MARICOPA ASSOCIATION of GOVERNMENTS

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July 22, 2010

TO: Members of the MAG Air Quality Technical Advisory Committee

FROM: Doug Kukino, Glendale, Chair

SUBJECT: MEETING NOTIFICATION AND TRANSMITTAL OF TENTATIVE AGENDA

Thursday, July 29, 2010 - 1:30 p.m.
MAG Office, Suite 200 - Saguaro Room
302 North 1st Avenue, Phoenix

A meeting of the MAG Air Quality Technical Advisory Committee has been scheduled for the time and place noted above. Members of the Air Quality Technical Advisory Committee may attend the meeting either in person, by videoconference or by telephone conference call. Those attending by videoconference must notify the MAG site three business days prior to the meeting. If you have any questions regarding the meeting, please contact Chair Kukino or Lindy Bauer at 602-254-6300.

Please park in the garage underneath the building, bring your ticket, and parking will be validated. For those using transit, Valley Metro/Regional Public Transportation Authority will provide transit tickets for your trip. For those using bicycles, please lock your bicycle in the bike rack in the garage.

In 1996, the Regional Council approved a simple majority quorum for all MAG advisory committees. If the MAG Air Quality Technical Advisory Committee does not meet the quorum requirement, members who arrived at the meeting will be instructed a legal meeting cannot occur and subsequently be dismissed. Your attendance at the meeting is strongly encouraged. If you are unable to attend the meeting, please make arrangements for a proxy from your entity to represent you.

Pursuant to Title II of the Americans with Disabilities Act (ADA), MAG does not discriminate on the basis of disability in admissions to or participation in its public meetings. Persons with a disability may request a reasonable accommodation, such as a sign language interpreter, by contacting Jason Stephens at the MAG office. Requests should be made as early as possible to allow time to arrange the accommodation.

TENTATIVE AGENDA

	COMMITTEE ACTION REQUESTED
1. Call to Order	
2. Call to the Audience An opportunity will be provided to members of the public to address the Air Quality Technical Advisory Committee on items not scheduled on the agenda that fall under the jurisdiction of MAG, or on items on the agenda for discussion but not for action. Members of the public will be requested not to exceed a three minute time period for their comments. A total of 15 minutes will be provided for the Call to the Audience agenda item, unless the Air Quality Technical Advisory Committee requests an exception to this limit. Please note that those wishing to comment on action agenda items will be given an opportunity at the time the item is heard.	2. For information.
3. Approval of the June 24, 2010 Meeting Minutes	3. Review and approve the June 24, 2010 meeting minutes.
4. Request for Project Change From Surprise On September 30, 2009, the MAG Regional Council approved an amendment and administrative modification to the FY 2008-2012 Transportation Improvement Program for several projects, including the addition of FY 2011 and FY 2012 PM-10 Pave Unpaved Road Projects. Since that time, the City of Surprise has requested to change the project location of a FY 2012 PM-10 paving project SUR12-801, from Dove Valley Road: 163rd Avenue to 179th Avenue to Dove Valley Road: 187th Avenue to 203rd Avenue. The change is requested due to significant drainage features associated with the prior project location. There is no change to the project length or estimated emission reductions.	4. For information, discussion, and recommendation for approval of the City of Surprise request to change the project location for SUR12-801, to Dove Valley Road: 187th Avenue to 203rd Avenue and forward the recommendation to the MAG Transportation Review Committee.

On December 11, 2008, the Air Quality Technical Advisory Committee made a recommendation to rank the Proposed PM-10 Paving Unpaved Road Projects for FY 2011 and FY 2012 CMAQ funding and forward to the MAG Transportation Review Committee. In accordance with the MAG Federal Fund Programming Principles, the requested change will go through the MAG Committee Process, as part of the Project Change request, beginning at the appropriate technical advisory committee that originally programmed/prioritized them. Please refer to the enclosed material.

5. <u>Update on Exceptional Events and MAG Five Percent Plan for PM-10</u>

On June 21, 2010, the MAG Executive Committee directed staff to retain legal counsel and other consultants to take administrative action needed regarding the Environmental Protection Agency (EPA) nonconcurrence on the four exceptional events at the West 43rd Avenue monitor in 2008 and the EPA's intent to disapprove the MAG Five Percent Plan for PM-10 for reducing dust pollution in the Valley. Pursuant to the approval actions by the MAG Regional Council on May 26, 2010, and the MAG Regional Council Executive Committee on June 21, 2010, MAG is engaging Mr. Roger Ferland and associates from the law firm of Quarles and Brady, LLP and is seeking additional expertise in air quality communications and intergovernmental relations with the public and the EPA. Due to the tight timeframes, it is expected that this expertise will be available in mid-August 2010.

On June 23, 2010, EPA indicated that the proposed consent decree has been lodged with the court. EPA has to propose action on the MAG Five Percent Plan for PM-10 by September 3, 2010, and finalize the action by

5. For information and discussion.

January 28, 2011. The proposed consent decree has now been published in the Federal Register and public comments are due by August 2, 2010.

The Arizona Department of Environmental Quality transmitted comments from ADEQ and MAG on the EPA exceptional events technical support document on June 30, 2010 and July 2, 2010 respectively. The transmittal included a letter from the Western States Air Resources Council expressing concern that EPA has not yet addressed the implementation issues with the Exceptional Events Rule. Solving these issues is more critical than ever. Further, EPA has issued decisions not to concur with California and Arizona exceptional events where both states are highly confident that these exceedances do meet the criteria in the Rule for qualifying as exceptional events.

On July 19, 2010, the Regional Council Executive Committee recommended approval of amending the FY 2011 MAG Unified Planning Work Program and Annual Budget to provide up to $500,000 of funding for legal advice and experts regarding the EPA nonconcurrence on the four exceptional events at the West 43rd Avenue monitor in 2008, and EPA's intent to disapprove the MAG Five Percent Plan for PM-10 for reducing dust pollution in the Valley. Please refer to the enclosed material.

6. <u>Final 2008 PM-10 Periodic Emissions Inventory</u>

In accordance with the Clean Air Act, the Final 2008 PM-10 Periodic Emissions Inventory has been prepared by the Maricopa County Air Quality Department. The inventory provides emissions estimates from point, area, nonroad mobile, onroad mobile and biogenic sources. The draft inventory was presented to the Air Quality Technical Advisory Committee at the April 29, 2010 meeting. A presentation on the

6. For information and discussion.

final inventory will be given by the Maricopa County Air Quality Department. Please refer to the enclosed material.

7. Call for Future Agenda Items

The next meeting of the Committee has been tentatively scheduled for Thursday, August 26, 2010 at 1:30 p.m. if necessary. The Chairman will invite the Committee members to suggest future agenda items.

7. For information and discussion.

MINUTES OF THE
MARICOPA ASSOCIATION OF GOVERNMENTS
AIR QUALITY TECHNICAL ADVISORY COMMITTEE MEETING

Thursday, June 24, 2010
MAG Office
Phoenix, Arizona

MEMBERS ATTENDING

Doug Kukino, Glendale, Chairman
Gaye Knight, Phoenix, Vice Chair
Sue McDermott, Avondale
Elizabeth Biggins-Ramer, Buckeye
*Jim Weiss, Chandler
#Jamie McCullough, El Mirage
Kurt Sharp for Tami Ryall, Gilbert
Cato Esquivel, Goodyear
Scott Bouchie, Mesa
#Maher Hazine for William Mattingly, City of Peoria
Larry Person, Scottsdale
#Antonio DeLaCruz, Surprise
Oddvar Tveit, Tempe
#Mark Hannah, Youngtown
Ramona Simpson, Queen Creek
*American Lung Association of Arizona
Wendy Crites for Grant Smedley, Salt River Project
Brian O'Donnell, Southwest Gas Corporation
Mark Hajduk, Arizona Public Service Company
#Gina Grey, Western States Petroleum Association
*Valley Metro/RPTA
Dave Berry, Arizona Motor Transport Association
Jeannette Fish, Maricopa County Farm Bureau
*Russell Bowers, Arizona Rock Products Association
*Greater Phoenix Chamber of Commerce
#Amanda McGennis, Associated General Contractors
Spencer Kamps, Homebuilders Association of Central Arizona
Mannie Carpenter, Valley Forward
Erin Taylor, University of Arizona Cooperative Extension
Beverly Chenausky, Arizona Department of Transportation
Diane Arnst, Arizona Department of Environmental Quality
*Wienke Tax, Environmental Protection Agency
Jo Crumbaker, Maricopa County Air Quality Department
*Duane Yantorno, Arizona Department of Weights and Measures
*Ed Stillings, Federal Highway Administration
*Judi Nelson, Arizona State University
Christopher Horan, Salt River Pima-Maricopa Indian Community

*Members neither present nor represented by proxy.
#Participated via telephone conference call.
+Participated via video conference call.

OTHERS PRESENT

Lindy Bauer, Maricopa Association of Governments
Ranjith Dandanayakula, Maricopa Association of Governments
Dean Giles, Maricopa Association of Governments
Patrisia Magallon, Maricopa Association of Governments
Matt Poppen, Maricopa Association of Governments
Feng Liu, Maricopa Association of Governments
Cathy Arthur Maricopa Association of Governments
Taejoo Shin, Maricopa Association of Governments
Ieesuck Jung, Maricopa Association of Governments
Joe Gibbs, City of Phoenix
Heather Hodgman, City of Apache Junction
Dan Catlin, Fort McDowell Yavapai Nation
Russell Van Leuven, Arizona Department of Agriculture
Lauren Neu, Strand Associates
Tami Stowe, Arizona Legislature
Kayelen Rolfe, Arizona Department of Administration
Joonwon Joo, Arizona Department of Transportation
Mitch Wagner, Maricopa County Department of Transportation
Kate Edwards, Pinal County
Leonard Montenegro, Arizona Department of Environmental Quality

1. Call to Order

A meeting of the MAG Air Quality Technical Advisory Committee was conducted on June 24, 2010. Doug Kukino, City of Glendale, Chair, called the meeting to order at approximately 1:32 p.m. Antonio DeLaCruz, City of Surprise; Maher Hazine, City of Peoria; Amanda McGennis, Associated General Contractors; Jamie McCullough, City of El Mirage; and Gina Grey, Western States Petroleum Association, attended the meeting via telephone conference call.

2. Call to the Audience

Mr. Kukino stated that according to the MAG public comment process, members of the audience who wish to speak are requested to fill out comment cards, which are available on the tables adjacent to the doorways inside the meeting room. Citizens are asked not to exceed a three minute time period for their comments. Public comment is provided at the beginning of the meeting for nonagenda items and nonaction agenda items. He noted that no public comment cards had been received.

3. Approval of the May 25, 2010 Meeting Minutes

The Committee reviewed the minutes from the May 25, 2010 meeting. Spencer Kamps, Homebuilders Association of Central Arizona, moved and Mannie Carpenter, Valley Forward, seconded and the motion to approve the May 25, 2010 meeting minutes carried unanimously.

4. Draft 2010 MAG Conformity Analysis for the Draft FY 2011-2015 MAG Transportation Improvement Program and Draft Regional Transportation Plan 2010 Update

Dean Giles, MAG, presented the Draft 2010 MAG Conformity Analysis for the Draft FY 2011-2015 MAG Transportation Improvement Program (TIP) and Draft Regional Transportation Plan (RTP) 2010 Update. He stated that transportation and air quality are linked by federal rules and regulations. Mr. Giles added that the Clean Air Act requires transportation plans, programs and projects to conform to the purpose of the regional air quality plans and ensures that transportation activities do not cause violations of the federal air quality standards. He noted that the air quality plans set the motor vehicle emissions budgets that are used for the conformity analysis.

Mr. Giles discussed the conformity requirements. He mentioned that the TIP and RTP must pass the conformity emissions tests. Mr. Giles added that the Conformity Analysis used the approved motor vehicle emissions budget from the Carbon Monoxide Maintenance Plan. He noted that the nitrogen oxide (NOx) and volatile organic compound (VOC) budgets were from the Eight-Hour Ozone Plan and have been found adequate by the Environmental Protection Agency (EPA) for transportation conformity purposes. Mr. Giles indicated that the PM-10 budget was obtained from the MAG 2007 Five Percent Plan for PM-10. He commented that the conformity analysis must also use the latest planning assumptions and emission models. Mr. Giles mentioned that the TIP and RTP must provide for the timely implementation of transportation measures. At the beginning of the process, MAG conducts consultation on the models, associated methods, and assumptions that will be used in the conformity analysis and the regionally significant transportation projects. He added that MAG also conducts consultation at the end of the process on the Draft Conformity Analysis document.

Mr. Giles presented the conformity budget test results for carbon monoxide (CO). He stated that the required conformity test uses the EPA approved motor vehicle emissions budget from the Carbon Monoxide Maintenance Plan. Mr. Giles indicated that the projected emissions from the

implementation of the TIP and the Regional Transportation Plan is less than the 2006 budget which is 699.7 metric tons per day. He added that the projected emissions for 2015, 2025 and 2031 are also less than the 2015 budget of 662.9 metric tons per day. The results indicate that the TIP and the RTP satisfy the conformity test for carbon monoxide.

Mr. Giles stated that conformity budget tests for NOx and VOC emissions were conducted for eight-hour ozone. He added that those budgets have been established in the Eight-Hour Ozone Plan and have been found adequate by EPA for transportation conformity. Mr. Giles mentioned that the projected VOC emissions from implementation of the TIP and the RTP for each analysis year are less than the 2008 budget of 67.9 metric tons per day. He commented that the projected NOx emissions from the draft TIP and RTP for each analysis year are less than the 2008 budget of 138.2 metric tons per day. The results indicate that the draft TIP and Regional Transportation Plan satisfy the conformity test for eight-hour ozone.

Mr. Giles discussed the PM-10 conformity budget test. He noted that the required conformity test uses the motor vehicle emissions budget from the MAG 2007 Five Percent Plan for PM-10 that EPA has found to be adequate for transportation conformity purposes. Mr. Giles added that the projected PM-10 emissions for implementation of the TIP and Regional Transportation Plan are less than the 2010 budget of 103.3 metric tons per day for all four analysis years. The results indicate that the TIP and Regional Transportation Plan satisfy the conformity test for PM-10.

Mr. Giles stated that the TIP and RTP must provide for the timely implementation of Transportation Control Measures (TCM) in approved air quality plans. He presented a chart representing the TCMs and funding levels for TCMs that are programmed in the TIP. Mr. Giles added that the TIP and Regional Transportation Plan do not interfere with the timely implementation of TCMs in the approved air quality plans. He noted that priority is given to implementation of these measures.

Mr. Giles provided the Conformity Analysis schedule. He indicated that the documents became available for public review on May 22, 2010. A public hearing was conducted on June 21, 2010 for the Draft Conformity Analysis, Draft Transportation Improvement Program, and Draft Regional Transportation Plan. Mr. Giles indicated that a possible recommendation from the Air Quality Technical Advisory Committee is being requested at this time. He commented that this item would go to the Management Committee on July 14, 2010 and then to the Regional Council on July 28, 2010 for approval. Mr. Giles mentioned that the finding of conformity is required by MAG prior to approval of the TIP and Regional Transportation Plan. He added that the 2010 MAG Conformity Analysis conducted on the TIP and RTP concludes that the transportation conformity requirements have been met and the finding of conformity is supported. The final determination of conformity for the TIP and Regional Transportation Plan is the responsibility of the Federal Highway Administration and the Federal Transit Administration.

Mr. Giles stated that a number of comments were received at the June 21, 2010 public hearing. He added that MAG prepared a response to comments and a copy is at each place. Mr. Giles mentioned that one comment inquired about the data behind the Conformity Analysis. MAG responded that the regional emissions analysis contained in the 2010 Conformity Analysis projects the motor vehicle emissions for carbon monoxide; the eight-hour ozone precursors, volatile organic compounds and nitrogen oxides; and particulate matter (PM-10) from implementation of the Draft FY 2011-2015 Transportation Improvement Program and Regional Transportation Plan 2010 Update.

Mr. Giles stated that the Arizona Public Interest Research Group Education Fund and the Southwest Energy Efficient Project commented that it does not appear to their organizations that MAG accounted for the reduction in transit funding caused by the State Legislature's stripping of the Local Transportation Assistance Fund (LTAF II) in the Regional Transportation Plan Update and Conformity Analysis. Mr. Giles added that MAG responded that the Regional Public Transportation Authority has advised MAG that several cities are currently in the process of conducting public meetings on transit services due to reductions in revenues, including LTAF. Once the public process is complete in mid-July and information is available on the impact to transit service, MAG anticipates that it will amend the TIP and Regional Transportation Plan, as may be appropriate, and prepare a new conformity analysis.

Mr. Giles noted that another person commented that 44 miles of alleys in Phoenix are being paved with federal funds and inquired about paving in the northwest unincorporated areas. Mr. Giles added that MAG responded that in FY 2012 of the Draft FY 2011-2015 MAG Transportation Improvement Program, the City of Phoenix project (PHX12-801) is programmed for $2,009,471 in federal Congestion Mitigation and Air Quality Improvement (CMAQ) funds to dust proof approximately 40 miles of alleys. In the north and northwest unincorporated part of the region, Maricopa County has four projects programmed for a total amount of $1,299,451 in CMAQ funding to pave approximately 1.3 miles of unpaved roads. Mr. Giles indicated that the two remaining comments and responses are related to a prior comment that has already been addressed in a prior response. He added that this item is to recommend approval of the Draft 2010 MAG Conformity Analysis for the Draft FY 2011-2015 MAG Transportation Improvement Program and Draft Regional Transportation Plan 2010 Update.

Diane Arnst, Arizona Department of Environmental Quality (ADEQ), referred to the first comment received at the public hearing held on June 21, 2010. She noted that the citizen seemed to be confused on the difference between conformity and attainment. Ms. Arnst added that the person may have been trying to indicate that the area was not in attainment. Brian O'Donnell, Southwest Gas Corporation, commented on addressing the issues around the one monitor that seems to be the problem. He inquired about any impacts on the submittal of this document. Mr. Giles responded that it would not be a problem.

Dave Berry, Arizona Motor Transport Association, recommended approval of the Draft 2010 MAG Conformity Analysis for the Draft FY 2011-2015 MAG Transportation Improvement Program and Draft Regional Transportation Plan 2010 Update. Gaye Knight, City of Phoenix, seconded, and the motion carried unanimously.

5. Update on Exceptional Events and MAG Five Percent Plan for PM-10

Lindy Bauer, MAG, provided an update on the Exceptional Events and the MAG Five Percent Plan for PM-10. She stated that on May 25, 2010, the EPA Region IX Administrator conducted a meeting in Phoenix on the review of exceptional events by EPA and the MAG Five Percent Plan for PM-10. Ms. Bauer added that the EPA Region IX Administrator indicated at the meeting that EPA does not concur with the Arizona Department of Environmental Quality documentation for four high wind exceptional events at the West 43rd Avenue monitor. She noted that MAG learned at the meeting that EPA signed a letter to that effect on May 21, 2010. Ms. Bauer stated that the four exceedances will count as a violation at the monitor. She indicated that no more than three exceedances are allowed at a monitor over a three year time period. Therefore, the region will not have its first year of clean data at the monitors and there will be no attainment of the standard by 2010. Ms. Bauer stated that the Five

Percent Plan for PM-10 indicated that the region would come into attainment by December 31, 2010. She added that if EPA would have approved one of those four high wind exceptional events, the region would have its first year of clean data at the monitors and still have a chance of attainment by 2010.

Ms. Bauer stated that the EPA Region IX Administrator acknowledged at the May 25, 2010 meeting that the EPA Exceptional Events Rule has problems and said it is flawed. She added that the Western States Air Resources Council (WESTAR), which is composed of 15 western states, has identified several issues with the implementation of the rule. Ms. Bauer indicated that the states are confused and do not know how much documentation should be provided to EPA. She noted that a letter from WESTAR to EPA has been provided to Committee members in their agenda packets. Ms. Bauer stated that due to the region not having its first year of clean data and therefore not coming into attainment as stated in the Plan, EPA has indicated their intention to disapprove the MAG 2007 Five Percent Plan for PM-10. She noted that EPA had stated that they could not provide the timing of the disapproval action at the meeting since they were negotiating with the Arizona Center in the Public Interest on the deadline for the disapproval action.

Ms. Bauer stated that going into the May 25, 2010 meeting, EPA indicated that they were making progress on the exceptional events. She indicated that MAG was very surprised and disturbed at the meeting. The MAG Executive Director, Dennis Smith, and Ms. Bauer were prepared to discuss the merits of the Rio Salado Oeste Project with EPA since it has potential for a long term permanent stabilization solution in that area. Ms. Bauer noted that after the meeting, an email was received that included the May 21, 2010 letter signed by the EPA Region IX Administrator and the EPA Technical Support Document (TSD) on the exceptional events with the rationale for why they were not concurring.

Ms. Bauer stated that on June 23, 2010, EPA notified MAG that the proposed consent decree had been lodged in the U.S. District Court for the District of Arizona. She added that EPA and the Arizona Center for Law in the Public Interest have agreed to a settlement on a timetable for EPA to take action on the Five Percent Plan for PM-10. Ms. Bauer stated that according to the proposed consent decree, EPA will publish a notice of proposed action by September 3, 2010 and finalize the action by January 28, 2011. In addition, EPA will publish the proposed consent decree in the Federal Register. Ms. Bauer indicated that a reasonable opportunity for public comments will be provided and EPA will respond to the comments. She noted that potential problems could occur with the proposed consent decree if comments disclose facts or other considerations which indicate that the consent decree is inappropriate, improper, inadequate, or inconsistent with the Clean Air Act; however, if there are no comments, EPA will then move for entry of the consent decree.

Ms. Bauer stated that EPA was originally concerned with four high wind days in 2008. She noted that the EPA Technical Support Document removed an April date and replaced it with the May 21st date. Ms. Bauer added that it is important to note that MAG has indicated to this Committee previously that MAG is in agreement with the documentation provided by ADEQ and disagrees with EPA. She commented that additional information was prepared by the MAG consultant, Sierra Research, to supplement ADEQ's exceptional event documentation. Several products were produced and ADEQ submitted the information to the Environmental Protection Agency.

Ms. Bauer discussed the consequences of the action to disapprove the Plan. She indicated that within 30 to 90 days after final disapproval in the Federal Register, the region would enter a conformity freeze. This would freeze the Transportation Improvement Program and Regional Transportation Plan.

Ms. Bauer mentioned that only projects in the first four years of the conforming TIP and RTP could proceed. She added that this means no new TIPs, RTPs or projects could proceed until a new Five Percent Plan is submitted which fulfills the Clean Air Act requirements and EPA finds the conformity budget adequate.

Ms. Bauer stated that the Clean Air Act sanctions would be imposed if the problem is not corrected within 18 months from disapproval action. The sanctions would include tighter controls on major industries. She added that if the problem is still not fixed in 24 months from disapproval action, the region would lose the federal highway funds. Ms. Bauer noted that $1.7 billion may be at risk in the Draft FY 2011-2015 MAG TIP. In addition, a federal implementation plan may be imposed. The imposition of highway sanctions may also trigger a conformity lapse which could impact major projects in the $7.3 billion Draft TIP.

Ms. Bauer discussed the consequences for the Five Percent Plan for PM-10. She stated that the emissions inventory in the current Plan is based upon a 2005 inventory. She added that since 2005, there has been a major downturn in the economy which has changed the mix of sources. Ms. Bauer indicated that Maricopa County will have the new 2008 inventory completed by June 30, 2010. She commented that the County previously provided the Committee with a presentation on the draft inventory. She indicated that additional measures may need to be added to the Plan to reduce emissions by five percent per year. Ms. Bauer mentioned that MAG will also need to revise the modeling in the Plan and three years of clean data will be necessary at the PM-10 monitors.

Ms. Bauer stated that the data collection effort is underway in cooperation with ADEQ, Arizona State University (ASU), EPA, MAG and the Maricopa County Air Quality Department. Ms. Bauer added that the effort involves research to identify sources during high wind days in the vicinity of the West 43rd Avenue monitor. Ms. Bauer presented a map of the temporary monitor locations. She noted that the rain has been an obstacle for the study. She indicated that the rain has resulted in stabilized soils, growth of vegetation, and water in the rivers.

Ms. Bauer discussed the next steps. She mentioned that MAG and ADEQ are thoroughly reviewing the EPA Technical Support Document on why the exceptional events are being rejected. Ms. Bauer stated that work also continues in the data collection plan. She commented that it is prudent to address the Plan issues as quickly as possible when they are identified by EPA. Ms. Bauer stated that it is important to still prevent violations at the monitors. She noted that there have been no exceedances or violations at the monitors in 2010. Ms. Bauer commented that it is important to obtain the new TIP and RTP conformity finding from the federal government as quickly as possible before a freeze occurs. She stated that MAG is also working to seek assistance from the Governor and the Congressional Delegation to suspend EPA's action on the Five Percent Plan for PM-10 until the flawed Exceptional Events Rule is fixed. In addition, MAG is also exploring a possible legal challenge.

Ms. Bauer commented that this presentation was provided to the MAG Regional Council on May 26, 2010. She stated that the Regional Council directed MAG staff to take recommendations to the MAG Regional Council Executive Committee on obtaining legal advice and suggested that MAG staff work with the Governor and the Congressional Delegation to stay the action of EPA until the policy is fixed. On June 21, 2010, the Regional Council Executive Committee directed MAG staff to retain legal council and other consultants to take administrative action needed regarding the EPA nonconcurrence on the four exceptional events in 2008 and EPA's intent to disapprove the MAG Five Percent Plan for PM-10.

Ms. Bauer referred to a comment made previously by Mr. O'Donnell. She stated that at the May 21, 2010 meeting, the EPA Region IX Administrator indicated that MAG could use CMAQ funds to help in the vicinity of the West 43rd Avenue monitor. She indicated that the MAG Executive Director responded that if there was a project that could be done with CMAQ funds in that vicinity, it would have already been done. Ms. Bauer mentioned that CMAQ funds can be used for transportation projects that reduce emissions to help attain or maintain the standard. She also noted that CMAQ funding is governed by federal rules. Ms. Bauer stated that the City of Phoenix and the Maricopa County Department of Transportation teamed up to pave unpaved roads and shoulders in the vicinity of the West 43rd Avenue monitor. Ms. Bauer mentioned that there are private unpaved roads in the area; however, public monies can not be used to pave private unpaved roads. She noted that MAG is not aware of any public unpaved roads that could be paved near the monitor.

Mark Hajduk, Arizona Public Service Company, inquired if MAG will be submitting comments on the proposed action. Ms. Bauer responded that MAG would like to see what is included in the proposed action, but will likely comment. She noted that the MAG elected officials are very disturbed over this issue. Mr. Berry commented on the thorough list of steps that should be taken. He noted the importance of being aware of this issue and engaging where it is appropriate.

Beverly Chenausky, Arizona Department of Transportation, asked about completing the conformity finding by September 3, 2010, in light of the public comments and issues with LTAF funding as a TCM. She inquired if the Federal Highway Administration would want to proceed with the conformity finding given the issues. Ms. Bauer responded that MAG has been in contact with Robert O'Loughlin, Federal Highway Administration. Mr. O'Loughlin has stated that it would be an appropriate course of action to evaluate changes made by the cities once they decide how they will adjust due to the LTAF repeal. She noted that the changes are still unknown at this time. Ms. Bauer indicated that the analysis should be completed by mid-July. She indicated that MAG staff will review the information at that time and may need to do a redetermination of conformity and remodel. She commented that this has been discussed with Mr. O'Loughlin and he has concurred that this is a reasonable approach.

Jeannette Fish, Maricopa County Farm Bureau, inquired if the EPA letter came before the MAG study was complete and submitted. Ms. Bauer responded that the EPA letter was dated May 21, 2010. She added that the data collection effort that is currently underway is not yet completed. Ms. Bauer indicated that the MAG consultant provided information to ADEQ prior to the letter and ADEQ has submitted much of this information to EPA.

Larry Person, City of Scottsdale, inquired about the status of EPA's review of the six other exceptional events that were submitted. He asked if there is a benefit to requesting EPA's analysis for those exceptional events. Mr. Person mentioned the Western States Air Resources Council letter and inquired if the analysis on the other six exceptional events could assist with some of the issues. Ms. Bauer asked if Mr. Person was referring to the seven exceedances in 2009. Mr. Person responded that his understanding was that ADEQ submitted exceptional event documentation for ten of the eleven exceedances; however, EPA only provided information on four of those exceptional events. Ms. Bauer referred to the EPA TSD document and indicated that EPA states that this finding does not necessarily mean that they agree with the rest of the exceptional events.

Ms. Bauer stated that MAG is now very concerned with the 2009 exceedances. She noted that ADEQ conducted a stakeholder meeting on April 21, 2010 and indicated that all seven of the exceedances were high wind exceptional events. Ms. Bauer noted that some of the exceedances occurred at the

West 43rd Avenue monitor. She indicated that she believes ADEQ will be submitting documentation on the 2009 exceptional events by the end of June. She inquired about the status from ADEQ. Ms. Arnst responded that there is a date where the data flag has to be submitted through the air quality system and then more time is allowed to submit the documentation. She added that she is unsure if any decisions have been made since up to three years are allowed after the date of the exceptional event.

Gina Grey, Western States Petroleum Association, commented on the exceptional events process and inquired if there is an appeals process. If no appeals process is in place, she asked about the states getting together to try and reform the exceptional events process. Ms. Bauer responded that through the lodging of the consent decree, MAG has learned that EPA will be publishing the timing of their action in the Federal Register and at that time there will be the opportunity to comment. She mentioned that on September 3, 2010, EPA would propose action on the Plan which provides another opportunity to comment. Ms. Bauer noted that MAG is in the exploratory stages on legal courses of action.

Mr. Hajduk inquired about EPA making a decision on only four of the exceptional events submitted. Ms. Bauer responded that EPA focused on four since they had concerns with those four exceptional events. She added that the EPA TSD indicates that although EPA only submitted documentation on those four exceedances, it does not necessarily mean that they agree with the rest of the exceptional events that were submitted. Mr. Hajduk inquired if there is potential for more information to be provided on the other exceptional events by the notice date. Ms. Bauer responded that she was only aware of what was provided in the Technical Support Document. Mr. Hajduk commented that it appeared as if EPA only reviewed four of the exceedances, just enough, and then stopped their review. He expressed concerns about having the rest of the exceedances turn into violations. Ms. Bauer responded that MAG shares the same concerns. She added that the language used in the TSD provides EPA with the opportunity to disagree with the documentation for the remaining exceptional events.

Mr. Kamps inquired if EPA can fight the consent decree. He asked if this was a binding document on EPA to move forward with the September 3, 2010 and January 28, 2011 dates. Ms. Bauer responded that the Center for Law in the Public Interest sued EPA for failure to take action on the Plan under the timelines provided by the Clean Air Act. She stated that EPA and the Center for Law in the Public Interest have been negotiating and have agreed to those dates. Ms. Bauer mentioned that EPA has indicated to the courts that a settlement has been reached; however, do not go final with it since a public review process will be conducted. Mr. Kamps inquired about the dates and the final disapproval of the Plan. Ms. Bauer responded that a clear date was not provided at the meeting held on May 25, 2010; however, on June 23, 2010, EPA provided the timing of the action. She indicated that if EPA had approved the four exceptional events, the region would have had the first year of clean data and be on our way of attaining the standard. Ms. Bauer added that EPA is stating that they are disapproving the Plan since the region will not be attaining the standard in 2010 as indicated in the Plan.

Ms. Arnst referred to earlier comments made by Ms. Grey and mentioned the Western States Air Resources Council letter. She stated that the letter represents 15 western states that are working together. Ms. Arnst noted that the letter is requesting specific revisions to the rule. She mentioned Imperial County and indicated that several districts in California have had nonconcurrences from EPA. Ms. Arnst stated that typically if there is final action by the administrator, there could be a petition for

reconsideration. She added that it is unclear of how this process works with exceptional events until there is something in the Federal Register.

Mr. Kukino inquired about the percent of safety projects in the TIP since they may be exempt. Ms. Bauer responded that she was unsure of the percent of safety projects in the TIP. She added that MAG would have to go through a protocol. Ms. Bauer noted that the first step is to apply the loss of federal highway funds. She stated that mass transit, safety projects, and air quality projects are exempt from the loss of the federal highway funds. The next step would be to apply the conformity lapse that applies to regionally significant projects regardless of funding. Ms. Bauer added that the list includes different types of projects that are exempt. Ms. Bauer noted that this is why MAG has provided the total dollar amounts in the TIP at this point in time.

Mr. Kamps inquired if we are waiting for the ASU study at the monitor to get new information on what controls would be effective to reduce the exceedances in that vicinity. Ms. Bauer responded that the study is looking at high wind conditions. Mr. Kamps mentioned the rainy conditions in the Valley and inquired if there will be time to complete the study by January 28, 2011 to make appropriate decisions based on the disapproval. Ms. Bauer responded that MAG is concerned with the timing. She added that EPA is moving on a fast track and MAG is concerned that the study may not be completed in time. Ms. Bauer noted that the study was originally scheduled to be completed on May 1, 2010 and then in July. She stated that the rain has been a major obstacle for the study.

Ms. Bauer mentioned that the Five Percent Plan for PM-10 was necessary due to the region exceeding the standard in 2005. She indicated that those exceedances were during stagnant conditions with minimal wind and an extensive period of drought. Since the Plan was submitted, the region has not had any violations during stagnant conditions. Ms. Bauer commented that the data collection effort is being conducted to look at the high wind events. She stated that she agrees with Mr. Kamps that timing is a concern. Mr. Kamps expressed concern with moving forward with the Plan after January 28, 2011 to satisfy the strict timeline from the Clean Air Act without the appropriate information. Ms. Bauer stated that MAG hoped the study would yield insight into what happens during high wind times. She commented that the study will likely not be completed by September 3, 2010. Ms. Bauer noted that the right conditions are needed for the study.

Ms. Arnst discussed the comments from Greg Nudd, EPA, that were made during the technical committee meetings. She stated that he keeps redirecting the group to two things in the Plan, the attainment demonstration and the demonstration of the five percent reduction for three years. Ms. Arnst indicated that it appears that as long as EPA agrees with the five percent per year part of it, based on the new reduced emissions inventory, that part could be approved even if they do not agree with the attainment demonstration right away. Ms. Arnst added that if EPA agrees with the five percent per year reductions, then perhaps the conformity freeze will lift. She suggested that clarity on this issue be requested in writing. Ms. Arnst commented on completing the study so the next control strategy is the final one.

Ms. Bauer commented on the statements made by EPA at the Five Percent Committee meeting. She mentioned that the five percent reduction in emissions drives the conformity budgets.

6. <u>CMAQ Methodologies</u>

Cathy Arthur, MAG, provided a presentation on the CMAQ Methodologies. She noted that changes will be made to the methodologies in the coming months. Another update could be provided to the

Committee at that time. Ms. Arthur stated that the CMAQ process has been around for nearly twenty years. She added that CMAQ was last authorized by the Safe, Accountable, Flexible, Efficient Transportation Equity Act, A Legacy for Users (SAFETEA-LU), which was the last reauthorization act from Congress. Ms. Arthur noted that the CMAQ Program is currently operating under continuing resolutions. She indicated that it is unknown whether CMAQ will survive the new reauthorization.

Ms. Arthur mentioned that the CMAQ process is done at the federal level and the states receive apportionments using a complex formula based on the U.S. Census population. She noted that the program is currently operating with a ten year old census which will soon be updated. Ms. Arthur added that the apportionment formula also considers nonattainment status. She indicated that benefits are given to areas that are nonattainment or maintenance for ozone or carbon monoxide. Ms. Arthur mentioned that PM-10 is not considered in the apportionment formula.

Ms. Arthur discussed the basis for apportionment. She stated that each state receives a minimum of 0.5 percent of total annual apportionment of federal CMAQ funds regardless of nonattainment area status within the states. She added that the CMAQ funds are spread out so air quality work is conducted in all states, including states that do not have an air quality problem. Ms. Arthur indicated that SAFETEA-LU also ensures that the states receive 90 percent of their estimated tax contributions to the Highway Trust Fund. She noted that this balancing act is done across all types of federal funds. Ms. Arthur indicated that the apportionment for Arizona is based on a formula that gives extra benefit to this area since it is a maintenance area for carbon monoxide and a nonattainment area for ozone. She commented that the MAG region is the only area in Arizona that is used in the formula. Ms. Arthur stated that the region received approximately $50 million in the apportionment for FY 2010; however, the obligation authority limits the region to using 93.5 percent of the apportionment funds. She noted that all of the CMAQ funds that the State of Arizona receives comes to the MAG region through ADOT.

Ms. Arthur discussed potential changes to CMAQ in the future. She mentioned the unknowns in a new federal transportation reauthorization bill for FY 2010 and beyond. Ms. Arthur added that a new ozone standard will be issued by EPA in August 2010. She indicated that the new standard will include more nonattainment areas for ozone which means that there will be more competition for funds. Ms. Arthur noted that it is unknown whether the CMAQ funds will be increased to accommodate that competition. She commented that there will also be higher population levels from the 2010 U.S. Census which will help to increase the apportionment of funds to Arizona. However, the Arizona tax revenues are down, which is another factor.

Ms. Arthur discussed changes made to the CMAQ Program by SAFETEA-LU. She added that the latest reauthorization was over five years ago. Ms. Arthur indicated that SAFETEA-LU emphasized the funding of diesel retrofits if these projects were submitted. She mentioned that SAFETEA-LU also includes discussion on cost effective projects from an air quality standpoint. In addition, there is a savings clause in SAFETEA-LU which states that it is not intended to disturb the existing authorities and roles of governmental agencies in making final project selections.

Ms. Arthur stated that projects that are eligible for CMAQ funding must reduce transportation-related pollutants. Although the apportionments are not based on PM-10, it is still a pollutant for which reductions can be shown and projects that reduce PM-10 are eligible for CMAQ funding. She noted the importance of this since there are paving projects that only reduce PM-10. Ms. Arthur indicated that the projects must come from a conforming TIP in order to be funded with CMAQ funds. She

presented additional criteria for CMAQ funding. Ms. Arthur provided examples of projects that are funded with CMAQ and added that many of the projects support transportation control measures. Ms. Arthur commented that nontraditional projects such as pilot projects are still transportation related projects that can be funded by CMAQ. She presented examples of projects that are not eligible for CMAQ funding, which include routine maintenance of transit and highways.

Ms. Arthur discussed the documentation to be submitted by agencies that are interested in receiving funding for CMAQ projects. She commented that the emphasis is on quantifying the benefit and the methodologies have been developed in an attempt to meet that guidance. Ms. Arthur added that the last methodologies were developed in April 2009. She noted that the current version is on the website. Ms. Arthur added that an update to the methodologies will be developed and the goal is to have the new set out by September 2010.

Ms. Arthur commented on how the CMAQ methodologies are used. She indicated that in a typical year, the MAG CMAQ methodologies are applied to evaluate eligible projects proposed for the last year of the TIP and projects proposed for Fiscal Year-End Closeout funds. Ms. Arthur mentioned that the PM-10 certified street sweepers and the paving projects are evaluated separately. In addition, MAG reports annually the emission reductions associated with projects that were funded with CMAQ in the previous year to the Federal Highway Administration. Ms. Arthur also presented the types of projects that are documented in the April 16, 2009 methodologies including variables used to calculate emission reductions.

Ms. Arthur stated that in 2008, MAG hired Sierra Research to compare MAG's CMAQ methodologies with those used in other western communities to help identify if the MAG methodologies need to be improved. She added that Sierra Research determined that the methodologies used by MAG are, in general, superior to others in the surveyed western communities.

Ms. Arthur mentioned the revisions made to the April 2009 methodologies. She commented that MAG will need to revise the methodologies again in 2010. Ms. Arthur indicated that one of the major updates will be incorporating MOVES2010 emission rates. She noted that the emission rates have changed considerably from MOBILE6. Ms. Arthur added that NOx and PM-10 emissions will be double what they were with MOBILE6 and this needs to be reflected in the new methodologies.

Ms. Arthur indicated that MAG contracted with Lee Engineering and the Texas Transportation Institute (TTI) to update the ITS methodology. She added that the project is in its final phase and MAG expects to have the final report by July 1, 2010. Ms. Arthur commented that MAG will use the new TTI approach and integrate it into the new methodologies. In addition, MAG conducted the 2008 Household Travel Survey and as a result, some data assumptions could also change. Ms. Arthur noted that MAG will hold a workshop on the 2010 CMAQ methodologies. She added that the workshop will provide more detail on specific methodologies.

Ms. Arthur discussed the emissions benefit calculation. She stated that MAG is currently using the MOBILE6 model until the methodology is updated. Ms. Arthur commented that AP-42 is used for reentrained dust. She indicated that MAG calculates emission rates for the first year that the project is implemented. Ms. Arthur added that some projects take longer to implement than others, which means there are different years for different projects.

Ms. Arthur commented that seasonal adjustments are applied when calculating cost-effectiveness. She added that the emission rate for carbon monoxide is divided by four to represent the three-month

winter season. Ms. Arthur indicated that the total organic gases (TOG) and NOx emission rates are divided by two to reflect a six-month ozone season. She mentioned that PM-10 is not adjusted seasonally since violations can occur at any time of the year.

Ms. Arthur commented on priority weights with regard to the cost-effectiveness calculation. She stated that in the April 2009 CMAQ methodologies, MAG doubled the weight for ozone precursors since a more stringent eight hour ozone standard was going to be imposed. She noted that at that time, the exact standard was unknown. Ms. Arthur indicated that the weight for carbon monoxide is zero since the standard has been attained and the monitored concentrations continue to fall. She stated that MAG has a CMAQ spreadsheet model that calculates CO, TOG, NOx and PM-10 emission reductions. Ms. Arthur added that the spreadsheet model uses a three percent discount rate and converts to annual emission reductions in order to obtain the cost-effectiveness (in dollars per metric ton). Ms. Arthur mentioned that the prioritized list is ranked in the order of dollars per metric ton reduced. She noted that approximately 40 to 50 projects are typically evaluated for CMAQ funding and there is very little time for turnaround.

Ms. Arthur presented example projects that are in the current April 16, 2009 methodologies. She noted that MAG has developed a cost-effectiveness for each project to show a general order of the projects. Ms. Arthur stated that the street sweepers and the pave road projects will typically be at the top of the list, while the park and ride lot projects are toward the middle of the list. She added that the air quality programs are also near the top of the list; however, ITS and intersection improvement projects are usually near the bottom of the list. Ms. Arthur indicated that the bicycle and pedestrian projects are also near the bottom of the list unless a shoulder paving component is included with the project. She mentioned that she is currently receiving input on the methodologies. Ms. Arthur noted that the Bicycle/Pedestrian Committee has already provided input. Any modifications will then be made to the draft methodologies for everyone to review. Ms. Arthur mentioned that the Committee may contact her with any input on the methodologies or address it at the workshop.

Ms. Arnst commented on MAG working with Lee Engineering and TTI. She referenced page two of the methodologies where Sierra Research mentions the TTI methods and that they were also used to quantify control measures for the Texas State Implementation Plans (SIPs). Ms. Arnst mentioned the footnote which indicates that there is not enough time to quantify to that level in the application process due to a two-week timeframe for the evaluation. She added that it appears at year end, over the course of the project, especially since an extra five percent has to be quantified, we would want the methodologies to quantify to that level. Ms. Arnst inquired if MAG's goal is to work with TTI on that issue. Ms. Arthur responded yes and that is why they were chosen. She added that TTI was on an on-call contract list as a subconsultant to Lee Engineering. Ms. Arthur indicated that MAG wanted the expertise of TTI since they developed the Texas SIP methodologies. She mentioned that TTI has recommended that MAG group the projects according to the architecture in the ITS plan. She indicated that this would provide a feel for all projects that support an outcome for a particular city. Ms. Arthur noted that this approach has never been done in this region. She stated that this approach is better since it will provide the result for all of the projects over time and quantify them in that context. Ms. Arthur commented that TTI has recommended that MAG hold off on using some of the new equations since another MAG study is being conducted that will provide local parameters. This study should be completed in the summer of 2011.

Ms. Arnst inquired about the two-week timeframe. She mentioned the meetings on the Federal Fund Programming Principles and added that Eric Anderson, MAG, spoke about moving the application

time back one week to allow more time for MAG staff review. She asked if this option is still being considered. Ms. Arthur responded that the methodologies are used in five different ways. She added that MAG shifted the deadline to allow more time for MAG staff review on projects that are added to the last year of the TIP. Ms. Arthur indicated that time constraints will still occur with the other applications. Mr. Kukino thanked MAG staff for the incredible amount of work on the CMAQ methodologies. He added that this presentation provides him with more confidence on the analysis behind the CMAQ evaluations.

7. Lawsuit Filed Against the State for the Repeal of the Lottery Funds for the Transit

Ms. Bauer discussed the lawsuit filed against the state for the repeal of the lottery funds for transit. She stated that on June 14, 2010, the Center for Law in the Public Interest filed a lawsuit against the State of Arizona for the repeal of the deposit of lottery funds into the Local Transportation Assistance Fund. Ms. Bauer added that the lawsuit was filed in the U.S. District Court for the District of Arizona. The Center is contending that the repeal violates one of the emission control measures in the Air Quality Plans for carbon monoxide and PM-10. Ms. Bauer indicated that the Center for Law in the Public Interest is requesting that the Court order the state to reinstate the monies.

8. Call for Future Agenda Items

Mr. Kukino announced that the next meeting of the Committee has been tentatively scheduled for Thursday, July 29, 2010 at 1:30 p.m. With no further comments, the meeting was adjourned at 2:44 p.m.

Agenda Item #4

Project Change Request

TIP #	Agency	Project Location	Project Description	Fiscal Year	Length	Fund Type	Local Cost	Federal Cost	Regional Cost	Total Cost	Requested Change
SUR12-801	Surprise	Dove Valley Rd: 187th Ave to 203rd Ave	Pave Unpaved Road	2012	2	CMAQ	$ 68,200	$ 956,800	0	$ 1,025,000	Amend: Change project limits from 163rd Ave to 179th Ave to those sepecified in the "Project Location" column.

Agenda Item #5

ADEQ Arizona Department of Environmental Quality **News Release**

1110 West Washington Street • Phoenix, Arizona 85007 • azdeq.gov

DATE: July 6, 2010
CONTACT: Mark Shaffer, Director of Communications, (602) 771-2215 (o); (480) 433-9551 (cell)

EPA Failed to Adequately Consider ADEQ's Scientific Research in Aftermath of Dust-Storm Air-Quality Exceedances

PHOENIX (July 6, 2010) – The U.S. Environmental Protection Agency failed to adequately consider the Arizona Department of Environmental Quality's scientific research in concluding that dust storms were not to blame for four air-pollution exceedances during 2008 at a monitoring station near 43rd Avenue and Broadway Road.

In a letter from ADEQ Director Benjamin H. Grumbles to EPA Region 9 Administrator Jared Blumenfeld, the state's environmental regulatory agency also noted that the EPA is not consistent with its own rules for determining whether air quality violations are caused by man or nature and is also not consistent in its analysis of Arizona's data and earlier analyses done within the San Joaquin Valley of California.

EPA in May denied ADEQ's request to classify several Maricopa County air quality violations related to dust as being the result of uncontrollable natural events. EPA's denial could lead to the disapproval of an air quality plan designed to reduce dust emissions in Maricopa County until EPA standards are achieved. A final disapproval of the air quality plan could result in sanctions, potentially putting billions of dollars of federal highway funding at risk in Arizona.

"The EPA analysis was incomplete and gave short shrift to our scientific research," Director Grumbles said. "EPA's analysis also was not shared with ADEQ or other local authorities prior to the announcement of its decision. ADEQ is seeking an opportunity to find common ground with EPA on the scientific and technical differences."

Grumbles noted in his letter that the EPA's preamble for its exceptional events rule indicated that the federal agency will work cooperatively with states, tribes and local agencies, a process that was not followed in Arizona's case.

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EPA may not be able to consider your comment.

Use of the *http://www.regulations.gov* Web site to submit comments to EPA electronically is EPA's preferred method for receiving comments. The electronic public docket system is an "anonymous access" system, which means EPA will not know your identity, e-mail address, or other contact information unless you provide it in the body of your comment. In contrast to EPA's electronic public docket, EPA's electronic mail (e-mail) system is not an "anonymous access" system. If you send an e-mail comment directly to the Docket without going through *http://www.regulations.gov,* your e-mail address is automatically captured and included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket.

Dated: June 28, 2010.

Kevin W. McLean,

Acting Associate General Counsel.

[FR Doc. 2010–16173 Filed 7–1–10; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[FRL–9170–9]

Proposed Consent Decree, Clean Air Act Citizen Suit

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of Proposed Consent Decree; Request for Public Comment.

SUMMARY: In accordance with section 113(g) of the Clean Air Act, as amended (CAA), 42 U.S.C. 7413(g), notice is hereby given of a proposed consent decree, to address a lawsuit filed by Sandra L. Bahr, Diane E. Brown and David Matusow, *Bahr, et al.* v. *Jackson,* No. CV 09–2511–PHX–MHM (D. Ariz.). Plaintiffs filed a deadline suit to compel the Administrator to take final action under section 110(k)(2) of the CAA on the "MAG 2007 Five Percent Plan for PM–10 for the Maricopa County Nonattainment Area," Maricopa Association of Governments, 2007 (the 5% Plan), a State implementation plan (SIP) revision submitted to the U.S. Environmental Protection Agency (EPA or Agency) in December 2007 by the State of Arizona pursuant to section 189(d) of the CAA. The proposed consent decree establishes deadlines for EPA action on the 5% Plan.

DATES: Written comments on the proposed consent decree must be received by *August 2, 2010*

ADDRESSES: Submit your comments, identified by Docket ID number EPA–HQ–OGC–2010–0428, online at http://*www.regulations.gov* (EPA's preferred method); by e-mail to *oei.docket@epa.gov;* mailed to EPA Docket Center, Environmental Protection Agency, Mailcode: 2822T, 1200 Pennsylvania Ave., NW., Washington, DC 20460–0001; or by hand delivery or courier to EPA Docket Center, EPA West, Room 3334, 1301 Constitution Ave., NW., Washington, DC, between 8:30 a.m. and 4:30 p.m. Monday through Friday, excluding legal holidays. Comments on a disk or CD–ROM should be formatted in Word or ASCII file, avoiding the use of special characters and any form of encryption, and may be mailed to the mailing address above.

FOR FURTHER INFORMATION CONTACT: Geoffrey L. Wilcox, Air and Radiation Law Office (2344A), Office of General Counsel, U.S. Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460; telephone: (202) 564–5601; fax number (202) 564–5603; e-mail address: *wilcox.geoffrey@epa.gov.*

SUPPLEMENTARY INFORMATION:

I. Additional Information About the Proposed Consent Decree

The proposed consent decree would resolve a lawsuit seeking to compel action by the Administrator to take final action under section 110(k)(2) of the CAA on the 5% Plan submitted by the State of Arizona to EPA as revisions to the SIP for the Maricopa County serious PM–10 nonattainment area as required by section 189(d) of the CAA.

The proposed consent decree requires EPA to sign for publication in the **Federal Register** no later than September 3, 2010, a notice of the Agency's proposed action on the 5% Plan pursuant to section 110(k) of the CAA and sign for publication in the **Federal Register** by January 28, 2011, a notice of the Agency's final action on the 5% Plan pursuant to section 110(k). If EPA fulfills its obligations, Plaintiffs have agreed to dismiss this suit without prejudice.

For a period of thirty (30) days following the date of publication of this notice, the Agency will accept written comments relating to the proposed consent decree from persons who were not named as parties or intervenors to the litigation in question. EPA or the Department of Justice may withdraw or withhold consent to the proposed consent decree if the comments disclose facts or considerations that indicate that such consent is inappropriate, improper, inadequate, or inconsistent with the requirements of the CAA. Unless EPA or the Department of Justice determines, based on any comment submitted, that consent to this consent decree should be withdrawn, the terms of the decree will be affirmed.

II. Additional Information About Commenting on the Proposed Consent Decree

A. How can I get a copy of the consent decree?

The official public docket for this action (identified by Docket ID No. EPA–HQ–OGC–2010–0428) contains a copy of the proposed consent decree. The official public docket is available for public viewing at the Office of Environmental Information (OEI) Docket in the EPA Docket Center, EPA West, Room 3334, 1301 Constitution Ave., NW., Washington, DC. The EPA Docket Center Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744, and the telephone number for the OEI Docket is (202) 566–1752.

An electronic version of the public docket is available through *http://www.regulations.gov.* You may use the *http://www.regulations.gov* to submit or view public comments, access the index listing of the contents of the official public docket, and to access those documents in the public docket that are available electronically. Once in the system, key in the appropriate docket identification number then select "search".

It is important to note that EPA's policy is that public comments, whether submitted electronically or on paper, will be made available for public viewing online at *http://www.regulations.gov* without change, unless the comment contains copyrighted material, CBI, or other information whose disclosure is restricted by statute. Information claimed as CBI and other information whose disclosure is restricted by statute is not included in the official public docket or in the electronic public docket. EPA's policy is that copyrighted material, including copyrighted material contained in a public comment, will not be placed in EPA's electronic public docket but will be available only in printed, paper form in the official public docket. Although not all docket materials may be available electronically, you may still access any of the publicly available docket materials through the EPA Docket Center.

B. How and to whom do I submit comments?

You may submit comments as provided in the **ADDRESSES** section. Please ensure that your comments are submitted within the specified comment period. Comments received after the close of the comment period will be marked "late." EPA is not required to consider these late comments.

If you submit an electronic comment, EPA recommends that you include your name, mailing address, and an e-mail address or other contact information in the body of your comment and with any disk or CD ROM you submit. This ensures that you can be identified as the submitter of the comment and allows EPA to contact you in case EPA cannot read your comment due to technical difficulties or needs further information on the substance of your comment. Any identifying or contact information provided in the body of a comment will be included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment.

Use of the *http://www.regulations.gov* Web site to submit comments to EPA electronically is EPA's preferred method for receiving comments. The electronic public docket system is an "anonymous access" system, which means EPA will not know your identity, e-mail address, or other contact information unless you provide it in the body of your comment. In contrast to EPA's electronic public docket, EPA's electronic mail (e-mail) system is not an "anonymous access" system. If you send an e-mail comment directly to the Docket without going through *http://www.regulations.gov*, your e-mail address is automatically captured and included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket.

Dated: June 28, 2010.

Kevin W. McLean,

Acting Associate General Counsel.

[FR Doc. 2010–16172 Filed 7–1–10; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

EPA–HQ–OPP–2010–0118; FRL–8829–1

Registration Review; Biopesticide Dockets Opened for Review and Comment

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: EPA has established registration review dockets for the pesticides listed in the table in Unit III.A. of this notice. With this document, EPA is opening the public comment period for these registration reviews. Registration review is EPA's periodic review of pesticide registrations to ensure that each pesticide continues to satisfy the statutory standard for registration, that is, the pesticide can perform its intended function without unreasonable adverse effects on human health or the environment. Registration review dockets contain information that will assist the public in understanding the types of information and issues that the Agency may consider during the course of registration reviews. Through this program, EPA is ensuring that each pesticide's registration is based on current scientific and other knowledge, including its effects on human health and the environment.

DATES: Comments must be received on or before August 31, 2010.

ADDRESSES: Submit your comments identified by the docket identification (ID) number for the specific pesticide of interest provided in the table in Unit III.A. of this notice, by one of the following methods:

• *Federal eRulemaking Portal: http://www.regulations.gov.* Follow the on-line instructions for submitting comments.

• *Mail*: Office of Pesticide Programs (OPP) Regulatory Public Docket (7502P), Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460–0001.

• *Delivery*: OPP Regulatory Public Docket (7502P), Environmental Protection Agency, Rm. S–4400, One Potomac Yard (South Bldg.), 2777 S. Crystal Dr., Arlington, VA. Deliveries are only accepted during the Docket Facility's normal hours of operation (8:30 a.m. to 4 p.m., Monday through Friday, excluding legal holidays). Special arrangements should be made for deliveries of boxed information. The Docket Facility's telephone number is (703) 305–5805.

Instructions: Direct your comments to the docket ID numbers listed in the table in Unit III.A. for the pesticides you are commenting on. EPA's policy is that all comments received will be included in the docket without change and may be made available on-line at *http://www.regulations.gov*, including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through regulations.gov or e-mail. The regulations.gov website is an "anonymous access" system, which means EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an e-mail comment directly to EPA without going through regulations.gov, your e-mail address will be automatically captured and included as part of the comment that is placed in the docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD-ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses.

Docket: All documents in the docket are listed in the docket index available at *http://www.regulations.gov*. Although listed in the index, some information is not publicly available, e.g., CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy form. Publicly available docket materials are available either in the electronic docket at *http://www.regulations.gov*, or, if only available in hard copy, at the OPP Regulatory Public Docket in Rm. S–4400, One Potomac Yard (South Bldg.), 2777 S. Crystal Dr., Arlington, VA. The hours of operation of this Docket Facility are from 8:30 a.m. to 4 p.m., Monday through Friday, excluding legal holidays. The Docket Facility's telephone number is (703) 305–5805.

FOR FURTHER INFORMATION CONTACT: *For pesticide specific information contact*: The Regulatory Action Leader (RAL) identified in the table in Unit III.A. for the pesticide of interest.

For general information contact: Kevin Costello, Pesticide Re-evaluation Division (7508P), Office of Pesticide

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF ARIZONA [PHOENIX DIVISION]

SANDRA L. BAHR, DIANE E. BROWN, and DAVID MATUSOW, Plaintiffs, v. LISA JACKSON, in her official capacity as Administrator of the United States Environmental Protection Agency, and the UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, Defendants.	CV 09-2511-PHX-MHM CONSENT DECREE

WHEREAS, on December 2, 2009, Plaintiffs Sandra L. Bahr, Diane E. Brown, and David Matusow filed the complaint in the above-captioned matter against Defendants Lisa Jackson, in her official capacity as Administrator of the United States Environmental Protection Agency, and the United States Environmental Protection Agency (collectively, "EPA"), alleging that EPA has failed to undertake a certain nondiscretionary duty under the Clean Air Act ("CAA"), 42 U.S.C. §§ 7401-7671q, and that such alleged failure is actionable under section 304(a)(2) of the CAA, 42 U.S.C. § 7604(a)(2);

WHEREAS, section 110(a)(1) of the CAA, 42 U.S.C. § 7410(a)(1), requires States to adopt and submit to EPA for review state implementation plans ("SIPs"), which establish specific control measures and other requirements that apply to particular sources of air pollution within a State and are designed to attain, maintain, and enforce National Ambient Air Quality Standards established by EPA that specify the maximum permissible concentrations for those pollutants in the ambient air, see 42 U.S.C. §§ 7408, 7409;

WHEREAS, section 189(d) of the CAA, 42 U.S.C. § 7513a(d), requires States to adopt and submit to EPA SIP revisions to meet specific additional requirements for serious PM-10 nonattainment areas that have failed to meet the standard by the applicable attainment date;

WHEREAS, section 110(k) of the CAA, 42 U.S.C. § 7410(k), sets forth the process by which EPA is to review SIP submissions, including SIP revisions;

WHEREAS, Plaintiffs' complaint alleges that EPA has a nondiscretionary duty to act on SIP submissions and revisions submitted to EPA within the time lines set forth in section 110(k)(2) of the CAA, 42 U.S.C. § 7410(k)(2);

WHEREAS, Plaintiffs' complaint alleges that EPA has failed to take timely action under CAA section 110(k)(2) on the "MAG 2007 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area," Maricopa Association of Governments, 2007 (the "5% Plan"), a SIP revision submitted to EPA in December 2007 by the State of Arizona pursuant to section 189(d);

WHEREAS, Plaintiffs' complaint seeks an order from this Court directing EPA to

either approve or disapprove, in whole or in part, the 5% Plan on a specific timetable;

WHEREAS, the parties have agreed to a settlement of this action without admission of any issue of fact or law;

WHEREAS, the parties, by entering into this Consent Decree, do not waive or limit any claim or defense, on any grounds, related to any final EPA action;

WHEREAS, the parties consider this Consent Decree to be an adequate and equitable resolution of all of the claims in this matter;

WHEREAS, it is in the interest of the public, the parties, and judicial economy to resolve this matter without protracted litigation;

WHEREAS, the parties agree that this Court has jurisdiction over this matter pursuant to the citizen suit provision in section 304(a)(2) of the CAA and that venue lies in the District of Arizona;

WHEREAS, the Court, by entering this Consent Decree, finds that the Consent Decree is fair, reasonable, in the public interest, and consistent with the CAA;

NOW THEREFORE, before the taking of testimony, without trial or determination of any issue of fact or law, and upon the consent of the parties, it is hereby ordered, adjudged and decreed that:

1. EPA shall sign for publication in the Federal Register:

   (a) no later than September 3, 2010, a notice of the Agency's proposed action on the 5% Plan pursuant to section 110(k) of the CAA. Once signed, EPA shall deliver the notice to the Office of the Federal Register for publication; and

   (b) no later than January 28, 2011, a notice of the Agency's final action on the 5% Plan pursuant to section 110(k) of the CAA. Once signed, EPA shall deliver the notice to the Office of the Federal Register for publication.

2. When EPA's obligations under Paragraph 1 have been completed, the parties will file a joint request to the Court to dismiss this matter with prejudice.

3. The deadlines in Paragraphs 1 and 9 may be extended (a) by written stipulation of Plaintiffs and EPA with notice to the Court, or (b) by the Court upon motion of EPA and upon consideration of any response by Plaintiffs.

4. Nothing in this Consent Decree shall be construed to limit or modify the discretion accorded EPA by the CAA and by general principles of administrative law, including the discretion to alter, amend or revise any response and/or final action contemplated by this Consent Decree. EPA's obligation to take the actions set forth in Paragraph 1 by the time specified therein does not constitute a limitation or modification of EPA's discretion within the meaning of this paragraph.

5. Nothing in this Consent Decree shall be construed to confer upon the district court jurisdiction to review any decision made in the final action identified in Paragraph 1. Nothing in this Consent Decree shall be construed to confer upon the district court jurisdiction to review any issues that are within the exclusive jurisdiction of the United States Courts of Appeals pursuant to sections 307(b)(1) and 505 of the CAA, 42 U.S.C. §§ 7607(b)(1), 7661d.

6. This Court shall retain jurisdiction to enforce the terms of this Consent Decree and to consider any requests for costs of litigation, including attorneys' fees.

7. In the event of a dispute between the parties concerning the interpretation or implementation of any aspect of this Consent Decree, the disputing party shall provide the other party with a written notice outlining the nature of the dispute and requesting informal negotiations. If the parties cannot reach an agreed-upon resolution within ten (10) business days after receipt of the notice, any party may move the Court to resolve the dispute.

8. No motion or other proceeding seeking to enforce this Consent Decree shall be considered properly filed, unless Plaintiffs have followed the procedure set forth in Paragraph 7 and provided EPA with written notice received at least ten (10) business days before the filing of such motion or proceeding.

9. EPA agrees that, pursuant to section 304(d) of the CAA, 42 U.S.C. § 7604(d), Plaintiffs are both eligible and entitled to recover their costs of litigation in this action, including reasonable attorneys' fees, incurred prior to entry of this Consent Decree. The deadline for filing a motion for costs of litigation, including reasonable attorneys' fees, is hereby extended until 90 days after the date on which the Court enters this Consent Decree. During this time the parties shall seek to resolve informally any claim for costs of litigation, including reasonable attorneys' fees.

10. The obligations imposed upon EPA under this Consent Decree may only be undertaken using appropriated funds. No provisions of this Consent Decree shall be interpreted as or constitute a commitment or requirement that EPA obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341, or any other applicable federal law.

11. Plaintiffs and EPA shall not challenge the terms of this Consent Decree or this Court's jurisdiction to enter this Consent Decree.

12. The parties agree and acknowledge that before this Consent Decree is entered by the Court, EPA must provide notice of this Consent Decree in the Federal Register and an opportunity for public comment pursuant to section 113(g) of the CAA, 42 U.S.C. § 7413(g). After this Consent Decree has undergone notice and comment, the Administrator and/or the Attorney General, as appropriate, shall promptly consider any such written comments in determining whether to withdraw or withhold their consent to the Consent Decree, in accordance with section 113(g) of the CAA. If the Administrator and/or the Attorney General do not elect to withdraw or withhold their consent, EPA shall promptly file a motion that requests the Court to enter this Consent Decree.

13. Any notices required or provided for by this Consent Decree shall be made in writing, via facsimile, e-mail or other means, and sent to the following:

For Plaintiffs:

Joy E. Herr-Cardillo
Arizona Center for Law in the Public Interest
2205 E. Speedway Blvd.

Tucson, AZ 85719
Phone: (520) 529-1798
Fax: (520) 529-2927
Email: jherrcardillo@aclpi.org

For Defendants:

Rochelle L. Russell
U.S. Department of Justice
Environment and Natural Resources Division
Environmental Defense Section
301 Howard Street, Suite 1050
San Francisco, CA 94105
Phone: (415) 744-6566
Fax: (415) 744-6476
Email: rochelle.russell@usdoj.gov

Geoffrey Wilcox
Office of General Counsel
U.S. Environmental Protection Agency
Ariel Rios Bldg., MC 2344A
1200 Pennsylvania Ave., N.W.
Washington, DC 20460
Phone: (202) 564-5601
Fax: (202) 564-5603
Email: wilcox.geoffrey@epa.gov

Jan Taradash
Office of Regional Counsel
U.S. Environmental Protection Agency
75 Hawthorne Street, ORC-2
San Francisco, CA 94105
Phone: (415) 972-3907
Fax: (415) 947-3570
Email: taradash.jan@epa.gov

14. The undersigned representatives of each party certify that they are fully authorized by the party that they represent to bind that party to the terms of this Consent Decree.

IT IS SO ORDERED.

Dated: _____

_____
MARY H. MURGUA
UNITED STATES DISTRICT JUDGE

COUNSEL FOR PLAINTIFFS:

Dated: June 23, 2010

/s/ Joy E. Herr-Cardillo (with permission)
JOY E. HERR-CARDILLO
TIMOTHY M. HOGAN
Arizona Center for law in the Public Interest
2205 E. Speedway Blvd.
Tucson, AZ 85719
Phone: (520) 529-1798
Email: jherrcardillo@aclpi.org
Email: thogan@aclpi.org
Counsel for Plaintiffs

COUNSEL FOR DEFENDANTS:

IGNACIA S. MORENO
Assistant Attorney General
Environment and Natural Resources Division

Dated: June 23, 2010

/s/ Rochelle L. Russell
ROCHELLE L. RUSSELL
Trial Attorney
United States Department of Justice
Environment and Natural Resources Division
Environmental Defense Section
301 Howard Street, Suite 1050
San Francisco, CA 94105
Phone: (415) 744-6566
Email: rochelle.russell@usdoj.gov
Attorney for Defendants

IGNACIA S. MORENO
Assistant Attorney General
Environment and Natural Resources Division

ROCHELLE L. RUSSELL
Trial Attorney
United States Department of Justice
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301 Howard Street, Suite 1050
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Email: rochelle.russell@usdoj.gov

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF ARIZONA [PHOENIX DIVISION]

SANDRA L. BAHR, DIANE E. BROWN, and DAVID MATUSOW, Plaintiffs, v. LISA JACKSON, in her official capacity as Administrator of the United States Environmental Protection Agency, and the UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, Defendants.	CV 09-2511-PHX-MHM **NOTICE OF LODGING OF PROPOSED CONSENT DECREE**

Defendant Lisa Jackson, in her official capacity as Administrator of the United States Environmental Protection Agency, and Defendant United States Environmental Protection Agency (collectively, "EPA"), hereby lodge with the Court a proposed consent decree that contains the terms of a proposed settlement of this action. See Attachment 1, Consent Decree.

The proposed consent decree should not be signed or entered by the Court at this time. Pursuant to section 113(g) of the Clean Air Act, 42 U.S.C. § 7413(g), the EPA Administrator must provide "a reasonable opportunity by notice in the Federal Register to persons who are not named as parties or intervenors to the action or matter to comment in writing" upon the proposed consent decree. Accordingly, EPA will publish in the Federal Register a notice of the proposed consent decree and request public comments. After a reasonable comment period, the EPA Administrator will promptly consider any written comments received and, if none of the comments disclose facts or considerations which indicate that the proposed consent decree is inappropriate, improper, inadequate, or inconsistent with the requirements of the Clean Air Act, Defendants will move for entry of the decree.

Respectfully submitted,

IGNACIA S. MORENO
Assistant Attorney General
Environment and Natural Resources Division

Dated: June 23, 2010

/s/ Rochelle L. Russell
ROCHELLE L. RUSSELL
Trial Attorney
United States Department of Justice
Environment and Natural Resources Division
Environmental Defense Section
301 Howard Street, Suite 1050
San Francisco, CA 94105
Phone: (415) 744-6566
Email: rochelle.russell@usdoj.gov
Attorney for Defendants

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on June 23, 2010, true and correct copies of the foregoing **NOTICE OF LODGING OF PROPOSED CONSENT DECREE** were served on the following Counsel of Record via the Court's CM/ECF system:

Joy E. Herr-Cardillo
Arizona Center for Law in the Public Interest
2205 E. Speedway Blvd.
Tucson, AZ 85719
520-529-1798
Fax: 520-529-2927
Email: jherrcardillo@aclpi.org

Timothy Michael Hogan
Arizona Center for Law in the Public Interest
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Tucson, AZ 85719
520-529-1798
Fax: 520-529-2927
Email: thogan@aclpi.org

/s/ Rochelle L. Russell
ROCHELLE L. RUSSELL

WESTERN STATES AIR RESOURCES COUNCIL

WESTAR

July 6, 2010

Ms. Gina McCarthy, Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue N.W.
Washington, DC 20760

Dear Ms. McCarthy,

On September 11, 2009, the Western States Air Resources (WESTAR) Council, an association of 15 western state air quality managers, offered a number of recommendations to EPA on ways to streamline the implementation of the rules governing the treatment of data influenced by exceptional events (attached). EPA responded to WESTAR's recommendations on March 8, 2010, indicating that over the coming six months, the agency would work with WESTAR to explore how the implementation of the exceptional events rule could be improved. As of this date, this collaborative effort between EPA and WESTAR has not yet begun.

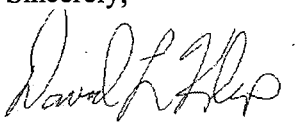
The issues we raised in 2009 related to implementation of the exceptional events rule are still with us today. In fact, solving these issues is more critical than ever. EPA continues to increase the stringency of standards for several pollutants and, as a result, states must determine attainment status, classifications, and non-attainment area boundaries, all of which are driven by what data are and are not included in the monitoring data sets. Meanwhile, state and local agencies continue to collect monitoring data influenced by exceptional and natural events; continue to flag data they believe should be excluded for establishing attainment status; continue to respond to seemingly endless requests for further analyses to justify exceptional events requests; and continue to wait for decisions from EPA on requests that, in some cases, are several years old. Further, EPA has recently issued decisions not to concur with California and Arizona requests for several exceptional events where both states are highly confident that these exceedances do, in fact, meet all the criteria in the Rule for qualifying as exceptional events.

As we noted in our earlier recommendations, revisions to the exceptional events rule are needed, revisions that will solve many of the implementation issues we have encountered over the past three years. While our earlier recommendations include alternatives that could be implemented without changes to the rule, fixing the rule would be more efficient, in part because actions taken based on clear regulatory language are less likely to be challenged than

actions taken based on guidance that, in effect, works around the core issues in the underlying regulation. WESTAR believes that EPA should begin rulemaking immediately.

Our scarce air quality management resources need to focus on problems we can solve, not on problems over which we have little or no control. Simple revisions to the exceptional events rule, and guidance that will result in expedited decisions on exceptional events requests, are urgently needed. We look forward to EPA following through on its commitment to work with WESTAR on this important issue in the coming weeks. If you have any questions, or wish to discuss this further, please contact Dan Johnson, WESTAR's Executive Director, at 206-254-9145.

Sincerely,



Dave Klemp, President
Western States Air Resources Council

CC: Bill Harnett, EPA/OAQPS
Bill Becker, NACAA
Dr. Alfredo "Al" Armendariz, EPA/Region 6
Callie Videtich, EPA/Region 8
Deborah Jordan, EPA/Region 9
Rick Albright, EPA/Region 10

CAROLYN S. ALLEN
DISTRICT 8

STATE SENATOR
FORTY-NINTH LEGISLATURE

COMMITTEES:

HEALTH, CHAIRMAN
VETERANS & MILITARY AFFAIRS
COMMERCE

Arizona State Senate

July 6, 2010

Mr. Glenn Hamer, President and CEO
Arizona Chamber of Commerce and Industry
1850 North Central Avenue, Suite 1433
Phoenix, AZ 85004

Mr. Todd Sanders, President and CEO
Greater Phoenix Chamber of Commerce
201 North Central Avenue, 27th Floor
Phoenix, AZ 85004

Mr. Barry Broome, President and CEO
Greater Phoenix Economic Council
Two North Central Avenue, #2500
Phoenix, AZ 85004-4469

Mr. Roger Ferland, Partner
Quarles and Brady, LLP
Two North Central Avenue
Phoenix, AZ 85004-2391

RE: ARIZONA AIR QUALITY ISSUES AND RELATED ENVIRONMENTAL CONCERNS

Dear Messrs. Hamer, Sanders, Broome and Ferland:

There is a looming environmental issue with potentially negative economic consequences that requires your attention: The possibility of US Environmental Protection Agency (EPA) sanctions against the State of Arizona for its failure to adequately address the reduction of particulate matter (PM10) required to meet the health standards under the Clean Air Act (CAA) National Ambient Air Quality Standards (NAAQS). From a public health and economic perspective, this is an issue that must receive immediate priority and attention.

My tenure in the Arizona Legislature concludes at the end of this year and so my bully pulpit to raise these issues will be diminished. This issue and other important environmental matters will require a long-term sustained effort, if we ever hope to make Arizona truly sustainable and globally competitive. It is imperative, therefore, that you and your organizations, on behalf of your members and the citizens of this state, petition the appropriate elected officials of this state for a specific and scientifically sound strategy for addressing the environmental strategies needed to address our air quality, water quality and other general environmental concerns on the county and state level. This must happen as early as possible.

1700 W. Washington, Senate Wing, Room 303, Phoenix, AZ 85007
Phone: (602) 926-4480; Fax (602) 926-3429 EMAIL: callen@azleg.gov

I am requesting that as business leaders in Arizona you rally your members to support a healthy environment, which is so important to Arizona's long-term success, and that you start with the immediate concern regarding the threat from EPA to impose a federal implementation plan (FIP) to address PM10 emissions in Maricopa and Pima Counties, and to inflict a sanction on the state in the form of withdrawing federal highway funds.

As you know, the history of Arizona's efforts to comply with the PM10 NAAQS has been a long and difficult one. The counties and ADEQ have submitted state implementation plans (SIPs) to EPA in the past that were designed to bring us into compliance. These were sound plans at that time, but there are unique challenges for desert communities like ours and the measures in those plans have failed to prevent situations where we exceed NAAQS at air quality monitors stationed in Maricopa and Pinal Counties.

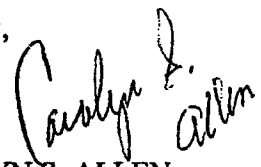
For our state to avoid the FIP sanctions, we must have policy and business leaders take up this issue and drive the necessary changes in state and local laws and regulations, to allow us to comply with the federal requirements. Your organizations' help in resolving this issue is critical, and time for your engagement is now. Failure to collectively succeed on this issue must not be acceptable because the loss of federal highway funds, especially at this time, will be extraordinarily painful as we seek to bring Arizona out of the current recession and work to improve our infrastructure in preparation for the economic upturn.

I respectfully request that you take these issues to your respective boards and, if necessary, seek permission to work with all relevant stakeholders to develop an effective SIP for PM10 that will be acceptable to the EPA.

This is not a one-time effort. Arizona needs strong leadership to plan for future environmental policies for our counties and the state, and I hope you will be counted among those who will make continuous effort to ensure that Arizona's environmental policies remain within the influence of Arizona stakeholders.

Please contact me no later than Monday, July 19, to respond to this letter. I look forward to hearing from you.

Sincerely,



CAROLYN S. ALLEN
State Senator

cc: Gov. Jan Brewer
Senate President Bob Burns
House Speaker Kirk Adams
ADEQ Director Ben Grumbles

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007
(602) 771-2300 • www.azdeq.gov

Janice K. Brewer
Governor

Benjamin H. Grumbles
Director

July 2, 2010

Mr. Jared Blumenfeld, Administrator
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

Dear Mr. ~~Blumenfeld~~ Jared:

This letter transmit comments prepared by the Maricopa Association of Governments (MAG) regarding the West 43rd Avenue PM10 monitoring site and the Exceptional Events Rule (EER), 40 C.F.R. § 50.14. ADEQ has reviewed these comments and concluded that they raise valid concerns, which we hope you will consider along with the work submitted by ADEQ on July 1.

We remain hopeful that, working together, we can develop a mutual agreement on ways to address Exceptional Events more effectively.

If you have questions or need to discuss this further, please contact Nancy Wrona, who can be reached at (602) 771-2311, or Lindy Bauer, Environmental Programs Director at MAG, who can be reached at (602) 254-6300.

Sincerely,

Benjamin H. Grumbles
Director

Enclosure

cc: Lindy Bauer (with enclosure)
Deborah Jordan (with enclosure)
Colleen McKaughan (with enclosure)

MAG Responses to EPA's Review of Exceptional Event Request,
Maricopa County, AZ, May 12, 2010

General MAG Responses:

EPA Comments, section 4.2, page 7; section 4.3, page 7; section 4.4, page 9; section 5.0, page 9:
EPA asserts in several sections of the document that ADEQ analysis of surrounding anthropogenic sources is limited and prohibits EPA from determining the role of human activity in contributing to the exceedance.

MAG Response:
The responses in this document primarily address EPA comments regarding anthropogenic sources in sections that evaluate the causal role of high winds on the event day and that demonstrate no exceedance would have occurred "but for" the high winds. However, as an initial response to EPA's concern, it is noted that even if human activity is ultimately shown to contribute to the exceedance, it does not prohibit the event from being flagged as exceptional. EPA's exceptional event rule clearly states,

> "Also, EPA recognized, in recently acting to retain PM_{10} as a measure of coarse particulate, that in some instances exceedances of this NAAQS 'may be caused in whole or in part, by exceptional events, including natural events such as windstorms * * * (and that) an exceedance may be treated as an exceptional event even though anthropogenic sources such as agricultural and mining emissions contribute to the exceedance.'"[1]

It is known to local air and planning agencies, as well as EPA, that there are significant PM-10 emission sources near the West 43rd Avenue monitor. This fact suggests that these sources may lead to a higher average PM-10 reading than other monitors, but it does not presume that these sources become the tipping point in the creation of an exceedance on a high wind day. On the exceedance days in question, there is no evidence that the anthropogenic sources near the West 43rd Avenue monitor were not reasonably controlled.

What is most germane to the exceptional event determination is whether there is any evidence that supports a causal relationship between human activity and the exceedance. EPA has provided no evidence that human activity on the day of the exceedance was not in line with historical norms. All available evidence points to general source compliance in the area around the monitor, except for the two instances noted by ADEQ in their assessment. EPA does not establish a causal link between source noncompliance and exceedances at the monitor on high wind days.[2]

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[1] 72 FR 13564

[2] On November 16, 2009, the Five Percent Plan Technical Committee, including EPA staff, received a spreadsheet from Maricopa County that identified the 2009 calendar year permit violations within two miles of the monitor. This spreadsheet showed several days when violations occurred, but no exceedances were recorded at the monitor.

EPA Comment, section 4.3, pages 7 and 8: EPA's discussion that elevated wind speeds associated with the event days do not constitute a "natural event".

MAG Response: In particular, EPA challenges the assertion that the elevated winds occurring on the event days were "unusual" for the time of year the events occurred, thus the event days were not natural events.[3] EPA argues that only seasonal (March-June) wind speed data should be used, and that the data should show how the event day relates to hourly historical wind speeds.

In response, hourly event day maximum wind speed (gusts) was compared against hourly historical gusts from four years (2005-2008) during the months of March through June at the West 43rd Avenue Monitor.[4] Table 1 and Figures 1 through 4 show the relationship between the hourly, seasonal historical wind gusts and the event days challenged by EPA.

It is clear in both the table and the figures that all four event days had a significant number of hours that were in the 95th and even the 99th percentile for the season in question. The 95th percentile represents approximately the 23 uppermost gusts out of 457 historical hours; while the 99th percentile represents approximately the 5 uppermost gusts out of 457. The gusts observed during these uppermost hours certainly are not usual and appropriately should be considered statistical outliers in the case of the 99th percentile hours.

On the event days in question, these 95th and 99th percentile gusts largely occur as consecutive hours, not independent of each other, compounding their statistical rarity. Specifically, March 14th recorded 6 total hours in the 95th percentile (all consecutive) with 2 of those hours in the 99th percentile. Hour 12 on March 14th also is the highest wind gust ever recorded in the four year period. April 30th recorded 6 hours in the 95th percentile (all consecutive) with 1 hour in the 99th percentile. May 21st recorded a staggering 13 hours in the 95th percentile (9 consecutive) with 6 hours in the 99th percentile. And lastly, June 4th recorded 11 hours in the 95th percentile (all consecutive) and 1 hour in the 99th percentile.[5] The shear amount and extended duration of these high winds definitively classifies these event days as "unusual" under any standard statistical measure.

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[3] It should be noted that "unusual" should not be equated with the rarity of the event. EPA states in the preamble to its rule regarding exceptional events data that, "It is important to note that natural events, which are one form of exceptional events according to this definition, may recur, sometimes frequently" (72 FR 13563).

[4] Maximum hourly wind speed (gusts) were not recorded until April 2005 at the West 43rd Avenue monitor, thus March 2005 is excluded from the data set.

[5] The above wind speed analysis used March – June in order to match the seasonal period cited in the EPA comment. Sierra Research used the period February – June for their analyses of unusual winds based on an historical analysis of high winds conducted by Peter Hyde, Arizona State University, for the Five Percent Plan Technical Committee.

Table 1. Event day max hourly wind speed (mph) vs. historical (2005-2008, March-June) max hourly wind speed (mph) at the West 43rd Avenue monitor.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Hours in 95th	Hours in 99th
Mean	8.4	8.2	7.7	7.5	7.1	6.8	6.9	7.9	9.2	10.6	11.7	13.4	14.7	16.1	17.3	17.8	17.6	16.7	15.0	11.8	9.9	9.5	9.2	8.8	NA	NA
95th Percentile	18.4	18.1	17.1	16.5	14.4	13.1	13.7	16.6	18.7	20.1	21.0	23.3	25.2	27.0	29.2	30.1	30.8	28.7	28.1	24.1	22.0	23.4	21.3	20.2	NA	NA
99th Percentile	24.9	23.6	23.2	25.1	20.4	20.7	19.6	22.1	26.5	26.8	27.5	31.4	30.0	34.7	34.2	37.0	39.3	38.9	34.8	32.0	31.2	30.7	27.5	27.1	NA	NA
Max	30.1[6]	29.6	29.2	27.5	27.1	30.8	30.2	29.5	37.9	33.8	35.6	41.2	36.1	37.8	42.0	43.1	53.3[7]	44.6	48.0	44.4	41.9	42.4	50.8	54.3	NA	NA
3/14/2008	8.8	10.4	7.5	7.2	8.6	7.9	10.8	6.1	4.8	22.7	23.9	31.2	36.1	35.6	30.6	25.5	23.9	19.7	13.7	15.1	21.8	21.6	10.8	10.6	6	2
4/30/2008	12.8	9.0	5.7	8.5	12.8	6.8	6.7	7.9	7.2	20.2	23.6	33.0	28.0	27.4	30.5	26.6	27.8	24.7	22.6	11.9	18.7	20.5	13.9	9.5	6	1
5/21/2008	21.2	18.6	11.5	7.1	14.2	8.9	9.3	20.8	28.8	31.5	29.5	29.3	33.8	34.8	34.4	30.3	30.5	31.7	30.6	22.4	19.9	16.6	21.1	15.7	13	6
6/4/2008	7.0	8.3	7.6	7.9	6.7	5.6	6.6	9.1	8.4	9.3	15.8	18.6	23.8	27.0	29.6	35.5	31.3	35.1	31.1	30.1	27.0	30.4	27.2	28.7	11	1

Note: Orange shading represents the 95th percentile; red shading represents the 99th percentile

[6] Max recorded speed of 96.3 mph removed as data outlier.
[7] Max recorded speed of 72.8 mph removed as data outlier.

