt /Other Agricultural Equipt	Transportation - Diesel
2270005060	Off-highway Diesel /Agricultural Equipt /Irrigation Sets	Transportation - Diesel
2270006005	Off-highway Diesel /Commercial Equipt /Generator Sets	Transportation - Diesel
2270006006	Off-highway Diesel /Commercial Equipt /	Transportation - Diesel
2270006010	Off-highway Diesel /Commercial Equipt /Pumps	Transportation - Diesel
2270006015	Off-highway Diesel /Commercial Equipt /Air Compressors	Transportation - Diesel
2270006025	Off-highway Diesel /Commercial Equipt /Welders	Transportation - Diesel
2270006030	Off-highway Diesel /Commercial Equipt /Pressure Washers	Transportation - Diesel

SCC	SCC Description	Surrogate Assignment
2270006035	Off-highway Diesel /Commercial Equipt /Hydro-power Units	Transportation - Diesel
2270007015	Off-highway Diesel /Logging Equipt /Forest Equipt - Feller/Bunch/Skidder	Transportation - Diesel
2270007020	Off-highway Diesel /Logging Equipt /Fellers/Bunchers	Transportation - Diesel
2270008005	Airport Ground Support Equipment, Diesel	Transportation - Diesel
2270009010	Off-highway Diesel /Underground Mining Equipt /Other Underground Mining Equipt	Transportation - Diesel
2270010010	Off-highway Diesel /Industrial Equipt /Other Oil Field Equipt	Transportation - Diesel
2275001000	Aircraft /Military Aircraft /Total	Transportation - Aviation Fuel
2275020000	Aircraft /Commercial Aircraft /Total: All Types	Transportation - Aviation Fuel
2275050000	Aircraft /General Aviation /Total	Transportation - Aviation Fuel
2275060000	Aircraft /Air Taxi /Total	Transportation - Aviation Fuel
2280002010	Marine Vessels, Commercial /Diesel /Ocean-going Vessels	Transportation - Diesel
2280002020	Marine Vessels, Commercial /Diesel /Harbor Vessels	Transportation - Diesel
2280002030	Marine Vessels, Commercial /Diesel /Fishing Vessels	Transportation - Diesel
2280002100	Marine Vessels, Commercial /Diesel /Port emissions	Transportation - Diesel
2280003010	Marine Vessels, Commercial /Residual /Ocean-going Vessels	Transportation - Diesel
2280003030	Marine Vessels, Commercial /Residual /Fishing Vessels	Transportation - Diesel
2282005010	Pleasure Craft /Gasoline 2-Stroke /Outboard	Transportation - Gasoline
2282005015	Pleasure Craft /Gasoline 2-Stroke /Personal Water Craft	Transportation - Gasoline
2282010005	Pleasure Craft /Gasoline 4-Stroke /Inboard/Sterndrive	Transportation - Gasoline
2282020005	Pleasure Craft /Diesel /Inboard/Sterndrive	Transportation - Diesel
2282020010	Pleasure Craft /Diesel /Outboard	Transportation - Diesel
2282020020	Pleasure Craft /Diesel /Sailboat Auxiliary Inboard	Transportation - Diesel
2285002005	Railroad Equipt /Diesel /Line Haul Locomotives (use subdivisions by class/operation)	Transportation - Diesel
2285002008	Railroad Equipment /Diesel /Line Haul Locomotives: Passenger Trains (Amtrak)	Transportation - Diesel
2285002010	Railroad Equipment /Diesel /Yard Locomotives	Transportation - Diesel
2285002015	Railroad Equipt /Diesel /Railway Maintenance	Transportation - Diesel
2285003015	Railroad Equipt /Gasoline, 2-Stroke /Railway Maintenance	Transportation - Gasoline
2285004015	Railroad Equipt /Gasoline, 4-Stroke /Railway Maintenance	Transportation - Gasoline

Appendix N
Canada Nonroad Mobile Source Projection Factors

Canada Nonroad Mobile Source Projection Factors

Province Code	Province Name	Surrogate Assignment	2011 Projection Factor	2017 Projection Factor
59000	British Columbia	Transportation - Aviation Fuel	1.1011	1.2055
48000	Alberta	Transportation - Aviation Fuel	1.0692	1.2161
47000	Saskatchewan	Transportation - Aviation Fuel	0.8056	0.8611
46000	Manitoba	Transportation - Aviation Fuel	0.9783	1.0435
24000	Quebec	Transportation - Aviation Fuel	1.0899	1.1561
35000	Ontario	Transportation - Aviation Fuel	1.0861	1.1887
13000	New Brunswick	Transportation - Aviation Fuel	0.9545	1.0000
59000	British Columbia	Transportation - Diesel	0.9592	1.0784
48000	Alberta	Transportation - Diesel	1.0170	1.3645
47000	Saskatchewan	Transportation - Diesel	1.0019	1.0357
46000	Manitoba	Transportation - Diesel	1.0370	1.1481
24000	Quebec	Transportation - Diesel	1.1053	1.1673
35000	Ontario	Transportation - Diesel	0.9978	1.0666
13000	New Brunswick	Transportation - Diesel	1.3308	1.3500
59000	British Columbia	Transportation - Gasoline	1.0304	0.9193
48000	Alberta	Transportation - Gasoline	1.0862	1.1729
47000	Saskatchewan	Transportation - Gasoline	1.0440	0.9327
46000	Manitoba	Transportation - Gasoline	0.9851	0.8763
24000	Quebec	Transportation - Gasoline	1.0112	0.8955
35000	Ontario	Transportation - Gasoline	0.9841	0.9381
13000	New Brunswick	Transportation - Gasoline	1.1926	1.0567
59000	British Columbia	Transportation - LPG	0.9375	0.9063
48000	Alberta	Transportation - LPG	1.0000	0.4615
47000	Saskatchewan	Transportation - LPG	0.5000	0.5000
46000	Manitoba	Transportation - LPG	1.0000	0.5000
24000	Quebec	Transportation - LPG	1.0000	0.8000
35000	Ontario	Transportation - LPG	1.1930	1.0175
13000	New Brunswick	Transportation - LPG	1.0000	1.0000
59000	British Columbia	Transportation - Natural Gas	2.0000	15.0000
48000	Alberta	Transportation - Natural Gas	3.0000	36.0000
47000	Saskatchewan	Transportation - Natural Gas	1.0000	1.0000
46000	Manitoba	Transportation - Natural Gas	1.0000	1.0000
24000	Quebec	Transportation - Natural Gas	1.0000	1.0000
35000	Ontario	Transportation - Natural Gas	0.5000	1.8571
13000	New Brunswick	Transportation - Natural Gas	1.0000	1.0000

Appendix O
Development of On-Road Emission Inventories for Mexico and Canada Portions of MAG Air Quality Modeling Domain

1.0 General MOVES Model Approach

The first step in applying MOVES to Mexico and Canada was to determine the appropriate MOVES run strategy. There are multiple ways to customize MOVES to local conditions. For U.S. use, MOVES provides a default database which enables estimation of on-road emissions to significant detail (i.e., by vehicle class, fuel type, road type and model year) for all 3,222 counties in the U.S., for all calendar years including 1990 and 1999 through 2050. To accomplish this requires a massive underlying database with model inputs for vehicle activity, population, meteorology, fuel properties, road characteristics, projection factors and emission rates. Default results are generated when the National Scale is selected in MOVES, and rely heavily on a "top down" allocation approach, where national totals of vehicle population and activity are allocated to individual U.S. counties based on available county-level surrogates. As an alternative to the default National Scale approach, MOVES also provides the County Scale feature to allow users to improve estimates in a "bottom-up" fashion, allowing customization of many of these elements through data importers. When County Scale is selected, MOVES supplies a template for users to provide data directly at the county level (the County Data Manager). This feature is relied on for development of the U.S. National Emissions Inventory and modeling uses required in the U.S. Clean Air Act, such as State Implementation Plan (SIP) inventories and transportation conformity analyses.

Customizing MOVES to Mexico and Canada could therefore be done following either the National or County Scale approaches. The main consideration was the level of detailed data available for adapting to either country. The MOVES County Scale requires information such as vehicle population, vehicle miles travelled, etc. to be provided at the level of geographic detail being modeled. This approach was developed focused on local inventories, where detailed data is more likely to be available. U.S. EPA does, in fact, use County Scale for the U.S. NEI, but even for this application local data are not available for many U.S. counties, requiring use of national defaults for around half of the counties in the U.S.[1]

An assessment of potential data sources in Mexico and Canada found that detailed information necessary to calculate emission inventories at the County Scale, as done for the U.S., are not available. Several data sources were identified at more aggregate levels of detail, however. ERG decided that developing a national default database for both countries would therefore be preferable, because: a) National Scale is more amenable to the available data in

[1]U.S. EPA 2011 National Emissions Inventory http://www.epa.gov/ttnchie1/net/2011inventory.html

Mexico and Canada; and b) once developed, a national default database provides means to estimate emissions in each Mexican municipality (or state) and Canadian province, for multiple years.

In general, to develop a national default database for Mexico and Canada required:

- domain-wide totals of vehicle fleet and activity inputs such as populations, kilometers travelled, age distribution and speeds;
- factors to allocate vehicle population and activity to the Mexican municipality and Canadian province levels;
- localized data on meteorology, fuels and vehicle inspection/maintenance; and
- for Mexico, updated emission rate database to reflect significant differences between U.S. and Mexican vehicle standards.

Sections 2.0 and 3.0 discuss how ERG developed each input for Mexico and Canada, respectively.

2.0 Development of Inventories for Mexico

ERG worked with consultant Verónica Garibay-Bravo to obtain data for developing Mexico-specific inputs. Ms. Garibay-Bravo worked closely with representatives from INECC to obtain underlying data used in Mexico's most recent National Emissions Inventory, and provide to ERG for use in MOVES. The specific data and sources are discussed in Section 2.1. Section 2.2 then discusses the specific MOVES tables updated to reflect the Mexico data, and any analysis required of the source data to prepare it for MOVES. In some cases, sufficient data for Mexico were not available, so U.S. defaults were used. Note, vehicle miles traveled (VMT) and vehicle kilometers traveled (VKT) are used interchangeably in this section, though MOVES requires VMT as input.

2.1 Data Sources

On-road motor vehicle activity data sources in Mexico are scarce compared to the U.S. Although several data sources are available pertaining to vehicle emissions, vehicle population and VKT, they are frequently inconsistent or based on outdated information. Also, most fuel quality and sales data are not publicly available. Recently, however, several studies have been carried out mostly by the National Institute of Ecology and Climate Change (INECC), the

National Institute of Geography and Statistics (INEGI), the National Population Council and the state-owned fuels company (PEMEX) to overcome these limitations. Although most of the information generated in these studies has not yet been published, we were able to access internal reports and spreadsheets through direct communication with INECC staff, who shared the databases used in their most recent mobile source emission estimates for 2013. Hence, unless otherwise noted, the following information was provided directly by INECC.[2]

2.1.1 Vehicle Population and Age Distribution

In Mexico, vehicle registration is carried out by state authorities, requiring different formats and level of detail, tailored to their particular needs. Usually, local authorities add new vehicles to the registry every year but rarely remove vehicles that are no longer in use. According to Mexican emission inventory experts, this has historically led to an overestimation of the vehicle fleet in emissions inventories. To avoid this, we used INECC estimates of vehicle population and age distribution instead of vehicle registration. These are considered more realistic since INECC derived retirement rates from several field studies carried out between 2007 and 2012 by INECC and the Mexican Petroleum Institute (IMP). INECC applied these retirement rates to historical state-level vehicle sales provided by the automotive industry, resulting in adjusted vehicle population at the state level. Imported used vehicle registries from the Mexican Treasury and Customs Authority (*Secretaría de Hacienda y Crédito Público* - SHCP) were also used to add these vehicles and obtain total population by age and vehicle type. These estimates were used for a recent 2013 emissions estimate developed by INECC.

2.1.2 Vehicle Kilometers Traveled (VKT)

Inventories in Mexico had traditionally used one average VKT number for the whole country based on a limited number of surveys performed in Mexico City, or on a travel demand modeling (TDM) exercise carried out for seven representative cities for the 1999 Mexico NEI. For the MAG inventory, we used data from surveys conducted by INECC between 2007 and 2011 in 20 cities, from which average national-level VKT by vehicle age and vehicle type (light, medium and heavy duty) were derived. These estimates were also used in the most recent 2013 emissions estimates.

[2]Personal Communications with José Andrés Aguilar-Gómez, Deputy Director for Emission Inventories and Air Quality Modeling, INECC (andres.aguilar@inecc.gob.mx).

2.1.3 Road Network

Road type distribution was taken from the National Institute of Geography and Statistics (INEGI) website.[3] GIS-based downloadable files include detailed, city-level data of the road network to 2011. We used these files and a technical report to harmonize INEGI's road types to those used in MOVES.[4] Significant analysis and processing these data were done to produce road type distributions by municipality, as described in Section 2.2.

2.1.4 Fuels

In Mexico, fuels are distributed and sold by a single, state-owned company (PEMEX). Gasoline and diesel sales are publicly available from PEMEX website but only at the state level. However, through INECC, we obtained fuel sales at the municipality level provided by PEMEX, for 2013. Since fuel quality certificates are not publicly available, we used the specifications in the current fuel quality standard as a reference. Actual sulfur concentrations in fuels, however, differ from the standard. We relied on expert opinion from INECC as to which municipalities have access to low-sulfur fuels.

2.1.5 Inspection/Maintenance Programs

Inspection/maintenance (I/M) programs in Mexico are managed by state or even local environmental authorities; however, these are enforced only in a limited number of cities. For example, the I/M program in Mexico City has tighter controls and more stringent conditions than those in other cities, but some cities adjacent to the Mexico City Metropolitan Area have adopted these conditions to avoid transit restrictions. The Federal environmental authority (SEMARNAT) compiles compliance data from all states in Mexico periodically. We used the latest internal status report (2012) provided by INECC, with information gathered by SEMARNAT, focused on this work for I/M areas within the MAG domain.

[3]Conjunto de Datos Vectoriales de Carreteras y Vialidades Urbanas Edición 1.0 (Distribución por Entidad Federativa). Sistema de consulta. INEGI. http://www.inegi.org.mx/geo/contenidos/topografia/vectoriales_carreteras.aspx, accessed June 12, 2015.

[4]Diccionaro de datos de localidades urbanas. pdf, INEGI. http://www.inegi.org.mx/geo/contenidos/urbana/doc/diccionario_datos_localidades_urbanas_ver_definitiva_septiembre07.pdf, accessed May 26, 2015.

2.1.6 Mexico Emission Standards

INECC provided information on Mexico vehicle standards relative to U.S. standards for light vehicles and heavy-duty trucks, summarized in Table 1. Overall, Mexican vehicle emission standards are outdated compared to U.S. standards. For light duty vehicles, current Mexican specifications (known as NOM42) were partially adapted from a combination of Tier 1 and Tier 2 Bins 5 through 9 EPA limit values, with a 50,000 mile durability. European Euro 4 certificates are also accepted. Emissions from medium duty vehicles are not currently regulated in Mexico. Heavy-duty gas and diesel vehicles are regulated based on NOM 76 and NOM 44, respectively; a primary difference being that Mexico has yet to implement the low NO_x and PM diesel standards implanted in the U.S. beginning in 2007.

According to the International Council on Clean Transportation (ICCT), based on analysis of 2012 model year data, a significant proportion of new cars and light trucks in Mexico comply with more stringent US emission standards.[5] This suggests that light-duty vehicle emissions may be lower than required (i.e., overcompliance). However, data on potential overcompliance were not available for enough years to account for this effect over time. As discussed in Section 2.3., for this work we used the "on-the-book" NOM regulations in Mexico to develop Mexico-specific emission rates, without accounting for overcompliance. This is considered a conservative first step in developing Mexico-specific emission rates.

[5]ICCT & INECC, "Market Analysis of New Light-Duty Vehicles Sales in Mexico and Comparison to U.S. Market" Presentation April 2015

Table 1. Mexico Vehicle Standard Information Provided by INECC

<table>
<tr><th>Cars & Light Trucks (NOM 42)</th><th>Heavy Duty Trucks & Buses (NOM 44 & 76)</th></tr>
<tr><td>
MY 1990 and older: No aftertreatment, no fuel injection to carburetor.
MY 1991-1992: 2- and 3-way catalytic converters
MY 1993-2005: U.S. Tier 0 Emission limits at 0 km (no durability requirements).
MY 1999-2005: U.S. Tier 0 Emission limits at 0 km, no OBD required.
MY 2007-2009: Emission limits at 80,000 km and OBD requirements. Phase-in – 2007, 25%; 2008, 50%; 2009, 75%.
MY 2007-2009: U.S. Tier1 emission limits for PM; U.S. Tier 2 Bin 10 limits for NO_x (Euro 3 accepted). Phase-in – 2007, 25%; 2008, 50%; 2009, 75%; 2010, 75%; 2011, 50%; 2012, 30%.
MY 2010 onwards. U.S. Tier 1 emission limits for PM and U.S. Tier 2 Bin 7 limits for NO_x. Euro 4 also accepted. Phase-in –2010, 25%; 2011, 50%; 2012, 70%; 2013, 100%.

Although the regulation does not consider full Tier 2 standards (mainly due to fuel quality), it is reasonable to suppose there Tier 2 vehicles are currently being sold in Mexico, due to the high integration between Mexican manufacturers in the U.S. market.
</td><td>
<u>Diesel (NOM 44)</u>
MY 1993 and older: No control
MY 1994-1997: same as U.S.
MY 1998-2008: U.S. 1998 (or similar Euro)
MY 2009 onwards: U.S. 2004 (or similar Euro)

Timeline of Mexico and EPA/Euro standards
<table>
<tr><th></th><th>Standard</th><th>Year</th><th>Required in Mexico</th></tr>
<tr><td rowspan="6">U.S.</td><td>EPA 1991</td><td>1991</td><td>1993</td></tr>
<tr><td>EPA 1994</td><td>1994</td><td>1994</td></tr>
<tr><td>EPA 1998</td><td>1998</td><td>1998</td></tr>
<tr><td>EPA 2004</td><td>2002</td><td>2008</td></tr>
<tr><td>EPA 2007</td><td>2007</td><td>Not considered in Mexican regulations</td></tr>
<tr><td>EPA 2010</td><td>2010</td><td>Proposed phase-in starting 2018.</td></tr>
<tr><td rowspan="6">Europe</td><td>EURO I</td><td>1992</td><td>Not sold in Mexico</td></tr>
<tr><td>EURO II</td><td>1996</td><td>Not sold in Mexico</td></tr>
<tr><td>EURO III</td><td>2000</td><td>2006</td></tr>
<tr><td>EURO IV</td><td>2005</td><td>2008</td></tr>
<tr><td>EURO V</td><td></td><td>Not considered in current Mexican regulations</td></tr>
<tr><td>EURO VI</td><td>2013</td><td>Proposed phase-in starting 2018.</td></tr>
</table>
<u>Gas (NOM 76)</u>
MY 1997 and older: No Control
MY 1998 onwards: NOM 076 “A” (Comparable to U.S. Tier 1 HD Gas Standards)

Emissions from medium duty vehicles are not currently regulated in Mexico. However, since manufacturers have to comply with U.S. and European regulations for these vehicles, it is reasonable to assume that they comply in a similar way as the light duty vehicles.
</td></tr>
</table>

2.1.7 Human Population

Current population was taken from 2010 census counts at the municipality level performed by INEGI and available on their website, projected population data were downloaded from the National Population Council (CONAPO) website.[6,7]

2.1.8 Meteorology

Temperature data for 2011 were used for both the 2011 and 2017 runs. State-average maximum and minimum temperatures by year and month are published by the Comisión Nacional Del Agua (CONAGUA) Servicio Meteorológico Nacional (SMN).[8] Hourly temperatures and/or humidity data were not available at this level of coverage; temperature and humidity information is available for individual weather stations across Mexico, but due to concern with coverage and the level of effort necessary to convert these to municipality-specific meteorology, these were not pursued. Instead, as discussed in Section 2.2, an approach developed by EPA to convert min/max temperatures to hourly diurnal profiles was used to generate hour temperatures by state, that were then applied to each municipality in a state. Monthly diurnal profiles of relative humidity were assigned to Mexico using MOVES data from the U.S. border states.

2.2 Updates to MOVES Database Tables

The data sources outlined in Section 2.1 were processed, in some cases with additional analysis, into the format needed by MOVES. The MOVES database is a relational database with dozens of underlying, linked tables providing the model with information on the geography, vehicle fleet, activity, fuels, meteorology and emissions required to produce emission inventories specified in the run specification file, along with necessary information files. Only a subset of 22 tables were updated for Mexico, based on a) Mexico fleet, activity, meteorology and fuel data discussed in Section 2.1; b) informational tables needed to update U.S. counties

[6]Población total con estimación en 2010 según tamaño localidad 2 tam - total. Sistema de consulta. Sistema Estatal y Municipal de Base de Datos. http://sc.inegi.org.mx/cobdem/resultados.jsp?w=24&Backidhecho=199&Backconstem=198&constembd=199&tm='Backidhecho:3,Backconstem:3,constembd:3', accessed May 26, 2015.

[7]Estimaciones y proyecciones de la población por entidad federativa. Archivo. Datos de proyecciones. http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos, accessed May 26, 2015.

[8]CONAGUA http://smn.cna.gob.mx/index.php?option=com_content&view=article&id=12&Itemid=77

and states to Mexico municipalities and states; and c) the need to adapt MOVES emission rates to Mexico emission standards. Table 2 provides a list of MOVES tables updated for Mexico. All other MOVES tables were left as in the U.S. default database.

Table 2. MOVES Database Tables Updated for MAG Mexico Runs

MOVES-Mexico Database Table Name	Purpose/Description
County	List of municipalities in Mexico.
State	List of states in Mexico.
CountyYear	Stage II refueling program efficiency.
FuelUsageFraction	E85 usage for flex fuel vehicles.
IMCoverage	Inspection and maintenance program description and coverage.
Link	Enables county-specific emissions output in an inventory run.
RegionCounty	Assignment of each county to a fuel region.
Zone	Allocation of the off-network activity from nationwide to municipality.
ZoneMonthHour	Diurnal temperature and relative humidity profiles for each month of year.
ZoneRoadType	Allocation of the on-network activity from nationwide to municipality. On-network activity includes source hours operating, which is how VMT gets allocated to each municipality.
HPMSVTypeYear	Nationwide VMT, annual total, by HPMS vehicle classification.
SourceTypeYear	Nationwide vehicle population by source use type classification.
SourceTypeAgeDistribution	Average fleet age distributions, MAG-domain average. Also two external table versions (1) border and (2) non-border.
AVFT	Gasoline/diesel relative fractions, for each source use type and vehicle model year.
RoadTypeDistribution	Distribution of VMT to road types.
FuelSupply	Assigns specific fuels to each fuel region, by month and calendar year.
FuelFormulation	Parameters for every fuel (e.g., sulfur level and vapor pressure).
MonthVMTFraction	Allocates annual VMT to the twelve months of year.
EmissionRateByAge	Base emission rates by age, model year group, regulatory class, fuel type, pollutant, emission process, and operating mode
CumTVVCoeffs	Coefficients used by MOVES to calculate tank vapor venting

The following sections include a description of how each of these tables were updated.

2.2.1 County

The County table was updated to list all municipalities in Mexico by 4- or 5-digit county code. Although the emission inventories for MAG are limited to municipalities fully or partially in the modeling domain, the database was populated with all municipalities so that the top-down allocation approach used by MOVES national scale worked correctly. The table also

contains a binary altitude description of low or high (L or H), barometric pressure, and geographic phase-in area fractions (GPA does not apply in Mexico). Altitude was set to low (L) everywhere in Mexico, barometric pressure was set to the mean value of the low altitude counties in U.S.

2.2.2 State

The State table was updated to include all states in Mexico, by 1- or 2-digit integer code. The MAG inventories are limited to states covered in the modeling domain, listed in Table 3 below.

Table 3. Mexico States in MAG Domain

stateID	stateName	stateAbbr
1	Aguascalientes	AG
2	Baja California	BC
3	Baja California Sur	BS
4	Campeche	CM
5	Coahuila	CO
8	Chihuahua	CH
10	Durango	DG
14	Jalisco	JA
18	Nayarit	NA
19	Nuevo León	NL
23	Quintana Roo	QR
24	San Luis Potosí	SL
25	Sinaloa	SI
26	Sonora	SO
28	Tamaulipas	TM
30	Veracruz	VE
31	Yucatán	YU
32	Zacatecas	ZA

2.2.3 CountyYear

The CountyYear table contains fractions representing the efficiency of Stage II refueling control programs for each county and year. Stage II refueling emissions are hydrocarbon emissions during gasoline refueling at service stations from either the pump dispenser itself (spillage losses) or the vehicle tank (vapor displacement losses). Control programs reduce these hydrocarbon emissions. However, refueling in the MAG inventories came from area source

emission inventory, and did not come out of MOVES. This table was a structural update only to include all Mexican municipality codes that exist in Mexico.

2.2.4 FuelUsageFraction

The FuelUsageFraction table allows the user to specify relative fractions of gasoline versus E85 use in flex-fuel vehicles by county and calendar year. All E85 was turned off for Mexico. This table also was also updated to include all Mexican municipality codes.

2.2.5 IMCoverage

The IMCoverage table defines specifics of vehicle inspection/maintenance (I/M) programs by municipality. I/M progams in Mexico are mostly idle tests, although some dynamometer testing is done in the state of Baja California. To reflect idle testing, we selected the Two-Speed Idle (TSI) test to represent the IM tests labeled as "static" and the Accelerated Simulation Mode (ASM) to represent those labeled as "dynamometer" in the raw data. The remainder of fields were populated using the local I/M program data discussed in Section 2.1.

Additional analysis was performed to calculate compliance factors for Mexico's I/M programs. The compliance factor determines the portion of the passenger cars and light truck fleet that actually receive the emissions benefit of a particular I/M test. The compliance factors were calculated as the ratio of the number of vehicles tested to the total light-duty gasoline population. For areas that had I/M, the average compliance was 45%. The minimum compliance factor was only 3% (in Mérida, Yucatán) because only official vehicles are subject to I/M in that city.

There was no Mexico data available on grace period or other exempted model years, so we adopted those particular parameters from the U.S. database.

2.2.6 Link

The Link table is informational to define county and roadtype pairs, and was only updated for the purpose of this work to include all the Mexican municipality codes.

2.2.7 RegionCounty

The RegionCounty table assigns each municipality to a fuel region. Source data on fuel formulations discussed in Section 3.1 specified differences in sulfur, RVP, and oxygenate use by municipality, depending on whether it was located (1) inside or outside a metropolitan area, (2) in a border or non-border state, and (3) RVP regions. This unique combination of metropolitan area, border state, and RVP region resulted in six fuel regions in Mexico, shown in Table 4:

Table 4. Fuel Regions Defined for Mexico

Fuel Region	Metropolitan Area	Border State	Volatility Group
1	No	No	2
2	Yes	Yes	2
3	No	Yes	1
4	No	No	3
5	No	No	1
6	Yes	Yes	1

Diesel sulfur content is 15 ppm in border states and metropolitan areas and is 500 ppm elsewhere. Gasoline sulfur content is 30 ppm in metropolitan areas; and a mix of 30 ppm and 300 ppm sulfur fuel elsewhere. However, due to complication attempting to adjust sulfur effects in MOVES, we ended up running the entire domain at 30ppm sulfur. This was considered a better alternative than applying very high U.S.-specific gasoline sulfur correction factors for advanced technology vehicles to the majority of older technology gasoline vehicles in Mexico that did not merit the adjustment.

Volatility group refers to Reid Vapor Pressure (RVP) of gasoline. RVP requirements vary by month and region in Mexico. From Table 4 above:

- Volatility Group 1 has the least stringent RVP restriction
  - 69 kPa (10 psi) March to October
  - 79 kPa (11.5 psi) January-February and November-December
  - Covers the Monterrey metropolitan area and the states of Nuevo León, Chihuahua, Durango, Coahuila, Tamaulipas, San Luis Potosí
- Volatility Group 2 – moderately stringent RVP restriction
  - 62 kPa (9 psi) June-August
  - 69 kPa (10 psi) Mar-May and Sep-Oct
  - 79 kPa (11.5 psi) Jan-Feb and Nov-Dec

- Covers the states Aguascalientes, Jalisco, Guanajuato, Michoacán, Zacatecas, Morelos, Tlaxcala, México, Distrito Federal, Hidalgo, Querétaro, Veracruz, Campeche, Puebla, Tabasco, Yucatán, Quintana Roo, Baja California, Baja California Sur, Sonora, Sinaloa, Nayarit, Colima, Guerrero, Oaxaca, and Chiapas.

o Volatility Group 3 – most stringent RVP restriction
  - 54 kPa (7.8 psi) year-round
  - Mexico City and Guadalajara metropolitan areas

2.2.8 Zone

The Zone table allocates off-network activity (related to the emission processes of start, evaporative and extended idle emissions) from nation to Mexico municipality. The activity allocated for off-network activity includes number of vehicle starts, source hours parked (SHP), and source hours idling (SHI). However, we did not include extended idling emissions in MAG inventories because this activity was deemed significantly smaller in Mexico than in the U.S.

The starts allocation was created using surrogates using surrogates, as follows:

1. National to State based on relative state-level vehicle population data
2. State to County based on relative county-level human population within each state

The SHP allocations were created by calculating SHP at the state level outside of MOVES to force the resulting MOVES-allocated vehicle population to match state totals in the source data discussed in Section 2.1. The equation for this calculation was Target_Population – SHO = SHP. The SHP was then normalized at the state level to create fractions that summed to one (1) over state, which were then subsequently further subdivided into municipalities using relative human population by municipality within each state. Start and Park allocations are shown below in Table 6, along with running allocations discussion in the ZoneRoadType table.

2.2.9 ZoneMonthHour

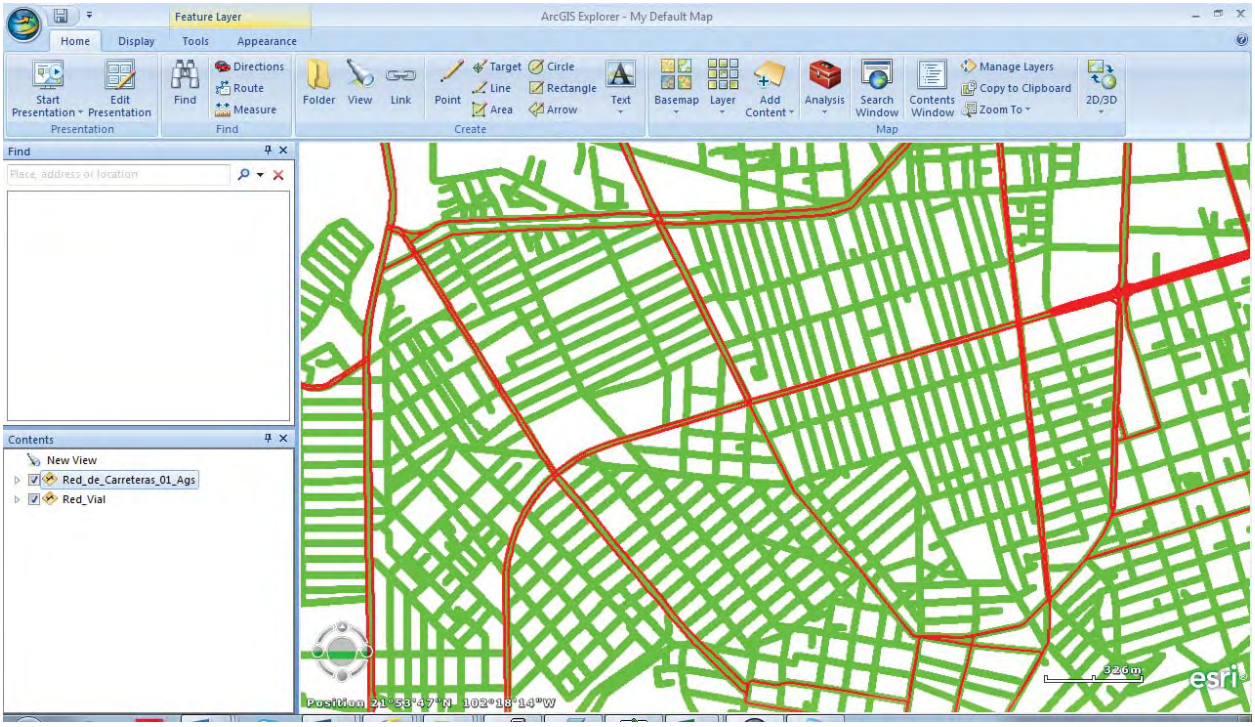
The ZoneMonthHour tables contains temperature and humidity data for each municipality, by month and hour of the the day. For the MAG runs, state-level averages where applied to each municipality in the state. 2011 min/max temperatures for each state and month

from CONAGUA were run through the EPA's temperature profile generator [cite] to estimate hourly temperatures. Since no average humidity data were available for Mexico, 30-year average data contained in the U.S. MOVES default database (calculated an average RH hourly profile over the four U.S. border states of Arizona, New Mexico, Texas, and California) were applied to all of Mexico.

2.2.10 ZoneRoadType

The ZoneRoadType table contains allocations that distribute national total VMT to municipalities, separately by road type. The allocation from nation to state reflect relative VKT at the state level based on 2013 state-level vehicle populations and VKT data discussed in Section 2.1. However, there was no VKT information available at the municipality or state levels, so we used a surrogate of roadway distance from a GIS dataset where the roadway network included distinction by roadway type. The primary data used were state-level GIS shapefiles of lane-meters of roadway by a Mexico road type classification from INEGI, discussed in Section 2.2. The detail of Mexico road type allowed us to determine the mix of Unrestricted Access vs. Restricted. A sample view of GIS shapefile of the roadway network in state of Aguascalientes is shown in Figure 1 below:

Figure 1. Sample Road Network GIS Shapefile from INEGI



Using the GIS roadway data we performed a GIS intersection analysis to determine which links were located in each municipality and totaled their lane-meters (total roadway capacity) accordingly. Road types from the GIS dataset were mapped to either "Restricted Access" or "Unrestricted Access" MOVES definitions, as shown in Table 5, based on road definitions from INEGI.[9,10]

Table 5. Road Type Mapping

GIS Roadtype	MOVES
ANDADOR (PEDESTRIAN)	---
AVENIDA	UNRESTRICTED
BOULEVARD	RESTRICTED
CALZADA	UNRESTRICTED
CALLE	UNRESTRICTED
AMPLIACION	UNRESTRICTED
CALLEJON*	UNRESTRICTED
CERRADA*	UNRESTRICTED
CIRCUITO	RESTRICTED
CIRCUNVALACION	UNRESTRICTED
CONTINUACION	UNRESTRICTED
CORREDOR	UNRESTRICTED
DIAGONAL	UNRESTRICTED
EJE VIAL	UNRESTRICTED
PASAJE (PEDESTRIAN)	---
PEATONAL (PEDESTRIAN)	---
PERIFERICO	RESTRICTED
PRIVADA*	UNRESTRICTED
PROLONGACION	UNRESTRICTED
RETORNO	UNRESTRICTED
VIADUCTO	RESTRICTED
CARRETERA	RESTRICTED

*PRIVADA, CALLEJÓN, CERRADA: These are very narrow roads or backstreets, with fewer, very slow traffic. Mostly destined for limited access to houses.

The INEGI road network did not provide any information on rural vs. urban split. We therefore conducted an analysis to develop a relationship between urban/rural split and

[9]INEGI, 2007. Diccionario de datos de localidades urbanas. Available at: http://www.inegi.org.mx/geo/contenidos/urbana/default.aspx?_file=/geo/contenidos/urbana/doc/diccionario_datos_localidades_urbanas_ver_definitiva_septiembre07.pdf. Downloaded: 06/12/2015

[10]INEGI, 2011. Documento técnico descriptivo – Conjunto de datos vectoriales de carreteras y vialidades. Edición 1.0. Available at: http://www.inegi.org.mx/geo/contenidos/topografia/default.aspx . Downloaded: 06/12/2015

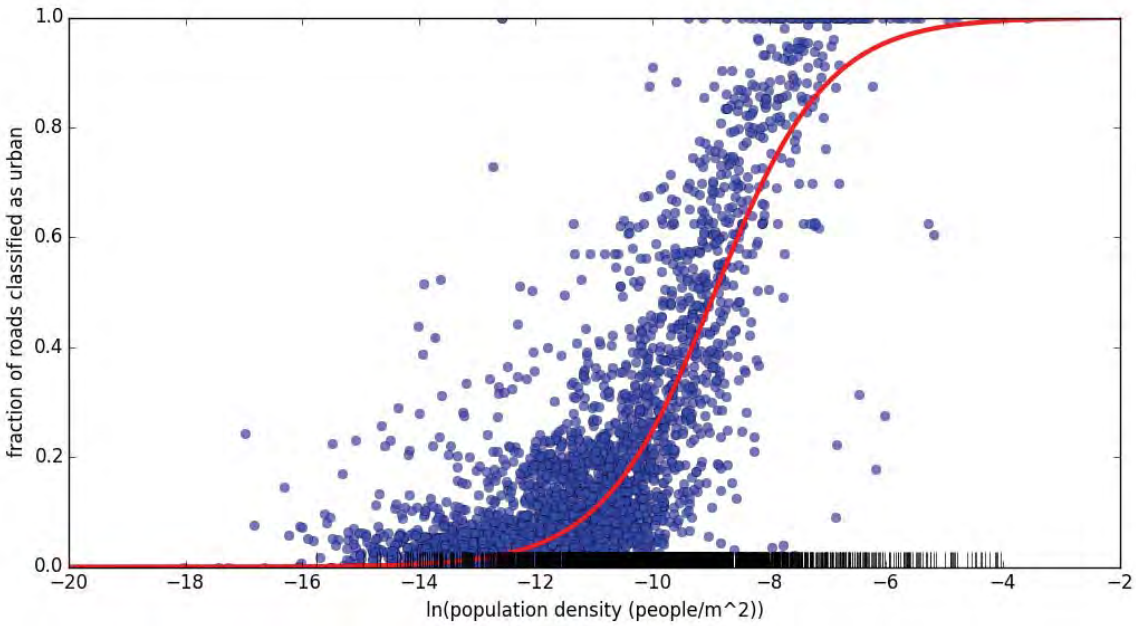
population density, based on MOVES default road distribution by county and U.S. county population density data from the U.S. Census. For this analysis, we obtained U.S. county population and land area data from the U.S. Census Bureau, respectively.[11] We determined the fraction of roads that are urban using data from the default MOVES 2014 database. We obtained population densities and fractions of unrestricted and restricted lane miles for the municipalities.[12]

Generation of the primary categories in the *roadTypeDistribution* table (i.e., fractions of urban restricted, urban unrestricted, rural restricted, and rural unrestricted road types) required an estimate of both the fraction of roads classified as urban and the number of restricted and unrestricted lane miles. Direct information on urban fraction in the Mexican municipalities was unavailable, so we used data from U.S. counties to derive a relationship between population density and urban fraction. Population and land area data were obtained from the U.S. Census Bureau, as described in Data Sources above; from these, population density can be calculated. The urban fractions for U.S. counties were calculated using the *zoneRoadType* and *roadTypeDistribution* tables from MOVES 2014. The relationship between urban fraction and population density was satisfactorily captured by a logistic function (Figure 2). Using this best-fit line, we estimated urban fractions for the municipalities based on their population densities. To determine the fraction of restricted and unrestricted lane miles, we extracted total urban and restricted lane miles from the INEGI GIS dat. Using the product of the urban (rural) fraction and the unrestricted (restricted) lane miles, normalized by total lane miles, we then calculated the *roadTypeVMTFraction* for each road type and applied this to all *sourceTypeIDs*.

[11]U.S. Census Bureau http://www.census.gov/popest/data/counties/totals/2014/CO-EST2014-01.html and http://www.census.gov/geo/maps-data/data/gazetteer2014.html

[12] CENSO NACIONAL DE POBLACIÓN Y VIVIENDA, 2010.INEGI: Sistema Estatal y Municipal de Datos (SIMBAD). http://sc.inegi.org.mx/cobdem/ Downloaded: 5/26/2015 POPULATION FROM NATIONAL CENSUS, by municipality 2010

Figure 2. U.S. Population Density vs. Urban Fraction



After assigning urban road fractions to each municipality, the lane-meters by municipality from the GIS analysis were multiplied by urban fractions and (rural fractions, as 1 – urban) to result in the surrogate of total roadway distance by the four MOVES road types for each municipality. The total roadway distances were normalized by MOVES road type, to fit the format of the ZoneRoadType table. The state level VKT determined part of the allocations from national to state, but the GIS and population density analysis drive the allocation from state to municipality. Shown in Table 6 are the aggregated state-level allocations for roadways (SHO), along with allocations for starts and park discussed in 2.2.8.

Table 6. Allocation Factors by Mexican State

State	Running (SHO)	Start	Park (SHP)
Aguascalientes	0.013	0.013	0.012
Baja California	0.047	0.047	0.042
Baja California Sur	0.012	0.012	0.011
Campeche	0.007	0.007	0.005
Coahuila	0.027	0.027	0.026
Colima	0.008	0.008	0.007
Chiapas	0.016	0.016	0.013
Chihuahua	0.048	0.048	0.045
Distrito Federal	0.133	0.133	0.132

State	Running (SHO)	Start	Park (SHP)
Durango	0.015	0.015	0.014
Guanajuato	0.041	0.041	0.043
Guerrero	0.021	0.021	0.022
Hidalgo	0.024	0.024	0.025
Jalisco	0.088	0.088	0.092
México	0.076	0.076	0.078
Michoacán	0.047	0.047	0.049
Morelos	0.014	0.014	0.015
Nayarit	0.010	0.010	0.010
Nuevo León	0.059	0.059	0.061
Oaxaca	0.019	0.013	0.014
Puebla	0.030	0.036	0.037
Querétaro	0.013	0.013	0.013
Quintana Roo	0.010	0.010	0.010
San Luis Potosí	0.024	0.024	0.024
Sinaloa	0.029	0.029	0.030
Sonora	0.029	0.029	0.030
Tabasco	0.013	0.013	0.013
Tamaulipas	0.041	0.041	0.042
Tlaxcala	0.006	0.006	0.006
Veracruz	0.045	0.045	0.046
Yucatán	0.015	0.015	0.015
Zacatecas	0.018	0.018	0.019

2.2.11 HPMSVTypeYear

This table contains annual, nationwide total vehicle miles traveled (VMT), by calendar year and Highway Performance Monitoring System (HPMS) vehicle groups. Source data included: (1) 2013 state-level vehicle population discussed in Section 2.1, (2) 2013 national VKT per vehicle per year, and (3) fuel projections. National vehicle populations were calculated by using per-vehicle VMT from Section 2.1, converting Mexico vehicle classes to MOVES source use types using methods described for the SourceTypeYear table, then finally aggregated over source types to arrive at HPMS groups. The 2013 VMT was then back-casted to 2011 and projected to 2017 using domestic fuel sales projections. Totals for the MAG domain only are shown in Table 7.

Table 7. Annual Mexico MAG Domain VMT Estimates by Source Type in 2011 and 2017

Source Type	MAG Domain 2011 VMT	MAG Domain 2017 VMT
Motorcycles	8,245,536,150	8,907,361,450
Passenger Cars	48,760,877,060	52,676,132,415
Passenger Trucks	1,020,919,235	1,102,857,355
Light Commercial Trucks	36,777,418,615	39,740,205,010
Transit Buses	1,951,180,135	2,184,297,240
Single Unit Short Haul	4,078,503,795	4,561,602,100
Single Unit Long Haul	242,793,985	271,550,510
Combination Short Haul	1,744,478,445	1,991,890,410
Combination Long Haul	4,114,869,475	4,698,496,810

2.2.12 SourceTypeYear

This table contains National total vehicle population by source use type by calendar year. The source data was 2013 state-level vehicle population by Mexico vehicle type. Data provided were in a different set of Mexico-specific vehicle classes, which needed to be mapped to MOVES source use types to represent the Mexico fleet. The mapping used is shown in Table 8 below. INECC informed us that "Public light transport trucks" include SUVs and vans but not pickups, and "Pickup Trucks" are for transferring a product (both passenger and commercial). Population in the class "Trucks with GVW > 3 ton" was mapped to Single Unit Trucks, and the "Trailer trucks" were mapped to Combination Unit Trucks.

Table 8. Vehicle Classes in Mexico Data Mapped to MOVES Source Types

#	Mexico Vehicle Type	MOVES Source Type	
1	Motorcycles	11	Motorcycle
2	Passenger cars	21	Passenger car
3	Taxi		
4	Public transport light truck	31	Passenger Truck
5	Pickup trucks	32	Light Commercial Truck
6	Trucks with GVW < 3 ton		
7	Buses	42	Transit Bus
8	Microbus/Midibus		
9	Trucks with GVW > 3 ton	52	X% Single Unit Short-haul Truck
		53	100-X% Single Unit Long-haul Truck
10	Trailer trucks	61	Y% Combination Short-haul Truck
		62	100-Y% Combination Long-haul Truck

Because we do not have use type data to distinguish long-haul vs. short-haul activity, U.S. default splits were used. The 2013 population was back-casted to 2011 and projected to 2017 using human population growth trends at the national level.

Population estimates within the MAG domain for 2011 and 2017 by source type (as mapped from Mexico vehicle classes from Table 8 above), are shown in Table 9.

Table 9. Mexico Domain Vehicle Population Estimates by Source Type in 2011 and 2017

Source Type	2011 Population	2017 Population
Motorcycles	454,056	490,500
Passenger Cars	4,808,545	5,194,675
Passenger Trucks	91,965	99,347
Light Commercial Trucks	3,438,594	3,715,625
Transit Buses	66,404	74,117
Single Unit Short Haul	231,665	259,106
Single Unit Long Haul	9,653	10,796
Combination Short Haul	42,323	48,326
Combination Long Haul	44,405	50,703

2.2.13 SourceTypeAgeDistribution

Source data were the 2013 state-level vehicle populations data discussed in Section 2.1, which was provided by individual model year. The Mexico classes were mapped to MOVES source use types, and distributions normalized over the 30 years available so that distributions sum to one (1). Because MOVES uses 31 years (age 0 to 30, inclusive), we divided the age 30 population by two to cover both age bins 30 and 31 year old vehicles. The core database was populated with the MAG domain-average age distributions. In addition to the domain-wide data, two external database tables were created using data specific to the border states and non-border states, separated to account for unique distributions of cars and light trucks in border area, which have a high number of aged vehicles (~ 10 years old) coming over from the U.S. The same age distributions in MOVES-Mexico were applied to all years, including 2011 and 2017. While MOVES has capability to project age distribution dynamically using vehicle growth and scrappage curves, the underlying data do not apply in Mexico so this feature of MOVES was not used for the MAG inventories.

Vehicle age summary charts for border and non-border areas are shown in Figures 3 and 4. Figure 3 shows the age distribution of passenger cars operating in border and non-border portions of the domain, showing the clear bump in ~10 year old vehicles in the border region.

Figure 4 shows the average age of all Mexico vehicle classes for the border and non-border regions.

Figure 3. Age distribution for Passenger Cars, Border vs. Non Border Areas

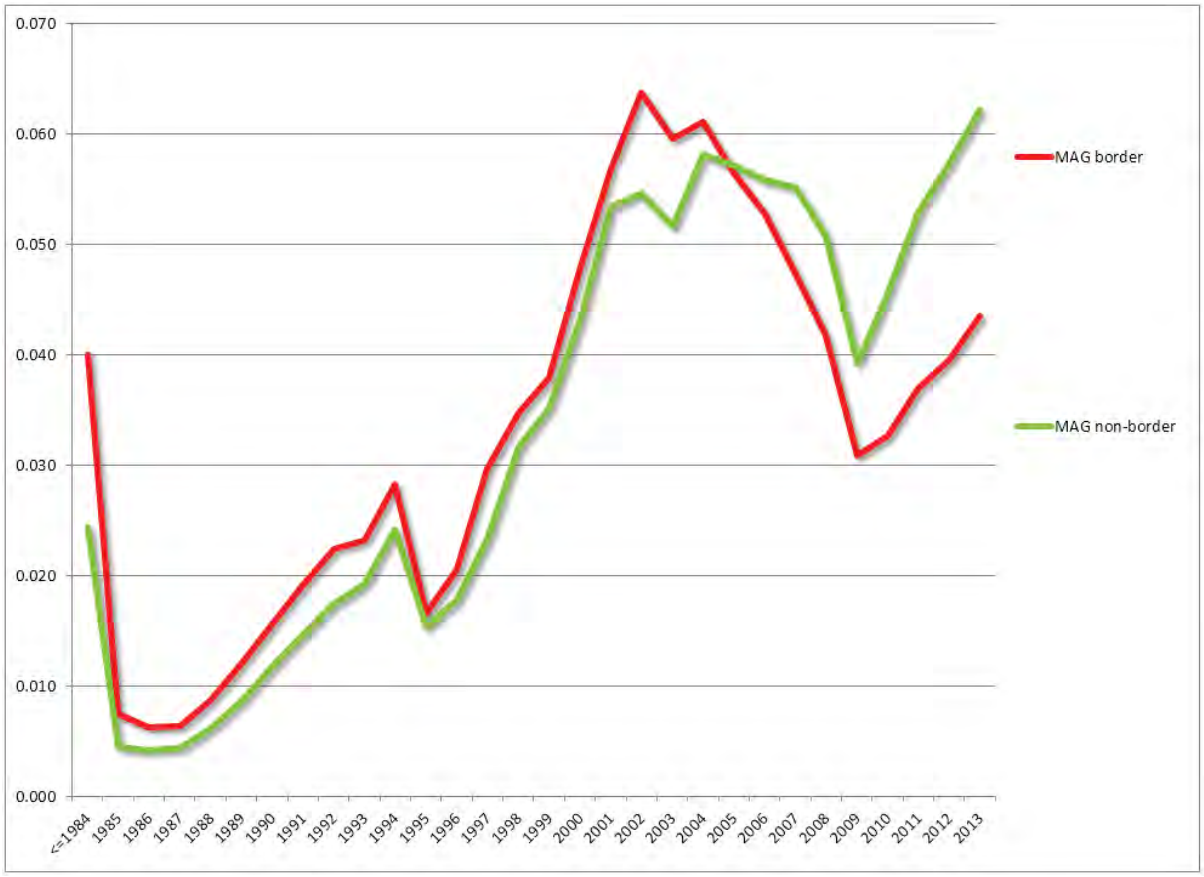
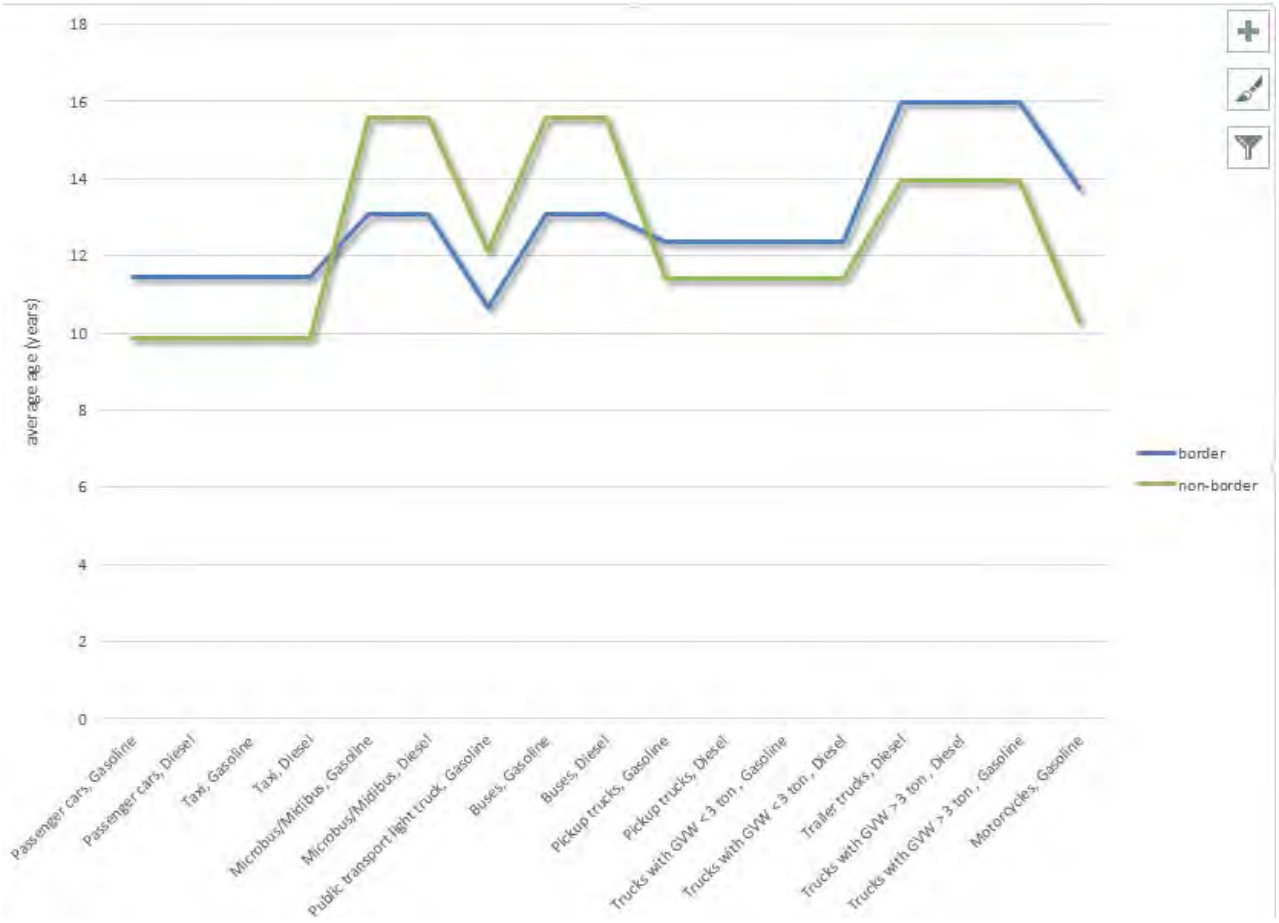


Figure 4. Average Age By Mexico Vehicle Class, Border vs. Non Border Areas



2.2.14 Alternative Vehicle & Fuel Technology (AVFT)

The AVFT table determines the distribution of fuel types, by source type and vehicle model year. The source data were the 2013 state-level vehicle population data discussed in Section 2.1, which included a split of population by gas and diesel. We mapped the Mexico vehicle classes to MOVES source use types using the methods described for the SourceTypeYear table, preserving the details of vehicle model year and fuel type. We then normalized the populations so that for each model year the gas and diesel fractions summed to one (1).

2.2.15 RoadTypeDistribution

The RoadTypeDistribution table contains national fractions of VMT that occur on the four MOVES road types, by source type. This table leveraged off the roadway network analysis described for the ZoneRoadType table. At the stage where total lane-meters are stored by the

four MOVES road types, we summed over the nation, and normalized. The national road type distribution is shown in Table 10 below. The distribution is the same for each source type, since no information was available to allow them to vary by source type, and the U.S. defaults were not considered applicable in this case.

Table 10. Mexico Domain Road Type Fraction by Source Type

Source Type	Rural Restricted	Rural Unrestricted	Urban Restricted	Urban Unrestricted
All Source Types	0.232	0.284	0.107	0.376

2.2.16 FuelSupply & FuelFormulation

These tables provides the market share and properties of individual fuel formulations, broken down for each fuel region, month, and year. Details of these fuels are described in detail in the discussion under RegionCounty table; the same fuels were assumed for 2017 as in 2011.

2.2.17 MonthVMTFraction

This table allocates annual total VMT from HPMSVtypeYear to months. MonthVMTFractions were updated using domestic PEMEX total fuel sales (gasoline + diesel together) relative in each month of the year. The assumption is that VMT will track with fuel sales.

2.3 Emission Rate Updates

2.3.1 Overview of Approach

Emission rates in MOVES were updated to reflect significant differences in vehicle emission controls between Mexico and the U.S. Similar updates were not made for Canada, because Canada emission standards have been harmonized with the U.S. since the late 1980s; for the MAG runs, where the majority of the fleet in 2011 and 2017 will be on post-1990 vehicles, the default U.S.-based emission rates were deemed appropriate. For this project, ERG combined two different methods to estimate emissions rates for the Mexico fleet: one for 2007 and newer light-duty vehicles, based on an adaptation of work ERG previously performed for EPA in developing the beta MOVES International model, and another method for both heavy-duty and older light-duty vehicles, based on fleet technology penetration. These two methods are described below.

2.3.2 Mapping U.S. Rates to Mexico

For Mexico, the approach taken was to adapt the U.S.-based emission rates to Mexico based on differences between the two countries in the level of emission standard and implementation years, summarized earlier in Table 1. For all heavy-duty vehicles, and light-duty prior to 2006 model year, this adaption took for form of simply re-mapping the U.S. emission rates other model years in correspondence with Mexico standards. This approach was taken because for these vehicle classes and model years, there is a direct correspondence between Mexico vehicle standard levels and previous year U.S. standards. Mexico Emission rates for 2006 and later cars and light trucks (reg class 20 and 30) were generated using the method, and a modified version of a script U.S. EPA used to generate U.S. based rates in MOVES, as detailed in the next section.

To facilitate the development of Mexico rates, a mapping between Mexico and U.S. vehicle standards was required. This was developed based on the information provided by INECC from Table 1. Tables 11 through 13 show the mapping of Mexico standards to U.S. standards, and how model years were correlated to enact this mapping.

Table 11. Car and Light-Duty Truck (Regulatory Class 20 and 30) Exhaust Model Year Mappings

Mexico Model Year Range	Correlated U.S. Technology/Standard	U.S. Model Year or Bins Applied
1980-1990	Pre-Catalyst	1970
1991-1992	Catalyst	1980
1993-2006	Tier 0	1990
2007-2009	Tier 2 Bin 10 Phase-In	25/50/75%
2010-2012	Tier 2 Bin 7 Phase-In	25/50/70%
2013 and later	Tier 2 Bin 7	100%

Table 12. Heavy-Duty Diesel Truck (Regulatory Class 40-48) Model Year Mappings

Mexico Model Year Range	Correlated U.S. Technology/Standard	U.S. Model Year or Bins Applied
1980-1992	Pre-Control	1980
1993	"1991"	1992
1994-1997	"1994"	1996
1998-2008	"1998" (Electronic Control)	2000
2009 and later	"2004" (EGR)	2004

Table 13. Heavy-Duty Gas Truck (Regulatory Class 40-48) Model Year Mappings

Mexico Model Year Range	Correlated U.S. Technology/Standard	U.S. Model Year or Bins Applied
1980-1997	Pre-Control	1980
1998 and later	Tier 1	1998

2.3.3 Adjustment Scripts

In the case of fleet technology penetration, ERG created a spreadsheet tool that allows users to select technology penetration by both type and calendar year, and use that information to reweight the existing FTP phase in fractions developed by EPA. Technology penetration fractions sum to 1.0, and vary from pre-Tier 1 technologies all the way through LEV2 (with Euro technologies integrated). Technology fractions can be provided for each model year to be analyzed, and users may alter or delay introduction of certain technologies as appropriate for their fleet. These inputs produced reweighted technology fractions by model year and technology type, which were also subsequently converted to CSV format and input to the modified SAS program.

For heavy duty vehicles and older light duty vehicles (2006 and older), the approach presented above did not apply. Instead, ERG developed a series of MySQL scripts to shift the default emission rates by model year in the MOVES Emission Rate By Age table (ERBAT) consistent with mappings shown in the tables above. These rates were then combined with the 2006 and later LD rates described above to arrive at a single ERBAT that could be used for all MOVES runs performed in Mexico.

2.3.4 Evaporative Emissions

According to INECC, evaporative emissions are not explicitly regulated in Mexico. However, for the purpose of this work, it was assumed that the level of evaporative control that corresponds with exhaust control in the U.S. would be in place in Mexico. An updated Cumulative Tank Vapor Venting Coefficient (CumTVVCoeff) table was prepared based on the mappings show in Tables 14 and 15, for cars/light trucks and heavy gas trucks.

Table 14. Car and Light-Duty Truck Evaporative Model Year Mappings

Mexico Model Year Range	Correlated U.S. Technology/Standard	U.S. Model Year or Bins Applied
1980-1992	Uncontrolled	1971-1977
1993-2007	Pre-Enhanced Control	1978-1995
2008-2050	Tier 2 Enhanced	2008-2016

Table 15. Heavy-Duty Gas Truck Evaporative Model Year Mappings

Mexico Model Year Range	Correlated U.S. Technology/Standard	U.S. Model Year or Bins Applied
1980-1997	Pre-Enhanced Control	1978-1995
1998 and later	Enhanced Control	1998

2.4 Inventory Runs

2.4.1 Configuration

Multiple runs of MOVES were needed to produce the emissions output needed for the onroad portion of the inventory. In order to efficiently generate the MOVES run input files (runspecs) for the 2011 and 2017 MOVES runs, ERG developed a Perl pre-processing script to build the input files based on a template input file and arrays containing the required parameters of municipalities, months, years, fuel types, and emission processes that needed to be included in each unique run.

Such a large number of MOVES runs would have been a large computational burden for a standalone desktop machine. After initial runtime tests, ERG decided to setup the MOVES runs to execute in an Amazon cloud computing environment using methods adapted from ERG's support of EPA's Office of Air Quality Planning and Standards (OAQPS) & Office of Transportation and Air Quality (OTAQ) for the National Emissions Inventory (NEI).

The cloud MOVES runs were grouped in units of two runs together (to separate fuels and emission processes for efficiency). There were 1,054 instances of this set of two runs. Each instance corresponds to two Amazon central processing unit (CPUs) with 4 GB of RAM, and ERG was permitted the use of 500 instances at a time. Therefore, the 1,054 instances were run in batches of three groups. The total runtime was approximately 1000 hours of processing time, which is about 1.3 months. The expense of using Amazon computing was a minimal cost to the project, roughly equivalent to two staff hours. ERG developed a Perl post-processing script that converts the raw MOVES output of emissions and VMT activity contained in the 2,108 MOVES output databases into a single on-road emissions by municipality, SCC, pollutant, and source type. The post-processing script executes a number of MySQL queries that (1) add labels to the database results and (2) perform basic addition and division calculations. The addition of labels was necessary to differentiate fuel processed from the MOVES outputs, as well as to make the results more easily understandable and readable.

National Scale runs covering the 527 municipalities in the MAG domain were executed for 2011 and 2017 ozone season day. Output was provided by Weekday and Weekend (Post-Processed to Average Day outside MOVES). Two run specification files were developed for each municipality/year: 1) Exhaust VOC, CO and NO_x in a runspec run with Day pre-aggregation, and 2) Evaporative VOC in a runspec with Hour pre-aggregation (required, but slows runtime) outputs by Day. Municipalities in states along the U.S. border called an external database with the border age distribution data. Likewise, other municipalities not in these states received the non-border age distribution.

All runs reference the external databases EmissionRateByAge and CumTVVCoeffs, and all runs produced outputs by SCC, municipality, year, day type. This resulted in 2,108 MOVES runs in total (527 counties × 2 runspecs × 2 years =2,108) run in parallel on Amazon Cloud, with an elapsed runtime of about one hour.

2.4.2 Mexico MAG Domain Results

Results were provided to MAG by municipality, year and Source Classification Code (SCC), for ozone season weekday and weekend. State level results are summarized for an average day in Tables 16 and 17 below.

Table 16. 2011 Emissions in Mexico MAG Domain, by State (Average Tons/Day)

State	NO_x	VOC	CO
Aguascalientes	1.2	0.3	5.6
Baja California	167.5	72.3	1,053.2
Baja California Sur	42.1	18.2	288.2
Campeche	1.7	0.7	10.9
Coahuila	97.1	46.5	699.8
Chihuahua	175.6	77.9	1,164.5
Durango	53.2	21.4	320.2
Jalisco	1.8	0.5	9.1
Nayarit	1.7	0.8	12.4
Nuevo León	213.9	105.1	1,451.3
Quintana Roo	28.1	11.3	179.5
San Luis Potosí	64.2	25.9	399.4
Sinaloa	98.4	44.3	689.7
Sonora	101.2	52.3	774.2
Tamaulipas	146.6	69.3	1,059.4
Veracruz	5.2	1.6	26.7
Yucatán	48.8	20.8	322.4
Zacatecas	53.9	21.0	300.9

Table 17. 2017 Emissions in Mexico MAG Domain, by State (Average Tons/Day)

State	NO_x	VOC	CO
Aguascalientes	1.0	0.2	4.3
Baja California	144.6	49.7	775.3
Baja California Sur	35.5	12.1	211.2
Campeche	1.4	0.4	8.0
Coahuila	84.3	31.9	522.0
Chihuahua	152.2	53.5	862.2
Durango	44.7	14.3	232.2
Jalisco	1.5	0.3	6.9
Nayarit	1.4	0.6	8.8
Nuevo León	184.4	71.8	1,099.9
Quintana Roo	23.7	7.6	130.9
San Luis Potosí	54.0	17.3	291.5
Sinaloa	83.0	29.6	506.4
Sonora	87.8	35.9	580.0
Tamaulipas	127.0	47.6	789.9
Veracruz	4.4	1.1	19.8
Yucatán	41.1	13.9	235.3
Zacatecas	45.3	14.1	216.0

3.0 Adapting MOVES to Canada

3.1 Data Sources

A Canada-specific MOVES input database was developed for Canada runs within the MAG domain. The extent of updates the database were more limited than for Mexico, because a) less data were available to make updates with, b) emissions were generated at the province level, requiring less data to allocate to finer geographic detail, and c) U.S. defaults were considered to be more representative of Canada vs. Mexico. With the exception of the table updates described below, the adaptation of MOVES for Canada used the default MOVES 2014 database for the U.S. This means several key inputs were based on U.S. defaults, such as emission rates, speeds and vehicle age distribution. The U.S. default were judged reasonable for Canada in these cases because of the close alignment between U.S. and Canadian vehicle fleet, emission standards, and transportation infrastructure.

Data for table updates were primarily drawn from a combination of the default MOVES 2014 database and several additional sources that provided national level estimates on which to base MOVES updates:

- The 2009 Canadian Vehicle Survey (CVS) report;[13]
- Updates to the SMOKE modeling framework for Canada that included vehicle activity estimates at the province level;[14] and
- Projections of future gasoline and diesel use for each province.

Other data were developed based on existing MOVES2014 defaults, as noted in the following sections.

3.2 Table Updates

3.2.1 fuelSupply

The *fuelSupply* table, containing fuel formulations for 2011 and 2017 applied to all provinces in the MAG study area, was generated by averaging the fuel supply mix across the

[13]Statistic Canada, Canadian Vehicle Survey: Annual 2009 http://www.statcan.gc.ca/pub/53-223-x/53-223-x2009000-eng.htm

[14]Zhang et al. "Improvements to SMOKE processing of Canadian on-road mobile emissions" presented at the 2012 International Emission Inventory Conference (http://www.epa.gov/ttn/chief/conference/ei20/)

U.S. states bordering Canada, weighted by the relative VMT of each state. The surrogate border states included were Idaho, Maine, Michigan, Minnesota, Montana, New York, Ohio, Pennsylvania, South Dakota, Vermont, Washington, and Wisconsin.

3.2.2 HPMSVtypeYear

The *HPMSVtypeYear* table contains VMT by year and *HPMSVtype*. Obtaining these data required the combination of multiple tables from the CVS to correctly map VMT onto the appropriate MOVES source type and fuel type (gasoline or diesel) so VMT could be projected to 2011 and 2017 using the fuel projections described above. VKT by province and weight class were obtained from Table 4.1 of the CVS. We apportioned this into VKT by vehicle type using Table 3.3 of the CVS, which provided vehicle population by vehicle type and weight class. We then translated the CVS vehicle types and weight classes to MOVES *sourceTypeIDs* using the mapping shown in Table 18. Some vehicle type/weight combinations mapped to multiple sourceTypeIDs, in which case we used the population splits contained in the 2009 sourceTypeYear table in MOVES 2014 to apportion the VKT to the two *sourceTypeIDs*. These VKTs by *sourceTypeID* were then split by fuel type using the gasoline and diesel splits found in Table 3.4 of the CVS. Bus and motorcycle populations were obtained from the raw CSV table 405-0004 found online.

Table 18. Mapping of Canadian Vehicle Survey Classes to MOVES Source Types

CVS Vehicle Type	CVS Vehicle Body	MOVES Source Type
Vehicles up to 4.5 tonnes	Car	21
Vehicles up to 4.5 tonnes	Station wagon	21
Vehicles up to 4.5 tonnes	Van	3132
Trucks 4.5 tonnes to 14.9 tonnes	Van	5253
Vehicles up to 4.5 tonnes	Sport utility vehicle	31
Vehicles up to 4.5 tonnes	Pickup	3132
Trucks 4.5 tonnes to 14.9 tonnes	Pickup	5253
Trucks 15 tonnes and over	Pickup	5253
Vehicles up to 4.5 tonnes	Straight truck	5253
Trucks 4.5 tonnes to 14.9 tonnes	Straight truck	5253
Trucks 15 tonnes and over	Straight truck	5253
Trucks 4.5 tonnes to 14.9 tonnes	Tractor trailer	6162
Trucks 15 tonnes and over	Tractor trailer	6162
Buses	Bus	42

Combining all of these data and converting to miles, for MOVES, yielded VMT for all *sourceTypeIDs* for 2009, which were then projected forward to 2011 and 2017 using the gasoline and diesel growth projections (Table 19). The gasoline and diesel data were then recombined. The final step was to map the *sourceTypeIDs* onto *HPMSVtype* using the *sourceUseType* table in MOVES 2014.

Table 19. Annual Canada MAG Domain VMT by Source Type in 2011 and 2017

Source Type	MAG Domain VMT 2011	MAG Domain VMT 2017
Motorcycles	1,436,914,173	1,521,575,562
Passenger Cars	109,847,953,341	116,320,072,857
Passenger Trucks	65,370,091,014	69,221,624,238
Light Commercial Trucks	10,713,859,840	11,345,108,573
Transit Buses	1,057,516,079	1,230,394,915
Single Unit Short Haul	10,132,582,064	12,401,354,254
Single Unit Long Haul	455,288,944	557,232,051
Combination Short Haul	4,757,838,928	5,433,208,033
Combination Long Haul	4,706,597,399	5,374,692,836

3.2.3 sourceTypeYear

The *sourceTypeYear* table, which contains vehicle population by *yearID* and *sourceTypeID*, was also generated using a combination of tables from the CVS. Vehicle counts by vehicle type, weight class, and province were obtained by combining the information in Tables 3.3 and 3.1 with the vehicle type and weight class to *sourceTypeID* mapping in to the CVS was again used to obtain gasoline/diesel splits, and then these population by *sourceTypeID* and fuel type data were projected forward to 2011 and 2017 using the fuel use projections and recombined (Table 20).

Table 20. Population Estimates by Source Type in 2011 and 2017

Source Type	2011 Population	2017 Population
Motorcycles	412,511	431,279
Passenger Cars	11,472,549	11,965,665
Passenger Trucks	6,827,269	7,075,809
Light Commercial Trucks	1,118,958	1,200,626
Transit Buses	63,211	79,547
Single Unit Short Haul	569,972	731,294
Single Unit Long Haul	25,610	33,165
Combination Short Haul	119,728	137,879
Combination Long Haul	118,439	146,690

3.2.4 roadTypeDistribution

We created a national average *roadTypeDistribution* table (the fractions of VMT allocated to different *roadTypeIDs* for each *sourceTypeID*) for the Canadian provinces included in the MAG study area by using *roadTypeDistributions* generated by MOVES 2014 for proxy U.S. states. The proxy states were based on the analysis contained in Zhang et al., as follows: Minnesota-Saskatchewan; Colorado-Alberta; Minnesota-Manitoba; Pennsylvania-Quebec; New York-Ontario; Washington-British Columbia; and Maine-New Brunswick. We ran MOVES 2014 for 2009 to match the CVS survey year, and then created the national average by calculating a VKT-weighted average across all of the MAG provinces, using VKT by province obtained from the CVS (Table 21).

Table 21. Domain Road Type Fraction by Source Type

Source Type	Rural Restricted	Rural Unrestricted	Urban Restricted	Urban Unrestricted
Motorcycles	0.075	0.215	0.257	0.453
Passenger Cars	0.075	0.215	0.257	0.453
Passenger Trucks	0.077	0.252	0.238	0.434
Light Commercial Trucks	0.077	0.252	0.238	0.433
Transit Buses	0.149	0.263	0.263	0.325
Single Unit Short Haul	0.149	0.263	0.263	0.325
Single Unit Long Haul	0.150	0.263	0.264	0.324
Combination Short Haul	0.204	0.260	0.285	0.251
Combination Long Haul	0.213	0.257	0.289	0.241

3.2.5 zoneRoadType

For *zoneRoadType,* which contains *SHOAllocFactor* by province and *roadTypeID*, we also used MOVES 2014 output for the proxy states identified in the Zhang et al. report. To back out the effect of the proxy states' VMTs on the hours allocated to each state, we divided the *SHOAllocFactor* for each state by its VMT. These normalized *SHOAllocFactors* were then scaled up in proportion to the provinces' VMT, i.e., the *SHOAllocFactor* for a specific province and road type was calculated as: $SHOAllocFactor_{province} = SHOAllocFactor_{proxy\ state} \times (VMT_{province}/VMT_{all\ MAG\ provinces})/(VMT_{proxy\ state}/VMT_{all\ proxy\ states})$. Table 22 shows the resulting SHO allocation factors by roadtype and province.

Table 22. Running (SHO) Allocation Factors by Province

Province	Rural Restricted	Rural Unrestricted	Urban Restricted	Urban Unrestricted
Alberta	0.185	0.148	0.163	0.153
British Columbia	0.150	0.091	0.128	0.109
Manitoba	0.032	0.058	0.031	0.030
New Brunswick	0.051	0.061	0.006	0.012
Ontario	0.248	0.343	0.451	0.426
Quebec	0.299	0.236	0.188	0.237
Saskatchewan	0.035	0.063	0.033	0.033

3.2.6 zone

The *zone* table contains three allocation factors for each province: *startAllocFactor, SHPAllocFactor*, and *idleAllocFactor.* The first two are simply the fraction of the population in the MAG study area contained in each province. *idleAllocFactor* is equal to the SHOAllocFactor for roadTypeID=2 in each province, calculated above for the *zoneRoadType* table. The resulting allocation factors are shown in Table 23, including Source Hours Idle, since Extended Idle was included for the Canadian runs.

Table 23. Start, Extended Idle, Park Allocation Factors by Province

Province	Rural Restricted	Rural Unrestricted	Urban Restricted
Alberta	0.143	0.185	0.143
British Columbia	0.138	0.150	0.138
Manitoba	0.036	0.032	0.036
New Brunswick	0.025	0.051	0.025
Ontario	0.377	0.248	0.377
Quebec	0.240	0.299	0.240
Saskatchewan	0.040	0.035	0.040

3.2.7 zoneMonthHour

To generate a *zoneMonthHour* table for the MAG provinces, we ran MOVES 2014 for proxy U.S. states located in close proximity to the provinces, as follows: Montana-Alberta; Washington-British Columbia; North Dakota-Manitoba; Maine-New Brunswick; Wisconsin-Ontario; Vermont-Quebec; and Montana-Saskatchewan.

3.3 Inventory runs

3.3.1 Configuration

We generated Canada emissions at the province using a National Scale MOVES 2014 run. To speed the runs, we arbitrarily chose seven counties to represent the seven MAG provinces (for simplicity, we chose the first county of the first seven states in MOVES), and specified the appropriate *zoneIDs* and *countyIDs* to map the data for each province to its respective county. We then ran MOVES for July 2011 and July 2017; all hours; all roadTypes; and both weekdays and weekends.

3.3.2 Results

Emissions were provided to MAG by province and SCC for both year. A summary by province is shown in Tables 24 and 25.

Table 24. 2011 Emissions by Province (Average Tons/Day)

Province	NO_x	VOC	CO
Alberta	229.6	90.5	890.0
British Columbia	165.1	72.3	706.2
Manitoba	47.0	20.8	216.8
New Brunswick	36.9	14.4	139.6
Ontario	446.4	193.5	1,888.9
Quebec	276.0	116.6	1,102.8
Saskatchewan	53.6	20.7	192.8

Table 25. 2017 Emissions by Province (Average Tons/Day)

Province	NO_x	VOC	CO
Alberta	119.4	49.4	568.5
British Columbia	89.0	41.6	439.8
Manitoba	24.8	11.7	134.7
New Brunswick	20.3	8.1	88.5
Ontario	247.1	112.4	1,240.0
Quebec	150.7	67.2	724.2
Saskatchewan	27.9	11.3	123.3

APPENDIX F

DRAFT EIGHT-HOUR OZONE NONATTAINMENT AREA EMISSIONS

Draft daily emissions for the period of May 1 through September 30 in 2011 and 2017 are developed for the 4 km domain. Daily emissions for the Maricopa eight-hour ozone nonattainment area are extracted from gridded daily emissions for the 4 km domain. Table F-1 presents 2011 and 2017 draft average daily emissions for May 1 through September 30 for the Maricopa eight-hour ozone nonattainment area, which will be used to meet the 15% VOC reduction requirement of the Reasonable Further Progress (RFP) for Marginal area under the CAA.

Table F-1 Draft average daily emissions for the eight-hour ozone nonattainment area (unit: metric tons/day)

	VOC			NOx			CO		
Source	2011	2017	Difference	2011	2017	Difference	2011	2017	Difference
Point	2.47	3.11	0.64	5.63	4.67	-0.96	4.05	5.33	1.28
Area	95.22	96.76	1.54	11.10	12.75	1.65	7.75	8.55	0.80
Onroad*	70.80	46.67	-24.13	117.53	63.51	-54.02	681.40	504.60	-176.80
Nonroad**	33.05	24.60	-8.45	54.09	36.76	-17.33	362.96	336.11	-26.85
Total	201.54	171.14	-30.40	188.35	117.69	-70.66	1,056.17	854.59	-201.57

* Draft onroad emissions are estimated with the MOVES2014, being revised with the MOVES2014a.

** Draft nonroad emissions are estimated with the NONROAD2008a, being revised with the MOVES2014a nonroad model.

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

APPENDICES

VOLUME FIVE

DECEMBER 2016

MARICOPA ASSOCIATION of GOVERNMENTS

MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

APPENDICES

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Exhibit 2: 2014 Periodic Emissions Inventory for Ozone Precursors for the Maricopa County, Arizona, Eight-Hour Ozone Nonattainment Area. Maricopa County Air Quality Department. September 2016.

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Exhibit 2: State of Arizona Fifty-Second Legislature Senate Bill 1255 and Final Revised Fact Sheet for Senate Bill 1255.

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Exhibit 1: Public Hearing Process Documentation.

Exhibit 2: Certification of Adoption and MAG Authority for Regional Air Quality Planning.

APPENDIX B

APPENDIX B

EXHIBIT 1:

Appendices to the:

Technical Support Document in Support of the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments.

APPENDIX B

RAMBOLL ENVIRON WEIGHT-OF-EVIDENCE REPORT

Weight of Evidence Analyses to Support the MAG Moderate Area Eight-Hour Ozone Attainment Demonstration for the 2008 Ozone Standard

Final Report

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RAMBOLL ENVIRON

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1.0 INTRODUCTION

The Maricopa Association of Governments (MAG) has contracted with Ramboll Environ (RE) to provide technical support for weight-of-evidence (WOE) analyses as part of the MAG moderate area attainment demonstration for the 2008 ozone standard. The goal was to identify and develop additional WOE analyses with which to bolster analyses that MAG has performed for the attainment demonstration.

EPA's modeling guidance (EPA, 2014) suggests developing WOE assessments to support the attainment determination. Supplemental analyses used in the WOE will help determine whether attainment will be reached where modeled results indicate future ozone levels are near the National Ambient Air Quality Standards (NAAQS) of 75 ppb. The guidance recommends three basic types of analyses: 1) additional modeling analyses, 2) analyses of trends in ambient air quality and emissions, and 3) additional emissions controls and reductions.

RE reviewed the MAG attainment demonstration and WOE analyses for the 2008 ozone standard and discussed with MAG on conference calls. The WOE analyses that MAG has completed for the attainment demonstration are as follows:

- Impact on future year ozone predictions from the choice of global atmospheric chemistry model (i.e., MOZART, CAM-Chem, and GEOS-Chem) used to derive initial and boundary conditions;
- Impact on future year ozone predictions from the choice of meteorological year (2011 vs. 2012);
- Trends in ambient air quality and ozone exceedance counts;
- Chemical process analysis (CPA);
- Ozone source apportionment analysis (OSAT);
- Decoupled direct method (DDM);
- Zero-out anthropogenic source emissions analysis.

This report presents our review of trends, CPA, OSAT, and zero-out analyses that MAG conducted, and additional analyses to support MAG's WOE. Chapter 2 provides additional modeling analyses and Chapter 3 includes additional ambient trend analyses. A summary is provided in Chapter 4.

2.0 SUPPLEMENTAL MODELING ANALYSES

2.1 EPA's Projected 2017 Ozone Concentrations

The EPA's 2014 modeling guidance suggests including results from additional modeling that may be available for the area of interest and that may have used different models and/or inputs. In this section we describe modeling results from EPA's proposed Cross-State Air Pollution Rule (CSAPR) for the 2008 ozone NAAQS (EPA, 2015). EPA released this modeling dataset as part of the July 23, 2015 Notice of Data Availability. The modeling results include 2017 projected ozone design values at individual monitoring sites for each US county and estimated state-by-state contributions to those 2017 concentrations. The 2017 projections are used by EPA to identify ozone monitoring sites that are projected to be nonattainment or have maintenance problems for the 2008 ozone NAAQS.

None of the monitoring sites in Maricopa County are projected to exceed the 2008 ozone NAAQS in 2017 based on EPA's CSAPR modeling (Table 2-1). EPA projected the 5-year weighted design value centered on 2011 to 2017 ("average" design value) to determine ozone attainment. EPA also projected the maximum 3-year design value from the same 5-year period to 2017 ("maximum" design value). Monitoring sites with a 2017 average design value below the NAAQS, but with a maximum design value that exceeds the NAAQS, are considered maintenance-only sites. The peak 2017 average design value is 75.0 ppb at the North Phoenix site (40131004), while all other sites are all below 73 ppb. Only the North Phoenix site has a 2017 maximum design value marginally above 75 ppb, so this site would be considered a maintenance-only site. These results affirm that Maricopa County would be in attainment of the 2008 ozone NAAQS in 2017.

2.2 NOx-Limited Ozone Reactions in the Urban Core and the Role of NOx Emissions

MAG has conducted Chemical Process Analysis (CPA) with CAMx to investigate NOx- vs. VOC-limited chemistry. The ozone formation process is controlled by the relative availability of NOx and VOC, and so ozone formation is described either as NOx-limited or VOC-limited, respectively. The ratio of the production rates of hydrogen peroxide (H_2O_2) and nitric acid (HNO_3) is the indicator used to classify ozone formation as being instantaneously limited by NOx or VOC. Ozone formation is classified as being NOx-limited when $P(H_2O_2)/P(HNO_3) > 0.35$ (Sillman, 1995). The CPA results (shown in Figure 2-1 as episode average from May through September) indicate a movement from 2011 VOC-limited conditions in the urban core to 2017 NOx-limited chemistry. This means NOx emission controls are the best mechanism for decreasing Maricopa ozone levels by 2017 and beyond. On-the-books and any further NOx reductions should be effective in bringing ozone levels down at monitors in this area. The area outside of the urban core of the Maricopa Nonattainment area is consistently NOx-limited.

Table 2-1. EPA's 2017 Projected Average and Maximum Design Values at each Maricopa County monitoring site from the CSAPR modeling (EPA, 2015). MAG's 2017 projected design values are shown in the last column.

Monitor ID	Site Name	EPA projections		MAG projections
		2017 Projected Average Design Value	2017 Projected Maximum Design Value	2017 Projected Average Design Value
40130019	West Phoenix	72.9	75.0	73.3
40131004	North Phoenix	**75.0**	**76.2**	**75.6**
40131010	Falcon Field	64.7	66.8	64.9
40132001	Glendale	70.8	72.1	71.9
40132005	Pinnacle Peak	71.1	72.0	70.1
40133002	Central Phoenix	69.9	71.5	69.7
40133003	South Scottsdale	71.2	72.4	71.6
40134003	South Phoenix	71.9	73.1	71.5
40134004	West Chandler	68.3	69.5	69.8
40134005	Tempe	65.6	66.8	67.7
40134008	Cave Creek	70.7	71.3	71.6
40134010	Dysart	66.1	67.0	68.1
40134011	Buckeye	61.5	62.5	63.4
40137003	St. John	66.4	67.6	Not available
40137020	Senior Center	69.3	70.5	69.6
40137021	Red Mountain	71.4	71.7	71.6
40137022	Lehi	68.2	69.8	69.4
40137024	High School	68.9	69.6	68.9
40139508	Humboldt Mountain	68.3	70.1	69.8
40139702	Blue Point	69.5	71.7	70
40139704	Fountain Hills	69.5	70.9	69.4
40139706	Rio Verde	69.0	69.9	68.3
40139997	Super Site	72.5	73.4	72.8

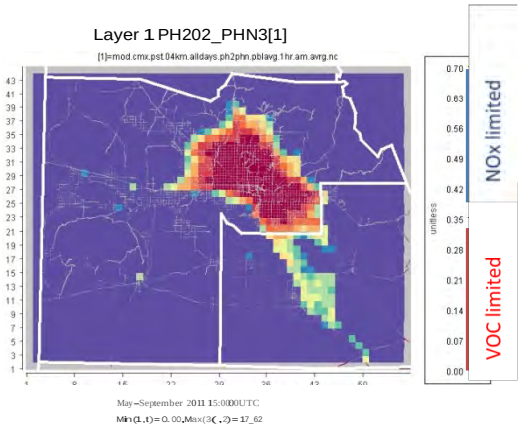
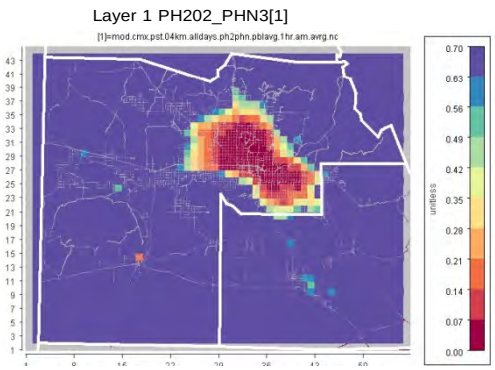
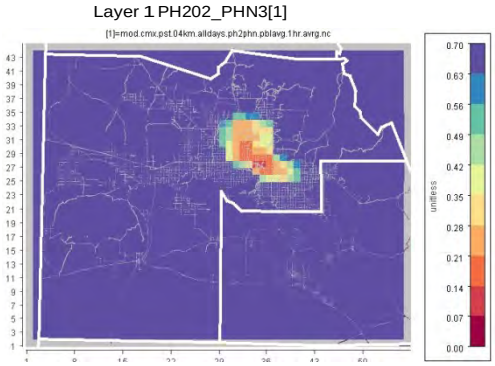
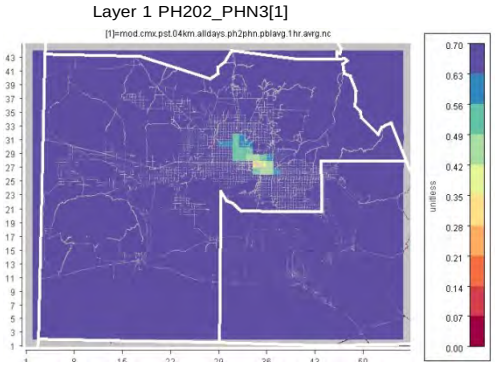
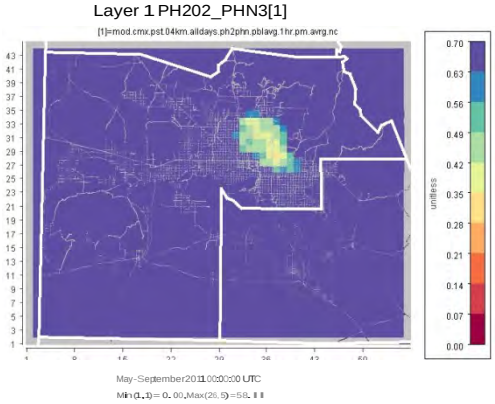
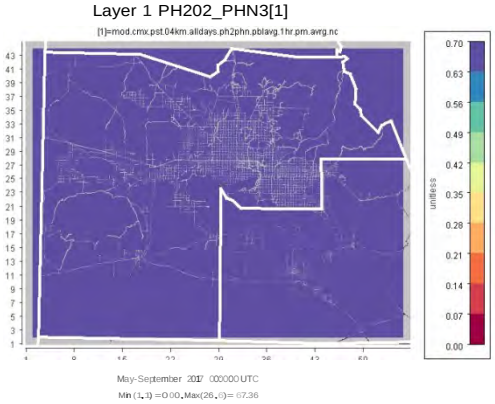
Time Period	2011	2017
AM Peak (8:00am)		
Mid-Day (12:00pm)		
PM Peak (5:00pm)		

Figure 2-1. Chemical Process Analysis results by time of day (episode average from May through September). Warm colors denote VOC-limited conditions, cool colors denote NOx-limited conditions.

These CPA results are consistent with findings by Kemball-Cook et al. (2013), who evaluated ambient air quality levels in the Maricopa Nonattainment Area for the years 2011 and 2012. Kemball-Cook et al. showed that the suburban monitors to the northeast of the Phoenix urban core are NOx-limited. For these monitors, on-the-books NOx reductions should continue to bring ozone levels down. Analysis of weekday/weekend[1] ozone differences showed that from 2009-2012, monitors in the Phoenix urban core varied together by year between being NOx- and VOC-limited (Figure 2-2). These results indicate that the Phoenix urban core is in a transitional regime, moving from VOC to NOx sensitive. This agrees with 2008-2011 trends in the Maricopa Nonattainment Area emission inventory, which indicates that NOx reductions have been larger than VOC reductions (later described in Figure 3-7). Recent Federal emissions control programs (e.g., reductions in highway and off-road vehicle emissions limits) have been primarily aimed at reducing NOx emissions. Wolff et al. (2013) note that, nationwide, a larger decline in NOx emissions than VOC emissions has pushed many areas from being VOC-limited to being NOx-limited. This means the Maricopa area may benefit from both NOx and VOC emission controls to reduce ozone in the short term, but that NOx emission controls are the best mechanism for decreasing Maricopa ozone levels in the long term.

Another indicator of whether ozone formation in a region is NOx-limited or VOC-limited is the VOC/NOx ratio of the emission inventory. Kemball-Cook et al. calculated the VOC/NOx ratio for the 2011 Maricopa Nonattainment Area emission inventory to be 6.2, which is within the VOC-limited regime, while the 2011 weekday/weekend analysis showed all but one monitor to be NOx-limited. Therefore, the VOC:NOx ratio of the emission inventory may be biased low as a result of too little VOC and/or too much NOx. If NOx emissions are overstated, adjustment to NOx emissions would improve effectiveness of ozone reduction in Maricopa County. In the next section, we examine model performance for NOx to determine whether NOx emissions are overstated.

2.3 NOx Model Performance Evaluation

We evaluate model performance for the 2011 baseline simulation of NO_2 to look for any indication of overstated NOx emissions in the inventory. Hourly NO_2 concentrations from the 2011 simulation are compared to observations at six monitors within Maricopa County. Monitor locations are shown in Figure 2-3. Five of these monitors (Super Site, West Phoenix, South Scottsdale, Greenwood, and Central Phoenix) are in the Phoenix urban area and the sixth monitor (Buckeye) is located southwest of the urban core.

Scatter plots of predicted and observed hourly NO_2 concentrations show over estimation biases with the predictions generally grouped above the 1:1 line (representing perfect agreement) at

[1] The main differences between weekday and weekend emissions are the absence of morning and evening commute periods and less heavy-duty truck traffic on weekends. NOx differences between weekdays and weekends are thus most pronounced during morning and afternoon commute hours; looking at the weekday-weekend difference is approximately equivalent to testing the effect on ozone of reducing NOx emissions. We might expect that since NOx and VOC emissions from traffic are lower on weekends, daily peak ozone would also be consistently lower. However, in some urban areas, the opposite occurs; this is known as the weekday/weekend effect. In NOx-rich, VOC-limited areas, lower NOx emissions on weekends remove the inhibiting effect of NOx and increase ozone production efficiency.