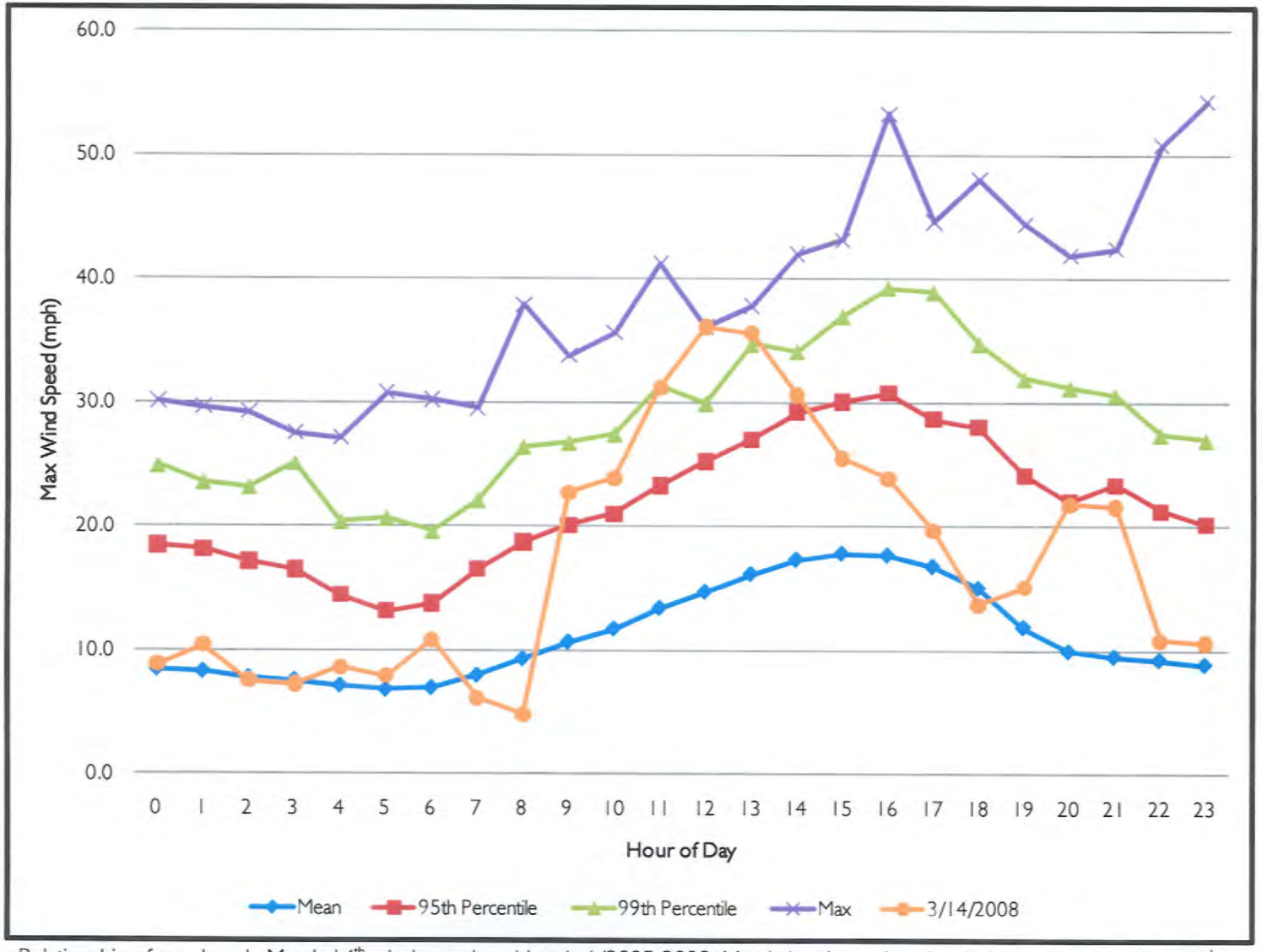

Figure 1. Relationship of max hourly March 14th wind speeds to historical (2005-2008, March-June) max hourly wind speeds at the West 43rd Avenue monitor.

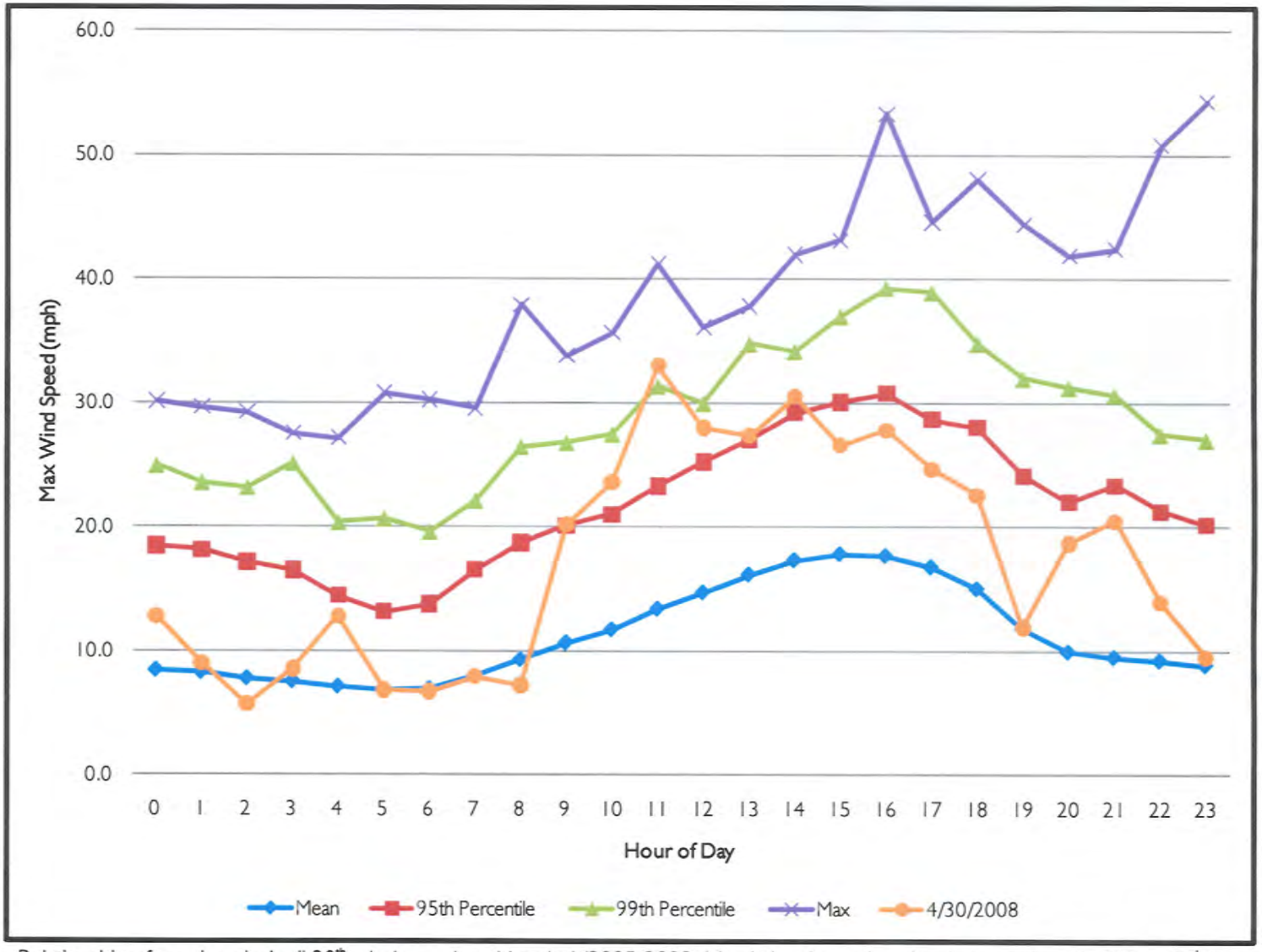

Figure 2. Relationship of max hourly April 30th wind speeds to historical (2005-2008, March-June) max hourly wind speeds at the West 43rd Avenue monitor.

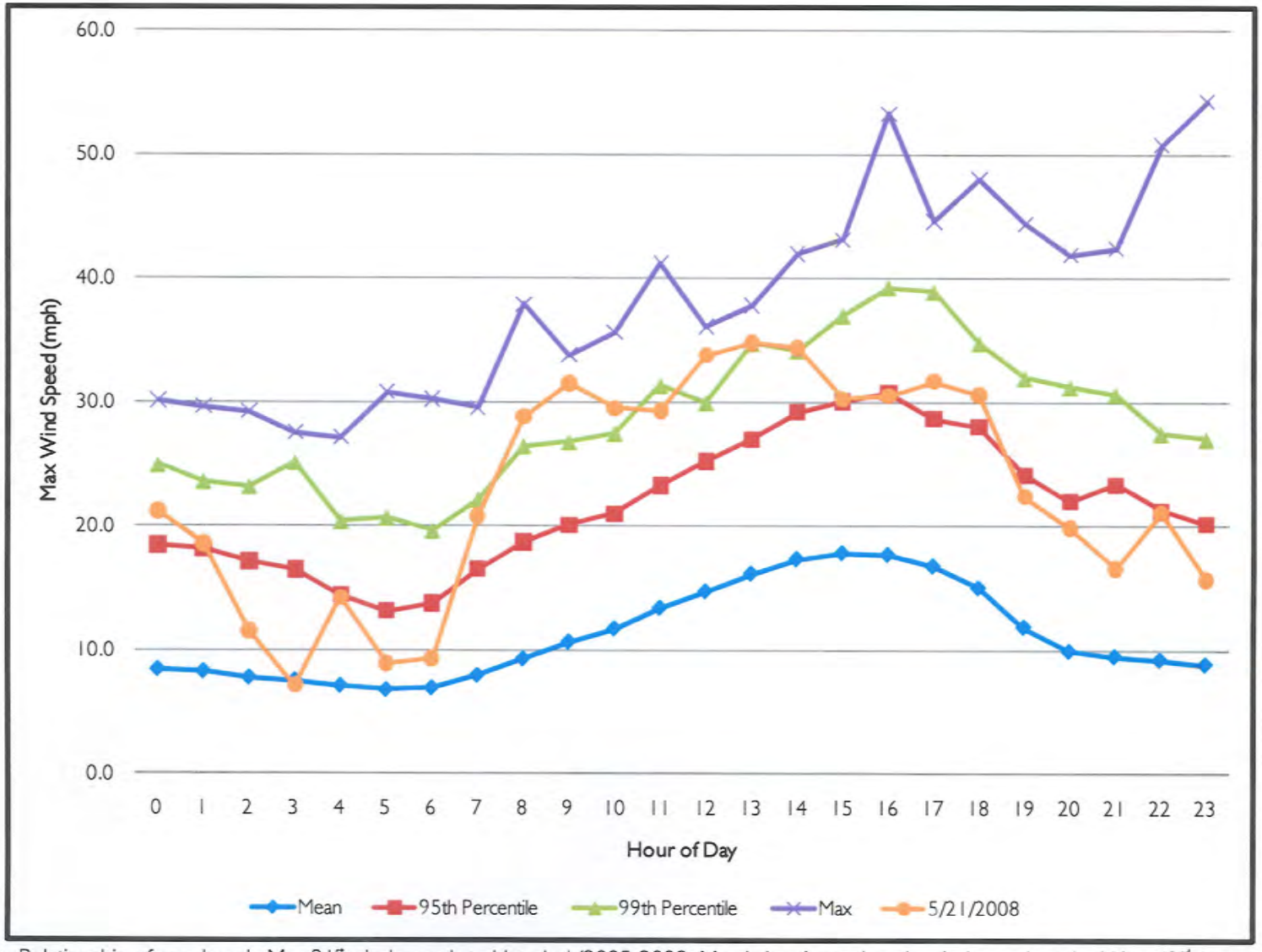

Figure 3. Relationship of max hourly May 21st wind speeds to historical (2005-2008, March-June) max hourly wind speeds at the West 43rd Avenue monitor.

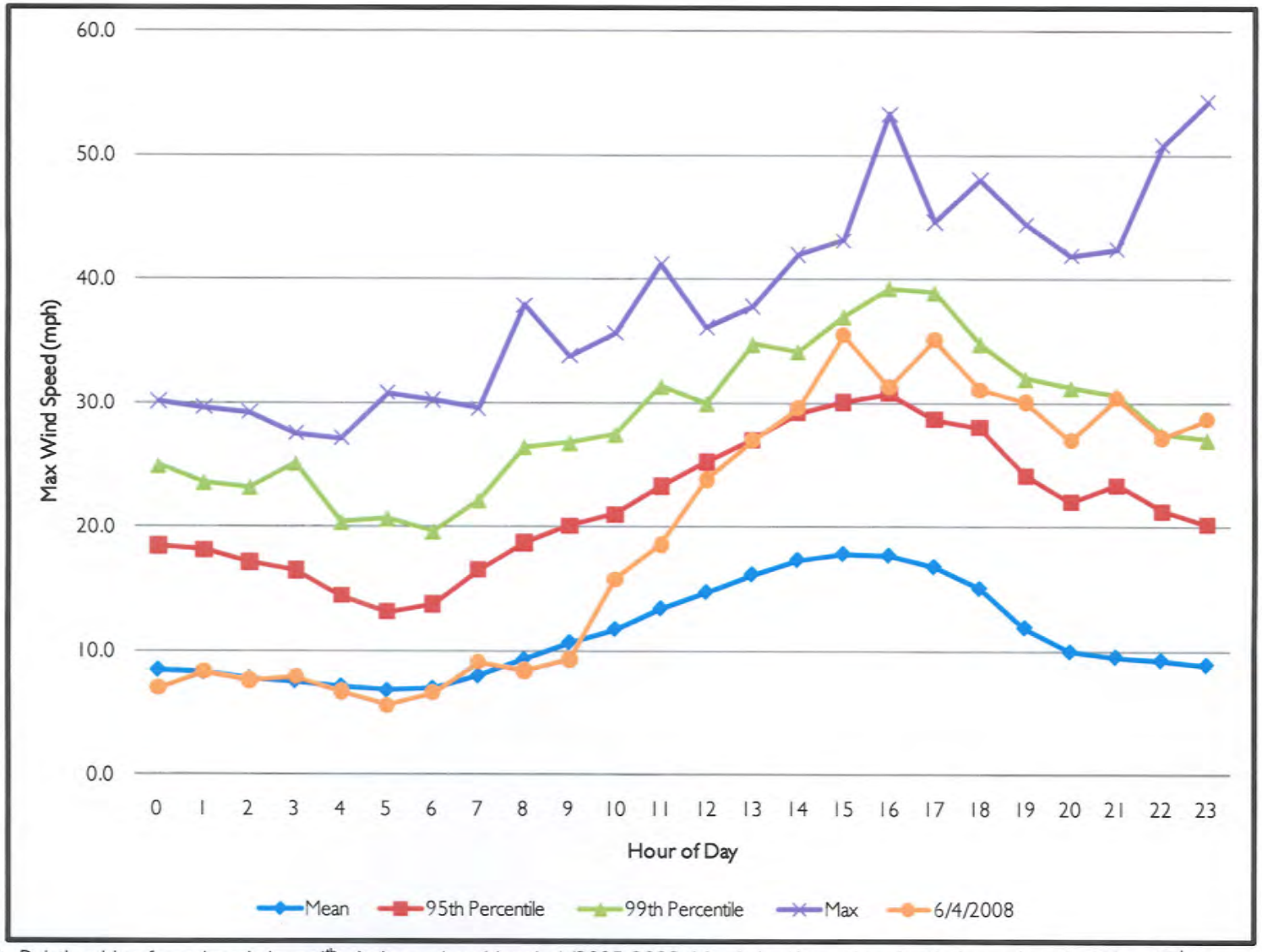

Figure 4. Relationship of max hourly June 4th wind speeds to historical (2005-2008, March-June) max hourly wind speeds at the West 43rd Avenue monitor.

EPA Comment, section 5.0, pages 16, 21, 26, 32: EPA asserts that the weight of evidence does not support a clear causal relationship between the observed elevated winds and the exceedance.

MAG Response: The correlation between increases in wind speed and PM-10 concentrations on event days at the West 43rd Avenue monitor is well presented in ADEQ's assessment and need not be repeated here. Indeed, EPA concurs with this established correlation at the West 43rd Avenue monitor in all four event days. In sections 5.1.1, 5.2.1, 5.3.1, and 5.4.1 EPA repeatedly makes statements to the fact that the observed PM-10 concentrations increase significantly with increased winds speeds.

EPA does not argue against the specific facts of the correlation observed at the West 43rd Avenue monitor, but rather points to the observation that other area monitors do not show the same level of correlation,

> "...there is not a similar correlation between PM_{10} and maximum wind speed at other monitoring sites in the area. These facts suggest that the elevated PM_{10} concentrations at West 43rd may have been caused by local upwind sources and were not regional in nature."[8]

EPA's exceptional event rule repeatedly talks about exceedances at the monitor in question; there is no mention of a requirement that multiple monitors in an area exceed in order for the event to be classified as exceptional. With particular regard to high winds, EPA takes pains to point out that evaluation and weight of evidence should focus on the exceeding monitor since high winds vary across a region and have different regional effects depending on geologic and meteorological conditions.

> "Since the conditions that cause or contribute to high wind events vary from area to area with soil type, precipitation, and the speed of wind gusts, States should provide appropriate documentation which indicates what types of circumstances contributed to the exceedances or violations ***at the monitoring site in question*** (emphasis added)."[9]

The quote above from the exceptional event rule again makes no mention that high winds need to be "regional"[10] in nature in order to be classified as a natural event; only that the weight of evidence supports the fact that high winds were the causal agent in the exceedance.[11] The fact that the West 43rd Avenue monitor may be more susceptible to increases in PM-10 concentrations associated with high winds only serves to add to the strength of the causal relationship.

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[8] Section 5.2.1, pg. 17

[9] 72 FR 13577

[10] Even if EPA had attempted such a requirement a definition of regional would need to be in place in order to classify the high winds in question.

[11] Footnote 11 of 72 FR 13566 states, "Therefore, in instances where the level of the wind speed results in exceedances or violations of particulate matter, for data affected by these events to be considered for exclusion under the weight of evidence approach, a clear causal relationship must be demonstrated between the exceedances measured at the ***air quality monitoring site*** (emphasis added) and the high wind event in question."

In addition to the data provided by ADEQ in their assessment, the following figures add to the weight of evidence that a clear causal relationship exists between high winds and increased PM-10 concentrations on the event days at the West 43rd Avenue monitor. All historical data in the following figures are from a four year period (2005-2008) where concurrent maximum hourly wind speed and PM-10 concentration data were recorded for the high wind season months of March through June.[12]

Figure 5 visibly shows the relationship between max wind speed and PM-10 concentration at the West 43rd Avenue monitor. The trend line of the figure is a classic fit for a second order polynomial, as referenced by the high R^2 value of 0.939. The trend line demonstrates that there are two distinct patterns with regards to max wind speed and PM-10 concentrations. First, when gusts stay below 15 mph, PM-10 concentrations actually decrease slightly with increasing wind speeds. However, as gusts rise past 15 mph, wind speeds have an exponential effect on PM-10 concentrations. This pattern is clearly born out on the event days in question, establishing a strong correlation between rising wind gusts and PM-10 concentrations.

Figure 6 compares the hourly mean PM-10 concentrations at the West 43rd Avenue monitor alongside hourly mean max wind speeds. A couple of plain relationships emerge in the figure: (1) the bulk of anthropogenic emissions occur in the hours between 0400 and 0800, when wind speeds are lowest and, (2) moderate afternoon (1100-1900) wind gusts (12-18 mph) actually help to disperse PM-10 concentrations and reduce the readings at the monitor. This graph further helps to show that elevated afternoon PM-10 concentrations (as occurred in all 4 event days) are not typical and would not historically be associated with anthropogenic sources.

Figure 7 strengthens this assumption by showing hourly mean PM-10 concentrations when wind gusts are at their lowest (5th percentile). It is important to state again that the data included in this figure does not include the winter months when inversion forces are at work, but is limited to March-June as requested by EPA[13]. Clearly, in terms of anthropogenic emissions, the highest levels of PM-10 concentrations are seen when the wind gusts are at their lowest.

This relationship dramatically changes when comparing mean PM-10 concentrations when gusts are at their highest. Figure 8 displays hourly mean PM-10 concentrations when maximum wind speeds are in the 95th percentile (highest 5% of observed wind speeds). No other conclusion can be drawn from this figure other than that when wind gusts reach these upper thresholds, PM-10 concentrations consistently and predictably rise, especially in the afternoon hours when the heat of the day has reduced the surface moisture of the affected soils. As mentioned above, elevated afternoon PM-10 concentrations are the rarity, not the norm, and can only reasonably be caused by high winds.

Figure 9 serves to strengthen this relationship shown in Figure 8 by comparing hourly mean PM-10 concentrations when wind gusts are in the 99th percentile (top 5 recorded wind speeds). The wind

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[12] March 2005 is excluded from the data set as max wind speeds were not recorded at the West 43rd Avenue monitor until April 2005.

[13] The above wind speed analysis used March – June in order to match the seasonal period cited in the EPA comment. Sierra Research used February – June for their analyses of unusual winds based on a historical analysis of high winds conducted by Peter Hyde, Arizona State University, for the Five Percent Plan Technical Committee.

gust and PM-10 concentration lines again show highest observed PM-10 concentrations in the afternoon hours, when wind gusts are at their greatest, almost maximum levels. All four event days in question had at least 1 hour that was in the 99th percentile of wind gusts.

Based on the seasonal data shown in the figures above, the only reasonable conclusion is that a clear causal relationship exists between elevated PM-10 concentrations and high winds at the West 43rd Avenue monitor. Given the historical pattern of highest anthropogenic emissions seen in the early morning hours, there is no evidence to suggest that anything but the high winds caused the exceedances on the event days in question.

Lastly, in direct address of EPA's concern that neighboring monitors did not exceed on the days that the West 43rd Avenue monitor exceeded, EPA itself compellingly disputes against the presumption of this concern. In a recently published finding[14] affirming the flagging of exceptional event days related to construction activity, EPA argues that activities that caused an exceedance one day, may not lead to an exceedance on another similar day. In the quote below, EPA is responding to comments from "Earthjustice" arguing that EPA did not establish a causal relationship between the event (construction activities) and the exceedance,

> "Earthjustice argues that because exceedances did not occur on other days when construction activities were occurring, this indicates that construction did not cause the exceedances in September and October 2006. But this argument is misleading. Generally, varying degrees, types and locations of the construction activity, and changing meteorological conditions lead to varying impacts on the monitor. The fact that construction activities did not cause exceedances on some days does not mean that they were not responsible for the exceedances that occurred on other days."[15]

This same judgment applies well to the event days in question, when only the West 43rd Avenue monitor exceeded and other area monitors did not. In fact, simply modifying the quote above by replacing the words "Earthjustice" with "EPA" and "construction activities" with "high winds", establishes a strong defense for flagging the event days in question:

> "*EPA* argues that because exceedances did not occur on other days when *high winds* were occurring, this indicates that *high winds* did not cause the exceedances in September and October 2006. But this argument is misleading. Generally, varying degrees, types and locations of the *high winds*, and changing meteorological conditions lead to varying impacts on the monitor. The fact that *high winds* did not cause exceedances on some days does not mean that they were not responsible for the exceedances that occurred on other days." (italicized sections changed from original EPA quote).

The logic of this argument is sound, and EPA should apply it to the high wind days in question here, as it did in affirming the exceptional events caused by construction activities in the San Joaquin Valley.

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[14] *Approval and Promulgation of Implementation Plans; Designation of Areas for Air Quality Planning Purposes; State of California; PM-10; Affirmation of Determination of Attainment for the San Joaquin Valley Nonattainment Area*, 73 FR 14687.

[15] 73 FR 14690

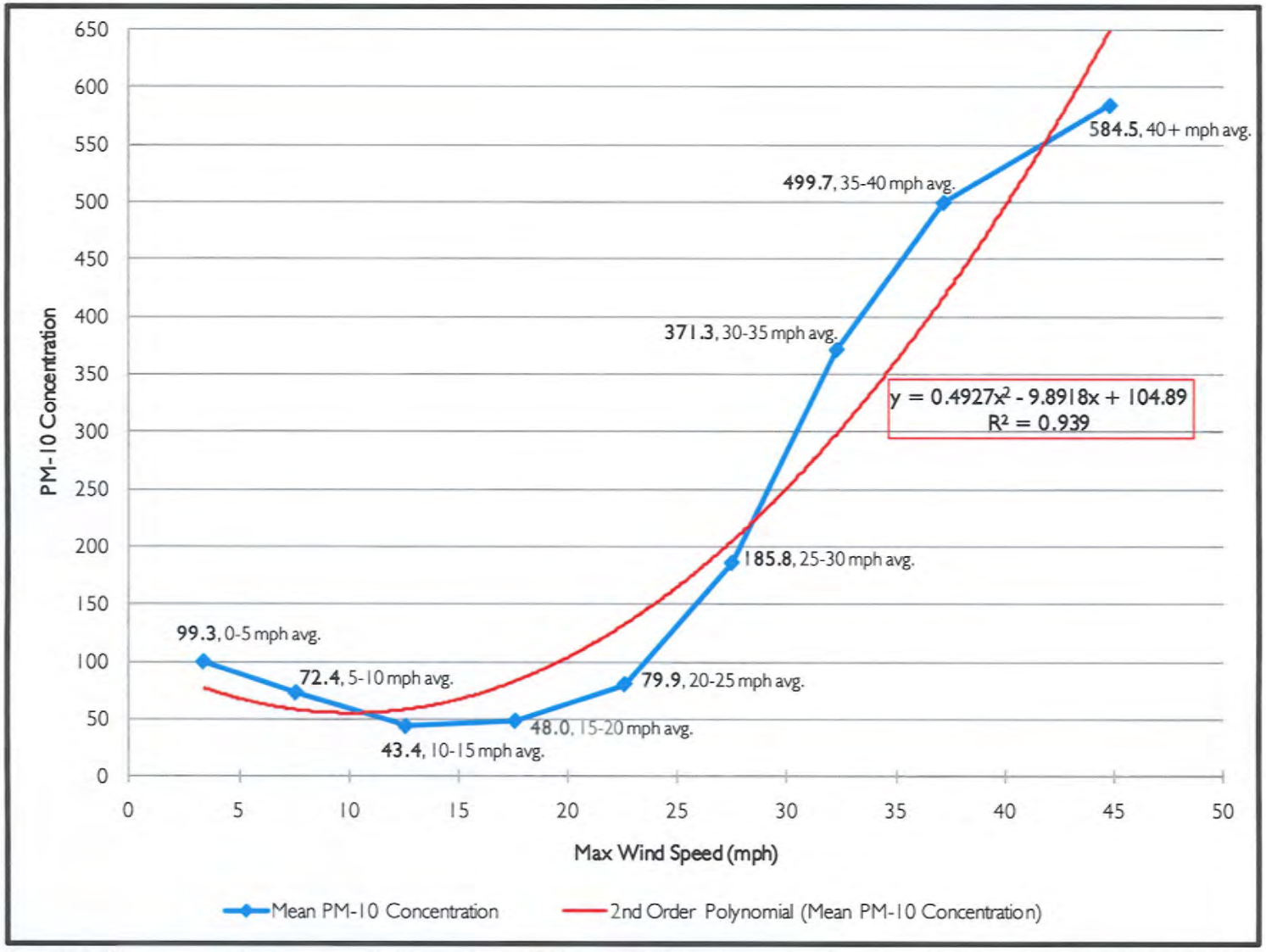

Figure 5. Mean PM-10 concentration by max wind speed bins (0-5 mph, 5-10 mph, etc.) at the West 43rd Ave. monitor (2005-2008, March-June).

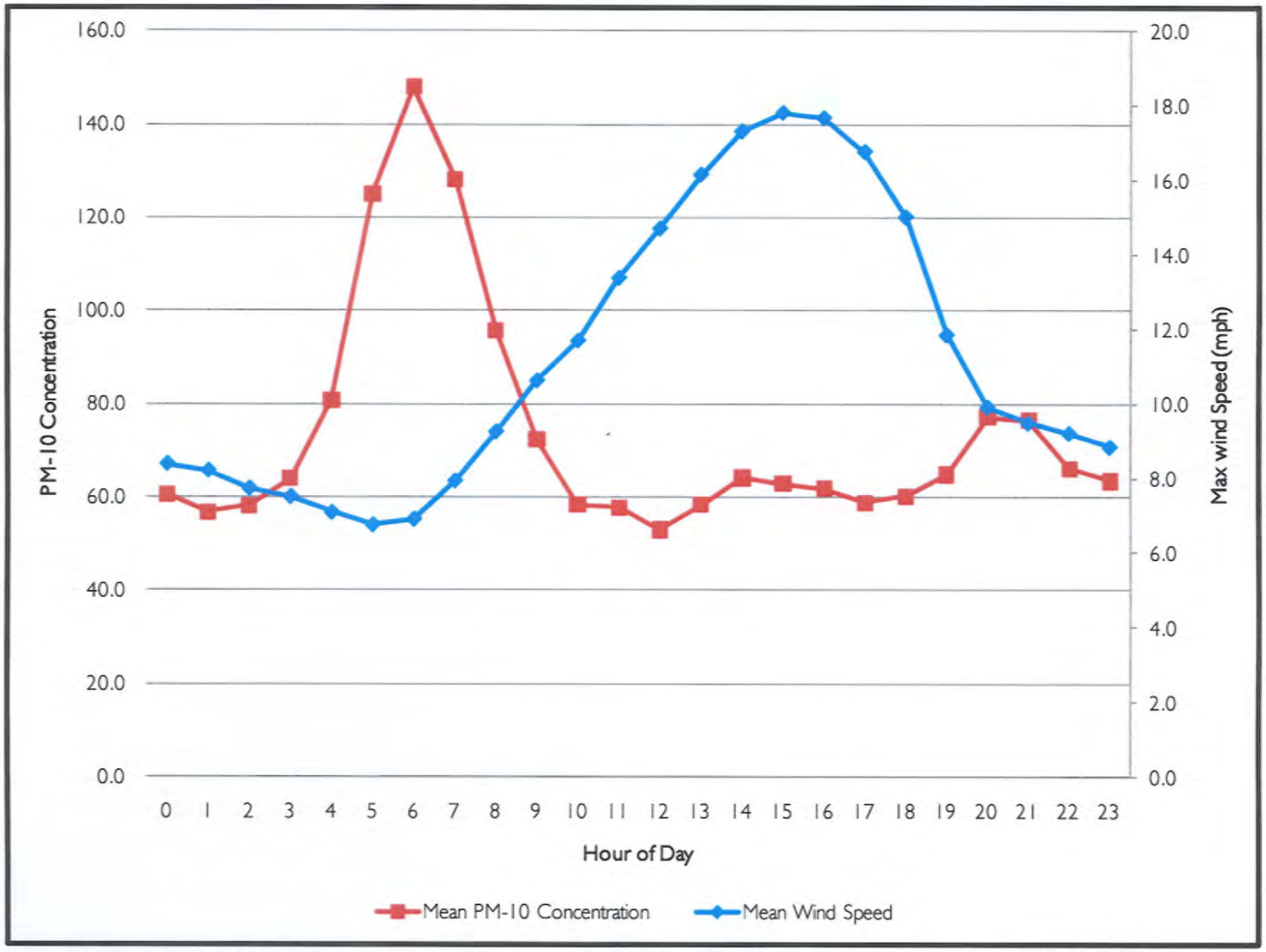

Figure 6. Hourly mean PM-10 concentration and max wind speed at the West 43rd Avenue monitor (2005-2008, March-June).

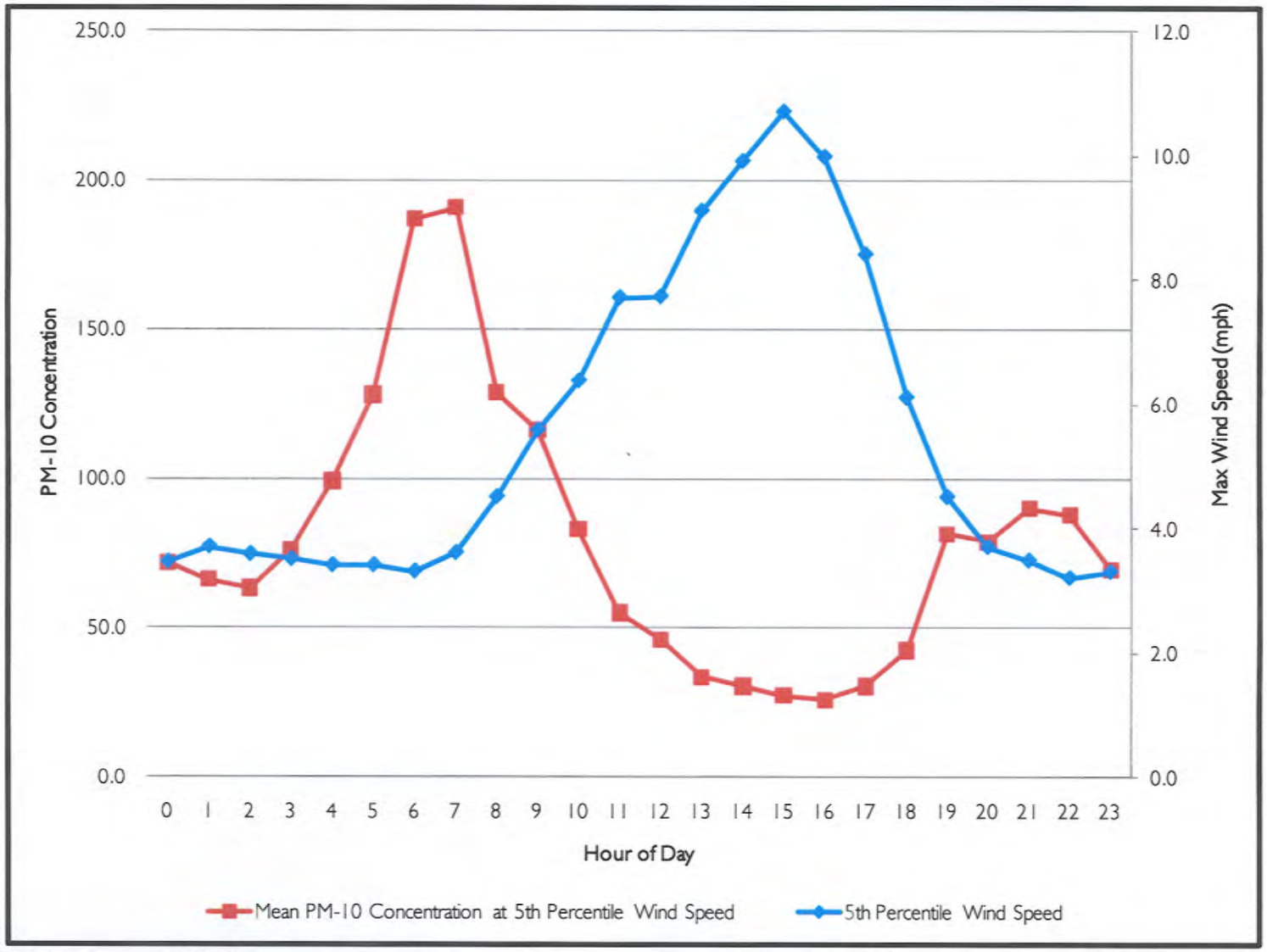

Figure 7. Hourly mean PM-10 concentration at 5th percentile max wind speed at the West 43rd Avenue monitor (2005-2008, March-June).

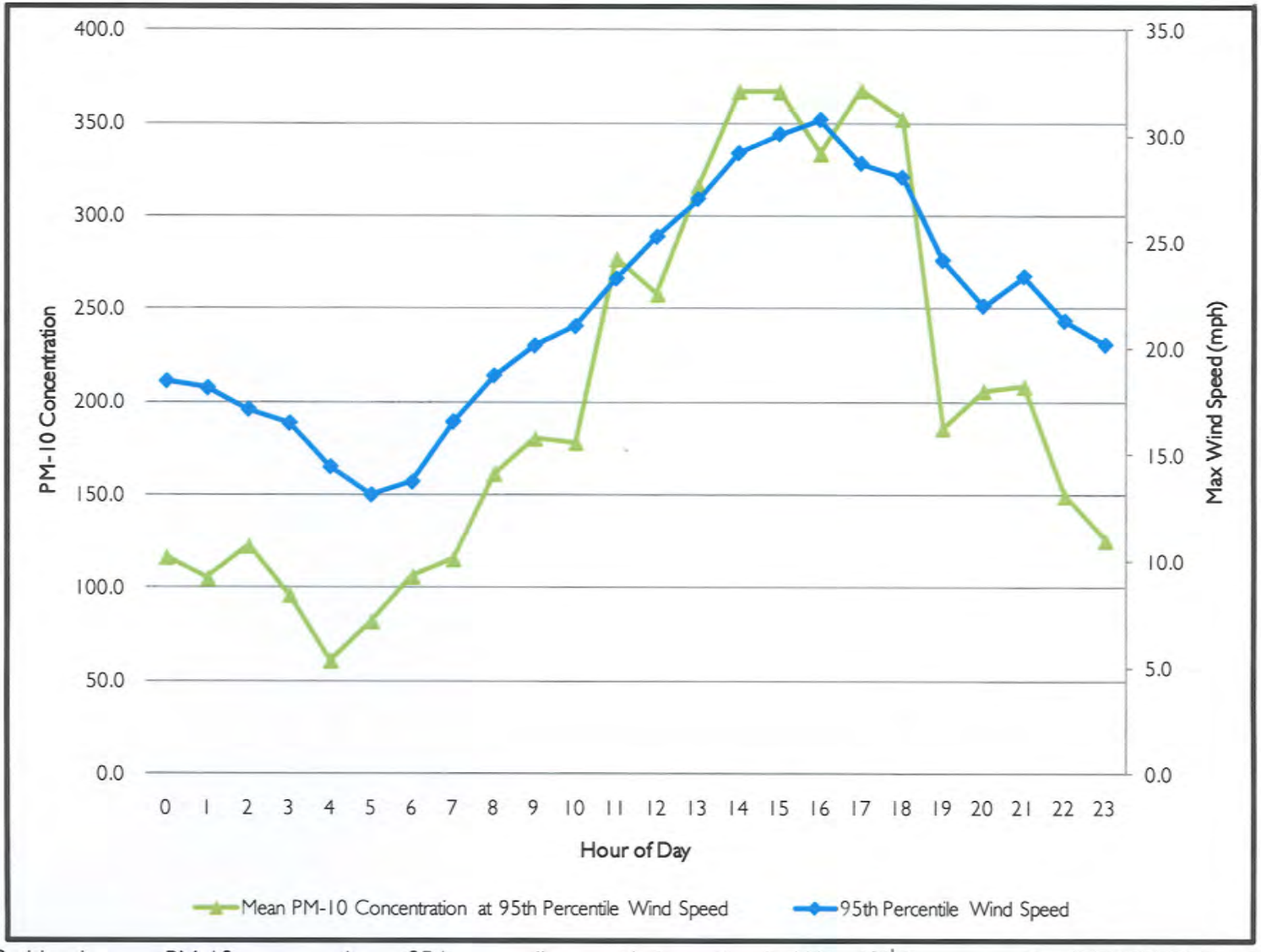

Figure 8. Hourly mean PM-10 concentration at 95th percentile max wind speed at the West 43rd Avenue monitor (2005-2008, March-June).

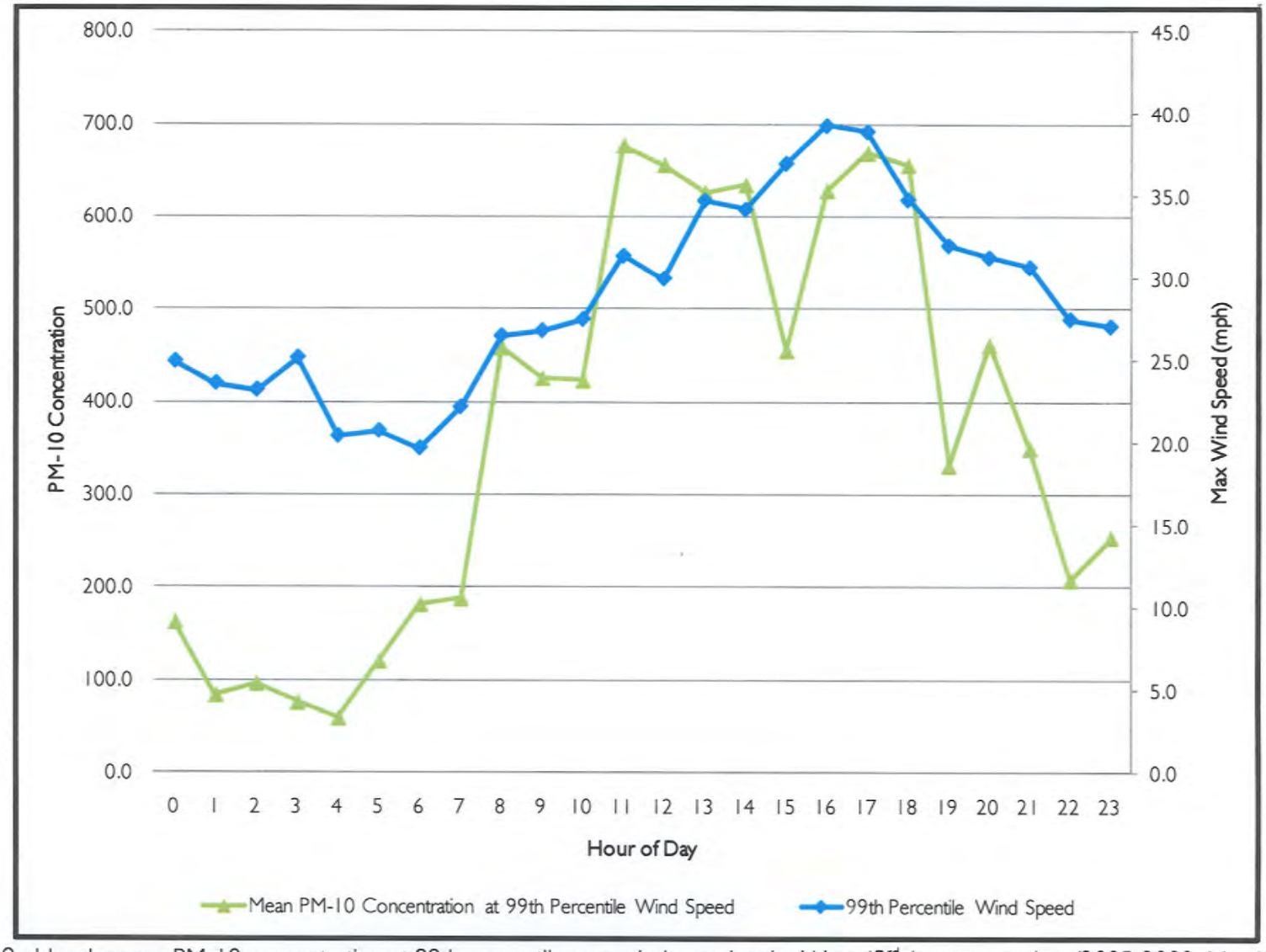

Figure 9. Hourly mean PM-10 concentration at 99th percentile max wind speed at the West 43rd Avenue monitor (2005-2008, March-June).

EPA Comment, section 7.0, page 33: EPA states ADEQ's method of excluding the PM-10 concentrations associated with the high wind hours to demonstrate that the monitor would not have exceeded but for the event,

> "...it was determined that the hours that have been chosen for exclusion are replaced by the average PM_{10} concentration calculated with remaining hours of the day."

EPA additionally comments that,

> "This is equivalent to assuming there is no normal increase during those hours. If there is a typical rise during this period, than the average used may not be representative of typical conditions."

MAG Response: As shown in the earlier discussion of the causal relationship between elevated wind speeds and elevated PM-10 concentrations at the West 43rd Avenue monitor, on average the bulk of anthropogenic emissions seen at the monitor occur in the morning hours.[16] So, typical emissions for the excluded hours (afternoon hours) would actually be **lower** than the estimates provided by ADEQ and is further proof that the exceedance on the event days is primarily linked to high winds.

As additional proof, the data in the tables and figures presented below show that even assuming worst case anthropogenic conditions during the excluded hours, the event days would not have exceeded the standard. Table 2 shows the breakout of 4-year (2005-2008), seasonal (March-June)[17], summed hourly PM-10 concentrations and their association with low (<20 mph) and high (>20 mph) hourly maximum wind speeds. Figure 10 graphs the PM-10 concentration amounts as presented in Table 2.

Table 3 and Figure 11 replicate the data presented in the preceding table and figure, but limit the observations to PM-10 concentrations recorded at or above the 95th percentile. This table and graph dramatically shows that high afternoon PM-10 concentrations are overwhelmingly linked to wind gusts greater than 20 mph. In fact, for 6 consecutive hours (1300-1800) PM-10 concentrations at or above the 95th percentile are exclusively linked to wind gusts above 20 mph.[18] When high winds are absent, the evidence overwhelmingly points to anthropogenic PM-10 emissions that are consistently lower in the afternoon.

Lastly, Table 4 provides a second ultra-conservative substitution method for event day windy hours. It shows that even when PM-10 concentrations during the 95th percentile windy hours (on the event days) are substituted with 95th percentile PM-10 concentrations from the historical period, an exceedance is not achieved. This worst case scenario provides ample evidence that but for the high winds on the event days, the monitors would not have exceeded the 24 hour PM-10 standard. It should be stated that both the method shown in Table 4 (replacement of windy hours with 95th percentile concentrations) and ADEQ's original method (replacement of windy hours with day-specific average concentrations) are conservative estimates that do not exceed the standard, as typical PM-10 concentrations are historically lowest in the afternoon hours.

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[16] See figures 6 and 7.

[17] As mentioned earlier, March 2005 data was excluded due to lack of maximum wind speed values.

[18] Hour 16 additionally has no 95th percentile concentrations linked to wind gusts below 25 mph, with hours 15, 17 and 18 only recording one observation of 95th percentile concentrations linked to gusts below 25 mph.

Table 2. Relationship of hourly PM-10 concentrations to low (<20 mph) and high (>20 mph) wind gust categories at the West 43rd Avenue monitor (2005-2008, March-June).

Hour	Total Period PM-10 Concentration ($\mu g/m^3$)	PM-10 Concentration Associated with Wind Gusts Below 20 mph ($\mu g/m^3$)	PM-10 Concentration Associated with Wind Gusts Above 20 mph ($\mu g/m^3$)	% PM-10 Concentration Associated with Wind Gusts Below 20 mph	% PM-10 Concentration Associated with Wind Gusts Above 20 mph
0	27,316.4	25,675.9	1,640.5	94%	6%
1	25,778.0	24,057.9	1,720.1	93%	7%
2	26,472.0	25,539.7	932.3	96%	4%
3	28,955.5	27,280.6	1,674.9	94%	6%
4	36,859.7	36,563.2	296.5	99%	1%
5	57,041.5	56,286.2	755.3	99%	1%
6	67,346.2	66,669.6	676.6	99%	1%
7	58,434.8	56,586.3	1,848.5	97%	3%
8	43,741.6	40,384.5	3,357.1	92%	8%
9	32,894.6	28,561.8	4,332.8	87%	13%
10	26,013.4	21,312.8	4,700.6	82%	18%
11	25,218.8	16,992.7	8,226.1	67%	33%
12	22,924.8	13,855.7	9,069.1	60%	40%
13	25,619.3	12,867.6	12,751.7	50%	50%
14	28,825.8	11,935.8	16,890.0	41%	59%
15	28,495.0	10,529.0	17,966.0	37%	63%
16	28,076.5	9,775.4	18,301.1	35%	65%
17	26,763.1	10,224.7	16,538.4	38%	62%
18	27,369.5	13,951.9	13,417.6	51%	49%
19	29,600.5	22,458.0	7,142.5	76%	24%
20	35,036.6	28,934.3	6,102.3	83%	17%
21	34,876.0	29,263.1	5,612.9	84%	16%
22	30,030.0	26,373.2	3,656.8	88%	12%
23	28,710.2	25,819.2	2,891.0	90%	10%

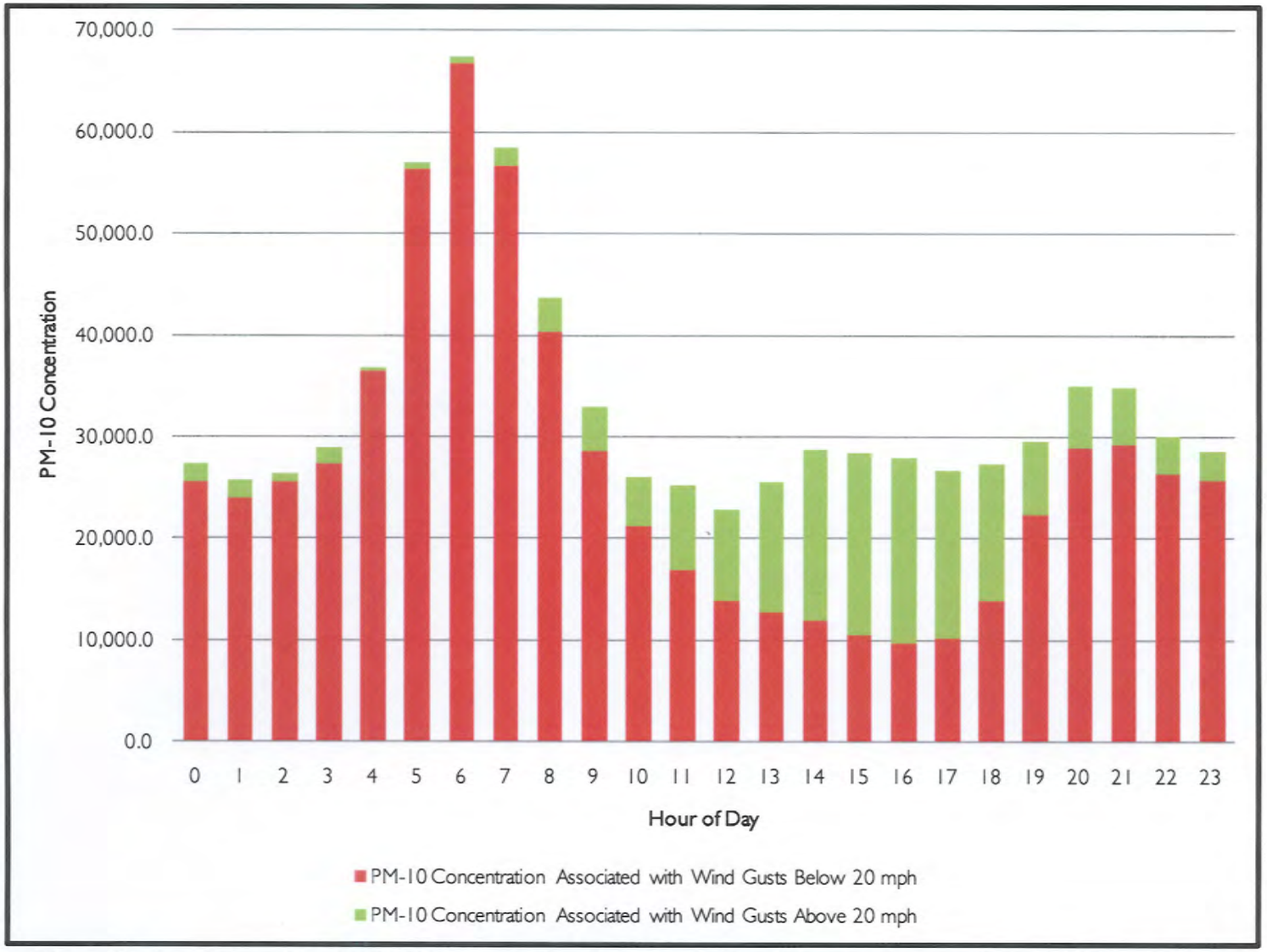

Figure 10. Association of hourly PM-10 concentrations by low and high wind gust categories (2005-2008, March-June).

Table 3. Relationship of hourly 95th percentile PM-10 concentrations to low (<20 mph) and high (>20 mph) wind gust categories at the West 43rd Avenue monitor (2005-2008, March-June).

Hour	95th Percentile Concentration ($\mu g/m^3$)	Total Period PM-10 Concentration ($\mu g/m^3$)	PM-10 Concentration Associated with Wind Gusts Below 20 mph ($\mu g/m^3$)	PM-10 Concentration Associated with Wind Gusts Above 20 mph ($\mu g/m^3$)	% PM-10 Concentration Associated with Wind Gusts Below 20 mph	% PM-10 Concentration Associated with Wind Gusts Above 20 mph
0	129.8	4,849.8	4,011.1	838.7	83%	17%
1	112.3	4,102.8	2,991.2	1,111.6	73%	27%
2	119.0	4,698.9	4,361.8	337.1	93%	7%
3	129.9	4,565.4	3,365.9	1,199.5	74%	26%
4	186.6	5,335.3	5,335.3	0.0	100%	0%
5	292.3	7,840.5	7,522.5	318.0	96%	4%
6	313.5	8,164.2	8,164.2	0.0	100%	0%
7	278.1	7,707.2	7,372.5	334.7	96%	4%
8	198.3	7,265.7	4,890.9	2,374.8	67%	33%
9	149.5	6,198.1	3,100.7	3,097.4	50%	50%
10	118.0	5,425.2	1,681.8	3,743.4	31%	69%
11	102.5	7,126.0	824.2	6,301.8	12%	88%
12	128.4	6,707.3	194.1	6,513.2	3%	97%
13	163.6	8,392.1	0.0	8,392.1	0%	100%
14	196.6	9,790.2	0.0	9,790.2	0%	100%
15	218.7	9,891.0	0.0	9,891.0	0%	100%
16	210.4	9,647.9	0.0	9,647.9	0%	100%
17	188.7	9,650.6	0.0	9,650.6	0%	100%
18	192.8	9,416.0	0.0	9,416.0	0%	100%
19	160.4	5,676.6	1,293.3	4,383.3	23%	77%
20	153.6	6,272.7	2,111.1	4,161.6	34%	66%
21	162.8	6,075.3	2,434.6	3,640.7	40%	60%
22	145.5	5,483.7	3,271.9	2,211.8	60%	40%
23	141.6	5,404.1	3,580.8	1,823.3	66%	34%

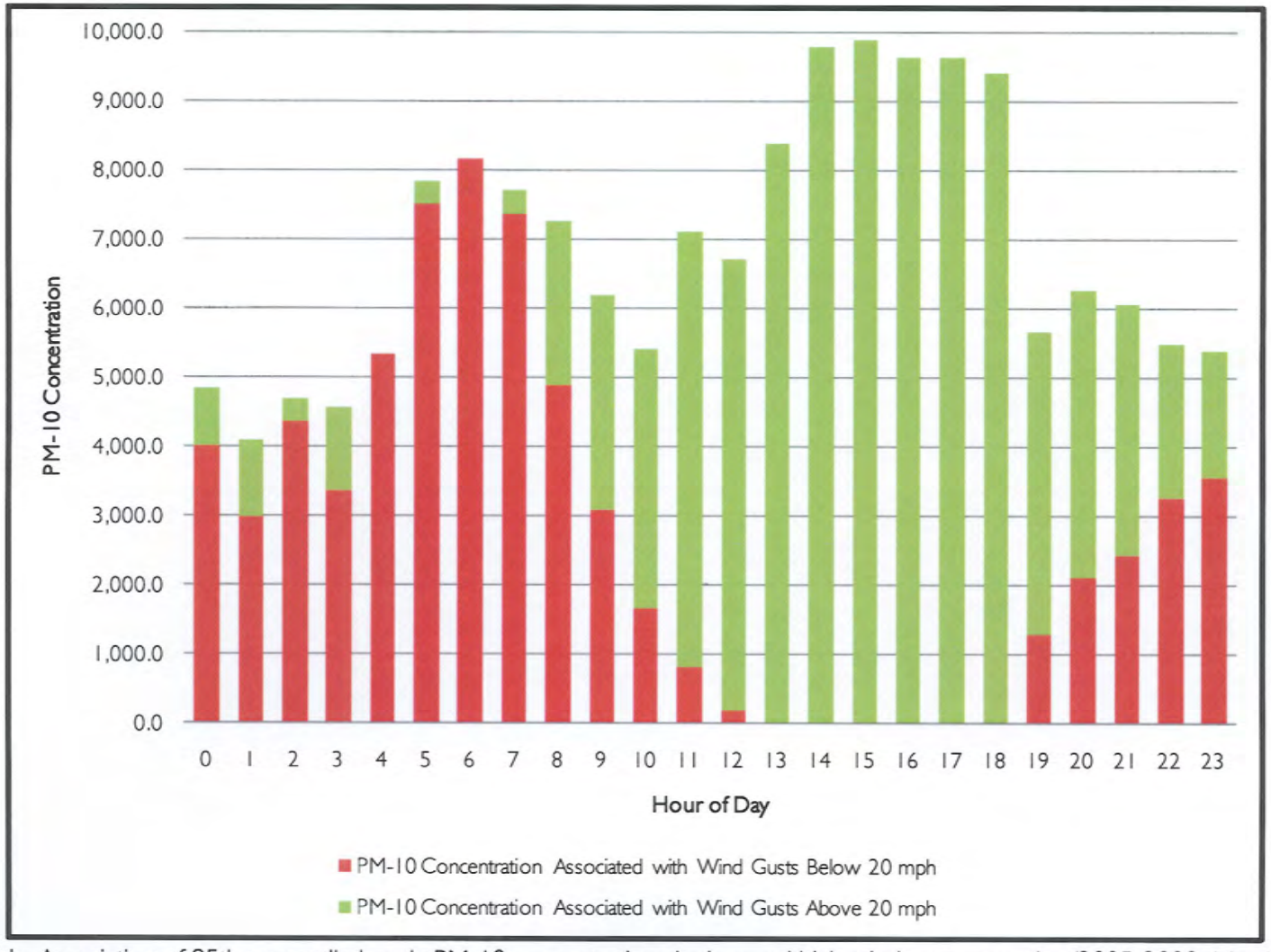

Figure 11. Association of 95th percentile hourly PM-10 concentrations by low and high wind gust categories (2005-2008, March-June).

Table 4. 24-Hour event day PM-10 concentrations after substituting actual 95th percentile windy hour PM-10 concentrations with historical (2005-2008, March-June) 95th percentile hourly PM-10 concentrations.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 HR PM-10 CONC.
95th Perc.	**129.8**	**112.3**	**119.0**	**129.9**	**186.6**	**292.3**	**313.5**	**278.1**	**198.3**	**149.5**	**118.0**	**102.5**	**128.5**	**163.6**	**196.6**	**218.7**	**210.4**	**188.7**	**192.8**	**160.4**	**153.6**	**162.8**	**145.5**	**141.6**	**174.7**
3/14/2008	26.1	28.9	22.2	28.4	64.6	154.6	145.5	133.8	187.7	328.9	118.0	102.5	128.5	163.6	196.6	87.0	57.1	23.6	37.1	40.8	86.4	93.1	73.4	72.9	92.6
4/30/2008	36.6	30.5	32.8	35.0	51.4	112.0	109.1	119.9	75.3	85.0	118.0	102.5	128.5	163.6	196.6	365.6	236.4	212.4	133.9	77.4	62.5	46.8	28.5	30.6	108.0
5/21/2008	87.1	46.7	40.2	28.7	32.0	60.3	54.9	135.2	198.3	149.5	118.0	102.5	128.5	163.6	196.6	218.7	224.8	188.7	192.8	104.9	76.7	69.2	58.1	69.9	114.4
6/4/2008	51.5	33.9	34.5	71.2	65.0	141.6	199.4	89.7	85.0	67.2	39.6	64.3	165.2	163.6	196.6	218.7	210.4	188.7	192.8	160.4	94.7	84.3	145.5	141.6	121.1

NOTE: Highlighted (yellow and green cells) values represent hours when max wind speeds were in the 95th percentile. Yellow highlighted cells were substituted with seasonal, historic 95th percentile PM-10 concentrations; green highlighted cells were not substituted because they represent actual PM-10 event day concentrations values below the 95th percentile. Clear cells are not subject to substitution as those hours did not have wind gusts at or above the 95th percentile.

EPA Comment, 1st paragraph, page 16 and at end of pages 20, 25, and 31: EPA reviewed all four events (March 14, 2008, April 30, 2008, May 21, 2008, and June 4, 2008). In the Clear Causal Relationship section of Chapter 5 of EPA's report, EPA recognized that "...the magnitude of PM-10 concentrations measured at the West 43rd Avenue site seem to be associated with factors in addition to wind speed."

MAG Response - Additional information detailing the unique susceptibility of the West 43rd Avenue monitor to high wind events: Even though it is not necessary to do so under EPA's current exceptional event rule, the following table is provided to help explain why the West 43rd Avenue monitor exceeded on the event days and the closest neighboring monitors did not. In addition to the work detailing the effects of surface roughness, Table 5 shows the amount of upwind acreage (NW-SW, degrees of 225-315[19]) capable of producing windblown dust emissions within two miles of the West 43rd Avenue, Durango Complex and South Phoenix monitors. The table shows that the West 43rd Avenue monitor contains 69% more acres that are subject to windblown dust emissions than South Phoenix, and 254% more acres than the Durango Complex monitor. The acreage below includes both disturbed and undisturbed soils. It is important to note that under high wind conditions, local soils produce dust with or without anthropogenic disturbance, although the threshold friction velocities are higher when the soils are undisturbed.

Table 5. Upwind (225-315 degrees) acreage capable of producing windblown dust.

Land Use	West 43rd (acres)	Durango Complex (acres)	South Phoenix (acres)
Agriculture	187.2	22.8	37.8
Developing Other	5.0	19.9	14.6
Developing Residential	20.4	0.0	17.4
Landfill/Sand & Gravel	601.0	28.1	383.1
Riverbed	577.5	315.9	121.4
Vacant	110.3	204.8	313.4
Grand Total	**1501.4**	**591.5**	**887.6**

EPA Comment, end of 2nd paragraph, page 34; and 2nd paragraph of page 35: "...the Assessments did not adequately establish a clear source-receptor relationship or make a convincing demonstration that the events in question should be considered natural events under the EER"; [and] "The June 4 DSR did not provide sufficient technical analysis to support a clear source receptor relationship or provide new evidence to support the notion that the June 4 event should be considered a natural event under the EER."

MAG Response: EPA has far exceeded the technical scope of the exceptional events rule (EER) by suggesting that source-receptor relationships need to be established in order to prove the causal relationship between the exceptional event and the exceedance. The EER clearly states the opposite in the following excerpt:

[19] This range also is in line with earlier land use analysis based upon back trajectories developed by Sierra Research and presented to EPA by MAG during the Five Percent Plan Technical Committee Meetings.

> "The EPA will maintain the proposed "but-for" requirement that air quality data may not be excluded except where States, Tribes, or local agencies show that exceedances or violations of applicable standards would not have occurred "but for" the influence of exceptional events. Through analyses, it is possible to demonstrate that an exceedance or violation would not have occurred but for the event [See sample "but-for" analysis in memo to docket, Husar *et al.* 2006 (*http://www.regulations.gov*, EPA–HQ–OAR– 2003–0061–0733 thru 0733.5)]. ***This analysis does not require a precise estimate of the estimated air quality impact from the event.*** The weight of evidence demonstration can present a range of possible concentrations which is not as technically demanding as justifying a specific adjustment to a measured value (emphasis added)."[20]

By including source-receptor relationships as a prerequisite to establishing cause between the event and the exceedance, EPA is in effect requiring that a modeling exercise of the event day be performed. In a recent federal notice affirming the State of California's exceptional events related to construction activity, the EPA rejected the idea that modeling was necessary to support an exceptional event determination,

> "Earthjustice seems to be suggesting that in order to meet the criterion "affects air quality" the State should have used an air quality model such as AERMOD or CalPuff to show the behavior of fugitive dust. In other words, Earthjustice is asking for a modeling demonstration that would show, quantitatively, that a given amount (either in the form of an emission rate or initial ambient concentrations at the source regions) can produce a particular concentration at a receptor point (e.g., monitoring site location). This type of modeling, at the scale Earthjustice is suggesting, is not an appropriate tool for use in this type of application because it cannot be performed with any degree of accuracy."[21]

The exceptional events rule, however flawed, should be applied equitably. EPA's own defense clearly shows that establishment of a source-receptor relationship is outside the bounds of the exceptional events rule, and thus should not be arbitrarily and capriciously applied to the events submitted here.

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[20] 72 FR 13570

[21] 73 FR 14702-3

Detailed MAG Responses:

1.0 EMISSION SOURCES

1.1 Natural Emission Sources

EPA Comment, end of 2nd paragraph, page 32: While ADEQ has concluded that the exceedance at West 43rd was caused by emissions originating in the Salt and Gila River channels, there little technical justification supporting this conclusion and there is no discussion explaining how emissions from these sources are not reasonably controllable or preventable.

MAG Response: On February 24, March 10, and April 7, 2010, MAG distributed a threshold friction velocity map to the Five Percent Plan Technical Committee, including EPA, which shows soils from the natural river terrain upwind of the West 43rd Avenue monitor (i.e., the Salt, Gila and Agua Fria riverbeds) become airborne at wind speeds exceeding 13 mph. Graphs prepared by Sierra Research and distributed to the Committee indicate that five-minute wind speeds frequently exceeded 13 mph on the four days of concern; therefore, the contribution of these upwind natural sources to exceedances at the West 43rd Avenue monitor is likely to be significant.

1.2 Upwind Sources & Control Measures

EPA Comment, end of 1st paragraph, page 34: The majority of the data concerning these relationships are presented in tables and a small number of graphs with no explanation of the interpretation of the information that has been presented.

EPA Comment, end of 2nd paragraph, page 34: With little discussion of the meteorological conditions on the event days combined with a very limited discussion on possible sources, the Assessments did not adequately establish a clear source-receptor relationship or make a convincing demonstration that the events in question should be considered natural events under the EER.

MAG Response: The maps, graphs and supporting text that MAG distributed to the Five Percent Plan Technical Committee, including EPA, in January through May 2010, provide extensive supplemental information on the meteorological conditions that occurred on March 14, April 16[22], April 30 and June 4, 2008. In addition, the threshold friction velocity maps that MAG distributed on February 24, March

[22]On December 2, 2009, Michael Flagg of EPA made a presentation to the Five Percent Plan Technical Committee that identified four exceptional event days of concern to EPA: March 14, April 16, April 30 and June 4, 2008. In EPA's May 12, 2010 technical support document that discusses nonconcurrence with four exceptional events in 2008, April 16 is missing and May 21 has been added. While participating in numerous meetings of the Five Percent Plan Technical Committee between January and May 2008, EPA staff never revealed that a different date than the four identified by Michael Flagg was of concern. The Committee spent considerable effort performing analyses on the four original dates provided by Michael Flagg. If May 21, 2008 had been identified as an exceptional event day of concern at any time over the last six months, the anthropogenic contribution and natural conditions on that date would also have been analyzed and distributed to EPA and other members of the Five Percent Plan Technical Committee.

10, and April 7, 2010 identify the potential sources located upwind of the West 43rd Avenue monitor based on the latest (2009) MAG land use data. MAG also distributed preliminary tables to the Five Percent Plan Technical Committee that showed the percent contribution of anthropogenic sources along the upwind back trajectories from the West 43rd Avenue monitor for each of the four event days. This supplemental data, which EPA received as a participant in the Five Percent Plan Technical Committee meetings, makes a compelling case that the four exceedances at the West 43rd Avenue monitor were exceptional events. Now that EPA has indicated that May 21, 2008 is also of concern, the same information is being prepared for this exceptional event day.

As a participant in the Five Percent Plan Technical Committee meetings, EPA also received the following information regarding ongoing and planned data collection for sources upwind and in the vicinity of the West 43rd Avenue monitor:

1. February 3, March 24, April 21, and May 19, 2010 meetings – MAG, MCAQD, and ADEQ staff will collect soil samples from areas that have potential for high wind erodiblity: areas with severe soil texture, areas with soil grain size conducive to wind erosion, and alluvial deposits. These soil samples will be analyzed by Arizona State University researchers for PM-10 emissions potential using dust resuspension chambers and standard sieving analysis. MAG is providing $21,500 to ADEQ to fund the analyses of the soil samples by Arizona State University.

2. March 24, 2010 meeting - Sierra Research is collecting activity data for rock product facilities upwind of the West 43rd Avenue monitor and control measures in place in 2008.

3. April 7, April 21, and May 19, 2010 meetings – ADEQ and MAG are collecting data on the types and distribution of crops grown in 2008, and drafting a crop calendar of different field activities and stages of crop growth with assistance from the Arizona Farm Bureau, Maricopa County Farm Bureau, Arizona Cotton Growers, Arizona Cotton Research and Protection Council, and the University of Arizona Cooperative Extension. ADEQ is contacting farmers for field activity data for the days of interest in 2008 and for the Agricultural Best Management Practices they had in place in 2008.

2.0 SURFACE ROUGHNESS & THRESHOLD FRICTION VELOCITY

EPA Comment, 3rd paragraph, page 10 (on March 14 date; similar statements are included for the three other dates): ADEQ also provided four graphs that show the potential correlation between maximum wind speeds and PM-10 concentrations at the West 43rd, Durango Complex, Greenwood, and South Phoenix monitoring sites. The graphs show that hourly PM-10 concentrations increase with an increase in maximum recorded wind speed at the West 43rd site, but not at the other three monitoring sites. In fact, the graphs show that the maximum wind speeds at the Durango Complex site were higher than those measured at the West 43rd site, but the Durango Complex site experienced significantly lower PM-10 values during periods of elevated wind speed. These data suggest that the elevated PM-10 concentrations at the West 43rd site may have been caused by local upwind sources and were not due to a high wind event that was regional in nature.

EPA Comment, 2nd paragraph, page 19: Given that the Durango Complex, South Phoenix, Greenwood, and West Phoenix sites are located within approximately five miles of the West 43rd site, one would expect to see greater consistency in the concentrations if a regional high wind event was occurring. The data suggest that the West 43rd site was most likely significantly influenced by local upwind sources and the claimed exceptional event was not regional in nature.

MAG Response: At the Five Percent Plan Technical Committee meetings on March 10 and April 7, 2010, MAG provided maps and a technical paper that explain the impact of surface roughness on the PM-10 concentrations at the West 43rdAvenue, Durango Complex, and South Phoenix monitors during the high westerly winds on March 14, April 16 and 30, and June 4, 2008. The technical paper demonstrates that a 400% increase in measured surface roughness levels between West 43rd Avenue and the Durango and South Phoenix monitors reduces PM-10 concentrations at the two downwind monitors. At the same meeting, MAG distributed a threshold friction velocity map that shows soils from the natural river terrain upwind of the West 43rd Avenue monitor (i.e., the Salt, Gila and Agua Fria riverbeds) become airborne at wind speeds exceeding 13 mph. Graphs prepared by Sierra Research and distributed to the Committee indicate that five-minute wind speeds frequently exceeded 13 mph on the four days of concern; therefore, the contribution of these upwind natural sources to exceedances at the West 43rd Avenue monitor is likely to be significant.

EPA Comment, 3rd paragraph, page 10: In fact, the graphs show that the maximum wind speeds at the Durango Complex site were higher than those measured at the West 43rd site, but the Durango Complex site experienced significantly lower PM-10 values during periods of elevated wind speed. These data suggest that the elevated PM_{10} concentrations at the West 43rd site may have been caused by local upwind sources and were not due to a high wind event that was regional in nature.

MAG Response: In the above statement, the EPA indicated that the elevated PM-10 concentrations at the West 43rd site may have been caused by local upwind sources. However, temporal variation of local PM-10 concentrations may be governed by other important local parameters and processes, including soil type, turbulent diffusion, dry deposition, and wind. Emissions from local upwind sources are only one of the possible causes of the elevated PM-10 concentrations at the West 43rd Avenue site.

If roughness of the land surface increases suddenly along with the air mass motion, the dry deposition rate will significantly increase due to the intensive turbulent exchange caused by high values of the gradient of surface roughness. This results in more windblown dust being deposited on the ground surface in this surface roughness transition zone. This is the case for the West 43rd Avenue monitoring site, which is located in an area where the surface roughness transitions from low surface roughness to high surface roughness, and will, as a result, have higher PM-10 emissions than the Durango Complex and South Phoenix monitoring sites. These two downwind monitors are located in a more urbanized area with uniformly higher surface roughness values. Hence, it is not appropriate to

characterize the elevated PM-10 concentrations at the West 43rdAvenue site as being due to only local upwind sources[23].

3.0 METEOROLOGY

3.1 Unusual Winds

EPA Comment, 1st paragraph, page 10: EPA also notes that Arizona provided a different set of meteorological data for each event. Considering the four events discussed in this document are very similar in nature, it is unclear why ADEQ did not provide the same data for each event. In some instances the most relevant meteorological data, (those data from the closest or upwind locations) are not included in the supporting documentation.

MAG Response: On April 7 and April 21, 2010, supplemental graphs and documentation prepared by Sierra Research were distributed to the Five Percent Plan Technical Committee, including EPA, for the exceptional events occurring on March 14, April 16, April 30, and June 4, 2008. These graphs were developed on the basis of consistent data for each event; meteorological and PM-10 concentration data recorded at the West 43rd Avenue monitor were used to prepare the graphs.

3.2 Similar Meteorological Conditions

EPA Comment, 2nd and 3rd paragraphs, page 14: The following analysis compares hourly PM_{10} data, wind speed, and wind gusts recorded at Goodyear Airport on March 14 with the same data for three days in March with similar meteorological conditions. And On March 14, the West 43rd monitor measured elevated PM_{10} concentrations of 1051 µg/m3 and 1270 µg/m3 at 1100 and 1200 hrs, respectively. Wind speeds at Goodyear Airport during this period were from the west (260°) at 14 and 18 mph with gusts of 29 and 34 mph. On March 2, the Goodyear station measured wind speeds and gusts of equal or higher magnitude: 23 mph with 34 mph gusts from the NW (310°- 320°) for two consecutive hours.

MAG Response: The wind direction on March 14th was from the west (260°), while the wind direction on March 2nd was from the northwest (310-320°). Since the wind directions on these two days differed by 50° to 60°, it is not appropriate to state that these two days had similar meteorological conditions. In addition, there was precipitation as high as 6 mm in the region on February 15, 20, and 22. The precipitation on these three days could significantly affect soil moisture content on March 2. Hence, it is not appropriate to directly compare the PM-10 concentrations on March 2nd and March 14th based on wind speed alone.

EPA Comment, 1st paragraph, page 15: Similarly, on March 29, wind speeds of 16 to 17 mph with wind gusts of 29 to 32 mph from the SSW (200°) and the WSW (240°) were recorded at Goodyear Airport for a period of three hours.

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[23] *High PM-10 Associated with High Wind Events in the Salt River Basin of Phoenix*, Feng Liu, Maricopa Association of Governments (see Met_High_PM10_final_030210.docx in MAG folder on ADEQ's ftp site)

MAG Response: The wind speed and wind gusts on March 29th are lower than those on March 14th. Wind tunnel experiments have shown that windblown dust emissions are proportional to the cube of wind speed and/or wind gust[24]. Hence, it is not appropriate that wind speed and wind gusts on March 14th were compared with those on March 29th, since the cube of the peak wind speed on March 14th is about 2.8 times the cube of the peak wind speed on March 29th.

EPA Comment, 1st and 2nd paragraphs, page 25: The following analysis compares the hourly PM_{10} data, wind speed, and wind gusts on May 21 with the same data from a similar day in May. Similarly, on May 12, the Goodyear station measured wind speeds and gusts of equal magnitude; 21 mph wind speeds and 30 mph gusts from the SW (230°). These elevated wind speeds, however, only correspond to moderate hourly PM_{10} values at the West 43rd site.

MAG Response: Similar to the response to EPA's previous comment on wind speeds for March 29th, the cube of the peak wind gust speed between 1200 to 1400 hour on May 12th is less than half (0.45) of the cube of the peak wind speed gust of wind between 0800 to 1000 hour on May 21. Hence, the meteorological conditions on these two days are not similar.

4.0 PM-10 CONCENTRATIONS ANALYSES

4.1 PM-10 and Wind Analyses

EPA Comment, Figures 4 - 6, 10, 14, and 18: These figures in the EPA report relate the temporal variation of PM-10 concentrations at the West 43rd Avenue site with wind speeds and wind gusts at the Goodyear Airport site.

MAG Response: EPA's report did not compare the wind gust data between the West 43rd Avenue site and Goodyear Airport site or indicate how different these two wind gust data sets were. However, the figures in EPA's report indicate that PM-10 concentrations at the West 43rd Avenue site were better correlated with wind *gusts* than wind *speeds* at the Goodyear Airport site. This implies that PM-10 concentrations at the West 43rd Avenue site are also more highly correlated with wind gusts than wind speeds. EPA did not take into account the impact of wind gusts on PM-10 concentrations at the West 43rd Avenue site.

4.2 Dust Storms

EPA Comment, Appendix B, page 40: Earlier research suggests that reduced visibility less than 7 miles constitutes dust storm classification (Orgill, Sehmel, 1976).

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[24] Bowker G., et.al, 2007. *Sand Flux Simulations at a Small Scale over a Heterogeneous Mesquite Area of the Northern Chihuahuan Desert.* Journal of Applied Meteorology and Applied Climatology; Park Y. and Park S., 2010. *Development of a New Wind-Blown-Dust Emission Module Using Comparative Assessment of Existing Dust Models.* Particle Science and Technology; Jickells T.D., et. al, 2005. *Global Iron Connections Between Desert Dust, Ocean Biogeochemistry, and Climate.* Science.

MAG Response: Appendix B in EPA's report discusses the relationship between dust storm and visibility and refers to two cutpoints for dust storm classification from two separate research papers as examples of definitions of dust storms. Then EPA's report compared the visibility recorded at the Goodyear Airport during the event days in question to this dust storm definition in Table 1 of Appendix B. The above dust storm/visibility reference used a reduced visibility of 7 miles or less as a cutpoint for dust storm classification. Using this criterion for dust storms, two event days (April 30 and May 21) could be characterized as having dust storms that resulted in elevated PM-10 concentrations.

4.3 Natural Events

EPA Comment, 1st paragraph, page 9: In summary, considering the limited analysis on the elevated wind speeds associated with the event combined with little analysis of possible contributing sources located directly upwind of the West 43rd site, EPA has determined that ADEQ's documentation did not provide sufficient evidence to support that the events in question should be considered "natural events" as required under the EER.

MAG Response: Graphs and accompanying documentation, prepared by Sierra Research, were distributed to the Five Percent Plan Technical Committee, including EPA staff, on April 7 and April 21, 2010. This material shows the five-minute wind speeds and their relationship to the 95th percentile on March 14, April 16, April 30, and June 4, 2008. The Sierra Research analysis indicates that wind speeds during the high wind event on each of these days were in the 98th percentile or higher.

5.0 Appendix A

EPA Comment, Appendix A, page 39: Appendix A in EPA's report provided pollution roses based on the percent total PM-10 mass for all four of the events in question.

MAG Response: These pollution roses do not provide any clear causal relationship between the potential local sources and the events in question. Also, there was no description about the pollution roses in the EPA report.

6.0 Summary

EPA Comment, end of 3rd paragraph, page 34: Although it is very clear that there is something unique about the measured exceedances at the West 43rd site, the assessments did not explain these differences in PM_{10} concentrations and how they are inconsistent with a regional high wind event.

MAG Response: The maps, graphs and supporting text that MAG distributed to the Five Percent Plan Technical Committee, including EPA, in January through May 2010, provide extensive documentation of the unique meteorology, geography and natural sources that contributed to exceedances of the PM-10 standard at the West 43rd Avenue monitor on March 14, April 16, April 30 and June 4, 2008.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

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Janice K. Brewer
Governor

Benjamin H. Grumbles
Director

June 30, 2010

Mr. Jared Blumenfeld
Regional Administrator
U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, CA 94105

Dear Mr. ~~Blumenfeld~~ Jared:

This letter responds to concerns raised in your May 21, 2010, letter and at our May 25, 2010, meeting regarding the West 43rd Avenue PM10 monitoring site and the Exceptional Events Rule (EER), 40 C.F.R. § 50.14. I am hopeful that, prior to EPA's publication of a final determination, ADEQ and EPA will find common ground on the information ADEQ should provide to EPA to satisfy the EER.

ADEQ has three principal concerns about EPA's review of our demonstrations under the EER. ADEQ has preliminarily determined that EPA's review:

- Is not always consistent with the EER and the preamble for the final rule.
- Failed to take into account some of ADEQ's supporting data and analysis.
- Is not always consistent with EPA's August 27, 2007, concurrence with California's request to exclude data from the determination of the attainment status for the San Joaquin Valley (SJV).

ADEQ recognizes EPA's review identifies some changes that we could make to strengthen our request. ADEQ therefore intends to develop and submit supplemental requests. The enclosure to this letter provides a comprehensive section-by-section response to the review. It addresses both the difficulties with EPA's review and areas that ADEQ intends to address in its supplemental documentation. ADEQ intends to submit supplemental information regarding the June 4, 2008, event by July 22, 2010, and for the other three events within a few weeks thereafter.

I. PROCESS ISSUES

The preamble for the EER emphasizes that the EPA regional offices should work cooperatively with states, tribes and local agencies:

The EPA regional offices will work with the States, Tribes, and local agencies to ensure that proper documentation is submitted to justify data exclusion.

The EPA does not believe that an appellate process is necessary because we anticipate that the States and Regional Offices will be working closely through the data and documentation submission process.
The process leading up to EPA's decision was not always in keeping with the spirit of cooperation envisioned by the preamble.

ADEQ first submitted requests for exceptional events exclusions pursuant to the EER on September 16, 2008. These requests addressed exceptional events that occurred in calendar year 2007. EPA did not respond to this request until May 22, 2009, and then only in the form of a draft letter. ADEQ, as discussed below, has attempted to address the issues raised in that correspondence.

ADEQ submitted preliminary assessments for the 2008 events in June 2009 to insure that it met the deadlines established in 40 C.F.R. § 50.14(c)(3)(i) and with the intention of addressing the issues raised in the May 22, 2009, letter in subsequent submissions. In July through September, 2009, ADEQ reformatted the submittals to address the concerns raised in the draft letter and added citations to the EER. ADEQ opened the 30-day public comment period for this submittal on October 15, 2009. EPA submitted no comments.

On November 17, 2009, ADEQ submitted final documentation for the twelve Maricopa County exceptional events that occurred in 2008, including the four that are the subject of EPA's non-concurrence.

At a December 2, 2009, meeting of the Five Percent Plan Technical Committee for the Phoenix Serious PM10 Nonattainment Area, EPA provided an in-person PowerPoint presentation on exceptional events. EPA representatives participated in numerous other Technical Committee meetings discussing the exceptional events.

In response to these discussions, ADEQ prepared a draft supplemental package for the June 4, 2008, event as a model for correcting prior and drafting future submittals of demonstrations under the EER as discussed with EPA. ADEQ submitted this package on March 17, 2010, and sought EPA feedback. Rather than providing the anticipated feedback, EPA proceeded to issue its non-concurrence with ADEQ's requests.

If EPA had instead raised the issues included in the non-concurrence in comments earlier in the process or in response to the March 17, 2010, draft supplemental package, ADEQ could have brought the issues identified below to EPA's attention. ADEQ and EPA could have likely resolved these issues prior to the May 21, 2010, correspondence. ADEQ is hopeful that EPA review of the supplemental information will lead to a mutual understanding of the nature and cause of these events.

II. EPA's SUBSTANTIVE REVIEW

Under 40 C.F.R. § 50.14(c)(3)(iii), a demonstration to justify the exclusion of data as being due to an exceptional event must provide evidence that:

(A) The event satisfies the criteria set forth in 40 CFR 50.1(j);
(B) There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area;
(C) The event is associated with a measured concentration in excess of normal historical fluctuations, including background; and
(D) There would have been no exceedance or violation but for the event.

Each of these elements is addressed below.