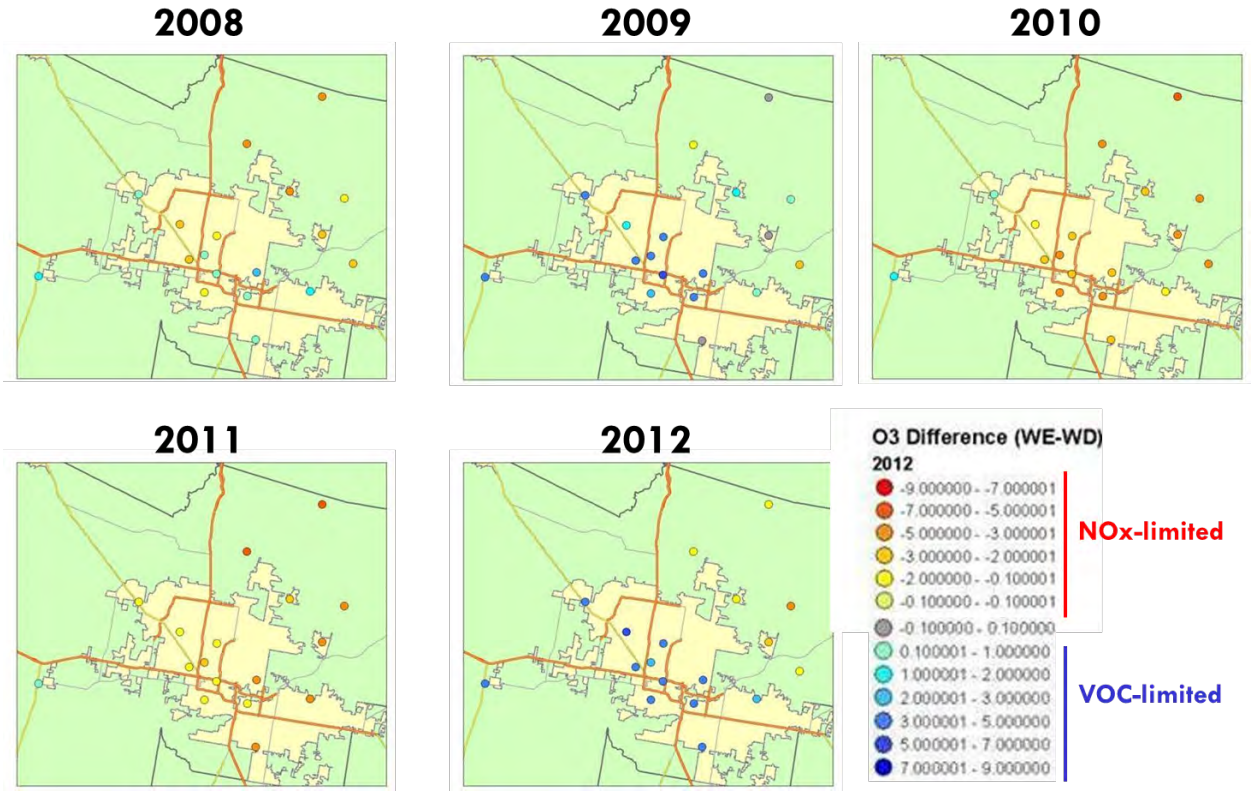


Figure 2-2. Peak weekday/weekend ozone differences in the Maricopa area; yellow area denotes the Maricopa urban core.

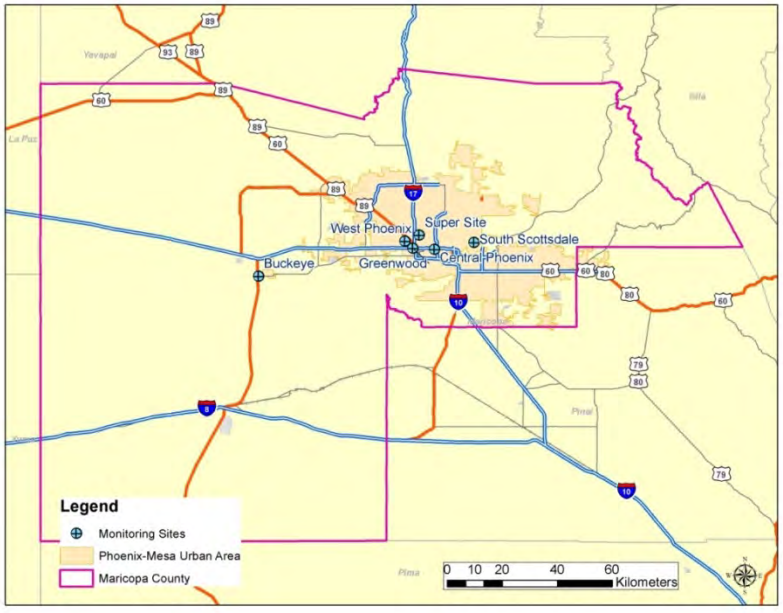


Figure 2-3. Location of NO_2 monitoring sites within Maricopa County.

all five urban monitors (Figure 2-4). The over prediction bias is largest at West Phoenix and Supersite where normalized mean biases (NMB) are about 60% and normalized mean errors (NME) are about 80%. Time series at Supersite show that the model reproduces the diurnal pattern of NO_2 relatively well but largely overestimates both morning and evening peaks (Figure 2-5). Midday NO_2 predictions agree well with the observations. In contrast, NO_2 is under predicted at Buckeye with NMB of -63% and NME of 68% (Figure 2-6).

Many factors can influence NO_2 model performance. High biased night-time NO_2 at urban sites may indicate insufficient mixing. The NO_2 over-prediction in the morning and evening may be related to insufficient mixing as well as overstated commute-hour emissions (i.e., on-road mobile sources) since they occur during the same time of day. Recent studies by the National Aeronautics and Space Administration (NASA), Air Quality Applied Sciences Team (AQAST) program, have used top-down estimates from satellite and aircraft remote sensing to show evidence of high NOx emission biases (Anderson et al., 2014; Travis et al., 2016). They have implicated the high bias to the EPA's Motor Vehicle Emissions Simulator (MOVES) model and noted that NEI emission estimates from mobile sources may be too high by a factor of two or more. If the NOx emissions are overstated as suggested in Section 2.2, the effectiveness of NOx emission reductions in lowering ozone concentrations in Maricopa County may be understated in the model.

2.4 Role and Importance of Non-Local Sources

Air masses arriving in the Maricopa Nonattainment Area come from various origins. The area is downwind from major source regions in Southern California and Northern Mexico. It is also close to mountainous areas where seasonal forest fires may influence ozone levels, and where late spring and early summer stratospheric ozone intrusions have been documented, especially in the Rocky Mountains (Lin, et al., 2012, 2015; Yates, et al., 2013). Trajectory analyses can qualitatively identify geographic origins of air masses on exceedance days, but give no information on quantifiable contributions. Source apportionment applications and sensitivity runs in which certain emission sectors or regions are zeroed-out can quantify contributions from specific geographic region to local ozone concentrations.

2.4.1 Review of Trajectory Analyses and Conceptual Model

A conceptual model identifies necessary and sufficient conditions for high ozone concentrations to occur in the local area. The conceptual model developed for the Maricopa Ozone Nonattainment area (MAG, 2015) found elevated ozone concentrations to be associated with intense summer photochemical reactions, local stagnation or long range transport of ozone precursor emissions, and synoptic and mesoscale atmospheric dynamics. More than 80% of exceedances during 2005-2014 occurred during the three months from May to July. The largest proportion of exceedance days and total exceedances occurred in June, followed by July and August. Analyses of 24-hour back trajectories on ozone exceedance days in 2011 revealed varied geographic origins of air masses (Figure 2-7):

- May exceedances are associated with westerly wind bringing air from Southern California enhanced by cold fronts and stratospheric intrusions from late spring low pressure systems.
- June exceedances are associated with westerly wind bringing air from Southern California enhanced by high temperature and long exposure to sunlight.
- July exceedances are associated with extremely high daytime temperatures and are influenced much more by the regional monsoon pattern. A large scale upper level high pressure feature usually aligns over the Four Corners area and pumps moist, unstable air from the southeast. The trajectories show multiple days of upwind air masses from Northern Mexico. Under monsoonal steering winds, small scale thunderstorms thrive under these favorable dynamics. High pressure often controls the local flow in between thunderstorm events. Stagnant winds can last long enough to combine with the extreme heat to trap pollutants and create the highest ozone of the season.
- August has similar meteorological conditions to July. Peak biogenic VOC emissions can enhance ozone formation.

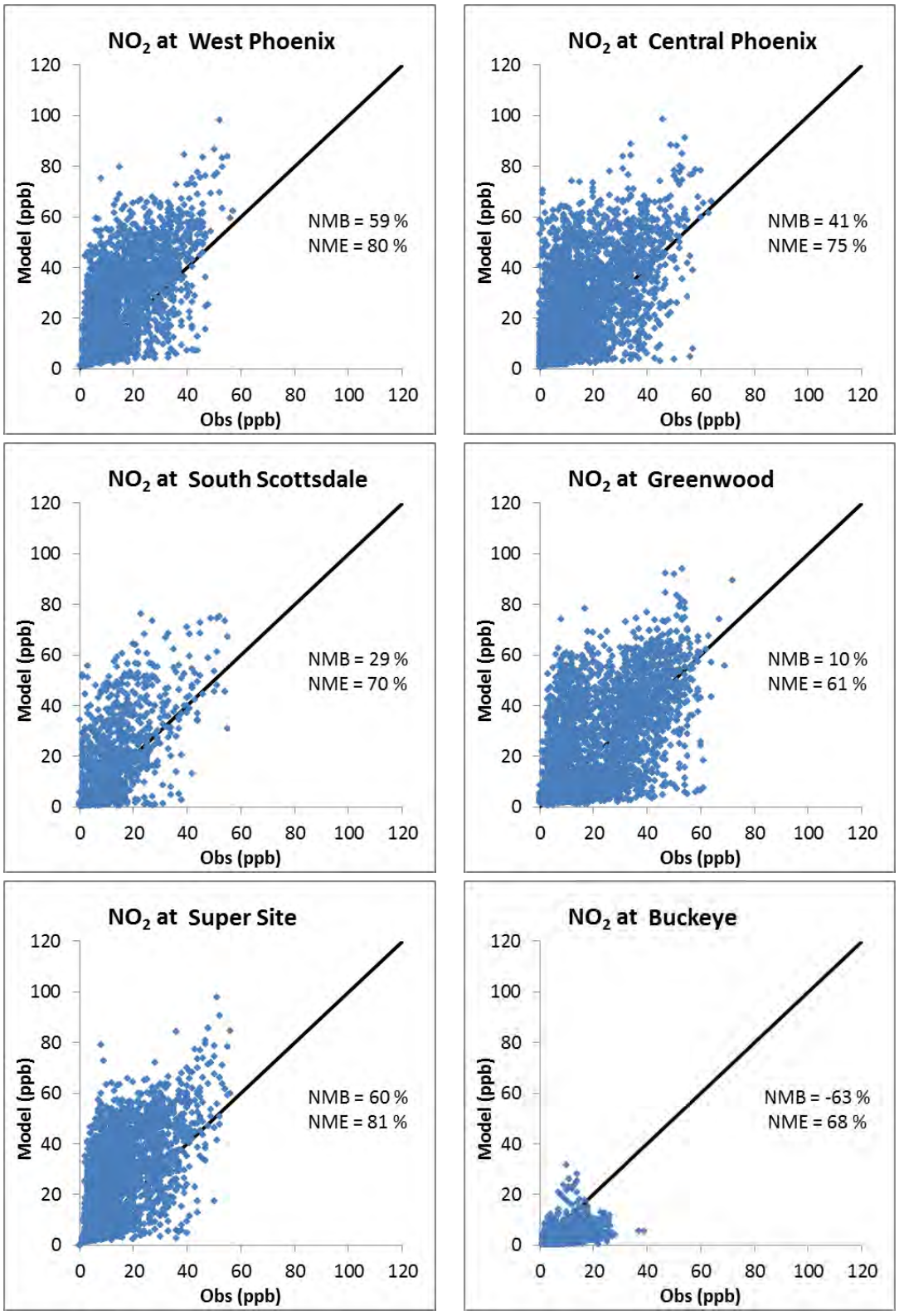


Figure 2-4. Scatter plots of predicted and observed hourly NO_2 concentrations for monitors in Maricopa County.

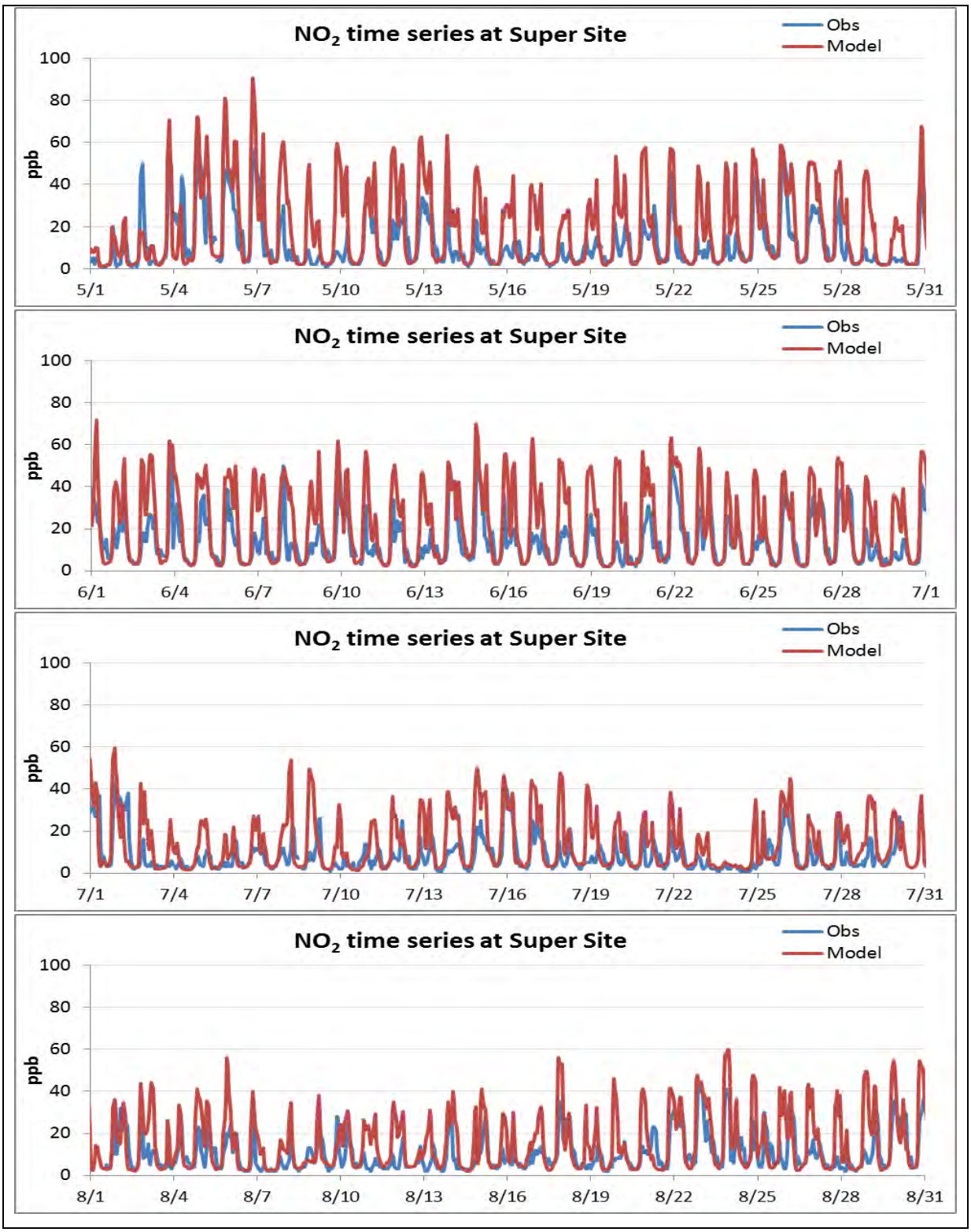


Figure 2-5. Time series of observed (blue) and predicted (red) NO_2 at Supersite in May-August, 2011.

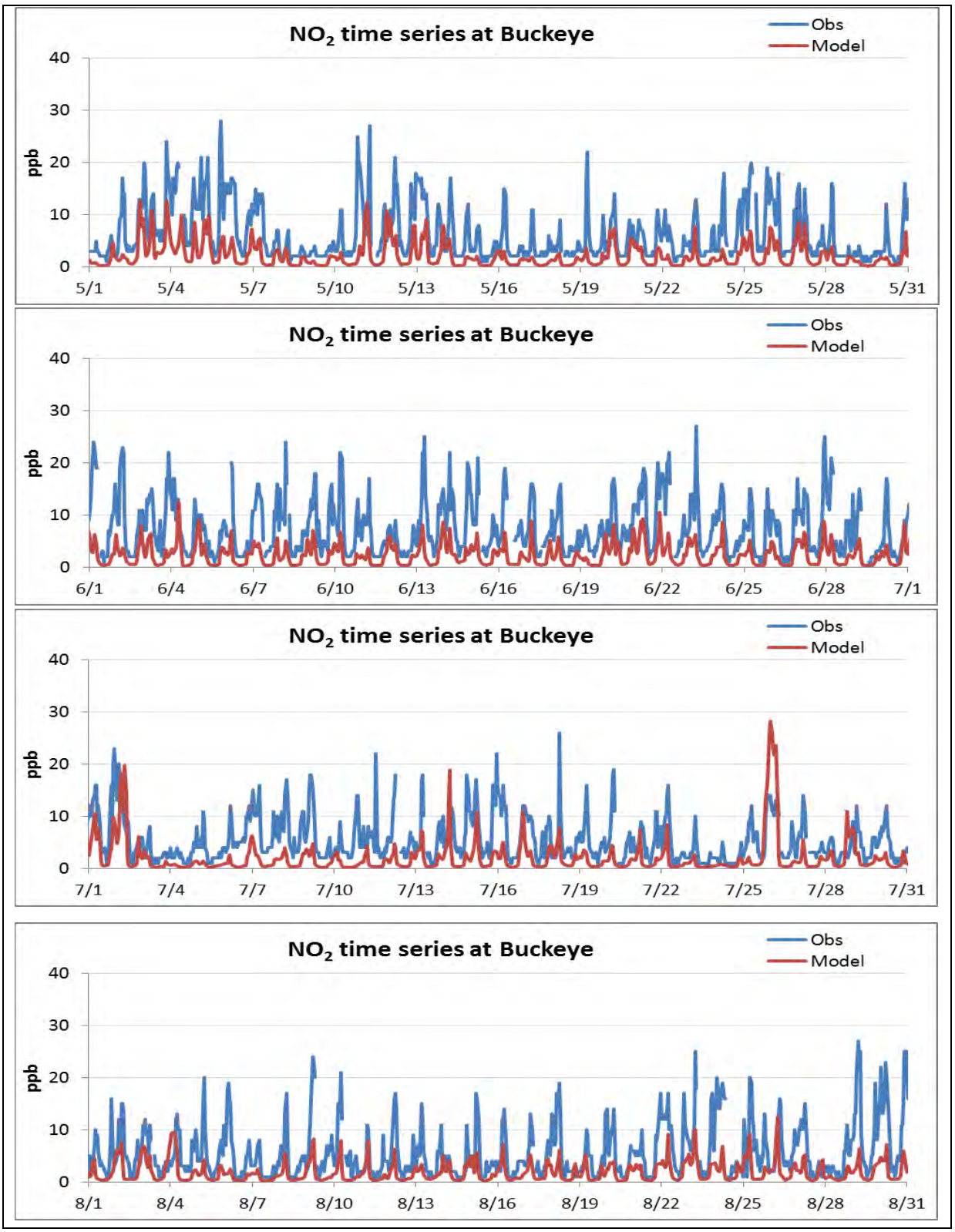


Figure 2-6. Time series of observed (blue) and predicted (red) NO_2 at Buckeye in May-August, 2011.

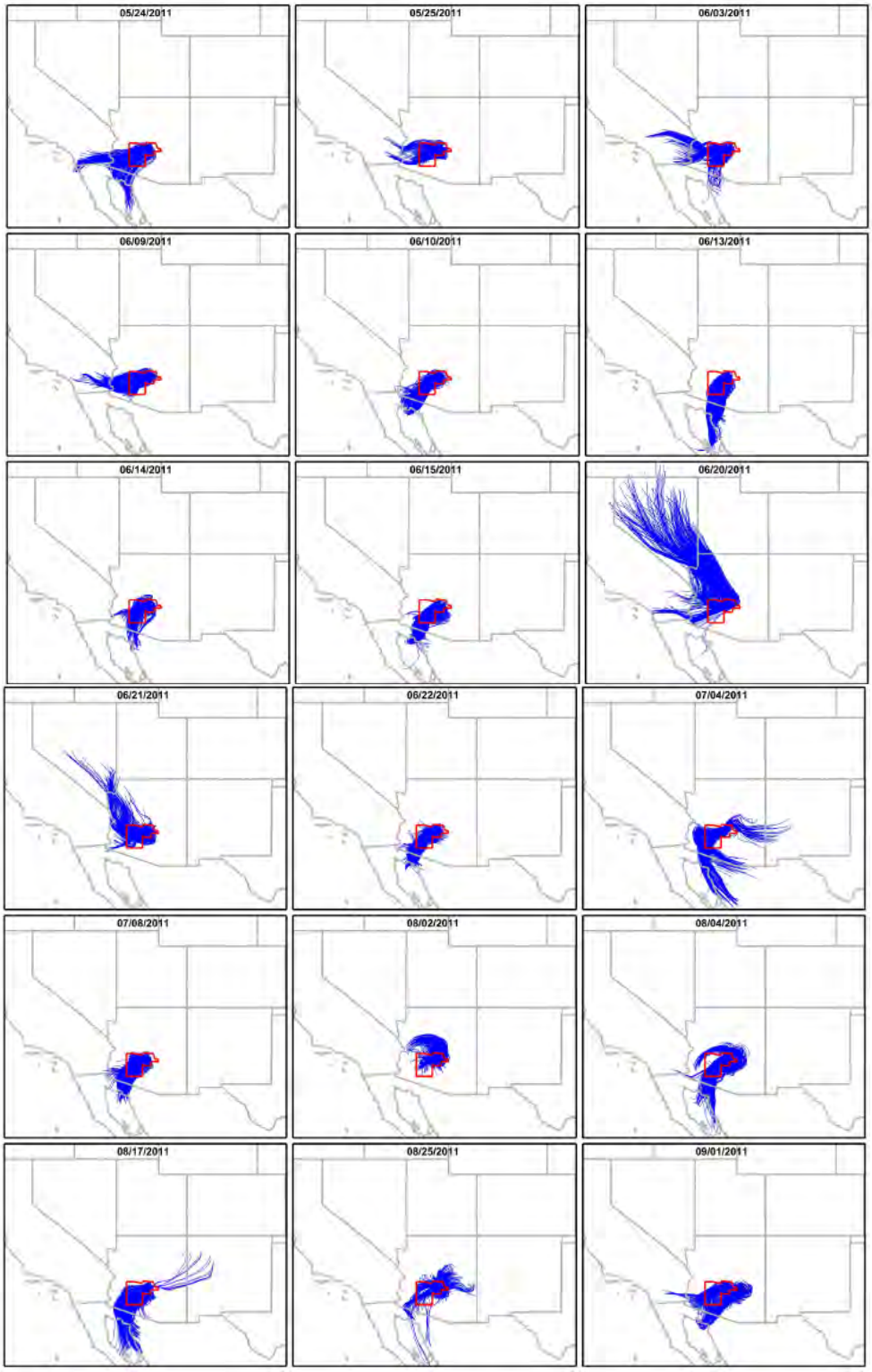


Figure 2-7. Daily maps of 24-hour HYSPLIT back trajectories for each day in the 2011 ozone season with at least one exceeding monitoring site in the Maricopa Ozone Nonattainment Area.

2.4.2 Background Ozone

Ozone and certain precursors can be transported long distances in the mid and upper troposphere (3-10 km) because their chemical lifetimes can span weeks. EPA recognized that sources other than US anthropogenic emissions can contribute large fractions of ozone at certain times and locations. EPA has defined US background (USB) ozone specific to the context of NAAQS implementation. USB includes all global natural sources of ozone (biogenic, wildfire, stratospheric, lightning), and all anthropogenic sources from outside the US. Appendix A summarizes the EPA (2015) characterization of background ozone.

Background ozone plays a major role in Maricopa County. Ozone contributions from Mexico and USB from a zero-out analysis conducted by MAG are shown in Table 2-2. The contributions are expressed as ppb (or %) of the 2017 Design Value (DVF) based on the top 10 highest daily maximum 8-hour (MDA8) days. Mexico contributes 3% (1.9 ppb) of the 2017 DVF with the highest impact predicted in July (10% or 7.1 ppb). USB contributes 63% (47.3 ppb), with more than 60% in all summer months except August. High background contributions would make local ozone less responsive to local emission controls.

Table 2-2. Predicted contributions of US background ozone and Mexico to the 2017 DVF based on the top 10 MDA8 days in each month and for the entire May-September period.

	Mexico		USB	
Month	**ppb**	**%**	**ppb**	**%**
May	0.6	1%	68.1	87%
Jun	3.2	4%	56.8	73%
Jul	7.1	10%	48.4	66%
Aug	4.5	6%	36.9	51%
Sep	3.5	5%	46.4	61%
May-Sep	**1.9**	**3%**	**47.3**	**63%**

The EPA's updated ozone transport modeling described in Section 2.1 analyzed 2017 ozone contributions at individual monitoring sites. Modeling results are used to quantify projected 2017 ozone contributions from Tribal, Canada & Mexico, Offshore, Initial & Boundary Concentration, and Biogenics categories. The analysis also includes interstate contributions from emissions in each upwind state to ozone concentrations at projected 2017 nonattainment and maintenance sites in other states (i.e., in downwind states). Contributions are calculated based on data for all model-predicted 8-hour ozone exceedance days (i.e., >=76 ppb) in the 2017 modeling. For those sites with fewer than 5 modeled exceedance days in 2017, the contributions were calculated based on the top 5 concentration days.

According to EPA's modeling, the 2017 ozone contributions from non-US anthropogenic sources (USB) are 52% at North Phoenix, the site with highest predicted 2017 ozone concentrations, and 55% averaged across all Maricopa County sites (Figure 2-8). These results confirm significant impacts from USB to local ozone in Maricopa County.

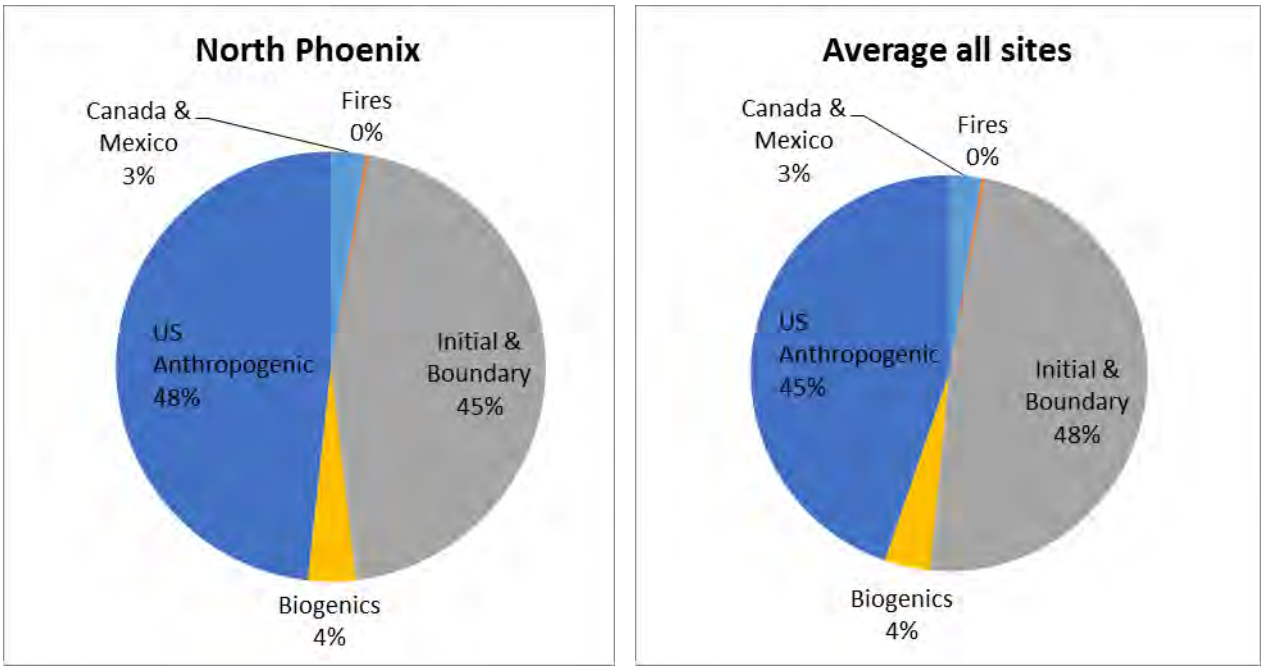


Figure 2-8. 2017 ozone contributions from US and non-US sources [Source: EPA's modeling data released as part of the July 23, 2015 Notice of Data Availability]

Observed ozone trends at rural locations in the western US suggest that background ozone is rising in response to increasing non-US emissions (Parrish et al., 2012; Cooper et al., 2012). Long-term regional modeling found increasing USB in Phoenix through 2020 in the absence of meteorological variation (Nopmongcol et al., 2016). The 2020 4th highest MDA8 USB in Phoenix is predicted to reach 50.4 ppb. Average MDA8 USB over the top 30 USB days and over all summer days (May – September) is rising more rapidly than the 4th highest MDA8 USB. USB contributions to surface ozone concentrations over the top 10 USB days exceed 60% in Phoenix and much of the southwestern US. These results are in agreement with MAG's zero-out analysis described above. Rising background ozone would make attaining the NAAQS an ever-increasing challenge.

2.4.3 Interstate transport

Interstate air pollution transport is a combination of local emissions and emissions from upwind sources. Back-trajectories described in Section 2.4.1 suggest influences from Southern California and Northern Mexico on high ozone days. In this Section we examine source contributions from neighboring and nearby states.

Based on the EPA's 2017 modeling described in Section 2.1, the top 5 states contributing ozone transport to monitors within Maricopa County are (in descending order) California, Texas, Nevada, Utah, and New Mexico (Table 2-3). EPA used a one percent screening threshold of the 75 ppb NAAQS (0.75 ppb) to define whether a state significantly contributes to or interferes with maintenance of the standard in downwind areas. California contributions exceed this

threshold at all Maricopa County sites and reach a maximum of 4.25 ppb at Cave Creek (Site 40134008). Clearly, ozone precursor emissions from California play a major role in attaining the 8-hour ozone NAAQS in Maricopa County. Contributions from other states are almost entirely below the 0.75 ppb threshold.

Significant contributions from California to ozone in Maricopa County are confirmed by the zero-out modeling performed by MAG. California contributions, shown in Table 2-4 are expressed as contributions (in ppb) of the 2017 DVF based on the top 10 MDA8 days by month. The contributions are roughly 2 ppb in May across all monitors, increase to a range of 2.7-7.3 ppb in June, and then drop to under 2 ppb in July and August. Peak contributions in June are consistent with back trajectories described in Section 2.4.1.

Table 2-3. 2017 ozone contributions (ppb) from nearby states according to EPA CSAPR modeling of 2017. Contributions greater than 1% of the 2008 ozone NAAQS (0.75 ppb) are highlighted.

Monitor ID	AZ	CA	TX	NV	UT	NM	Tribal
40130019	**29.29**	**2.76**	0.24	0.18	0.04	0.05	0.04
40131004	**31.57**	**3.44**	0.16	0.27	0.11	0.06	0.09
40131010	**24.60**	**2.24**	0.36	0.16	0.05	0.08	0.06
40132001	**30.75**	**2.70**	0.19	0.21	0.06	0.07	0.07
40132005	**27.32**	**4.14**	0.05	0.27	0.11	0.01	0.08
40133002	**28.46**	**3.36**	0.21	0.08	0.05	0.07	0.05
40133003	**29.43**	**2.54**	0.27	0.23	0.09	0.07	0.07
40134003	**26.88**	**2.38**	0.19	0.17	0.04	0.04	0.04
40134004	**23.35**	**1.65**	**0.95**	0.28	0.08	0.25	0.08
40134005	**26.23**	**2.61**	0.06	0.15	0.03	0.02	0.05
40134008	**27.15**	**4.25**	0.08	0.13	0.12	0.03	0.12
40134010	**29.82**	**1.86**	0.47	0.18	0.12	0.17	0.08
40134011	**19.18**	**2.78**	0.17	0.19	0.14	0.25	0.11
40137003	**17.42**	**2.98**	0.68	0.22	0.16	0.36	0.05
40137020	**28.64**	**2.47**	0.27	0.22	0.09	0.07	0.07
40137021	**29.70**	**2.20**	0.25	0.20	0.08	0.07	0.07
40137022	**28.37**	**2.10**	0.24	0.19	0.08	0.06	0.07
40137024	**28.48**	**2.46**	0.26	0.22	0.09	0.07	0.07
40139508	**19.72**	**3.55**	0.04	0.17	0.09	0.05	0.03
40139702	**27.96**	**2.35**	0.39	0.29	0.13	0.11	0.13
40139704	**27.13**	**3.34**	0.27	0.21	0.10	0.08	0.10
40139706	**26.45**	**3.81**	0.05	0.26	0.10	0.02	0.09
40139997	**29.52**	**3.48**	0.22	0.09	0.05	0.07	0.05
Average	**26.84**	**2.85**	0.26	0.20	0.09	0.09	0.07

[Source: EPA's modeling data released as part of the July 23, 2015 Notice of Data Availability]

Table 2-4. California contributions to the Maricopa 2017 eight-hour ozone (ppb).

AIRSID	Site Name	County	DVB (2011)	Influence on the Maricopa Eight-Hour Ozone (ppb)					
				May	June	July	August	September	May-September
40070010	Tonto NM	Gila	73.7	2.1	2.7	1.1	1.1	2.0	2.1
40130019	West Phoenix	Maricopa	76.7	2.7	4.9	2.0	1.1	3.2	1.6
40131004	North Phoenix	Maricopa	**79.7**	2.4	4.5	1.8	1.1	3.1	1.3
40131010	Falcon Field	Maricopa	69.7	1.9	3.2	1.4	0.9	2.5	1.0
40132001	Glendale	Maricopa	74.7	2.5	5.3	2.2	1.1	3.2	1.6
40132005	Pinnacle Peak	Maricopa	76.0	2.3	3.5	1.9	1.1	2.4	1.4
40133002	Central Phoenix	Maricopa	73.3	2.4	4.6	1.6	0.9	3.2	1.2
40133003	South Scottsdale	Maricopa	75.7	2.2	4.1	1.7	1.0	2.8	1.2
40134003	South Phoenix	Maricopa	74.7	2.2	6.5	n/a	1.1	3.3	1.7
40134004	West Chandler	Maricopa	72.7	2.4	4.0	0.7	0.9	3.2	1.5
40134005	Tempe	Maricopa	69.7	2.2	4.2	1.4	0.9	2.9	1.1
40134008	Cave Creek	Maricopa	76.3	2.1	4.2	1.2	1.0	2.6	1.8
40134010	Dysart	Maricopa	71.0	2.2	6.6	1.2	1.3	3.0	1.7
40134011	Buckeye	Maricopa	65.0	2.3	7.3	n/a	n/a	4.7	2.0
40135100	Yuma Frank[1]	Maricopa	70.3	2.1	2.9	1.8	1.0	2.0	1.4
40137020	Senior Center[2]	Maricopa	73.7	2.1	3.6	1.6	0.9	2.4	1.0
40137021	Red Mountain[2]	Maricopa	76.7	2.1	3.5	1.5	1.0	2.7	1.1
40137022	Lehi[2]	Maricopa	73.3	2.1	3.6	1.5	0.8	2.7	1.1
40137024	High School[2]	Maricopa	73.3	2.0	3.5	1.5	0.8	2.3	1.1
40139508	Humboldt Mountain	Maricopa	74.0	2.5	4.0	1.3	1.8	2.2	3.4
40139702	Blue Point	Maricopa	74.7	2.0	3.2	1.4	0.9	2.5	1.6
40139704	Fountain Hills	Maricopa	74.3	2.2	3.3	1.9	1.0	2.1	1.4
40139706	Rio Verde	Maricopa	74.0	2.1	3.3	1.8	1.5	2.4	2.2
40139997	Super Site	Maricopa	76.0	2.6	4.7	1.8	1.0	3.1	1.2
40213001	Apache Junction	Pinal	73.0	2.0	3.2	1.3	1.0	2.5	1.3
40218001	Queen Valley	Pinal	75.0	2.0	3.1	1.7	1.2	2.2	1.2
Monitored Area Max			**79.7**	2.7	7.3	2.2	1.8	4.7	3.4

1. Fort McDowell Yavapai Nation
2. Salt River Pima-Maricopa Indian Community

3.0 SUPPLEMENTAL TREND ANALYSES

3.1 Causes of High Ozone in 2011/2012

The projected 2017 design values are influenced by a selection of baseline ozone and meteorological conditions. MAG chose the year 2011 as the base year because the EPA's National Emissions Inventory (NEI) for the year 2011 is the most recently compiled and quality assured national inventory. However, the 2011 design values were among the highest during the span of 2002-2014. Kemball-Cook et al. (2013), under contract to MAG, evaluated recent ozone trends in Maricopa County to specifically determine the cause(s) of rising ozone concentrations in 2011-2012 (Figure 3-1). They evaluated a number of hypotheses that included both local and regional factors, including:

- Changes in emissions
  - Summer-time use of 10% ethanol gasoline blend fuel since 2011
  - Local/regional anthropogenic emissions
  - Local biogenic emissions
  - Local and regional wildfire activity
- Shifts from volatile organic compound (VOC)-limited ozone formation in the urban core toward nitrogen oxide (NOx)-sensitive conditions (described in Section 2.2)
- Changes in local and regional meteorological and climatic conditions
  - Temperature, winds, clouds/rainfall, El Nino phase, etc.
- Changes in background ozone concentrations and transport

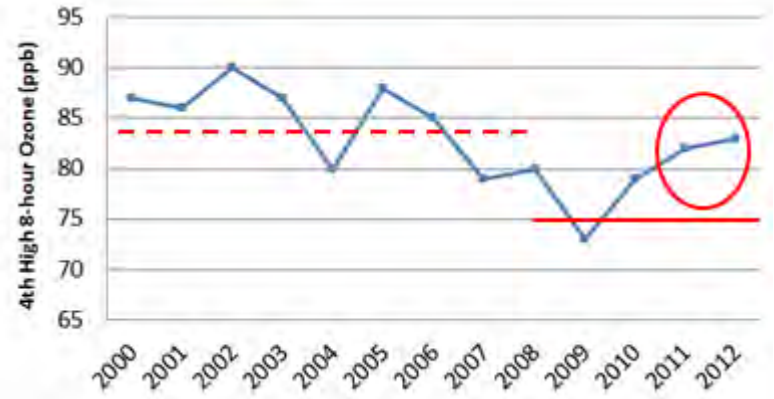


Figure 3-1. Maximum 4th highest daily maximum 8-hour (MDA8) ozone concentration among Maricopa County ozone monitors from 2000-2012, including the 1997 ozone standard (dashed red line) and the 2008 ozone standard (solid red line). Data supplied by MAG.

The analyses revealed that the 2008-2012 ozone trend observed at Maricopa County monitors was similar to ozone trends measured in other large metropolitan areas in nearby states (Figure

3-2). This suggested that regional-scale factors were important in determining 2011-2012 ozone levels in Maricopa County.

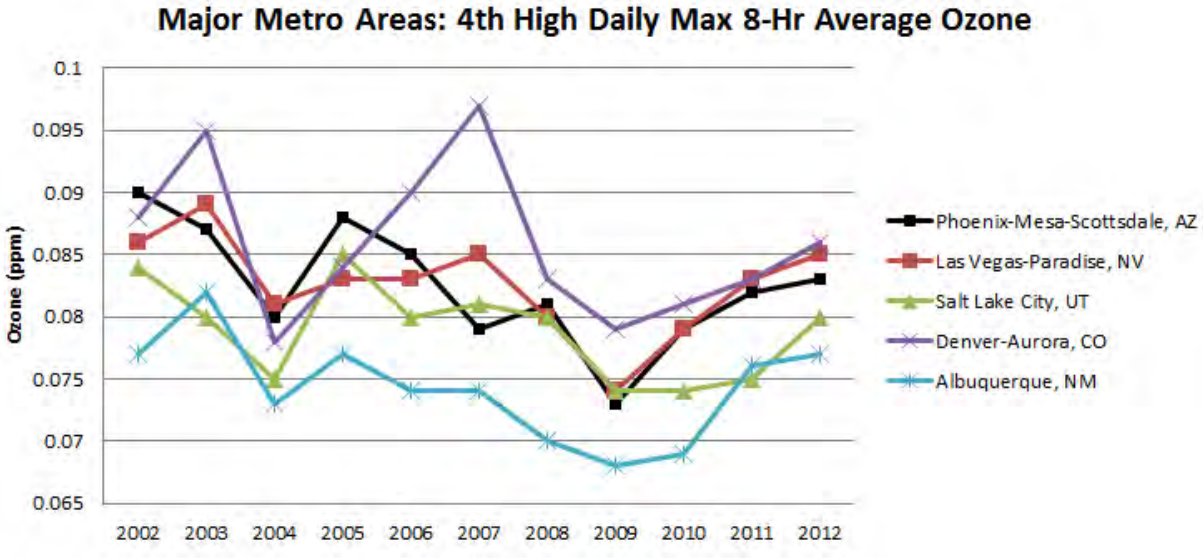


Figure 3-2. 2002-2012 4th high MDA8 ozone trends for major metropolitan areas in the western US located east of the Sierra Nevada Mountains. Data from U.S. EPA www.epa.gov/airdata/ad_rep_mon.html.

The May-June period during 2008-2012 recorded the largest number of high ozone days in Maricopa County (Figure 3-3). This period precedes the cloudy/rainy summer monsoon that typically begins in July and lasts into August. Variations in May-June cloudiness during 2008-2012 were consistent with Maricopa ozone trends. Satellite-derived measures of regional cloudiness and local Phoenix cloud cover data (Figure 3-4) showed an unusually large amount of cloud cover in May-June 2009 and an unusually small amount of cloud cover in May-June 2011-2012.

Other factors that may have contributed to high ozone levels in 2012 included an unusually large number of high-temperature days in 2012 (Figure 3-5), and more potential impacts from wildfire emissions in 2012 than in 2008-2011 (Figure 3-6). No inter-annual changes were evident in transport patterns or in background ozone entering the US that would indicate that regional or international transport played a significant role in rising Maricopa ozone levels in 2011-2012.

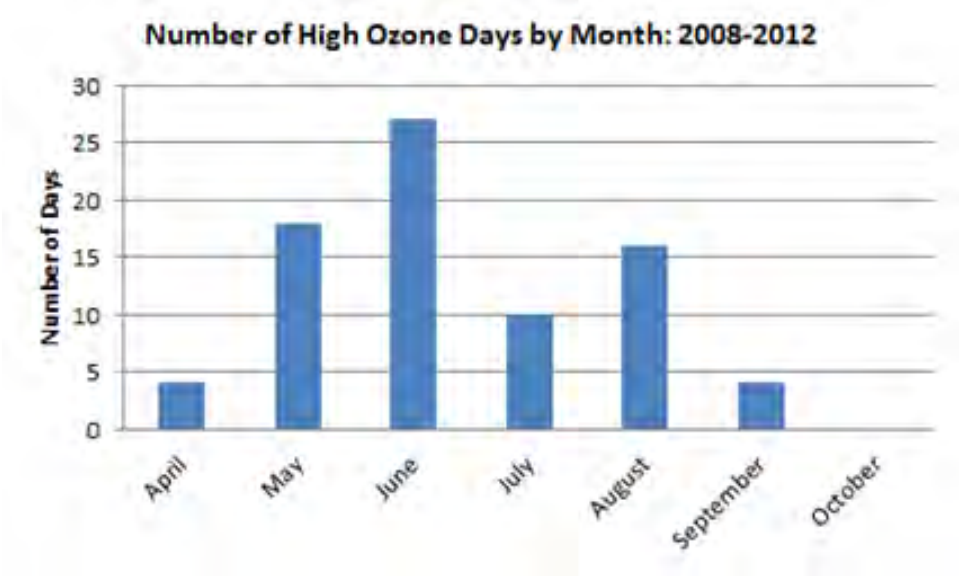


Figure 3-3. Number of high ozone days by month for Maricopa County during 2008-2012. High ozone days are defined to be any day for which one or more Maricopa County ozone monitors has MDA8>75 ppb.

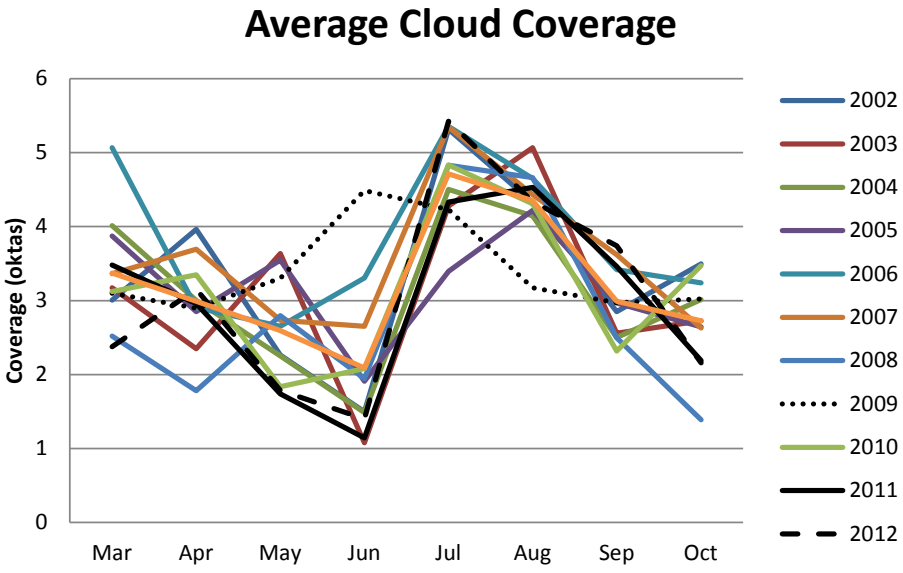


Figure 3-4. Monthly average cloud coverage for each year from 2002-2012 for the Phoenix Sky Harbor Airport (KPHX).

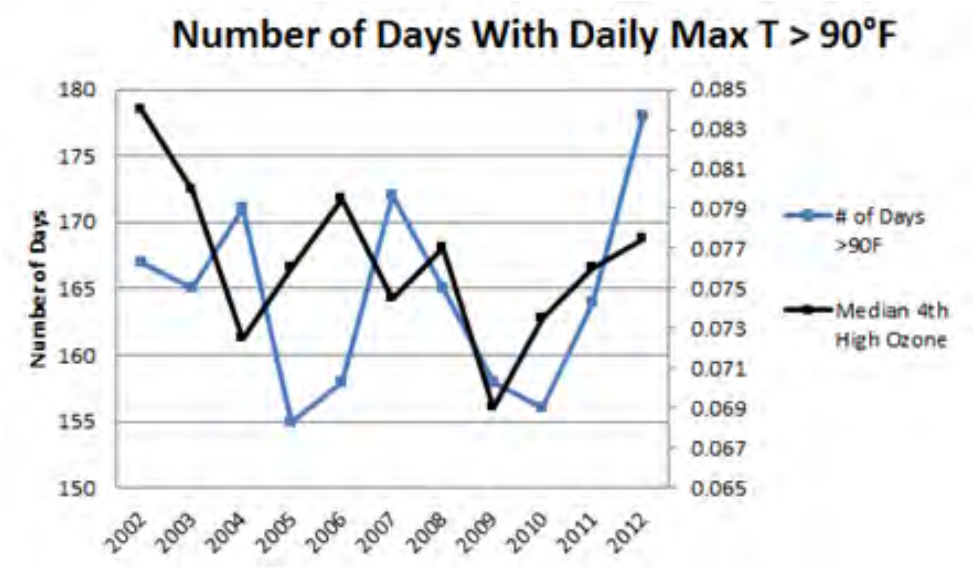


Figure 3-5. Number of days with daily maximum temperature >90°F for each year from 2002-2012 for the Phoenix Sky Harbor Airport, KPHX, and median value of the 4th high MDA8 among all Maricopa County ozone monitors.

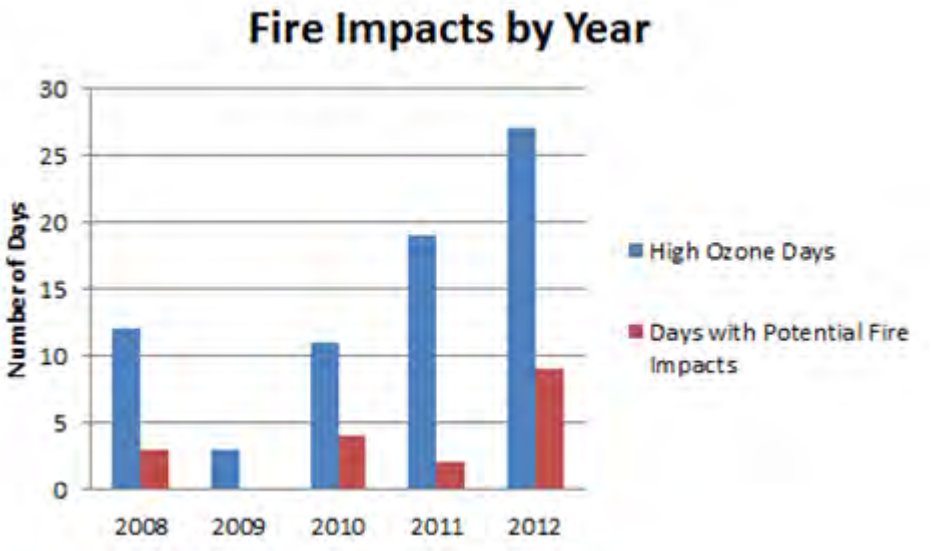


Figure 3-6. Number of high ozone days (MDA8>75 ppb for one or more Maricopa County monitors) and number of high ozone days with potential ozone impacts from fire emissions during 2008-2012.

Anthropogenic NOx and VOC emissions generally decreased during 2008-2011 in the Maricopa Nonattainment Area (Figure 3-7). Modeling of on-road mobile sources using the U.S. Environmental Protection Agency's Motor Vehicle Emissions Simulator (MOVES) model indicated that vehicle emissions declined overall during 2008-2012, but do show some increase in VOC emissions after 2010 due to the use of 10% ethanol blend (E10) fuel (Figure 3-8).

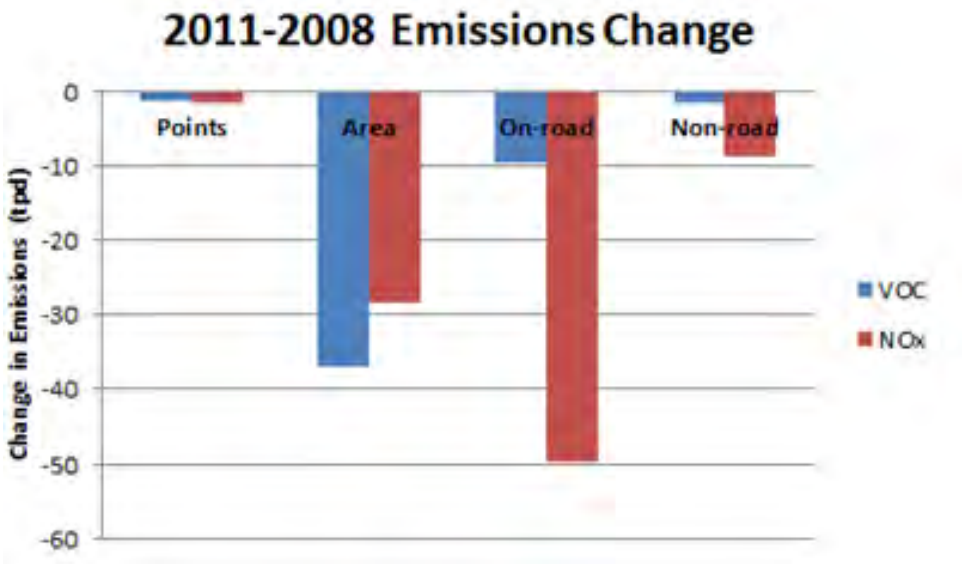


Figure 3-7. Emissions trends for Maricopa Nonattainment Area: 2008 to 2011. Emission inventory data provided by MAG.

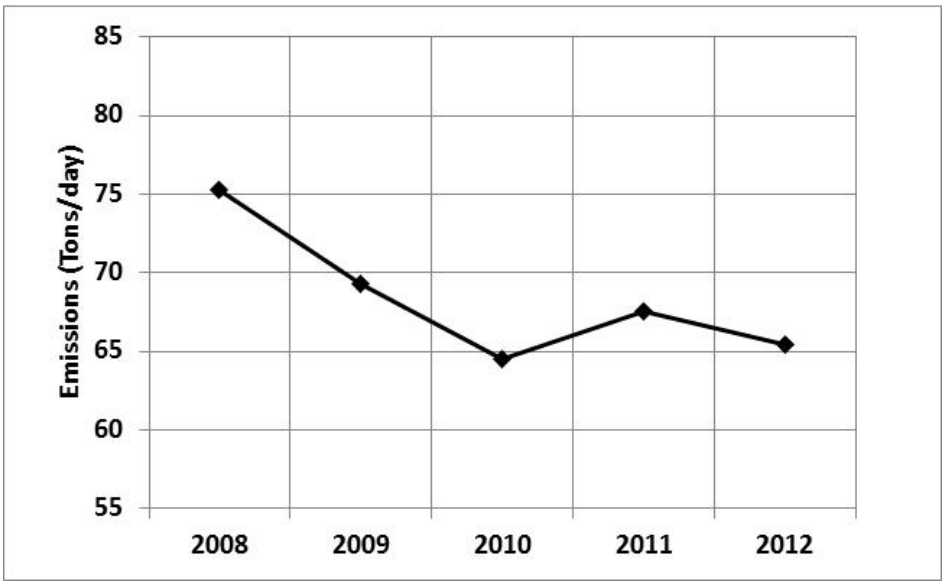


Figure 3-8. MOVES ozone season average on-road VOC emissions for Maricopa County.

3.2 Air quality related trends

3.2.1 Ozone Precursor Trends

The Maricopa Ozone Nonattainment Area has seen a continual decline of NOx and VOC emissions in the past decade. Point source growth has been modest. Tightening federal regulations on vehicle tailpipe sources and Tier 2, Tier 3, and Tier 4 non-road standards push the emission trends downward despite continued growth in vehicle miles traveled, population and housing in the Phoenix area. This trend continues through 2017.

Efforts in reducing emissions are realized in the ambient air quality trends. Ambient NOx concentrations at the Supersite show a strong downward trend (R^2 = 0.9) since 1999 (Figure 3-9). Summer season mean NOx in 2015 has reduced to only one third of the 1999 level. VOC concentrations (shown in Figure 3-9 as Total Non-methane Organic Carbon or TNMOC) have also declined by more than half during the same period. VOCs with molecules containing the carbonyl (C=O) bond can efficiently provide radical sources which are important to ozone formation. The simplest VOC molecule that contains the carbonyl bond is formaldehyde followed by acetaldehyde. Concentrations of both VOCs declined at the Supersite during 1999-2010, slightly increased in 2011, and then re-established the decreasing trend in 2012. The increase in 2011 may reflect the adoption of 10% ethanol gasoline blend fuel that year. The downward trends of ozone precursor are expected to continue through 2017.

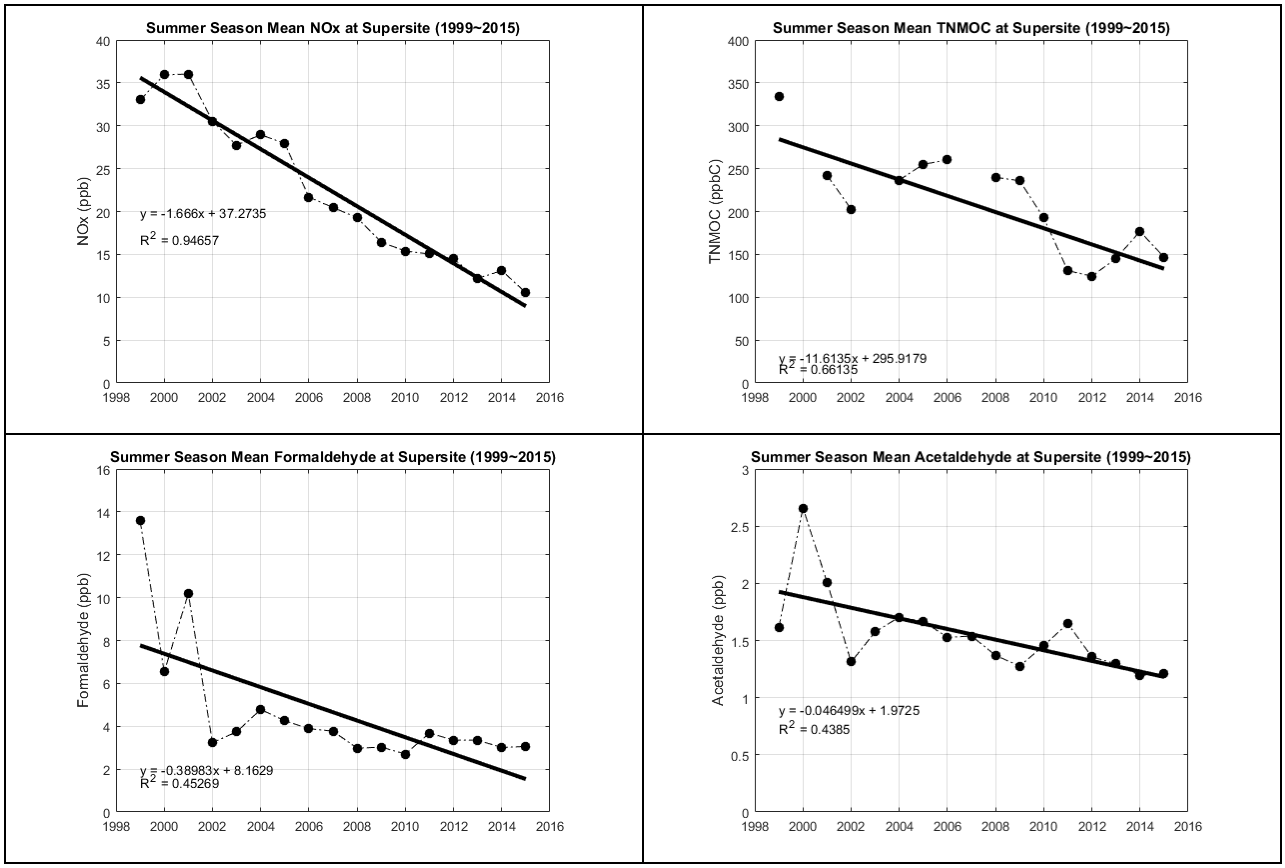
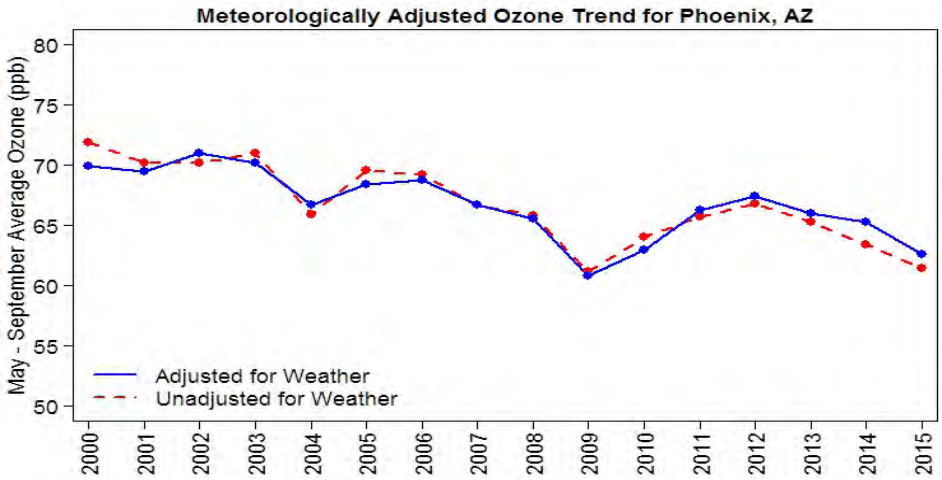


Figure 3-9. Ambient ozone precursor trends at the Phoenix Supersite.

3.2.2 Ozone Trends

Ambient data and emissions trends are very important elements of WOE analyses when the attainment date for an area is in the near future. The EPA's 2014 modeling guidance suggests that if an area is only one or two years away from their attainment date, ambient data is in most cases the best predictor of likely air quality levels in the near future. The guidance also suggests accounting for year-to-year meteorological variations when assessing the ambient data trends. Although the meteorologically adjusted ozone trends through 2016 will not be available in time for this WOE analysis, they are not likely to diverge significantly from the trends through 2015 as illustrated in Figure 3-10. Preliminary 2016 ozone concentration data through August 18, 2016 are presented and discussed in Section 3.2.3.

Unadjusted ozone trends at sites in Maricopa County that were exceeding the NAAQS in 2011 have similar patterns (Figure 3-11). During the span of 1995-2009, design values decreased but then increased between 2009 and 2012. The years of 2013, 2014, and 2015 have reestablished the decreasing trend. As a result, the overall ozone trends between 2000 and 2015 are very weak despite significant reduction of precursor emissions during the same period. Due to the non-linear relationship between ozone and its NOx and VOC precursors, it is impossible to establish a relationship between past emissions changes and historical and current ozone air quality. The weak ozone trends, despite sharp downward precursor trends, emphasize the stiffness of ozone responses to local emission reductions. Nonetheless, the 2015 ozone design values at West Phoenix and Cave Creek are lower than 75 ppb. Ozone at North Phoenix has also been lower in the past three years. When excluding the years 2009 and 2011-2012 to remove effects of unusual meteorology and fire influences (as described in Section 3.1), the annual 4th highest MDA8 since 2005 trends downward to below 75 ppb by 2017 (Figure 3-12). For these reasons, it is expected that the 2017 design values would be at or below the 2008 ozone NAAQS at these three sites.



Source: https://www.epa.gov/sites/production/files/2016-06/_metadj_all.zip

Figure 3-10. Comparison of metrological adjusted and unadjusted summer (May – September) average of daily maximum 8-hour ozone concentrations in Phoenix, according to analyses conducted by EPA.

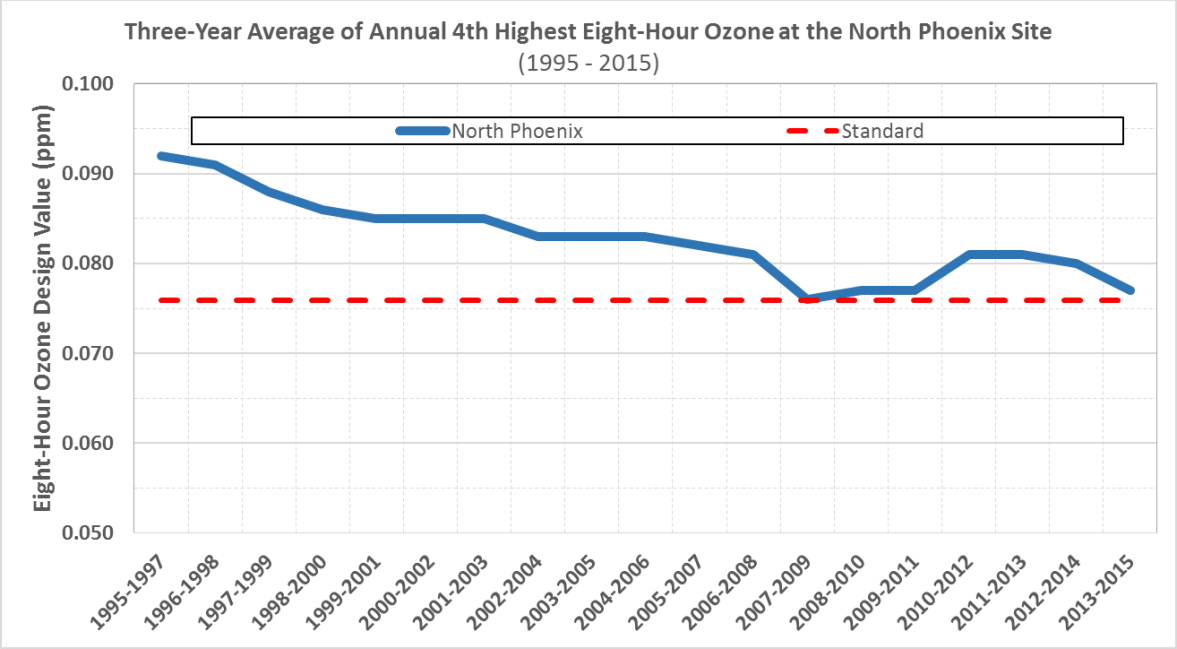


Figure 3-11(a). Design value ozone trends from 1995 to 2015 at monitors in Maricopa County: North Phoenix.

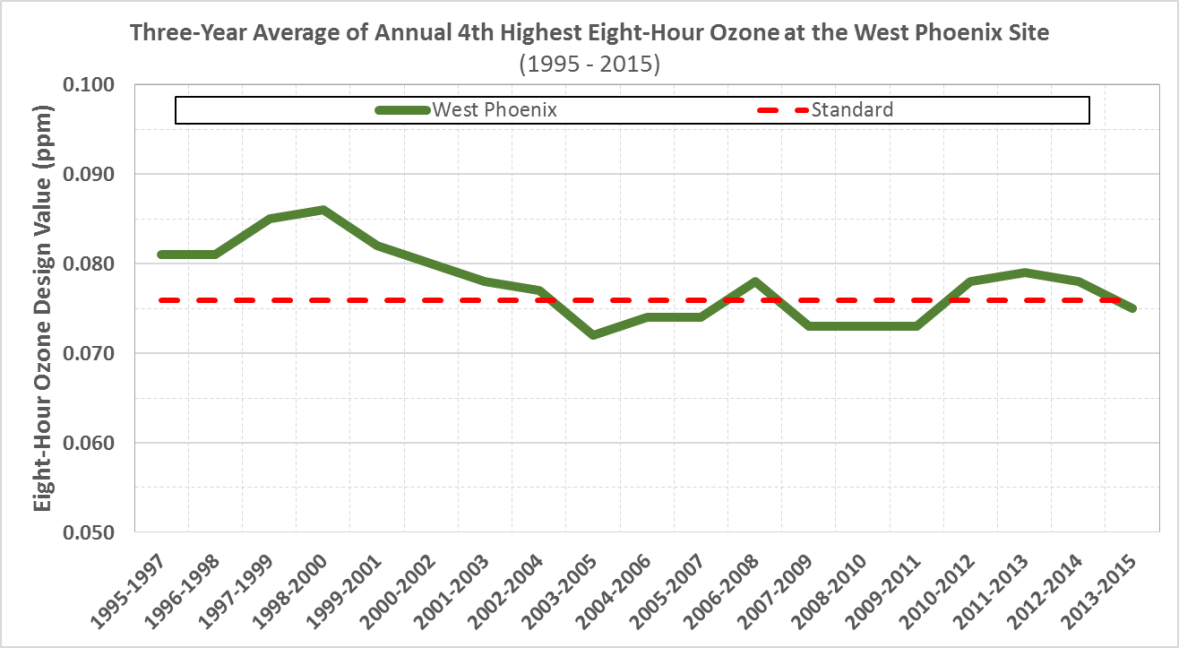


Figure 3-11(b). Design value ozone trends from 1995 to 2015 at monitors in Maricopa County: West Phoenix.

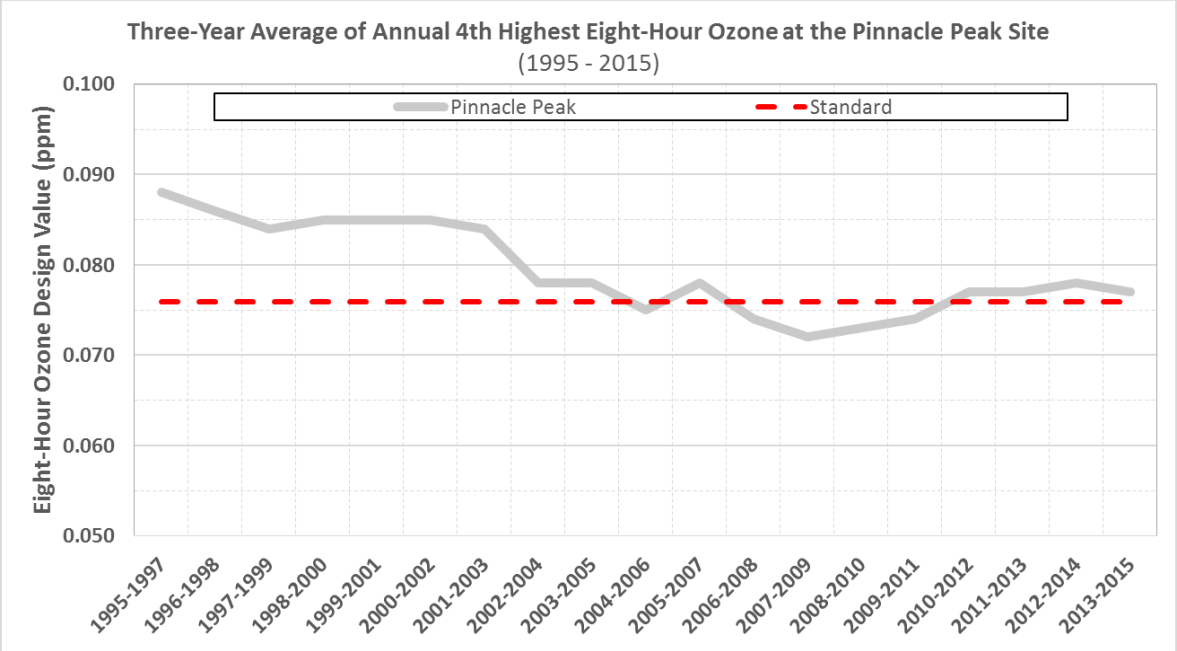


Figure 3-11(c). Design value ozone trends from 1995 to 2015 at monitors in Maricopa County: Pinnacle Peak.

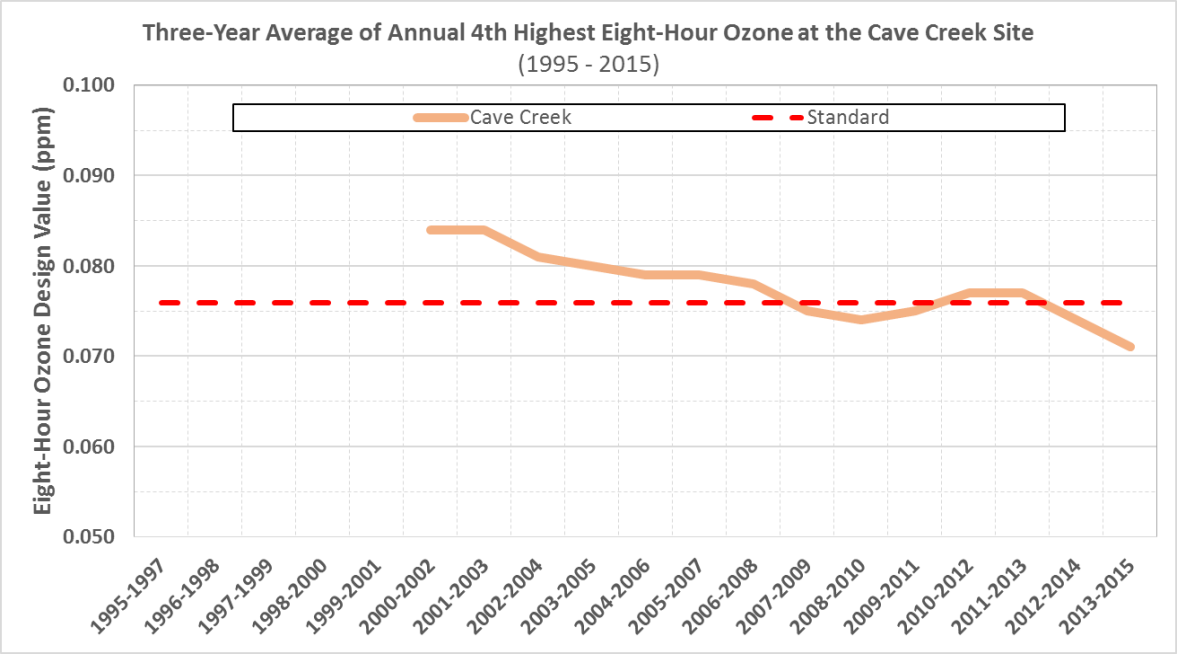


Figure 3-11(d). Design value ozone trends from 1995 to 2015 at monitors in Maricopa County: Cave Creek.

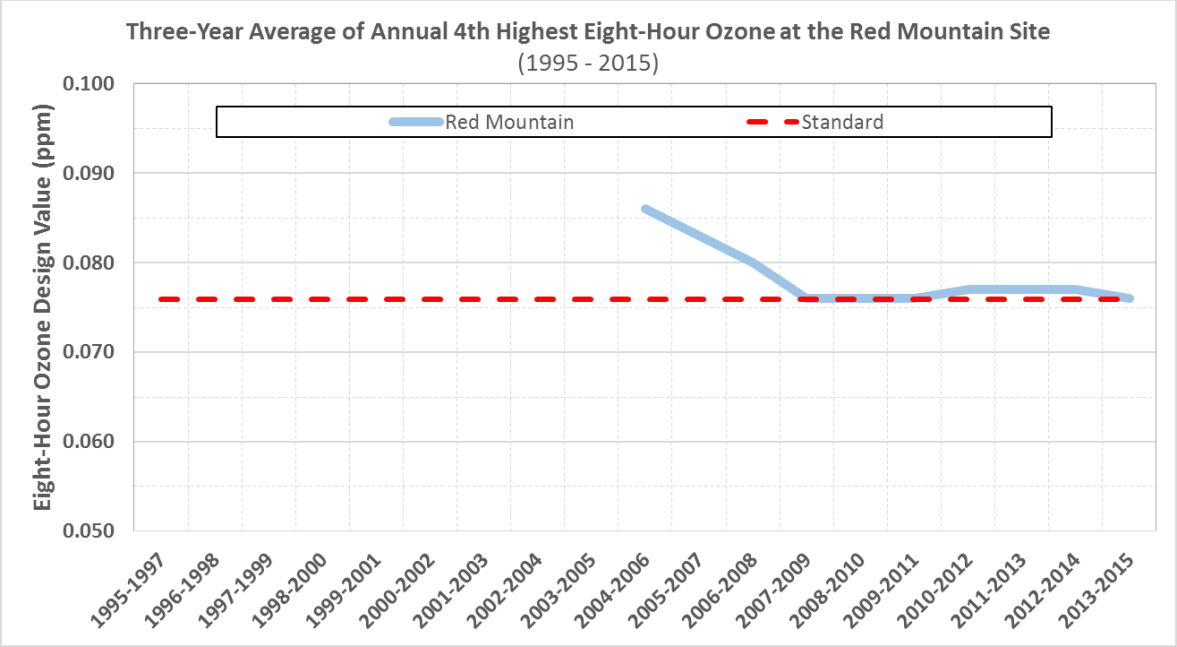


Figure 3-11(e). Design value ozone trends from 1995 to 2015 at monitors in Maricopa County: Red Mountain.

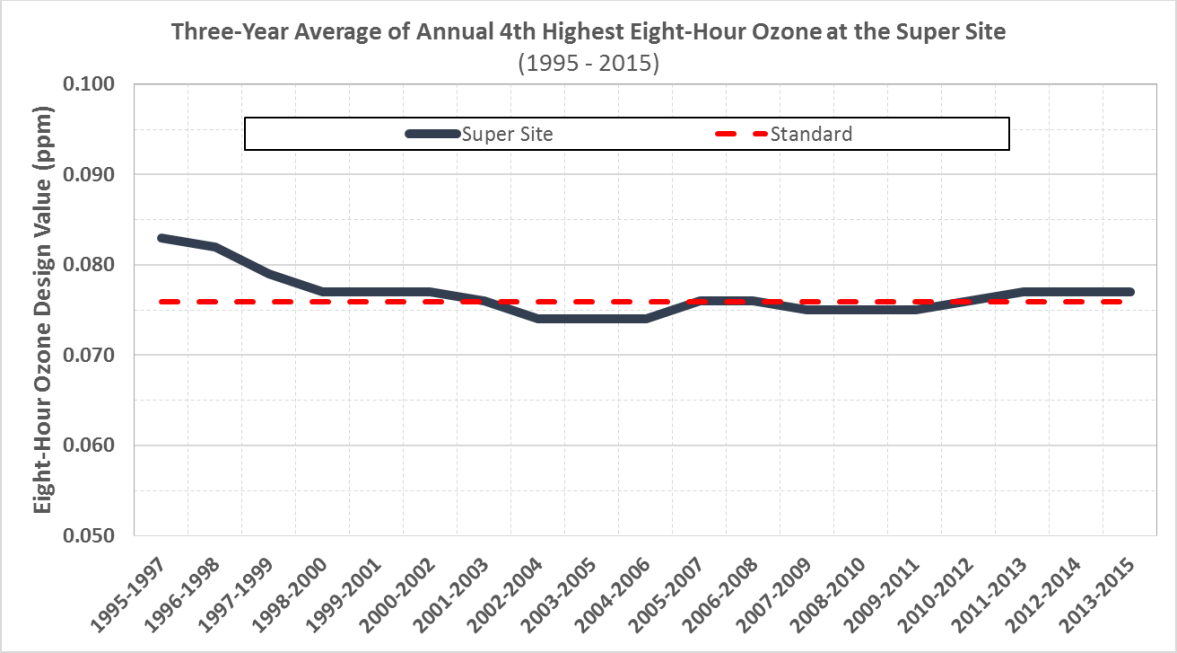


Figure 3-11(f). Design value ozone trends from 1995 to 2015 at monitors in Maricopa County: Super Site.

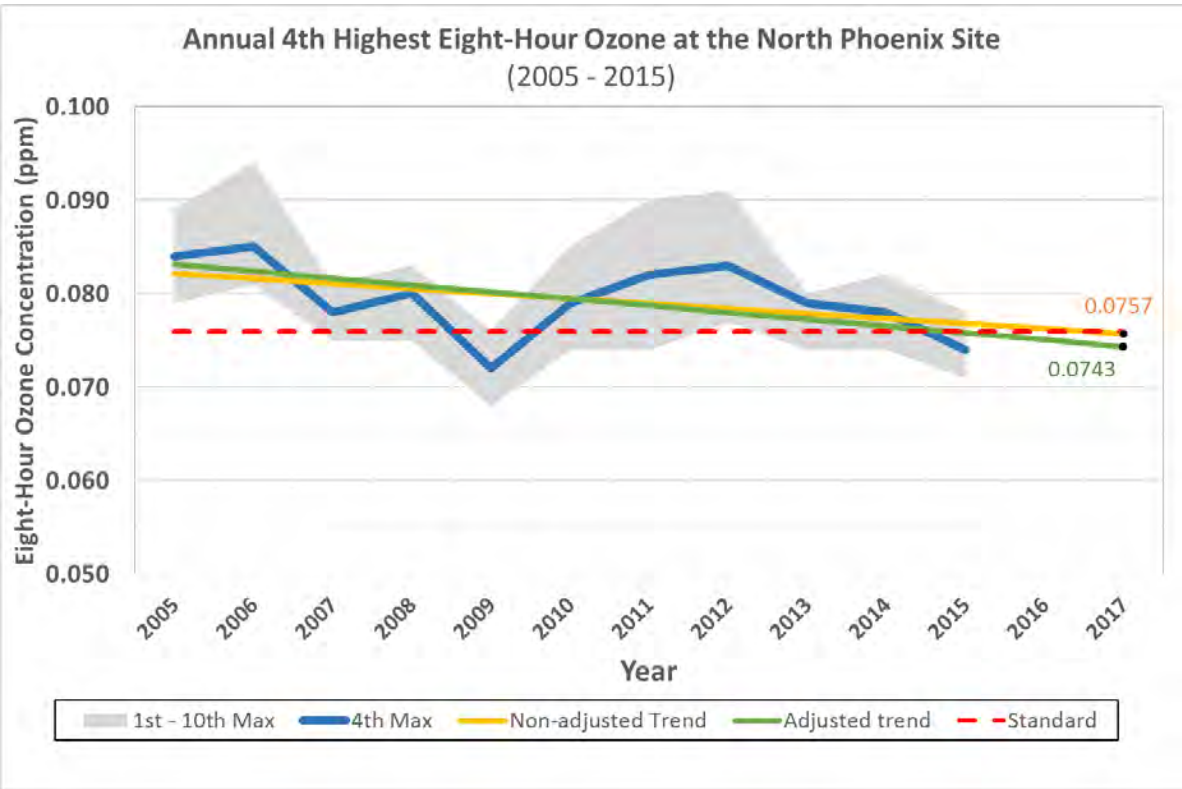


Figure 3-12. Annual 4th highest MDA8 ozone trends from 2005 to 2015 at North Phoenix Site. Adjusted trend excludes the years 2009 and 2011-2012.

3.2.3 Preliminary 2016 Ozone Concentrations

Data on ozone concentrations gathered through August 18, 2016 in the Maricopa eight-hour ozone nonattainment area confirm the continuing trend of declining ozone concentrations at the nonattainment area monitors. While the 2016 data are still preliminary, and the 2016 ozone season is not yet complete, the likelihood of additional exceedances of the 2008 ozone standard in 2016 beyond August 18, 2016 is significantly lower than during the peak ozone season months of June and July.

As of August 18, 2016, all nonattainment area monitors have 2016 fourth-high maximum daily eight-hour average ozone concentrations of 0.075 ppm or less, at or below the 2008 ozone standard. This is a continuation of the trend seen in 2015, where all nonattainment area monitors had fourth-high ozone concentrations of 0.075 ppm or less, after exclusion of the June 20, 2015 ozone concentrations attributed to an ozone wildfire exceptional event. Currently, only one nonattainment area monitor (Pinnacle Peak) has a preliminary 2014-2016 ozone design value (0.076 ppm) that is over the 2008 ozone standard. All other nonattainment area monitors are meeting the standard based upon preliminary 2014-2016 ozone design values.

These data confirm that the downward trend in ozone concentrations is likely to continue through the remainder of 2016 and into 2017. As only one of the 20 nonattainment area monitors is just slightly over the 2008 ozone standard based upon 2014-2016 data, it is expected that the 2015-2017 ozone design values at all nonattainment area monitors will attain the 2008 ozone standard.

4.0 SUMMARY

This report contains weight-of-evidence (WOE) analyses for the MAG moderate area attainment demonstration for the 2008 ozone standard. The following section summarizes the principal findings from these analyses.

- An alternative modeling database recently used in EPA's rulemakings (Cross-State Air Pollution Rule) suggest that the Maricopa Ozone Nonattainment Area would be in attainment in 2017.
- NOx emissions controls are the best mechanism for decreasing Maricopa ozone levels by 2017 and beyond. The NOx emissions and ambient trends have continued to decline and will benefit ozone levels.
- NOx emissions from on-road sources in the modeling inventory may be overstated based on our analyses. Recent literature using top-down estimates from satellite and aircraft remote sensing implicated MOVES in overestimating NOx by a factor of two. For this reason, the effectiveness of NOx emission reductions in lowering ozone concentrations in Maricopa County may be understated in the model. It is anticipated that adjustment to NOx emissions would lower the 2017 design values.
- Back trajectories and source apportionment analyses suggest significant contributions to elevated ozone in Maricopa County from background ozone (USB) and California.
- Ambient NOx and VOC concentrations show an aggressive and persistent downward trend since 2000. In contrast, ozone trends are weak, indicating stiffness in the model because the area is significantly impacted by outside sources, especially background ozone, and possibly because of overstated NOx from on-road sources.
- Design value ozone in recent years show a re-established downward trend that would suggest attainment in 2017.

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APPENDIX A

EPA's Characterization of Background Ozone

Appendix A. EPA's Characterization of Background Ozone

During the latest review of the NAAQS for ozone, the US Environmental Protection Agency (EPA) recognized that sources other than US anthropogenic emissions can contribute large fractions of ozone at certain times and locations. EPA developed a white paper (EPA, 2015) that clarifies EPA's definition of this "background" ozone, describes its sources and processes, summarizes its spatial and seasonal variability, and describes policy tools with which to address implementation challenges stemming from high background contributions. On February 24-25, 2016, EPA held a workshop with States, Tribes and stakeholders in Phoenix, Arizona to discuss information from the white paper. This section summarizes the EPA (2015) characterization of background ozone.

Definition

EPA considers a specific definition for background ozone specific to the context of NAAQS implementation: US background (USB) includes all global natural sources of ozone (biogenic, wildfire, stratospheric, lightning), and all anthropogenic sources from outside the US. EPA notes that it can be difficult to determine whether certain emission sectors are within the US (e.g., marine shipping and aviation) or considered anthropogenic (e.g., prescribed fires). EPA acknowledges that stakeholders may define background ozone differently, such as all sources outside a specific local jurisdiction. USB does not include intrastate or interstate transport of anthropogenic ozone and precursors within the US; such processes are addressed by specific provisions of the Clean Air Act (CAA).

Sources

Ozone and certain precursors can be transported long distances in the mid and upper troposphere (3-10 km) because their chemical lifetimes can span weeks. Ozone at such altitudes can be transported vertically to the surface by several meteorological processes. Stratospheric chemistry (>10 km) is the largest natural source of ozone; dynamic exchange processes continually transport ozone-laden stratospheric air into the upper troposphere. Certain meteorological conditions can bring filaments of stratospheric air deep into the troposphere and directly raise surface ozone concentrations. Referred to as stratospheric intrusions, such events can result in relatively high USB episodes, particularly in elevated terrain (e.g., Langford et al., 2009; 2015). Wildfires, lightning and vegetation are other natural sources of ozone precursors, which can significantly raise USB over episodic to seasonal time scales. Anthropogenic precursor emissions from other countries contribute to the global tropospheric ozone burden and can impact USB on episodic to seasonal scales according to intercontinental transport patterns. Global natural and anthropogenic emissions of methane, which are slowly converted to ozone over annual time scales, also contribute to USB.

Characterization

USB can vary considerably in space and time, and contribute toward a wide range of the total ozone measured at any particular point. Photochemical models have been widely used to quantify background contributions (Fiore et al., 2003; Wang et al., 2009; Zhang et al., 2011; Emery et al., 2012; Lin et al., 2012; EPA, 2014; Lefohn et al., 2014; Dolwick et al., 2015) because

of inherent limitations in using monitoring data for this purpose. Two basic approaches are used to model USB: "zero-out" and "source apportionment." The former approach refers to removing certain emission sectors from the model (e.g., zeroing US anthropogenic precursor emissions, resulting in a "brute-force" estimate of USB). The latter approach employs internal chemical apportionment algorithms that meter the contribution of specific source sectors to ozone chemistry as the model runs (i.e., emissions are not altered, resulting in an estimate of USB as part of the total ozone prediction). Note that zero-out alters the model's chemical environment because emissions are explicitly modified, whereas source apportionment does not alter the model's chemistry.

Historical Estimates of Background Ozone

As part of the Integrated Science Assessment (ISA) developed for the 2015 NAAQS review, EPA (2013) summarized results from independent modeling studies published before 2012:

1) Seasonal mean background ozone is highest in the inter-mountain western US;
2) Seasonal mean background ozone is generally highest in the spring and early summer;
3) Background contributions occur on episodic and non-episodic scales with the highest contributions associated with discrete events such as stratospheric intrusions or wildfires;
4) Models compare reasonably with one another in terms of seasonal mean background ozone estimates, but are not capable of precise background estimates on a daily level.

For example, Zhang et al. (2011) report model estimates of seasonal mean USB ranging from a low of 24 ppb in the summer in the northeast US to a high of 42 ppb in the spring at high elevation sites in the western US. More recently, Fiore et al. (2014) show greater variability in modeled background estimates, with April-June mean values reaching up to 50 ppb at many western high elevation sites. A modeling analysis conducted by Lefohn et al. (2014) concluded that background ozone could comprise greater than 70% of the annual-average hourly total ozone at such high elevation sites.

EPA Estimates of USB

As part of the Policy Assessment (PA) for the 2015 NAAQS review, EPA (2014) summarized results from their zero-out and source apportionment modeling. The two approaches estimated similar seasonal-mean (April through October) USB impacts over rural areas of the western US (Dolwick et al., 2015). However, the greatest differences between the two approaches occurred in urban areas, where source apportionment estimated lower USB concentrations as a result of maintaining the chemical destruction of USB ozone from nitrogen oxide (NOx) emissions, a process that was absent with the removal of US anthropogenic emissions in the zero-out case. EPA's results were consistent with previous studies described above: seasonal mean USB ranged 25-50 ppb across the US, with contributions greater than 40 ppb in the inter-mountain western US and lower values in the eastern US. USB represented a relatively larger percentage (60-80%) of seasonal mean ozone within the inter-mountain western US and along the borders with Mexico and Canada. In locations where ozone is generally higher (e.g., urban areas in California and the eastern US), seasonal mean background fractions were smaller (e.g., 40-60%).

From the NAAQS implementation perspective, the level of USB on ozone exceedance days is more important than seasonal means. EPA (2014) concluded, based on results from Zhang et al. (2011), Emery et al. (2012), and EPA (2012), that "results suggest that background concentrations on the days with the highest total O_3 concentrations are not dramatically higher than typical seasonal average background concentrations." As a result, days with high modeled ozone tend to have smaller relative contributions from USB and conversely greater contributions from US anthropogenic sources. EPA (2014) further concluded that "anthropogenic sources within the US are largely responsible for 4th highest 8-hour [average] daily maximum O_3 [MDA8] concentrations."

However, EPA (2014) acknowledged some cases when model-estimated USB fractions were much higher during periods of "high" (>60 ppb) total ozone concentrations. These usually occurred in relation to specific events and in specific locations (e.g., stratospheric intrusions in high elevations or areas influenced by wildfires). Assessments based on monitoring have indicated similar event-oriented USB impacts on high ozone days (California Air Resources Board, 2011; Wyoming Department of Environmental Quality, 2013; Langford et al., 2015).

Trends in USB

According to analyses of remote monitoring data (Cooper et al, 2012; Lin et al., 2015), over the past 20 years mid-tropospheric ozone concentrations have been increasing at roughly 0.4±0.1-0.7 ppb/year. This trend will depend on future global emissions of ozone precursors and methane (HTAP, 2010), as well as climate change effects (temperatures, wildfires, weather patterns, etc.; Jacob and Winner; 2009). NOx emissions in North America and Europe are expected to decline out to 2030, while NOx emissions in East and South Asia are expected to increase. Global methane emissions are expected to continue to increase. Technologies and policies exist that, if implemented, could decrease global NOx and methane emissions. Additionally, aggressive climate change mitigation policy might halt the growth of global NOx and methane emissions (Amann et al., 2013; Klimont et al., 2015).

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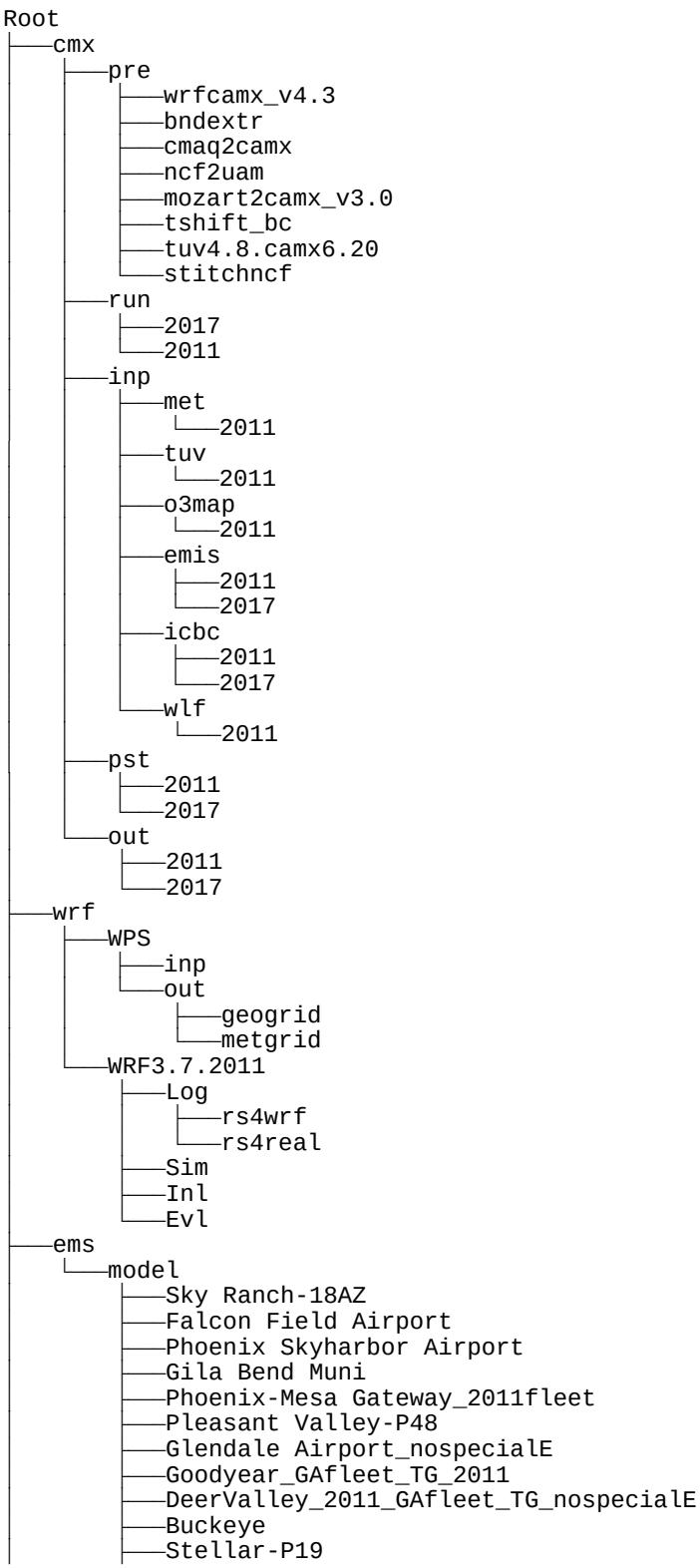
APPENDIX C

DATA FILE LIST

Directory Structure for the Data Files



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│           ├──Casa_grande
│           ├──Arizona_Soaring
│           ├──Coolidge
│           ├──Pinal_Airpark
│           └──Ak_Chin
├──gcm
│   └──MOZART
├──man
│   └──wld
├──mov
│   ├──run
│   │   ├──2011
│   │   └──2017
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│   │   ├──2011
│   │   └──2017
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│   │   └──2017
│   ├──in
│   └──out
├──meg
│   └──ozsip2011
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│       │   ├──MGNMET
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│           └──CB6
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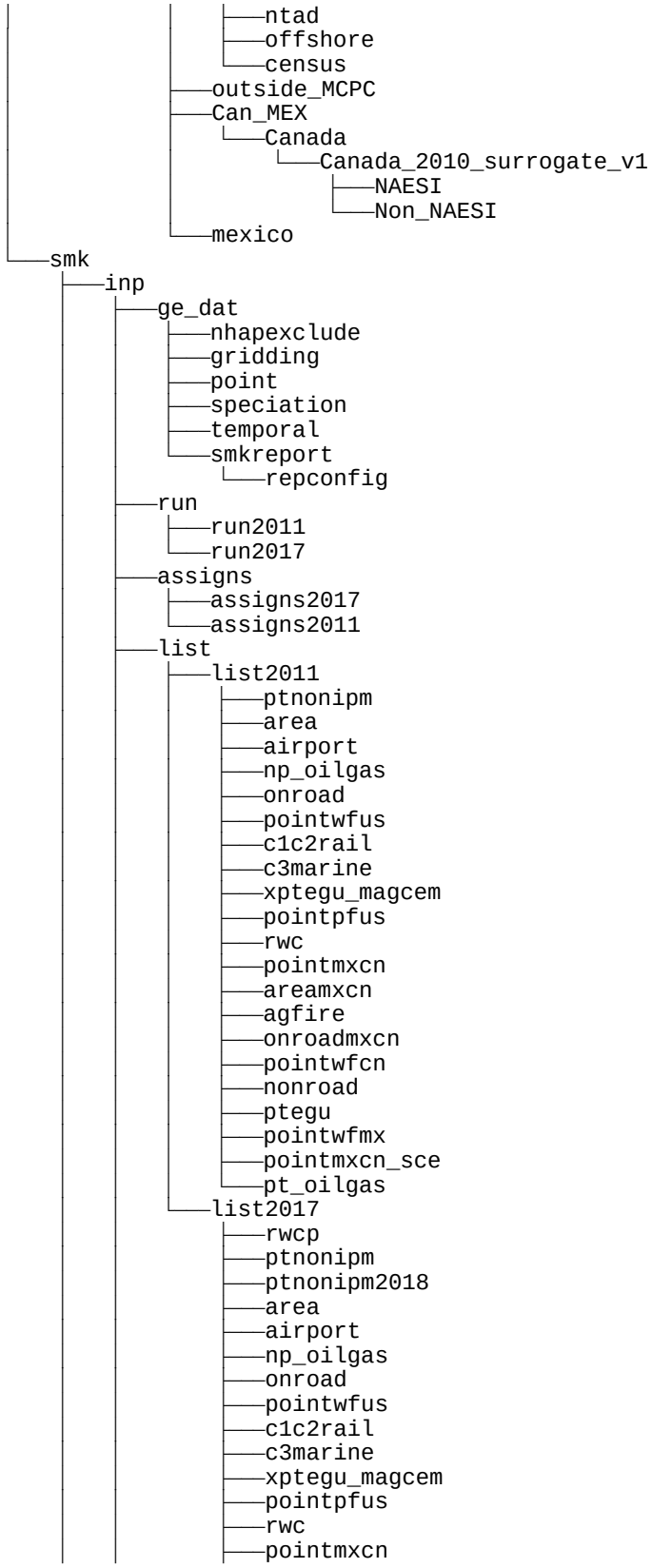
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inp
ge_dat
nhapexclude
gridding
point
speciation
temporal
smkreport
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run
run2011
run2017
assigns
assigns2017
assigns2011
list
list2011
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c3marine
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│   │   │   ├── 2018
│   │   │   └── 2011
│   │   ├── airport
│   │   ├── point
│   │   │   ├── 2017
│   │   │   ├── 2018
│   │   │   └── 2011
│   │   └── nonroad
│   │       ├── 2017
│   │       ├── 2018
│   │       └── 2011
│   └── ERG_OZSIP_2011_2017_v08142015
│       └── final_smoke
├── check
└── out
    └── emis
        ├── 2017
        │   ├── 4km
        │   │   ├── v6_elvated_pt_2017
        │   │   │   ├── elv_ptnonipm
        │   │   │   ├── elv_xptegu
        │   │   │   ├── elv_0ptnonipmMCPC
        │   │   │   └── elv_ptnonipm_v2
        │   │   └── v9_merged_2D
        │   ├── 12km
        │   │   ├── v9_merged_2D_w2012bio
        │   │   ├── v6_elevated_pt_final_zeroout_4km_pt
        │   │   │   ├── 0ptnonipm
        │   │   │   ├── 0ptegu
        │   │   │   ├── 0pointmxcn_sce
        │   │   │   ├── 0pt_oilgas
        │   │   │   └── 0pointmxcn
        │   │   └── v9_merged_2D
        │   └── 36km
        │       ├── v9_merged_2D_w2012bio
        │       ├── v6_elevated_pt
        │       └── v9_merged_2D
        └── 2011
            ├── 4km
            │   ├── v9_merged_2D_w2012bio
            │   ├── v6_elvated_pt
            │   │   ├── elv_ptnonipm
            │   │   ├── elv_xptegu_annual_adjusted_tpro
            │   │   └── elv_0ptnonipmMCPC2011
            │   └── v9_merged_2D
            ├── 12km
            │   ├── v9_merged_2D_w2012bio
            │   ├── v6_elevated_pt_final_zeroout_4km_pt
            │   │   ├── elv_pointmxcn_2011
            │   │   ├── elv_ptnonipm_2011
            │   │   ├── elv_pointmxcn_sce_2011
            │   │   ├── elv_ptegu_2011
            │   │   └── elv_pt_oilgas_2011
            │   └── v9_merged_2D
            └── 36km
                ├── v9_merged_2D_w2012bio
                ├── v9_elevated_pt
                └── v9_merged_2D
```

Complete File List

```
.:
cmx  ems  gcm  man  meg  mov  non  smk  sps  wrf

./cmx:
inp  out  pre  pst  run

./cmx/inp:
emis      icbc      met       o3map     tuv       wlf
CAMx6.2.chemparam.2_NONE      mech.2.CAMx6.2
mech.3.CAMx6.2      mech.5.CAMx6.2      mech.6.CAMx6.2

./cmx/inp/emis:
2011  2017

./cmx/inp/emis/2011:
pre.smk.ems.04km.20110501.bin ~ pre.smk.ems.04km.20110930.bin
pre.smk.ems.12km.20110501.bin ~ pre.smk.ems.12km.20110930.bin
pre.smk.ems.36km.20110501.bin ~ pre.smk.ems.36km.20110930.bin

./cmx/inp/emis/2017:
pre.smk.ems.04km.20110501.bin ~ pre.smk.ems.04km.20110930.bin
pre.smk.ems.12km.20110501.bin ~ pre.smk.ems.12km.20110930.bin
pre.smk.ems.36km.20110501.bin ~ pre.smk.ems.36km.20110930.bin

./cmx/inp/icbc:
2011  2017

./cmx/inp/icbc/2011:
pre.cmx.bc.cb6.12km.20110501.bin ~ pre.cmx.bc.cb6.12km.20110930.bin
pre.cmx.ic.cb6.12km.20110501.bin

./cmx/inp/icbc/2017:
pre.cmx.bc.cb6.12km.20110501.bin ~ pre.cmx.bc.cb6.12km.20110930.bin
pre.cmx.ic.cb6.12km.20110501.bin

./cmx/inp/met:
2011

./cmx/inp/met/2011:
pre.wrf.2d.04km.20110430.bin  ~  pre.wrf.2d.04km.20110930.bin
pre.wrf.2d.12km.20110430.bin  ~  pre.wrf.2d.12km.20110930.bin
pre.wrf.2d.36km.20110430.bin  ~  pre.wrf.2d.36km.20110930.bin
pre.wrf.3d.04km.20110430.bin  ~  pre.wrf.3d.04km.20110930.bin
pre.wrf.3d.12km.20110430.bin  ~  pre.wrf.3d.12km.20110930.bin
pre.wrf.3d.36km.20110430.bin  ~  pre.wrf.3d.36km.20110930.bin
pre.wrf.cr.04km.20110430.bin  ~  pre.wrf.cr.04km.20110930.bin
pre.wrf.cr.12km.20110430.bin  ~  pre.wrf.cr.12km.20110930.bin
pre.wrf.cr.36km.20110430.bin  ~  pre.wrf.cr.36km.20110930.bin
pre.wrf.kv.04km.20110430.bin.CMAQ  ~  pre.wrf.kv.04km.20110930.bin.CMAQ
pre.wrf.kv.12km.20110430.bin.CMAQ  ~  pre.wrf.kv.12km.20110930.bin.CMAQ
pre.wrf.kv.36km.20110430.bin.CMAQ  ~  pre.wrf.kv.36km.20110930.bin.CMAQ
pre.wrf.lu.04km.20110430.bin  ~  pre.wrf.lu.04km.20110930.bin
pre.wrf.lu.12km.20110430.bin  ~  pre.wrf.lu.12km.20110930.bin
pre.wrf.lu.36km.20110430.bin  ~  pre.wrf.lu.36km.20110930.bin

./cmx/inp/o3map:
2011

./cmx/inp/o3map/2011:
pre.o3m.04km.20110501.txt ~  pre.o3m.04km.20110930.txt
pre.o3m.12km.20110501.txt ~  pre.o3m.12km.20110930.txt
pre.o3m.36km.20110501.txt ~  pre.o3m.36km.20110930.txt

./cmx/inp/tuv:
2011

./cmx/inp/tuv/2011:
pre.tuv.do.cb6.04km.20110501.txt ~ pre.tuv.do.cb6.04km.20110930.txt
pre.tuv.do.cb6.12km.20110501.txt ~ pre.tuv.do.cb6.12km.20110930.txt
pre.tuv.do.cb6.36km.20110501.txt ~ pre.tuv.do.cb6.36km.20110930.txt

./cmx/inp/wlf:
2011

./cmx/inp/wlf/2011:
04km  12km  36km

./cmx/inp/wlf/2011/04km:
egts_l.20110501.1.MCIP_4km.mag4.ncf ~  egts_l.20110930.1.MCIP_4km.mag4.ncf

./cmx/inp/wlf/2011/12km:
egts_l.20110501.1.MCIP_12km.mag12.ncf ~  egts_l.20110930.1.MCIP_12km.mag12.ncf

./cmx/inp/wlf/2011/04km:
egts_l.20110501.1.MCIP_36km.mag36.ncf ~  egts_l.20110930.1.MCIP_36km.mag36.ncf

./cmx/out:
2011  2017

./cmx/out/2011:
mod.cmx.12km.20110501.avrg.grd01 ~  mod.cmx.12km.20110930.avrg.grd01
mod.cmx.12km.20110501.avrg.grd02 ~  mod.cmx.12km.20110930.avrg.grd02
mod.cmx.12km.20110501.depn.grd01 ~  mod.cmx.12km.20110930.depn.grd01
```

```
mod.cmx.12km.20110501.depn.grd02 ~  mod.cmx.12km.20110930.depn.grd02
mod.cmx.12km.20110501.diag  ~  mod.cmx.12km.20110930.diag
mod.cmx.12km.20110501.finst ~  mod.cmx.12km.20110930.finst
mod.cmx.12km.20110501.inst  ~  mod.cmx.12km.20110930.inst
mod.cmx.12km.20110501.mass  ~  mod.cmx.12km.20110930.mass
mod.cmx.12km.20110501.out   ~  mod.cmx.12km.20110930.out
mod.cmx.12km.20110501.pig   ~  mod.cmx.12km.20110930.pig
mod.cmx.36km.20110501.avrg.grd01 ~  mod.cmx.36km.20110930.avrg.grd01
mod.cmx.36km.20110501.depn.grd01 ~  mod.cmx.36km.20110930.depn.grd01
mod.cmx.36km.20110501.diag  ~  mod.cmx.36km.20110930.diag
mod.cmx.36km.20110501.finst ~  mod.cmx.36km.20110930.finst
mod.cmx.36km.20110501.inst  ~  mod.cmx.36km.20110930.inst
mod.cmx.36km.20110501.mass  ~  mod.cmx.36km.20110930.mass
mod.cmx.36km.20110501.out   ~  mod.cmx.36km.20110930.out
mod.cmx.36km.20110501.pig   ~  mod.cmx.36km.20110930.pig

./cmx/out/2017:
mod.cmx.12km.20110501.avrg.grd01 ~  mod.cmx.12km.20110930.avrg.grd01
mod.cmx.12km.20110501.avrg.grd02 ~  mod.cmx.12km.20110930.avrg.grd02
mod.cmx.12km.20110501.depn.grd01 ~  mod.cmx.12km.20110930.depn.grd01
mod.cmx.12km.20110501.depn.grd02 ~  mod.cmx.12km.20110930.depn.grd02
mod.cmx.12km.20110501.diag  ~  mod.cmx.12km.20110930.diag
mod.cmx.12km.20110501.finst ~  mod.cmx.12km.20110930.finst
mod.cmx.12km.20110501.inst  ~  mod.cmx.12km.20110930.inst
mod.cmx.12km.20110501.mass  ~  mod.cmx.12km.20110930.mass
mod.cmx.12km.20110501.out   ~  mod.cmx.12km.20110930.out
mod.cmx.12km.20110501.pig   ~  mod.cmx.12km.20110930.pig
mod.cmx.36km.20110501.avrg.grd01 ~  mod.cmx.36km.20110930.avrg.grd01
mod.cmx.36km.20110501.depn.grd01 ~  mod.cmx.36km.20110930.depn.grd01
mod.cmx.36km.20110501.diag  ~  mod.cmx.36km.20110930.diag
mod.cmx.36km.20110501.finst ~  mod.cmx.36km.20110930.finst
mod.cmx.36km.20110501.inst  ~  mod.cmx.36km.20110930.inst
mod.cmx.36km.20110501.mass  ~  mod.cmx.36km.20110930.mass
mod.cmx.36km.20110501.out   ~  mod.cmx.36km.20110930.out
mod.cmx.36km.20110501.pig   ~  mod.cmx.36km.20110930.pig

./cmx/pre:
bndextr    mozart2camx_v3.0  stitchncf  tuv4.8.camx6.20
cmaq2camx  ncf2uam       tshift_bc      wrfcamx_v4.3

./cmx/pre/bndextr:
bndextr.f  bndextr.linux

./cmx/pre/cmaq2camx:
cmaq2camx.rev.04km.2011.job   mrguam.srf.rev.12km.2017.job
cmaq2camx.rev.04km.2017.job   mrguam.srf.rev.36km.2011.job
cmaq2camx.rev.12km.2011.job   mrguam.srf.rev.36km.2017.job
cmaq2camx.rev.12km.2017.job   ptsmrg.fnl.04km.2011.job
cmaq2camx.rev.36km.2011.job   ptsmrg.fnl.04km.2017.job
cmaq2camx.rev.36km.2017.job   ptsmrg.fnl.12km.2011.job
mrguam.srf.rev.04km.2011.job  ptsmrg.fnl.12km.2017.job
mrguam.srf.rev.04km.2017.job  ptsmrg.fnl.36km.2011.job
mrguam.srf.rev.12km.2011.job  ptsmrg.fnl.36km.2017.job

./cmx/pre/mozart2camx_v3.0:
mozart2camx.v02.36km.cb6.2011.bc.job  mozart2camx.v02.36km.cb6.2011.ic.job

./cmx/pre/ncf2uam:
ncf2uam.smk.elv.fnl.04km.2011.job  ncf2uam.smk.srf.rev.04km.2011.job
ncf2uam.smk.elv.fnl.04km.2017.job  ncf2uam.smk.srf.rev.04km.2017.job
ncf2uam.smk.elv.fnl.12km.2011.job  ncf2uam.smk.srf.rev.12km.2011.job
ncf2uam.smk.elv.fnl.12km.2017.job  ncf2uam.smk.srf.rev.12km.2017.job
ncf2uam.smk.elv.fnl.36km.2011.job  ncf2uam.smk.srf.rev.36km.2011.job
ncf2uam.smk.elv.fnl.36km.2017.job  ncf2uam.smk.srf.rev.36km.2017.job

./cmx/pre/stitchncf:
stitchncf.wlf.v02.04km.2011.job  stitchncf.wlf.v02.36km.2011.job
stitchncf.wlf.v02.12km.2011.job

./cmx/pre/tshift_bc:
tshift.bc.2011.cb6.36km.v02.job

./cmx/pre/tuv4.8.camx6.20:
tuv.do.cb6.04km.2011.job  tuv.do.cb6.12km.2011.job  tuv.do.cb6.36km.2011.job

./cmx/pre/wrfcamx_v4.3:
wrfcamx.v02.04km.2011.job  wrfcamx.v02.12km.2011.job  wrfcamx.v02.36km.2011.job

./cmx/pst:
2011  o3.mc.lcp.2011.txt        postproc.rev.04km.2017.job
2017  postproc.rev.04km.2011.job

./cmx/pst/2011:
extstats.04km.alldays.o3.1hr.txt
extstats.04km.alldays.o3.8hr.txt
mod.cmx.pst.04km.20110501.o3.1hr.avrg  ~  mod.cmx.pst.04km.20110930.o3.1hr.avrg
mod.cmx.pst.04km.20110501.o3.8hr.avrg  ~  mod.cmx.pst.04km.20110930.o3.8hr.avrg
mod.cmx.pst.04km.alldays.o3.1hr.avrg
mod.cmx.pst.04km.alldays.o3.8hr.avrg
obsmax.04km.20110501.o3.1hr.txt  ~  obsmax.04km.20110930.o3.1hr.txt
obsmax.04km.20110501.o3.8hr.txt  ~  obsmax.04km.20110930.o3.8hr.txt
predobs.04km.20110501.o3.1hr.txt ~  predobs.04km.20110930.o3.1hr.txt
predobs.04km.20110501.o3.8hr.txt ~  predobs.04km.20110930.o3.8hr.txt
stats.04km.20110501.o3.1hr.txt ~  stats.04km.20110930.o3.1hr.txt
stats.04km.20110501.o3.8hr.txt ~  stats.04km.20110930.o3.8hr.txt
```

```
./cmx/pst/2017:
extstats.04km.alldays.o3.1hr.txt
extstats.04km.alldays.o3.8hr.txt
mod.cmx.pst.04km.20110501.o3.1hr.avrg  ~  mod.cmx.pst.04km.20110930.o3.1hr.avrg
mod.cmx.pst.04km.20110501.o3.8hr.avrg  ~  mod.cmx.pst.04km.20110930.o3.8hr.avrg
mod.cmx.pst.04km.alldays.o3.1hr.avrg
mod.cmx.pst.04km.alldays.o3.8hr.avrg
obsmax.04km.20110501.o3.1hr.txt  ~  obsmax.04km.20110930.o3.1hr.txt
obsmax.04km.20110501.o3.8hr.txt  ~  obsmax.04km.20110930.o3.8hr.txt
predobs.04km.20110501.o3.1hr.txt ~  predobs.04km.20110930.o3.1hr.txt
predobs.04km.20110501.o3.8hr.txt ~  predobs.04km.20110930.o3.8hr.txt
stats.04km.20110501.o3.1hr.txt ~  stats.04km.20110930.o3.1hr.txt
stats.04km.20110501.o3.8hr.txt ~  stats.04km.20110930.o3.8hr.txt

./cmx/run:
2011  2017

./cmx/run/2011:
run.cmx.rev.12km.pig.omp.job  run.cmx.rev.36km.pig.omp.job

./cmx/run/2017:
run.cmx.rev.12km.pig.omp.job  run.cmx.rev.36km.pig.omp.job

./ems:
model

./ems/model:
00Pinal_County                              LUF_emissions_10222015_v1.xlsx
Buckeye                                     Phoenix-Mesa Gateway_2011fleet
Chandler Airport                            Phoenix Skyharbor Airport
DeerValley_2011_GAfleet_TG_nospecialE       Pleasant Valley-P48
Falcon Field Airport                        Scottsdale Airport_2011_fleet_nospecialE
Gila Bend Muni                              Sky Ranch-18AZ
Glendale Airport_nospecialE                 Stellar-P19
Goodyear_GAfleet_TG_2011                    Wickenburg

./ems/model/00Pinal_County:
Ak_Chin  Arizona_Soaring  Casa_grande  Coolidge  Eloy  Pinal_Airpark

./ems/model/00Pinal_County/Ak_Chin:
AC_EMIS.dbf   ANALYEAR.dbf  GSE_GATE.dbf  REC_NETC.dbf      STN_EMIS.dbf
AC_GSE.dbf    Baseline      GSE_POP.dbf   REC_NETP.dbf      TAXIPATH.dbf
AC_HAPS.dbf   BUILDING.dbf  PARKING.dbf   ROADWAYS.dbf      TAXIWAYS.dbf
AC_MAIN.dbf   CNFGRNWY.dbf  PROF_DAY.dbf  RUNWAYS.dbf       VEH_EMIS.dbf
AC_OPS.dbf    CONFIGS.dbf   PROF_MON.dbf  SCENARIO.dbf
AIRPORTS.dbf  FIRES.dbf     PROF_QHR.dbf  SCNAPT.dbf
Ak_Chin.edm   GATES.dbf     REC_DISC.dbf  SCNAPTYR.dbf
ALL_EMIS.dbf  GSE_EMIS.dbf  REC_DISP.dbf  STATNRY.dbf

./ems/model/00Pinal_County/Arizona_Soaring:
AC_EMIS.dbf   Arizona_Soaring.edm  GSE_GATE.dbf  REC_NETC.dbf  STN_EMIS.dbf
AC_GSE.dbf    Baseline             GSE_POP.dbf   REC_NETP.dbf  TAXIPATH.dbf
AC_HAPS.dbf   BUILDING.dbf         PARKING.dbf   ROADWAYS.dbf  TAXIWAYS.dbf
AC_MAIN.dbf   CNFGRNWY.dbf         PROF_DAY.dbf  RUNWAYS.dbf   VEH_EMIS.dbf
AC_OPS.dbf    CONFIGS.dbf          PROF_MON.dbf  SCENARIO.dbf
AIRPORTS.dbf  FIRES.dbf            PROF_QHR.dbf  SCNAPT.dbf
ALL_EMIS.dbf  GATES.dbf            REC_DISC.dbf  SCNAPTYR.dbf
ANALYEAR.dbf  GSE_EMIS.dbf         REC_DISP.dbf  STATNRY.dbf

./ems/model/00Pinal_County/Casa_grande:
AC_EMIS.dbf   Baseline         GSE_GATE.dbf  REC_NETC.dbf  STN_EMIS.dbf
AC_GSE.dbf    BUILDING.dbf     GSE_POP.dbf   REC_NETP.dbf  TAXIPATH.dbf
AC_HAPS.dbf   Casa_grande.edm  PARKING.dbf   ROADWAYS.dbf  TAXIWAYS.dbf
AC_MAIN.dbf   CNFGRNWY.dbf     PROF_DAY.dbf  RUNWAYS.dbf   VEH_EMIS.dbf
AC_OPS.dbf    CONFIGS.dbf      PROF_MON.dbf  SCENARIO.dbf
AIRPORTS.dbf  FIRES.dbf        PROF_QHR.dbf  SCNAPT.dbf
ALL_EMIS.dbf  GATES.dbf        REC_DISC.dbf  SCNAPTYR.dbf
ANALYEAR.dbf  GSE_EMIS.dbf     REC_DISP.dbf  STATNRY.dbf

./ems/model/00Pinal_County/Coolidge:
AC_EMIS.dbf   Baseline      GSE_GATE.dbf  REC_NETC.dbf      STN_EMIS.dbf
AC_GSE.dbf    BUILDING.dbf  GSE_POP.dbf   REC_NETP.dbf      TAXIPATH.dbf
AC_HAPS.dbf   CNFGRNWY.dbf  PARKING.dbf   ROADWAYS.dbf      TAXIWAYS.dbf
AC_MAIN.dbf   CONFIGS.dbf   PROF_DAY.dbf  RUNWAYS.dbf       VEH_EMIS.dbf
AC_OPS.dbf    Coolidge.edm  PROF_MON.dbf  SCENARIO.dbf
AIRPORTS.dbf  FIRES.dbf     PROF_QHR.dbf  SCNAPT.dbf
ALL_EMIS.dbf  GATES.dbf     REC_DISC.dbf  SCNAPTYR.dbf
ANALYEAR.dbf  GSE_EMIS.dbf  REC_DISP.dbf  STATNRY.dbf

./ems/model/00Pinal_County/Eloy:
AC_EMIS.dbf   Baseline      GSE_GATE.dbf  REC_NETC.dbf      STN_EMIS.dbf
AC_GSE.dbf    BUILDING.dbf  GSE_POP.dbf   REC_NETP.dbf      TAXIPATH.dbf
AC_HAPS.dbf   CNFGRNWY.dbf  PARKING.dbf   ROADWAYS.dbf      TAXIWAYS.dbf
AC_MAIN.dbf   CONFIGS.dbf   PROF_DAY.dbf  RUNWAYS.dbf       VEH_EMIS.dbf
AC_OPS.dbf    Eloy.edm      PROF_MON.dbf  SCENARIO.dbf
AIRPORTS.dbf  FIRES.dbf     PROF_QHR.dbf  SCNAPT.dbf
ALL_EMIS.dbf  GATES.dbf     REC_DISC.dbf  SCNAPTYR.dbf
ANALYEAR.dbf  GSE_EMIS.dbf  REC_DISP.dbf  STATNRY.dbf

./ems/model/00Pinal_County/Pinal_Airpark:
AC_EMIS.dbf   Baseline      GSE_POP.dbf        REC_NETC.dbf  STN_EMIS.dbf
AC_GSE.dbf    BUILDING.dbf  PARKING.dbf        REC_NETP.dbf  TAXIPATH.dbf
AC_HAPS.dbf   CNFGRNWY.dbf  Pinal_Airpark.edm  ROADWAYS.dbf  TAXIWAYS.dbf
AC_MAIN.dbf   CONFIGS.dbf   PROF_DAY.dbf       RUNWAYS.dbf   VEH_EMIS.dbf
AC_OPS.dbf    FIRES.dbf     PROF_MON.dbf       SCENARIO.dbf
AIRPORTS.dbf  GATES.dbf     PROF_QHR.dbf       SCNAPT.dbf
ALL_EMIS.dbf  GSE_EMIS.dbf  REC_DISC.dbf       SCNAPTYR.dbf
```

```
ANALYEAR.dbf  GSE_GATE.dbf  REC_DISP.dbf       STATNRY.dbf

./ems/model/Buckeye:
AC_EMIS.dbf   Baseline             GSE_GATE.dbf  REC_NETC.dbf  STN_EMIS.dbf
AC_GSE.dbf    Buckeye 2011 Oz.edm  GSE_POP.dbf   REC_NETP.dbf  TAXIPATH.dbf
AC_HAPS.dbf   BUILDING.dbf         PARKING.dbf   ROADWAYS.dbf  TAXIWAYS.dbf
AC_MAIN.dbf   CNFGRNWY.dbf         PROF_DAY.dbf  RUNWAYS.dbf   VEH_EMIS.dbf
AC_OPS.dbf    CONFIGS.dbf          PROF_MON.dbf  SCENARIO.dbf
AIRPORTS.dbf  FIRES.dbf            PROF_QHR.dbf  SCNAPT.dbf
ALL_EMIS.dbf  GATES.dbf            REC_DISC.dbf  SCNAPTYR.dbf
ANALYEAR.dbf  GSE_EMIS.dbf         REC_DISP.dbf  STATNRY.dbf

./ems/model/Chandler Airport:
AC_EMIS2.txt  ANALYEAR.dbf  GSE_EMIS.dbf  REC_DISP.dbf      STATNRY.dbf
AC_EMIS.dbf   Baseline      GSE_GATE.dbf  REC_NETC.dbf      STN_EMIS.dbf
AC_GSE.dbf    BUILDING.dbf  GSE_POP.dbf   REC_NETP.dbf      TAXIPATH.dbf
AC_HAPS.dbf   Chandler.edm  PARKING.dbf   ROADWAYS.dbf      TAXIWAYS.dbf
AC_MAIN.dbf   CNFGRNWY.dbf  PROF_DAY.dbf  RUNWAYS.dbf       VEH_EMIS.dbf
AC_OPS.dbf    CONFIGS.dbf   PROF_MON.dbf  SCENARIO.dbf
AIRPORTS.dbf  FIRES.dbf     PROF_QHR.dbf  SCNAPT.dbf
ALL_EMIS.dbf  GATES.dbf     REC_DISC.dbf  SCNAPTYR.dbf

./ems/model/DeerValley_2011_GAfleet_TG_nospecialE:
AC_EMIS.dbf   Baseline                GSE_GATE.dbf  REC_NETC.dbf  STN_EMIS.dbf
AC_GSE.dbf    BUILDING.dbf            GSE_POP.dbf   REC_NETP.dbf  TAXIPATH.dbf
AC_HAPS.dbf   CNFGRNWY.dbf            PARKING.dbf   ROADWAYS.dbf  TAXIWAYS.dbf
AC_MAIN.dbf   CONFIGS.dbf             PROF_DAY.dbf  RUNWAYS.dbf   VEH_EMIS.dbf
AC_OPS.dbf    DVT 2011_2011fleet.edm  PROF_MON.dbf  SCENARIO.dbf
AIRPORTS.dbf  FIRES.dbf               PROF_QHR.dbf  SCNAPT.dbf
ALL_EMIS.dbf  GATES.dbf               REC_DISC.dbf  SCNAPTYR.dbf
ANALYEAR.dbf  GSE_EMIS.dbf            REC_DISP.dbf  STATNRY.dbf

./ems/model/Falcon Field Airport:
AC_EMIS.dbf   BUILDING.dbf              PARKING.dbf   RUNWAYS.dbf
AC_GSE.dbf    CNFGRNWY.dbf              PROF_DAY.dbf  SCENARIO.dbf
AC_HAPS.dbf   CONFIGS.dbf               PROF_MON.dbf  SCNAPT.dbf
AC_MAIN.dbf   Falcon Field Airport.edm  PROF_QHR.dbf  SCNAPTYR.dbf
AC_OPS.dbf    FIRES.dbf                 REC_DISC.dbf  STATNRY.dbf
AIRPORTS.dbf  GATES.dbf                 REC_DISP.dbf  STN_EMIS.dbf
ALL_EMIS.dbf  GSE_EMIS.dbf              REC_NETC.dbf  TAXIPATH.dbf
ANALYEAR.dbf  GSE_GATE.dbf              REC_NETP.dbf  TAXIWAYS.dbf
Baseline      GSE_POP.dbf               ROADWAYS.dbf  VEH_EMIS.dbf

./ems/model/Gila Bend Muni:
AC_EMIS.dbf   BUILDING.dbf                PARKING.dbf       RUNWAYS.dbf
AC_GSE.dbf    CNFGRNWY.dbf                PROF_DAY.dbf      SCENARIO.dbf
AC_HAPS.dbf   CONFIGS.dbf                 PROF_MON.dbf      SCNAPT.dbf
AC_MAIN.dbf   FIRES.dbf                   PROF_QHR.dbf      SCNAPTYR.dbf
AC_OPS.dbf    GATES.dbf                   REC_DISC.dbf      STATNRY.dbf
AIRPORTS.dbf  Gila Bend Muni 2011 Oz.edm  REC_DISP.dbf      STN_EMIS.dbf
ALL_EMIS.dbf  GSE_EMIS.dbf                REC_NETC.dbf      TAXIPATH.dbf
ANALYEAR.dbf  GSE_GATE.dbf                REC_NETP.dbf      TAXIWAYS.dbf
Baseline      GSE_POP.dbf                 ROADWAYS.dbf      VEH_EMIS.dbf

./ems/model/Glendale Airport_nospecialE:
AC_EMIS.dbf   Baseline             GSE_GATE.dbf  REC_NETC.dbf        STN_EMIS.dbf
AC_GSE.dbf    BUILDING.dbf         GSE_POP.dbf   REC_NETP.dbf        TAXIPATH.dbf
AC_HAPS.dbf   CNFGRNWY.dbf         PARKING.dbf   ROADWAYS.dbf        TAXIWAYS.dbf
AC_MAIN.dbf   CONFIGS.dbf          PROF_DAY.dbf  RUNWAYS.dbf         VEH_EMIS.dbf
AC_OPS.dbf    FIRES.dbf            PROF_MON.dbf  SCENARIO.dbf
AIRPORTS.dbf  GATES.dbf            PROF_QHR.dbf  SCNAPT.dbf
ALL_EMIS.dbf  Glendale Airport.edm  REC_DISC.dbf  SCNAPTYR.dbf
ANALYEAR.dbf  GSE_EMIS.dbf         REC_DISP.dbf  STATNRY.dbf

./ems/model/Goodyear_GAfleet_TG_2011:
AC_EMIS.dbf   CNFGRNWY.dbf                    PROF_DAY.dbf     SCNAPT.dbf
AC_GSE.dbf    CONFIGS.dbf                     PROF_MON.dbf     SCNAPTYR.dbf
AC_HAPS.dbf   FIRES.dbf                       PROF_QHR.dbf     STATNRY.dbf
AC_MAIN.dbf   GATES.dbf                       REC_DISC.dbf     STN_EMIS.dbf
AC_OPS.dbf    Goodyear 2011_GAfleet_2011.edm  REC_DISP.dbf     TAXIPATH.dbf
AIRPORTS.dbf  GSE_EMIS.dbf                    REC_NETC.dbf     TAXIWAYS.dbf
ALL_EMIS.dbf  GSE_GATE.dbf                    REC_NETP.dbf
ANALYEAR.dbf  GSE_POP.dbf                     ROADWAYS.dbf
Baseline      PARKING.dbf                     RUNWAYS.dbf
BUILDING.dbf  SCENARIO.dbf                    VEH_EMIS.dbf

./ems/model/Phoenix-Mesa Gateway_2011fleet:
AC_EMIS.dbf   FIRES.dbf                                          REC_NETC.dbf
AC_GSE.dbf    GATES.dbf                                          REC_NETP.dbf
AC_HAPS.dbf   GSE_EMIS.dbf                                       ROADWAYS.dbf
AC_MAIN.dbf   GSE_GATE.dbf                                       RUNWAYS.dbf
AC_OPS.dbf    GSE_POP.dbf                                        SCENARIO.dbf
AIRPORTS.dbf  PARKING.dbf                                        SCNAPT.dbf
ALL_EMIS.dbf  Phoenix-Mesa Gateway 2011 Ozone_2011fleet.edm      SCNAPTYR.dbf
ANALYEAR.dbf  PROF_DAY.dbf                                       STATNRY.dbf
Baseline      PROF_MON.dbf                                       STN_EMIS.dbf
BUILDING.dbf  PROF_QHR.dbf                                       TAXIPATH.dbf
CNFGRNWY.dbf  REC_DISC.dbf                                       TAXIWAYS.dbf
CONFIGS.dbf   REC_DISP.dbf                                       VEH_EMIS.dbf

./ems/model/Phoenix Skyharbor Airport:
AC_EMIS.dbf   FIRES.dbf                                  REC_NETC.dbf
AC_GSE.dbf    GATES.dbf                                  REC_NETP.dbf
AC_HAPS.dbf   GSE_EMIS.dbf                               ROADWAYS.dbf
AC_MAIN.dbf   GSE_GATE.dbf                               RUNWAYS.dbf
AC_OPS.dbf    GSE_POP.dbf                                SCENARIO.dbf
AIRPORTS.dbf  PARKING.dbf                                SCNAPT.dbf
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ALL_EMIS.dbf  Phoenix Skyharbor Airport 2011 Ozone.edm      SCNAPTYR.dbf
ANALYEAR.dbf  PROF_DAY.dbf                                  STATNRY.dbf
Baseline      PROF_MON.dbf                                  STN_EMIS.dbf
BUILDING.dbf  PROF_QHR.dbf                                  TAXIPATH.dbf
CNFGRNWY.dbf  REC_DISC.dbf                                  TAXIWAYS.dbf
CONFIGS.dbf   REC_DISP.dbf                                  VEH_EMIS.dbf

./ems/model/Pleasant Valley-P48:
AC_EMIS.dbf   BUILDING.dbf  Pleasant Valley 2011 Oz.edm      RUNWAYS.dbf
AC_GSE.dbf    CNFGRNWY.dbf  PROF_DAY.dbf                     SCENARIO.dbf
AC_HAPS.dbf   CONFIGS.dbf   PROF_MON.dbf                     SCNAPT.dbf
AC_MAIN.dbf   FIRES.dbf     PROF_QHR.dbf                     SCNAPTYR.dbf
AC_OPS.dbf    GATES.dbf     REC_DISC.dbf                     STATNRY.dbf
AIRPORTS.dbf  GSE_EMIS.dbf  REC_DISP.dbf                     STN_EMIS.dbf
ALL_EMIS.dbf  GSE_GATE.dbf  REC_NETC.dbf                     TAXIPATH.dbf
ANALYEAR.dbf  GSE_POP.dbf   REC_NETP.dbf                     TAXIWAYS.dbf
Baseline      PARKING.dbf   ROADWAYS.dbf                     VEH_EMIS.dbf

./ems/model/Scottsdale Airport_2011_fleet_nospecialE:
AC_EMIS.dbf   BUILDING.dbf  PROF_DAY.dbf  SCENARIO.dbf
AC_GSE.dbf    CNFGRNWY.dbf  PROF_MON.dbf  SCNAPT.dbf
AC_HAPS.dbf   CONFIGS.dbf   PROF_QHR.dbf  SCNAPTYR.dbf
AC_MAIN.dbf   FIRES.dbf     REC_DISC.dbf  Scottsdale Airport 2011 Ozone.edm
AC_OPS.dbf    GATES.dbf     REC_DISP.dbf  STATNRY.dbf
AIRPORTS.dbf  GSE_EMIS.dbf  REC_NETC.dbf  STN_EMIS.dbf
ALL_EMIS.dbf  GSE_GATE.dbf  REC_NETP.dbf  TAXIPATH.dbf
ANALYEAR.dbf  GSE_POP.dbf   ROADWAYS.dbf  TAXIWAYS.dbf
Baseline      PARKING.dbf   RUNWAYS.dbf   VEH_EMIS.dbf

./ems/model/Sky Ranch-18AZ:
AC_EMIS.dbf   Baseline            GSE_POP.dbf   REC_NETP.dbf           STN_EMIS.dbf
AC_GSE.dbf    BUILDING.dbf  PARKING.dbf   ROADWAYS.dbf                 TAXIPATH.dbf
AC_HAPS.dbf   CNFGRNWY.dbf  PROF_DAY.dbf  RUNWAYS.dbf                  TAXIWAYS.dbf
AC_MAIN.dbf   CONFIGS.dbf   PROF_MON.dbf  SCENARIO.dbf                 VEH_EMIS.dbf
AC_OPS.dbf    FIRES.dbf     PROF_QHR.dbf  SCNAPT.dbf
AIRPORTS.dbf  GATES.dbf     REC_DISC.dbf  SCNAPTYR.dbf
ALL_EMIS.dbf  GSE_EMIS.dbf  REC_DISP.dbf  Sky Ranch_2011 Oz.edm
ANALYEAR.dbf  GSE_GATE.dbf  REC_NETC.dbf  STATNRY.dbf

./ems/model/Stellar-P19:
AC_EMIS.dbf   Baseline      GSE_POP.dbf   REC_NETP.dbf             STN_EMIS.dbf
AC_GSE.dbf    BUILDING.dbf  PARKING.dbf   ROADWAYS.dbf             TAXIPATH.dbf
AC_HAPS.dbf   CNFGRNWY.dbf  PROF_DAY.dbf  RUNWAYS.dbf              TAXIWAYS.dbf
AC_MAIN.dbf   CONFIGS.dbf   PROF_MON.dbf  SCENARIO.dbf             VEH_EMIS.dbf
AC_OPS.dbf    FIRES.dbf     PROF_QHR.dbf  SCNAPT.dbf
AIRPORTS.dbf  GATES.dbf     REC_DISC.dbf  SCNAPTYR.dbf
ALL_EMIS.dbf  GSE_EMIS.dbf  REC_DISP.dbf  STATNRY.dbf
ANALYEAR.dbf  GSE_GATE.dbf  REC_NETC.dbf  Stellar 2011_Oz.edm

./ems/model/Wickenburg:
AC_EMIS.dbf   Baseline      GSE_POP.dbf   REC_NETP.dbf      TAXIPATH.dbf
AC_GSE.dbf    BUILDING.dbf  PARKING.dbf   ROADWAYS.dbf      TAXIWAYS.dbf
AC_HAPS.dbf   CNFGRNWY.dbf  PROF_DAY.dbf  RUNWAYS.dbf       VEH_EMIS.dbf
AC_MAIN.dbf   CONFIGS.dbf   PROF_MON.dbf  SCENARIO.dbf      Wickenburg_2011_Oz.edm
AC_OPS.dbf    FIRES.dbf     PROF_QHR.dbf  SCNAPT.dbf
AIRPORTS.dbf  GATES.dbf     REC_DISC.dbf  SCNAPTYR.dbf
ALL_EMIS.dbf  GSE_EMIS.dbf  REC_DISP.dbf  STATNRY.dbf
ANALYEAR.dbf  GSE_GATE.dbf  REC_NETC.dbf  STN_EMIS.dbf

./gcm:
MOZART

./gcm/MOZART:
MOZART_output

./man:
wld

./man/wld:
mod.man.wld.all.day.cn.wrap.2011.txt  mod.man.wld.all.inv.cn.wrap.2011.txt
mod.man.wld.all.day.mx.wrap.2011.txt  mod.man.wld.all.inv.mx.wrap.2011.txt
mod.man.wld.all.day.us.wrap.2011.txt  mod.man.wld.all.inv.us.wrap.2011.txt

./meg:
ozsip2011

./meg/ozsip2011:
inp  out

./meg/ozsip2011/inp:
MAP  MGNMET

./meg/ozsip2011/inp/MAP:
EF_MAG_2008_12km_org.csv  LAI_MAG_2008_12km_org.csv  PFT_MAG_2008_12km_org.csv
EF_MAG_2008_36km_org.csv  LAI_MAG_2008_36km_org.csv  PFT_MAG_2008_36km_org.csv
EF_MAG_2008_4km_org.csv   LAI_MAG_2008_4km_org.csv   PFT_MAG_2008_4km_org.csv
EF_MAG_2008_4km_upd.csv   LAI_MAG_2008_4km_upd.csv   PFT_MAG_2008_4km_upd.csv

./meg/ozsip2011/inp/MGNMET:
MET.MEGAN.d01.2011119.ncf  ~  MET.MEGAN.d01.2011273.ncf
MET.MEGAN.d02.2011119.ncf  ~  MET.MEGAN.d02.2011273.ncf
MET.MEGAN.d03.2011119.ncf  ~  MET.MEGAN.d03.2011273.ncf

./meg/ozsip2011/out:
CB6

./meg/ozsip2011/out/CB6:
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```
MEGANv2.10.upd.d01.CB6.2011119.moles.ncf  ~  MEGANv2.10.upd.d01.CB6.2011273.moles.ncf
MEGANv2.10.upd.d01.CB6.2011119.TONHR.ncf  ~  MEGANv2.10.upd.d01.CB6.2011273.TONHR.ncf
MEGANv2.10.upd.d02.CB6.2011119.moles.ncf  ~  MEGANv2.10.upd.d02.CB6.2011273.moles.ncf
MEGANv2.10.upd.d02.CB6.2011119.TONHR.ncf  ~  MEGANv2.10.upd.d02.CB6.2011273.TONHR.ncf
MEGANv2.10.upd.d03.CB6.2011119.moles.ncf  ~  MEGANv2.10.upd.d03.CB6.2011273.moles.ncf
MEGANv2.10.upd.d03.CB6.2011119.TONHR.ncf  ~  MEGANv2.10.upd.d03.CB6.2011273.TONHR.ncf

./mov:
out  run

./mov/out:
2011  2017

./mov/out/2011:
mod.mov.04km.ia.20110430.nc  ~  mod.mov.04km.ia.20111001.nc
mod.mov.04km.ic.20110430.nc  ~  mod.mov.04km.ic.20111001.nc
mod.mov.04km.oac.20110430.nc ~  mod.mov.04km.oac.20111001.nc

./mov/out/2017:
mod.mov.04km.ia.20110430.nc  ~  mod.mov.04km.ia.20111001.nc
mod.mov.04km.ic.20110430.nc  ~  mod.mov.04km.ic.20111001.nc
mod.mov.04km.oac.20110430.nc ~  mod.mov.04km.oac.20111001.nc

./mov/run:
2011  2017

./mov/run/2011:
mag_oz_mod_ia_20110430_m2014a_out_ei.mrs  ~  mag_oz_mod_ia_20111001_m2014a_out_ei.mrs
mag_oz_mod_ia_20110430_m2014a_out_er.mrs  ~  mag_oz_mod_ia_20111001_m2014a_out_er.mrs
mag_oz_mod_ic_20110430_m2014a_out_ei.mrs  ~  mag_oz_mod_ic_20111001_m2014a_out_ei.mrs
mag_oz_mod_ic_20110430_m2014a_out_er.mrs  ~  mag_oz_mod_ic_20111001_m2014a_out_er.mrs
mag_oz_mod_oac_20110430_m2014a_out_ei.mrs  ~  mag_oz_mod_oac_20111001_m2014a_out_ei.mrs
mag_oz_mod_oac_20110430_m2014a_out_er.mrs  ~  mag_oz_mod_oac_20111001_m2014a_out_er.mrs

./mov/run/2017:
mag_oz_mod_ia_20170430_m2014a_out_ei.mrs  ~  mag_oz_mod_ia_20171001_m2014a_out_ei.mrs
mag_oz_mod_ia_20170430_m2014a_out_er.mrs  ~  mag_oz_mod_ia_20171001_m2014a_out_er.mrs
mag_oz_mod_ic_20170430_m2014a_out_ei.mrs  ~  mag_oz_mod_ic_20171001_m2014a_out_ei.mrs
mag_oz_mod_ic_20170430_m2014a_out_er.mrs  ~  mag_oz_mod_ic_20171001_m2014a_out_er.mrs
mag_oz_mod_oac_20170430_m2014a_out_ei.mrs  ~  mag_oz_mod_oac_20171001_m2014a_out_ei.mrs
mag_oz_mod_oac_20170430_m2014a_out_er.mrs  ~  mag_oz_mod_oac_20171001_m2014a_out_er.mrs

./non:
in  out  run

./non/in:
Nonroad_activity_input_MC_MOVES2014a.xlsx  Nonroad_pop_input_MC_MOVES2014a.xlsx

./non/out:
mod.non.all.04km.mc.2011.txt  mod.non.all.04km.pc.2011.txt
mod.non.all.04km.mc.2017.txt  mod.non.all.04km.pc.2017.txt

./non/run:
2011  2017  SIP_batch_MOVES2014a.bat

./non/run/2011:
MC_SIP_2011-05-01.mrs  ~  MC_SIP_2011-09-30.mrs
PC_SIP_2011-05-01.mrs  ~  PC_SIP_2011-09-30.mrs

./non/run/2017:
MC_SIP_2017-05-01.mrs  ~  MC_SIP_2017-09-30.mrs
PC_SIP_2017-05-01.mrs  ~  PC_SIP_2017-09-30.mrs

./smk:
check  inp  out

./smk/check:
CheckCO36km.docx
Check_SMK_v5.docx
Emission and EMission Processing.docx
Emission and EMission Processing.pdf
QA_4km_all_v1_20160405.xlsx
smoke_2011_24hrs_4kmDomain_in_12km.v6.dat
smoke_2011_24hrs_4kmDomain_in_36km.v6.dat
smoke_2011_24hrs_4kmDomain_in_4km.v6.dat
smoke_2011_daily_4kmDomain_in_12km.v6.dat
smoke_2011_daily_4kmDomain_in_36km.v6.dat
smoke_2011_daily_4kmDomain_in_4km.v6
smoke_2011_daily_emissions_in_different_domains_v3.xlsx
smoke_2011_daily_emissions_in_different_domains.xlsx
smoke_2011_daily_Maricopa_County_in_36km.xlsx
smoke_2011_daily.v6.xlsx

./smk/inp:
assigns  ge_dat  inventory  list  run

./smk/inp/assigns:
assigns2011  assigns2017

./smk/inp/assigns/assigns2011:
ASSIGNS.MAG_CB6_12km_CM_201105_AREA
ASSIGNS.MAG_CB6_12km_CM_201105_ONROAD
ASSIGNS.MAG_CB6_12km_CM_201105_POINT
ASSIGNS.MAG_CB6_12km_US_201105_AREA
ASSIGNS.MAG_CB6_12km_US_201105_AREA_05
ASSIGNS.MAG_CB6_12km_US_201105_AREA_06
ASSIGNS.MAG_CB6_12km_US_201105_AREA_07
```

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ASSIGNS.MAG_CB6_12km_US_201105_AREA_08
ASSIGNS.MAG_CB6_12km_US_201105_AREA_09
ASSIGNS.MAG_CB6_12km_US_201105_FIRE
ASSIGNS.MAG_CB6_12km_US_201105_FIRE_days
ASSIGNS.MAG_CB6_12km_US_201105_NONROAD
ASSIGNS.MAG_CB6_12km_US_201105_NONROAD_05
ASSIGNS.MAG_CB6_12km_US_201105_NONROAD_06
ASSIGNS.MAG_CB6_12km_US_201105_NONROAD_07
ASSIGNS.MAG_CB6_12km_US_201105_NONROAD_08
ASSIGNS.MAG_CB6_12km_US_201105_NONROAD_09
ASSIGNS.MAG_CB6_12km_US_201105_ONROAD
ASSIGNS.MAG_CB6_12km_US_201105_ONROAD_mag2014
ASSIGNS.MAG_CB6_12km_US_201105_ONROAD_mag2014_05
ASSIGNS.MAG_CB6_12km_US_201105_ONROAD_mag2014_06
ASSIGNS.MAG_CB6_12km_US_201105_ONROAD_mag2014_07
ASSIGNS.MAG_CB6_12km_US_201105_ONROAD_mag2014_08
ASSIGNS.MAG_CB6_12km_US_201105_ONROAD_mag2014_09
ASSIGNS.MAG_CB6_12km_US_201105_ONROAD_mag2014_CM
ASSIGNS.MAG_CB6_12km_US_201105_POINT
ASSIGNS.MAG_CB6_12km_US_201105_PTNONIPM
ASSIGNS.MAG_CB6_12km_US_201105_PT_OILGAS
ASSIGNS.MAG_CB6_12km_US_201105_RWC
ASSIGNS.MAG_CB6_36km_201105
ASSIGNS.MAG_CB6_36km_CM_201105_AREA
ASSIGNS.MAG_CB6_36km_CM_201105_ONROAD
ASSIGNS.MAG_CB6_36km_CM_201105_ONROAD_days
ASSIGNS.MAG_CB6_36km_CM_201105_POINT
ASSIGNS.MAG_CB6_36km_US_201105_AREA
ASSIGNS.MAG_CB6_36km_US_201105_AREA_05
ASSIGNS.MAG_CB6_36km_US_201105_AREA_06
ASSIGNS.MAG_CB6_36km_US_201105_AREA_07
ASSIGNS.MAG_CB6_36km_US_201105_AREA_08
ASSIGNS.MAG_CB6_36km_US_201105_AREA_09
ASSIGNS.MAG_CB6_36km_US_201105_FIRE
ASSIGNS.MAG_CB6_36km_US_201105_FIRE_days
ASSIGNS.MAG_CB6_36km_US_201105_NONROAD
ASSIGNS.MAG_CB6_36km_US_201105_NONROAD_05
ASSIGNS.MAG_CB6_36km_US_201105_NONROAD_06
ASSIGNS.MAG_CB6_36km_US_201105_NONROAD_07
ASSIGNS.MAG_CB6_36km_US_201105_NONROAD_08
ASSIGNS.MAG_CB6_36km_US_201105_NONROAD_09
ASSIGNS.MAG_CB6_36km_US_201105_ONROAD
ASSIGNS.MAG_CB6_36km_US_201105_ONROAD_CM
ASSIGNS.MAG_CB6_36km_US_201105_ONROAD_mag2014
ASSIGNS.MAG_CB6_36km_US_201105_ONROAD_mag2014_05
ASSIGNS.MAG_CB6_36km_US_201105_ONROAD_mag2014_06
ASSIGNS.MAG_CB6_36km_US_201105_ONROAD_mag2014_07
ASSIGNS.MAG_CB6_36km_US_201105_ONROAD_mag2014_08
ASSIGNS.MAG_CB6_36km_US_201105_ONROAD_mag2014_09
ASSIGNS.MAG_CB6_36km_US_201105_ONROAD_mag2014_CM
ASSIGNS.MAG_CB6_36km_US_201105_POINT
ASSIGNS.MAG_CB6_36km_US_201105_PTNONIPM
ASSIGNS.MAG_CB6_36km_US_201105_PT_OILGAS
ASSIGNS.MAG_CB6_36km_US_201105_RWC
ASSIGNS.MAG_CB6_4km_US_201105_AREA
ASSIGNS.MAG_CB6_4km_US_201105_AREA_5months
ASSIGNS.MAG_CB6_4km_US_201105_FIRE
ASSIGNS.MAG_CB6_4km_US_201105_NONROAD
ASSIGNS.MAG_CB6_4km_US_201105_NONROAD_05
ASSIGNS.MAG_CB6_4km_US_201105_NONROAD_06
ASSIGNS.MAG_CB6_4km_US_201105_NONROAD_07
ASSIGNS.MAG_CB6_4km_US_201105_NONROAD_08
ASSIGNS.MAG_CB6_4km_US_201105_NONROAD_09
ASSIGNS.MAG_CB6_4km_US_201105_POINT
ASSIGNS.MAG_CB6_4km_US_201105_POINT_magtpro
ASSIGNS.MAG_CB6_4km_US_201105_PTNONIPM
ASSIGNS.MAG_CB6_4km_US_201105_PTNONIPM_5months
check_settings.scr
set_case.scr
set_dirs.scr
setmerge_files.scr
setmerge_files.scr_12km
setmerge_files.scr_36km
setmerge_files.scr_4km
smk_mkdir
smk_rmfiles.scr
sysflags
unset.scr

./smk/inp/assigns/assigns2017:
ASSIGNS.MAG_CB6_12km_CM_201705_AREA
ASSIGNS.MAG_CB6_12km_CM_201705_ONROAD
ASSIGNS.MAG_CB6_12km_CM_201705_POINT
ASSIGNS.MAG_CB6_12km_CM_201705_POINTX
ASSIGNS.MAG_CB6_12km_US_201705_AREA
ASSIGNS.MAG_CB6_12km_US_201705_AREAX
ASSIGNS.MAG_CB6_12km_US_201705_FIRE
ASSIGNS.MAG_CB6_12km_US_201705_FIRE_2
ASSIGNS.MAG_CB6_12km_US_201705_FIRE_3
ASSIGNS.MAG_CB6_12km_US_201705_FIRE_4
ASSIGNS.MAG_CB6_12km_US_201705_FIRE_5
ASSIGNS.MAG_CB6_12km_US_201705_NONROAD
ASSIGNS.MAG_CB6_12km_US_201705_NONROADX
ASSIGNS.MAG_CB6_12km_US_201705_NONROADX_05
ASSIGNS.MAG_CB6_12km_US_201705_NONROADX_06
ASSIGNS.MAG_CB6_12km_US_201705_NONROADX_07
ASSIGNS.MAG_CB6_12km_US_201705_NONROADX_08
```

```
ASSIGNS.MAG_CB6_12km_US_201705_NONROADX_09
ASSIGNS.MAG_CB6_12km_US_201705_ONROAD
ASSIGNS.MAG_CB6_12km_US_201705_ONROAD_mag2014
ASSIGNS.MAG_CB6_12km_US_201705_ONROAD_mag2014_05
ASSIGNS.MAG_CB6_12km_US_201705_ONROAD_mag2014_06
ASSIGNS.MAG_CB6_12km_US_201705_ONROAD_mag2014_07
ASSIGNS.MAG_CB6_12km_US_201705_ONROAD_mag2014_08
ASSIGNS.MAG_CB6_12km_US_201705_ONROAD_mag2014_09
ASSIGNS.MAG_CB6_12km_US_201705_ONROAD_mag2014_CM
ASSIGNS.MAG_CB6_12km_US_201705_ONROAD_mag2014X
ASSIGNS.MAG_CB6_12km_US_201705_POINT
ASSIGNS.MAG_CB6_12km_US_201705_POINTX
ASSIGNS.MAG_CB6_12km_US_201705_PTNONIPM
ASSIGNS.MAG_CB6_12km_US_201705_PTNONIPMX
ASSIGNS.MAG_CB6_12km_US_201705_PT_OILGAS
ASSIGNS.MAG_CB6_12km_US_201705_PT_OILGASX
ASSIGNS.MAG_CB6_12km_US_201705_RWC
ASSIGNS.MAG_CB6_12km_US_201705_RWCX
ASSIGNS.MAG_CB6_36km_CM_201705_AREA
ASSIGNS.MAG_CB6_36km_CM_201705_ONROAD
ASSIGNS.MAG_CB6_36km_CM_201705_POINT
ASSIGNS.MAG_CB6_36km_CM_201705_POINTX
ASSIGNS.MAG_CB6_36km_US_201705_AREA
ASSIGNS.MAG_CB6_36km_US_201705_AREAX
ASSIGNS.MAG_CB6_36km_US_201705_FIRE
ASSIGNS.MAG_CB6_36km_US_201705_FIRE_1
ASSIGNS.MAG_CB6_36km_US_201705_FIRE_2
ASSIGNS.MAG_CB6_36km_US_201705_FIRE_3
ASSIGNS.MAG_CB6_36km_US_201705_FIRE_4
ASSIGNS.MAG_CB6_36km_US_201705_FIRE_5
ASSIGNS.MAG_CB6_36km_US_201705_NONROAD
ASSIGNS.MAG_CB6_36km_US_201705_NONROADX
ASSIGNS.MAG_CB6_36km_US_201705_NONROADX_05
ASSIGNS.MAG_CB6_36km_US_201705_NONROADX_06
ASSIGNS.MAG_CB6_36km_US_201705_NONROADX_07
ASSIGNS.MAG_CB6_36km_US_201705_NONROADX_08
ASSIGNS.MAG_CB6_36km_US_201705_NONROADX_09
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD_CM
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD_mag2014
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD_mag2014_05
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD_mag2014_06
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD_mag2014_07
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD_mag2014_08
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD_mag2014_09
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD_mag2014_CM
ASSIGNS.MAG_CB6_36km_US_201705_ONROAD_mag2014X
ASSIGNS.MAG_CB6_36km_US_201705_POINT
ASSIGNS.MAG_CB6_36km_US_201705_POINTX
ASSIGNS.MAG_CB6_36km_US_201705_PTNONIPM
ASSIGNS.MAG_CB6_36km_US_201705_PTNONIPMX
ASSIGNS.MAG_CB6_36km_US_201705_PT_OILGAS
ASSIGNS.MAG_CB6_36km_US_201705_PT_OILGASX
ASSIGNS.MAG_CB6_36km_US_201705_RWC
ASSIGNS.MAG_CB6_36km_US_201705_RWCX
ASSIGNS.MAG_CB6_4km_US_201705_AREA
ASSIGNS.MAG_CB6_4km_US_201705_FIRE
ASSIGNS.MAG_CB6_4km_US_201705_NONROAD
ASSIGNS.MAG_CB6_4km_US_201705_NONROAD_05
ASSIGNS.MAG_CB6_4km_US_201705_NONROAD_06
ASSIGNS.MAG_CB6_4km_US_201705_NONROAD_07
ASSIGNS.MAG_CB6_4km_US_201705_NONROAD_08
ASSIGNS.MAG_CB6_4km_US_201705_NONROAD_09
ASSIGNS.MAG_CB6_4km_US_201705_POINT
ASSIGNS.MAG_CB6_4km_US_201705_POINT_magtpro
ASSIGNS.MAG_CB6_4km_US_201705_PTNONIPM
ASSIGNS.MAG_CB6_4km_US_201705_PTNONIPM_orig
check_settings.scr
set_case.scr
set_dirs.scr
setmerge_files.scr
setmerge_files.scr_12km
setmerge_files.scr_36km
setmerge_files.scr_4km
smk_mkdir
smk_rmfiles.scr
sysflags
unset.scr

./smk/inp/ge_dat:
artopnt_2002detroit_12jul2007_v0.txt
costcy_for_2007platform_10mar2015_nf_v13.txt
gridding
holidays.txt
invtable_2011v2_platform_cb6_integrate_12mar2015_v1.txt
invtable_2011v2_platform_cb6_integrate_16dec2014_v0.txt
invtable_hapcap_cb05_no_bafm_12nov2014_v8.txt
invtable_hapcapnohapuse_cb05soa_nomp_nohg_14aug2013_v9.txt
invtable_MOVES2014_25sep2014_nf_v1.txt
nhapexclude
orisdesc_04dec2006_v0.txt
orisdesc_27dec2013_v1.txt_updated_20131227
oris_info.txt
point
pstk.m3.txt
scc_desc.txt
sic_desc.txt
```

```
smkreport
speciation
temporal

./smk/inp/ge_dat/gridding:
agref_np_oilgas_for_20140211_surrogates_27jan2015_v2.txt
amgref_can2010_mex2010v3_12US1_05jan2015_v7.txt
amgref_can2010_mex2010v3_12US1_05jan2015_v7.txtmag
amgref_us_2011platform_05jan2015_v8.txt
amgref_us_2011platform_05jan2015_v8.txt_4km
Canada_Mexico_2010_surrogate_descriptions_25aug2014_v1.txt
griddesc_lambertonly_18sep2014_v61.txt
mgref_us_2011v2platform_onroad_28jan2015_v2.txt
srgdesc_CONUS12_2010_v5_12nov2014_v4.txt
xportfrac.12US2.from4km.v2.ncf

./smk/inp/ge_dat/nhapexclude:
c3marine_nhapexclude_2011eg_12nov2014_v3.txt
nhapexclude_2011eg_pt_oilgas_14jan2015_nf_v3.txt
nhapexclude_2011NEIv2_c1c2rail_25sep2014_v0.txt
nhapexclude_2011NEIv2_nonpt_csv_03dec2014_v1.txt
nhapexclude_2011NEIv2_nonpt_csv_12mar2015_v2.txt
nhapexclude_2011NEIv2_np_oilgas_25sep2014_v0.txt
nhapexclude_2011NEIv2_rwc_25sep2014_v0.txt
nhapexclude_nonroad_2011ec_10sep2013_v2.txt
nhapexclude_nonroad_LPGCNG_Calif_19jul2012_v0.txt
nhapexclude_othpt_with_nonUS_c3_23aug2013_v0.txt

./smk/inp/ge_dat/point:
pelvconfig_inline_20m_13nov2012_v0.txt
pelvconfig.inline.txt
pelvconfig_ptfire_inline_pf31_03may2011_v1.txt
pelvconfig_seca_c3_22jul2010_v1.txt
pstk_20nov2006_v0.txt

./smk/inp/ge_dat/smkreport:
naicsdesc_02jan2008_v0.txt  repconfig
orisdesc_04dec2006_v0.txt   sccdesc_pf31_05jan2015_v22.txt

./smk/inp/ge_dat/smkreport/repconfig:
repconfig_afdust_invgrid_2011platform_11aug2014_v0.txt
repconfig_area_inv_2011platform_11aug2014_v0.txt
repconfig_area_inv_2011platform_11aug2014_v1.txt
repconfig_area_inv2_2011platform_11aug2014_v0.txt
repconfig_area_inv2_2011platform_11aug2014_v1.txt
repconfig_area_inv2_2011platform_11aug2014_v2.txt
repconfig_area_invgrid_2011platform_11aug2014_v0.txt
repconfig_area_invgrid_2011platform_11aug2014_v1.txt
repconfig_area_invgrid_2011platform_29oct2014_v3.txt
repconfig_area_noPM_inv_2011platform_11aug2014_v1.txt
repconfig_nonroad_inv2a_2011platform_11aug2014_v0.txt
repconfig_nonroad_inv2b_2011platform_11aug2014_v0.txt
repconfig_nonroad_inv2c_2011platform_11aug2014_v0.txt
repconfig_onroad_inv_2011platform_11may2011_v0.txt
repconfig_onroad_invgrid_2011platform_18aug2014_v1.txt
repconfig_point_inv_2011platform_11aug2014_v0.txt
repconfig_point_inv_2011platform_11aug2014_v1.txt
repconfig_point_inv_2011platform_11aug2014_v2.txt
repconfig_point_inv_2011platform_2016_v1.txt
repconfig_point_inv2_2011platform_11aug2014_v0.txt
repconfig_point_invgrid_2011platform_11aug2014_v0.txt

./smk/inp/ge_dat/speciation:
gscnv_cmaq_cb6_2011eh_cb6v2_v6_11g_nf.txt
gscnv_cmaq_cb6_2025eh_cb6v2_v6_11g_12mar2015.txt
gspro_beis_cmaq_cb05_soa_2011eh_cb05_v6_11g_19apr2013.txt
gspro_cmaq_cb6_2011eh_cb6v2_v6_11g_28feb2015.txt
gspro_cmaq_cb6_2025eh_cb6v2_v6_11g_12mar2015.txt
gspro_combo_2010cdc_2010ef_nonpt_12nov2012_v0.txt
gspro_combo_2010cdc_2010ef_nonroad_05jan2015_v1.txt
gspro_combo_2017eh_stationary_13mar2015_v0.txt
gspro_combo_2025eh_stationary_12mar2015_v0.txt
gspro_combo_canadamexico2005_27jan2015_v2.txt
gspro_combo_canadamexico2005_29jan2013_v1.txt
gspro_MOVES2014_CB6_29dec2014_v0.txt
gsref_2011eh_v6_11g_05jan2015.txt
gsref_2011eh_v6_11g_05jan2015.txt_mag
gsref_ag_othar_2011eh_v6_11g_05jan2015.txt
gsref_ag_othar_cmaq_cb6_2025eh_cb6_v6_11g_05jan2015.txt
gsref_cmaq_cb6_2025eh_cb6v2_v6_11g_nf.txt
gsref_othpt_2011eh_v6_11g_05jan2015.txt
gsref_othpt_cmaq_cb6_2025eh_cb6_v6_11g_11mar2015.txt
testing_gsref_MOVES2014_dummy_nei_17nov2014_v2.txt

./smk/inp/ge_dat/temporal:
amptpro_Canada_2010_tpro_hourly_05jan2015_v1
amptpro_Canada_2010_tpro_monthly_06nov2014_v0
amptpro_Canada_2010_tpro_weekly_05jan2015_v1
amptpro_for_2011_platform_with_carb_mobile_2011CEM_moves_13aug2013_v0_tpro_monthly_13aug2014_v0
amptpro_general_2011platform_tpro_hourly_6nov2014_13nov2014_v1
amptpro_general_2011platform_tpro_hourly_6nov2014_13nov2014_v1mag
amptpro_general_2011platform_tpro_monthly_6nov2014_06nov2014_v0
amptpro_general_2011platform_tpro_monthly_6nov2014_06nov2014_v0mag
amptpro_general_2011platform_tpro_weekly_6nov2014_13nov2014_v1
amptpro_general_2011platform_tpro_weekly_6nov2014_13nov2014_v1mag
amptref_Canada_2010_tref_05jan2015_v1
amptref_Canada_2010_tref_05jan2015_v1mag
```

```
amptref_Canada_2010_tref_06nov2014_v0
amptref_general_2011platform_tref_6nov2014_05jan2015_v3
amptref_general_2011platform_tref_6nov2014_05jan2015_v3mag
atref_rwc_forGentpro_2011v2platform_SMOKE36_07nov2014_v1
Gentpro_TPRO_DAY_RWC_2011ef_11g_SMOKE36_07nov2014_v0
Gentpro_TPRO_DAY_RWC_2011ef_11g_SMOKE36_mag09282015_v1
Gentpro_TPRO_HOUR_HOURLY_BASH_NH3.agNH3_bash_2011ef_11g-newgent_smk36.ncf
holidays_04may2006_v0.txt
mtpro_hourly_moves2014_23oct2014_13nov2014_v1
mtpro_weekly_moves2014_17oct2014_13nov2014_v2
mtref_onroad_moves2014_23oct2014_28jan2015_v3
summer_diurnal_egu_tpro_2011_21nov2014_v0
summer_diurnal_egu_tref_2011_13mar2015_v2
summer_diurnal_egu_tref_2011_15jan2015_v1
tpro_monthly_Gentpro_RWC_2011eg_11g_07nov2014_v0
winter_diurnal_egu_tpro_2011_csv_21nov2014_v0
winter_diurnal_egu_tref_2011_15jan2015_v1

./smk/inp/inventory:
EPA_platformv62  ERG_OZSIP_2011_2017_v08142015    MAG_LOCAL_data_Ozone_SIP

./smk/inp/inventory/EPA_platformv62:
2011  2017

./smk/inp/inventory/EPA_platformv62/2011:
2011eh_cb05_v6_11g_nr            2011eh_onroad_by_state    area_by_state
2011eh_cb05_v6_11g_pt            2011eh_v6_11g_inputs_cem
2011eh_cb05_v6_11g_ptfire  2011eh_v6_11g_inputs_oth

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_nr:
inputs

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_nr/inputs:
nonroad

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_nr/inputs/nonroad:
2011NEIv1_nonroad_20130621_17oct2014_v6_part1.csv
2011NEIv1_nonroad_20130621_17oct2014_v6_part2.csv
2011_SLT_nonroad_01feb2013_Texas_monthly_ff10_07feb2014_v3.csv
nonroad_ff10_california_2011nei_augmented_VOC_11sep2013_v7.csv

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_pt:
inputs

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_pt/inputs:
ptegu  ptnonipm  pt_oilgas

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_pt/inputs/ptegu:
2011NEIv2_POINT_ptegu_NOV_2014_29jan2015_v1.csv
ptipm_ff10_noncem_2011eg_Nov19_2014_29jan2015_v2
ptipm_ff10_noncem_2011eg_prevdec_Nov19_2014_29jan2015_v2

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_pt/inputs/ptnonipm:
ethanol_plants_2011NEIv2_POINT_20141123_03feb2015_v1.csv
ptnonipm_2011NEIv2_POINT_20140913_revised_20150115_09feb2015_v2.csv
refueling_2011NEIv2_POINT_20140913_04dec2014_v2.csv

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_pt/inputs/pt_oilgas:
pt_oilgas_2011NEIv2_POINT_20140913_03feb2015_v4.csv

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_ptfire:
inputs

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_ptfire/inputs:
ptfire    ptprescfire  ptwildfire

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_ptfire/inputs/ptfire:
ptinv_ptfire_2011_SF2_Plus_GA_Submit_24nov2014_v5_orl.txt

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_ptfire/inputs/ptprescfire:
ptday_ptfire_apr_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_aug_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_dec_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_feb_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_jan_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_jul_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_jun_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_mar_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_may_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_nov_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_oct_2011v2_prescribed_16jan2015_v0_orl.txt
ptday_ptfire_sep_2011v2_prescribed_16jan2015_v0_orl.txt
ptinv_ptfire_2011_SF2_Plus_GA_Submit_from_v5_prescribed_16jan2015_v0_orl.txt

./smk/inp/inventory/EPA_platformv62/2011/2011eh_cb05_v6_11g_ptfire/inputs/ptwildfire:
ptday_ptfire_apr_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_aug_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_dec_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_feb_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_jan_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_jul_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_jun_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_mar_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_may_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_nov_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_oct_2011v2_wild_16jan2015_v0_orl.txt
ptday_ptfire_sep_2011v2_wild_16jan2015_v0_orl.txt
```

```
ptinv_ptfire_2011_SF2_Plus_GA_Submit_from_v5_wild_16jan2015_v0_orl.txt

./smk/inp/inventory/EPA_platformv62/2011/2011eh_onroad_by_state:
2011eh_onroad_SMOKE_MOVES_MOVES2014_no_speciated_pm.csv

./smk/inp/inventory/EPA_platformv62/2011/2011eh_v6_11g_inputs_cem:
2011eh_cb05_v6_11g

./smk/inp/inventory/EPA_platformv62/2011/2011eh_v6_11g_inputs_cem/2011eh_cb05_v6_11g:
inputs

./smk/inp/inventory/EPA_platformv62/2011/2011eh_v6_11g_inputs_cem/2011eh_cb05_v6_11g/inputs:
cem  cem17

./smk/inp/inventory/EPA_platformv62/2011/2011eh_v6_11g_inputs_cem/2011eh_cb05_v6_11g/inputs/cem:
cemsum_2011_corrected_2.1_Nov12_revised_partial_year.txt
HOUR_UNIT_2010_12_31dec.txt
HOUR_UNIT_2011_01_1-30jan.txt
HOUR_UNIT_2011_01_31jan.txt
HOUR_UNIT_2011_02_1-28feb.txt
HOUR_UNIT_2011_02_28feb.txt
HOUR_UNIT_2011_03_1-30mar.txt
HOUR_UNIT_2011_03_31mar.txt
HOUR_UNIT_2011_04_1-29apr.txt
HOUR_UNIT_2011_04_30apr.txt
HOUR_UNIT_2011_05_1-30may.txt
HOUR_UNIT_2011_05_31may.txt
HOUR_UNIT_2011_06_1-29jun.txt
HOUR_UNIT_2011_06_30jun.txt
HOUR_UNIT_2011_07_1-30jul.txt
HOUR_UNIT_2011_07_31jul.txt
HOUR_UNIT_2011_08_1-30aug.txt
HOUR_UNIT_2011_08_31aug.txt
HOUR_UNIT_2011_09_1-29sep.txt
HOUR_UNIT_2011_09_30sep.txt
HOUR_UNIT_2011_10_1-30oct.txt
HOUR_UNIT_2011_10_31oct.txt
HOUR_UNIT_2011_11_1-29nov.txt
HOUR_UNIT_2011_11_30nov.txt
HOUR_UNIT_2011_12_1-30dec.txt
HOUR_UNIT_2011_12_31dec.txt

./smk/inp/inventory/EPA_platformv62/2011/2011eh_v6_11g_inputs_oth:
2011eh_cb05_v6_11g

./smk/inp/inventory/EPA_platformv62/2011/2011eh_v6_11g_inputs_oth/2011eh_cb05_v6_11g:
inputs

./smk/inp/inventory/EPA_platformv62/2011/2011eh_v6_11g_inputs_oth/2011eh_cb05_v6_11g/inputs:
othpt

./smk/inp/inventory/EPA_platformv62/2011/2011eh_v6_11g_inputs_oth/2011eh_cb05_v6_11g/inputs/othpt:
othpt_offshore_oil_2011NEIv2_POINT_20140913_16sep2014_v0.csv
point_oilsands_canada_2010_FF10_20130606_06aug2014_v0.csv
ptinv_eca_imo_nonUS_nonCANADA_caps_vochaps_2011_22aug2013_v0_orl.txt

./smk/inp/inventory/EPA_platformv62/2011/area_by_state:
agburn_monthly_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_01.csv
 ~ agburn_monthly_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_88.csv
c1c2rail_2011NEIv2_NONPOINT_20141108_11nov2014_v1_FIPS_01.csv
 ~ c1c2rail_2011NEIv2_NONPOINT_20141108_11nov2014_v1_FIPS_88.csv
c3marine_2011NEIv2_NONPOINT_20141108_14nov2014_v1_FIPS_01.csv
 ~ c3marine_2011NEIv2_NONPOINT_20141108_14nov2014_v1_FIPS_55.csv
nonpt_2011NEIv2_NONPOINT_20141108_21jan2015_v5_FIPS_01.csv
 ~ nonpt_2011NEIv2_NONPOINT_20141108_21jan2015_v5_FIPS_88.csv
np_oilgas_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_01.csv
 ~ np_oilgas_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_78.csv
pfc_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_01.csv
 ~ pfc_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_88.csv
refueling_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_01.csv
 ~ refueling_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_88.csv
rwc_2011NEIv2_NONPOINT_20141108_24nov2014_v3_FIPS_01.csv
 ~ rwc_2011NEIv2_NONPOINT_20141108_24nov2014_v3_FIPS_88.csv

./smk/inp/inventory/EPA_platformv62/2017:
2017eh_cb6v2_v6_11g_ar        2017eh_cb6v2_v6_11g_oth       onroad
2017eh_cb6v2_v6_11g_cem       2017eh_cb6v2_v6_11g_pt
2017eh_cb6v2_v6_11g_nr        area_by_state

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_ar:
c1c2rail  np_oilgas  rwc

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_ar/c1c2rail:
2017eh_from_c1c2_offshore_2011NEIv2_NONPOINT_20141108_25feb2015_v0.csv
2017eh_from_c1c2rail_2011NEIv2_NONPOINT_20141108_25feb2015_v0.csv

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_ar/np_oilgas:
CoST_step2_2017eh_from_np_oilgas_2011NEIv2_NONPOINT_20141108_09mar2015_v0.csv

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_ar/rwc:
2017eh_from_rwc_2011NEIv2_NONPOINT_20141108_03mar2015_v0.csv

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_cem:
inputs

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_cem/inputs:
cem
```

```
./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_cem/inputs/cem:
cemsum_2017eh_adj_final.txt           HOUR_UNIT_2011_06_2017eh_30jun.txt
HOUR_UNIT_2010_12_2017eh_31dec.txt    HOUR_UNIT_2011_07_2017eh_1-30jul.txt
HOUR_UNIT_2011_01_2017eh_1-30jan.txt  HOUR_UNIT_2011_07_2017eh_31jul.txt
HOUR_UNIT_2011_01_2017eh_31jan.txt    HOUR_UNIT_2011_08_2017eh_1-30aug.txt
HOUR_UNIT_2011_02_2017eh_1-28feb.txt  HOUR_UNIT_2011_08_2017eh_31aug.txt
HOUR_UNIT_2011_02_2017eh_28feb.txt    HOUR_UNIT_2011_09_2017eh_1-29sep.txt
HOUR_UNIT_2011_03_2017eh_1-30mar.txt  HOUR_UNIT_2011_09_2017eh_30sep.txt
HOUR_UNIT_2011_03_2017eh_31mar.txt    HOUR_UNIT_2011_10_2017eh_1-30oct.txt
HOUR_UNIT_2011_04_2017eh_1-29apr.txt  HOUR_UNIT_2011_10_2017eh_31oct.txt
HOUR_UNIT_2011_04_2017eh_30apr.txt    HOUR_UNIT_2011_11_2017eh_1-29nov.txt
HOUR_UNIT_2011_05_2017eh_1-30may.txt  HOUR_UNIT_2011_11_2017eh_30nov.txt
HOUR_UNIT_2011_05_2017eh_31may.txt    HOUR_UNIT_2011_12_2017eh_1-30dec.txt
HOUR_UNIT_2011_06_2017eh_1-29jun.txt  HOUR_UNIT_2011_12_2017eh_31dec.txt

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_nr:
inputs

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_nr/inputs:
nonroad

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_nr/inputs/nonroad:
2017_california_nonroad_monthly_ff10_18oct2013_v2.csv
2017_nonroad_ff10_adjusted_from_2018_noCalif_23mar2015_v0.csv

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_oth:
inputs

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_oth/inputs:
othpt

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_oth/inputs/othpt:
othpt_offshore_oil_2011NEIv2_POINT_20140913_16sep2014_v0.csv
point_oilsands_canada_2010_FF10_20130606_06aug2014_v0.csv
ptinv_2017eh_from_eca_imo_nonUS_nonCANADA_caps_vochaps_2011_25feb2015_v0_orl.txt

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_pt:
inputs

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_pt/inputs:
ptegu  ptnonipm  pt_oilgas

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_pt/inputs/ptegu:
Flatfile_2017_20150319_23mar2015_v2.csv
ptipm_ff10_noncem_2017eh_final_adj_29apr2015_v0
ptipm_ff10_noncem_2017eh_final_adj_prev_dec_29apr2015_v0

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_pt/inputs/ptnonipm:
2017eh_from_ethanol_plants_2011NEIv2_POINT_20141123_10mar2015_v0.csvx
2017eh_from_ptnonipm_2011NEIv2_POINT_20140913_revised_20150115_10mar2015_v0.csvx
2017eh_from_refueling_2011NEIv2_POINT_20140913_10mar2015_v0.csvx
Biodiesel_Plants_2018_ff10_11apr2013_v0.csvx
cement_newkilns_year_2018_from_ISIS2013_NEI2011v1_17mar2015_v2.csvx

./smk/inp/inventory/EPA_platformv62/2017/2017eh_cb6v2_v6_11g_pt/inputs/pt_oilgas:
2017eh_from_pt_oilgas_2011NEIv2_POINT_20140913_09mar2015_v0.csv_without_PM

./smk/inp/inventory/EPA_platformv62/2017/area_by_state:
2017

./smk/inp/inventory/EPA_platformv62/2017/area_by_state/2017:
2017eh_from_afdust_2011NEIv2_NONPOINT_20141108_10mar2015_v0_FIPS_01.csv
 ~ 2017eh_from_afdust_2011NEIv2_NONPOINT_20141108_10mar2015_v0_FIPS_88.csv
2017eh_from_ag_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_01.csv
 ~ 2017eh_from_ag_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_88.csv
2017eh_from_c3marine_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_01.csv
 ~ 2017eh_from_c3marine_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_55.csv
2017eh_from_EPA_2011_afdust_no_precipadj_paved_unpaved_noNEIv2RPOstates_10mar2015_v0_FIPS_01.csv
 ~ 2017eh_from_EPA_2011_afdust_no_precipadj_paved_unpaved_noNEIv2RPOstates_10mar2015_v0_FIPS_56.csv
2018_cellulosic_inventory_06jan2014_v1_FIPS_06.csv
2018_cellulosic_inventory_06jan2014_v1_FIPS_17.csv
2018_cellulosic_inventory_06jan2014_v1_FIPS_26.csv
2018_cellulosic_inventory_06jan2014_v1_FIPS_39.csv
2018_cellulosic_inventory_06jan2014_v1_FIPS_42.csv
2018_cellulosic_inventory_06jan2014_v1_FIPS_48.csv
cellulosic_new_Iowa_plants_from2018docket_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_19.csv
cement_newkilns_year_2018_from_ISIS2013_NEI2011v1_NONPOINT_12feb2015_v1_FIPS_13.csv
cement_newkilns_year_2018_from_ISIS2013_NEI2011v1_NONPOINT_12feb2015_v1_FIPS_42.csv
cement_newkilns_year_2018_from_ISIS2013_NEI2011v1_NONPOINT_12feb2015_v1_FIPS_45.csv
cement_newkilns_year_2018_from_ISIS2013_NEI2011v1_NONPOINT_12feb2015_v1_FIPS_48.csv
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_01.csv
 ~ CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_88.csv
CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_01.csv
 ~ CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_88.csv
for12km
pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_01.csv
 ~ pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_56.csv

./smk/inp/inventory/EPA_platformv62/2017/area_by_state/2017/for12km:
2017eh_from_c1c2rail_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_04.csvx
2017eh_from_c1c2rail_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_06.csvx
2017eh_from_c1c2rail_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_08.csvx
2017eh_from_c1c2rail_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_32.csvx
2017eh_from_c1c2rail_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_35.csvx
2017eh_from_c1c2rail_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_48.csvx
2017eh_from_c1c2rail_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_49.csvx
2017eh_from_c1c2rail_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_88.csvx
```

```
2017eh_from_c3marine_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_06.csvx
2017eh_from_c3marine_2011NEIv2_NONPOINT_20141108_25feb2015_v0_FIPS_48.csvx
2017eh_from_rwc_2011NEIv2_NONPOINT_20141108_03mar2015_v0_FIPS_04.csvx
2017eh_from_rwc_2011NEIv2_NONPOINT_20141108_03mar2015_v0_FIPS_06.csvx
2017eh_from_rwc_2011NEIv2_NONPOINT_20141108_03mar2015_v0_FIPS_08.csvx
2017eh_from_rwc_2011NEIv2_NONPOINT_20141108_03mar2015_v0_FIPS_32.csvx
2017eh_from_rwc_2011NEIv2_NONPOINT_20141108_03mar2015_v0_FIPS_35.csvx
2017eh_from_rwc_2011NEIv2_NONPOINT_20141108_03mar2015_v0_FIPS_48.csvx
2017eh_from_rwc_2011NEIv2_NONPOINT_20141108_03mar2015_v0_FIPS_49.csvx
2017eh_from_rwc_2011NEIv2_NONPOINT_20141108_03mar2015_v0_FIPS_88.csvx
2018_cellulosic_inventory_06jan2014_v1_FIPS_06.csvx
2018_cellulosic_inventory_06jan2014_v1_FIPS_48.csvx
cement_newkilns_year_2018_from_ISIS2013_NEI2011v1_NONPOINT_12feb2015_v1_FIPS_48.csvx
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_04.csvx
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_06.csvx
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_06.csvx2
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_08.csvx
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_32.csvx
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_35.csvx
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_48.csvx
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_48.csvx2
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_49.csvx
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_88.csvx
CoST_step2_2017eh_from_np_oilgas_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_04.csvx
CoST_step2_2017eh_from_np_oilgas_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_06.csvx
CoST_step2_2017eh_from_np_oilgas_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_08.csvx
CoST_step2_2017eh_from_np_oilgas_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_32.csvx
CoST_step2_2017eh_from_np_oilgas_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_35.csvx
CoST_step2_2017eh_from_np_oilgas_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_48.csvx
CoST_step2_2017eh_from_np_oilgas_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_49.csvx
CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_04.csvx
CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_06.csvx
CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_32.csvx
CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_35.csvx
CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_48.csvx
CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_49.csvx
CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_88.csvx
pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_04.csvx
pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_06.csvx
pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_08.csvx
pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_32.csvx
pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_35.csvx
pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_48.csvx
pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_49.csvx

./smk/inp/inventory/EPA_platformv62/2017/onroad:
2017eh_onroad_SMOKE_MOVES_MOVES2014_no_speciated_pm.csv

./smk/inp/inventory/ERG_OZSIP_2011_2017_v08142015:
final_smoke

./smk/inp/inventory/ERG_OZSIP_2011_2017_v08142015/final_smoke:
CA_Area_2011_Annual_OSD_v2.csv
CA_Area_2017_Annual_OSD_v2.csv
Canada_Onroad_2017_Annual_OSD_FF10_v2.csv
CA_Nonroad_2011_Annual_OSD_v2.csv
CA_Nonroad_2017_Annual_OSD_v2.csv
CA_Onroad_2011_Annual_OSD_v2.csv
CA_Point_2011_Annual_FF10_v1.csv
CA_Point_2017_Annual_FF10_v1.csv
Mex_Area_2011_Annual_OSD_v2.csv
Mex_Area_2017_Annual_OSD_v2.csv
Mexico_Onroad_2011_Annual_OSD_FF10_v2.csv
Mexico_Onroad_2017_Annual_OSD_FF10_v2.csv
Mex_Nonroad_2011_Annual_OSD_v2.csv
Mex_Nonroad_2017_Annual_OSD_v2.csv
Mex_Point_2011_Annual_FF10_v1.csv
Mex_Point_2017_Annual_FF10_v1.csv

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP:
airport  area  nonroad        point

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/airport:
airport_sources_list_v4_2011_2017.FF10_zeros
airport_sources_list_v4_2011_2017.FF10_zeros_PINAL
Aviation_emissions_PINAL_SIP_FF10_hourly_20110501_20110930_v20160624.csv
Aviation_emissions_PINAL_SIP_FF10_hourly_20170501_20170930_v20160624.csv
Aviation_emissions_SIP_FF10_hourly_20110501_20110930_v20160624_v13.csv
Aviation_emissions_SIP_FF10_hourly_20170501_20170930_v20160624_v13.csv
Aviation_emissions_SIP_FF10_hourly_20180501_20180930_v20160624_v13.csv
zxfinalRevised_2011NEIv2_Maricopa_pointx_faked_ELEVATED.csv

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/area:
2011  2018
2017  MAG_Maricopa_year_2011_2017area_annual_norwc_0126_v9_zero_emissions.csv

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/area/2011:
agburn_monthly_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_04.csv_WO_MCPC_VOCNOXCO
MAG_Maricopa_year_2011_area_week_days_norwc_05232016_v11_3holidays.csv
MAG_Pinal_year_2011_area_annual_norwc_10082015_v6.csv
nonpt_2011NEIv2_NONPOINT_20141108_21jan2015_v5_FIPS_04.csv_WO_MCPC_VOCNOXCO
pfc_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_04.csv_WO_MCPC
refueling_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_04.csv_WO_MCPC

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/area/2017:
agburn_monthly_2011NEIv2_NONPOINT_20141108_11nov2014_v0_FIPS_04.csv_WO_MCPC_VOCNOXCO
CoST_step2_2017eh_from_nonpt_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_04.csvx_VOCNOXCO_header
```

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CoST_step2_2017eh_from_refueling_2011NEIv2_NONPOINT_20141108_09mar2015_v0_FIPS_04.csvx_VOCNOXCO_header
MAG_Maricopa_year_2017_area_week_days_norwc_05232016_v11_3holidays.csv
MAG_Pinal_year_2017_area_annual_norwc_10082015_v6.csv
pfc_2018_2011v6_2_ff10_28jan2015_28jan2015_v0_FIPS_04.csvx_WO_MCPC_VOC

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/area/2018:
MAG_Maricopa_year_2018_area_week_days_norwc_05232016_v11_3holidays.csv
MAG_Pinal_year_2018_area_annual_norwc_05232016_v10.csv

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/nonroad:
2011  Nonroad_zeroemis_inv_04013_2011_norr.csv
2017  Nonroad_zeroemis_inv_04021_2011_norr.csv
2018

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/nonroad/2011:
2011NEIv1_nonroad_20130621_17oct2014_v6_part1.csv_AZ_WO_MCPC_VOCNOXCO
MAG_Maricopa_year_2011_locomotive_annual_10082015_v6.csv
MAG_Maricopa_year_2011_locomotive_peakday_10082015_v6.csv
MAG_Pinal_year_2011_locomotive_annual_10082015_v6.csv
mod.non.all.04km.mc.2011.txt
mod.non.all.04km.pc.2011.txt

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/nonroad/2017:
2017_nonroad_ff10_adjusted_from_2018_noCalif_23mar2015_v0.csv_WOMCPC_VOCNOXCO_w_header
MAG_Maricopa_year_2017_locomotive_annual_10082015_v6.csv
MAG_Maricopa_year_2017_locomotive_peakday_10082015_v6.csv
MAG_Pinal_year_2017_locomotive_annual_10082015_v6.csv
mod.non.all.04km.mc.2017.txt
mod.non.all.04km.pc.2017.txt
Nonroad_zeroemis_inv_04013_2017_norr.csv
Nonroad_zeroemis_inv_04021_2017_norr.csv

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/nonroad/2018:
mod.non.all.04km.mc.2018.txt  mod.non.all.04km.pc.2018.txt