A. CRITERIA SET FORTH IN 40 C.F.R. § 50.1(J)

Section 50.1(j), defines an exceptional event as one that:

[1] affects air quality,
[2] is not reasonably controllable or preventable,
[3] is an event caused by human activity that is unlikely to recur at a particular location or a natural event,
[4] is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event[, and]
[5] does not include stagnation of air masses or meteorological inversions, a meteorological event involving high temperatures or lack of precipitation, or air pollution relating to source noncompliance.

(Emphasis and formatting added.)

The first criterion is satisfied by showing that two other elements of the overall test—a clear causal connection and a measured concentration in excess of normal historical fluctuations—are satisfied. These elements are addressed in sections 0 and 0 below. ADEQ does not claim that the events were caused by human activity that is unlikely to recur. Our discussion of the third criterion, therefore, will focus on whether they qualified as "natural events." Whether the fourth criterion should be satisfied is of course the subject of this document. With regard to the fifth criterion, there appears to be no question that the events subject to ADEQ's request did not "include stagnation of air masses or meteorological inversions, a meteorological event involving high temperatures or lack of precipitation." We will therefore limit our discussion of that criterion to the important question of whether events included "air pollution relating to source noncompliance."

A central objection raised by EPA in its review of both the second and third criteria—the event is not reasonably controllable or preventable and is a natural event—is that ADEQ failed to identify

the specific anthropogenic sources that may have contributed to the measured concentrations. In section 4.2 of its review, EPA states that:
Without addressing the types, and locations of sources in the area, however, it is not possible to evaluate whether sources in the area were reasonably controlled.

In section 4.2, EPA contends that:

The lack of analysis regarding anthropogenic contribution upwind of the West 43rd site makes it difficult to determine the contributing role of human activity to the exceedances at the West 43rd site, particularly where it is known that commercial activities such as agriculture, sand and gravel mining and construction are known to take place.

These objections are inconsistent with the EER and past Region 9 practice.

According to the EER preamble:

The EPA's final rule concerning high wind events states that ambient particulate matter concentrations due to dust being raised by unusually high winds will be treated as due to uncontrollable natural events where ... the dust originated from anthropogenic sources within the State, that are determined to have been reasonably well-controlled at the time that the event occurred ...

73 Fed. Reg. at 13576. Thus, the rule does not require identification of specific anthropogenic sources that contributed to particulate matter concentrations. It states that even if wind-blown dust originated from anthropogenic sources, it will be treated as part of a natural event as long as those sources are "reasonably well-controlled."

ADEQ's request demonstrated that this requirement was met in two ways.

First, it referred to the comprehensive control strategy that has been developed and implemented for the Phoenix Serious PM10 nonattainment area. Because of the intractability of the PM10 nonattainment problem in Maricopa County, anthropogenic sources of PM10 in this area have likely received more scrutiny from the State, the public and EPA than any other sources in the country. The control strategy and compliance program developed for the area meet the most stringent planning requirements of the Clean Air Act, including the Best Available Control Measures (BACM) requirement of section 189(b)(1)(B) and the most stringent measures requirement of section. [ADD FR CITES] The control strategy had to include a comprehensive inventory of sources, so any suggestion that there are unknown, uncontrolled sources that could be identified from satellite images (see Review § 4.3 at 7) is unwarranted.

Second, the demonstration included a comprehensive review of all available compliance data for the 72-hour periods leading up to and including the events. Except for two minor violations identified by Maricopa County inspectors on June 4, 2008, no unusual dust-producing activities

were identified. There is no basis for concluding that anthropogenic emissions varied significantly before, during or after the event.

That this type of demonstration satisfies the EER is shown by EPA's concurrence in a September 22, 2006, exceptional event request for the SJV:

Section 50.1(j) of the Exceptional Events Rule requires that for an event to qualify as an exceptional event, whether natural or anthropogenic, a state must show that the event was not reasonably preventable or controllable. Here this requirement is met by demonstrating that despite reasonable and appropriate measures in place, the September 22, 2006, wind event caused the exceedances. During this event there were no other unusual dust-producing activities occurring in the SJV and anthropogenic emissions were approximately constant before, during and after the event. In addition, the State shows that reasonable and appropriate measures were in place, including Regulation VIII (the District's general fugitive dust rules) and Rule 4550 which limits fugitive dust emissions specifically from agricultural operations through Conservation Management Practices. Moreover, EPA has approved the District's best available control measure (BACM) demonstration for all significant sources of PM-10 in the SJV as meeting CAA section 189(b)(1)(B).

72 Fed. Reg. 49046, 49051 (Aug. 27, 2007). EPA's rejection of ADEQ's substantially identical demonstration warrants further dialogue between the agencies.

Other discrepancies in EPA's analysis of the § 50.1(j) criteria are discussed in the enclosure.

B. CLEAR CAUSAL RELATIONSHIP

Of the objections EPA raises to ADEQ's showing of a clear causal relationship, the one that deserves by far the greatest attention is EPA's claim that there is no geographical correlation between high winds and high PM10 concentrations on any of the four dates in question.

The first subsection of each causal relationship discussion emphasizes that there was supposedly no correlation between wind speed and PM10 concentrations across a wider geographic area:

The graphs show that hourly PM10 concentrations increase with an increase in maximum recorded wind speed at the West 43rd site, but not at the other three monitoring sites. [§ 5.1.1]

While the hourly PM10 concentrations increase with an increase in maximum recorded wind speeds at the West 43rd site, there is not a similar correlation between PM10 and maximum wind speed at the other monitoring sites in the area. [§§ 5.2.1 and 5.3.1]

The graphs show that, at the West 43rd site, the hourly PM10 concentrations increase with an increase in maximum recorded wind speeds at the West 43rd site; however, there does not seem to be a similar correlation between PM10 and maximum wind speed for the other monitoring sites in the area until later in the evening. [§ 5.4.1]

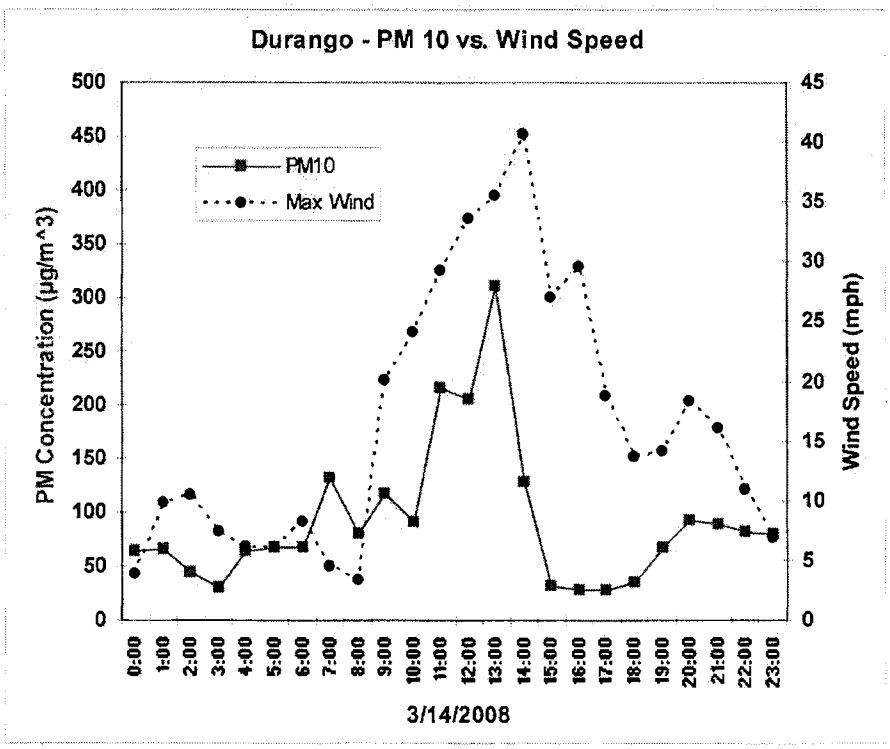
After each of these statements, the same EPA conclusion follows:

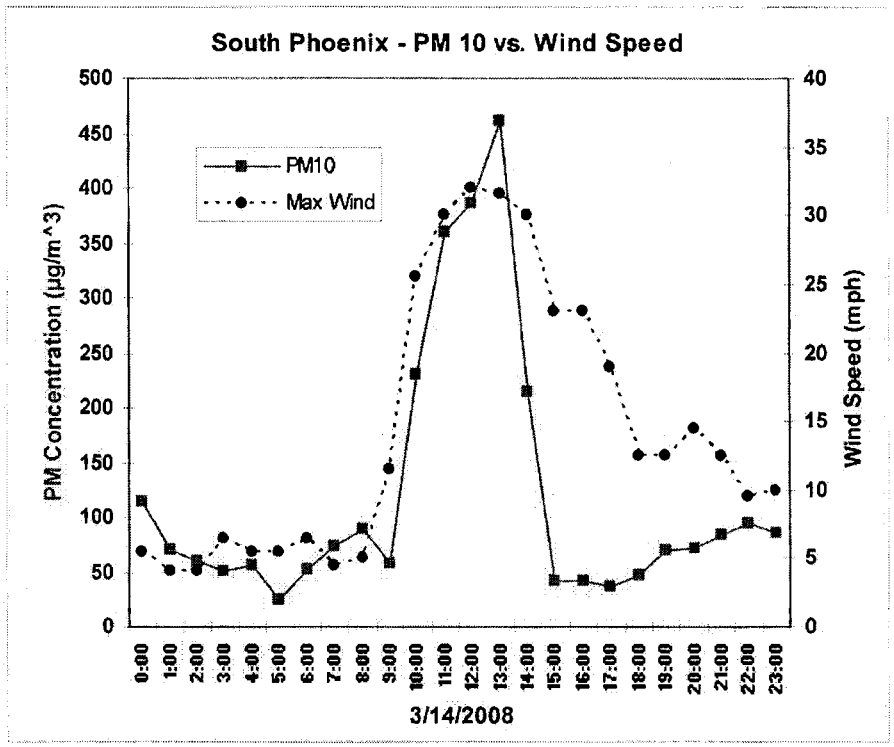
These facts suggest that the elevated PM10 concentrations at West 43rd may have been caused by local upwind sources and were not regional in nature. [§5.1.1, 5.2.1, 5.3.1; cf. § 5.4.1]

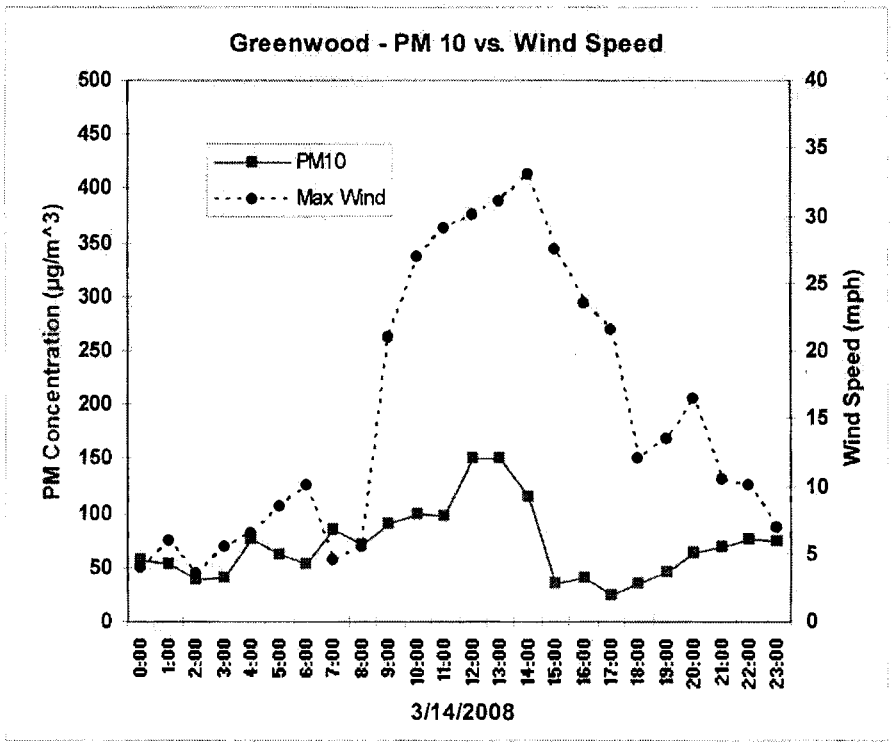
This point is emphasized again in EPA's conclusion for each causation section:
The data show that the spatial extent of PM10 during this day was isolated and not regional in nature. The data also show differences in the measured PM10 concentrations at the West 43rd site and the remaining sites in the Phoenix area. [§§ 5.1.7, 5.2.7, 5.3.7]

The data show that the spatial extent of PM10 during the early portion of the day was isolated and not regional in nature. [§ 5.4.9]

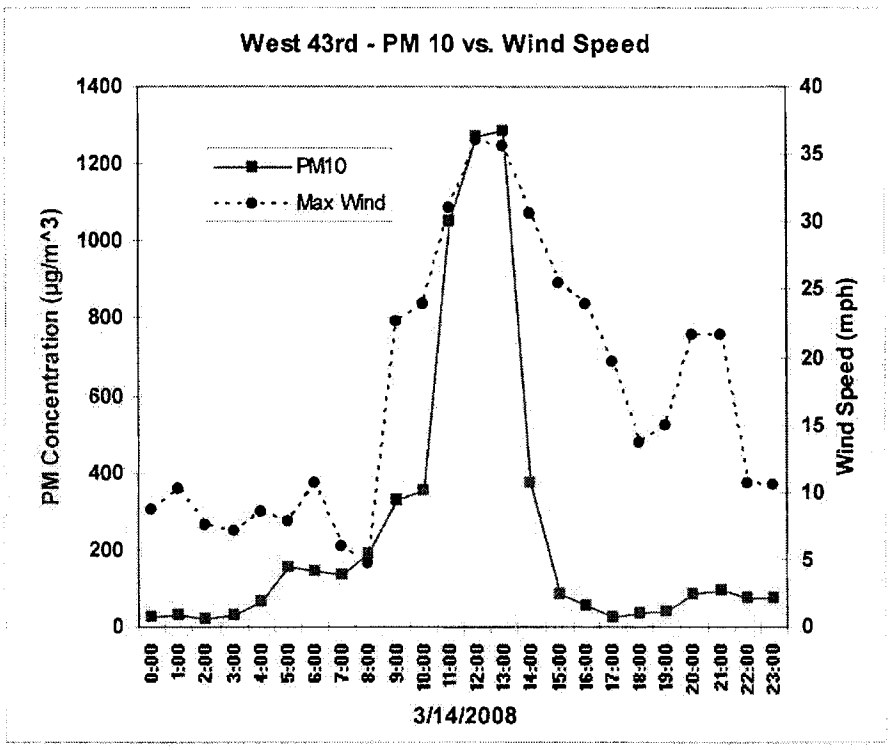
This objection is simply not true. Both the data and graphs included in ADEQ's request and the graphs in EPA's own review show that high wind speeds were, in fact, correlated with higher PM10 concentrations at all four monitoring locations. Although the correlation is evident in the original graphs, it is easier to see when the scale is adjusted to reflect the generally lower concentrations at the other three sites, as in the following adjusted graphs for the March 14, 2008, event:




South Phoenix - PM 10 vs. Wind Speed
PM10
Max Wind
PM Concentration (µg/m^3)
Wind Speed (mph)
3/14/2008


Greenwood - PM 10 vs. Wind Speed
PM10
Max Wind
PM Concentration (µg/m^3)
Wind Speed (mph)
3/14/2008

For the purpose of comparison, this is the original chart for the West 43rd Avenue site:



Thus, EPA's statement that the "graphs show that hourly PM10 concentrations increase with recorded wind speed at the West 43rd site, but not at the other three monitoring sites" is not supported by the facts. The concentrations did increase with an increase in wind speed, and in many cases the hourly measurements exceeded the 24-hour NAAQS by a substantial margin. The only difference between the West 43rd Avenue monitor and the others is that the 24-hour concentrations recorded at the other three did not exceed the NAAQS.

The source of the discrepancy between the magnitude of the concentration increases at the monitors is evident from ADEQ's submissions. Because of its location, the West 43rd monitor is especially susceptible to dust generated by high winds traveling from a west or southwest direction along the Gila and Salt River channels and at their confluence.

EPA's conclusion that the concentrations at the West 43rd Avenue monitor "may have been caused by local upwind sources and were not regional in nature" is not substantiated by the facts. In any case, this conclusion, even if justified, would not legally support EPA's determination that there was not a clear causal connection between the winds and the concentrations. As already noted, local, anthropogenic sources may be considered part of an exceptional high wind event, so long as they are reasonably controlled. As discussed above, there

is ample basis for concluding that the sources in the vicinity of the West 43rd Avenue monitor satisfied this requirement.

A section-by-section response to all of EPA's statements relating to causation is included in the enclosure.

C. A MEASURED CONCENTRATION IN EXCESS OF NORMAL HISTORICAL FLUCTUATIONS

In section 6.0 its review, EPA acknowledges that all of the measurements ADEQ seeks to exclude were well above the 95th percentile values for the West 43rd Avenue monitor.

EPA then states:

There is no specific threshold test for this requirement, but concentrations in the high percentiles can provide supporting evidence and informs EPA's weight of evidence analysis of the exceptional events in question.

The rule, however, calls for a determination of whether concentrations are in excess of normal fluctuations as a distinct element of the exceptional event requirements. Concentrations in the high percentiles are not simply data points to be considered in determining whether other elements, such as causation, are satisfied. They are direct evidence that this specific element is satisfied.

D. NO EXCEEDANCE BUT FOR THE EVENT

A critique of EPA's analysis of the "but-for" test is included in the enclosure. As demonstrated in the enclosure, EPA's conclusion that ADEQ failed to establish this element is not supported by the facts.

Thank you for your consideration of this information. If your staff has questions or would like to discuss this further, please have them contact Nancy Wrona, who can be reached at (602) 771-2311.

Sincerely,

Benjamin H. Grumbles
Director

Enclosure

cc: Deborah Jordan (with Enclosure)
Colleen McKaughan (with Enclosure)

Enclosure

SECTION BY SECTION RESPONSE TO

Review of Exceptional Events Request
Maricopa County AZ
24-Hour PM_{10}

- March 14, 2008
- April 30, 2008
- May 21, 2008
- June 4, 2008

U.S. Environmental Protection Agency
Region 9

May 12, 2010

PREPARED BY

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
AIR ASSESSMENT SECTION

June 30, 2010

This document contains a section by section presentation of and response to the Technical Support Document (TSD) developed by the U.S. Environmental Protection Agency (EPA) in response to the Exceptional Events demonstrations submitted to EPA by the Arizona Department of Environmental Quality (ADEQ).

Review of Exceptional Event Request

Maricopa County, AZ

24-Hour PM_{10}

- March 14, 2008
- April 30, 2008
- May 21, 2008
- June 4, 2008

U.S. Environmental Protection Agency
Region 9

May 12, 2010

ADEQ COMMENTS

1. ADEQ Submitted the 2007 Exceptional Events Rule (EER) Demonstrations on September 16, 2008.

2. ADEQ received an un-official, unsigned response from EPA in May 2009 in response. There was no resolution, clarification or finalization of information content or need.

3. ADEQ Submitted preliminary assessments for the 2008 events in June 2009 followed by the final submittals in November 2009 that included ADEQ's "Unusual Winds" and the "Control Measures" White Papers.

4. ADEQ prepared a supplemental package for the June 4, 2008 event as a model for future submittals and sought EPA feedback on the submittal. Only the June 4, 2008, event has had a supplement added to the original "complete" reports that were submitted in November 2009. ADEQ is still waiting for a response.

5. EPA's response does not address the earlier 2007 and other 2008 submittals.

6. EPA's co-mingling of issues between events makes it difficult to develop a clear picture of EPA's vision for the expected contents of an "acceptable" EER demonstration.

7. EPA should respond completely to the June 4, 2008 event which corresponds to the event that ADEQ generated substantially more information in the supplemental submittal to determine what if any additional information may be needed.

RELEVENT FEDERAL REGISTER CITATIONS:

72 FR 13573
To obtain concurrence, EPA must determine that the demonstration is complete and provides a reasonable technical demonstration.

Because of the variability in the nature of exceptional events and the resulting demonstration requirements, States should consult with the appropriate EPA Regional Office early in the process of preparing their demonstrations. We are not specifying what will be required as a minimum level of documentation in all cases because facts and circumstances will vary significantly based on, among other things, geography, meteorology and the relative complexity of source contributions to measured concentrations in any particular location. We believe, however, that at a minimum, the elements of such a demonstration should include a showing that an event occurred at a time when meteorological conditions were conducive to transporting emissions from the event downwind to the monitor recording a high concentration of one or more criteria pollutants. Acceptable documentation will be determined through consultation with the EPA regional offices. However, certain minimum requirements (e.g., ''but for'' test) will be necessary as discussed in the earlier sections of this rule.

72 FR 13574
Comment: One commenter stated that EPA must provide a reasonable explanation and documentation for their decision to deny any request for the flagging of data. *Response:* The EPA regional offices will work with the States, Tribes, and local agencies to ensure that proper documentation is submitted to justify data exclusion. The EPA will make the response and associated explanation publicly available. *Comment:* One commenter stated that EPA must establish a technically-based appellate process for States to follow when Regional Offices do not concur with a data flag. *Response: t*he EPA does not believe that an appellate process is necessary because we anticipate that the States and Regional Offices will be working closely through the data and documentation submission process.

72 FR 13581
§50.14(c)
(3) *Submission of demonstrations.*
(i) A State that has flagged data as being due to an exceptional event and is requesting exclusion of the affected measurement data shall, after notice and opportunity for public comment, submit a demonstration to justify data exclusion to EPA not later than the lesser of, 3 years following the end of the calendar quarter in which the flagged concentration was recorded or, 12 months prior to the date that a regulatory decision must be made by EPA. A State must submit the public comments it received along with its demonstration to EPA.

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ADEQ COMMENTS

EPA's general interpretation of "unusual winds" (see Sections 4.3 and 9.0)

ADEQ has reviewed EPA's concerns about ADEQ's treatment of "unusual winds." ADEQ has also reviewed EPA's actions regarding exceptional events submitted by other jurisdictions. As a result, ADEQ has concluded that EPA's treatment of ADEQ's demonstrations differs significantly from similar actions for other jurisdictions. Therefore, it is difficult for ADEQ, in revising past and preparing future demonstrations to understand the nature and type of analyses that would lead to EPA concurrence.

For example, in the San Joaquin Valley (SJV) EER demonstration for the exceptional event that occurred on October 25, 2006, on which EPA concurred (72 FR 49055), EPA acknowledged that, "... The documentation also states that wind speeds of these intensities are relatively rare in the southwestern part of the SJV and occur less than 5% of the time, based on long-term monitoring records." EPA thus concurred that winds exceeding the 95th percentile are unusual. ADEQ used the same basis in developing the "Unusual Winds" White Paper. Nowhere in the SJV EER demonstration were these wind speeds analyzed or presented by season. Although the preamble does acknowledge that states should show the winds were unusual for the time of year, in the case of SJV no such requirement was imposed by EPA. The EPA concurrence flag was applied without this demonstration. For EPA to be calling for ADEQ to provide a seasonal breakdown, while the SJV was not required to do so, creates an inconsistency, which ADEQ would like to understand and resolve.

Further, EPA's focus on the 5% observation for hourly-average wind speeds ignores the remainder of the submittal in the Unusual Winds White Paper. The literature is clear that winds in the 15 mph range can create blowing dust, and that the wind speeds in question during the events were substantially higher than this minimum, generally with gusts at or above 28 mph that occur less than 1.5 percent of the time. Also, the data presented in the White Paper shows the same general pattern of wind speed to PM concentration occurs from the Buckeye monitor in the West Valley, through Phoenix (West 43rd & Durango), to the Higley monitor in the East Valley.

The wind-gust frequency table for the West 43rd Avenue in the White Paper is presented below:

WEST 43RD AVE																
PM10 Category	< 1	1 mph	2 mph	3 mph	4 mph	5-6	7 mph	8-10	11-13	14-16	17-21	22-27	28-34	35-43	44+	TOTAL
1996-3161 ug/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1258-1994 ug/m3	-	-	-	-	-	-	-	-	-	-	2	-	-	7	-	9
794-1257 ug/m3	-	-	1	-	-	3	1	-	1	-	3	1	12	14	5	41
501-793 ug/m3	-	1	2	6	8	5	1	-	1	2	6	6	33	27	6	103
316-500 ug/m3	-	1	1	26	74	94	11	19	4	2	5	26	69	25	6	351
199-315 ug/m3	-	4	9	93	252	468	89	91	14	9	25	82	86	16	1	1,239
125-198 ug/m3	1	4	31	214	562	1,054	242	358	90	42	70	181	103	13	1	2,966
79-124 ug/m3	-	15	60	399	912	1,738	528	758	320	159	275	263	60	8	-	5,495
50-78 ug/m3	-	29	63	383	951	1,897	721	1,399	732	470	654	276	47	3	1	7,635
31-49 ug/m3	-	21	68	277	656	1,840	715	1,912	1,414	992	976	235	17	5	2	8,930
19-30 ug/m3	-	20	27	138	287	780	461	1,511	1,443	1,006	714	117	13	3	1	6,521
12-18 ug/m3	-	10	16	59	127	340	186	679	647	450	286	57	12	-	-	2,868
7-11 ug/m3	-	8	5	16	34	129	97	276	228	169	117	34	3	1	-	1,116
5-6 ug/m3	-	1	1	7	10	24	19	57	50	28	21	9	-	-	-	227
3-4 ug/m3	-	-	1	1	7	14	9	36	35	25	23	7	-	-	-	157
1-2 ug/m3	-	1	-	-	3	12	2	10	22	10	11	2	-	-	-	73
<1 ug/m3	-	-	-	-	1	7	3	9	7	7	10	2	-	-	-	46
TOTAL	1	115	285	1,626	3,884	8,205	3,084	7,114	5,008	3,371	3,198	1,296	445	122	23	37,777

Of the 37, 777 hours of data that were examined, only 590 hours (445+122+23) had wind gusts at or above 28 mph. This represents only 1.5 % of the hours. Even if all of these hours occurred in the same season, which is not the case, it would represent 6 % of the hours, a small deviation from the 5% threshold that was the basis for EPA's concurrence with the SJV demonstration. Instead of acquiring and processing other data in the TSD to make the argument against concurring with ADEQ's demonstration, EPA's time would have been better spent reviewing the data submitted by ADEQ. EPA should focus on the wind-gust data presented in the demonstrations. EPA's focus on average wind speeds is misplaced, because elevated PM10 concentrations during the events are driven by peak winds.

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ADEQ COMMENTS

EPA's reliance on newly-created data is not consistent with the principle of public awareness and review established in 40 CFR 50.14(c)(3)(i).

ADEQ assembled and analyzed quality-assured and validated data, organized in an easy to understand fashion, to allow the general public to understand the nature of the event and the basis for ADEQ's assertion that it qualified as an exceptional event. These data were presented at stakeholder meetings, and were subjected to a 30-day comment period (with the exception of the draft supplement for June 4th which was submitted for the purpose of discussion with EPA). ADEQ stakeholders reviewed the data and offered no comments related to concerns or questions related to the data.

Throughout the TSD EPA relied upon data that was not submitted by ADEQ, and as such, is not traceable to a quality-assured source. Specifically, the data contained in Appendix A, Appendix B, Tables 1-6, and Figures 1-18 were not based on data submitted by ADEQ. Although some portions of the data submitted by ADEQ may be part of these tables and figures, the majority is not. EPA's creation of data, and use of that data in arguments without affording the opportunity for public review is contrary to principles established in 40 CFR 50.14(c)(3)(i).

If EPA concludes that the data submitted by ADEQ does not enable them to concur, in the spirit of collaboration discussed in the preamble to the EER, EPA should identify the areas where ADEQ should improve the quality of the demonstration. Reliance on newly-created data which the public has not been given an opportunity to review should be avoided, in favor of providing ADEQ with timely feedback.

The general tone of the concerns raised by EPA could have been easily articulated by EPA sending a letter informing ADEQ that the information that was submitted was not sufficient for EPA to concur with the demonstration. EPA could have identified areas for improvement and suggesting that ADEQ:

- Add a seasonal breakdown component to the Unusual Wind White Paper, and better explain the issue of what constitutes "unusual winds" for the purpose of the EER.
- Include all particulate matter data in the demonstration.
- Include all available meteorological data in the demonstration.
- Identify the location of any NOVs issued to sources on the days in questions to determine whether or not the emissions were significant contributors.
- Demonstrate why the emissions from the alluvial plain west of the West 43rd monitor are not reasonably controllable.

1.0 Introduction

On March 22, 2007, EPA adopted the *Treatment of Data Influenced by Exceptional Events,*[1] also known as the Exceptional Events Rule (EER), to govern the review and handling of certain air quality monitoring data for which the normal planning and regulatory processes are not appropriate. Under the terms of the EER, a state may request EPA to exclude data showing exceedances or violations of the National Ambient Air Quality Standard (NAAQS) that are directly due to an exceptional event from use in determinations by demonstrating to EPA's satisfaction that such event caused a specific air pollution concentration at a particular air quality monitoring location.[2] Before EPA will exclude data from these regulatory determinations, the state must flag the data in EPA's AQS database and, after notice and an opportunity for public comment, submit a demonstration to justify the exclusion. After considering the weight of evidence provided, EPA will determine if the demonstration satisfies all the requirements of the EER and either concur or nonconcur with the state's request.

On June 30, 2009, the Arizona Department of Environmental Quality (ADEQ) submitted to EPA a preliminary demonstration for exceedances that occurred at various monitoring locations throughout Arizona on 27 separate days in 2008, including five at the West 43rd monitoring site located in southwestern Phoenix. On November 17, 2009 ADEQ submitted final demonstrations for twelve of these exceedances, including five at the West 43rd site.[3]

This document sets forth the legal and factual basis for EPA's decision regarding four exceedances of the 24-hour PM_{10} NAAQS in 2008 at the West 43rd monitoring site on March 14, April 30, May 21, and June 4, 2008 that ADEQ has flagged as "high wind" exceptional events.[4] EPA has not yet completed its analysis of the remaining dates and is not making a concurrence or non-concurrence determination for them at this time.

The documentation submitted by ADEQ and considered by EPA in support of the exceptional events claims includes the following:

- Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM_{10}) Concentration Events in the Phoenix Area on March 14, 2008 (March 14 Assessment);
- Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM_{10}) Concentration Events in the Phoenix Area on April 30, 2008 (April 30 Assessment);

[1] 72 FR 13560-13581, March 22, 2007.
[2] 40 CFR §50.14 (a).
[3] On March 17, 2010 EPA received a draft-supplemental report titled "Assessment of Qualification for Treatment Under the Federal Exceptional Events Rule: High Particulate (PM_{10}) Concentration Events in the Phoenix and Yuma Areas on June 4th, 2008." Information presented in this document will be considered in EPA's concurrence/non-concurrence decision for the claimed event that occurred on June 4, 2008. EPA has not received additional information concerning the other three events we are reviewing in this document.
[4] The West 43rd monitor also measured a fifth exceedance on November 9, 2008; EPA is not reviewing this event at this time.

ADEQ COMMENTS

- Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM_{10}) Concentration Events in the Phoenix Area on May 21, 2008 (May 21 Assessment);
- Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM_{10}) Concentration Events in the Phoenix Area on June 4, 2008 (June 4 Assessment);
- The Impact of Exceptional Events "Unusual Winds" on PM_{10} Concentrations in Arizona (Unusual Winds White Paper);
- High Wind Exceptional Events and Control Measures for PM_{10} Areas (Controls White Paper); and
- DRAFT – Supplemental Report: Assessment of Qualification for Treatment under the Federal Exceptional Events Rule: High Particulate (PM_{10}) Concentration Events in the Phoenix and Yuma Areas on June 4, 2008 (June 4 DSR).

2.0 Summary of the Events

In 2008, there were seventeen PM_{10} monitoring sites operating in Maricopa County, ten of which use continuous PM_{10} analyzers that produce hourly data. During 2008, the West 43rd monitoring site, which measures PM_{10} with a continuous analyzer,[5] measured five exceedances of the 24-hour PM_{10} NAAQS, four of which are reviewed in this document.[6] ADEQ has claimed that the exceedances at the West 43rd site resulted from the transport of dust from soils by high winds, the high wind event was a regional phenomenon that affected the entire Phoenix area, and the events were the result of the transport of dust and soils from high winds that suspended natural soils and soils from areas where BACM was in place.[7]

Table 1: West 43rd 2008 PM_{10} Exceedances

Date	PM_{10} (ug/m^3)	Weather Condition	Wind Direction
March 14	251	Low Pressure Trough	W
April 30	173	Frontal System Passage	WSW
May 21	279	Frontal System Passage	W
June 4	194	Frontal System Passage	WSW

3.0 Requirements of the Exceptional Events Rule

Pursuant to 40 CFR §50.14(c)(3)(iii) a request for EPA's concurrence on an exceptional event flag must be accompanied by a demonstration that:

(A) The event satisfies the criteria set forth in 40 CFR §50.1(j) that it:
1. affects air quality;
2. is not reasonably controllable or preventable;

[5] All of the continuous analyzers in Maricopa County, including the analyzer at West 43rd, are Thermo Scientific TEOM 1400AB analyzers with EPA FEM designation number EQPM-1090-079.
[6] EPA is not analyzing the exceedance on November 9, 2008 at this time.
[7] March 14, April 30, May 21, and June 4 Assessments at p.4.

ADEQ COMMENTS

1. The "Unusual Winds White Paper" and "Control Measures White Paper" were two developments submitted in November 2009 as an enhancement to earlier submittals. EPA never reviewed and provided feedback to ADEQ on these two important work products until the publication of the TSD. Earlier feedback would have allowed ADEQ to respond to, for example, the need to provide a seasonal breakdown of unusual winds.

2. The Supplemental Report developed for the June 4, 2008, event was anticipated to be a model for a re-engineered structure for all demonstrations. EPA never provided feedback on how the proposed restructuring improved the reviewability of the submittals.

3. In 2007 there were 35 events that caused 67 monitor measurements that were flagged by ADEQ. Documentation of these events was submitted to EPA on a timely basis. EPA has still not responded to these submittals.

4. The "Summary of Events" fails to acknowledge that the June 4 event also resulted in exceedances of the PM_{10} NAAQS at the Buckeye and Coyote Lakes monitors in Maricopa County and the Yuma monitor, which were flagged "RJ" for high winds, along with 5 monitors in California and one in Nevada that were also flagged "RJ" (see below). Thus, in total the regional high wind frontal system passage on June 4th contributed to a total of 10 exceedances that a variety of agencies have requested concurrence for "high wind" flags from EPA.

JUNE 4, 2008 MONITOR READING FLAGGED

The following are all the monitors in the AQS database that were flagged "RJ" (for high-wind) that have been requested for EPA concurrence which were caused by the regional high wind event that occurred on June 4th (See Attached AQS Report run on 3/15/2010):

1. AZ – 04-013-4009 – West 43rd Ave (1pm/10p)
2. AZ – 04-013-4011 – Buckeye (4pm/10p)
3. AZ – 04-013-4014 – Coyote Lakes (6pm/11p)
4. AZ – 04-027-0004 – Yuma (3pm/7pm)
5. CA – 06-065-1999 – Riverside Co (1pm/8pm)
6. CA – 06-065-2002 – Riverside Co (11am/6pm)
7. CA – 06-065-5001 – Riverside Co (11pm/7pm)
8. CA - 06-071-0306 – San Bernardino Co (3pm)
9. CA – 06-071-1234 – San Bernardino Co (12noon)
10. NV – 32-023-0014 – Nye Co (3pm)

5. The table in Section 2.0 includes a "Wind Direction." A corresponding entry can not be found in the data submitted by ADEQ. What is the source of the value? EPA's response should either rely on data provided by the submitting agency, or EPA should provide a reference to the data.

6. EPA contends that the regional event must be based on regional blowing dust. ADEQ refers to the elevated winds as the regional event. Whether dust is generated from a particular area is dependent on soil type, soil moisture, threshold friction velocity, wind direction and wind speed. In all the cases reviewed for West 43rd, natural soils from the alluvial plain were the source.

3. is caused by human activity that is unlikely to recur at a particular location, or is a natural event;
4. does not include stagnation of air masses or meteorological inversions, a meteorological event involving high temperatures or lack of precipitation, or pollution relating to source noncompliance;

(B) There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area;

(C) The event is associated with a measured concentration in excess of normal historical fluctuations, including background; and

(D) There would have been no exceedance or violation but for the event.

The demonstrations must fully meet all the above criteria to EPA's satisfaction; failure to meet any one of the criteria will result in the non-concurrence of the event in question.. In addition to the technical criteria, the EER also has procedural requirements. 40 CFR §50.14(c)(2)(iii) requires that data claimed to be due to an exceptional event must be flagged in the AQS database, and that an initial description of the event be provided to EPA; both must occur by July 1 of the year following the event. In addition, 40 CFR §50.14(c)(3)(i) requires that the State:

- submit a demonstration to EPA within three years of the calendar quarter of the event or 12 months prior to an EPA regulatory decision;
- provide notice and opportunity for public comment; and
- submit any public comments along with the demonstration.

EPA's concurrence or non-concurrence with a State's flag constitutes its agreement or disagreement with the State on whether the data should be excluded from regulatory decisions involving a State's compliance with the NAAQS. EPA's determination regarding a State's attainment status or action on a state SIP submission will be issued in a rulemaking which is a final agency action that is judicially reviewable under CAA section 307(b)(1).

The following sections evaluate ADEQ's assessments of March 14, April 30, May 21, and June 4, 2008 with respect to these requirements.

4.0 Criteria Set Forth in 40 CFR §50.1(j)

4.1 Affect Air Quality

As stated in the preamble to the EER, the event in question shall be considered to have affected air quality if it can be shown that there is a clear causal relationship between the monitored exceedance and the event (section 5.0), and that the event is associated with a measured concentration in excess of normal historical fluctuations (section 6.0).[8]

[8] 72 FR 13569, 72 FR 49051, and 73 FR 14702.

ADEQ COMMENTS

4.2 Reasonably Controllable or Preventable

A determination of whether a particular event was "not reasonably controllable or preventable" depends on the specific facts and circumstances surrounding the event. Therefore, EPA addresses this and the other criteria of the EER on a case by case basis.

This factor of the analysis should consider whether anthropogenic sources contributing to the exceedance caused by the event were reasonably controlled.[9] ADEQ's supporting documentation, however, did not specifically identify the type or location of the possible contributing sources in the area, other than the Salt and Gila River channels, located upwind of the West 43rd monitoring site.. Although the June 4 DSR identifies that the alluvial channels located upwind of the West 43rd monitor most likely significantly contributed to the exceedance at West 43rd site, ADEQ did not evaluate whether emissions from those sources were reasonably controllable or preventable.

The June 4 DSR included a table titled, "Rules Regulating Particulate Matter Emissions in Maricopa County," which includes the rule number, title, and a brief description of the general sources that the rule is designed to control. Without addressing the types, and locations of sources in the area, however, it is not possible to evaluate whether sources in the area were reasonably controlled.

4.3 Human Activity/Natural Event

The term "natural event" is defined at 40 CFR §50.1(k) as "an event in which human activity plays little or no direct causal role." As described in the preamble to the EER, high wind events may qualify as exceptional events if the following conditions are met: the wind speed associated with the event is "unusual for the affected area during the time of year that the event occurred," and, in instances where wind produces emissions from anthropogenic sources, all reasonable and appropriate measures must be in place for all contributing sources.[10] An event that was caused by human activity, but is unlikely to recur at a given location may be considered an exceptional event assuming all other requirements of the rule are met.

ADEQ's Assessments briefly discussed the various source categories in the area, including industrial sources, construction, area sources (unpaved parking lots and shoulders), roads, track out, and windblown dust. According to ADEQ, the windblown dust category includes significant contribution from the following sources: agriculture, alluvial channels, vacant lots, construction, industrial, disturbed areas, and stockpiles. In addition, EPA has identified, through satellite images and visits to the area, numerous anthropogenic sources in the area that could contribute to elevated PM_{10} concentrations. The commercial nature associated with many of these activities indicates that some portion of them can be reasonably expected to recur.

To establish that the exceedances at the West 43rd site may properly be classified as "natural events," the data must support a finding that "human activity plays little or no direct causal

[9] EER Preamble, 72 FR 13566, n. 11.
[10] EER Preamble, 72 FR 13566.

ADEQ COMMENTS

EPA's response in 4.2 fails to recognize two fundamental facts in the demonstration.

1. All controllable sources of PM_{10} in the area are subject to an EPA approved Serious Area SIP (MAG, 2000), including numerous Maricopa County rules as well as other local dust control measures. Millions of dollars have been invested by the stakeholders and local governments in implementation of these controls. A staff of inspectors and compliance personnel routinely monitors the operations of sources in the area. The fact that no significant finding of non-compliance was observed is a prima-facie demonstration that the PM emissions that caused the exceedance were not "Reasonably Controllable or Preventable."
2. For the June 4th event, NWS data showed that blowing dust was generated in Southern California and transported into Arizona. Areas prone to dust generation along the entire path of the frontal system passage experienced blowing dust, either transported into the area, or generated locally and added to the dust cloud. Regional blowing dust was not the only contribution to the elevated concentrations in the Phoenix area. The river beds of the Gila, Salt, Agua Fria Rivers and others are prime sources of fine dusts when winds are sufficiently high to entrain that material.

The Federal Register for the proposed approval of the San Joaquin area included approval of several exceptional events under the EER. EPA allowed San Joaquin to rely on existing measures in their control programs as adequate. Specifically, at 72 FR 49055, column 1, paragraph 1, EPA acknowledges the following:

72 FR 49055
"ii. Not Reasonably Controllable or Preventable
Section 50.1(j) requires that for an event to qualify as an exceptional event, whether natural or anthropogenic, a state must show that the event was not reasonably preventable or controllable. Here this requirement is met by demonstrating that despite reasonable and appropriate measures in place, the October 25, 2006 wind event caused the exceedances. During this event, there were no other unusual dust-producing activities occurring in the SJV and anthropogenic emissions were approximately constant before, during and after the event. In addition, the State showed that reasonable and appropriate measures were in place, including regulation VIII (the District's general fugitive dust rules) and Rule 4550 which limits fugitive dust emissions specifically from agricultural operations through Conservation Management Practices.47 Moreover, EPA has approved the District's BACM demonstration for all significant sources of PM–10 in the SJV as meeting CAA section 189(b)(1)(B).48"

Finally, the alluvial channel referred to throughout this document is a "natural" source of dust (dried river bottom) as opposed to an anthropogenic source.

role."[11] ADEQ's Assessments of the four exceedances did not analyze potential contribution from anthropogenic sources. The Controls White Paper states that because of "the relative complexity of the emitting source mix, parsing out a specific source or source category along with the applicable control measures for a determination of relative effectiveness can be difficult and may even be counter-productive." ADEQ's Assessments also stated that "no specific emission allocation is possible based on the data for analysis" and that "the primary source appears to be wind-blown dust over central Arizona for which there is not an effective or efficient method to estimate the relative contributions from specific sources."[12]

The lack of analysis regarding anthropogenic contribution upwind of the West 43rd site makes it difficult to determine the contributing role of human activity to the exceedances at the West 43rd site, particularly where it is known that commercial activities such as agriculture, sand and gravel mining and construction are known to take place.

EPA notes that the EER did not set a specific threshold to define a "high wind event,"[13] but suggested the use of a comparison of wind speeds measured on the event day to be compared to historical wind speed levels "for the season of the year that the event occurred."[14] The analysis that supports ADEQ's definition of "unusual" wind was based on data from 2005 through 2009 for the entire year period and was only analyzed for four monitoring sites (Buckeye, West 43rd, Durango Complex, and Higley). The use of a complete year of data in this situation rather than the season during which the events occurred likely biases the statistical analysis low. The Phoenix area experiences more consistent elevated wind speed levels associated with frontal passages during the months of March through June.

Conclusions drawn from this analysis suggest that wind speeds that occur less than 5% of the time should be considered "unusual" for exceptional events purposes. For the West 43rd monitoring station, this standard would correspond to sustained hourly wind speeds greater than 10 mph and wind gusts[15] greater than 20 mph. ADEQ's documentation did not provide any specific analysis pertaining to certain hours of the day and there is no discussion of the wind speeds that are associated with the event and their relationship to the 95th percentile. While wind speeds above the 95th percentile may seem unusual, the frequency of occurrence of hourly wind speeds over 10 mph at this site is approximately 100 days per year.[16]

The Unusual Winds White Paper further stated that "unusual winds can be defined as any wind that has the ability to create windblown dust." ADEQ's definition could be interpreted to treat all windblown PM_{10} as exceptional as long as the wind speeds are about the threshold friction velocity for that area. Threshold wind speeds provide a minimum baseline for wind speeds that are capable of producing windblown dust and are based on particle interaction on the ground surface, while "high" and "unusual" wind speed definitions should be based on a separate analysis. Thus, although this evidence may contribute to the exceptional analysis, it should not

[11] 40 CFR §50.1(k)
[12] March 14, April 30, May 21, and June 4 Assessments at p.4.
[13] EER Preamble 72 FR 13577.
[14] Id. at 13566.
[15] Wind gusts from Maricopa County stations are 1-sec maximum wind speed value for the hour.
[16] Based on data from 2007-2009.

ADEQ COMMENTS

EPA's response in 4.3 fails to recognize the history of the area under consideration for exceptional event review. Numerous State Implementation Plans, including the EPA approved Serious Area SIP (MAG, 2000) have been written to address the well known dust issues in and around the Phoenix Metro area. There are three basic premises that EPA ignores when it comes to the control measures required by these SIPs.

1. No control measure has an unfailing degree of control
2. Exceptional events can override the best controls
3. Exceptional events are not a reliable determinant of control efficacy

In the case of controls that could have been overwhelmed by the exceptional nature of the event or where it can be shown that *on average* the control measures have a high degree of control, save the exceptional nature of the event, ADEQ is asking that the event be disregarded as a violation of the NAAQS.

EPA's statement that the "frequency of occurrence of hourly wind speeds over 10 mph at this site is approximately 100 days per year" implies that ADEQ would perhaps wish to treat those days as exceptional as well. For EPA to allude that ADEQ is trying to make that claim is false. ADEQ stated in the Unusual Winds White Paper that "literature and data from monitors indicate that the phenomenon of blowing dust can occur over a broad range, but generally is associated with hourly averaged wind speeds that are above 10 mph, which are commonly associated with wind gusts above 20 mph". Contrary to EPA's implication, ADEQ does not assert that any day experiencing an hourly average wind speed greater than 10 mph should be considered exceptional in nature.

EPA's statement that ADEQ only performed the analysis for four monitors is fundamentally irrelevant, since the center piece of the analysis was the West 43rd monitor, which was the only monitor being examined by EPA in the TSD.

Hourly average wind speeds over 10 mph do not alone create exceptional windblown dust events. In fact, it has been shown that wind gusts, and not hourly average wind speeds, are more influential in the creation of windblown dust. For this reason, ADEQ analyzes maximum wind gusts in all exceptional event demonstrations (see WRAP Fugitive Dust Handbook, page 1-7).

ADEQ asserts that windblown dust typically occurs only when hourly average winds are at least 10 mph and gusts are at least 20 mph. That isn't to say that any wind of 10mph or gust of 20 mph is "exceptional" or would create blowing dust. The 10 and 20 mph values are given as estimates for when winds may be considered "unusual", and this is backed up by the fact that the NWS typically does not report wind gusts unless they are greater than 15 mph. As EPA has not provided a threshold value for wind speed that they would consider "unusual," ADEQ used available data to estimate the wind speed at which 5% or less of all values would fall. As was pointed out in the discussion of this issue is found in comments facing Page 2 of the TSD, EPA used a reference to the 5% when approving the SJV submittals.

EPA cites the Federal Register discussion that winds should be compared to historical wind speed levels "for the season of the year that the event occurs." EPA goes on to suggest that March through June should be the benchmark of comparison. March through June is not a "season". Meteorological Seasons are defined by the National Weather Service as Winter (December, January, February), Spring (March, April, May), Summer (June, July, August), and Autumn (September, October, November). Using the argument of "similarity", EPA could arbitrarily ask ADEQ to include October into the Spring "season" as easily as June.

be a major deciding factor when determining whether wind speed associated with an exceptional event is "unusual."

In summary, considering the limited analysis on the elevated wind speeds associated with the event combined with little analysis of possible contributing sources located directly upwind of the West 43rd site, EPA has determined that ADEQ's documentation did not provide sufficient evidence to support that the events in question should be considered "natural events" as required under the EER.

4.4 Stagnation of Air Masses/Inversions/High Temperature/Lack of Precipitation/Source Noncompliance

ADEQ did not provide any evidence suggesting that the exceedances at the West 43rd monitoring site were the direct result of stagnation of air masses, inversions, high temperature, or lack of precipitation. Regarding source noncompliance, ADEQ states that, "no local sources were reported as significantly contributing to the air quality episode" for all days except June 4. This statement assumes that because there were no observations made (i.e. there were no reported civilian complaints or enforcement actions), that all sources in the area were in compliance with all applicable fugitive dust control measures.

The June 4 assessment explained that there were two Notice of Violations (NOV) issued on June 4 and June 5 for noncompliance with Maricopa County's (MCAQD) fugitive dust rules. The June 4 DSR also states that "one complaint based inspection of a dust control permit on June 4... resulted in a Notice of Violation (NOV) for track-out under Rule 310" and on June 5 "an inspection of a Rule 316 source resulted in the issuance of a notice of violation for failure to install a wheel washer." Both of the NOVs were issued to sources that are located within a two mile radius of the West 43rd monitoring site, but the specific locations of these facilities were not identified in the June 4 assessment or DSR. The NOVs provide some evidence that nearby sources may not have been reasonably controlled during the time of the event.

5.0 Clear Causal Relationship

In order for EPA to concur with an exceptional event request, the EER requires the State to demonstrate that there is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected air quality in the area. 40 CFR §50.14(a)(2); 40 CFR §50.14(c)(3)(iii). To address this element for "high wind events," such as those flagged by Arizona, the state should reasonably consider the relationship between an event, the PM_{10} emissions caused by unusually high winds, and a measured exceedance at a monitoring site. Arizona's Assessments included various data points relevant to this analysis. EPA's technical review also considered additional data regarding wind speed and direction, PM_{10} concentration, and visibility.[17]

As a preliminary matter relevant to this issue, EPA notes that ADEQ's limited analysis of the potential sources that might have contributed to the exceedances at the West 43rd site (sections

[17] Appendix A contains pollution roses based on % total PM_{10} mass for all four of the events in question.

ADEQ COMMENTS

EPA Failure To Focus On Wind Gusts vs Average Winds

EPA participated in and assisted in funding work of the Western Regional Air Partnership (WRAP). The WRAP Fugitive Dust Handbook was a collaborative work product on dust sources, modeling, and controls. On page 1-7, the document states:

> "**Wind Gusts**. Although mean atmospheric wind speeds may not be sufficient to initiate wind erosion from a particular "limited-reservoir" surface, wind gusts may quickly deplete a substantial portion of its erosion potential. ... For this reason, the use of an average wind speed to calculate an average emission rate is inappropriate."

EPA Comments on Stagnation Are Not Relevent

Regarding "stagnation", by definition, a high-wind event can not be a stagnation event. There should be no need to argue that stagnation was not occurring when the winds are substantially over 20 mph.

EPA Misrepresentation of Evidence of Controls In Place and Inspections

In section 4.4 EPA notes two minor violations reported within two miles of the West 43rd monitor within the time period encompassing 72 hours prior to and 72 hours following the event. About these NOVs, ADEQ asserts the following:

1. The data show that inspectors were out in the field actively looking for dust control issues and only noted the two minor violations.
2. Based on ADEQ's experience, the two minor violations listed would not have been sufficient to significantly contribute to the concentrations of dust reported during the June 4th event.
3. Based on the review of all available data, it seems justifiable to conclude that BACM were in place and being used on all other controllable sources near the West 43rd site during the June 4th event.
4. Any contributions from those controlled sources upwind of the monitor were due to BACM being overwhelmed.

As previously stated, no control measure has an unfailing degree of control and Exceptional Events can override the best controls. ADEQ must again assert that the event be disregarded as a violation of the NAAQS in the case of controls that were overwhelmed by the exceptional nature of the event or where it has been shown that *on average* the control measures have a high degree of control save the exceptional nature of the event.

4.2 and 4.3) makes it difficult to comprehensively evaluate the causal relationship between the event and the exceedance. Another general point concerns the data provided by Arizona for each event. EPA notes that, for each of the four events reviewed in this document, Arizona provided different sets of PM_{10} data drawn from among the ten monitoring stations using continuous analyzers. EPA also notes that Arizona provided a different set of meteorological data for each event. Considering the four events discussed in this document are very similar in nature, it is unclear why ADEQ did not provide the same data for each event. In some instances the most relevant meteorological data, (those data from the closest or upwind locations) are not included in the supporting documentation.[18]

5.1 March 14, 2008

5.1.1 Correlation between Wind Speed and PM_{10}

The March 14 Assessment included tabular hourly and maximum wind speed and PM_{10} data for five monitoring sites in the Phoenix area: West 43rd, Durango Complex, West Phoenix, Coyote Lakes, and Central Phoenix. ADEQ also included meteorological data from three National Weather Service (NWS) stations: Goodyear Airport, Glendale Airport, and Phoenix Sky Harbor.[19] EPA notes that ADEQ did not provide hourly PM_{10} data from the other four continuous PM_{10} analyzers in the Phoenix area and did not include wind speed and direction data from numerous other meteorological stations in the Phoenix area.

ADEQ also provided four graphs that show the potential correlation between maximum wind speeds and PM_{10} concentrations at the West 43rd, Durango Complex, Greenwood, and South Phoenix monitoring sites. [20] The graphs show that hourly PM_{10} concentrations increase with an increase in maximum recorded wind speed at the West 43rd site, but not at the other three monitoring sites. In fact, the graphs show that the maximum wind speeds at the Durango Complex site were higher than those measured at the West 43rd site, but the Durango Complex site experienced significantly lower PM_{10} values during periods of elevated wind speed. These data suggest that the elevated PM_{10} concentrations at the West 43rd site may have been caused by local upwind sources and were not due to a high wind event that was regional in nature.

5.1.2 Visibility

The March 14, Assessment included photographs from numerous locations throughout the Phoenix area. Unfortunately, there is not a significant discernable difference between the conditions preceding and during the event. Therefore, the photographs do not significantly

[18] Table 1 in Appendix A identifies the PM_{10} and meteorological stations ADEQ used in their analysis of the 2008 exceptional events in question.

[19] ADEQ also included meteorological data from two AZMET stations. These data are collected at 3 meters, while NWS and Maricopa County data are collected at 10 meters. There does not seem to be any correction or adjustment for the difference in the heights of these stations.

[20] The max wind speed values used in this comparison are the instantaneous max wind speed values recorded by onsite data loggers, which have the capability of recording these instantaneous values in a fraction of a second. ADEQ does not explain why the use of the maximum 1-sec value for an hour is the appropriate measure for comparison to hourly average PM_{10} values.

ADEQ COMMENTS

EPA asserts in Section 5.1.2 that "there is not a significant discernable difference between the conditions preceding and during the event." However, ADEQ strongly believes that the White Tank Mountain images included with the March 14, 2008, event submittal clearly show that this is not true. (Images from Figure 1 of the 3/14/08 demo):

Before the Event – 10:45am

During the Event – 1:45pm

After the Event Began to Subside – 2:45pm

The timing of reduced visibility in the images corresponds to the onset of elevated winds and PM_{10} concentrations. For EPA to state that there is no discernable difference in the conditions preceding and during the event in the images may be an indication that they did not fully review the submitted materials and/or did not consider the full weight of evidence presented to them. ADEQ contends that exceptional events do not need to rise to the intensity of haboobs (dust clouds of biblical proportions.)

Regarding footnote 20, EPA continues to fail to acknowledge that wind gusts provide the energy to suspend dusts more than the hourly average wind speeds.

contribute to establishing a causal relationship between wind speed, potential contributing sources, and PM_{10} concentrations at the West 43rd site.

The March 14 Assessement also stated that reduced visibility during the event throughout portions of the Phoenix provides further evidence of a clear causal relationship between the high wind event and the measured exceedance at the West 43rd site. The visibility at Goodyear Airport before the event ranged from 60 to 20 statute miles, while during the time of the elevated PM_{10} concentrations at West 43rd the visibility ranged from 15 to 10 miles. Other NWS stations in the area did not record any decrease in visibility throughout the entire day: visibility at Glendale Airport remained at 20 miles, Sky Harbor remained at 10 miles, and Luke Air Force Base remained at 10 miles. Visibility throughout the day in the Phoenix area was never significantly reduced; thus, this information does not significantly contribute to establishing a clear causal relationship.[21]

5.1.3 Review of 24-Hour PM_{10} Data

The 24-hour PM_{10} concentrations measured on March 14 at the West 43rd and surrounding sites are listed in Table 2 and shown in Figure 1. On this day, the West 43rd site was the only site in the Phoenix area to exceed the 24-hour PM_{10} standard. Furthermore, PM_{10} concentrations at the West 43rd site were 2-3 times higher than those measured at other sites, which is generally inconsistent with the notion that a regional high wind event caused the exceedance.[22]

Table 2: March 14, 2008 24-Hour PM_{10}

Site Name	PM_{10} (ug/m3)	Site Name	PM_{10} (ug/m3)
Buckeye[23]	80	West PHX	57
West 43rd	251	Central PHX	69
Durango Complex	92	JLG Supersite	41
South PHX	120	Higley	54
Greenwood	71	Coyote Lakes	48

[21] Appendix B contains information pertaining to reduced visibility and dust storms in Arizona.
[22] The only other exceedance recorded in Arizona on March 14, 2008, was the Cowtown monitoring site in Pinal County, which was not flagged as an exceptional event.
[23] 24-hour PM_{10} data for this site was not included in Arizona's Assessment.

ADEQ COMMENTS

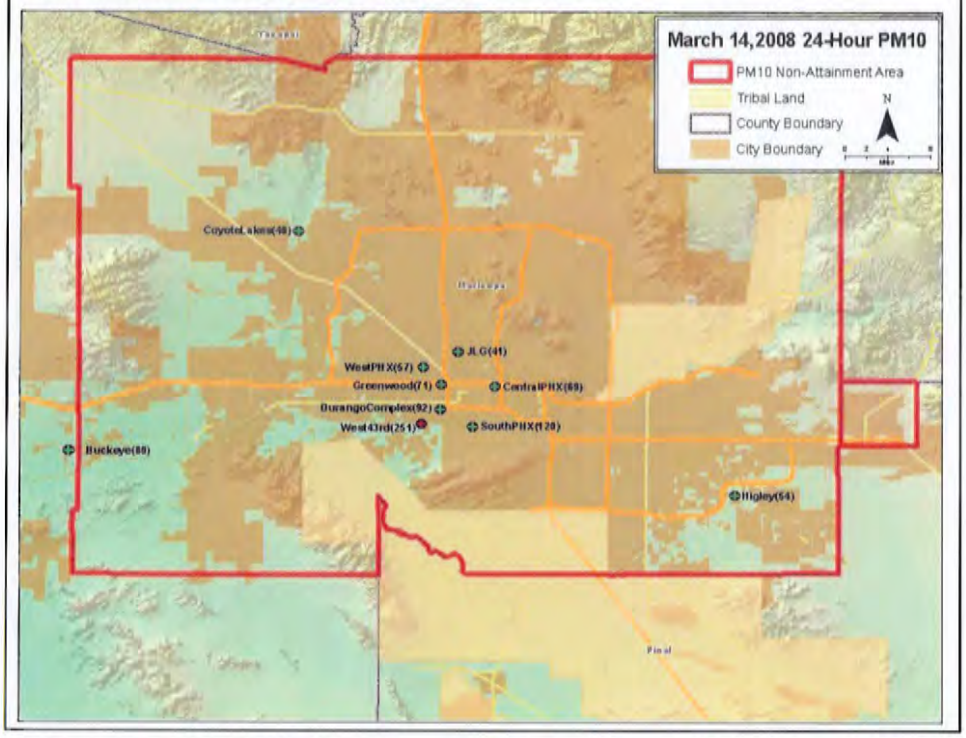
EPA's citation of visual range data from airports is out of context and demonstrates a lack of understanding of airport operations requirements for standard visual range. Many transmissometers used at airports are capped to read a maximum visual range substantially below the true visual range. It is common to see 10 miles as a maximum. This is because airport operational procedures are not impacted until the visual range is lower (i.e., 7 miles). The visibility impacts referred to in the ADEQ demonstrations are based on images from a visibility camera network operated by Air Resource Specialists, the primary contractor for visibility measurement systems in the U.S.

In order to utilize airport visual range as a surrogate for PM concentration, extinction efficiency models can be relied upon. The IMPROVE extinction efficiencies can be used to convert standard visual range to an estimate of PM concentration (i.e. assuming a 90% coarse, 10% fine soil split) as follows:

- 9 miles = 406 $\mu g/m^3$,
- 7 miles = 527 $\mu g/m^3$,
- 5 miles = 744 $\mu g/m^3$,
- 3 miles = 1,250 $\mu g/m^3$,
- 1 mile = 3,781 $\mu g/m^3$, and
- 0.5 miles = 7,577 $\mu g/m^3$.

ADEQ does not rely on these converted PM estimates for standard visual ranges exceeding 10 miles, because the data reported from many airport transmissometers is capped at 10 miles.

Figure 1: March 14, 2008 24-Hour PM_{10}



5.1.4 Review of Hourly PM_{10} and Meteorological Data

The hourly PM_{10} data are shown in Figure 2. As early at 0500 hrs, the West 43rd site began to experience an increase in PM_{10} concentration that was not characteristic of the other nine monitoring sites in the Phoenix area. From 0500 to 1000 hrs, the hourly PM_{10} values increased from 150 $\mu g/m^3$ to 360 $\mu g/m^3$. During these hours the hourly wind speeds throughout the Phoenix area remained below 9 mph, which suggests these elevated concentrations were not driven by high wind, but by some other mechanism. Thus, the elevated PM_{10} during these hours do not appear to have been caused by elevated wind conditions.

The first sign of any elevated winds occurred at the majority of the stations around 1100 hrs. NWS data for Goodyear Airport showed an increase in wind speed from 6 to 14 mph (accompanied by a 29 mph gust); while an increase in hourly wind speed from 12 to 15.9 mph was recorded at the West 43rd site. At 1100 hrs, the PM_{10} concentration at the West 43rd site also rose from 355 to 1051 $\mu g/m^3$ and continued to increase over the next two hours to a maximum hourly concentration of 1286 $\mu g/m^3$. While the values at some of the other sites in the area increased over the same time period, the values at the West 43rd site ranged from 3-20 times higher than other sites in the Phoenix area. Given that the Durango Complex, South Phoenix,

ADEQ COMMENTS

In Section 5.1.4 EPA mentions concerns regarding the timing of elevated winds and elevated PM_{10} concentrations at the West 43rd Ave. monitor. There are three issues to note about the winds reported during the March 14, 2008, event.

1. Glendale airport did report elevated hourly average winds greater than 15 mph with gusts of 23 mph beginning as early as the 9:00 hour (10:00 report)
   (See graphs below from Fig. 1 of the 3/14/2008 demo)
2. Unfortunately there were no data collected at the NWS Glendale station prior to their 10:00 report, and thus, it cannot be determined if those winds were occurring even earlier in the morning at that site, though it is a possibility.
3. The timing of elevated winds beginning during the 9:00 hour at NWS Glendale coincides with the increase in the PM_{10} readings from188 $\mu g/m^3$ to 329 $\mu g/m^3$, and eventually as high as 1286 $\mu g/m^3$ during the peak wind gusts of 30 to 40 mph reported at various weather stations.

It is important for the EPA to realize that wind speeds are not homogeneous across a landscape and the timing of elevated winds and elevated PM_{10} levels may not always be identical, especially when looking at NWS stations located distances of 13 miles or greater from the West 43rd particulate monitor. Additionally, slight variations in terrain and in urban build-up around NWS sites or monitors may also have an impact on timing due to funneling winds or shielding certain areas from winds given only slight variations in direction.

Even if the 188 $\mu g/m^3$ reading is not excluded, the exclusion of the readings recorded from the 10:00 a.m. report to the 3:00 p.m. report, all of which occurred during a period of strong and gusty winds, would bring the 24-hour PM_{10} concentrations well below the NAAQS. As the winds began to subside, PM10 concentrations also decreased, further demonstrating a causal relationship between the two.

NWS-Goodyear Airport

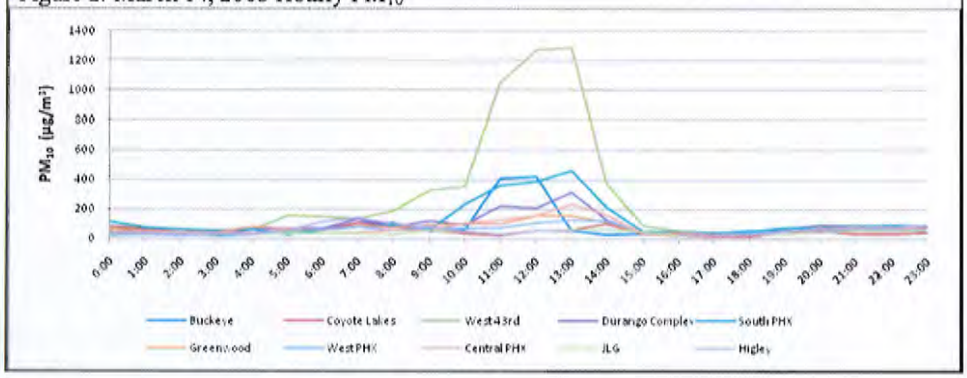
Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	0	0		0	0	N/A
2	0	0		0	0	N/A
3	0	0		0	0	N/A
4	0	0		0	0	N/A
5	0	0		0	0	N/A
6	0	0		0	0	N/A
7	0	0		0	0	N/A
8	61	60		9	9	W
9	66	40		9	9	SW
10	70	30		7	7	W
11	73	20		6	6	SW
12	82	15		14	29	W
1	86	10		18	34	W
2	86	15		25	43	W
3	84	20		14	23	W
4	84	20		17	17	SW
5	82	40		17	17	SW
6	81	40		11	11	W
7	75	40		6	6	*VR
8	0	0		0	0	N/A
9	70	20		11	11	SW
10	0	0		0	0	N/A
11	0	0		0	0	N/A
12	0	0		0	0	N/A

NWS-Glendale Airport

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	0	0		0	0	N/A
2	0	0		0	0	N/A
3	0	0		0	0	N/A
4	0	0		0	0	N/A
5	0	0		0	0	N/A
6	0	0		0	0	N/A
7	0	0		0	0	N/A
8	0	0		0	0	N/A
9	0	0		0	0	N/A
10	70	20		15	23	SW
11	73	20		16	23	SW
12	79	20		18	23	W
1	81	20		20	26	W
2	82	20		21	26	W
3	82	20		20	25	W
4	81	20		14	23	SW
5	82	20		11	21	W
6	81	20		11	11	SW
7	75	20		5	5	W
8	0	0		0	0	N/A
9	0	0		0	0	N/A
10	0	0		0	0	N/A
11	0	0		0	0	N/A
12	0	0		0	0	N/A

Greenwood, and West Phoenix sites are located within approximately five miles of the West 43rd site, one would expect to see greater consistency in the PM_{10} concentrations if a regional high wind event was occurring. It is also worth noting that the West 43rd site came close to reaching the peak concentration seen by other nearby sites well before the arrival of elevated wind speeds. The closest site, Durango Complex, reached a maximum concentration of 310 $\mu g/m^3$ at 1300 hrs, while West 43rd exceeded this level at 0900 hrs. The inconsistency in the PM_{10} concentrations during the period from 1100 to 1400 hrs and the relatively low wind speeds in the morning hours suggest that the West 43rd site was most likely significantly influenced by local upwind sources and the claimed exceptional event was not regional in nature.

Figure 2: March 14, 2008 Hourly PM_{10}



5.1.5 Review of 5-Min PM_{10} and Wind Speed Data

The 5-min data reinforce the fact that even though elevated wind speeds were measured at other nearby locations, the West 43rd monitor consistently measured much higher PM_{10} concentrations than other locations. Figure 3 shows the 5- min PM_{10} and wind speed data from West 43rd and Durango Complex monitoring sites. These monitors are located only 2 miles apart, yet there seems to be a considerable difference in the relationship between PM_{10} and wind speed on March 14. Both sites experience similar wind speed levels, but during some periods of the day the 5-min PM_{10} concentrations at the West 43rd site were more than five times those measured at Durango Complex. These data provide further evidence that the claimed regional high wind event only affected PM_{10} concentrations at the West 43rd site and the elevated PM_{10} concentrations measured at this site were most likely significantly influenced by local sources and the claimed exceptional event was not regional in nature.

ADEQ COMMENTS

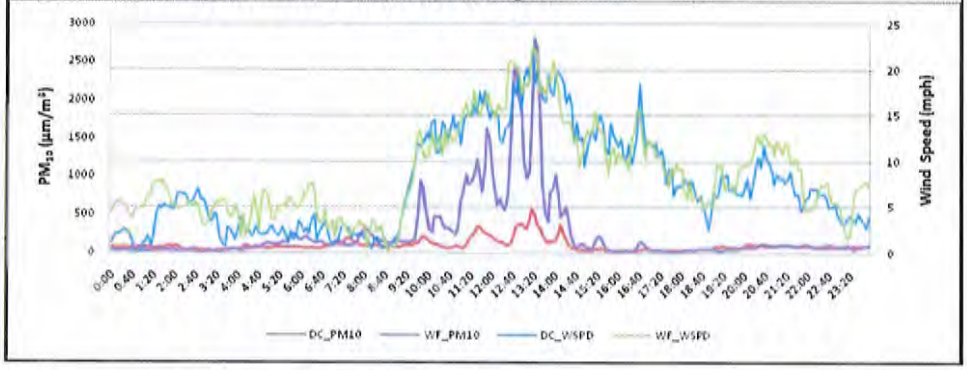
For the March 14th event, if the source of the PM was in the river channel, the concentration profile would look like that presented in Figure 2. Note the concentrations of Durango Complex and South Phoenix are approximately even. A Gaussian plume centered in the river channel would have this shape of distribution.

In footnote 24 on the next page, EPA erroneously implies that there is a fundamental difference between the maximum wind speed measured by the Maricopa County data logger, and the value from a National Weather Service observation. This is fundamentally wrong. The exact wording from the Federal Meteorological Handbook No. 1 (September 2005) Page 5-1 & Page 5-2 is:

> "**5.4.4 Wind Gust.** The wind speed data for the most recent 10 minutes shall be examined to evaluate the occurrence of gusts. Gusts are indicated by rapid fluctuations in wind speed with a variation of 10 knots or more between peaks and lulls. The speed of a gust shall be the **maximum instantaneous wind speed**." (emphasis added)
>
> "**5.5.4 Wind Gust.** When a gust is detected within 10 minutes of the actual time of the observation, the **maximum instantaneous speed** shall be reported (see paragraph 12.6.5.a)." (emphasis added)

Thus EPA's assertion that wind gusts are reported as 5-second average is incorrect. NWS reported gusts and maximum winds from a data logger are comparable measures.

Figure 3: March 14, 2008 5-Min PM_{10} and Wind Speed



5.1.6 Days with Similar Meteorological Conditions

The following discussion emphasizes that meteorological conditions in upwind locations do not always affect on PM_{10} concentrations at the West 43rd site. The NWS station at Goodyear Airport is located approximately 13 miles to the west of the West 43rd monitoring site and serves as the closest location with readily available meteorological data for the area directly to the west of the West 43rd monitoring site.[24]

Wind speeds at Goodyear Airport exceeded 15 mph on ten days in March 2008. On six of those days, wind gusts exceeded 25 mph. Despite these facts, March 14 was the only day in the month of March that measured an exceedance of the 24-hour PM_{10} NAAQS. The following analysis compares hourly PM_{10} data, wind speed, and wind gusts recorded at Goodyear Airport on March 14 with the same data for three days in March with similar meteorological conditions.

On March 14, the West 43rd monitor measured elevated PM_{10} concentrations of 1051 $\mu g/m^3$ and 1270 $\mu g/m^3$ at 1100 and 1200 hrs, respectively. Wind speeds at Goodyear Airport during this period were from the west (260°) at 14 and 18 mph with gusts of 29 and 34 mph. On March 2, the Goodyear station measured wind speeds and gusts of equal or higher magnitude: 23 mph with 34 mph gusts from the NW (310°-320°) for two consecutive hours. Elevated wind speeds on March 2 corresponded to an increase in PM_{10} from 29 $\mu g/m^3$ to 177 $\mu g/m^3$ at the West 43rd monitoring site. This increase in PM_{10} is relatively minor compared to PM_{10} concentrations on measured on March 14, which reached at maximum of 1270 $\mu g/m^3$.

[24] NWS stations report meteorological data differently than meteorological stations operated by Maricopa County. NWS service stations report wind speeds as a 2-min average and wind gusts are defined as "a rapid fluctuation of wind speed with variations of 10 knots or more between peaks and lulls," which are reported as a 5-sec average. Maricopa County meteorological stations have the capability of reporting wind speeds as a 5-min average, an hourly average, or a maximum wind speed, which is recorded as an instantaneous reading that can be less than one second in duration.

ADEQ COMMENTS

EPA inappropriate use of vector average wind speed data (Figure 3)
EPA'S Meteorological Monitoring Guidance for Regulatory Modeling Applications recommends that scalar wind speeds be used for modeling applications (see 6.9 Recommendations). EPA's reliance on a graph with 5-minute vector average wind speed significantly understates the kinetic energy of the wind involved in the dust generating process. ADEQ did not provide or rely on the data presented in Figure 3. The maximum 5-minute average wind speed reported in the 1:00 p.m. time period was approximately 21 mph, while the maximum wind gust during the hour was measured at 36 mph. At 36 mph, the air would have 3 times the kinetic energy that would be present at 21 mph. It also occurs less than 0.4 percent of the time (greater that the 99.5 percentile). See supplemental comment on use of wind gusts vs average wind speeds.

EPA failed to acknowledge the relevant data that was presented by ADEQ
The data presented by ADEQ consisted of the following (Figure 1 of the 3/14/08 demo):

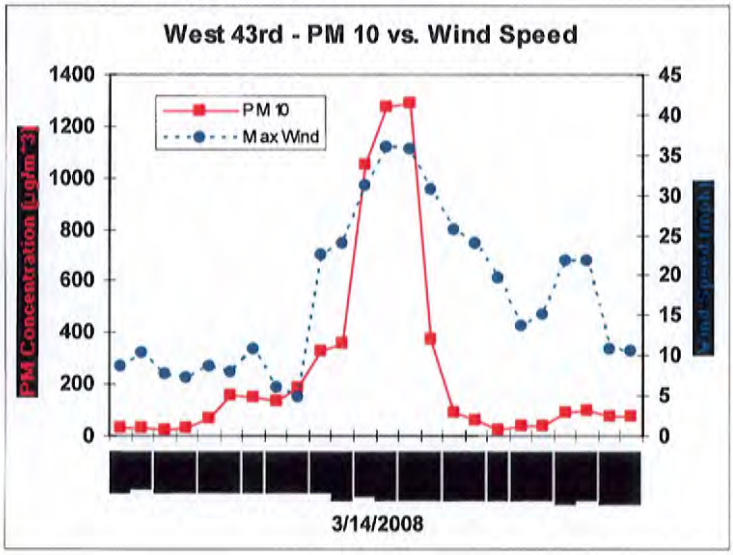
Wind and PM table:

16659 (112.14Wx33.41N)

MC - WEST FORTY THIR

	Hr	T(F)		PM	Spd	Max	Dir
MC - WEST FORTY THIR	1	69		26	5	9	SW
	2	68		28	6	10	SW
	3	66		22	5	8	W
	4	64		28	5	7	SW
	5	58		64	3	9	NE
	6	57		154	5	8	E
	7	57		145	4	11	E
	8	59		133	2	6	E
	9	64		187	2	5	NE
	10	73		328	7	23	W
	11	77		355	12	24	W
	12	79		1051	16	31	W
	1	82		1270	18	36	W
	2	83		1286	19	36	W
	3	84		374	14	31	W
	4	84		87	12	26	W
	5	83		57	12	24	W
	6	81		23	10	20	W
	7	77		37	6	14	W
	8	75		40	8	15	SW
	9	74		86	11	22	SW
	10	72		93	10	22	SW
	11	67		73	6	11	W
	12	66		72	5	11	SW

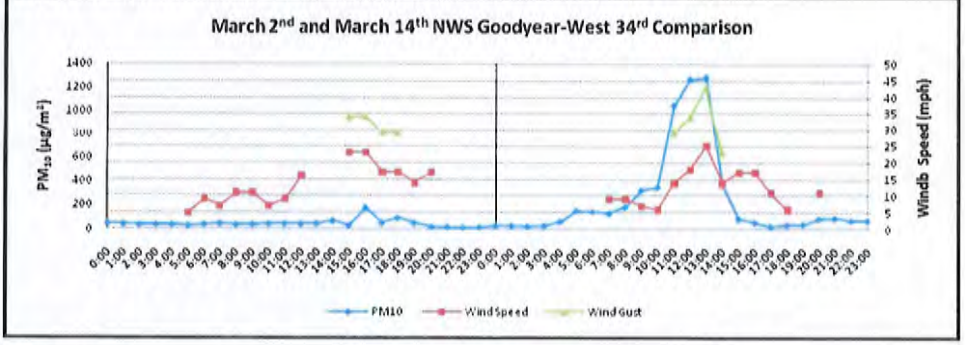
Graph of Concentration:



12:45 South Mountain:
Dust blocking Estrella Range
(Right edge of screen)

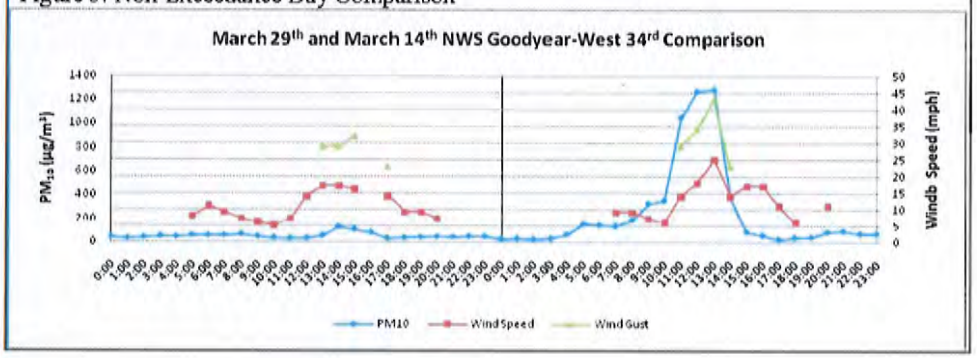
12:45pm Estrella Mountain
Dust in river channel blocking Foreground of Estrella Mtn.
(dust heavier closer to bottom)

Figure 4: Non-Exceedance Day Comparison



Similarly, on March 29, wind speeds of 16 to 17 mph with wind gusts of 29 to 32 mph from the SSW (200°) and the WSW (240°) were recorded at Goodyear Airport for a period of three hours. The corresponding PM_{10} concentrations at West 43rd remained below 130 $\mu g/m^3$ for the entire day. On the following day, March 30, wind speeds of 25 to 29 mph from the SW (230°-240°) were recorded at Goodyear, which corresponded to a spike in PM_{10} concentration at the West 43rd site. There are, however, significant differences between the spike measured on March 30 and the one measured on March 14 and flagged as an exceptional event. First, the spike on March 30 clearly follows a period of elevated wind speed while the spike measured on March 14 was coincident with or even precedes the elevated wind. In addition, the PM_{10} spike on March 30 was shorter in duration and much smaller in magnitude.

Figure 5: Non-Exceedance Day Comparison



ADEQ COMMENTS

EPA Failure to Consider Wind Direction (EPA TSD Pages 14-15):

In the arguments presented that the wind speeds on other days were similar to March 14th, EPA fails to recognize the most important parameter used in characterizing pollution concentration from a source, i.e. wind direction. The geometry of the source-receptor relationship is the overwhelming consideration when computing ambient concentrations. The other factors, given a fixed source strength, are wind speed and turbulence. EPA failed to consider this primary factor in their argument.

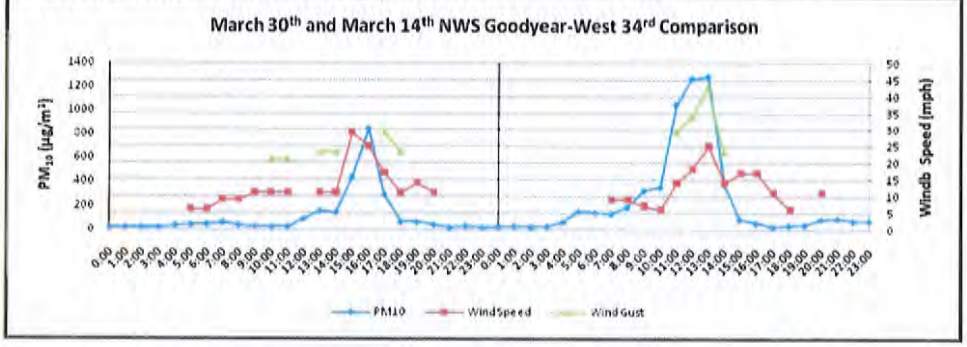
The comparison of March 14 to March 2 is not a valid one given the disparity in wind direction and duration. ADEQ has suggested that the most prevalent potential source for PM_{10} at the West 43rd monitor is the Salt River channel, which has the greatest fetch to the west and southwest of the monitor location. There are two main issues with using March 2, 2008, for comparison.

1. Winds on March 2nd were out of the northwest. While the Salt River channel does run past the north side of the West 43rd monitor, the fetch over which northwesterly winds can draw from it as a potential PM source is much more limited than when westerly or southwesterly winds are occurring.
2. Winds on March 2nd included gusts of 23 mph and 34 mph lasting for only two hours. Winds on March 14th gusted over 23 mph for four consecutive hours at the NWS Goodyear station and gusted over 23 mph for up to 7 consecutive hours at other proximal NWS stations (Glendale and Sky Harbor).

As can be seen above, the comparison of March 14, 2008, to March 2, 2008, by EPA provides little or no support for EPA's claims. ADEQ has stated that the emissions from the river channel are the primary contributor to the West 43rd monitor readings. EPA's identification of a day with similar wind speeds, but different wind direction that did not experience elevated particulate matter concentration is consistent with ADEQ's proposed explanation of the elevated particulate matter concentrations.

EPA attempts to compare winds from March 29th and March 30th to the winds of the March 14th event, and while the wind directions are comparable to the March 14th event, the wind gusts were significantly lower and shorter in duration on March 29-30 than were reported on March 14th. For these reasons, each comparison provides little or no support to EPA's claims. It also should be noted that while wind speeds recorded by the NWS upwind of a monitor may be important in showing potential transport, winds measured at the monitor itself are also important, especially if local sources, both controllable and uncontrollable, may be potentially contributing a portion of the measured PM_{10}.

Figure 6: Non-Exceedance Day Comparison



These examples illustrate how elevated wind speeds in upwind areas are related to elevated PM_{10} concentrations on occasion, but the magnitude of PM_{10} concentrations measured at the West 43rd site seem to be associated with factors in addition to wind speed. Also, March 2, March 29, and March 30 were weekend days, which also indicates that elevated wind speeds are not necessarily the primary factor in creating elevated PM_{10} concentrations at the West 43rd site.

5.1.7 Summary of Clear Causal Relationship for March 14, 2008

ADEQ's conclusions that the recorded exceedance was caused by a regional high wind event are not substantiated by relevant monitoring and meteorological data. The data show that the spatial extent of PM_{10} during this day was isolated and not regional in nature. The data also show differences in the measured PM_{10} concentrations at the West 43rd site and the remaining sites in the Phoenix area. In addition, as explained above, ADEQ provided only limited analysis of possible contribution from human activity, making it difficult to determine the relationship between the claimed event and the exceedance. Therefore, EPA has determined that the weight of evidence presented in the March 14 Assessment does not demonstrate a clear causal relationship as required by the EER.

5.2 April 30, 2008

5.2.1 Correlation between Wind Speed and PM_{10}

The April 30 Assessment included hourly and maximum wind speed and PM_{10} data for five sites in the Phoenix area: West 43rd, Durango Complex, South Phoenix, Central Phoenix, and Higley. ADEQ also included meteorological data from the NWS Sky Harbor and Deer Valley stations.[25] ADEQ did not provide tabular hourly PM_{10} data from the other four continuous PM_{10} analyzers in the Phoenix area and did not include wind speed and direction data from numerous other meteorological stations in the Phoenix area. The assessment also did not include any information discussing the 7 filter-based monitoring sites that collected samples on this day.

[25] ADEQ also includes meteorological data from two AZMET stations. These data are collected at 3 m while NWS and Maricopa County data are collected at 10 m. There does not seem to be any correction or adjustment for the collection heights of these stations, and therefore should not be used in the exceptional events analysis.

ADEQ COMMENTS

Refer to Appendix A for more information on the PM_{10} and meteorological data used in the April 30 assessment.

ADEQ also provided four graphs that show the potential correlation between maximum wind speeds and PM_{10} concentrations. The four graphs display data from the West 43rd, Durango Complex, Greenwood, and South Phoenix monitoring sites. While the hourly PM_{10} concentrations increase with an increase in maximum recorded wind speeds at the West 43rd site, there is not a similar correlation between PM_{10} and maximum wind speed at the other monitoring sites in the area. These facts suggest that the elevated PM_{10} concentrations at West 43rd may have been caused by local upwind sources and were not regional in nature.

5.2.2 Visibility

The April 30 assessment included photographs from numerous locations throughout the Phoenix area. Unfortunately, there is not a significant discernable difference between the conditions preceding and during the event. Therefore, the photographs do not significantly contribute to establishing a clear causal relationship between wind speed, potential contributing sources, and PM_{10} concentrations at the West 43rd monitoring site.

ADEQ also stated that reduced visibility during the event at Goodyear Airport provides further evidence of a causal relationship between the high wind event and the measured exceedance at the West 43rd site. The visibility at Goodyear Airport before and during the event ranged from 20 to 7 statute miles. Other NWS stations in the area did not record any decrease in visibility throughout the entire day: visibility at Glendale Airport remained at 20 miles and Sky Harbor remained at 10 miles. At the Goodyear Airport, the minimum recorded visibility was 7 statute miles. The visibility throughout the day in the Phoenix area was never significantly reduced, and thus this information does not significantly contribute to establishing a clear causal relationship.[26]

5.2.3 Review of 24-hour PM_{10} Data

The 24-hour PM_{10} concentrations measured on April 30 at the West 43rd and surrounding sites are listed in Table 3 and shown in Figure 7. On this day, the West 43rd monitor was the only site in the entire Phoenix area to violate the 24-hour PM_{10} standard.[27] Furthermore, PM_{10} concentrations at the West 43rd site were more than double those recorded at other local sites, which is generally inconsistent with the notion that a regional high wind event caused the exceedance.

[26] See Appendix B for information regarding reduced visibility and dust storms in Arizona.
[27] Similar to the data for March 14, 2008, the only other exceedance recorded in Arizona on this day was the Cowtown monitoring site in Pinal County, which was not flagged as an exceptional event.

ADEQ COMMENTS

EPA asserts in Section 5.2.2 that visibility in the Phoenix area was never significantly reduced and that visibility information from NWS stations in the area does not significantly contribute to establishing a clear causal relationship. This, however, seems contradictory to both the observation data and to EPA's own statements.

- EPA itself has stated that the Goodyear NWS station "serves as the closest location with readily available meteorological data for the area directly to the west of the West 43rd monitoring site"
- A reduction in visibility by more than 50% at the NWS Goodyear station is relevant
- The fact that areas directly upwind of the West 43rd monitor were experiencing reduced visibility as a result of the elevated winds helps add to the weight of evidence and establish a clear causal relationship due to their concurrent timing

See ADEQ's comments to page 11 of the TSD.

Figure 7: April 30, 2008 24-Hour PM_{10}

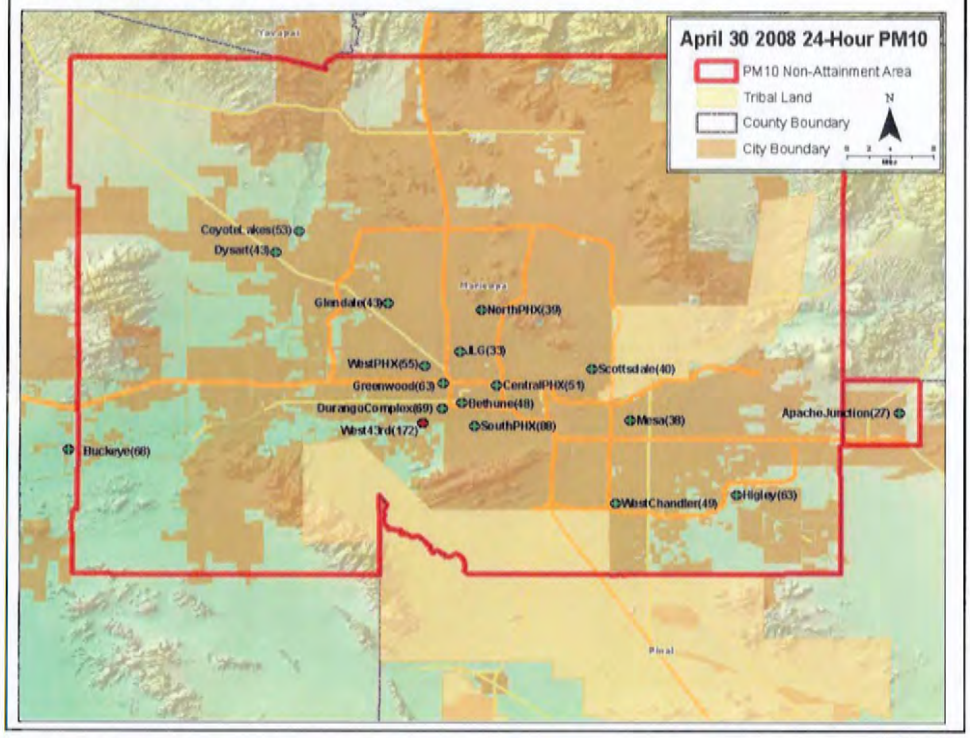


Table 3: April 30, 2008 24-Hour PM_{10}			
Site Name	**PM_{10} (ug/m^3)**	**Site Name**	**PM_{10} (ug/m^3)**
Buckeye*[28]	68	Glendale(FRM) [29]*	43
West 43rd	172	Mesa (FRM)*	38
Durango Complex	69	North PHX (FRM)*	39
South PHX	88	South Scottsdale (FRM)*	40
Greenwood	63	West Chandler (FRM)*	49
West PHX	55	Bethune Elementary (FRM)*	48
Central PHX	51	Dysart (FRM)*	43
JLG Supersite	46	Coyote Lakes	53
Higley	63		

[28] 24-hour PM_{10} data for these sites were not included in the Assessment.
[29] PM_{10} FRM samplers operate on a 1 in 6 day schedule.

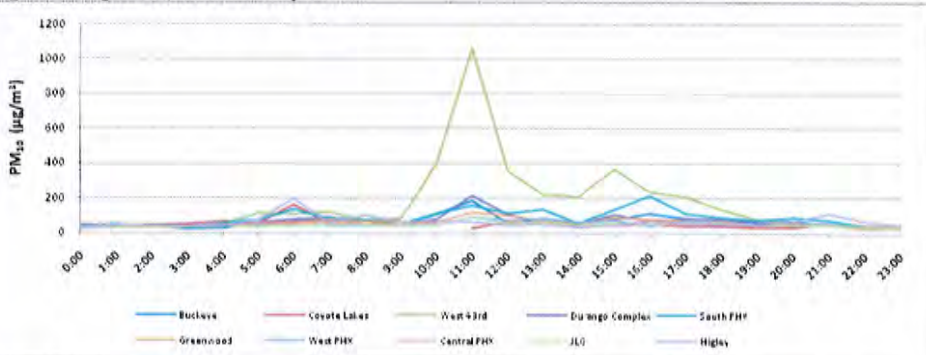
ADEQ COMMENTS

5.2.4 Review of Hourly PM_{10} and Meteorological Data

The hourly PM_{10} data are shown in Figure 8. As early as 1000 hrs, the West 43rd site began to experience an increase in PM_{10} concentration that was not characteristic of the other nine monitors in the Phoenix area. From 0900 to 1000 hrs the hourly PM_{10} values at the West 43rd site increased from 85 $\mu g/m^3$ to 404 $\mu g/m^3$, while PM_{10} values at surrounding sites remained below 120 $\mu g/m^3$. The first sign of any elevated winds occurred at the majority of the stations around 1100 hrs. NWS data for Goodyear Airport showed an increase in wind speed from 16 to 17 mph (accompanied by a 29 mph gust); while an increase in hourly wind speed from 12.7 to the day's maximum value of 16 mph was recorded at the West 43rd site. At 1100 hrs, the PM_{10} concentration at the West 43rd site also rose from 404 $\mu g/m^3$ to the day's maximum value of 1065 $\mu g/m^3$.

While values at other sites in the area increased over the same time period, the values at the West 43rd site ranged from 5 to 10 times higher than other sites in the Phoenix area. For example, the majority of the sites measured maximum PM_{10} concentrations that were coincident with the maximum PM_{10} concentrations at the West 43rd site, but all sites in Maricopa County measured maximum PM_{10} concentrations less than 220 $\mu g/m^3$. Given that the Durango Complex, South Phoenix, Greenwood, and West Phoenix sites are located within approximately five miles of the West 43rd site, one would expect to see greater consistency in the concentrations if a regional high wind event was occurring. The data suggest that the West 43rd site was most likely significantly influenced by local upwind sources and the claimed exceptional event was not regional in nature.

Figure 8: April 30, 2008 Hourly PM_{10}



5.2.5 Review of 5-Min PM_{10} and Wind Speed Data

The 5-min data reinforce the fact that even though elevated wind speeds were measured at other nearby locations, the West 43rd monitor consistently measured much higher PM_{10} concentrations than other locations. Figure 9 shows the 5- min PM_{10} and wind speed data from West 43rd and Durango Complex. These monitors are located only 2 miles apart, yet there seems to be a considerable difference in the relationship between PM_{10} and wind speed on April 30. Both sites experience similar wind speed levels, but during some periods of the day the 5-min PM_{10}

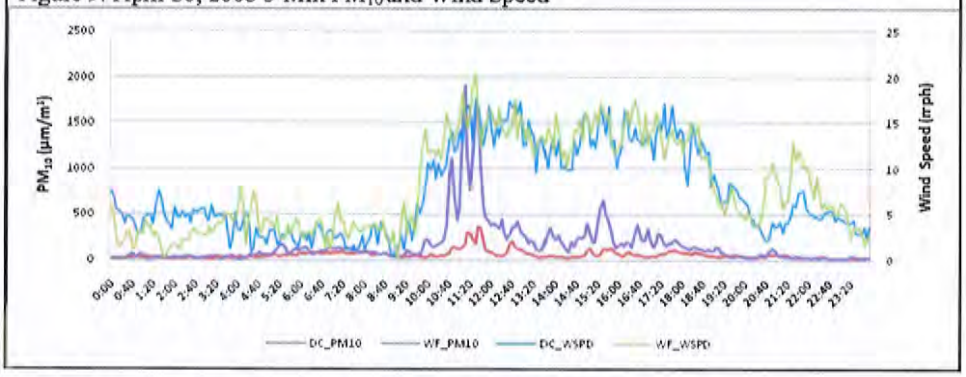
ADEQ COMMENTS

The source of the discrepancy between the magnitude of the concentration increases at the monitors is evident from ADEQ's submissions. Because of its location, the West 43rd monitor is especially susceptible to dust generated by high winds traveling from a west or southwest direction along the Gila and Salt River channel.

EPA's conclusion that the concentrations at the West 43rd Avenue monitor "may have been caused by local upwind sources and were not regional in nature" is therefore unsubstantiated. In any case, this conclusion, even if justified, would not legally support EPA's determination that there was not a clear causal connection between the winds and the concentrations. Local, anthropogenic sources may be considered part of an exceptional high wind event, as long as they are reasonably controlled. As previously discussed, there is ample basis for concluding that the sources in the vicinity of the West 43rd Avenue monitor satisfied this requirement.

concentrations at West 43rd site were more than 9 times those measured at Durango Complex. The two highest 5-min PM_{10} averages measured at the West 43rd site were approximately 1920 and 1624 $\mu g/m^3$, while PM_{10} concentrations at Durango Complex during the same time period were 178 and 373 $\mu g/m^3$, respectively. These data provide further evidence that the claimed regional high wind event only affected PM_{10} concentrations at the West 43rd site and the elevated PM_{10} concentrations measured at this site were most likely significantly influenced by local sources and the claimed exceptional event was not regional in nature.

Figure 9: April 30, 2008 5-Min PM_{10} and Wind Speed



5.2.6 Review of Days with Similar Meteorological Conditions

On twenty days in April 2008, the wind speeds at Goodyear Airport exceeded 15 mph. On six of those days, wind gusts exceeded 25 mph. The following analysis compares the hourly PM_{10} data, wind speed, and wind gusts recorded at Goodyear Airport on April 30 with the same data from a similar day in April.

On April 30, the West 43rd monitor experienced elevated PM_{10} concentrations of 404 $\mu g/m^3$ and 1065 $\mu g/m^3$ at 1000 and 1100 hrs, respectively. Wind speeds at Goodyear Airport during this period were from the WSW (240°-260°) at 17 mph with gusts of 29 mph. On April 29, the Goodyear station measured wind speeds and gusts of equal magnitude; 17 mph winds and 29 mph gusts from the SW (230°) for three consecutive hours. A maximum concentration of 177 $\mu g/m^3$ was observed during this period, but it is considerably lower than the PM_{10} concentrations measured on the day the exceptional event is claimed to have occurred. This example illustrates how elevated wind speeds in upwind areas are related to elevated PM_{10} concentrations on occasion, but the magnitude of PM_{10} concentrations measured at the West 43rd site seem to be dependent on a number of different factors.

ADEQ COMMENTS

EPA inappropriate use of vector average wind speed data (Figure 9)

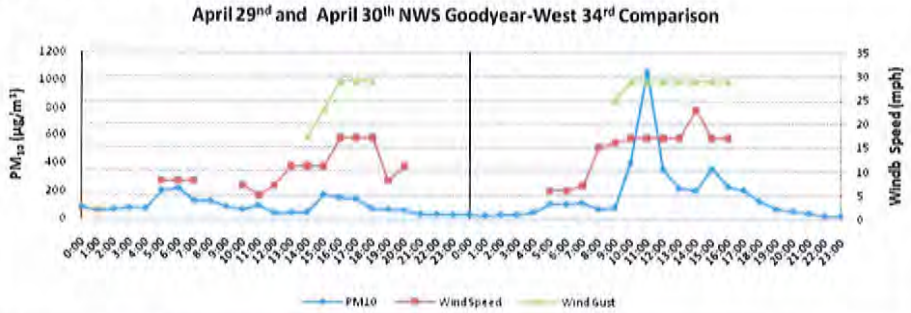
EPA's reliance on a graph with 5-minute vector average wind speed significantly understates the kinetic energy of the wind involved in the dust generating process. ADEQ did not provide or rely on the data presented in Figure 9. It was distributed in the 5% Technical Committee deliberations.

EPA failed to acknowledge the relevant data that was presented

As with the March 14, 2008 event, EPA discounted the data that was included in the submission.

Also see ADEQ's comments to page 14 of the TSD.

Figure 10: Non-Exceedance Day Comparison



5.2.7 Summary of Clear Causal Relationship for April 30, 2008

ADEQ's conclusions that the recorded exceedance was caused by a regional high wind event are not substantiated by relevant monitoring and meteorological data. The data show that the spatial extent of PM_{10} during this day was isolated and not regional in nature. The data also show differences in the measured PM_{10} concentrations at the West 43rd site and the remaining sites in the Phoenix area. In addition, ADEQ provided only limited analysis of possible contribution from human activity, making it difficult to comprehensively evaluate the relationship between the claimed event and the exceedance. Therefore, EPA has determined that the weight of evidence presented in the April 30 Assessment does not demonstrate a clear causal relationship as required by the EER.

5.3 May 21, 2008

5.3.1 Correlation between Wind Speed and PM_{10}

The May 21 Assessment included tabular hourly and maximum wind speed and PM_{10} data for five sites in the Phoenix area: West 43rd, Durango Complex, South Phoenix, and Buckeye.[30] ADEQ also included meteorological data from the NWS Luke Air Force Base station. ADEQ did not provide hourly PM_{10} and meteorological data from the remaining five continuous PM_{10} analyzers in the Phoenix area and did not include wind speed and direction data from numerous other meteorological stations in the Phoenix area. Appendix A contains more information on the PM_{10} and meteorological data used in the May 21assessment.

ADEQ also provided three graphs that show the potential correlation between maximum wind speeds and PM_{10} concentrations. The three graphs display data from the West 43rd, Durango Complex, and South Phoenix monitoring sites. While the hourly PM_{10} concentrations significantly increase with an increase in maximum recorded wind speeds at the West 43rd site,

[30] ADEQ's supporting documentation for this event also contained information pertaining to measured exceedances at monitoring sites in Yuma County (Yuma Courthouse site). The Yuma monitor is more than 150 miles from the West 43rd site. We expect the circumstances that caused the exceedance at the Yuma MCAS site to be different that those affecting the Phoenix area; therefore we are giving this data relatively little weight in our evaluation.

ADEQ COMMENTS

The graphs show that concentrations did increase with an increase in wind speed at each monitor, and in many cases the hourly measurements exceeded the 24-hour NAAQS by a substantial margin. The only difference between the West 43rd Avenue monitor and the others, is that the 24-hour concentrations recorded at the other three did not exceed the NAAQS.

The source of the discrepancy between the magnitude of the concentration increases at the monitors is evident from ADEQ's submissions. Because of its location, the West 43rd monitor is especially susceptible to dust generated by high winds traveling from a west or southwest direction along the Gila and Salt River channels.

EPA's conclusion that the concentrations at the West 43rd Avenue monitor "may have been caused by local upwind sources and were not regional in nature" is therefore unsubstantiated. In any case, this conclusion, even if justified, would not legally support EPA's determination that there was not a clear causal connection between the winds and the concentrations. Local, anthropogenic sources may be considered part of an exceptional high wind event, as long as they are reasonably controlled. As previously discussed, there is ample basis for concluding that the sources in the vicinity of the West 43rd Avenue monitor satisfied this requirement.

there is not a similar correlation between PM_{10} and maximum wind speed at the other monitoring sites in the area. These facts suggest that the elevated PM_{10} concentrations at West 43rd may have been caused by local upwind sources and were not regional in nature.

5.3.2 Visibility

The assessment included photographs from numerous locations throughout the Phoenix area. Photographs taken at 1330 hrs show evidence of reduced visibility and a potential regional event; however, PM_{10} concentrations at the West 43rd site began to increase at 0800 hrs. Photographs were provided for 0930, 1330, 1430, and 1530 hrs. Photographs were not submitted for the hours preceding the elevated PM_{10} concentrations measured at the West 43rd site. Therefore, the photographs do not significantly contribute to establishing a causal relationship between wind speed, potential contributing sources, and PM_{10} concentrations at the West 43rd monitoring site during the morning hours.

ADEQ also stated that reduced visibility during the event throughout portions of Phoenix provides further evidence of a clear causal relationship. The visibility at Goodyear Airport before the event ranged from 20 to 7 statute miles; visibilities of 7 miles were recorded at 1047, 1647, and 1747 hrs. Chandler Airport recorded observations of blowing dust (BLDU) at 1347 hrs, which was followed by a recorded visibility of 7 miles at 1447 hrs. Visibility at other NWS stations in the area remained above 10 miles for the entire day: Glendale Airport ranged from 10 to 20 miles, Sky Harbor remained at 10 miles, and Luke Air Force Base remained at 10 miles. The visibility throughout the day in the Phoenix area was never significantly reduced, and thus this information does not significantly contribute to establishing a clear causal relationship.[31]

5.3.3 Review of 24-Hour PM_{10} Data

The 24-hour PM_{10} concentrations measured on May 21 at the West 43rd and surrounding sites are listed in Table 4 and shown geographically in Figure 11. On this day, the West 43rd monitor was the only site in the entire Phoenix area to violate the 24-hour PM_{10} standard. Furthermore, PM_{10} concentrations at West 43rd were more than double those recorded at other local sites, which is generally inconsistent with the notion that a regional high wind event caused the exceedance.

[31] See Appendix B for information regarding reduced visibility and dust storms in Arizona.

ADEQ COMMENTS

Visibility was decreased at locations in the Phoenix area during the high wind event occurring on May 31, 2008, as is described by EPA in Section 5.2.2. Yet, EPA states that visibility in the Phoenix area was never significantly reduced and that visibility information from NWS stations in the area does not significantly contribute to establishing a clear causal relationship. This, however, seems contradictory both to the observation data and to EPA's own statements.

- EPA itself has stated that the Goodyear NWS station "serves as the closest location with readily available meteorological data for the area directly to the west of the West 43rd monitoring site"
- A reduction in visibility by more than 50% at the NWS Goodyear station during the period of high winds and elevated PM_{10} concentrations seems very relevant
- The fact that areas directly upwind of the West 43rd monitor were experiencing reduced visibility as a result of the elevated winds helps add to the weight of evidence and establish a clear causal relationship due to the winds occurring concurrently with the reduced visibility

See ADEQ's comments to page 11 of the TSD.

Figure 11: May 21, 2008 24-Hour PM_{10}

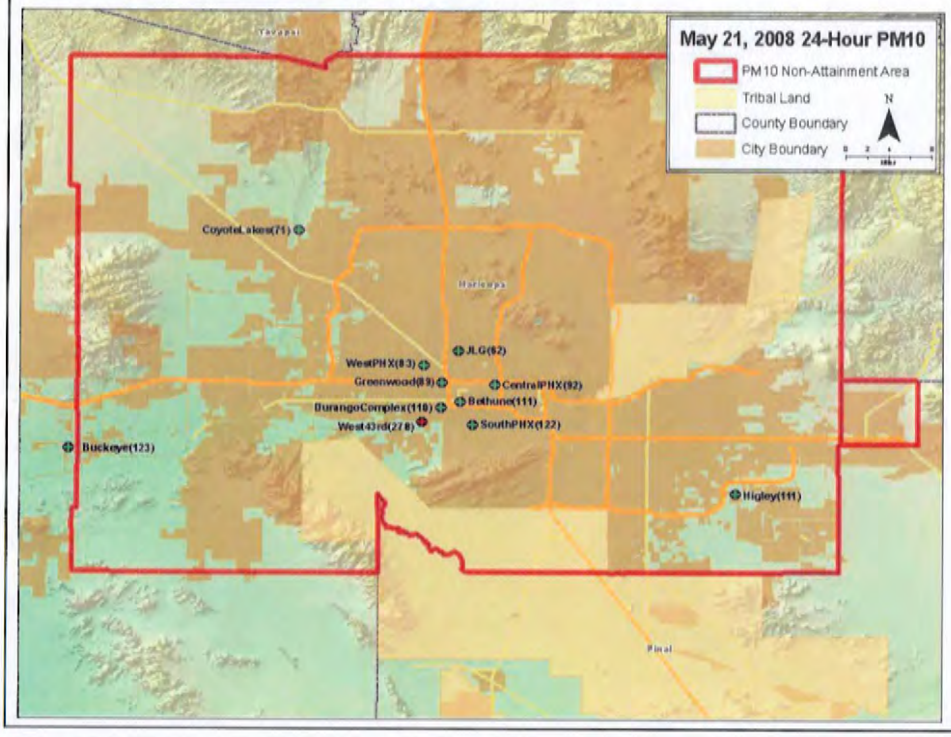


Table 4: May 21, 2008 24-Hour PM_{10}

Site Name	PM_{10} (ug/m3)	Site Name	PM_{10} (ug/m3)
Buckeye*[32]	123	West PHX*	83
West 43rd	278	Central PHX*	92
Durango Complex	110	JLG Supersite*	62
South PHX	122	Higley*	111
Greenwood	89	Coyote Lakes*	71
Bethune (FRM)*	111		

5.3.4 Review of Hourly PM_{10} and Meteorological Data

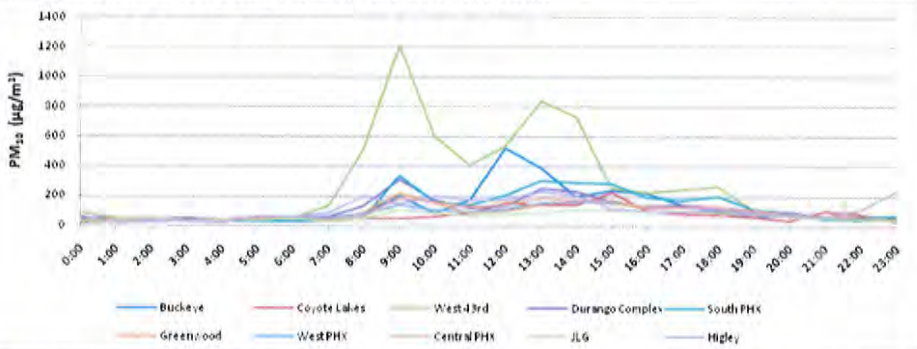
The hourly PM_{10} data for Maricopa County are shown in Figure 12. The peak PM_{10} concentration of 1207 $\mu g/m^3$ at 0900 hrs measured at the West 43rd site coincides with an increase in wind speed from 11 to 22 mph, and a recorded wind gust of 28 mph at the Goodyear

[32] 24-hour PM_{10} data from these sites were not included in the Assessment.

ADEQ COMMENTS

station and an increase in hourly wind speed from 15.3 to 18.1 mph at the West 43rd monitoring site. Similar to previously discussed events, the measured PM_{10} concentrations at West 43rd were more than 3.9 times the PM_{10} values measured at the Durango Complex station just 2 miles to the northeast and 3.6 times the values measured at the South Phoenix station 4 miles to the east. The inconsistencies in PM_{10} concentrations suggest that the West 43rd site most likely was influenced by local upwind sources and the claimed exceptional event was not regional in nature.

Figure 12: May 21, 2008 Maricopa County Hourly PM_{10}



5.2.5 Review of 5-Min PM_{10} and Wind Speed Data

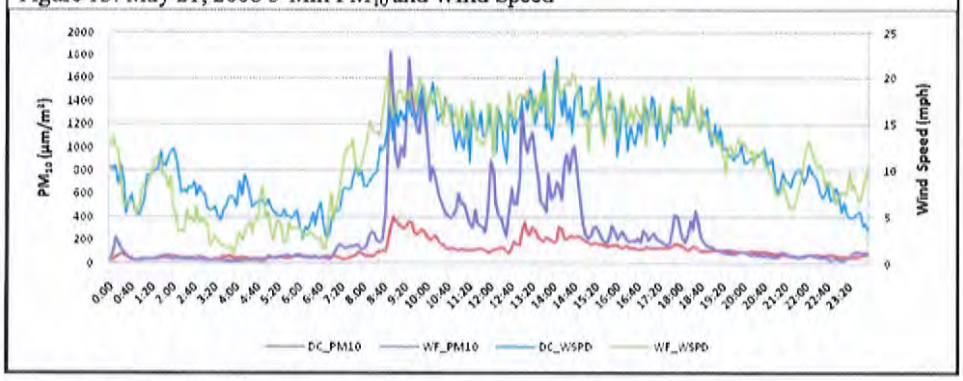
The 5-min data reinforce the fact that even though elevated wind speeds were measured at other nearby locations, the West 43rd monitor consistently measured much higher PM_{10} concentrations than other locations. Figure 13 shows the 5- min PM_{10} and wind speed data from the West 43rd and Durango Complex sites. These monitors are located only 2 miles apart, yet there seems to be a considerable difference in the relationship between PM_{10} and wind speed on May 21. Both sites experience similar wind speed levels, but during some periods of the day the 5-min PM_{10} concentrations at West 43rd site ranged from 3-6 times higher than those measured at Durango Complex. The two highest 5-min PM_{10} averages measured at the West 43rd site were approximately 1837 and 1769 $\mu g/m^3$, while PM_{10} concentrations at Durango Complex during the same time period were 290 and 362 $\mu g/m^3$, respectively. These data provide further evidence that the claimed regional high wind event only affected PM_{10} concentrations at West 43rd and the elevated PM_{10} concentrations measured at this site were most likely significantly influenced by local sources and the claimed exceptional event was not regional in nature.

ADEQ COMMENTS

The source of the discrepancy between the magnitude of the concentration increases at the monitors is evident from ADEQ's submissions. Because of its location, the West 43rd monitor is especially susceptible to dust generated by high winds traveling from a west or southwest direction along the Gila and Salt River channel.

EPA's conclusion that the concentrations at the West 43rd Avenue monitor "may have been caused by local upwind sources and were not regional in nature" is therefore unsubstantiated. In any case, this conclusion, even if justified, would not legally support EPA's determination that there was not a clear causal connection between the winds and the concentrations. Local, anthropogenic sources may be considered part of an exceptional high wind event, as long as they are reasonably controlled. As previously discussed, there is ample basis for concluding that the sources in the vicinity of the West 43rd Avenue monitor satisfied this requirement.

Figure 13: May 21, 2008 5-Min PM_{10} and Wind Speed

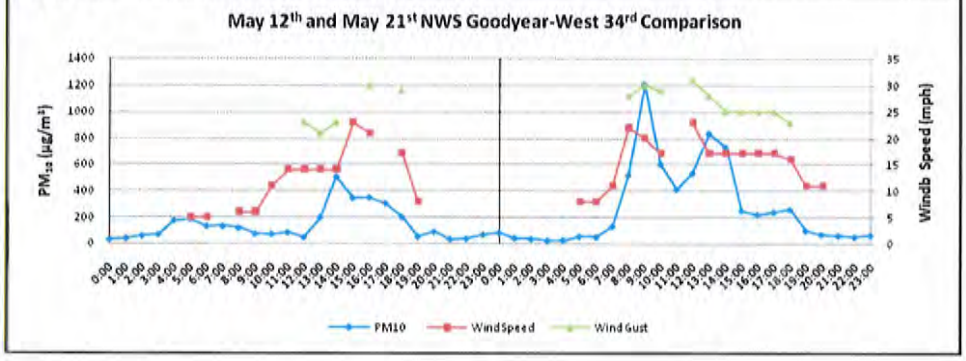


5.3.6 EPA Review of Days with Similar Meteorological Conditions

On fourteen days in May 2008, the wind speed at Goodyear Airport exceeded 15 mph. On three of those days, wind gusts exceeded 25 mph. The following analysis compares the hourly PM_{10} data, wind speed, and wind gusts on May 21 with the same data from a similar day in May.

On May 21, the West 43rd monitor experienced elevated PM_{10} concentrations of 518 µg/m^3 and 1207 µg/m^3 at 0800 and 0900 hrs, respectively. Wind speeds at Goodyear Airport during this period were from the WSW (240°) at 22 and 21 mph with gusts of 28 and 30 mph. Similarly, on May 12, the Goodyear station measured wind speeds and gusts of equal magnitude; 21 mph wind speeds and 30 mph gusts from the SW (230°). These elevated wind speeds, however, only correspond to moderate hourly PM_{10} values at the West 43rd site. Hourly PM_{10} concentrations on May 12 were considerably lower than the PM_{10} concentrations measured on the day the exceptional event is claimed to have occurred; maximum PM_{10} values on May 12 only reached 500 µg/m^3. This example illustrates how elevated wind speeds in upwind areas are related to elevated PM_{10} concentrations on occasion, but the magnitude of PM_{10} concentrations measured at the West 43rd site seem to be dependent on a number of different factors.

Figure 14: Non-Exceedance Day Comparison



ADEQ COMMENTS

As stated earlier, the use of vector average winds is inappropriate for this analysis, and fails to acknowledge the peak gusts which occurred during the event.

On May 21, 2008, the Goodyear NWS monitor experienced wind gusts of 25 mph or greater for nine total hours, six of which occurred consecutively. Contrastingly, on May 12, 2008, winds gusted to 25 mph or greater for only two, non-consecutive hours. Therefore, it is apparent that a comparison of the two days as being equivalent meteorologically is inappropriate, as both the average winds and wind gusts of May 21st were substantially greater in both duration and overall impact than those occurring on May 12th.

Also see ADEQ's comments to page 14 of the TSD.

5.3.7 Summary of Clear Causal Relationship for May 21, 2008

ADEQ's conclusions that the recorded exceedance was caused by a regional high wind event are not substantiated by relevant monitoring and meteorological data. The data show that the spatial extent of PM_{10} during this day was isolated and not regional in nature. The data also show differences in the measured PM_{10} concentrations at the West 43rd site and the remaining sites in the Phoenix area. In addition, as explained above, ADEQ provided only limited analysis of possible contribution from human activity (sections 4.2 and 4.3 above), making it difficult to comprehensively evaluate the relationship between the claimed event and the exceedance. Therefore, EPA has determined that the weight of evidence presented in the May 21 Assessment does not demonstrate a clear causal relationship as required by the EER.

5.4 June 4, 2008 Event

The June 4 assessment contained information pertaining to measured exceedances at monitoring sites in both the Phoenix area (Buckeye, Coyote Lakes, and West 43rd site) and Yuma County (Yuma MCAS site). These two locations are over 150 miles apart and the data concerning the Yuma area has limited value in determining whether or not exceptional events occurred in the Phoenix area. It is also important to note that EPA is not evaluating the exceedances measured at the Buckeye and Coyote Lakes monitoring sites in this document. As discussed in the next section, it is clear that the PM_{10} concentrations at these sites are not correlated to those measured at the West 43rd site for the majority of the day on June 4 and were most likely influenced by a different set of sources and meteorological conditions (Figure 16).

5.4.1 Correlation between Wind Speed and PM_{10}

The assessment included tabular wind speed and PM_{10} data for five sites in the Phoenix area: West 43rd, Durango Complex, Central Phoenix, Coyote Lakes, and Buckeye. ADEQ also included meteorological data from the NWS Luke Air Force Base station. ADEQ did not provide tabular hourly PM_{10} data from the remaining five continuous PM_{10} analyzers in the Phoenix area and did not include wind speed and direction data from numerous other meteorological stations in the Phoenix area. Appendix A contains more information on the meteorological data used in the June 4 supporting documentation.

ADEQ also provided seven graphs that show the potential correlation between maximum wind speeds and PM_{10} concentrations. The graphs show that, at the West 43rd site, the hourly PM_{10} concentrations increase with an increase in maximum recorded wind speeds at the West 43rd site; however, there does not seem to be a similar correlation between PM_{10} and maximum wind speed for the other monitoring sites in the area until later in the evening. These data suggest that the elevated PM_{10} concentrations in the morning and early afternoon hours at the West 43rd site were most likely caused by local upwind sources and are not regional in nature.

5.4.2 High Winds

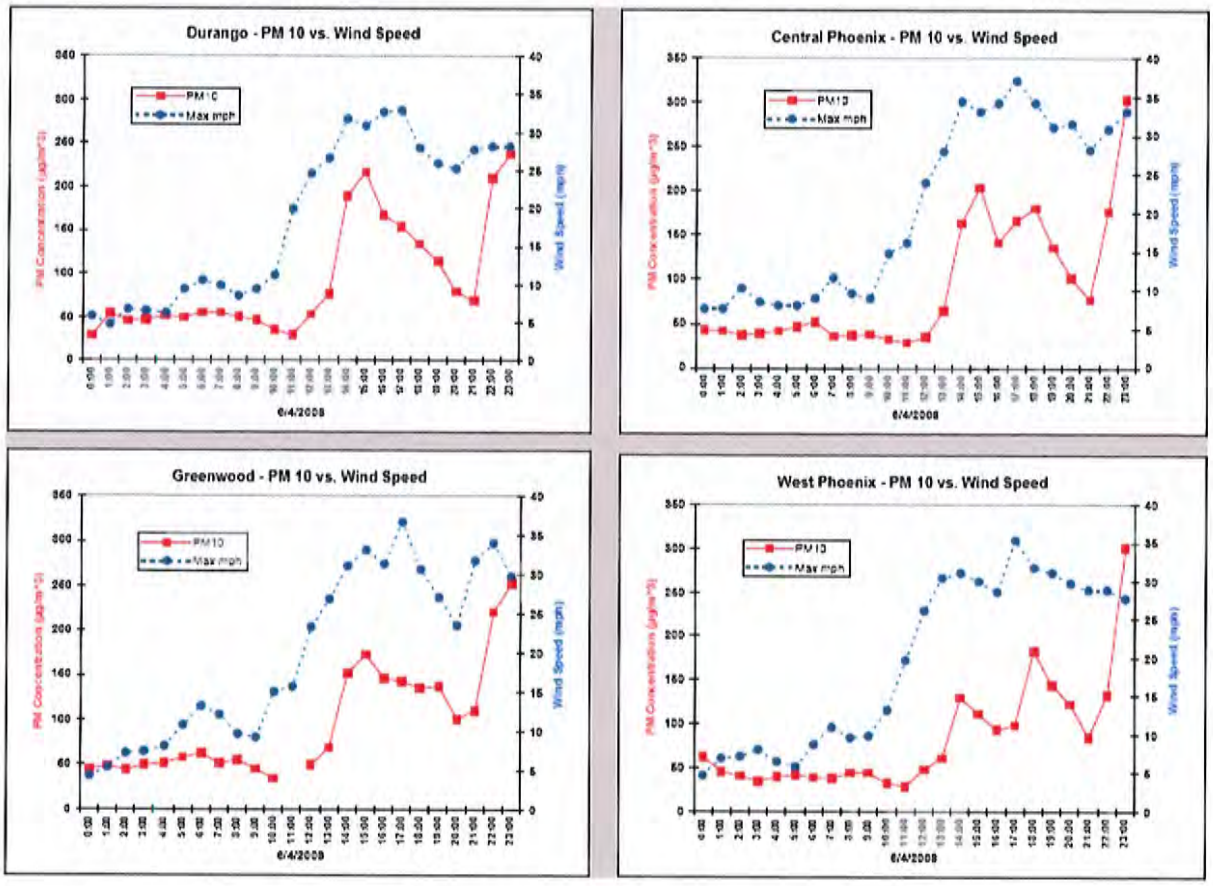
While Section 4.3 contains a general discussion of ADEQ's high wind analysis, ADEQ's DSR provided a more detailed discussion of the meteorological conditions that were associated with

ADEQ COMMENTS

EPA's response in Section 5.4.1 sites a number of monitors whose data were not included in the assessment submitted by ADEQ.

- On page 33 of this review document EPA seems to agree that ADEQ shows, in comparison to normal historical fluctuations, concentrations measured on each flagged day at West 43rd are "in the high percentiles", which indicates that "a lesser amount of documentation or evidence may be required." Yet, additional information and analysis were included in the June 4, 2008, supplemental submittal which showed unusually high winds occurred throughout, not just the Phoenix Metro area, but the entire State of Arizona and much of the entire Southwestern United States.

In EPA's analysis of the graphs in section 5.4.1, EPA fails to acknowledge the graphs establish a clear causal relationship between the onset of strong and gusty winds and the onset of elevated PM_{10} values at West 43rd, as both are showed to have occurred concurrently. Similar patterns are evident in the graphs of other monitor locations included with the event submittal and depicted below.



the claimed exceptional event occurring on June 4. Unlike the previously discussed events, the DSR contained copies of NWS advisories concerning the meteorological conditions in the Phoenix area. These reports provide additional evidence of the nature of the wind speeds associated with the claimed exceptional event. Specifically, NWS issued a wind advisory at 0356 hrs on June 4 that was set to be in effect from 1500 to 2100 hrs. The advisory states that "wind speeds of 25 to 30 mph with gusts up to 40 mph can be expected" and warned that "strong winds over desert areas could result in briefly lowered visibilities to well under a mile at times in blowing dust or blowing sand…especially near empty farm fields and construction areas."

While these advisories continued to be in effect during the afternoon hours of June 4, the average hourly wind speeds observed at the West 43rd monitoring site never exceeded 17.1 mph for the entire day, while wind gusts reached a maximum of 36 mph at 1600 hrs. ADEQ's DSR states that during the afternoon hours the Phoenix area experienced "unusually high gusts of 35-40 mph which would likely overwhelm BACM in place for PM in the Phoenix" area, but as discussed in section 4.2.2, ADEQ has not determined at which wind speeds this may be occurring. As discussed below, the West 43rd monitoring site began measuring elevated PM_{10} concentrations at 1200 hrs, well before the NWS advisories were put into effect.

5.4.3 Visibility

The assessment included photographs from numerous locations throughout the Phoenix area. Photographs taken at 1830 hrs show evidence of reduced visibility and a potential regional event,[33] but it is important to note that PM_{10} concentrations at the West 43rd monitoring site began to increase at 1200 hrs. No photographs were submitted for this time period or for hours preceding the elevated PM_{10} concentrations. Therefore, the photographs do not significantly contribute to establishing a causal relationship between observed wind speeds, potential contributing sources, and PM_{10} concentrations at the West 43rd monitoring site during the late morning, early afternoon hours.

ADEQ also stated that reduced visibility during the event at Goodyear Airport provides further evidence of a clear causal relationship. The visibility at Goodyear Airport during the morning and early afternoon hours ranged from 20 to 10 statute miles. While the reduced visibility observed at numerous NWS after 1800 hrs suggests a regional event may have occurred, it is important to note that PM_{10} concentrations at the West 43rd site began to increase at 1200 hrs: a time when visibility was between 10 to 20 miles.

5.4.4 Review of 24-Hour PM_{10} Data

The 24-hour PM_{10} concentrations measured on June 4 at the West 43rd and surrounding sites are shown in Figure 15. On this day, the West 43rd monitor measured PM_{10} concentrations that were more than double those measured at other monitoring sites in the area, except for the Buckeye and Coyote Lakes sites, which recorded similar concentrations.

[33] See Appendix B regarding visibility and dust storms in Arizona.

ADEQ COMMENTS

EPA focuses on the timing of the maximum wind gusts in section 5.4.2, claiming that the highest winds did not occur until after the West 43rd monitoring site began measuring elevated PM_{10} concentrations. These gusts measured to 36 mph at the 4:00p.m. reading. EPA appears to disregard a number of other valid considerations as follows:

1. The 4 highest PM_{10} concentrations measured on June 4th by the West 43rd monitor occurred concurrent with winds gusting to over 30 mph
2. The concurrent timing of winds and PM_{10} concentrations indicates clear causal relationship between the elevated wind speeds and the most elevated PM_{10} concentrations
3. Elevated hourly concentrations that were recorded during and after that maximum gust were undoubtedly a result of a high wind regional dust event, as is evident by the Buckeye and Coyote Lakes beginning to spike around the same time

In that same section, EPA cites the ADEQ submittal and notes that ADEQ has not determined at which wind speeds BACM may be overwhelmed. As is discussed in the Unusual Winds White Paper, there does not exist substantial literature aimed at determining at what wind speeds BACM are overwhelmed, and EPA has not provided a standard for determining what weight of evidence is necessary to meet the burden of proof for showing that BACM is overwhelmed. ADEQ, however, provided data and information to demonstrate that BACM was overwhelmed.

1. ADEQ listed all dust control measures that are required to be in place in the 5 Percent Plan for PM_{10} (MAG, 2007).
2. ADEQ listed the inspection and complaints reported for the 72 hours preceding and following the June 4th high wind event.
3. ADEQ included all pertinent wind information to show that strong and gusty winds were occurring at or upwind of the affected monitors.

As only two minor violations were found by inspectors in the two mile radius around West 43rd, it is fair to assume, given reviews of all available data, that control measures were in place, and if dust from local sources under these controls contributed significantly to the PM_{10} event at West 43rd, it was due to those controls being overwhelmed by the strong, gusty winds, that were reported in the area. Additionally, in response to EPA's assertion that the West 43rd monitoring site began measuring elevated PM_{10} concentrations well before the NWS advisories were put into effect, ADEQ would like to note that this does not mean that winds were not increasing before the advisory was put effect. In fact, ADEQ provided data that shows increasing winds well before the NWS advisory was in effect, and these elevated winds were coincident with elevated PM_{10} concentrations recorded at the West 43rd site.

In order to show the severity of the dust that impacted the area, only the worst visibility images were included with the June 4th event analysis; however, ADEQ does have images showing significantly reduced visibility and blowing dust starting earlier than 1830 hrs. EPA must understand that visibility does not go from clear to completely obscured instantaneously, and thus, the images showing how much visibility decreased between 1400 hrs and 1830 hrs should indicate that visibility decreased significantly over that time period. That is also the period when concentrations were at their highest at the West 43rd monitor. ADEQ would be pleased to provide these images to EPA for their consideration.

Figure 15: June 4, 2008 24-Hour PM_{10}

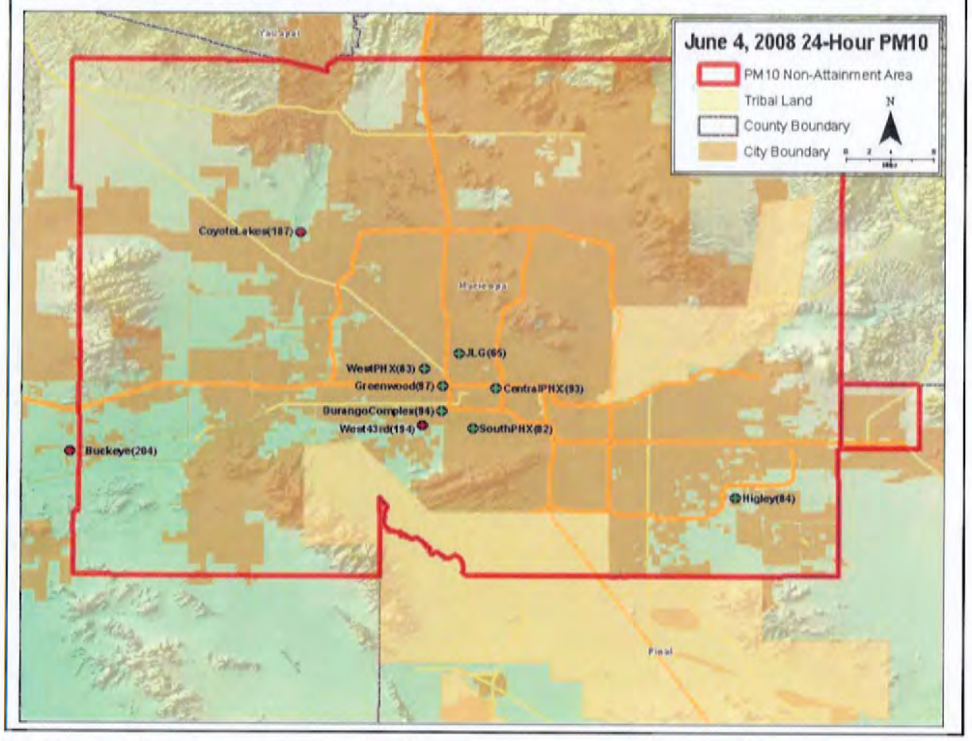


Table 5: June 4, 2008 24-Hour PM_{10}			
Site Name	**PM_{10} (ug/m3)**	**Site Name**	**PM_{10} (ug/m3)**
Buckeye	204	Greenwood*	97
West 43rd	194	West PHX*	83
Coyote Lakes	187	Central PHX*	93
Durango Complex*[34]	94	JLG Supersite*	65
South PHX*	82	*Higley*	84

5.4.5 Review of Hourly PM_{10} and Meteorological Data

The patterns observed through the morning hours and mid-day on June 4 are similar to the claimed exceptional event days discussed in previous sections and the data from this time period does not indicate an influence from a regional high wind event. Also, similar to the previously

[34] 24-hour PM_{10} data for this station was not included in the Assessment.

ADEQ COMMENTS

Back on page 27 of the TSD, EPA refers to a national weather service advisory that was issued at 3:56am out of the Phoenix NWS station. The header and key points in that advisory:

WWUS75 KPSR 041056
NPWPSR
URGENT – WEATHER MESSAGE
NATIONAL WEATHER SERVICE PHOENIX AZ
365 AM MST WED JUN 4 2008
…
{Included advisories for most of Arizona and California.}

"WIND ADVISORY IN EFFECT FROM 3 PM THIS AFTERNOON TO 9 PM MST THIS EVENTING FOR SOUTHWEST AND SOUTH-CENTRAL ARIZONA INCLUDING THE PHOENIX METRO AREA…"

At 5:56 a.m., a RED FLAG WARNING was issued.

"DUE TO VERY STRONG WINDS…LOW HUMIDITY…AND HIGH FIRE DANGER…THE NATIONAL WEATHER SERICE IN PHOENIX HAS ISSUED A RED FLAG WARNING…WHICH IS IN EFFECT FROM 1 PM MST /1 PM PDT/ THIS AFTERNOON TO 10 PM MST / 10 PM PDT/ THIS EVENING."

And at 2:35 p.m., the URGENT – WEATHER MESSAGE

"…WIND ADVISORY REMAINS IN EFFECT UNTIL 9 PM MST /9 PM PDT THIS EVENING."

EPA stated on page 27:

"…the wind gusts reached a maximum of 36 mph at 1600 hrs."

"…the West 43rd monitoring site began measuring elevated PM10 concentrations at 1200 hrs, well before the NWS advisories were put into effect"

There are four points that should be noted:

1. The forecast of a wind advisory 11 hours before an event contains uncertainties, especially with respect to time of onset, and should not be used in place of measurements.
2. The Red Flag warning issued two hours later moved up the time of onset to 1:00 p.m., and the message at 2:35 p.m. implies the advisory was already in effect.
3. The PM_{10} at West 43rd did not start elevating until closer to 1:30 p.m. with the onset of gusty winds (see EPA TSD Figure 17).
4. Winds at West 43rd began gusting above 24 mph between Noon and 1:00 p.m.

discussed events, the West 43rd site measured elevated PM_{10} concentrations earlier and of a higher magnitude than other monitoring sites located nearby. For example, on the early afternoon of June 4, the West 43rd monitor began measuring PM_{10} concentrations ranging from 165 $\mu g/m^3$ to 645 $\mu g/m^3$ between 1200 and 1400 hrs, while all other monitors in the Phoenix area remained below 200 $\mu g/m^3$ for the same time period. The inconsistencies in these concentrations suggest that the West 43rd site was most likely significantly influenced by local upwind sources and the claimed exceptional event was not regional in nature. ADEQ acknowledged that the concurrent timing of elevated wind speeds "may indicate that PM sources in close proximity to the monitor contributed significantly to the dust event" and "it is likely that the loose particulates deposited in the dry river bed to the west and south-west of the monitor were transported the short distance to the West 43rd monitor by the high winds."[35]

It appears that a regional weather event began on the evening of June 4 and lasted into the morning of June 5. Figure 16 shows that the Buckeye site begins to measure significantly elevated PM_{10} concentrations at 1600 hrs, followed by an increase in PM_{10} at the Coyote Lakes site a few hours later. The West 43rd site lagged behind Buckeye and Coyote Lakes and did not show elevated PM_{10} from the regional event until 2200 hrs on June 4. While the West 43rd, Buckeye, and Coyote Lakes sites all exceeded on June 4, the cause of the exceedances seems to be different. The exceedances at Buckeye and Coyote Lakes were most likely due to a regional event that began in the evening and did not reach West 43rd until 2200 hrs, while the exceedance at West 43rd was most likely caused by a different set of circumstances (Figure 16). Also, beginning around 2200 hrs and extending into the early morning hours of June 5, PM_{10} concentrations at all sites in the Phoenix area were elevated and uniformly consistent, illustrating a potential regional event. In the DSR, ADEQ acknowledged that "a more homogeneous dust plume affected the area just after midnight on the following day."

While there was some contribution to the 24-hour PM_{10} concentration that can be attributed to this evening event, the West 43rd monitor began measuring high PM_{10} concentrations well before the arrival of the "dust plume" described in the June 4 DSR. Furthermore, the arrival of the dust plume began at around 2100 hrs and only contributed to approximately 11.3 percent of the total PM_{10} mass concentration for June 4. With such a small total contribution, if all PM_{10} concentrations measured after 2100 hrs were completely removed from the data set, the PM_{10} 24-hour average for June 4 would still be above the PM_{10} 24-hour NAAQS. The majority of the PM_{10} mass was measured well before the arrival of the evening event described above and the high PM_{10} concentrations measured in the late morning and early afternoon hours have been determined to be independent from the regional event that took place on the evening of June 4.

[35] June 4 DSR at p. 24.

ADEQ COMMENTS

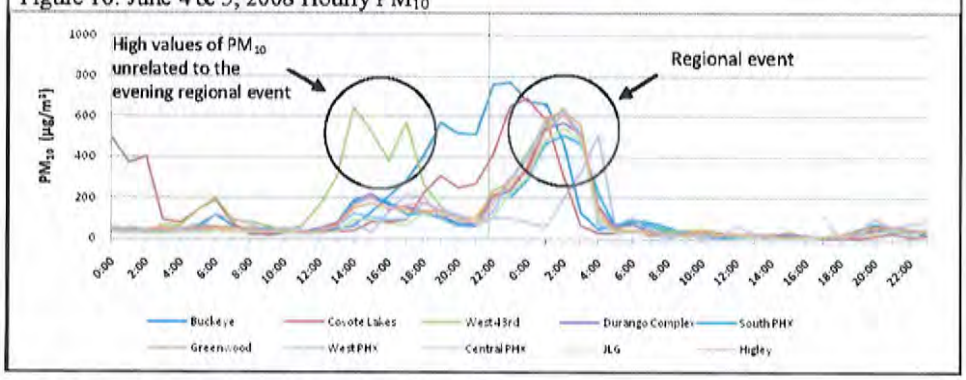
As high winds have been shown to drive PM_{10} events, EPA is incorrect in Section 5.4.5 when they state that "it appears that a regional weather event began on the evening of June 4 and lasted into the morning of June 5." ADEQ provides ample evidence that a regional weather event in the form of elevated strong and gusty winds began in the late morning / early afternoon hours of June 4th.

1. Winds at the West 43rd monitor gusted to 24 mph as early as the noon hour, and reached a maximum of 36 mph during the 3:00p.m. hour.
2. Additional documentation included by ADEQ shows that similarly timed and similar strength winds were occurring throughout much of the Phoenix area (as well as areas of California, Nevada and northern Arizona), with the strongest Phoenix area winds on the western periphery of the Valley.

Thus, while PM_{10} levels may not have been significantly elevated in some areas until later in the evening, winds began to become elevated to levels above typical historical fluctuations much earlier in the day.

Additionally, EPA asserts that only approximately 11.3 percent of the total PM_{10} mass concentration for June 4th can be attributed to the exceptional event. This, however, is based upon discounting the effect that strong and gusty winds had on the West 43rd monitor readings before the period when other monitors in the Valley were impacted by a larger, more homogeneous, dust plume. A different conclusion may be reached if one considers that all PM_{10} concentrations measured at West 43rd during the period of elevated winds, and definitely all concentrations measured there after 1400 (when winds were near their peak and Buckeye began to experience elevated PM_{10} as well) are removed from the 24-hour average PM_{10} calculation.

Figure 16: June 4 & 5, 2008 Hourly PM_{10}



5.4.6 Review of 5-Min PM_{10} and Wind Speed Data

The 5-min data also show that even though elevated wind speeds were measured at other nearby locations, the West 43rd monitor consistently measured much higher PM_{10} concentrations than other locations. Figure 18 shows the 5- min PM_{10} and wind speed data from West 43rd and Durango Complex:. these monitors are located only 2 miles apart, yet there seems to be a considerable difference in the relationship between PM_{10} and wind speed on June 4 during the late morning and early afternoon hours. Both sites experience similar wind speed levels, but during some periods of the day the 5-min PM_{10} concentrations at West 43rd site ranged from four to nine times higher than those measured at Durango Complex. The two highest 5-min PM_{10} averages measured at the West 43rd site were approximately 1475 and 975 $\mu g/m^3$, while PM_{10} concentrations at Durango Complex during the same time period were 153 and 264 $\mu g/m^3$, respectively.

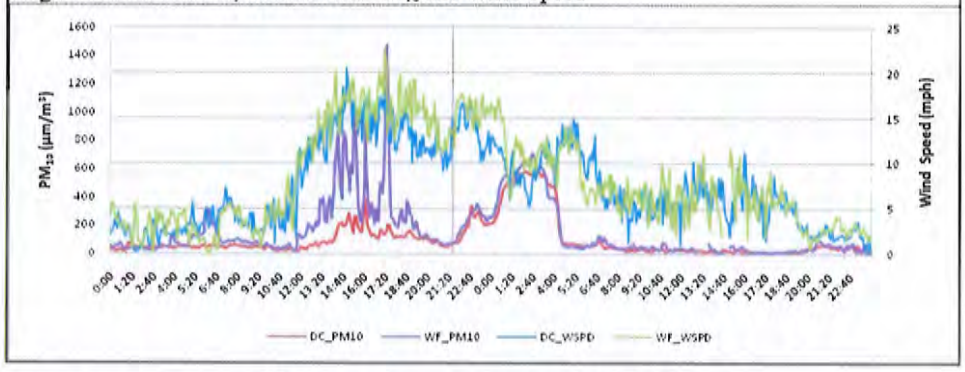
These data provide further evidence that the claimed regional high wind event only affected PM_{10} concentrations at West 43rd and the elevated PM_{10} concentrations measured at this site in the morning and early afternoon hours were most likely significantly influenced by local sources and the claimed exceptional event was not regional in nature.

ADEQ COMMENTS

The "regional event" noted in the early morning hours of June 5th did not cause an exceedance of the NAAQs at any location. The "regional wind" event the previous day on June 4th did cause exceedances at several locations. The source of the discrepancy between the magnitude of the concentration increases at the monitors is evident from ADEQ's submissions. Because of its location, the West 43rd monitor is especially susceptible to dust generated by high winds traveling from a west or southwest direction along the Gila and Salt River channels.

EPA's conclusion that the concentrations at the West 43rd Avenue monitor "may have been caused by local upwind sources and were not regional in nature" is therefore unsubstantiated. In any case, this conclusion, even if justified, would not legally support EPA's determination that there was not a clear causal connection between the winds and the concentrations. Local, anthropogenic sources may be considered part of an exceptional high wind event, as long as they are reasonably controlled. As previously discussed, there is ample basis for concluding that the sources in the vicinity of the West 43rd Avenue monitor satisfied this requirement.

Figure 17: June 4 & 5, 2008 5-Min PM_{10} and Wind Speed

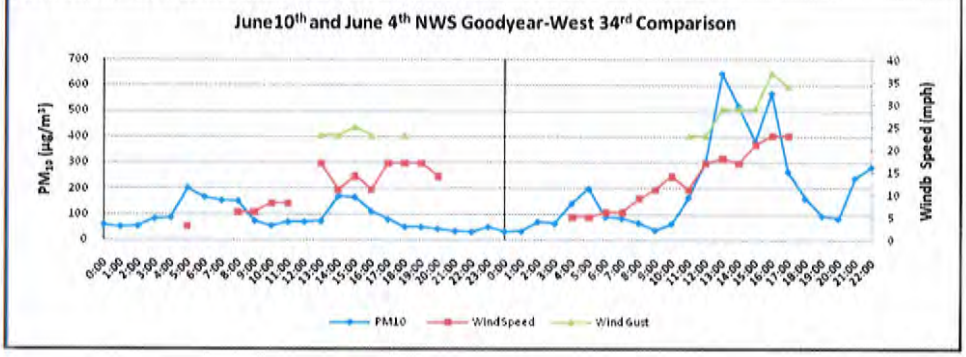


5.4.7 Review of Days with Similar Meteorological Conditions

On twelve days in June 2008, the wind speed at Goodyear Airport exceeded 15 mph. On two of those days, wind gusts exceeded 25 mph. The following analysis compares the hourly PM_{10} data, wind speed, and wind gusts on June 4 with the same data from a similar day in May.

On June 4, the West 43rd monitor experienced elevated PM_{10} concentrations of 307 $\mu g/m^3$ and 644.9 $\mu g/m^3$ at 1300 and 1400 hrs, respectively. Wind speeds at Goodyear Airport during this period were from the WSW (242°) at 17 and 18 mph with gusts of 23 and 29 mph. Similarly, on June 10, the Goodyear station measured wind speeds and gusts of similar magnitude; 17 mph wind speeds and 23 mph gusts from the WSW (240°). These elevated wind speeds, however, only correspond to a slight increase in hourly PM_{10} values at the West 43rd site. This example illustrates how elevated wind speeds in upwind areas are related to elevated PM_{10} concentrations on occasion, but the magnitude of PM_{10} concentrations measured at the West 43rd site seem to be dependent on a number of different factors.

Figure 18: Non-Exceedance Day Comparison



ADEQ COMMENTS

EPA inappropriate use of vector average wind speed data (Figure 3)

EPA's reliance on a graph with 5-minute vector average wind speed significantly understates the kinetic energy of the wind involved in the dust generating process. ADEQ did not provide or rely on the data presented in Figure 17.

It is apparent in Figure 18 provided by EPA that the winds occurring on June 10th were substantially weaker and shorter in duration than those occurring on June 4th. Wind gusts on June 4th were measured at or greater than 25 mph for five consecutive hours at the Goodyear NWS station on June 4th and were as high as 37 mph, while winds at the same location on June 10th appear to have gusted to near 25 mph for only one hour. EPA's statement that these two days experienced winds of similar magnitude is inaccurate and misleading. No conclusion as far as the magnitudes of PM_{10} in relation to wind gusts can be accurately drawn from a comparison of these two dates, as the winds experienced on June 4th were substantially greater than those experienced on June 10th.

5.4.8 Summary of Clear Causal Relationship for June 4, 2008

The data show that the spatial extent of PM_{10} during the early portion of the day was isolated and not regional in nature. In addition, ADEQ did not adequately address the possible contributing sources in the area directly upwind of the West 43rd monitor, which makes a causal relationship difficult to evaluate. ADEQ has also failed to adequately explain the differences in the measured PM_{10} concentrations at the West 43rd site and the remaining sites in the Phoenix area experiencing similar wind conditions.

ADEQ asserted that while elevated wind speeds occurred throughout the Phoenix area, "the blowing dust that was generated from these high winds occurred at sporadic locations;" the "high concentrations of blowing dust only occurred where dust sources were located;" and "these dust sources are typically located in depositional areas where fine and coarse particles are deposited during times of precipitation." ADEQ further concluded that "cause of the exceedances for the Maricopa County monitors was alluvial dust generated by high winds in the river channels, coupled with the generally elevated dust from the region-wide dust storm." Even more explicitly, ADEQ explained that the exceedance at West 43rd "was due to generally elevated PM_{10} from the dust storm coupled with contributions from dust generated in the alluvial plain of the Salt and Gila Rivers due to high, gusty winds." While ADEQ has concluded that the exceedance at West 43rd was caused by emissions originating in the Salt and Gila River channels, there little technical justification supporting this conclusion and there is no discussion explaining how emissions from these sources are not reasonably controllable or preventable.

While there appears to be some component of the PM_{10} that could be attributed to a regional dust storm event, the time series (Figures 16 and 17) indicate that the regional event did not influence the measured PM_{10} at the West 43rd site until very late on June 4 and the principal cause of the exceedance were emissions from local sources. Therefore, the weight of evidence does not demonstrate a clear causal relationship as required by the EER.

6.0 Concentration in Excess of Normal Historical Fluctuations

Pursuant to 40 CFR 50.14(c)(3)(iii)(C), the demonstration must show that "the event is associated with a measured concentration in excess of normal historical fluctuations." ADEQ provided tables for each event that ranked the PM_{10} exceedances using data from the past five years (2003-2008). A comparison was made to five years of data from the "spring season" and the complete five year data set. Table 6 summarizes these data.

Table 6: ADEQ Historical Distribution

Exceedance Date	PM_{10} Concentration	Seasonal Percentile	Yearly Percentile
3.14.08	251 $\mu g/m^3$	< 99.5	< 99.5
4.30.08	172 $\mu g/m^3$	< 97.5	< 99.7
5.21.08	279 $\mu g/m^3$	< 99.5	< 99.5
6.4.08	194 $\mu g/m^3$	< 97.5	< 99.0

ADEQ COMMENTS

EPA's asserts incorrectly in Section 5.4.8 that ADEQ's West 43rd event submittal is lacking in evidence to show that the Salt and Gila River channels are a primary source of PM_{10} emissions.

1. ADEQ included a map showing the location of the West 43rd monitor and its proximity to the Salt River Channel.

2. ADEQ included a detailed map showing the threshold friction velocities in and around the Phoenix Metro Area.

3. ADEQ has shown that adequate dust control measures are in place for many potential sources positioned upwind from the West 43rd monitor.

4. ADEQ has shown that any impacts those potential upwind sources might have on PM_{10} concentrations during the high winds are most likely the result of BACM being overwhelmed.

There is no specific threshold test for this requirement, but concentrations in the high percentiles can provide supporting evidence and informs EPA's weight of evidence analysis of the exceptional events in question. As stated in the EER preamble, "For extremely high concentrations relative to historical values, a lesser amount of documentation or evidence may be required." [36] While the relative comparison to the historical fluctuations informs the amount of evidence required, for an event to be considered an exceptional event, all criteria listed under section 3.0 must be met.

7.0 No Exceedances But For the Event

Pursuant to 40 CFR §50.14(c)(3)(iii)(D), the demonstration must show that "there would have been no exceedance or violation but for the event." The weight of evidence in a demonstration does not require a precise estimate of the air quality impact from the event,[37] though such information could be useful.

Assessments for all events include an "event contribution analysis" to support the notion that there would have been no exceedance but for the event. This analysis consists of a table that calculates the 24-hour PM_{10} concentration excluding the hours of the day that the event was assumed to have occurred. There is no explanation of how to interpret this analysis, and it is unclear how these hours are chosen for exclusion. Also, from the documentation alone, it is unclear how this calculation is performed. After conversations with staff members of ADEQ, it was determined that the hours that have been chosen for exclusion are replaced by the average PM_{10} concentration calculated with remaining hours of the day. This is equivalent to assuming there is no normal increase during those hours. If there is a typical rise during that period, then the average used may not be representative of typical conditions. Considering the weight of evidence, the assessments for all four events do not provide sufficient evidence to establish that there would not have been an exceedance but for the event.

8.0 Procedural Requirements

The EER at 40 CFR §50.14(c)(2)(iii) requires that data claimed to be due to an exceptional event must be flagged in the AQS database, and that an initial description of the event be provided to EPA by July 1 of the year following the event.

Pursuant to 40 CFR §50.14(c)(3)(i) the State must submit a demonstration to EPA within three years of the event. EPA received the final demonstrations for the 2008 events in question on November 17, 2009, which satisfies the three year submission requirement.

40 CFR §50.14(c)(3)(i) also requires notice and opportunity for public comment. ADEQ's documentation was available on the ADEQ web-site and the ADEQ Library in Phoenix beginning on October 15, 2009. No comments were received from the public during the comment period.[38] Information included in the draft supplemental report, received by EPA on March 17, 2010, has not yet gone through the public comment process.

[36] EER Preamble, 72 FR 13569.
[37] Id. at 13570.
[38] Letter from Nancy Wrona, ADEQ, to Deborah Jordan, USEPA Region 9 received on November 17, 2009.

ADEQ COMMENTS

From section 7.0 of EPA's TSD, referring to the Event Contribution Analysis (aka the 'But For' analysis), EPA incorrectly states that "there is no explanation of how to interpret this analysis."

This statement is simply not true as the June 4th DSR explains very clearly what the table is showing. For example, page 23 of the June 4th DSR states:

> 'The Event Contribution Analysis above highlights hours that exhibited elevated levels of PM_{10} due to unusually high winds at the Buckeye monitor on June 4, 2008. Data highlighted in pink are those hours that are being flagged for exclusion due to the influence of high winds. The calculation of the 24-hr average for PM_{10} is given both including the flagged event hours as well as omitting those hours from the average and replacing those values with the average of the rest of the day's PM_{10} values that were not influenced by the high wind event. The number highlighted in red shows the 24-hr PM_{10} concentration that would be above the NAAQS when including the concentrations measured during the high wind event, while the number highlighted in green shows a 24-hr average PM_{10} concentration that is below the NAAQS when replacing the elevated values due to the high winds with the average PM_{10} of the hours not occurring during the wind event.'

9.0 Conclusion

ADEQ stated that the measured exceedances at the West 43rd monitoring site, during these days, were a result of the transport of dust from soils by high winds that were associated with approaching low pressure systems. For all of the events, there appears to be elevated wind speeds in various locations throughout the Phoenix area, but as discussed in section 4.3, ADEQ's approach to defining "unusual" winds relies on complete yearly data, rather than the season during which the events occurred. In addition, ADEQ's approach would find that "unusual" winds occur on approximately 100 days a year. Also, there is little discussion or explanation concerning the meteorological conditions that were occurring on the days in question and how those conditions affected the elevated PM_{10} concentrations at the West 43rd monitoring site. The majority of the data concerning these relationships are presented in tables and a small number of graphs with no explanation of the interpretation of the information that has been presented.

Moreover, the Assessments did not adequately address the sources that may have been contributing to the event. Without this information, it is difficult to determine whether the elevated PM_{10} concentrations resulted from controllable anthropogenic sources or natural desert sources. Since there are numerous anthropogenic sources located in upwind areas, this information is critical to assessing whether an exceedance is the result of an exceptional event or uncontrolled anthropogenic sources. With little discussion of the meteorological conditions on the event days combined with a very limited discussion on possible sources, the Assessments did not adequately establish a clear source-receptor relationship or make a convincing demonstration that the events in question should be considered natural events under the EER.

Furthermore, the information in the Assessments did not support the broad conclusion that the elevated PM_{10} concentrations were caused by transport of dust from soils by high winds. Again, without acknowledging the sources that may be contributing to the event, it is difficult to determine where the dust originated from and how it was transported to West 43rd. Also, the monitoring data is inconsistent with the notion of transport. If transport was occurring on these days, one would expect to see similar concentrations at nearby monitoring locations. One of the most interesting aspects of these events is that on March 14 and April 30 the West 43rd monitor is the only monitor to violate the 24-hour standard, not only in the Phoenix area, but the entire state of Arizona except for the Cowtown monitor in Pinal County, which consistently measures the highest levels of PM_{10} within Region 9 due to its proximity to a large cattle feedlot. Also, the differences between the hourly PM_{10} concentrations at West 43rd and other sites that are located just a few miles away are striking. Although it is very clear that there is something unique about the measured exceedances at the West 43rd site, the assessments did not explain these differences in PM_{10} concentrations and how they are inconsistent with a regional high wind event.

The June 4 DSR included a more detailed discussion of the meteorological conditions during the event and provided some discussion on the sources that may be influencing the elevated PM_{10} concentrations at the West 43rd monitoring site. The additional documentation asserted that the exceedance measured at the West 43rd monitoring site can be attributed to emissions from the dry Gila and Salt River channels that were coupled with contributions from a regional dust storm. As previously discussed, the documentation Assessments did not provide sufficient technical

ADEQ COMMENTS

ADEQ asserts that windblown dust typically occurs only when hourly average winds are at least 10 mph and gusts are at least 20 mph. That isn't to say that any wind of 10mph or gust of 20 mph is "exceptional" or would creaste blowing dust. The 10 and 20 mph values are given as estimates for when winds may be considered "unusual", and this is backed up by the fact that the NWS typically does not report wind gusts unless they are greater than 15mph. As EPA has not provided a threshold value for wind speed that they would consider "unusual", ADEQ used available data to come up with an estimate for the wind speed at which 5% or less of all values would fall.

As previously discussed, the assertion that ADEQ's approach would result in claims that 100 days per year are unusual is misleading and does not look at wind gusts, which have been shown in both our data and in previous literature to be more influential than hourly average winds in creating windblown dust.

justification of this conclusion and did not explain how emissions from these sources were not reasonably controllable or preventable. Furthermore, the data show that the contribution from the regional dust storm during the late night hours of June 4 was not significant and the exceedance was most likely driven by the elevated PM_{10} concentrations measured in the late morning and early afternoon hours.

The June 4 DSR provided some new information regarding the significant differences in the hourly PM_{10} values seen at the Durango Complex and South Phoenix monitoring sites. The documentation stated that "it is also entirely possible that the urbanized core of the Phoenix metro area acted to reduce the amount of blowing dust compared to the western periphery due to increased surface roughness." While this might be relevant, it does not account for the nearly identical PM_{10} concentrations measured throughout the entire Phoenix area in the evening hours of June 4 and the morning hours of June 5. The June 4 DSR did not provide sufficient technical analysis to support a clear source receptor relationship or provide new evidence to support the notion that the June 4 event should be considered a natural event under the EER. Considering the weight of available evidence, EPA does not concur that the March 14, April 30, May 21 and June 4, 2008 exceedances at the West 43rd monitoring site should be treated as exceptional events.

ADEQ COMMENTS

The rule does not require identification of specific anthropogenic sources that contributed to particulate matter concentrations. It states that even if wind-blown dust originated from anthropogenic sources, it will be treated as part of a natural event as long as those sources are "reasonably well-controlled."

ADEQ's request demonstrated that this requirement was met in two ways.

First, it referred to the comprehensive control strategy that has been developed and implemented for the Phoenix Serious PM_{10} nonattainment area (MAG, 2000; MAG, 2007). Because of the intractability of the PM_{10} nonattainment problem in Maricopa County, anthropogenic sources of PM_{10} in this area probably have received more scrutiny from the State, the public and EPA than any other sources in the country. The control strategy and compliance program developed for the area were developed in response to the most stringent planning requirements of the Clean Air Act, including the Best Available Control Measures (BACM) requirement and the most stringent measures requirement. The control strategy had to include a comprehensive inventory of sources, so any suggestion that there are unknown, uncontrolled sources (see Review § 4.3 at 7) is unwarranted.

Second, the demonstration included a comprehensive review of all available compliance data for the 72-hour periods leading up to and including the events. Except for two minor violations identified by Maricopa County inspectors on June 4, 2008, no unusual dust-producing activities were identified. Thus, there is no basis for concluding that anthropogenic emissions varied significantly before, during or after the event.

Appendix A

Table 1: Meteorological Data Used in ADEQ's Assessments[39]						
Available Met Data	**Distance to West 43rd**	**Direction**	**3.14.08**	**4.30.08**	**5.21.08**	**6.4.08**
WEST PHOENIX	5	N	x		x	
MESA	16	E		x		
NORTH PHOENIX	12	NNE				
GLENDALE	12	N				
PINNACLE PEAK	27	NE				
CENTRAL PHOENIX	7	ENE	x	x		x
SOUTH SCOTTSDALE	14	ENE		x		
GREENWOOD	4	NNE				
SOUTH PHOENIX	4	E		x	x	
COYOTE LAKES*	21	NNW	x			x
WEST CHANDLER	17	ESE		x		
TEMPE	12	E				
HIGLEY	25	ESE		x		
WEST 43RD	n/a	n/a	x	x	x	x
DYSART	20	NNE				
BUCKEYE	28	W			x	x
DURANGO COMPLEX	2	NE	x	x	x	x
JLG SUPERSITE	7	NNE				
WEST INDIAN ROAD	6	N				
FALCON FIELD	24	E				
CAVE CREEK	29	NNE				
BLUE POINT	32	ENE				
FOUNTAIN HILLS	28	ENE				
GOODYEAR	13	W	x	x		
LUKE AFB	16	NW				x
GLENDALE	13	NW	x			
SKY HARBOR	9	ENE	x		x	
DEER VALLEY	20	N			x	
SCOTTSDALE	20	NE				
FALCON FIELD	24	E				
CHANDLER	21	ESE				
WILLIAMS GATEWAY	29	ESE				

[39] The highlighted areas in Table 1 correspond to either the closest meteorological station or stations upwind of the West 43rd monitoring site.

ADEQ COMMENTS

Appendix A is irrelevant. ADEQ presented the wind data that were relevant to the discussion and event being discussed.

Table 2: PM_{10} Data Used in ADEQ's Assessments[40]				
Site Name	**Distance to West 43rd**	**Direction**	**24 Hour PM_{10} Data**	**Hourly PM_{10} Data**
		3.14.08		
WEST PHOENIX	5	N	x	x
CENTRAL PHOENIX	7	ENE	x	x
GREENWOOD	4	NNE	x	x
SOUTH PHOENIX	4	E	x	
COYOTE LAKES	21	NNW	x	x
HIGLEY	25	ESE	x	
WEST 43RD	n/a	n/a	x	x
BUCKEYE	28	W		
DURANGO COMPLEX	2	NE	x	x
JLG SUPERSITE	7	NNE	x	
		4.30.08		
WEST PHOENIX	5	N	x	
MESA	16	E		n/a
NORTH PHOENIX	12	NNE		n/a
GLENDALE	12	N		n/a
CENTRAL PHOENIX	7	ENE	x	x
SOUTH SCOTTSDALE	14	ENE		n/a
GREENWOOD	4	NNE	x	x
SOUTH PHOENIX	4	E	x	x
COYOTE LAKES	21	NNW	x	
WEST CHANDLER	17	ESE		n/a
HIGLEY	25	ESE	x	x
WEST 43RD	n/a	n/a	x	x
DYSART	20	NNE		n/a
BUCKEYE	28	W		
BETHUNE	4	NE		n/a
DURANGO COMPLEX	2	NE	x	x
JLG SUPERSITE	7	NNE	x	
		5.21.08		
WEST PHOENIX	5	N		x
CENTRAL PHOENIX	7	ENE		
GREENWOOD	4	NNE	x	
SOUTH PHOENIX	4	E	x	x
COYOTE LAKES	21	NNW		
HIGLEY	25	ESE		
WEST 43RD	n/a	n/a	x	x
BUCKEYE	28	W		x
BETHUNE	4	NE		n/a
DURANGO COMPLEX	2	NE	x	x
JLG SUPERSITE	7	NNE		

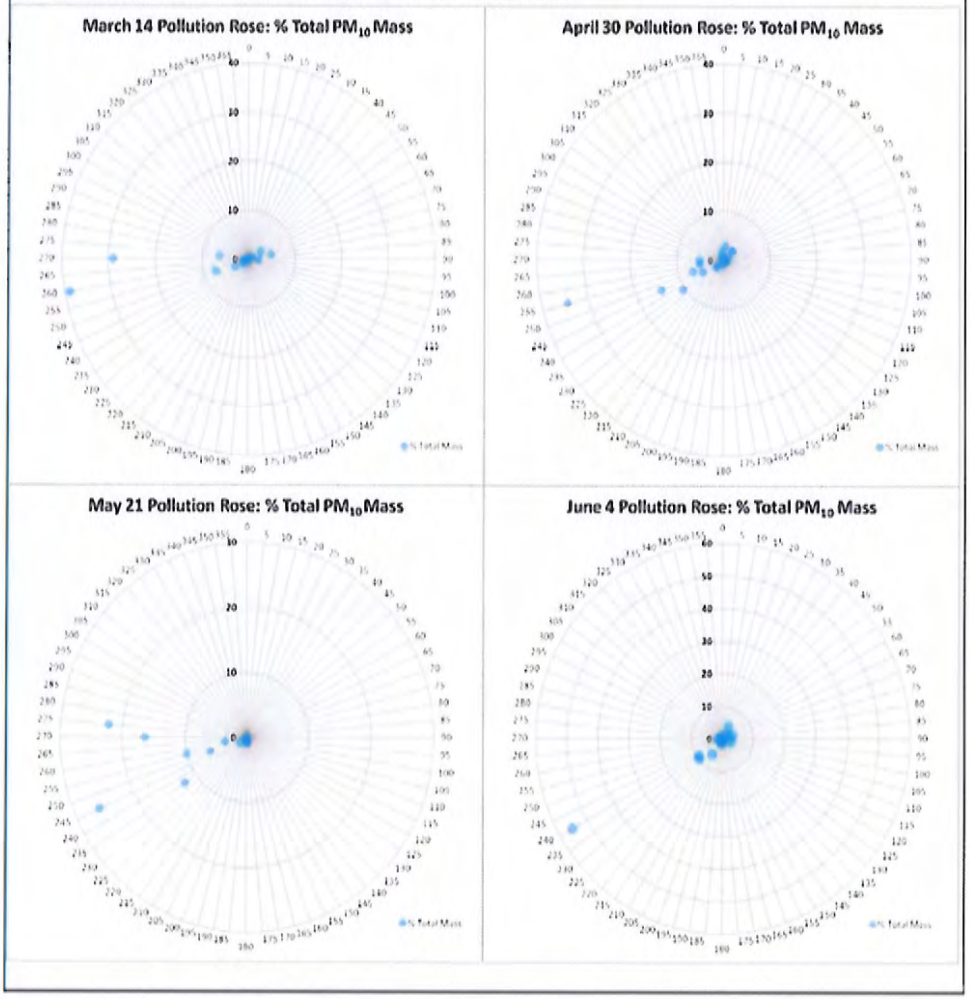
[40] The highlighted areas in Table 1 correspond to either the closest meteorological station or stations upwind of the West 43rd monitoring site.

ADEQ COMMENTS

6.4.08				
WEST PHOENIX	5	N		x
CENTRAL PHOENIX	7	ENE		x
GREENWOOD	4	NNE		x
SOUTH PHOENIX	4	E		
COYOTE LAKES	21	NNW	x	x
HIGLEY	25	ESE		
WEST 43RD	n/a	n/a	x	x
BUCKEYE	28	W	x	x
BETHUNE	4	NE		
DURANGO COMPLEX	2	NE		x
JLG SUPERSITE	7	NNE		

ADEQ COMMENTS

Figure 1: West 43rd Pollution Roses % Total PM_{10} Mass



ADEQ COMMENTS

Appendix B

EPA acknowledges that massive dust storms do occur in the Southwestern United States and that these events could quality as exceptional events if all requirements of the EER were satisfied. The following information could be used as evidence in an exceptional events demonstration if the conditions of the event were consistent with those observed during a dust storm.

The relationship between weather types, wind speed, and dust storm generation has been researched and examined for many years. Generally, there are generally four different weather types that are capable of producing dust storms. These conditions were examined in further detail by Brazel and Nickling in two separate research papers during the 1980's. Both studies conclude that the frequency of dust storms can be directly linked to specific weather conditions which are accompanied by elevated wind speeds, but also note that dust events are "strongly affected by antecedent conditions (i.e. surface moisture, vegetation cover, surface crusting, and anthropogenic disturbances)". For the years 1965 -1980, 80% of all intense dust storms[41] in the Phoenix area were related to thunderstorm activity in the region. The mean wind speed for dust storms during this time period in the Phoenix area were 12.4 m/s or 27.7 mph, while the mean peak gusts were 17.8 m/s or 39.8 mph (Nickling W.G., Brazel A.J., 1984). Some of these intense dust storms that occur in the Phoenix area could potentially be classified as "haboobs": events that are caused by powerful downdrafts from thunderstorms and have the potential to create solid walls of advancing dust (Idso, 1972).

There are a number of different definitions of "dust storms" based on different levels of reduced visibility. The National Weather Service issues a dust storm advisory when visibility drops below 1 mile and a dust storm warning when visibility is less than ¼ mile. NWS further states that "typically, Blowing Dust Advisories are issued for widespread winds that may produce localized areas of blowing dust" and "dust storms can occur with widespread winds, or may be associated with thunderstorm outflow." Table 2 lists all days in 2008 that had reports of blowing dust or dust storms at Phoenix NWS stations.

Similarly, Nickling and Brazel (1984) also use a reduced visibility of 1 mile as a cut-off point for dust storm classification. This criterion was chosen to be the most representative of the conditions that can be attributed to dust storms in Arizona. Earlier research suggests that reduced visibility less than 7 miles constitutes dust storm classification (Orgill, Sehmel, 1976). Table 1 shows the visibility recorded at Goodyear Airport during the event days in question compared to the various dust storm definitions discussed above.

In 2008, the Phoenix area experienced numerous occurrences of thunderstorm activity and elevated winds. A detailed account of these events is displayed in table 3 and is available in the NWS report "Storm Data and Unusual Weather Phenomena". Four of the events are described as dust storms.[42] For example, an event occurring on September 11 was described as "a

[41] Intense dust storms (IDS) correspond with visibility ≤ 1 mile, while moderate-to-weak dust storms (MWDS) correspond to visibility >1 mile but ≤ 7 miles.