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/point:
2011  2017  2018

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/point/2011:
finalRevised_2011NEIv2_Maricopa_pointx_csv_EGU_CEMonly_EGU_profile_adjusted.csv
finalRevised_2011NEIv2_Pinal_pointx_csv_EGU_CEMonly.csv
MAG_Maricopa_from_EGU_2_ptnonipm_day_specific_2011.csv
MAG_Maricopa_PTEGU_CEMonly_day_specific_2011.csv
MAG_Maricopa_ptnonimp_day_specific_2011_v3_12182015.csv
ptnonipm_2011NEIv2_POINT_20140913_revised_20150115_09feb2015_v2.csv_AZ_WO_MCPC_VOCCONOX_complete
zfinalRevised_2011NEIv2_Maricopa_pointx_csv_nonpim.csv
zfinalRevised_2011NEIv2_Pinal_pointx_csv_nonpim.csv

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/point/2017:
2017eh_from_ptnonipm_2011NEIv2_POINT_20140913_revised_20150115_10mar2015_v0_FIPS_04.csv_WO_MCPC_VOCNOXCO_header_v3
finalRevised_2017NEIv2_Maricopa_pointx.csv_EGU_CEMonly_EGU_profile_adjusted
finalRevised_2017NEIv2_Pinal_pointx.csv_EGU_CEMonly
MAG_Maricopa_from_EGU_2_ptnonipm_day_specific_2017.csv
MAG_Maricopa_PTEGU_CEMonly_day_specific_2017.csv
MAG_Maricopa_ptnonimp_day_specific_2017_v3_12182015.csv
zfinalRevised_2017NEIv2_Maricopa_pointx_csv_nonpim.csv
zfinalRevised_2017NEIv2_Pinal_pointx_csv_nonpim.csv

./smk/inp/inventory/MAG_LOCAL_data_Ozone_SIP/point/2018:
MAG_Maricopa_ptnonimp_day_specific_2018_v4_06012016.csv
zfinalRevised_2018NEIv2_Pinal_pointx.csv_nonpim_revised_06012016

./smk/inp/list:
list2011  list2017

./smk/inp/list/list2011:
agfire    c1c2rail   onroad         pointpfus     ptegu     xptegu_magcem
airport   c3marine   onroadmxcn     pointwfcn     ptnonipm
area      nonroad    pointmxcn      pointwfmx     pt_oilgas
areamxcn  np_oilgas  pointmxcn_sce  pointwfus     rwc

./smk/inp/list/list2011/agfire:
arinv.agfire.12lst  arinv.agfire.lst

./smk/inp/list/list2011/airport:
pthour.airport.4lst  ptinv.airport.4lst

./smk/inp/list/list2011/area:
arday.area.4lst  arinv.area.12lst  arinv.area.4lst  arinv.area.lst

./smk/inp/list/list2011/areamxcn:
arinv.areamxcn.12lst  arinv.areamxcn.lst

./smk/inp/list/list2011/c1c2rail:
arday.c1c2rail.4lst   arinv.c1c2rail.4lst
arinv.c1c2rail.12lst  arinv.c1c2rail.lst

./smk/inp/list/list2011/c3marine:
arinv.c3marine.12lst  arinv.c3marine.lst

./smk/inp/list/list2011/nonroad:
arday.nonroad.4lst  arinv.nonroad.12lst  arinv.nonroad.4lst  arinv.nonroad.lst

./smk/inp/list/list2011/np_oilgas:
arinv.np_oilgas.12lst  arinv.np_oilgas.lst

./smk/inp/list/list2011/onroad:
```

```
arinv.onroad.12lst  arinv.onroad.4lst  arinv.onroad.lst

./smk/inp/list/list2011/onroadmxcn:
arinv.onroadmxcn.12lst        arinv.onroadmxcn.lst

./smk/inp/list/list2011/pointmxcn:
ptinv.pointmxcn.12lst  ptinv.pointmxcn.lst

./smk/inp/list/list2011/pointmxcn_sce:
ptinv.pointmxcn_sce.12lst  ptinv.pointmxcn_sce.lst

./smk/inp/list/list2011/pointpfus:
ptday.pointpfus.12lst  ptday.pointpfus.lst    ptinv.pointpfus.4lst
ptday.pointpfus.4lst   ptinv.pointpfus.12lst  ptinv.pointpfus.lst

./smk/inp/list/list2011/pointwfcn:
ptday.pointwfcn.lst  ptinv.pointwfcn.lst

./smk/inp/list/list2011/pointwfmx:
ptday.pointwfmx.12lst  ptinv.pointwfmx.12lst
ptday.pointwfmx.lst    ptinv.pointwfmx.lst

./smk/inp/list/list2011/pointwfus:
ptday.pointwfus.12lst  ptday.pointwfus.lst    ptinv.pointwfus.4lst
ptday.pointwfus.4lst   ptinv.pointwfus.12lst  ptinv.pointwfus.lst

./smk/inp/list/list2011/ptegu:
ptday.ptegu.12lst  pthour.ptegu.12lst  ptinv.ptegu.12lst
ptday.ptegu.lst    pthour.ptegu.lst    ptinv.ptegu.lst

./smk/inp/list/list2011/ptnonipm:
ptday.ptnonipm.4lst   ptinv.ptnonipm.4lst
ptinv.ptnonipm.12lst  ptinv.ptnonipm.lst

./smk/inp/list/list2011/pt_oilgas:
ptinv.pt_oilgas.12lst  ptinv.pt_oilgas.lst

./smk/inp/list/list2011/rwc:
arinv.rwc.12lst  arinv.rwc.12lst.bak  arinv.rwc.lst  arinv.rwc.lst.bak

./smk/inp/list/list2011/xptegu_magcem:
ptday.xptegu_magcem.4lst  pthour.xptegu_magcem.4lst  ptinv.xptegu_magcem.4lst

./smk/inp/list/list2017:
airport      c1c2rail     onroad         pointwfcn   ptnonipm2018  xptegu_magcem
airport2018  c3marine     onroadmxcn     pointwfmx   pt_oilgas
area         nonroad      pointmxcn      pointwfus   readme
area2018     nonroad2018  pointmxcn_sce  ptegu       rwc
areamxcn     np_oilgas    pointpfus      ptnonipm    rwcp

./smk/inp/list/list2017/airport:
pthour.airport.4lst  ptinv.airport.4lst

./smk/inp/list/list2017/airport2018:
pthour.airport2018.4lst  ptinv.airport2018.4lst
pthour.airport.4lst  ptinv.airport.4lst

./smk/inp/list/list2017/area:
arday.area.4lst  arinv.area.12lst  arinv.area.4lst  arinv.area.lst

./smk/inp/list/list2017/area2018:
arday.area2018.4lst                arinv.area2018.4lst
arday.area2018.4lst_v11_w3holidays  mytemp

./smk/inp/list/list2017/areamxcn:
arinv.areamxcn.12lst  arinv.areamxcn.lst

./smk/inp/list/list2017/c1c2rail:
arday.c1c2rail.4lst   arinv.c1c2rail.4lst
arinv.c1c2rail.12lst  arinv.c1c2rail.lst

./smk/inp/list/list2017/c3marine:
arinv.c3marine.12lst  arinv.c3marine.lst

./smk/inp/list/list2017/nonroad:
arday.nonroad.4lst  arinv.nonroad.12lst  arinv.nonroad.4lst  arinv.nonroad.lst

./smk/inp/list/list2017/nonroad2018:
arday.nonroad2018.4lst        arinv.nonroad2018.4lst

./smk/inp/list/list2017/np_oilgas:
arinv.np_oilgas.12lst  arinv.np_oilgas.lst

./smk/inp/list/list2017/onroad:
arinv.onroad.12lst  arinv.onroad.4lst  arinv.onroad.lst

./smk/inp/list/list2017/onroadmxcn:
arinv.onroadmxcn.12lst        arinv.onroadmxcn.lst

./smk/inp/list/list2017/pointmxcn:
ptinv.pointmxcn.12lst  ptinv.pointmxcn.lst

./smk/inp/list/list2017/pointmxcn_sce:
ptinv.pointmxcn_sce.12lst  ptinv.pointmxcn_sce.lst

./smk/inp/list/list2017/pointpfus:
ptday.pointpfus.12lst  ptday.pointpfus.lst    ptinv.pointpfus.4lst
```

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ptday.pointpfus.4lst   ptinv.pointpfus.12lst  ptinv.pointpfus.lst

./smk/inp/list/list2017/pointwfcn:
ptday.pointwfcn.lst  ptinv.pointwfcn.lst

./smk/inp/list/list2017/pointwfmx:
ptday.pointwfmx.12lst  ptinv.pointwfmx.12lst
ptday.pointwfmx.lst    ptinv.pointwfmx.lst

./smk/inp/list/list2017/pointwfus:
ptday.pointwfus.12lst  ptday.pointwfus.lst    ptinv.pointwfus.4lst
ptday.pointwfus.4lst   ptinv.pointwfus.12lst  ptinv.pointwfus.lst

./smk/inp/list/list2017/ptegu:
ptday.ptegu.12lst  pthour.ptegu.12lst  ptinv.ptegu.12lst
ptday.ptegu.lst    pthour.ptegu.lst    ptinv.ptegu.lst

./smk/inp/list/list2017/ptnonipm:
ptday.ptnonipm.4lst   ptinv.ptnonipm.4lst
ptinv.ptnonipm.12lst  ptinv.ptnonipm.lst

./smk/inp/list/list2017/ptnonipm2018:
ptday.ptnonipm2018.4lst  ptinv.ptnonipm2018.4lst

./smk/inp/list/list2017/pt_oilgas:
ptinv.pt_oilgas.12lst  ptinv.pt_oilgas.lst

./smk/inp/list/list2017/rwc:
arinv.rwc.12lst  arinv.rwc.lst

./smk/inp/list/list2017/rwcp:
arinv.rwcp.4lst

./smk/inp/list/list2017/xptegu_magcem:
ptday.ptegu_mag.4lst            pthour.xptegu_magcem.4lst
ptday.ptegu_magcem.4lst   ptinv.xptegu_magcem.4lst
ptday.xptegu_magcem.4lst  ptinv.xptegu_magcem.4lst_default_annual

./smk/inp/run:
run2011  run2017

./smk/inp/run/run2011:
cntl_run.csh
make_invdir.csh
mybat
qa_run.csh
smk_area_nctox.csh
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_temp_05
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_temp_06
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_temp_07
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_temp_08
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_temp_09
smk_area_ozsip_12km_cb6.csh_agfire_hap_exclude
smk_area_ozsip_12km_cb6.csh_agfire_hap_exclude_05
smk_area_ozsip_12km_cb6.csh_agfire_hap_exclude_06
smk_area_ozsip_12km_cb6.csh_agfire_hap_exclude_07
smk_area_ozsip_12km_cb6.csh_agfire_hap_exclude_08
smk_area_ozsip_12km_cb6.csh_agfire_hap_exclude_09
smk_area_ozsip_12km_cb6.csh_area_hap_exclude
smk_area_ozsip_12km_cb6.csh_c1c2rail_hap_exclude
smk_area_ozsip_12km_cb6.csh_c3marine_hap_exclude
smk_area_ozsip_12km_cb6.csh_np_oilgas_hap_exclude
smk_area_ozsip_12km_cb6.csh_rwc_hap_exclude
smk_area_ozsip_36km_cb6.csh_agfire_hap_exclude
smk_area_ozsip_36km_cb6.csh_agfire_hap_exclude_05
smk_area_ozsip_36km_cb6.csh_agfire_hap_exclude_06
smk_area_ozsip_36km_cb6.csh_agfire_hap_exclude_07
smk_area_ozsip_36km_cb6.csh_agfire_hap_exclude_08
smk_area_ozsip_36km_cb6.csh_agfire_hap_exclude_09
smk_area_ozsip_36km_cb6.csh_area_hap_exclude
smk_area_ozsip_36km_cb6.csh_c1c2rail_hap_exclude
smk_area_ozsip_36km_cb6.csh_c3marine_hap_exclude
smk_area_ozsip_36km_cb6.csh_np_oilgas_hap_exclude
smk_area_ozsip_36km_cb6.csh_rwc_hap_exclude
smk_area_ozsip_4km_cb6.csh_agfire
smk_area_ozsip_4km_cb6.csh_c1c2rail_hap_exclude
smk_area_ozsip_4km_cb6.csh_xarea
smk_bg_nctox.csh
smk_fire_ozsip_12km_cb6_US_prescb
smk_fire_ozsip_12km_cb6_US_wild
smk_fire_ozsip_12km_cb6_wfmx
smk_fire_ozsip_36km_cb6_US_prescb
smk_fire_ozsip_36km_cb6_US_wild
smk_fire_ozsip_36km_cb6_wfcn
smk_fire_ozsip_36km_cb6_wfmx
smk_fire_ozsip_4km_cb6_US_prescb
smk_fire_ozsip_4km_cb6_US_wild
smk_nonroad_nctox.csh
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_05
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_06
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_07
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_08
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_09
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_05
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smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_06
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_07
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_08
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_09
smk_onroadmxcn_ozsip_12km_cb6_final_v2
smk_onroadmxcn_ozsip_12km_cb6_mag2014
smk_onroadmxcn_ozsip_36km_cb6
smk_onroadmxcn_ozsip_36km_cb6_final_days
smk_onroadmxcn_ozsip_36km_cb6_final_v2
smk_onroad_ozsip_12km_cb6
smk_onroad_ozsip_12km_cb6_mag2014
smk_onroad_ozsip_12km_cb6_mag2014_05
smk_onroad_ozsip_12km_cb6_mag2014_06
smk_onroad_ozsip_12km_cb6_mag2014_07
smk_onroad_ozsip_12km_cb6_mag2014_08
smk_onroad_ozsip_12km_cb6_mag2014_09
smk_onroad_ozsip_36km_cb6
smk_onroad_ozsip_36km_cb6_mag2014
smk_onroad_ozsip_36km_cb6_mag2014_05
smk_onroad_ozsip_36km_cb6_mag2014_06
smk_onroad_ozsip_36km_cb6_mag2014_07
smk_onroad_ozsip_36km_cb6_mag2014_08
smk_onroad_ozsip_36km_cb6_mag2014_09
smk_onroad_ozsip_36km_cb6_mag2014_update_spro
smk_onroad_ozsip_36km_cb6_tmp
smk_ozsip.csh_mag_12km_cb6_areamxcn
smk_ozsip.csh_mag_36km_cb6_areamxcn
smk_ozsip_mrgall_cb6_2D.csh_4km
smk_ozsip_mrgall_cb6.csh_12km
smk_ozsip_mrgall_cb6.csh_36km
smk_ozsip_mrgall_cb6_wf_3D.csh_12km
smk_ozsip_mrgall_cb6_wf_3D.csh_36km
smk_ozsip_mrgall_cb6_wf_3D.csh_4km
smk_point_nctox.csh
smk_point_nctox.csh_mag_4km_cb6
smk_point_nctox.csh_mag_4km_cb6_xairport
smk_point_nctox.csh_mag_4km_cb6_xptnonipm
smk_point_ozsip_12km_cb6.csh_pointmxcn
smk_point_ozsip_12km_cb6.csh_pointmxcn_sce
smk_point_ozsip_12km_cb6.csh_ptegu
smk_point_ozsip_12km_cb6.csh_ptegu_flat
smk_point_ozsip_12km_cb6.csh_ptnonipm
smk_point_ozsip_12km_cb6.csh_pt_oilgas_hap_exclude
smk_point_ozsip_36km_cb6.csh_pointmxcn
smk_point_ozsip_36km_cb6.csh_pointmxcn_sce
smk_point_ozsip_36km_cb6.csh_ptegu
smk_point_ozsip_36km_cb6.csh_ptnonipm
smk_point_ozsip_36km_cb6.csh_pt_oilgas
smk_point_ozsip_36km_cb6.csh_pt_oilgas_hap_exclude
smk_point_ozsip_4km_cb6.csh_xptegu_magcem_skipcem_magtpro_adjusted_annual
smk_run.csh
smk_run_wf.csh

./smk/inp/run/run2017:
cntl_run.csh
make_invdir.csh
movelog.csh
qa_run.csh
smk_area_nctox.csh
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_tmp_05
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_tmp_06
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_tmp_07
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_tmp_08
smk_area_nctox.csh_mag_4km_cb6_SIP_xnonroad_tmp_09
smk_area_ozsip_12km_cb6.csh_area_hap_exclude
smk_area_ozsip_12km_cb6.csh_c1c2rail_hap_exclude
smk_area_ozsip_12km_cb6.csh_c3marine_hap_exclude
smk_area_ozsip_12km_cb6.csh_np_oilgas_hap_exclude
smk_area_ozsip_12km_cb6.csh_rwc_hap_exclude
smk_area_ozsip_36km_cb6.csh_area_hap_exclude
smk_area_ozsip_36km_cb6.csh_c1c2rail_hap_exclude
smk_area_ozsip_36km_cb6.csh_c3marine_hap_exclude
smk_area_ozsip_36km_cb6.csh_np_oilgas_hap_exclude
smk_area_ozsip_36km_cb6.csh_rwc_hap_exclude
smk_area_ozsip_4km_cb6.csh
smk_area_ozsip_4km_cb6.csh_c1c2rail_hap_exclude
smk_area_ozsip_4km_cb6.csh_xarea
smk_area_ozsip_4km_cb6.csh_xarea2018
smk_bg_nctox.csh
smk_fire_ozsip_12km_cb6_US_prescb
smk_fire_ozsip_12km_cb6_US_wild
smk_fire_ozsip_12km_cb6_wfmx
smk_fire_ozsip_36km_cb6_US_prescb
smk_fire_ozsip_36km_cb6_US_wild
smk_fire_ozsip_36km_cb6_wfcn
smk_fire_ozsip_36km_cb6_wfmx
smk_fire_ozsip_4km_cb6_US_prescb
smk_fire_ozsip_4km_cb6_US_wild
smk_nonroad_nctox.csh
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_05
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_06
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_07
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_08
smk_NONROAD_nctox.csh_mag_12km_cb6_hap_exclude_09
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude
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smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_05
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_06
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_07
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_08
smk_NONROAD_nctox.csh_mag_36km_cb6_hap_exclude_09
smk_NONROAD_nctox.csh_mag_4km_cb6
smk_onroadmxcn_ozsip_12km_cb6_final_v2
smk_onroadmxcn_ozsip_12km_cb6_mag2014
smk_onroadmxcn_ozsip_36km_cb6
smk_onroadmxcn_ozsip_36km_cb6_final_v2
smk_onroadmxcn_ozsip_36km_cb6_mag2014
smk_onroad_ozsip_12km_cb6
smk_onroad_ozsip_12km_cb6_mag2014
smk_onroad_ozsip_12km_cb6_mag2014_05
smk_onroad_ozsip_12km_cb6_mag2014_06
smk_onroad_ozsip_12km_cb6_mag2014_07
smk_onroad_ozsip_12km_cb6_mag2014_08
smk_onroad_ozsip_12km_cb6_mag2014_09
smk_onroad_ozsip_36km_cb6
smk_onroad_ozsip_36km_cb6_mag2014
smk_onroad_ozsip_36km_cb6_mag2014_05
smk_onroad_ozsip_36km_cb6_mag2014_06
smk_onroad_ozsip_36km_cb6_mag2014_07
smk_onroad_ozsip_36km_cb6_mag2014_08
smk_onroad_ozsip_36km_cb6_mag2014_09
smk_ozsip.csh_mag_12km_cb6_areamxcn
smk_ozsip.csh_mag_36km_cb6_areamxcn
smk_ozsip_mrgall_cb6_2D.csh_4km
smk_ozsip_mrgall_cb6_2D.csh_4km_no_anthrop
smk_ozsip_mrgall_cb6.csh_12km
smk_ozsip_mrgall_cb6.csh_12km_no_US_anthrop
smk_ozsip_mrgall_cb6.csh_36km
smk_ozsip_mrgall_cb6.csh_36km_days
smk_ozsip_mrgall_cb6.csh_36km_no_US_anthrop
smk_ozsip_mrgall_cb6_wf_3D.csh_1
smk_ozsip_mrgall_cb6_wf_3D.csh_12km
smk_ozsip_mrgall_cb6_wf_3D.csh_12km_2
smk_ozsip_mrgall_cb6_wf_3D.csh_12km_3
smk_ozsip_mrgall_cb6_wf_3D.csh_12km_4
smk_ozsip_mrgall_cb6_wf_3D.csh_12km_5
smk_ozsip_mrgall_cb6_wf_3D.csh_36km_2
smk_ozsip_mrgall_cb6_wf_3D.csh_36km_3
smk_ozsip_mrgall_cb6_wf_3D.csh_36km_4
smk_ozsip_mrgall_cb6_wf_3D.csh_36km_5
smk_ozsip_mrgall_cb6_wf_3D.csh_4km
smk_point_nctox.csh
smk_point_nctox.csh_mag_4km_cb6
smk_point_nctox.csh_mag_4km_cb6_xairport
smk_point_nctox.csh_mag_4km_cb6_xairport2018
smk_point_nctox.csh_mag_4km_cb6_xptnonipm
smk_point_nctox.csh_mag_4km_cb6_xptnonipm2018
smk_point_ozsip_12km_cb6.csh_pointmxcn
smk_point_ozsip_12km_cb6.csh_pointmxcn_sce
smk_point_ozsip_12km_cb6.csh_ptegu
smk_point_ozsip_12km_cb6.csh_ptegu_wo_day_just_hour
smk_point_ozsip_12km_cb6.csh_ptnonipm
smk_point_ozsip_12km_cb6.csh_pt_oilgas_hap_exclude
smk_point_ozsip_36km_cb6.csh_pointmxcn
smk_point_ozsip_36km_cb6.csh_pointmxcn_sce
smk_point_ozsip_36km_cb6.csh_pointmxcn_sce_5days
smk_point_ozsip_36km_cb6.csh_ptegu
smk_point_ozsip_36km_cb6.csh_ptnonipm
smk_point_ozsip_36km_cb6.csh_pt_oilgas
smk_point_ozsip_36km_cb6.csh_pt_oilgas_hap_exclude
smk_point_ozsip_4km_cb6.csh_xptegu_magcem_skipcem_magtpro_annual
smk_run.csh
smk_run_wf.csh

./smk/out:
emis

./smk/out/emis:
2011  2017

./smk/out/emis/2011:
12km  36km  4km

./smk/out/emis/2011/12km:
readme_no_change_to_elvated_since_v6  v9_merged_2D
v6_elevated_pt_final_zeroout_4km_pt   v9_merged_2D_w2012bio

./smk/out/emis/2011/12km/v6_elevated_pt_final_zeroout_4km_pt:
elv_pointmxcn_2011            elv_ptegu_2011         elv_pt_oilgas_2011
elv_pointmxcn_sce_2011        elv_ptnonipm_2011

./smk/out/emis/2011/12km/v6_elevated_pt_final_zeroout_4km_pt/elv_pointmxcn_2011:
inlnts_l.pointmxcn.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.pointmxcn.20111001.1.MCIP_12km.mag12.ncf
stack_groups.pointmxcn.MCIP_12km.mag12.ncf

./smk/out/emis/2011/12km/v6_elevated_pt_final_zeroout_4km_pt/elv_pointmxcn_sce_2011:
inlnts_l.pointmxcn_sce.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.pointmxcn_sce.20111001.1.MCIP_12km.mag12.ncf
stack_groups.pointmxcn_sce.MCIP_12km.mag12.ncf

./smk/out/emis/2011/12km/v6_elevated_pt_final_zeroout_4km_pt/elv_ptegu_2011:
inlnts_l.ptegu.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.ptegu.20111001.1.MCIP_12km.mag12.ncf
stack_groups.ptegu.MCIP_12km.mag12.ncf
```

```
./smk/out/emis/2011/12km/v6_elevated_pt_final_zeroout_4km_pt/elv_ptnonipm_2011:
inlnts_l.ptnonipm.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.ptnonipm.20111001.1.MCIP_12km.mag12.ncf
stack_groups.ptnonipm.MCIP_12km.mag12.ncf

./smk/out/emis/2011/12km/v6_elevated_pt_final_zeroout_4km_pt/elv_pt_oilgas_2011:
inlnts_l.pt_oilgas.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.pt_oilgas.20111001.1.MCIP_12km.mag12.ncf
stack_groups.pt_oilgas.MCIP_12km.mag12.ncf

./smk/out/emis/2011/36km:
readme_no_change_to_elevated_pt    v9_merged_2D
v9_elevated_pt                     v9_merged_2D_w2012bio

./smk/out/emis/2011/4km:
v6_elvated_pt  v9_merged_2D  v9_merged_2D_w2012bio

./smk/out/emis/2017:
12km  36km  4km

./smk/out/emis/2017/12km:
v6_elevated_pt_final_zeroout_4km_pt  v9_merged_2D  v9_merged_2D_w2012bio

./smk/out/emis/2017/12km/v6_elevated_pt_final_zeroout_4km_pt:
0pointmxcn  0pointmxcn_sce  0ptegu  0ptnonipm  0pt_oilgas

./smk/out/emis/2017/12km/v6_elevated_pt_final_zeroout_4km_pt/0pointmxcn:
inlnts_l.pointmxcn.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.pointmxcn.20111001.1.MCIP_12km.mag12.ncf
stack_groups.pointmxcn.MCIP_12km.mag12.ncf

./smk/out/emis/2017/12km/v6_elevated_pt_final_zeroout_4km_pt/0pointmxcn_sce:
inlnts_l.pointmxcn_sce.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.pointmxcn_sce.20111001.1.MCIP_12km.mag12.ncf
stack_groups.pointmxcn_sce.MCIP_12km.mag12.ncf

./smk/out/emis/2017/12km/v6_elevated_pt_final_zeroout_4km_pt/0ptegu:
inlnts_l.ptegu.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.ptegu.20111001.1.MCIP_12km.mag12.ncf
stack_groups.ptegu.MCIP_12km.mag12.ncf

./smk/out/emis/2017/12km/v6_elevated_pt_final_zeroout_4km_pt/0ptnonipm:
inlnts_l.ptnonipm.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.ptnonipm.20111001.1.MCIP_12km.mag12.ncf
stack_groups.ptnonipm.MCIP_12km.mag12.ncf

./smk/out/emis/2017/12km/v6_elevated_pt_final_zeroout_4km_pt/0pt_oilgas:
inlnts_l.pt_oilgas.20110428.1.MCIP_12km.mag12.ncf  ~  inlnts_l.pt_oilgas.20111001.1.MCIP_12km.mag12.ncf
stack_groups.pt_oilgas.MCIP_12km.mag12.ncf

./smk/out/emis/2017/36km:
readme_no_change_elv_pt  v6_elevated_pt  v9_merged_2D  v9_merged_2D_w2012bio

./smk/out/emis/2017/4km:
readme    v6_elvated_pt_2017  v9_merged_2D

./sps:
cfg  inp  out  readme

./sps/cfg:
srgtool_Canada_NAESI
srgtool_Canada_non_NAESI
srgtool_Canada_non_NAESI_91201
srgtools_2015_Maricopa_4km
srgtools_2015_MX
srgtools_2015_Pinal_4km
srgtool_US_12km
srgtool_US_36km
WWW_surrogate_specification_2015_v6_09162015.xlsx

./sps/cfg/srgtool_Canada_NAESI:
control_variables_GRID101_CAN_NAESI.csv  surrogate_generation_can_naesi.csv
GRIDDESC                                 surrogate_IDs_can_naesi.csv
shapefile_catalog_2010_can_naesi.csv     surrogate_specification_can_naesi.csv

./sps/cfg/srgtool_Canada_non_NAESI:
control_variables_GRID101_CAN.csv  surrogate_generation_canada.csv
GRIDDESC                           surrogate_ID_can.csv
shapefile_catalog_2006.csv         surrogate_specification_can.csv

./sps/cfg/srgtool_Canada_non_NAESI_91201:
control_variables_GRID101_CAN.csv  surrogate_generation_canada.csv
GRIDDESC                           surrogate_ID_can.csv
shapefile_catalog_2006.csv         surrogate_specification_can.csv

./sps/cfg/srgtools_2015_Maricopa_4km:
control_variables_grid_MAG2015_4km_MC_20150705_v4.csv
GRIDDESC
shapefile_catalog_201506_MC_v4.csv
surrogate_codes_2015_MC_v4.csv
surrogate_generation_grid_2015_MC_v4.csv
surrogate_specification_2015_MC_v5.csv
SurrogateTools.jar
WWW_surrogate_specification_2015_v5_08182015.xlsx

./sps/cfg/srgtools_2015_MX:
control_variables_grid_MAG2015_12km_MEX.csv
control_variables_grid_MAG2015_36km_MEX.csv
GRIDDESC
shapefile_catalog_2015_3600_MEX.csv
surrogate_codes_MAG2015.csv
surrogate_generation_grid_2015MAG_MX.csv
surrogate_specification_2015_v1.csv
```

```
WWW_MEXICO_Spatial_surrogates_09102015_v1.xlsx

./sps/cfg/srgtools_2015_Pinal_4km:
control_variables_grid_MAG2015_4km_PC_20150820_v2.csv
GRIDDESC
shapefile_catalog_201506_MC_v4.csv
spatial_surrogate_PC.xlsx
surrogate_codes_2015_MC_v4.csv
surrogate_generation_grid_2015_PC_v2.csv
surrogate_specification_2015_PC_CGA_v2.csv

./sps/cfg/srgtool_US_12km:
control_variables_grid_MAG2015_12km_v01.csv  shapefile_catalog_2015_v02.csv
control_variables_grid_MAG2015_12km_v02.csv  shapefile_catalog_2015_v03.csv
control_variables_grid_MAG2015_12km_v03.csv  shapefile_catalog_2015_v04.csv
control_variables_grid_MAG2015_12km_v04.csv  surrogate_codes_2015.csv
GRIDDESC                                     surrogate_generation_grid_2015.csv
shapefile_catalog_2015_v01.csv               surrogate_specification_2015.csv

./sps/cfg/srgtool_US_36km:
control_variables_grid_MAG2015_12km_v01.csv  ~  control_variables_grid_MAG2015_12km_v04.csv
control_variables_grid_MAG2015_36km_v00.csv  ~  control_variables_grid_MAG2015_36km_v25.csv
control_variables_grid_MAG2015_4km_v00_out_MCPC.csv
GRIDDESC
shapefile_catalog_2015_4km_v00.csv
shapefile_catalog_2015_v00.csv  ~  shapefile_catalog_2015_v25.csv
shapefile_catalog_2015_v1201.csv ~ shapefile_catalog_2015_v1204.csv
surrogate_codes_2015.csv
surrogate_generation_grid_2015.csv
surrogate_generation_grid_2015_v1.csv
surrogate_specification_2015.csv
US_SpatialSurrogate_Workbook_v072115.xlsx

./sps/inp:
data_shapefile

./sps/inp/data_shapefile:
Canada           emiss_shp2010  mexico        pinal
emiss_shp2003    maricopa       outside_MCPC

./sps/inp/data_shapefile/Canada:
Canada                                US_SpatialSurrogate_Documentation_v070115.pdf
SurrogateTools_Scripts_2014.zip       US_SpatialSurrogate_Workbook_v072115.xlsx

./sps/inp/data_shapefile/Canada/Canada:
2010_surrogate_documentation_workbook_16Jan2013.xlsx
Canada_2010_surrogate_v1

./sps/inp/data_shapefile/Canada/Canada/Canada_2010_surrogate_v1:
NAESI  Non_NAESI

./sps/inp/data_shapefile/Canada/Canada/Canada_2010_surrogate_v1/NAESI:
control_variables_GRID101_CAN_NAESI.csv  surrogate_generation_can_naesi.csv
SHAPEFILE                                surrogate_IDs_can_naesi.csv
shapefile_catalog_2010_can_naesi.csv     surrogate_specification_can_naesi.csv

./sps/inp/data_shapefile/Canada/Canada/Canada_2010_surrogate_v1/NAESI/SHAPEFILE:
gisnodat.shp  naesi_dat.shp

./sps/inp/data_shapefile/Canada/Canada/Canada_2010_surrogate_v1/Non_NAESI:
control_variables_GRID101_CAN.csv  surrogate_generation_canada.csv
SHAPEFILE                          surrogate_ID_can.csv
shapefile_catalog_2006.csv         surrogate_specification_can.csv

./sps/inp/data_shapefile/Canada/Canada/Canada_2010_surrogate_v1/Non_NAESI/SHAPEFILE:
CANRAIL.shp
chboisv8S0_.shp
da2006_pop_labour.shp
lowmedjet_ll.shp
marine.shp
merge123_10km.shp
naesi_fert.shp
paved4.shp
pr2001ca_regions_bc_waste.shp
pr2001ca_regions_simplify.shp
treesa.shp
ua2001.shp
unpaved4.shp
unpaved5.shp

./sps/inp/data_shapefile/emiss_shp2003:
airport-area.shp
county_lu2k.shp
military_air.shp
mines_nlcd.shp
us_ag2k.shp
uscells05g.shp
us_dryclean.shp
us_gas_sta.shp
us_golf.shp
us_oilgas.shp
us_oil.shp
us_timb.shp
us_wwtp.shp

./sps/inp/data_shapefile/emiss_shp2010:
acs
```

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census
cty_pophu2k_revised.shp
ERTAC_railyard_WRF.shp
extended_idle
fema
ladco
nlcd
ntad
offshore
spatial_insights
state_group
state_pophu2010.shp
tiger
US_Airports_NEI08v2_WRF.shp
usgs

./sps/inp/data_shapefile/emiss_shp2010/acs:
heating_fuels_acs0510_c2010.shp

./sps/inp/data_shapefile/emiss_shp2010/census:
pophu_bg2010_AZ4.shp
pophu_bg2010.shp

./sps/inp/data_shapefile/emiss_shp2010/extended_idle:
potential_idling_locations_v2_final.shp

./sps/inp/data_shapefile/emiss_shp2010/fema:
fema_bsf_2002bnd_04013.shp
fema_bsf_2002bnd.shp

./sps/inp/data_shapefile/emiss_shp2010/ladco:
GreatLakes_IWW_EI_EERA_2011_WRF.shp

./sps/inp/data_shapefile/emiss_shp2010/nlcd:
nlcd2006_10s_waterland.shp
nlcd2006_20s_developed.shp
nlcd2006_40_forest.shp
nlcd2006_80s_agri.shp
nlcd2011az_10s_250m_nosimple_latlon.shp
nlcd2011az_10s_250m_nosimple_stateplane.shp
nlcd2011az_20s_250m_nosimv2_latlon.shp
nlcd2011az_40s_250m_nos_v2_latlon.shp
nlcd2011az_80s_250m_nos_v2_latlon.shp
nlcd2011az_lakes_stateplane.shp

./sps/inp/data_shapefile/emiss_shp2010/ntad:
ipcd.shp
ports_ntad2010.shp
rail_lines_ntad2012.shp
waterway_ntad2011.shp

./sps/inp/data_shapefile/emiss_shp2010/offshore:
GulfofMexico_SupportVessels_Density_WRF.shp
nav_water_activity.shp
NewFederalStateWaters120606.shp
Ports_081412_NEI2011_NOx_WRF.shp
ShippingLanes_112812_NEI2011_NOx_WRF.shp
TUGvessel_SURROGATE_GREATLAKES.shp

./sps/inp/data_shapefile/emiss_shp2010/spatial_insights:
drycleaner_surrogate.shp
gas_station_surrogate.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group:
12km_only  group03  group07  group11   group122  group14  group18  group22
group_000  group04  group08  group12   group123  group15  group19  group23
group01    group05  group09  group120  group124  group16  group20  group24
group02    group06  group10  group121  group13   group17  group21  group25

./sps/inp/data_shapefile/emiss_shp2010/state_group/12km_only:
cty_pophu2k_revised_12kmClip.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group_000:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group01:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group02:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group03:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group04:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group05:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group06:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group07:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group08:
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cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group09:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group10:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group11:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group12:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group120:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group121:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group122:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group123:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group124:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group13:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group14:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group15:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group16:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group17:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group18:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group19:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group20:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group21:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group22:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group23:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group24:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/state_group/group25:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/emiss_shp2010/tiger:
rail_tiger2010.shp
rd_ps_tiger2010_az.shp
rd_ps_tiger2010.shp

./sps/inp/data_shapefile/emiss_shp2010/usgs:
mines_usgs2003_wrf.shp
quarries_usgs2003_wrf.shp

./sps/inp/data_shapefile/maricopa:
Active_MSW_Landfills.shp
ARIZONA_RAILROAD_latlon.shp
AZ_all_hospital_latlon.shp
AZ_landfill_except_NW_latlon.shp
AZ_medical_facilities_latlon.shp
cty_pophu2k_revised_PC.shp
cty_pophu2k_revised.shp
MAG_2011_Traffic_data_latlon_roadtype24.shp
MAG_2011_Traffic_data_latlon_roadtype2.shp
MAG_2011_Traffic_data_latlon_roadtype3.shp
MAG_2011_Traffic_data_latlon_roadtype4.shp
MAG_2011_Traffic_data_latlon_roadtype5.shp
MAG_2011_Traffic_data_latlon.shp
MAG_2012_Traffic_data.shp
MAG_landuse_2012_latlon.shp
MAG_Maricopa_Pinal_2010Census_latlon.shp
MAG_Residential_construction_completed_2011.shp
Maricopa_2011_employers_latlon.shp
Maricopa_2012_commercial_land.shp
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Maricopa_agriculture_2010_latlon.shp
Maricopa_agriculture_2012_latlon.shp
Maricopa_industrial_2012_latlon.shp
Maricopa_only_lakes_latlon.shp
Maricopa_Pinal_golf_latlon.shp
Maricopa_single_family_all_latlon.shp
Maricopa_single_low_intensity.shp
Maricopa_vacant_land_2012_latlon.shp
MC_15_airports_latlon.shp
MC_employers_2011dryclean.shp
MC_multiple_family_latlon.shp
MC_singleFamily_low_medium_latlon.shp
MC_single_highdensity_latlon.shp
MC_wastewater_treatment_latlon.shp
PINAL_agriculture_2011_latlon.shp
us_ag2k_lonlat.shp
XY_Fueling_Facilities_MC_and_PC_latlon.shp

./sps/inp/data_shapefile/mexico:
A_Agricola.shp
BOSQUE_LAD.shp
carretera_ESPHE.shp
carretera_latlong.shp
CARR_POB.shp
com_ind_viv.shp
hwybdrx.shp
mexico_air.shp
mexico_hh.shp
Mexico_muni.shp
Mexico_pop.shp
mexico_ports.shp
mexico_region.shp
mexico_rivers.shp
mexico_roads.shp
mexico_rr.shp
mexico.shp
mexmunic_new.shp
municipal_MXFIPS.shp
REP_CRUCES.shp
REPMEX_ES_HEAT1.shp

./sps/inp/data_shapefile/outside_MCPC:
cty_pophu2k_revised.shp

./sps/inp/data_shapefile/pinal:
CAAG_2010_employment_ll.shp
Pinal_2010_all_residential_ll.shp
Pinal_2010_all_residential_norural_ll.shp
Pinal_2010_CAG_landuse_lonlat.shp
Pinal_2011_all_residential_norural_ll.shp
PINAL_landuse_2011_ll.shp
Pinal_Resd_Comme_Indus_Insti_Goven.shp
PINAL_Residential_completed_2011_ll.shp

./sps/inp/data_shapefile/readme:
2010shapefiles.acs.tar.contents.txt
2010shapefiles.census_full.tar.contents.txt
2010shapefiles.census_split.tar.contents.txt
2010shapefiles.fema.tar.contents.txt
2010shapefiles.ladco.tar.contents.txt
2010shapefiles.mexico.tar.contents.txt
2010shapefiles.misc.tar.contents.txt
2010shapefiles.nlcd_agri_forest.tar.contents.txt
2010shapefiles.nlcd_devwaterland.tar.contents.txt
2010shapefiles.ntad.tar.contents.txt
2010shapefiles.offshore.tar.contents.txt
2010shapefiles.tiger.tar.contents.txt
2010shapefiles.usgs.tar.contents.txt
README

./sps/out:
Spatial_Surrogate_12km        Spatial_Surrogate_36km        Spatial_Surrogate_4km

./sps/out/Spatial_Surrogate_12km:
MEX_10_NOFILL.txt  ~  MEX_888_NOFILL.txt
SRGDESC.txt
USA_100_FILL.txt   ~  USA_890_FILL.txt
USA_100_NOFILL.txt ~  USA_890_NOFILL.txt

./sps/out/Spatial_Surrogate_36km:
CA_9100_NOFILL.txt  ~  CA_9997_NOFILL.txt
CA_91201_NOFILL.txt ~  CA_92457_NOFILL.txt
MEX_10_NOFILL.txt   ~  MEX_888_NOFILL.txt
SRGDESC.txt
USA_100_FILL.txt    ~  USA_890_FILL.txt
USA_100_NOFILL.txt  ~  USA_890_NOFILL.txt

./sps/out/Spatial_Surrogate_4km:
SRGDESC.txt
USA_100_NOFILL.txt  ~  USA_890_NOFILL.txt

./wrf:
WPS   WRF3.7.2011

./wrf/WPS:
inp   out
```

```
./wrf/WPS/inp:
2011042400.AWIP3D ~  2011100200.AWIP3D
2011042400.AWIPSF ~  2011100200.AWIPSF
2011042403.AWIP3D ~  2011100203.AWIP3D
2011042403.AWIPSF ~  2011100203.AWIPSF
2011042406.AWIP3D ~  2011100206.AWIP3D
2011042406.AWIPSF ~  2011100206.AWIPSF
2011042409.AWIP3D ~  2011100209.AWIP3D
2011042409.AWIPSF ~  2011100209.AWIPSF
2011042412.AWIP3D ~  2011100212.AWIP3D
2011042412.AWIPSF ~  2011100212.AWIPSF
2011042415.AWIP3D ~  2011100215.AWIP3D
2011042415.AWIPSF ~  2011100215.AWIPSF
2011042418.AWIP3D ~  2011100218.AWIP3D
2011042418.AWIPSF ~  2011100218.AWIPSF
2011042421.AWIP3D ~  2011100221.AWIP3D
2011042421.AWIPSF ~  2011100221.AWIPSF

./wrf/WPS/out:
geogrid metgrid

./wrf/WPS/out/geogrid:
geo_em.d01.nc  geo_em.d02.nc  geo_em.d03.nc

./wrf/WPS/out/metgrid:
met_em.d01.2011-04-20_00:00:00.nc  ~  met_em.d01.2011-10-02_00:00:00.nc
met_em.d01.2011-04-20_03:00:00.nc  ~  met_em.d01.2011-10-02_03:00:00.nc
met_em.d01.2011-04-20_06:00:00.nc  ~  met_em.d01.2011-10-02_06:00:00.nc
met_em.d01.2011-04-20_09:00:00.nc  ~  met_em.d01.2011-10-02_09:00:00.nc
met_em.d01.2011-04-20_12:00:00.nc  ~  met_em.d01.2011-10-02_12:00:00.nc
met_em.d01.2011-04-20_15:00:00.nc  ~  met_em.d01.2011-10-02_15:00:00.nc
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APPENDIX D

2011 AND 2017 EMISSIONS INVENTORY SUMMARY

Area Source

Table D-1. Ozone season average daily area source emissions for Maricopa County in 2011 and 2017 (unit: metric tons/day)

No.	SCC	Description	2011			2017		
			VOC	NOx	CO	VOC	NOx	CO
1	2102004001	Industrial distillate oil: Boilers	0.002	0.177	0.044	0.002	0.207	0.052
2	2102004002	Industrial distillate oil: Engines	0.000	5.345	1.150	0.000	6.253	1.346
3	2102006000	Industrial natural gas	0.099	1.952	1.216	0.116	2.284	1.423
4	2103004001	Commercial/institutional distillate oil: Boilers	0.000	0.000	0.000	0.000	0.000	0.000
5	2103004002	Commercial/institutional distillate oil: Engines	0.000	0.011	0.002	0.000	0.012	0.003
6	2103006000	Commercial/institutional natural gas	0.114	2.267	1.390	0.126	2.501	1.534
7	2104006000	Residential natural gas	0.054	0.927	0.395	0.060	1.023	0.435
8	2301000000	Chemical manufacturing	0.272	0.000	0.000	0.318	0.000	0.000
9	2302002100	Commercial cooking - Conveyorized charbroiling	0.062	0.000	0.218	0.068	0.000	0.241
10	2302002200	Commercial cooking - Underfired charbroiling	0.213	0.000	0.695	0.235	0.000	0.766
11	2302003000	Commercial cooking - Deep fat frying	0.065	0.000	0.000	0.072	0.000	0.000
12	2302003100	Commercial cooking - Flat griddle frying	0.031	0.000	0.065	0.034	0.000	0.072
13	2302003200	Commercial cooking - Clamshell griddle frying	0.001	0.000	0.000	0.001	0.000	0.000
14	2302050000	Bakeries	0.248	0.000	0.000	0.274	0.000	0.000
15	2304000000	Secondary metal production	0.139	0.049	0.316	0.163	0.057	0.370
16	2308000000	Rubber/Plastic product mfg.	6.428	0.000	0.000	7.091	0.000	0.000
17	2312000000	Machinery (electrical)	0.338	0.062	0.007	0.396	0.072	0.009
18	2399000000	Industrial processes, not elsewhere classified (NEC)	0.148	0.565	0.238	0.173	0.661	0.279
19	2401001000	Architectural coatings	13.890	0.000	0.000	15.322	0.000	0.000
20	2401005000	Auto refinishing	4.652	0.000	0.000	5.132	0.000	0.000
21	2401008000	Traffic markings	0.827	0.000	0.000	0.849	0.000	0.000
22	2401015000	Factory finished wood	0.634	0.000	0.000	0.699	0.000	0.000
23	2401020000	Wood furniture	1.558	0.000	0.000	1.719	0.000	0.000
24	2401075000	Aircraft surface coatings	0.215	0.000	0.000	0.225	0.000	0.000
25	2401090000	Miscellaneous surface coatings	1.112	0.000	0.000	1.226	0.000	0.000

No.	SCC	Description	2011			2017		
			VOC	NOx	CO	VOC	NOx	CO
26	2415000000	Degreasing	0.658	0.000	0.000	0.726	0.000	0.000
27	2420000000	Dry cleaning	0.081	0.000	0.000	0.089	0.000	0.000
28	2425000000	Graphics arts	1.010	0.000	0.000	1.114	0.000	0.000
29	2440000000	Misc. Ind. Solvent use	2.325	0.000	0.000	2.720	0.000	0.000
30	2460100000	Personal care products	9.751	0.000	0.000	10.756	0.000	0.000
31	2460200000	Household products	9.238	0.000	0.000	10.190	0.000	0.000
32	2460400000	Automotive aftermarket products	6.980	0.000	0.000	7.699	0.000	0.000
33	2460500000	Coatings and related products	4.875	0.000	0.000	5.378	0.000	0.000
34	2460600000	Adhesives and sealants	2.925	0.000	0.000	3.227	0.000	0.000
35	2460800000	FIFRA related products	9.135	0.000	0.000	10.077	0.000	0.000
36	2460900000	Miscellaneous products, NEC	0.359	0.000	0.000	0.396	0.000	0.000
37	2461021000	Cutback Asphalt	2.072	0.000	0.000	2.126	0.000	0.000
38	2461022000	Emulsified Asphalt	2.147	0.000	0.000	2.202	0.000	0.000
39	2461023000	Roofing Asphalt	0.011	0.000	0.000	0.012	0.000	0.000
40	2461850000	Agricultural Pesticides	1.317	0.000	0.000	1.285	0.000	0.000
41	2501011011	Residential Permeation	2.205	0.000	0.000	0.141	0.000	0.000
42	2501011012	Residential Evaporation	4.306	0.000	0.000	0.276	0.000	0.000
43	2501011013	Residential Spill in Transport	0.562	0.000	0.000	0.551	0.000	0.000
44	2501011014	Residential Vapor Displacement	0.206	0.000	0.000	0.214	0.000	0.000
45	2501011015	Residential Spill at Pump	0.016	0.000	0.000	0.018	0.000	0.000
46	2501012011	Commercial Permeation	0.070	0.000	0.000	0.004	0.000	0.000
47	2501012012	Commercial Evaporation	0.138	0.000	0.000	0.009	0.000	0.000
48	2501012013	Commercial Spill in Transport	0.766	0.000	0.000	0.751	0.000	0.000
49	2501012014	Commercial Vapor Displacement	0.397	0.000	0.000	0.413	0.000	0.000
50	2501012015	Commercial Spill at Pump	0.032	0.000	0.000	0.035	0.000	0.000
51	2501055120	Bulk plants	0.299	0.000	0.000	0.271	0.000	0.000
52	2501060051	Gasoline Service Stations Stage 1: Submerged Filling	0.240	0.000	0.000	0.217	0.000	0.000
53	2501060053	Gasoline Service Stations Stage 1: Balanced Submerged Filling	0.647	0.000	0.000	0.586	0.000	0.000

No.	SCC	Description	2011			2017		
			VOC	NOx	CO	VOC	NOx	CO
54	2501060201	Gasoline Service Stations Underground Tank: Breathing and Emptying	1.877	0.000	0.000	1.700	0.000	0.000
55	2501080050	Airports : Aviation Gasoline Stage 1: Total	0.864	0.000	0.000	0.782	0.000	0.000
56	2501080100	Airports : Aviation Gasoline Stage 2: Total	0.045	0.000	0.000	0.041	0.000	0.000
57	2505030120	Truck: Gasoline (Tank Trucks in Transit)	0.143	0.000	0.000	0.130	0.000	0.000
58	2505040120	Pipeline Gasoline	0.043	0.000	0.000	0.039	0.000	0.000
59	2510000000	Volatile organic liquid (VOL) storage and transport	0.083	0.000	0.000	0.091	0.000	0.000
60	2601000000	Onsite incineration	0.000	0.010	0.002	0.001	0.011	0.003
61	2610000500	Land clearing debris	0.009	0.004	0.088	0.010	0.005	0.097
62	2620000000	Landfills	0.091	0.076	0.271	0.100	0.084	0.298
63	2630020000	Publicly owned treatment works	0.262	0.000	0.000	0.289	0.000	0.000
64	2650000000	Other waste	0.005	0.056	0.196	0.005	0.061	0.216
65	2660000000	Leaking underground storage tanks	0.015	0.000	0.000	0.013	0.000	0.000
66	2801500000	Agricultural Field burning (ditchbank & fence row)	0.365	0.162	3.445	0.356	0.158	3.361
67	2810030000	Structure Fires	0.033	0.004	0.179	0.033	0.004	0.179
68	2810040000	Aircraft engine testing	0.012	0.118	0.041	0.012	0.124	0.043
69	2810050000	Vehicle Fires	0.023	0.003	0.090	0.023	0.003	0.090
70	2810060100	Crematories	0.023	0.040	0.008	0.026	0.044	0.009
71	2830001000	Accidental releases	0.001	0.000	0.000	0.001	0.000	0.000
72	2850000000	Hospitals (Total: All Operations)	0.024	0.000	0.000	0.026	0.000	0.000

Table D-2. Ozone season average daily area source emissions for Pinal County in 2011 and 2017 (unit: metric tons/day)

No.	SCC	Description	2011			2017		
			VOC	NOx	CO	VOC	NOx	CO
1	2103008000	Commercial/institutional wood	0.001	0.009	0.024	0.001	0.008	0.023
2	2104004000	Residential distillate oil	0.000	0.000	0.000	0.000	0.000	0.000
3	2104006000	Residential natural gas	0.008	0.132	0.056	0.009	0.153	0.065
4	2104007000	Residential liquefied petroleum gas (LPG)	0.002	0.051	0.028	0.002	0.059	0.033
5	2302002100	Commercial cooking - Conveyorized charbroiling	0.004	0.000	0.013	0.004	0.000	0.015
6	2302002200	Commercial cooking - Under-fired charbroiling	0.013	0.000	0.042	0.015	0.000	0.049
7	2302003000	Commercial cooking - Deep fat frying	0.002	0.000	0.000	0.002	0.000	0.000
8	2302003100	Commercial cooking - Flat griddle frying	0.002	0.000	0.003	0.002	0.000	0.004
9	2302003200	Commercial cooking - Clamshell griddle frying	0.000	0.000	0.000	0.000	0.000	0.000
10	2401001000	Architectural coatings	0.099	0.000	0.000	0.115	0.000	0.000
11	2401005000	Auto refinishing	0.051	0.000	0.000	0.060	0.000	0.000
12	2401008000	Traffic markings	0.002	0.000	0.000	0.002	0.000	0.000
13	2401015000	Factory finished wood	0.007	0.000	0.000	0.008	0.000	0.000
14	2401020000	Wood furniture	0.020	0.000	0.000	0.023	0.000	0.000
15	2401055000	Machinery and Equipment coatings	0.002	0.000	0.000	0.002	0.000	0.000
16	2401065000	Electronic and Other Electrical coatings	0.001	0.000	0.000	0.001	0.000	0.000
17	2401070000	Motor Vehicles coatings	0.015	0.000	0.000	0.017	0.000	0.000
18	2401075000	Aircraft surface coatings	0.000	0.000	0.000	0.000	0.000	0.000
19	2401090000	Miscellaneous surface coatings	0.001	0.000	0.000	0.001	0.000	0.000
20	2401100000	Surface Coating, Industrial Maintenance Coatings	0.070	0.000	0.000	0.067	0.000	0.000
21	2401200000	Surface Coating, Other Special Purpose Coatings	0.030	0.000	0.000	0.029	0.000	0.000
22	2415000000	Degreasing	0.094	0.000	0.000	0.109	0.000	0.000
23	2420000000	Dry cleaning	0.000	0.000	0.000	0.001	0.000	0.000
24	2460100000	Personal care products	0.887	0.000	0.000	1.027	0.000	0.000
25	2460200000	Household products	0.841	0.000	0.000	0.973	0.000	0.000
26	2460400000	Automotive aftermarket products	0.635	0.000	0.000	0.735	0.000	0.000
27	2460500000	Coatings and related products	0.444	0.000	0.000	0.513	0.000	0.000

No.	SCC	Description	2011			2017		
			VOC	NOx	CO	VOC	NOx	CO
28	2460600000	Adhesives and sealants	0.266	0.000	0.000	0.308	0.000	0.000
29	2460800000	FIFRA related products	0.831	0.000	0.000	0.962	0.000	0.000
30	2460900000	Miscellaneous products, NEC	0.033	0.000	0.000	0.038	0.000	0.000
31	2461021000	Cutback Asphalt	0.232	0.000	0.000	0.238	0.000	0.000
32	2461022000	Emulsified Asphalt	0.192	0.000	0.000	0.196	0.000	0.000
33	2461850000	Agricultural Pesticides	1.570	0.000	0.000	1.563	0.000	0.000
34	2501011011	Permeation	0.080	0.000	0.000	0.005	0.000	0.000
35	2501011012	Evaporation (includes Diurnal losses)	0.156	0.000	0.000	0.010	0.000	0.000
36	2501011013	Spillage During Transport	0.020	0.000	0.000	0.020	0.000	0.000
37	2501011014	Refilling at the Pump - Vapor Displacement	0.007	0.000	0.000	0.008	0.000	0.000
38	2501011015	Refilling at the Pump - Spillage	0.000	0.000	0.000	0.001	0.000	0.000
39	2501012011	Permeation	0.002	0.000	0.000	0.000	0.000	0.000
40	2501012012	Evaporation (includes Diurnal losses)	0.005	0.000	0.000	0.000	0.000	0.000
41	2501012013	Spillage During Transport	0.028	0.000	0.000	0.027	0.000	0.000
42	2501012014	Refilling at the Pump - Vapor Displacement	0.014	0.000	0.000	0.015	0.000	0.000
43	2501012015	Refilling at the Pump - Spillage	0.001	0.000	0.000	0.001	0.000	0.000
44	2501060051	Gasoline Service Stations Stage 1: Submerged Filling	0.861	0.000	0.000	0.779	0.000	0.000
45	2501060052	Gasoline Service Stations Stage 1: Splash Filling	0.198	0.000	0.000	0.179	0.000	0.000
46	2501060201	Gasoline Service Stations Underground Tank: Breathing and Emptying	0.208	0.000	0.000	0.188	0.000	0.000
47	2501080050	Airports : Aviation Gasoline Stage 1: Total	0.081	0.000	0.000	0.073	0.000	0.000
48	2501080100	Airports : Aviation Gasoline Stage 2: Total	0.004	0.000	0.000	0.004	0.000	0.000
49	2505030120	Truck: Gasoline (Tank Trucks in Transit)	0.014	0.000	0.000	0.012	0.000	0.000
50	2505040120	Pipeline Gasoline	0.005	0.000	0.000	0.004	0.000	0.000
51	2610000500	Land clearing debris	0.048	0.022	0.457	0.056	0.025	0.529
52	2610030000	Household waste	0.087	0.061	0.863	0.101	0.071	0.999
53	2620000000	Landfills	0.128	0.002	0.005	0.148	0.002	0.005
54	2630020000	Publicly owned treatment works	0.015	0.000	0.000	0.018	0.000	0.000
55	2810060100	Crematories	0.000	0.000	0.000	0.000	0.000	0.000

Locomotive Source

Table D-3. Ozone season average daily locomotive emissions for Maricopa County in 2011 and 2017 (unit: metric tons/day)

No.	SCC	Description	2011			2017		
			VOC	NOx	CO	VOC	NOx	CO
1	2285002006	Locomotives Line Haul Class I	0.171	3.139	0.576	0.126	2.314	0.425
2	2285002008	Locomotives Passenger Trains	0.001	0.021	0.003	0.001	0.016	0.002
3	2285002010	Locomotives Yard Locomotives	0.021	0.334	0.031	0.015	0.246	0.023

Table D-4. Ozone season average daily locomotive emissions for Pinal County in 2011 and 2017 (unit: metric tons/day)

No.	SCC	Description	2011			2017		
			VOC	NOx	CO	VOC	NOx	CO
1	2285002006	Locomotives Line Haul Class I	0.159	3.090	0.457	0.117	2.277	0.337
2	2285002007	Line Haul Locomotives: Class II / III Operations	0.013	0.327	0.032	0.009	0.241	0.024

Growth Factors

Table D-5. Growth factors for area sources in Maricopa County

No.	SCC	Description	Growth Index	Growth Factor
1	2102004001	Industrial distillate oil: Boilers	Industrial Employment	1.17
2	2102004002	Industrial distillate oil: Engines	Industrial Employment	1.17
3	2102006000	Industrial natural gas	Industrial Employment	1.17
4	2103004001	Commercial/institutional distillate oil: Boilers	Population	1.10
5	2103004002	Commercial/institutional distillate oil: Engines	Population	1.10
6	2103006000	Commercial/institutional natural gas	Population	1.10
7	2104006000	Residential natural gas	Population	1.10
8	2301000000	Chemical manufacturing	Industrial Employment	1.17
9	2302002100	Commercial cooking - Conveyorized charbroiling	Population	1.10
10	2302002200	Commercial cooking - Underfired charbroiling	Population	1.10
11	2302003000	Commercial cooking - Deep fat frying	Population	1.10
12	2302003100	Commercial cooking - Flat griddle frying	Population	1.10
13	2302003200	Commercial cooking - Clamshell griddle frying	Population	1.10
14	2302050000	Bakeries	Population	1.10
15	2304000000	Secondary metal production	Industrial Employment	1.17
16	2308000000	Rubber/Plastic product mfg.	Population	1.10
17	2312000000	Machinery (electrical)	Industrial Employment	1.17
18	2399000000	Industrial processes, not elsewhere classified (NEC)	Industrial Employment	1.17
19	2401001000	Architectural coatings	Population	1.10
20	2401005000	Auto refinishing	Population	1.10
21	2401008000	Traffic markings	Roadway Lane Miles	1.03
22	2401015000	Factory finished wood	Population	1.10
23	2401020000	Wood furniture	Population	1.10
24	2401075000	Aircraft surface coatings	Airport Operations	1.05
25	2401090000	Miscellaneous surface coatings	Population	1.10
26	2415000000	Degreasing	Population	1.10
27	2420000000	Dry cleaning	Population	1.10
28	2425000000	Graphics arts	Population	1.10
29	2440000000	Miscellaneous Industrial Solvent use	Industrial Employment	1.17
30	2460100000	Personal care products	Population	1.10
31	2460200000	Household products	Population	1.10
32	2460400000	Automotive aftermarket products	Population	1.10
33	2460500000	Coatings and related products	Population	1.10
34	2460600000	Adhesives and sealants	Population	1.10
35	2460800000	FIFRA related products	Population	1.10

No.	SCC	Description	Growth Index	Growth Factor
36	2460900000	Miscellaneous products, NEC	Population	1.10
37	2461021000	Cutback Asphalt	Roadway Lane Miles	1.03
38	2461022000	Emulsified Asphalt	Roadway Lane Miles	1.03
39	2461023000	Roofing Asphalt	Population	1.10
40	2461850000	Agricultural Pesticides	Agricultural Acres	0.98
41	2501011011	Residential Permeation	Gas Can Rule	0.06
42	2501011012	Residential Evaporation	Gas Can Rule	0.06
43	2501011013	Residential Spill in Transport	Gas Can Rule	0.98
44	2501011014	Residential Vapor Displacement	Gas Can Rule	1.04
45	2501011015	Residential Spill at Pump	Gas Can Rule	1.12
46	2501012011	Commercial Permeation	Gas Can Rule	0.06
47	2501012012	Commercial Evaporation	Gas Can Rule	0.06
48	2501012013	Commercial Spill in Transport	Gas Can Rule	0.98
49	2501012014	Commercial Vapor Displacement	Gas Can Rule	1.04
50	2501012015	Commercial Spill at Pump	Gas Can Rule	1.12
51	2501055120	Bulk plants	Gasoline Consumption	0.91
52	2501060051	Gasoline Service Stations Stage 1: Submerged Filling	Gasoline Consumption	0.91
53	2501060053	Gasoline Service Stations Stage 1: Balanced Submerged Filling	Gasoline Consumption	0.91
54	2501060201	Gasoline Service Stations Underground Tank: Breathing and Emptying	Gasoline Consumption	0.91
55	2501080050	Airports : Aviation Gasoline Stage 1: Total	Gasoline Consumption	0.91
56	2501080100	Airports : Aviation Gasoline Stage 2: Total	Gasoline Consumption	0.91
57	2505030120	Truck: Gasoline (Tank Trucks in Transit)	Gasoline Consumption	0.91
58	2505040120	Pipeline Gasoline	Gasoline Consumption	0.91
59	2510000000	Volatile organic liquid (VOL) storage and transport	Population	1.10
60	2601000000	Onsite incineration	Population	1.10
61	2610000500	Land clearing debris	Population	1.10
62	2620000000	Landfills	Population	1.10
63	2630020000	Publicly owned treatment works	Population	1.10
64	2650000000	Other waste	Population	1.10
65	2660000000	Leaking underground storage tanks	Gasoline Consumption	0.91
66	2801500000	Agricultural Field burning (ditchbank & fence row)	Agricultural Acres	0.98
67	2810030000	Structure Fires	No Growth	1.00
68	2810040000	Aircraft engine testing	Airport Operations	1.05
69	2810050000	Vehicle Fires	No Growth	1.00
70	2810060100	Crematories	Population	1.10
71	2830001000	Accidental releases	No Growth	1.00
72	2850000000	Hospitals (Total: All Operations)	Population	1.10

Table D-6. Growth factors for area sources in Pinal County

No.	SCC	Description	Growth Index	Growth Factor
1	2103008000	Commercial/institutional wood	Industrial Employment	0.96
2	2104004000	Residential distillate oil	Population	1.16
3	2104006000	Residential natural gas	Population	1.16
4	2104007000	Residential liquefied petroleum gas (LPG)	Population	1.16
5	2302002100	Commercial cooking - Conveyorized charbroiling	Population	1.16
6	2302002200	Commercial cooking - Under-fired charbroiling	Population	1.16
7	2302003000	Commercial cooking - Deep fat frying	Population	1.16
8	2302003100	Commercial cooking - Flat griddle frying	Population	1.16
9	2302003200	Commercial cooking - Clamshell griddle frying	Population	1.16
10	2401001000	Architectural coatings	Population	1.16
11	2401005000	Auto refinishing	Population	1.16
12	2401008000	Traffic markings	Roadway Lane Miles	1.02
13	2401015000	Factory finished wood	Population	1.16
14	2401020000	Wood furniture	Population	1.16
15	2401055000	Machinery and Equipment coatings	Industrial Employment	0.96
16	2401065000	Electronic and Other Electrical coatings	Industrial Employment	0.96
17	2401070000	Motor Vehicles coatings	Population	1.16
18	2401075000	Aircraft surface coatings	Airport Operations	1.49
19	2401090000	Miscellaneous surface coatings	Population	1.16
20	2401100000	Surface Coating, Industrial Maintenance Coatings	Industrial Employment	0.96
21	2401200000	Surface Coating, Other Special Purpose Coatings	Industrial Employment	0.96
22	2415000000	Degreasing	Population	1.16
23	2420000000	Dry cleaning	Population	1.16
24	2460100000	Personal care products	Population	1.16
25	2460200000	Household products	Population	1.16
26	2460400000	Automotive aftermarket products	Population	1.16
27	2460500000	Coatings and related products	Population	1.16
28	2460600000	Adhesives and sealants	Population	1.16
29	2460800000	FIFRA related products	Population	1.16
30	2460900000	Miscellaneous products, NEC	Population	1.16
31	2461021000	Cutback Asphalt	Roadway Lane Miles	1.02
32	2461022000	Emulsified Asphalt	Roadway Lane Miles	1.02
33	2461850000	Agricultural Pesticides	Agricultural Acres	1.00
34	2501011011	Permeation	Gas Can Rule	0.06
35	2501011012	Evaporation (includes Diurnal losses)	Gas Can Rule	0.06
36	2501011013	Spillage During Transport	Gas Can Rule	0.98
37	2501011014	Refilling at the Pump - Vapor Displacement	Gas Can Rule	1.04

No.	SCC	Description	Growth Index	Growth Factor
38	2501011015	Refilling at the Pump - Spillage	Gas Can Rule	1.12
39	2501012011	Permeation	Gas Can Rule	0.06
40	2501012012	Evaporation (includes Diurnal losses)	Gas Can Rule	0.06
41	2501012013	Spillage During Transport	Gas Can Rule	0.98
42	2501012014	Refilling at the Pump - Vapor Displacement	Gas Can Rule	1.04
43	2501012015	Refilling at the Pump - Spillage	Gas Can Rule	1.12
44	2501060051	Gasoline Service Stations Stage 1: Submerged Filling	Gasoline Consumption	0.91
45	2501060052	Gasoline Service Stations Stage 1: Splash Filling	Gasoline Consumption	0.91
46	2501060201	Gasoline Service Stations Underground Tank: Breathing and Emptying	Gasoline Consumption	0.91
47	2501080050	Airports : Aviation Gasoline Stage 1: Total	Gasoline Consumption	0.91
48	2501080100	Airports : Aviation Gasoline Stage 2: Total	Gasoline Consumption	0.91
49	2505030120	Truck: Gasoline (Tank Trucks in Transit)	Gasoline Consumption	0.91
50	2505040120	Pipeline Gasoline	Gasoline Consumption	0.91
51	2610000500	Land clearing debris	Population	1.16
52	2610030000	Household waste	Population	1.16
53	2620000000	Landfills	Population	1.16
54	2630020000	Publicly owned treatment works	Population	1.16
55	2810060100	Crematories	Population	1.16

Wildfires

Table D-7. Day-specific wildfire emissions in the Maricopa eight-hour ozone nonattainment area and the 4 km modeling domain (unit: metric tons/day)

	Maricopa Eight-Hour Ozone NA			4 km Modeling Domain		
Date	VOC	NOx	CO	VOC	NOx	CO
5/7/11	0.000	0.000	0.000	0.053	0.006	0.223
5/8/11	0.000	0.000	0.000	10.193	1.222	42.443
5/27/11	0.000	0.000	0.000	0.011	0.001	0.046
6/1/11	0.000	0.000	0.000	0.002	0.000	0.007
6/2/11	0.000	0.000	0.000	0.004	0.000	0.017
6/4/11	0.000	0.000	0.000	0.138	0.017	0.573
6/5/11	0.000	0.000	0.000	0.138	0.017	0.573
6/6/11	0.000	0.000	0.000	0.106	0.013	0.441
6/7/11	0.000	0.000	0.000	0.060	0.007	0.249
6/8/11	0.000	0.000	0.000	0.060	0.007	0.249
6/9/11	0.000	0.000	0.000	0.032	0.004	0.132
6/10/11	17.399	1.467	73.190	17.431	1.471	73.323
6/11/11	0.000	0.000	0.000	0.032	0.004	0.132
6/12/11	0.000	0.000	0.000	0.759	0.091	3.160
6/16/11	0.000	0.000	0.000	0.002	0.000	0.007
6/18/11	0.090	0.011	0.377	0.090	0.011	0.377
6/19/11	0.001	0.000	0.003	0.001	0.000	0.003
6/27/11	22.108	2.650	92.056	22.108	2.650	92.056
7/2/11	3.066	0.368	12.767	3.066	0.368	12.767
7/9/11	0.000	0.000	0.000	0.001	0.000	0.002
7/10/11	0.000	0.000	0.000	0.001	0.000	0.002
7/23/11	1.041	0.128	4.331	1.043	0.128	4.339
7/28/11	11.680	1.151	48.932	11.680	1.151	48.932
7/31/11	0.000	0.000	0.000	0.032	0.004	0.134
8/11/11	0.759	0.091	3.160	0.759	0.091	3.160
8/18/11	0.000	0.000	0.000	0.011	0.001	0.045
8/20/11	1.362	0.163	5.672	1.362	0.163	5.672
8/21/11	10.807	1.295	45.001	10.807	1.295	45.001
8/24/11	0.000	0.000	0.000	9.713	1.018	40.619
8/29/11	0.000	0.000	0.000	13.293	1.631	55.307
8/30/11	0.000	0.000	0.000	150.883	17.353	629.143
8/31/11	0.000	0.000	0.000	133.580	16.392	555.758
9/1/11	0.000	0.000	0.000	72.078	8.178	300.683
9/2/11	0.000	0.000	0.000	4.432	0.544	18.439
9/3/11	0.000	0.000	0.000	8.862	1.088	36.871
9/7/11	0.000	0.000	0.000	3.229	0.377	13.456
9/8/11	0.000	0.000	0.000	0.006	0.001	0.024

	Maricopa Eight-Hour Ozone NA			4 km Modeling Domain		
Date	VOC	NOx	CO	VOC	NOx	CO
9/9/11	0.000	0.000	0.000	0.001	0.000	0.003
9/15/11	0.000	0.000	0.000	0.003	0.000	0.011
9/16/11	0.000	0.000	0.000	0.003	0.000	0.011
9/17/11	0.759	0.091	3.160	4.643	0.420	19.498
9/18/11	0.005	0.001	0.020	0.005	0.001	0.020
9/19/11	0.005	0.001	0.020	0.005	0.001	0.020
9/20/11	0.005	0.001	0.020	0.005	0.001	0.020
9/22/11	0.000	0.000	0.000	3.888	0.329	16.356
9/23/11	0.000	0.000	0.000	3.888	0.329	16.356
9/27/11	0.000	0.000	0.000	9.228	0.636	38.989
9/29/11	0.000	0.000	0.000	0.001	0.000	0.003
9/30/11	1.278	0.157	5.316	1.278	0.157	5.316
Total	70.364	7.574	294.026	499.002	57.175	2,080.971

Spatial Surrogate

Table D-8. Configuration of the spatial surrogate tool for Maricopa County

No.	Surrogate	Surrogate Code	Data Shapefile	Weight Attribute	Function
1	Population	100	MAG_Maricopa_Pinal_2010Census_latlon	TOTAL_POP	None
2	Construction	141	MAG_Residential_construction_completed_2011	SQFT	None
3	Total Road Miles	240	MAG_2011_Traffic_data_latlon	LANE_LENGTH	None
4	NTAD Total Railroad Density	261	ARIZONA_RAILROAD_latlon	NONE	None
5	Agriculture	309	MAG_landuse_2012_latlon	NONE	Filter Function (LONG_DISPL = 1)
6	Water	350	Maricopa_only_lakes_latlon	NONE	None
7	Open Land	401	MAG_landuse_2012_latlon	NONE	Filter Function (LONG_DISPL = 15,16,28)
8	Commercial Land	500	MAG_landuse_2012_latlon	NONE	Filter Function (LONG_DISPL = 3,9,21,22)
9	Aircraft Engine Manufacturers	504	Maricopa_2011_employers_latlon	EMPLOYEES	Filter Function (NAICS = 336412)
10	Industrial Land	505	MAG_landuse_2012_latlon	NONE	Filter Function (LONG_DISPL = 10)
11	Commercial plus Industrial	510	MAG_landuse_2012_latlon	NONE	Filter Function (LONG_DISPL = 3,9,10,21,22)
12	Commercial plus Institutional Land	515	MAG_landuse_2012_latlon	NONE	Filter Function (LONG_DISPL = 3,9,20,21,22)
13	Residential	531	MAG_landuse_2012_latlon	NONE	Filter Function (LONG_DISPL = 12,23,24,25)
14	Residential + Commercial + Industrial + Institutional + Government	535	MAG_landuse_2012_latlon	NONE	Filter Function (LONG_DISPL = 3,9,10,14,20,12,21,22, 23,24,25)
15	Auto refinish	544	Maricopa_2011_employers_latlon	EMPLOYEES	Filter Function (NAICS = 811121)
16	Hospital (COM6)	560	AZ_all_hospital_latlon	CAPACITY	None
17	Fuel Dispensing Facility	601	XY_Fueling_Facilities_MC_and_PC_latlon	NONE	None
18	Golf Courses	850	Maricopa_Pinal_golf_latlon	NONE	None
19	Wastewater Treatment Facilities	870	MC_wastewater_treatment_latlon	Capacity	None
20	Landfills	871	AZ_landfill_except_NW_latlon	NONE	None
21	Crematories	872	Maricopa_2011_employers_latlon	EMPLOYEES	Filter Function (NAICS = 812220)

Table D-9. Configuration of the spatial surrogate tool for Pinal County

No.	Surrogate	Surrogate Code	Data Shapefile	Weight Attribute	Filter/Weight Function
1	Population	100	MAG_Maricopa_Pinal_2010Census_latlon	TOTAL_POP	None
2	Construction	141	PINAL_Residential_completed_2011_ll	SQFT	None
3	Total Road Miles	240	MAG_2011_Traffic_data_latlon	LANE_LENGTH	None
4	NTAD Total Railroad Density	261	ARIZONA_RAILROAD_latlon	NONE	None
5	Agriculture	309	nlcd2011az_80s_250m_nos_v2_latlon	NONE	Filter Function (GRID_CODE = 81,82)
6	Water	350	Maricopa_only_lakes_latlon	NONE	None
7	Open Land	401	pophu_bg2010_AZ4	NONE	Filter Function (AREA_CODE = 2,3,4)
8	Commercial Land	500	fema_bsf_2002bnd	NONE	Weight Function (COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9)
9	Industrial Land	505	fema_bsf_2002bnd	NONE	Weight Function (IND1+IND2+IND3+IND4+IND5+IND6)
10	Commercial plus Industrial	510	fema_bsf_2002bnd	NONE	Weight Function (COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9+IND1+IND2+IND3+IND4+IND5+IND6)
11	Commercial plus Institutional Land	515	fema_bsf_2002bnd	NONE	Weight Function (COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9+RES5+RES6+EDU1+EDU2+REL1)
12	Residential	531	Pinal_2011_all_residential_norural_II	NONE	None
13	Residential + Commercial + Industrial + Institutional + Government	535	Pinal_Resd_Comme_Indus_Insti_Goven	NONE	None
14	Auto refinish	544	CAAG_2010_employment_II	JOBS2010	Filter Function (NAICS_= 811121)
15	Hospital (COM6)	560	AZ_all_hospital_latlon	CAPACITY	None
16	Fuel Dispensing Facility	601	XY_Fueling_Facilities_MC_and_PC_latlon	NONE	None
17	Golf Courses	850	Maricopa_Pinal_golf_latlon	NONE	None
18	Wastewater Treatment Facilities	870	CAAG_2010_employment_II	JOBS2010	Filter Function (NAICS = 221320)
19	Landfills	871	AZ_landfill_except_NW_latlon	NONE	None
20	Crematories	872	CAAG_2010_employment_II	JOBS2010	Filter Function (NAICS = 812220)

Table D-10. Spatial surrogates used for area sources in the 4 km modeling domain

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
1	2102004001	Stationary Source Fuel Combustion	Industrial	Distillate Oil	All Boiler Types	505	Industrial Land
2	2102004002	Stationary Source Fuel Combustion	Industrial	Distillate Oil	All IC Engine Types	505	Industrial Land
3	2102006000	Stationary Source Fuel Combustion	Industrial	Natural Gas	Total: Boilers and IC Engines	505	Industrial Land
4	2103004001	Stationary Source Fuel Combustion	Commercial/ Institutional	Distillate Oil	Boilers	515	Commercial plus Institutional Land
5	2103004002	Stationary Source Fuel Combustion	Commercial/ Institutional	Distillate Oil	IC Engines	515	Commercial plus Institutional Land
6	2103006000	Stationary Source Fuel Combustion	Commercial/ Institutional	Natural Gas	Total: Boilers and IC Engines	515	Commercial plus Institutional Land
7	2104001000	Stationary Source Fuel Combustion	Residential	Anthracite Coal	Total: All Combustor Types	531	Residential
8	2104002000	Stationary Source Fuel Combustion	Residential	Bituminous/Subbituminous Coal	Total: All Combustor Types	531	Residential
9	2104004000	Stationary Source Fuel Combustion	Residential	Distillate Oil	Total: All Combustor Types	531	Residential
10	2104006000	Stationary Source Fuel Combustion	Residential	Natural Gas	Total: All Combustor Types	531	Residential
11	2104007000	Stationary Source Fuel Combustion	Residential	Liquified Petroleum Gas (LPG)	Total: All Combustor Types	531	Residential
12	2104008100	Stationary Source Fuel Combustion	Residential	Wood	Fireplace: general	531	Residential
13	2104008210	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; non-EPA certified	531	Residential
14	2104008220	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; non-catalytic	531	Residential
15	2104008230	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; catalytic	531	Residential
16	2104008310	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, non-EPA certified	531	Residential
17	2104008320	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, non-catalytic	531	Residential
18	2104008330	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, catalytic	531	Residential
19	2104008400	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: pellet-fired, general (freestanding or FP insert)	531	Residential
20	2104008610	Stationary Source Fuel Combustion	Residential	Wood	Hydronic heater: outdoor	531	Residential

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
21	2104008700	Stationary Source Fuel Combustion	Residential	Wood	Outdoor wood burning device, NEC (fire-pits, chimineas, etc)	531	Residential
22	2104009000	Stationary Source Fuel Combustion	Residential	Firelog	Total: All Combustor Types	531	Residential
23	2104011000	Stationary Source Fuel Combustion	Residential	Kerosene	Total: All Heater Types	531	Residential
24	2301000000	Industrial Processes	Chemical Manufacturing: SIC 28	All Processes	Total	505	Industrial Land
25	2302002100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Conveyorized Charbroiling	500	Commercial Land
26	2302002200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Under-fired Charbroiling	500	Commercial Land
27	2302003000	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Deep Fat Fying	500	Commercial Land
28	2302003100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Flat Griddle Frying	500	Commercial Land
29	2302003200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Clamshell Griddle Frying	500	Commercial Land
30	2302050000	Industrial Processes	Food and Kindred Products: SIC 20	Bakery Products	Total	500	Commercial Land
31	2304000000	Industrial Processes	Secondary Metal Production: SIC 33	All Processes	Total	505	Industrial Land
32	2308000000	Industrial Processes	Rubber/Plastics: SIC 30	All Processes	Total	505	Industrial Land
33	2312000000	Industrial Processes	Machinery: SIC 35	All Processes	Total	505	Industrial Land
34	2399000000	Industrial Processes	Industrial Processes: NEC	Industrial Processes: NEC	Total	505	Industrial Land
35	2401001000	Solvent Utilization	Surface Coating	Architectural Coatings	Total: All Solvent Types	535	Residential + Commercial + Industrial + Institutional + Government
36	2401005000	Solvent Utilization	Surface Coating	Auto Refinishing: SIC 7532	Total: All Solvent Types	544	Auto refinish
37	2401008000	Solvent Utilization	Surface Coating	Traffic Markings	Total: All Solvent Types	240	Total Road Miles
38	2401015000	Solvent Utilization	Surface Coating	Factory Finished Wood: SIC 2426 thru 242	Total: All Solvent Types	505	Industrial Land
39	2401020000	Solvent Utilization	Surface Coating	Wood Furniture: SIC 25	Total: All Solvent Types	505	Industrial Land
40	2401075000	Solvent Utilization	Surface Coating	Aircraft: SIC 372	Total: All Solvent Types	505	Industrial Land
41	2401090000	Solvent Utilization	Surface Coating	Miscellaneous Manufacturing	Total: All Solvent Types	505	Industrial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
42	2415000000	Solvent Utilization	Degreasing	All Processes/ All Industries	Total: All Solvent Types	510	Commercial plus Industrial
43	2420000000	Solvent Utilization	Dry Cleaning	All Processes	Total: All Solvent Types	500	Commercial Land
44	2425000000	Solvent Utilization	Graphic Arts	All Processes	Total: All Solvent Types	500	Commercial Land
45	2440000000	Solvent Utilization	Miscellaneous Industrial	All Processes	Total: All Solvent Types	500	Commercial Land
46	2460100000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Personal Care Products	Total: All Solvent Types	531	Residential
47	2460200000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Household Products	Total: All Solvent Types	531	Residential
48	2460400000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Automotive Aftermarket Products	Total: All Solvent Types	531	Residential
49	2460500000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Coatings and Related Products	Total: All Solvent Types	531	Residential
50	2460600000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Adhesives and Sealants	Total: All Solvent Types	531	Residential
51	2460800000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All FIFRA Related Products	Total: All Solvent Types	531	Residential
52	2460900000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	Miscellaneous Products (Not Otherwise Covered)	Total: All Solvent Types	531	Residential
53	2461021000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Cutback Asphalt	Total: All Solvent Types	240	Total Road Miles
54	2461022000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Emulsified Asphalt	Total: All Solvent Types	240	Total Road Miles
55	2461023000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Asphalt Roofing	Total: All Solvent Types	531	Residential
56	2461850000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	All Processes	309	Agriculture
57	2501011011	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Permeation	531	Residential
58	2501011012	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Evaporation (includes Diurnal losses)	531	Residential
59	2501011013	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Spillage During Transport	531	Residential
60	2501011014	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Refilling at the Pump - Vapor Displacement	601	Fuel Dispensing Facility
61	2501011015	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Refilling at the Pump - Spillage	601	Fuel Dispensing Facility

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
62	2501012011	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Permeation	500	Commercial Land
63	2501012012	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Evaporation (includes Diurnal losses)	500	Commercial Land
64	2501012013	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Spillage During Transport	500	Commercial Land
65	2501012014	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Refilling at the Pump - Vapor Displacement	601	Fuel Dispensing Facility
66	2501012015	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Refilling at the Pump - Spillage	601	Fuel Dispensing Facility
67	2501050120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Terminals: All Evaporative Losses	Gasoline	601	Fuel Dispensing Facility
68	2501055120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Plants: All Evaporative Losses	Gasoline	601	Fuel Dispensing Facility
69	2501060051	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Submerged Filling	601	Fuel Dispensing Facility
70	2501060053	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Balanced Submerged Filling	601	Fuel Dispensing Facility
71	2501060100	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Total	601	Fuel Dispensing Facility
72	2501060201	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Underground Tank: Breathing and Emptying	601	Fuel Dispensing Facility
73	2501080050	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 1: Total	710	Airport Points
74	2501080100	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 2: Total	710	Airport Points
75	2505030120	Storage and Transport	Petroleum and Petroleum Product Transport	Truck	Gasoline	240	Total Road Miles
76	2505040120	Storage and Transport	Petroleum and Petroleum Product Transport	Pipeline	Gasoline	240	Total Road Miles
77	2510000000	Storage and Transport	Organic Chemical Storage	All Storage Types: Breathing Loss	Total: All Products	505	Industrial Land
78	2601000000	Waste Disposal, Treatment, and Recovery	On-site Incineration	All Categories	Total	505	Industrial Land
79	2610000100	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Leaf Species Unspecified	531	Residential
80	2610000300	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Weed Species Unspecified (incl Grass)	531	Residential
81	2610000400	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Brush Species Unspecified	531	Residential

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
82	2610000500	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)	531	Residential
83	2620000000	Waste Disposal, Treatment, and Recovery	Landfills	All Categories	Total	871	Landfills
84	2630020000	Waste Disposal, Treatment, and Recovery	Wastewater Treatment	Public Owned	Total Processed	870	Wastewater Treatment Facilities
85	2650000000	Waste Disposal, Treatment, and Recovery	Scrap and Waste Materials	Scrap and Waste Materials	Total: All Processes	505	Industrial Land
86	2660000000	Waste Disposal, Treatment, and Recovery	Leaking Underground Storage Tanks	Leaking Underground Storage Tanks	Total: All Storage Types	505	Industrial Land
87	2801500000	Miscellaneous Area Sources	Agriculture Production - Crops	Agricultural Field Burning - whole field set on fire	Unspecified	309	Agriculture
88	2810030000	Miscellaneous Area Sources	Other Combustion	Structure Fires	Unspecified	535	Residential + Commercial + Industrial + Institutional + Government
89	2810040000	Miscellaneous Area Sources	Other Combustion	Aircraft/Rocket Engine Firing and Testing	Total	504	Aircraft Engine Manufacturers
90	2810050000	Miscellaneous Area Sources	Other Combustion	Motor Vehicle Fires	Unspecified	240	Total Road Miles
91	2810060100	Miscellaneous Area Sources	Other Combustion	Cremation	Humans	872	Crematories
92	2830001000	Miscellaneous Area Sources	Catastrophic/Accidental Releases	Industrial Accidents	Total	505	Industrial Land
93	2850000000	Miscellaneous Area Sources	Health Services	Hospitals	Total: All Operations	560	Hospital (COM6)
94	2260001010	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Recreational Equipment	Motorcycles: Off-road	401	Open Land
95	2260001020	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Recreational Equipment	Snowmobiles	401	Open Land
96	2260001030	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Recreational Equipment	All Terrain Vehicles	401	Open Land
97	2260001060	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Recreational Equipment	Specialty Vehicles/Carts	401	Open Land
98	2260002006	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Tampers/ Rammers	141	Construction
99	2260002009	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Plate Compactors	141	Construction

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
100	2260002021	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Paving Equipment	141	Construction
101	2260002027	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Signal Boards/ Light Plants	141	Construction
102	2260002039	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Concrete/ Industrial Saws	141	Construction
103	2260002054	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Construction and Mining Equipment	Crushing/ Processing Equipment	141	Construction
104	2260003030	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Industrial Equipment	Sweepers/ Scrubbers	505	Industrial Land
105	2260003040	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land
106	2260004015	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Rotary Tillers < 6 HP (Residential)	531	Residential
107	2260004016	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Rotary Tillers < 6 HP (Commercial)	500	Commercial Land
108	2260004020	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Chain Saws < 6 HP (Residential)	531	Residential
109	2260004021	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Chain Saws < 6 HP (Commercial)	500	Commercial Land
110	2260004025	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Trimmers/Edgers/ Brush Cutters (Residential)	531	Residential
111	2260004026	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Trimmers/Edgers/ Brush Cutters (Commercial)	500	Commercial Land
112	2260004030	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Leafblowers/ Vacuums (Residential)	531	Residential
113	2260004031	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Leafblowers/ Vacuums (Commercial)	500	Commercial Land
114	2260004035	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Snowblowers (Residential)	531	Residential
115	2260004036	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Snowblowers (Commercial)	500	Commercial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
116	2260004071	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Lawn and Garden Equipment	Turf Equipment (Commercial)	500	Commercial Land
117	2260005035	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Agricultural Equipment	Sprayers	309	Agriculture
118	2260006005	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Commercial Equipment	Generator Sets	500	Commercial Land
119	2260006010	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Commercial Equipment	Pumps	500	Commercial Land
120	2260006015	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Commercial Equipment	Air Compressors	500	Commercial Land
121	2260006035	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	Commercial Equipment	Hydro-power Units	500	Commercial Land
122	2265001010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Recreational Equipment	Motorcycles: Off-road	401	Open Land
123	2265001030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Recreational Equipment	All Terrain Vehicles	401	Open Land
124	2265001050	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Recreational Equipment	Golf Carts	850	Golf Courses
125	2265001060	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Recreational Equipment	Specialty Vehicles/Carts	401	Open Land
126	2265002003	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Pavers	141	Construction
127	2265002006	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Tampers/ Rammers	141	Construction
128	2265002009	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Plate Compactors	141	Construction
129	2265002015	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Rollers	141	Construction
130	2265002021	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Paving Equipment	141	Construction
131	2265002024	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Surfacing Equipment	141	Construction

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
132	2265002027	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Signal Boards/ Light Plants	141	Construction
133	2265002030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Trenchers	141	Construction
134	2265002033	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Bore/Drill Rigs	141	Construction
135	2265002039	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Concrete/Industrial Saws	141	Construction
136	2265002042	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Cement and Mortar Mixers	141	Construction
137	2265002045	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Cranes	141	Construction
138	2265002054	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Crushing/ Processing Equipment	141	Construction
139	2265002057	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Rough Terrain Forklifts	141	Construction
140	2265002060	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Rubber Tire Loaders	141	Construction
141	2265002066	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Tractors/Loaders/ Backhoes	141	Construction
142	2265002072	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Skid Steer Loaders	141	Construction
143	2265002078	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Dumpers/ Tenders	141	Construction
144	2265002081	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Construction and Mining Equipment	Other Construction Equipment	141	Construction
145	2265003010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Aerial Lifts	505	Industrial Land
146	2265003020	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Forklifts	505	Industrial Land
147	2265003030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Sweepers/ Scrubbers	505	Industrial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
148	2265003040	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land
149	2265003050	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Other Material Handling Equipment	505	Industrial Land
150	2265003060	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	AC\Refrigeration	505	Industrial Land
151	2265003070	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Industrial Equipment	Terminal Tractors	505	Industrial Land
152	2265004010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Lawn Mowers (Residential)	531	Residential
153	2265004011	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Lawn Mowers (Commercial)	500	Commercial Land
154	2265004015	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Rotary Tillers < 6 HP (Residential)	531	Residential
155	2265004016	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Rotary Tillers < 6 HP (Commercial)	500	Commercial Land
156	2265004025	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Trimmers/Edgers/ Brush Cutters (Residential)	531	Residential
157	2265004026	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Trimmers/Edgers/ Brush Cutters (Commercial)	500	Commercial Land
158	2265004030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Leafblowers/ Vacuums (Residential)	531	Residential
159	2265004031	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Leafblowers/ Vacuums (Commercial)	500	Commercial Land
160	2265004035	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Snowblowers (Residential)	531	Residential
161	2265004036	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Snowblowers (Commercial)	500	Commercial Land
162	2265004040	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Rear Engine Riding Mowers (Residential)	531	Residential
163	2265004041	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Rear Engine Riding Mowers (Commercial)	500	Commercial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
164	2265004046	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Front Mowers (Commercial)	500	Commercial Land
165	2265004051	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Shredders < 6 HP (Commercial)	531	Residential
166	2265004055	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Lawn and Garden Tractors (Residential)	500	Commercial Land
167	2265004056	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Lawn and Garden Tractors (Commercial)	500	Commercial Land
168	2265004066	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Chippers/ Stump Grinders (Commercial)	500	Commercial Land
169	2265004071	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Turf Equipment (Commercial)	500	Commercial Land
170	2265004075	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Other Lawn and Garden Equipment (Residential)	531	Residential
171	2265004076	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	Other Lawn and Garden Equipment (Commercial)	500	Commercial Land
172	2265005010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	2-Wheel Tractors	309	Agriculture
173	2265005015	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Agricultural Tractors	309	Agriculture
174	2265005020	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Combines	309	Agriculture
175	2265005025	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Balers	309	Agriculture
176	2265005030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Agricultural Mowers	309	Agriculture
177	2265005035	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Sprayers	309	Agriculture
178	2265005040	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Tillers : 6 HP	309	Agriculture
179	2265005045	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Swathers	309	Agriculture