[42] The events described by the NWS as dust storms occurred on May 15, July 1, July 10, and September 9. The meteorological events that occurred on the days of concern for the present analysis (March 14, April 30, May 21, and June 4) were not characterized as such.

ADEQ COMMENTS

EPA's Appendix B seems to imply that only a major dust "storms" can be excluded. This is not true. Any wind capable of generating dust, and overwhelming BACM controls can be a source of an exceptional event.

2000 TCD Page 2 Paragraph 3 discuses the experience of the ADEQ contractor performing work on Arizona soils.

"Prior research has shown that high wind speeds especially when coupled with drought conditions and low soil moisture have caused dust storms in the southwest United States. A portable wind tunnel was used by ADEQ contractors in 1989 to estimate wind erosion at various wind speeds over different soils in Arizona; Nickling, W.G. and Gillies, J.A. 1989, Emission of Fine Grained Particulates from Desert Soils. Their investigations found disturbed desert soils became suspended at about 7.0 meters per second (15.7 mph). Subsequent hour-by-hour measurements of PM_{10} and wind by ADEQ at various locations have substantiated this finding. This information was given to the natural exceptional events researchers for incorporation in the qualification criteria."

Also, see Table 3 U_{t10m} in the original Nickling, W.G. and Gillies, J.A. 1989.

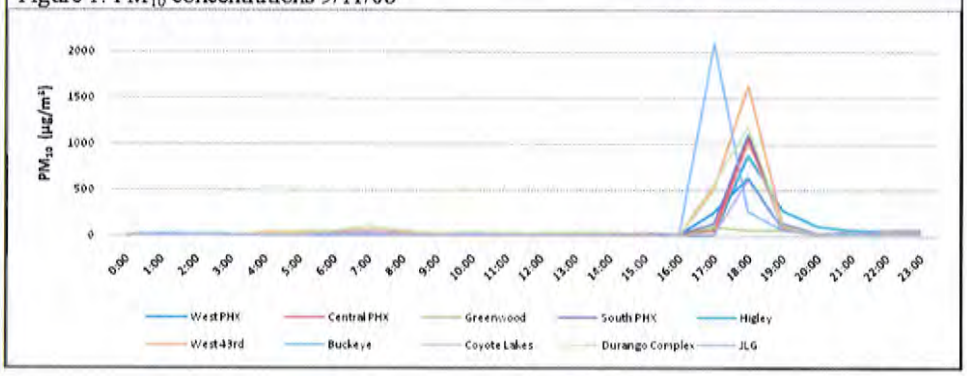
spectacular dust storm moved across west-central and central Maricopa County, including the Greater Phoenix area. Dust moved southwest to northeast, with winds typically 30-50 mph accompanying the blowing dust. A 3-mile stretch of power poles was blown down along old U.S. highway 80 south of Buckeye and north of Gila Bend (615 PM)".

Table 1: Dust Storm Comparison

Event Date	**3.14.08**	**4.30.08**	**5.21.08**	**6.4.08**
Event Visibility (miles)[43]	**10**	**7**	**7**	**20**
0.25[44]	N	N	N	N
1[45]	N	N	N	N
7[46]	N	N	N	N

Figure 1 further illustrates how PM_{10} concentrations can be affected during these events. The September 9 dust storm originated in the southwest and moved through Phoenix, heading northeast. Wind speeds throughout the Phoenix area reached 30 mph, with 40 mph wind gusts reported at the NWS Luke Air Force Base station. Wind direction during the event was predominately from the west/southwest. The visibility during the event dropped below ¼ mile at one station and remained below 5 miles for other stations in the area. Figure 1 shows the west to east movement of the dust storm and its effect on the PM_{10} monitoring stations in the Phoenix area. PM_{10} concentrations spike first at the Buckeye monitor at 1700 hrs and the rest of the central Phoenix area experiences elevated PM_{10} concentrations at 1800 hrs.

Figure 1: PM_{10} concentrations 9/11/08



[43] Visibility during periods of elevated wind speed and elevated PM_{10} at West 43rd
[44] NWS Warning
[45] NWS Advisory & Nickling and Brazel
[46] Orgill and Sehmel

ADEQ COMMENTS

Table 2: National Weather Service Significant Weather Types 2008

Date	Goodyear	Luke AFB	Glendale	Sky Harbor	Chandler	Williams Gateway	Falcon Field	Scottsdale	Deer Valley
3.14.08									
4.16.08	BLDU								
4.30.08									
5.15.08	BLDU	SQ			BLDU				
5.21.08					BLDU				
6.4.08	BLDU	BLDU DU							
6.5.08		HZ		BLDU HZ	BLDU	HZ		HZ	HZ
7.1.08		BLDU			BLDU				HZ SQ
7.3.08		BLDU							
7.4.08			BLDU					HZ	
7.10.08				BLDU					
7.13.08				BLDU					
7.26.08						BLDU			
8.7.08		BLDU		BLDU	BLDU				
8.14.08	BLDU	BLDU		BLDU	BLDU	BLDU			
8.25.08	BLDU	BLDU SQ	BLDU	BLDU					
8.30.08		BLDU			BLDU				
9.8.08					BLDU				
9.11.08	DS	BLDU HZ	BLDU	BLDU HZ SQ	BLDU	DS HZ	BLDU	HZ SQ	HZ
9.26.08						BLDU			
9.27.08				BLDU					
11.9.08	BLDU	HZ		BLDU	BLDU		BLDU		HZ
12.13.08	BLDU								

Notes: BLDU - Blowing Dust DS - Dust Storm DU - Dust HZ - Haze SQ – Squall[47]

Table 3: NWS Storm Data and Unusual Weather Phenomena Reports 2008

Date	Location[48]	Event	Time	Description
3.14.08	**NONE**			
4.16.08	**NONE**			
4.30.08	**NONE**			
5.15.08	AZZ028-Central Deserts	**Dust Storm**	1515-1640	Strong and gusty winds uprooted trees in Eastern Chandler. **Dense blowing dust** with low visibility was reported at Gateway airport
	Maricopa County	Thunderstorm Wind	1535-1610	Portions of eastern Maricopa county and Pinal county received gusty winds from a line of thunderstorms that moved rapidly toward the south.
5.21.08	NONE			

[47] NWS definition: sudden onset of a strong wind with increase of at least 16 knots and sustained at 22 knots or more for at least one minute

[48] See Figure 2 for NWS Forecast Areas

ADEQ COMMENTS

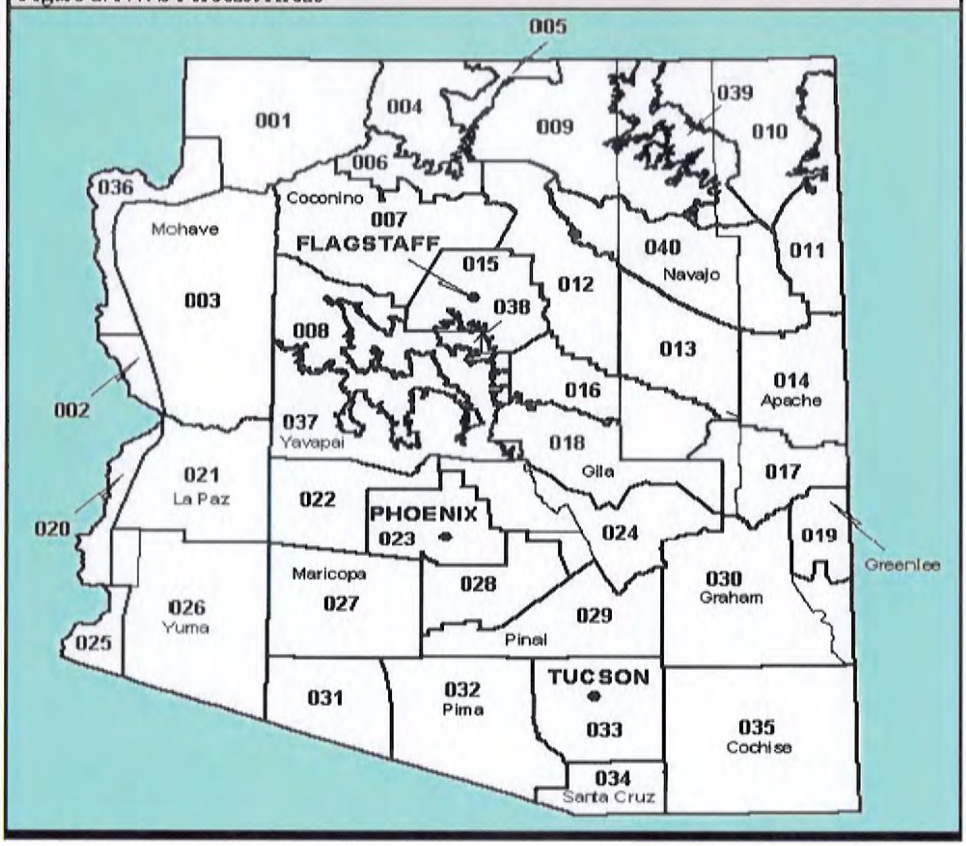
6.4.08	**NONE**			
6.5.08	NONE			
7.1.08	AZZ028-Central Deserts	**Dust Storm**	1740-1800	Low visibility due to blowing dust resulted from strong winds from nearby thunderstorms. Winds were generally in the 30 to 40 mph range with reports of **blowing dust** in the Phoenix East Valley Late in the afternoon and early afternoon.
7.3.08	Maricopa County	Funnel Cloud	2140	Pilot reported sighting a brief funnel cloud. Thunderstorms were triggered by an old outflow boundary. The associated peak wind gusts were 28 knots at Sky Harbor and 39 knots at Scottsdale airport
	Pinal County	Thunderstorm Wind	1630-1631	Several trees were uprooted at Saddlebrook
7.4.08	Maricopa County	Thunderstorm Wind	1900-2000	Scottsdale airport recorded peak winds of 53 mph during thunderstorms. Winds at Sky Harbor airport reached as high as 39 mph and some tents at the fireworks display were blown down
7.10.08	AZZ026 - Southwestern Deserts	**Dust Storm**	1540-1700	Strong winds from nearby thunderstorms resulted in **dense blowing dust**.
	Maricopa County	Thunderstorm Wind	1830-2045	Winds caused power outages and property damage due to microburst winds as high as 65 mph. Winds blew down a tree near 78th Street and McDonald which damaged a covered parking structure.
	Maricopa County	Thunderstorm Wind	1915-1925	Winds speed measured at 68 mph at Bush Highway and Usery Pass Road. According to radar, these storms were moving west at about 35 mph.
	Pinal County	Thunderstorm Wind	1927-1940	Spotters in two locations in Apache Junction had gusts to 67 and 89 mph
7.13.08	Maricopa County	Thunderstorm Wind	1600-1630	Winds from a microburst blew down about 25 trees and damaged light poles at Mesa Community College. A security officer was slightly injured when the strong winds blew him from his golf cart.
7.26.08	Maricopa County	Thunderstorm Wind	1830	Power poles and trees were reported down at Chandler Heights and Greenfield roads, as well as Ocotillo and Higley and at Ocotillo and Power roads. Brief strong winds caused isolated damage to parts of the Southeast Valley
8.7.08	Maricopa County	Thunderstorm Wind	1940-1950	Power poles and lines reported blown down. As many as 70 poles were down in the Buckeye area alone. Note: the estimated wind gust of 60 knots is equivalent to 69 mph.
	Maricopa County	Thunderstorm Wind	2017-2020	Power poles down in Central Phoenix. Note: the estimated wind gust of 60 knots is equivalent to 69 mph.
	Maricopa County	Thunderstorm Wind	2020-2025	Large branches blown from trees. Note: the estimated wind gust of 55 knots is equivalent to 63 mph.
8.14.08	Pinal County	Thunderstorm Wind	1810-1850	Strong winds reported by spotter. Note: the estimated wind gust of 52 knots is equivalent to 60 mph.

ADEQ COMMENTS

	Maricopa County	Thunderstorm Wind	1812-1852	Several crashes on the Loop 202 were blamed on strong winds and rain. Power outages were reported after winds and rain moved through the East Valley. SRP reported about 3,000 customers were left without electricity... and APS reported 2,000 customers without power. Note: the estimated wind gust of 52 knots is equivalent to 60 mph.
	Maricopa County	Thunderstorm Wind	1838	Strong winds reported at Brown and Mesa. Trees were damaged. Note: the estimated wind gust of 50 knots is equivalent to 58 mph.
	Maricopa County	Thunderstorm Wind	1905	Winds at Chandler Airport reached 50 knots as severe thunderstorms moved toward the west. The southern and central portions of Arizona were very moist and unstable. Storms developed and moved toward the southwest and strong winds kicked up widespread areas of **blowing dust**. A Severe Thunderstorm Watch was in effect for much of the evening. Note: the measured wind gust of 50 knots is equivalent to 58 mph.
8.25.08	Maricopa County	Thunderstorm Wind	1510-1526	Microburst winds hit Chandler airport and flipped at least two planes. Winds also damaged a fence and other property. Northeast winds peaked at 67 mph at 3:25 pm. Thunderstorm winds over 80 mph damaged planes at Chandler Municipal Airport. Strong winds also blew down tress and damaged some homes in the Chandler area. **Dense blowing dust** was also reported. Note: the measured wind gust of 58 knots is equivalent to 67 mph.
8.30.08	NONE			
9.8.08	NONE			
9.11.08	Maricopa County	Thunderstorm Wind	1710-1720	Shingles were blown off homes, and a few trees were uprooted.
	Maricopa County	Thunderstorm Wind	1734-1742	Winds estimated to reach as high as 60 mph along with visibility to less than a 1/4 mile in **blowing dust**.
	Maricopa County	Thunderstorm Wind	1740	Flood control district sensor measured a gust to 60 mph.
	AZZ023-Greater Phoenix Area	**Dust Storm**	1745-1815	Thunderstorms moved steadily toward the northeast during afternoon hours. As a result, locally heavy rain, strong winds and very low visibility due to **dust and sand moved across the deserts**
	Maricopa County	Thunderstorm Wind	1815-1840	According to Arizona Public Service, 48 power poles across a distance of three miles were blown down along Old Highway 80 between Buckeye and Gila Bend. Winds were measured up to 56 mph on the Palo Verde Nuclear Generating Station tower.
9.26.08	NONE			
9.27.08	NONE			
11.9.08	NONE			
12.13.08	NONE			

ADEQ COMMENTS

Figure 2: NWS Forecast Areas



ADEQ COMMENTS

References

Adams, D.K and Comrie, A.C. 1997. The North American Monsoon. *Bulletin of the American Meteorological Society*. 78: 2197-2213.

Brazel, A.J. and Nickling, W.G. 1986. The Relationship of Weather Types to Dust Storm Generation in Arizona (1965-1980). *Journal of Climatology*. 6: 255-275

Brazel, A.J. and Nickling, W.G. 1984. Temporal and Spatial Characteristics of Arizona Dust Storms (1965-1980). *Journal of Climatology*. 4: 645-660.

Breed, C.S., and Reheis, M.C. (Eds.) 1999. Desert Winds: Monitoring Wind-Related Surface Processes in Arizona, New Mexico, and California. *U.S. Geological Survey Professional Paper 1598*.

Chow, J.C., Pace, T.G., and Watson, J.G. 2000. Fugitive Dust. In *Air Pollution Engineering Manual*, Davis, W.T., (Ed.) Van Nostrand Reinhold, New York, NY.

Cowherd, C. 1995. Wind Tunnel Studies of BACM Effectiveness. Final Test Report. Prepared for South Coast Air Quality Management District by Midwest Research Institute (MRI). Contract No. 95017. MRI Project No. 3826.

Cowherd, C. 2000. Wind Erodibility Assessment of the Stabilized Soils in the Antelope Valley. Test Report. Prepared for Southern California Edison and the City of Los Angeles Department of Airports by Midwest Research Institute (MRI). Contract No. U1109008. MRI Project No. 110028.

Dulla, R.G. and Liu, W. 2008. PM-10 Source Apportionment and Deposition Study. Prepared for Maricopa Association of Govenments by Sierra Research, Inc. Report No. 2008-03-01.

Fernando, H.J.S., Dimitrova, R., Runger, G., Lurponglukana, N., Hyde, P., Hedquist, B., and Anderson, J. 2009. Children's Health Project: Linking Asthma to PM10 in Central Phoenix – A Report to the Arizona Department of Environmental Quality. Prepared by Arizona State University's Center for Environmental Fluid Dynamics andCenter for Health Information and Research.

Fitz, D.R. 1996. Field Study to Determine Limits of Best Available Control Methods for Fugitive Dust Under High Wind Conditions. Final Report. Prepared for South Coast Air Quality Management District by University of California Riverside, CA. Contract R-C94159.

Gillette, D.A., Holcombe, T.L., and Ley T. 1997. Effects of Prior Precipitation and Source Area Characteristics on the Threshold Wind Velocities for Blowing Dust Episodes, Sonoran Desert 1948-78. *Journal of Applied Meteorology*. 36: 1060-1175.

ADEQ COMMENTS

ADEQ References

MAG, 2000. Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area, February 2000.

MAG, 2007. MAG 2007 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area, December 2007.

Gillette, D.A., Adams, J., Endo, A., and Smith, D. 1980. Threshold Velocities for Input of Soil Particles into the Air by Desert Soils. *Journal of Geophysical Research.* 85: 5621-5630

Gillette, D.A. 1999. A Qualitative Geophysical Explanation for "Hot Spot' Dust Emitting Source Regions. *Contr. Atomos. Phys.* 72: 67-77.

Goudie, A.S. and Middleton, N.J. 1992. The Changing Frequency of Dust Storms Through Time. *Climatic Change.* 20: 197-225

Idso, S.B., Ingram, R.S., and Pritchard, J.M. 1972. An American Haboob. *Bulletin of the American Meteorological Society.* 53: 930-935.

Mansell, G.E., Lau, S., Russell, J. and Omary, M. 2006. Fugitive Wind Blown Dust Emissions and Model Performance Evaluation Phase II. Prepared for Western Governors' Association by ENVIRON International Corporation and the University of California at Riverside College of Engineering.

Nickling, W.G. and Gillies, J.A. 1989. Emission of Fine Grained Particulates From Desert Soils. In *Paleoclimatology and Paleometeorology: Maodern and Past Patterns of Global Atmospheric Transport.* Leinen, M. and Sarnthein, M., (Eds.) Kluwer Academic Publishers. 133-165.

Orgil, M.M. and Sehmel, G.A. 1976. Frequency and Diurnal Variation of Dust Storms in the Contiguous U.S.A. *Atmospheric Environment.* 10: 813-825.

Sharratt, B., Feng, G, and Wending, L. 2007. Loss of Soil and PM10 From Agricultural Fields Associated with High Winds on the Columbia Plateau. *Earth Surface Processes and Landforms.* 32: 621-630.

Stout E. 2001. Dust and Environment in the Southern High Plains of North America. *Journal of Arid Environments.* 47: 425-441.

U.S. EPA 1986. Guideline on the Identification and the Use of Air Quality Data Affected by Exceptional Events. EPA-450/4-86-0007.

U.S. EPA 1992. Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures. EPA-450/2-92-004.

Watson, J.G. and Chow, J.C. 2000. Reconciling Urban Fugitive Dust Emissions Inventory and Ambient Source Contribution Estimates: Summary of Current Knowledge and Needed Research. *DRI Document No. 6110.4F.*

Watson, J.G., Chow, J.C., and Gillies, J.A. 1996. Effectiveness Demonstration of Fugitive Dust Control Methods for Public Unpaved Roads and Unpaved Shoulders on Paved Roads.

ADEQ COMMENTS

None.

Final Report. Prepared by Desert Research Institute (DRI) for California Air Resources Board. DRI Document No. 685-5200-1F1.

Weaver, D. 1922. Initial Blowsand Study for the Coachella Valley, California. Prepared for South Coast Air Quality Management District.

Pinal County Air Quality Control District Source Apportionment Study 2005. Prepared by Pinal County Air Quality Staff.

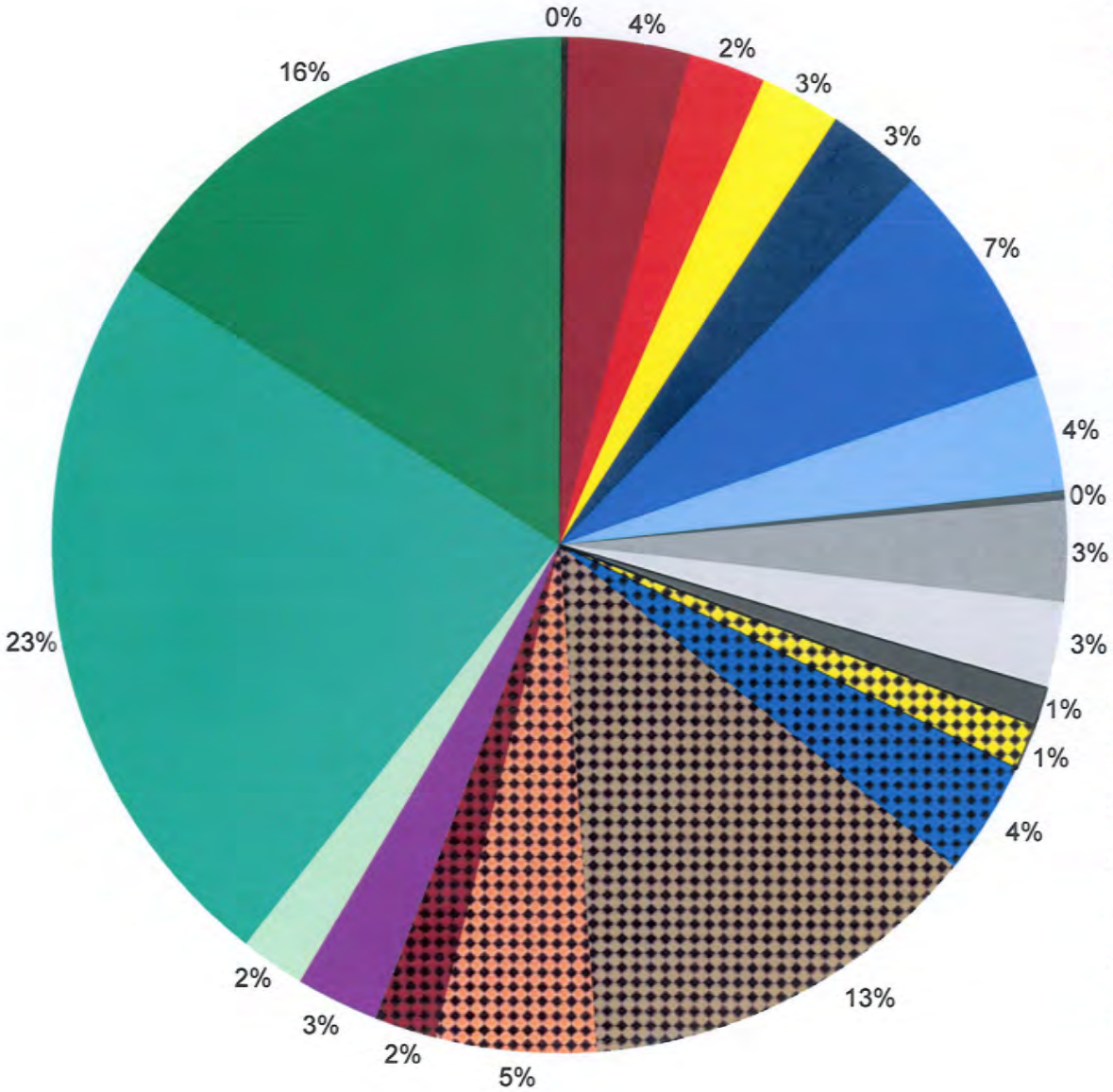
An Inventory of Vacant Land Soil Stability and Private Unpaved Roads in the Las Vegas Valley Using Remote Sensing Imagery. Prepared for Clark County Department of Finance Purchasing and Contracts by Environmental Quality Maganement, Inc. and Midwest Research Institute. PN 70204.001.

ADEQ COMMENTS

None.

2008 PM_{10} Emissions Inventory

(PM_{10} Nonattainment Area Total = 73,410 tons/yr)



Source Categories	%
Major stationary point sources	(<0.5%)
All other industrial processes	(4%)
Fuel combustion and fires	(2%)
Agriculture	(3%)
Construction, residential	(3%)
Construction, commercial	(7%)
Construction, road	(4%)
Other earthmvg: trenching, weed control	(<0.5%)
Travel on unpaved parking lots	(3%)
Offroad rec. vehicles fugitive dust	(3%)
Leaf blowers fugitive dust	(1%)
Windblown: agricultural land	(1%)
Windblown: developing land	(4%)
Windblown: vacant land	(13%)
Windblown: open areas	(5%)
Windblown: S&G, landfills, test tracks	(2%)
Nonroad mobile sources	(3%)
Exhaust/tire wear/brake wear	(2%)
Paved road fugitive dust, including trackout	(23%)
Unpaved road fugitive dust	(16%)

Emissions Inventory Unit, MCAQD

June 30, 2010

Agenda Item #6

Maricopa County
Air Quality Department

2008 PM_{10} Periodic Emissions Inventory

for the
Maricopa County, Arizona, Nonattainment Area

Final Draft
June 2010

2008 PM_{10} Periodic Emission Inventory
for the Maricopa County, Arizona Nonattainment Area

Final Draft
June 2010

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- Announcement of Public Workshop at MCAQD (May 14, 2010)

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Table A5–1. Sample of MOBILE6.2 Input Files A5-1
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1. Introduction

1.1 Overview

This 2008 periodic PM_{10} 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 emission 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 serious nonattainment for PM_{10}.

PM_{10} is defined as particulate matter less than or equal to ten micrometers in diameter. This inventory includes primary emissions of PM_{10} and $PM_{2.5}$ as well as three particulate matter precursors: nitrogen oxides (NO_x), sulfur dioxides (SO_x) and ammonia (NH_3). 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 2008 Periodic PM_{10} Emissions Inventory for Maricopa County. Point sources and the majority of area, and nonroad mobile source emission estimates were prepared by MCAQD. The Maricopa Association of Governments (MAG) prepared the emission estimates for onroad mobile, biogenic, and some area and nonroad mobile source categories. 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 contacts
2. Point Sources	Matt Poppen, MCAQD (602) 506-6790	–Eric Raisanen and Dena Konopka MCAQD (602) 506-6790 –Cathy Arthur, MAG (602) 254-6300
3. Area Sources	–Matt Poppen, Eric Raisanen and Dena Konopka, MCAQD (602) 506-6790 –Cathy Arthur, MAG (602) 254-6300	–Bob Downing, MCAQD (602) 506-6790 –Cathy Arthur, MAG (602) 254-6300
4. Nonroad Mobile Sources	Matt Poppen and Bob Downing MCAQD (602) 506-6790	–Eric Raisanen and Dena Konopka MCAQD (602) 506-6790 –Cathy Arthur, MAG (602) 254-6300
5. Onroad Mobile Sources	Ieesuck Jung and Cathy Arthur MAG (602) 254-6300	Bob Downing and Dena Konopka MCAQD (602) 506-6790
6. Biogenic Sources	Feng Liu MAG (602) 254-6300	Bob Downing and Dena Konopka MCAQD (602) 506-6790

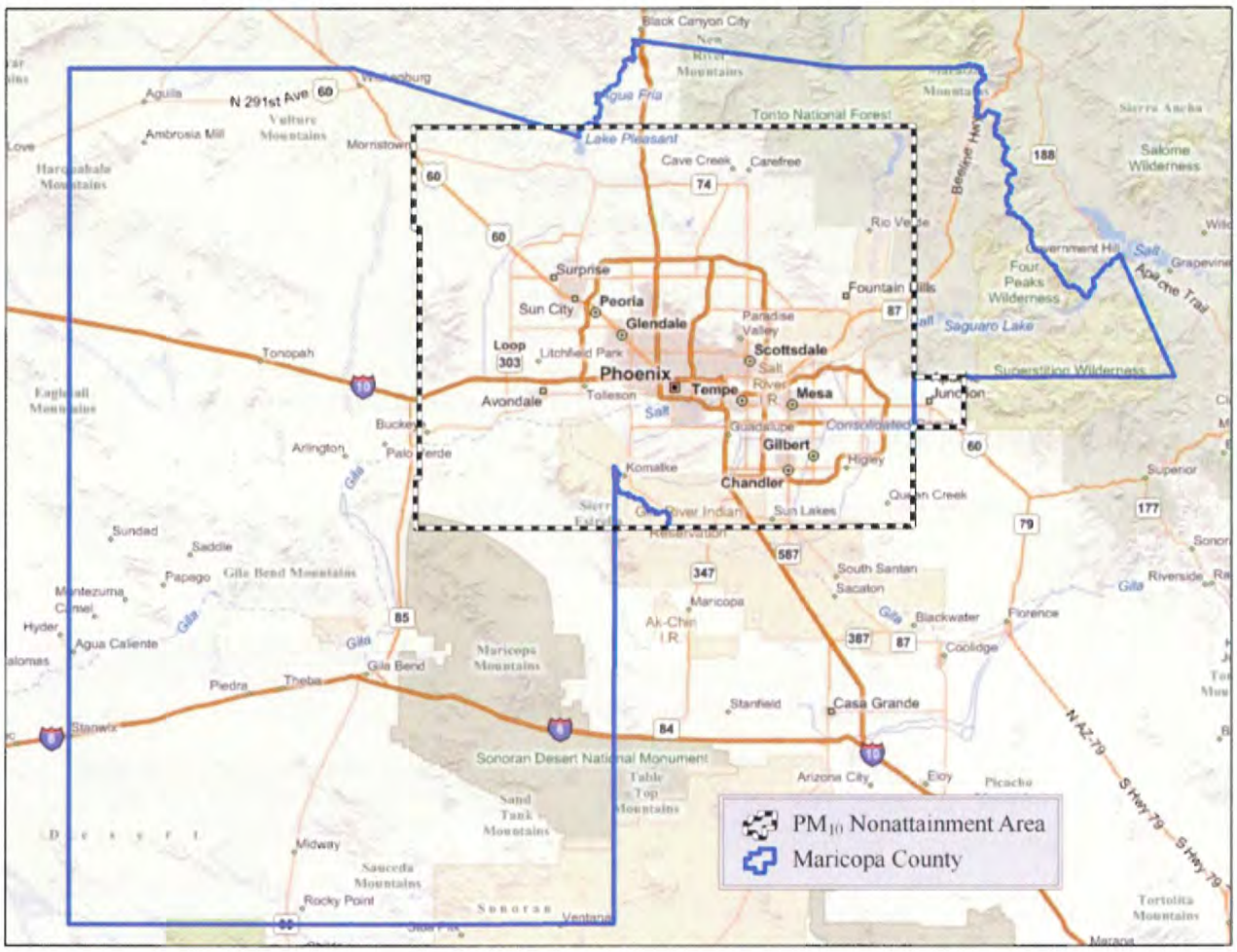
1.3 Temporal scope

Annual and typical daily emissions were estimated for the year 2008, for Maricopa County and the Maricopa County PM_{10} nonattainment area (NAA).

1.4 Geographic scope

This inventory includes emission estimates for Maricopa County and for the Maricopa County PM_{10} nonattainment area. Maricopa County encompasses approximately 9,223 square miles of land area, while the Maricopa County PM_{10} nonattainment area is approximately 2,880 square miles or approximately 31 percent of the Maricopa County land area. A map of Maricopa County and the PM_{10} nonattainment area is provided in Figure 1.4–1.

Figure 1.4–1. Map of Maricopa County and the PM_{10} nonattainment area.



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 2008, for both Maricopa County and the PM_{10} nonattainment area. Table 1.5–1 provides an overview of the 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 PM_{10} NAA from county-level calculations. It is important to note, however, that the nonattainment area includes a portion of Pinal County, AZ (Apache Junction) 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 PM_{10} nonattainment area.

Demographic variable	Maricopa County	PM_{10} NAA	Percent within PM_{10} NAA
Total resident population	4,026,000	4,024,530	99.96%
Total non-resident population	253,760	272,610	107.43%
Total population:	**4,279,760**	**4,297,140**	**100.41%**
Retail employment	537,430	536,100	99.75%
Office employment	444,170	444,980	100.18%
Industrial employment	412,580	411,520	99.74%
Public employment	278,610	274,500	98.52%
Other employment	191,770	189,010	98.56%
Construction	79,680	78,980	99.12%
Work at Home	65,620	64,940	98.96%
Total employment:	**2,009,860**	**2,000,030**	**99.51%**
Single Family/Multi-Family Household Split:			
Single Family	75%	75%	
Multi-Family	25%	25%	

Source: Maricopa Association of Governments

1.5.2 Land use data

MAG provided draft 2009 land use data (as of March 2010). The draft 2009 land use data was assumed to be representative of 2008. 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 in Maricopa County	Acreage within PM_{10} NAA	Percentage within PM_{10} NAA
General/active open space/golf course (e.g., parks)	228,295	223,290	97.81%
Passive/restricted open space (e.g., mountain preserves)	2,373,545	302,999	12.77%
Lakes	12,525	9,510	75.93%
Agriculture	295,509	130,445	44.14%
Vacant (e.g., developable land)	2,227,981	472,831	21.22%

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, industrial processes and large manufacturing 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 typical daily emissions from point sources in Maricopa County and the PM_{10} nonattainment area, respectively. A detailed breakdown of emissions calculations for all point sources is contained in Chapter 2.

Table 1.6–1. Summary of annual and typical daily emissions from point sources in Maricopa County.

	Annual (tons/yr)					Typical day (lbs/day)				
Geographic Area	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Maricopa County	601.27	555.15	2,206.71	81.15	279.06	3,323.2	3,069.1	12,161.4	449.3	1,534.2
PM_{10} NAA	149.84	132.94	1,319.65	28.76	132.18	841.2	747.7	7,264.2	158.2	727.0

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 PM_{10} nonattainment area, respectively. A detailed breakdown of emissions calculations for each area source category is contained in Chapter 3.

Table 1.6–2. Summary of annual and typical daily emissions from area sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Fuel combustion	1,303.61	1,271.30	12,289.62	898.83	51.27	9,673.4	9,370.0	78,161.3	5,773.3	328.7
Industrial processes	14,928.89	3,268.45	362.58	129.60	1,731.34	96,246.9	21,076.1	2,816.5	1,005.8	11,077.2
Waste treatmt./disposal	230.52	204.35	77.47	58.20	1,488.07	1,613.0	1,438.8	515.3	320.0	8,131.5
Misc. area sources	135,133.31	14,269.99	126.52	32.64	13,059.05	758,826.5	83,717.8	1,676.1	446.4	71,686.1
All area sources:	**151,596.33**	**19,014.09**	**12,856.18**	**1,119.27**	**16,329.74**	**866,359.8**	**115,602.7**	**83,169.2**	**7,545.5**	**91,223.5**

Table 1.6–3. Summary of annual and typical daily emissions from area sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Fuel combustion	1,300.65	1,268.35	12,248.07	895.83	51.11	9,653.8	9,350.6	77,895.2	5,754.1	327.6
Industrial processes	13,327.74	3,047.62	360.48	129.58	1,724.27	85,937.0	19,656.9	2,802.3	1,005.7	11,034.4
Waste treatmt./disposal	120.77	95.42	50.30	56.85	1,494.12	799.8	630.5	309.9	312.6	8,164.6
Misc. area sources	26,097.92	3,268.14	115.94	29.74	7,693.04	156,539.2	25,024.8	2,318.0	622.4	42,455.4
All area sources:	**40,847.07**	**7,679.53**	**12,774.79**	**1,112.00**	**10,962.54**	**252,929.8**	**54,662.7**	**83,325.3**	**7,694.7**	**61,982.0**

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 PM_{10} nonattainment area, respectively. A detailed breakdown of emissions calculations for each source category is contained in Chapter 4.

Table 1.6–4. Annual and typical daily emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Agricultural	34.27	33.24	365.55	0.14	0.67	219.7	213.1	2,343.3	0.9	4.3
Airport GSE (+APU)	27.21	26.68	586.73	26.43		148.7	145.8	3,206.1	144.4	
Commercial	117.97	112.98	1,395.23	2.40	21.12	756.2	724.2	8,943.8	15.4	135.4
Construction & mining	1,260.98	1,220.75	14,796.63	6.60	28.10	8,083.2	7,825.3	94,850.2	42.3	180.1
Industrial	101.69	98.96	2,593.13	3.22	56.23	651.8	634.4	16,622.7	20.6	360.5
Lawn and garden	182.28	168.79	798.14	3.16	19.63	1,250.1	1,156.9	5,571.5	23.1	144.6
Pleasure craft	9.25	8.54	77.74	0.85	1.73	124.5	114.9	1,046.5	11.4	23.3
Railway maintenance	1.13	1.10	9.23	0.00	0.02	7.8	7.6	63.9	0.0	0.1
Recreational equipment	45.58	41.98	63.80	0.42	2.10	389.6	358.8	545.3	3.6	18.0
Aircraft	187.91	181.41	2,625.94	317.64		1,026.8	991.3	14,349.4	1,735.8	
Locomotives	70.21	65.53	1,854.62	18.72	4.45	383.6	358.1	10,134.5	102.3	24.3
All nonroad mobile sources:	**2,038.46**	**1,959.95**	**25,166.75**	**379.58**	**134.06**	**13,042.0**	**12,530.3**	**157,677.4**	**2,099.8**	**890.6**

Table 1.6–5. Annual and typical daily emissions from all nonroad mobile sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Agricultural	15.13	14.67	161.35	0.06	0.30	97.0	94.0	1,034.3	0.4	1.9
Airport GSE (+APU)	26.99	26.48	578.95	26.22		147.5	144.7	3,163.7	143.3	
Commercial	117.66	112.69	1,391.61	2.39	21.06	754.2	722.4	8,920.6	15.3	135.0
Construction & mining	1,249.88	1,210.00	14,666.42	6.55	27.85	8,012.1	7,756.4	94,015.6	42.0	178.5
Industrial	101.42	98.71	2,586.39	3.21	56.09	650.1	632.7	16,579.4	20.6	359.5
Lawn and garden	183.02	169.48	801.41	3.17	19.71	1,255.3	1,161.6	5,594.4	23.2	145.2
Pleasure craft	7.02	6.48	59.03	0.64	1.32	94.5	87.3	794.6	8.6	17.7
Railway maintenance	1.13	1.10	9.26	0.00	0.02	7.8	7.6	64.1	0.0	0.1
Recreational equipment	7.68	7.08	10.76	0.07	0.35	65.7	60.5	91.9	0.6	3.0
Aircraft	183.80	177.60	2,620.31	316.00		1,004.3	970.5	14,318.6	1,726.8	
Locomotives	34.16	31.88	907.76	9.11	2.16	186.7	174.2	4,960.4	49.8	11.8
All nonroad mobile sources:	**1,927.89**	**1,856.17**	**23,793.26**	**367.42**	**128.87**	**12,275.2**	**11,811.9**	**149,537.7**	**2,030.5**	**852.9**

1.6.4 Onroad mobile sources

Emissions from onroad mobile sources were calculated for the PM_{10} nonattainment area located primarily within Maricopa County, as well as for Maricopa County as a whole. A detailed breakout of emissions calculations for each area source category is contained in Chapter 5.

Tables 1.6–6 and 1.6–7 summarize annual and typical daily emissions from onroad mobile sources in Maricopa County and the PM_{10} nonattainment area, respectively.

Table 1.6–6. Annual and average daily emissions from all onroad mobile sources in Maricopa County.

Emission	Annual emissions (tons/year)					Average daily emissions (lbs/day)				
Category	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Exhaust, tire wear, and brake wear	1,601.53	999.17	51,609.08	309.83	3,330.43	8,752.0	5,459.7	282,017.2	1,692.6	18,199.0
Paved road fugitive dust	18,556.4	617.4	—	—	—	101,401.2	3,373.8	—	—	—
Unpaved road and alley fugitive dust	12,358.2	1,233.6	—	—	—	67,530.9	6,741.0	—	—	—
Totals:	**32,516.13**	**2,850.17**	**51,609.08**	**309.83**	**3,330.43**	**177,684.1**	**15,574.5**	**282,017.2**	**1,692.6**	**18,199.0**

Table 1.6–7. Annual and typical daily emissions from all onroad mobile sources in the PM_{10} NAA.

Emission	Annual emissions (tons/year)					Average daily emissions (lbs/day)				
Category	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Exhaust, tire wear, and brake wear	1,529.54	954.23	49,142.49	295.90	3,180.66	8,357.7	5,213.8	268,538.4	1,616.4	17,380.4
Paved road fugitive dust	17,245.1	547.9	—	—	—	94,235.7	2,994.2	—	—	—
Unpaved road and alley fugitive dust	11,710.7	1,169.0	—	—	—	63,993.1	6,387.8	—	—	—
Totals:	**30,485.34**	**2,671.13**	**49,142.49**	**295.90**	**3,180.66**	**166,586.5**	**14,595.8**	**268,538.4**	**1,616.4**	**17,380.4**

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 PM_{10} 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 MEGAN2.04. MEGAN2.04 was used to compute biogenic emissions in Maricopa County and the PM_{10} nonattainment area. Annual and daily NO_x emissions from biogenic sources are shown in Table 1.6–8 for Maricopa County and the PM_{10} nonattainment area.

Table 1.6–8. Annual and season-day NO_x emissions from biogenic sources.

Geographic area	Annual emissions (tons/yr)	Typical daily emissions (lbs/day)
Maricopa County	896.27	4,890.0
PM_{10} NAA	332.77	1,815.3

1.6.6 Summary of all source categories

Tables 1.6–9 and 1.6–10 provide summary totals of annual and typical daily emissions from all emission sources in Maricopa County and the PM_{10} nonattainment area, respectively.

Table 1.6–9. Annual and typical daily emissions from all sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Section	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Point Sources	**601.27**	**555.15**	**2,206.71**	**81.15**	**279.06**	**3,323.2**	**3,069.1**	**12,161.4**	**449.3**	**1,534.2**
Area Sources:										
Fuel combustion										
Industrial natural gas	30.78	30.78	575.29	2.42	12.70	197.3	197.3	3,687.7	15.5	81.4
Industrial fuel oil	458.79	458.79	6,375.08	609.61	26.25	2,941.0	2,941.0	40,865.9	3,907.8	168.3
Comm./ind. natural gas	66.54	66.54	1,267.11	5.23	4.20	426.5	426.5	8,122.5	33.5	26.9
Comm./ind. fuel oil	224.14	224.14	3,273.40	271.27	8.13	1,436.8	1,436.8	20,983.3	1,738.9	52.1
Residential natural gas	61.75	61.75	763.81	4.88		337.5	337.5	4,173.8	26.6	
Residential wood	461.59	429.28	34.69	5.34		4,334.2	4,030.8	325.7	50.1	
Residential fuel oil	0.01	0.01	0.25	0.10		0.1	0.1	2.3	0.9	
All combustion	**1,303.61**	**1,271.30**	**12,289.62**	**898.83**	**51.27**	**9,673.4**	**9,370.0**	**78,161.3**	**5,773.3**	**328.7**
Industrial Processes										
Chemical manufacturing	187.43	151.42	0.00	0.34	0.03	1,445.8	1,164.5	0.0	2.6	0.9
Food products										
Commercial cooking	988.99	917.18				5,434.0	5,039.5			
Grain handling	20.59	6.71				149.3	49.5			
Ammonia storage					1,678.43					10,759.2
Secondary metal prod.	60.56	52.16	49.73	18.65	0.04	442.7	386.2	358.8	142.7	0.0
Mineral processes (concrete batch, etc.)	195.81	97.28				1,357.4	671.7			
Mining & quarry (sand & gravel)	210.39	59.56				1,442.1	390.8			
Wood products	217.26	203.25				1,668.6	1,548.3			
Rubber/plastics mfg.	140.94	105.96				953.3	698.8			
Fabricated metal mfg.	51.48	42.62			4.50	538.1	460.6			28.9
Residential const.	2,451.72	245.17				15,716.1	1,571.6			
Commercial const.	5,739.18	573.92				36,789.6	3,679.0			
Road construction	3,580.67	358.07				22,953.0	2,295.3			
Construction – other	258.16	25.82				1,654.9	165.5			
Electric equip. mfg.	13.94	9.64	20.45	0.18	31.55	76.9	53.2	112.4	1.1	193.7
ADEQ portables	59.00	29.50	282.18	88.93		492.9	246.5	2,275.7	721.7	
Unpaved road travel	608.17	282.95				4,178.8	1,928.8			
Industrial proc. NEC	144.60	107.24	10.22	21.49	16.79	953.3	726.4	69.6	137.7	94.6
All Ind. Processes	**14,928.89**	**3,268.45**	**362.58**	**129.60**	**1,731.34**	**96,246.9**	**21,076.1**	**2,816.5**	**1,005.8**	**11,077.2**
Waste Treatment/Disp.										
On-site incineration	0.06	0.04	5.01	0.01		0.7	0.4	38.9	0.1	
Open burning	111.46	111.46	29.96			902.15	902.15	242.37		
Landfills	86.21	75.92	24.11	7.57		486.1	425.4	132.9	41.7	
POTWs					1,488.07					8,131.5
Other waste	32.78	16.93	18.39	50.62		224.1	110.9	101.0	278.1	
All Waste Treat/Disp.	**230.52**	**204.35**	**77.47**	**58.20**	**1,488.07**	**1,613.0**	**1,438.8**	**515.3**	**320.0**	**8,131.5**
Misc. Area Sources										
Wildfires	470.39	403.43	103.79	28.46	21.76	6,271.8	5,379.0	1,383.8	379.4	290.2
Prescribed fires	0.51	0.51	0.39	0.11	0.03	169.3	169.3	131.2	36.0	10.6
Structure fires	15.04	15.04	1.95			82.2	82.2	10.7		
Vehicle fires	30.04	30.04	1.20			164.1	164.1	6.6		
Aircraft engine testing	0.18	0.17	6.74	2.49		1.3	1.2	50.5	19.0	
Tilling	2,059.00	308.85				22,932.4	3,439.9			
Harvesting	136.93	20.54				3,938.9	590.8			
Unpaved agric. roads	1,739.52	173.95				11,150.8	1,115.1			
Cotton ginning	17.90	5.11				103.8	29.7			
Fertilizer application					2,276.43					12,439.5
Livestock	455.80	50.14			9,583.89	2,490.7	274.0			52,514.5
Crematories	0.93	0.62	12.39	1.58		7.0	4.7	93.1	11.9	
Accidental releases	0.01	0.01	0.06			0.1	0.1	0.3		
Humans					1,176.93					6,431.3
Leaf blowers fugitive	891.36	336.41				4,870.8	1,838.3			
Offroad rec. vehicles fugitive dust	12,082.12	1,200.11				66,022.5	6,558.0			
Travel on unpaved parking lots	4,445.36	446.24				24,291.6	2,438.5			
Windblown dust	112,788.23	11,278.82				616,329.1	61,632.9			
All Misc. Area Sources	**135,133.31**	**14,269.99**	**126.52**	**32.64**	**13,059.05**	**758,826.5**	**83,717.8**	**1,676.1**	**446.4**	**71,686.1**
All Area Sources:	**151,596.33**	**19,014.09**	**12,856.18**	**1,119.27**	**16,329.74**	**866,359.8**	**115,602.7**	**83,169.2**	**7,545.5**	**91,223.5**

Table 1.6–9 (continued). Annual and typical daily emissions from all sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Section	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Nonroad Sources:										
Agricultural equipment	34.27	33.24	365.55	0.14	0.67	219.7	213.1	2,343.3	0.9	4.3
Airport GSE (+APU)	27.21	26.68	586.73	26.43		148.7	145.8	3,206.1	144.4	
Commercial equipment	117.97	112.98	1,395.23	2.40	21.12	756.2	724.2	8,943.8	15.4	135.4
Construction and mining equipment	1,260.98	1,220.75	14,796.63	6.60	28.10	8,083.2	7,825.3	94,850.2	42.3	180.1
Industrial equipment	101.69	98.96	2,593.13	3.22	56.23	651.8	634.4	16,622.7	20.6	360.5
Lawn and garden equipment	182.28	168.79	798.14	3.16	19.63	1,250.1	1,156.9	5,571.5	23.1	144.6
Pleasure craft	9.25	8.54	77.74	0.85	1.73	124.5	114.9	1,046.5	11.4	23.3
Railway maintenance equipment	1.13	1.10	9.23	0.00	0.02	7.8	7.6	63.9	0.0	0.1
Recreational equipment	45.58	41.98	63.80	0.42	2.10	389.6	358.8	545.3	3.6	18.0
Aircraft	187.91	181.41	2,625.94	317.64		1,026.8	991.3	14,349.4	1,735.8	
Locomotives	70.21	65.53	1,854.62	18.72	4.45	383.6	358.1	10,134.5	102.3	24.3
All Nonroad Sources	**2,038.46**	**1,959.95**	**25,166.75**	**379.58**	**134.06**	**13,042.0**	**12,530.3**	**157,677.4**	**2,099.8**	**890.6**
Onroad Sources:										
Exhaust, tire wear, and brake wear	1,601.53	999.17	51,609.08	309.83	3,330.43	8,752.0	5,459.7	282,017.2	1,692.6	18,199.0
Paved road fugitive dust	18,556.4	617.4				101,401.2	3,373.8			
Unpaved road and alley fugitive dust	12,358.2	1,233.6				67,530.9	6,741.0			
All Mobile Sources:	**32,516.13**	**2,850.17**	**51,609.08**	**309.83**	**3,330.43**	**177,684.1**	**15,574.5**	**282,017.2**	**1,692.6**	**18,199.0**
Biogenic Sources:			**896.27**					**4,890.0**		
TOTAL, All Sources:	**186,752.18**	**24,379.36**	**91,838.72**	**1,889.83**	**20,073.28**	**1,060,409.1**	**146,776.6**	**535,025.1**	**11,787.1**	**111,847.3**

Table 1.6–10. Annual and typical daily emissions from all sources in the PM_{10} nonattainment area.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Section	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Point Sources	**149.84**	**132.94**	**1,319.65**	**28.76**	**132.18**	**841.2**	**747.7**	**7,264.2**	**158.2**	**727.0**
Area Sources:										
Fuel combustion										
Industrial natural gas	30.70	30.70	573.79	2.41	12.66	196.8	196.8	3,678.2	15.5	81.2
Industrial fuel oil	457.60	457.60	6,358.50	608.03	26.19	2,933.3	2,933.3	40,759.6	3,897.6	167.9
Comm./ind. natural gas	66.20	66.20	1,260.65	5.20	4.18	424.4	424.4	8,081.1	33.3	26.8
Comm./ind. fuel oil	223.00	223.00	3,256.70	269.88	8.09	1,429.5	1,429.5	20,876.3	1,730.0	51.8
Residential natural gas	61.73	61.73	763.51	4.87		337.3	337.3	4,172.2	26.6	
Residential wood	461.41	429.11	34.67	5.33		4,332.5	4,029.2	325.6	50.1	
Residential fuel oil	0.01	0.01	0.25	0.10		0.1	0.1	2.3	0.9	
All combustion	**1,300.65**	**1,268.35**	**12,248.07**	**895.83**	**51.11**	**9,653.8**	**9,350.6**	**77,895.2**	**5,754.1**	**327.6**
Industrial Processes										
Chemical manufacturing	186.94	151.03	0.00	0.34	0.03	1,442.0	1,161.5	0.0	2.6	0.9
Food products										
Commercial cooking	993.04	920.94				5,456.3	5,060.1			
Grain handling	16.73	5.68				125.3	43.0			
Ammonia storage					1,674.07					10,731.2
Secondary metal prod.	60.56	52.16	49.73	18.65	0.04	442.7	386.2	358.8	142.7	0.0
Mineral processes										
(concrete batch, etc.)	190.45	93.72				1,320.7	647.9			
Mining & quarry (sand &										
gravel)	184.25	50.64				1,266.6	331.9			
Wood products	216.69	202.72				1,664.3	1,544.3			
Rubber/plastics mfg.	140.57	105.68				950.9	697.0			
Fabricated metal mfg.	51.35	42.51			4.49	536.7	459.4			28.8
Residential const.	2,245.39	224.54				14,465.2	1,446.5			
Commercial const.	5,380.95	538.10				34,382.4	3,438.2			
Road construction	2,724.87	272.49				17,471.4	1,747.1			
Construction – other	215.70	21.57				1,385.5	138.6			
Electric equip. mfg.	13.94	9.64	20.45	0.18	31.55	76.9	53.2	112.4	1.1	193.7
ADEQ portable sources	59.00	29.50	282.18	88.93		492.9	246.5	2,275.7	721.7	
Unpaved road travel	511.29	227.58				3,551.3	1,573.8			
Industrial proc. NEC	136.00	99.12	8.12	21.47	14.10	906.0	681.7	55.4	137.6	79.8
All Ind. Processes	**13,327.74**	**3,047.62**	**360.48**	**129.58**	**1,724.27**	**85,937.0**	**19,656.9**	**2,802.3**	**1,005.7**	**11,034.4**
Waste Treatment/Disp.										
On-site incineration	0.06	0.04	5.01	0.01		0.7	0.4	38.9	0.1	
Open burning	27.67	27.67	7.44			232.6	232.6	62.5		
Landfills	60.25	50.78	19.47	6.22		342.4	286.6	107.4	34.3	
POTWs					1,494.12					8,164.6
Other waste	32.78	16.93	18.39	50.62		224.1	110.9	101.0	278.1	
All Waste Treat/Disp.	**120.77**	**95.42**	**50.30**	**56.85**	**1,494.12**	**799.8**	**630.5**	**309.9**	**312.6**	**8,164.6**
Misc. Area Sources										
Wildfires	423.56	363.27	93.46	25.62	19.60	9,412.5	8,072.7	2,076.8	569.4	435.5
Prescribed fires	0.21	0.21	0.16	0.04	0.01	104.0	104.0	80.6	22.1	6.5
Structure fires	15.10	15.10	1.96			82.5	82.5	10.7		
Vehicle fires	30.16	30.16	1.21			164.81	164.81	6.59		
Aircraft engine testing	0.18	0.17	6.74	2.49		1.3	1.2	50.5	19.0	
Tilling	834.20	125.13				9,327.3	1,399.1			
Harvesting	54.14	8.12				1,560.0	234.0			
Unpaved agric. roads	731.03	73.10				4,686.1	468.6			
Cotton ginning	4.86	1.39				26.7	7.6			
Fertilizer application					1,004.82					5,490.8
Livestock	260.95	28.70			5,486.90	1,426.0	156.9			30,065.2
Crematories	0.93	0.62	12.36	1.58		7.0	4.6	92.6	11.8	
Accidental releases	0.01	0.01	0.06			0.1	0.1	0.3		
Humans					1,181.71					6,457.5
Leaf blowers fugitive	894.98	337.78				4,890.6	1,845.8			
Offroad rec. vehicles										
fugitive dust	2,014.17	200.09				11,006.4	1,093.4			
Travel on unpaved										
parking lots	2,368.07	237.45				12,923.9	1,297.5			
Windblown dust	18,468.36	1,846.84				100,920.0	10,092.0			
All Misc. Area Sources	**26,100.92**	**3,268.14**	**115.94**	**29.74**	**7,693.04**	**156,539.2**	**25,024.8**	**2,318.0**	**622.4**	**42,455.4**
All Area Sources:	**40,847.07**	**7,679.53**	**12,774.79**	**1,112.00**	**10,962.54**	**252,929.8**	**54,662.7**	**83,325.3**	**7,694.7**	**61,982.0**

Table 1.6–10 (cont'd). Annual and typical daily emissions from all sources in the PM_{10} nonattainment area.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Section	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Nonroad Sources:										
Agricultural equipment	15.13	14.67	161.35	0.06	0.30	97.0	94.0	1,034.3	0.4	1.9
Airport GSE (+APU)	26.99	26.48	578.95	26.22		147.5	144.7	3,163.7	143.3	
Commercial equipment	117.66	112.69	1,391.61	2.39	21.06	754.2	722.4	8,920.6	15.3	135.0
Construction and mining equipment	1,249.88	1,210.00	14,666.42	6.55	27.85	8,012.1	7,756.4	94,015.6	42.0	178.5
Industrial equipment	101.42	98.71	2,586.39	3.21	56.09	650.1	632.7	16,579.4	20.6	359.5
Lawn and garden equipment	183.02	169.48	801.41	3.17	19.71	1,255.3	1,161.6	5,594.4	23.2	145.2
Pleasure craft	7.02	6.48	59.03	0.64	1.32	94.5	87.3	794.6	8.6	17.7
Railway maintenance equipment	1.13	1.10	9.26	0.00	0.02	7.8	7.6	64.1	0.0	0.1
Recreational equipment	7.68	7.08	10.76	0.07	0.35	65.7	60.5	91.9	0.6	3.0
Aircraft	183.80	177.60	2,620.31	316.00		1,004.3	970.5	14,318.6	1,726.8	
Locomotives	34.16	31.88	907.76	9.11	2.16	186.7	174.2	4,960.4	49.8	11.8
All Nonroad Sources:	**1,927.89**	**1,856.17**	**23,793.26**	**367.42**	**128.87**	**12,275.2**	**11,811.9**	**149,537.7**	**2,030.5**	**852.9**
Onroad Sources:										
Exhaust, tire wear, and brake wear	1,529.54	954.23	49,142.49	295.90	3,180.66	8,357.7	5,213.8	268,538.4	1,616.4	17,380.4
Paved road fugitive dust	17,245.1	547.9				94,235.7	2,994.2			
Unpaved road and alley fugitive dust	11,710.7	1,169.0				63,993.1	6,387.8			
All Mobile Sources:	**30,485.34**	**2,671.13**	**49,142.49**	**295.90**	**3,180.66**	**166,586.5**	**14,595.8**	**268,538.4**	**1,616.4**	**17,380.4**
Biogenic Sources:			**332.77**					**1,815.3**		
TOTAL, All Sources:	**73,410.15**	**12,339.77**	**87,030.19**	**1,804.08**	**14,404.25**	**432,632.7**	**81,818.2**	**508,665.6**	**11,499.8**	**80,942.3**

1.7 Public review process

Maricopa County Air Quality Department released a draft version of this document, its 2008 PM_{10} emission inventory, for a 30-day public review and comment period on April 26, 2010. (The department's news release announcing the availability of the draft report, and outlining the schedule for public review and comment, is contained in Appendix 1). The department held a public workshop on May 14, 2010 to discuss the draft inventory. No formal comments were received during the 30-day public comment period.

2. Point Sources

2.1 Introduction and scope

This inventory of PM_{10} and related pollutants is one of a number of emission inventories being prepared to meet US EPA reporting requirements.

In addition to preparing periodic emissions inventories for the PM_{10} nonattainment area (NAA) as a commitment under the current PM_{10} 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 Emission Inventory (NEI) for 2008. This inventory is being developed concurrently with similar inventories for CO and ozone precursors (VOC, NO_x, and CO), as part of Maricopa County's requirements under the respective SIPs.

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...this 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)*

Additionally, EPA guidance requires emission inventories prepared for SIP development purposes to consider point sources with 25 miles of the nonattainment area boundary. No additional point sources met this reporting threshold.

Several tables have been constructed to provide the point source emissions and category totals. Table 2.2–1 provides an alphabetical listing of all point sources and their location. Table 2.4–1 shows the 2008 annual and typical day emissions of PM_{10}, $PM_{2.5}$, NO_x, SO_x and NH_3 for those point sources which reported emissions of one or more of these pollutants broken out by facility. Table 2.6–1 summarizes point source emissions by source category for the county and PM_{10} nonattainment area. Note that totals shown in the 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 2008 annual emissions reports submitted to the department. A total of 25 stationary sources were identified as point sources using the definition described in Section 2.1. There are no additional point sources within the 25-mile boundary around the PM_{10} nonattainment area with permits issued by the Pinal County Air Quality Control District (PCAQCD). 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	
245	337122	AF Lorts Manufacturing Company	8120 W Harrison St	Tolleson	85353	
3313	221112	APS West Phx Power Plant	4606 W Hadley St	Phoenix	85043	
43063	221112	Dynegy Arlington Valley LLC	39027 W Elliot Rd	Arlington	85322	*
44439	221112	Gila River Power Station	1250 E Watermelon Rd	Gila Bend	85337	*
1418	326299	Goodrich Aircraft Interior Products	3414 S 5th St	Phoenix	85040	
355	336412	Honeywell-Engines Systems & Services	111 S 34th St	Phoenix	85034	
3300	92811	Luke AFB – 56th Fighter Wing	14002 W Marauder St	Glendale	85309	
62	33711	Mastercraft Cabinets Inc	305 S Brooks	Mesa	85202	
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	
1331	337122	Oak Canyon Manufacturing Inc	3021 N 29th Dr	Phoenix	85017	
52382	221112	Ocotillo Power Plant	1500 E University Dr	Tempe	85281	
1341	33992	Penn Racquet Sports Inc	306 S 45th Ave	Phoenix	85043	
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	
552	337122	Thornwood Furniture Mfg	5125 E Madison St	Phoenix	85034	
1210	337122	Trendwood Inc (S. 15th Ave.)	2402 S 15th Ave	Phoenix	85007	
1211	337122	Trendwood Inc (E. University)	261 E University Dr	Phoenix	85004	
174	325998	W R Meadows of Az Inc	4220 S Sarival Ave	Goodyear	85338	
1382	33711	Woodcase Fine Cabinetry Inc	3255 W Osborn Rd	Phoenix	85017	

* = Facility is outside the PM_{10} nonattainment area.

2.3 Procedures for estimating emissions from point sources

Annual and typical daily emission estimates were determined from annual source emission 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 2 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 Calculation of $PM_{2.5}$ emissions

For all county-permitted sources that submitted an annual emission inventory report, all process-level emissions for PM_{10}, NO_x, SO_x, and NH_3 were calculated for each facility. Actual emissions for these pollutants were calculated using reported emission factors (from AP–42 or source test results) and reflecting any control devices installed. $PM_{2.5}$ was calculated using a variety of methods, depending on the Source Classification Code (SCC) of the process reported:

1. For those SCCs and control device combinations included in EPA's *WebFIRE*, this database was used to calculate $PM_{2.5}$, using EPA-recommended emission factors and typical control efficiencies.
2. For processes with no PM_{10} controls, emission factors for $PM_{2.5}$ published by the California Air Resources Board (CARB, 2004) were used where available.
3. For all other processes (where neither of the above resources provided guidance), $PM_{2.5}$ was assumed equal to PM_{10} as a conservative estimate.

2.3.2 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 emission 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.

MCAQD has estimated RE for three distinct groups of industrial processes. (See Appendix 3 for details on the methods and data used in computing RE rates):

- For manually controlled processes that are regulated under Maricopa County Rule 316 (Non-metallic Mineral Processing), the analysis showed an overall rule effectiveness of 49.62%.
- For most other 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 90.94% (for Title V processes) and 84.27% (for non-Title V) were calculated.

2.4 Detailed overview of point source emissions

Table 2.4–1 provides a summary of annual and typical daily emissions from all point sources, within and outside the PM_{10} nonattainment area. Sources for which rule effectiveness has been applied (for PM_{10} emissions) 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 typical daily point source emissions, by facility.

			Annual emissions (tons/yr)					Typical daily (lbs/day)				
ID #	Business name		PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
245	AF Lorts Manufacturing Company	*	2.69	2.68	0.01	0.00	0.00	20.7	20.6	0.1	0.0	0.0
3313	APS West Phx Power Plant		22.94	19.47	394.24	4.51	81.39	126.0	107.0	2,166.1	24.8	447.2
43063	Dynegy Arlington Valley LLC	†*	6.40	3.58	35.50	2.20	5.38	36.5	20.9	214.4	15.2	29.6
44439	Gila River Power Station	†	99.50	92.13	343.01	17.36	5.77	546.9	506.4	1,887.5	95.4	31.8
1418	Goodrich Aircraft Interior Products	*	0.16	0.16	0.42	0.00	0.01	1.5	1.5	3.2	0.0	0.1
355	Honeywell-Engines Systems & Srvs.		3.17	3.16	51.42	9.91	0.65	17.7	17.6	282.5	54.5	4.0
3300	Luke AFB – 56th Fighter Wing	*	0.60	0.59	7.15	0.15	0.02	3.7	3.7	43.1	1.0	0.1
62	Mastercraft Cabinets Inc		0.18	0.14	0.04	0.00	0.00	1.4	1.1	0.3	0.0	0.0
44186	Mesquite Generating Station	†	152.65	144.01	243.09	17.12	15.56	838.8	791.3	1,336.4	94.1	85.5
43530	New Harquahala Generating Co	†	116.35	116.11	86.29	6.46	93.52	639.3	638.0	474.1	35.5	513.9
20706	New Wincup Holdings Inc		0.94	0.94	12.42	0.07	0.40	5.2	5.2	68.3	0.4	2.2
1331	Oak Canyon Manufacturing Inc		0.01	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0
52382	Ocotillo Power Plant		8.37	6.48	64.45	0.29	1.67	46.0	35.6	354.1	1.6	9.2
1341	Penn Racquet Sports Inc	*	1.74	1.74	3.51	0.02	0.11	13.4	13.4	27.0	0.2	0.9
42956	Redhawk Generating Facility	†	76.53	66.38	179.16	9.25	26.65	420.5	364.7	984.8	50.9	146.4
303	Rexam Beverage Can Company	*	0.33	0.33	4.39	0.03	0.14	1.8	1.8	24.1	0.1	0.8
3315	Santan Generating Station		51.88	50.33	313.85	10.59	35.55	285.1	276.5	1,724.4	58.2	195.3
4175	SFPP LP Phoenix Terminal		0.63	0.61	4.96	0.24	0.00	3.5	3.3	27.2	1.3	0.0
3316	SRP Agua Fria Generating Station		25.21	18.01	392.20	0.58	3.67	138.5	98.9	2,154.9	3.2	20.1
3317	SRP Kyrene Generating Station		26.24	25.64	60.60	2.19	8.56	144.2	140.9	333.0	12.1	47.0
552	Thornwood Furniture Mfg	*	2.66	2.42	0.10	0.00	0.00	20.5	18.6	0.8	0.0	0.0
1210	Trendwood Inc (S. 15th Ave.)		0.05	0.05	0.00	0.00	0.00	0.4	0.4	0.0	0.0	0.0
1211	Trendwood Inc (E. University)		0.01	0.01	0.00	0.00	0.00	0.1	0.0	0.0	0.0	0.0
174	W R Meadows of Az Inc		0.01	0.01	0.12	0.00	0.00	0.1	0.1	1.5	0.0	0.0
1382	Woodcase Fine Cabinetry Inc		0.23	0.18	0.00	0.00	0.00	1.8	1.4	0.0	0.0	0.0

† = Facility is outside the PM_{10} nonattainment area.
* = 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 PM_{10}, NO_x, and SO_x. Only one previously operational facility maintains emission reduction credits that are still valid for inclusion in this report and the rate of progress plan.

Table 2.5–1. Emission reduction credits.

		Emission reduction credits (tons/yr)		
ID	Facility	PM_{10}	NO_x	SO_x
1151	Freescale Semiconductor, Inc. (formerly Motorola Mesa)	1.80	9.80	0.16

2.6 Summary of point source emissions

Table 2.6–1 provides an overview of source category contributions to point source emissions for Maricopa County and the PM_{10} nonattainment area.

Table 2.6–1. Annual and typical daily point source emissions (including emission reduction credits).

	Annual (tons/yr)					Typical day (lbs/day)				
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	599.47	555.15	2,196.91	80.99	279.06	3,313.4	3,069.1	12,107.8	448.4	1,534.2
PM_{10} NAA	148.04	132.94	1,309.85	28.60	132.18	831.4	747.7	7,210.6	157.3	727.0

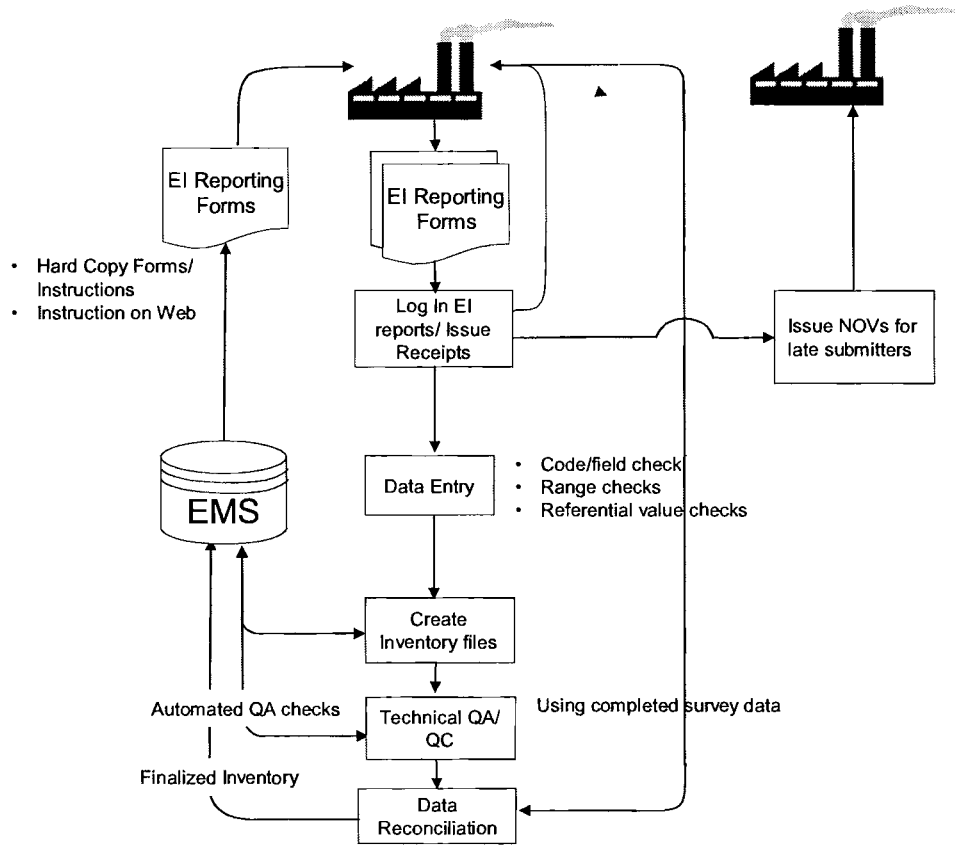
2.7 Quality assurance / quality control procedures

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 Emission 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 2). The EI Unit asks sources to verify and update the data. The EI Unit also holds workshops from February through April 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 emission 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 runs Microsoft Access queries on the data in the EMS to pull fields for the NEI Input format (NIF) tables.

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 2008 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 2008 annual emissions report.

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

2.8 References

CARB, 2004. Speciation Profiles and Size Fractions. Available at: http://www.arb.ca.gov/ei/speciate/speciate.htm.

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

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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. 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 area-source 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 PM_{10} inventory.

SCC Code	Category Description	Section
	Fuel combustion:	
2102006000	Industrial natural gas	3.2.1
2102004000	Industrial fuel oil	3.2.2
2103006000	Commercial/institutional natural gas	3.2.3
2103004000	Commercial/institutional fuel oil	3.2.4
2104006000	Residential natural gas	3.2.5
2104008000	Residential wood	3.2.6
2104004000	Residential fuel oil	3.2.7
	Industrial processes:	
2301010000	Chemical manufacturing	3.3.1
2302002000	Commercial cooking	3.3.2.1
2302040000	Grain handling/processing	3.3.2.2
2302080000	Ammonia cold storage	3.3.2.3
2304000000	Secondary metal production	3.3.3
2305000000	Non-metallic mineral processes	3.3.4
2325000000	Mining and quarrying	3.3.5
2307000000	Wood product manufacturing	3.3.6
2308000000	Rubber/plastics manufacturing	3.3.7
2309000000	Fabricated metal products manufacturing	3.3.8
2311010000	Residential construction	3.3.9
2311020000	Commercial construction	3.3.9
2311030000	Road construction	3.3.9
n/a	Other construction	3.3.9
2312000000	Electrical equipment manufacturing	3.3.10
n/a	State-permitted portable sources	3.3.11
n/a	Paved/unpaved road travel on industrial sites	3.3.12
2399000000	Industrial processes not elsewhere classified (NEC)	3.3.13
	Waste treatment and disposal:	
2601000000	On-site incineration	3.4.1
2610000000	Open burning	3.4.2
2620000000	Landfills	3.4.3
2630000000	Publicly owned treatment works (POTWs)	3.4.4
2650000000	Other industrial waste disposal	3.4.5
	Miscellaneous area sources:	
2810001000	Wildfires	3.5.1.1
2810014000	Prescribed fires	3.5.1.2

Table 3.1–1. (continued) List of area-source categories.

SCC Code	Category Description	Section
	Miscellaneous area sources: (continued)	
2810030000	Structure fires	3.5.1.3
2810050000	Vehicle fires	3.5.1.4
2810040000	Engine testing	3.5.1.5
2801000003	Tilling	3.5.2.1
2801000005	Harvesting	3.5.2.2
n/a	Travel on unpaved agricultural roads	3.5.2.3
2801000000	Cotton ginning	3.5.2.4
2801700000	Fertilizer application	3.5.2.5
2810060000	Livestock	3.5.3
2810060000	Health services: crematories	3.5.4
2830000000	Accidental releases	3.5.5
2810010000	Humans	3.5.6
n/a	Leaf blower fugitive dust	3.5.7
n/a	Offroad recreational vehicle fugitive dust	3.5.8
n/a	Unpaved parking lots fugitive dust	3.5.9
2730100000	Windblown dust	3.5.10

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., ammonia cold storage), 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., wood product manufacturing), these data were combined with employment data to "scale up" reported emissions to reflect the entire source category.
- For those source categories that have detailed emissions data available from most or all of the significant sources in the category, emissions were calculated based on the 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 emissions for the following seven categories of fuel consumption were calculated: Industrial natural gas, industrial fuel oil, commercial/institutional natural gas, commercial/ institutional fuel oil, residential natural gas, residential wood, and residential fuel oil. Data for emissions calculations from natural gas combustion 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 data by supply company and end-user category.

	Sales by end user category (in MMCF/yr)					
Natural gas supplier	**Electric Utilities**	**Industrial**	**Commercial/ Institutional**	**Residential**	**Transport***	**Other***
Southwest Gas	17.07	1,543.27	15,643.15	14,911.67	6,487.35	n/a
City of Mesa	6.52	93.02	1,609.12	1,339.62	n/a	244.97
El Paso	227,608.92	201.90	n/a	n/a	n/a	6.07

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

Area-source emissions for wood and fuel oil combustion were calculated from Arizona state-level sales and consumption data as described in the following subsections. Area-source emissions from coal and liquid petroleum gas were not calculated, as emissions from these categories were determined to be insignificant.

3.2.1 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 2008. Area-source industrial natural gas usage for the county is based on the reported total volume of natural gas sold to industrial sources, minus natural gas used by industrial point sources:

County area-source industrial natural gas usage	=	Total reported industrial natural gas sales	–	Industrial point source natural gas usage
	=	8,576.57 MMCF	–	516.15 MMCF
	=	8,060.43 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.

Annual emissions for the county and the PM_{10} nonattainment area were calculated by multiplying natural gas usage by the respective AP-42 emission factors for external and internal combustion, as in this example for PM_{10} emissions from external natural gas combustion:

PM_{10} emissions from external natural gas combustion	=	External industrial natural gas usage (MMCF)	×	PM_{10} emission factor for external natural gas combustion (lb/MMCF)	÷ 2,000 lbs/ton
	=	7,934.68	×	7.6	÷ 2,000
	=	30.78 tons PM_{10}/yr			

Table 3.2–2. Natural gas usage, emission factors, and annual emissions from area-source industrial natural gas combustion, by combustion type.

Type of Combustion	% of total	Natural gas use (MMCF)	Emission factors (lb/MMCF)					Annual emissions (tons/yr)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
External	98.44	7,934.68	7.6	7.6	100	0.6	3.2	30.15	30.15	396.73	2.38	12.70
Internal	1.56	125.74	10.0	10.0	2840	0.6	n/a	0.63	0.63	178.55	0.04	n/a
Total:	**100.00**	**8,060.43**						**30.78**	**30.78**	**575.29**	**2.42**	**12.70**

Typical daily emissions for the county were calculated by dividing annual emissions by the number of days that activity occurs throughout the year:

Typical daily PM_{10} emissions from industrial natural gas (lbs/day)	=	Annual PM_{10} emissions	÷ (days/week × wks/yr)	× 2,000 lbs/ton
	=	30.78 tons/yr	÷ (6 × 52)	× 2,000
	=	197.3 lbs PM_{10}/day		

Annual and typical daily emissions within the PM_{10} nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations. (See Section 1.5.1 for a discussion of the employment data used).

Emissions from area-source industrial natural gas combustion	= Annual county PM_{10} emissions (tons/yr)	× NAA:County industrial employment ratio in the PM_{10} NAA
	= 30.78	× 0.9974
	= 30.70 tons PM_{10}/yr	

Table 3.2–3. Annual and typical daily emissions from area-source industrial natural gas combustion.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	30.78	30.78	575.29	2.42	12.70	197.3	197.3	3,687.7	15.5	81.4
PM_{10} NAA	30.70	30.70	573.79	2.41	12.66	196.8	196.8	3,678.2	15.5	81.2

3.2.2 Industrial fuel oil

Area-source emissions from industrial fuel oil combustion were calculated by a multi-step process which allocates Arizona state-level industrial fuel oil sales as reported by the U.S. Department of Energy, Energy Information Administration (US DOE, 2010a) to Maricopa County.

To derive industrial fuel oil usage in Maricopa County, reported Arizona state-level sales of high-sulfur diesel for 2008 are first subtracted from Arizona state-level total industrial fuel oil sales, as it is presumed that no high-sulfur diesel fuel is used in Maricopa County due to local air quality regulations and market conditions.

State industrial fuel oil sales other than high-sulfur diesel (in thousand gallons, or Mgal)	= Reported state total industrial fuel oil sales	– Reported state high-sulfur diesel sales
	= 137,044 Mgal	– 224 Mgal
	= 136,820 Mgal/yr	

Arizona state industrial fuel oil sales (less high-sulfur diesel fuel) are then multiplied by the ratio of industrial employment in Maricopa County to Arizona State (0.70), as determined by data from the US Census Bureau (2010a) to estimate annual Maricopa County-level industrial fuel oil sales, as follows:

Maricopa County industrial fuel oil sales	= Arizona state industrial fuel oil sales less high-sulfur diesel	× Maricopa County:State industrial employment ratio
	= 136,820 Mgal	× 0.7007
	= 95,869.77 Mgal/yr	

To avoid double-counting, industrial fuel oil use attributable to stationary point sources (addressed in Chapter 2) and nonroad mobile sources (addressed in Chapter 4) are subtracted from County industrial fuel oil sales to estimate county fuel oil usage by area sources:

Maricopa County area source fuel oil sales	=	Maricopa County industrial fuel oil sales	–	Fuel oil used by industrial nonroad mobile equipment	–	Fuel oil used by industrial stationary point sources
	=	95,869.77 Mgal	–	11,596.87 Mgal	–	136.82 Mgal
	=	84,136.09 Mgal/yr				

Industrial fuel oil is used for both external combustions (boilers, heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source industrial fuel oil sales derived above must be apportioned between these two categories. This apportionment was based on the percentages of external and internal fuel oil combustion reported by all industrial area sources surveyed in 2008 (shown in Table 3.2–4 below).

Annual emissions for the county and the PM_{10} nonattainment area were calculated by multiplying industrial fuel oil sales by the respective AP-42 emission factors for external and internal combustion, as in this example for PM_{10} emissions from external fuel oil combustion:

Annual PM_{10} emissions from external industrial fuel oil combustion	=	External industrial fuel oil sales (Mgal)	×	PM_{10} emission factor for external fuel oil combustion (lb/Mgal)	÷	2,000 lbs/ton
	=	65,634.56	×	2	÷	2,000
	=	65.63 tons PM_{10}/yr				

Table 3.2–4. Emission factors and annual emissions from area-source industrial fuel oil combustion, by combustion type.

Combustion type	% of total	Annual sales (Mgal)	Emission factors (lb/Mgal)					Annual emissions (tons/yr)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
External	78.01	65,634.56	2.0	2.0	24	7.39	0.8	65.63	65.63	787.61	242.36	26.25
Internal	21.99	18,501.53	42.5	42.5	604	39.70	–	393.16	393.16	5,587.46	367.26	n/a
Totals:	**100.00**	**84,136.09**						**458.79**	**458.79**	**6,375.08**	**609.61**	**26.25**

Typical daily emissions for the county were calculated by dividing annual emissions by the number of days during which activity occurs throughout the year, as recommended by EIIP guidance (US EPA, 2001a):

Typical daily PM_{10} emissions from industrial fuel oil	=	Annual PM_{10} emissions (tons/yr)	÷	(days/week × wks/yr)	×	2,000 lbs/ton
	=	458.79	÷	(6 × 52)	×	2,000
	=	2,941.0 lbs PM_{10}/day				

Annual and typical daily emissions in the PM_{10} nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations. (See Section 1.5.1 for a discussion of the employment data used).

PM_{10} NAA emissions from area source industrial fuel oil combustion	=	Annual county PM_{10} emissions	×	NAA:County industrial employment ratio
	=	458.79 tons/yr	×	0.9974
	=	457.60 tons PM_{10}/yr		

Table 3.2–5. Annual and typical daily emissions from area-source industrial fuel oil combustion.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	458.79	458.79	6,375.08	609.61	26.25	2,941.0	2,941.0	40,865.9	3,907.8	168.3
PM_{10} NAA	457.60	457.60	6,358.50	608.03	26.19	2,933.3	2,933.3	40,759.6	3,897.6	167.9

3.2.3 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 2008. 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, minus natural gas used by C&I point sources:

County area-source C&I natural gas usage = Reported C&I natural gas sales – C&I point source natural gas usage

= 17,503.31 MMCF – 84.08 MMCF

= 17,419.23 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.

Annual emissions for the county were calculated by multiplying natural gas usage by the respective AP-42 emission factors for external and internal combustion, as in this example for PM_{10} emissions from external natural gas combustion:

Annual PM_{10} emissions from external natural gas combustion = External C&I natural gas usage (MMCF) × PM_{10} emission factor for external natural gas combustion (lb/MMCF) ÷ 2,000 lbs/ton

= 17,130.07 × 7.6 ÷ 2,000

= 65.09 tons PM_{10}/yr

Table 3.2–6. Emission factors and annual emissions from area-source commercial/institutional natural gas combustion, by combustion type.

			Emission factors (lb/MMCF)					Annual emissions (tons/yr)				
Combustion type	**% of total**	**C&I natural gas usage (MMCF)**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
External	98.34	17,130.07	7.6	7.6	100	0.6	0.49	65.09	65.09	856.50	5.14	4.20
Internal	1.66	289.16	10.0	10.0	2840	0.6	n/a	1.45	1.45	410.61	0.09	n/a
Total:	**100.00**	**17,419.23**						**66.54**	**66.54**	**1,267.11**	**5.23**	**4.20**

Typical daily emissions for the county were calculated by dividing annual emissions by the number of days that activity occurs throughout the year:

Typical daily PM_{10} emissions from comm./inst. natural gas = Annual PM_{10} emissions (tons/yr) ÷ (days/week × wks/yr) × 2,000 lbs/ton

= 66.54 ÷ (6 × 52) × 2,000

= 426.54 lbs/day

Annual and typical daily emissions within the PM_{10} 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. (See Section 1.5.1 for a discussion of the employment data used).

PM_{10} NAA emissions from area-source comm./inst. natural gas combustion	= Annual county PM_{10} emissions (tons/yr)	×	NAA:County C&I employment ratio
	= 66.54	×	0.9949
	= 66.20 tons PM_{10}/yr		

Table 3.2–7. Annual and typical daily emissions from area-source commercial/institutional natural gas combustion.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	66.54	66.54	1,267.11	5.23	4.20	426.5	426.5	8,122.5	33.5	26.9
PM_{10} NAA	66.20	66.20	1,260.65	5.20	4.18	424.4	424.4	8,081.1	33.3	26.8

3.2.4 Commercial/institutional fuel oil

Area-source emissions from commercial and institutional (C&I) fuel oil combustion were calculated by a multi-step process of allocating Arizona state-level C&I fuel oil sales as reported by the U.S. Department of Energy, Energy Information Administration (US DOE, 2010b) to Maricopa County.