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
180	2265005055	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Other Agricultural Equipment	309	Agriculture
181	2265005060	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Agricultural Equipment	Irrigation Sets	309	Agriculture
182	2265006005	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Generator Sets	500	Commercial Land
183	2265006010	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Pumps	500	Commercial Land
184	2265006015	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Air Compressors	500	Commercial Land
185	2265006025	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Welders	500	Commercial Land
186	2265006030	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Pressure Washers	500	Commercial Land
187	2265006035	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	Commercial Equipment	Hydro-power Units	500	Commercial Land
188	2267001060	Mobile Sources	LPG	Recreational Equipment	Specialty Vehicles/Carts	401	Open Land
189	2267002003	Mobile Sources	LPG	Construction and Mining Equipment	Pavers	141	Construction
190	2267002015	Mobile Sources	LPG	Construction and Mining Equipment	Rollers	141	Construction
191	2267002021	Mobile Sources	LPG	Construction and Mining Equipment	Paving Equipment	141	Construction
192	2267002024	Mobile Sources	LPG	Construction and Mining Equipment	Surfacing Equipment	141	Construction
193	2267002030	Mobile Sources	LPG	Construction and Mining Equipment	Trenchers	141	Construction
194	2267002033	Mobile Sources	LPG	Construction and Mining Equipment	Bore/Drill Rigs	141	Construction
195	2267002039	Mobile Sources	LPG	Construction and Mining Equipment	Concrete/ Industrial Saws	141	Construction
196	2267002045	Mobile Sources	LPG	Construction and Mining Equipment	Cranes	141	Construction
197	2267002054	Mobile Sources	LPG	Construction and Mining Equipment	Crushing/ Processing Equipment	141	Construction
198	2267002057	Mobile Sources	LPG	Construction and Mining Equipment	Rough Terrain Forklifts	141	Construction
199	2267002060	Mobile Sources	LPG	Construction and Mining Equipment	Rubber Tire Loaders	141	Construction
200	2267002066	Mobile Sources	LPG	Construction and Mining Equipment	Tractors/Loaders/ Backhoes	141	Construction
201	2267002072	Mobile Sources	LPG	Construction and Mining Equipment	Skid Steer Loaders	141	Construction
202	2267002081	Mobile Sources	LPG	Construction and Mining Equipment	Other Construction Equipment	141	Construction
203	2267003010	Mobile Sources	LPG	Industrial Equipment	Aerial Lifts	505	Industrial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
204	2267003020	Mobile Sources	LPG	Industrial Equipment	Forklifts	505	Industrial Land
205	2267003030	Mobile Sources	LPG	Industrial Equipment	Sweepers/ Scrubbers	505	Industrial Land
206	2267003040	Mobile Sources	LPG	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land
207	2267003050	Mobile Sources	LPG	Industrial Equipment	Other Material Handling Equipment	505	Industrial Land
208	2267003070	Mobile Sources	LPG	Industrial Equipment	Terminal Tractors	505	Industrial Land
209	2267004066	Mobile Sources	LPG	Lawn and Garden Equipment	Chippers/ Stump Grinders (Commercial)	500	Commercial Land
210	2267005055	Mobile Sources	LPG	Agricultural Equipment	Other Agricultural Equipment	309	Agriculture
211	2267005060	Mobile Sources	LPG	Agricultural Equipment	Irrigation Sets	309	Agriculture
212	2267006005	Mobile Sources	LPG	Commercial Equipment	Generator Sets	500	Commercial Land
213	2267006010	Mobile Sources	LPG	Commercial Equipment	Pumps	500	Commercial Land
214	2267006015	Mobile Sources	LPG	Commercial Equipment	Air Compressors	500	Commercial Land
215	2267006025	Mobile Sources	LPG	Commercial Equipment	Welders	500	Commercial Land
216	2267006030	Mobile Sources	LPG	Commercial Equipment	Pressure Washers	500	Commercial Land
217	2267006035	Mobile Sources	LPG	Commercial Equipment	Hydro-power Units	500	Commercial Land
218	2268002081	Mobile Sources	CNG	Construction and Mining Equipment	Other Construction Equipment	141	Construction
219	2268003020	Mobile Sources	CNG	Industrial Equipment	Forklifts	505	Industrial Land
220	2268003030	Mobile Sources	CNG	Industrial Equipment	Sweepers/ Scrubbers	505	Industrial Land
221	2268003040	Mobile Sources	CNG	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land
222	2268003060	Mobile Sources	CNG	Industrial Equipment	AC\Refrigeration	505	Industrial Land
223	2268003070	Mobile Sources	CNG	Industrial Equipment	Terminal Tractors	505	Industrial Land
224	2268005055	Mobile Sources	CNG	Agricultural Equipment	Other Agricultural Equipment	309	Agriculture
225	2268005060	Mobile Sources	CNG	Agricultural Equipment	Irrigation Sets	309	Agriculture
226	2268006005	Mobile Sources	CNG	Commercial Equipment	Generator Sets	500	Commercial Land
227	2268006010	Mobile Sources	CNG	Commercial Equipment	Pumps	500	Commercial Land
228	2268006015	Mobile Sources	CNG	Commercial Equipment	Air Compressors	500	Commercial Land
229	2268006020	Mobile Sources	CNG	Commercial Equipment	Gas Compressors	500	Commercial Land
230	2268006035	Mobile Sources	CNG	Commercial Equipment	Hydro-power Units	500	Commercial Land
231	2270001060	Mobile Sources	Off-highway Vehicle Diesel	Recreational Equipment	Specialty Vehicles/Carts	500	Commercial Land
232	2270002003	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Pavers	141	Construction
233	2270002006	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Tampers/ Rammers	141	Construction

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
234	2270002009	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Plate Compactors	141	Construction
235	2270002015	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Rollers	141	Construction
236	2270002018	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Scrapers	141	Construction
237	2270002021	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Paving Equipment	141	Construction
238	2270002024	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Surfacing Equipment	141	Construction
239	2270002027	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Signal Boards/Light Plants	141	Construction
240	2270002030	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Trenchers	141	Construction
241	2270002033	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Bore/Drill Rigs	141	Construction
242	2270002036	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Excavators	141	Construction
243	2270002039	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Concrete/ Industrial Saws	141	Construction
244	2270002042	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Cement and Mortar Mixers	141	Construction
245	2270002045	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Cranes	141	Construction
246	2270002048	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Graders	141	Construction
247	2270002051	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Off-highway Trucks	141	Construction
248	2270002054	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Crushing/ Processing Equipment	141	Construction
249	2270002057	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Rough Terrain Forklifts	141	Construction
250	2270002060	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Rubber Tire Loaders	141	Construction
251	2270002066	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Tractors/Loaders/ Backhoes	141	Construction
252	2270002069	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Crawler Tractor/ Dozers	141	Construction
253	2270002072	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Skid Steer Loaders	141	Construction
254	2270002075	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Off-highway Tractors	141	Construction
255	2270002078	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Dumpers/ Tenders	141	Construction
256	2270002081	Mobile Sources	Off-highway Vehicle Diesel	Construction and Mining Equipment	Other Construction Equipment	141	Construction
257	2270003010	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Aerial Lifts	505	Industrial Land
258	2270003020	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Forklifts	505	Industrial Land
259	2270003030	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Sweepers/ Scrubbers	505	Industrial Land
260	2270003040	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Other General Industrial Equipment	505	Industrial Land
261	2270003050	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Other Material Handling Equipment	505	Industrial Land
262	2270003060	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	AC\Refrigeration	505	Industrial Land
263	2270003070	Mobile Sources	Off-highway Vehicle Diesel	Industrial Equipment	Terminal Tractors	505	Industrial Land

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
264	2270004031	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Leafblowers/ Vacuums (Commercial)	500	Commercial Land
265	2270004036	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Snowblowers (Commercial)	500	Commercial Land
266	2270004046	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Front Mowers (Commercial)	500	Commercial Land
267	2270004056	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Lawn and Garden Tractors (Commercial)	500	Commercial Land
268	2270004066	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Chippers/ Stump Grinders (Commercial)	500	Commercial Land
269	2270004071	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Turf Equipment (Commercial)	500	Commercial Land
270	2270004076	Mobile Sources	Off-highway Vehicle Diesel	Lawn and Garden Equipment	Other Lawn and Garden Equipment (Commercial)	500	Commercial Land
271	2270005010	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	2-Wheel Tractors	309	Agriculture
272	2270005015	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Agricultural Tractors	309	Agriculture
273	2270005020	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Combines	309	Agriculture
274	2270005025	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Balers	309	Agriculture
275	2270005030	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Agricultural Mowers	309	Agriculture
276	2270005035	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Sprayers	309	Agriculture
277	2270005040	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Tillers: 6 HP	309	Agriculture
278	2270005045	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Swathers	309	Agriculture
279	2270005055	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Other Agricultural Equipment	309	Agriculture
280	2270005060	Mobile Sources	Off-highway Vehicle Diesel	Agricultural Equipment	Irrigation Sets	309	Agriculture
281	2270006005	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Generator Sets	500	Commercial Land
282	2270006010	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Pumps	500	Commercial Land
283	2270006015	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Air Compressors	500	Commercial Land
284	2270006020	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Gas Compressors	500	Commercial Land
285	2270006025	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Welders	500	Commercial Land
286	2270006030	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Pressure Washers	500	Commercial Land
287	2270006035	Mobile Sources	Off-highway Vehicle Diesel	Commercial Equipment	Hydro-power Units	500	Commercial Land
288	2282005010	Mobile Sources	Pleasure Craft	Gasoline 2-Stroke	Outboard	350	Water
289	2282005015	Mobile Sources	Pleasure Craft	Gasoline 2-Stroke	Personal Water Craft	350	Water
290	2282010005	Mobile Sources	Pleasure Craft	Gasoline 4-Stroke	Inboard/Sterndrive	350	Water
291	2282020005	Mobile Sources	Pleasure Craft	Diesel	Inboard/Sterndrive	350	Water
292	2282020010	Mobile Sources	Pleasure Craft	Diesel	Outboard	350	Water
293	2285002006	Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class I Operations	261	NTAD Total Railroad Density

NO.	SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Spatial Surrogate	Surrogate Name
294	2285002008	Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Passenger Trains (Amtrak)	261	NTAD Total Railroad Density
295	2285002010	Mobile Sources	Railroad Equipment	Diesel	Yard Locomotives	261	NTAD Total Railroad Density
296	2285002015	Mobile Sources	Railroad Equipment	Diesel	Railway Maintenance	261	NTAD Total Railroad Density
297	2285004015	Mobile Sources	Railroad Equipment	Gasoline 4-Stroke	Railway Maintenance	261	NTAD Total Railroad Density
298	2285006015	Mobile Sources	Railroad Equipment	LPG	Railway Maintenance	261	NTAD Total Railroad Density

APPENDIX E

2011 AND 2017 DAILY EMISSIONS
FOR THE MODELING EPISODE
(SMOKE GRIDDED EMISSIONS)

Table E-1. Daily point source emissions extracted from the SMOKE gridded emissions in 2011 and 2017 (metric tons/day)

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
5/1	3.08	2.87	3.57	3.53	5.23	4.49	2.24	2.64	2.90	2.72	5.02	3.94
5/2	3.12	3.56	3.78	3.63	6.61	4.91	2.28	3.33	3.14	2.81	6.40	4.38
5/3	3.13	3.81	4.00	3.66	7.10	5.17	2.29	3.56	3.22	2.84	6.86	4.53
5/4	3.14	3.96	4.04	3.68	7.40	5.26	2.30	3.71	3.27	2.87	7.15	4.63
5/5	3.13	3.83	4.00	3.67	7.14	5.18	2.29	3.58	3.23	2.85	6.90	4.55
5/6	3.11	3.43	3.74	3.61	6.36	4.83	2.27	3.21	3.10	2.80	6.15	4.30
5/7	3.10	3.20	3.65	3.58	5.90	4.68	2.26	2.97	3.02	2.76	5.69	4.16
5/8	3.08	2.87	3.57	3.53	5.23	4.49	2.24	2.64	2.90	2.72	5.02	3.94
5/9	3.12	3.56	3.78	3.63	6.61	4.91	2.28	3.33	3.14	2.81	6.40	4.38
5/10	3.13	3.81	4.00	3.66	7.10	5.17	2.29	3.56	3.22	2.84	6.86	4.53
5/11	3.14	3.96	4.04	3.68	7.40	5.26	2.30	3.71	3.27	2.87	7.15	4.63
5/12	3.13	3.83	4.00	3.67	7.14	5.18	2.29	3.58	3.23	2.85	6.90	4.55
5/13	3.11	3.43	3.74	3.61	6.36	4.83	2.27	3.21	3.10	2.80	6.15	4.30
5/14	3.10	3.20	3.65	3.58	5.90	4.68	2.26	2.97	3.02	2.76	5.69	4.16
5/15	3.08	2.87	3.57	3.53	5.23	4.49	2.24	2.64	2.90	2.72	5.02	3.94
5/16	3.12	3.56	3.78	3.63	6.61	4.91	2.28	3.33	3.14	2.81	6.40	4.38
5/17	3.13	3.81	4.00	3.66	7.10	5.17	2.29	3.56	3.22	2.84	6.86	4.53
5/18	3.14	3.96	4.04	3.68	7.40	5.26	2.30	3.71	3.27	2.87	7.15	4.63
5/19	3.13	3.83	4.00	3.67	7.14	5.18	2.29	3.58	3.23	2.85	6.90	4.55
5/20	3.11	3.43	3.74	3.61	6.36	4.83	2.27	3.21	3.10	2.80	6.15	4.30
5/21	3.10	3.20	3.65	3.58	5.90	4.68	2.26	2.97	3.02	2.76	5.69	4.16
5/22	3.08	2.87	3.57	3.53	5.23	4.49	2.24	2.64	2.90	2.72	5.02	3.94
5/23	3.12	3.56	3.78	3.63	6.61	4.91	2.28	3.33	3.14	2.81	6.40	4.38
5/24	3.13	3.81	4.00	3.66	7.10	5.17	2.29	3.56	3.22	2.84	6.86	4.53
5/25	3.14	3.96	4.04	3.68	7.40	5.26	2.30	3.71	3.27	2.87	7.15	4.63
5/26	3.13	3.83	4.00	3.67	7.14	5.18	2.29	3.58	3.23	2.85	6.90	4.55
5/27	3.11	3.43	3.74	3.61	6.36	4.83	2.27	3.21	3.10	2.80	6.15	4.30
5/28	3.10	3.20	3.65	3.58	5.90	4.68	2.26	2.97	3.02	2.76	5.69	4.16
5/29	3.08	2.87	3.57	3.53	5.23	4.49	2.24	2.64	2.90	2.72	5.02	3.94
5/30	3.08	2.87	3.57	3.53	5.23	4.49	2.24	2.64	2.90	2.72	5.02	3.94
5/31	3.13	3.81	4.00	3.66	7.10	5.17	2.29	3.56	3.22	2.84	6.86	4.53
6/1	3.29	6.69	5.23	4.06	12.82	7.19	2.44	6.40	4.20	3.24	12.51	6.35
6/2	3.28	6.47	5.15	4.03	12.37	7.04	2.43	6.17	4.12	3.21	12.07	6.21
6/3	3.24	5.76	4.73	3.93	10.98	6.47	2.39	5.50	3.89	3.11	10.72	5.77
6/4	3.21	5.34	4.58	3.88	10.15	6.19	2.37	5.09	3.75	3.06	9.90	5.51
6/5	3.18	4.75	4.42	3.79	8.97	5.85	2.34	4.49	3.54	2.97	8.70	5.12
6/6	3.25	5.98	4.81	3.96	11.43	6.61	2.41	5.72	3.97	3.14	11.17	5.92
6/7	3.28	6.43	5.15	4.03	12.29	7.03	2.43	6.14	4.11	3.20	11.99	6.18

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
6/8	3.29	6.69	5.23	4.06	12.82	7.19	2.44	6.40	4.20	3.24	12.51	6.35
6/9	3.28	6.47	5.15	4.03	12.37	7.04	2.43	6.17	4.12	3.21	12.07	6.21
6/10	3.24	5.76	4.73	3.93	10.98	6.47	2.39	5.50	3.89	3.11	10.72	5.77
6/11	3.21	5.34	4.58	3.88	10.15	6.19	2.37	5.09	3.75	3.06	9.90	5.51
6/12	3.18	4.75	4.42	3.79	8.97	5.85	2.34	4.49	3.54	2.97	8.70	5.12
6/13	3.25	5.98	4.81	3.96	11.43	6.61	2.41	5.72	3.97	3.14	11.17	5.92
6/14	3.28	6.43	5.15	4.03	12.29	7.03	2.43	6.14	4.11	3.20	11.99	6.18
6/15	3.29	6.69	5.23	4.06	12.82	7.19	2.44	6.40	4.20	3.24	12.51	6.35
6/16	3.28	6.47	5.15	4.03	12.37	7.04	2.43	6.17	4.12	3.21	12.07	6.21
6/17	3.24	5.76	4.73	3.93	10.98	6.47	2.39	5.50	3.89	3.11	10.72	5.77
6/18	3.21	5.34	4.58	3.88	10.15	6.19	2.37	5.09	3.75	3.06	9.90	5.51
6/19	3.18	4.75	4.42	3.79	8.97	5.85	2.34	4.49	3.54	2.97	8.70	5.12
6/20	3.25	5.98	4.81	3.96	11.43	6.61	2.41	5.72	3.97	3.14	11.17	5.92
6/21	3.28	6.43	5.15	4.03	12.29	7.03	2.43	6.14	4.11	3.20	11.99	6.18
6/22	3.29	6.69	5.23	4.06	12.82	7.19	2.44	6.40	4.20	3.24	12.51	6.35
6/23	3.28	6.47	5.15	4.03	12.37	7.04	2.43	6.17	4.12	3.21	12.07	6.21
6/24	3.24	5.76	4.73	3.93	10.98	6.47	2.39	5.50	3.89	3.11	10.72	5.77
6/25	3.21	5.34	4.58	3.88	10.15	6.19	2.37	5.09	3.75	3.06	9.90	5.51
6/26	3.18	4.75	4.42	3.79	8.97	5.85	2.34	4.49	3.54	2.97	8.70	5.12
6/27	3.25	5.98	4.81	3.96	11.43	6.61	2.41	5.72	3.97	3.14	11.17	5.92
6/28	3.28	6.43	5.15	4.03	12.29	7.03	2.43	6.14	4.11	3.20	11.99	6.18
6/29	3.29	6.69	5.23	4.06	12.82	7.19	2.44	6.40	4.20	3.24	12.51	6.35
6/30	3.28	6.47	5.15	4.03	12.37	7.04	2.43	6.17	4.12	3.21	12.07	6.21
7/1	3.38	8.03	6.60	4.25	15.36	8.70	2.50	7.56	4.60	3.40	14.83	7.10
7/2	3.34	7.45	6.37	4.17	14.20	8.31	2.47	6.99	4.40	3.32	13.68	6.73
7/3	3.30	6.64	6.21	4.06	12.56	7.88	2.43	6.15	4.11	3.20	12.01	6.19
7/4	3.30	6.64	6.21	4.06	12.56	7.88	2.43	6.15	4.11	3.20	12.01	6.19
7/5	3.44	9.01	7.41	4.39	17.25	9.67	2.55	8.45	4.91	3.52	16.61	7.67
7/6	3.45	9.38	7.52	4.44	17.97	9.89	2.57	8.82	5.04	3.57	17.34	7.90
7/7	3.44	9.06	7.40	4.40	17.34	9.68	2.55	8.50	4.93	3.53	16.71	7.70
7/8	3.38	8.03	6.60	4.25	15.36	8.70	2.50	7.56	4.60	3.40	14.83	7.10
7/9	3.34	7.45	6.37	4.17	14.20	8.31	2.47	6.99	4.40	3.32	13.68	6.73
7/10	3.30	6.64	6.21	4.06	12.56	7.88	2.43	6.15	4.11	3.20	12.01	6.19
7/11	3.39	8.35	6.71	4.30	15.98	8.91	2.52	7.88	4.71	3.44	15.46	7.30
7/12	3.44	9.01	7.41	4.39	17.25	9.67	2.55	8.45	4.91	3.52	16.61	7.67
7/13	3.45	9.38	7.52	4.44	17.97	9.89	2.57	8.82	5.04	3.57	17.34	7.90
7/14	3.44	9.06	7.40	4.40	17.34	9.68	2.55	8.50	4.93	3.53	16.71	7.70
7/15	3.38	8.03	6.60	4.25	15.36	8.70	2.50	7.56	4.60	3.40	14.83	7.10
7/16	3.34	7.45	6.37	4.17	14.20	8.31	2.47	6.99	4.40	3.32	13.68	6.73

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
7/17	3.30	6.64	6.21	4.06	12.56	7.88	2.43	6.15	4.11	3.20	12.01	6.19
7/18	3.39	8.35	6.71	4.30	15.98	8.91	2.52	7.88	4.71	3.44	15.46	7.30
7/19	3.44	9.01	7.41	4.39	17.25	9.67	2.55	8.45	4.91	3.52	16.61	7.67
7/20	3.45	9.38	7.52	4.44	17.97	9.89	2.57	8.82	5.04	3.57	17.34	7.90
7/21	3.44	9.06	7.40	4.40	17.34	9.68	2.55	8.50	4.93	3.53	16.71	7.70
7/22	3.38	8.03	6.60	4.25	15.36	8.70	2.50	7.56	4.60	3.40	14.83	7.10
7/23	3.34	7.45	6.37	4.17	14.20	8.31	2.47	6.99	4.40	3.32	13.68	6.73
7/24	3.30	6.64	6.21	4.06	12.56	7.88	2.43	6.15	4.11	3.20	12.01	6.19
7/25	3.39	8.35	6.71	4.30	15.98	8.91	2.52	7.88	4.71	3.44	15.46	7.30
7/26	3.44	9.01	7.41	4.39	17.25	9.67	2.55	8.45	4.91	3.52	16.61	7.67
7/27	3.45	9.38	7.52	4.44	17.97	9.89	2.57	8.82	5.04	3.57	17.34	7.90
7/28	3.44	9.06	7.40	4.40	17.34	9.68	2.55	8.50	4.93	3.53	16.71	7.70
7/29	3.38	8.03	6.60	4.25	15.36	8.70	2.50	7.56	4.60	3.40	14.83	7.10
7/30	3.34	7.45	6.37	4.17	14.20	8.31	2.47	6.99	4.40	3.32	13.68	6.73
7/31	3.30	6.64	6.21	4.06	12.56	7.88	2.43	6.15	4.11	3.20	12.01	6.19
8/1	3.61	12.39	8.61	4.86	23.97	11.86	2.73	11.82	6.08	3.99	23.33	9.83
8/2	3.68	13.38	9.55	5.00	25.87	12.93	2.77	12.70	6.38	4.11	25.07	10.39
8/3	3.71	13.94	9.72	5.07	26.97	13.27	2.80	13.25	6.57	4.19	26.19	10.75
8/4	3.68	13.45	9.54	5.01	26.02	12.95	2.78	12.78	6.41	4.12	25.23	10.44
8/5	3.59	11.91	8.44	4.79	23.02	11.55	2.70	11.34	5.91	3.92	22.38	9.52
8/6	3.54	11.03	8.10	4.67	21.27	10.96	2.66	10.47	5.61	3.80	20.63	8.96
8/7	3.48	9.79	7.83	4.50	18.77	10.28	2.59	9.20	5.17	3.62	18.09	8.15
8/8	3.61	12.39	8.61	4.86	23.97	11.86	2.73	11.82	6.08	3.99	23.33	9.83
8/9	3.68	13.38	9.55	5.00	25.87	12.93	2.77	12.70	6.38	4.11	25.07	10.39
8/10	3.71	13.94	9.72	5.07	26.97	13.27	2.80	13.25	6.57	4.19	26.19	10.75
8/11	3.68	13.45	9.54	5.01	26.02	12.95	2.78	12.78	6.41	4.12	25.23	10.44
8/12	3.59	11.91	8.44	4.79	23.02	11.55	2.70	11.34	5.91	3.92	22.38	9.52
8/13	3.54	11.03	8.10	4.67	21.27	10.96	2.66	10.47	5.61	3.80	20.63	8.96
8/14	3.48	9.79	7.83	4.50	18.77	10.28	2.59	9.20	5.17	3.62	18.09	8.15
8/15	3.61	12.39	8.61	4.86	23.97	11.86	2.73	11.82	6.08	3.99	23.33	9.83
8/16	3.68	13.38	9.55	5.00	25.87	12.93	2.77	12.70	6.38	4.11	25.07	10.39
8/17	3.71	13.94	9.72	5.07	26.97	13.27	2.80	13.25	6.57	4.19	26.19	10.75
8/18	3.68	13.45	9.54	5.01	26.02	12.95	2.78	12.78	6.41	4.12	25.23	10.44
8/19	3.59	11.91	8.44	4.79	23.02	11.55	2.70	11.34	5.91	3.92	22.38	9.52
8/20	3.54	11.03	8.10	4.67	21.27	10.96	2.66	10.47	5.61	3.80	20.63	8.96
8/21	3.48	9.79	7.83	4.50	18.77	10.28	2.59	9.20	5.17	3.62	18.09	8.15
8/22	3.61	12.39	8.61	4.86	23.97	11.86	2.73	11.82	6.08	3.99	23.33	9.83
8/23	3.68	13.38	9.55	5.00	25.87	12.93	2.77	12.70	6.38	4.11	25.07	10.39
8/24	3.71	13.94	9.72	5.07	26.97	13.27	2.80	13.25	6.57	4.19	26.19	10.75

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
8/25	3.68	13.45	9.54	5.01	26.02	12.95	2.78	12.78	6.41	4.12	25.23	10.44
8/26	3.59	11.91	8.44	4.79	23.02	11.55	2.70	11.34	5.91	3.92	22.38	9.52
8/27	3.54	11.03	8.10	4.67	21.27	10.96	2.66	10.47	5.61	3.80	20.63	8.96
8/28	3.48	9.79	7.83	4.50	18.77	10.28	2.59	9.20	5.17	3.62	18.09	8.15
8/29	3.61	12.39	8.61	4.86	23.97	11.86	2.73	11.82	6.08	3.99	23.33	9.83
8/30	3.68	13.38	9.55	5.00	25.87	12.93	2.77	12.70	6.38	4.11	25.07	10.39
8/31	3.71	13.94	9.72	5.07	26.97	13.27	2.80	13.25	6.57	4.19	26.19	10.75
9/1	3.34	7.70	5.60	4.20	14.83	7.85	2.49	7.40	4.55	3.38	14.52	7.00
9/2	3.30	6.85	5.13	4.09	13.16	7.18	2.45	6.59	4.27	3.26	12.89	6.47
9/3	3.27	6.35	4.95	4.02	12.16	6.85	2.43	6.09	4.09	3.19	11.90	6.15
9/4	3.23	5.63	4.75	3.92	10.72	6.43	2.39	5.36	3.84	3.09	10.45	5.69
9/5	3.23	5.63	4.75	3.92	10.72	6.43	2.39	5.36	3.84	3.09	10.45	5.69
9/6	3.34	7.66	5.59	4.20	14.74	7.83	2.49	7.36	4.53	3.37	14.43	6.97
9/7	3.36	7.97	5.70	4.24	15.37	8.03	2.51	7.68	4.64	3.41	15.06	7.17
9/8	3.34	7.70	5.60	4.20	14.83	7.85	2.49	7.40	4.55	3.38	14.52	7.00
9/9	3.30	6.85	5.13	4.09	13.16	7.18	2.45	6.59	4.27	3.26	12.89	6.47
9/10	3.27	6.35	4.95	4.02	12.16	6.85	2.43	6.09	4.09	3.19	11.90	6.15
9/11	3.23	5.63	4.75	3.92	10.72	6.43	2.39	5.36	3.84	3.09	10.45	5.69
9/12	3.31	7.12	5.23	4.12	13.70	7.35	2.47	6.86	4.36	3.30	13.43	6.65
9/13	3.34	7.66	5.59	4.20	14.74	7.83	2.49	7.36	4.53	3.37	14.43	6.97
9/14	3.36	7.97	5.70	4.24	15.37	8.03	2.51	7.68	4.64	3.41	15.06	7.17
9/15	3.34	7.70	5.60	4.20	14.83	7.85	2.49	7.40	4.55	3.38	14.52	7.00
9/16	3.30	6.85	5.13	4.09	13.16	7.18	2.45	6.59	4.27	3.26	12.89	6.47
9/17	3.27	6.35	4.95	4.02	12.16	6.85	2.43	6.09	4.09	3.19	11.90	6.15
9/18	3.23	5.63	4.75	3.92	10.72	6.43	2.39	5.36	3.84	3.09	10.45	5.69
9/19	3.31	7.12	5.23	4.12	13.70	7.35	2.47	6.86	4.36	3.30	13.43	6.65
9/20	3.34	7.66	5.59	4.20	14.74	7.83	2.49	7.36	4.53	3.37	14.43	6.97
9/21	3.36	7.97	5.70	4.24	15.37	8.03	2.51	7.68	4.64	3.41	15.06	7.17
9/22	3.34	7.70	5.60	4.20	14.83	7.85	2.49	7.40	4.55	3.38	14.52	7.00
9/23	3.30	6.85	5.13	4.09	13.16	7.18	2.45	6.59	4.27	3.26	12.89	6.47
9/24	3.27	6.35	4.95	4.02	12.16	6.85	2.43	6.09	4.09	3.19	11.90	6.15
9/25	3.23	5.63	4.75	3.92	10.72	6.43	2.39	5.36	3.84	3.09	10.45	5.69
9/26	3.31	7.12	5.23	4.12	13.70	7.35	2.47	6.86	4.36	3.30	13.43	6.65
9/27	3.34	7.66	5.59	4.20	14.74	7.83	2.49	7.36	4.53	3.37	14.43	6.97
9/28	3.36	7.97	5.70	4.24	15.37	8.03	2.51	7.68	4.64	3.41	15.06	7.17
9/29	3.34	7.70	5.60	4.20	14.83	7.85	2.49	7.40	4.55	3.38	14.52	7.00
9/30	3.30	6.85	5.13	4.09	13.16	7.18	2.45	6.59	4.27	3.26	12.89	6.47
Average	3.33	7.40	5.95	4.16	14.16	7.98	2.47	7.02	4.41	3.32	13.75	6.75

Table E-2. Daily area source emissions extracted from the SMOKE gridded emissions in 2011 and 2017 (metric tons/day)

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
5/1	98.49	7.39	5.77	100.01	8.54	6.45	89.40	7.25	4.15	90.72	8.39	4.67
5/2	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/3	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/4	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/5	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/6	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/7	99.75	11.79	8.43	101.20	13.54	9.46	90.64	11.61	6.77	91.89	13.34	7.65
5/8	98.49	7.39	5.77	100.01	8.54	6.45	89.40	7.25	4.15	90.72	8.39	4.67
5/9	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/10	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/11	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/12	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/13	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/14	99.75	11.79	8.43	101.20	13.54	9.46	90.64	11.61	6.77	91.89	13.34	7.65
5/15	98.49	7.39	5.77	100.01	8.54	6.45	89.40	7.25	4.15	90.72	8.39	4.67
5/16	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/17	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/18	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/19	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/20	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/21	99.75	11.79	8.43	101.20	13.54	9.46	90.64	11.61	6.77	91.89	13.34	7.65
5/22	98.49	7.39	5.77	100.01	8.54	6.45	89.40	7.25	4.15	90.72	8.39	4.67
5/23	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/24	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/25	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/26	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/27	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
5/28	99.75	11.79	8.43	101.20	13.54	9.46	90.64	11.61	6.77	91.89	13.34	7.65
5/29	98.49	7.39	5.77	100.01	8.54	6.45	89.40	7.25	4.15	90.72	8.39	4.67
5/30	98.49	7.39	5.77	100.01	8.54	6.45	89.40	7.25	4.15	90.72	8.39	4.67
5/31	105.68	11.95	11.96	107.63	13.70	12.92	96.35	11.70	8.73	98.11	13.43	9.56
6/1	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/2	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/3	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/4	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
6/5	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
6/6	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/7	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
6/8	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/9	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/10	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/11	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
6/12	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
6/13	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/14	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/15	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/16	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/17	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/18	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
6/19	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
6/20	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/21	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/22	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/23	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/24	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/25	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
6/26	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
6/27	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/28	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/29	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
6/30	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/1	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/2	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
7/3	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
7/4	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
7/5	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/6	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/7	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/8	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/9	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
7/10	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
7/11	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/12	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/13	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/14	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/15	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/16	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65

Date	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
7/17	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
7/18	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/19	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/20	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/21	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/22	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/23	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
7/24	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
7/25	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/26	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/27	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/28	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/29	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
7/30	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
7/31	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
8/1	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/2	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/3	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/4	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/5	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/6	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
8/7	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
8/8	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/9	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/10	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/11	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/12	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/13	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
8/14	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
8/15	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/16	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/17	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/18	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/19	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/20	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
8/21	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
8/22	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/23	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/24	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
8/25	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/26	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/27	99.90	11.75	7.92	101.24	13.50	8.96	90.68	11.60	6.77	91.90	13.34	7.65
8/28	98.65	7.35	5.27	100.05	8.51	5.95	89.44	7.25	4.14	90.73	8.39	4.66
8/29	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/30	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
8/31	105.83	11.92	11.46	107.67	13.66	12.42	96.39	11.70	8.72	98.11	13.43	9.56
9/1	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/2	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/3	99.81	11.77	8.08	101.26	13.52	9.11	90.65	11.61	6.77	91.90	13.34	7.65
9/4	98.55	7.37	5.43	100.07	8.53	6.10	89.41	7.25	4.15	90.73	8.39	4.67
9/5	98.55	7.37	5.43	100.07	8.53	6.10	89.41	7.25	4.15	90.73	8.39	4.67
9/6	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/7	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/8	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/9	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/10	99.81	11.77	8.08	101.26	13.52	9.11	90.65	11.61	6.77	91.90	13.34	7.65
9/11	98.55	7.37	5.43	100.07	8.53	6.10	89.41	7.25	4.15	90.73	8.39	4.67
9/12	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/13	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/14	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/15	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/16	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/17	99.81	11.77	8.08	101.26	13.52	9.11	90.65	11.61	6.77	91.90	13.34	7.65
9/18	98.55	7.37	5.43	100.07	8.53	6.10	89.41	7.25	4.15	90.73	8.39	4.67
9/19	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/20	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/21	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/22	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/23	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/24	99.81	11.77	8.08	101.26	13.52	9.11	90.65	11.61	6.77	91.90	13.34	7.65
9/25	98.55	7.37	5.43	100.07	8.53	6.10	89.41	7.25	4.15	90.73	8.39	4.67
9/26	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/27	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/28	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/29	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
9/30	105.74	11.93	11.61	107.69	13.68	12.57	96.36	11.70	8.73	98.11	13.43	9.56
Average	103.79	11.16	10.09	105.54	12.81	11.02	94.46	10.96	7.71	96.05	12.59	8.50

Table E-3. Daily nonroad mobile source emissions extracted from the SMOKE gridded emissions in 2011 and 2017 (metric tons/day)

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
5/1	32.41	42.85	330.99	24.59	31.05	298.45	22.94	35.19	286.10	17.42	24.77	257.61
5/2	26.84	67.91	345.15	21.02	46.55	308.70	21.72	58.58	313.70	16.82	39.36	279.86
5/3	28.75	67.78	354.65	22.43	46.49	318.46	23.43	58.46	322.60	18.10	39.30	289.08
5/4	30.53	68.10	362.40	23.67	46.73	324.64	25.07	58.78	330.07	19.23	39.55	295.01
5/5	30.62	68.10	363.02	23.85	46.77	326.53	25.12	58.79	330.61	19.39	39.59	296.85
5/6	30.21	68.09	361.54	23.53	46.82	324.69	24.73	58.78	329.14	19.08	39.64	295.01
5/7	36.01	42.02	349.90	26.65	30.27	315.45	26.04	34.39	303.55	19.16	24.01	273.31
5/8	34.09	42.28	337.67	25.07	30.55	304.42	24.28	34.65	291.68	17.68	24.29	262.59
5/9	25.52	67.79	339.34	19.93	46.46	303.87	20.52	58.46	307.98	15.82	39.25	275.11
5/10	25.94	68.02	344.29	20.59	46.57	308.81	20.98	58.67	313.02	16.51	39.36	280.13
5/11	27.48	68.01	349.93	21.71	46.60	314.17	22.35	58.68	318.39	17.50	39.40	285.25
5/12	29.19	68.06	358.73	22.99	46.73	322.76	23.85	58.75	326.64	18.65	39.54	293.35
5/13	30.93	68.01	363.13	24.09	46.77	326.87	25.37	58.70	330.56	19.59	39.59	297.04
5/14	34.82	41.93	344.68	25.78	30.21	311.50	24.99	34.29	298.52	18.39	23.96	269.53
5/15	33.92	42.43	339.70	25.15	30.78	306.55	24.17	34.79	293.75	17.82	24.52	264.77
5/16	26.91	67.67	346.76	20.99	46.45	311.32	21.75	58.35	314.96	16.78	39.26	282.17
5/17	26.62	67.88	345.41	21.14	46.55	310.17	21.58	58.55	313.98	17.00	39.35	281.35
5/18	25.09	67.82	336.76	19.65	46.44	301.88	20.12	58.48	305.48	15.57	39.23	273.19
5/19	26.73	68.58	348.53	21.37	47.12	313.00	21.74	59.23	317.28	17.25	39.91	284.34
5/20	27.85	68.28	350.76	22.02	46.93	315.12	22.70	58.96	319.15	17.79	39.73	286.13
5/21	34.87	42.20	345.26	26.07	30.48	312.03	25.10	34.56	299.38	18.71	24.21	270.30
5/22	34.28	42.36	340.62	25.24	30.64	307.18	24.48	34.73	294.58	17.86	24.38	265.31
5/23	27.99	67.69	351.95	21.59	46.41	315.80	22.72	58.37	319.84	17.31	39.23	286.38
5/24	27.86	67.96	352.64	22.08	46.69	316.97	22.68	58.63	320.86	17.84	39.50	287.84
5/25	29.43	67.70	358.69	22.83	46.34	322.12	24.04	58.39	326.44	18.45	39.15	292.57
5/26	30.18	67.88	360.20	23.21	46.58	323.43	24.67	58.57	327.68	18.75	39.40	293.64
5/27	30.50	67.87	361.63	23.71	46.68	325.48	24.95	58.56	329.08	19.22	39.50	295.67
5/28	35.91	41.47	343.90	26.11	29.90	310.00	25.84	33.85	297.07	18.56	23.65	267.44
5/29	32.55	41.45	331.03	23.92	29.90	298.64	22.86	33.82	285.16	16.64	23.64	256.93
5/30	32.46	42.47	333.39	24.39	30.74	301.37	22.90	34.81	288.29	17.16	24.47	260.34
5/31	29.33	67.55	355.25	22.68	46.23	318.37	23.80	58.22	322.74	18.19	39.04	288.61
6/1	33.10	73.88	401.22	25.25	50.41	363.98	25.98	63.85	360.94	19.67	42.70	327.20
6/2	33.26	74.00	400.14	25.66	50.65	363.75	26.11	63.97	359.87	20.04	42.94	326.97
6/3	33.45	73.95	399.66	25.57	50.54	363.13	26.25	63.93	359.35	19.91	42.83	326.32
6/4	47.68	46.43	420.73	34.16	33.62	382.12	32.40	37.94	354.83	23.08	26.54	322.97
6/5	48.59	46.66	420.45	34.63	33.95	382.34	33.11	38.18	354.08	23.41	26.88	322.75
6/6	33.45	73.57	400.78	25.17	50.24	364.03	26.23	63.56	360.12	19.54	42.53	326.92
6/7	33.43	73.77	401.50	25.52	50.37	364.91	26.24	63.74	361.13	19.87	42.66	328.05

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
6/8	33.91	73.90	403.75	25.93	50.49	366.83	26.72	63.88	363.30	20.29	42.78	329.90
6/9	34.28	74.05	404.23	26.16	50.63	367.55	27.02	64.03	363.70	20.47	42.92	330.56
6/10	34.71	73.97	407.41	26.39	50.62	370.68	27.37	63.95	366.65	20.66	42.92	333.47
6/11	47.44	46.51	422.12	34.00	33.72	383.83	32.19	38.02	356.21	22.94	26.64	324.66
6/12	47.14	46.63	418.34	33.70	33.98	380.68	31.85	38.15	352.27	22.63	26.90	321.37
6/13	34.48	73.57	405.51	26.11	50.24	368.88	27.11	63.55	364.73	20.36	42.54	331.65
6/14	36.57	73.58	411.35	27.64	50.30	374.45	28.99	63.58	370.22	21.73	42.60	336.91
6/15	37.37	73.68	414.02	27.90	50.38	376.30	29.69	63.68	372.67	21.93	42.69	338.56
6/16	36.27	73.80	409.38	27.39	50.55	372.95	28.70	63.80	368.15	21.51	42.86	335.32
6/17	35.93	73.73	409.21	26.82	50.39	372.28	28.39	63.72	368.03	20.96	42.69	334.70
6/18	48.63	46.20	424.95	34.71	33.55	386.79	33.17	37.72	358.38	23.53	26.48	327.03
6/19	46.99	46.70	418.19	33.50	34.06	380.63	31.73	38.21	352.03	22.46	26.98	321.24
6/20	35.33	73.54	407.49	26.66	50.32	371.12	27.90	63.53	366.45	20.87	42.62	333.67
6/21	38.07	73.48	414.30	28.67	50.27	377.60	30.27	63.48	372.83	22.62	42.57	339.75
6/22	38.83	73.30	416.34	28.92	50.16	379.48	30.89	63.31	374.58	22.79	42.47	341.37
6/23	38.09	73.63	417.51	28.29	50.41	380.60	30.28	63.64	375.75	22.27	42.72	342.50
6/24	37.87	73.58	416.07	27.93	50.34	379.39	30.05	63.59	374.29	21.91	42.65	341.28
6/25	50.58	46.09	431.82	35.44	33.42	392.85	34.85	37.63	364.47	24.10	26.36	332.38
6/26	51.27	46.29	429.19	35.84	33.67	390.10	35.37	37.83	361.66	24.38	26.62	329.47
6/27	40.13	73.20	418.44	29.33	49.95	380.97	31.94	63.21	376.33	23.05	42.27	342.55
6/28	38.58	73.27	418.77	28.23	49.95	381.02	30.68	63.28	376.86	22.16	42.26	342.78
6/29	38.28	73.33	419.34	27.92	50.06	381.59	30.43	63.34	377.42	21.90	42.37	343.35
6/30	35.77	73.59	411.51	26.29	50.31	374.61	28.24	63.60	370.07	20.48	42.62	336.80
7/1	38.22	71.75	400.59	28.08	49.17	362.60	30.41	61.93	360.21	22.05	41.60	325.78
7/2	52.65	44.82	417.53	37.12	32.72	378.61	36.77	36.49	351.84	25.67	25.77	319.73
7/3	49.09	44.04	408.16	34.07	31.95	370.32	33.60	35.70	342.78	22.91	25.00	311.72
7/4	46.03	45.16	401.11	32.14	32.94	362.79	30.97	36.81	336.70	21.24	25.97	305.06
7/5	35.35	71.44	395.18	26.01	48.87	357.68	27.89	61.61	355.09	20.23	41.30	321.13
7/6	34.30	71.84	394.35	25.32	49.12	355.06	27.03	62.01	354.69	19.66	41.54	318.89
7/7	35.65	71.76	398.96	26.15	49.16	360.82	28.21	61.94	358.82	20.40	41.59	324.22
7/8	36.85	71.62	401.68	26.78	49.05	363.27	29.23	61.80	361.25	20.92	41.48	326.42
7/9	49.58	45.08	415.36	34.69	32.81	375.84	34.17	36.74	350.23	23.57	25.85	317.46
7/10	47.44	45.59	406.63	33.78	33.36	368.50	32.35	37.24	342.34	22.85	26.39	310.88
7/11	32.95	71.55	386.35	24.48	48.85	348.60	25.81	61.71	346.97	18.89	41.26	312.69
7/12	35.32	71.77	400.02	26.17	49.15	361.16	28.01	61.94	360.04	20.51	41.58	324.70
7/13	35.42	71.79	399.35	26.25	49.10	360.61	28.06	61.96	359.42	20.54	41.52	324.20
7/14	34.94	72.10	397.33	26.16	49.44	358.74	27.67	62.27	357.64	20.50	41.86	322.54
7/15	34.48	71.91	393.38	25.81	49.32	355.88	27.20	62.07	353.74	20.14	41.73	319.72
7/16	47.92	45.21	410.30	34.09	32.99	371.67	32.74	36.86	345.85	23.10	26.03	313.90

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
7/17	49.81	45.27	412.81	34.61	32.99	373.12	34.30	36.94	347.63	23.41	26.03	314.69
7/18	37.00	71.21	398.44	26.57	48.62	360.23	29.29	61.39	357.95	20.64	41.05	323.32
7/19	36.35	71.35	401.78	26.51	48.79	363.94	28.82	61.52	361.43	20.71	41.22	327.15
7/20	36.99	71.59	404.82	26.79	48.98	366.62	29.39	61.77	364.34	20.96	41.41	329.72
7/21	36.66	71.91	403.12	27.02	49.33	365.02	29.14	62.09	362.82	21.22	41.76	328.28
7/22	35.55	71.86	400.05	26.20	49.37	362.37	28.14	62.04	359.83	20.49	41.79	325.70
7/23	47.37	45.07	410.80	33.23	32.79	372.63	32.24	36.72	346.21	22.29	25.82	314.74
7/24	46.63	45.25	405.50	32.69	32.95	366.41	31.56	36.90	341.18	21.78	25.98	308.76
7/25	32.66	71.70	387.14	24.47	49.06	349.69	25.55	61.86	347.80	18.90	41.48	313.80
7/26	35.75	71.65	402.21	26.16	48.99	363.69	28.32	61.82	362.05	20.43	41.42	327.07
7/27	34.88	71.63	399.66	25.72	49.04	358.29	27.53	61.80	359.64	20.04	41.46	321.80
7/28	36.26	71.75	400.51	26.44	49.12	361.83	28.74	61.92	360.20	20.65	41.54	325.08
7/29	36.22	71.85	399.96	26.59	49.28	361.70	28.75	62.02	359.75	20.83	41.71	325.03
7/30	49.18	45.01	415.57	34.27	32.70	376.31	33.81	36.67	350.46	23.17	25.74	317.95
7/31	48.58	45.21	410.39	33.70	32.98	371.24	33.23	36.87	345.33	22.62	26.02	312.93
8/1	35.38	71.60	396.98	25.94	48.95	357.93	27.94	61.77	356.96	20.16	41.37	321.47
8/2	38.39	71.36	404.79	27.68	48.72	365.48	30.55	61.54	364.15	21.66	41.15	328.46
8/3	38.08	71.49	403.98	27.57	48.92	364.67	30.31	61.67	363.41	21.58	41.36	327.71
8/4	36.75	71.97	402.45	27.12	49.34	363.11	29.19	62.15	362.25	21.26	41.77	326.48
8/5	37.24	71.68	404.07	26.92	49.07	365.48	29.57	61.86	363.51	21.03	41.50	328.53
8/6	48.38	45.00	414.91	33.80	32.73	375.58	33.06	36.66	349.84	22.72	25.78	317.30
8/7	48.42	45.38	410.94	33.62	33.08	370.60	33.07	37.04	345.90	22.51	26.13	312.35
8/8	34.41	71.39	394.48	25.14	48.80	355.99	27.06	61.56	354.38	19.45	41.23	319.46
8/9	35.10	71.42	399.92	25.47	48.81	360.71	27.70	61.59	359.68	19.76	41.23	324.05
8/10	35.33	71.57	400.58	25.74	48.91	361.32	27.95	61.74	360.36	20.04	41.34	324.68
8/11	34.13	71.94	396.31	25.34	49.27	357.33	26.91	62.10	356.55	19.72	41.69	321.09
8/12	33.47	71.81	395.35	24.75	49.19	357.12	26.30	61.98	355.53	19.18	41.61	320.83
8/13	46.92	45.14	410.40	32.94	32.85	370.80	31.79	36.80	345.81	21.98	25.88	312.94
8/14	47.78	45.16	410.33	33.18	32.95	370.36	32.49	36.82	345.32	22.13	25.99	312.14
8/15	35.34	71.24	396.93	25.69	48.71	358.36	27.85	61.41	356.59	19.91	41.14	321.60
8/16	35.53	71.38	398.61	26.10	48.80	360.04	28.08	61.55	358.44	20.33	41.22	323.43
8/17	36.59	71.18	399.78	26.46	48.57	360.86	28.95	61.35	359.34	20.57	40.99	324.02
8/18	38.59	71.23	403.72	27.59	48.68	364.62	30.67	61.41	362.94	21.52	41.12	327.48
8/19	35.49	71.49	395.02	26.10	48.87	356.52	28.03	61.66	354.98	20.30	41.30	320.03
8/20	47.92	44.81	413.36	33.55	32.50	373.74	32.69	36.47	348.54	22.51	25.53	315.69
8/21	48.30	44.96	412.19	33.60	32.71	372.47	32.94	36.62	347.15	22.49	25.75	314.22
8/22	37.58	71.17	403.00	26.94	48.63	363.64	29.81	61.35	362.31	20.99	41.06	326.57
8/23	38.29	71.05	404.22	27.43	48.52	364.96	30.41	61.23	363.47	21.39	40.95	327.85
8/24	38.81	71.25	407.00	27.71	48.63	367.34	30.89	61.44	366.19	21.65	41.07	330.17

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
8/25	38.31	71.31	405.31	27.49	48.73	365.73	30.45	61.50	364.59	21.46	41.16	328.64
8/26	39.65	71.10	404.79	28.09	48.57	365.24	31.57	61.29	363.76	21.94	41.00	327.87
8/27	50.28	44.39	417.14	34.72	32.15	376.77	34.65	36.07	351.54	23.44	25.20	318.01
8/28	48.24	44.64	411.11	33.58	32.45	371.91	32.88	36.31	345.98	22.48	25.49	313.57
8/29	37.30	71.07	400.70	26.83	48.48	361.62	29.53	61.25	360.12	20.86	40.91	324.65
8/30	37.74	71.11	406.28	27.12	48.49	366.63	29.99	61.29	365.59	21.18	40.92	329.56
8/31	38.08	71.30	407.28	27.45	48.68	367.83	30.39	61.49	366.79	21.56	41.13	330.94
9/1	35.05	69.19	382.38	25.31	47.28	344.80	28.73	59.75	347.78	20.37	40.02	313.16
9/2	30.64	69.20	370.51	22.91	47.40	334.76	24.89	59.75	336.66	18.33	40.13	303.79
9/3	39.32	41.52	360.66	28.19	29.59	327.40	28.36	33.83	311.80	19.99	23.29	283.00
9/4	39.60	41.72	357.93	28.14	29.86	324.93	28.52	34.03	308.90	19.86	23.57	280.38
9/5	38.24	42.63	359.02	27.01	30.73	325.59	27.40	34.94	310.04	18.93	24.43	281.09
9/6	32.22	68.94	373.98	23.78	47.05	337.21	26.27	59.50	339.88	19.06	39.78	306.02
9/7	33.54	69.21	380.71	24.77	47.27	343.13	27.51	59.76	346.46	20.01	40.00	311.79
9/8	33.86	69.14	380.83	24.75	47.23	343.29	27.73	59.70	346.44	19.94	39.96	311.83
9/9	29.97	68.83	365.16	22.03	46.96	328.90	24.22	59.38	331.33	17.44	39.69	297.94
9/10	36.86	42.09	353.39	26.69	30.08	320.50	26.23	34.39	305.27	18.69	23.77	276.77
9/11	36.58	42.79	351.07	26.60	30.77	317.61	26.00	35.08	303.13	18.63	24.45	274.04
9/12	30.34	68.99	365.87	22.59	47.07	328.93	24.59	59.53	332.21	17.99	39.79	298.12
9/13	30.44	69.14	368.57	23.31	47.21	332.66	24.79	59.68	335.18	18.76	39.93	302.09
9/14	29.84	69.35	367.42	22.93	47.29	331.10	24.30	59.88	334.29	18.45	40.00	300.76
9/15	30.67	69.68	371.92	23.53	47.74	335.23	25.08	60.22	338.52	19.03	40.46	304.65
9/16	30.45	69.39	369.36	23.14	47.46	332.95	24.79	59.93	335.89	18.59	40.19	302.31
9/17	36.46	42.38	354.38	26.65	30.32	321.09	25.96	34.67	306.53	18.75	24.01	277.59
9/18	37.03	42.87	352.40	27.02	30.93	319.42	26.40	35.16	304.40	19.01	24.61	275.78
9/19	31.49	69.10	369.56	23.58	47.14	332.97	25.62	59.64	335.86	18.88	39.87	302.13
9/20	32.12	69.00	373.80	24.10	46.98	336.55	26.24	59.55	340.06	19.39	39.71	305.67
9/21	33.00	69.28	374.89	25.14	47.31	338.43	27.05	59.83	341.14	20.37	40.04	307.54
9/22	33.41	69.50	378.42	25.07	47.54	341.32	27.40	60.05	344.49	20.28	40.27	310.27
9/23	33.86	69.44	377.52	25.53	47.56	340.86	27.77	60.00	343.49	20.70	40.29	309.72
9/24	38.67	42.17	360.85	27.92	30.13	327.16	27.84	34.47	312.33	19.79	23.83	283.07
9/25	37.54	42.91	355.85	27.30	30.95	322.40	26.85	35.21	307.56	19.27	24.65	278.51
9/26	30.54	69.20	367.24	23.33	47.33	331.20	24.84	59.74	333.78	18.74	40.05	300.57
9/27	31.27	69.02	372.71	23.56	47.05	336.12	25.51	59.57	339.02	18.95	39.77	305.28
9/28	30.92	69.29	373.57	23.43	47.22	336.15	25.24	59.83	340.08	18.87	39.94	305.49
9/29	31.31	69.51	373.13	24.28	47.68	336.95	25.57	60.05	339.57	19.67	40.41	306.23
9/30	31.58	69.00	368.04	23.48	47.22	331.87	25.66	59.55	334.11	18.77	39.95	300.82
Average	36.60	62.78	387.21	26.89	43.49	350.04	27.89	53.58	343.58	20.26	36.26	310.41

Table E-4. Daily onroad mobile source emissions extracted from the SMOKE gridded emissions in 2011 and 2017 (metric tons/day)

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
5/1	53.69	105.56	473.29	35.86	60.80	337.60	48.39	85.22	427.93	32.05	47.25	307.14
5/2	69.53	156.91	688.18	45.04	89.54	494.60	62.17	125.87	620.66	39.88	68.89	448.61
5/3	74.31	162.72	743.00	48.25	92.34	538.07	66.53	130.76	670.16	42.72	71.14	487.98
5/4	77.67	166.88	774.67	50.49	94.47	562.39	69.60	134.18	698.74	44.70	72.81	510.01
5/5	78.69	168.22	785.47	51.15	95.18	570.87	70.53	135.24	708.53	45.28	73.35	517.72
5/6	79.59	173.75	809.47	51.52	98.12	588.54	71.28	139.69	729.97	45.59	75.60	533.56
5/7	67.45	131.32	623.58	44.78	74.28	452.47	60.78	106.03	562.90	39.88	57.59	410.72
5/8	59.83	108.19	524.37	40.06	61.81	378.85	54.10	87.66	474.12	35.88	48.19	344.57
5/9	67.81	152.90	661.77	43.71	87.59	473.41	60.60	122.51	596.79	38.71	67.33	429.41
5/10	67.29	155.87	656.14	43.32	89.43	467.47	60.07	124.72	591.63	38.33	68.64	423.98
5/11	71.02	161.45	714.29	45.89	92.01	514.15	63.46	129.44	644.06	40.59	70.72	466.20
5/12	75.45	164.60	759.67	48.90	93.41	550.54	67.54	132.17	685.14	43.29	71.91	499.24
5/13	81.19	173.57	821.32	52.67	97.93	597.90	72.76	139.63	740.72	46.61	75.51	542.08
5/14	65.16	130.15	614.26	43.09	73.70	445.22	58.67	105.04	554.47	38.41	57.12	404.13
5/15	59.13	107.88	519.40	39.60	61.66	374.98	53.45	87.39	469.61	35.46	48.07	341.05
5/16	70.77	156.18	703.86	45.85	88.97	508.01	63.33	125.40	634.82	40.63	68.51	460.76
5/17	69.03	156.22	685.64	44.53	89.27	492.39	61.67	125.19	618.22	39.41	68.61	446.51
5/18	67.82	150.83	656.40	43.58	86.88	466.87	60.52	120.60	591.79	38.54	66.67	423.39
5/19	68.58	158.53	685.14	44.13	90.83	489.19	61.19	126.85	617.82	39.02	69.70	443.65
5/20	72.81	166.21	743.06	46.91	94.57	535.71	65.01	133.23	669.81	41.46	72.65	485.57
5/21	64.04	128.65	604.24	42.37	72.96	437.31	57.62	103.78	545.38	37.74	56.52	396.94
5/22	60.25	108.60	527.39	40.36	62.01	381.23	54.49	88.00	476.85	36.14	48.36	346.74
5/23	72.86	159.53	731.71	47.17	90.58	529.97	65.26	128.26	660.06	41.83	69.83	480.71
5/24	71.89	160.82	719.57	46.50	91.49	519.43	64.32	129.09	648.92	41.19	70.41	471.05
5/25	76.60	166.33	771.88	49.65	94.18	560.29	68.62	133.73	696.21	43.97	72.59	508.09
5/26	79.16	168.34	793.85	51.40	95.17	577.62	70.98	135.40	716.13	45.53	73.38	523.87
5/27	81.38	173.53	825.29	52.72	97.91	601.02	72.95	139.61	744.32	46.68	75.50	544.92
5/28	69.89	129.82	646.97	46.25	73.36	470.83	63.07	104.97	584.11	41.26	56.97	427.42
5/29	57.90	106.50	510.77	38.65	60.99	368.18	52.32	86.22	461.79	34.62	47.52	334.86
5/30	55.65	106.74	491.01	37.24	61.28	352.15	50.20	86.29	443.92	33.30	47.67	320.32
5/31	76.86	163.76	759.56	50.03	92.80	551.01	68.90	131.70	685.17	44.31	71.55	499.75
6/1	75.56	166.65	765.70	48.66	93.14	552.36	67.83	134.85	691.51	43.23	72.28	501.34
6/2	75.92	168.01	768.27	48.97	93.89	554.06	68.13	135.91	693.77	43.48	72.84	502.83
6/3	77.60	172.82	789.31	50.00	96.48	569.34	69.61	139.75	712.66	44.36	74.79	516.59
6/4	69.21	131.46	623.58	46.04	73.45	450.38	62.53	106.71	563.77	41.07	57.27	409.31
6/5	68.27	111.16	556.24	46.01	62.39	401.70	62.04	90.81	503.61	41.23	49.06	365.66
6/6	76.42	162.59	765.51	49.28	90.78	553.10	68.60	131.26	691.33	43.86	70.61	502.13
6/7	76.24	165.61	765.23	49.23	92.54	552.15	68.47	134.07	691.13	43.74	71.86	501.17

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
6/8	76.71	167.05	774.05	49.50	93.28	558.86	68.89	135.24	699.09	43.98	72.43	507.25
6/9	78.24	169.19	787.10	50.53	94.39	568.62	70.28	136.98	710.85	44.88	73.29	516.07
6/10	80.96	173.38	820.69	52.22	96.55	593.98	72.74	140.40	741.16	46.38	74.96	539.03
6/11	68.37	131.27	628.18	45.22	73.31	454.03	61.79	106.61	567.96	40.41	57.18	412.64
6/12	64.93	110.54	549.05	43.47	62.10	396.11	58.88	89.90	496.95	38.96	48.44	360.42
6/13	79.19	163.71	777.75	51.39	91.29	562.53	71.17	132.24	702.41	45.60	70.45	510.46
6/14	83.97	168.65	811.58	54.72	93.84	588.20	75.54	136.23	733.00	48.52	72.40	533.74
6/15	86.75	168.70	832.64	56.57	93.81	604.28	78.09	136.34	752.06	50.17	72.42	548.33
6/16	84.17	170.14	831.13	54.44	94.60	602.84	75.68	137.45	750.63	48.31	73.00	546.99
6/17	84.97	172.93	845.03	55.02	96.16	612.89	76.33	139.59	763.05	48.77	74.12	555.99
6/18	71.92	131.67	646.06	47.67	73.41	467.92	65.01	106.61	584.02	42.54	56.86	425.09
6/19	64.38	110.11	549.71	42.97	61.88	396.63	58.38	89.57	497.55	38.55	48.27	360.89
6/20	80.90	163.74	792.47	52.44	91.18	573.95	72.77	132.38	715.80	46.59	70.45	520.87
6/21	87.23	169.68	830.31	56.89	94.25	602.74	78.58	137.19	750.01	50.49	72.80	546.97
6/22	91.73	170.72	852.05	60.09	94.70	619.33	82.76	138.13	769.68	53.30	73.20	562.03
6/23	89.55	168.04	863.38	58.15	93.34	627.87	80.72	135.94	779.92	51.67	72.14	569.76
6/24	90.15	168.46	889.90	58.34	93.59	647.66	81.19	136.25	803.80	51.82	72.32	587.65
6/25	77.83	129.42	674.83	51.74	72.10	490.28	70.53	104.96	610.14	46.20	55.95	445.45
6/26	75.07	111.24	585.51	50.43	62.25	424.44	68.37	90.70	530.04	45.25	48.69	386.20
6/27	94.66	166.38	843.45	62.26	92.25	613.48	85.62	134.82	762.08	55.31	71.45	556.84
6/28	90.62	164.91	861.74	58.91	91.59	627.11	81.78	133.53	778.56	52.40	70.88	569.17
6/29	90.69	159.76	877.94	58.82	88.99	639.40	81.79	129.32	793.22	52.28	68.85	580.32
6/30	85.57	168.88	847.02	55.21	93.88	615.21	77.01	136.50	765.07	49.07	72.49	558.25
7/1	91.29	170.60	843.27	59.44	93.61	613.10	82.45	138.32	762.01	52.76	72.41	556.64
7/2	84.51	125.27	665.97	56.58	69.00	484.36	76.95	102.04	602.43	50.51	53.75	440.34
7/3	73.74	98.27	577.73	49.34	54.88	419.45	67.23	80.46	523.29	44.26	43.13	381.95
7/4	66.89	93.77	569.06	44.57	52.63	412.73	60.83	76.77	515.43	40.02	41.38	375.82
7/5	84.09	139.88	836.91	54.35	77.68	608.98	75.82	113.67	756.48	48.30	60.36	553.04
7/6	82.10	140.51	822.60	53.16	78.16	597.87	73.93	114.00	743.46	47.20	60.63	542.94
7/7	85.08	143.89	840.39	54.93	79.77	611.97	76.77	116.86	759.71	48.90	61.93	555.84
7/8	88.82	153.48	873.73	57.34	84.75	636.72	80.15	124.57	789.73	51.00	65.70	578.19
7/9	75.48	115.86	658.10	49.90	64.20	478.26	68.47	94.40	595.29	44.59	50.08	434.79
7/10	68.00	94.34	561.31	45.64	52.96	406.70	61.82	77.19	508.38	40.88	41.61	370.33
7/11	77.28	133.76	778.90	49.76	74.65	564.87	69.58	108.60	703.94	44.28	57.98	512.98
7/12	82.45	148.86	818.96	53.03	82.39	595.13	74.34	120.85	740.18	47.23	63.90	540.44
7/13	82.75	164.86	797.85	53.42	90.77	578.72	74.57	133.57	720.98	47.49	70.18	525.50
7/14	79.99	162.90	778.27	51.64	89.84	563.78	72.02	131.90	703.25	45.90	69.42	511.93
7/15	81.59	166.57	803.57	52.58	91.79	582.35	73.41	134.80	725.96	46.69	70.87	528.65
7/16	72.91	127.45	629.24	48.34	70.28	455.85	66.07	103.62	569.08	43.17	54.63	414.38

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
7/17	74.72	107.28	566.70	50.20	59.54	410.89	68.16	87.71	513.28	45.02	46.66	374.15
7/18	87.80	144.40	822.72	57.02	79.86	598.84	79.37	117.46	743.81	50.73	62.11	543.97
7/19	87.12	148.40	843.52	56.32	81.98	614.18	78.68	120.63	762.47	50.15	63.69	557.76
7/20	87.97	150.12	855.85	56.73	82.89	623.66	79.46	121.96	773.69	50.52	64.35	566.44
7/21	87.48	151.66	834.00	56.78	83.74	607.02	79.01	123.15	753.90	50.51	64.96	551.33
7/22	85.79	160.12	848.54	55.09	88.21	617.24	77.35	129.85	766.83	49.04	68.31	560.43
7/23	72.17	113.12	654.66	47.54	62.83	475.60	65.39	92.15	592.17	42.51	49.02	432.37
7/24	65.47	92.65	561.07	43.59	52.08	406.52	59.49	75.83	508.17	39.13	40.95	370.17
7/25	77.91	130.97	785.99	50.40	73.19	570.37	70.14	106.38	710.41	44.79	56.88	518.01
7/26	84.68	148.98	829.43	54.62	82.35	603.25	76.41	121.02	749.68	48.64	63.92	547.82
7/27	83.34	151.90	823.82	53.62	83.99	598.86	75.14	123.22	744.57	47.74	65.08	543.84
7/28	86.06	151.23	832.53	55.56	83.53	605.89	77.70	122.80	752.56	49.49	64.80	550.29
7/29	86.33	151.48	861.56	55.58	83.76	627.33	77.83	122.90	778.67	49.42	64.92	569.63
7/30	77.56	114.78	664.64	51.61	63.60	483.35	70.41	93.56	601.23	46.07	49.65	439.42
7/31	72.00	94.66	576.81	48.24	53.03	418.74	65.57	77.54	522.46	43.23	41.72	381.29
8/1	84.88	139.77	837.47	55.22	78.14	609.99	76.52	113.57	756.56	49.06	60.83	553.66
8/2	91.69	149.75	867.78	59.71	83.23	633.04	82.88	121.76	783.94	53.12	64.78	574.53
8/3	90.10	150.64	867.95	58.46	83.76	632.88	81.34	122.37	784.05	51.98	65.14	574.36
8/4	88.14	145.38	859.93	57.44	81.03	626.68	79.51	118.13	776.74	51.00	63.06	568.69
8/5	90.41	158.77	900.53	58.21	88.07	656.92	81.55	128.88	813.28	51.78	68.38	596.00
8/6	75.74	121.37	680.71	49.95	67.76	495.78	68.65	98.58	615.41	44.69	52.71	450.48
8/7	70.29	96.32	586.02	46.88	54.28	425.89	63.98	78.84	530.50	42.11	42.73	387.56
8/8	84.21	139.07	844.30	54.52	77.84	615.33	75.92	112.98	762.78	48.51	60.56	558.53
8/9	84.65	153.89	834.64	54.52	85.52	607.34	76.34	124.94	753.88	48.58	66.44	551.17
8/10	84.88	158.30	838.91	54.66	87.93	610.37	76.51	128.39	757.69	48.67	68.20	553.89
8/11	81.55	140.62	841.96	52.48	78.80	612.76	73.39	114.09	760.45	46.68	61.21	556.04
8/12	82.62	149.83	866.08	52.91	83.68	630.20	74.26	121.43	782.02	47.02	64.88	571.70
8/13	72.73	115.65	672.61	48.04	64.78	489.49	65.80	93.96	608.06	42.89	50.45	444.76
8/14	69.86	97.56	583.26	46.53	54.98	423.74	63.58	79.81	528.00	41.82	43.22	385.61
8/15	86.22	148.71	834.55	55.85	82.73	607.75	77.81	120.82	753.93	49.71	64.36	551.65
8/16	85.69	147.22	845.31	55.47	82.03	615.61	77.28	119.59	763.56	49.36	63.79	558.68
8/17	89.23	148.29	876.92	57.74	82.61	639.85	80.55	120.44	792.18	51.40	64.21	580.71
8/18	89.44	148.89	864.64	57.95	82.82	630.30	80.76	121.00	781.08	51.58	64.44	572.04
8/19	87.03	149.89	881.53	56.42	83.58	642.16	78.33	121.58	796.01	50.04	64.88	582.55
8/20	74.30	121.23	670.67	49.07	67.65	487.97	67.28	98.48	606.30	43.85	52.65	443.37
8/21	71.08	105.01	573.80	47.43	58.89	416.38	64.73	85.78	519.42	42.63	46.18	378.92
8/22	90.10	154.55	844.56	58.52	85.82	615.54	81.47	125.53	763.00	52.14	66.68	558.71
8/23	92.56	155.25	861.92	60.23	86.13	628.50	83.72	126.16	778.61	53.63	66.96	570.40
8/24	93.78	158.61	873.26	60.96	87.90	637.04	84.82	128.83	788.86	54.28	68.29	578.14

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
8/25	91.83	154.54	871.17	59.48	85.76	635.42	83.01	125.58	786.96	52.97	66.68	576.66
8/26	97.68	160.77	916.75	63.45	89.02	669.50	88.33	130.58	827.99	56.36	69.16	607.44
8/27	80.63	119.86	691.51	53.51	66.85	504.19	73.18	97.48	625.21	47.74	52.10	458.13
8/28	72.11	97.94	584.40	48.37	55.16	424.62	65.65	80.13	529.03	43.39	43.37	386.41
8/29	90.01	151.40	845.02	58.62	84.13	615.88	81.36	123.03	763.43	52.18	65.43	559.03
8/30	90.49	155.19	858.27	58.65	86.10	625.69	81.80	126.10	775.30	52.26	66.94	567.85
8/31	91.75	157.54	867.64	59.48	87.36	632.66	82.90	127.93	783.77	52.92	67.87	574.17
9/1	92.03	158.29	871.56	59.65	87.82	635.91	83.11	128.51	787.01	53.04	68.10	576.88
9/2	84.56	154.96	881.75	54.03	86.44	642.08	75.98	125.53	795.81	47.97	66.86	582.17
9/3	76.90	127.86	687.72	50.70	71.01	500.14	69.60	104.00	621.15	45.23	55.24	453.92
9/4	74.04	107.43	591.86	49.50	60.10	429.96	67.38	87.78	535.42	44.36	47.09	390.99
9/5	70.04	101.99	593.07	46.45	57.31	430.90	63.66	83.36	536.51	41.72	44.94	391.83
9/6	85.39	147.93	848.60	55.14	82.53	618.33	76.92	120.05	766.25	49.00	64.02	560.93
9/7	87.05	154.08	856.58	56.18	85.77	624.27	78.45	124.99	773.41	49.94	66.46	566.28
9/8	88.36	158.93	854.48	57.10	88.18	622.65	79.67	128.99	771.52	50.77	68.36	564.82
9/9	82.78	164.68	846.90	52.93	91.48	615.04	74.31	133.34	764.18	46.96	70.71	557.57
9/10	70.01	120.38	649.53	46.23	67.32	470.45	63.14	97.75	586.52	41.14	52.31	426.94
9/11	64.42	100.42	554.33	43.02	56.69	400.78	58.36	81.89	501.38	38.48	44.35	364.44
9/12	78.85	145.55	779.93	50.96	81.48	565.61	70.87	117.92	704.09	45.24	63.10	513.09
9/13	76.75	145.39	766.87	49.54	81.55	554.93	68.86	117.63	692.13	43.90	63.07	503.30
9/14	76.08	144.74	769.15	49.02	81.30	556.35	68.21	117.04	694.08	43.42	62.83	504.50
9/15	77.80	150.90	786.48	50.05	84.42	569.90	69.82	122.10	709.81	44.38	65.25	516.84
9/16	80.96	159.90	828.70	51.99	89.13	600.93	72.60	129.35	747.66	46.03	68.84	544.73
9/17	67.59	127.82	634.71	44.34	71.22	458.95	60.92	103.70	573.09	39.52	55.26	416.49
9/18	65.23	108.67	549.41	43.60	60.99	396.95	59.12	88.52	496.92	39.00	47.61	360.97
9/19	81.39	157.77	780.65	52.86	87.83	566.09	73.23	127.80	704.71	46.89	67.94	513.49
9/20	82.83	162.43	793.13	53.84	90.29	575.27	74.51	131.52	715.89	47.72	69.79	521.75
9/21	83.51	164.99	800.50	54.26	91.63	580.71	75.12	133.57	722.53	48.08	70.80	526.66
9/22	84.70	164.51	813.24	54.97	91.30	590.64	76.24	133.27	734.08	48.75	70.60	535.69
9/23	88.45	174.27	854.92	57.34	96.40	621.24	79.57	141.13	771.44	50.77	74.49	563.19
9/24	74.01	134.12	664.18	48.84	74.36	481.84	66.88	108.94	599.81	43.52	57.73	437.29
9/25	65.84	108.56	556.74	43.83	60.92	402.65	59.71	88.46	503.57	39.28	47.56	366.15
9/26	78.13	158.58	762.45	50.51	88.36	552.00	70.21	128.33	688.20	44.82	68.27	500.68
9/27	80.12	159.96	788.05	51.74	89.01	571.34	72.00	129.50	711.31	45.91	68.81	518.20
9/28	79.01	156.47	789.23	50.86	87.29	572.02	70.95	126.61	712.31	45.12	67.45	518.76
9/29	80.11	157.75	794.75	51.64	87.92	576.29	71.97	127.68	717.30	45.81	67.95	522.64
9/30	85.01	168.54	852.12	54.70	93.47	619.10	76.38	136.47	768.90	48.49	72.24	561.25
Average	78.71	144.63	748.33	51.31	80.85	543.04	70.96	117.15	675.97	45.65	62.69	492.98

Table E-5. Daily biogenic source emissions extracted from the SMOKE gridded emissions in 2011 and 2017 (metric tons/day)

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
5/1	291.40	1.60	39.57	291.40	1.60	39.57	109.50	0.61	15.03	109.50	0.61	15.03
5/2	375.77	2.09	49.23	375.77	2.09	49.23	140.32	0.79	18.59	140.32	0.79	18.59
5/3	625.77	3.37	80.77	625.77	3.37	80.77	226.51	1.24	29.92	226.51	1.24	29.92
5/4	950.08	4.79	120.67	950.08	4.79	120.67	343.54	1.78	44.71	343.54	1.78	44.71
5/5	993.82	4.98	127.93	993.82	4.98	127.93	376.13	1.90	49.26	376.13	1.90	49.26
5/6	1,010.53	5.09	129.90	1,010.53	5.09	129.90	382.20	1.94	49.97	382.20	1.94	49.97
5/7	922.97	4.75	119.94	922.97	4.75	119.94	338.65	1.77	44.82	338.65	1.77	44.82
5/8	709.32	3.87	93.37	709.32	3.87	93.37	259.04	1.44	34.68	259.04	1.44	34.68
5/9	328.77	1.90	45.42	328.77	1.90	45.42	123.03	0.71	17.20	123.03	0.71	17.20
5/10	267.65	1.49	36.47	267.65	1.49	36.47	99.84	0.56	13.77	99.84	0.56	13.77
5/11	423.30	2.35	54.96	423.30	2.35	54.96	159.87	0.90	21.06	159.87	0.90	21.06
5/12	696.87	3.72	88.60	696.87	3.72	88.60	269.22	1.46	34.67	269.22	1.46	34.67
5/13	1,051.83	5.10	132.30	1,051.83	5.10	132.30	399.51	1.98	51.31	399.51	1.98	51.31
5/14	721.09	3.80	95.84	721.09	3.80	95.84	273.39	1.46	36.92	273.39	1.46	36.92
5/15	611.50	3.24	80.87	611.50	3.24	80.87	232.10	1.24	31.07	232.10	1.24	31.07
5/16	490.64	2.67	65.59	490.64	2.67	65.59	185.46	1.01	25.05	185.46	1.01	25.05
5/17	366.22	2.07	49.43	366.22	2.07	49.43	139.51	0.80	19.00	139.51	0.80	19.00
5/18	237.24	1.57	30.06	237.24	1.57	30.06	78.48	0.58	9.88	78.48	0.58	9.88
5/19	310.10	1.68	41.31	310.10	1.68	41.31	115.11	0.64	15.52	115.11	0.64	15.52
5/20	486.27	2.61	63.24	486.27	2.61	63.24	185.03	1.01	24.44	185.03	1.01	24.44
5/21	676.68	3.54	86.95	676.68	3.54	86.95	257.39	1.36	33.55	257.39	1.36	33.55
5/22	677.68	3.47	89.61	677.68	3.47	89.61	254.41	1.33	34.08	254.41	1.33	34.08
5/23	589.41	3.08	77.95	589.41	3.08	77.95	219.84	1.17	29.54	219.84	1.17	29.54
5/24	592.70	3.07	78.64	592.70	3.07	78.64	222.62	1.17	30.02	222.62	1.17	30.02
5/25	864.94	4.23	110.39	864.94	4.23	110.39	327.43	1.63	42.56	327.43	1.63	42.56
5/26	1,042.53	4.90	134.86	1,042.53	4.90	134.86	390.28	1.88	51.48	390.28	1.88	51.48
5/27	1,193.08	5.54	151.52	1,193.08	5.54	151.52	447.73	2.12	57.88	447.73	2.12	57.88
5/28	1,074.85	5.20	139.17	1,074.85	5.20	139.17	397.52	1.98	52.50	397.52	1.98	52.50
5/29	595.70	2.95	82.83	595.70	2.95	82.83	223.61	1.12	31.55	223.61	1.12	31.55
5/30	510.94	2.58	68.74	510.94	2.58	68.74	194.19	1.00	26.49	194.19	1.00	26.49
5/31	995.02	4.81	123.70	995.02	4.81	123.70	379.89	1.86	48.09	379.89	1.86	48.09
6/1	1,230.55	5.80	157.32	1,230.55	5.80	157.32	459.77	2.23	59.76	459.77	2.23	59.76
6/2	885.27	4.17	120.83	885.27	4.17	120.83	330.92	1.58	46.32	330.92	1.58	46.32
6/3	923.84	4.24	121.99	923.84	4.24	121.99	337.27	1.59	45.74	337.27	1.59	45.74
6/4	1,113.85	4.97	142.39	1,113.85	4.97	142.39	406.26	1.88	53.36	406.26	1.88	53.36
6/5	1,294.16	5.67	164.26	1,294.16	5.67	164.26	474.51	2.14	61.90	474.51	2.14	61.90
6/6	906.01	4.32	123.50	906.01	4.32	123.50	333.75	1.63	46.60	333.75	1.63	46.60
6/7	958.54	4.48	124.81	958.54	4.48	124.81	345.24	1.67	46.30	345.24	1.67	46.30

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
6/8	892.69	4.16	119.26	892.69	4.16	119.26	326.30	1.57	44.76	326.30	1.57	44.76
6/9	912.59	4.32	119.52	912.59	4.32	119.52	336.82	1.64	45.22	336.82	1.64	45.22
6/10	1,089.10	4.98	141.12	1,089.10	4.98	141.12	402.61	1.91	53.49	402.61	1.91	53.49
6/11	1,069.08	4.86	140.10	1,069.08	4.86	140.10	395.13	1.86	53.15	395.13	1.86	53.15
6/12	1,110.79	4.93	144.78	1,110.79	4.93	144.78	408.33	1.88	54.54	408.33	1.88	54.54
6/13	1,130.28	4.95	148.12	1,130.28	4.95	148.12	411.93	1.87	55.69	411.93	1.87	55.69
6/14	1,441.18	6.16	182.93	1,441.18	6.16	182.93	537.83	2.37	69.91	537.83	2.37	69.91
6/15	1,706.15	7.07	217.08	1,706.15	7.07	217.08	624.04	2.69	81.90	624.04	2.69	81.90
6/16	1,559.29	6.57	202.08	1,559.29	6.57	202.08	570.44	2.49	76.10	570.44	2.49	76.10
6/17	1,420.42	6.05	184.97	1,420.42	6.05	184.97	514.50	2.28	68.95	514.50	2.28	68.95
6/18	1,495.65	6.26	192.41	1,495.65	6.26	192.41	546.85	2.37	72.29	546.85	2.37	72.29
6/19	1,346.88	5.88	177.60	1,346.88	5.88	177.60	492.49	2.24	66.79	492.49	2.24	66.79
6/20	1,430.84	6.07	186.99	1,430.84	6.07	186.99	519.07	2.31	70.04	519.07	2.31	70.04
6/21	1,903.25	7.47	240.80	1,903.25	7.47	240.80	708.05	2.87	92.07	708.05	2.87	92.07
6/22	2,385.58	8.83	299.55	2,385.58	8.83	299.55	884.64	3.38	114.09	884.64	3.38	114.09
6/23	2,120.80	8.29	270.42	2,120.80	8.29	270.42	787.35	3.18	103.11	787.35	3.18	103.11
6/24	1,948.46	7.95	248.06	1,948.46	7.95	248.06	717.27	3.03	93.94	717.27	3.03	93.94
6/25	2,086.68	8.28	265.56	2,086.68	8.28	265.56	768.89	3.15	100.50	768.89	3.15	100.50
6/26	2,187.27	8.57	279.32	2,187.27	8.57	279.32	810.83	3.27	106.30	810.83	3.27	106.30
6/27	2,522.79	9.47	317.71	2,522.79	9.47	317.71	932.97	3.60	120.58	932.97	3.60	120.58
6/28	2,496.02	9.56	314.65	2,496.02	9.56	314.65	932.93	3.68	120.60	932.93	3.68	120.60
6/29	2,183.39	8.75	280.12	2,183.39	8.75	280.12	820.55	3.37	107.80	820.55	3.37	107.80
6/30	1,792.12	7.32	234.59	1,792.12	7.32	234.59	664.14	2.79	89.23	664.14	2.79	89.23
7/1	2,333.54	8.70	293.76	2,333.54	8.70	293.76	860.62	3.31	111.15	860.62	3.31	111.15
7/2	2,798.75	10.72	343.84	2,798.75	10.72	343.84	1,029.43	4.11	128.40	1,029.43	4.11	128.40
7/3	2,014.53	8.71	262.42	2,014.53	8.71	262.42	783.14	3.46	103.96	783.14	3.46	103.96
7/4	1,523.26	7.17	196.67	1,523.26	7.17	196.67	581.59	2.82	77.01	581.59	2.82	77.01
7/5	1,573.74	7.65	202.90	1,573.74	7.65	202.90	609.77	2.99	80.30	609.77	2.99	80.30
7/6	1,745.75	8.62	222.76	1,745.75	8.62	222.76	672.75	3.31	87.82	672.75	3.31	87.82
7/7	1,981.55	8.92	255.25	1,981.55	8.92	255.25	767.42	3.50	100.87	767.42	3.50	100.87
7/8	2,113.49	9.38	269.26	2,113.49	9.38	269.26	780.49	3.56	102.57	780.49	3.56	102.57
7/9	2,207.95	9.42	282.88	2,207.95	9.42	282.88	833.39	3.67	109.18	833.39	3.67	109.18
7/10	1,817.63	8.32	234.58	1,817.63	8.32	234.58	703.81	3.29	93.57	703.81	3.29	93.57
7/11	1,563.46	7.90	199.44	1,563.46	7.90	199.44	599.17	3.09	78.71	599.17	3.09	78.71
7/12	1,584.52	7.50	207.00	1,584.52	7.50	207.00	589.81	2.84	78.94	589.81	2.84	78.94
7/13	1,491.23	6.80	196.39	1,491.23	6.80	196.39	555.61	2.57	74.47	555.61	2.57	74.47
7/14	1,264.49	5.81	167.36	1,264.49	5.81	167.36	466.44	2.18	62.86	466.44	2.18	62.86
7/15	1,337.27	6.06	173.49	1,337.27	6.06	173.49	489.71	2.27	64.84	489.71	2.27	64.84
7/16	1,572.90	7.03	201.30	1,572.90	7.03	201.30	579.97	2.63	75.51	579.97	2.63	75.51

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
7/17	1,902.09	8.65	240.27	1,902.09	8.65	240.27	717.81	3.30	92.18	717.81	3.30	92.18
7/18	1,757.49	8.53	222.92	1,757.49	8.53	222.92	684.05	3.33	87.98	684.05	3.33	87.98
7/19	1,949.93	8.83	251.41	1,949.93	8.83	251.41	735.04	3.39	96.57	735.04	3.39	96.57
7/20	1,963.04	8.71	250.55	1,963.04	8.71	250.55	736.16	3.34	96.06	736.16	3.34	96.06
7/21	1,945.52	8.63	246.76	1,945.52	8.63	246.76	719.80	3.26	93.92	719.80	3.26	93.92
7/22	1,594.09	7.56	206.29	1,594.09	7.56	206.29	598.94	2.86	78.96	598.94	2.86	78.96
7/23	1,118.64	6.04	142.59	1,118.64	6.04	142.59	451.87	2.39	58.61	451.87	2.39	58.61
7/24	1,171.80	8.12	143.96	1,171.80	8.12	143.96	456.73	3.16	56.86	456.73	3.16	56.86
7/25	893.84	7.96	105.39	893.84	7.96	105.39	283.00	2.91	33.53	283.00	2.91	33.53
7/26	1,687.32	8.43	209.83	1,687.32	8.43	209.83	594.53	3.38	74.89	594.53	3.38	74.89
7/27	1,654.25	8.09	208.02	1,654.25	8.09	208.02	600.64	3.06	77.19	600.64	3.06	77.19
7/28	1,034.88	7.46	123.37	1,034.88	7.46	123.37	353.36	2.76	43.36	353.36	2.76	43.36
7/29	949.18	6.77	111.03	949.18	6.77	111.03	377.39	2.61	44.67	377.39	2.61	44.67
7/30	1,521.60	7.64	189.32	1,521.60	7.64	189.32	576.98	2.95	72.93	576.98	2.95	72.93
7/31	1,697.04	7.92	213.60	1,697.04	7.92	213.60	643.12	3.09	82.53	643.12	3.09	82.53
8/1	1,891.76	9.18	238.84	1,891.76	9.18	238.84	691.17	3.32	90.13	691.17	3.32	90.13
8/2	2,461.78	10.57	307.90	2,461.78	10.57	307.90	903.35	3.99	115.67	903.35	3.99	115.67
8/3	2,468.20	10.27	313.25	2,468.20	10.27	313.25	897.48	3.85	117.07	897.48	3.85	117.07
8/4	2,130.05	9.43	270.84	2,130.05	9.43	270.84	765.00	3.56	99.85	765.00	3.56	99.85
8/5	2,104.82	9.22	269.57	2,104.82	9.22	269.57	757.50	3.47	100.07	757.50	3.47	100.07
8/6	1,780.50	8.26	229.79	1,780.50	8.26	229.79	644.42	3.13	85.60	644.42	3.13	85.60
8/7	1,538.89	7.75	194.85	1,538.89	7.75	194.85	578.91	2.97	75.96	578.91	2.97	75.96
8/8	1,362.57	6.93	175.75	1,362.57	6.93	175.75	547.37	2.69	72.56	547.37	2.69	72.56
8/9	1,436.48	7.34	176.88	1,436.48	7.34	176.88	516.28	2.81	65.53	516.28	2.81	65.53
8/10	1,350.66	7.09	171.69	1,350.66	7.09	171.69	487.27	2.74	63.53	487.27	2.74	63.53
8/11	993.37	5.80	125.03	993.37	5.80	125.03	379.09	2.26	49.08	379.09	2.26	49.08
8/12	1,151.34	6.21	145.55	1,151.34	6.21	145.55	442.91	2.43	56.99	442.91	2.43	56.99
8/13	1,044.78	6.57	123.54	1,044.78	6.57	123.54	330.75	2.41	38.48	330.75	2.41	38.48
8/14	1,554.18	7.59	193.11	1,554.18	7.59	193.11	546.61	2.80	70.38	546.61	2.80	70.38
8/15	1,445.56	7.05	186.05	1,445.56	7.05	186.05	525.27	2.67	69.46	525.27	2.67	69.46
8/16	1,365.94	7.09	170.68	1,365.94	7.09	170.68	522.00	2.72	67.02	522.00	2.72	67.02
8/17	1,848.43	8.93	227.98	1,848.43	8.93	227.98	683.85	3.35	86.61	683.85	3.35	86.61
8/18	2,126.57	9.46	268.97	2,126.57	9.46	268.97	777.55	3.59	101.02	777.55	3.59	101.02
8/19	1,768.85	8.24	224.88	1,768.85	8.24	224.88	646.03	3.10	85.19	646.03	3.10	85.19
8/20	1,556.80	7.46	198.34	1,556.80	7.46	198.34	565.21	2.76	73.89	565.21	2.76	73.89
8/21	1,693.58	7.99	213.02	1,693.58	7.99	213.02	612.49	2.95	79.09	612.49	2.95	79.09
8/22	2,047.99	9.08	255.11	2,047.99	9.08	255.11	742.73	3.36	94.89	742.73	3.36	94.89
8/23	2,359.52	10.00	290.62	2,359.52	10.00	290.62	856.88	3.72	108.19	856.88	3.72	108.19
8/24	1,962.13	9.11	247.06	1,962.13	9.11	247.06	707.34	3.40	91.50	707.34	3.40	91.50

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
8/25	1,973.12	9.10	247.28	1,973.12	9.10	247.28	736.92	3.46	94.21	736.92	3.46	94.21
8/26	2,180.35	9.71	270.10	2,180.35	9.71	270.10	780.23	3.65	99.91	780.23	3.65	99.91
8/27	2,116.19	9.56	262.49	2,116.19	9.56	262.49	762.26	3.61	97.42	762.26	3.61	97.42
8/28	1,591.03	7.86	202.60	1,591.03	7.86	202.60	581.17	2.89	76.02	581.17	2.89	76.02
8/29	1,906.99	8.73	236.99	1,906.99	8.73	236.99	650.96	3.02	83.64	650.96	3.02	83.64
8/30	1,933.58	8.78	241.50	1,933.58	8.78	241.50	646.38	3.02	83.37	646.38	3.02	83.37
8/31	1,835.60	8.54	232.71	1,835.60	8.54	232.71	625.17	2.97	82.04	625.17	2.97	82.04
9/1	1,817.48	8.38	228.90	1,817.48	8.38	228.90	618.49	2.91	80.10	618.49	2.91	80.10
9/2	1,282.80	6.94	161.90	1,282.80	6.94	161.90	427.23	2.44	55.08	427.23	2.44	55.08
9/3	1,664.83	7.83	206.76	1,664.83	7.83	206.76	577.51	2.74	73.81	577.51	2.74	73.81
9/4	1,747.05	8.15	216.61	1,747.05	8.15	216.61	598.79	2.83	76.97	598.79	2.83	76.97
9/5	1,259.80	6.77	157.28	1,259.80	6.77	157.28	483.99	2.50	63.16	483.99	2.50	63.16
9/6	1,250.03	6.58	154.34	1,250.03	6.58	154.34	435.54	2.34	55.84	435.54	2.34	55.84
9/7	1,619.04	7.68	200.97	1,619.04	7.68	200.97	542.36	2.67	69.54	542.36	2.67	69.54
9/8	1,667.47	7.52	207.53	1,667.47	7.52	207.53	545.67	2.56	70.42	545.67	2.56	70.42
9/9	1,174.17	6.02	148.61	1,174.17	6.02	148.61	383.54	2.08	50.14	383.54	2.08	50.14
9/10	1,058.87	5.39	133.86	1,058.87	5.39	133.86	357.95	1.91	46.75	357.95	1.91	46.75
9/11	948.49	5.11	118.11	948.49	5.11	118.11	328.77	1.79	42.18	328.77	1.79	42.18
9/12	975.24	5.25	121.40	975.24	5.25	121.40	335.51	1.85	42.99	335.51	1.85	42.99
9/13	752.01	4.49	93.92	752.01	4.49	93.92	264.59	1.69	34.00	264.59	1.69	34.00
9/14	626.39	4.13	77.54	626.39	4.13	77.54	212.63	1.59	27.21	212.63	1.59	27.21
9/15	707.60	4.11	88.65	707.60	4.11	88.65	235.68	1.39	30.48	235.68	1.39	30.48
9/16	725.46	4.20	90.93	725.46	4.20	90.93	239.24	1.42	30.83	239.24	1.42	30.83
9/17	666.12	3.84	84.67	666.12	3.84	84.67	221.64	1.31	29.06	221.64	1.31	29.06
9/18	801.93	4.35	98.94	801.93	4.35	98.94	272.88	1.51	34.53	272.88	1.51	34.53
9/19	976.82	4.95	119.82	976.82	4.95	119.82	326.38	1.71	41.35	326.38	1.71	41.35
9/20	1,047.76	5.20	128.84	1,047.76	5.20	128.84	351.43	1.79	44.53	351.43	1.79	44.53
9/21	1,048.51	5.22	128.83	1,048.51	5.22	128.83	352.18	1.79	44.56	352.18	1.79	44.56
9/22	1,025.39	5.24	126.38	1,025.39	5.24	126.38	335.73	1.77	42.59	335.73	1.77	42.59
9/23	1,107.17	5.56	135.58	1,107.17	5.56	135.58	365.76	1.89	46.10	365.76	1.89	46.10
9/24	956.87	5.15	117.23	956.87	5.15	117.23	330.31	1.77	41.68	330.31	1.77	41.68
9/25	815.34	4.41	101.43	815.34	4.41	101.43	273.10	1.52	34.76	273.10	1.52	34.76
9/26	659.29	3.68	82.06	659.29	3.68	82.06	217.70	1.25	27.90	217.70	1.25	27.90
9/27	709.21	4.09	86.19	709.21	4.09	86.19	233.28	1.39	29.28	233.28	1.39	29.28
9/28	781.64	4.40	95.02	781.64	4.40	95.02	261.94	1.51	32.68	261.94	1.51	32.68
9/29	792.35	4.40	96.11	792.35	4.40	96.11	268.33	1.54	33.42	268.33	1.54	33.42
9/30	855.00	4.66	102.73	855.00	4.66	102.73	296.22	1.66	36.42	296.22	1.66	36.42
Average	1,336.57	6.32	169.62	1,336.57	6.32	169.62	487.52	2.37	63.46	487.52	2.37	63.46