To derive commercial/institutional fuel oil usage in Maricopa County, reported Arizona state-level sales of high-sulfur diesel for 2008 are first subtracted from Arizona state-level total C&I fuel oil sales, as it is presumed that no high-sulfur diesel fuel is used in Maricopa County due to local clean air act requirements and market conditions.

State C&I fuel oil sales other than high-sulfur diesel (in thousand gallons, or Mgal)	= Reported state total C&I fuel oil sales	–	Reported state high-sulfur diesel sales
	= 47,586 Mgal	–	367 Mgal
	= 47,219 Mgal/yr		

Arizona state commercial/institutional fuel oil sales (less high-sulfur diesel fuel) are then multiplied by the ratio of C&I employment in Maricopa County to Arizona state (0.80), as determined by data from the US Census Bureau (2010a) to estimate annual Maricopa County-level commercial/institutional fuel oil sales, as follows:

Maricopa County C&I fuel oil sales	= Arizona state C&I fuel oil sales (less high-sulfur diesel)	×	Maricopa County:state commercial/ institutional employment ratio
	= 47,219 Mgal	×	0.7973
	= 37,647.71 Mgal/yr		

To avoid double-counting, C&I fuel oil use attributable to stationary point sources (addressed in Chapter 2) and nonroad mobile sources (addressed in Chapter 4) are subtracted from County C&I fuel oil sales to estimate county fuel oil usage used by area sources:

Annual Maricopa County commercial/institutional area-source fuel oil sales	= Maricopa County C&I fuel oil sales	–	Fuel oil used by C&I nonroad mobile equipment	–	Fuel oil used by C&I stationary point sources
	= 37,647.71 Mgal	–	7,291.00 Mgal	–	3.94 Mgal
	= 30,352.78 Mgal/yr				

Fuel oil is used for both external combustions (boilers, heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source C&I fuel oil sales derived above must be apportioned between these two categories. This apportionment was based on the percentages of external and internal fuel oil combustion reported by all commercial and institutional area sources surveyed in 2008 (shown in Table 3.2–8 below).

Annual emissions for the county were calculated by multiplying comm./inst. fuel oil sales by the respective AP-42 emission factors for external and internal combustion, as in this example for PM_{10} emissions from external fuel oil combustion:

Annual PM_{10} emissions from external fuel oil combustion	= External C&I fuel oil sales (Mgal)	×	PM_{10} emission factor for external fuel oil combustion (lb/Mgal)	÷	2,000 lbs/ton
	= 20,321.18	×	1.08	÷	2,000
	= 10.97 tons PM_{10}/yr				

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

			Emission factors (lb/Mgal)					Annual emissions (tons/yr)				
Combustion type	**% of total**	**C&I fuel oil sales (Mgal)**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
External	66.95	20,321.18	1.08	1.08	24	7.1	0.8	10.97	10.97	243.85	72.14	8.13
Internal	33.05	10,031.59	42.5	42.5	604	39.7	n/a	213.17	213.17	3,029.54	199.13	n/a
Total:	**100.00**	**30,352.78**						**224.14**	**224.14**	**3,273.40**	**271.27**	**8.13**

Typical daily emissions for the county were calculated by dividing annual emissions by the number of days activity occurs throughout the year, as recommended by EIIP guidance (US EPA, 2001a):

Typical daily PM_{10} emissions from C&I fuel oil combustion	= Annual PM_{10} emissions (tons/yr)	÷ (days/week × wks/yr)	×	2,000 lbs/ton
	= 224.14	÷ (6 × 52)	×	2,000
	= 1,436.8 lbs/day			

Annual and typical daily emissions within the PM_{10} nonattainment area were calculated by applying the combined ratio of retail, public, office and other employment in the nonattainment area to county-level emission calculations. (See Section 1.5.1 for a discussion of the employment data used).

PM_{10} NAA emissions from area source C&I fuel oil combustion	= Annual county PM_{10} emissions (tons/yr)	×	NAA:County C&I employment ratio
	= 224.14	×	0.9949
	= 223.00 tons PM_{10}/yr		

Table 3.2–9. Annual and typical daily emissions from area-source commercial/institutional fuel oil combustion.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	224.14	224.14	3,273.40	271.27	8.13	1,436.8	1,436.8	20,983.3	1,738.9	52.1
PM_{10} NAA	223.00	223.00	3,256.70	269.88	8.09	1,429.5	1,429.5	20,876.3	1,730.0	51.8

3.2.5 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 residential natural gas sales by emission factors for residential natural gas combustion summarized in the table below (US EPA, 1998a), as follows:

Table 3.2–10. Residential natural gas combustion emission factors.

Emission Factors (lb/MMCF)			
PM_{10}	**$PM_{2.5}$**	**NO_x**	**SO_x**
7.6	7.6	94	0.6

Annual PM_{10} emissions from residential natural gas combustion = Annual sales of residential natural gas (MMCF) × PM_{10} emission factor for residential natural gas (lbs/MMCF) ÷ 2,000 lbs/ton

= 16,251.29 × 7.6 ÷ 2,000

= 61.75 tons PM_{10}/yr

Typical daily emissions were calculated by dividing annual emissions by the number of days (366) that activity occurs for residential natural gas combustion, as follows:

Typical daily PM_{10} emissions from residential natural gas combustion = Annual PM_{10} emissions × 2,000 lbs/ton ÷ days/yr

= 61.75 tons/yr × 2, 000 ÷ 366

= 337.4 lbs PM_{10}/day

Annual and typical daily residential natural gas emissions in the PM_{10} nonattainment area were calculated by multiplying county-level emissions by the percentage of total residential population in the PM_{10} nonattainment area as follows:

Annual PM_{10} emissions from residential natural gas combustion in the NAA = Annual PM_{10} emissions in Maricopa County × % of County residential population in the NAA

= 61.75 × 99.96%

= 61.73 tons PM_{10}/yr

Table 3.2–11. Annual and typical daily emissions from residential natural gas combustion.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	61.75	61.75	763.81	4.88	337.5	337.5	4,173.8	26.6
PM_{10} NAA	61.73	61.73	763.51	4.87	337.3	337.3	4,172.2	26.6

3.2.6 Residential wood combustion

Area-source emissions from residential wood combustion were calculated based on the amount of wood burned in fireplaces and woodstoves in Maricopa County, as recommended by EIIP guidance (US EPA, 2001b). Residential wood combustion in the county is estimated by multiplying data on statewide residential wood combustion usage from the US Department of Energy (US DOE, 2010c) by the ratio of county to state households that report use of wood for heating from the US Census Bureau (2010b). The latest available data on residential wood use for household heating from the US Department of Energy is for the calendar year 2007. Since all fireplaces in homes constructed since 1999 are required by Arizona statute to be clean-burning, it is assumed that these new homes have negligible emissions. Thus, year 2007 data is assumed to be representative of 2008 emissions.

Maricopa County residential wood usage (cords/yr)	= Arizona residential wood usage (cords/yr)	×	Ratio of county:state households using wood for heat
	= 651,000	×	1,457 / 44,330
	= 21,397 cords/yr		

To calculate emissions, the amount of wood used is converted to tons by multiplying cords by the number of cubic feet of wood in a cord and by the density of the wood used (US EPA, 2001b). Wood density is determined by weighted average of types of wood used for residential combustion in Maricopa County, provided by the US Forest Service (USFS, 1993).

County residential wood usage (tons/yr)	=	County wood usage (cords)	× avg. ft^3 wood/cord	×	Wood density (lbs/ ft^3)	÷ 2,000 lbs/ton
	=	21,397	× 79	×	31.57	÷ 2,000
	=	26,682 tons				

Annual emissions from residential wood combustion were calculated by multiplying the tons of wood used by the PM_{10} emission factor for residential woodstoves and fireplaces from Table 2.4 –1 of US EPA (2001b).

Annual PM_{10} emissions from residential wood combustion (tons/yr)	= Residential wood usage (tons)	×	PM_{10} emission factor (lbs/ton)	÷	2,000 lbs/ton
	= 26,682	×	34.6	÷	2,000
	= 461.59 tons PM_{10}/yr				

Table 3.2–12. Annual wood usage, emission factors, and annual emissions from residential wood combustion.

Residential wood usage (tons/yr)	Emission factors (lbs/ton)				Annual emissions (tons/yr)			
	PM_{10}	$PM_{2.5}$*	NO_x	SO_x	PM_{10}	$PM_{2.5}$*	NO_x	SO_x
26,681.76	34.6	32.2	2.6	0.4	461.59	429.28	34.69	5.34

*$PM_{2.5}$ is assumed to be 93% of PM_{10} (Houck and Tiegs, 1998).

Typical daily emissions were calculated by apportioning wood burning activity based on heating degree days (i.e., the number of degrees per day that the daily average temperature is below 65°F). Data provided by Arizona Department of Commerce (ADOC, 2010) indicated that there were five months (April, plus June–September, totaling 152 days) in 2008 where no heating degree days were recorded. Assuming that no wood burning activity took place during those months, it is assumed that all residential wood burning occurred during the remaining 213 days

of the year. Thus, typical daily emissions were calculated by dividing annual emissions by the number of days residential wood burning occurred, as follows:

Typical daily PM_{10} emissions from residential wood combustion (lbs/day) = Annual PM_{10} emissions (tons/yr) × 2,000 lbs/ton ÷ no. days wood burning occurred

= 461.59 × 2,000 ÷ 213

= 4,334.2 lbs PM_{10}/day

Annual and typical daily emissions within the PM_{10} nonattainment area (presented in Table 3.2–13) were calculated by multiplying county totals by the ratio of residential population in the nonattainment area to the residential population in the county. See Section 1.5.1 for a further discussion of the population used.

Annual emissions from residential wood combustion in the PM_{10} NAA (tons/yr) = County annual emissions × NAA:county residential population ratio

= 461.59 × 0.9996

= 461.41 tons PM_{10}/yr

Table 3.2–13. Annual and typical daily emissions from residential wood combustion.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	461.59	429.28	34.69	5.34	4,334.2	4,030.8	325.7	50.1
PM_{10} NAA	461.41	429.11	34.67	5.33	4,332.5	4,029.2	325.6	50.1

3.2.7 Residential fuel oil

Emissions from residential fuel oil use were calculated using an approach similar to that used for residential wood combustion described in Section 3.2.6. County-level residential fuel oil use was derived from statewide totals (US EIA, 2010) using the ratio of county to state households that report fuel oil use from the US Census Bureau (2010c):

Maricopa County residential fuel oil usage (Mgal/yr) = Arizona residential fuel oil use (Mgal/yr) × Ratio of county:state households reporting fuel oil use

= 91 × 573 / 1,881

= 27.72 Mgal/yr

Annual and daily emissions were calculated using AP-42 emission factors (shown below in Table 3.2-14) and data on heating degree days and residential housing units described in Section 3.2.6. Annual and daily emissions are shown below in Table 3–2.14.

Table 3.2–14. Annual and typical daily emissions from residential fuel oil combustion.

	Emission factors (lb/Mgal)				Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	0.4	0.4	18	7.1	0.01	0.01	0.25	0.10	0.1	0.1	2.3	0.9
PM_{10} NAA	0.4	0.4	18	7.1	0.01	0.01	0.25	0.10	0.1	0.1	2.3	0.9

3.2.8 Summary of all area-source fuel combustion

Tables 3.2–15 and 3.2–16 provide a summary of annual and typical daily emissions from all fuel combustion, for Maricopa County and the PM_{10} nonattainment area, respectively.

Table 3.2–15. Annual and typical daily emissions from area-source fuel combustion in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Fuel combustion type	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Industrial natural gas	30.78	30.78	575.29	2.42	12.70	197.3	197.3	3,687.7	15.5	81.4
Industrial fuel oil	458.79	458.79	6,375.08	609.61	26.25	2,941.0	2,941.0	40,865.9	3,907.8	168.3
Comm./inst. natural gas	66.54	66.54	1,267.11	5.23	4.20	426.5	426.5	8,122.5	33.5	26.9
Comm./inst. fuel oil	224.14	224.14	3,273.40	271.27	8.13	1,436.8	1,436.8	20,983.3	1,738.9	52.1
Residential natural gas	61.75	61.75	763.81	4.88		337.5	337.5	4,173.8	26.6	
Residential wood	461.59	429.28	34.69	5.34		4,334.2	4,030.8	325.7	50.1	
Residential fuel oil	0.01	0.01	0.25	0.10		0.1	0.1	2.3	0.9	
Total:	1,303.61	1,271.30	12,289.62	898.83	51.27	9,673.4	9,370.0	78,161.3	5,773.3	328.7

Table 3.2–16. Annual and typical daily emissions from all area-source fuel combustion for the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Fuel combustion type	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Industrial natural gas	30.70	30.70	573.79	2.41	12.66	196.8	196.8	3,678.2	15.5	81.2
Industrial fuel oil	457.60	457.60	6,358.50	608.03	26.19	2,933.3	2,933.3	40,759.6	3,897.6	167.9
Comm./inst. natural gas	66.20	66.20	1,260.65	5.20	4.18	424.4	424.4	8,081.1	33.3	26.8
Comm./inst. fuel oil	223.00	223.00	3,256.70	269.88	8.09	1,429.5	1,429.5	20,876.3	1,730.0	51.8
Residential natural gas	61.73	61.73	763.51	4.87		337.3	337.3	4,172.2	26.6	
Residential wood	461.41	429.11	34.67	5.33		4,332.5	4,029.2	325.6	50.1	
Residential fuel oil	0.01	0.01	0.25	0.10		0.1	0.1	2.3	0.9	
Total:	1,300.65	1,268.35	12,248.07	895.83	51.11	9,653.8	9,350.6	77,895.2	5,754.1	327.6

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 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 (2010a) 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 2007 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. NAICS codes and descriptions for chemical manufacturing.

NAICS Code	Description	US Census employment data
325	Chemical Manufacturing	3,930
42469	Other Chemical and Allied Products Merchant Wholesalers	1,093
424910	Farm Supplies Merchant Wholesalers	229
33312	Construction Machinery Manufacturing	212
Total:		**5,464**

There were no point sources in this category. Area-source employment estimate were used to "scale up" emissions reported from those facilities surveyed in 2008 as follows:

$$\text{Area-source } PM_{10} \text{ emissions from chemical mfg.} = \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment}$$

$$= \frac{35.71 \text{ tons of } PM_{10}/\text{yr}}{1{,}041 \text{ employees}} \times 5{,}464 \text{ employees}$$

$$= 187.43 \text{ tons } PM_{10}/\text{yr}$$

Typical daily emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and typical daily emissions for the PM_{10} 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.)

$$PM_{10} \text{ emissions from area-source chemical mfg. in the } PM_{10} \text{ NAA (tons/yr)} = \text{Annual Maricopa County emissions (tons/yr)} \times \text{NAA:county ratio of industrial employment}$$

$$= 187.43 \times 0.9974$$

$$= 186.94 \text{ tons } PM_{10}/\text{yr}$$

Table 3.3–2 summarizes annual and typical daily emissions from chemical manufacturing in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–2. Annual and typical daily emissions from area-source chemical manufacturing.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NHx**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NHx**
Maricopa County	187.43	151.42	0.00	0.34	0.03	1,445.8	1,164.5	0.0	2.6	0.9
PM_{10} NAA	186.94	151.03	0.00	0.34	0.03	1,442.0	1,161.5	0.0	2.6	0.9

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 EPA methodology (US EPA, 2006a). The equipment types include: chain-driven charbroilers, under-fired charbroilers, deep-fat fryers, flat griddles, and clamshell griddles. EPA's methodology estimates commercial cooking activity rates for restaurants with each type of cooking equipment (ethnic, family, fast food, seafood, and steak & barbeque) based on an average number of equipment pieces in each restaurant type, and also the and average quantity of meat cooked on each type of equipment per week (steak, hamburger, poultry, pork, and seafood). The estimates number of restaurants in Maricopa County for the five restaurant types was obtained from a commercial database (www.selectoryonline.com) and is shown in Table 3.3–3.

Table 3.3–3. Number of Maricopa County restaurants, by restaurant type.

Restaurant Type	No. of restaurants
Ethnic food	907
Fast food	1,068
Family	253
Seafood	37
Steak and barbecue	75
All restaurants:	**2,340**

Using EPA's emissions estimation methodology (US EPA, 2006a), commercial cooking activity data were estimated by first multiplying the county number of restaurants that use commercial cooking equipment in each category (ethnic, fast food, family, seafood, and steak and barbeque) by the percentage of restaurants with each type of cooking equipment (Table 3.3–4).

Number of ethnic food restaurants with under-fired charbroilers	=	Number of ethnic food restaurants in Maricopa County	×	% ethnic food restaurants with underfired charbroilers
	=	907	×	47.5%
	=	431		

Table 3.3–4. Percentages of restaurants with each type of cooking equipment.

Restaurant Type	Chain-driven Charbroilers	Underfired Charbroilers	Deep Fat Fryers	Flat Griddles	Clamshell Griddles
Ethnic	3.5%	47.5%	81.9%	62.7%	4.0%
Family	10.1%	60.9%	91.4%	82.9%	1.4%
Fast Food	18.6%	30.8%	96.8%	51.9%	14.7%
Seafood	0.0%	52.6%	100.0%	36.8%	10.5%
Steak and Barbeque	6.9%	55.2%	82.8%	89.7%	0.0%

The resulting product was then multiplied by the average number of equipment pieces by restaurant type (shown in Table 3.3–5) to derive an estimate of the total number of each cooking equipment type in Maricopa County restaurants (Table 3.3–6).

Table 3.3–5. Average number of equipment pieces per restaurant, by type.

Restaurant Type	Chain-driven Charbroilers	Underfired Charbroilers	Deep Fat Fryers	Flat Griddles	Clamshell Griddles
Ethnic	1.62	1.54	1.63	1.88	1.80
Family	1.71	1.29	2.34	2.03	—
Fast Food	1.07	1.58	3.10	1.43	2.09
Seafood	—	1.10	2.47	1.11	1.50
Steak and Barbeque	—	1.63	2.42	1.35	—

Number of underfired charbroilers at ethnic food restaurants	=	number of ethnic food restaurants with underfired charbroilers	×	average number of underfired char-broilers per ethnic food restaurant
	=	431	×	1.54
	=	664		

Table 3.3–6. Total pieces of cooking equipment, by restaurant type.

Restaurant Type	Chain-driven Charbroilers	Underfired Charbroilers	Deep Fat Fryers	Flat Griddles	Clamshell Griddles
Ethnic	51.43	663.47	1,210.82	1,069.14	65.30
Family	43.70	198.76	541.11	425.77	—
Fast Food	212.55	519.73	3204.85	792.64	328.12
Seafood	—	21.41	91.39	15.11	5.83
Steak and Barbeque	—	67.48	150.28	90.82	—
Totals:	**307.68**	**1,470.85**	**5,198.45**	**2,393.47**	**399.25**

The total number of each type of cooking equipment is then multiplied by average pounds of meat cooked on each type of equipment per week (Table 3.3–7) to derive the total estimate of the amount of meat cooked in Maricopa County each week (Table 3.3–8).

Table 3.3–7. Meat cooked weekly per restaurant (in pounds), by equipment type.

Type of Meat	Chain-driven Charbroilers	Underfired Charbroilers	Deep Fat Fryers	Flat Griddles	Clamshell Griddles
Steak	236	180	181	166	94
Hamburger	798	270	274	362	1314
Poultry, with Skin	147	144	365	88	113
Poultry, Skinless	266	179	208	111	108
Pork	57.6	148	58.6	112	118
Seafood	119	143	159	92.1	632
Other	0	41.5	274	57.5	0

Total steak cooked on all under-fired charbroilers (tons/wk)	=	Steak cooked on each under-fired charbroiler (lbs/wk)	× Total number of under-fired charbroilers at all restaurants	÷ 2,000 lbs/ton
	=	180 lbs/ week	× 1,470.85	÷ 2,000
	=	132.38 tons/week		

Table 3.3–8. Total meat cooked weekly (in tons), by equipment type.

Type of Meat	Chain-driven Charbroilers	Underfired Charbroilers	Deep Fat Fryers	Flat Griddles	Clamshell Griddles
Steak	36.31	132.38	470.46	198.66	18.76
Hamburger	122.76	198.56	712.19	433.22	262.31
Poultry, with Skin	22.61	105.90	948.72	105.31	22.56
Poultry, Skinless	40.92	131.64	540.64	132.84	21.56
Pork	8.86	108.84	152.31	134.03	23.56
Seafood	18.31	105.17	413.28	110.22	126.16
Other	0.00	30.52	712.19	68.81	0.00
Totals:	**249.77**	**813.01**	**3,949.78**	**1,183.09**	**474.91**

The total amount of meat cooked in Maricopa County restaurants weekly (as shown in Table 3.3–8, (Table 3.3–8) was then multiplied by the appropriate emission factor from Table 3.3–9 (US EPA, 2006a). The results were then summed to estimate annual emissions for each type of cooking equipment, shown in Table 3.3–10. Commercial cooking is assumed to occur uniformly throughout both the week (i.e., 7 days/week) and year.

Table 3.3–9. PM_{10} and $PM_{2.5}$ emission factors for commercial cooking equipment, by device type.

Equipment type	PM_{10} (lb/ton)	$PM_{2.5}$ (lb/ton)
Chain-driven charbroilers	15.996058	15.506208
Underfired charbroilers	32.666124	31.577929
Deep fat fryers	0.00	0.00
Flat griddle fryers	5.922517	4.501113
Clamshell griddles	1.006137	0.852257

Table 3.3–10. Annual and daily emissions from commercial cooking equipment in Maricopa County.

	Annual Emissions (tons/yr)		Typical Daily Emissions (lbs/day)	
Equipment type	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Chain-driven charbroilers	103.88	100.70	570.8	553.3
Underfired charbroilers	690.51	667.51	3,794.0	3,667.6
Deep fat fryers	0.00	0.00	0.0	0.0
Flat griddles	182.18	138.46	1,001.0	760.7
Clamshell griddles	12.42	10.52	68.3	57.8
Totals:	**988.99**	**917.18**	**5,434.0**	**5,039.5**

Annual and typical daily emissions for the PM_{10} 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 (100.41%) (See Section 1.5.1 for a discussion of the population data used.) Table 3.3–11 summarizes the annual and typical daily emissions from commercial cooking for the PM_{10} NAA.

Table 3.3–11. Annual and daily PM emissions from commercial cooking equipment in the PM_{10} NAA.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Equipment type	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Chain-driven charbroilers	104.31	101.11	573.11	555.55
Underfired charbroilers	693.34	670.24	3,809.55	3,682.65
Deep fat fryers	0.00	0.00	0.00	0.00
Flat griddles	182.93	139.02	1,005.09	763.87
Clamshell griddles	12.47	10.57	68.54	58.06
Totals:	**993.04**	**920.94**	**5,456.29**	**5,060.13**

3.3.2.2 Grain handling/processing

Annual emissions from area-source grain handling and processing operations were derived from annual emission reports submitted by permitted sources. It was assumed that there were no significant unpermitted sources within Maricopa County.

Typical daily emissions were calculated based on reported activity data (days per week) for each individual process, and then summed. Nearly all processes reported operating on either a 5- or 6-day week. Annual and typical daily emissions for the PM_{10} nonattainment area were derived based on the location data of the individual facilities. Annual and typical daily emissions for both the County and the PM_{10} NAA are shown in Table 3.3–12.

Table 3.3–12. Annual and typical daily emissions from area-source grain handling and processing.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	20.59	6.71	149.3	49.5
PM_{10} NAA	16.73	5.68	125.3	43.0

3.3.2.3 Ammonia cold storage

Area-source emissions from ammonia cold storage are estimates of ammonia emissions from food and kindred products industrial sources that use ammonia for refrigeration of food products. Emission calculations are based on the number of employees in the food and kindred products industry classification (NAICS codes 311, 312) as reported by the 2007 County Business Patterns (US Census Bureau, 2010a). Annual emissions were calculated by multiplying employment numbers by the emission factor for ammonia cold storage as listed in Table 6-5 of "Development and Selection of Ammonia Emission Factors" (Battye et al., 1994) as follows:

Annual NH_3 emissions from ammonia cold storage (tons/yr)	= Number of employees in relevant industries (from CBP)	× NH_3 emission factor (lb/employee-yr)	÷ 2,000 lbs/ton
	= 8,128	× 413	÷ 2,000
	= 1,678.43 tons NH_3/yr		

Typical daily emissions were calculated by dividing annual emissions by the number of days per year that activity occurred, as follows:

Typical daily NH_3 emissions (lbs/day)	= Annual emissions (tons/yr)	× 2,000 lbs/ton	÷ (weeks/year × days/week)
	= 1,678.43	× 2,000	÷ (52 × 6)
	= 10,759.2 lbs NH_3/day		

Annual and typical daily emissions for the PM_{10} nonattainment area (shown in Table 3.3–13 below) were calculated by multiplying Maricopa County emissions by the ratio of County industrial employment that occurs in the PM_{10} nonattainment area. (See Section 1.5.1 for a more detailed discussion of the employment data used).

Annual NH_3 emissions from ammonia cold storage in the PM_{10} NAA (tons/yr)	= Annual county emissions (tons/yr)	× NAA:County industrial employment ratio
	= 1,678.43	× 0.9974
	= 1,674.07 tons NH_3/yr	

Table 3.3–13. Annual and typical daily ammonia emissions from ammonia cold storage.

Geographic area	Annual emissions (tons/yr)	Typical daily emissions (lbs/day)
Maricopa County	1,678.43	10,759.2
PM_{10} NAA	1,674.07	10,731.2

3.3.3 Secondary metal production

Annual emissions from secondary metal production facilities were derived from annual emission 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 PM_{10} nonattainment area, total emission values for the county and the PM_{10} NAA from area-source secondary metal production are equal. Annual and daily emissions are shown in Table 3.3–14.

Table 3.3–14. Annual and typical daily emissions from secondary metal production.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	60.56	52.16	49.73	18.65	0.04	442.7	386.2	358.8	142.7	0.0
PM_{10} NAA	60.56	52.16	49.73	18.65	0.04	442.7	386.2	358.8	142.7	0.0

3.3.4 Non-metallic mineral processes

The primary contributors to this source category include concrete batch plants, ceramic clay and tile manufacturing, brick manufacturing, and gypsum mining. Emissions from this source were derived from annual emission reports from permitted facilities. Since all permitted facilities in this category were surveyed in 2008, it was assumed that there were no significant unpermitted sources within Maricopa County. Some portable concrete batch operations which operate within Maricopa County for only part of the year are issued air quality permits by the Arizona Department of Environmental Quality (ADEQ). All state-permitted portable sources are addressed in Section 3.3.11.

Typical daily emissions were calculated based on the operating schedule data reported by surveyed facilities. Annual and typical daily emissions for the PM_{10} nonattainment area were derived based on the location data of the individual facilities. County-permitted portable sources with no location data were assumed to operate within the PM_{10} nonattainment area as a conservative estimate.

Table 3.3–15 summarizes annual and typical daily emissions from non-metallic mineral processing activities in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–15. Annual and typical daily emissions from area-source non-metallic mineral products.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	195.81	97.28	1,357.4	671.7
PM_{10} NAA	190.45	93.72	1,320.7	647.9

3.3.5 Mining and quarrying

Annual emissions from area-source mining and quarrying (sand and gravel) operations were derived from annual emission reports submitted by permitted sources. It was assumed that there were no significant unpermitted sources within Maricopa County. Some portable mining and quarrying operations which operate within Maricopa County for only part of the year are issued air quality permits by the Arizona Department of Environmental Quality (ADEQ). All state-permitted portable sources are addressed in Section 3.3.11.

Typical daily emissions were calculated based on reported activity data (days per week) for each individual process, and then summed. Nearly all processes reported operating on either a 5- or 6-day week. Emissions within the PM_{10} nonattainment area were identified using information on the location of each permitted facility. County-permitted portable sources with no location data were assumed to operate within the PM_{10} nonattainment area as a conservative estimate. Annual and daily emissions are shown in Table 3.3–16.

Table 3.3–16. Annual and typical daily emissions from area-source mining and quarrying operations.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	210.39	59.56	1,442.1	390.8
PM_{10} NAA	184.25	50.64	1,266.6	331.9

3.3.6 Wood product manufacturing

Emissions from wood product 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 (2010a) to estimate an annual per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent employment estimates (for the year 2007) from the US Census Bureau's County Business Patterns (CBP) were used. Table 3.3–17 shows the NAICS codes and employment estimates used to calculate emissions from wood product manufacturing.

Table 3.3–17. County-level employment estimates for wood product manufacturing, by NAICS code.

NAICS Code	NAICS Code Description	2007 employment estimate
321---	Wood products manufacturing	6,917
337---	Furniture and related products manufacturing	7,153
Total:		**14,070**

Since some larger facilities in this category are considered point sources, they have been included in the point source calculations presented earlier in Chapter 2. To avoid double-counting, employment at point sources was subtracted from total employment as follows:

Total area-source employment in wood products	= Total County employment for the sector	– Employment reported from facilities reported as point sources
	= 14,070	– 930
	= 13,140 employees	

Annual emissions for the entire wood product manufacturing sector were calculated by "scaling up" detailed area-source emissions reported from those facilities surveyed in 2008 as follows:

$$\text{Total area-source emissions} = \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment}$$

$$\text{Area-source } PM_{10} \text{ emissions from wood products} = \frac{102.99 \text{ tons } PM_{10}/\text{yr}}{6{,}229 \text{ employees}} \times 13{,}140 \text{ employees}$$

$$= 217.26 \text{ tons } PM_{10}/\text{yr}$$

Typical daily emissions were calculated in the same method, using surveyed daily emissions estimates from the subset of surveyed area sources. From these County totals, emissions estimates for the PM_{10} nonattainment area were calculated by multiplying the County totals by the percentage of industrial employment within the nonattainment area. (See Section 1.5.1 for a discussion of the employment data used.)

PM_{10} emissions from area-source wood product manufacturing in the PM_{10} NAA (tons/yr)	= Total County emissions	× NAA:county ratio for industrial employment
	= 217.26 tons/yr	× 0.9974
	= 216.69 tons PM_{10}/yr	

Table 3.3–18 summarizes annual and typical daily emissions from wood products manufacturing in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–18. Annual and typical daily emissions from area-source wood product manufacturing.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	217.26	203.25	1,668.6	1,548.3
PM_{10} NAA	216.69	202.72	1,664.3	1,544.3

3.3.7 Rubber/plastics manufacturing

Emissions from area-source rubber and plastic manufacturing facilities 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 (2010a) 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 2007 employment were used. Where CBP employment estimates were presented as a range, the midpoint values were chosen for these calculations. Table 3.3–19 lists the NAICS codes and employment data used to calculate emissions from rubber and plastic manufacturing facilities.

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 as follows:

Total area-source employment in rubber & plastic product manufacturing	= Total employment (from US Census' County Business Patterns)	– Employment at point sources (from annual emission reports)
	= 11,380	– 896
	= 10,484 employees	

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2008 as follows:

Total area-source PM_{10} emissions from rubber/plastic product mfg.	= $\frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}}$	× Area-source employment
	= $\frac{30.37 \text{ tons } PM_{10}/\text{yr}}{2{,}256 \text{ employees}}$	× 10,484 employees
	= 140.94 tons PM_{10}/yr	

Table 3.3–19. County-level employment estimates for rubber and plastic manufacturing, by NAICS code.

NAICS Code	NAICS Code Description	2007 employment estimate
32614	Polystyrene Foam Product Manufacturing	351
32619	Other Plastics Product Manufacturing	4,178
32622	Rubber & Plastics Hoses & Belting Manufacturing	60
33992	Sporting & Athletic Goods Manufacturing	1,750
42461	Plastics Materials & Basic Forms & Shapes Merchant Wholesalers	368
325211	Plastics Material & Resin Manufacturing	10
325520	Adhesive Manufacturing	123
325991	Custom Compounding of Purchased Resins	194
326113	Unlaminated Plastics Film & Sheet (except Packaging) Mfg.	60
326122	Plastics Pipe & Pipe Fitting Manufacturing	144
326140	Polystyrene Foam Product Manufacturing	351
326160	Plastics Bottle Manufacturing	175
326199	All Other Plastics Product Manufacturing	175
326212	Tire Retreading	42
326299	All Other Rubber Product Manufacturing	71
327991	Cut Stone & Stone Product Manufacturing	583
332913	Plumbing Fixture Fitting & Trim Manufacturing	10
336612	Boat Building	53
337920	Blind & Shade Manufacturing	286
339113	Surgical Appliance & Supplies Manufacturing	88
339115	Ophthalmic Goods Manufacturing	60
441320	Tire Dealers	2,248

Typical daily emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and typical daily emissions for the PM_{10} 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.)

PM_{10} emissions from area-source plastic/rubber in the PM_{10} NAA (tons/yr)	= Annual Maricopa County emissions	× NAA:county ratio of industrial employment
	= 140.94 tons PM_{10}/yr	× 0.9974
	= 140.57 tons PM_{10}/yr	

Table 3.3–20 summarizes annual and typical daily emissions from rubber/plastic products manufacturing in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–20. Annual and typical daily emissions from area-source rubber/plastic product manufacturing.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	140.94	105.96	953.3	698.8
PM_{10} NAA	140.57	105.68	950.9	697.0

3.3.8 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 (2010a) 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 2007 employment were used. CBP employment data for NAICS code 332* (fabricated metal products manufacturing) indicated that there were 16,138 employees in this industry in Maricopa County. 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 as follows:

Total area-source employment in fab. metal products	= Total employment (from US Census' County Business Patterns)	–	Employment at point sources (from annual emission reports)
	= 16,138	–	4,000
	= 12,138 employees		

Annual emissions were calculated by "scaling up" area-source emissions reported from those facilities surveyed in 2007 as follows:

$$\text{Total area-source emissions} = \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment}$$

$$\text{Area-source } PM_{10} \text{ emissions from fab. metal products} = \frac{18.07 \text{ tons of } PM_{10}/\text{yr}}{4{,}261 \text{ employees}} \times 12{,}138 \text{ employees}$$

$$= 51.48 \text{ tons } PM_{10}/\text{yr}$$

Typical daily emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and typical daily emissions for the PM_{10} 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.)

PM_{10} emissions from area-source fabricated metal production in the PM_{10} NAA (tons/yr)	= Annual Maricopa County emissions (tons/yr)	×	NAA:County ratio of industrial employment
	= 51.48 tons/yr	×	0.9974
	= 51.35 tons PM_{10}/yr		

Table 3.3–21 summarizes annual and typical daily emissions from fabricated metal products manufacturing in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–21. Annual and typical daily emissions from area-source fabricated metal product manufacturing.

	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**NH_x**	**PM_{10}**	**$PM_{2.5}$**	**NH_x**
Maricopa County	51.48	42.62	4.50	538.1	460.6	28.9
PM_{10} NAA	51.35	42.51	4.49	536.7	459.4	28.8

3.3.9 Construction

Maricopa County's air quality permits database was used to identify all dust control permits issued during 2008. A total of 4,622 permits were issued, comprising a total of 42,130 acres (Table 3.3–22). Data requested on each dust control permit application includes the project type and acreage. It was assumed there is no unpermitted earthmoving activity.

Table 3.3–22. Maricopa County dust control permits issued in 2008, by type.

Total Acreage, by Project Type	Reported Acres
Residential (single- and multi-family)	20,437.0
Commercial	10,850.0
Road construction	4,449.0
Trenching	3,396.1
Demolition	1,970.6
Weed control	687.0
Site prep / land development	218.9
Temp. storage yard	122.4
Totals:	**42,130.9**

The Western Regional Air Partnership (WRAP) Fugitive Dust Handbook (WRAP, 2006a) provides different emission factors for residential (single-family houses and apartment buildings), nonresidential, road, and general construction. MCAQD used the WRAP-suggested emission factors except for the following activities:

- The WRAP Fugitive Dust Handbook recommended using 0.42 ton PM_{10}/acre-month for road construction to account for the large amount of dirt moved during the construction of roadways. However, both the South Coast Air Quality Management District (SCAQMD) and the Clark County Department of Air Quality and Environmental Management have estimated that a certain percentage of their road construction projects do not involve large-scale earthmoving activities, and thus have developed average emission factors for road construction projects (0.1895 ton PM_{10}/acre-month and 0.265 ton PM_{10}/acre-month, respectively). Since Maricopa County and Clark County have similar population growth rates, climatic conditions, and PM_{10} sources, MCAQD used the Clark County road construction emission factor of 0.265 tons/acre-month to estimate emissions from road construction projects (Clark County, 2001).

- Specific emission factors were not available in the WRAP Fugitive Dust Handbook for trenching, demolition, weed control, and temporary storage yard activities; thus, the general construction emission factor of 0.11 tons PM_{10}/acre-month was used to estimate emissions from these activities.

Information was not readily available regarding the breakout of residential construction activity between single-family and multi-family residential construction; thus, acreage for residential construction was allocated based on single-family and multi-family household percentages (See Section 1.5.1 for single-family and multi-family household percentages used).

Estimates for the duration of house and apartment construction were obtained from EIIP guidance (US EPA, 2002). Estimates for the duration of nonresidential construction and road construction were obtained from the WRAP Fugitive Dust Handbook (WRAP, 2006a). No estimates for the duration of trenching, demolition, weed control, site prep/land development, and temporary storage yard activities were available; thus, MCAQD assumed the following:

- 1-month duration for trenching, demolition, and weed control.
- 8-month duration for site prep/land development activities (weighted average of residential and commercial duration) because the duration depends on the project type and size.
- 12-month duration for temporary storage yard activities because these activities are frequently associated with road construction.

The average duration of construction activity and emission factors for each project type are shown below in Table 3.3–23.

Table 3.3–23. Average project duration and emission factor, by project type.

Project Type	Average Duration (months)	Emission factor (tons PM_{10}/acre-month)
Residential: single-family	6	0.032
Residential: multi-family	12	0.11
Commercial	11	0.19
Road construction	12	0.265
Trenching	1	0.11
Demolition	1	0.11
Weed control	1	0.11
Site prep / land development	8	0.11
Temp. storage yard	12	0.11

County-wide annual uncontrolled PM_{10} emissions for each construction category were then calculated as follows:

Annual uncontrolled PM_{10} emissions	= total acres/yr	× no. months	× emission factor
Example:			
Annual uncontrolled PM_{10} emissions from single-family residential construction	= 15,327.8 acres/yr = 2,942.93 tons PM_{10}/yr	× 6 months	× 0.032 tons PM_{10}/acre-month

As in prior years, a control efficiency of 90% was applied to the uncontrolled emissions calculations. This factor is in line with values applied in a number of earlier SIP documents for Maricopa and Clark Counties, including:

- Revised MAG 1999 Serious Area Particulate Plan for PM_{10} (Appendices volume two, page V-9, and vol. four), Feb. 2000.
- Revised MAG 1999 Serious Area Particulate Plan for PM_{10}, (Appendix C, Exhibit 3: Evaluation for Compliance with 24-Hour PM_{10} Standard for West Chandler and Gilbert Microscale Sites, Arizona Department of Environmental Quality, June 1999, pp. 3-5 and 3-9), Feb. 2000.
- "Evaluation of Fugitive Dust Control in the Maricopa Co. PM_{10} Nonattainment Area", report by ENSR in: Final Plan for Attainment of the 24-hour PM_{10} Standard, ADEQ, May 1997, Appendix B.
- Clark Co. PM_{10} State Implementation Plan, June 2001, pg. L-5. (An 87% emission reduction percentage is assumed for watering at construction activities.)

A recent rule effectiveness study by Maricopa County (contained in Appendix 3) indicated an 83% compliance rate with Maricopa County Rule 310 on dust control at construction sites.

Thus, an overall control effectiveness of 74.7% (= 90% × 83%) was applied. Controlled PM_{10} emissions were calculated as follows:

Annual controlled PM_{10} emissions = Uncontrolled PM_{10} emissions (tons/yr) × [1 – (control efficiency × rule effectiveness)]

Example:
Annual controlled PM_{10} emissions from single-family residential construction = 2,942.93 tons/yr × [1 – (90% control × 83% rule effectiveness)]
= 744.83 tons PM_{10}/yr

$PM_{2.5}$ emissions were estimated to comprise 10% of PM_{10} emissions (WRAP, 2006a). Table 3.3–24 summarizes the calculations for each dust control permit category.

Table 3.3–24. Annual emissions from construction in Maricopa County, by project type.

Project Type	Total acre-months	Emission factor (tons/acre-month)	Uncontrolled PM_{10}	Controlled PM_{10}	Controlled $PM_{2.5}$
Residential: single-family	91,966.5	0.032	2,942.93	744.83	74.48
Residential: multi-unit	61,311.0	0.11	6,744.21	1,706.89	170.69
Commercial	119,349.7	0.19	22,676.44	5,739.18	573.92
Road construction	53,388.0	0.265	14,147.82	3,580.67	358.07
Trenching	3,396.1	0.11	373.57	94.55	9.45
Demolition	1,970.6	0.11	216.76	54.86	5.49
Weed control	687.0	0.11	75.56	19.12	1.91
Site prep/land development	1,750.9	0.11	192.60	48.74	4.87
Temporary storage yard	1,468.7	0.11	161.55	40.89	4.09
Totals:			**47,531.45**	**12,029.74**	**1,202.97**

Dust control permit site location data were used to determine construction activity that occurred in the Maricopa County PM_{10} nonattainment area. The same average duration of construction activity and emission factors used to estimate Maricopa County emissions (see Table 3.3–18) were applied to construction activity in the Maricopa County PM_{10} nonattainment area. Table 3.3–25 summarizes Maricopa County PM_{10} nonattainment area construction activity and calculations for each project type.

Table 3.3–25. Annual emissions from construction within the Maricopa County portion of the PM_{10} nonattainment area, by project type.

Project Type	Total Acres	Total acre-months	EF (tons/ acre-month)	Uncontrolled PM_{10}	Controlled PM_{10}	Controlled $PM_{2.5}$
Residential: single-family	13,989.0	83,934.0	0.032	2,685.89	679.77	67.98
Residential: multi-unit	4,663.0	55,956.0	0.11	6,155.16	1,557.81	155.78
Commercial	10,125.2	111,376.9	0.19	21,161.61	5,355.79	535.58
Road construction	3,383.9	40,606.8	0.265	10,760.80	2,723.45	272.35
Trenching	1,938.2	1,938.2	0.11	213.20	53.96	5.40
Demolition	1,949.0	1,949.0	0.11	214.39	54.26	5.43
Weed control	638.5	638.5	0.11	70.23	17.78	1.78
Site prep/land development	218.9	1,750.9	0.11	192.60	48.74	4.87
Temporary storage yard	122.4	1,468.7	0.11	161.55	40.89	4.09
Totals:	**37,027.9**			**41,615.42**	**10,532.45**	**1,053.24**

In addition, the Pinal County Air Quality Department (PCAQD) provided construction emission estimates for the Pinal County portion of the PM_{10} nonattainment. PCAQD estimated that approximately 0.8 percent of the Pinal County construction activity occurred in the Pinal County portion of the PM_{10} nonattainment area, thus, annual and typical daily emission for the Pinal

County portion of the PM_{10} nonattainment area was calculated by multiplying the Pinal County emission totals by 0.8 percent. The PCAQD estimates (presented in Table 3.3–26 below) incorporated the same assumptions concerning relevant input variables such as the average duration of construction activity, emission factors, control efficiency, and rule effectiveness as Maricopa County's estimates.

Table 3.3–26. Annual emissions from construction in the Pinal County portion of the PM_{10} NAA, by project type.

Project Type	PM_{10}	$PM_{2.5}$
Residential: single-family	7.65	0.77
Residential: multi-family	0.16	0.02
Commercial	25.16	2.52
Road construction	1.42	0.14
Trenching	0.08	0.00
Totals:	**34.47**	**3.45**

To calculate average daily emissions from construction activity, It was assumed that construction activity typically occurs 6 days per week and remains relatively even throughout the year. Thus, typical daily emissions were calculated by dividing annual emissions for each category were divided by 312 (= 6 days/wk × 52 wks/yr) to derive the daily emissions estimates shown in Table 3.3–27.

Table 3.3–27. Annual and typical daily emissions from construction in Maricopa County and the PM_{10} NAA.

	Maricopa County				PM_{10} NAA			
	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)		Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Construction Type	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Residential	2,451.72	245.17	15,716.1	1,571.6	2,245.39	224.54	14,465.2	1,446.5
Commercial	5,739.18	573.92	36,789.6	3,679.0	5,380.95	538.10	34,382.4	3,438.2
Road construction	3,580.67	358.07	22,953.0	2,295.3	2,724.87	272.49	17,471.4	1,747.1
All other*	258.16	25.82	1,654.9	165.5	215.70	21.57	1,385.5	138.6
Total:	**12,029.73**	**1,202.97**	**77,113.7**	**7,711.4**	**10,566.91**	**1,056.70**	**67,704.5**	**6,770.5**

*Includes: trenching, demolition, weed control, site prep/land development, and temporary storage yard.

3.3.10 Electrical equipment manufacturing

Annual and typical daily emissions from electric equipment manufacturing were derived from annual emission 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 PM_{10} nonattainment area, emission totals for both areas are equal. Annual and typical daily emissions are shown in Table 3.3–28.

Table 3.3–28. Annual and typical daily emissions from area-source electric equipment manufacturing.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Maricopa County	13.94	9.64	20.45	0.18	31.55	76.9	53.2	112.4	1.1	193.7
PM_{10} NAA	13.94	9.64	20.45	0.18	31.55	76.9	53.2	112.4	1.1	193.7

3.3.11 State-permitted portable sources

The Arizona Department of Environmental Quality (ADEQ) retains the authority to permit certain categories of sources within Maricopa County, including portable sources. MCAQD requested information from ADEQ for all ADEQ-permitted sources that reported any activity in Maricopa County during 2008. Annual total emissions for most pollutants were provided, along with information on the facility type, and information on the location of the site(s) during the year. Permits were classified into four major types: asphalt batch, concrete batch, crushing/ screening, and other (including soil remediation, generators, etc.). From this information, emissions that occurred within Maricopa County were estimated as in the following example.

Data provided:

Source information:	McNeil Brothers - Erie Strayer Portable Plant
Permit type:	Concrete batch plant
Operating schedule:	Operated from 1/1-5/15 in Mesa at SR202 and McKellips (SE Corner); operated from 10/16-12/31 in Goodyear at Northside I-10 east of Estrella.

Total annual emissions: (tons/yr)	PM_{10}	$PM_{2.5}$ *	NO_x	SO_x
	0.923	0.461	8.429	2.306

* $PM_{2.5}$ was assumed to be 50% of reported PM_{10} for crushing/screening operations.

Using this information, calculations were made to determine:

Total operating days in 2008: 136 = 31 (Jan.) + 29 (Feb.) + ...16 (Oct.) + 30 (Nov.) + 31 (Dec.)
Total operating days in Maricopa County: 136 = 31 (Jan.) + 29 (Feb.) + ...16 (Oct.) + 30 (Nov.) + 31 (Dec.)

All emissions were assumed to be equally distributed among all reported days of operation. First, emissions attributable to activity within Maricopa County were calculated as follows:

$$\text{Annual } PM_{10} \text{ emissions in Maricopa County} = \text{Total annual emissions (tons/yr)} \times \frac{\text{operating days in Maricopa County}}{\text{total operating days in 2008}}$$

$$= 0.923 \times \frac{136}{136}$$

$$= 0.923 \text{ tons } PM_{10}/\text{yr}$$

Typical daily emissions were then calculated as follows:

$$\text{Typical daily emissions (lbs/day)} = \frac{\text{total emissions attributable to activity in Maricopa County}}{\text{number of operating days in Maricopa County}} \times \frac{2{,}000 \text{ lbs}}{\text{ton}}$$

$$= \frac{0.923 \text{ tons}}{136 \text{ days}} \times \frac{2{,}000 \text{ lbs}}{\text{ton}}$$

$$= 13.6 \text{ lbs } PM_{10}/\text{day}$$

Table 3.3–29 summarizes the annual and typical daily emissions for all ADEQ-permitted portable sources that operated within Maricopa County at some point during 2008. Since precise location data was not available for all permits, all emissions are conservatively assumed to have originated within the PM_{10} nonattainment area; thus emission estimates for Maricopa County and the PM_{10} nonattainment area are equal.

Table 3.3–29. Annual and typical daily emissions from ADEQ-permitted portable sources.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	PM_{10}	$PM_{2.5}$	NO_x	SO_x
Total:	59.00	29.50	282.18	88.93	492.9	246.5	2,275.7	88.9

3.3.12 Paved/unpaved road travel on industrial sites

This section addresses emissions from travel on paved and unpaved roads within the boundaries of a permitted facility. Emissions from motor vehicle travel on public and private roads is addressed in Chapter 5, Mobile Sources, and road travel emissions from facilities considered point sources are addressed in Chapter 2, Point Sources. PM_{10} emissions from this source category were derived from annual emission reports from permitted sources, using AP-42 equations based on vehicle size and average speed (US EPA, 1997; 1998b). It is assumed that there are no unpermitted sources with significant emissions from on-site road travel.

$PM_{2.5}$ emissions were calculated from PM_{10} using a ratio derived from California Air Resources Board's (CARB) $PM_{2.5}$ Fraction Table (CARB, 2006).

Typical daily emissions were calculated using operating schedule information for each reported process (normally a 5 or 6-day week), which were then summed to provide total daily emissions for the county. Emissions totals for the PM_{10} nonattainment area were determined from the site locations of each facility. Results for each geographic area are shown in Table 3.3–30.

Table 3.3–30. Annual and typical daily emissions from paved and unpaved road travel at industrial facilities.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Maricopa County	608.17	282.95	4,178.8	1,928.8
PM_{10} NAA	511.29	227.58	3,551.3	1,573.8

3.3.13 Industrial processes not elsewhere classified (NEC)

Annual area-source emissions from other industrial processes NEC were derived 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. Typical daily emissions were calculated based on operating schedule information provided by individual facilities through MCAQD's annual emissions reporting program. Emissions estimates for the PM_{10} nonattainment area were derived using data on the location of the facilities that report other industrial processes. Emissions totals are presented in Table 3.3–31.

Table 3.3–31. Annual and typical daily emissions from other industrial processes not elsewhere classified.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Maricopa County	144.60	107.24	10.22	21.49	16.79	953.3	726.4	69.6	137.7	94.6
PM_{10} NAA	136.00	99.12	8.12	21.47	14.10	906.0	681.7	55.4	137.6	79.8

3.3.14 Summary of all area-source industrial processes

Tables 3.3–32 and 3.3–33 provide a summary of annual and typical daily emissions from all industrial sources, for Maricopa County and the PM_{10} nonattainment area, respectively.

Table 3.3–32. Annual and daily emissions from all area-source industrial processes in Maricopa County.

	Annual emissions (tons/yr)				
Source category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Chemical manufacturing	187.43	151.42	0.00	0.34	0.03
Commercial cooking	988.99	917.18			
Grain handling/processing	20.59	6.71			
Ammonia cold storage					1,678.43
Secondary metal production	60.56	52.16	49.73	18.65	.004
Non-metallic mineral processes	195.81	97.28			
Mining and quarrying	210.39	59.56			
Wood product manufacturing.	217.26	203.25			
Rubber/plastic product manufacturing	140.94	105.96			
Fabricated metal product manufacturing	51.48	42.62			
Residential construction	2,451.72	245.17			
Commercial construction	5,739.18	573.92			
Road construction	3,580.67	358.07			
Other construction	258.18	25,82			
Electrical equipment manufacturing	13.94	9.64	20.45	0.18	31.55
ADEQ-permitted portable sources	59.00	29.50	282.18	88.93	
Road travel at industrial sites	608.17	282.95			
Industrial processes NEC	144.60	107.24	10.22	21.49	16.79
All industrial processes:	**14,928.89**	**3,268.45**	**362.58**	**129.60**	**1,731.34**

	Typical daily emissions (lbs/day)				
Source category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Chemical manufacturing	1,445.8	1,164.5	0.0	2.6	0.6
Commercial cooking	5,434.0	5,039.5			
Grain handling/processing	149.3	49.5			
Ammonia cold storage					10,759.2
Secondary metal production	442.7	386.2	358.8	142.7	0.0
Non-metallic mineral processes	1,357.4	671.7			
Mining and quarrying	1,442.1	390.8			
Wood product manufacturing.	1,668.6	1,548.3			
Rubber/plastic product manufacturing	953.3	698.8			
Fabricated metal product manufacturing	538.1	460.6			28.9
Residential construction	15,716.1	1,571.6			
Commercial construction	36,789.6	3,679.0			
Road construction	22,953.0	2,295.3			
Other construction	1,654.9	165.5			
Electrical equipment manufacturing	76.9	53.2	112.4	1.1	193.7
ADEQ-permitted portable sources	492.9	246.5	2,275.7	721.7	
Road travel at industrial sites	4,178.8	1,928.8			
Industrial processes NEC	953.3	726.4	69.6	137.7	94.6
All industrial processes:	**96,246.9**	**21,076.1**	**2,816.5**	**1,005.8**	**11,077.2**

Table 3.3–33. Annual and typical daily emissions from all area-source industrial processes in the PM_{10} NAA.

	Annual emissions (tons/yr)				
Source category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Chemical manufacturing	186.94	151.03	0.00	0.34	0.03
Commercial cooking	993.04	920.94			
Grain handling/processing	16.73	5.68			
Ammonia cold storage					1,674.1
Secondary metal production	60.56	52.16	49.73	18.65	0.04
Non-metallic mineral processes	190.45	93.72			
Mining and quarrying	184.25	50.64			
Wood product manufacturing.	216.69	202.72			
Rubber/plastic product manufacturing	140.57	105.68			
Fabricated metal product manufacturing	51.35	42.51			4.49
Residential construction	2,245.39	224.54			
Commercial construction	5,380.95	538.10			
Road construction	2,724.87	272.49			
Other construction	215.70	21.57			
Electrical equipment manufacturing	13.94	9.64	20.45	0.18	31.55
ADEQ-permitted portable sources	59.00	29.50	282.18	88.93	
Road travel at industrial sites	511.29	227.58			
Industrial processes NEC	136.00	99.12	8.12	21.47	14.10
All industrial processes:	**13,327.74**	**3,047.62**	**360.48**	**129.58**	**1,724.27**

	Typical daily emissions (lbs/day)				
Source category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Chemical manufacturing	1,442.0	1,161.5	0.0	2.6	0.9
Commercial cooking	5,456.3	5,060.1			
Grain handling/processing	125.3	43.0			
Ammonia cold storage					10,731.2
Secondary metal production	442.7	386.2	358.8	142.7	0.0
Non-metallic mineral processes	1,320.7	647.9			
Mining and quarrying	1,266.6	331.9			
Wood product manufacturing.	1,664.3	1,544.3			
Rubber/plastic product manufacturing	950.9	697.0			
Fabricated metal product manufacturing	536.7	459.4			28.8
Residential construction	14,465.2	1,446.5			
Commercial construction	34,382.4	3,438.2			
Road construction	17,471.4	1,747.1			
Other construction	1,385.5	138.6			
Electrical equipment manufacturing	76.9	53.2	112.4	1.1	193.7
ADEQ-permitted portable sources	492.9	246.5	2,275.7	721.7	
Road travel at industrial sites	3,551.3	1,573.8			
Industrial processes NEC	906.0	681.7	55.4	137.6	79.8
All industrial processes:	**85,937.0**	**19,656.9**	**2,802.3**	**1,005.7**	**11,034.4**

3.4 Waste treatment and disposal

3.4.1 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 3.5.4. There were no incinerators at residential (e.g., apartment complexes) or commercial/institutional facilities (e.g., hospitals, service establishments) in operation during 2008.

Emissions from on-site incineration were determined from annual emission inventory reports. It is assumed that all incinerator emissions are accounted for, since all permitted incinerators received surveys in 2008. All surveyed facilities are located within the PM_{10} nonattainment area, thus total emissions for the county and NAA are equal.

Table 3.4–1. Annual and typical daily emissions from on-site incineration.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	0.06	0.04	5.01	0.01	0.7	0.4	38.9	0.1
PM_{10} NAA	0.06	0.04	5.01	0.01	0.7	0.4	38.9	0.1

3.4.2 Open burning

Emissions from controlled open burning are regulated by Maricopa County Air Pollution Control Regulations Rule 314 (Open Outdoor Fires), 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, air curtain destructor burning of trees, and fire fighting training. Maricopa County's burn permit data base was used to identify all burn permits issued during 2008. A total of 55 permits were issued during the year; however, not all permit applications contained the requested information that is needed to calculate emissions. Where data were missing, activity data for each permit category was grown from those permits that contained the necessary information, as follows:

$$\text{Total activity} = \sum \text{activity reported} \times \frac{\text{total number of permits issued}}{\text{number of permits with activity data}}$$

Example:

$$\text{Total ditch - bank/fencerows} = 541{,}336 \text{ linear ft (reported)} \times \frac{32 \text{ burn permits issued}}{22 \text{ permits with data}} = 787{,}398 \text{ linear ft}$$

Reported and estimated activity data for each open burning category are summarized in Table 3.4–2. Permits issued for firefighting training are addressed Section 3.5.1.2.

Table 3.4–2. Summary of 2008 Maricopa County burn permit activity.

Category	Unit of measure	Total reported activity	Number of permits with activity data	Total permits issued	Estimated total annual activity level
Ditchbank/fencerow	Linear ft	541,336	22	32	787,398
Land clearance	Acres	564	5	12	1,354
Air curtain	Tons of Material Burned	70*	0	7	70
Tumbleweeds	Piles	14	2	4	28

* Assumed that air curtain destructors burn 10 tons/day of brush/trees/vegetation.

The above activity data were converted to tons material burned using fuel loading factors from AP-42, Table 2.5–5 (US EPA, 1992). The emission and loading factors used are shown in Table 3.4–3. As a conservative estimate, all particulate matter is presumed to be PM_{10} (and $PM_{2.5}$).

Table 3.4–3. Emission and fuel loading factors for open burning.

Category	Emission factors (lbs/ton burned)					Fuel loading factor (tons/acre)
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	
Weeds, unspecified	15	15	4	N/A	N/A	3.2
Russian Thistle (tumbleweeds)	22	22	4	N/A	N/A	0.1
Orchard crops: Citrus	6	6	4	N/A	N/A	1.0

The following assumptions were made based on previous Maricopa County emission inventory and information from MCAQD's open burn program staff:

- Ditch banks and fence rows in Maricopa County average 7 feet in width and are burned twice per year (MCESD, 1999).
- A pile of tumbleweeds 15 feet in diameter and 5 feet high weighs 200 lbs (MCESD, 1993). This is equivalent to the AP-42 fuel loading factor for tumbleweeds (0.1 tons/acre).
- Air curtain destructors burn between 7–10 tons of material per day (MCAQD, 2006).

To calculate the annual amount of material burned on ditch banks and fence rows in Maricopa County, MCAQD estimated the area burned and then applied AP-42 fuel loading factor. The tons of material burned in ditch banks and fence rows in Maricopa County were estimated as follows:

Material burned from ditchbanks and fence rows $= \frac{787{,}398 \text{ ft length}}{43{,}560 \text{ ft}^2/\text{acre}} \times 7 \text{ ft width} \times 3.2 \text{ tons/acre} \times 2 \text{ times/yr}$

$= 809.81$ tons/yr

Activity data for the other categories were similarly converted to derive the total mass of material burned using AP-42 fuel loading factors.

Annual emissions were then calculated by multiplying the amount of material burned by AP-42 emission factors (listed in Table 3.4–3) for each open burning category. To account for unpermitted illegal outdoor burning, all calculated emissions estimates were multiplied by a factor of 2.87, based on complaints received in 2008 reporting suspected open or illegal outside burning in the County (158 complaints were received in 2008; thus 158 complaints/55 open burn permits = 2.87).

Annual PM_{10} emissions from ditchbank and fence row burning = Total material burned × emission factor × unit conversion factor

= 809.81 tons × 15 lbs/ton × 1 ton / 2,000 lbs

= 6.07 tons/yr

Total annual PM_{10} emissions including unpermitted burning = Calculated emissions from permit data × unpermitted burning adjustment factor

= 6.07 tons/yr × 2.87

= 17.43 tons PM_{10}/yr

Table 3.4–4 summarizes the 2008 emissions in Maricopa County from each category of open burning activity.

Table 3.4–4. Annual and typical daily emissions from open burning in Maricopa County.

		Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Category	**Ton-equivalents**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**
Ditchbank/fencerow	809.8	17.45	17.45	4.65	179.0	179.0	47.7
Land clearance	4,331.5	93.32	93.32	24.89	717.9	717.9	191.4
Air curtain	70.0	0.60	0.60	0.40	4.6	4.6	3.1
Tumbleweeds	2.8	0.09	0.09	0.02	0.7	0.7	0.1
Totals:		**111.46**	**111.46**	**29.96**	**902.2**	**902.2**	**242.4**

It was assumed that open burning occurs 5 days per week (most burn permits are issued for weekdays but permits may be issued on weekends depending on circumstances). Open burning occurs year-round with the exception of ditch bank and fence row burning, which is not allowed during the CO season (November through January).

PM_{10} typical daily emissions for Maricopa County were derived as follows:

Typical daily PM_{10} emissions $= \dfrac{\text{annual } PM_{10} \text{ emissions (tons/yr)} \times 2000 \text{ lbs/ton}}{\text{(burn days/week)} \times \text{(burn weeks/year)}}$

Typical daily PM_{10} emissions from ditchbank/ fence row burning $= \dfrac{17.45 \text{ tons/yr} \times 2000 \text{ lbs/ton}}{5 \text{ days/wk} \times 39 \text{ wks/yr}}$

$= 179.0$ lbs PM_{10}/day

Table 3.4–4 above summarizes the typical daily emissions for Maricopa County from each open burning category.

Annual and daily emissions for the nonattainment area were calculated by multiplying the percentage of agricultural and/or vacant land use within the PM_{10} nonattainment area by the County wide emissions estimates, results are shown in Table 3.4–5. (See Section 1.5.1 for a discussion of the land use data used.) Table 3.4–6 summarizes the annual emissions for the PM_{10} nonattainment area.

Table 3.4–5. Surrogate land use classes and County:NAA activity ratios for burn permit categories.

Category	**Surrogate land use categories**	**2008 NAA:county land use ratio**
Ditchbank/fencerow	Agriculture	44.14 %
Land clearance	Vacant	21.22 %
Air curtain	Agriculture and vacant	23.91 %
Tumbleweeds	Agriculture and vacant	23.91 %

Table 3.4–6. Annual and typical daily emissions from open burning in the PM_{10} NAA.

	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**
Ditchbank/fencerow	7.70	7.70	2.05	79.0	79.0	21.1
Land clearance	19.81	19.81	5.28	152.4	152.4	40.6
Air curtain	0.14	0.14	0.10	1.1	1.1	0.7
Tumbleweeds	0.02	0.02	0.00	0.2	0.2	0.0
Totals:	**27.67**	**27.67**	**7.44**	**232.6**	**232.6**	**62.5**

3.4.3 Landfills

Emissions from municipal solid waste (MSW) landfills come from uncontrolled landfill gas emissions as well as from cover operations and combustion from control measures, such as a flare. Total emissions were calculated from annual emissions inventory reports from all landfills located within the county; results are shown in Table 3.4–7 below. No landfills were considered point sources; thus all MSW landfills are reported here as an area-source activity.

Table 3.4–7. Annual and typical daily emissions from landfills.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	86.21	75.92	24.11	7.57	486.07	425.39	132.93	41.71
PM_{10} NAA	60.25	50.78	19.47	6.22	342.45	286.57	107.42	34.29

3.4.4 Publicly owned treatment works (POTWs)

Emissions from publicly owned treatment works (POTWs) were calculated by multiplying per-capita emission factors (Battye et al., 1994) by population estimates and per-capita wastewater usage estimates of 100 gallons per day per person (Tchobanoglous, 1979), as shown in Table 3.4–8. Typical daily emissions were calculated by dividing annual emissions by 366 days, as activity is assumed to occur uniformly throughout the year.

Table 3.4–8. NH_3 emissions from publicly-owned treatment works (POTWs).

Geographic area	2008 Population	NH_3 emission factor (lbs/10^6 gals treated)	Annual NH_3 emissions (tons/yr)	Typical daily NH_3 emissions (lbs/day)
Maricopa County	4,279,760	19.0	1,488.07	8,131.5
PM_{10} NAA	4,297,140	19.0	1,494.12	8,164.6

3.4.5 Other industrial waste disposal

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. Typical daily emissions were calculated based on operating schedule information provided by the facilities in their annual emissions report. Emission estimates are shown in Table 3.4–9 below.

All facilities that reported area-source emissions from other industrial waste disposal are located inside the PM_{10} nonattainment area, therefore emissions for Maricopa County and the PM_{10} NAA are equal.

Table 3.4–9. Annual and typical daily emissions from other industrial waste disposal.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	32.78	16.93	18.39	50.62	224.1	110.9	101.0	278.2
PM_{10} NAA	32.78	16.93	18.39	50.62	224.1	110.9	101.0	278.2

3.4.6 Summary of all area-source waste disposal

Tables 3.4–10 and 3.4–11 provide a summary of annual and typical daily emissions from all waste disposal activity, for Maricopa County and the PM_{10} nonattainment area, respectively.

Table 3.4–10. Annual and typical daily emissions from all area-source waste disposal for Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
On-site incineration	0.06	0.04	5.01	0.01		0.7	0.4	38.9	0.1	
Open burning	111.46	111.46	29.96			902.2	902.2	242.4		
Landfills	86.21	75.92	24.11	7.57		486.1	425.4	132.9	41.7	
POTWs					1,488.07					8,131.5
Other	32.78	16.93	18.39	50.62		224.1	110.9	101.0	278.1	
Total:	**230.52**	**204.35**	**77.47**	**58.20**	**1,488.07**	**1,613.0**	**1,438.8**	**515.3**	**320.0**	**8,131.5**

Table 3.4–11. Annual and typical daily emissions from all area-source waste disposal for the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
On-site incineration	0.06	0.04	5.01	0.01		0.7	0.4	38.9	0.1	
Open burning	27.67	27.67	7.44			232.62	232.62	62.46		
Landfills	60.25	50.78	19.47	6.22		342.4	286.6	107.4	34.3	
POTWs					1,494.12					8,164.6
Other	32.78	16.93	18.39	50.62		224.1	110.9	101.0	278.1	
Total:	**120.77**	**95.42**	**50.30**	**56.85**	**1,494.12**	**799.8**	**630.5**	**309.9**	**312.6**	**8,164.6**

3.5 Miscellaneous area sources

3.5.1 Other combustion

3.5.1.1 Wildfires

Data on wildfires in 2008 within Maricopa County were obtained from the Arizona State Land Department (ASLD) Forestry Division (ASLD, 2009); the Arizona Department of Fire, Building, and Life Safety (DFBLS, 2009); and the Federal Fire Occurrence website (FFOW, 2009).

The ASLD Forestry Division provides for the prevention and suppression of wildfires on state and private lands located outside of incorporated municipalities. The wildfire data provided by ASLD includes wildfires that occur outside of local fire districts and municipalities on State, private, and U.S. Bureau of Land Management (BLM) land in 2008. The ASLD reported 25 wildfires in 2008 in Maricopa County, encompassing a total of nearly 750 acres. Wildfire data provided by ASLD were compared to that data reported in the Geospatial Multi-Agency Coordination Group (GeoMAC) Wildland Fire Support database[1] and 2008 Incident Status Summary reports (ICS-209) to identify wildfires that may have occurred outside of ASLD jurisdiction. GeoMAC and ICS-209 reports only include large wildfires, generally fires greater than 100 acres. Three Maricopa County wildfires were reported in GeoMAC and on ICS-209 reports in 2008 (USDA, 2008a; USGS, 2008). Two of these fires were included in the ASLD data, one fire, the Ethan fire, was not captured in the ASLD data because it occurred on tribal lands. The Ethan fire encompassed 6,660 acres.

1. The GeoMAC, is an internet-based mapping application designed for fire managers to access online maps of current fire locations and perimeters in the conterminous 48 States and Alaska. Historical fire data is also housed in the GeoMac database http://www.geomac.gov/.

The DFBLS coordinates reporting to the National Fire Incident Reporting System (NFIRS) for Arizona fire departments. NFIRS is a 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. Twenty-one of thirty-six fire departments in Maricopa County reported over 10,000 fires to NFIRS in 2008. This included ten "forest, woods or wildland fires". The ten "forest, woods or wildland fires" were analyzed for inclusion in the wildfire emission estimates. First, the DFBLS fires were culled for duplicates by comparing the incident dates and locations with wildfires reported by ASLD. One DFBLS fire was excluded from combined data-set because it may have been a duplicate already captured in the ASLD data. Because only four of the ten DFBLS fires included acreage, an average number of acres burned per fire (= 1.05 acres) were determined from the fires with reported acreage. This average number of acres burned was then applied to the fires with no reported acreage.

The Federal Fire Occurrence Website is an official government website that provides users with the ability to query, research and download wildland fire occurrence data. The data available through this website contains over 548,000 fire records collected by Federal land management agencies for fires that occurred from 1980 through 2008 in the United States. The 2008 data for Maricopa County included eighty-one fires. The federal wildland fire occurrence data were culled for duplicates by comparing the incident names, dates and locations with wildfires reported by ASLD and DFBLS. Thirteen fires were excluded from the combined dataset as they appeared to be duplicates already captured in either the ASLD or DFBLS data and seven fires contained no acreage data. The final 2008 dataset listed 96 fires encompassing over 7,400 acres. Table 3.5–1 summarizes fire data obtained from each data source.

Table 3.5–1. Sources and input data used to estimate emissions from fires in Maricopa County.

Data Source	Number of Fires in 2008	Total Acreage
Arizona State Land Department (ASLD)	25	747.25
Arizona Department of Fire, Building, and Life Safety (DFBLS)	9	9.45
Federal Fire Occurrence website (FFOW)	61	16.79
ICS-209	1	6,660.00
Total:	**96**	**7,433.49**

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 3.5–2. NFDRS fuel model categories and fuel loading factors for 2008 Maricopa County wildfires.

NFDRS Model Category	2008 Fires	Total Acreage	Fuel Loading Factor (tons/acre)
Agriculture*	33	744.05	4.5
California chaparral	1	0.01	19.5
Barren*	2	0.4	0.5
Pine-grass savanna	1	0.01	4.7
Intermediate brush	17	2.87	15.0
Sagebrush grass	42	6,686.15	4.5
Total	**96**	**7,433.49**	—

* "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 number of acres burned for each category by the applicable fuel loading factor. Table 3.5–3 shows the number of wildfires and acres burned within both Maricopa County and the PM_{10} nonattainment area during 2008, as well as estimates of total material burned.

Table 3.5–3. Summary of data on fire occurrence, total acres burned, and total material burned in 2008.

Geographic Area	No. of Fires	Total Acres Burned	Material Burned (tons)
Maricopa County	96	7,433	33,479
PM_{10} NAA	55	6,699	30,147

The prescribed-fire emission factors listed in Table 3.5–4 were obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emission Inventory (WGA/WRAP, 2005).

Table 3.5–4. Summary of emission factors for prescribed fire.

	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
WRAP Emission Factors for Wildfires and Prescribed Broadcast Burning (lbs/ton)	28.1	24.1	6.2	1.7	1.3

Source: WGA/WRAP, 2005

Annual emissions from wildfires for each geographic area were calculated as follows:

$$\text{Annual } PM_{10} \text{ emissions from wildfires in Maricopa County} = \frac{\text{material burned} \times \text{emission factor (lbs/ton)}}{2{,}000 \text{ lbs/ton}}$$

$$= \frac{33{,}479 \text{ tons of material burned} \times 28.1 \text{ lbs } PM_{10}\text{/ton}}{2{,}000 \text{ lbs/ton}}$$

$$= 470.38 \text{ tons } PM_{10}\text{/yr}$$

The majority of fire data included fire locations in latitude and longitude. For those fires without longitude and latitude, the fire location address was used to determine latitude and longitude. This latitude and longitude data was used to determine the number of acres burned inside of the nonattainment areas. Fifty-five wildfires occurred within the PM_{10} nonattainment area, resulting in nearly 6,700 acres burned. The largest fire within the PM_{10} nonattainment area was the Ethan fire which occurred in July 2008 and resulted in more than 6,600 acres burned.

Annual emissions from wildfires within the nonattainment area were calculated in the same method as Maricopa County annual emissions.

Table 3.5–5. Annual emissions from wildfires in Maricopa County and the PM_{10} NAA.

	Annual emissions (tons/yr)				
Geographic Area	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Maricopa County	470.39	403.43	103.79	28.46	21.76
PM_{10} NAA	423.56	363.27	93.46	25.62	19.60

Average daily emissions were estimated by dividing annual emissions by the number of burn days in 2008. There were 150 burn days in Maricopa County and 90 burn days in the PM_{10} nonattainment area in 2008; thus:

$$\text{Average daily } PM_{10} \text{ emissions from wildfires in Maricopa County} = \frac{470.39 \text{ tons } PM_{10}\text{/yr} \times 2{,}000 \text{ lbs/ton}}{150 \text{ days/yr}}$$

$$= 6{,}271.8 \text{ lbs } PM_{10}\text{/day}$$

Table 3.5–6. Average daily emissions from wildfires in Maricopa County and the PM_{10} NAA.

Geographic Area	Number of Burn Days	Average daily emissions (lbs/day)				
		PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Maricopa County	150	6,271.8	5,379.0	1,383.8	379.4	290.2
PM_{10} NAA	90	9,412.5	8,072.7	2,076.8	569.4	435.5

3.5.1.2 Prescribed fires

Prescribed fires data were obtained from the U. S. Forest Service (USFS, 2009). The USFS reported that six prescribed fires occurred in Maricopa County in 2008. Twenty-nine acres of piled fuels were burned. Four of six prescribed fires occurred inside the PM_{10} nonattainment area. Because all 2008 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. The data provided by the USFS, the resulting material burned for each fire, and whether the fire occurred within the nonattainment area are shown below in Table 3.5–7.

Table 3.5–7. Summary of data used to estimate emissions from prescribed fires.

Burn Date	Burn Number	Burn Location	Acres Treated	Tons of Piles/ Acre	Material Burned (tons)	Within NAA?
01/13/2008	TNF0106	T6N,R7E,S28	3	1	3	Yes
03/13/2008	TNF0106P	T6N,R7E,S28	3	3	9	Yes
04/04/2008	TNF0302	T3N,R7E,S34	2	5	10	Yes
04/09/2008	TNF0302	T3N,R8E,S28	5	5	25	No
09/25/2008	TNF0302	T3N,R8E,S31	10	5	50	No
11/06/2008	TNF0302	T2N,R7E,S18	6	5	30	Yes
			29	**24**	**127**	

Prescribed fire emission factors for "piled fuels" were obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emission Inventory (WGA/WRAP, 2005). The emission factors are listed below in Table 3.5–8.

Table 3.5–8. Emission factors for prescribed fires.

Type of fire	Emission factors (lbs/ton burned)				
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Prescribed fire (piled fuels)	8.0	8.0	6.2	1.7	0.5

Annual emissions from prescribed fires in Maricopa County were calculated as follows.

$$\text{Annual } PM_{10} \text{ emissions from prescribed fires in Maricopa County} = \frac{\text{material burned (tons/acre)} \times \text{emission factor (lbs/ton)}}{2{,}000 \text{ lbs/ton}}$$

$$= \frac{127 \text{ tons/acres} \times 8.0 \text{ lbs/ton}}{2{,}000 \text{ lbs/ton}}$$

$$= 0.508 \text{ tons } PM_{10}\text{/yr}$$

It was assumed that each prescribed fire lasted one day. Thus, daily emissions from prescribed fires were determined by dividing the annual emissions (converted to lbs/yr) by the number of burn days. Because six prescribed fires occurred in Maricopa County in 2008, it was assumed that there were 6 burn days in 2008.

$$\text{Typical daily } PM_{10} \text{ emissions} = \frac{\text{annual } PM_{10} \text{ emissions (lbs) from prescribed fires}}{\text{Number of burn days}}$$

$$= \frac{1{,}016 \text{ lbs } PM_{10}}{6 \text{ burn days}}$$

$$= 169.3 \text{ lbs } PM_{10}\text{/day}$$

Since the prescribed fire data provided by USFS (2009) included burn location, GIS was used to determine the fires that burned inside the nonattainment area. Fifty-two of the one-hundred twenty-seven acres burned were within the nonattainment area. Thus, annual emissions from prescribed fires for the nonattainment area were determined using the formula shown above with the material burned within the nonattainment area. Results are shown in Table 3.5–9 below.

Table 3.5–9. Annual and typical daily emission from prescribed fire in Maricopa County and the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emission (lbs/day)				
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	0.51	0.51	0.39	0.11	0.03	169.3	169.3	131.2	36.0	10.6
PM_{10} NAA	0.21	0.21	0.16	0.04	0.01	104.0	104.0	80.6	22.1	6.5

3.5.1.3 Structure fires

2008 structure fire data were from the Arizona Department of Fire, Building, and Life Safety (DFBLS; DFBLS, 2009). The DFBLS coordinates reporting to the National Fire Incident Reporting System (NFIRS) for Arizona fire departments. The NFIRS is a 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. Twenty-one of thirty-six fire departments in Maricopa County reported over 10,000 fires to NFIRS in 2008. This included nearly 2,150 reported structure fires. Because the DFBLS data only included data reported by twenty-one of thirty-six fire departments in Maricopa County, the number of structure fires reported were scaled up to the entire inventory area based on population. The most recent population estimates for Maricopa County were used to scale up the number of structure fires (ADC, 2008). Seven open burn permits were issued in 2008 for fire training; these were included in the total number of estimated structure fires for 2008. It was estimated that 2,422 structure fires occurred in Maricopa County in 2008.

Estimates of the material burned in a structure fire were determined by multiplying the number of structure fires by a fuel loading factor of 1.15 tons of material per fire, which factors in the estimated percentage of structural loss and content loss (US EPA, 2001c). The amount (tons) of material burned was estimated as follows:

Material burned in structure fires (tons/yr) = 2,422 fires/yr × 1.15 tons/fire

= 2,785 tons material burned/yr

Table 3.5–10. Material burned, emission and fuel loading factors for structure fires.

Estimated number of structure fires	Fuel loading factor (tons/fire)	Material burned (tons)	Emission factors (lbs/ton)				
			PM_{10}	$PM_{2.5}$*	NO_x	SO_x	NH_3
2,422	1.15	2,785	10.8	10.8	1.4	n/a	n/a

* All PM_{10} is assumed to be $PM_{2.5}$.

Annual emissions were then calculated by multiplying the amount of material burned by the emission factors listed in Table 3.5–10 (from US EPA, 2001c), as follows:

Annual PM_{10} emissions from structure fires in Maricopa County = Quantity of material burned × emission factor × unit conversion factor

= 2,785 tons × 10.8 lbs/ton × (1 ton/2,000 lbs)

= 15.04 tons PM_{10}/yr

Annual emissions for the PM_{10} nonattainment area were derived by multiplying Maricopa County annual emissions by the percentage of total residential population within the PM_{10} non-attainment area (100.41%), as shown in the example below. See Section 1.5.2 for a discussion of the population data used.

Annual PM_{10} emissions within the PM_{10} NAA = Annual PM_{10} emissions for Maricopa County × Percentage residential population within the NAA

= 15.04 tons/yr × 100.41%

= 15.10 tons PM_{10}/yr

Typical daily emissions for both Maricopa County and the PM_{10} nonattainment area were calculated by dividing annual emissions by 366, as activity is assumed to take place 7 days a week. Typical daily emissions for Maricopa County were derived using the following formula:

$$\text{Typical daily } PM_{10} \text{ emissions from structure fires} = \frac{\text{annual } PM_{10} \text{ emissions (lbs)}}{366 \text{ days/yr}}$$

$$= \frac{30{,}080 \text{ lbs}}{366}$$

$$= 82.2 \text{ lbs/day}$$

Table 3.5–11. Annual and typical daily emissions from structure fires in Maricopa County and the NAA.

Geographic area	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
	PM_{10}	$PM_{2.5}$	NO_x	PM_{10}	$PM_{2.5}$	NO_x
Maricopa County	15.04	15.04	1.95	82.2	82.2	10.7
PM_{10} NAA	15.10	15.10	1.96	82.5	82.5	10.7

3.5.1.4 Vehicle fires

2008 vehicle fire data were from the Arizona Department of Fire, Building, and Life Safety (DFBLS) (DFBLS, 2009). The DFBLS coordinates reporting to the National Fire Incident Reporting System (NFIRS) for Arizona fire department. NFIRS is a 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. Twenty-one of thirty-six fire departments in Maricopa County reported over 10,000 fires to NFIRS in 2008. This included over 2,100 reported vehicle fires. Because the DFBLS data only included data reported by twenty-one of thirty-six fire departments in Maricopa County, the number of vehicle fires reported were scaled up to the entire inventory area based on population. The most recent population estimates for Maricopa County were used to scale up the number of vehicle fires (ADC, 2008). It was estimated that 2,403 vehicle fires occurred in Maricopa County in 2008.

Annual emissions from vehicle fires were calculated by first multiplying the number of vehicle fires by a fuel loading factor of per vehicle fire to estimate the annual amount of material burned in vehicle fires (US EPA, 2000). The amount of annual material burned in vehicle fires is then multiplied by emission factors for open burning of automobile components from AP-42 as listed in table 3.5–12 (US EPA, 1992).

Annual PM_{10} emissions from vehicle fires	= annual number of vehicle fires	× fuel loading factor	× emission factor	× unit conversion factor
	= 2,403	× 0.25 tons/vehicle	× 100 lbs/ton	× (1 ton / 2,000 lbs)
	= 30.04 tons PM_{10}/yr			

Table 3.5–12. Estimated material burned, fuel loading factors, and emission factors for vehicle fires.

Vehicle fires reported	Fuel loading factor (tons/fire)	Material burned (tons)	Emission factors (lbs/ton)				
			PM_{10}	$PM_{2.5}$*	NO_x	SO_x	NH_3
2,403	0.25	600.75	100	100	4	n/a	n/a

* All PM_{10} is assumed to be $PM_{2.5}$.

Annual emissions for the PM_{10} nonattainment area were derived by multiplying Maricopa County annual emissions by the percentage of total residential population within the PM_{10} non-attainment area (100.41%). See Section 1.5.1 for a discussion of the population data used.

Annual PM_{10} emissions from vehicle fires in the PM_{10} NAA	= annual PM_{10} emissions for Maricopa County	× percentage of total residential population within the PM_{10} NAA
	= 30.04 tons/yr	× 100.41%
	= 30.16 tons/yr	

It is assumed that vehicle fires occur evenly throughout the year. Thus, typical daily emissions were derived by dividing the Maricopa County and nonattainment area annual emissions by 366 days/year. The results are shown in Table 3.5–13 below.

Table 3.5–13. Annual and typical daily emissions from vehicle fires.

	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Geographic area	PM_{10}	$PM_{2.5}$	NO_x	PM_{10}	$PM_{2.5}$	NO_x
Maricopa County	30.04	30.04	1.20	164.1	164.1	6.6
PM_{10} NAA	30.16	30.16	1.21	164.8	164.8	6.6

3.5.1.5 Engine testing

Annual emissions from engine testing facilities were derived from annual emission 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. Typical daily emissions were calculated based on operating schedule information provided in the facilities' annual emission reports.

Since all facilities considered in this section are located within the PM_{10} nonattainment area, total emission values for the county and the PM_{10} NAA are equal. Results are shown in Table 3.5–14.