Table E-6. Daily wildfire emissions extracted from the SMOKE gridded emissions in 2011 and 2017 (metric tons/day)

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
5/1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/7	0.05	0.01	0.22	0.05	0.01	0.22	0.00	0.00	0.00	0.00	0.00	0.00
5/8	10.19	1.22	42.44	10.19	1.22	42.44	0.00	0.00	0.00	0.00	0.00	0.00
5/9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/27	0.01	0.00	0.05	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
5/28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/1	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
6/2	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
6/3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/4	0.14	0.02	0.57	0.14	0.02	0.57	0.00	0.00	0.00	0.00	0.00	0.00
6/5	0.14	0.02	0.57	0.14	0.02	0.57	0.00	0.00	0.00	0.00	0.00	0.00
6/6	0.11	0.01	0.44	0.11	0.01	0.44	0.00	0.00	0.00	0.00	0.00	0.00
6/7	0.06	0.01	0.25	0.06	0.01	0.25	0.00	0.00	0.00	0.00	0.00	0.00

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
6/8	0.06	0.01	0.25	0.06	0.01	0.25	0.00	0.00	0.00	0.00	0.00	0.00
6/9	0.03	0.00	0.13	0.03	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00
6/10	17.43	1.47	73.32	17.43	1.47	73.32	17.40	1.47	73.19	17.40	1.47	73.19
6/11	0.03	0.00	0.13	0.03	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00
6/12	0.76	0.09	3.16	0.76	0.09	3.16	0.00	0.00	0.00	0.00	0.00	0.00
6/13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/16	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
6/17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/18	0.09	0.01	0.38	0.09	0.01	0.38	0.09	0.01	0.38	0.09	0.01	0.38
6/19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/27	22.11	2.65	92.06	22.11	2.65	92.06	22.11	2.65	92.06	22.11	2.65	92.06
6/28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2	3.07	0.37	12.77	3.07	0.37	12.77	3.07	0.37	12.77	3.07	0.37	12.77
7/3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
7/17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/23	1.04	0.13	4.34	1.04	0.13	4.34	1.04	0.13	4.33	1.04	0.13	4.33
7/24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/28	11.68	1.15	48.93	11.68	1.15	48.93	11.68	1.15	48.93	11.68	1.15	48.93
7/29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/31	0.03	0.00	0.13	0.03	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00
8/1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/11	0.76	0.09	3.16	0.76	0.09	3.16	0.76	0.09	3.16	0.76	0.09	3.16
8/12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/18	0.01	0.00	0.05	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
8/19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/20	1.36	0.16	5.67	1.36	0.16	5.67	1.36	0.16	5.67	1.36	0.16	5.67
8/21	10.81	1.30	45.00	10.81	1.30	45.00	10.81	1.30	45.00	10.81	1.30	45.00
8/22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/24	9.71	1.02	40.62	9.71	1.02	40.62	0.00	0.00	0.00	0.00	0.00	0.00

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
8/25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/29	13.29	1.63	55.31	13.29	1.63	55.31	0.00	0.00	0.00	0.00	0.00	0.00
8/30	150.88	17.35	629.14	150.88	17.35	629.14	0.00	0.00	0.00	0.00	0.00	0.00
8/31	133.58	16.39	555.76	133.58	16.39	555.76	0.00	0.00	0.00	0.00	0.00	0.00
9/1	72.08	8.18	300.68	72.08	8.18	300.68	0.00	0.00	0.00	0.00	0.00	0.00
9/2	4.43	0.54	18.44	4.43	0.54	18.44	0.00	0.00	0.00	0.00	0.00	0.00
9/3	8.86	1.09	36.87	8.86	1.09	36.87	0.00	0.00	0.00	0.00	0.00	0.00
9/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/7	3.23	0.38	13.46	3.23	0.38	13.46	0.00	0.00	0.00	0.00	0.00	0.00
9/8	0.01	0.00	0.02	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
9/9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/15	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
9/16	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
9/17	4.64	0.42	19.50	4.64	0.42	19.50	0.76	0.09	3.16	0.76	0.09	3.16
9/18	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02
9/19	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02
9/20	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02
9/21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/22	3.89	0.33	16.36	3.89	0.33	16.36	0.00	0.00	0.00	0.00	0.00	0.00
9/23	3.89	0.33	16.36	3.89	0.33	16.36	0.00	0.00	0.00	0.00	0.00	0.00
9/24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/27	9.23	0.64	38.99	9.23	0.64	38.99	0.00	0.00	0.00	0.00	0.00	0.00
9/28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/30	1.28	0.16	5.32	1.28	0.16	5.32	1.28	0.16	5.32	1.28	0.16	5.32
Average	3.26	0.37	13.60	3.26	0.37	13.60	0.46	0.05	1.92	0.46	0.05	1.92

Table E-7. Daily total emissions for the 4 km modeling domain and the Maricopa eight-hour ozone nonattainment area extracted from the SMOKE gridded emissions (metric tons/day)

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
5/1	479.07	160.27	853.19	455.39	107.22	686.56	272.47	130.91	736.11	252.41	86.04	588.39
5/2	580.94	242.42	1,098.30	553.09	158.49	870.36	322.84	200.27	964.82	297.94	128.87	761.00
5/3	837.64	249.63	1,194.38	807.74	163.00	955.39	415.11	205.72	1,034.63	388.28	131.97	821.07
5/4	1,167.10	255.68	1,273.74	1,135.55	167.09	1,025.88	536.86	210.15	1,085.52	508.45	134.72	863.92
5/5	1,211.94	257.08	1,292.38	1,180.12	167.77	1,043.43	570.42	211.21	1,100.36	541.76	135.17	877.94
5/6	1,229.12	262.31	1,316.61	1,196.82	170.09	1,060.88	576.83	215.32	1,120.91	547.78	136.76	892.40
5/7	1,129.33	193.09	1,105.72	1,099.23	128.75	902.22	518.37	156.77	921.06	492.34	102.40	740.66
5/8	915.00	165.82	1,007.19	888.18	111.22	830.02	429.06	133.64	807.53	406.04	87.33	650.45
5/9	530.90	238.10	1,062.27	503.67	156.26	840.53	302.78	196.71	933.84	278.48	127.12	735.66
5/10	469.69	241.14	1,052.86	442.85	158.29	830.84	279.53	199.21	930.37	255.63	128.85	731.97
5/11	630.62	247.72	1,135.18	602.21	162.06	901.46	344.33	204.43	995.51	318.94	131.60	786.70
5/12	910.32	252.16	1,222.96	880.06	164.70	980.00	459.25	207.66	1,058.41	432.12	133.24	841.37
5/13	1,272.74	262.06	1,332.45	1,239.83	169.86	1,074.82	596.26	215.22	1,134.42	566.62	136.66	904.29
5/14	923.92	190.87	1,066.86	894.74	127.15	866.70	449.95	155.37	899.70	424.84	101.57	722.39
5/15	806.12	163.81	949.31	779.79	109.45	773.34	401.36	133.31	801.48	378.82	87.24	645.50
5/16	697.12	242.03	1,131.95	668.74	158.40	902.75	369.17	199.79	986.70	343.79	128.61	781.92
5/17	570.68	241.93	1,096.44	543.18	158.69	870.08	321.40	199.80	963.15	296.87	129.05	760.95
5/18	438.97	236.13	1,039.22	411.78	155.99	816.99	257.77	195.07	919.15	233.57	127.06	720.65
5/19	514.22	244.57	1,090.94	486.90	160.47	861.60	296.68	202.00	962.58	272.34	130.58	757.62
5/20	695.72	252.48	1,172.76	666.44	164.17	931.82	371.36	208.11	1,025.23	345.19	132.97	810.00
5/21	878.44	189.38	1,048.53	849.90	126.42	850.43	433.01	154.28	888.10	408.49	101.12	712.60
5/22	873.78	164.69	966.96	846.82	109.89	788.96	425.02	133.95	812.56	401.85	87.48	654.74
5/23	799.06	245.81	1,177.35	769.43	160.38	941.55	406.45	202.83	1,021.31	379.90	130.06	810.57
5/24	801.26	247.61	1,166.81	772.57	162.05	933.13	408.26	204.15	1,011.75	382.60	131.37	803.00
5/25	1,079.79	254.17	1,256.96	1,048.73	165.85	1,010.98	518.74	209.16	1,077.21	490.83	133.95	857.41
5/26	1,260.68	256.90	1,304.87	1,228.44	167.49	1,054.01	584.57	211.13	1,107.25	555.52	134.99	883.10
5/27	1,413.76	262.32	1,354.19	1,380.76	170.19	1,095.82	644.25	215.20	1,143.11	614.54	136.70	912.33
5/28	1,283.50	191.48	1,142.12	1,251.99	127.90	934.14	579.33	155.38	943.47	551.99	101.63	759.17
5/29	787.72	161.16	933.97	761.81	107.61	760.59	390.43	131.05	785.55	368.31	85.69	631.95
5/30	700.62	162.05	902.48	676.11	108.37	733.20	358.93	131.99	765.75	338.09	86.55	615.76
5/31	1,210.02	251.88	1,254.47	1,179.02	164.64	1,011.17	571.23	207.04	1,067.95	543.34	132.74	850.54
6/1	1,448.33	264.94	1,340.94	1,416.19	175.83	1,093.28	652.41	219.03	1,125.13	624.02	143.15	904.21
6/2	1,103.56	264.57	1,305.87	1,071.60	174.74	1,058.12	523.98	219.33	1,112.80	495.76	142.86	891.89
6/3	1,143.96	268.69	1,327.15	1,111.01	175.90	1,073.35	531.91	222.47	1,130.36	502.76	143.36	903.98
6/4	1,333.99	199.97	1,199.77	1,299.31	135.71	990.61	594.24	163.22	982.48	565.37	108.93	798.80
6/5	1,512.99	175.61	1,151.21	1,478.78	119.51	960.67	661.44	142.87	927.27	632.85	95.17	760.09
6/6	1,125.07	258.39	1,306.50	1,092.20	170.44	1,060.10	527.38	213.87	1,110.74	498.40	139.37	891.13
6/7	1,177.38	262.22	1,308.40	1,145.05	173.35	1,061.57	538.77	217.32	1,111.39	510.16	141.61	891.26

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
6/8	1,112.49	263.73	1,314.00	1,079.91	174.42	1,064.81	520.74	218.79	1,120.07	491.92	142.72	897.82
6/9	1,134.25	265.95	1,327.59	1,101.01	175.37	1,075.28	532.94	220.52	1,132.61	503.49	143.35	907.62
6/10	1,331.27	271.48	1,458.73	1,296.74	178.26	1,197.99	618.90	224.93	1,247.10	588.27	145.41	1,014.51
6/11	1,288.03	199.73	1,203.03	1,253.45	135.54	993.24	582.16	163.18	987.84	553.44	108.92	803.61
6/12	1,325.45	174.29	1,125.02	1,292.56	118.58	936.53	590.84	141.67	911.44	563.62	94.31	746.11
6/13	1,353.03	260.13	1,347.65	1,319.41	171.57	1,098.56	609.01	215.08	1,135.52	579.14	139.46	913.28
6/14	1,670.83	266.74	1,422.47	1,635.24	176.25	1,165.03	741.18	220.02	1,185.96	709.39	142.79	956.30
6/15	1,939.39	268.06	1,480.43	1,902.35	177.74	1,217.27	830.65	220.81	1,219.55	797.49	143.74	984.70
6/16	1,788.84	268.90	1,459.21	1,752.82	177.75	1,197.34	773.64	221.61	1,207.72	741.58	143.85	974.18
6/17	1,650.39	270.39	1,455.40	1,613.86	177.24	1,189.03	718.00	222.79	1,212.64	685.45	143.24	974.97
6/18	1,719.40	201.23	1,276.30	1,683.24	136.88	1,062.65	738.17	163.40	1,025.59	707.97	108.96	837.95
6/19	1,560.08	174.79	1,155.19	1,527.19	119.30	966.66	674.38	141.76	924.05	647.20	94.58	758.70
6/20	1,656.15	261.25	1,403.22	1,621.57	172.66	1,151.09	718.54	215.64	1,164.98	687.78	139.98	940.06
6/21	2,137.66	268.98	1,502.02	2,100.51	177.94	1,240.59	915.72	221.38	1,227.74	882.47	143.66	994.53
6/22	2,625.26	271.46	1,584.63	2,586.32	180.17	1,317.97	1,097.12	222.92	1,271.27	1,062.08	144.99	1,033.40
6/23	2,357.55	268.35	1,567.92	2,318.94	178.07	1,298.35	997.17	220.63	1,271.62	962.61	143.54	1,031.14
6/24	2,185.55	267.67	1,570.22	2,146.33	176.52	1,294.00	927.29	220.07	1,284.64	892.22	142.15	1,038.20
6/25	2,318.20	200.88	1,384.71	2,278.98	137.45	1,163.84	967.32	162.43	1,085.63	934.15	108.70	891.49
6/26	2,415.44	178.20	1,303.71	2,377.38	121.97	1,105.66	1,006.35	143.54	1,005.68	974.16	95.67	831.75
6/27	2,788.77	269.60	1,687.93	2,748.12	179.41	1,423.25	1,171.44	221.70	1,363.74	1,134.69	144.57	1,127.51
6/28	2,734.33	266.09	1,611.77	2,694.86	177.05	1,342.23	1,144.21	218.33	1,288.85	1,108.80	142.24	1,048.29
6/29	2,421.48	260.45	1,594.09	2,381.86	174.28	1,320.72	1,031.60	214.13	1,291.36	996.08	140.53	1,047.38
6/30	2,022.57	268.18	1,509.73	1,985.32	177.54	1,243.87	868.21	220.76	1,237.21	835.01	143.40	1,000.05
7/1	2,572.26	271.00	1,555.68	2,532.98	180.50	1,290.58	1,072.37	222.82	1,246.69	1,036.94	145.58	1,010.23
7/2	3,042.22	200.38	1,454.40	3,000.93	140.51	1,236.85	1,239.37	161.60	1,106.61	1,203.90	111.02	915.62
7/3	2,239.31	165.01	1,259.79	2,202.05	116.61	1,066.02	975.84	133.02	978.28	944.24	91.99	808.48
7/4	1,738.13	160.09	1,178.32	1,704.08	113.81	986.02	765.26	129.80	937.39	736.78	90.57	768.74
7/5	1,802.45	239.90	1,453.86	1,766.16	165.11	1,191.65	812.42	198.42	1,205.50	779.93	134.69	971.70
7/6	1,971.43	242.27	1,458.69	1,936.34	167.53	1,198.00	872.67	199.84	1,199.73	841.29	136.25	967.11
7/7	2,211.55	245.55	1,513.46	2,174.70	168.85	1,250.14	971.34	202.50	1,233.05	938.36	137.16	998.19
7/8	2,348.37	254.43	1,562.73	2,309.53	172.20	1,290.37	988.76	209.19	1,266.87	953.92	139.00	1,023.84
7/9	2,436.25	189.56	1,370.63	2,397.95	134.13	1,154.25	1,029.18	153.40	1,065.87	996.77	106.62	875.81
7/10	2,035.02	162.24	1,214.00	2,001.16	115.71	1,023.61	889.85	131.12	952.54	861.47	91.69	785.63
7/11	1,782.91	233.48	1,382.86	1,749.67	161.04	1,134.24	793.47	192.98	1,143.05	763.89	131.22	921.24
7/12	1,811.56	249.06	1,444.85	1,775.78	169.95	1,185.38	791.10	205.78	1,192.79	759.18	138.36	961.31
7/13	1,718.68	264.75	1,412.57	1,683.01	178.30	1,158.03	757.20	218.62	1,168.63	725.32	145.04	941.63
7/14	1,488.69	261.79	1,361.82	1,454.36	176.09	1,111.98	665.07	216.55	1,137.40	634.48	143.60	914.59
7/15	1,562.55	264.49	1,388.50	1,527.58	176.19	1,132.84	689.21	218.40	1,157.86	658.05	143.13	929.87
7/16	1,796.97	198.89	1,255.13	1,760.74	138.00	1,046.09	771.93	161.70	1,001.61	741.46	110.31	818.17

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
7/17	2,128.57	175.19	1,231.26	2,091.01	122.25	1,038.11	912.14	141.35	961.34	880.17	96.39	791.87
7/18	1,991.51	244.41	1,462.25	1,953.05	166.65	1,203.32	891.62	201.76	1,203.17	856.97	135.38	972.13
7/19	2,182.67	249.51	1,515.58	2,144.82	170.51	1,251.62	941.48	205.69	1,234.10	907.53	138.34	998.71
7/20	2,197.28	251.72	1,530.20	2,158.67	172.21	1,263.14	943.97	207.59	1,247.85	909.32	139.87	1,009.68
7/21	2,178.93	253.18	1,502.74	2,141.39	172.70	1,240.90	926.89	208.70	1,224.29	893.17	140.12	990.79
7/22	1,824.64	259.49	1,472.94	1,787.30	174.16	1,207.02	803.32	214.01	1,218.94	769.98	141.22	981.75
7/23	1,342.46	183.56	1,226.68	1,305.86	129.49	1,012.43	643.69	149.98	1,012.49	612.93	104.38	824.43
7/24	1,385.85	160.01	1,122.01	1,352.19	114.22	930.72	639.65	129.29	914.46	611.57	90.49	746.64
7/25	1,113.63	230.90	1,296.69	1,080.68	159.85	1,046.78	477.60	190.73	1,105.17	448.24	130.16	882.20
7/26	1,917.02	249.99	1,460.34	1,880.16	170.68	1,198.86	798.20	206.37	1,200.25	765.23	138.76	967.01
7/27	1,881.75	252.92	1,450.48	1,845.70	172.75	1,187.48	802.27	208.60	1,195.16	770.10	140.37	960.29
7/28	1,278.15	252.57	1,424.20	1,240.63	172.26	1,162.12	570.42	208.83	1,218.70	536.82	140.39	984.92
7/29	1,180.94	250.05	1,390.61	1,143.27	168.83	1,121.18	582.86	206.79	1,196.41	549.15	137.50	955.99
7/30	1,751.58	186.63	1,283.82	1,712.89	131.64	1,066.25	774.35	151.77	1,035.79	741.44	105.36	844.68
7/31	1,919.60	161.78	1,212.41	1,883.12	115.00	1,017.54	833.79	130.90	958.57	802.90	91.23	787.60
8/1	2,121.46	244.86	1,493.36	2,085.45	173.90	1,231.04	894.75	202.18	1,218.45	862.49	142.28	984.65
8/2	2,701.37	256.98	1,601.48	2,661.84	182.05	1,331.77	1,115.94	211.69	1,278.86	1,080.35	148.42	1,038.61
8/3	2,705.92	258.26	1,606.36	2,666.97	183.58	1,336.49	1,108.32	212.84	1,279.82	1,073.34	149.97	1,039.45
8/4	2,364.45	252.15	1,554.22	2,327.29	179.48	1,286.00	972.87	208.32	1,253.97	939.49	147.05	1,015.02
8/5	2,341.89	263.50	1,594.07	2,302.41	183.04	1,315.94	967.71	217.25	1,291.49	932.34	149.16	1,043.68
8/6	2,008.06	197.41	1,341.43	1,970.16	143.52	1,121.07	839.47	160.44	1,063.23	807.53	115.59	869.99
8/7	1,759.73	166.59	1,204.91	1,723.94	122.39	1,007.57	767.99	135.30	961.67	737.88	98.31	788.68
8/8	1,590.63	241.70	1,434.60	1,554.76	171.20	1,171.35	749.47	200.75	1,204.52	717.43	141.24	969.94
8/9	1,665.74	257.95	1,432.45	1,629.14	181.20	1,170.28	719.48	213.74	1,194.19	686.84	148.98	960.70
8/10	1,580.41	262.82	1,432.36	1,543.80	184.56	1,169.07	690.92	217.82	1,196.87	658.28	151.90	962.41
8/11	1,219.32	243.82	1,387.46	1,184.63	173.64	1,123.65	579.32	203.02	1,184.37	548.48	143.91	949.37
8/12	1,376.85	251.68	1,426.88	1,341.46	175.76	1,156.84	642.56	208.88	1,209.17	611.14	144.73	968.60
8/13	1,267.87	190.14	1,222.57	1,231.67	138.97	1,003.75	521.68	155.24	1,004.73	491.32	112.71	812.79
8/14	1,773.95	167.45	1,199.80	1,738.44	122.80	1,003.44	734.71	135.88	953.01	704.91	98.49	780.94
8/15	1,676.56	251.31	1,437.60	1,639.63	176.12	1,176.44	730.05	208.42	1,194.78	696.99	144.93	962.10
8/16	1,596.67	250.99	1,435.61	1,560.18	177.45	1,171.68	726.52	208.26	1,204.12	693.91	146.23	969.08
8/17	2,083.79	254.26	1,525.86	2,045.37	180.74	1,254.38	892.54	210.09	1,253.42	858.12	148.17	1,011.65
8/18	2,364.12	254.95	1,558.38	2,324.80	180.64	1,289.31	988.15	210.48	1,260.17	952.88	147.81	1,020.54
8/19	2,000.79	253.45	1,521.33	1,963.83	177.37	1,247.53	851.48	209.38	1,250.81	818.40	145.09	1,006.85
8/20	1,783.82	196.44	1,304.06	1,746.69	142.54	1,085.64	759.88	159.94	1,046.78	728.63	115.07	855.23
8/21	1,925.90	176.40	1,257.11	1,889.97	128.17	1,063.10	813.00	143.10	999.97	782.77	102.66	830.04
8/22	2,285.11	259.11	1,522.74	2,245.98	181.16	1,258.57	953.13	213.76	1,235.00	917.96	147.86	999.56
8/23	2,599.88	261.60	1,577.77	2,559.85	184.18	1,309.43	1,070.17	215.51	1,265.37	1,034.12	150.13	1,026.39
8/24	2,213.97	265.85	1,589.12	2,173.25	187.29	1,317.75	922.24	218.62	1,261.84	885.57	152.38	1,020.12

	4 km Modeling Domain						Eight-Hour Ozone Nonattainment Area					
	2011			2017			2011			2017		
Date	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO	VOC	NOx	CO
8/25	2,212.77	260.32	1,544.76	2,172.77	183.27	1,273.80	949.55	215.02	1,260.89	913.58	149.96	1,019.51
8/26	2,427.10	265.41	1,611.54	2,384.35	183.98	1,328.81	999.22	218.56	1,306.29	960.56	149.62	1,054.30
8/27	2,350.54	196.59	1,387.16	2,310.33	143.33	1,163.37	963.43	159.23	1,086.55	929.14	114.88	890.17
8/28	1,813.51	167.58	1,211.21	1,777.53	122.75	1,015.36	771.73	135.78	960.34	741.39	98.23	788.81
8/29	2,157.03	257.14	1,558.09	2,118.26	180.60	1,294.08	860.97	210.82	1,221.99	826.10	146.12	986.71
8/30	2,322.20	277.73	2,156.20	2,282.90	200.25	1,888.31	857.33	214.81	1,239.36	822.04	149.38	1,000.73
8/31	2,208.55	279.63	2,084.57	2,168.85	201.60	1,814.65	837.65	217.34	1,247.89	801.95	151.59	1,007.46
9/1	2,125.72	263.67	1,800.73	2,086.41	180.17	1,530.71	829.18	210.27	1,228.17	793.39	138.98	986.70
9/2	1,511.47	250.42	1,449.34	1,475.95	168.16	1,176.93	626.91	206.01	1,200.55	594.90	135.75	957.07
9/3	1,892.99	196.42	1,305.04	1,857.86	135.20	1,087.13	768.55	158.27	1,017.62	737.82	106.51	824.53
9/4	1,962.47	170.30	1,176.58	1,928.68	117.36	984.03	786.49	137.25	929.28	756.83	92.33	758.70
9/5	1,469.86	164.39	1,119.55	1,437.25	114.06	926.30	666.85	133.41	917.70	638.46	90.71	746.44
9/6	1,476.72	243.04	1,394.12	1,440.84	164.58	1,130.28	637.58	200.95	1,175.23	605.08	134.00	939.32
9/7	1,851.96	251.25	1,469.03	1,815.15	170.15	1,202.43	747.19	206.80	1,202.78	713.83	137.62	964.34
9/8	1,898.78	255.22	1,460.07	1,861.22	171.44	1,193.91	751.92	210.35	1,201.66	717.87	138.83	963.63
9/9	1,395.96	258.31	1,377.41	1,360.91	171.30	1,112.30	580.88	213.09	1,158.65	549.31	138.80	921.68
9/10	1,268.82	185.98	1,149.81	1,237.07	128.47	940.77	540.40	151.75	949.40	512.87	103.23	764.26
9/11	1,151.27	161.32	1,033.69	1,122.10	111.82	849.03	504.93	131.37	854.68	479.70	89.43	691.02
9/12	1,193.48	238.84	1,284.04	1,160.60	161.18	1,035.86	529.80	197.86	1,092.38	500.15	131.60	870.41
9/13	968.28	238.61	1,246.56	936.75	161.67	1,001.91	457.09	198.06	1,074.57	428.73	132.55	855.92
9/14	841.41	238.12	1,231.42	810.27	161.77	985.59	404.01	197.89	1,068.95	376.02	132.91	849.20
9/15	925.15	244.32	1,264.27	893.07	164.78	1,014.21	429.43	202.81	1,092.09	400.58	135.05	868.53
9/16	945.91	252.27	1,305.74	912.37	167.63	1,044.57	435.44	208.99	1,127.38	405.23	136.77	893.90
9/17	877.89	192.58	1,106.29	847.03	131.48	900.17	402.36	157.47	922.70	375.76	105.91	740.10
9/18	1,005.97	168.89	1,010.95	976.54	115.52	827.86	450.20	137.80	843.86	424.71	92.57	681.66
9/19	1,198.75	250.87	1,286.89	1,165.07	167.30	1,038.82	524.06	207.71	1,095.03	493.56	136.38	873.20
9/20	1,271.79	256.22	1,312.99	1,237.59	170.89	1,061.08	551.03	211.92	1,113.76	520.02	139.15	888.50
9/21	1,274.12	259.39	1,321.53	1,239.84	173.21	1,068.57	553.22	214.57	1,121.60	522.15	141.12	895.49
9/22	1,256.47	259.21	1,351.61	1,221.21	172.92	1,095.12	538.22	214.19	1,134.44	506.25	140.59	905.11
9/23	1,342.41	268.38	1,401.12	1,305.71	176.69	1,133.79	571.91	221.31	1,174.03	538.60	142.99	935.04
9/24	1,172.63	199.56	1,155.29	1,138.91	135.32	942.19	518.11	162.88	964.68	488.71	108.57	775.84
9/25	1,020.50	168.88	1,024.20	990.46	115.53	839.01	451.46	137.80	853.88	425.47	92.57	689.78
9/26	877.01	250.51	1,228.59	844.94	166.75	985.18	411.58	207.88	1,062.97	382.67	136.43	845.36
9/27	938.91	253.30	1,303.14	905.63	169.21	1,053.04	429.64	209.52	1,092.87	399.62	137.83	869.29
9/28	1,000.67	250.06	1,275.13	967.86	167.96	1,023.79	457.00	207.33	1,098.44	427.45	137.39	873.66
9/29	1,012.85	251.29	1,281.20	980.16	168.51	1,029.77	464.72	208.37	1,103.57	435.30	137.85	878.85
9/30	1,081.91	261.14	1,344.95	1,046.24	172.35	1,078.77	498.35	216.13	1,157.75	466.13	140.33	919.84
Average	1,562.26	232.68	1,334.80	1,527.73	158.01	1,095.30	683.76	191.12	1,097.06	653.27	127.71	884.01

APPENDIX F

DEVELOPMENT OF 2018 EMISSIONS INVENTORY
FOR CONTINGENCY MEASURES

The 2018 anthropogenic emissions inventory for the Maricopa eight-hour ozone nonattainment area was based on the same approaches used in the development of 2017 emissions. The growth factors from 2011 and 2018 were developed to calculate the 2018 point, area, nonroad, and onroad source emissions. The socio-economic projections from 2011 to 2018 were used to develop the growth factors in Tables F-1 and F-2.

Table F-1. Growth indices and growth factors for non-EGU point and area sources in Maricopa County

Growth Index	2011	2018	Growth Factor
Agricultural Acres	275,050	267,006	0.97
Airport Operations	1,718,536	1,820,844	1.06
Gasoline Consumption (gallons/day)	4,308,054	3,834,168	0.89
Industrial Employment	336,654	407,742	1.21
Number of Aircrafts at Luke AFB	136	154	1.13
Population	3,843,373	4,331,088	1.13
Roadway Lane Miles	22,551	23,137	1.03

Table F-2. Growth indices and growth factors for non-EGU point and area sources in Pinal County

Growth Index	2011	2018	Growth Factor
Agricultural Acres	449,368	447,088	0.99
Airport Operations	175,528	260,812	1.49
Gasoline Consumption (gallons/day)	417,529	359,075	0.86
Industrial Employment	8,111	8,351	1.03
Population	384,221	460,921	1.20
Roadway Lane Miles	6,368	6,508	1.02

Point Source Emissions

The growth factors for the non-EGU point sources emissions were developed using industrial employment estimates for 2011 and 2018. Two additional growth factors based on population and the number of military aircrafts were used to calculate emissions at Northwest Regional Landfill and Luke Air Force Base (not the aircraft emissions), respectively. All EGU point source emissions in 2018 were assumed to be the same as those in 2017.

Area Source Emissions

The 2018 area source emissions in Maricopa and Pinal Counties were projected from the 2011 base year area source emissions by applying the growth factors. The growth factors developed from the socio-economic data are available in Tables F-1 and F-2. The 2018 emissions for the ten area source categories for the portable fuel containers (PFC) were obtained by interpolating the EPA 2015 and 2020 controlled emissions for PFC.

Nonroad Source Emissions

The EPA MOVES2014a model was used to estimate daily nonroad mobile source emissions in 2018. MOVES2014a nonroad model runs for the year 2018 are based on the 2018 default values of the model for Maricopa and Pinal Counties.

Airport emissions in 2018 were developed using the EDMS model. The 2018 operation data were obtained from the FAA Terminal Area Forecast (TAF) (FAA, 2016) for the eight major airports among the airports in Table III-3. The operation data for the six small airports were assumed to be unchanged from 2011 to 2018 because no operation data for the year 2018 were available for the small airports. The 2018 emissions for the fourteen airports were calculated using the FAA EDMS model and the 2011 temporal profiles and 2011 meteorology.

Luke AFB F-16 aircraft emissions in 2011 were projected using the ratio of F-16 aircrafts in 2018 to those in 2011. Luke AFB aircraft and GSE emissions for the future fleet of 144 F-35 aircrafts of the L6 scenario were obtained from the 2012 environmental impact statement (USAF, 2012). The 2018 future year emissions were calculated by multiplying the ratio of the 82 F-35 aircrafts in 2018 to the 144 F-35 aircrafts by the L6 scenario emissions then adding the F-16 aircraft emissions in 2018 to the F-35 emissions in 2018. The 2018 locomotive emissions were assumed to be constant between 2017 and 2018.

Onroad Mobile Source Emissions

The 2018 onroad mobile source emissions for the Maricopa eight-hour ozone nonattainment area were developed using EPA MOVES2014a model, MOVESLINK2014 tool, and local input data. The 2018 traffic assignment data were provided by the MAG transportation modeling group to develop onroad emissions based on link-specific vehicle speeds and VMTs.

APPENDIX G

MODEL INPUT FILES

Appendix G-1

MOVES2014a Input Files

Onroad Mobile Sources

In order to calculate onroad source emissions, MOVES2014a was executed using local input data for each episode day and each geographical area (Area A and outside Area A). The following contains a portion of the MOVES2014a RunSpec and local input data for June 9, 2017 as an example.

MOVES2014a RunSpec

```
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<pollutantprocessassociation pollutantkey="185" pollutantname="Naphthalene gas" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="185" pollutantname="Naphthalene gas" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="185" pollutantname="Naphthalene gas" processkey="18" processname="Refueling Displacement Vapor Loss"/>
<pollutantprocessassociation pollutantkey="185" pollutantname="Naphthalene gas" processkey="19" processname="Refueling Spillage Loss"/>
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useParameters No
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	<pmsize value="0"/>
	<outputfactors>
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	</outputfactors>
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</runspec>
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MOVES2014a Local Input Data

[HPMSvTypeYear]

HPMSVtypeID	yearID	HPMSBaseYearVMT
10	2017	195,878,101
25	2017	32,458,104,889
40	2017	78,591,751
50	2017	1,255,155,459
60	2017	897,530,012

[SourceTypeYear]

yearID	sourceTypeID	sourceTypePopulation
2017	11	104,220
2017	21	2,409,439
2017	31	528,885
2017	32	133,600
2017	41	268
2017	42	999
2017	43	8,962
2017	51	1,181
2017	52	41,019
2017	53	1,738
2017	54	10,716
2017	61	7,082
2017	62	7,938

[FuelFormulation]

fuel Formulation ID	fuel Subtype ID	RVP	sulfur Level	ETOH Volume	MTBE Volume	ETBE Volume	TAME Volume	aromatic Content	olefin Content	benzene Content	e200	e300	BioDiesel Ester Volume	Cetane Index	PAH Content	T50	T90
10	10	7	30	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	218	329
20	20	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	30	0	7.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	51	8	11	85	0	0	0	0	0	0	49.9	89.5	0	0	0	200	300
90	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	10	9	338	0	0	0	0	26.4	11.9	1.64	50	83	0	0	0	199.816	329.409
97	10	7	150	0	11.76	0	0	24	11	0.8	52	84	0	0	0	195.735	324.864
98	10	7	30	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	218	329
99	10	7	90	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	218	329
3577	12	7	9	10	0	0	0	21.98	4.44	0.53	44.52	88.81	0	0	0	211	303
3578	12	12	9	10	0	0	0	21.98	4.44	0.53	50.54	91.2	0	0	0	198.48	291.95
3579	12	10	9	10	0	0	0	21.98	4.44	0.53	47.91	90.16	0	0	0	203.85	296.69
25005	21	0	15	0	0	0	0	0	0	0	0	0	5	0	0	0	0
27001	52	10.5	8	74	0	0	0	0	0	0	49.9	89.5	0	0	0	200	300
27002	52	7.7	8	74	0	0	0	0	0	0	49.9	89.5	0	0	0	200	300
28001	30	0	7.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[FuelUsageFraction]

countyID	fuelYearID	modelYearGroupID	sourceBinFuelTypeID	fuelSupplyFuelTypeID	usageFraction
4013	2017	0	1	1	1
4013	2017	0	2	2	1
4013	2017	0	3	3	1
4013	2017	0	5	1	0.947025
4013	2017	0	5	5	0.052975
4013	2017	0	9	9	1

[FuelSupply]

fuelRegionID	fuelYearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV
1570011000	2017	6	3577	1	0.5
1570011000	2017	6	25005	1	0.5
1570011000	2017	6	27002	1	0.5
1570011000	2017	6	28001	1	0.5
1570011000	2017	6	90	1	0.5

[CountyYear]

countyID	yearID	refuelingVaporProgramAdjust	refuelingSpillProgramAdjust
4013	2017	0.5	0

[ZoneMonthHour]

monthID	zoneID	hourID	temperature	temperatureCV	relHumidity	heatIndex	specificHumidity	relativeHumidityCV
6	40130	1	81	0	14	0	0	0
6	40130	2	78	0	18	0	0	0
6	40130	3	76	0	20	0	0	0
6	40130	4	73	0	18	0	0	0
6	40130	5	73	0	21	0	0	0
6	40130	6	71	0	22	0	0	0
6	40130	7	73	0	17	0	0	0
6	40130	8	78	0	16	0	0	0
6	40130	9	82	0	12	0	0	0
6	40130	10	86	0	10	0	0	0
6	40130	11	89	0	9	0	0	0
6	40130	12	91	0	8	0	0	0
6	40130	13	94	0	7	0	0	0
6	40130	14	96	0	6	0	0	0
6	40130	15	97	0	6	0	0	0
6	40130	16	96	0	7	0	0	0
6	40130	17	96	0	5	0	0	0
6	40130	18	96	0	6	0	0	0
6	40130	19	95	0	6	0	0	0
6	40130	20	93	0	8	0	0	0
6	40130	21	92	0	7	0	0	0
6	40130	22	86	0	11	0	0	0
6	40130	23	88	0	10	0	0	0
6	40130	24	87	0	11	0	0	0

[SourceTypeAgeDistribution]

sourceTypeID	yearID	ageID	ageFraction
11	2017	0	0.072895
11	2017	1	0.072853
11	2017	2	0.040005
11	2017	3	0.059060
11	2017	4	0.054325
11	2017	5	0.045513
11	2017	6	0.031160
11	2017	7	0.022984
11	2017	8	0.051146
11	2017	9	0.053235
11	2017	10	0.068588
11	2017	11	0.066135
11	2017	12	0.055870
11	2017	13	0.041153
11	2017	14	0.047875
11	2017	15	0.038518
11	2017	16	0.032886
11	2017	17	0.027435
11	2017	18	0.023529
11	2017	19	0.016352
11	2017	20	0.012991
11	2017	21	0.011992
11	2017	22	0.009993
11	2017	23	0.008267
11	2017	24	0.007631
11	2017	25	0.005360
11	2017	26	0.003997
11	2017	27	0.003725
11	2017	28	0.003906
11	2017	29	0.003725
11	2017	30	0.006898
21	2017	0	0.072895
21	2017	1	0.071856
21	2017	2	0.048455
21	2017	3	0.068901
21	2017	4	0.069734
21	2017	5	0.058824
21	2017	6	0.047735
21	2017	7	0.041595
21	2017	8	0.033652
21	2017	9	0.051082
21	2017	10	0.059872
21	2017	11	0.057392
21	2017	12	0.053788
21	2017	13	0.045747
21	2017	14	0.037987
21	2017	15	0.031571
21	2017	16	0.026712
21	2017	17	0.023291
21	2017	18	0.018223
21	2017	19	0.013413
21	2017	20	0.011171
21	2017	21	0.007774
21	2017	22	0.006899
21	2017	23	0.004998
21	2017	24	0.003740
21	2017	25	0.002874
21	2017	26	0.002500
21	2017	27	0.002006
21	2017	28	0.001639
21	2017	29	0.001272
21	2017	30	0.022400
31	2017	0	0.081981
31	2017	1	0.082423
31	2017	2	0.027645
31	2017	3	0.057614
31	2017	4	0.050416
31	2017	5	0.040868
31	2017	6	0.038081
31	2017	7	0.023964
31	2017	8	0.019103
31	2017	9	0.045591
31	2017	10	0.058512
31	2017	11	0.061351
31	2017	12	0.050534
31	2017	13	0.050467
31	2017	14	0.041227
31	2017	15	0.035701
31	2017	16	0.038348
31	2017	17	0.032560
31	2017	18	0.024358
31	2017	19	0.018760
31	2017	20	0.018924
31	2017	21	0.013049
31	2017	22	0.012618
31	2017	23	0.010828
31	2017	24	0.007191
31	2017	25	0.004771
31	2017	26	0.004036
31	2017	27	0.003752
31	2017	28	0.003843
31	2017	29	0.002894
31	2017	30	0.038590
32	2017	0	0.081711
32	2017	1	0.081957
32	2017	2	0.031237
32	2017	3	0.057905
32	2017	4	0.051702
32	2017	5	0.043745
32	2017	6	0.039090
32	2017	7	0.023896
32	2017	8	0.019962
32	2017	9	0.046609
32	2017	10	0.062233
32	2017	11	0.065143
32	2017	12	0.050897
32	2017	13	0.047906
32	2017	14	0.038904
32	2017	15	0.033444
32	2017	16	0.036110
32	2017	17	0.032566
32	2017	18	0.023522
32	2017	19	0.017785
32	2017	20	0.017886
32	2017	21	0.012393
32	2017	22	0.011984
32	2017	23	0.010170
32	2017	24	0.006793
32	2017	25	0.004510
32	2017	26	0.003855
32	2017	27	0.003585
32	2017	28	0.003618
32	2017	29	0.002730
32	2017	30	0.036151
41	2017	0	0.057008
41	2017	1	0.055734
41	2017	2	0.077462
41	2017	3	0.058005
41	2017	4	0.051580
41	2017	5	0.055865
41	2017	6	0.035647
41	2017	7	0.016048
41	2017	8	0.021699
41	2017	9	0.042444
41	2017	10	0.089177
41	2017	11	0.086287
41	2017	12	0.058977
41	2017	13	0.040158
41	2017	14	0.028521
41	2017	15	0.022115
41	2017	16	0.029584
41	2017	17	0.037133
41	2017	18	0.033207
41	2017	19	0.018441
41	2017	20	0.017480
41	2017	21	0.014771
41	2017	22	0.014430
41	2017	23	0.008575
41	2017	24	0.005922
41	2017	25	0.004568
41	2017	26	0.003785
41	2017	27	0.004862
41	2017	28	0.002850
41	2017	29	0.002167
41	2017	30	0.005500
42	2017	0	0.056996
42	2017	1	0.055740
42	2017	2	0.077462
42	2017	3	0.058005
42	2017	4	0.051580
42	2017	5	0.055866
42	2017	6	0.035647
42	2017	7	0.016049
42	2017	8	0.021700
42	2017	9	0.042444
42	2017	10	0.089177
42	2017	11	0.086288
42	2017	12	0.058977
42	2017	13	0.040158
42	2017	14	0.028521
42	2017	15	0.022115
42	2017	16	0.029584
42	2017	17	0.037133
42	2017	18	0.033207
42	2017	19	0.018441
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42	2017	23	0.008575
42	2017	24	0.005922
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42	2017	28	0.002850
42	2017	29	0.002167
42	2017	30	0.005500
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43	2017	1	0.055542
43	2017	2	0.065161
43	2017	3	0.057586
43	2017	4	0.061693
43	2017	5	0.071253
43	2017	6	0.048220
43	2017	7	0.023309
43	2017	8	0.029156
43	2017	9	0.058731
43	2017	10	0.105822
43	2017	11	0.111603
43	2017	12	0.059966
43	2017	13	0.025132
43	2017	14	0.018150
43	2017	15	0.013351
43	2017	16	0.017008
43	2017	17	0.040209
43	2017	18	0.019004
43	2017	19	0.010282
43	2017	20	0.009713
43	2017	21	0.007556
43	2017	22	0.007113

sourceTypeID	yearID	ageID	ageFraction
43	2017	23	0.004592
43	2017	24	0.003264
43	2017	25	0.002399
43	2017	26	0.002545
43	2017	27	0.002487
43	2017	28	0.001840
43	2017	29	0.001517
43	2017	30	0.008771
51	2017	0	0.065776
51	2017	1	0.063998
51	2017	2	0.064529
51	2017	3	0.057028
51	2017	4	0.061095
51	2017	5	0.070427
51	2017	6	0.047492
51	2017	7	0.022921
51	2017	8	0.028613
51	2017	9	0.057545
51	2017	10	0.103685
51	2017	11	0.109130
51	2017	12	0.058541
51	2017	13	0.024486
51	2017	14	0.017654
51	2017	15	0.012986
51	2017	16	0.016509
51	2017	17	0.038966
51	2017	18	0.018377
51	2017	19	0.009927
51	2017	20	0.009358
51	2017	21	0.007268
51	2017	22	0.006940
51	2017	23	0.004456
51	2017	24	0.003224
51	2017	25	0.002337
51	2017	26	0.002478
51	2017	27	0.002386
51	2017	28	0.001749
51	2017	29	0.001420
51	2017	30	0.008698
52	2017	0	0.066164
52	2017	1	0.064310
52	2017	2	0.053864
52	2017	3	0.056621
52	2017	4	0.057847
52	2017	5	0.061868
52	2017	6	0.044652
52	2017	7	0.023006
52	2017	8	0.025871
52	2017	9	0.054194
52	2017	10	0.091220
52	2017	11	0.096008
52	2017	12	0.056642
52	2017	13	0.032082
52	2017	14	0.024601
52	2017	15	0.019941
52	2017	16	0.023680
52	2017	17	0.038299
52	2017	18	0.020927
52	2017	19	0.013109
52	2017	20	0.012782
52	2017	21	0.009437
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52	2017	26	0.003187
52	2017	27	0.002998
52	2017	28	0.002557
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52	2017	30	0.018019
53	2017	0	0.065910
53	2017	1	0.064079
53	2017	2	0.063750
53	2017	3	0.057306
53	2017	4	0.061224
53	2017	5	0.069893
53	2017	6	0.047438
53	2017	7	0.022894
53	2017	8	0.028388
53	2017	9	0.057272
53	2017	10	0.102540
53	2017	11	0.107790
53	2017	12	0.058100
53	2017	13	0.024655
53	2017	14	0.017785
53	2017	15	0.013087
53	2017	16	0.016662
53	2017	17	0.038629
53	2017	18	0.018337
53	2017	19	0.009973
53	2017	20	0.009417
53	2017	21	0.007300
53	2017	22	0.007435
53	2017	23	0.004816
53	2017	24	0.003771
53	2017	25	0.002582
53	2017	26	0.002764
53	2017	27	0.002522
53	2017	28	0.001814
53	2017	29	0.001417
53	2017	30	0.010448
54	2017	0	0.066114
54	2017	1	0.064212
54	2017	2	0.064579
54	2017	3	0.057072
54	2017	4	0.061142
54	2017	5	0.070481
54	2017	6	0.047529
54	2017	7	0.022938
54	2017	8	0.028635
54	2017	9	0.057589
54	2017	10	0.103765
54	2017	11	0.109214
54	2017	12	0.058586
54	2017	13	0.024504
54	2017	14	0.017668
54	2017	15	0.012996
54	2017	16	0.016522
54	2017	17	0.038996
54	2017	18	0.018391
54	2017	19	0.009934
54	2017	20	0.009365
54	2017	21	0.007273
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54	2017	28	0.001733
54	2017	29	0.001465
54	2017	30	0.008767
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61	2017	1	0.048572
61	2017	2	0.065772
61	2017	3	0.058126
61	2017	4	0.062271
61	2017	5	0.072007
61	2017	6	0.048854
61	2017	7	0.023648
61	2017	8	0.029615
61	2017	9	0.059737
61	2017	10	0.107634
61	2017	11	0.113653
61	2017	12	0.061150
61	2017	13	0.025660
61	2017	14	0.018557
61	2017	15	0.013650
61	2017	16	0.017411
61	2017	17	0.041219
61	2017	18	0.019505
61	2017	19	0.010568
61	2017	20	0.009996
61	2017	21	0.007787
61	2017	22	0.007394
61	2017	23	0.004654
61	2017	24	0.003428
61	2017	25	0.002452
61	2017	26	0.002651
61	2017	27	0.002548
61	2017	28	0.001807
61	2017	29	0.001459
61	2017	30	0.008333
62	2017	0	0.049120
62	2017	1	0.048270
62	2017	2	0.065811
62	2017	3	0.058160
62	2017	4	0.062308
62	2017	5	0.072049
62	2017	6	0.048883
62	2017	7	0.023662
62	2017	8	0.029632
62	2017	9	0.059772
62	2017	10	0.107698
62	2017	11	0.113720
62	2017	12	0.061187
62	2017	13	0.025676
62	2017	14	0.018568
62	2017	15	0.013659
62	2017	16	0.017422
62	2017	17	0.041244
62	2017	18	0.019517
62	2017	19	0.010575
62	2017	20	0.010002
62	2017	21	0.007792
62	2017	22	0.007424
62	2017	23	0.004740
62	2017	24	0.003460
62	2017	25	0.002495
62	2017	26	0.002670
62	2017	27	0.002573
62	2017	28	0.001864
62	2017	29	0.001512
62	2017	30	0.008533

[IMCoverage]

polProcess ID	state ID	county ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	begModelYearID	endModelYearID	inspectFreq	testStandardsID	useIMyn	compliance Factor
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101	4	4013	2017	21	1	110	1996	2013	2	51	N	90.04
101	4	4013	2017	31	1	103	1967	1980	1	13	N	57.62
101	4	4013	2017	31	1	106	1981	1995	2	31	N	64.12
101	4	4013	2017	31	1	110	1996	2013	2	51	N	90.04
101	4	4013	2017	32	1	103	1967	1980	1	13	N	57.62
101	4	4013	2017	32	1	106	1981	1995	2	31	N	64.12
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101	4	4013	2017	52	1	103	1967	2013	1	13	N	87.20
102	4	4013	2017	21	1	103	1967	1980	1	13	N	57.62
102	4	4013	2017	21	1	106	1981	1995	2	31	N	64.12
102	4	4013	2017	21	1	110	1996	2013	2	51	N	90.04
102	4	4013	2017	31	1	103	1967	1980	1	13	N	57.62
102	4	4013	2017	31	1	106	1981	1995	2	31	N	64.12
102	4	4013	2017	31	1	110	1996	2013	2	51	N	90.04
102	4	4013	2017	32	1	103	1967	1980	1	13	N	57.62
102	4	4013	2017	32	1	106	1981	1995	2	31	N	64.12
102	4	4013	2017	32	1	110	1996	2013	2	51	N	90.04
102	4	4013	2017	52	1	103	1967	2013	1	13	N	87.20
112	4	4013	2017	21	1	108	1996	2013	2	43	N	83.81
112	4	4013	2017	21	1	109	1981	1995	2	44	N	64.12
112	4	4013	2017	31	1	108	1996	2013	2	43	N	83.81
112	4	4013	2017	31	1	109	1981	1995	2	44	N	64.12
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112	4	4013	2017	32	1	109	1981	1995	2	44	N	64.12
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201	4	4013	2017	21	1	106	1981	1995	2	31	N	64.12
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302	4	4013	2017	52	1	103	1967	2013	1	13	N	87.20
101	4	4013	2017	21	5	303	1967	1980	1	13	N	57.62
101	4	4013	2017	21	5	306	1981	1995	2	31	N	64.12
101	4	4013	2017	21	5	310	1996	2013	2	51	N	90.04
101	4	4013	2017	31	5	303	1967	1980	1	13	N	57.62
101	4	4013	2017	31	5	306	1981	1995	2	31	N	64.12
101	4	4013	2017	31	5	310	1996	2013	2	51	N	90.04
101	4	4013	2017	32	5	303	1967	1980	1	13	N	57.62

polProcess ID	state ID	county ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	begModelYearID	endModelYearID	inspectFreq	testStandardsID	useIMyn	compliance Factor
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101	4	4013	2017	32	5	310	1996	2013	2	51	N	90.04
101	4	4013	2017	52	5	303	1967	2013	1	13	N	87.20
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102	4	4013	2017	21	5	306	1981	1995	2	31	N	64.12
102	4	4013	2017	21	5	310	1996	2013	2	51	N	90.04
102	4	4013	2017	31	5	303	1967	1980	1	13	N	57.62
102	4	4013	2017	31	5	306	1981	1995	2	31	N	64.12
102	4	4013	2017	31	5	310	1996	2013	2	51	N	90.04
102	4	4013	2017	32	5	303	1967	1980	1	13	N	57.62
102	4	4013	2017	32	5	306	1981	1995	2	31	N	64.12
102	4	4013	2017	32	5	310	1996	2013	2	51	N	90.04
102	4	4013	2017	52	5	303	1967	2013	1	13	N	87.20
112	4	4013	2017	21	5	308	1996	2013	2	43	N	83.81
112	4	4013	2017	21	5	309	1981	1995	2	44	N	64.12
112	4	4013	2017	31	5	308	1996	2013	2	43	N	83.81
112	4	4013	2017	31	5	309	1981	1995	2	44	N	64.12
112	4	4013	2017	32	5	308	1996	2013	2	43	N	83.81
112	4	4013	2017	32	5	309	1981	1995	2	44	N	64.12
112	4	4013	2017	52	5	307	1981	2013	1	41	N	86.29
201	4	4013	2017	21	5	303	1967	1980	1	13	N	57.62
201	4	4013	2017	21	5	306	1981	1995	2	31	N	64.12
201	4	4013	2017	21	5	310	1996	2013	2	51	N	90.04
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201	4	4013	2017	52	5	303	1967	2013	1	13	N	87.20
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202	4	4013	2017	21	5	306	1981	1995	2	31	N	64.12
202	4	4013	2017	21	5	310	1996	2013	2	51	N	90.04
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202	4	4013	2017	32	5	303	1967	1980	1	13	N	57.62
202	4	4013	2017	32	5	306	1981	1995	2	31	N	64.12
202	4	4013	2017	32	5	310	1996	2013	2	51	N	90.04
202	4	4013	2017	52	5	303	1967	2013	1	13	N	87.20
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301	4	4013	2017	21	5	306	1981	1995	2	31	N	64.12
301	4	4013	2017	21	5	310	1996	2013	2	51	N	90.04
301	4	4013	2017	31	5	303	1967	1980	1	13	N	57.62
301	4	4013	2017	31	5	306	1981	1995	2	31	N	64.12
301	4	4013	2017	31	5	310	1996	2013	2	51	N	90.04
301	4	4013	2017	32	5	303	1967	1980	1	13	N	57.62
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301	4	4013	2017	32	5	310	1996	2013	2	51	N	90.04
301	4	4013	2017	52	5	303	1967	2013	1	13	N	87.20
302	4	4013	2017	21	5	303	1967	1980	1	13	N	57.62
302	4	4013	2017	21	5	306	1981	1995	2	31	N	64.12
302	4	4013	2017	21	5	310	1996	2013	2	51	N	90.04
302	4	4013	2017	31	5	303	1967	1980	1	13	N	57.62
302	4	4013	2017	31	5	306	1981	1995	2	31	N	64.12
302	4	4013	2017	31	5	310	1996	2013	2	51	N	90.04
302	4	4013	2017	32	5	303	1967	1980	1	13	N	57.62
302	4	4013	2017	32	5	306	1981	1995	2	31	N	64.12
302	4	4013	2017	32	5	310	1996	2013	2	51	N	90.04
302	4	4013	2017	52	5	303	1967	2013	1	13	N	87.20
101	4	4013	2017	21	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	21	1	6	1981	1995	2	31	Y	63.62
101	4	4013	2017	21	1	10	1996	2013	2	51	Y	83.16
101	4	4013	2017	31	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	31	1	6	1981	1995	2	31	Y	63.62
101	4	4013	2017	31	1	10	1996	2013	2	51	Y	78.17
101	4	4013	2017	32	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	32	1	6	1981	1995	2	31	Y	63.62
101	4	4013	2017	32	1	10	1996	2013	2	51	Y	73.18
101	4	4013	2017	41	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	42	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	43	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	51	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	52	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	53	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	54	1	3	1967	1980	1	13	Y	57.21

polProcess ID	state ID	county ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	begModelYearID	endModelYearID	inspectFreq	testStandardsID	useIMyn	compliance Factor
101	4	4013	2017	61	1	3	1967	1980	1	13	Y	57.21
101	4	4013	2017	62	1	3	1967	1980	1	13	Y	57.21
102	4	4013	2017	21	1	3	1967	1980	1	13	Y	57.21
102	4	4013	2017	21	1	6	1981	1995	2	31	Y	63.62
102	4	4013	2017	21	1	10	1996	2013	2	51	Y	83.16
102	4	4013	2017	31	1	3	1967	1980	1	13	Y	57.21
102	4	4013	2017	31	1	6	1981	1995	2	31	Y	63.62
102	4	4013	2017	31	1	10	1996	2013	2	51	Y	78.17
102	4	4013	2017	32	1	3	1967	1980	1	13	Y	57.21
102	4	4013	2017	32	1	6	1981	1995	2	31	Y	63.62
102	4	4013	2017	32	1	10	1996	2013	2	51	Y	73.18
102	4	4013	2017	41	1	3	1967	1980	1	13	Y	57.21
102	4	4013	2017	42	1	3	1967	1980	1	13	Y	57.21
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102	4	4013	2017	52	1	3	1967	1980	1	13	Y	57.21
102	4	4013	2017	53	1	3	1967	1980	1	13	Y	57.21
102	4	4013	2017	54	1	3	1967	1980	1	13	Y	57.21
102	4	4013	2017	61	1	3	1967	1980	1	13	Y	57.21
102	4	4013	2017	62	1	3	1967	1980	1	13	Y	57.21
112	4	4013	2017	21	1	8	1996	2013	2	45	Y	89.34
112	4	4013	2017	21	1	9	1981	1995	2	44	Y	63.62
112	4	4013	2017	21	1	11	1967	1980	1	41	Y	86.77
112	4	4013	2017	31	1	8	1996	2013	2	45	Y	83.98
112	4	4013	2017	31	1	9	1981	1995	2	44	Y	59.80
112	4	4013	2017	31	1	11	1967	1980	1	41	Y	86.77
112	4	4013	2017	32	1	8	1996	2013	2	45	Y	78.62
112	4	4013	2017	32	1	9	1981	1995	2	44	Y	55.98
112	4	4013	2017	32	1	11	1967	1980	1	41	Y	86.77
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112	4	4013	2017	41	1	11	1967	1980	1	41	Y	86.77
112	4	4013	2017	42	1	7	1981	2013	1	41	Y	85.61
112	4	4013	2017	42	1	11	1967	1980	1	41	Y	86.77
112	4	4013	2017	43	1	7	1981	2013	1	41	Y	85.61
112	4	4013	2017	43	1	11	1967	1980	1	41	Y	86.77
112	4	4013	2017	51	1	7	1981	2013	1	41	Y	85.61
112	4	4013	2017	51	1	11	1967	1980	1	41	Y	86.77
112	4	4013	2017	52	1	7	1981	2013	1	41	Y	85.61
112	4	4013	2017	52	1	11	1967	1980	1	41	Y	86.77
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112	4	4013	2017	62	1	7	1981	2013	1	41	Y	85.61
112	4	4013	2017	62	1	11	1967	1980	1	41	Y	86.77
113	4	4013	2017	21	1	8	1996	2013	2	45	Y	89.34
113	4	4013	2017	21	1	9	1981	1995	2	44	Y	63.62
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113	4	4013	2017	62	1	11	1967	1980	1	41	Y	86.77
201	4	4013	2017	21	1	3	1967	1980	1	13	Y	57.21
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201	4	4013	2017	32	1	3	1967	1980	1	13	Y	57.21
201	4	4013	2017	32	1	6	1981	1995	2	31	Y	63.62
201	4	4013	2017	32	1	10	1996	2013	2	51	Y	73.18
201	4	4013	2017	41	1	3	1967	1980	1	13	Y	57.21
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201	4	4013	2017	54	1	3	1967	1980	1	13	Y	57.21
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202	4	4013	2017	21	1	6	1981	1995	2	31	Y	63.62
202	4	4013	2017	21	1	10	1996	2013	2	51	Y	83.16
202	4	4013	2017	31	1	3	1967	1980	1	13	Y	57.21
202	4	4013	2017	31	1	6	1981	1995	2	31	Y	63.62
202	4	4013	2017	31	1	10	1996	2013	2	51	Y	78.17
202	4	4013	2017	32	1	3	1967	1980	1	13	Y	57.21
202	4	4013	2017	32	1	6	1981	1995	2	31	Y	63.62
202	4	4013	2017	32	1	10	1996	2013	2	51	Y	73.18
202	4	4013	2017	41	1	3	1967	1980	1	13	Y	57.21
202	4	4013	2017	42	1	3	1967	1980	1	13	Y	57.21
202	4	4013	2017	43	1	3	1967	1980	1	13	Y	57.21
202	4	4013	2017	51	1	3	1967	1980	1	13	Y	57.21
202	4	4013	2017	52	1	3	1967	1980	1	13	Y	57.21
202	4	4013	2017	53	1	3	1967	1980	1	13	Y	57.21
202	4	4013	2017	54	1	3	1967	1980	1	13	Y	57.21
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301	4	4013	2017	21	1	3	1967	1980	1	13	Y	57.21
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301	4	4013	2017	21	1	10	1996	2013	2	51	Y	83.16
301	4	4013	2017	31	1	3	1967	1980	1	13	Y	57.21
301	4	4013	2017	31	1	6	1981	1995	2	31	Y	63.62
301	4	4013	2017	31	1	10	1996	2013	2	51	Y	78.17
301	4	4013	2017	32	1	3	1967	1980	1	13	Y	57.21
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302	4	4013	2017	21	1	10	1996	2013	2	51	Y	83.16
302	4	4013	2017	31	1	3	1967	1980	1	13	Y	57.21
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101	4	4013	2017	21	5	510	1996	2013	2	51	Y	83.16
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102	4	4013	2017	21	5	510	1996	2013	2	51	Y	83.16
102	4	4013	2017	31	5	503	1967	1980	1	13	Y	57.21
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102	4	4013	2017	31	5	510	1996	2013	2	51	Y	78.17
102	4	4013	2017	32	5	503	1967	1980	1	13	Y	57.21
102	4	4013	2017	32	5	506	1981	1995	2	31	Y	63.62
102	4	4013	2017	32	5	510	1996	2013	2	51	Y	73.18
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102	4	4013	2017	62	5	503	1967	1980	1	13	Y	57.21
112	4	4013	2017	21	5	508	1996	2013	2	45	Y	89.34
112	4	4013	2017	21	5	509	1981	1995	2	44	Y	63.62
112	4	4013	2017	21	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	31	5	508	1996	2013	2	45	Y	83.98
112	4	4013	2017	31	5	509	1981	1995	2	44	Y	59.80
112	4	4013	2017	31	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	32	5	508	1996	2013	2	45	Y	78.62
112	4	4013	2017	32	5	509	1981	1995	2	44	Y	55.98
112	4	4013	2017	32	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	41	5	507	1981	2013	1	41	Y	85.61
112	4	4013	2017	41	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	42	5	507	1981	2013	1	41	Y	85.61
112	4	4013	2017	42	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	43	5	507	1981	2013	1	41	Y	85.61
112	4	4013	2017	43	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	51	5	507	1981	2013	1	41	Y	85.61
112	4	4013	2017	51	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	52	5	507	1981	2013	1	41	Y	85.61
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112	4	4013	2017	53	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	54	5	507	1981	2013	1	41	Y	85.61
112	4	4013	2017	54	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	61	5	507	1981	2013	1	41	Y	85.61
112	4	4013	2017	61	5	511	1967	1980	1	41	Y	86.77
112	4	4013	2017	62	5	507	1981	2013	1	41	Y	85.61
112	4	4013	2017	62	5	511	1967	1980	1	41	Y	86.77
113	4	4013	2017	21	5	508	1996	2013	2	45	Y	89.34
113	4	4013	2017	21	5	509	1981	1995	2	44	Y	63.62
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113	4	4013	2017	31	5	509	1981	1995	2	44	Y	59.80
113	4	4013	2017	31	5	511	1967	1980	1	41	Y	86.77
113	4	4013	2017	32	5	508	1996	2013	2	45	Y	78.62
113	4	4013	2017	32	5	509	1981	1995	2	44	Y	55.98
113	4	4013	2017	32	5	511	1967	1980	1	41	Y	86.77
113	4	4013	2017	41	5	507	1981	2013	1	41	Y	85.61
113	4	4013	2017	41	5	511	1967	1980	1	41	Y	86.77
113	4	4013	2017	42	5	507	1981	2013	1	41	Y	85.61
113	4	4013	2017	42	5	511	1967	1980	1	41	Y	86.77
113	4	4013	2017	43	5	507	1981	2013	1	41	Y	85.61
113	4	4013	2017	43	5	511	1967	1980	1	41	Y	86.77
113	4	4013	2017	51	5	507	1981	2013	1	41	Y	85.61
113	4	4013	2017	51	5	511	1967	1980	1	41	Y	86.77
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113	4	4013	2017	52	5	511	1967	1980	1	41	Y	86.77
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113	4	4013	2017	53	5	511	1967	1980	1	41	Y	86.77
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113	4	4013	2017	54	5	511	1967	1980	1	41	Y	86.77
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polProcess ID	state ID	county ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	begModelYearID	endModelYearID	inspectFreq	testStandardsID	useIMyn	compliance Factor
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101	4	4013	2017	61	5	504	1981	2013	2	13	Y	86.52
101	4	4013	2017	62	5	504	1981	2013	2	13	Y	86.52
102	4	4013	2017	41	5	504	1981	2013	2	13	Y	86.52
102	4	4013	2017	42	5	504	1981	2013	2	13	Y	86.52
102	4	4013	2017	43	5	504	1981	2013	2	13	Y	86.52
102	4	4013	2017	51	5	504	1981	2013	2	13	Y	86.52
102	4	4013	2017	52	5	504	1981	2013	2	13	Y	86.52
102	4	4013	2017	53	5	504	1981	2013	2	13	Y	86.52
102	4	4013	2017	54	5	504	1981	2013	2	13	Y	86.52
102	4	4013	2017	61	5	504	1981	2013	2	13	Y	86.52
102	4	4013	2017	62	5	504	1981	2013	2	13	Y	86.52

polProcess ID	state ID	county ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	begModelYearID	endModelYearID	inspectFreq	testStandardsID	useIMyn	compliance Factor
201	4	4013	2017	41	5	504	1981	2013	2	13	Y	86.52
201	4	4013	2017	42	5	504	1981	2013	2	13	Y	86.52
201	4	4013	2017	43	5	504	1981	2013	2	13	Y	86.52
201	4	4013	2017	51	5	504	1981	2013	2	13	Y	86.52
201	4	4013	2017	52	5	504	1981	2013	2	13	Y	86.52
201	4	4013	2017	53	5	504	1981	2013	2	13	Y	86.52
201	4	4013	2017	54	5	504	1981	2013	2	13	Y	86.52
201	4	4013	2017	61	5	504	1981	2013	2	13	Y	86.52
201	4	4013	2017	62	5	504	1981	2013	2	13	Y	86.52
202	4	4013	2017	41	5	504	1981	2013	2	13	Y	86.52
202	4	4013	2017	42	5	504	1981	2013	2	13	Y	86.52
202	4	4013	2017	43	5	504	1981	2013	2	13	Y	86.52
202	4	4013	2017	51	5	504	1981	2013	2	13	Y	86.52
202	4	4013	2017	52	5	504	1981	2013	2	13	Y	86.52
202	4	4013	2017	53	5	504	1981	2013	2	13	Y	86.52
202	4	4013	2017	54	5	504	1981	2013	2	13	Y	86.52
202	4	4013	2017	61	5	504	1981	2013	2	13	Y	86.52
202	4	4013	2017	62	5	504	1981	2013	2	13	Y	86.52
301	4	4013	2017	41	5	504	1981	2013	2	13	Y	86.52
301	4	4013	2017	42	5	504	1981	2013	2	13	Y	86.52
301	4	4013	2017	43	5	504	1981	2013	2	13	Y	86.52
301	4	4013	2017	51	5	504	1981	2013	2	13	Y	86.52
301	4	4013	2017	52	5	504	1981	2013	2	13	Y	86.52
301	4	4013	2017	53	5	504	1981	2013	2	13	Y	86.52
301	4	4013	2017	54	5	504	1981	2013	2	13	Y	86.52
301	4	4013	2017	61	5	504	1981	2013	2	13	Y	86.52
301	4	4013	2017	62	5	504	1981	2013	2	13	Y	86.52
302	4	4013	2017	41	5	504	1981	2013	2	13	Y	86.52
302	4	4013	2017	42	5	504	1981	2013	2	13	Y	86.52
302	4	4013	2017	43	5	504	1981	2013	2	13	Y	86.52
302	4	4013	2017	51	5	504	1981	2013	2	13	Y	86.52
302	4	4013	2017	52	5	504	1981	2013	2	13	Y	86.52
302	4	4013	2017	53	5	504	1981	2013	2	13	Y	86.52
302	4	4013	2017	54	5	504	1981	2013	2	13	Y	86.52
302	4	4013	2017	61	5	504	1981	2013	2	13	Y	86.52
302	4	4013	2017	62	5	504	1981	2013	2	13	Y	86.52

[RoadType]

roadTypeID	roadDesc	rampFraction	isAffectedByOnroad	isAffectedByNonroad	shouldDisplay
2	Rural Restricted Access	0.0744035	1	0	1
4	Urban Restricted Access	0.133283	1	0	1

[MonthVMTFraction]

sourceTypeID	monthID	monthVMTFraction
11	6	0.082456
21	6	0.082456
31	6	0.082456
32	6	0.082456
41	6	0.082456
42	6	0.082456
43	6	0.082456
51	6	0.082456
52	6	0.082456
53	6	0.082456
54	6	0.082456
61	6	0.082456
62	6	0.082456

[DayVMTFraction]

sourceTypeID	monthID	roadTypeID	dayID	dayVMTFraction
11	6	1	5	0.788642
21	6	1	5	0.788642
31	6	1	5	0.788642
32	6	1	5	0.788642
41	6	1	5	0.788642
42	6	1	5	0.788642
43	6	1	5	0.788642
51	6	1	5	0.788642
52	6	1	5	0.788642
53	6	1	5	0.788642
54	6	1	5	0.788642
61	6	1	5	0.788642
62	6	1	5	0.788642
11	6	2	5	0.791091
21	6	2	5	0.791091
31	6	2	5	0.791091
32	6	2	5	0.791091
41	6	2	5	0.791091
42	6	2	5	0.791091
43	6	2	5	0.791091
51	6	2	5	0.791091
52	6	2	5	0.791091
53	6	2	5	0.791091
54	6	2	5	0.791091
61	6	2	5	0.791091
62	6	2	5	0.791091
11	6	3	5	0.786164
21	6	3	5	0.786164
31	6	3	5	0.786164
32	6	3	5	0.786164
41	6	3	5	0.786164
42	6	3	5	0.786164
43	6	3	5	0.786164
51	6	3	5	0.786164
52	6	3	5	0.786164
53	6	3	5	0.786164
54	6	3	5	0.786164
61	6	3	5	0.786164
62	6	3	5	0.786164
11	6	4	5	0.791091
21	6	4	5	0.791091
31	6	4	5	0.791091
32	6	4	5	0.791091
41	6	4	5	0.791091
42	6	4	5	0.791091
43	6	4	5	0.791091
51	6	4	5	0.791091
52	6	4	5	0.791091
53	6	4	5	0.791091
54	6	4	5	0.791091
61	6	4	5	0.791091
62	6	4	5	0.791091
11	6	5	5	0.786164
21	6	5	5	0.786164
31	6	5	5	0.786164
32	6	5	5	0.786164
41	6	5	5	0.786164
42	6	5	5	0.786164
43	6	5	5	0.786164
51	6	5	5	0.786164
52	6	5	5	0.786164
53	6	5	5	0.786164
54	6	5	5	0.786164
61	6	5	5	0.786164
62	6	5	5	0.786164

[HourVMTFraction] (SourceTypeID 21: Passenger Car)

SourceTypeID	RoadTypeID	DayID	HourID	HourVMTFraction
21	1	5	1	0.0079
21	1	5	2	0.0055
21	1	5	3	0.0052
21	1	5	4	0.0074
21	1	5	5	0.0217
21	1	5	6	0.0377
21	1	5	7	0.0538
21	1	5	8	0.0654
21	1	5	9	0.0608
21	1	5	10	0.0521
21	1	5	11	0.0503
21	1	5	12	0.0534
21	1	5	13	0.0565
21	1	5	14	0.0597
21	1	5	15	0.0638
21	1	5	16	0.0668
21	1	5	17	0.0686
21	1	5	18	0.0688
21	1	5	19	0.0567
21	1	5	20	0.0409
21	1	5	21	0.0338
21	1	5	22	0.0292
21	1	5	23	0.0210
21	1	5	24	0.0132
21	2	5	1	0.0098
21	2	5	2	0.0070
21	2	5	3	0.0069
21	2	5	4	0.0107
21	2	5	5	0.0336
21	2	5	6	0.0496
21	2	5	7	0.0585
21	2	5	8	0.0608
21	2	5	9	0.0585
21	2	5	10	0.0538
21	2	5	11	0.0507
21	2	5	12	0.0518
21	2	5	13	0.0547
21	2	5	14	0.0614
21	2	5	15	0.0637
21	2	5	16	0.0607
21	2	5	17	0.0589
21	2	5	18	0.0566
21	2	5	19	0.0496
21	2	5	20	0.0389
21	2	5	21	0.0338
21	2	5	22	0.0309
21	2	5	23	0.0240
21	2	5	24	0.0156
21	3	5	1	0.0061
21	3	5	2	0.0040
21	3	5	3	0.0034
21	3	5	4	0.0040
21	3	5	5	0.0096
21	3	5	6	0.0257
21	3	5	7	0.0489
21	3	5	8	0.0700
21	3	5	9	0.0633
21	3	5	10	0.0503
21	3	5	11	0.0498
21	3	5	12	0.0550
21	3	5	13	0.0584
21	3	5	14	0.0580
21	3	5	15	0.0640
21	3	5	16	0.0730
21	3	5	17	0.0785
21	3	5	18	0.0812
21	3	5	19	0.0639
21	3	5	20	0.0430
21	3	5	21	0.0338
21	3	5	22	0.0275
21	3	5	23	0.0179
21	3	5	24	0.0107
21	4	5	1	0.0098
21	4	5	2	0.0070
21	4	5	3	0.0069
21	4	5	4	0.0107
21	4	5	5	0.0336
21	4	5	6	0.0496
21	4	5	7	0.0585
21	4	5	8	0.0608
21	4	5	9	0.0585
21	4	5	10	0.0538
21	4	5	11	0.0507
21	4	5	12	0.0518
21	4	5	13	0.0547
21	4	5	14	0.0614
21	4	5	15	0.0637
21	4	5	16	0.0607
21	4	5	17	0.0589
21	4	5	18	0.0566
21	4	5	19	0.0496
21	4	5	20	0.0389
21	4	5	21	0.0338
21	4	5	22	0.0309
21	4	5	23	0.0240
21	4	5	24	0.0156
21	5	5	1	0.0061
21	5	5	2	0.0040
21	5	5	3	0.0034
21	5	5	4	0.0040
21	5	5	5	0.0096
21	5	5	6	0.0257
21	5	5	7	0.0489
21	5	5	8	0.0700
21	5	5	9	0.0633
21	5	5	10	0.0503
21	5	5	11	0.0498
21	5	5	12	0.0550
21	5	5	13	0.0584
21	5	5	14	0.0580
21	5	5	15	0.0640
21	5	5	16	0.0730
21	5	5	17	0.0785
21	5	5	18	0.0812
21	5	5	19	0.0639
21	5	5	20	0.0430
21	5	5	21	0.0338
21	5	5	22	0.0275
21	5	5	23	0.0179
21	5	5	24	0.0107

[RoadTypeDistribution]

sourceTypeID	roadTypeID	roadTypeVMTFraction
11	1	0.000000
11	2	0.009333
11	3	0.075503
11	4	0.313082
11	5	0.602083
21	1	0.000000
21	2	0.010031
21	3	0.06028
21	4	0.381675
21	5	0.548013
31	1	0.000000
31	2	0.010031
31	3	0.06028
31	4	0.381675
31	5	0.548013
32	1	0.000000
32	2	0.010031
32	3	0.06028
32	4	0.381675
32	5	0.548013
41	1	0.000000
41	2	0.047379
41	3	0.059473
41	4	0.519899
41	5	0.373249
42	1	0.000000
42	2	0.047379
42	3	0.059473
42	4	0.519899
42	5	0.373249
43	1	0.000000
43	2	0.047379
43	3	0.059473
43	4	0.519899
43	5	0.373249
51	1	0.000000
51	2	0.020377
51	3	0.055302
51	4	0.559562
51	5	0.364759
52	1	0.000000
52	2	0.020377
52	3	0.055302
52	4	0.559562
52	5	0.364759
53	1	0.000000
53	2	0.020377
53	3	0.055302
53	4	0.559562
53	5	0.364759
54	1	0.000000
54	2	0.020377
54	3	0.055302
54	4	0.559562
54	5	0.364759
61	1	0.000000
61	2	0.085406
61	3	0.058587
61	4	0.612989
61	5	0.243018
62	1	0.000000
62	2	0.085406
62	3	0.058587
62	4	0.612989
62	5	0.243018

[AvgSpeedDistribution] (SourceTypeID 21: Passenger Car and RoadTypeID 2: Rural Restricted Access)

sourceTypeID	roadTypeID	hourDayID	avgSpeedBinID	avgSpeedFraction
21	2	15	1	0.00000
21	2	15	2	0.00000
21	2	15	3	0.00000
21	2	15	4	0.00000
21	2	15	5	0.00000
21	2	15	6	0.00000
21	2	15	7	0.00000
21	2	15	8	0.00000
21	2	15	9	0.00000
21	2	15	10	0.00000
21	2	15	11	0.00000
21	2	15	12	0.00000
21	2	15	13	0.00000
21	2	15	14	0.19937
21	2	15	15	0.80063
21	2	15	16	0.00000
21	2	25	1	0.00000
21	2	25	2	0.00000
21	2	25	3	0.00000
21	2	25	4	0.00000
21	2	25	5	0.00000
21	2	25	6	0.00000
21	2	25	7	0.00000
21	2	25	8	0.00000
21	2	25	9	0.00000
21	2	25	10	0.00000
21	2	25	11	0.00000
21	2	25	12	0.00000
21	2	25	13	0.00000
21	2	25	14	0.19937
21	2	25	15	0.80063
21	2	25	16	0.00000
21	2	35	1	0.00000
21	2	35	2	0.00000
21	2	35	3	0.00000
21	2	35	4	0.00000
21	2	35	5	0.00000
21	2	35	6	0.00000
21	2	35	7	0.00000
21	2	35	8	0.00000
21	2	35	9	0.00000
21	2	35	10	0.00000
21	2	35	11	0.00000
21	2	35	12	0.00000
21	2	35	13	0.00000
21	2	35	14	0.19937
21	2	35	15	0.80063
21	2	35	16	0.00000
21	2	45	1	0.00000
21	2	45	2	0.00000
21	2	45	3	0.00000
21	2	45	4	0.00000
21	2	45	5	0.00000
21	2	45	6	0.00000
21	2	45	7	0.00000
21	2	45	8	0.00000
21	2	45	9	0.00000
21	2	45	10	0.00000
21	2	45	11	0.00000
21	2	45	12	0.00000
21	2	45	13	0.00000
21	2	45	14	0.19937
21	2	45	15	0.80063
21	2	45	16	0.00000
21	2	55	1	0.00000
21	2	55	2	0.00000
21	2	55	3	0.00000
21	2	55	4	0.00000
21	2	55	5	0.00000
21	2	55	6	0.00000
21	2	55	7	0.00000
21	2	55	8	0.00000
21	2	55	9	0.00000
21	2	55	10	0.00000
21	2	55	11	0.00000
21	2	55	12	0.00000
21	2	55	13	0.00000
21	2	55	14	0.19937
21	2	55	15	0.80063
21	2	55	16	0.00000
21	2	65	1	0.00000
21	2	65	2	0.00000
21	2	65	3	0.00000
21	2	65	4	0.00000
21	2	65	5	0.00000
21	2	65	6	0.00000
21	2	65	7	0.00000
21	2	65	8	0.00000
21	2	65	9	0.00000
21	2	65	10	0.00000
21	2	65	11	0.00000
21	2	65	12	0.00000
21	2	65	13	0.00000
21	2	65	14	0.19937
21	2	65	15	0.80063
21	2	65	16	0.00000
21	2	75	1	0.00000
21	2	75	2	0.00000
21	2	75	3	0.00000
21	2	75	4	0.00000
21	2	75	5	0.00000
21	2	75	6	0.00000
21	2	75	7	0.00000
21	2	75	8	0.00000
21	2	75	9	0.00000
21	2	75	10	0.00000
21	2	75	11	0.19232
21	2	75	12	0.09258
21	2	75	13	0.00000
21	2	75	14	0.16303
21	2	75	15	0.55206
21	2	75	16	0.00000
21	2	85	1	0.00000
21	2	85	2	0.00000
21	2	85	3	0.00000
21	2	85	4	0.00000
21	2	85	5	0.00000
21	2	85	6	0.00000
21	2	85	7	0.00000
21	2	85	8	0.00000
21	2	85	9	0.00000
21	2	85	10	0.00000
21	2	85	11	0.19232
21	2	85	12	0.09258
21	2	85	13	0.00000
21	2	85	14	0.16303
21	2	85	15	0.55206
21	2	85	16	0.00000
21	2	95	1	0.00000
21	2	95	2	0.00000
21	2	95	3	0.00000
21	2	95	4	0.00000
21	2	95	5	0.00000
21	2	95	6	0.00000
21	2	95	7	0.00000

sourceTypeID	roadTypeID	hourDayID	avgSpeedBinID	avgSpeedFraction
21	2	95	8	0.00000
21	2	95	9	0.00000
21	2	95	10	0.00000
21	2	95	11	0.19232
21	2	95	12	0.09258
21	2	95	13	0.00000
21	2	95	14	0.16303
21	2	95	15	0.55206
21	2	95	16	0.00000
21	2	105	1	0.00000
21	2	105	2	0.00000
21	2	105	3	0.00000
21	2	105	4	0.00000
21	2	105	5	0.00000
21	2	105	6	0.00000
21	2	105	7	0.00000
21	2	105	8	0.00000
21	2	105	9	0.00000
21	2	105	10	0.00000
21	2	105	11	0.00000
21	2	105	12	0.00000
21	2	105	13	0.00000
21	2	105	14	0.18634
21	2	105	15	0.81366
21	2	105	16	0.00000
21	2	115	1	0.00000
21	2	115	2	0.00000
21	2	115	3	0.00000
21	2	115	4	0.00000
21	2	115	5	0.00000
21	2	115	6	0.00000
21	2	115	7	0.00000
21	2	115	8	0.00000
21	2	115	9	0.00000
21	2	115	10	0.00000
21	2	115	11	0.00000
21	2	115	12	0.00000
21	2	115	13	0.00000
21	2	115	14	0.18634
21	2	115	15	0.81366
21	2	115	16	0.00000
21	2	125	1	0.00000
21	2	125	2	0.00000
21	2	125	3	0.00000
21	2	125	4	0.00000
21	2	125	5	0.00000
21	2	125	6	0.00000
21	2	125	7	0.00000
21	2	125	8	0.00000
21	2	125	9	0.00000
21	2	125	10	0.00000
21	2	125	11	0.00000
21	2	125	12	0.00000
21	2	125	13	0.00000
21	2	125	14	0.18634
21	2	125	15	0.81366
21	2	125	16	0.00000
21	2	135	1	0.00000
21	2	135	2	0.00000
21	2	135	3	0.00000
21	2	135	4	0.00000
21	2	135	5	0.00000
21	2	135	6	0.00000
21	2	135	7	0.00000
21	2	135	8	0.00000
21	2	135	9	0.00000
21	2	135	10	0.00000
21	2	135	11	0.00000
21	2	135	12	0.00000
21	2	135	13	0.00000
21	2	135	14	0.18634
21	2	135	15	0.81366
21	2	135	16	0.00000
21	2	145	1	0.00000
21	2	145	2	0.00000
21	2	145	3	0.00000
21	2	145	4	0.00000
21	2	145	5	0.00000
21	2	145	6	0.00000
21	2	145	7	0.00000
21	2	145	8	0.00000
21	2	145	9	0.00000
21	2	145	10	0.00000
21	2	145	11	0.00000
21	2	145	12	0.00000
21	2	145	13	0.00000
21	2	145	14	0.18634
21	2	145	15	0.81366
21	2	145	16	0.00000
21	2	155	1	0.00000
21	2	155	2	0.00000
21	2	155	3	0.00000
21	2	155	4	0.00000
21	2	155	5	0.00000
21	2	155	6	0.00000
21	2	155	7	0.00000
21	2	155	8	0.00000
21	2	155	9	0.00000
21	2	155	10	0.00000
21	2	155	11	0.00000
21	2	155	12	0.13576
21	2	155	13	0.18529
21	2	155	14	0.12407
21	2	155	15	0.55488
21	2	155	16	0.00000
21	2	165	1	0.00000
21	2	165	2	0.00000
21	2	165	3	0.00000
21	2	165	4	0.00000
21	2	165	5	0.00000
21	2	165	6	0.00000
21	2	165	7	0.00000
21	2	165	8	0.00000
21	2	165	9	0.00000
21	2	165	10	0.00000
21	2	165	11	0.00000
21	2	165	12	0.13576
21	2	165	13	0.18529
21	2	165	14	0.12407
21	2	165	15	0.55488
21	2	165	16	0.00000
21	2	175	1	0.00000
21	2	175	2	0.00000
21	2	175	3	0.00000
21	2	175	4	0.00000
21	2	175	5	0.00000
21	2	175	6	0.00000
21	2	175	7	0.00000
21	2	175	8	0.00000
21	2	175	9	0.00000
21	2	175	10	0.00000
21	2	175	11	0.00000
21	2	175	12	0.13576
21	2	175	13	0.18529
21	2	175	14	0.12407
21	2	175	15	0.55488
21	2	175	16	0.00000
21	2	185	1	0.00000
21	2	185	2	0.00000
21	2	185	3	0.00000

sourceTypeID	roadTypeID	hourDayID	avgSpeedBinID	avgSpeedFraction
21	2	185	4	0.00000
21	2	185	5	0.00000
21	2	185	6	0.00000
21	2	185	7	0.00000
21	2	185	8	0.00000
21	2	185	9	0.00000
21	2	185	10	0.00000
21	2	185	11	0.00000
21	2	185	12	0.13576
21	2	185	13	0.18529
21	2	185	14	0.12407
21	2	185	15	0.55488
21	2	185	16	0.00000
21	2	195	1	0.00000
21	2	195	2	0.00000
21	2	195	3	0.00000
21	2	195	4	0.00000
21	2	195	5	0.00000
21	2	195	6	0.00000
21	2	195	7	0.00000
21	2	195	8	0.00000
21	2	195	9	0.00000
21	2	195	10	0.00000
21	2	195	11	0.00000
21	2	195	12	0.00000
21	2	195	13	0.00000
21	2	195	14	0.19937
21	2	195	15	0.80063
21	2	195	16	0.00000
21	2	205	1	0.00000
21	2	205	2	0.00000
21	2	205	3	0.00000
21	2	205	4	0.00000
21	2	205	5	0.00000
21	2	205	6	0.00000
21	2	205	7	0.00000
21	2	205	8	0.00000
21	2	205	9	0.00000
21	2	205	10	0.00000
21	2	205	11	0.00000
21	2	205	12	0.00000
21	2	205	13	0.00000
21	2	205	14	0.19937
21	2	205	15	0.80063
21	2	205	16	0.00000
21	2	215	1	0.00000
21	2	215	2	0.00000
21	2	215	3	0.00000
21	2	215	4	0.00000
21	2	215	5	0.00000
21	2	215	6	0.00000
21	2	215	7	0.00000
21	2	215	8	0.00000
21	2	215	9	0.00000
21	2	215	10	0.00000
21	2	215	11	0.00000
21	2	215	12	0.00000
21	2	215	13	0.00000
21	2	215	14	0.19937
21	2	215	15	0.80063
21	2	215	16	0.00000
21	2	225	1	0.00000
21	2	225	2	0.00000
21	2	225	3	0.00000
21	2	225	4	0.00000
21	2	225	5	0.00000
21	2	225	6	0.00000
21	2	225	7	0.00000
21	2	225	8	0.00000
21	2	225	9	0.00000
21	2	225	10	0.00000
21	2	225	11	0.00000
21	2	225	12	0.00000
21	2	225	13	0.00000
21	2	225	14	0.19937
21	2	225	15	0.80063
21	2	225	16	0.00000
21	2	235	1	0.00000
21	2	235	2	0.00000
21	2	235	3	0.00000
21	2	235	4	0.00000
21	2	235	5	0.00000
21	2	235	6	0.00000
21	2	235	7	0.00000
21	2	235	8	0.00000
21	2	235	9	0.00000
21	2	235	10	0.00000
21	2	235	11	0.00000
21	2	235	12	0.00000
21	2	235	13	0.00000
21	2	235	14	0.19937
21	2	235	15	0.80063
21	2	235	16	0.00000
21	2	245	1	0.00000
21	2	245	2	0.00000
21	2	245	3	0.00000
21	2	245	4	0.00000
21	2	245	5	0.00000
21	2	245	6	0.00000
21	2	245	7	0.00000
21	2	245	8	0.00000
21	2	245	9	0.00000
21	2	245	10	0.00000
21	2	245	11	0.00000
21	2	245	12	0.00000
21	2	245	13	0.00000
21	2	245	14	0.19937
21	2	245	15	0.80063
21	2	245	16	0.00000

[AVFT] (SourceTypeID 42: Transit Bus)

sourceTypeID	modelYearID	fuelTypeID	engTechID	fuelEngFraction
42	1960	1	1	0.009615
42	1960	2	1	0.990385
42	1960	3	1	0.000000
42	1961	1	1	0.009615
42	1961	2	1	0.990385
42	1961	3	1	0.000000
42	1962	1	1	0.009615
42	1962	2	1	0.990385
42	1962	3	1	0.000000
42	1963	1	1	0.009615
42	1963	2	1	0.990385
42	1963	3	1	0.000000
42	1964	1	1	0.009615
42	1964	2	1	0.990385
42	1964	3	1	0.000000
42	1965	1	1	0.009615
42	1965	2	1	0.990385
42	1965	3	1	0.000000
42	1966	1	1	0.009615
42	1966	2	1	0.990385
42	1966	3	1	0.000000
42	1967	1	1	0.009615
42	1967	2	1	0.990385
42	1967	3	1	0.000000
42	1968	1	1	0.009615
42	1968	2	1	0.990385
42	1968	3	1	0.000000
42	1969	1	1	0.009615
42	1969	2	1	0.990385
42	1969	3	1	0.000000
42	1970	1	1	0.009615
42	1970	2	1	0.990385
42	1970	3	1	0.000000
42	1971	1	1	0.009615
42	1971	2	1	0.990385
42	1971	3	1	0.000000
42	1972	1	1	0.009615
42	1972	2	1	0.990385
42	1972	3	1	0.000000
42	1973	1	1	0.009615
42	1973	2	1	0.990385
42	1973	3	1	0.000000
42	1974	1	1	0.009615
42	1974	2	1	0.990385
42	1974	3	1	0.000000
42	1975	1	1	0.009615
42	1975	2	1	0.990385
42	1975	3	1	0.000000
42	1976	1	1	0.009615
42	1976	2	1	0.990385
42	1976	3	1	0.000000
42	1977	1	1	0.009615
42	1977	2	1	0.990385
42	1977	3	1	0.000000
42	1978	1	1	0.009615
42	1978	2	1	0.990385
42	1978	3	1	0.000000
42	1979	1	1	0.009615
42	1979	2	1	0.990385
42	1979	3	1	0.000000
42	1980	1	1	0.009615
42	1980	2	1	0.990385
42	1980	3	1	0.000000
42	1981	1	1	0.008696
42	1981	2	1	0.991304
42	1981	3	1	0.000000
42	1982	1	1	0.011321
42	1982	2	1	0.988679
42	1982	3	1	0.000000
42	1983	1	1	0.008081
42	1983	2	1	0.991919
42	1983	3	1	0.000000
42	1984	1	1	0.009671
42	1984	2	1	0.990329
42	1984	3	1	0.000000
42	1985	1	1	0.010448
42	1985	2	1	0.989552
42	1985	3	1	0.000000
42	1986	1	1	0.010243
42	1986	2	1	0.989757
42	1986	3	1	0.000000
42	1987	1	1	0.009825
42	1987	2	1	0.990175
42	1987	3	1	0.000000
42	1988	1	1	0.009990
42	1988	2	1	0.990010
42	1988	3	1	0.000000
42	1989	1	1	0.009441
42	1989	2	1	0.990559
42	1989	3	1	0.000000
42	1990	1	1	0.010174
42	1990	2	1	0.982645
42	1990	3	1	0.007181
42	1991	1	1	0.009632
42	1991	2	1	0.971979
42	1991	3	1	0.018389
42	1992	1	1	0.009752
42	1992	2	1	0.944149
42	1992	3	1	0.046099
42	1993	1	1	0.009238
42	1993	2	1	0.914550
42	1993	3	1	0.076212
42	1994	1	1	0.010211
42	1994	2	1	0.904914
42	1994	3	1	0.084876
42	1995	1	1	0.010022
42	1995	2	1	0.836860
42	1995	3	1	0.153118
42	1996	1	1	0.009941
42	1996	2	1	0.892002
42	1996	3	1	0.098057
42	1997	1	1	0.000000
42	1997	2	1	1.000000
42	1997	3	1	0.000000
42	1998	1	1	0.000000
42	1998	2	1	0.000000
42	1998	3	1	1.000000
42	1999	1	1	0.000000
42	1999	2	1	0.000000
42	1999	3	1	1.000000
42	2000	1	1	0.000000
42	2000	2	1	0.000000
42	2000	3	1	1.000000
42	2001	1	1	0.000000
42	2001	2	1	0.000000
42	2001	3	1	1.000000
42	2002	1	1	0.000000
42	2002	2	1	0.000000
42	2002	3	1	1.000000
42	2003	1	1	0.000000
42	2003	2	1	0.000000
42	2003	3	1	1.000000
42	2004	1	1	0.000000
42	2004	2	1	0.327869
42	2004	3	1	0.672131
42	2005	1	1	0.000000
42	2005	2	1	1.000000
42	2005	3	1	0.000000
42	2006	1	1	0.000000

sourceTypeID	modelYearID	fuelTypeID	engTechID	fuelEngFraction
42	2006	2	1	0.075758
42	2006	3	1	0.924242
42	2007	1	1	0.000000
42	2007	2	1	1.000000
42	2007	3	1	0.000000
42	2008	1	1	0.000000
42	2008	2	1	0.385542
42	2008	3	1	0.614458
42	2009	1	1	0.108108
42	2009	2	1	0.135135
42	2009	3	1	0.756757
42	2010	1	1	0.000000
42	2010	2	1	1.000000
42	2010	3	1	0.000000
42	2011	1	1	0.000000
42	2011	2	1	0.048780
42	2011	2	11	0.414634
42	2011	3	1	0.536585
42	2012	1	1	0.000000
42	2012	2	1	0.000000
42	2012	3	1	1.000000
42	2013	1	1	0.045455
42	2013	2	1	0.054545
42	2013	2	11	0.118182
42	2013	3	1	0.781818
42	2014	1	1	0.010417
42	2014	2	1	0.114583
42	2014	3	1	0.875000
42	2015	1	1	0.024619
42	2015	2	1	0.817351
42	2015	3	1	0.158030
42	2016	1	1	0.024619
42	2016	2	1	0.817351
42	2016	3	1	0.158030
42	2017	1	1	0.024619
42	2017	2	1	0.817351
42	2017	3	1	0.158030
42	2018	1	1	0.024619
42	2018	2	1	0.817351
42	2018	3	1	0.158030
42	2019	1	1	0.024619
42	2019	2	1	0.817351
42	2019	3	1	0.158030
42	2020	1	1	0.024619
42	2020	2	1	0.817351
42	2020	3	1	0.158030
42	2021	1	1	0.024619
42	2021	2	1	0.817351
42	2021	3	1	0.158030
42	2022	1	1	0.024619
42	2022	2	1	0.817351
42	2022	3	1	0.158030
42	2023	1	1	0.024619
42	2023	2	1	0.817351
42	2023	3	1	0.158030
42	2024	1	1	0.024619
42	2024	2	1	0.817351
42	2024	3	1	0.158030
42	2025	1	1	0.024619
42	2025	2	1	0.817351
42	2025	3	1	0.158030
42	2026	1	1	0.024619
42	2026	2	1	0.817351
42	2026	3	1	0.158030
42	2027	1	1	0.024619
42	2027	2	1	0.817351
42	2027	3	1	0.158030
42	2028	1	1	0.024619
42	2028	2	1	0.817351
42	2028	3	1	0.158030
42	2029	1	1	0.024619
42	2029	2	1	0.817351
42	2029	3	1	0.158030
42	2030	1	1	0.024619
42	2030	2	1	0.817351
42	2030	3	1	0.158030
42	2031	1	1	0.024619
42	2031	2	1	0.817351
42	2031	3	1	0.158030
42	2032	1	1	0.024619
42	2032	2	1	0.817351
42	2032	3	1	0.158030
42	2033	1	1	0.024619
42	2033	2	1	0.817351
42	2033	3	1	0.158030
42	2034	1	1	0.024619
42	2034	2	1	0.817351
42	2034	3	1	0.158030
42	2035	1	1	0.024619
42	2035	2	1	0.817351
42	2035	3	1	0.158030
42	2036	1	1	0.024619
42	2036	2	1	0.817351
42	2036	3	1	0.158030
42	2037	1	1	0.024619
42	2037	2	1	0.817351
42	2037	3	1	0.158030
42	2038	1	1	0.024619
42	2038	2	1	0.817351
42	2038	3	1	0.158030
42	2039	1	1	0.024619
42	2039	2	1	0.817351
42	2039	3	1	0.158030
42	2040	1	1	0.024619
42	2040	2	1	0.817351
42	2040	3	1	0.158030
42	2041	1	1	0.024619
42	2041	2	1	0.817351
42	2041	3	1	0.158030
42	2042	1	1	0.024619
42	2042	2	1	0.817351
42	2042	3	1	0.158030
42	2043	1	1	0.024619
42	2043	2	1	0.817351
42	2043	3	1	0.158030
42	2044	1	1	0.024619
42	2044	2	1	0.817351
42	2044	3	1	0.158030
42	2045	1	1	0.024619
42	2045	2	1	0.817351
42	2045	3	1	0.158030
42	2046	1	1	0.024619
42	2046	2	1	0.817351
42	2046	3	1	0.158030
42	2047	1	1	0.024619
42	2047	2	1	0.817351
42	2047	3	1	0.158030
42	2048	1	1	0.024619
42	2048	2	1	0.817351
42	2048	3	1	0.158030
42	2049	1	1	0.024619
42	2049	2	1	0.817351
42	2049	3	1	0.158030
42	2050	1	1	0.024619
42	2050	2	1	0.817351
42	2050	3	1	0.158030

Nonroad Mobile Sources

In order to calculate nonroad mobile source emissions, MOVES2014a was executed using local input data for each episode day and each geographical area (Maricopa and Pinal County).

This section contains the MOVES2014a RunSpec for June 9 as an example.

MOVES2014a RunSpec for Maricopa County on June 9, 2011

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<runspec version="MOVES2014a-20151028">
<description><![CDATA[2011-06-09 Maricopa County daily nonroad for SIP modeling]]></description>
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        <model value="NONROAD"/>
</models>
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<modeldomain value="NATIONAL"/>
<geographicselections>
        <geographicselection type="COUNTY" key="4013" description="ARIZONA - Maricopa County"/>
</geographicselections>
<timespan>
        <year key="2011"/>
        <month id="6"/>
        <day id="5"/>
        <beginhour id="0"/>
        <endhour id="0"/>
        <aggregateBy key="Hour"/>
</timespan>
<onroadvehicleselections>
</onroadvehicleselections>
<offroadvehicleselections>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="5"
sectorname="Agriculture"/>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="6"
sectorname="Commercial"/>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="2"
sectorname="Construction"/>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="3"
sectorname="Industrial"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="5" sectorname="Agriculture"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="6" sectorname="Commercial"/>
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        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="1" sectorname="Recreational"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="5"
sectorname="Agriculture"/>
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sectorname="Commercial"/>
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sectorname="Construction"/>
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sectorname="Industrial"/>
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sectorname="Lawn/Garden"/>
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sectorname="Pleasure Craft"/>
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        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="15"
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processname="Refueling Displacement Vapor Loss"/>
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processname="Refueling Spillage Loss"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="20"
processname="Evap Tank Permeation"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="21"
processname="Evap Hose Permeation"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="30"
processname="Diurnal Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="31"
processname="HotSoak Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="32"
processname="RunningLoss Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="100"  pollutantname="Primary  Exhaust  PM10  -  Total"
processkey="1" processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="110"  pollutantname="Primary  Exhaust  PM2.5  -  Total"
processkey="1" processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="31"  pollutantname="Sulfur  Dioxide  (SO2)"  processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="15"
processname="Crankcase Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="18"
processname="Refueling Displacement Vapor Loss"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="19"
processname="Refueling Spillage Loss"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="20"
processname="Evap Tank Permeation"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="21"
processname="Evap Hose Permeation"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="30"
processname="Diurnal Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="31"
processname="HotSoak Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="32"
processname="RunningLoss Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="1"
processname="Running Exhaust"/>
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processname="Crankcase Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="18"
processname="Refueling Displacement Vapor Loss"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="19"
processname="Refueling Spillage Loss"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="20"
processname="Evap Tank Permeation"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="21"
processname="Evap Hose Permeation"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="30"
processname="Diurnal Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="31"
processname="HotSoak Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="32"
processname="RunningLoss Fuel Vapor Venting"/>
</pollutantprocessassociations>
<databaseselections>
        <databaseselection servername="localhost" databasename="MC_SIP_2011-06-09_in" description=""/>
</databaseselections>
<internalcontrolstrategies>
<  i  n  t  e  r  n  a  l  c  o  n  t  r  o  l  s  t  r  a  t  e  g  y
classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontrolstrategies.rateofprogress.RateOfProgress
Strategy"><![CDATA['useParameters No']]></internalcontrolstrategy>
</internalcontrolstrategies>
<inputdatabase servername="" databasename="" description=""/>
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<geographicoutputdetail description="COUNTY"/>
<outputemissionsbreakdownselection>
        <modelyear selected="false"/>
        <fueltype selected="false"/>
        <fuelsubtype selected="false"/>
        <emissionprocess selected="true"/>
        <onroadoffroad selected="true"/>
        <roadtype selected="false"/>
        <sourceusetype selected="false"/>
        <movesvehicletype selected="false"/>
        <onroadscc selected="true"/>
        <estimateuncertainty    selected="false"    numberOfIterations="2"    keepSampledData="false"
```

```
keepIterations="false"/>
        <sector selected="true"/>
        <engtechid selected="false"/>
        <hpclass selected="false"/>
        <regclassid selected="false"/>
</outputemissionsbreakdownselection>
<outputdatabase servername="" databasename="MC_SIP_2011-06-09_out" description=""/>
<outputtimestep value="24-Hour Day"/>
<outputvmtdata value="false"/>
<outputsho value="false"/>
<outputsh value="false"/>
<outputshp value="false"/>
<outputshidling value="false"/>
<outputstarts value="false"/>
<outputpopulation value="false"/>
<scaleinputdatabase servername="" databasename="" description=""/>
<pmsize value="0"/>
<outputfactors>
        <timefactors selected="true" units="Days"/>
        <distancefactors selected="true" units="Miles"/>
        <massfactors selected="true" units="U.S. Ton" energyunits="Joules"/>
</outputfactors>
<savedata>

</savedata>

<donotexecute>

</donotexecute>

<generatordatabase shouldsave="false" servername="" databasename="" description=""/>
        <donotperformfinalaggregation selected="false"/>
<lookuptableflags scenarioid="" truncateoutput="true" truncateactivity="true" truncatebaserates="true"/>
</runspec>
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MOVES2014a RunSpec for Pinal County on June 9, 2011

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<runspec version="MOVES2014a-20151028">
<description><![CDATA[2011-06-09 Pinal County daily nonroad for SIP modeling]]></description>
<models>
        <model value="NONROAD"/>
</models>
<modelscale value="Inv"/>
<modeldomain value="NATIONAL"/>
<geographicselections>
        <geographicselection type="COUNTY" key="4021" description="ARIZONA - Pinal County"/>
</geographicselections>
<timespan>
        <year key="2011"/>
        <month id="6"/>
        <day id="5"/>
        <beginhour id="0"/>
        <endhour id="0"/>
        <aggregateBy key="Hour"/>
</timespan>
<onroadvehicleselections>
</onroadvehicleselections>
<offroadvehicleselections>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="5"
sectorname="Agriculture"/>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="6"
sectorname="Commercial"/>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="2"
sectorname="Construction"/>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="3"
sectorname="Industrial"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="5" sectorname="Agriculture"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="6" sectorname="Commercial"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="2" sectorname="Construction"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="3" sectorname="Industrial"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="4" sectorname="Lawn/Garden"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="11" sectorname="Pleasure Craft"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="12" sectorname="Railroad"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="1" sectorname="Recreational"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="5"
sectorname="Agriculture"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="6"
sectorname="Commercial"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="2"
sectorname="Construction"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="3"
sectorname="Industrial"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="4"
sectorname="Lawn/Garden"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="12"
sectorname="Railroad"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="1"
sectorname="Recreational"/>
        <offroadvehicleselection   fueltypeid="24"   fueltypedesc="Marine   Diesel   Fuel"   sectorid="11"
sectorname="Pleasure Craft"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="5"
sectorname="Agriculture"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="6"
sectorname="Commercial"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="2"
sectorname="Construction"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="3"
sectorname="Industrial"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="4"
sectorname="Lawn/Garden"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="12"
sectorname="Railroad"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="1"
sectorname="Recreational"/>
</offroadvehicleselections>
<offroadvehiclesccs>
</offroadvehiclesccs>
<roadtypes separateramps="false">
        <roadtype roadtypeid="100" roadtypename="Nonroad" modelCombination="M2"/>
</roadtypes>
<pollutantprocessassociations>
        <pollutantprocessassociation   pollutantkey="30"   pollutantname="Ammonia   (NH3)"   processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="2"  pollutantname="Carbon  Monoxide  (CO)"  processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="1"
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```
processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="15"
processname="Crankcase Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="18"
processname="Refueling Displacement Vapor Loss"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="19"
processname="Refueling Spillage Loss"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="20"
processname="Evap Tank Permeation"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="21"
processname="Evap Hose Permeation"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="30"
processname="Diurnal Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="31"
processname="HotSoak Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="32"
processname="RunningLoss Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="100"  pollutantname="Primary  Exhaust  PM10  -  Total"
processkey="1" processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="110"  pollutantname="Primary  Exhaust  PM2.5  -  Total"
processkey="1" processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="31"  pollutantname="Sulfur  Dioxide  (SO2)"  processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="15"
processname="Crankcase Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="18"
processname="Refueling Displacement Vapor Loss"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="19"
processname="Refueling Spillage Loss"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="20"
processname="Evap Tank Permeation"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="21"
processname="Evap Hose Permeation"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="30"
processname="Diurnal Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="31"
processname="HotSoak Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="32"
processname="RunningLoss Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="15"
processname="Crankcase Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="18"
processname="Refueling Displacement Vapor Loss"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="19"
processname="Refueling Spillage Loss"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="20"
processname="Evap Tank Permeation"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="21"
processname="Evap Hose Permeation"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="30"
processname="Diurnal Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="31"
processname="HotSoak Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="32"
processname="RunningLoss Fuel Vapor Venting"/>
</pollutantprocessassociations>
<databaseselections>
        <databaseselection servername="localhost" databasename="PC_SIP_2011-06-09_in" description=""/>
</databaseselections>
<internalcontrolstrategies>
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classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontrolstrategies.rateofprogress.RateOfProgress
Strategy"><![CDATA['useParameters No']]></internalcontrolstrategy>
</internalcontrolstrategies>
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<uncertaintyparameters uncertaintymodeenabled="false" numberofrunspersimulation="0" numberofsimulations="0"/>
<geographicoutputdetail description="COUNTY"/>
<outputemissionsbreakdownselection>
        <modelyear selected="false"/>
        <fueltype selected="false"/>
        <fuelsubtype selected="false"/>
        <emissionprocess selected="true"/>
        <onroadoffroad selected="true"/>
        <roadtype selected="false"/>
        <sourceusetype selected="false"/>
        <movesvehicletype selected="false"/>
        <onroadscc selected="true"/>
```

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        <estimateuncertainty     selected="false"     numberOfIterations="2"     keepSampledData="false"
keepIterations="false"/>
        <sector selected="true"/>
        <engtechid selected="false"/>
        <hpclass selected="false"/>
        <regclassid selected="false"/>
</outputemissionsbreakdownselection>
<outputdatabase servername="" databasename="PC_SIP_2011-06-09_out" description=""/>
<outputtimestep value="24-Hour Day"/>
<outputvmtdata value="false"/>
<outputsho value="false"/>
<outputsh value="false"/>
<outputshp value="false"/>
<outputshidling value="false"/>
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<outputpopulation value="false"/>
<scaleinputdatabase servername="" databasename="" description=""/>
<pmsize value="0"/>
<outputfactors>
        <timefactors selected="true" units="Days"/>
        <distancefactors selected="true" units="Miles"/>
        <massfactors selected="true" units="U.S. Ton" energyunits="Joules"/>
</outputfactors>
<savedata>

</savedata>

<donotexecute>

</donotexecute>

<generatordatabase shouldsave="false" servername="" databasename="" description=""/>
        <donotperformfinalaggregation selected="false"/>
<lookuptableflags scenarioid="" truncateoutput="true" truncateactivity="true" truncatebaserates="true"/>
</runspec>
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MOVES2014a RunSpec for Maricopa County on June 9, 2017

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</models>
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<modeldomain value="NATIONAL"/>
<geographicselections>
        <geographicselection type="COUNTY" key="4013" description="ARIZONA - Maricopa County"/>
</geographicselections>
<timespan>
        <year key="2017"/>
        <month id="6"/>
        <day id="5"/>
        <beginhour id="0"/>
        <endhour id="0"/>
        <aggregateBy key="Hour"/>
</timespan>
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</onroadvehicleselections>
<offroadvehicleselections>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="5"
sectorname="Agriculture"/>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="6"
sectorname="Commercial"/>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="2"
sectorname="Construction"/>
        <offroadvehicleselection  fueltypeid="3"  fueltypedesc="Compressed  Natural  Gas  (CNG)"  sectorid="3"
sectorname="Industrial"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="5" sectorname="Agriculture"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="6" sectorname="Commercial"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="2" sectorname="Construction"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="3" sectorname="Industrial"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="4" sectorname="Lawn/Garden"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="11" sectorname="Pleasure Craft"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="12" sectorname="Railroad"/>
        <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sectorid="1" sectorname="Recreational"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="5"
sectorname="Agriculture"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="6"
sectorname="Commercial"/>
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sectorname="Construction"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="3"
sectorname="Industrial"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="4"
sectorname="Lawn/Garden"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="12"
sectorname="Railroad"/>
        <offroadvehicleselection  fueltypeid="4"  fueltypedesc="Liquefied  Petroleum  Gas  (LPG)"  sectorid="1"
sectorname="Recreational"/>
        <offroadvehicleselection   fueltypeid="24"   fueltypedesc="Marine   Diesel   Fuel"   sectorid="11"
sectorname="Pleasure Craft"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="5"
sectorname="Agriculture"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="6"
sectorname="Commercial"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="2"
sectorname="Construction"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="3"
sectorname="Industrial"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="4"
sectorname="Lawn/Garden"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="12"
sectorname="Railroad"/>
        <offroadvehicleselection   fueltypeid="23"   fueltypedesc="Nonroad   Diesel   Fuel"   sectorid="1"
sectorname="Recreational"/>
</offroadvehicleselections>
<offroadvehiclesccs>
</offroadvehiclesccs>
<roadtypes separateramps="false">
        <roadtype roadtypeid="100" roadtypename="Nonroad" modelCombination="M2"/>
</roadtypes>
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processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="2"  pollutantname="Carbon  Monoxide  (CO)"  processkey="1"
processname="Running Exhaust"/>
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```
processname="Running Exhaust"/>
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processname="Refueling Displacement Vapor Loss"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="19"
processname="Refueling Spillage Loss"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="20"
processname="Evap Tank Permeation"/>
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processname="Evap Hose Permeation"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="30"
processname="Diurnal Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="31"
processname="HotSoak Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="32"
processname="RunningLoss Fuel Vapor Venting"/>
        <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="100"  pollutantname="Primary  Exhaust  PM10  -  Total"
processkey="1" processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="110"  pollutantname="Primary  Exhaust  PM2.5  -  Total"
processkey="1" processname="Running Exhaust"/>
        <pollutantprocessassociation  pollutantkey="31"  pollutantname="Sulfur  Dioxide  (SO2)"  processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="1"
processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="15"
processname="Crankcase Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="18"
processname="Refueling Displacement Vapor Loss"/>
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processname="Refueling Spillage Loss"/>
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processname="HotSoak Fuel Vapor Venting"/>
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MOVES2014a RunSpec for Pinal County on June 9, 2017

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Appendix G-2

EDMS Input Files

EDMS Input File for PHX

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#Study name: Phoenix Skyharbor Airport 2011 Ozone
#Study description: Add a description.
#Study directory: C:\xia\Models\EDMS\2011_2017_Ozone_modeling\Phoenix Skyharbor Airport\
!Version 5.1.4.1
!Settings
Study Type: Emissions
Criteria Pollutants: Criteria Pollutants
Unit System: Metric
Emissions Inventory Units: Metric Tonnes

!SCENARIOS
# IN_STUDY; SCENARIO; ISBASELINE; TIM_BASIS; TAXI_MODEL; SULFR_CONV; DESCRIPT
  T       ; Baseline; T         ;         0;          0;     0.0240; Add a description.

!AIRPORTS
# IN_STUDY; APT_NAME             ; SYSAIRPORT; APT_IATA; CTRYCODE; APT_ICAO; APT_FAA; REGIONICAO;
REGION_ENG; CITY    ; STATE   ; COUNTRY                      ; ELEV_FEET; LOC_LATLON;   LATITUDE;
LONGITUDE;   NORTHING;   EASTING; UTM_ZONE; DESCRIPT
  T       ; Phoenix Sky Harbor Intl; 33112KPHX ; PHX     ; US      ; KPHX    ;         ; K
;           2; Phoenix; Arizona; United States of America;    1135.00; T          ; 33.434167;
-112.008056; 3699874.64; 406293.61;       12; Phoenix Sky Harbor Intl

!YEARS
# ANALYEAR
      2011
      2017

!PROPERTIES_FOR_SCENARIO-AIRPORT_COMBINATIONS
# SCEN_APT; SCENARIO; APT_NAME                ; MX_HEIGHT; USEHRLYMET; TEMP_AVG; TEMP_DLYHI;
TEMP_DLYLO; PRESSURE; PRES_MSL; HUMIDITY; WIND_SPEED; WIND_DIR;  CEILING; VISIBILITY; RUN_AERMET;
AMETSFC_FN; AMETPFL_FN; AMETMET_FN; PROFBASE_M
         1; Baseline; Phoenix Sky Harbor Intl;   3000.00; T         ;    72.00;      82.35;
61.65;    28.74;    29.88;    32.59;       5.22;     0.00; 99999.99;      50.00; F         ; Y.SFC
   ; Y.PFL     ; Y.met     ;     345.95

!PROPERTIES_FOR_SCENARIO-AIRPORT-YEAR_COMBINATIONS
# SCEN_APT; ANAL_YEAR; DEFTOTTAXI; DEFTOTTAXO; DEFUIMTAXI; DEFUIMTAXO; USEACSCHED; ACSCHED_FN

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         1;      2017;       7.00;      19.00;       0.00;       0.00; F         ;


!AIRCRAFT_DEFINITIONS
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APU_ID; APU_TIME_D; APU_TIME_A; USE_DEFGSE; GATE_NAME; FUEL_SULFR
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         1;          3; A320-1     ; 1CM008    ; AC3A-A320 - Airbus A320 All Series      ; F
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13.00;      13.00; T         ;          ;   0.000680
        1;         24; CRJ9       ; 8GE107    ; ML10-CRJ9 - Bombardier CRJ-900          ; F
 ;          ; T         ;      80000;      73500; T         ;        3.0; T         ;     13;
13.00;      13.00; T         ;          ;   0.000680
        1;         25; CL300      ; 6AL006    ; GA31-CL30 - Bombardier (Canadair) Challe; F
 ;          ; T         ;      36000;      29700; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;         26; CL601      ; 1GE034    ; GA7-CL60 - Bombardier Challenger 600/601; F
 ;          ; T         ;      43100;      32400; T         ;        3.0; T         ;      7;
13.00;      13.00; T         ;          ;   0.000680
        1;         27; LEAR35     ; 1AS001    ; GA27-LJ35 - Bombardier Learjet 35/36    ; F
 ;          ; T         ;      18300;      13800; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;         28; LEAR36     ; 1AS001    ; AC17-LJ35 - Bombardier Learjet 35/36    ; F
 ;          ; T         ;      18300;      13800; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;         29; LEAR45     ; 1AS001    ; GA5-LJ45 - Bombardier Learjet 45        ; F
 ;          ; T         ;      18300;      13800; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;         30; LEAR60     ; TFE731    ; GA30-LJ60 - Bombardier Learjet 60       ; F
 ;          ; T         ;      18300;      13800; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;         31; CNA172     ; IO360     ; GA10-C172 - Cessna Skyhawk 172/Cutlass  ; F
 ;          ; T         ;       2450;       2450; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;         32; CNA182     ; IO360     ; GA11-C182 - Cessna Skylane 182          ; F
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 ;          ; T         ;       2800;       2800; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          33; CNA210     ; TIO540    ; GA24-C210 - Cessna 210 Centurion        ; F
 ;          ; T         ;       3000;       2700; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          34; CNA402     ; TIO540    ; AC18-C402 - Cessna 401/402              ; F
 ;          ; T         ;       5500;       5500; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          35; CNA414     ; TIO540    ; GA34-C414 - Cessna Chancellor 414       ; F
 ;          ; T         ;       5500;       5500; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          36; CNA421     ; TIO540    ; GA29-C421 - Cessna Golden Eagle 421     ; F
 ;          ; T         ;       5500;       5500; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          37; CNA425     ; PT6A60    ; GA37-C425 - Cessna 425 Corsair          ; F
 ;          ; T         ;       9850;       8424; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          38; CNA525     ; 1PW035    ; GA16-C525 - Cessna CitationJet/CJ1       ; F
 ;          ; T         ;      14700;      12600; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          39; CNA525     ; 1PW035    ; GA23-C25B - Cessna Citation CJ3          ; F
 ;          ; T         ;      14700;      12600; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          40; CNA525     ; 1PW035    ; GA32-DA40 - Diamond Star DA40            ; F
 ;          ; T         ;      14700;      12600; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          41; CNA525     ; 1PW035    ; GA33-C25A - Cessna Citation CJ2          ; F
 ;          ; T         ;      14700;      12600; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          42; CNA550     ; 1PW036    ; GA17-C550 - Cessna Citation II/Bravo     ; F
 ;          ; T         ;      14800;      12150; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          43; CNA560-XL  ; 1PW037    ; AT5-C56X - Cessna Excel/XLS              ; F
 ;          ; T         ;      14800;      12150; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          44; CNA560-XL  ; 1PW037    ; GA8-C56X - Cessna Excel/XLS              ; F
 ;          ; T         ;      14800;      12150; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          45; CNA560     ; 1PW037    ; GA2-C560 - Cessna Citation V/Ultra/Encor; F
 ;          ; T         ;      14800;      12150; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          46; CNA650     ; 1AS002    ; GA22-C650 - Cessna III/VI/VII            ; F
 ;          ; T         ;      20000;      15300; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          47; CNA750     ; 6AL022    ; AT6-C750 - Cessna Citation X             ; F
 ;          ; T         ;      35700;      28620; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          48; CNA750     ; 6AL022    ; GA21-C750 - Cessna Citation X            ; F
 ;          ; T         ;      35700;      28620; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          49; SR22       ; TIO540    ; GA14-SR22 - Cirrus SR 22                 ; F
 ;          ; T         ;       2440;       2160; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          50; FAL2000    ; 7PW080    ; GA20-F2TH - Dassault Falcon 2000         ; F
 ;          ; T         ;      35700;      28620; T         ;        3.0; T         ;      8;
13.00;      13.00; T         ;          ;   0.000680
        1;          51; FAL900     ; 1AS002    ; GA35-F900 - Dassault Falcon 900          ; F
 ;          ; T         ;      19200;      14600; T         ;        3.0; T         ;      8;
13.00;      13.00; T         ;          ;   0.000680
        1;          52; ERJ190     ; 11GE140   ; AC15-E190 - Embraer 190                 ; F
 ;          ; T         ;     126900;      99900; T         ;        3.0; T         ;      8;
13.00;      13.00; T         ;          ;   0.000680
        1;          53; GULF4      ; 1RR019    ; GA13-GLF4 - Gulfstream IV/G400           ; F
 ;          ; T         ;      63410;      59400; T         ;        3.0; T         ;      7;
13.00;      13.00; T         ;          ;   0.000680
        1;          54; GULF5      ; 4BR008    ; GA25-GLF5 - Gulfstream V/G500            ; F
 ;          ; T         ;      76925;      67770; T         ;        3.0; T         ;      6;
13.00;      13.00; T         ;          ;   0.000680
        1;          55; GULF1      ; RDA7      ; GA26-AC90 - Gulfstream Commander         ; F
 ;          ; T         ;      46500;      38700; T         ;        3.0; T         ;      8;
13.00;      13.00; T         ;          ;   0.000680
        1;          56; HS125-7    ; 1AS002    ; GA6-H25B - BAe HS 125/700-800/Hawker 800; F
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 ;          ; T         ;      28660;      24560; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          57; MIL-C130   ; T56A15    ; ML8-C130 - Lockheed 130 Hercules        ; F
 ;          ; T         ;     132000;     121500; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          58; MOONEY-M20K; TSIO36    ; GA36-M20P - Mooney M-20C Ranger         ; F
 ;          ; T         ;       3000;       2700; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          59; PC12       ; PT6A67    ; GA9-PC12 - Pilatus PC-12                ; F
 ;          ; T         ;       7875;       4250; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          60; PA28       ; IO320     ; GA15-P28A - Piper Cherokee              ; F
 ;          ; T         ;       2200;       1980; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          61; BEECH1900-C; PT6A6B    ; AT4-B190 - Beech 1900/C-12J             ; F
 ;          ; T         ;      15500;      14940; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          62; BEECH58    ; TIO540    ; GA12-BE58 - Beech 58                    ; F
 ;          ; T         ;       5500;       5500; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          63; BEECH36    ; TIO540    ; GA18-BE36 - Beech Bonanza 36            ; F
 ;          ; T         ;       7875;       4250; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          64; BEECH36    ; TIO540    ; GA19-BE35 - Beech Bonanza 35            ; F
 ;          ; T         ;       7875;       4250; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          65; BEECH400   ; 1PW037    ; GA4-BE40 - Raytheon/Beech Beechjet 400/T; F
 ;          ; T         ;      14100;      11900; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          66; BEECH400   ; 1PW037    ; ML7-BE40 - Raytheon/Beech Beechjet 400/T; F
 ;          ; T         ;      14100;      11900; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          67; HS125-1000 ; TFE731    ; ML2-TEX2 - Raytheon Texan 2             ; F
 ;          ; T         ;      18300;      13800; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          68; BEECH90    ; P6135A    ; GA1-BE9L - Beech King Air 90            ; F
 ;          ; T         ;      12500;      11070; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          69; PREMIER    ; 1PW035    ; GA28-PRM1 - Raytheon Premier 1/390 Premi; F
 ;          ; T         ;      14800;      12150; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          70; BEECH200   ; PT6A42    ; GA3-BE20 - Beech 200 Super King         ; F
 ;          ; T         ;      12500;      11070; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          71; BEECH200   ; PT6A42    ; ML4-BE20 - Beech 200 Super King         ; F
 ;          ; T         ;      12500;      11070; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          72; MIL-T38    ; J855HA    ; ML5-T38 - Northrop T-38 Talon           ; F
 ;          ; T         ;      10279;      12093; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680
        1;          73; DHC8-2     ; PW123C    ; AT3-DH8B - Bombardier DHC8-200          ; F
 ;          ; T         ;      38700;      37800; T         ;        3.0; T         ;      0;
13.00;      13.00; T         ;          ;   0.000680

!AIRCRAFT_OPERATIONS
# SCEN_APT; STUDYAC_ID; ANAL_YEAR; TAXITIME_O; TAXITIME_I;     DEP_COUNT; DEP_PROFQH; DEP_PROFDY;
DEP_PROFMO;     ARR_COUNT; ARR_PROFQH; ARR_PROFDY; ARR_PROFMO; TGO_COUNT; TGO_PROFQH; TGO_PROFDY;
TGO_PROFMO
        1;          1;      2011;      14.00;       7.00;    10.000000;          6;          8;
      8;    10.000000;          6;          8;          8;  0.000000;          0;          0;
    0
        1;          1;      2017;      14.00;       7.00;     9.000000;          6;          8;
      8;     9.000000;          6;          8;          8;  0.000000;          0;          0;
    0
        1;          2;      2011;      14.00;       7.00; 13598.000000;          2;          2;
      4; 13598.000000;          2;          2;          4;  0.000000;          0;          0;
    0
        1;          2;      2017;      14.00;       7.00; 14075.000000;          2;          2;
      4; 14075.000000;          2;          2;          4;  0.000000;          0;          0;
    0
        1;          3;      2011;      14.00;       7.00;  6219.000000;          2;          2;
      4;  6219.000000;          2;          2;          4;  0.000000;          0;          0;
```

```
0
   1;          3;      2017;      14.00;       7.00;  6437.000000;          2;          2;
   4;  6437.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          4;      2011;      14.00;       7.00;  6219.000000;          2;          2;
   4;  6219.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          4;      2017;      14.00;       7.00;  6438.000000;          2;          2;
   4;  6438.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          5;      2011;      14.00;       7.00;  4573.000000;          2;          2;
   4;  4573.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          5;      2017;      14.00;       7.00;  4734.000000;          2;          2;
   4;  4734.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          6;      2011;      14.00;       7.00; 11098.000000;          2;          2;
   4; 11098.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          6;      2017;      14.00;       7.00; 11487.000000;          2;          2;
   4; 11487.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          7;      2011;      14.00;       7.00;   251.000000;          2;          2;
   4;   251.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          7;      2017;      14.00;       7.00;   260.000000;          2;          2;
   4;   260.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          8;      2011;      14.00;       7.00;  1162.000000;          2;          2;
   4;  1162.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          8;      2017;      14.00;       7.00;  1202.000000;          2;          2;
   4;  1202.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          9;      2011;      14.00;       7.00; 21562.000000;          2;          2;
   4; 21562.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          9;      2017;      14.00;       7.00; 22318.000000;          2;          2;
   4; 22318.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         10;      2011;      14.00;       7.00;  2826.000000;          2;          2;
   4;  2826.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         10;      2017;      14.00;       7.00;  2925.000000;          2;          2;
   4;  2925.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         11;      2011;      14.00;       7.00;   890.000000;          2;          2;
   4;   890.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         11;      2017;      14.00;       7.00;   922.000000;          2;          2;
   4;   922.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         12;      2011;      14.00;       7.00;  3723.000000;          2;          2;
   4;  3723.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         12;      2017;      14.00;       7.00;  3854.000000;          2;          2;
   4;  3854.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         13;      2011;      14.00;       7.00;    25.000000;          6;          8;
   8;    25.000000;          6;          8;          8;  0.000000;          0;          0;
0
   1;         13;      2017;      14.00;       7.00;    23.000000;          6;          8;
   8;    23.000000;          6;          8;          8;  0.000000;          0;          0;
0
   1;         14;      2011;      14.00;       7.00;   301.000000;          6;          8;
   8;   301.000000;          6;          8;          8;  0.000000;          0;          0;
0
   1;         14;      2017;      14.00;       7.00;   276.000000;          6;          8;
   8;   276.000000;          6;          8;          8;  0.000000;          0;          0;
0
   1;         15;      2011;      14.00;       7.00;  1158.000000;          2;          2;
   4;  1158.000000;          2;          2;          4;  0.000000;          0;          0;
```

```
0
   1;         15;      2017;      14.00;       7.00;  1199.000000;          2;          2;
   4;  1199.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         16;      2011;      14.00;       7.00;   803.000000;          2;          2;
   4;   803.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         16;      2017;      14.00;       7.00;   831.000000;          2;          2;
   4;   831.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         17;      2011;      14.00;       7.00;    16.000000;          6;          8;
   8;    16.000000;          6;          8;          8;  0.000000;          0;          0;
0
   1;         17;      2017;      14.00;       7.00;    15.000000;          6;          8;
   8;    15.000000;          6;          8;          8;  0.000000;          0;          0;
0
   1;         18;      2011;      14.00;       7.00;   409.000000;          2;          2;
   4;   409.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         18;      2017;      14.00;       7.00;   423.000000;          2;          2;
   4;   423.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         19;      2011;      14.00;       7.00;   830.000000;          2;          2;
   4;   830.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         19;      2017;      14.00;       7.00;   859.000000;          2;          2;
   4;   859.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         20;      2011;      14.00;       7.00;  3012.000000;          2;          4;
   2;  3012.000000;          2;          4;          2;  0.000000;          0;          0;
0
   1;         20;      2017;      14.00;       7.00;  2262.000000;          2;          4;
   2;  2262.000000;          2;          4;          2;  0.000000;          0;          0;
0
   1;         21;      2011;      14.00;       7.00;  1949.000000;          2;          2;
   4;  1949.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         21;      2017;      14.00;       7.00;  2017.000000;          2;          2;
   4;  2017.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         22;      2011;      14.00;       7.00;   282.000000;          2;          2;
   4;   282.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         22;      2017;      14.00;       7.00;   292.000000;          2;          2;
   4;   292.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;         23;      2011;      14.00;       7.00;  6985.000000;          2;          4;
   2;  6985.000000;          2;          4;          2;  0.000000;          0;          0;
0
   1;         23;      2017;      14.00;       7.00;  5246.000000;          2;          4;
   2;  5246.000000;          2;          4;          2;  0.000000;          0;          0;
0
   1;         24;      2011;      14.00;       7.00;     9.000000;          6;          8;
   8;     9.000000;          6;          8;          8;  0.000000;          0;          0;
0
   1;         24;      2017;      14.00;       7.00;     8.000000;          6;          8;
   8;     8.000000;          6;          8;          8;  0.000000;          0;          0;
0
   1;         25;      2011;      14.00;       7.00;    46.000000;          4;          6;
   6;    46.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         25;      2017;      14.00;       7.00;    44.000000;          4;          6;
   6;    44.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         26;      2011;      14.00;       7.00;   168.000000;          4;          6;
   6;   168.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         26;      2017;      14.00;       7.00;   161.000000;          4;          6;
   6;   161.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         27;      2011;      14.00;       7.00;    54.000000;          4;          6;
   6;    54.000000;          4;          6;          6;  0.000000;          0;          0;
```

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0
   1;          27;       2017;       14.00;       7.00;    52.000000;          4;          6;
   6;    52.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          28;       2011;       14.00;       7.00;   260.000000;          2;          2;
   4;   260.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          28;       2017;       14.00;       7.00;   269.000000;          2;          2;
   4;   269.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          29;       2011;       14.00;       7.00;   177.000000;          4;          6;
   6;   177.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          29;       2017;       14.00;       7.00;   170.000000;          4;          6;
   6;   170.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          30;       2011;       14.00;       7.00;    46.000000;          4;          6;
   6;    46.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          30;       2017;       14.00;       7.00;    45.000000;          4;          6;
   6;    45.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          31;       2011;       14.00;       7.00;   146.000000;          4;          6;
   6;   146.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          31;       2017;       14.00;       7.00;   140.000000;          4;          6;
   6;   140.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;   109.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;   104.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    60.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          33;       2017;       14.00;       7.00;    58.000000;          4;          6;
   6;    58.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          34;       2011;       14.00;       7.00;   259.000000;          2;          2;
   4;   259.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          34;       2017;       14.00;       7.00;   268.000000;          2;          2;
   4;   268.000000;          2;          2;          4;  0.000000;          0;          0;
0
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   6;    39.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    37.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    47.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    45.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    37.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    35.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    93.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    90.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          39;       2011;       14.00;       7.00;    63.000000;          4;          6;
   6;    63.000000;          4;          6;          6;  0.000000;          0;          0;
```

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0
   1;         39;      2017;      14.00;       7.00;    61.000000;          4;          6;
   6;    61.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         40;      2011;      14.00;       7.00;    44.000000;          4;          6;
   6;    44.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         40;      2017;      14.00;       7.00;    42.000000;          4;          6;
   6;    42.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    39.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         41;      2017;      14.00;       7.00;    37.000000;          4;          6;
   6;    37.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    92.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    88.000000;          4;          6;          6;  0.000000;          0;          0;
0
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0
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   2;    79.000000;          2;          4;          2;  0.000000;          0;          0;
0
   1;         44;      2011;      14.00;       7.00;   148.000000;          4;          6;
   6;   148.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         44;      2017;      14.00;       7.00;   142.000000;          4;          6;
   6;   142.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;   285.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;   274.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         46;      2011;      14.00;       7.00;    70.000000;          4;          6;
   6;    70.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    68.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         47;      2011;      14.00;       7.00;   105.000000;          2;          4;
   2;   105.000000;          2;          4;          2;  0.000000;          0;          0;
0
   1;         47;      2017;      14.00;       7.00;    79.000000;          2;          4;
   2;    79.000000;          2;          4;          2;  0.000000;          0;          0;
0
   1;         48;      2011;      14.00;       7.00;    71.000000;          4;          6;
   6;    71.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         48;      2017;      14.00;       7.00;    68.000000;          4;          6;
   6;    68.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         49;      2011;      14.00;       7.00;   102.000000;          4;          6;
   6;   102.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    98.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         50;      2011;      14.00;       7.00;    78.000000;          4;          6;
   6;    78.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         50;      2017;      14.00;       7.00;    75.000000;          4;          6;
   6;    75.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;         51;      2011;      14.00;       7.00;    37.000000;          4;          6;
   6;    37.000000;          4;          6;          6;  0.000000;          0;          0;
```

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0
   1;          51;       2017;       14.00;       7.00;    36.000000;          4;          6;
   6;    36.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          52;       2011;       14.00;       7.00;   302.000000;          2;          2;
   4;   302.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          52;       2017;       14.00;       7.00;   312.000000;          2;          2;
   4;   312.000000;          2;          2;          4;  0.000000;          0;          0;
0
   1;          53;       2011;       14.00;       7.00;   107.000000;          4;          6;
   6;   107.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          53;       2017;       14.00;       7.00;   103.000000;          4;          6;
   6;   103.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          54;       2011;       14.00;       7.00;    56.000000;          4;          6;
   6;    56.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          54;       2017;       14.00;       7.00;    54.000000;          4;          6;
   6;    54.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          55;       2011;       14.00;       7.00;    56.000000;          4;          6;
   6;    56.000000;          4;          6;          6;  0.000000;          0;          0;
0
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0
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   6;   173.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          56;       2017;       14.00;       7.00;   166.000000;          4;          6;
   6;   166.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          57;       2011;       14.00;       7.00;    10.000000;          6;          8;
   8;    10.000000;          6;          8;          8;  0.000000;          0;          0;
0
   1;          57;       2017;       14.00;       7.00;     9.000000;          6;          8;
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0
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   6;    37.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    36.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          59;       2011;       14.00;       7.00;   147.000000;          4;          6;
   6;   147.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          59;       2017;       14.00;       7.00;   141.000000;          4;          6;
   6;   141.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          60;       2011;       14.00;       7.00;   100.000000;          4;          6;
   6;   100.000000;          4;          6;          6;  0.000000;          0;          0;
0
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   6;    96.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          61;       2011;       14.00;       7.00;   772.000000;          2;          4;
   2;   772.000000;          2;          4;          2;  0.000000;          0;          0;
0
   1;          61;       2017;       14.00;       7.00;   580.000000;          2;          4;
   2;   580.000000;          2;          4;          2;  0.000000;          0;          0;
0
   1;          62;       2011;       14.00;       7.00;   108.000000;          4;          6;
   6;   108.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          62;       2017;       14.00;       7.00;   104.000000;          4;          6;
   6;   104.000000;          4;          6;          6;  0.000000;          0;          0;
0
   1;          63;       2011;       14.00;       7.00;    88.000000;          4;          6;
   6;    88.000000;          4;          6;          6;  0.000000;          0;          0;
```

```
0
    1;          63;       2017;       14.00;        7.00;     84.000000;          4;          6;
   6;     84.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          64;       2011;       14.00;        7.00;     82.000000;          4;          6;
   6;     82.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          64;       2017;       14.00;        7.00;     78.000000;          4;          6;
   6;     78.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          65;       2011;       14.00;        7.00;    210.000000;          4;          6;
   6;    210.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          65;       2017;       14.00;        7.00;    202.000000;          4;          6;
   6;    202.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          66;       2011;       14.00;        7.00;     12.000000;          6;          8;
   8;     12.000000;           6;           8;           8;   0.000000;          0;          0;
0
    1;          66;       2017;       14.00;        7.00;     11.000000;          6;          8;
   8;     11.000000;           6;           8;           8;   0.000000;          0;          0;
0
    1;          67;       2011;       14.00;        7.00;     59.000000;          6;          8;
   8;     59.000000;           6;           8;           8;   0.000000;          0;          0;
0
    1;          67;       2017;       14.00;        7.00;     54.000000;          6;          8;
   8;     54.000000;           6;           8;           8;   0.000000;          0;          0;
0
    1;          68;       2011;       14.00;        7.00;    425.000000;          4;          6;
   6;    425.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          68;       2017;       14.00;        7.00;    408.000000;          4;          6;
   6;    408.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          69;       2011;       14.00;        7.00;     53.000000;          4;          6;
   6;     53.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          69;       2017;       14.00;        7.00;     51.000000;          4;          6;
   6;     51.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          70;       2011;       14.00;        7.00;    238.000000;          4;          6;
   6;    238.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          70;       2017;       14.00;        7.00;    229.000000;          4;          6;
   6;    229.000000;           4;           6;           6;   0.000000;          0;          0;
0
    1;          71;       2011;       14.00;        7.00;     25.000000;          6;          8;
   8;     25.000000;           6;           8;           8;   0.000000;          0;          0;
0
    1;          71;       2017;       14.00;        7.00;     23.000000;          6;          8;
   8;     23.000000;           6;           8;           8;   0.000000;          0;          0;
0
    1;          72;       2011;       14.00;        7.00;     16.000000;          6;          8;
   8;     16.000000;           6;           8;           8;   0.000000;          0;          0;
0
    1;          72;       2017;       14.00;        7.00;     15.000000;          6;          8;
   8;     15.000000;           6;           8;           8;   0.000000;          0;          0;
0
    1;          73;       2011;       14.00;        7.00;   2614.000000;          2;          4;
   2;   2614.000000;           2;           4;           2;   0.000000;          0;          0;
0
    1;          73;       2017;       14.00;        7.00;   1964.000000;          2;          4;
   2;   1964.000000;           2;           4;           2;   0.000000;          0;          0;
0

!AIRCRAFT_GSE_ASSIGNMENTS
#  SCEN_APT;  STUDYAC_ID;  SYSGSE_ID;  FUEL_TYPE;  OP_TIMEDEP;  OP_TIMEARR;  HORSEPOWER;  LOADFACTOR;
MANU_YEAR; REFERENCE
        1;           1;        21; D         ;        5.00;        5.00;         25;     0.5000;
   0; Taylor Dunn
        1;           1;        30; D         ;      120.00;        0.00;        158;     0.8200;
   0;
```

```
      1;          1;        38; D        ;       5.00;       5.00;        115;     0.5000;
0;
      1;          1;        39; D        ;       0.00;       0.00;        140;     0.5000;
0;
      1;          2;         3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;          2;         4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;          2;         8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;          2;        13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;          2;        14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;          2;        17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;          2;        23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;          2;        35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;          2;        36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;          2;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;          2;        43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;          3;         3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;          3;         4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;          3;         8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;          3;        13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;          3;        14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;          3;        17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;          3;        23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;          3;        35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;          3;        36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;          3;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;          3;        43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;          4;         3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;          4;         4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;          4;         8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;          4;        13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;          4;        14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;          4;        17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;          4;        23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;          4;        35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;          4;        36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;          4;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;          4;        43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;          5;         3; E        ;      23.00;       7.00;          0;     0.7500;
0;
```

```
      1;          5;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;          5;          8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;          5;         13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;          5;         14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;          5;         17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;          5;         23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;          5;         35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;          5;         36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;          5;         41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;          5;         43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;          6;          3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;          6;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;          6;          8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;          6;         13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;          6;         14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;          6;         17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;          6;         23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;          6;         35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;          6;         36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;          6;         41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;          6;         43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;          7;          3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;          7;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;          7;          8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;          7;         13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;          7;         14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;          7;         17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;          7;         23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;          7;         35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;          7;         36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;          7;         41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;          7;         43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;          8;          3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;          8;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;          8;          8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;          8;         13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
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```
      1;          8;         14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;          8;         17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;          8;         23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;          8;         35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;          8;         36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;          8;         41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;          8;         43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;          9;          3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;          9;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;          9;          8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;          9;         13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;          9;         14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;          9;         17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;          9;         23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;          9;         35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;          9;         36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;          9;         41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;          9;         43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;         10;          3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;         10;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;         10;          8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;         10;         13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         10;         14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         10;         17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;         10;         23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;         10;         35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;         10;         36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         10;         41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         10;         43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;         11;          3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;         11;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;         11;          8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;         11;         13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         11;         14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         11;         17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;         11;         23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
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      1;         11;         35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;         11;         36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         11;         41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         11;         43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;         12;          3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;         12;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;         12;         10; D        ;       8.00;       0.00;        190;     0.8000;
0; Stewart & Stevenson TUG GT-50H
      1;         12;         13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         12;         14; G        ;      24.00;      24.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         12;         17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;         12;         23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;         12;         35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;         12;         36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         12;         41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         12;         43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;         13;         21; D        ;       5.00;       5.00;         25;     0.5000;
0; Taylor Dunn
      1;         13;         30; D        ;     120.00;       0.00;        158;     0.8200;
0;
      1;         13;         38; D        ;       5.00;       5.00;        115;     0.5000;
0;
      1;         13;         39; D        ;       0.00;       0.00;        140;     0.5000;
0;
      1;         14;         21; D        ;       5.00;       5.00;         25;     0.5000;
0; Taylor Dunn
      1;         14;         30; D        ;     120.00;       0.00;        158;     0.8200;
0;
      1;         14;         38; D        ;       5.00;       5.00;        115;     0.5000;
0;
      1;         14;         39; D        ;       0.00;       0.00;        140;     0.5000;
0;
      1;         15;          3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;         15;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;         15;          8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;         15;         13; G        ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         15;         14; D        ;      24.00;      24.00;         71;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         15;         17; D        ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;         15;         23; D        ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;         15;         35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;         15;         36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         15;         41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         15;         43; E        ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;         16;          3; E        ;      23.00;       7.00;          0;     0.7500;
0;
      1;         16;          4; D        ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
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      1;         16;         8; D         ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;         16;        13; G         ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         16;        14; D         ;      24.00;      24.00;         71;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         16;        17; D         ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;         16;        23; D         ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;         16;        35; D         ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;         16;        36; D         ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         16;        41; D         ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         16;        43; E         ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;         17;         3; E         ;      23.00;       7.00;          0;     0.7500;
0;
      1;         17;         4; D         ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;         17;         8; D         ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;         17;        13; G         ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         17;        14; D         ;      24.00;      24.00;         71;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         17;        17; D         ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;         17;        23; D         ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;         17;        35; D         ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;         17;        36; D         ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         17;        41; D         ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         17;        43; E         ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;         18;         3; E         ;      23.00;       7.00;          0;     0.7500;
0;
      1;         18;         4; D         ;       7.00;       0.00;        425;     0.9000;
0; ACE 180
      1;         18;         8; D         ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;         18;        13; G         ;      38.00;      37.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         18;        14; D         ;      24.00;      24.00;         71;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         18;        17; D         ;      10.00;      10.00;        210;     0.5300;
0; Hi-Way F650
      1;         18;        23; D         ;       8.00;       7.00;        210;     0.5300;
0; Hi-Way F650
      1;         18;        35; D         ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;         18;        36; D         ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         18;        41; D         ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         18;        43; E         ;      12.00;       0.00;          0;     0.2000;
0; Gate Service
      1;         19;         8; D         ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;         19;        13; G         ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         19;        14; G         ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         19;        22; D         ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         19;        35; D         ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
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```
      1;         19;        36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         19;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         20;         8; D        ;       8.00;       0.00;         88;     0.8000;
0; Stewart & Stevenson TUG GT-35, Douglas TBL-180
      1;         20;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         20;        14; G        ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         20;        22; D        ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         20;        35; D        ;      12.00;       0.00;        235;     0.7000;
0; F250 / F350
      1;         20;        36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         20;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         21;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         21;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         21;        14; G        ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         21;        22; D        ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         21;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         21;        36; G        ;       0.00;      15.00;         97;     0.2500;
0; TLD 1410
      1;         21;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         22;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         22;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         22;        14; G        ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         22;        22; D        ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         22;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         22;        36; G        ;       0.00;      15.00;         97;     0.2500;
0; TLD 1410
      1;         22;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         23;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         23;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         23;        14; G        ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         23;        22; D        ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         23;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         23;        36; G        ;       0.00;      15.00;         97;     0.2500;
0; TLD 1410
      1;         23;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         24;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         24;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         24;        14; G        ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         24;        22; D        ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         24;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         24;        36; G        ;       0.00;      15.00;         97;     0.2500;
0; TLD 1410
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      1;         24;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         25;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         25;        13; G        ;      18.00;       0.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         25;        14; G        ;      15.00;       0.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         25;        22; D        ;       5.00;       0.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         25;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         25;        33; D        ;      50.00;       0.00;        194;     0.7500;
0; TLD, 400 Hz AC
      1;         25;        36; G        ;       0.00;       0.00;         97;     0.2500;
0; TLD 1410
      1;         25;        41; D        ;       8.00;       0.00;        235;     0.2000;
0; F250 / F350
      1;         26;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         26;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         26;        14; G        ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         26;        22; D        ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         26;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         26;        33; D        ;      50.00;       0.00;        194;     0.7500;
0; TLD, 400 Hz AC
      1;         26;        36; G        ;       0.00;      15.00;         97;     0.2500;
0; TLD 1410
      1;         26;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         27;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         27;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         28;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         28;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         29;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         29;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         30;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         30;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         31;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         32;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         33;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         34;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         35;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         36;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         37;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         37;        32; D        ;      40.00;       0.00;         71;     0.7500;
0; TLD, 28 VDC
      1;         38;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         38;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         38;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
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      1;         39;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         39;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         39;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         40;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         40;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         40;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         41;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         41;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         41;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         42;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         42;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         42;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         43;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         43;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         43;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         44;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         44;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         44;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         45;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         45;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         45;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         46;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         46;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         46;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         47;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         47;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         47;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         48;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         48;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         48;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         49;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         50;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         50;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         50;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         51;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         51;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
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      1;         51;        32; D        ;      40.00;       0.00;         71;     0.7500;
0; TLD, 28 VDC
      1;         52;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         52;        13; G        ;      18.00;       0.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         52;        14; G        ;      15.00;       0.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         52;        22; D        ;       5.00;       0.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         52;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         52;        36; D        ;       0.00;       0.00;         56;     0.2500;
0; TLD 1410
      1;         52;        41; D        ;       8.00;       0.00;        235;     0.2000;
0; F250 / F350
      1;         53;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         53;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         53;        14; G        ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         53;        22; D        ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         53;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         53;        36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         53;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         54;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         54;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         54;        14; G        ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         54;        22; D        ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         54;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         54;        36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         54;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         55;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         55;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         55;        14; G        ;      15.00;      15.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         55;        22; D        ;       5.00;       5.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         55;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         55;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         55;        36; D        ;       0.00;      15.00;         56;     0.2500;
0; TLD 1410
      1;         55;        41; D        ;       8.00;       7.00;        235;     0.2000;
0; F250 / F350
      1;         56;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         56;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         56;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         57;        21; D        ;       5.00;       5.00;         25;     0.5000;
0; Taylor Dunn
      1;         57;        30; D        ;     120.00;       0.00;        158;     0.8200;
0;
      1;         57;        38; D        ;       5.00;       5.00;        115;     0.5000;
0;
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      1;         57;        39; D        ;       0.00;       0.00;        140;     0.5000;
0;
      1;         58;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         59;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         59;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         59;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         60;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         61;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         61;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         61;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         61;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         62;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         63;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         64;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         65;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         65;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         65;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         66;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         66;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         66;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         67;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         67;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         67;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         68;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         68;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         68;        32; D        ;      40.00;       0.00;         71;     0.7500;
0; TLD, 28 VDC
      1;         69;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         69;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         69;        31; G        ;      40.00;       0.00;        107;     0.7500;
0; TLD
      1;         70;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         70;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         70;        32; D        ;      40.00;       0.00;         71;     0.7500;
0; TLD, 28 VDC
      1;         71;        13; G        ;      18.00;      17.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         71;        29; D        ;      10.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         71;        32; D        ;      40.00;       0.00;         71;     0.7500;
0; TLD, 28 VDC
      1;         72;        21; D        ;       5.00;       0.00;         25;     0.5000;
0; Taylor Dunn
      1;         72;        30; D        ;     120.00;       0.00;        158;     0.8200;
0;
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```
      1;         72;        38; D        ;       5.00;       0.00;        115;     0.5000;
0;
      1;         72;        39; D        ;       0.00;       0.00;        140;     0.5000;
0;
      1;         73;        11; D        ;       5.00;       0.00;         86;     0.8000;
0; Stewart & Stevenson TUG MC
      1;         73;        13; G        ;      18.00;       0.00;        107;     0.5500;
0; Stewart & Stevenson TUG MA 50
      1;         73;        14; G        ;      15.00;       0.00;        107;     0.5000;
0; Stewart & Stevenson TUG 660
      1;         73;        16; D        ;       5.00;       0.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         73;        22; D        ;       5.00;       0.00;         71;     0.5300;
0; Hi-Way / TUG 660 chasis
      1;         73;        29; D        ;      20.00;       0.00;        175;     0.2500;
0; F750, Dukes Transportation Services, DART 3000 to 6000 gallon
      1;         73;        32; D        ;      40.00;       0.00;         71;     0.7500;
0; TLD, 28 VDC
      1;         73;        36; D        ;       0.00;       0.00;         56;     0.2500;
0; TLD 1410
      1;         73;        41; D        ;       8.00;       0.00;        235;     0.2000;
0; F250 / F350

!TRAINING_FIRES
# SCEN_APT; NAME; ANAL_YEAR; INSTUDY; USER_EDIT; ELEVATION; X; Y; PROF_QHR; PROF_DAY; PROF_MON;
GAL/YEAR; GAL/HOUR; YEAR_HOUR; FUEL_TYPE; TEMP; DIAMETER; VELOCITY; RELHEIGHT; CO_G/GAL; HC_G/GAL;
NOX_G/GAL; SOX_G/GAL; PM10_G/GAL
#No records.

!STATIONARY_SOURCES
# SCEN_APT; ANAL_YEAR; NAME; INSTUDY; SUBSTANCE; YEAR_OPS; HOUR_OPS; YEAR_HOUR; PROF_QHR; PROF_DAY;
PROF_MON; CATEGORY; TYPE; USER_EDIT; CO_UI; HC_UI; NOX_UI; SOX_UI; PM10_UI; PM10/UNIT; SULFUR;
CA2S_RATIO; ASH; CO_PCF; HC_PCF; NOX_PCF; SOX_PCF; PM10_PCF; HORSEPOWER; MODE1; MODE2; MODE3; MODE4;
TANK_HGT; TANK_DIAM; MAX_LEVEL; AVG_LEVEL; RVP_PSI; DENSITY; CONC; AREA; DISTURBS; MOISTURE;
MEAN_WIND; FAST_MILE; FRIC_SPEED; ROUGHNESS; WIND_RATIO; PM25_RATIO; ENGINE_UID; USRACNAME; ELEV;
HEIGHT; SIGMA_Z0; SIGMA_Y0; DIAMETER; VELOCITY; TEMP; AMB_TEMP; STACK; POINTS; X_01; Y_01; X_02;
Y_02; X_03; Y_03; X_04; Y_04; X_05; Y_05; X_06; Y_06; X_07; Y_07; X_08; Y_08; X_09; Y_09; X_10; Y_10;
X_11; Y_11; X_12; Y_12; X_13; Y_13; X_14; Y_14; X_15; Y_15; X_16; Y_16; X_17; Y_17; X_18; Y_18; X_19;
Y_19; X_20; Y_20
#No records.

!BUILDINGS
# SCEN_APT; NAME; INSTUDY; ELEVATION; HEIGHT; NUM_POINTS; X_01; Y_01; X_02; Y_02; X_03; Y_03; X_04;
Y_04; X_05; Y_05; X_06; Y_06; X_07; Y_07; X_08; Y_08; X_09; Y_09; X_10; Y_10; X_11; Y_11; X_12; Y_12;
X_13; Y_13; X_14; Y_14; X_15; Y_15; X_16; Y_16; X_17; Y_17; X_18; Y_18; X_19; Y_19; X_20; Y_20
#No records.

!GATES
# SCEN_APT; INSTUDY; NAME; ELEVATION; RELHEIGHT; SIGMA_Y0; SIGMA_Z0; NUMPOINTS; X_01; Y_01; X_02;
Y_02; X_03; Y_03; X_04; Y_04; X_05; Y_05; X_06; Y_06; X_07; Y_07; X_08; Y_08; X_09; Y_09; X_10; Y_10;
X_11; Y_11; X_12; Y_12; X_13; Y_13; X_14; Y_14; X_15; Y_15; X_16; Y_16; X_17; Y_17; X_18; Y_18; X_19;
Y_19; X_20; Y_20
#No records.

!RUNWAYS
# SCEN_APT; NAME1; NAME2; X1; Y1; X2; Y2; GLIDE1; GLIDE2; INSTUDY; ELEV1; ELEV2
#No records.

!RUNWAY_CONFIGURATIONS
# SCEN_APT; NAME; INSTUDY; USE_DISTR; FRACTNUSED; WINDAN_MIN; WINDAN_MAX; USEMINWANG; USEMAXWANG;
WINDSP_MIN; WINDSP_MAX; USEMINWSPD; USEMAXWSPD; HOUR_MIN; HOUR_MAX; USEMINHOUR; USEMAXHOUR;
CEILNG_MIN; CEILNG_MAX; USEMINCEIL; USEMAXCEIL; VIS_MIN; VIS_MAX; USEMINVIS; USEMAXVIS; TEMP_MIN;
TEMP_MAX; USEMINTEMP; USEMAXTEMP; NUMPOINTS; A_01; D_01; A_02; D_02; A_03; D_03
#No records.

!CONFIGURATION_RUNWAYS
# SCEN_APT; CONFIGNAME; ACSIZE; RUNWAYNAME; ARRIVAL; DEPARTURE; TGO
#No records.

!TAXIWAYS
# SCEN_APT; INSTUDY; TAXI_NAME; NUMPOINTS; WIDTH; X_01; Y_01; Z_01; SPEED_01; X_02; Y_02; Z_02;
SPEED_02; X_03; Y_03; Z_03; SPEED_03; X_04; Y_04; Z_04; SPEED_04; X_05; Y_05; Z_05; SPEED_05; X_06;
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Y_06; Z_06; SPEED_06; X_07; Y_07; Z_07; SPEED_07; X_08; Y_08; Z_08; SPEED_08; X_09; Y_09; Z_09;
SPEED_09; X_10; Y_10; Z_10; SPEED_10; X_11; Y_11; Z_11; SPEED_11; X_12; Y_12; Z_12; SPEED_12; X_13;
Y_13; Z_13; SPEED_13; X_14; Y_14; Z_14; SPEED_14; X_15; Y_15; Z_15; SPEED_15; X_16; Y_16; Z_16;
SPEED_16; X_17; Y_17; Z_17; SPEED_17; X_18; Y_18; Z_18; SPEED_18; X_19; Y_19; Z_19; SPEED_19; X_20;
Y_20; Z_20
#No records.

!TAXIPATHS
# SCEN_APT; GATE_NAME; RNWY_NAME; RNWY_EXIT; OUTBOUND; TAXI_NAME
#No records.

!PARKING_FACILITIES
# SCEN_APT; ANAL_YEAR; NAME; INSTUDY; USE_ANNUAL; VEH_TYPE; MANU_YEAR; VEH_YEAR; VEH_HOUR; SPEED;
DISTANCE; IDLE_TIME; FUEL; PROF_QHR; PROF_DAY; PROF_MON; USER_EDIT; CO_GPVM; THC_GPVM; NMHC_GPVM;
VOC_GPVM; TOG_GPVM; NOX_GPVM; SOX_GPVM; PM10_GPVM; PM25_GPVM; BENZ_GPVM; MTBE_GPVM; BUTA_GPVM;
FORM_GPVM; ACET_GPVM; ACRO_GPVM; LEVELS; HEIGHT; SPACING; ELEVATION; POINTS; X_01; Y_01; X_02; Y_02;
X_03; Y_03; X_04; Y_04; X_05; Y_05; X_06; Y_06; X_07; Y_07; X_08; Y_08; X_09; Y_09; X_10; Y_10; X_11;
Y_11; X_12; Y_12; X_13; Y_13; X_14; Y_14; X_15; Y_15; X_16; Y_16; X_17; Y_17; X_18; Y_18; X_19; Y_19;
X_20; Y_20
#No records.

!ROADWAYS
# SCEN_APT; ANAL_YEAR; NAME; INSTUDY; USE_ANNUAL; VEH_TYPE; FUEL_TYPE; MANU_YEAR; SPEED; DISTANCE;
OPS_ANNUAL; OPS_PEAK; PROF_QHR; PROF_DAY; PROF_MON; USER_EDIT; CO_GPVM; THC_GPVM; NMHC_GPVM;
VOC_GPVM; TOG_GPVM; NOX_GPVM; SOX_GPVM; PM10_GPVM; PM25_GPVM; BENZ_GPVM; MTBE_GPVM; BUTA_GPVM;
FORM_GPVM; ACET_GPVM; ACRO_GPVM; SIGMA_Z0; WIDTH; POINTS; X_01; Y_01; Z_01; X_02; Y_02; Z_02; X_03;
Y_03; Z_03; X_04; Y_04; Z_04; X_05; Y_05; Z_05; X_06; Y_06; Z_06; X_07; Y_07; Z_07; X_08; Y_08; Z_08;
X_09; Y_09; Z_09; X_10; Y_10; Z_10; X_11; Y_11; Z_11; X_12; Y_12; Z_12; X_13; Y_13; Z_13; X_14; Y_14;
Z_14; X_15; Y_15; Z_15; X_16; Y_16; Z_16; X_17; Y_17; Z_17; X_18; Y_18; Z_18; X_19; Y_19; Z_19; X_20;
Y_20; Z_20
#No records.

!GSE_POPULATION
# SCEN_APT; ANAL_YEAR; SYSGSE_ID; FUEL_TYPE; USER_ID; GSE_TYPE; REFERENCE; POPULATION; USE_ANNUAL;
OPS_ANNUAL; OPS_PEAK; PROF_QTR; PROF_DAY; PROF_MON; NONROADVER; HORSEPOWER; LOADFACTOR; NONROAD;
MANU_YEAR
#No records.

!GSE_POPULATION_GATE_ASSIGNMENTS
# SCEN_APT; SYSGSE_ID; FUEL_TYPE; USER_ID; GATE_ID; FACTOR
#No records.

!QUARTER_HOURLY_PROFILES
# SCEN_APT; PROF_ID; PROF_NAME          ;   QH01;   QH02;   QH03;   QH04;   QH05;   QH06;   QH07;
 QH08;   QH09;   QH10;   QH11;   QH12;   QH13;   QH14;   QH15;   QH16;   QH17;   QH18;   QH19;
QH20;   QH21;   QH22;   QH23;   QH24;   QH25;   QH26;   QH27;   QH28;   QH29;   QH30;   QH31;   QH32;
 QH33;   QH34;   QH35;   QH36;   QH37;   QH38;   QH39;   QH40;   QH41;   QH42;   QH43;   QH44;
QH45;   QH46;   QH47;   QH48;   QH49;   QH50;   QH51;   QH52;   QH53;   QH54;   QH55;   QH56;   QH57;
 QH58;   QH59;   QH60;   QH61;   QH62;   QH63;   QH64;   QH65;   QH66;   QH67;   QH68;   QH69;
QH70;   QH71;   QH72;   QH73;   QH74;   QH75;   QH76;   QH77;   QH78;   QH79;   QH80;   QH81;   QH82;
 QH83;   QH84;   QH85;   QH86;   QH87;   QH88;   QH89;   QH90;   QH91;   QH92;   QH93;   QH94;
QH95;   QH96
         1;       0; DEFAULT             ; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000;
1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000;
1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000;
1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000;
1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000;
1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000;
1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000;
1.0000; 1.0000; 1.0000; 1.0000; 1.0000
         1;       2; Qrtr-Hrly Profile-AC; 0.0964; 0.0964; 0.0964; 0.0964; 0.0212; 0.0212; 0.0212;
0.0212; 0.0078; 0.0078; 0.0078; 0.0078; 0.0298; 0.0298; 0.0298; 0.0298; 0.0455; 0.0455; 0.0455;
0.0455; 0.1068; 0.1068; 0.1068; 0.1068; 0.6147; 0.6147; 0.6147; 0.6147; 0.9010; 0.9010; 0.9010;
0.9010; 0.9497; 0.9497; 0.9497; 0.9497; 0.9765; 0.9765; 0.9765; 0.9765; 1.0000; 1.0000; 1.0000;
1.0000; 0.7117; 0.7117; 0.7117; 0.7117; 0.8851; 0.8851; 0.8851; 0.8851; 0.7620; 0.7620; 0.7620;
0.7620; 0.7673; 0.7673; 0.7673; 0.7673; 0.9436; 0.9436; 0.9436; 0.9436; 0.6291; 0.6291; 0.6291;
0.6291; 0.8989; 0.8989; 0.8989; 0.8989; 0.8835; 0.8835; 0.8835; 0.8835; 0.7539; 0.7539; 0.7539;
0.7539; 0.8072; 0.8072; 0.8072; 0.8072; 0.5074; 0.5074; 0.5074; 0.5074; 0.3782; 0.3782; 0.3782;
0.3782; 0.2014; 0.2014; 0.2014; 0.2014
         1;       4; Qrtr-Hrly Profile-GA; 0.2994; 0.2994; 0.2994; 0.2994; 0.0382; 0.0382; 0.0382;
0.0382; 0.0430; 0.0430; 0.0430; 0.0430; 0.0430; 0.0430; 0.0430; 0.0430; 0.0478; 0.0478; 0.0478;
```

```
0.0478; 0.1545; 0.1545; 0.1545; 0.1545; 0.5191; 0.5191; 0.5191; 0.5191; 0.8535; 0.8535; 0.8535;
0.8535; 0.8646; 0.8646; 0.8646; 0.8646; 1.0000; 1.0000; 1.0000; 1.0000; 0.8089; 0.8089; 0.8089;
0.8089; 0.8376; 0.8376; 0.8376; 0.8376; 0.7580; 0.7580; 0.7580; 0.7580; 0.8217; 0.8217; 0.8217;
0.8217; 0.8694; 0.8694; 0.8694; 0.8694; 0.8455; 0.8455; 0.8455; 0.8455; 0.9889; 0.9889; 0.9889;
0.9889; 0.8726; 0.8726; 0.8726; 0.8726; 0.5780; 0.5780; 0.5780; 0.5780; 0.4204; 0.4204; 0.4204;
0.4204; 0.2946; 0.2946; 0.2946; 0.2946; 0.2404; 0.2404; 0.2404; 0.2404; 0.1895; 0.1895; 0.1895;
0.1895; 0.1354; 0.1354; 0.1354; 0.1354
         1;       6; Qrtr-Hrly Profile-ML; 1.0000; 1.0000; 1.0000; 1.0000; 0.0114; 0.0114; 0.0114;
0.0114; 0.0000; 0.0000; 0.0000; 0.0000; 0.0057; 0.0057; 0.0057; 0.0057; 0.0057; 0.0057; 0.0057;
0.0057; 0.0057; 0.0057; 0.0057; 0.0057; 0.0625; 0.0625; 0.0625; 0.0625; 0.1818; 0.1818; 0.1818;
0.1818; 0.2614; 0.2614; 0.2614; 0.2614; 0.2330; 0.2330; 0.2330; 0.2330; 0.4034; 0.4034; 0.4034;
0.4034; 0.4659; 0.4659; 0.4659; 0.4659; 0.3920; 0.3920; 0.3920; 0.3920; 0.3182; 0.3182; 0.3182;
0.3182; 0.2727; 0.2727; 0.2727; 0.2727; 0.2045; 0.2045; 0.2045; 0.2045; 0.1875; 0.1875; 0.1875;
0.1875; 0.2386; 0.2386; 0.2386; 0.2386; 0.3125; 0.3125; 0.3125; 0.3125; 0.1761; 0.1761; 0.1761;
0.1761; 0.2386; 0.2386; 0.2386; 0.2386; 0.3125; 0.3125; 0.3125; 0.3125; 0.1875; 0.1875; 0.1875;
0.1875; 0.0114; 0.0114; 0.0114; 0.0114

!MONTHLY_PROFILES
# SCEN_APT; PROF_ID; PROF_NAME         ;    JAN;    FEB;    MAR;    APR;    MAY;    JUN;    JUL;
 AUG;    SEP;    OCT;    NOV;    DEC
         1;       0; DEFAULT          ; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000;
1.0000; 1.0000; 1.0000; 1.0000; 1.0000
         1;       2; Monthly Profile-AT; 0.0000; 0.0000; 0.0000; 0.0000; 0.9646; 0.9714; 0.9816;
0.9998; 1.0000; 0.0000; 0.0000; 0.0000
         1;       4; Monthly Profile-AC; 0.0000; 0.0000; 0.0000; 0.0000; 1.0000; 0.9798; 0.9984;
0.9758; 0.8927; 0.0000; 0.0000; 0.0000
         1;       6; Monthly Profile-GA; 0.0000; 0.0000; 0.0000; 0.0000; 1.0000; 0.8261; 0.8003;
0.7861; 0.9018; 0.0000; 0.0000; 0.0000
         1;       8; Monthly Profile-ML; 0.0000; 0.0000; 0.0000; 0.0000; 1.0000; 0.9129; 0.7635;
0.7510; 0.5809; 0.0000; 0.0000; 0.0000

!DAILY_PROFILES
# SCEN_APT; PROF_ID; PROF_NAME       ;    MON;    TUE;    WED;    THU;    FRI;    SAT;    SUN
         1;       0; DEFAULT         ; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000; 1.0000
         1;       2; Daily Profile-AC; 0.9580; 0.9463; 0.9537; 1.0000; 0.9933; 0.8348; 0.9152
         1;       4; Daily Profile-AT; 0.8354; 0.9432; 0.9642; 1.0000; 0.9682; 0.6420; 0.6846
         1;       6; Daily Profile-GA; 0.7260; 0.9177; 0.9244; 1.0000; 0.7901; 0.4326; 0.5358
         1;       8; Daily Profile-ML; 0.6000; 0.7886; 0.8971; 0.9943; 1.0000; 0.7184; 0.5543

!DISCRETE_CARTESIAN_RECEPTORS
# SCEN_APT; NAME; INSTUDY; X; Y; HEIGHT; ELEVATION
#No records.

!DISCRETE_POLAR_RECEPTORS
# SCEN_APT; NAME; INSTUDY; SOURCETYPE ; SOURCENAME ; DIRECTION; DISTANCE; HEIGHT; ELEVATION
#No records.

!NETWORK_CARTESIAN_RECEPTORS
# SCEN_APT; NAME; INSTUDY; X_START; Y_START; X_COUNT; Y_COUNT; X_DELTA; Y_DELTA; HEIGHT; ELEVATION
#No records.

!NETWORK_POLAR_RECEPTORS
# SCEN_APT; NAME; INSTUDY; SRCBASED; SOURCETYPE ; SOURCENAME ; X_ORIG; Y_ORIG; R_START; D_START;
R_COUNT; D_COUNT; R_DELTA; D_DELTA; HEIGHT; ELEVATION
#No records.

!ALL_EMISSIONS
# SCEN_APT; ANAL_YEAR; NAME; CO_KG; THC_KG; NMHC_KG; VOC_KG; TOG_KG; NOX_KG; SOX_KG; PM10_KG;
PM25_KG; PMNV_KG; PMSO_KG; PMFO_KG; FUEL_KG
#No records.

!AIRCRAFT_EMISSIONS
# SCEN_APT; ANAL_YEAR; STUDYAC_ID; AC_NAME; ENG_NAME; USER_ID; ACCAT_EURO; MODE; CO_KG; THC_KG;
NMHC_KG; VOC_KG; TOG_KG; NOX_KG; SOX_KG; PM10_KG; PM25_KG; PMNV_KG; PMSO_KG; PMFO_KG; FUEL_KG
#No records.

!GSE_POPULATION_EMISSIONS
# SCEN_APT; ANAL_YEAR; TYPE; FUEL; REFERENCE; NAME; CO_KG; THC_KG; NMHC_KG; VOC_KG; TOG_KG; NOX_KG;
SOX_KG; PM10_KG; PM25_KG
#No records.

!VEHICLE_EMISSIONS
```

```
# SCEN_APT; ANAL_YEAR; NAME; TYPE; CO_KG; THC_KG; NMHC_KG; VOC_KG; TOG_KG; NOX_KG; SOX_KG; PM10_KG;
PM25_KG; BENZ_KG; MTBE_KG; BUTA_KG; FORM_KG; ACET_KG; ACRO_KG
#No records.

!STATIONARY_SOURCE_EMISSIONS
# SCEN_APT; ANAL_YEAR; NAME; TYPE; CO_KG; THC_KG; NMHC_KG; VOC_KG; TOG_KG; NOX_KG; SOX_KG; PM10_KG;
PM25_KG
#No records.

!USER-CREATED_AIRCRAFT
#     USRACNAME;  CATEGORY;  AIR_TAXI  ;  EURO_GRP;  NUM_ENG;  USESYSEMIS;  EMISACCODE;  EMISENGUID;
PERFACCODE; PERFENGUID; BP_RATIO; DEF_SOX_EI; TIME_MIN_1; FUEL_KGS_1;  CO_EI_1;  HC_EI_1; NOX_EI_1;
PM_EI_1;  SN_1; TIME_MIN_2; FUEL_KGS_2;  CO_EI_2;  HC_EI_2; NOX_EI_2;  PM_EI_2;  SN_2; TIME_MIN_3;
FUEL_KGS_3;   CO_EI_3;   HC_EI_3;  NOX_EI_3;   PM_EI_3;   SN_3;  TIME_MIN_4;  FUEL_KGS_4;   CO_EI_4;
HC_EI_4; NOX_EI_4;  PM_EI_4;  SN_4; TIME_MIN_5
  My Aircraft; LCJP    ;          ; JM      ; 2      ; F         ;           ;           ; A109
  ; 250B17    ;     0.00;          ;     19.00;     0.000; 0.000000; 0.000000; 0.000000; 0.000000;
0.000;      0.70;     0.000; 0.000000; 0.000000; 0.000000; 0.000000; 0.000;      2.20;     0.000;
0.000000; 0.000000; 0.000000; 0.000000; 0.000;      4.00;     0.000; 0.000000; 0.000000; 0.000000;
0.000000; 0.000;       7.00

!USER-CREATED_APUS
#  APU_ID;  NAME;  DEF_TIME_A;  DEF_TIME_D;  USER_EMIS;  CO_KG_HR;  HC_KG_HR;  NOX_KG_HR;  SOX_KG_HR;
PM_KG_HR; SYS_APU_ID
#No records.

!USER-CREATED_GSE
#  USR_GSE_ID; NAME; SYS_GSE_ID; SYS_TYPE; TYPE_YEAR; HORSEPOWER; LOADFACTOR; OPTIME_ARR; OPTIME_DEP;
ANN_OPTIME;  USER_EMIS;  DIESEL_CO;  DIESEL_HC;  DIESEL_NOX;  DIESEL_SOX;  DIESEL_PM;  GAS_CO;  GAS_HC;
GAS_NOX; GAS_SOX; GAS_PM; CNG_CO; CNG_HC; CNG_NOX; CNG_SOX; CNG_PM; LPG_CO; LPG_HC; LPG_NOX; LPG_SOX;
LPG_PM
#No records.
```

Appendix G-3

MEGAN Input Files

TXT2IOAPI Job Script File

```
#! /bin/csh -f
source ../setcase.csh
set dom =   ( 36km 12km 4km )
set domID = ( d01  d02  d03 )
set i  = ${NO_DOMAIN}
setenv PRJ $MAPYEAR
setenv DOM $dom[$i]
setenv PROMPTFLAG N
setenv PROG   txt2ioapi
setenv EXEDIR $MGNEXE
setenv EXEC   $EXEDIR/$PROG
setenv GRIDDESC $MGNRUN/GRIDDESC_${DOM}
setenv GDNAM3D MCIP_${DOM}
setenv EFSTXTF $MGNINP/MAP/EF_MAG_${PRJ}_${DOM}_$DATAID.csv
setenv PFTTXTF $MGNINP/MAP/PFT_MAG_${PRJ}_${DOM}_$DATAID.csv
setenv LAITXTF $MGNINP/MAP/LAI_MAG_${PRJ}_${DOM}_$DATAID.csv
setenv EFMAPS  $MGNINP/MAP/EF_MAG_${PRJ}_${DOM}_$DATAID.ncf
setenv PFTS16  $MGNINP/MAP/PFT_MAG_${PRJ}_${DOM}_$DATAID.ncf
setenv LAIS46  $MGNINP/MAP/LAI_MAG_${PRJ}_${DOM}_$DATAID.ncf
setenv RUN_EFS T       # [T|F]
setenv RUN_LAI T       # [T|F]
setenv RUN_PFT T       # [T|F]
rm -f $EFMAPS $LAIS46 $PFTS16
if ( ! -e $MGNLOG/$PROG ) mkdir -p $MGNLOG/$PROG
$EXEC | tee $MGNLOG/$PROG/log.run.$PROG.${PRJ}.${DOM}.$DATAID.txt
```

MET2MGN Job Script File

```
#!/bin/csh -f
source ../setcase.csh
set year = $MGNCASE
set STJD = ${year}120
set EDJD = ${year}275
set frstdom = 1

setenv EPISODE_SDATE $STJD
setenv EPISODE_STIME 000000
set i  =  $frstdom
while ($i <= ${NO_DOMAIN})
setenv GRIDDESC GRIDDESC_$dom[$i]
setenv GDNAM3D2 $domID[$i]
setenv GDNAM3D MCIP_$dom[$i]
setenv PROG met2mgn
if ($i == 3 ) then
setenv EXE $MGNEXE/$PROG.d03
else
setenv EXE $MGNEXE/$PROG
endif

set logdir = $MGNLOG/$PROG
if ( ! -e $logdir) mkdir -p $logdir

set INPPATH = $METMCIP
set OUTPATH = $MGNINP/MGNMET
if (! -e $OUTPATH) mkdir $OUTPATH
setenv PFILE $OUTPATH/PFILE
rm -fv $PFILE
set JDATE = $STJD

while ($JDATE <= $EDJD)
@ jdy = $JDATE - 2000000
@ kdy = $jdy + 1
setenv STDATE ${jdy}00
setenv ENDATE ${kdy}00
setenv MCIPMET Y
setenv TMCIP  TEMP2 #MCIP v3.3 or newer
setenv MCIPRAD Y
set begy = $year
set begm = 1
set endy = $begy
set endm = 12    #$begm
@ y    = $begy
@ ay   = $y % 400
@ by   = $y % 4
@ cy   = $y % 100
if( $ay == 0 ) then
  @ febd   = 29
  @ exdays = 6
else if( $by == 0 && $cy != 0 ) then
  @ febd   = 29
  @ exdays = 6
else
  @ febd   = 28
  @ exdays = 5
endif

set mday = (31 $febd 31 30 31 30 31 31 30 31 30 31)
@ fyear = $begy
@ nday = 0
while ($fyear <= $endy)
  @ mon  = 1
while ($mon <= 12 )
  @ day  = 1
while ($day <= $mday[$mon])
  @ nday = $nday + 1
if ($nday < 10 ) then
set nnday = 00$nday
```

```
endif
if ($nday < 100 && $nday >= 10 ) then
set nnday = 0$nday
endif
if ($nday >= 100 ) then
set nnday = $nday
endif
if ( $JDATE == $fyear$nnday ) then
  echo $fyear $mon $day $nnday
  if ($day < 10 ) then
    set fday = 0$day
  else
    set fday = $day
  endif
  if ($mon < 10 ) then
    set fmon = 0$mon
  else
    set fmon = $mon
  endif
  set JDATE2 = $fyear$fmon$fday

  if ($mon == $begm - 1 ) then
    @ stday = $nday + 1
  endif
endif
@ day ++
end
@ mon ++
end
@ fyear ++
end
setenv  EPISODE_SDATE $JDATE
if ($JDATE == $EPISODE_SDATE) then   #always use the file as start, otherwise there is problems
  setenv METCRO2Dfile1 $INPPATH/METCRO2D_${GDNAM3D2}_${JDATE2}.nc
else
  setenv METCRO2Dfile1 $INPPATH/METCRO2D_${GDNAM3D2}_${JDATE2}.nc
  setenv METCRO2Dfile2 $INPPATH/METCRO2D_${GDNAM3D2}_${JDATE2}.nc
endif
setenv METCRO3Dfile  $INPPATH/METCRO3D_${GDNAM3D2}_${JDATE2}.nc
setenv METDOT3Dfile  $INPPATH/METDOT3D_${GDNAM3D2}_${JDATE2}.nc

setenv OUTFILE $OUTPATH/MET.MEGAN.$GDNAM3D2.$JDATE.ncf
rm -rf $OUTFILE

$EXE |tee $logdir/log.$PROG.$GDNAM3D2.$JDATE.txt

@ JDATE++
end  # End while JDATE
@ i++
end
```

EMPROC Job Script File

```
#! /bin/csh -f
source ../setcase.csh
set dom   = ( 36km 12km 4km )
set domID = ( d01  d02  d03 )
set i  = ${NO_DOMAIN}
set STDATE = 2011119
set ENDATE = 2011274
setenv PRJ $MAPYEAR
setenv PROMPTFLAG N
setenv PROG   emproc
setenv EXEDIR $MGNEXE
setenv EXE    $EXEDIR/$PROG
setenv INPDIR $MGNINP/MAP
setenv METDIR $MGNINP/MGNMET
setenv INTDIR $MGNINT
setenv OUTDIR $MGNOUT
setenv LOGDIR $MGNLOG/$PROG
if ( ! -e $LOGDIR ) mkdir -p $LOGDIR
set JD = $STDATE
while ($JD <= $ENDATE)
setenv SDATE $JD        #start date
setenv STIME 0
setenv RLENG 250000
setenv RUN_MEGAN   Y       # Run megan?
setenv ONLN_DT     Y       # Use online daily average temperature
                           # No will use from EFMAPS
setenv ONLN_DS     Y       # Use online daily average solar radiation
                           # No will use from EFMAPS
setenv GRIDDESC $MGNRUN/GRIDDESC_${dom[$i]}
setenv GDNAM3D MCIP_$dom[$i]
set    GDNAM3D2 =  $domID[$i]
setenv EFMAPS $INPDIR/EF_MAG_${PRJ}_${dom[$i]}_$DATAID.ncf
setenv PFTS16 $INPDIR/PFT_MAG_${PRJ}_${dom[$i]}_$DATAID.ncf
setenv LAIS46 $INPDIR/LAI_MAG_${PRJ}_${dom[$i]}_$DATAID.ncf
setenv MGNMET $METDIR/MET.MEGAN.$GDNAM3D2.${SDATE}.ncf
setenv MGNERS $INTDIR/ER.$DATAID.$GDNAM3D2.${SDATE}.ncf
if ( $RUN_MEGAN == 'Y' ) then
   rm -f $MGNERS
   time $EXE >&! $LOGDIR/log.run.$PROG.$DATAID.$GDNAM3D2.$SDATE.txt
endif

@ JD++
end  # End while JD
```

MGN2MECH Job Script File

```
#! /bin/csh -f
source ../setcase.csh
set dom =   ( 36km 12km 4km )
set domID = ( d01  d02  d03 )
if ($MGNCASE == 2014 ) then
set i  = 3
set STDATE = 2014001
set ENDATE = 2014365
else if ($MGNCASE == 2012 ) then
set i  = 3   #(1, 2, 3)
set STDATE = 2012120
set ENDATE = 2012274
else if ($MGNCASE == 2011 ) then
set i  = 3   #(1, 2, 3)
set STDATE = 2011119
set ENDATE = 2011274
else if ($MGNCASE == 2009 ) then
set i = 3  #(1,2,3)
set STDATE = 2009119
set ENDATE = 2009273
endif
setenv PRJ $MAPYEAR
setenv PROMPTFLAG N
setenv PROG   mgn2mech
setenv EXEDIR $MGNEXE
setenv EXE    $EXEDIR/$PROG
setenv INPDIR $MGNINP/MAP
setenv INTDIR $MGNOUT/INT
setenv OUTDIR $MGNOUT
setenv METDIR $MGNINP/MGNMET
setenv GRIDDESC $MGNRUN/GRIDDESC_${dom[$i]}
setenv LOGDIR $MGNLOG/$PROG
if ( ! -e $LOGDIR ) mkdir -p $LOGDIR
setenv TSTEP 10000
setenv RUN_SPECIATE   Y    # run MG2MECH
setenv RUN_CONVERSION Y    # run conversions?
                           # run conversions MEGAN to model mechanism
                           # units are moles/s (old is mol/s)
setenv SPCTONHR       Y    # speciation output unit in tonnes per hour
                           # This will convert 138 species to tonne per
                           # hour or mechasnim species to tonne per hour.
setenv MECHANISM    CB6
setenv GDNAM3D MCIP_$dom[$i]
set    GDNAM3D2 = $domID[$i]
setenv EFMAPS  $INPDIR/EF_MAG_${PRJ}_${dom[$i]}_$DATAID.ncf
setenv PFTS16  $INPDIR/PFT_MAG_${PRJ}_${dom[$i]}_$DATAID.ncf
setenv MGNERS $INTDIR/ER.$DATAID.$GDNAM3D2.${SDATE}.ncf
set OUTPATH  = $OUTDIR/$MECHANISM
if ( ! -e $OUTPATH ) mkdir -p $OUTPATH
if ($SPCTONHR == 'Y' ) then
setenv MGNOUT $OUTPATH/MEGANv2.10.$DATAID.$GDNAM3D2.$MECHANISM.$SDATE.TONHR.ncf
else
setenv MGNOUT $OUTPATH/MEGANv2.10.$DATAID.$GDNAM3D2.$MECHANISM.$SDATE.moles.ncf
endif
if ( $RUN_SPECIATE == 'Y' ) then
   rm -f $MGNOUT
   if ($SPCTONHR == 'Y' ) then
   $EXE | tee $LOGDIR/log.run.$PROG.$DATAID.$GDNAM3D2.$MECHANISM.$SDATE.TONHR.txt
   else
   $EXE | tee $LOGDIR/log.run.$PROG.$DATAID.$GDNAM3D2.$MECHANISM.$SDATE.moles.txt
   endif
endif
@ JD++
end  # End while JD
```

Appendix G-4

SMOKE Input Files

Environment Variable	Setting	Description
AGREF	$GE_DAT/gridding/amgref_us_2011platform_05jan2015_v8.txt_4km	
ATREF	$GE_DAT/temporal/amptref_general_2011platform_tref_6nov2014_05jan2015_v3	
ATPRO_MONTHLY	$GE_DAT/temporal/amptpro_general_2011platform_tpro_monthly_6nov2014_06nov2014_v0	Monthly Temporal Profiles for area sources
ATPRO_WEEKLY	$GE_DAT/temporal/amptpro_general_2011platform_tpro_weekly_6nov2014_13nov2014_v1	Weekly Temporal Profiles for area sources
ATPRO_HOURLY	$GE_DAT/temporal/amptpro_general_2011platform_tpro_hourly_6nov2014_13nov2014_v1	Hourly Temporal Profiles for area sources
ATPRO_HOURLY_NCF	$GE_DAT/temporal/Gentpro_TPRO_HOUR_HOURLY_BASH_NH3.agNH3_bash_2011ef_11g-newgent_smk36.ncf	Residential wood burning
GSREF	$GE_DAT/speciation/gsref_2011eh_v6_11g_05jan2015.txt	
GSPRO	$GE_DAT/speciation/gspro_cmaq_cb6_2011eh_cb6v2_v6_11g_28feb2015.txt	Speciation profiles
GSPRO_COMBO	$GE_DAT/speciation/gspro_combo_2010cdc_2010ef_nonpt_12nov2012_v0.txt	
PTREF	$GE_DAT/temporal/amptref_general_2011platform_tref_6nov2014_05jan2015_v3mag	
PTPRO_MONTHLY	$GE_DAT/temporal/amptpro_general_2011platform_tpro_monthly_6nov2014_06nov2014_v0mag	Monthly Temporal Profiles for point source
PTPRO_WEEKLY	$GE_DAT/temporal/amptpro_general_2011platform_tpro_weekly_6nov2014_13nov2014_v1mag	Weekly Temporal Profiles for point source
PTPRO_HOURLY	$GE_DAT/temporal/amptpro_general_2011platform_tpro_hourly_6nov2014_13nov2014_v1mag	Hourly Temporal Profiles for point source
PELVCONFIG	$GE_DAT/point/pelvconfig_inline_20m_13nov2012_v0.txt	
INVTABLE	$GE_DAT/invtable_2011v2_platform_cb6_integrate_16dec2014_v0.txt	AREA
INVTABLE	$GE_DAT/invtable_hapcap_cb05_no_bafm_12nov2014_v8.txt	NONROAD and POINT
GSCNV	$GE_DAT/speciation/gscnv_cmaq_cb6_2011eh_cb6v2_v6_11g_nf.txt	
PSTK	$GE_DAT/point/pstk_20nov2006_v0.txt	
DAY_SPECIFIC_YN	Y	Area, nonroad, c1c2rail, wildfire, ptnonipm
HOUR_SPECIFIC_YN	Y	Airport
POLLUTANT_CONVERSION	Y	
RUN_SMKINVEN	Y	
RUN_SPCMAT	Y	
RUN_GRDMAT	Y	
RUN_TEMPORAL	Y	
RUN_SMKMERGE	Y	
RUN_SMKREPORT	Y	
FILL_ANNUAL	Y	nonroad
RAW_DUP_CHECK	N	
NONHAP_TYPE	TOG	

Appendix G-5

WRF Input Files

WPS Name List

```
&share
 wrf_core = 'ARW',
 max_dom = 3,
 start_date = START_TIME,START_TIME,START_TIME,START_TIME,
 end_date   = END_TIME,END_TIME,END_TIME,END_TIME,
 interval_seconds = INTERVALS
 io_form_geogrid = 2,
/

&geogrid
 parent_id         =   1,    1,    2,  3,
 parent_grid_ratio =   1,    3,    3,  3,
 i_parent_start    =   1,   24,   51, 28,
 j_parent_start    =   1,   21,   39, 26,
 e_we              = 142,  124,   67, 67,
 e_sn              = 104,   97,   55, 55,
 geog_data_res     = GEOG,GEOG,GEOG
 dx = 36000,
 dy = 36000,
 map_proj = 'lambert',
 ref_lat   =  34.00,
 ref_lon   = -111.00,
 truelat1  =  33.0,
 truelat2  =  45.0,
 stand_lon = -111.0,
 ref_x     = 47.0,
 ref_y     = 38.33,
 geog_data_path = '/data/samba/fliu/WPS/geog'
/
&ungrib
 out_format = 'WPS',
 prefix = 'AWIP',
/

&metgrid
 fg_name = 'AWIP'
 io_form_metgrid = 2,
/

WPS Job File

#! /bin/csh -f
set landuseID    = NLCD            #MAG # MODIS   #MODIS2USGS  #MAG this is for the year after 2008
if ($landuseID == USGS ) then
set geogres      = 30s
else if ($landuseID == MODIS ) then
set geogres      = modis_30s+30s
else if ($landuseID == MAG ) then
set geogres      = mag_30s
else if ($landuseID == NLCD ) then
 set geogres      = nlcd2011_9s
# set geogres      = modis_15s
endif

set RawDataID    = GRIB1
set RawDataBase  = ( RUC  AWIP  NAM   )
set RawFrequency = ( 3600 10800 21600 )
set RawDataEndh  = ( 23   21    18    )
set RawDataUsed  = 2
set InitialID    = $RawDataBase[$RawDataUsed]

@ nr = 1
if ($nr == 1 ) then
set year  = 2011
set begm  = 04
set endm  = 10
set begd  = 20
set endd  = 02
set begh  = 00
```

```
set endh  = 21
else if ($nr == 2 ) then
set year  = 2009
set begm  = 04
set endm  = 05
set begd  = 20
set endd  = 01
set begh  = 00
set endh  = 21
#set endh  = 21 # for interval 10800, 3hours
else if ($nr == 3 ) then
set year  = 2012
set begm  = 04
set endm  = 10
set begd  = 20
set endd  = 05
set begh  = 00
set endh  = 21

endif

set DataID = AWIP #NARR
rm Vtable

if ($year == 2012 || $year == 2011 || $year == 2009 ) then
ln -fs ungrib/Variable_Tables/Vtable.$DataID Vtable
set INTERVALS = 10800
else if ($year == 2014 ) then
set INTERVALS = 21600
ln -fs ungrib/Variable_Tables/Vtable.NAM Vtable #data after Jan. 2013 according to WRFhelp
endif

set DataPath     = /data/samba/ozsip/mod/wrf/wps/$DataID/$year
set DataInDir    = $DataPath/inp
set DataOutDir   = $DataPath/out
set Intermediate = $DataOutDir/intermediate
set Metdata      = $DataOutDir/metgrid
set Geogrid      = $DataOutDir/geogrid
set Logdata      = $DataOutDir/logfile
if ( ! -d "$Intermediate" ) mkdir -p $Intermediate
if ( ! -d "$Metdata"      ) mkdir -p $Metdata
if ( ! -d "$Geogrid"      ) mkdir -p $Geogrid
if ( ! -d "$Logdata"      ) mkdir -p $Logdata

if ($DataID == AWIP ) then
./link_grib.csh $DataInDir/$year
else if ($DataID == NARR ) then
./link_grib.csh $DataInDir/rr-fixd.grb
endif

set START_TIME = ${year}-${begm}-${begd}_${begh}:00:00
set END_TIME   = ${year}-${endm}-${endd}_${endh}:00:00
cp ./namelist.wps.mag.$DataID namelist.wps.temp01
sed -e "s/START_TIME/'${START_TIME}'/g"       namelist.wps.temp01 >& namelist.wps.temp02
sed -e "s/END_TIME/'${END_TIME}'/g"           namelist.wps.temp02 >& namelist.wps.temp01
sed -e "s/INTERVALS/$INTERVALS/g"         namelist.wps.temp01 >& namelist.wps.temp02
sed -e "s/GEOG/'$geogres'/g"                  namelist.wps.temp02 >& namelist.wps

rm namelist.wps.temp01 namelist.wps.temp02
#./geogrid.exe
./ungrib.exe
mpirun -n 8 ./metgrid.exe
mv met_em.d0*     $Metdata
mv ${DataID}:*    $Intermediate
mv geogrid.log    $Logdata/geogrid.log.$year
mv ungrib.log     $Logdata/ungrib.log.$year
mv metgrid.log.*  $Logdata/
#mv geo_em.d0*     $Geogrid
mv namelist.wps   $Logdata/namelist.wps.$year
/bin/rm GRIBFILE.*
exit
```

WRF Name List

```
&time_control
run_days                            = 1,
run_hours                           = 12,
run_minutes                         = 0,
run_seconds                         = 0,
start_year                          = 2011,  2011,  2011,  2011,
start_month                         = 09, 09, 09, 09,
start_day                           = 30,   30,   30,   30,
start_hour                          = 12,  12,  12,  12,
start_minute                        = 00,   00,   00,   00,
start_second                        = 00,   00,   00,   00,
end_year                            = 2011, 2011, 2011, 2011,
end_month                           = 10,  10,  10,  10,
end_day                             = 02,    02,    02,    02,
end_hour                            = 00,   00,   00,   00,
interval_seconds                    = 10800,
input_from_file                     = .true.,.true.,.true., .true.,
history_interval                    = 60,  60,   60,  60,
frames_per_outfile                  = 12,  12,   12,  12,
auxinput11_interval_s               = 180, 180, 180, 180,
auxinput11_end_h                    = 6, 6, 6, 6,
restart                             = .false.,
restart_interval                    = 14400,
io_form_history                     = 2
io_form_restart                     = 2
io_form_input                       = 2
io_form_boundary                    = 2
debug_level                         = 0
/

&domains
time_step                           = 180,
time_step_fract_num                 = 0,
time_step_fract_den                 = 1,
max_dom                             = 3,
e_we = 142, 124, 67, 67,
e_sn = 104,  97, 55, 55,
e_vert                              = 24,   24,   24,    24,
eta_levels                          = 1.000, 0.995, 0.990, 0.985, 0.980, 0.970,
                                      0.960, 0.950, 0.940, 0.920, 0.900, 0.880,
                                      0.860, 0.820, 0.770, 0.700, 0.650, 0.600,
                                      0.550, 0.500, 0.450, 0.250, 0.050, 0.000,
p_top_requested                     = 10000,
num_metgrid_levels                  = 27,
num_metgrid_soil_levels             = 4,
dx                                  = 36000,  12000,  4000, 1333.333
dy                                  = 36000,  12000,  4000, 1333.333
grid_id                             = 1,     2,     3,   4,
parent_id                           = 0,     1,     2,   3,
i_parent_start = 1, 24, 51, 28,
j_parent_start = 1, 21, 39, 26,
parent_grid_ratio                   = 1,     3,     3,   3,
parent_time_step_ratio              = 1,     3,     3,   3,
feedback                            = 1,
smooth_option                       = 0
nproc_x                             = -1
nproc_y                             = -1
/

&physics
mp_physics                          = 4,     8,     8,   8,
ra_lw_physics                       = 1,     1,     1,   1,
ra_sw_physics                       = 2,     2,     2,   2,
radt                                = 30,    15,    10,  10,
sf_sfclay_physics                   = 1,     1,     1,   1,
sf_surface_physics                  = 2,     2,     2,   2,
bl_pbl_physics                      = 11,    11,    11,  11,
bldt                                = 0,     0,     0,   0,
cu_physics                          = 16,    16,     0,   0,
```

```
cudt                                = 5,     5,     5,   5,
isfflx                              = 1,
ifsnow                              = 0,
icloud                              = 3,
surface_input_source                = 1,
num_land_cat                        = 40,
num_soil_layers                     = 4,
sf_urban_physics                    = 0,     0,     0,   0,
mp_zero_out                         = 2,
mp_zero_out_thresh                  = 1.e-8,
maxiens                             = 1,
mp_zero_out_thresh                  = 1.e-8,
maxiens                             = 1,
maxens                              = 3,
maxens2                             = 3,
maxens3                             = 16,
ensdim                              = 144,
/

&fdda
grid_fdda                           = 1,     1,     1,   1,
gfdda_inname                        = "wrffdda_d<domain>",
gfdda_end_h                         =  36,   36,   36,  36,
gfdda_interval_m                    = 180,  180,  180, 180,
fgdt                                = 0,     0,     0,   0,
if_no_pbl_nudging_uv                = 1,     1,     0,   0,
if_no_pbl_nudging_t                 = 1,     1,     0,   0,
if_no_pbl_nudging_q                 = 1,     1,     0,   0,
if_zfac_uv                          = 1,     1,     1,   1,
 k_zfac_uv                          = 13,   13,    13,  13,
if_zfac_t                           = 1,     1,     1,   1,
 k_zfac_t                           = 13,   13,    13,  13,
if_zfac_q                           = 1,     1,     1,   1,
 k_zfac_q                           = 13,   13,    13,   13,
guv                                 = 0.0003,     0.0003,     0.0003,    0.0003,
gt                                  = 0.0003,     0.0003,     0.0003,    0.0003,
gq                                  = 0.0003,     0.0003,     0.0003,    0.0003,
if_ramping                          = 1,
dtramp_min                          = 60.0,
/

&dynamics
rk_ord                              = 3,
w_damping                           = 1,
diff_opt                            = 1,
km_opt                              = 4,
diff_6th_opt                        = 0,     0,    0,     0,
diff_6th_factor                     = 0.12,  0.12, 0.12,  0.12,
base_temp                           = 290.
damp_opt                            = 1,
zdamp                               = 5000.,  5000.,   5000.,  5000.,
dampcoef                            = 0.01,    0.01,    0.01,   0.01,
khdif                               = 0,      0,      0,    0,
kvdif                               = 0,      0,      0,    0,
non_hydrostatic                     = .true., .true., .true., .true.,
moist_adv_opt                       = 1,      1,      1,    1,
scalar_adv_opt                      = 1,      1,      1,    1,
use_baseparam_fr_nml                = .true.,
tke_adv_opt                         = 2,      0,       0,   0,

/

&bdy_control
spec_bdy_width                      = 5,
spec_zone                           = 1,
relax_zone                          = 4,
specified                           = .true., .false.,.false., .false.,
nested                              = .false., .true., .true., .true.,
/

&grib2
/
```

```
&chem
kemit                               = 19,
chem_opt                            =  0,         0,    0,    0,
bioemdt                             = 30,        30,   30,   30,
photdt                              = 30,        30,   30,   30,
chemdt                              = 2.,        2.,   2.,   2.,
frames_per_emissfile                = 25,
emi_inname                          = "wrfchemi_d<domain>_<date>",
io_style_emissions                  = 2,
emiss_inpt_opt                      = 1,         1,    1,    1,
emiss_opt                           = 3,         3,    3,    3,
chem_in_opt                         = 0,         0,    0,    0,
phot_opt                            = 1,         1,    1,    1,
drydep_opt                          = 1,         1,    1,    1,
bio_emiss_opt                       = 1,         1,    1,    1,
dust_opt                            = 0,
dmsemis_opt                         = 0,
seas_opt                            = 0,
dmsemis_opt                         = 0,
seas_opt                            = 0,
gas_bc_opt                          = 1,         1,    1,    1,
gas_ic_opt                          = 1,         1,    1,    1,
aer_bc_opt                          = 1,         1,    1,    1,
aer_ic_opt                          = 1,         1,    1,    1,
gaschem_onoff                       = 1,         1,    1,    1,
aerchem_onoff                       = 1,         1,    1,    1,
wetscav_onoff                       = 0,         0,    0,    0,
cldchem_onoff                       = 0,         0,    0,    0,
vertmix_onoff                       = 1,         1,    1,    1,
chem_conv_tr                        = 1,         1,    1,    1,
biomass_burn_opt                    = 0,         0,    0,    0,
plumerisefire_frq                   = 30,        30,   30,  30,
aer_ra_feedback                     = 0,         0,    0,    0,
have_bcs_chem                       = .false., .false.,.false., .false.,
/

&namelist_quilt
nio_tasks_per_group = 0,
nio_groups = 1,
/
```

WRF Job Script File

```
#! /bin/csh -f
set DomID       = d3.mag.new       #d3.mag
set ModelVN     = WRF3.7           #WRF3.3.1
set paralleID   = dmpar            #smpar #dm2sm
set Ndomain     = `echo $DomID|cut -c2`
set MPd01       = 4                #WSM5 Hong, Dudhia and Chen (2004, MWR) 2004
set MPd02       = 8                #Thompson, Field, Rasmussen and Hall (2008,MWR 2009)
set CaseID      = EPISODES         #STORM            #SWS          #EPISODES     # PM10
set DataID      = NARR             #AWIP is ds609.2, NARR is ds608.0
set EtaLevels   = 24               #71
set landuseID   = NLCD             # MAG or MODIS2USGS or NLCD
if ($landuseID == USGS || $landuseID == MAG || $landuseID == MODIS2USGS ) then
set LANDUSECAT  = 24
else if ($landuseID == MODIS ) then
set LANDUSECAT  = 20
else if ($landuseID == NLCD) then
set LANDUSECAT  = 40
endif
 set ModelID     = $ModelVN
@ nr = 1     #CASENUMBER
set year   = 2011
set nday   = 162
set mo     = ( 04 04 04 04 04 04 04 \
05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 05 \
06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 06 \
07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 \
08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 08 \
09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 09 \
10 10 10 10 )
set dy     = ( 24 25 26 27 28 29 30 \
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 \
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 \
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 \
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 \
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 \
01 02 03 04 )
set DataPath    = /data/samba/ozsip/mod/wrf
set DataInDir   = $DataPath/wps/$DataID/$year/out/metgrid
set DataOutDir  = $DataPath/${ModelID}.${year}
set DataSimDir  = $DataOutDir/Sim
set DataSpinDir = $DataSimDir/Spin
set DataLogDir  = $DataOutDir/Log
set RealLogDir  = $DataLogDir/rs4real
set WRFLogDir   = $DataLogDir/rs4wrf
set DataRstDir  = $DataOutDir/Rst
set DataInlDir  = $DataOutDir/Inl
set DataFddDir  = $DataOutDir/Fdd
set DataEvlDir  = $DataOutDir/Evl
set DataFigDir  = $DataOutDir/Fig
if (! -d "$DataSpinDir") mkdir -p $DataSpinDir
if (! -d "$RealLogDir")  mkdir -p $RealLogDir
if (! -d "$WRFLogDir" )  mkdir -p $WRFLogDir
if (! -d "$DataRstDir")  mkdir -p $DataRstDir
if (! -d "$DataInlDir")  mkdir -p $DataInlDir
if (! -d "$DataFddDir")  mkdir -p $DataFddDir
if (! -d "$DataEvlDir")  mkdir -p $DataEvlDir
if (! -d "$DataFigDir")  mkdir -p $DataFigDir
set WRFDATAFILE = `ls $DataInDir/`
foreach metfile ($WRFDATAFILE)
ln -sf $DataInDir/$metfile $metfile
end
@ i = 1
while ( $i <= $nday )
@ j = $i + 2   #if starth .ge. 12, otherwise j = $i + 1
cp namelist.wrf.d4.mag.new.$DataID ./namelist.temp
set startm  = $mo[$i]
set startd  = $dy[$i]
set endm    = $mo[$j]
set endd    = $dy[$j]
```

```
set runday  = 1
set runhour = 12
set starth  = 12
set endh    = 00
set month   = $mo[$i]
sed -e "s/WRF_RUN_DAYS/$runday/g"    namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/WRF_RUN_HOURS/$runhour/g"  namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/WRF_START_YEAR/$year/g"    namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/WRF_START_YEAR/$year/g"    namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/WRF_START_MONTH/$startm/g" namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/WRF_START_DAY/$startd/g"   namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/WRF_START_HOUR/$starth/g"  namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/WRF_END_MONTH/$endm/g"     namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/WRF_END_DAY/$endd/g"       namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/WRF_END_HOUR/$endh/g"      namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/LANDUSECAT/$LANDUSECAT/g"  namelist.temp >& namelist.input
mv namelist.input namelist.temp
if ($EtaLevels <= 30 ) then
sed -e "s/TIMESTEP/180/g"            namelist.temp >& namelist.input
else
sed -e "s/TIMESTEP/60/g"             namelist.temp >& namelist.input
endif
mv namelist.input namelist.temp
sed -e "s/DOMAIN_NUMBER/$Ndomain/g"  namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/MPd01/$MPd01/g"           namelist.temp >& namelist.input
mv namelist.input namelist.temp
sed -e "s/MPd02/$MPd02/g"           namelist.temp >& namelist.input

mpirun -machinefile machines -np 16 ./real.exe
mv rsl.*     $RealLogDir
mpirun -machinefile machines -np 96 ./wrf.exe
if ($i > 1 ) then   #leave the first run at the Sim dir for post processing
@ dm = 1
while ($dm <= $Ndomain )
mv wrfout_d0${dm}_${year}-${month}-${dy[$i]}_12:00:00   $DataSpinDir
@ dm++
end
endif
mv wrfout_d0*    $DataSimDir
mv wrfinput_d0*  $DataInlDir
mv wrfbdy_d01    $DataInlDir
mv wrffdda_d0*   $DataFddDir
mv rsl.*         $WRFLogDir
@ i++
end
rm namelist.temp met_em.d0*
mv namelist.output $DataLogDir
mv namelist.input  $DataLogDir
#cp go.wrf          $DataLogDir
cd $DataSimDir
chfilname2nc24     # change the file name for plot which uses the netCDF file with Ext ".nc"
cd -
exit
```

Appendix G-6

CAMx Input Files

This section contains sample CAMx input files used for modeling years 2011 and 2017.

CAMx Input for 2011 (36 km)

```
 &CAMx_Control

 Run_Message      = 'CAMx 6.20 -- Mech2 NONE CB6 mod.cmx.36km',

!--- Model clock control ---

 Time_Zone        = 7,                ! (0=UTC,5=EST,6=CST,7=MST,8=PST)
 Restart          = .false.,
 Start_Date_Hour  = 2011,08,01,0000,   ! (YYYY,MM,DD,HHmm)
 End_Date_Hour    = 2011,08,01,2400,   ! (YYYY,MM,DD,HHmm)

 Maximum_Timestep    = 15.,           ! minutes
 Met_Input_Frequency = 60.,           ! minutes
 Ems_Input_Frequency = 60.,           ! minutes
 Output_Frequency    = 60.,           ! minutes

!--- Map projection parameters ---

 Map_Projection           = 'LAMBERT',  ! (LAMBERT,POLAR,UTM,LATLON)
 UTM_Zone                 = 0,
 POLAR_Longitude_Pole     = 0.,        ! deg (west<0,south<0)
 POLAR_Latitude_Pole      = 0.,        ! deg (west<0,south<0)
 LAMBERT_Central_Meridian = -111.,     ! deg (west<0,south<0)
 LAMBERT_Center_Longitude = -111.,     ! deg (west<0,south<0)
 LAMBERT_Center_Latitude  =  33.355,   ! deg (west<0,south<0)
 LAMBERT_True_Latitude1   =  45.,      ! deg (west<0,south<0)
 LAMBERT_True_Latitude2   =  33.,      ! deg (west<0,south<0)

!--- Parameters for the master (first) grid ---

 Number_of_Grids      = 1,
 Master_Origin_XCoord = -1565.999,     ! km or deg, SW corner of cell(1,1)
 Master_Origin_YCoord = -1182.252,     ! km or deg, SW corner of cell (1,1)
 Master_Cell_XSize    = 36.,           ! km or deg
 Master_Cell_YSize    = 36.,           ! km or deg
 Master_Grid_Columns  = 135,
 Master_Grid_Rows     = 97,
 Number_of_Layers     = 23,

!--- Model options ---

 Diagnostic_Error_Check = .false.,     ! True = will stop after 1st timestep
 Advection_Solver       = 'PPM',       ! (PPM,BOTT)
 Chemistry_Solver       = 'EBI',       ! (EBI,IEH,LSODE)
 PiG_Submodel           = 'GREASD',    ! (None,GREASD,IRON)
 Probing_Tool           = 'None',      ! (None,OSAT,GOAT,APCA,PSAT,DDM,PA,RTRAC)
 Drydep_Model           = 'ZHANG03',   ! (None,WESELY89,ZHANG03)
 Chemistry              = .true.,
 Wet_Deposition         = .true.,
 ACM2_Diffusion         = .false.,
 Super_Stepping         = .true.,
 Gridded_Emissions      = .true.,
 Point_Emissions        = .true.,
 Ignore_Emission_Dates  = .true.,
 Flexi_Nest             = .false.,

!--- Output specifications ---

 Root_Output_Name         = '/data/samba/ozsip/mod/cmx/out/2011/rev/mod.cmx.36km.20110801',
 Average_Output_3D        = .false.,
 Output_3D_Grid           = .true.,
 Output_Species_Names(1)  = 'BZO2',
 Output_Species_Names(2)  = 'C2O3',
 Output_Species_Names(3)  = 'CRO',
 Output_Species_Names(4)  = 'CXO3',
 Output_Species_Names(5)  = 'EPX2',
 Output_Species_Names(6)  = 'HCO3',
 Output_Species_Names(7)  = 'HO2',
 Output_Species_Names(8)  = 'ISO2',
 Output_Species_Names(9)  = 'MEO2',
 Output_Species_Names(10) = 'O',
 Output_Species_Names(11) = 'O1D',
 Output_Species_Names(12) = 'OH',
 Output_Species_Names(13) = 'OPO3',
 Output_Species_Names(14) = 'RO2',
 Output_Species_Names(15) = 'ROR',
 Output_Species_Names(16) = 'TO2',
 Output_Species_Names(17) = 'XLO2',
 Output_Species_Names(18) = 'XO2',
```

```
 Output_Species_Names(19) = 'XO2H',
 Output_Species_Names(20) = 'XO2N',
 Output_Species_Names(21) = 'AACD',
 Output_Species_Names(22) = 'ACET',
 Output_Species_Names(23) = 'ALD2',
 Output_Species_Names(24) = 'ALDX',
 Output_Species_Names(25) = 'BENZ',
 Output_Species_Names(26) = 'CAT1',
 Output_Species_Names(27) = 'CO',
 Output_Species_Names(28) = 'CRES',
 Output_Species_Names(29) = 'CRON',
 Output_Species_Names(30) = 'EPOX',
 Output_Species_Names(31) = 'ETH',
 Output_Species_Names(32) = 'ETHA',
 Output_Species_Names(33) = 'ETHY',
 Output_Species_Names(34) = 'ETOH',
 Output_Species_Names(35) = 'FACD',
 Output_Species_Names(36) = 'FORM',
 Output_Species_Names(37) = 'GLY',
 Output_Species_Names(38) = 'GLYD',
 Output_Species_Names(39) = 'H2O2',
 Output_Species_Names(40) = 'HNO3',
 Output_Species_Names(41) = 'HONO',
 Output_Species_Names(42) = 'HPLD',
 Output_Species_Names(43) = 'INTR',
 Output_Species_Names(44) = 'IOLE',
 Output_Species_Names(45) = 'ISOP',
 Output_Species_Names(46) = 'ISPD',
 Output_Species_Names(47) = 'ISPX',
 Output_Species_Names(48) = 'KET',
 Output_Species_Names(49) = 'MEOH',
 Output_Species_Names(50) = 'MEPX',
 Output_Species_Names(51) = 'MGLY',
 Output_Species_Names(52) = 'N2O5',
 Output_Species_Names(53) = 'NO',
 Output_Species_Names(54) = 'NO2',
 Output_Species_Names(55) = 'NO3',
 Output_Species_Names(56) = 'NTR1',
 Output_Species_Names(57) = 'NTR2',
 Output_Species_Names(58) = 'O3',
 Output_Species_Names(59) = 'OLE',
 Output_Species_Names(60) = 'OPAN',
 Output_Species_Names(61) = 'OPEN',
 Output_Species_Names(62) = 'PACD',
 Output_Species_Names(63) = 'PAN',
 Output_Species_Names(64) = 'PANX',
 Output_Species_Names(65) = 'PAR',
 Output_Species_Names(66) = 'PNA',
 Output_Species_Names(67) = 'PRPA',
 Output_Species_Names(68) = 'ROOH',
 Output_Species_Names(69) = 'SO2',
 Output_Species_Names(70) = 'SULF',
 Output_Species_Names(71) = 'TERP',
 Output_Species_Names(72) = 'TOL',
 Output_Species_Names(73) = 'XOPN',
 Output_Species_Names(74) = 'XYL',
 Output_Species_Names(75) = 'ECH4',
 Pig_Sampling_Grid    = .false.,
!--- Input files ---

 Chemistry_Parameters = '/data/samba/ozsip/mod/cmx/inp/CAMx6.2.chemparam.2_NONE',
 Photolyis_Rates      = '/data/samba/ozsip/mod/cmx/inp/tuv/2011/v01/pre.tuv.do.cb6.36km.20110801.txt',
 Ozone_Column         = '/data/samba/ozsip/mod/cmx/inp/o3map/2011/v01/pre.o3m.36km.20110801.txt',
 Initial_Conditions   = '/data/samba/ozsip/mod/cmx/inp/icbc/2011/v02/pre.moz.ic.cb6.36km.20110501.bin',
 Boundary_Conditions  = '/data/samba/ozsip/mod/cmx/inp/icbc/2011/v02/pre.moz.bc.cb6.36km.20110801.bin',
 Top_Concentrations   = ' ',
 Point_Sources        = '/data/samba/ozsip/mod/cmx/inp/emis/2011/fnl/pre.smk.pnt.36km.20110801.bin',
 Master_Grid_Restart  = '/data/samba/ozsip/mod/cmx/out/2011/rev/mod.cmx.36km.20110731.inst',
 PiG_Restart          = '/data/samba/ozsip/mod/cmx/out/2011/rev/mod.cmx.36km.20110731.pig',

 Surface_Grid(1) = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.lu.36km.20110801.bin',
 Met3D_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.3d.36km.20110801.bin',
 Met2D_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.2d.36km.20110801.bin',
 Vdiff_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.kv.36km.20110801.bin.CMAQ',
 Cloud_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.cr.36km.20110801.bin',
 Emiss_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/emis/2011/rev/pre.smk.ems.36km.20110801.bin',

 /
!------------------------------------------------------------------------------
```

CAMx Input for 2011 (12 & 4 km)

```
 &CAMx_Control

 Run_Message      = 'CAMx 6.20 -- Mech2 NONE CB6 mod.cmx.12km',

!--- Model clock control ---

 Time_Zone        = 7,                ! (0=UTC,5=EST,6=CST,7=MST,8=PST)
 Restart          = .false.,
 Start_Date_Hour  = 2011,08,01,0000,   ! (YYYY,MM,DD,HHmm)
 End_Date_Hour    = 2011,08,01,2400,   ! (YYYY,MM,DD,HHmm)

 Maximum_Timestep    = 15.,           ! minutes
 Met_Input_Frequency = 60.,           ! minutes
 Ems_Input_Frequency = 60.,           ! minutes
 Output_Frequency    = 60.,           ! minutes

!--- Map projection parameters ---

 Map_Projection           = 'LAMBERT',  ! (LAMBERT,POLAR,UTM,LATLON)
 UTM_Zone                 = 0,
 POLAR_Longitude_Pole     = 0.,        ! deg (west<0,south<0)
 POLAR_Latitude_Pole      = 0.,        ! deg (west<0,south<0)
 LAMBERT_Central_Meridian = -111.,     ! deg (west<0,south<0)
 LAMBERT_Center_Longitude = -111.,     ! deg (west<0,south<0)
 LAMBERT_Center_Latitude  =  33.355,   ! deg (west<0,south<0)
 LAMBERT_True_Latitude1   =  45.,      ! deg (west<0,south<0)
 LAMBERT_True_Latitude2   =  33.,      ! deg (west<0,south<0)

!--- Parameters for the master (first) grid ---

 Number_of_Grids      = 2,
 Master_Origin_XCoord = -786.000,     ! km or deg, SW corner of cell(1,1)
 Master_Origin_YCoord = -510.252,     ! km or deg, SW corner of cell (1,1)
 Master_Cell_XSize    = 12.,           ! km or deg
 Master_Cell_YSize    = 12.,           ! km or deg
 Master_Grid_Columns  = 113,
 Master_Grid_Rows     = 86,
 Number_of_Layers     = 23,

!--- Parameters for the second grid ---

 Nest_Meshing_Factor(2) = 3,           ! Cell size relative to master grid
 Nest_Beg_I_Index(2)    = 48,          ! Relative to master grid
 Nest_End_I_Index(2)    = 65,          ! Relative to master grid
 Nest_Beg_J_Index(2)    = 36,          ! Relative to master grid
 Nest_End_J_Index(2)    = 49,          ! Relative to master grid

!--- Model options ---

 Diagnostic_Error_Check = .false.,     ! True = will stop after 1st timestep
 Advection_Solver       = 'PPM',       ! (PPM,BOTT)
 Chemistry_Solver       = 'EBI',       ! (EBI,IEH,LSODE)
 PiG_Submodel           = 'GREASD',    ! (None,GREASD,IRON)
 Probing_Tool           = 'None',      ! (None,OSAT,GOAT,APCA,PSAT,DDM,PA,RTRAC)
 Drydep_Model           = 'ZHANG03',   ! (None,WESELY89,ZHANG03)
 Chemistry              = .true.,
 Wet_Deposition         = .true.,
 ACM2_Diffusion         = .false.,
 Super_Stepping         = .true.,
 Gridded_Emissions      = .true.,
 Point_Emissions        = .true.,
 Ignore_Emission_Dates  = .true.,
 Flexi_Nest             = .false.,

!--- Output specifications ---

 Root_Output_Name         = '/data/samba/ozsip/mod/cmx/out/2011/rev/mod.cmx.12km.20110801',
 Average_Output_3D        = .false.,
 Output_3D_Grid           = .false.,
 Output_Species_Names(1)  = 'ACET',
 Output_Species_Names(2)  = 'ALD2',
 Output_Species_Names(3)  = 'ALDX',
 Output_Species_Names(4)  = 'BENZ',
 Output_Species_Names(5)  = 'CO',
 Output_Species_Names(6)  = 'ETH',
 Output_Species_Names(7)  = 'ETHA',
 Output_Species_Names(8)  = 'ETHY',
 Output_Species_Names(9)  = 'ETOH',
 Output_Species_Names(10) = 'FORM',
```

```
 Output_Species_Names(11) = 'HNO3',
 Output_Species_Names(12) = 'HONO',
 Output_Species_Names(13) = 'IOLE',
 Output_Species_Names(14) = 'ISOP',
 Output_Species_Names(15) = 'KET',
 Output_Species_Names(16) = 'MEOH',
 Output_Species_Names(17) = 'NO',
 Output_Species_Names(18) = 'NO2',
 Output_Species_Names(19) = 'O3',
 Output_Species_Names(20) = 'OLE',
 Output_Species_Names(21) = 'PAN',
 Output_Species_Names(22) = 'PAR',
 Output_Species_Names(23) = 'PRPA',
 Output_Species_Names(24) = 'SO2',
 Output_Species_Names(25) = 'SULF',
 Output_Species_Names(26) = 'TERP',
 Output_Species_Names(27) = 'TOL',
 Output_Species_Names(28) = 'XYL',

!--- Input files ---

 Chemistry_Parameters = '/data/samba/ozsip/mod/cmx/inp/CAMx6.2.chemparam.2_NONE',
 Photolyis_Rates      = '/data/samba/ozsip/mod/cmx/inp/tuv/2011/v01/pre.tuv.do.cb6.12km.20110801.txt',
 Ozone_Column         = '/data/samba/ozsip/mod/cmx/inp/o3map/2011/v01/pre.o3m.12km.20110801.txt',
 Initial_Conditions   = '/data/samba/ozsip/mod/cmx/inp/icbc/2011/rev/pre.cmx.ic.cb6.12km.20110801.bin',
 Boundary_Conditions  = '/data/samba/ozsip/mod/cmx/inp/icbc/2011/rev/pre.cmx.bc.cb6.12km.20110801.bin',
 Top_Concentrations   = ' ',
 Point_Sources        = '/data/samba/ozsip/mod/cmx/inp/emis/2011/fnl/pre.smk.pnt.12km.20110801.bin',
 Master_Grid_Restart  = '/data/samba/ozsip/mod/cmx/out/2011/rev/mod.cmx.12km.20110731.inst',
 Nested_Grid_Restart  = '/data/samba/ozsip/mod/cmx/out/2011/rev/mod.cmx.12km.20110731.finst',
 PiG_Restart          = '/data/samba/ozsip/mod/cmx/out/2011/rev/mod.cmx.12km.20110731.pig',

 Surface_Grid(1) = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.lu.12km.20110801.bin',
 Met2D_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.2d.12km.20110801.bin',
 Met3D_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.3d.12km.20110801.bin',
 Vdiff_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.kv.12km.20110801.bin.CMAQ',
 Cloud_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.cr.12km.20110801.bin',
 Emiss_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/emis/2011/rev/pre.smk.ems.12km.20110801.bin',

 Surface_Grid(2) = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.lu.04km.20110801.bin',
 Met2D_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.2d.04km.20110801.bin',
 Met3D_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.3d.04km.20110801.bin',
 Vdiff_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.kv.04km.20110801.bin.CMAQ',
 Cloud_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.cr.04km.20110801.bin',
 Emiss_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/emis/2011/rev/pre.smk.ems.04km.20110801.bin',

 /
!--------------------------------------------------------------------------------
```

CAMx Input for 2017 (36 km)

```
 &CAMx_Control

 Run_Message      = 'CAMx 6.20 -- Mech2 NONE CB6 mod.cmx.36km',

!--- Model clock control ---

 Time_Zone        = 7,                ! (0=UTC,5=EST,6=CST,7=MST,8=PST)
 Restart          = .false.,
 Start_Date_Hour  = 2011,08,01,0000,   ! (YYYY,MM,DD,HHmm)
 End_Date_Hour    = 2011,08,01,2400,   ! (YYYY,MM,DD,HHmm)

 Maximum_Timestep    = 15.,           ! minutes
 Met_Input_Frequency = 60.,           ! minutes
 Ems_Input_Frequency = 60.,           ! minutes
 Output_Frequency    = 60.,           ! minutes

!--- Map projection parameters ---

 Map_Projection           = 'LAMBERT', ! (LAMBERT,POLAR,UTM,LATLON)
 UTM_Zone                 = 0,
 POLAR_Longitude_Pole     = 0.,        ! deg (west<0,south<0)
 POLAR_Latitude_Pole      = 0.,        ! deg (west<0,south<0)
 LAMBERT_Central_Meridian = -111.,     ! deg (west<0,south<0)
 LAMBERT_Center_Longitude = -111.,     ! deg (west<0,south<0)
 LAMBERT_Center_Latitude  =  33.355,   ! deg (west<0,south<0)
 LAMBERT_True_Latitude1   =  45.,      ! deg (west<0,south<0)
 LAMBERT_True_Latitude2   =  33.,      ! deg (west<0,south<0)

!--- Parameters for the master (first) grid ---

 Number_of_Grids      = 1,
 Master_Origin_XCoord = -1565.999,     ! km or deg, SW corner of cell(1,1)
 Master_Origin_YCoord = -1182.252,     ! km or deg, SW corner of cell (1,1)
 Master_Cell_XSize    = 36.,           ! km or deg
 Master_Cell_YSize    = 36.,           ! km or deg
 Master_Grid_Columns  = 135,
 Master_Grid_Rows     = 97,
 Number_of_Layers     = 23,

!--- Model options ---

 Diagnostic_Error_Check = .false.,     ! True = will stop after 1st timestep
 Advection_Solver       = 'PPM',       ! (PPM,BOTT)
 Chemistry_Solver       = 'EBI',       ! (EBI,IEH,LSODE)
 PiG_Submodel           = 'GREASD',    ! (None,GREASD,IRON)
 Probing_Tool           = 'None',      ! (None,OSAT,GOAT,APCA,PSAT,DDM,PA,RTRAC)
 Drydep_Model           = 'ZHANG03',   ! (None,WESELY89,ZHANG03)
 Chemistry              = .true.,
 Wet_Deposition         = .true.,
 ACM2_Diffusion         = .false.,
 Super_Stepping         = .true.,
 Gridded_Emissions      = .true.,
 Point_Emissions        = .true.,
 Ignore_Emission_Dates  = .true.,
 Flexi_Nest             = .false.,

!--- Output specifications ---

 Root_Output_Name         = '/data/samba/ozsip/mod/cmx/out/2017/rev/mod.cmx.36km.20110801',
 Average_Output_3D        = .false.,
 Output_3D_Grid           = .true.,
 Output_Species_Names(1)  = 'BZO2',
 Output_Species_Names(2)  = 'C2O3',
 Output_Species_Names(3)  = 'CRO',
 Output_Species_Names(4)  = 'CXO3',
 Output_Species_Names(5)  = 'EPX2',
 Output_Species_Names(6)  = 'HCO3',
 Output_Species_Names(7)  = 'HO2',
 Output_Species_Names(8)  = 'ISO2',
 Output_Species_Names(9)  = 'MEO2',
 Output_Species_Names(10) = 'O',
 Output_Species_Names(11) = 'O1D',
 Output_Species_Names(12) = 'OH',
 Output_Species_Names(13) = 'OPO3',
 Output_Species_Names(14) = 'RO2',
 Output_Species_Names(15) = 'ROR',
 Output_Species_Names(16) = 'TO2',
 Output_Species_Names(17) = 'XLO2',
 Output_Species_Names(18) = 'XO2',
```

```
 Output_Species_Names(19) = 'XO2H',
 Output_Species_Names(20) = 'XO2N',
 Output_Species_Names(21) = 'AACD',
 Output_Species_Names(22) = 'ACET',
 Output_Species_Names(23) = 'ALD2',
 Output_Species_Names(24) = 'ALDX',
 Output_Species_Names(25) = 'BENZ',
 Output_Species_Names(26) = 'CAT1',
 Output_Species_Names(27) = 'CO',
 Output_Species_Names(28) = 'CRES',
 Output_Species_Names(29) = 'CRON',
 Output_Species_Names(30) = 'EPOX',
 Output_Species_Names(31) = 'ETH',
 Output_Species_Names(32) = 'ETHA',
 Output_Species_Names(33) = 'ETHY',
 Output_Species_Names(34) = 'ETOH',
 Output_Species_Names(35) = 'FACD',
 Output_Species_Names(36) = 'FORM',
 Output_Species_Names(37) = 'GLY',
 Output_Species_Names(38) = 'GLYD',
 Output_Species_Names(39) = 'H2O2',
 Output_Species_Names(40) = 'HNO3',
 Output_Species_Names(41) = 'HONO',
 Output_Species_Names(42) = 'HPLD',
 Output_Species_Names(43) = 'INTR',
 Output_Species_Names(44) = 'IOLE',
 Output_Species_Names(45) = 'ISOP',
 Output_Species_Names(46) = 'ISPD',
 Output_Species_Names(47) = 'ISPX',
 Output_Species_Names(48) = 'KET',
 Output_Species_Names(49) = 'MEOH',
 Output_Species_Names(50) = 'MEPX',
 Output_Species_Names(51) = 'MGLY',
 Output_Species_Names(52) = 'N2O5',
 Output_Species_Names(53) = 'NO',
 Output_Species_Names(54) = 'NO2',
 Output_Species_Names(55) = 'NO3',
 Output_Species_Names(56) = 'NTR1',
 Output_Species_Names(57) = 'NTR2',
 Output_Species_Names(58) = 'O3',
 Output_Species_Names(59) = 'OLE',
 Output_Species_Names(60) = 'OPAN',
 Output_Species_Names(61) = 'OPEN',
 Output_Species_Names(62) = 'PACD',
 Output_Species_Names(63) = 'PAN',
 Output_Species_Names(64) = 'PANX',
 Output_Species_Names(65) = 'PAR',
 Output_Species_Names(66) = 'PNA',
 Output_Species_Names(67) = 'PRPA',
 Output_Species_Names(68) = 'ROOH',
 Output_Species_Names(69) = 'SO2',
 Output_Species_Names(70) = 'SULF',
 Output_Species_Names(71) = 'TERP',
 Output_Species_Names(72) = 'TOL',
 Output_Species_Names(73) = 'XOPN',
 Output_Species_Names(74) = 'XYL',
 Output_Species_Names(75) = 'ECH4',

!--- Input files ---

 Chemistry_Parameters = '/data/samba/ozsip/mod/cmx/inp/CAMx6.2.chemparam.2_NONE',
 Photolyis_Rates      = '/data/samba/ozsip/mod/cmx/inp/tuv/2011/v01/pre.tuv.do.cb6.36km.20110801.txt',
 Ozone_Column         = '/data/samba/ozsip/mod/cmx/inp/o3map/2011/v01/pre.o3m.36km.20110801.txt',
 Initial_Conditions   = '/data/samba/ozsip/mod/cmx/inp/icbc/2011/v02/pre.moz.ic.cb6.36km.20110501.bin',
 Boundary_Conditions  = '/data/samba/ozsip/mod/cmx/inp/icbc/2011/v02/pre.moz.bc.cb6.36km.20110801.bin',
 Top_Concentrations   = ' ',
 Point_Sources        = '/data/samba/ozsip/mod/cmx/inp/emis/2017/fnl/pre.smk.pnt.36km.20110801.bin',
 Master_Grid_Restart  = '/data/samba/ozsip/mod/cmx/out/2017/rev/mod.cmx.36km.20110731.inst',
 Nested_Grid_Restart  = '/data/samba/ozsip/mod/cmx/out/2017/rev/mod.cmx.36km.20110731.finst',
 PiG_Restart          = '/data/samba/ozsip/mod/cmx/out/2017/rev/mod.cmx.36km.20110731.pig',

 Surface_Grid(1) = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.lu.36km.20110801.bin',
 Met3D_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.3d.36km.20110801.bin',
 Met2D_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.2d.36km.20110801.bin',
 Vdiff_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.kv.36km.20110801.bin.CMAQ',
 Cloud_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.cr.36km.20110801.bin',
 Emiss_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/emis/2017/rev/pre.smk.ems.36km.20110801.bin',

 /
!------------------------------------------------------------------------------
```

CAMx Input for 2017 (12 & 4 km)

```
 &CAMx_Control

 Run_Message      = 'CAMx 6.20 -- Mech2 NONE CB6 mod.cmx.12km',

!--- Model clock control ---

 Time_Zone        = 7,                ! (0=UTC,5=EST,6=CST,7=MST,8=PST)
 Restart          = .false.,
 Start_Date_Hour  = 2011,08,01,0000,   ! (YYYY,MM,DD,HHmm)
 End_Date_Hour    = 2011,08,01,2400,   ! (YYYY,MM,DD,HHmm)

 Maximum_Timestep    = 15.,           ! minutes
 Met_Input_Frequency = 60.,           ! minutes
 Ems_Input_Frequency = 60.,           ! minutes
 Output_Frequency    = 60.,           ! minutes

!--- Map projection parameters ---

 Map_Projection           = 'LAMBERT', ! (LAMBERT,POLAR,UTM,LATLON)
 UTM_Zone                 = 0,
 POLAR_Longitude_Pole     = 0.,        ! deg (west<0,south<0)
 POLAR_Latitude_Pole      = 0.,        ! deg (west<0,south<0)
 LAMBERT_Central_Meridian = -111.,     ! deg (west<0,south<0)
 LAMBERT_Center_Longitude = -111.,     ! deg (west<0,south<0)
 LAMBERT_Center_Latitude  =  33.355,   ! deg (west<0,south<0)
 LAMBERT_True_Latitude1   =  45.,      ! deg (west<0,south<0)
 LAMBERT_True_Latitude2   =  33.,      ! deg (west<0,south<0)

!--- Parameters for the master (first) grid ---

 Number_of_Grids      = 2,
 Master_Origin_XCoord = -786.000,      ! km or deg, SW corner of cell(1,1)
 Master_Origin_YCoord = -510.252,      ! km or deg, SW corner of cell (1,1)
 Master_Cell_XSize    = 12.,           ! km or deg
 Master_Cell_YSize    = 12.,           ! km or deg
 Master_Grid_Columns  = 113,
 Master_Grid_Rows     = 86,
 Number_of_Layers     = 23,

!--- Parameters for the second grid ---

 Nest_Meshing_Factor(2) = 3,           ! Cell size relative to master grid
 Nest_Beg_I_Index(2)    = 48,          ! Relative to master grid
 Nest_End_I_Index(2)    = 65,          ! Relative to master grid
 Nest_Beg_J_Index(2)    = 36,          ! Relative to master grid
 Nest_End_J_Index(2)    = 49,          ! Relative to master grid

!--- Model options ---

 Diagnostic_Error_Check = .false.,     ! True = will stop after 1st timestep
 Advection_Solver       = 'PPM',       ! (PPM,BOTT)
 Chemistry_Solver       = 'EBI',       ! (EBI,IEH,LSODE)
 PiG_Submodel           = 'GREASD',    ! (None,GREASD,IRON)
 Probing_Tool           = 'None',      ! (None,OSAT,GOAT,APCA,PSAT,DDM,PA,RTRAC)
 Drydep_Model           = 'ZHANG03',   ! (None,WESELY89,ZHANG03)
 Chemistry              = .true.,
 Wet_Deposition         = .true.,
 ACM2_Diffusion         = .false.,
 Super_Stepping         = .true.,
 Gridded_Emissions      = .true.,
 Point_Emissions        = .true.,
 Ignore_Emission_Dates  = .true.,
 Flexi_Nest             = .false.,

!--- Output specifications ---

 Root_Output_Name         = '/data/samba/ozsip/mod/cmx/out/2017/rev/mod.cmx.12km.20110801',
 Average_Output_3D        = .false.,
 Output_3D_Grid           = .false.,
 Output_Species_Names(1)  = 'ACET',
 Output_Species_Names(2)  = 'ALD2',
 Output_Species_Names(3)  = 'ALDX',
 Output_Species_Names(4)  = 'BENZ',
 Output_Species_Names(5)  = 'CO',
 Output_Species_Names(6)  = 'ETH',
 Output_Species_Names(7)  = 'ETHA',
 Output_Species_Names(8)  = 'ETHY',
 Output_Species_Names(9)  = 'ETOH',
 Output_Species_Names(10) = 'FORM',
```

```
 Output_Species_Names(11) = 'HNO3',
 Output_Species_Names(12) = 'HONO',
 Output_Species_Names(13) = 'IOLE',
 Output_Species_Names(14) = 'ISOP',
 Output_Species_Names(15) = 'KET',
 Output_Species_Names(16) = 'MEOH',
 Output_Species_Names(17) = 'NO',
 Output_Species_Names(18) = 'NO2',
 Output_Species_Names(19) = 'O3',
 Output_Species_Names(20) = 'OLE',
 Output_Species_Names(21) = 'PAN',
 Output_Species_Names(22) = 'PAR',
 Output_Species_Names(23) = 'PRPA',
 Output_Species_Names(24) = 'SO2',
 Output_Species_Names(25) = 'SULF',
 Output_Species_Names(26) = 'TERP',
 Output_Species_Names(27) = 'TOL',
 Output_Species_Names(28) = 'XYL',

!--- Input files ---

 Chemistry_Parameters = '/data/samba/ozsip/mod/cmx/inp/CAMx6.2.chemparam.2_NONE',
 Photolyis_Rates      = '/data/samba/ozsip/mod/cmx/inp/tuv/2011/v01/pre.tuv.do.cb6.12km.20110801.txt',
 Ozone_Column         = '/data/samba/ozsip/mod/cmx/inp/o3map/2011/v01/pre.o3m.12km.20110801.txt',
 Initial_Conditions   = '/data/samba/ozsip/mod/cmx/inp/icbc/2017/rev/pre.cmx.ic.cb6.12km.20110801.bin',
 Boundary_Conditions  = '/data/samba/ozsip/mod/cmx/inp/icbc/2017/rev/pre.cmx.bc.cb6.12km.20110801.bin',
 Top_Concentrations   = ' ',
 Point_Sources        = '/data/samba/ozsip/mod/cmx/inp/emis/2017/fnl/pre.smk.pnt.12km.20110801.bin',
 Master_Grid_Restart  = '/data/samba/ozsip/mod/cmx/out/2017/rev/mod.cmx.12km.20110731.inst',
 Nested_Grid_Restart  = '/data/samba/ozsip/mod/cmx/out/2017/rev/mod.cmx.12km.20110731.finst',
 PiG_Restart          = '/data/samba/ozsip/mod/cmx/out/2017/rev/mod.cmx.12km.20110731.pig',

 Surface_Grid(1) = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.lu.12km.20110801.bin',
 Met2D_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.2d.12km.20110801.bin',
 Met3D_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.3d.12km.20110801.bin',
 Vdiff_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.kv.12km.20110801.bin.CMAQ',
 Cloud_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.cr.12km.20110801.bin',
 Emiss_Grid(1)   = '/data/samba/ozsip/mod/cmx/inp/emis/2017/rev/pre.smk.ems.12km.20110801.bin',

 Surface_Grid(2) = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.lu.04km.20110801.bin',
 Met2D_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.2d.04km.20110801.bin',
 Met3D_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.3d.04km.20110801.bin',
 Vdiff_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.kv.04km.20110801.bin.CMAQ',
 Cloud_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/met/2011/v02/pre.wrf.cr.04km.20110801.bin',
 Emiss_Grid(2)   = '/data/samba/ozsip/mod/cmx/inp/emis/2017/rev/pre.smk.ems.04km.20110801.bin',

 /
!--------------------------------------------------------------------------------
```

APPENDIX B

EXHIBIT 2:

State of Arizona Fifty-Second Legislature Senate Bill 1255 and Final Revised Fact Sheet for Senate Bill 1255.

State of Arizona
Senate
Fifty-second Legislature
Second Regular Session
2016

CHAPTER 34

SENATE BILL 1255

AN ACT

REPEALING SECTION 41-3017.01, ARIZONA REVISED STATUTES; AMENDING TITLE 41, CHAPTER 27, ARTICLE 2, ARIZONA REVISED STATUTES, BY ADDING SECTION 41-3022.09; RELATING TO THE VEHICLE EMISSIONS INSPECTION PROGRAM.

(TEXT OF BILL BEGINS ON NEXT PAGE)

Be it enacted by the Legislature of the State of Arizona:

Section 1. Repeal

Section 41-3017.01, Arizona Revised Statutes, is repealed.

Sec. 2. Title 41, chapter 27, article 2, Arizona Revised Statutes, is amended by adding section 41-3022.09, to read:

41-3022.09. Vehicle emissions inspection program; termination July 1, 2022

A. THE VEHICLE EMISSIONS INSPECTION PROGRAM TERMINATES ON JULY 1, 2022.

B. TITLE 49, CHAPTER 3, ARTICLE 5 IS REPEALED ON JANUARY 1, 2023.

Sec. 3. Purpose

Pursuant to section 41-2955, subsection B, Arizona Revised Statutes, the legislature continues the vehicle emissions inspection program to identify violations and compel compliance with vehicle emissions requirements.

APPROVED BY THE GOVERNOR MARCH 17, 2016.

FILED IN THE OFFICE OF THE SECRETARY OF STATE MARCH 18, 2016.

ARIZONA STATE SENATE

Fifty-Second Legislature, Second Regular Session

FINAL REVISED

FACT SHEET FOR S.B. 1255

vehicle emissions inspection program; continuation

Purpose

Continues the Vehicle Emissions Inspection Program (VEIP) for six years.

Background

The VEIP is administered either annually or bi-annually by the Department of Environmental Quality. This program was established in 1976 as a result of the designation of the Phoenix (area A) and Tucson (area B) areas as nonattainment areas. Minimum emissions standards in both areas A and B are set forth in A.R.S. § 49-542. Each inspection station must have a technical assistant available to assist persons who fail the emissions test.

A vehicle that has a model year of 1967 or later is required to be emissions tested before it can be registered in area A or B. Most vehicles of the newest five model years are exempt from emissions testing. Most light duty vehicles, from 1996 or newer, are tested with an on board diagnostics (OBD) test. With the OBD test, engine operating data is accessed by connecting directly to a computer in the vehicle that continuously monitors engine emission control systems operation. Vehicles also undergo a visual tampering inspection that includes a test of gas cap integrity (A.R.S. § 49-542).

Any registered owner or lessee of a fleet of at least 25 vehicles may apply to the director of the Arizona Department of Environmental Quality (Director) for a permit to establish a fleet emissions inspection station. Before the permit is issued, the Director is required to ensure that certain requirements are met. The holder of a fleet emissions inspection station permit may not inspect or certify any vehicle for which the permit holder is not the registered owner or lessee unless authorized by the Director. Also, any vehicle subject to these provisions is required to be inspected at least once every year following any original registration or reregistration (A.R.S. § 49-546).

There is no anticipated fiscal impact to the state General Fund associated with this legislation.

Provisions

1. Continues the Vehicle Emissions Inspection Program until July 1, 2022.

2. Repeals the Vehicle Emissions Inspection Program on January 1, 2023.

3. Contains a purpose statement.

4. Becomes effective on the general effective date.

Senate Action				House Action			
NR	2/1/16	DP	6-1-0-0	TI	3/1/16	DP	8-0-0-1
3rd Read	2/11/16		22-7-1	3rd Read	3/16/16		48-11-1

Signed by the Governor 3/17/16
Chapter 34

Prepared by Senate Research
March 24, 2016
KN/JN/ls

APPENDIX C

APPENDIX C

EXHIBIT 1:

Public Hearing Process Documentation.

CERTIFICATION OF HOLDING OF PUBLIC HEARING ON THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

I affirm that a public hearing was held by the Maricopa Association of Governments (MAG) starting at 5:30 p.m. Monday, October 17, 2016 at the MAG Offices, Saguaro Room, 302 North 1st Avenue, Phoenix, Arizona and that the hearing was held in accordance with the Arizona open meeting laws and 40 CFR 51.102(d) to receive public comment on the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area.

October 18, 2016
Date

Lindy Bauer
Lindy Bauer, ~~MAG~~
Environmental Director

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

Personally appeared before me the above-named Lindy Bauer known to me to be the same person who executed the foregoing instrument and to be the Environmental Director for the Maricopa Association of Governments and acknowledged to me that she executed the same as her free act.

SUBSCRIBED AND SWORN TO before me on this 18th day of October 2016.

Valerie Day
Notary Public

My Commission Expires:
August 15, 2020

VALERIE DAY
Notary Public - State of Arizona
MARICOPA COUNTY
My Commission Expires
August 15, 2020

AFFIDAVIT OF PUBLICATION

THE ARIZONA REPUBLIC

PUBLIC HEARING ON THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

October 17, 2016, at 5:30 p.m.
MAG Offices, Saguaro Room
302 North 1st Avenue, Second Floor
Phoenix, Arizona 85003

The Maricopa Association of Governments (MAG) will conduct a public hearing on the Draft MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area on October 17, 2016, at 5:30 p.m. The purpose of this hearing is to receive public comments. According to Section 182(b) of the federal Clean Air Act, the Eight-Hour Ozone Moderate Area Plan is required to be submitted to the Environmental Protection Agency (EPA) by January 1, 2017. Collectively, the plan contains 493 existing control measures that are being implemented to reduce ozone. The plan includes reasonable further progress, reasonably available control technology, reasonably available control measures, new source review, emissions inventories, modeling, attainment demonstration for 2017 (ozone season prior to the July 20, 2018 attainment date), contingency measures, and motor vehicle emissions budgets for transportation conformity. The draft document is available for public review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Monday through Friday and on the MAG website at www.azmag.gov. Public comments are welcome at the hearing, or may be submitted in writing by 5:30 p.m. on October 17, 2016 to Kara Maynard at the address below. After considering the public comments, the MAG Regional Council may take action on the plan on December 7, 2016. The ADEQ may then adopt the plan for submittal to the EPA.

Contact Person: Kara Maynard, MAG (602) 254-6300
302 N. 1st Avenue, Suite 300
Phoenix, AZ 85003
Fax: (602) 254-6490
E-mail: KMaynard@azmag.gov

Pub: September 16, 17, 2016

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Melissa Hoekstra, being first duly sworn, upon oath deposes and says: That she is a legal advertising representative of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, Coconino, Pima and Pinal, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

The Arizona Republic

9/16/2016
9/17/2016

Sworn to before me this
19TH day of
September A.D. 2016

BRIAN BILLINGS
Notary Public - Arizona
Maricopa County
My Commission Expires
July 25, 2018

Notary Public

MARICOPA ASSOCIATION of GOVERNMENTS

302 North 1st Avenue, Suite 300 ▲ Phoenix, Arizona 85003
Phone (602) 254-6300 ▲ FAX (602) 254-6490
E-mail: mag@azmag.gov ▲ www.azmag.gov

50th Anniversary
1967–2017

September 16, 2016

TO: Interested Parties for Air Quality

FROM: Lindy Bauer, Environmental Director

SUBJECT: PUBLIC HEARING ON THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOP NONATTAINMENT AREA

Public Hearing
October 17, 2016 at 5:30 p.m.
MAG Offices, Saguaro Room
302 North 1st Avenue, Second Floor
Phoenix, Arizona 85003

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According to Section 182(b) of the federal Clean Air Act, the Eight-Hour Ozone Moderate Area Plan is required to be submitted to the Environmental Protection Agency (EPA) by January 1, 2017. Collectively, the plan contains 93 existing control measures that are being implemented to reduce ozone. The plan includes reasonable further progress; reasonably available control technology; reasonably available control measures; new source review; emissions inventories; modeling attainment demonstration for 2017 (ozone season prior to the July 20, 2018 attainment date); contingency measures; and motor vehicle emissions budgets for transportation conformity.

For your information and convenience, a copy of the public hearing notice is enclosed. The draft document is available for public review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Monday through Friday. In addition, the draft document is available for agency and public review on the MAG website at www.azmag.gov.

Attachment

PUBLIC HEARING ON THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

October 17, 2016 at 5:30 p.m.
MAG Offices, Saguaro Room
302 North 1st Avenue, Second Floor
Phoenix, Arizona 85003

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The draft document is available for public review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Monday through Friday and on the MAG website at www.azmag.gov. Public comments are welcome at the hearing, or may be submitted in writing by 5:30 p.m. on October 17, 2016 to Kara Maynard at the address below. After considering the public comments, the MAG Regional Council may take action on the plan on December 7, 2016. The Arizona Department of Environmental Quality may then adopt the plan for submittal to the EPA.

Contact Person: Kara Maynard, MAG (602) 254-6300
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Phoenix, AZ 85003
Fax: (602) 254-6490
E-mail: KMaynard@azmag.gov

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50th Anniversary 1967–2017

TITLE VI
LETTER EXAMPLE

September 16, 2016

Ms. Cynthia Zwick
Director
Arizona Community Action Association
2700 North 3rd Street, Suite 3040
Phoenix, AZ 85004-1122

Dear Ms. Zwick:

You are cordially invited to a public hearing on the Draft MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. The hearing will be conducted by the Maricopa Association of Governments (MAG) on Monday, October 17, 2016 at 5:30 p.m. in the Saguaro Room at the MAG Offices, 302 North 1st Avenue, Second Floor, Phoenix, Arizona, 85003. The purpose of this hearing is to receive public comments. Written and verbal comments are welcomed at the public hearing. After considering public comments, the MAG Regional Council may take action on the plan on December 7, 2016.

According to Section 182(b) of the federal Clean Air Act, the Eight-Hour Ozone Moderate Area Plan is required to be submitted to the Environmental Protection Agency (EPA) by January 1, 2017. Collectively, the plan contains 93 existing control measures that are being implemented to reduce ozone. The plan includes reasonable further progress; reasonably available control technology; reasonably available control measures; new source review; emissions inventories; modeling attainment demonstration for 2017 (ozone season prior to the July 20, 2018 attainment date); contingency measures; and motor vehicle emissions budgets for transportation conformity.

The draft document is available for review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Monday through Friday. In addition, the draft document is available for agency and public review on the MAG website at www.azmag.gov. We hope to see you or your representative at the hearing and to include your input in future planning efforts. For your convenience, a copy of the public hearing notice is attached. If you have any questions or would like to set up a time for us to meet with your, organization, please do not hesitate to contact me at (602) 254-6300.

Sincerely,

Lindy Bauer

Lindy Bauer
Environmental Director

Attachment

PUBLIC HEARING ON THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

October 17, 2016 at 5:30 p.m.
MAG Offices, Saguaro Room
302 North 1st Avenue, Second Floor
Phoenix, Arizona 85003

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The draft document is available for public review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Monday through Friday and on the MAG website at www.azmag.gov. Public comments are welcome at the hearing, or may be submitted in writing by 5:30 p.m. on October 17, 2016 to Kara Maynard at the address below. After considering the public comments, the MAG Regional Council may take action on the plan on December 7, 2016. The Arizona Department of Environmental Quality may then adopt the plan for submittal to the EPA.

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MARICOPA ASSOCIATION of GOVERNMENTS

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Phone (602) 254-6300 ▲ FAX (602) 254-6490
E-mail: mag@azmag.gov ▲ www.azmag.gov

50th Anniversary 1967–2017

September 16, 2016

TO: Leslie Rogers, Federal Transit Administration
Karla Petty, Federal Highway Administration
John Halikowski, Arizona Department of Transportation
Misael Cabrera, Arizona Department of Environmental Quality
Maria Hyatt, City of Phoenix Public Transit Department
Scott Smith, Valley Metro/RPTA
Philip McNeely, Maricopa County Air Quality Department
Kenneth Hall, Central Arizona Governments
Michael Sundblom, Pinal County Air Quality Control District
Irene Higgs, Sun Corridor Metropolitan Planning Agency
Jerry Wamsley, U.S. Environmental Protection Agency, Region IX

FROM: Lindy Bauer, Environmental Director

SUBJECT: TRANSMITTAL OF THE DRAFT MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

The Maricopa Association of Governments (MAG) has prepared the Draft MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area. The draft document is available for public review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Monday through Friday. In addition, the draft document is available for agency and public review on the MAG website at www.azmag.gov. Any comments are requested by 5:30 p.m. on October 17, 2016.

According to Section 182(b) of the federal Clean Air Act, the Eight-Hour Ozone Moderate Area Plan is required to be submitted to the Environmental Protection Agency (EPA) by January 1, 2017. Collectively, the plan contains 93 existing control measures that are being implemented to reduce ozone. The plan includes reasonable further progress; reasonably available control technology; reasonably available control measures; new source review; emissions inventories; modeling attainment demonstration for 2017 (ozone season prior to the July 20, 2018 attainment date); contingency measures; and motor vehicle emissions budgets for transportation conformity.

On October 17, 2016, a public hearing will be held by MAG at the MAG Offices, Saguaro Room, Second Floor, Phoenix, Arizona, at 5:30 p.m. A copy of the public hearing notice is attached. After considering public comments, the MAG Regional Council may take action on the plan on December 7, 2016. The ADEQ may then adopt the plan for submittal to the EPA. If you have any questions, please do not hesitate to contact me at (602) 254-6300.

cc: Marina Mejia, Arizona Department of Environmental Quality
Dallas Hammit, P.E., Arizona Department of Transportation

Attachment

PUBLIC HEARING ON THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

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MAG Offices, Saguaro Room
302 North 1st Avenue, Second Floor
Phoenix, Arizona 85003

The Maricopa Association of Governments (MAG) will conduct a public hearing on the Draft MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area on October 17, 2016 at 5:30 p.m. The purpose of this hearing is to receive public comments.

According to Section 182(b) of the federal Clean Air Act, the Eight-Hour Ozone Moderate Area Plan is required to be submitted to the Environmental Protection Agency (EPA) by January 1, 2017. Collectively, the plan contains 93 existing control measures that are being implemented to reduce ozone. The plan includes reasonable further progress; reasonably available control technology; reasonably available control measures; new source review; emissions inventories; modeling attainment demonstration for 2017 (ozone season prior to the July 20, 2018 attainment date); contingency measures; and motor vehicle emissions budgets for transportation conformity.

The draft document is available for public review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Monday through Friday and on the MAG website at www.azmag.gov. Public comments are welcome at the hearing, or may be submitted in writing by 5:30 p.m. on October 17, 2016 to Kara Maynard at the address below. After considering the public comments, the MAG Regional Council may take action on the plan on December 7, 2016. The Arizona Department of Environmental Quality may then adopt the plan for submittal to the EPA.

Contact Person: Kara Maynard, MAG (602) 254-6300
302 N. 1st Avenue, Suite 300
Phoenix, AZ 85003
Fax: (602) 254-6490
E-mail: KMaynard@azmag.gov

MARICOPA ASSOCIATION OF GOVERNMENTS

PUBLIC HEARING ON THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

Phoenix, Arizona

October 17, 2016

5:30 p.m.

Prepared By:

Maricopa Association of Governments

(Original)

Prepared By:

KARA MAYNARD

Administrative Assistant

MARICOPA ASSOCIATION OF GOVERNMENTS

PUBLIC HEARING ON THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

commenced at 5:45 p.m. on October, 17, 2016 at the offices of Maricopa Association of Governments, 302 North First Avenue, Suite 200, Phoenix, Arizona before KARA MAYNARD, Administrative Assistant for the Environmental Division of Maricopa Association of Governments.

* * * * *

A P P E A R A N C E S

Maricopa Association of Governments:

Lindy Bauer

Phoenix, Arizona

October 17, 2016

5:45 p.m.

PROCEEDINGS

MS. BAUER: I'd like to welcome everyone in attendance this evening to the public hearing.

This public hearing is being held by the Maricopa Association of Governments to receive public comments on the Draft MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area.

Those driving to the meeting, who parked in the garage, can have their tickets validated by the MAG staff.

Now we will begin the public hearing with an overview presentation by the MAG staff. Following the presentation hearing participants are invited to make comments for the public record. Written comments are also welcome at the public hearing.

For those participants wishing to speak, please fill out a form on the table and place it in the box.

If you need to speak early to meet a bus schedule, please tell the MAG staff; and we will accommodate that request.

As you come up to the podium, please state some information for the formal record: your name and who you represent.

I would like to note that we have a timer to assist the public with their presentations. We have a three minute limit. When two minutes have elapsed, the yellow light will come on, notifying the speaker that they have one minute to sum up. At the end of the three minute time period, the red light will come on.

Now we will begin with a presentation on the plan.

Thank you very much. Ground level ozone is a summer air pollution problem, it is not directly emitted into the atmosphere. It is formed by a chemical reaction that occurs between volatile organic compounds and nitrogen oxides in the presence of sunlight.

In accordance with the Clean Air Act, the Maricopa eight-hour ozone nonattainment area is classified as a Moderate Area for the standard set by the Environmental Protection Agency in 2008 for ozone. That standard is 0.075 parts per million. A new plan, the Moderate Area Plan, is due January 1, 2017. That plan is required to achieve at least a 15 percent reduction in volatile organic compound emissions over a six year period. That period is 2012 through 2017.

The attainment date for Moderate Areas is July 20, 2018. Since the attainment date is in the middle of the summer ozone season, the plan is required to demonstrate attainment of the standard in the prior 2017 ozone season. The region will also need three years of clean data at the monitors in 2017 to meet the standard. This will be based on data between 2015 and 2017.

The Maricopa eight-hour ozone nonattainment area

encompasses 5,017 square miles. There are 20 air quality monitors in the nonattainment area monitoring for ozone concentrations.

Over time, significant progress has been made to reduce ozone. There have been no violations of the one-hour ozone standard since 1996 and no violations of the 1997 eight-hour ozone standard since 2004. We have not yet met the 2008 ozone standard.

You will notice toward the end of this graph you can see that in 2016 the region has only one violating monitor. That monitor was the Pinnacle Peak monitor and the concentration was 0.076 parts per million which is only slightly over the 0.075 parts per million standard. Indeed, we have made tremendous progress but we need to get all monitors in compliance by the end of the ozone season next year.

The sources of volatile organic compound emissions that contribute to ozone formation are indicated on this chart. Biogenics is the biggest contributor; these are plants, trees, vegetation, about 58.5 percent. The second largest source is called area sources, 19 percent, includes solvents, coatings, landfills, fuel storage and transport, and wildfires. Then the onroad category, these are cars and trucks, contribute 12.3 percent. This is, again, motor vehicle exhaust. Nonroad which is off-road equipment and lawn and garden equipment, 9.8 percent. Point sources - manufacturing, electrical generation, and power plants, 0.5 percent.

We also need to take a look at nitrogen oxides. The

largest source is onroad for nitrogen oxides at 60.9 percent. Nonroad is 28.5 percent. Area is 6.3 percent. Point source is 3 percent. Biogenics is 1.2 percent.

The new Moderate Area Eight-Hour Ozone Plan includes 93 control measures that have been approved by the Environmental Protection Agency in prior air quality plans and existing federal control measures. We are fortunate to have 93 existing control measures in place. The plan contains a Reasonably Available Control Measure Demonstration. The 93 measures in the plan were compared to the Environmental Protection Agency's Menu of Control Measures and also to the Sacramento Metropolitan Air Quality Management District measures. The results of this analysis indicate that no new or strengthened measures were necessary to demonstrate attainment or meet reasonable further progress requirements.

The Maricopa Association of Governments maintains the latest, state-of-the-art air quality modeling system. For the attainment demonstration or predicting weather or not we are going to attain the standard, we used photochemical grid modeling and we modeled the entire ozone season. That was 153 days, it was a very rigorous effort. A subset of the 93 control measures was used for the attainment demonstration. The plan does demonstrate attainment of the standard in 2017 with a design value of 0.0756 parts per million and then it is truncated which brings it down to the standard 0.075. In addition to the modeling attainment

demonstration, we also did a Weight-of-the-Evidence analysis to support the attainment demonstration.

We wanted to also indicate the size of the modeling domains that we use. Ozone transports. In the blue you can see the meteorological modeling domain. This covers the entire United States and parts of Canada and Mexico because we have to take into account their emissions as well. You can see the red border. The red border is the air quality modeling domain and we use the CAMx Model. When we cover the entire United States and portions of Canada and Mexico, that is very important because it is good to account for background ozone. Background ozone is an important consideration in our nonattainment area. It is critical to take that into account.

The inner modeling domain covers the nonattainment area and portions of Maricopa and Pinal County, so it is pretty large as well. There were 13 existing measures, this is the subset of the 93, that were used for the modeling attainment demonstration and as you review this list you can see that we have Clean Burning Fuels, Vehicle Emissions Testing Program, Coordinated Traffic Signal Systems, Federal Vehicle Emissions Standards, Federal Nonroad Equipment Standards, and also Federal Portable Fuel Container Rules. Most of these measures are geared toward the onroad mobile source emissions.

The plan is also required to include what is known as a Rate of Progress Plan. This is the 15 percent reduction in

volatile organic compound emissions. The highest blue bar is the 2011 baseline for volatile organic compound emissions, 195.78 metric tons per day. The red line represents the target for the 15 percent reduction target level that the plan is supposed to reduce emissions to. The target level is 166.41 metric tons per day. The blue bar shows how far that the plan brings those emissions down. It brings them down to 165.28 metric tons per day. It is below that target. The plan demonstrates the 15 percent reduction in volatile organic compound emissions.

The plan also contains contingency measures. They are required to be implemented without further action if the area fails to attain the standard or make reasonable further progress. They are also required to represent one-year's worth of progress, which is a three percent reduction in the 2011 base year nitrogen oxide emissions or volatile organic compound emissions. Now the existing measures in the plan provide continuing emission reduction benefits of 3.86 percent above and beyond what is needed for attainment and this is what is used to meet the contingency measure requirements.

This pie chart is for the attainment year of 2017 with the measures applied. This is for volatile organic compound emissions. The onroad portion of this pie chart is used to produce a motor vehicle emissions budget for transportation conformity.

This is the pie chart for nitrogen oxide emissions in 2017 attainment year and again the onroad portion is what is used to set a motor vehicle emission budget for conformity.

The motor vehicle emissions budgets for conformity - the 2017 budget for volatile organic compounds is 45.7 metric tons per day. The 2017 budget for nitrogen oxide emissions is 62.7 metric tons per day. The Maricopa Association of Governments must demonstrate that the emissions coming from the transportation plans, programs, and projects do not exceed the motor vehicle emission budgets set by the air quality plans

Here is the schedule. On September 16, 2016, a draft plan was made available for public review. October 17, 2016, today, we are conducting the public hearing. On October 27, 2016 the MAG Air Quality Technical Advisory Committee may make a recommendation on the plan. On November 9, 2016, the MAG Management Committee may make a recommendation. Then on December 7, 2016, the MAG Regional Council may adopt the plan. On December 16, 2016, the Maricopa Association of Governments would submit the plan to the Arizona Department of Environmental Quality and the Environmental Protection Agency.

I want to point out that there will be additional opportunity for public comments on this plan beyond this hearing. Additional comments on the plan will also be accepted at the following meetings: the MAG Air Quality Technical Advisory Committee meeting on October 27, 2016 at 1:30 p.m.; at the MAG Management Committee meeting on November 9, 2016, at 12:00 noon; and at the MAG Regional Council meeting on December 7, 2016, at 11:30 a.m.

That concludes my presentation this evening. Thank you very much.

PUBLIC COMMENTS

MS. BAUER: At this time public comments are invited. Again, if you would like to speak, please fill out a speaker form and place it in the box. Please adhere to the three minute time limit. Do we have anyone wishing to speak?

It appears that we do not have anyone wishing to speak at this time and we have not received any written public comments presented at this public hearing.

The Maricopa Association of Governments appreciates your interest in regional air quality issues and we will be presenting the results of this public hearing to the MAG Air Quality Technical Advisory Committee at the October 27, 2016 meeting at 1:30 p.m. If we do receive some comments we will be preparing a response to comments and also presenting that to the MAG Air Quality Technical Advisory Committee.

Thank you very much for your participation this evening.

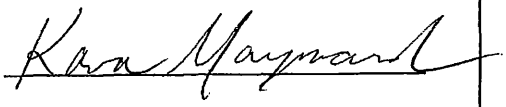
(The proceedings concluded at approximately 6:00 p.m.)

STATE OF ARIZONA

COUNTY OF MARICOPA

I HEREBY CERTIFY that the foregoing was taken before me, KARA MAYNARD; that I was present at the public hearing and that the public hearing was video taped, and thereafter reduced to writing by me based upon my presence at the hearing and the video tape; and that the foregoing 10 pages contain a full, true, and correct transcript of said record, all done to the best of my skill and ability.

WITNESS my hand this 20th day of October, 2016.



KARA MAYNARD

Administrative Assistant

MAG Environmental Division

MARICOPA ASSOCIATION of GOVERNMENTS

302 North 1st Avenue, Suite 300 ▲ Phoenix, Arizona 85003
Phone (602) 254-6300 ▲ FAX (602) 254-6490
mag@mag.maricopa.gov

Meeting: Public Hearing on the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area

Room: Saguaro Room

Date: October 17, 2016

PLEASE SIGN IN BELOW:

NAME	ORGANIZATION/AFFILIATION	MAILING ADDRESS
Megan Sheldon	city of Glendale	
Hether Krause	MCAQD.	
Phil McNeely	MCAQD	

RESPONSIVENESS SUMMARY

DRAFT MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

OCTOBER 17, 2016 PUBLIC HEARING

An advertised public hearing on the Draft MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area was conducted on October 17, 2016. The draft document was made available for public review on September 16, 2016. No comments were received during the public hearing comment period.

APPENDIX C

EXHIBIT 2:

Certification of Adoption and MAG Authority for Regional Air Quality Planning.

RESOLUTION TO ADOPT THE MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE MARICOPA NONATTAINMENT AREA

WHEREAS, the Maricopa Association of Governments (MAG) is a Council of Governments composed of twenty-seven cities and towns within Maricopa County and portions of Pinal County, Maricopa County, Pinal County, the Gila River Indian Community, the Salt River Pima-Maricopa Indian Community, Fort McDowell Yavapai Nation, Arizona Department of Transportation, and Citizens Transportation Oversight Committee; and

WHEREAS, the Governor of Arizona designated MAG as the regional air quality planning agency and metropolitan planning organization for transportation for all jurisdictions in Maricopa County, including the Phoenix urbanized area and the contiguous urbanized area in Pinal County, including the Town of Florence and City of Maricopa; and

WHEREAS, the Environmental Protection Agency reclassified the Maricopa nonattainment area as a Moderate Area for the eight-hour ozone standard of 0.075 parts per million in May 2016 in accordance with the Clean Air Act; and

WHEREAS, the attainment date for Moderate Areas is July 20, 2018 and a Moderate Area Plan is required to be submitted to the Environmental Protection Agency by January 1, 2017; and

WHEREAS, MAG has prepared the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area; and

WHEREAS, A.R.S. 49-406 H. requires that the governing body of the metropolitan planning organization adopt the nonattainment area plan.

NOW THEREFORE, BE IT RESOLVED BY THE MARICOPA ASSOCIATION OF GOVERNMENTS REGIONAL COUNCIL as follows:

SECTION 1. That the MAG Regional Council adopts the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area.

SECTION 2. That the MAG Regional Council authorizes the submission of the plan to the Arizona Department of Environmental Quality and the U.S. Environmental Protection Agency.

PASSED AND ADOPTED BY THE REGIONAL COUNCIL OF THE MARICOPA ASSOCIATION OF GOVERNMENTS THIS SEVENTH DAY OF DECEMBER 2016.

Greg Stanton
Chair, MAG Regional Council
Mayor of Phoenix

ATTEST:

Dennis Smith
Executive Director, MAG

CERTIFICATION OF ADOPTION OF THE
MAG 2017 EIGHT-HOUR OZONE MODERATE AREA PLAN FOR THE
MARICOPA NONATTAINMENT AREA

An Excerpt from the December 7, 2016 MAG Regional Council Meeting Minutes

I certify that on December 7, 2016, the MAG Regional Council adopted the MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa Nonattainment Area.

Dennis Smith
MAG Executive Director

12/07/16
Date

WESLEY BOLIN
GOVERNOR

OFFICE OF THE GOVERNOR

STATE HOUSE
PHOENIX, ARIZONA 85007

IN REPLY
REFER TO:

February 7, 1978

The Honorable Douglas M. Costle
Administrator
United States Environmental Protection Agency
401 "M" Street, S.W.
Washington, DC 20460

Dear Mr. Costle:

In accordance with Section 174(a) of the Clean Air Act as amended August 7, 1977, I hereby designate the Maricopa Association of Governments as the lead planning organization for Maricopa County, (Phoenix) Arizona and the Pima Association of Governments as the lead planning organization for Pima County, (Tucson) Arizona for the purpose of determining which elements of a revised Air Quality Implementation Plan will be planned, implemented and enforced by the State and local governments in Arizona. Attached are letters from each agency requesting such designations.

This action is required because national primary ambient air quality standards for carbon monoxide and photochemical oxidants will not be attained in metropolitan Phoenix and Tucson by July 1, 1979. Detailed agreements with the above organizations of elected officials of local governments and the State of Arizona are now being developed. These agreements will identify the responsibilities of each of the participants, i.e. the Maricopa Association of Governments, the Pima Association of Governments, the Maricopa County Health Department, and the Arizona Department of Health Services. Upon completion of such agreements, they will be certified by this office and forwarded to the U.S. Environmental Protection Agency.

Sincerely,

Wesley Bolin

WB:vabclm
Attachments

cc: Suzanne Dandoy
Bruce Scott
G. Kenneth Driggs
Thomas L. Swanson
Paul De Falco, Jr.

STATE OF ARIZONA
EXECUTIVE OFFICE

FIFE SYMINGTON
Governor

June 24, 1993

The Honorable Charles Hayes
Chairman, MAG Regional Council
1820 West Washington
Phoenix, AZ 85007

Dear Mayor Hayes:

I concur with your May 10th letter--MAG should coordinate its aviation planning with the statewide aviation planning effort.

Please inform the Regional Council that I support their continuation as the Metropolitan Planning Organization. I believe the MAG Regional Aviation System Plan will do much to help your region of the state make decisions on airport improvements. I salute your process.

If you are not aware, however, my Regional Airport Feasibility Assessment (RAFA) was a statewide aviation planning effort. In the case of the RAFA, regional does not mean a limited area like MAG but means the Southwestern United States. My RAFA study was paid for by FAA funding and focused on the statewide issue of a new major airport facility to serve needs throughout Arizona and the entire Southwest within the next 20 to 30 years. It also considers long-term economic effects on the state. Your MAG RASP was also paid for by FAA funding but focused on 10 to 20 years of airport improvements in Maricopa County. As you can see, the two studies differ greatly in scope and substance.

RECD JUN 28 1993

1700 WEST WASHINGTON, PHOENIX, ARIZONA 85007 • (602) 542-4331

I notice that about a dozen of your MAG RASP Committee Members were also on my GRAAC Committee. It seems to me that this overlap of membership provides a good basis for the coordination you seek.

Thank you for your continued concern to keep Arizona's aviation industry viable and vital in the 21st century.

Sincerely,

Fife Symington
GOVERNOR

FS/JL:me

cc: Joe Lane, Executive Assistant for the Governor
Marvin Cohen, GRAAC Chairman
Linda Brock-Nelson, GRAAC Vice Chairman
GRAAC Committee Members
MAG Regional Council

49-406. Nonattainment area plan

A. For any ozone, carbon monoxide or particulate nonattainment or maintenance area the governor shall certify the metropolitan planning organization designated to conduct the continuing, cooperative and comprehensive transportation planning process for that area under 23 United States Code section 134 as the agency responsible for the development of a nonattainment or maintenance area plan for that area.

B. For any ozone, carbon monoxide or particulate nonattainment or maintenance area for which no metropolitan planning organization exists, the department shall be certified as the agency responsible for development of a nonattainment or maintenance area plan for that area.

C. For any ozone, carbon monoxide or particulate nonattainment or maintenance area, the department, the planning agency certified pursuant to subsection A of this section on behalf of elected officials of affected local government, the county air pollution control department or district, and the department of transportation shall, by November 15, 1992, and from time to time as necessary, jointly review and update planning procedures or develop new procedures.

D. In preparing the procedures described in subsection C of this section, the department, the planning agency certified pursuant to subsection A of this section on behalf of elected officials of affected local government, the county air pollution control department or district, and the department of transportation shall determine which elements of each revised implementation plan will be developed, adopted, and implemented, through means including enforcement, by the state and which by local governments or regional agencies, or any combination of local governments, regional agencies or the state.

E. The department, the planning agency certified pursuant to subsection A of this section on behalf of elected officials of affected local government, the county air pollution control department or district, and the department of transportation shall enter into a memorandum of agreement for the purpose of coordinating the implementation of the procedures described in subsection C and D of this section.

F. At a minimum, the memorandum of agreement shall contain:

1. The relevant responsibilities and authorities of each of the coordinating agencies.
2. As appropriate, procedures, schedules and responsibilities for development of nonattainment or maintenance area plans or plan revisions and for determining reasonable further progress.
3. Assurances for adequate plan implementation.
4. Procedures and responsibilities for tracking plan implementation.
5. Responsibilities for preparing demographic projections including land use, housing, and employment.
6. Coordination with transportation programs.
7. Procedures and responsibilities for adoption of control measures and emissions limitations.
8. Responsibilities for collecting air quality, transportation and emissions data.
9. Responsibility for conducting air quality modeling.
10. Responsibility for administering and enforcing stationary source controls.
11. Provisions for the timely and periodic sharing of all data and information among the signatories relating to:

(a) Demographics.
(b) Transportation.
(c) Emissions inventories.
(d) Assumptions used in developing the model.
(e) Results of modeling done in support of the plan.
(f) Monitoring data.

G. Each agency that commits to implement any emission limitation or other control measure, means or technique contained in the implementation plan shall describe that commitment in a resolution adopted by the appropriate governing body of the agency. The resolution shall specify the following:

1. Its authority for implementing the limitation or measure as provided in statute, ordinance or rule.
2. A program for the enforcement of the limitation or measure.

3. The level of personnel and funding allocated to the implementation of the measure.

H. The state, in accordance with the rules adopted pursuant to section 49-404, and the governing body of the metropolitan planning organization shall adopt each nonattainment or maintenance area plan developed by a certified metropolitan planning organization. The adopted nonattainment or maintenance area plan shall be transmitted to the department for inclusion in the state implementation plan provided for under section 49-404.

I. After adoption of a nonattainment or maintenance area plan, if on the basis of the reasonable further progress determination described in subsection F of this section or other information, the control officer determines that any person has failed to implement an emission limitation or other control measure, means or technique as described in the resolution adopted pursuant to subsection G of this section, the control officer shall issue a written finding to the person, and shall provide an opportunity to confer. If the control officer subsequently determines that the failure has not been corrected, the county attorney, at the request of the control officer, shall file an action in superior court for a preliminary injunction, a permanent injunction, or any other relief provided by law.

J. After adoption of a nonattainment or maintenance area plan, if, on the basis of the reasonable further progress determination described in subsection F of this section or other information, the director determines that any person has failed to implement an emission limitation or other control measure, means or technique as described in the resolution adopted pursuant to subsection G of this section, and that the control officer has failed to act pursuant to subsection I of this section, the director shall issue a written finding to the person and shall provide an opportunity to confer. If the director subsequently determines that the failure has not been corrected, the attorney general, at the request of the director, shall file an action in superior court for a preliminary injunction, a permanent injunction, or any other relief provided by law.

K. Notwithstanding subsections A and B of this section, in any metropolitan area with a metropolitan statistical area population of less than two hundred fifty thousand persons, the governor shall designate an agency that meets the criteria of section 174 of the clean air act and that is recommended by the city that causes the metropolitan area to exist and the affected county. That agency shall prepare and adopt the nonattainment or maintenance area plan. If the governor does not designate an agency, the department shall be certified as the agency responsible for the development of a nonattainment or maintenance area plan for that area.

STATE OF ARIZONA
OFFICE OF THE GOVERNOR

DOUGLAS A. DUCEY
GOVERNOR

EXECUTIVE OFFICE

June 22, 2016

Ms. Alexis Strauss, Acting Regional Administrator
U.S. Environmental Protection Agency, Region IX
Mail Code ORA-1
75 Hawthorne Street
San Francisco, CA 94105

Re: Certification of Maricopa Association of Governments and Pima Association of Governments as Lead Planning Organizations under Clean Air Act § 174(a) and A.R.S. § 49-406(A)

Dear Ms. Strauss:

The purpose of this letter is to update the certification of the lead planning organizations for the Phoenix and Tucson nonattainment and maintenance areas and to designate the lead planning organization for recently designated PM_{10} and $PM_{2.5}$ nonattainment areas in Pinal County under section 174(a) of the Clean Air Act (CAA), 42 U.S.C. § 7504(a), and section 49-406 of the Arizona Revised Statutes (A.R.S.).

Designations

- The Maricopa Association of Governments (MAG) is recertified as the lead planning organization for the following nonattainment and maintenance areas:
    - the Phoenix maintenance area for the 1-hour ozone national ambient air quality standard (NAAQS),
    - the Phoenix maintenance area for the 1997 8-hour ozone NAAQS,
    - the Phoenix nonattainment area for the 2008 8-hour ozone NAAQS,
    - the Phoenix nonattainment planning area for the PM_{10} NAAQS, and
    - the Phoenix maintenance area for the carbon monoxide NAAQS.

- MAG is certified as the lead planning organization for the West Central Pinal nonattainment area for the 2006 24-hour $PM_{2.5}$ NAAQS and the West Pinal nonattainment area for the PM_{10} NAAQS. MAG will develop future air quality plans for these areas in cooperation with the Sun Corridor Metropolitan Planning Organization (SCMPO). As explained in greater detail below, MAG and PAG each have transportation planning responsibility for a portion of this nonattainment area.

- To the extent permissible under section 174(a), MAG is certified as the lead planning organization for the Phoenix nonattainment area for the 2015 8-hour ozone NAAQS when it is designated.

- The Pima Association of Governments (PAG) is recertified as the lead planning organization for the Tucson carbon monoxide limited maintenance area.

Background

Congress first adopted section 174 in the 1977 Clean Air Act Amendments.[1] Section 174(a) required Governors to designate "an organization of elected officials of local governments in the affected area or a State agency" to prepare SIPs for carbon monoxide and ozone nonattainment areas.[2]

On February 7, 1978, Governor Bolin of Arizona sent the EPA Administrator a letter (Attachment A) designating MAG "as the lead planning organization for Maricopa County (Phoenix) Arizona" and PAG "as the lead planning organization for Pima County (Tucson) Arizona for the purpose of determining which elements of a revised Air Quality Implementation Plan will be planned, implemented and enforced by the State and local governments in Arizona" under section 174(a).

In the 1990 Clean Air Act Amendments, Congress amended section 174(a) to provide that:

> The implementation plan required by this part shall be prepared by an organization certified by the State, in consultation with elected officials of local governments and in accordance with the determination under the second sentence of this subsection. Such organization shall include elected officials of local governments in the affected area, and representatives of the State air quality planning agency, the State transportation planning agency, the metropolitan planning organization designated to conduct the continuing, cooperative and comprehensive transportation planning process for the area under section 134 of title 23, the organization responsible for the air quality maintenance planning process under regulations implementing this chapter, and any other organization with responsibilities for developing, submitting, or implementing the plan required by this part. *Such organization may be one that carried out these functions before November 15, 1990.*[3]

As amended, section 174(a) applies to PM_{10}, as well as ozone and carbon monoxide, nonattainment and maintenance areas.

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[1] Pub. L. No. 95-95, § 129(b), 91 Stat. 685, 748-749 (1977).
[2] At the time, the indicator for ozone pollution was "photochemical oxidants."
[3] Pub. L. No. 101-549, title I, § 102(d), 104 Stat. 2399, 2417 (1990) (codified at 42 U.S.C. § 7504(a)) (emphasis added).

In 1992, the Arizona Legislature enacted A.R.S. § 49-406 to implement the amended planning requirements of section 174(a). Section 49-406(A) requires the Governor to certify the MPO, where one exists, for "any ozone, carbon monoxide or particulate nonattainment or maintenance area," as the "agency responsible for the development of a nonattainment or maintenance area plan for that area." Section 49-406(B) requires certification of the Arizona Department of Environmental Quality (ADEQ) as the responsible agency for areas without an MPO.

MAG is the MPO for the Phoenix ozone and PM_{10} nonattainment areas, the Phoenix carbon monoxide and ozone maintenance areas, and for portions of the West Pinal PM_{10} and West Central Pinal $PM_{2.5}$ nonattainment areas. PAG is the MPO for the Tucson carbon monoxide limited maintenance area. Both MAG and PAG include the representatives of state, regional and local governments required by section 174(a) in their governing councils or air quality planning committees. In addition, MAG and PAG, as noted above, "carried out these functions before November 15, 1990" for the Phoenix and Tucson nonattainment and maintenance areas. Thus they qualify for certification under section 174(a).

On May 6, 2013, Governor Brewer sent a letter (Attachment B) to the Federal Highway Administration (FHWA) designating SCMPO as the metropolitan planning organization (MPO) under 23 U.S.C. § 134 for the urbanized area of Pinal County that includes Casa Grande, Coolidge and Eloy. On May 9, 2013, Governor Brewer sent the FHWA notification (Attachment C) that MAG's metropolitan planning area boundaries had been expanded to add portions of Pinal County, including the Town of Florence, the City of Maricopa, and the Pinal County portion of the Gila River Indian Community.

Together, MAG and SCMPO cover the West Pinal PM_{10} and West Central Pinal $PM_{2.5}$ nonattainment areas in their entirety with respect to transportation planning. MAG and SCMPO have agreed that MAG will serve as the lead air quality planning organization for the West Central Pinal nonattainment area for the 2006 24-hour $PM_{2.5}$ NAAQS and the West Pinal nonattainment area for the PM_{10} NAAQS and will work in cooperation with SCMPO on the preparation of plans for those areas.

MAG, PAG and SCMPO are also working with ADEQ, the Arizona Department of Transportation and local governments to adopt new, or update existing, memoranda of agreement to address the division of planning responsibilities, as required by section 174(a) and A.R.S. § 49-406.

Sincerely,

Douglas A. Ducey
Governor
State of Arizona