Table 3.5–14. Annual and typical daily emissions from engine testing.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	0.18	0.17	6.74	2.49	1.3	1.2	50.5	19.0
PM_{10} NAA	0.18	0.17	6.74	2.49	1.3	1.2	50.5	19.0

3.5.2 Agricultural activities

3.5.2.1 Tilling

Tillage emissions were estimated using the tillage emission factor equation and Maricopa County specific soil silt content for agricultural land (URS and ERG, 2001). The majority of planted acres were obtained from the 2008 Arizona Agricultural Statistics Bulletin (AASS, 2009). Planted acres for potatoes and sorghum for grain were obtained from the USDA National Agricultural Statistics Service for 2008 (USDA, 2008b) and vegetables and citrus acreage were obtained from the 2007 Census of Agriculture (USDA, 2007a). Crop-specific annual land preparation operations data were obtained from the Technical Support Document for Quantification of Agricultural Best Management Practices (URS and ERG, 2001). The agricultural tillage emission factor was calculated as follows:

$$EF = k\,(4.8)\,s^{0.6}$$

where:

EF = Agricultural emission tillage factor (lbs PM_{10}/acre-pass)
k = Particle size multiplier (value of 0.15 for PM_{10})
s = Silt content of soil (%) = 35.2% (URS and ERG, 2001)

Thus: $EF = 0.15 \times 4.8 \times (35.2)^{0.6}$

$= 6.10$ lbs PM_{10}/acre-pass

Annual PM_{10} emissions from agricultural tillage were calculated for each crop category using the following equation (URS and ERG, 2001; Pollack et al., 2003):

$$Tillage_{Crop} = EF \times AP_{Crop} \times A_{Crop}$$

where:

$Tillage_{Crop}$ = Annual PM_{10} emissions from tilling each crop type (lbs)
EF = Tillage emission factor (lbs PM_{10}/acre-pass)
AP_{Crop} = Number of tillage passes per crop (passes)
A_{Crop} = Total number of tilled acres for each crop type (acres)

For example, annual PM_{10} emissions from cotton tilling were calculated using:

EF = 6.10 lbs PM_{10}/acre-pass
AP_{cotton} = 8.8 tillage passes for a cotton crop
AP_{cotton} = 19,300 acres cotton

Thus:

$$Tillage_{cotton} = 6.10 \times 8.8 \times 19{,}300$$
$$= 1{,}036{,}024 \text{ lbs/yr}$$
$$= 518.01 \text{ tons/yr}$$

Table 3.5–15 lists crop types and acreage; typical number of land preparation operations and acre-passes; and annual uncontrolled PM_{10} emissions from agricultural tillage for Maricopa County.

Table 3.5–15. 2008 crop acreage, activity, and annual uncontrolled PM_{10} emissions in Maricopa County.

Crop	Acres Planted	No. of land preparation operations/yr	Acre-passes	Annual uncontrolled PM_{10} emissions (tons/yr)
Cotton	19,300	8.8	169,978	518.43
Corn	11,500	7.3	84,180	256.75
Wheat	30,500	3.1	93,488	285.14
Barley	10,100	2.1	20,856	63.61
Alfalfa (stand establishment)[1]	21,875	5.1	110,469	336.93
Potatoes	1,400	10.6	14,805	45.16
Sorghum for grain	16,500	3.1	50,575	154.25
Vegetables[2]	16,072	14.0	224,888	685.91
Citrus[3]	425	5.0	2,124	6.48
Totals:	**127,672**			**2,352.66**

1. Alfalfa is a multi-year crop and alfalfa stand establishment is assumed to occur once every 4 years to approximately 25% of the total alfalfa acreage (URS and ERG, 2001).
2. Including melons, not including potatoes.
3. 15 to 20% of citrus orchard acreage is non-bearing in a given year (URS and ERG, 2001); therefore, tillage is assumed to occur in 20% of the reported harvested acreage.

In November 2007, the agricultural PM_{10} general permit (Arizona Administrative Code R18-2-610 and R18-2-611) was expanded to apply to commercial farming practices within the Maricopa County portion of Area A. Previously this rule only applied to the Maricopa County PM_{10} NAA. The agricultural PM_{10} general permit revisions also resulted in the requirement for commercial farmers to implement six agricultural best management practices (BMP) (up from 3 BMPs) to control PM_{10} emissions generated from tillage and harvest, non-cropland, and cropland. Because no data is available on the additional BMPs being implemented, MCAQD used the net control efficiencies from the implementation of agricultural BMPs developed by

URS and ERG (2001) in the *Technical Support Document for Quantification of Agricultural BMPs*. URS and ERG quantified three BMPs for tillage: 1) combining tractor operations, 2) limited activity during high-wind events, and 3) multi-year crops. URS and ERG (2001) derived net control efficiencies by multiplying mid-point BMP control efficiency by a compliance factor and a relevancy factor for applicable crops. MCAQD has used the same mid-point BMP control efficiency and relevancy factor with a revised compliance factor of 55% (from 80%). The revised compliance factor was derived based on latest EPA rule effectiveness guidance (US EPA, 2005) which eliminates use of the 80% default rule effectiveness value. (Rule effectiveness calculations for agricultural activities are included as Appendix 3). To estimate controlled tillage emissions from agricultural operations taking place within the Maricopa County portion of Area A, the mid-point net control efficiency for each BMP were applied to 63.09% (the percent of agricultural land in the Maricopa County portion of Area A) of the uncontrolled annual emissions (MAG, 2009) as follows:

Controlled annual $tillage_{Crop}$ emissions	=	Annual uncontrolled PM_{10} emissions	×	(100% – mid-point net control $efficiency_{crop}$)	×	% agricultural land in the Area A
Controlled annual $tillage_{Cotton}$ emissions	=	518.01 tons PM_{10}/yr	×	(100% – 22.8%)	×	63.09%
	=	252.30 tons PM_{10}/yr				

The uncontrolled portion of tillage emissions from agricultural operations taking place outside Area A but within Maricopa County were estimated by multiplying the uncontrolled annual PM_{10} emissions by the percentage of agricultural land located within Maricopa County but outside of Area A (100% – 63.09%) as follows:

Uncontrolled annual $tillage_{Crop}$ emissions	=	Uncontrolled annual PM_{10} emissions	×	36.91%
	=	518.01 tons PM_{10}/yr	×	36.91%
	=	191.20 tons PM_{10}/yr		

Controlled and uncontrolled emissions were then summed to estimate total annual PM_{10} emissions from agricultural tillage in Maricopa County. Annual $PM_{2.5}$ emissions from agricultural tillage were calculated by multiplying the annual PM_{10} emissions by a conversion factor of 0.15 (WRAP, 2006b). Annual PM_{10} and $PM_{2.5}$ emissions from agricultural tillage in Maricopa County and Area A are shown in Table 3.5–16.

Table 3.5–16. Annual emissions from agricultural tillage in Maricopa County and Area A (tons/yr).

Crop	Net control efficiency (%)	Area A (controlled)		Outside Area A (uncontrolled)	Maricopa Co. (Area A + outside Area A)	
		PM_{10}	$PM_{2.5}$	PM_{10}	PM_{10}	$PM_{2.5}$
Cotton	22.8%	252.36	37.85	191.35	443.72	66.56
Corn	22.8%	124.98	18.75	94.77	219.75	32.96
Wheat	22.8%	138.80	20.82	105.24	244.04	36.61
Barley	22.8%	30.96	4.64	23.48	54.44	8.17
Alfalfa (stand establishment)	13.8%	183.23	27.49	124.36	307.60	46.14
Potatoes	16.8%	21.98	3.30	16.67	38.65	5.80
Sorghum for grain	22.8%	75.09	11.26	56.94	132.02	19.80
Vegetables	16.8%	359.82	53.97	253.17	612.99	91.95
Citrus	16.8%	3.40	0.51	2.39	5.79	0.87
Totals:		**1,190.63**	**178.59**	**868.37**	**2,059.00**	**308.85**

*Includes melons, excludes potatoes.

Annual PM_{10} emissions from agricultural tillage in the PM_{10} NAA were calculated in the same manner as the annual PM_{10} emissions for the Maricopa County portion of Area A; the only difference being the percent of agricultural land located within the Maricopa County PM_{10} NAA is 44.14% (rather than 63.09% for Area A). Results are shown in Table 3.5–17.

Table 3.5–17. Annual emissions from agricultural tillage in the PM_{10} NAA (tons/yr).

Crop	Net Control Efficiency (%)	Fraction of Ag Land in PM_{10} NAA	PM_{10} NAA annual emissions	
			PM_{10}	$PM_{2.5}$
Cotton	22.8%	44.14%	176.56	26.48
Corn	22.8%	44.14%	87.44	13.12
Wheat	22.8%	44.14%	97.11	14.57
Barley	22.8%	44.14%	21.66	3.25
Alfalfa (stand establishment)	13.8%	44.14%	128.20	19.23
Potatoes	16.8%	44.14%	16.57	2.49
Sorghum for grain	22.8%	44.14%	52.53	7.88
Vegetables	16.8%	44.14%	251.75	37.76
Citrus	16.8%	44.14%	2.38	0.36
Totals:			**834.20**	**125.13**

Typical daily emissions for Maricopa County, Area A, and the PM_{10} NAA were calculated by dividing the annual emissions by estimated days per year of tillage operation by crop. The number of days of tillage operations was estimated using the calendar of tillage operations by crop in the Technical Support Document for Quantification of Agricultural BMPs (URS and ERG, 2001) and assuming tillage activities occur 7 days per week during the months of tillage operations. Results are shown in Table 3.5–18. The calendar of tillage operations did not include months of tillage operations for citrus, thus, a conservative estimate of three (3) months per year was assumed.

Table 3.5–18. Controlled typical daily emissions from tillage (in lbs/day).

Crop	Tillage operations[1] (months/yr)	Tillage operations (days/yr)	Maricopa County		Area A		PM_{10} NAA	
			PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Cotton	12	364	2,438.0	365.7	1,386.6	208.0	970.1	145.5
Corn	5	152	2,897.8	434.7	1,648.1	247.2	1,153.1	173.0
Wheat	8	243	2,011.3	301.7	1,143.9	171.6	800.3	120.1
Barley	8	243	448.7	67.3	255.2	38.3	178.6	26.8
Alfalfa (stand establishment)	3	91	6,760.3	1,014.1	4,027.1	604.1	2,817.5	422.6
Potatoes	6	182	424.7	63.7	241.6	36.2	182.1	27.3
Sorghum for grain	8	243	1,088.1	163.2	618.9	92.8	433.0	64.9
Vegetables	6	182	6,736.2	1,010.4	3,954.1	593.1	2,766.4	415.0
Citrus	3	91	127.2	19.1	37.3	5.6	26.1	3.9
Totals:			**22,932.4**	**3,439.9**	**13,312.8**	**1,996.9**	**9,327.3**	**1,399.1**

[1] Source: URS and ERG (2001), Table 3-2, p. 3-5.

3.5.2.2 Harvesting

Harvest emissions were estimated using crop-specific emission factors (CARB, 2003). The majority of harvest acres were obtained from the 2008 Arizona Agricultural Statistics Bulletin (AASS, 2009). Harvest acres for potatoes were obtained from the USDA National Agricultural Statistics Service for 2008 (USDA, 2008b) and vegetables and citrus were obtained from the 2007 Census of Agriculture (USDA, 2007a). Table 3.5–19 lists the crop types, acres harvested and associated PM_{10} emission factors used to calculate emissions from agricultural harvesting.

Table 3.5–19. Maricopa County harvested acres and emission factors.

Crop	PM_{10} emission factor (lb/acre-yr)	2008 Acreage
Cotton	3.4	18,800
Wheat	5.8	30,100
Barley	5.8	9,900
Alfalfa Hay	0.0	83,000
Other Hay	1.68	4,500
Corn	1.68	700
Sorghum for Grain**	5.8	2,200
Potatoes	2.7	1,400
Vegetables*	0.08	16,072
Citrus	0.08	2,124
Total		**168,796**

*Includes melons, exclude potatoes.
** Assumed same emission factor, control efficiency, and number of harvest days per year as wheat and barley.

Annual PM_{10} emissions from agricultural harvesting were calculated using the following equation:

Uncontrolled annual $harvest_{Crop}$ emissions $= EF \times A_{Crop} \times ton / 2{,}000\ lb$

where:

$harvest_{Crop}$ = harvest emissions for each crop type (tons PM_{10}/yr)
EF_{Crop} = harvest emission factor (lbs PM_{10}/acre)
A_{Crop} = number of harvested acres for each crop type per year

Example:
EF_{Cotton} = 3.4 lbs PM_{10}/acre for cotton

A_{Cotton} = 18,800 acres of cotton

Uncontrolled annual Harvest$_{Cotton}$ Emissions = 3.4 lbs PM_{10}/acre ×18,800 acres × 1 ton/2,000 lbs
= 31.96 tons PM_{10}/yr

In November 2007, the agricultural PM_{10} general permit program (Arizona Administrative Code R18-2-610 and 611) was expanded to apply to commercial farming practices within the Maricopa County portion of Area A. (Previously this requirement had only applied to the Maricopa County PM_{10} NAA.) The agricultural PM_{10} general permit revisions also resulted in the requirement for commercial farmers to implement six agricultural best management practices (BMP) (up from 3 BMPs) to control PM_{10} emissions generated from tillage and harvest, non-cropland, and cropland. Because no data is available on the additional BMPs being implemented, MCAQD used the net control efficiencies from the implementation of agricultural BMPs developed by URS and ERG (2001) in the *Technical Support Document for Quantification of Agricultural BMPs*. URS and ERG quantified two BMPs for harvesting: 1) combining tractor operations, and 2) reduced harvest activity. URS and ERG (2001) derived net control efficiencies by multiplying mid-point BMP control efficiency by a compliance factor and a relevancy factor for applicable crops. MCAQD has used the same mid-point BMP control efficiency and relevancy factor with a revised compliance factor of 55% (from 80%). The revised compliance factor was derived based on latest EPA rule effectiveness guidance (US EPA, 2005) which eliminates use of the 80% default rule effectiveness value. (Rule effectiveness calculations for agricultural activities are included as Appendix 3). To estimate controlled harvest emissions from agricultural operations taking place within the Maricopa County portion of Area A, the mid-point net control efficiency for each BMP were applied to 63.09% of the uncontrolled annual emissions (the percent of agricultural land in the Maricopa County portion of Area A) (MAG, 2009) as follows:

Controlled annual harvest$_{Crop}$ emissions	=	annual uncontrolled PM_{10} emissions	× (100% – mid-point net control efficiency$_{crop}$)	×	% agricultural land in the Maricopa Co. portion of Area A
Controlled annual harvest$_{Cotton}$ emissions from within the Maricopa Co. portion of Area A	=	31.96 tons PM_{10}/yr	×(100% – 25.6%)	×	63.09%
	=	15.01 tons PM_{10}/yr			

The uncontrolled portion of harvest emissions from agricultural operations outside the Maricopa County portion of Area A but within Maricopa County were estimated by multiplying the uncontrolled annual PM_{10} emissions by the percent of agricultural land located within Maricopa County but outside of the Area A (100% – 63.09%) as follows:

Uncontrolled annual Harvest$_{Cotton}$ emission from outside the Maricopa Co. portion of Area A	=	Uncontrolled PM_{10} emissions	×	36.91%
	=	31.96 tons PM_{10}/yr	×	36.91%
	=	11.80 tons PM_{10}/yr		

The total controlled and uncontrolled annual emissions were then summed to estimate total annual PM_{10} emissions from agricultural harvesting in Maricopa County as follows:

Total annual harvest$_{Cotton}$ emissions for Maricopa County	=	Uncontrolled annual harvest$_{Cotton}$ emissions from outside Area A	+	Controlled annual harvest$_{Cotton}$ emissions from within the Maricopa Co. portion of Area A
	=	11.80	+	15.01
	=	26.81 tons PM_{10}/yr		

Annual $PM_{2.5}$ emissions from agricultural harvesting were calculated by multiplying the annual PM_{10} emissions by a conversion factor of 0.15 (WRAP, 2006c). Annual PM_{10} and $PM_{2.5}$ emissions from harvesting in Maricopa Co. and Area A are shown in Table 3.5–20.

Table 3.5–20. Annual emissions from harvesting in Maricopa County and Area A (in tons/yr).

Crop	Net control efficiency	Maricopa Co. Uncontrolled	Area A (controlled)		Outside Area A (uncontrolled)	Maricopa Co. (Area A + outside Area A)	
	(%)	PM_{10}	PM_{10}	$PM_{2.5}$	PM_{10}	PM_{10}	$PM_{2.5}$
Cotton	25.5%	31.96	15.02	2.25	11.80	26.81	4.02
Wheat	23.5%	87.29	42.15	6.32	32.22	74.37	11.16
Barley	23.5%	28.71	13.86	2.08	10.60	24.46	3.67
Alfalfa Hay	27.6%	0.00	0.00	0.00	0.00	0.00	0.00
Other Hay	27.6%	3.78	1.73	0.26	1.40	3.12	0.47
Corn	23.5%	0.59	0.28	0.04	0.22	0.50	0.08
Sorghum for Grain**	23.5%	6.38	3.08	0.46	2.35	5.44	0.82
Potatoes	23.5%	1.89	0.91	0.14	0.70	1.61	0.24
Vegetables*	23.5%	0.64	0.31	0.05	0.24	0.55	0.08
Citrus	23.5%	0.08	0.04	0.01	0.03	0.07	0.01
Total		161.33	77.39	11.61	59.54	136.93	20.54

*Includes melons, excludes potatoes.
** Assumed same emission factor, control efficiency, and number of harvest days per year as wheat and barley.

Annual PM_{10} emissions from agricultural harvesting in the PM_{10} NAA were calculated in the same manner as the annual PM_{10} emissions for the Maricopa County portion of Area A. The only difference being the percent of agricultural land located within the Maricopa County PM_{10} NAA is 44.14% (rather than 63.09% for Area A). Results are shown in Table 3.5–21.

Table 3.5–21. Annual emissions from harvesting in the PM_{10} NAA (tons/yr).

Crop	Net control efficiency	Fraction of Ag land in	PM_{10} NAA (controlled)	
	(%)	PM_{10} NAA	PM_{10}	$PM_{2.5}$
Cotton	25.5%	44.1%	10.51	1.58
Wheat	23.5%	44.1%	29.49	4.42
Barley	23.5%	44.1%	9.70	1.45
Alfalfa Hay	27.6%	44.1%	0.00	0.00
Other Hay	27.6%	44.1%	1.21	0.18
Corn	23.5%	44.1%	0.20	0.03
Sorghum for Grain**	23.5%	44.1%	2.16	0.32
Potatoes	23.5%	44.1%	0.64	0.10
Vegetables*	23.5%	44.1%	0.22	0.03
Citrus	23.5%	44.1%	0.03	0.00
Total			54.14	8.12

*Includes melons, excludes potatoes.
** Assumed same emission factor, control efficiency, and number of harvest days per year as wheat and barley.

Typical daily emissions for Maricopa County, Area A, and the PM_{10} NAA were calculated by dividing the annual emissions by the number of harvest days per year and multiplying the result by 2000 lbs/ton (URS and ERG, 2001). Because acres harvested were not reported for individual vegetables and citrus fruit, an average number of harvest days per year were used for vegetables and citrus (116 and 188 harvest days per year, respectively). Results are shown in Table 3.5–22.

Table 3.5–22. Typical daily emissions from harvesting, by crop (in lbs/day).

Crop	Harvest days/yr	Maricopa County		Area A		PM_{10} NAA	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Cotton	143	375.0	56.2	210.0	31.5	146.9	22.0
Wheat	60	2,479.0	371.8	1,405.1	210.8	983.0	147.5
Barley	60	815.3	122.3	462.2	69.3	323.3	48.5
Alfalfa Hay	294	0.0	0.0	0.0	0.0	0.0	0.0
Other Hay	294	21.2	3.2	11.7	1.8	8.2	1.2
Corn	91	11.0	1.7	6.2	0.9	4.4	0.7
Sorghum for Grain**	60	181.2	27.2	102.7	15.4	71.8	10.8
Potatoes	70	46.0	6.9	26.1	3.9	18.2	2.7
Vegetables*	116	9.4	1.4	5.3	0.8	3.7	0.6
Citrus	188	0.8	0.1	0.4	0.1	0.3	0.0
Total		3,938.9	590.8	2,229.9	334.5	1,560.0	234.0

*Includes melons, excludes potatoes.
** Assumed same emission factor, control efficiency, and number of harvest days per year as wheat and barley.

3.5.2.3 Travel on unpaved agricultural roads

Resuspended PM_{10} emissions from travel on unpaved agricultural roads were estimated using an unpaved road emission factor derived from AP-42 13.2.2 (US EPA, 2006b). The unpaved road emission factor equation is shown below:

Unpaved road emission factor (EF) (lb/VMT) = $k\,(s/12)^a\,(W/3)^b$

where:

s = surface material silt content = 11.90% (MAG, 2000)
W = mean vehicle weight (tons) = 2.80 (URS and ERG, 2001)
k = 1.5 (PM_{10} constant; US EPA, 2006b)
a = 0.9 (PM_{10} constant; US EPA, 2006b)
b = 0.45 (PM_{10} constant; US EPA, 2006b)

Unpaved road emission factor (lb/VMT) $= 1.5\,(11.9/12)^{0.9}\,(2.8/3)^{0.45}$
$= 1.444$ lb/VMT

Emissions were estimated using farm vehicle activity data obtained from the Technical Support Document for Quantification of Agricultural Best Management Practices (URS and ERG, 2001). URS and ERG (2001) estimated average daily vehicle miles traveled per 1,000 acres to be 49.5 VMT.

Daily emissions from travel on unpaved agricultural roads were then estimated as follows:

Daily uncontrolled PM_{10} = unpaved road EF × VMT/1000 acres × 2008 harvested acres

emissions from ag roads = 1.444 lbs/VMT ×49.5 VMT/1000 acres × 168,796 acres
= 12,065 lbs/day

In November 2007, the agricultural PM_{10} general permit (Arizona Administrative Codes R18-2-610 and 611) was expanded to apply to commercial farming practices within the Maricopa County portion of Area A. Previously this rule only applied to the Maricopa County PM_{10} NAA. The agricultural PM_{10} general permit revisions also resulted in the requirement for commercial farmers to implement six agricultural best management practices (BMP) (up from 3 BMPs) to control PM_{10} emissions generated from tillage and harvest, non-cropland, and cropland. Because no data is available on the additional BMPs being implemented, MCAQD used the net control efficiencies from the implementation of agricultural BMPs developed by URS and ERG (2001) in the Technical Support Document for quantification of Agricultural BMPs.

Two BMPs were quantified for unpaved road travel: 1) access restriction and 2) reduced vehicle speed. A 2001 study (URS and ERG, 2001) estimated net control efficiencies by multiplying a midpoint BMP control efficiency by a compliance factor and a relevancy factor for applicable crops. MCAQD has used the same mid-point BMP control efficiency and relevancy factor with a revised compliance factor of 55% (from 80%). The revised compliance factor was derived based on latest EPA rule effectiveness guidance (US EPA, 2005) which eliminates use of the 80% default rule effectiveness value. (Rule effectiveness calculations for agricultural activities are included as Appendix 3).

To estimate controlled daily emissions from travel on unpaved agricultural roads within Area A, the mid-point net control efficiency for each BMP (0.4% and 11.6 %, respectively) were applied to 63.09 % (the percent of agricultural land in Area A) of the uncontrolled daily PM_{10} emissions as follows:

Controlled daily unpaved ag road emissions within Area A	= Daily uncontrolled PM_{10} emissions	× (100%-mid-point net control efficiency)	× % agricultural land in Area A
	= 12,065 lbs/day	× (100% – 12.0%)	× 63.09%
	= 6,698.4 lbs/day		

The uncontrolled portion of unpaved agricultural road daily emissions outside the Maricopa County portion of Area A but within Maricopa County were estimated by multiplying uncontrolled daily PM_{10} emissions by the percent of agricultural land located within Maricopa County but outside of Area A (100% – 63.09%) as follows:

Uncontrolled daily unpaved ag road emissions from outside of Area A	= Uncontrolled PM_{10} emissions × (100% - 63.09%)
	= 12,065 lbs/day × 36.91%
	= 4,453 lbs/day

Total controlled and uncontrolled daily emissions were then summed to estimate total daily PM_{10} emissions from travel on unpaved agricultural roads in Maricopa County as follows:

Total daily unpaved ag road emissions for Maricopa County from outside Area A	= Uncontrolled daily unpaved ag road emissions	+	Controlled daily unpaved ag road emissions from within Area A
	= 4,453	+	6,698

= 11,151 lbs PM_{10}/day

Daily PM_{10} emissions from unpaved agricultural roads in the PM_{10} NAA were calculated in the same manner as the daily PM_{10} emissions for the Maricopa County portion of Area A. The only difference being the percent of agricultural land located within the Maricopa County PM_{10} NAA is 44.14% (rather than 63.09% for Area A). Results are shown in Table 3.5–21.

Annual emissions for Maricopa County, Area A and the PM_{10} NAA were calculated by multiplying daily emission estimates by 312 (=6 days per week × 52 weeks per year).

Annual and daily $PM_{2.5}$ emission from travel on unpaved agricultural roads were calculated by multiplying the annual and daily PM_{10} emissions by a conversion factor of 0.10 (WRAP, 2006c).

Annual and daily PM_{10} and $PM_{2.5}$ emissions from unpaved agricultural roads are shown in Table 3.5–23.

Table 3.5–23. Annual and typical daily emissions from travel on unpaved agricultural roads.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Maricopa County (Area A + outside Area A)	1,739.52	173.95	11,150.8	1,115.1
Area A (controlled)	1,044.92	104.49	6,698.2	669.8
PM_{10} NAA (controlled)	731.03	73.10	4,686.1	468.6

3.5.2.4 Cotton ginning

Annual emissions from cotton ginning were derived from annual emission reports from all permitted cotton gins in the county. Typical daily emissions were calculated based on the operating schedule data reported by surveyed facilities. Annual and typical daily emissions for the PM_{10} nonattainment area were derived based on the location data of the individual facilities.

Table 3.5–24 summarizes annual and typical daily emissions from cotton gins in both Maricopa County and the PM_{10} nonattainment area.

Table 3.5–24. Annual and typical daily emissions from area-source cotton ginning.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	17.90	5.11	103.8	29.7
PM_{10} NAA	4.86	1.39	26.7	7.6

3.5.2.5 Fertilizer application

Annual NH_3 emissions from synthetic nitrogen fertilizers for 2008 were obtained from the US EPA 2008 National Emissions Inventory (US EPA, 2010).

In 2005, MCAQD used the CMU Ammonia Model v.3.6 to calculate NH_3 emissions from synthetic nitrogen fertilizers (MCAQD, 2007). The CMU Ammonia Model used semiannual sales data for 2002 from the Association of American Plant Food Control Officials and crop calendar information from National Agricultural Statistics Service (NASS) to estimate monthly

fertilizer application rates for each county. The activity data in the CMU Ammonia Model v.3.6 has not been updated and therefore, MCAQD was unable to use the model to calculated 2008 NH_3 emissions. EPA, however, obtained county-level fertilizer consumption data for 2002 and 2007 from the Fertilizer Institute's Commercial Fertilizer 2002 and 2007 reports and calculated the percent change in county-level fertilizer quantities applied between 2002 and 2007. EPA used the percent change in applied fertilizer quantity to grow the fertilizer activity files provided with the CMU Ammonia Model v.3.6. EPA then ran the CMU Ammonia Model with the updated county-level fertilizer quantities to calculate NH_3 emissions. Typical daily NH_3 emissions were derived by dividing annual emissions by 366 days/year. Annual and typical daily emissions for the PM_{10} nonattainment area were derived by multiplying the county annual and typical daily emissions by the percentage of agricultural land located in the PM_{10} NAA (44.1%). See Section 1.5.2 for a discussion of the land use data used. Annual and typical daily NH_3 emissions from fertilizer application are shown in Table 3.5–25.

Table 3.5–25. Annual and typical daily NH_3 emissions from fertilizer application.

	Maricopa County		PM_{10} NAA	
Fertilizer Category	**Annual Emissions (tons/year)**	**Daily NH_3 Emissions (lbs/day)**	**Annual NH_3 Emissions (tons/year)**	**Daily NH_3 Emissions (lbs/day)**
Anhydrous ammonia	70.64	386.0	31.18	170.4
Aqueous ammonia	3.75	20.5	1.65	9.0
Ammonium nitrate	0.00	0.0	0.00	0.0
Ammonium sulfate	74.40	406.5	32.84	179.5
Ammonium thiosulfate	0.00	0.0	0.00	0.0
N-P-K (multi-grade nutrient fertilizers)	0.00	0.0	0.00	0.0
Calcium ammonium nitrate	0.00	0.0	0.00	0.0
Nitrogen solutions	1,397.66	7637.5	616.93	3371.2
Urea	496.42	2712.7	219.12	1197.4
Diammonium phosphate	2.66	14.6	1.18	6.4
Monoammonium phosphate	71.77	392.2	31.68	173.1
Liquid ammonium polyphosphate	38.94	212.8	17.19	93.9
Potassium nitrate	0.95	5.2	0.42	2.3
Miscellaneous	119.24	651.6	52.63	287.6
Total	2,276.43	12,439.5	1,004.82	5,490.8

3.5.3 Livestock

PM_{10} and $PM_{2.5}$ emissions estimates were derived using Maricopa County cattle inventory estimates for 2008 from Arizona Agricultural Statistics Bulletin (AASS, 2009) and emission factor for PM_{10} for dairy cattle, and feedlot cattle from the California Air Resources Board (CARB, 2004). $PM_{2.5}$ was presumed to be 11% of PM_{10} per WRAP Fugitive Dust Handbook (WRAP, 2006d).

The number of "cattle on feed" was not available from the Arizona Agricultural Statistics Bulletin (AASS, 2009) for 2005 through 2008; therefore, 2004 numbers were used. Beef cows were excluded from the inventory as information provided by Arizona Agricultural Statistics staff (Koong, 2004) indicated that the majority of beef cows that are not on feed are grazed on range and pastures. Cattle on feed, milk cows, and other cattle (heifers, steers, bulls, and calves on dairies and ranches) were included in the PM_{10} and $PM_{2.5}$ emission estimates for livestock.

The 2008 Maricopa County cattle inventory and applicable PM emission factors are contained in Table 3.5–26.

Table 3.5–26. Maricopa County cattle populations and PM emission factors.

Animal type	No. of Head	PM_{10} Emission Factor (lb/1000 head/day)	$PM_{2.5}$:PM_{10} Ratio
Cattle on feed	5,000	28.9	0.11
Milk cows	100,000	6.7	0.11
Other cattle	58,000	28.9	0.11
Total:	**170,000**		

Typical daily PM_{10} emissions from livestock in Maricopa County were calculated using the following formula:

Typical daily emissions (lbs/day) from dairy cattle = milk cow inventory (1,000 head) × emission factor (lbs PM_{10}/1,000 head/day)
= 100 × 6.7
= 670.0 lbs PM_{10}/day

It was assumed that livestock emissions occur evenly throughout the year. Annual PM_{10} and $PM_{2.5}$ emissions were derived by multiplying typical daily emissions by 366 days/year.

NH_3 emissions from livestock in Maricopa County were estimated by growing the 2005 NH_3 emissions by the percentage change in Maricopa County cattle and calve numbers from 2002 to 2008 (AASS, 2003; AASS, 2009)[2]. The cattle and calf populations declined 8.11% from 2002 to 2008; as shown in Table 3.5–27 below. The estimated 2005 and 2008 NH_3 emissions from livestock emissions are shown in Table 3.5–28.

Table 3.5–27. Maricopa County cattle inventory for 2002 and 2008.

	Maricopa Co.		Percentage
	2002	2008	Change
All cattle & calves	185,000	170,000	-8.1%

Table 3.5–28. Annual and typical daily NH_3 emissions from livestock in Maricopa County.

	Annual emissions (tons/year)	Typical daily emissions (lbs/day)
2005 Emissions	10,429.53	57,148.1
% Change in cattle and calves, 2002 to 2008	–8.11%	-8.11%
2008 Emissions	**9,583.89**	**52,514.5**

MCAQD determined through GIS analysis of confined animal feeding operation (CAFO) locations and animal numbers in Maricopa County that 57.3% of CAFO animals are located within the nonattainment area. Therefore, annual and typical daily emissions for the nonattainment area were calculated by multiplying the Maricopa County emission totals by 57.3%.

Table 3.5–29 summarizes the annual and typical daily emissions from livestock for Maricopa County and the PM_{10} nonattainment area.

2. The 2005 NH_3 emissions were calculated using the CMU Ammonia Model (CMU, 2004). The activity levels in the CMU model are based on the 2002 Census of Agriculture; therefore, emissions were grown using the percentage change in cattle and calve numbers from 2002 to 2008.

Table 3.5–29. Annual and typical daily emissions from livestock.

	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NH_3**
Maricopa County	455.80	50.14	9,583.89	2,490.7	274.0	52,514.5
PM_{10} NAA	260.95	28.70	5,486.90	1,426.0	156.9	30,065.2

3.5.4 Health services: crematories

Emissions from human and animal crematories were calculated from annual emissions inventory reports from all crematories located within the county. Typical daily emissions were calculated based on the operating schedule data reported by surveyed facilities. Annual and typical daily emissions for the PM_{10} nonattainment area were derived based on the location data of the individual facilities.

Table 3.5–30 summarizes annual and typical daily emissions from crematories in both Maricopa County and the PM_{10} nonattainment area.

Table 3.5–30. Annual and typical daily emissions from crematories.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	0.93	0.62	12.39	1.58	7.0	4.7	93.1	11.9
PM_{10} NAA	0.93	0.62	12.36	1.58	7.0	4.6	92.6	11.8

3.5.5 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 0.01 tons of PM_{10} and 0.06 tons of NO_x for the year 2008. To be conservative, $PM_{2.5}$ amounts are assumed to be equal to PM_{10} amounts. (No accidental releases of SO_x or NH_3 were reported).

Typical daily emissions were calculated by summing reported releases and dividing the total by 366 days. Emissions in the PM_{10} nonattainment area were calculated based on locations of facilities that reported releases. The resulting estimates are shown in Table 3-5–31 below.

Table 3.5–31. Annual and typical daily emissions from accidental releases.

	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Geographic area	**PM_{10}**	**$PM_{2.5}$***	**NO_x**	**PM_{10}**	**$PM_{2.5}$***	**NO_x**
Maricopa County	0.01	0.01	0.06	0.1	0.1	0.3
PM_{10} NAA	0.01	0.01	0.06	0.1	0.1	0.3

* As a conservative estimate, all PM_{10} emissions are assumed to be $PM_{2.5}$.

3.5.6 Humans

A literature review by Battye et al. (1994) recommended using a per-capita emission factor developed for the National Acid Precipitation Assessment Program (NAPAP) inventory in 1985. This factor was applied to MAG population estimates for the county and PM_{10} nonattainment areas (see section 1.5 for population information). Daily emissions were calculated by dividing annual values by 366. The resulting estimates are shown in Table 3-5–32.

Table 3.5–32. Annual and typical daily NH_3 emissions from human activity.

Geographic Area	Population	Emission factor (lbs/ person-yr)	Annual NH_3 emissions (tons/yr)	Typical daily NH_3 emissions (lbs/day)
Maricopa County	4,279,760	0.55	1,176.93	6,431.3
PM_{10} NAA	4,297,140	0.55	1,181.71	6,457.5

3.5.7 Leaf blower fugitive dust

Fugitive dust emissions from leaf blowers are the result of blowing loose material from the area being cleared by the leaf blowers. Exhaust emissions from gasoline-powered leaf blowers are covered under the Nonroad Mobile Sources section of this report (Chapter 4). Fugitive dust emission estimates are developed with the use of three sources: EPA's NONROAD model, California Air Resources Board report to legislature on leaf blowers (CARB, 2000), and a recent research effort done by the University of Riverside (Fitz et al., 2005).

EPA's 2008NONROAD model was used to estimate the number of gasoline-powered leaf blowers in Maricopa County (n = 109,787), along with the average activity figures for those leaf blowers. Total leaf blower population estimates were derived from CARB (2000), which estimated that 60% of all leaf blowers sold are electric. Thus assuming the remaining 40% are gasoline-powered, the total population was estimated as:

$$\begin{aligned} \text{Total leaf blower population} &= \text{Gas-powered leaf blower population} \div 40\% \\ &= 109{,}787 \div 0.4 \\ &= 274{,}468 \text{ units} \end{aligned}$$

The remaining 164,681 units [= 274,468 – 109,787] are thus assumed to be electric-powered. Fitz et al. (2005) developed emission factors for PM_{10} and $PM_{2.5}$ fugitive dust emissions from leaf blowers. For this report, the most conservative (highest) emission factors were chosen to estimate emissions. Given these two data sources, Table 3.5–33 lists the equipment population numbers, activity estimates and emission factors for leaf blowers in Maricopa County.

Table 3.5–33. Leaf blower equipment populations, activity levels and emission factors for Maricopa County.

Leaf blower description	Population	Annual activity (hrs/yr)	PM_{10} emission factors (mg/m^2)	$PM_{2.5}$ Emission factors (mg/m^2)
Commercial 2-stroke gasoline	3,345	626	70	30
Commercial 4-stroke gasoline	1,639	626	70	30
Residential 2-stroke gasoline	99,624	10	70	30
Residential 4-stroke gasoline	5,179	10	70	30
Electric	164,681	10	130	40
Total:	**274,468**	n/a	n/a	n/a

CARB (2000) estimates that approximately 1600m^2 of surface can be cleared in one hour of leaf blower operation. Therefore, annual emission estimates were calculated by using the following formula, as in this example for electric leaf blowers:

Annual PM_{10} emissions from electric leaf blowers	=	population	× activity (hrs/yr)	× emission factor (mg/m^2)	× area covered (m^2/hr)
	=	164,681	× 10 hrs/yr	× 130 mg/m^2	× 1600 m^2/hr
	=	342,536,480,000 mg/yr			
	=	377.24 tons PM_{10}/yr			

The activity hours associated with leaf blowers can occur at any time during the year in Maricopa County due to the temperate climate, with no substantial seasonal variation. Therefore, typical daily emissions were estimated by dividing annual totals by 366 days per year. Emissions for the PM_{10} nonattainment area are allocated based on the ratio of population in the County to the nonattainment area (see Section 1.5 for information on population). Table 3.5–34 lists annual and daily fugitive emissions from leaf blowers for Maricopa County and the PM_{10} nonattainment area.

Table 3.5–34. Annual and typical daily emissions from leaf blower fugitive dust.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	891.36	336.41	4,870.8	1,838.3
PM_{10} NAA	894.98	337.78	4,890.6	1,845.8

3.5.8 Offroad recreation vehicles fugitive dust

The EPA NONROAD2008 model estimates exhaust emissions for offroad recreational vehicles. These emissions are included in the nonroad emissions category of the 2008 particulate emissions inventory. Particulate emissions are also generated by recreational vehicles traveling on unpaved surfaces. For the 2008 periodic inventory, these emissions were estimated by MAG using mileage and activity data for offroad recreational vehicles in Maricopa County from the NONROAD2008 model. The methodology and assumptions for calculating fugitive dust emissions from offroad recreational vehicles traveling are described in this section.

The EPA NONROAD2008 model provides annual mileage and number of vehicles by county for all-terrain vehicles (ATVs), offroad motorcycles (ORMs), and specialty vehicles/carts (SVCs). The NONROAD2008 default values for annual mileage and number of vehicles by type for Maricopa County in 2008 are shown in Table 3.5–35.

To be consistent with the 2005 Periodic Emissions Inventory for PM_{10} (MCAQD, 2007), it was assumed that 75 percent of the annual travel by offroad recreational vehicles occurs on unpaved surfaces inside Maricopa County, with the remaining 25 percent occurring on paved surfaces within Maricopa County and paved and unpaved surfaces outside of Maricopa County. The product of the mileage, number of vehicles, and 75 percent produces the annual vehicle miles traveled (VMT) on unpaved surfaces, shown in Table 3.5–35. Dividing annual VMT totals by 366 produces a daily estimated offroad recreational vehicle travel on unpaved surfaces in Maricopa County in 2008.

Table 3.5–35. 2008 offroad recreational vehicle travel on unpaved surfaces in Maricopa County.

Vehicle Type	Annual Mileage	Number of Vehicles	2008 Annual VMT	2008 Daily VMT
ATV	1,608	30,424	36,691,344	100,250
ORM	1,600	7,359	8,830,800	24,128
SVC (Non-Diesel)	65	1,718	83,753	229
SVC (Diesel)	435	150	48,938	134

The VMTs above were multiplied by emission factors for unpaved industrial roads from AP-42 (US EPA, 2006b), assuming a silt content of 11.9 percent and an average vehicle weight of one-half of a ton. The resultant PM_{10} emission factor for ATVs and SVCs is 0.594 pounds per vehicle mile traveled. This emission factor was reduced by 50 percent for ORMs (i.e., 0.297 pounds per mile) to account for two wheels generating dust instead of four. Applying the AP-42 equation results in a $PM_{2.5}$ emission factor for ATVs and SVCs of 0.059 pounds per mile, while the comparable $PM_{2.5}$ emission factor for ORMs is 0.0295 pounds per mile.

The AP-42 emission rates were multiplied by the annual and daily VMTs in Table 3.5–36 to obtain uncontrolled fugitive dust emissions in pounds per day and tons per year. The results for Maricopa County are shown in Table 3.5–37.

The emissions for the PM_{10} nonattainment area were derived by applying geographic information systems (GIS) to MAG 2009 land use data[1] to obtain the acreage of passive open space in the PM_{10} nonattainment area and Maricopa County. Passive open space includes open desert, mountains and washes. The detailed calculations for deriving the PM_{10} nonattainment area emissions are shown below:

Passive Open Space in the PM_{10} nonattainment area (NAA) = 262,662 acres

Passive Open Space in Maricopa County = 1,476,922 acres

Ratio of Passive Open Space in PM_{10} NAA vs. Maricopa County = 17.8%

PM_{10} NAA Emissions = 0.178 × Maricopa County Emissions

Application of the ratio above to Maricopa County emissions produces the uncontrolled annual and typical daily PM_{10} NAA emissions shown in Table 3.5–36. The PM_{10} and $PM_{2.5}$ emissions for all offroad recreational vehicle types (i.e., ATVs, ORMs and SVCs) are summed in this table. These uncontrolled emissions do not include the 2008 emission reductions attributed to the committed measures in the MAG 2007 Five Percent Plan.

Table 3.5–36. 2008 uncontrolled emissions from offroad recreational vehicles.

	Annual emissions (tons/yr)		Typical Daily Emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	12,248.11	1,216.56	66,929.6	6,647.9
PM_{10} NAA	2,180.16	216.55	11,913.5	1,183.3

Two committed measures that reduce emissions from offroad recreational vehicles were quantified in the MAG 2007 Five Percent Plan for PM_{10} (MAG, 2007). The benefit taken in 2008 for these measures in the Five Percent Plan is shown in Table 3.5–37.

1. Draft, as of March 24, 2010.

Table 3.5–37. Benefits of measures that reduce offroad recreational vehicle emissions.

Committed Measures in Five Percent Plan	2008 PM_{10} Emission Reductions tons/yr	lbs/day
1. Reduce offroad vehicle use in areas with high offroad vehicle activity (Measure 19)	140.3	766.5
2. Ban ATV use on high pollution days (Measure 23)	25.7	140.6
Total 2008 PM_{10} emission reductions for offroad recreational vehicles	**166.0**	**907.0**

The emission benefits in Table 3.5–37 were subtracted from the uncontrolled PM_{10} emissions in Table 3.5–36. The 2008 PM-10 emission reduction of 166.0 tons per year represents 7.6% of the uncontrolled emissions in the PM-10 NAA of 2,180.16 tons per year. This percent reduction was applied to the uncontrolled $PM_{2.5}$ emissions in the PM_{10} NAA; then the absolute reduction in $PM_{2.5}$ emissions due to the control measures was applied to the uncontrolled $PM_{2.5}$ emissions in Maricopa County. The annual and daily controlled emission estimates are shown in Table 3.5-38 below.

Table 3.5–38. 2008 controlled emissions from offroad recreational vehicles.

Geographic Area	Annual Emissions (tons/yr) PM_{10}	$PM_{2.5}$	Typical Daily Emissions (lbs/day) PM_{10}	$PM_{2.5}$
Maricopa County	12,082.12	1,200.11	66,022.5	6,558.0
PM_{10} NAA	2,014.17	200.09	11,006.4	1,093.4

3.5.9 Unpaved parking lots fugitive dust

Fugitive dust emissions from vehicles traveling on unpaved parking lots were developed by MAG based on land area devoted to unpaved parking lots, vehicle activity on unpaved parking lots, and emission rates from AP-42 (US EPA, 2006b). The methodology, assumptions and calculations involved in estimating fugitive dust from vehicles traveling on unpaved parking lots are described in this section.

The vehicle miles traveled on unpaved parking lots in the PM_{10} nonattainment area (NAA) were derived using assumptions from the Phase I windblown dust modeling for the Western Regional Air Partnership (ENVIRON, 2004). This study estimated that eight percent of the vacant land in core urban areas is disturbed and thirty percent of the land under development is disturbed. For the 2008 periodic emissions inventory, the core urban area is defined as the carbon monoxide maintenance area. In addition, the thirty percent of disturbed land under development has been reduced by two-thirds (i.e., from thirty percent to ten percent) to mirror a 67 percent decline in total permitted construction acreage in the PM_{10} NAA between 2005 and 2008. GIS was applied to 2009 MAG land use data[2] to estimate that there are 171,785 acres of vacant land in the core urbanized area and 64,519 acres of land under development in the PM_{10} NAA. Multiplying the vacant disturbed percentages by these land areas produces:

171,785 acres × 0.08 = 13,743 acres of vacant disturbed land in the urbanized core

64,519 acres × 0.10 = 6,452 acres of vacant disturbed land under development

Summing the vacant disturbed acres in the urbanized core and areas under development produces a total of 20,195 acres of vacant disturbed land in the PM_{10} NAA. In estimating fugitive dust emissions from unpaved parking lots, the MAG Serious Area PM_{10} Plan assumed that 24 percent

2. *Ibid.*

of the disturbed vacant non-agricultural land is devoted to unpaved parking areas (MAG, 2000). Applying this percentage to the acres of vacant disturbed land results in 4,847 acres of unpaved parking lots in the PM_{10} NAA.

The MAG Serious Area PM_{10} Plan also assumed that the average size of an unpaved parking lot is 625 square meters (i.e., 0.154 acres), an average of ten vehicles travel on each lot per day, and each vehicle travels an average distance of 0.031 miles on a lot. Multiplying 10 vehicles per day times 0.031 miles per vehicle and dividing by 0.154 acres produces 2.0 vehicle miles of travel (VMT) per acre per day. Multiplying 2.0 by 4,847 acres yields 9,694 VMT per day on unpaved parking lots in the PM_{10} NAA.

The emission factors for unpaved parking lots were derived from the AP-42 equation for unpaved industrial roads (US EPA, 2006b), assuming a silt content of 11.9 percent and an average vehicle weight of 3.18 tons. The resultant AP-42 emission factors are 1.365 pounds per mile for PM_{10} and 0.137 pounds per mile for $PM_{2.5}$.

These AP-42 emission factors were applied to the unpaved parking lot VMT of 9,694 to obtain uncontrolled emissions in pounds per day. The pounds per day were converted to tons per year, assuming 366 days in 2008. The results for the PM_{10} NAA are shown in Table 3.5–40.

To estimate emissions for Maricopa County, GIS was applied to 2009 MAG land use data[3] to obtain 2,227,981 acres of vacant land in Maricopa County. Removing the vacant land in the Maricopa County portion of the PM_{10} NAA (i.e., 466,553 acres) results in 1,761,428 vacant acres located inside Maricopa County, but outside the PM_{10} NAA.

Assuming one percent of the vacant land outside the PM_{10} NAA is disturbed (Clark County, 2006) and 24 percent of the disturbed vacant land is unpaved parking areas (MAG, 2000), results in 4,227 acres of unpaved parking areas inside Maricopa County, but outside the PM_{10} NAA. Multiplying by 2.0 VMT per acre per day results in 8,454 VMT per day. Applying the AP-42 emission rates produces the unpaved parking lot emissions inside Maricopa County, but outside the PM_{10} NAA of 11,539.7 pounds per day of PM_{10} and 1,158.2 pounds per day of $PM_{2.5}$.

The final step in estimating Maricopa County emissions requires removing the Pinal County portion of the PM_{10} NAA. The unpaved parking lot emissions in the Pinal County portion of the PM_{10} NAA are assumed to be proportional to the acres of vacant land. These were derived using GIS and 2009 MAG land use data[4], with the results shown below:

Vacant land in the Pinal County portion of the PM_{10} NAA = 6,278 acres

Vacant land in the PM_{10} NAA = 472,831 acres

Ratio = 6,278/472,831 = 1.3%; Pinal County portion = 1.3% × PM_{10} NAA emissions

Pinal County portion of PM_{10} emissions = 1.3% × 13,232.3 = 172.0 pounds per day

Pinal County portion of $PM_{2.5}$ emissions = 1.3% × 1,158.2 = 17.3 pounds/day

Adding the emissions inside and outside the PM_{10} NAA and subtracting the Pinal County portion produces total Maricopa County emissions attributable to vehicles traveling on unpaved parking

3. *Ibid.*

4. *Ibid.*

lots in pounds per day. Pounds per day were multiplied by 366 [= no. days in 2008] to derive annual totals. The resultant 2008 uncontrolled emissions for Maricopa County are shown in Table 3.5–39. Uncontrolled emissions do not include the 2008 emission reductions attributed to the committed measure in the MAG 2007 Five Percent Plan.

Table 3.5–39. 2008 uncontrolled emissions from vehicles traveling on unpaved parking lots.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	4,501.80	451.83	24,600.0	2,469.0
PM_{10} NAA	2,421.51	243.04	13,232.3	1,328.1

One committed measure that reduces emissions from unpaved parking lots was quantified in the MAG 2007 Five Percent Plan for PM_{10} (MAG, 2007). The benefit taken in 2008 for this measure in the Five Percent Plan is shown in Table 3.5–40.

Table 3.2–40. Benefits of measure that reduces unpaved parking lot emissions.

	2008 PM_{10} emission reduction	
Committed Measure in Five Percent Plan	**tons/yr**	**lbs/day**
1. Pave or stabilize existing unpaved parking lots (Measure 25)	56.4	308.4

The emission benefit in Table 3.5-40 was subtracted from the uncontrolled PM_{10} emissions in Table 3.5-39. The 2008 PM_{10} emission reduction of 56.4 tons per year represents 2.3% of the uncontrolled emissions in the PM_{10} NAA of 2,421.51 tons per year. This percent reduction was applied to the uncontrolled $PM_{2.5}$ emissions in the PM_{10} NAA; then the absolute reduction in $PM_{2.5}$ emissions due to the control measure was applied to the uncontrolled $PM_{2.5}$ emissions in Maricopa County. The annual and daily controlled emission estimates are shown in Table 3.5-41 below.

Table 3.5–41. Annual and typical daily controlled emissions from unpaved parking lots.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	4,445.36	446.24	24,291.6	2,438.5
PM_{10} NAA	2,365.07	237.45	12,923.9	1,297.5

3.5.10 Windblown dust

Windblown dust emissions were calculated using a combination of local meteorology conditions, land use and vertical flux emission rates. A full description of the methodology is included as Appendix 4. Tables 3.5–42 and 3.5–43 summarize annual and typical daily emissions from windblown dust by major land use category for Maricopa County and the PM_{10} nonattainment area.

Table 3.5–42. Annual and typical daily emissions from fugitive windblown dust for Maricopa County.

	Annual Emissions (tons/yr)		Avg. Daily Emissions (lb/day)	
Land Use Category	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Agriculture, harvested	1,711.76	171.18	9,353.9	935.4
Agriculture, unharvested	1,349.51	134.95	7,374.4	737.4
Developing	3,334.78	333.48	18,222.8	1,822.3
Landfill, Sand & Gravel, Automotive Test Tracks	1,646.51	164.65	8,997.3	899.7
Passive/Restricted Open Space	44,174.80	4,417.48	241,392.4	24,139.2
Vacant	60,570.87	6,057.09	330,988.4	33,098.8
Total	**112,788.23**	**11,278.82**	**616,329.1**	**61,632.9**

Table 3.5–43. Annual and typical daily emissions from fugitive windblown dust for the PM_{10} NAA.

	Annual Emissions (tons/yr)		Avg. Daily Emissions (lb/day)	
Land Use Category	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Agriculture, harvested	755.57	75.56	4,128.8	412.9
Agriculture, unharvested	327.69	32.77	1,790.7	179.1
Developing	2,664.48	266.45	14,560.0	1,456.0
Landfill, Sand & Gravel, Automotive Test Tracks	1,435.81	143.58	7,845.9	784.6
Passive/Restricted Open Space	3,762.38	376.24	20,559.5	2,056.0
Vacant	9,522.43	952.24	52,035.2	5,203.5
Total	**18,468.36**	**1,846.84**	**100,920.0**	**10,092.0**

3.5.11 Summary of all miscellaneous area sources

Tables 3.5–44 and 3.5–45 provide a summary of annual and typical daily emissions from all miscellaneous area sources, for Maricopa County and the PM_{10} nonattainment area, respectively.

Table 3.5–44. Annual and typical daily emissions from all miscellaneous area sources for Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Wildfires	470.39	403.43	103.79	28.46	21.76	6,271.8	5,379.0	1,383.8	379.4	290.2
Prescribed fires	0.51	0.51	0.39	0.11	0.03	169.3	169.3	131.2	36.0	10.6
Structure fires	15.04	15.04	1.95			82.2	82.2	10.7		
Vehicle fires	30.04	30.04	1.20			164.1	164.1	6.6		
Engine testing	0.18	0.17	6.74	2.49		1.3	1.2	50.5	19.0	
Tilling	2,059.00	308.85				22,932.4	3,439.9			
Harvesting	136.93	20.54				3,938.9	590.8			
Unpaved ag roads	1,739.52	173.95				11,150.8	1,115.1			
Cotton ginning	17.90	5.11				103.8	29.7			
Fertilizer					2,276.43					12,439.5
Livestock	455.80	50.14			9,583.89	2,490.7	274.0			52,514.5
Crematories	0.93	0.62	12.39	1.58		7.0	4.7	93.1	11.9	
Accidental releases	0.01	0.01	0.06			0.1	0.1	0.3		
Humans					1,176.93					6,431.3
Leaf blowers dust	891.36	336.41				4,870.8	1,838.3			
Offroad rec. veh. dust	12,082.12	1,200.11				66,022.5	6,558.0			
Unpaved parking lots	4,445.36	446.24				24,291.6	2,438.5			
Windblown dust	112,788.23	11,278.82				616,329.1	61,632.9			
Total:	**135,133.31**	**14,269.99**	**126.52**	**32.64**	**13,059.05**	**758,826.5**	**83,717.8**	**1,676.1**	**446.4**	**71,686.1**

Table 3.5–45. Annual and typical daily emissions from all miscellaneous area sources for the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Wildfires	423.56	363.27	93.46	25.62	19.60	9,412.5	8,072.7	2,076.8	569.4	435.5
Prescribed fires	0.21	0.21	0.16	0.04	0.01	104.0	104.0	80.6	22.1	6.5
Structure fires	15.10	15.10	1.96			82.5	82.5	10.7		
Vehicle fires	30.16	30.16	1.21			164.81	164.81	6.59		
Engine testing	0.18	0.17	6.74	2.49		1.3	1.2	50.5	19.0	
Tilling	834.20	125.13				9,327.3	1,399.1			
Harvesting	54.14	8.12				1,560.0	234.0			
Unpaved ag roads	731.03	73.10				4,686.1	468.6			
Cotton ginning	4.86	1.39				26.7	7.6			
Fertilizer					1,004.82					5,490.8
Livestock	260.95	28.70			5,486.90	1,426.0	156.9			30,065.2
Crematories	0.93	0.62	12.36	1.58		7.0	4.6	92.6	11.8	
Accidental releases	0.01	0.01	0.06			0.1	0.1	0.3		
Humans					1,181.71					6,457.5
Leaf blowers dust	894.98	337.78				4,890.6	1,845.8			
Offroad rec. veh. dust	2,014.17	200.09				11,006.4	1,093.4			
Unpaved parking lots	2,365.07	237.45				12,923.9	1,297.5			
Windblown dust	18,468.36	1,846.84				100,920.0	10,092.0			
Total:	**26,097.92**	**3,268.14**	**115.94**	**29.74**	**7,693.04**	**156,539.2**	**25,024.8**	**2,318.0**	**622.4**	**61,982.0**

3.6 Summary of all area sources

Tables 3.6–1 and 3.6–2 summarize the total annual and typical daily emissions from all area sources addressed in this chapter, for both Maricopa County and the PM_{10} nonattainment area, respectively.

Table 3.6–1. Summary of annual and typical daily emissions from all area sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Fuel Combustion										
Industrial natural gas	30.78	30.78	575.29	2.42	12.70	197.3	197.3	3,687.7	15.5	81.4
Industrial fuel oil	458.79	458.79	6,375.08	609.61	26.25	2,941.0	2,941.0	40,865.9	3,907.8	168.3
Comm./inst. natural gas	66.54	66.54	1,267.11	5.23	4.20	426.5	426.5	8,122.5	33.5	26.9
Comm./inst. fuel oil	224.14	224.14	3,273.40	271.27	8.13	1,436.8	1,436.8	20,983.3	1,738.9	52.1
Residential natural gas	61.75	61.75	763.81	4.88		337.5	337.5	4,173.8	26.6	
Residential wood	461.59	429.28	34.69	5.34		4,334.2	4,030.8	325.7	50.1	
Residential fuel oil	0.01	0.01	0.25	0.10		0.1	0.1	2.3	0.9	
All fuel combustion	**1,303.61**	**1,271.30**	**12,289.62**	**898.83**	**51.27**	**9,673.4**	**9,370.0**	**78,161.3**	**5,773.3**	**328.7**
Industrial Processes										
Chemical manufacturing	187.43	151.42	0.00	0.34	0.03	1,445.8	1,164.5	0.0	2.6	0.6
Commercial cooking	988.99	917.18				5,434.0	5,039.5			
Grain processing	20.59	6.71				149.3	49.5			
Cold storage					1,678.43					10.759.2
Secondary metal prod.	60.56	52.16	49.73	18.65	.004	442.7	386.2	358.8	142.7	0.0
Mineral processes	195.81	97.28				1,357.4	671.7			
Mining & quarrying	210.39	59.56				1,442.1	390.8			
Wood product mfg.	217.26	203.25				1,668.6	1,548.3			
Rubber/plastic mfg.	140.94	105.96				953.3	698.8			
Fabricated metal mfg.	51.48	42.62				538.1	460.6			28.9
Residential construction	2,259.80	225.98				14,343.5	1,434.3			
Commercial construction	5,364.98	536.50				34,332.0	3,433.2			
Road construction	2,725.90	272.59				17,458.0	1,745.8			
Other construction	216.23	21.62				1,382.2	138.2			
Electrical equip mfg.	13.94	9.64	20.45	0.18	31.55	76.9	53.2	112.4	1.1	193.7
ADEQ-permitted portable sources	59.00	29.50	282.18	88.93		492.9	246.5	2.275.7	721.7	
Road travel at industrial sites	608.17	282.95				4,178.8	1,928.8			
Industrial processes NEC	144.60	107.24	10.22	21.49	16.79	953.3	726.4	69.6	137.7	94.6
All Industrial Processes	**14,928.89**	**3,268.45**	**362.58**	**129.60**	**1,731.34**	**96,246.9**	**21,076.1**	**2,816.5**	**1,005.8**	**11,077.2**
Waste Treatment/disposal										
On-site incineration	0.06	0.04	5.01	0.01		0.7	0.4	38.9	0.1	
Open burning	111.46	111.46	29.96			902.2	902.2	242.4		
Landfills	86.21	75.92	24.11	7.57		486.1	425.4	132.9	41.7	
POTWs					1,484.01					8,131.5
Other waste	32.78	16.93	18.39	50.62		224.1	110.9	101.0	278.1	
All Waste Treatment/ Disposal	**230.52**	**204.35**	**77.47**	**58.20**	**1,484.01**	**1,613.0**	**1,438.8**	**515.3**	**320.0**	**8,131.5**

Table 3.6–1. Summary of annual and typical daily emissions from all area sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Misc. Area Sources										
Wildfires fires	470.39	403.43	103.79	28.46	21.76	6,271.8	5,379.0	1,383.8	379.4	290.2
Prescribed fires	0.51	0.51	0.39	0.11	0.03	169.3	169.3	131.2	36.0	10.6
Structure fires	15.04	15.04	1.95			82.2	82.2	10.7		
Vehicle fires	30.04	30.04	1.20			164.1	164.1	6.6		
Engine testing	0.18	0.17	6.74	2.49		1.3	1.2	50.5	19.0	
Tilling	2,059.00	308.85				22,932.4	3,439.9			
Harvesting	136.93	20.54				3,938.9	590.8			
Unpaved ag roads	1,739.52	173.95				11,150.8	1,115.1			
Cotton ginning	17.90	5.11				103.8	29.7			
Fertilizer application					2,276.43					12,439.5
Livestock	455.80	50.14			9,583.89	2,490.7	274.0			52,514.5
Crematories	0.93	0.62	12.39	1.58		7.0	4.7	93.1	11.9	
Accidental releases	0.01	0.01	0.06			0.1	0.1	0.3		
Humans					1,176.93					6,431.3
Leaf blowers dust	891.36	336.41				4,870.8	1,838.3			
Offroad rec. veh. dust	12,082.12	1,200.11				66,022.5	6,558.0			
Unpaved parking lots	4,445.36	446.24				24,291.6	2,438.5			
Windblown dust	112,788.23	11,278.82				616,329.1	61,632.9			
All Misc. Sources	**135,133.31**	**14,269.99**	**126.52**	**32.64**	**13,059.05**	**758,826.5**	**83,717.8**	**1,676.1**	**446.4**	**71,686.1**
TOTAL, ALL AREA SOURCES	**151,596.33**	**19,014.09**	**12,856.18**	**1,119.27**	**16,329.74**	**866,359.8**	**115,602.7**	**83,169.2**	**7,545.5**	**91,223.5**

Table 3.6–2. Summary of annual and typical daily emissions from all area sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Fuel Combustion										
Industrial natural gas	30.70	30.70	573.79	2.41	12.66	196.8	196.8	3,678.2	15.5	81.2
Industrial fuel oil	457.60	457.60	6,358.50	608.03	26.19	2,933.3	2,933.3	40,759.6	3,897.6	167.9
Comm./inst. natural gas	66.20	66.20	1,260.65	5.20	4.18	424.4	424.4	8,081.1	33.3	26.8
Comm./inst. fuel oil	223.00	223.00	3,256.70	269.88	8.09	1,429.5	1,429.5	20,876.3	1,730.0	51.8
Residential natural gas	61.73	61.73	763.51	4.87		337.3	337.3	4,172.2	26.6	
Residential wood	461.41	429.11	34.67	5.33		4,332.5	4,029.2	325.6	50.1	
Residential fuel oil	0.01	0.01	0.25	0.10		0.1	0.1	2.3	0.9	
All fuel combustion	**1,300.65**	**1,268.35**	**12,248.07**	**895.83**	**51.11**	**9,653.8**	**9,350.6**	**77,895.2**	**5,754.1**	**327.6**
Industrial Processes										
Chemical manufacturing	186.94	151.03	0.00	0.34	0.03	1,442.0	1161.5	0.0	2.6	0.9
Commercial cooking	993.04	920.94				5,456.3	5,060.1			
Grain processing	16.73	5.68				125.3	43.0			
Cold storage					1,674.1					10,731.2
Secondary metal prod.	60.56	52.16	49.73	18.65	0.04	442.7	386.2	358.8	142.7	0.0
Mineral processes	190.45	93.72				1,320.7	647.9			
Mining & quarrying	184.25	50.64				1,266.6	331.9			
Wood product mfg.	216.69	202.72				1,664.3	1,544.3			
Rubber/plastic mfg.	140.57	105.68				950.9	697.0			
Fabricated metal mfg.	51.35	42.51			4.49	536.7	459.4			28.8
Residential construction	2,245.39	224.54				14,465.2	1,446.5			
Commercial construction	5,380.95	538.10				34,382.4	3,438.2			
Road construction	2,724.87	272.49				17,471.4	1,747.1			
Other construction	215.70	21.57				1,385.5	138.6			
Electrical equip mfg	13.94	9.64	20.45	0.18	31.55	76.9	53.2	112.4	1.1	193.7
ADEQ-permitted portable sources	59.00	29.50	282.18	88.93		492.9	246.5	2,275.7	721.7	
Road travel at industrial sites	511.29	227.58				3,551.3	1,573.8			
Industrial processes NEC	136.00	99.12	8.12	21.47	14.10	906.0	681.7	55.4	137.6	79.8
All Industrial Processes	**13,327.74**	**3,047.62**	**360.48**	**129.58**	**1,724.27**	**85,937.0**	**19,656.9**	**2,802.3**	**1,005.7**	**11,034.4**

Table 3.6–2 (cont'd). Summary of annual and typical daily emissions from all area sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Fuel Combustion										
Waste Treatment/disposal										
On-site incineration	0.06	0.04	5.01	0.01		0.7	0.4	38.9	0.1	
Open burning	27.67	27.67	7.44			232.6	232.6	62.5		
Landfills	60.25	50.78	19.47	6.22		342.4	286.6	107.4	34.3	
POTWs					1,494.12					8,164.6
Other waste	32.78	16.93	18.39	50.62		224.1	110.9	101.0	278.1	
All Waste Treatment/ Disposal	**120.77**	**95.42**	**50.30**	**56.85**	**1,494.12**	**799.8**	**630.5**	**309.9**	**312.6**	**8,164.6**
Misc. Area Sources										
Wildfires	423.56	363.27	93.46	25.62	19.60	9,412.5	8,072.7	2,076.8	569.4	435.5
Prescribed fires	0.21	0.21	0.16	0.04	0.01	104.0	104.0	80.6	22.1	6.5
Structure fires	15.10	15.10	1.96			82.5	82.5	10.7		
Vehicle fires	30.16	30.16	1.21			164.81	164.81	6.59		
Engine testing	0.18	0.17	6.74	2.49		1.3	1.2	50.5	19.0	
Tilling	834.20	125.13				9,327.3	1,399.1			
Harvesting	54.14	8.12				1,560.0	234.0			
Unpaved ag roads	731.03	73.10				4,686.1	468.6			
Cotton ginning	4.86	1.39				26.7	7.6			
Fertilizer application					1,004.82					5,490.8
Livestock	260.95	28.70			5,486.90	1,426.0	156.9			30,065.2
Crematories	0.93	0.62	12.36	1.58		7.0	4.6	92.6	11.8	
Accidental releases	0.01	0.01	0.06			0.1	0.1	0.3		
Humans					1,181.71					6,457.5
Leaf blowers dust	894.98	337.78				4,890.6	1,845.8			
Offroad rec. veh. dust	2,014.17	200.09				11,006.4	1,093.4			
Unpaved parking lots	2,365.07	237.45				12,923.9	1,297.5			
Windblown dust	18,468.36	1,846.84				100,920.0	10,092.0			
All Misc. Sources	**26,097.92**	**3,268.14**	**115.94**	**29.74**	**7,693.04**	**156,539.2**	**25,024.8**	**2,318.0**	**622.4**	**42,455.4**
TOTAL, ALL AREA SOURCES:	**40,847.07**	**7,679.53**	**12,774.79**	**1,112.00**	**10,962.54**	**252,929.8**	**54,662.7**	**83,325.3**	**7,694.7**	**61,982.0**

3.7 Quality assurance/quality control procedures

Quality assurance and quality control (QA/QC) activities for the area source emissions inventory were driven by the goal of creating 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 selected for inclusion in the inventory based on the latest Emission Inventory Improvement Program (EIIP) guidance available. EPA's guidance for area source categories included in the draft 2002 National Emission Inventory (NEI) was also evaluated, as area source emissions from this inventory will be submitted to EPA for the 2008 NEI. 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 (such as industrial coal combustion and oil and gas production). The 1999 Maricopa County Periodic Ozone and Carbon Monoxide Emission Inventories and other regional emission inventories were also consulted to confirm the completeness of the area source categories chosen for inclusion.

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 Arizona 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. Further quality analysis was performed by inputting the emission estimates into EPA's "QA/QC basic format and content checker", prior to submitting the data to the 2008 NEI.

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.

3.8 References

AASS, 2003. 2002 Arizona Agricultural Statistics Bulletin, Arizona Agricultural Statistics Service, September 2003.

AASS, 2009. 2008 Arizona Agricultural Statistics Bulletin, Arizona Agricultural Statistics Service, September 2009.

ADC, 2008. July 1, 2008 Population Estimates for Arizona's Counties, Incorporated Places and Balance of County, Population Statistics Unit, Research Administration, Arizona Department of Commerce, December 12, 2008. Internet address: http://www.azcommerce.com/doclib/econinfo/FILES/2008AZestimates.pdf

ADOC, 2010. Arizona Department of Commerce. Heating Degree Days: Phoenix. Internet address: http://www.azcommerce.com/doclib/ENERGY/Degreedays.pdf

ASLD, 2009. Glen Buettner [glenbuettner@azstatefire.org], Forestry Division, Arizona State Land Department, Re: 2008 wildland fire data for Maricopa County, e-mail message, April 20, 2009.

Battye, R., W. Battye, C. Overcash and S. Fudge, 1994. Development and Selection of Ammonia Emission Factors, p. 6-3. Prepared for U.S. Environmental Protection Agency, Atmospheric Research and Exposure Assessment Laboratory by EC/R Inc., Durham, NC, Internet address: http://www.sraproject.org/wp-content/uploads/2007/12/developmentandselectionofammoniaemissionfactors.pdf

CARB, 2000. A report to the California legislature on the potential health and environmental impacts of leaf blowers. February, 2000

CARB, 2003. Area-wide Source Methodologies, Section 7.5 Agricultural Harvest Operations, revised January 2003. Internet address: http://www.arb.ca.gov/ei/areasrc/index7.htm.

CARB, 2004. Area Source Methodologies – Section 7.6 (Cattle Feedlot Dust). California Air Resources Board, Sacramento, CA. Revised May 2004. Internet address: http://www.arb.ca.gov/ei/areasrc/fullpdf/FULL7-6.PDF.

CARB, 2006 Speciation Profiles and Size Fractions. California Air Resources Board, Sacramento, CA. Internet address: http://www.arb.ca.gov/emisinv/speciate/speciate.htm.

Clark County, 2001. PM_{10} State Implementation Plan for Clark County (Nevada), Appendix B: Emissions Inventory Methodology, Emission Factors, and Emission Estimates, June 2001, p. B-59. Internet address: http://www.co.clark.nv.us/daqem/aq/plans/pm10sip2001.html.

Clark County, 2006. Inventory of Vacant Land Soil Stability and Unpaved Private Roads in the Las Vegas Valley Using Remote Sensing Imagery. Prepared by Environmental Quality Management, Inc. and Midwest Research Institute for the Clark County (Nevada) Department of Finance. December 2006.

CMU, 2004. Carnegie Mellon University Ammonia Model Version 3. Internet address: http://www.cmu.edu/ammonia/.

DFBLS, 2009. Frank Fisher [frank.fisher@dfbls.az.gov] , Arizona Department of Fire, Building, and Life Safety (DFBLS), Re: data request - 2008 fire data for Maricopa County, e-mail message, May 4, 2009.

ENVIRON, 2004. Final Report, Determining Fugitive Dust Emissions From Wind Erosion. Prepared by ENVIRON for the Western Governors' Association. March 12, 2004.

FFOW, 2009. Federal Fire Occurrence website, http://wildfire.cr.usgs.gov/firehistory/data.html, federal wildland fire occurrence data downloaded on Aug. 18, 2009.

Fitz, Dennis, D. Pankrath, S. Pederson, J. Bristow, and G. Arcemont, 2005. Determination [of] Particulate Emission Rates from Leaf Blowers. Center for Environmental Research and Technology, University of California Riverside. Internet address: http://www.epa.gov/ttn/chief/conference/ei15/ session5/fitz.pdf

Koong, 2004. Dennis Koong, Arizona Agricultural Statistical Service, pers. commun. February 3, 2004.

MAG, 2000. Draft Final Report 1994 Regional PM_{10} Emission Inventory for the Maricopa County Nonattainment Area, Revised MAG 1999 Serious Area Particulate Plan for PM_{10} for the Maricopa County Nonattainment Area, Appendices Volume One. Maricopa Association of Governments, Phoenix, AZ, Feb. 2000.

MAG, 2000a. Revised MAG 1999 Serious Area Particulate Plan for PM_{10} for the Maricopa County Nonattainment Area. Prepared by the Maricopa Association of Governments. February 2000.

MAG, 2007. MAG 2007 Five Percent Plan for PM_{10} for the Maricopa County Nonattainment Area. Prepared by the Maricopa Association of Governments. December 2007.

MAG, 2009. Maricopa Association of Governments, Anubhav Bagley (abagley@mag.maricopa.gov), "Agricultural Land in Area A", e-mail message, December 11, 2009.

MCAQD, 2007. 2005 Periodic Emissions Inventory for PM_{10} for the Maricopa County, Arizona, Nonattainment Area. Prepared by the Maricopa County Air Quality Department. May 2007.

MCESD, 1993. 1990 Base Year Ozone Emission Inventory for Maricopa County, Arizona, Nonattainment Area, Draft Submittal, Maricopa County Environmental Quality & Community Services Agency, Phoenix, AZ, March 1993.

MCESD, 1999. 1999 Periodic Ozone Emissions Inventory for the Maricopa County, Arizona Nonattainment Area, Maricopa County Environmental Services Department, Phoenix AZ, Rev. Aug. 2002.

MCESD, 2009. Hans Moesbergen, Maricopa County Environmental Services Department, "Permit Average 2008", e-mail message, February13, 2009.

MCAQD, 2006. Personal communications with George Mills, Dust Compliance Division, MCAQD, and Dena Konopka, MCAQD, November 2006.

MCAQD, 2007. Maricopa County Air Quality Department, 2005 Periodic Emissions Inventory for PM_{10} for the Maricopa County, Arizona, Nonattainment Area, May 2007, Available at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/reports/Default.aspx

Tchobanoglous, G., 1979. Wastewater Engineering: Treatment, Disposal, and Reuse. McGraw-Hill Science/Engineering/Math, New York.

URS and ERG, 2001. Technical Support Document of Quantification of Agricultural Best Management Practices, Final, URS Corporation and Eastern Research Group, Inc., June 8, 2001

US Census Bureau, 2010a. 2007 County Business Patterns (NAICS). Internet address: http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl.

US Census Bureau, 2010b. Selected Housing Characteristics: 2008, 2008 American Community Survey 1-Year Estimates, House Heating Fuel for Maricopa County and Arizona State. Internet address: http://factfinder.census.gov

US Census Bureau, 2010c. B25117. Tenure by House Heating Fuel – Universe: Occupied Housing Units. 2008 American Community 1-Year Estimates, Fuel oil, kerosene, etc. for Maricopa County and Arizona State [Owner occupied and renter occupied]. Internet address: http://factfinder.census.gov

USDA, 2007a. United States Department of Agriculture, National Agricultural Statistics Service, 2007 Census of Agriculture, Volume 1, Chapter 2: County Level Data. Table 32. Fruits and Nuts: 2007 and 2002, and Table 28. Other Crops: 2007 and 2002. Available at: http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Arizona/index.asp.

USDA, 2007b. United States Department of Agriculture, National Agricultural Statistics Service, 2007 Census of Agriculture, Volume 1, Chapter 2: County Level Data. Table 42. Fertilizers and Chemicals Applied: 2007 and 2002, Available at: http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Arizona/index.asp.

USDA, 2008a. U.S. Department of Agriculture, Forest Service, Fire and Aviation Management Web Applications (FAMWEB), Previous Years ICS-209s. Internet address: http://fam.nwcg.gov/fam-web/.

USDA, 2008b. United States Department of Agriculture National Agricultural Statistics Service, Quick Stats, U.S. & All States County Data – Crops, Potatoes, 2008. Available at: http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp.

US DOE, 2010a. US Department of Energy, Energy Information Administration. Adjusted Sales for Industrial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2008 (Table 21)

US DOE, 2010b. US Department of Energy, Energy Information Administration. Adjusted Sales for Commercial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene, 2008 (Table 20)

US DOE, 2010c. US Department of Energy, Energy Information Administration. State Energy Data 2007: Consumption, Table 8–Residential Sector Energy Consumption Estimates, 1960–2007, Arizona. Internet address: http://www.eia.doe.gov/emeu/states/sep_use/notes/use_print2007.pdf

US EIA, 2010. U.S. Energy Information Administration, Arizona Total Distillate Sales/Deliveries to Residential Consumers. Internet address: http://tonto.eia.doe.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=KD0VRSSAZ1&f=A.

US EPA, 1992. Compilation of Air Pollution Emission Factors (AP-42). Fifth Ed. Vol. I: Stationary Point and Area Sources. Section 2.5: Open Burning. US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

US EPA, 1997. Compilation of Air Pollution Emission Factors (AP-42). Fifth Ed. Vol. I: Stationary Point and Area Sources. Section 13.2.1: Paved Roads. US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

US EPA, 1998a. Compilation of Air Pollution Emission Factors (AP-42). Fifth Ed. Vol. I: Stationary Point and Area Sources. Section 1.4: Natural Gas Combustion. US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Internet address: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf.

US EPA, 1998b. Compilation of Air Pollution Emission Factors (AP-42). Fifth Ed. Vol. I: Stationary Point and Area Sources. Section 13.2.2: Unpaved Roads. US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

US EPA, 2000. Area Source Category Method Abstract: Vehicle Fires. Emission Inventory Improvement Program (EIIP), May 2000. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/vehclf13.pdf

US EPA, 2001a. Introduction to Area Source Emission Inventory Development. Emission Inventory Improvement Program (EIIP) Vol. III, Chap. 1. Prepared by Eastern Research Group, Revised Final, Jan. 2001. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii01_apr2001.pdf.

US EPA, 2001b. Residential Wood Combustion. Emission Inventory Improvement Program (EIIP) Vol. III, Chap. 2. Revised Final, Jan. 2001. Prepared by Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii02_apr2001.pdf.

US EPA, 2001c. Structure Fires. Emission Inventory Improvement Program (EIIP) Vol. III, Chap. 18. Revised Final, Jan. 2001. Prepared by Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii18_apr2001.pdf.

US EPA, 2002. Residential Construction – Fugitive Dust. Emission Inventory Improvement Program (EIIP) Vol. IX: Particulate Emissions. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume09/residn3.pdf.

US EPA, 2005. Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations. USEPA Office of Air Quality Planning and Standards, Research Triangle Park, NC. August 2005, updated Nov. 2005. Available at: http://www.epa.gov/ttn/chief/eidocs/eiguid/.

US EPA, 2006a. Documentation for the 2002 Preliminary Nonpoint Source National Emission Inventory for Criteria and Hazardous Air Pollutants (Feb. 2006 Version). Appendix A: Criteria and HAP Emissions Estimation Methodology, Commercial Cooking, pp. A-16. Prepared by E.H. Pechan & Associates, Inc. for Emission Factor and Inventory Group. Internet address: ftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/nonpoint/2002nei_final_nonpoint_documentation0206version.pdf

US EPA, 2006b. Compilation of Air Pollution Emission Factors (AP-42). Fifth Ed. Vol. I: Stationary Point and Area Sources. Section 13.2.2: Unpaved Roads. November 2006. Internet address: http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0202.pdf

USGS, 2008. United States Geological Survey, GeoMAC (Geospatial Multi-Agency Coordination) Wildland Fire Support database. Internet address: http://www.geomac.gov/

USFS, 1993. Cliff Dills, US Forest Service, Payson Ranger Station, Payson AZ, pers. comm.

USFS, 2009. Ronald Sherron [Sherron.Ronald@azdeq.gov], US Forest Service , Re: Data Request - 2008 Maricopa County Prescribed Fire Data and Tonto Natl Forest Wildfire Data Needed, e-mail message, July 28, 2009.

WGA/WRAP, 2005. 2002 Fire Emission Inventory for the WRAP Region – Phase II. Project No. 178-6. Western Governors Association/Western Regional Air Partnership. July 22, 2005. Tables 5 and 6. Internet address: http://www.wrapair.org/forums/fejf/documents/WRAP_2002_PhII_EI_Report_20050722.pdf

WRAP 2006a. Fugitive Dust Handbook. Chapter 3.0 Construction and Demolition, September 2006. Internet address: http://wrapair.org/forums/dejf/fdh/index.html.

WRAP 2006b. Fugitive Dust Handbook. Chapter 2.0 Agricultural Tilling, September 2006. Internet address: http://wrapair.org/forums/dejf/fdh/index.html.

WRAP 2006c. Fugitive Dust Handbook. Chapter 10.0 Agricultural Harvesting, September 2006. Internet address: http://wrapair.org/forums/dejf/fdh/index.html.

WRAP 2006c. Fugitive Dust Handbook. Chapter 6.0 Unpaved Roads, September 2006. Internet address: http://wrapair.org/forums/dejf/fdh/index.html.

WRAP 2006d. Fugitive Dust Handbook. Chapter 13.0 Livestock Husbandry, September 2006. Internet address: http://wrapair.org/forums/dejf/fdh/index.html.

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 NONROAD model, ver. 2008.1.0 (Core version 2008, April 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 (Burlington Northern Santa Fe, Union Pacific and Amtrak).

County specific temperature and fuel-related inputs are required for the operation of the NON-ROAD 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. NONROAD model county temperature- and fuel-related inputs.

Month	Temperatures (°F) Max.	Min.	Average	Fuel RVP (psi)	Diesel Sulfur (ppm)	Gasoline Sulfur (ppm)	Ethanol Blend ETOH (Vol%)	Market Share (%)	Total Oxygen (wt%)
January	64	45	54.90	8.8	6	35	9.47	100	3.49
February	69	48	58.45	8.4	6	23	9.24	100	3.42
March	79	54	66.84	8.4	7	49	9.18	100	3.41
April	87	61	74.23	7.8	7	23	5.57	100	2.06
May	91	66	78.74	6.8*	6 *	27*	0.00*	0*	0.00*
June	107	80	93.40	6.6	6	25	0.00	0	0.00
July	106	84	95.16	7.0	4	19	0.00	0	0.00
August	104	82	93.16	6.8	6	29	0.00	0	0.00
September	101	79	90.07	6.5	6	35	0.00	0	0.00
October	91	65	78.13	7.9	7 †	25	6.79	100	2.52
November	81	56	68.67	8.4	7 †	15	8.78	100	3.27
December	65	46	56.03	8.3†	7	28†	8.17†	100†	3.03†

* Since measurements were not available, the average of June, July, August and September data was used.

† Since measurements were not available, the average of October, November, January, February, March and April data was used.

EPA recommends adjusting default NONROAD 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 NONROAD 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 is a considerable decrease in emissions from this category, compared with earlier results using EPA default data.

The NONROAD model does not calculate emission values for NH_3. Ammonia emission calculations for the NONROAD model were derived by using a multiplier of NO_x emissions developed by ENVIRON (2003).

Spatial allocation factors were developed (based on EPA guidance documents) to apportion nonroad emissions to the PM_{10} nonattainment area. The approaches used are described in each section of this chapter.

Temporal allocations (used to calculate PM_{10} average-day emissions) for nonroad equipment categories modeled in the NONROAD model come from EPA recommendations on weekday and weekend day activity levels for each nonroad equipment category (US EPA, 1999). Table 4.1–2 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 average-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 NONROAD model as discussed above. County-wide results are shown in Table 4.2–1.

Table 4.2–1. Annual emissions (tons/yr) from agricultural equipment in Maricopa County.

PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
34.27	33.24	365.55	0.14	0.67

Annual emissions for the PM_{10} nonattainment area were calculated based on EIIP guidance (US EPA, 2002) which recommends using the ratio of agricultural land inside the nonattainment area to agricultural land inside the county. See Section 1.5.2 for a discussion of land use data used.

PM_{10} NAA emissions from agricultural equipment	=	Total County PM_{10} emissions from agricultural equipment	×	Agricultural land use allocation factor
	=	34.27 tons	×	44.14%
	=	15.13 tons PM_{10} /yr		

Table 4.2–2. Annual emissions (tons/yr) from agricultural equipment in the PM_{10} NAA.

PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
15.13	14.67	161.35	0.06	0.30

County average-day emissions were calculated by multiplying annual emissions (generated by the NONROAD 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 (52) in the year (US EPA, 1999), as follows:

Average County PM_{10} daily emissions (lbs/day)	=	Annual PM_{10} emissions (tons/yr)	×	daily activity allocation factor for agricultural equipment (week/day)	×	2000 (lbs/ton)	÷ 52 (wks/yr)
	=	34.27	×	0.166667	×	2000	÷ 52
	=	219.7 lbs/day					

Table 4.2–3. Typical daily emissions (lbs/day) from agricultural equipment in Maricopa County.

PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
219.7	213.1	2,343.3	0.9	4.3

PM_{10} nonattainment area average-day emissions were calculated by multiplying County average-day emissions by the agricultural land use allocation factor:

PM_{10} NAA average-day emissions	=	Maricopa County PM_{10} average-day emissions	×	Agricultural land use allocation factor
	=	219.7 lbs/day	×	44.14%
	=	100.4 lbs/day		

Table 4.2–4. Typical daily emissions (lbs/day) from agricultural equipment in the PM_{10} nonattainment area.

PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
97.0	94.0	1,034.3	0.4	1.9

4.3 Airport ground support equipment and auxiliary power units

Annual emissions from airport ground support equipment (GSE) and auxiliary power units (APUs) at most airports in the county were estimated using the Emissions Dispersion Modeling System (EDMS, v. 5.1.1) from the U.S. Federal Aviation Administration (FAA). The model can estimate emissions from affiliated ground support equipment (GSE) and auxiliary power units (APUs), by using either default equipment profiles, or user-specified data on equipment populations and activity patterns. In most cases, activity data on 2008 aircraft operations and GSE / APU usage was obtained from individual airport surveys issued by MAG and/or MCAQD. Where survey responses were incomplete or information was otherwise unavailable, activity data was estimated using commercially available data, and EDMS default assumptions where appropriate. Further details concerning the modeling input data and results are presented in Section 4.11 of this report.

For Luke Air Force Base (AFB), emissions estimates for ground support equipment were obtained from a recent base-wide mobile source emissions inventory for calendar year 2008 that had recently been completed for the US Air Force (Weston, 2010). Using data on the frequency and intensity of usage for each type of equipment, annual emissions were calculated as in the following example for a light card equipped with a diesel engine:

$$E_{pol} = ELHP \times OT \times LF \times EF / CF$$

where:

E_{pol} = Annual emissions of a particular pollutant (lb/yr)	
ELHP = Maximum horsepower rating of engine (hp)	e.g. 10.7 hp
OT = Operating time (hr/yr)	e.g. 52,560 hr/yr
LF = Typical load factor that the engine operates (% of max)	e.g. 51%
EF = Emission factor (g/hp-hr)	e.g. 7.8 g/hp-hr
CF = Conversion factor to convert grams to pounds	(453.59 g/lb)

Thus, total annual NO_x emissions all similar pieces of this type of GSE was calculated as:

$$E_{NOx} = 10.7\ (hp) \times 52{,}560\ (hrs/yr) \times 51\% \times 7.8\ (g/hp\text{-}hr) / 453.59\ (g/lb)$$
$$= 4{,}932\ (lb/yr) / 2{,}000\ (lb/ton)$$
$$= 2.47\ tpy$$

GSE emissions from the Luke AFB study were added to the EDMS-estimated emissions from the other airports in the County. (The Luke study assumed APU usage, and thus emissions, to be negligible.) A simplifying assumption was made for all airports; i.e., that activity is spread fairly evenly throughout the week and year; thus daily emissions were estimated by dividing annual totals by 366 (= days/yr in 2008). Tables 4.3–1 and 4.3–2 below present the totals for all airport GSE and APU usage within both Maricopa County and the PM_{10} nonattainment area, on an annual and typical daily basis, respectively.

Table 4.3–1. Annual emissions (tons/yr) from all airport ground support equipment (GSE) and auxiliary power units (APUs).

	Maricopa County					PM_{10} nonattainment area				
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
GSE	14.92	14.39	497.97	13.62	*	14.72	14.21	490.28	13.42	*
APUs	12.29	12.29	88.76	12.82	*	12.27	12.27	88.68	12.80	*
Total:	**27.21**	**26.68**	**586.73**	**26.43**		**26.99**	**26.48**	**578.95**	**26.22**	

* At present, EDMS does not include calculation of ammonia emissions from aircraft operations.

Table 4.3–2. Typical daily emissions (lb) from airport GSE and APU usage.

	Maricopa County					PM_{10} nonattainment area				
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
GSE	81.5	78.7	2,721.1	74.4	*	80.4	77.7	2,679.1	73.3	*
APUs	67.1	67.1	485.0	70.0	*	67.1	67.1	484.6	70.0	*
Total:	**148.7**	**145.8**	**3,206.1**	**144.4**		**147.5**	**144.7**	**3,163.7**	**143.3**	

* At present, EDMS does not include calculation of ammonia emissions from aircraft operations.

4.4 Commercial equipment

Annual emissions from commercial equipment in Maricopa County were calculated using EPA's NONROAD model, as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of industrial employment in the non-attainment area to Maricopa County-level 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.

Table 4.4–1. Annual emissions (tons/yr) from commercial equipment usage.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
117.97	112.98	1,395.23	2.40	21.12	117.66	112.69	1,391.61	2.39	21.06

County average-day emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD 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 (52) in the year (US EPA, 1999). PM_{10} nonattainment area average-day emissions were calculated based on industrial employment ratios as described above.

Table 4.4–2. Typical daily emissions (lbs/day) from commercial equipment usage.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
756.2	724.2	8,943.8	15.4	135.4	754.2	722.4	8,920.6	15.3	135.0

4.5 Construction and mining equipment

Annual emissions from construction and mining equipment in Maricopa County were calculated using EPA's NONROAD model as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of construction employment in the nonattainment area to Maricopa County-level totals as a conservative estimate, as 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 employment data used.

Table 4.5–1. Annual emissions (tons/yr) from construction and mining equipment usage.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
1,260.98	1,220.75	14,796.63	6.60	28.10	1,249.88	1,210.00	14,666.42	6.55	27.85

County average-day emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD 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 (52) in the year (US EPA, 1999). PM_{10} nonattainment area average-day emissions were calculated based on population ratios as described above.

Table 4.5–2. Typical daily emissions (lbs/day) from construction and mining equipment usage.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
8,083.2	7,825.3	94.850.2	42.3	180.1	8,012.1	7,756.4	94,015.6	42.0	178.5

4.6 Industrial equipment

Annual emissions from industrial equipment in Maricopa County were calculated using EPA's NONROAD model, as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of industrial employment in the nonattainment area to Maricopa County-level totals as a conservative estimate, as the number of employees in manufacturing recommended by EIIP guidance (US EPA, 2002) was unavailable. See Section 1.5.1 for a discussion of the industrial employment data used.

Table 4.6–1. Annual emissions (tons/yr) from industrial equipment usage.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
101.69	98.96	2,593.13	3.22	56.23	101.42	98.71	2,586.39	3.21	56.09

County average-day emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD 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 (52) in the year (US EPA, 1999). PM_{10} nonattainment area average-day emissions were calculated based on industrial employment ratios as described above.

Table 4.6–2. Typical daily emissions (lbs/day) from industrial equipment usage.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
651.8	634.4	16,622.7	20.6	360.5	650.1	632.7	16,579.4	20.6	359.5

4.7 Lawn and garden equipment

Annual emissions from lawn and garden equipment in Maricopa County were calculated using EPA's NONROAD model, as described in Section 4.1. These results reflect revised equipment population and usage estimates from survey work done in early 2003 for the Arizona Department of Environmental Quality (discussed in further detail in Section 4.1). Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County-level totals (since data on housing units was unavailable, it was not possible to implement the EIIP-recommended calculation approach (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used.

Table 4.7–1. Annual emissions (tons/yr) from lawn and garden equipment.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
182.28	168.79	798.14	3.16	19.63	183.02	169.48	801.41	3.17	19.71

County average-day emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD 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 52 (the number of weeks in a year; US EPA, 1999). PM_{10} nonattainment area average-day emissions were calculated by applying a population-based ratio as described in Section 4.7 above.

Table 4.7–2. Typical daily emissions (lbs/day) from lawn and garden equipment.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
1,250.1	1,156.9	5,571.5	23.1	144.6	1,255.3	1,161.6	5,594.4	23.2	145.2

4.8 Pleasure craft

Annual emissions from pleasure craft equipment in Maricopa County were calculated using EPA's NONROAD model, as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of water surface area in the nonattainment area to Maricopa County-level totals, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land use data used.

Table 4.8–1. Annual emissions (tons/yr) from pleasure craft equipment.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
9.25	8.54	77.74	0.85	1.73	7.02	6.48	59.03	0.64	1.32

County average-day emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD model) by the most conservative weekday/weekend day activity allocation factor for pleasure craft (0.3500000) listed in Table 4.1–2, and dividing the product by the number of weeks (52) in the year (US EPA, 1999). PM_{10} nonattainment area average-day emissions were calculated based on water surface area as described above.

Table 4.8–2. Typical daily emissions (lbs/day) from pleasure craft equipment.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
124.5	114.9	1,046.5	11.4	23.3	94.5	87.3	794.6	8.6	17.7

4.9 Railway maintenance equipment

Annual emissions from railway maintenance equipment in Maricopa County were calculated using EPA's NONROAD model, as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County-level totals, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used.

Table 4.9–1. Annual emissions (tons/yr) from railway maintenance equipment.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
1.13	1.09	9.23	0.00	0.02	1.13	1.10	9.26	0.00	0.02

County average-day emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD 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 (52) in the year (US EPA, 1999). PM_{10} nonattainment area average-day emissions were calculated based on the population ratio as described above.

Table 4.9–2. Typical daily emissions (lbs/day) from railway maintenance equipment.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
7.8	7.6	63.9	0.0	0.1	7.8	7.6	64.1	0.0	0.1

4.10 Recreational equipment

Annual emissions from recreational equipment in Maricopa County were calculated using EPA's NONROAD model, as described in Section 4.1. Annual emissions for the PM_{10} 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-level totals as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land use data used.

Table 4.10–1. Annual emissions (tons/yr) from recreational equipment.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
45.58	41.98	63.80	0.42	2.10	7.68	7.08	10.76	0.07	0.35

County average-day emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD 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 (52) in the year (US EPA, 1999). PM_{10} nonattainment area average-day emissions were calculated based on land use as described above.

Table 4.10–2. Typical daily emissions (lbs/day) from recreational equipment.

Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
389.6	358.8	545.3	3.6	18.0	65.7	60.5	91.9	0.6	3.0

4.11 Aircraft

Emissions from aircraft operations at the largest civilian airports in Maricopa County were estimated using the Federal Aviation Administration's Emissions and Dispersion Model (EDMS, v. 5.1.1). The EDMS model combines specified aircraft and activity levels with default emission factors in order to estimate annual emissions inventories for a specific airport. The model calculates emissions of sulfur oxides (SOx), oxides of nitrogen (NOx), carbon monoxide (CO), and volatile organic compounds (VOC), and (for a small subset of aircraft and engine types), PM10 and PM2.5 as well. The model also estimates emissions from affiliated ground support equipment (GSE) and auxiliary power units (APUs); these emissions are reported separately and are summarized in Section 4.3.)

MCAQD surveyed all medium-size and large airports in Maricopa County to gather data on the types and levels of aircraft activity (specifically the number of landing and takeoff cycles, or LTO's) or touch and go operations (TGOs) where applicable, along with information on the types of aircraft that comprise the airport's typical fleet mix, and other operational data, such as typical usage patterns of ground support equipment (GSE) and auxiliary power units (APUs), average taxi/idle times, etc. Where survey responses were unavailable or incomplete, aircraft activity data from publicly accessible databases, such as the FAA's Air Traffic Activity System (ATADS) and Enhanced Traffic Management System Counts (ETMSC), were used.

All emission estimates in this section have been developed using the EDMS model, with the exception of Luke Air Force Base (AFB), whose emissions calculations have been prepared as part of a base-wide 2008 mobile source emissions inventory that has recently been completed (Weston, 2010). Luke AFB's emissions reported here as 'aircraft activity' actually comprise three distinct, though related, types of activity: (1) the operation of aircraft stationed at the base, (2) a much smaller level of "transient" aircraft traffic within Luke's airspace, and (3) emissions produced during on-wing engine testing – considered a "mobile source" emission category. 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.

In addition to the LTOs (and occasional TGO activity) reported by other airports in the area, Luke reported two additional, types of aircraft operations: aircraft low fly bys (LFB), and aircraft low fly patterns (LFP). Each of these types of operations can be characterized by a distinctive combination of the times in mode (TIM); (e.g., approach, taxi in/out, takeoff and climb out.) For F-16 activity, Luke's emissions are based not on the number of LTOs, but rather the aggregate annual operational time in modes (TIMs) for all aircraft of this type. For the F-16, an LTO cycle includes five modes of operation: idle (taxi in/out), intermediate, approach, military and afterburner. The F-16 emissions were estimated using the annual TIMs provided by Luke AFB and emission factors from military guidance documents.

Table 4.11–1 lists the data sources for each airport's activity level, as well as fleet mix. The total number of aircraft operations in 2008 is also listed. For all airports other than Luke AFB, aircraft emissions were 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.

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	2008 Operations
Buckeye Municipal	BXK	airnav.com	Generic GA profile	GA	26,535
Chandler Municipal	CHD	FAA/ATADS	FAA/ETMSC	AT	2,882
				GA	233,713
				ML	247
Falcon Field	FFZ	FAA/ATADS	FAA/ETMSC	AC	6
				AT	3,813
				GA	313,448
				ML	2,152
Gila Bend Municipal	E63	airnav.com	Generic GA profile	GA	1,768
Glendale Municipal	GEU	FAA/ATADS, Survey response	FAA/ETMSC	AT	1,873
				GA	134,282
				ML	57
Luke Air Force Base	LUF	[Emission totals provided by Luke AFB are based on times-in-mode.]			
Phoenix Deer Valley	DVT	Survey response	Survey response, FAA/ETMSC	AC	284
				AT	6,217
				GA	370,003 *
				ML	130
Phoenix Goodyear	GYR	Survey response	Survey response, FAA/ETMSC	AC	140
				AT	1962
				GA	169,177 *
				ML	6,747
Phoenix-Mesa Gateway (formerly Williams Gateway)	IWA	FAA/ATADS, Survey response	FAA/ETMSC	AC	3,876
				AT	5,937
				GA	211,674
				ML	5,939
Phoenix Sky Harbor	PHX	Survey response	Survey response, FAA/ETMSC	AC	391,518
				AT	77,354
				GA	30,868
				ML	2,759
Pleasant Valley	P48	airnav.com	Generic GA profile	GA	23,535
Scottsdale	SDL	FAA/ATADS	FAA/ETMSC	AT	11,232
				GA	179,619
				ML	560
Sky Ranch at Carefree	18AZ	Survey response	Generic GA profile	GA	1,515
Stellar Airpark	P19	airnav.com	Generic GA profile	GA	19,528
Wickenburg Municipal	E25	Survey responses	Generic GA profile	GA	6,000

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.
* includes touch-and-go (TGO) operations levels reported by the airport.

The following section describes how activity and emissions were estimated for a representative airport, Chandler Municipal (CHD). Data from FAA's Air Traffic Activity System (ATADS, http://www.aspm.faa.gov) provided data on 2008 activity by aircraft type; these results are contained in Table 4.11–1. While ATADS reported a total of 233,713 general aviation operations at this airport in 2008, 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 CHD in 2008 comprises 152 different aircraft types, totaling 3,589 operations, (See Table 4.11–2). To simplify modeling input requirements, this aircraft-specific activity data was ranked in order of decreasing frequency and activity data for the most frequently reported aircraft was then grown to represent all general aviation ("GA") activity, as shown in Table 4.11–2 below.

Table 4.11–2. Example showing how most common aircraft-specific activity was grown for EDMS modeling.

Rank	Aircraft Type	ETMSC-reported operations	% of total reported operations	Cumulative Percent	"Grown" operations for EDMS modeling
1	BE20 - Beech 200 Super King	240	6.7%		21,919
2	BE58 - Beech 58	233	6.5%		21,280
3	PA28 - Piper Cherokee	233	6.5%		21,280
4	C525 - Cessna CitationJet/CJ1	232	6.5%		21,189
5	C182 - Cessna Skylane 182	203	5.7%	31.8%	18,540
6	C172 - Cessna Skyhawk 172/Cutlass	194	5.4%		17,718
7	TBM7 - Socata TBM-7	166	4.6%		15,161
8	R22 - Robinson R-22 Mariner	138	3.8%		12,604
9	BE9L - Beech King Air 90	106	3.0%		9,681
10	BE36 - Beech Bonanza 36	97	2.7%	51.3%	8,859
11	BE55 - Beech Baron 55	90	2.5%		8,220
12	BE35 - Beech Bonanza 35	87	2.4%		7,946
13	C210 - Cessna 210 Centurion	75	2.1%		6,850
14	PA32 - Piper Cherokee Six	73	2.0%		6,667
15	P28R - Cherokee Arrow/Turbo	71	2.0%	62.4%	6,484
16	P46T - Piper Malibu Meridian	67	1.9%		6,119
17	SR22 - Cirrus SR 22	67	1.9%		6,119
18	BE30 - Raytheon 300 Super King Air	65	1.8%		5,936
19	MO20 - Mooney M-20	62	1.7%		5,662
20	C560 - Cessna Citation V/Ultra/Encore	60	1.7%	71.3%	5,480
⋮	⋮	⋮	⋮	⋮	
152	XL2 - Liberty XL-2	1	< 0.1%	100.0%	(n/a)
	Totals:	**3,589**			**233,713**

This approach of ranking reported activity, and then growing the most frequently occurring subset of aircraft typically resulted in a set comprised of 10 to 30 aircraft types being modeled for each airport/aircraft class combination, representing 60 to 100% of all reported activity. Since the EDMS model includes estimates of PM_{10} emissions only for a relatively small number of aircraft/engine types, all model output files were reviewed for missing data. For those aircraft/engine combinations for which the EDMS model indicated zero PM_{10} emissions, the default EPA emission factors listed in Table 4.11–3 (US EPA, 2003) were incorporated into the EDMS output data files, and total PM emissions recalculated.

Table 4.11–3. EPA's default PM_{10} emission factors for aircraft, by activity type.

Activity type	PM_{10} Emission Factor (lb/LTO)
Air Carrier, Air Taxi, Military	0.60333
General Aviation	0.2367

Following EPA guidance (US EPA, 2003), $PM_{2.5}$ emissions were estimated to be 92% of PM_{10} levels. For ease in modeling computation and the assessment of emissions, all activity was assumed to occur evenly throughout the year. Thus, average daily emissions were calculated by dividing annual totals by 366 (= days per year in 2008). Tables 4.11–4 and 4.11–5 list the total

annual emissions and average daily emissions, for each airport and aircraft type, for airports within and outside the PM_{10} NAA, respectively.

Table 4.11–4. Annual and average daily emissions, by airport and aircraft type, from airports within the PM_{10} NAA.

Airport	Cate-gory	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
		PM_{10}	$PM_{2.5}$	NO_x	SO_x	PM_{10}	$PM_{2.5}$	NO_x	SO_x
Chandler Municipal	AT	0.27	0.27	0.94	0.24	1.5	1.5	5.1	1.3
	GA	12.68	11.79	18.51	6.43	69.3	64.4	101.1	35.1
	ML	0.04	0.04	0.12	0.02	0.2	0.2	0.6	0.1
	Total	*12.99*	*12.10*	*19.56*	*6.68*	*71.0*	*66.1*	*106.9*	*36.5*
Falcon Field	AC	0.00	0.00	0.00	-	0.0	0.0	0.0	0.0
	AT	0.23	0.23	2.94	0.49	1.3	1.2	16.0	2.7
	GA	18.49	17.07	14.34	6.16	101.0	93.3	78.3	33.7
	ML	0.31	0.29	0.40	0.13	1.7	1.6	2.2	0.7
	Total	*19.03*	*17.59*	*17.67*	*6.78*	*104.0*	*96.1*	*96.6*	*37.0*
Glendale Municipal	AT	1.06	1.05	9.70	2.43	5.8	5.7	53.0	13.3
	GA	6.90	6.41	5.51	2.20	37.7	35.0	30.1	12.0
	ML	0.01	0.01	0.12	0.02	0.0	0.0	0.6	0.1
	Total	*8.17*	*7.66*	*15.51*	*4.71*	*44.6*	*41.8*	*84.8*	*25.7*
Luke Air Force Base†	ML	*62.82*	*62.82*	*382.40*	*31.81*	*343.3*	*343.3*	*2,089.6*	*173.8*
Phoenix Deer Valley	AC	0.04	0.04	0.05	0.01	0.2	0.2	0.3	0.1
	AT	0.41	0.41	3.97	0.76	2.2	2.2	21.7	4.2
	GA	10.10	9.43	62.81	14.61	55.2	51.5	343.2	79.8
	ML	0.02	0.02	0.07	0.02	0.1	0.1	0.4	0.1
	Total	*10.57*	*9.90*	*66.91*	*15.40*	*57.8*	*54.1*	*365.6*	*84.1*
Phoenix Goodyear	AC	0.02	0.01	0.36	0.05	0.1	0.1	1.9	0.3
	AT	0.19	0.19	1.61	0.28	1.1	1.0	8.8	1.5
	GA	0.66	0.66	18.86	5.25	3.6	3.6	103.0	28.7
	ML	0.96	0.89	3.66	1.07	5.2	4.8	20.0	5.8
	Total	*1.83*	*1.74*	*24.48*	*6.64*	*10.0*	*9.5*	*133.8*	*36.3*
Phoenix Sky Harbor Intl.	AC	22.38	22.38	1,751.85	185.77	122.3	122.3	9,573.0	1,015.2
	AT	4.24	4.02	116.92	17.51	23.2	22.0	638.9	95.7
	GA	3.37	3.21	12.81	2.83	18.4	17.6	70.0	15.4
	ML	0.45	0.43	23.48	2.34	2.5	2.4	128.3	12.8
		30.45	*30.05*	*1,905.06*	*208.45*	*166.4*	*164.2*	*10,410.2*	*1,139.1*
Phoenix-Mesa Gateway Airport	AC	0.16	0.15	13.25	1.72	0.9	0.8	72.4	9.4
	AT	0.63	0.62	3.02	0.64	3.4	3.4	16.5	3.5
	GA	12.99	12.04	17.41	5.48	71.0	65.8	95.2	29.9
	ML	0.58	0.55	26.56	3.14	3.2	3.0	145.1	17.1
		14.35	*13.36*	*60.24*	*10.98*	*78.4*	*73.0*	*329.2*	*60.0*
Pleasant Valley	GA	0.36	0.33	1.65	0.34	1.9	1.8	9.0	1.8
Scottsdale	AT	1.03	1.02	7.84	1.37	5.7	5.6	42.8	7.5
	GA	19.83	18.86	116.13	21.79	108.4	103.1	634.6	119.1
	ML	0.08	0.08	0.24	0.06	0.5	0.4	1.3	0.3
		20.95	*19.96*	*124.21*	*23.22*	*114.5*	*109.1*	*678.8*	*126.9*
Skyranch at Carefree	GA	*0.18*	*0.17*	*0.39*	*0.10*	*1.0*	*0.9*	*2.1*	*0.5*
Stellar Airpark	GA	*2.31*	*2.13*	*2.42*	*0.97*	*12.6*	*11.6*	*13.2*	*5.3*
PM_{10} NAA totals:		**183.80**	**177.61**	**2,620.31**	**316.00**	**1,004.3**	**970.5**	**14,318.6**	**1,726.8**

† Sum of emissions from the following categories, as reported in Weston (2010): (1) aircraft stationed at Luke AFB, (2) transient aircraft, and (3) on-wing aircraft engine testing.

Table 4.11–5. Annual and average daily emissions, by aircraft type, from airports outside the PM_{10} NAA.

Facility	Cate-gory	Annual emissions (tons/yr)				Average daily emissions (lbs/day)			
		PM_{10}	$PM_{2.5}$	NO_x	SO_x	PM_{10}	$PM_{2.5}$	NO_x	SO_x
Buckeye Municipal	GA	3.14	2.89	2.70	0.97	17.2	15.8	14.8	5.3
Gila Bend Municipal	GA	0.21	0.19	0.18	0.06	1.1	1.1	1.0	0.3
Wickenburg Municipal	GA	0.77	0.73	2.75	0.61	4.2	4.0	15.0	3.3
Maricopa County totals:		**187.91**	**181.42**	**2,625.94**	**317.64**	**1,026.8**	**991.4**	**14,349.4**	**1,735.8**

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 two categories: Class I haul lines and yard/ switching operations. Annual emissions from these two activity categories 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.

Activity type	Emission factors (lbs/gal diesel)				
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Class I haul line	0.015	0.014	0.394	0.004	0.0001
Yard/switch operations	0.015	0.014	0.421	0.004	0.0001

The example below illustrates how emissions were calculated for each locomotive activity type. Fuel use reported by railroads, and emission totals are summarized in Table 4.12–2.

PM_{10} emissions from UP Class I haul lines = Diesel use (gals/yr) × PM_{10} emission factor (lbs/gal) ÷ 2,000 lbs/ton

= 7,780,284 gals/yr × 0.015 lbs/gal ÷ 2,000 lbs/ton

= 58.35 tons PM_{10}/yr

Table 4.12–2. Total diesel use and annual emissions from locomotives in Maricopa County.

Locomotive type	Diesel use (gals/yr)	Annual emissions (tons/yr)				
		PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
BNSF Class I haul line	750,094	5.63	5.25	147.77	1.50	0.36
UP Class I haul line	7,780,284	58.35	54.46	1,532.72	15.56	3.70
BNSF yard/switch operations	400,000	3.00	2.80	84.20	0.80	0.19
UP yard/switch operations	378,199	2.84	2.65	79.61	0.76	0.18
Amtrak	52,416	0.39	0.37	10.33	0.10	0.02
Totals:	**9,360,993**	**70.21**	**65.53**	**1,854.62**	**18.72**	**4.45**

PM_{10} nonattainment area emissions were calculated by multiplying Maricopa County emissions by the percentage of track miles within the PM_{10} nonattainment area, determined by GIS mapping. Results are shown in Table 4.12–3.

PM_{10} nonattainment area emissions from UP Class I haul lines (tons/yr) = County PM_{10} emissions (tons/yr) × Percentage of track miles within the PM_{10} nonattainment area

= 56.99 tons PM_{10}/yr × 44.27%

= 25.83 tons PM_{10}/yr

Table 4.12–3. Annual emissions (in tons/yr) from locomotives in the PM_{10} NAA.

Locomotive type	Track in nonattainment area (%)	Annual emissions (tons/yr)				
		PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
BNSF Class I haul line	44.27	2.49	2.32	65.42	0.66	0.16
UP Class I haul line	44.27	25.83	24.11	678.53	6.89	1.64
BNSF yard/switch operations	100.00	3.00	2.80	84.20	0.80	0.19
UP yard/switch operations	100.00	2.84	2.65	79.61	0.76	0.18
Amtrak	0.00	0.00	0.00	0.00	0.00	0.00
Totals:		**34.16**	**31.88**	**907.76**	**9.11**	**2.16**

PM_{10} typical daily emissions for both the county (shown in Table 4.12–4) and the PM_{10} non-attainment area (Table 4.12–5) were calculated by dividing annual totals by 366 days (since 2008 was a leap year), as locomotive activity is assumed to be uniform throughout the year.

PM_{10} typical daily emissions from haul lines = Annual PM_{10} emissions (tons) × 2000 lbs/ton ÷ 366 days

= 58.35 tons PM_{10}/yr × 2000 lbs/ton ÷ 366 days

= 312.3 lbs PM_{10}/day

Table 4.12–4. Typical daily emissions (in lbs/day) from locomotives in Maricopa County.

Locomotive type	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
BNSF Class I haul line	30.7	28.7	807.5	8.2	1.9
UP Class I haul line	318.9	297.6	8,375.5	85.0	20.2
BNSF yard/switch operations	16.4	15.3	460.1	4.4	1.0
UP yard/switch operations	15.5	14.5	435.0	4.1	1.0
Amtrak	2.1	2.0	56.4	0.6	0.1
Totals:	**383.6**	**358.1**	**10,134.5**	**102.3**	**24.3**

Table 4.12–5. Typical daily emissions (in lbs/day) from locomotives in the PM_{10} nonattainment area.

Locomotive type	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
BNSF Class I haul line	13.6	12.7	357.5	3.6	0.9
UP Class I haul line	141.2	131.8	3,707.8	37.6	8.9
BNSF yard/switch operations	16.4	15.3	460.1	4.4	1.0
UP yard/switch operations	15.5	14.5	435.0	4.1	1.0
Amtrak	0.0	0.0	0.0	0.0	0.0
Totals:	**186.7**	**174.2**	**4,960.4**	**49.8**	**11.8**

4.13 Summary of all nonroad mobile source emissions

Table 4.13–1 summarizes annual and daily emissions of PM_{10}, $PM_{2.5}$, NO_x, SO_x and NH_3 from nonroad mobile sources in Maricopa County. Table 4.13–2 shows annual and typical daily emissions for these pollutants for the PM_{10} nonattainment area.

Table 4.13–1. Annual and typical daily emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Agricultural	34.27	33.24	365.55	0.14	0.67	219.7	213.1	2,343.3	0.9	4.3
Airport GSE	27.21	26.68	586.73	26.43		148.7	145.8	3,206.1	144.4	
Commercial	117.97	112.98	1,395.23	2.40	21.12	756.2	724.2	8,943.8	15.4	135.4
Construction & mining	1,260.98	1,220.75	14,796.63	6.60	28.10	8,083.2	7,825.3	94,850.2	42.3	180.1
Industrial	101.69	98.96	2,593.13	3.22	56.23	651.8	634.4	16,622.7	20.6	360.5
Lawn & garden	182.28	168.79	798.14	3.16	19.63	1,250.1	1,156.9	5,571.5	23.1	144.6
Pleasure craft	9.25	8.54	77.74	0.85	1.73	124.5	114.9	1,046.5	11.4	23.3
Railway maintenance	1.13	1.10	9.23	0.00	0.02	7.8	7.6	63.9	0.0	0.1
Recreational	45.58	41.98	63.80	0.42	2.10	389.6	358.8	545.3	3.6	18.0
Aircraft	187.91	181.41	2,625.94	317.64		1,026.8	991.3	14,349.4	1,735.8	
Locomotives	70.21	65.53	1,854.62	18.72	4.45	383.6	358.1	10,134.5	102.3	24.3
Totals:	**2,038.46**	**1,959.95**	**25,166.75**	**379.58**	**134.06**	**13,042.0**	**12,530.3**	**157,677.4**	**2,099.8**	**890.6**

Table 4.13–2. Annual and typical daily emissions from nonroad mobile sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Agricultural	15.13	14.67	161.35	0.06	0.30	97.0	94.0	1,034.3	0.4	1.9
Airport GSE	26.99	26.48	578.95	26.22		147.5	144.7	3,163.7	143.3	
Commercial	117.66	112.69	1,391.61	2.39	21.06	754.2	722.4	8,920.6	15.3	135.0
Construction & mining	1,249.88	1,210.00	14,666.42	6.55	27.85	8,012.1	7,756.4	94,015.6	42.0	178.5
Industrial	101.42	98.71	2,586.39	3.21	56.09	650.1	632.7	16,579.4	20.6	359.5
Lawn & garden	183.02	169.48	801.41	3.17	19.71	1,255.3	1,161.6	5,594.4	23.2	145.2
Pleasure craft	7.02	6.48	59.03	0.64	1.32	94.5	87.3	794.6	8.6	17.7
Railway maintenance	1.13	1.10	9.26	0.00	0.02	7.8	7.6	64.1	0.0	0.1
Recreational	7.68	7.08	10.76	0.07	0.35	65.7	60.5	91.9	0.6	3.0
Aircraft	183.80	177.60	2,620.31	316.00		1,004.3	970.5	14,318.6	1,726.8	
Locomotives	34.16	31.88	907.76	9.11	2.16	186.7	174.2	4,960.4	49.8	11.8
Totals:	**1,927.89**	**1,856.17**	**23,793.26**	**367.42**	**128.87**	**12,275.2**	**11,811.9**	**149,537.7**	**2,030.5**	**852.9**

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 not involved in developing the modeling inputs/outputs and spreadsheets being reviewed. In addition, the emissions estimates were reviewed for reasonableness by external agency staff.

4.15 References

ENVIRON et al., 2003. Maricopa County 2002 Comprehensive Emission Inventory for the Cap and Trade Oversight Committee, Final Rep. prepared for Arizona Dept. of Environmental Quality, Oct. 9, 2003.

ERG, 2001. Documentation for the Draft 1999 Base Year Aircraft, Commercial Marine Vessels, and Locomotive National Emissions Inventory for Criteria and Hazardous Air Pollutants. Prepared by Eastern Research Group, Morrisville, NC for the US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, Oct. 29, 2001. Available at: http://www.epa.gov/ttn/chief/eidocs/partllsec4.pdf.

US EPA, 1992. Procedures for Emission Inventory Preparation – Vol. IV: Mobile Sources. Office of Air and Radiation, EPA Rep. EPA420-R-92-009, December.

US EPA, 1998. National Air Pollutant Emission Trends Procedures Document, 1900-1996. Office of Air Quality Planning and Standards, Rep. EPA-454/R-98-008, Research Triangle Park, NC. May.

US EPA, 1999. Weekday and Weekend Day Temporal Allocation of Activity in the NONROAD Model. EPA Office of Transportation and Air Quality, Rep. EPA420-P-99-033, March. Available at: http://www.epa.gov/otaq/models/nonrdmdl/p99033.pdf.

US EPA, 2002. Geographic Allocation of State Level Nonroad Engine Population Data to the County Level. EPA Office of Transportation and Air Quality, Rep. EPA420-P-02-009, July. Available at: http://www.epa.gov/otaq/models/nonrdmdl/p02009.pdf.

US EPA, 2003. Documentation for the NONROAD Model Criteria Air Pollutant Component of the National Emissions Inventory (NEI) for Base Years 1970–2001. Rept. prepared by E.H. Pechan & Associates for US EPA Office of Air Quality Planning and Standards, Sept. 2003. Available at: ftp://ftp.epa.gov/EmisInventory/finalnei99ver3/criteria/documentation/nonroad/nonroad_neimethods.pdf.

US EPA, 2010. 2008 National Emissions Inventory, Nonpoint: Fertilizer Application, May 2010. Internet address: http://www.epa.gov/ttn/chief/net/2008inventory.html.

US EPA, 2009. Emission Factors for Locomotives. Office of Transportation and Air Quality. Rep. EPA420-F-09-025, April 2009. Internet address: http://www.epa.gov/otaq/regs/nonroad/locomotv/420f09025.pdf.

Weston Solutions Inc., 2010. 2008 Mobile Source Air Emissions Inventory for Luke Air Force Base. Rept. prepared for Air Education and Training Command (AETC), US Air Force, Randolph AFB, TX. June 2010.

5. Onroad Mobile Sources

5.1 Introduction

Onroad mobile source emissions have been calculated for particulate matter for the 2008 Periodic Emissions Inventory (PEI) for the Maricopa County area. For the purposes of this particulate matter inventory, the following pollutants were included: PM_{10}, $PM_{2.5}$, nitrogen oxides (NO_x), sulfur oxides (SO_x), and ammonia (NH_3). PM_{10} refers to all particles less than or equal to 10 micrometers in diameter and $PM_{2.5}$ refers to particles less than or equal to 2.5 micrometers in diameter.

Onroad mobile source emissions were estimated for the PM_{10} nonattainment area (NAA) (approximately 3,000 square miles), as well as for Maricopa County (approximately 9,000 square miles). Emission factors were calculated using MOBILE6.2, which is the latest version in a series of models developed by the U.S. Environmental Protection Agency (EPA) for the purpose of estimating motor vehicle emission factors, and AP-42, which is the EPA Compilation of Air Pollutant Emission Factors. AP-42 emission factors were used to calculate fugitive dust emissions, while MOBILE6.2 was used to estimate exhaust, tire wear, and brake wear emissions.

The MOBILE6.2 modeling accounted for the oxygenated fuel and the Arizona Vehicle Inspection/ Maintenance (I/M) programs applied in Maricopa County in 2008. The fuel use assumptions, including oxygen content and Reid Vapor Pressure (RVP), were derived from the 2008 testing results provided by the Arizona Department of Weight and Measures.

In order to develop the onroad mobile source emissions, the 2008 vehicle miles of travel (VMT) estimates were derived from the 2008 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 2008 vehicle registration data for Maricopa County provided by ADOT. The VMT by vehicle class was multiplied by the appropriate MOBILE6.2 emission factors to produce 2008 onroad exhaust, tire wear, and brake wear emissions.

Paved road fugitive dust emissions estimates were derived from the AP-42 emission factors and the 2008 traffic assignment produced by the Maricopa Association of Governments (MAG) travel demand model. The 2008 VMTs for freeways, high-traffic arterials, and low-traffic arterials were derived from the 2008 traffic assignment. Low-traffic arterials carry less than 10,000 vehicles on an average weekday, while high-traffic arterials carry 10,000 or more vehicles on an average weekday. These traffic assignment VMTs were normalized to 2008 HPMS VMTs and multiplied by the appropriate particulate emission factors derived from the AP-42 equation for paved roads. The 2008 benefits of the committed measures in the MAG 2007 Five Percent Plan for the Maricopa County PM_{10} Nonattainment Area (MAG, 2007) were applied to estimate 2008 paved road particulate emissions for the PEI.

Unpaved road VMT for 2008 was derived from the MAG 2009 Unpaved Road Inventory (MAG, 2010). Unpaved alley VMT for 2008 was derived from a GIS analysis of 2009 aerial photographs conducted by MAG. The unpaved road and alley VMTs were multiplied by the appropriate AP-42 emission factors for unpaved roads and alleys, respectively. The 2008 benefits of the committed measures in the MAG 2007 Five Percent Plan were applied to estimate 2008 unpaved road and alley particulate emissions for the PEI.

The main references for preparing the onroad mobile source portion of the 2008 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);
- Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation (US EPA, 2002);
- User's Guide to MOBILE6.1 and MOBILE6.2 (Mobile Source Emission Factor Model), (US EPA, 2003); and
- Compilation of Air Pollutant Emissions Factors, AP-42 (US EPA, 2006).

5.2 VMT estimation

MAG prepared the 2008 VMT estimates for the PM_{10} NAA and Maricopa County. The VMTs used to develop vehicle exhaust, tire wear, brake wear, and paved road fugitive dust emissions were derived from 2008 HPMS data provided by ADOT. The 2008 HPMS VMTs for the PM_{10} NAA and Maricopa County are 87,153,000 miles per day and 91,257,000 miles per day, respectively.

The 2008 VMTs by facility type were used to estimate onroad exhaust, tire wear, and brake wear emissions. The VMT distribution by facility type for the PM_{10} NAA and Maricopa County was obtained from the 2007 Maricopa County Estimates of Daily Vehicle Travel by Highway Functional Classification derived from 2007 HPMS data by ADOT. The 2007 VMT distributions were multiplied by the estimated 2008 VMT for the PM_{10} NAA and Maricopa County. The resultant VMT estimates by facility type for the PM_{10} NAA and Maricopa County are shown in Table 5.2–1.

The 2008 VMTs by silt loading category were used to estimate paved road fugitive dust emissions. Daily VMTs by silt loading category for the PM_{10} NAA and Maricopa County are shown in Table 5.2–2. The VMTs were derived by applying geographic information systems (GIS) to a 2008 traffic assignment output by the MAG travel demand model, TransCAD. The 2008 weekday traffic volumes output by TransCAD was normalized to 2008 HPMS VMTs for the PM_{10} NAA and Maricopa County to produce the VMTs by silt loading category shown in Table 5.2–2.

The 2008 VMTs for unpaved roads and alleys were used to estimate unpaved road fugitive dust emissions. The 2008 daily VMTs on unpaved roads and alleys in the PM_{10} NAA and Maricopa County are shown in Table 5.2–3. The 2008 VMT for unpaved roads in the PM_{10} NAA was derived from the MAG 2009 Unpaved Road Inventory (MAG, 2010). The 2008 VMT for unpaved alleys in the PM_{10} NAA was derived by multiplying a MAG GIS-derived estimate of 650 miles of dirt alleys by an annual average daily traffic estimate of 9.1 vehicles per day. The 2008 Maricopa County VMTs were obtained by applying a ratio of 1.047 to the PM_{10} NAA VMTs in Table 5.2–3. This ratio represents 2008 VMT on all roads in Maricopa County to 2008 VMT on all roads in the PM_{10} NAA, as shown in Table 5.2–4. The VMTs in Table 5.2–4 represent 2008 HPMS data submitted to the Federal Highway Administration by ADOT in August 2009.

Table 5.2–1. 2008 daily VMT by facility type (annual average daily traffic).

	Facility Type	PM_{10} NAA (thousand miles/day)	Maricopa County (thousand miles/day)
Rural	Interstate	2,458	3,163
	Other Principal Arterial	937	1,205
	Minor Arterial	391	503
	Major Collector	1,149	1,478
	Minor Collector	163	210
	Local	1,188	1,529
Urban	Interstate	11,208	11,527
	Other Freeway/Expressway	19,079	19,622
	Other Principal Arterial	22,074	22,703
	Minor Arterial	14,472	14,884
	Collector	4,781	4,917
	Local	9,253	9,516
Totals:		**87,153**	**91,257**

Table 5.2–2. 2008 VMT by silt loading category for paved roads.

	Daily VMT	
Silt Loading Category	**PM_{10} NAA**	**Maricopa County**
Freeways	30,835,329	32,526,693
High-Traffic Arterials	42,498,543	43,586,568
Low-Traffic Arterials	**13,819,127**	15,143,740
Totals:	**87,153,000**	**91,257,000**

Table 5.2–3. 2008 VMT on unpaved roads in the PM_{10} NAA and Maricopa County.

	2008 Annual Average Daily VMT	
Area	**Unpaved Roads**	**Unpaved Alleys**
PM_{10} NAA	47,984	5,915
Maricopa County	50,239	6,193

Table 5.2–4. 2008 VMT on all roads in the PM_{10} NAA and Maricopa County.

Area	2008 Annual Average Daily VMT (in thousands)	Ratio to 2008 Annual Average Daily VMT in the PM_{10} NAA
PM_{10} NAA	87,153	1.000
Maricopa County	91,257	1.047

5.3 Speed estimation

Vehicle speeds have no effect on the emission factors for exhaust particulate matter, re-entrained dust from paved roads, brake wear, tire wear, or exhaust NH_3, but they have a significant impact on exhaust NO_x emissions and re-entrained dust from unpaved roads, and a slight impact on SO_2 and SO_4. For onroad mobile source exhaust emissions, the 2008 traffic assignment data provided by the MAG Transportation Group in June 2008 were applied to develop the speed estimates for all facility types, except local roadways. To develop the speed estimates, VMTs and vehicle hours of travel (VHTs) were accumulated separately for three facility type groups (i.e., freeway, arterial, and collector) and two area types (i.e., urban and rural) across all four time periods (i.e., AM peak, midday, PM peak, and nighttime) in Maricopa County. Then, average daily speeds for the three facility type groups and two area types were calculated by dividing VMTs by VHTs. The same methodology was applied to develop the speed estimates for the PM_{10} NAA. For local

roadways, a default speed of 12.9 miles per hour was assumed by MOBILE6.2. Table 5.3–1 presents average daily speeds applied for the MOBILE6.2 runs. An average speed of 25 miles per hour was assumed on all unpaved roads.

Table 5.3–1. Average daily speeds for the 2008 periodic emissions inventory.

	HPMS Facility Type	PM_{10} NAA (mph)	Maricopa County (mph)
Rural	Principal Arterial - Interstate	46.8	51.5
	Principal Arterial - Other	36.0	38.1
	Minor Arterial	36.0	38.1
	Major Collector	30.0	30.3
	Minor Collector	30.0	30.3
	Local	12.9	12.9
Urban	Principal Arterial - Interstate	44.1	44.4
	Freeway and Expressway	44.1	44.4
	Principal Arterial - Other	29.5	30.1
	Minor Arterial	29.5	30.1
	Collector	24.3	24.2
	Local	12.9	12.9

5.4 Monthly VMT factors

For exhaust, tire wear, and brake wear emissions, annual emissions were calculated by aggregating estimated monthly emissions, which were derived by applying monthly emission factors to monthly VMTs. The monthly VMTs were calculated as the product of annual average daily VMT, monthly VMT adjustment factors, and the number of days for a given month.

Since VMT varies by month, annual average daily VMT was adjusted by the monthly VMT adjustment factors to derive daily VMT for each month. The monthly VMT adjustment factors 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. These monthly factors are shown in Table 5.4–1.

These factors indicate, as an example, that an average day in February has four percent more traffic on arterials than an annual average day, while an average day in July has two percent less traffic on freeways than an annual average day.

Table 5.4–1. Average daily VMT adjustment factors by month.

Month	Arterials	Freeways
January	0.99	1.00
February	1.04	1.03
March	1.03	1.03
April	1.04	1.02
May	1.02	1.01
June	0.97	1.01
July	0.91	0.98
August	0.97	0.97
September	1.01	0.97
October	1.01	0.99
November	1.02	1.00
December	1.00	1.00

5.5 Emission factor estimation

Vehicle exhaust emission factors for PM_{10}, $PM_{2.5}$, NO_x, SO_x, and NH_3 were calculated using MOBILE6.2, as well as tire wear and brake wear emission factors for PM_{10} and $PM_{2.5}$. The exhaust PM_{10} and $PM_{2.5}$ estimates include the components of lead, sulfate, and carbon (organic, elemental, and total). The MOBILE6.2 emission factors were combined with VMT estimates to produce total emission estimates for onroad vehicle exhaust, tire wear, and brake wear emissions. The MOBILE6.2 runs were executed by MAG. The contact person for the MOBILE6.2 emission estimates is Ieesuck Jung (602-254-6300).

In order to calculate vehicle emission factors for the 2008 annual average day, two MOBILE6.2 runs reflecting vehicles registered locally (subject to the I/M program) and those not registered locally (not participating in the I/M program) were executed using fuel and temperature data for each month of the year.

Fugitive dust emission factors were derived from AP-42 by MAG. The derivation of paved and unpaved road emission factors is discussed in Section 5.5.2. The contact person for the fugitive dust emission estimates is Cathy Arthur (602-254-6300).

5.5.1 MOBILE6.2 emission factor model

The emission factors not related to fugitive dust were calculated using MOBILE6.2. The emission factors estimated with these runs were combined to reflect 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 Arizona Vehicle Inspection/ Maintenance Program. It is important to note that participation in the I/M program is required for all vehicles registered in the PM_{10} NAA, with the exception of certain model years and vehicle classes. However, it is assumed that only 91.6 percent of the vehicles operating within the PM_{10} NAA 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). In the absence of any additional data, this percentage split is assumed to apply directly to VMT as well.

5.5.1.1 MOBILE6.2 inputs

In order to accurately reflect the state of the I/M program in the PM_{10} NAA, several MOBILE6.2 runs were performed and the emission factors from those runs weighted together. The specific model run inputs to the MOBILE6.2 model are described in Appendix 5.

5.5.1.2 MOBILE6.2 outputs

MOBILE6.2 was executed with the inputs described in Appendix 5 to obtain composite emission factors in grams per mile (g/mi) for PM_{10}, $PM_{2.5}$, NO_x, SO_x, and NH_3. These values were obtained for the following eight vehicle classes: light-duty gas vehicles (LDGV), light-duty gas trucks of gross vehicle weight under 6000 pounds (LDGT1/LDGT2; LDGT12) and 6000 pounds

or more (LDGT3/LDGT4; LDGT34), heavy-duty gas vehicles (HDGV), light-duty diesel vehicles (LDDV), light-duty diesel trucks (LDDT), heavy-duty diesel vehicles (HDDV), and motorcycles (MC); by the following twelve facility types: rural interstate, rural other principal arterial, rural minor arterial, rural major collector, rural minor collector, rural local, urban interstate, urban other freeway/expressway, urban other principal arterial, urban minor arterial, urban collector, and urban local. The emission factors generated for each month of the year in 2008 are presented in Appendix 5. These values were subsequently used in developing emission estimates.

5.5.1.3 MOBILE6.2 emission estimates

MOBILE6.2 was used to generate onroad emission factors and VMT mix by vehicle class and facility type. Daily VMTs for an annual average day (Table 5.2–1) were then multiplied by the VMT mix by vehicle class and the appropriate emission factor (Appendix 5) to estimate emissions. VMT mix refers to the fraction of total onroad vehicle miles of travel from a particular vehicle type. The 2008 vehicle registration data for Maricopa County was input to MOBILE6.2 to obtain the VMT mix.

Tables 5.5–1 and 5.5–2 show the calculated annual and average daily PM_{10}, $PM_{2.5}$, NO_x, SO_x, and NH_3 emissions by facility type and vehicle class in the PM_{10} NAA and Maricopa County, respectively. Emission estimates for PM_{10} and $PM_{2.5}$ in these tables represent exhaust, tire wear, and brake wear emissions.

Table 5.5–1. Annual and average daily onroad mobile source emissions by facility type and vehicle class in the PM_{10} NAA.

	Vehicle Class	SCC	Annual emissions (tons/yr)					Average daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Rural Interstate	LDGV	2201001110	9.04	4.14	214.04	2.47	36.93	49.4	22.6	1,169.6	13.5	201.8
	LDGT12	2201020110	8.52	3.96	301.17	2.96	33.96	46.6	21.6	1,645.7	16.2	185.6
	LDGT34	2201040110	3.56	1.65	135.02	1.62	14.17	19.4	9.0	737.8	8.8	77.5
	HDGV	2201070110	2.49	1.80	91.03	0.64	1.74	13.6	9.8	497.4	3.5	9.5
	MC	2201080110	0.17	0.10	6.95	0.02	0.05	1.0	0.5	38.0	0.1	0.3
	LDDV	2230001110	0.05	0.04	0.29	0.00	0.00	0.2	0.2	1.6	0.0	0.0
	LDDT	2230060110	0.17	0.13	1.45	0.01	0.01	0.9	0.7	7.9	0.0	0.1
	HDDV	2230070110	19.12	15.09	740.19	0.64	2.84	104.5	82.5	4,044.7	3.5	15.5
Rural Other Principal Arterial	LDGV	2201001130	3.45	1.58	77.74	0.94	14.08	18.8	8.6	424.8	5.1	76.9
	LDGT12	2201020130	3.25	1.51	109.22	1.13	12.94	17.7	8.2	596.8	6.2	70.7
	LDGT34	2201040130	1.36	0.63	49.26	0.62	5.40	7.4	3.4	269.2	3.4	29.5
	HDGV	2201070130	0.95	0.68	31.95	0.24	0.66	5.2	3.7	174.6	1.3	3.6
	MC	2201080130	0.07	0.04	2.47	0.01	0.02	0.4	0.2	13.5	0.0	0.1
	LDDV	2230001130	0.02	0.01	0.10	0.00	0.00	0.1	0.1	0.5	0.0	0.0
	LDDT	2230060130	0.06	0.05	0.49	0.00	0.01	0.4	0.3	2.7	0.0	0.0
	HDDV	2230070130	7.29	5.75	227.12	0.25	1.08	39.8	31.4	1,241.1	1.3	5.9
Rural Minor Arterial	LDGV	2201001150	1.44	0.66	32.44	0.39	5.87	7.9	3.6	177.3	2.1	32.1
	LDGT12	2201020150	1.35	0.63	45.58	0.47	5.40	7.4	3.4	249.1	2.6	29.5
	LDGT34	2201040150	0.57	0.26	20.56	0.26	2.25	3.1	1.4	112.3	1.4	12.3
	HDGV	2201070150	0.40	0.29	13.33	0.10	0.28	2.2	1.6	72.9	0.6	1.5
	MC	2201080150	0.03	0.02	1.03	0.00	0.01	0.2	0.1	5.6	0.0	0.0
	LDDV	2230001150	0.01	0.01	0.04	0.00	0.00	0.0	0.0	0.2	0.0	0.0
	LDDT	2230060150	0.03	0.02	0.20	0.00	0.00	0.1	0.1	1.1	0.0	0.0
	HDDV	2230070150	3.04	2.40	94.77	0.10	0.45	16.6	13.1	517.9	0.6	2.5
Rural Major Collector	LDGV	2201001170	4.23	1.93	97.56	1.15	17.26	23.1	10.6	533.1	6.3	94.3
	LDGT12	2201020170	3.99	1.86	135.78	1.38	15.87	21.8	10.1	742.0	7.6	86.7
	LDGT34	2201040170	1.67	0.77	61.24	0.76	6.62	9.1	4.2	334.7	4.1	36.2
	HDGV	2201070170	1.16	0.84	37.34	0.30	0.81	6.3	4.6	204.0	1.6	4.4
	MC	2201080170	0.08	0.05	2.90	0.01	0.02	0.4	0.2	15.9	0.0	0.1
	LDDV	2230001170	0.02	0.02	0.12	0.00	0.00	0.1	0.1	0.7	0.0	0.0
	LDDT	2230060170	0.08	0.06	0.60	0.00	0.01	0.4	0.3	3.3	0.0	0.0
	HDDV	2230070170	8.94	7.05	279.39	0.30	1.33	48.8	38.5	1,526.7	1.6	7.3
Rural Minor Collector	LDGV	2201001190	0.60	0.27	13.84	0.16	2.45	3.3	1.5	75.6	0.9	13.4
	LDGT12	2201020190	0.57	0.26	19.26	0.20	2.25	3.1	1.4	105.3	1.1	12.3
	LDGT34	2201040190	0.24	0.11	8.69	0.11	0.94	1.3	0.6	47.5	0.6	5.1
	HDGV	2201070190	0.16	0.12	5.30	0.04	0.12	0.9	0.6	28.9	0.2	0.6
	MC	2201080190	0.01	0.01	0.41	0.00	0.00	0.1	0.0	2.2	0.0	0.0
	LDDV	2230001190	0.00	0.00	0.02	0.00	0.00	0.0	0.0	0.1	0.0	0.0
	LDDT	2230060190	0.01	0.01	0.08	0.00	0.00	0.1	0.0	0.5	0.0	0.0
	HDDV	2230070190	1.27	1.00	39.63	0.04	0.19	6.9	5.5	216.6	0.2	1.0
Rural Local	LDGV	2201001210	4.39	2.02	100.79	1.18	17.85	24.0	11.0	550.8	6.4	97.5
	LDGT12	2201020210	4.13	1.92	137.58	1.42	16.41	22.6	10.5	751.8	7.7	89.7
	LDGT34	2201040210	1.72	0.80	62.38	0.77	6.85	9.4	4.4	340.8	4.2	37.4
	HDGV	2201070210	1.20	0.86	33.26	0.31	0.84	6.5	4.7	181.8	1.7	4.6
	MC	2201080210	0.08	0.05	2.52	0.01	0.03	0.5	0.3	13.8	0.0	0.1
	LDDV	2230001210	0.02	0.02	0.17	0.00	0.00	0.1	0.1	0.9	0.0	0.0
	LDDT	2230060210	0.08	0.06	0.83	0.00	0.01	0.4	0.3	4.5	0.0	0.0
	HDDV	2230070210	9.24	7.29	361.90	0.31	1.37	50.5	39.9	1,977.6	1.7	7.5

Table 5.5–1. Annual and average daily onroad mobile source emissions by facility type and vehicle class in the PM_{10} NAA (continued).

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Average daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Urban Interstate	LDGV	2201001230	41.23	18.88	966.38	11.26	168.40	225.3	103.1	5,280.8	61.5	920.2
	LDGT12	2201020230	38.85	18.04	1,359.1	13.51	154.84	212.3	98.6	7,426.8	73.8	846.1
	LDGT34	2201040230	16.23	7.54	610.22	7.38	64.63	88.7	41.2	3,334.5	40.3	353.2
	HDGV	2201070230	11.34	8.19	406.42	2.92	7.94	62.0	44.7	2,220.9	16.0	43.4
	MC	2201080230	0.80	0.44	30.63	0.07	0.24	4.4	2.4	167.4	0.4	1.3
	LDDV	2230001230	0.21	0.17	1.27	0.00	0.01	1.1	0.9	6.9	0.0	0.1
	LDDT	2230060230	0.77	0.60	6.27	0.02	0.07	4.2	3.3	34.3	0.1	0.4
	HDDV	2230070230	87.19	68.80	3,208.5	2.94	12.94	476.4	376.0	17,532.	16.0	70.7
Urban Other Freeway And Expressway	LDGV	2201001250	70.18	32.13	1,645.0	19.17	286.65	383.5	175.6	8,989.3	104.7	1,566.4
	LDGT12	2201020250	66.13	30.71	2,313.5	23.00	263.59	361.3	167.8	12,642.	125.7	1,440.4
	LDGT34	2201040250	27.63	12.83	1,038.7	12.56	110.02	151.0	70.1	5,676.3	68.6	601.2
	HDGV	2201070250	19.31	13.94	691.83	4.98	13.52	105.5	76.2	3,780.5	27.2	73.9
	MC	2201080250	1.36	0.75	52.15	0.12	0.41	7.4	4.1	285.0	0.7	2.3
	LDDV	2230001250	0.35	0.29	2.16	0.00	0.02	1.9	1.6	11.8	0.0	0.1
	LDDT	2230060250	1.32	1.02	10.67	0.04	0.11	7.2	5.6	58.3	0.2	0.6
	HDDV	2230070250	148.41	117.12	5,461.7	5.00	22.04	811.0	640.0	29,845.	27.3	120.4
Urban Other Principal Arterial	LDGV	2201001270	81.19	37.17	1,882.3	22.17	331.62	443.7	203.1	10,286.	121.2	1,812.1
	LDGT12	2201020270	76.65	35.68	2,616.8	26.61	304.91	418.8	195.0	14,299.	145.4	1,666.2
	LDGT34	2201040270	32.02	14.84	1,180.2	14.53	127.26	175.0	81.1	6,449.7	79.4	695.4
	HDGV	2201070270	22.28	16.08	714.80	5.76	15.64	121.8	87.9	3,906.0	31.5	85.5
	MC	2201080270	1.57	0.87	55.62	0.14	0.48	8.6	4.8	303.9	0.8	2.6
	LDDV	2230001270	0.41	0.33	2.33	0.00	0.02	2.2	1.8	12.8	0.0	0.1
	LDDT	2230060270	1.52	1.18	11.53	0.05	0.13	8.3	6.5	63.0	0.3	0.7
	HDDV	2230070270	171.73	135.53	5,386.8	5.79	25.49	938.4	740.6	29,436.	31.6	139.3
Urban Minor Arterial	LDGV	2201001290	53.23	24.37	1,234.1	14.54	217.41	290.9	133.2	6,743.8	79.4	1,188.1
	LDGT12	2201020290	50.25	23.39	1,715.6	17.44	199.90	274.6	127.8	9,374.9	95.3	1,092.4
	LDGT34	2201040290	20.99	9.73	773.81	9.52	83.43	114.7	53.2	4,228.5	52.0	455.9
	HDGV	2201070290	14.61	10.54	468.63	3.77	10.25	79.8	57.6	2,560.8	20.6	56.0
	MC	2201080290	1.03	0.57	36.46	0.09	0.31	5.6	3.1	199.3	0.5	1.7
	LDDV	2230001290	0.27	0.22	1.53	0.00	0.02	1.5	1.2	8.4	0.0	0.1
	LDDT	2230060290	1.00	0.77	7.56	0.03	0.09	5.5	4.2	41.3	0.2	0.5
	HDDV	2230070290	112.59	88.86	3,531.6	3.80	16.71	615.2	485.5	19,298.	20.7	91.3
Urban Collector	LDGV	2201001310	17.66	8.09	429.01	4.80	71.83	96.5	44.2	2,344.3	26.2	392.5
	LDGT12	2201020310	16.63	7.73	590.53	5.70	66.04	90.9	42.2	3,227.0	31.1	360.9
	LDGT34	2201040310	6.94	3.21	266.16	3.15	27.56	37.9	17.6	1,454.4	17.2	150.6
	HDGV	2201070310	4.82	3.47	148.35	1.25	3.39	26.3	19.0	810.6	6.9	18.5
	MC	2201080310	0.34	0.19	11.40	0.03	0.10	1.9	1.0	62.3	0.2	0.6
	LDDV	2230001310	0.09	0.07	0.53	0.00	0.01	0.5	0.4	2.9	0.0	0.0
	LDDT	2230060310	0.33	0.26	2.62	0.01	0.03	1.8	1.4	14.3	0.1	0.2
	HDDV	2230070310	37.20	29.35	1,223.6	1.25	5.52	203.3	160.4	6,686.3	6.9	30.2
Urban Local	LDGV	2201001330	34.17	15.72	785.04	9.16	139.01	186.7	85.9	4,289.8	50.0	759.6
	LDGT12	2201020330	32.19	14.95	1,071.5	11.03	127.81	175.9	81.7	5,855.4	60.3	698.4
	LDGT34	2201040330	13.42	6.25	485.82	6.04	53.34	73.3	34.1	2,654.8	33.0	291.5
	HDGV	2201070330	9.31	6.71	259.07	2.43	6.56	50.9	36.7	1,415.7	13.3	35.8
	MC	2201080330	0.66	0.37	19.64	0.06	0.20	3.6	2.0	107.3	0.3	1.1
	LDDV	2230001330	0.17	0.14	1.30	0.00	0.01	0.9	0.8	7.1	0.0	0.1
	LDDT	2230060330	0.64	0.50	6.43	0.02	0.05	3.5	2.7	35.1	0.1	0.3
	HDDV	2230070330	71.99	56.81	2,818.7	2.43	10.68	393.4	310.4	15,402.	13.3	58.4

Table 5.5–2. Annual and average daily onroad mobile source emissions by facility type and vehicle class in Maricopa County.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Average daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Rural Interstate	LDGV	2201001110	11.64	5.33	280.13	3.18	47.52	63.6	29.1	1,530.8	17.4	259.7
	LDGT12	2201020110	10.96	5.09	394.47	3.81	43.70	59.9	27.8	2,155.6	20.8	238.8
	LDGT34	2201040110	4.58	2.13	176.49	2.08	18.24	25.0	11.6	964.4	11.4	99.7
	HDGV	2201070110	3.20	2.31	121.33	0.82	2.24	17.5	12.6	663.0	4.5	12.2
	MC	2201080110	0.22	0.12	9.77	0.02	0.07	1.2	0.7	53.4	0.1	0.4
	LDDV	2230001110	0.06	0.05	0.43	0.00	0.00	0.3	0.3	2.3	0.0	0.0
	LDDT	2230060110	0.22	0.17	2.11	0.01	0.02	1.2	0.9	11.5	0.0	0.1
	HDDV	2230070110	24.60	19.42	1,063.5	0.83	3.65	134.5	106.1	5,811.5	4.5	20.0
Rural Other Principal Arterial	LDGV	2201001130	4.43	2.03	100.45	1.21	18.10	24.2	11.1	548.9	6.6	98.9
	LDGT12	2201020130	4.18	1.94	141.23	1.45	16.64	22.8	10.6	771.7	7.9	91.0
	LDGT34	2201040130	1.74	0.81	63.64	0.79	6.95	9.5	4.4	347.8	4.3	38.0
	HDGV	2201070130	1.22	0.88	41.77	0.31	0.85	6.7	4.8	228.2	1.7	4.7
	MC	2201080130	0.09	0.05	3.22	0.01	0.03	0.5	0.3	17.6	0.0	0.1
	LDDV	2230001130	0.02	0.02	0.13	0.00	0.00	0.1	0.1	0.7	0.0	0.0
	LDDT	2230060130	0.08	0.06	0.63	0.00	0.01	0.5	0.4	3.5	0.0	0.0
	HDDV	2230070130	9.37	7.40	295.20	0.32	1.39	51.2	40.4	1,613.1	1.7	7.6
Rural Minor Arterial	LDGV	2201001150	1.85	0.85	41.93	0.51	7.56	10.1	4.6	229.1	2.8	41.3
	LDGT12	2201020150	1.74	0.81	58.95	0.61	6.95	9.5	4.4	322.1	3.3	38.0
	LDGT34	2201040150	0.73	0.34	26.56	0.33	2.90	4.0	1.8	145.2	1.8	15.8
	HDGV	2201070150	0.51	0.37	17.43	0.13	0.36	2.8	2.0	95.3	0.7	1.9
	MC	2201080150	0.04	0.02	1.34	0.00	0.01	0.2	0.1	7.3	0.0	0.1
	LDDV	2230001150	0.01	0.01	0.05	0.00	0.00	0.1	0.0	0.3	0.0	0.0
	LDDT	2230060150	0.03	0.03	0.26	0.00	0.00	0.2	0.1	1.4	0.0	0.0
	HDDV	2230070150	3.91	3.09	123.22	0.13	0.58	21.4	16.9	673.4	0.7	3.2
Rural Major Collector	LDGV	2201001170	5.44	2.49	125.26	1.48	22.20	29.7	13.6	684.5	8.1	121.3
	LDGT12	2201020170	5.13	2.39	174.46	1.78	20.42	28.0	13.1	953.3	9.7	111.6
	LDGT34	2201040170	2.14	0.99	78.69	0.97	8.52	11.7	5.4	430.0	5.3	46.6
	HDGV	2201070170	1.49	1.08	48.16	0.39	1.05	8.2	5.9	263.2	2.1	5.7
	MC	2201080170	0.11	0.06	3.75	0.01	0.03	0.6	0.3	20.5	0.1	0.2
	LDDV	2230001170	0.03	0.02	0.16	0.00	0.00	0.1	0.1	0.9	0.0	0.0
	LDDT	2230060170	0.10	0.08	0.77	0.00	0.01	0.6	0.4	4.2	0.0	0.0
	HDDV	2230070170	11.50	9.07	359.17	0.39	1.71	62.8	49.6	1,962.7	2.1	9.3
Rural Minor Collector	LDGV	2201001190	0.77	0.35	17.80	0.21	3.15	4.2	1.9	97.3	1.2	17.2
	LDGT12	2201020190	0.73	0.34	24.79	0.25	2.90	4.0	1.9	135.5	1.4	15.9
	LDGT34	2201040190	0.30	0.14	11.18	0.14	1.21	1.7	0.8	61.1	0.8	6.6
	HDGV	2201070190	0.21	0.15	6.84	0.05	0.15	1.2	0.8	37.4	0.3	0.8
	MC	2201080190	0.01	0.01	0.53	0.00	0.00	0.1	0.0	2.9	0.0	0.0
	LDDV	2230001190	0.00	0.00	0.02	0.00	0.00	0.0	0.0	0.1	0.0	0.0
	LDDT	2230060190	0.01	0.01	0.11	0.00	0.00	0.1	0.1	0.6	0.0	0.0
	HDDV	2230070190	1.63	1.29	51.03	0.06	0.24	8.9	7.0	278.9	0.3	1.3
Rural Local	LDGV	2201001210	5.65	2.60	129.72	1.51	22.97	30.9	14.2	708.9	8.3	125.5
	LDGT12	2201020210	5.32	2.47	177.06	1.82	21.12	29.1	13.5	967.6	10.0	115.4
	LDGT34	2201040210	2.22	1.03	80.28	1.00	8.81	12.1	5.6	438.7	5.5	48.2
	HDGV	2201070210	1.54	1.11	42.81	0.40	1.08	8.4	6.1	233.9	2.2	5.9
	MC	2201080210	0.11	0.06	3.25	0.01	0.03	0.6	0.3	17.7	0.1	0.2
	LDDV	2230001210	0.03	0.02	0.21	0.00	0.00	0.2	0.1	1.2	0.0	0.0
	LDDT	2230060210	0.11	0.08	1.06	0.00	0.01	0.6	0.4	5.8	0.0	0.0
	HDDV	2230070210	11.90	9.39	465.78	0.40	1.77	65.0	51.3	2,545.2	2.2	9.6

Table 5.5–2. Annual and average daily onroad mobile source emissions by facility type and vehicle class in Maricopa County (continued).

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Average daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Urban Interstate	LDGV	2201001230	42.40	19.41	995.06	11.58	173.19	231.7	106.1	5,437.5	63.3	946.4
	LDGT12	2201020230	39.95	18.55	1,399.3	13.90	159.25	218.3	101.4	7,646.8	75.9	870.2
	LDGT34	2201040230	16.69	7.75	628.29	7.59	66.47	91.2	42.4	3,433.3	41.5	363.2
	HDGV	2201070230	11.66	8.42	419.01	3.01	8.17	63.7	46.0	2,289.7	16.4	44.6
	MC	2201080230	0.82	0.45	31.64	0.07	0.25	4.5	2.5	172.9	0.4	1.4
	LDDV	2230001230	0.21	0.17	1.31	0.00	0.01	1.2	1.0	7.2	0.0	0.1
	LDDT	2230060230	0.80	0.62	6.50	0.03	0.07	4.4	3.4	35.5	0.1	0.4
	HDDV	2230070230	89.67	70.76	3,319.7	3.02	13.31	490.0	386.7	18,140.	16.5	72.8
Urban Other Freeway And Expressway	LDGV	2201001250	72.18	33.05	1,693.8	19.71	294.81	394.4	180.6	9,256.0	107.7	1,611.0
	LDGT12	2201020250	68.01	31.59	2,382.0	23.65	271.09	371.6	172.6	13,016.	129.3	1,481.3
	LDGT34	2201040250	28.41	13.20	1,069.5	12.92	113.15	155.3	72.1	5,844.4	70.6	618.3
	HDGV	2201070250	19.86	14.34	713.27	5.12	13.90	108.5	78.3	3,897.7	28.0	76.0
	MC	2201080250	1.39	0.77	53.85	0.12	0.42	7.6	4.2	294.3	0.7	2.3
	LDDV	2230001250	0.36	0.30	2.24	0.00	0.02	2.0	1.6	12.2	0.0	0.1
	LDDT	2230060250	1.36	1.05	11.06	0.04	0.12	7.4	5.7	60.4	0.2	0.6
	HDDV	2230070250	152.64	120.45	5,651.1	5.14	22.66	834.1	658.2	30,880.	28.1	123.8
Urban Other Principal Arterial	LDGV	2201001270	83.51	38.23	1,926.3	22.81	341.07	456.3	208.9	10,526.	124.6	1,863.8
	LDGT12	2201020270	78.83	36.69	2,681.9	27.36	313.60	430.8	200.5	14,655.	149.5	1,713.7
	LDGT34	2201040270	32.93	15.26	1,209.6	14.94	130.88	180.0	83.4	6,610.2	81.6	715.2
	HDGV	2201070270	22.94	16.54	738.38	5.92	16.08	125.3	90.4	4,034.9	32.3	87.9
	MC	2201080270	1.61	0.90	57.42	0.14	0.49	8.8	4.9	313.8	0.8	2.7
	LDDV	2230001270	0.42	0.34	2.39	0.01	0.02	2.3	1.9	13.1	0.0	0.1
	LDDT	2230060270	1.57	1.21	11.81	0.05	0.13	8.6	6.6	64.6	0.3	0.7
	HDDV	2230070270	176.62	139.39	5,518.9	5.95	26.22	965.2	761.7	30,158.	32.5	143.3
Urban Minor Arterial	LDGV	2201001290	54.75	25.06	1,262.8	14.95	223.60	299.2	137.0	6,901.1	81.7	1,221.9
	LDGT12	2201020290	51.68	24.06	1,758.2	17.94	205.59	282.4	131.5	9,607.9	98.0	1,123.5
	LDGT34	2201040290	21.59	10.01	793.05	9.79	85.81	118.0	54.7	4,333.6	53.5	468.9
	HDGV	2201070290	15.04	10.84	484.08	3.88	10.54	82.2	59.2	2,645.3	21.2	57.6
	MC	2201080290	1.06	0.59	37.65	0.09	0.32	5.8	3.2	205.7	0.5	1.8
	LDDV	2230001290	0.27	0.22	1.57	0.00	0.02	1.5	1.2	8.6	0.0	0.1
	LDDT	2230060290	1.03	0.80	7.74	0.03	0.09	5.6	4.4	42.3	0.2	0.5
	HDDV	2230070290	115.79	91.38	3,618.2	3.90	17.19	632.8	499.4	19,771.	21.3	93.9
Urban Collector	LDGV	2201001310	18.16	8.32	441.76	4.94	73.87	99.2	45.5	2,414.0	27.0	403.7
	LDGT12	2201020310	17.11	7.95	607.95	5.86	67.92	93.5	43.4	3,322.1	32.0	371.1
	LDGT34	2201040310	7.13	3.31	273.97	3.24	28.35	39.0	18.1	1,497.1	17.7	154.9
	HDGV	2201070310	4.96	3.57	152.46	1.29	3.48	27.1	19.5	833.1	7.0	19.0
	MC	2201080310	0.35	0.19	11.71	0.03	0.11	1.9	1.1	64.0	0.2	0.6
	LDDV	2230001310	0.09	0.07	0.55	0.00	0.01	0.5	0.4	3.0	0.0	0.0
	LDDT	2230060310	0.34	0.26	2.70	0.01	0.03	1.9	1.4	14.7	0.1	0.2
	HDDV	2230070310	38.25	30.19	1,260.0	1.29	5.68	209.0	165.0	6,885.7	7.0	31.0
Urban Local	LDGV	2201001330	35.14	16.17	807.35	9.42	142.96	192.0	88.3	4,411.8	51.5	781.2
	LDGT12	2201020330	33.11	15.38	1,101.9	11.34	131.45	180.9	84.0	6,021.8	62.0	718.3
	LDGT34	2201040330	13.80	6.43	499.63	6.21	54.86	75.4	35.1	2,730.2	33.9	299.8
	HDGV	2201070330	9.58	6.90	266.44	2.50	6.74	52.3	37.7	1,455.9	13.6	36.8
	MC	2201080330	0.68	0.38	20.20	0.06	0.21	3.7	2.1	110.4	0.3	1.1
	LDDV	2230001330	0.18	0.14	1.33	0.00	0.01	1.0	0.8	7.3	0.0	0.1
	LDDT	2230060330	0.66	0.51	6.61	0.02	0.06	3.6	2.8	36.1	0.1	0.3
	HDDV	2230070330	74.03	58.43	2,898.8	2.50	10.99	404.5	319.3	15,840.	13.6	60.0

5.5.2 Fugitive dust emissions

While exhaust, tire wear, and brake wear emissions were calculated using the EPA MOBILE6.2 model, fugitive dust emissions from paved and unpaved roads were calculated using the equations found in sections 13.2.1 and 13.2.2 of the EPA Compilation of Air Pollutant Emission Factors, AP-42 (US EPA, 2006).

5.5.2.1 Paved road fugitive dust emissions

In the AP-42 equations, paved road fugitive dust emissions are a function of silt loading values on road surfaces. Paved roads have been classified as freeways, high-traffic arterials, and low-traffic arterials to reflect different silt loading assumptions. An arterial carrying a traffic volume of less than 10,000 vehicles per average weekday is classified as low-traffic; all other roads that are not freeways are classified as high-traffic arterials. The silt loading levels, in grams per square meter, are 0.02 for freeways, 0.067 for high-traffic arterials, and 0.23 for low-traffic arterials. These silt loadings and the average vehicle weight are consistent with assumptions in the MAG 2007 Five Percent Plan. The fugitive dust emission factors for paved roads were derived by applying the following AP-42 equation:

$$E = \left[k\left(\frac{sL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - C \right]\left(1 - \frac{P}{4N}\right)$$

where: E = annual average particulate emission factor (g/mile),
k = particle size multiplier for particle size range (7.3 g/mile for PM_{10} and 1.1 g/mile for $PM_{2.5}$),
sL = road surface silt loading (0.02 g/m^2 for freeways, 0.067 g/m^2 for high-traffic arterials, and 0.23 g/m^2 for low-traffic arterials),
W = average weight of the vehicles traveling on the roads (3.18 tons),
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear (0.2119 g/mile for PM_{10} and 0.1617 g/mile for $PM_{2.5}$),
P = annual number of "wet" days with at least 0.254 mm (0.01 in) of precipitation (39 days[3] in 2008), and
N = annual number of days (366 days in 2008).

The annual average PM_{10} and $PM_{2.5}$ emission factors for paved roads derived from the AP-42 equation are presented in Table 5.5–3. Applying the emission factors in Table 5.5–3 to the VMTs in Table 5.2–2 and converting to pounds per day produces the 2008 uncontrolled particulate emissions from paved roads for the PM_{10} NAA and Maricopa County, shown in Table 5.5–4. These uncontrolled emissions do not include the 2008 emission reductions attributed to the committed measures in the MAG 2007 Five Percent Plan.

3. Precipitation data for 2008 were obtained from National Oceanic and Atmospheric Administration (NOAA) in the form of local climatological data at Phoenix Sky Harbor Airport.

Table 5.5–3. Fugitive dust emission factors for paved roads.

	Emission factors (g/mi)	
Silt Loading Category	**PM_{10}**	**$PM_{2.5}$**
Freeways	0.18	0.00
High-Traffic Arterials	0.65	0.00
Low-Traffic Arterials	1.69	0.13

Table 5.5–4. Daily uncontrolled fugitive dust emissions from paved roads.

	PM_{10} NAA (lbs/day)		Maricopa County (lbs/day)	
Silt Loading Category	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Freeways	12,236.3	0.0	12,907.5	0.0
High-Traffic Arterials	60,900.0	0.0	62,459.1	0.0
Low-Traffic Arterials	51,486.9	3,960.5	56,422.2	4,340.2
Totals:	**124,623.3**	**3,960.5**	**131,788.8**	**4,340.2**

The MAG 2007 Five Percent Plan contains a number of committed measures that reduce paved road fugitive dust emissions in the PM_{10} NAA. Five committed measures that reduce paved road particulate emissions were quantified in the MAG 2007 Five Percent Plan. Table 5.5–5 shows the emission reductions attributed to these committed measures based on their implementation status in 2008. In addition, Table 5.5–5 includes emission reduction credit for 97 PM_{10} certified street sweepers purchased by December 31, 2007 with FY 2001-2006 MAG Congestion Mitigation and Air Quality Improvement (CMAQ) funds. Reductions for the sweepers that were purchased with FY 2001-2006 CMAQ funds were also applied to base case uncontrolled paved road emissions in the MAG 2007 Five Percent Plan.

Table 5.5–5. 2008 benefits of measures that reduce paved road fugitive dust in the PM_{10} NAA.

	PM_{10} emission reduction	
Committed Measures in the MAG 2007 Five Percent Plan	**Annual (tons/yr)**	**Average daily (lbs/day)[4]**
1. Public education and outreach program (Measure 1)[5]	19.80	108.2
2. Reduce trackout onto paved roads (Measures 14/15/17)	1,487.0	8,125.7
3. Sweep streets with PM_{10}-certified sweepers (Measure 24)	427.9	2,338.1
4. Pave or stabilize existing unpaved shoulders (Measure 28)	598.1	3,268.2
5. Additional $5M in FY07 MAG TIP for paving roads/shoulders (Measure 43)[6]	21.0	115.0
97 PM_{10}-certified sweepers purchased with FY 2001-2006 CMAQ funds:	3,007.1	16,432.4
Total 2008 PM_{10} emission reductions for paved roads:	**5,560.9**	**30,387.6**

The emission benefits in Table 5.5-5 were subtracted from the uncontrolled PM_{10} emissions in Table 5.5-4. The total 2008 PM_{10} emission reduction of 30,387.6 pounds per day in the PM_{10} NAA represents 24.4 percent of the uncontrolled PM_{10} emissions of 124,623.3 pounds per day. This percent reduction was applied to the uncontrolled $PM_{2.5}$ emissions in the PM_{10} NAA; then the absolute reduction in $PM_{2.5}$ emissions due to the control measures was applied to the uncontrolled $PM_{2.5}$ emissions in Maricopa County. The controlled emissions in tons per year and pounds per day are shown in Table 5.5-6.

4. 366 days were used to convert tons per year to pounds per day in 2008.
5. Measure benefit reflects a 0.1% reduction in 2008 uncontrolled paved road emissions in the MAG 2007 Five Percent Plan.
6. Measure benefit includes only the projects that paved unpaved shoulders in 2008.

Table 5.5–6. Annual controlled fugitive dust emissions from paved roads.

	Annual emissions (tons/year)		Average daily emissions (lbs/day)	
Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
PM_{10} NAA	17,245.1	547.9	94,235.7	2,994.2
Maricopa County	18,556.4	617.4	101,401.2	3,373.8

5.5.2.2 Unpaved road and alley fugitive dust emissions

AP-42 emission factors were applied to unpaved road and alley VMTs to estimate fugitive dust emissions (US EPA, 2006). The unpaved road particulate emission factors were derived from the following AP-42 equation for publicly accessible unpaved roads, assuming a silt content of 11.9%, a soil moisture content of 0.5%, and an average speed of 25 miles per hour:

$$E = \left[\frac{k\left(\frac{s}{12}\right)^{1}\left(\frac{S}{30}\right)^{0.5}}{\left(\frac{M}{0.5}\right)^{0.2}} - C\right]\left(1 - \frac{P}{N}\right)$$

where:

E = annual average particulate emission factor extrapolated for natural mitigation (lb/mile),

k = particle size multiplier for particle size range (1.8 lb/mile for PM_{10} and 0.18 lb/mile for $PM_{2.5}$),

s = surface material silt content (11.9%),

S = mean vehicle speed (25 mph),

M = surface material moisture content (0.5%),

C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear (0.00047 lb/mile for PM_{10} and 0.00036 lb/mile for $PM_{2.5}$),

P = annual number of "wet" days with at least 0.254 mm (0.01 in) of precipitation (39 days in 2008), and

N = number of days/year (366 days in 2008).

The unpaved road emission factors resulting from the above equation are 1.4554 pounds per mile for PM_{10} and 0.1453 pounds per mile for $PM_{2.5}$. The same equation was applied to estimate unpaved alley emission factors, substituting a mean vehicle speed of 10 mph. The resultant unpaved alley emission factors are 0.9203 pounds per mile for PM_{10} and 0.0918 pounds per mile for $PM_{2.5}$. Multiplying these emission factors by the VMTs in Table 5.2–3 results in the uncontrolled emissions shown in Table 5.5–7. These uncontrolled emissions do not include the 2008 emission reductions attributed to the committed measures in the MAG 2007 Five Percent Plan for PM_{10}.

Table 5.5–7. Daily uncontrolled unpaved road and alley fugitive dust emissions.

	PM_{10} (lbs/day)		$PM_{2.5}$ (lbs/day)	
Area	**Unpaved Roads**	**Unpaved Alleys**	**Unpaved Roads**	**Unpaved Alleys**
PM_{10} NAA	69,835.9	5,443.6	6,972.1	543.0
Maricopa County	73,117.8	5,699.4	7,299.7	568.5

The MAG 2007 Five Percent Plan contains a number of committed measures that reduce unpaved road and alley fugitive dust emissions in the PM_{10} NAA (MAG, 2007). Four committed measures that reduce unpaved road and alley PM_{10} emissions were quantified in the MAG 2007 Five Percent Plan. The 2008 emission reductions attributed to these measures are shown in Table 5.5–8.

Table 5.5–8. 2008 benefits of measures that reduce unpaved road and alley fugitive dust in the PM_{10} NAA.

	PM_{10} emission reductions	
Committed Measures in the MAG 2007 Five Percent Plan	**Annual (tons/yr)**	**Average daily (lbs/day)[7]**
1. Public education and outreach program (Measure 1)[8]	17.5	95.6
2. Pave or stabilize existing public dirt roads and alleys (Measure 26)	1,488.0	8,131.2
3. Limit speeds to 15 mph on high-traffic dirt roads (Measure 27)	390.4	2,133.4
4. Additional $5M in FY07 MAG TIP for paving roads/shoulders (Measure 43)[9]	169.5	926.2
Total 2008 PM_{10} emission reductions for unpaved roads:	**2,065.4**	**11,286.4**

The reductions in Table 5.5-8 were subtracted from the uncontrolled PM_{10} emissions in Table 5.5-7. The total 2008 PM_{10} emission reduction of 11,286.4 pounds per day represents 15.0 percent of the total uncontrolled unpaved road and alley PM_{10} emissions of 75,279.5 pounds per day in the PM_{10} NAA. This percent reduction was applied to the uncontrolled $PM_{2.5}$ emissions in the PM_{10} NAA; then the absolute reduction in $PM_{2.5}$ emissions due to the control measures was applied to the uncontrolled $PM_{2.5}$ emissions in Maricopa County. The controlled emissions in tons per year and pounds per day are shown in Table 5.5-9.

Table 5.5–9. Annual and average daily controlled fugitive dust emissions from unpaved roads.

	Annual emissions (tons/year)		Average daily emissions (lbs/day)	
Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
PM_{10} NAA	11,710.70	1,169.00	63,993.1	6,387.8
Maricopa County	12,358.20	1,233.60	67,530.9	6,741.0

7. 366 days were used to convert tons per year to pounds per day in 2008.
8. Measure benefit reflects a 0.1% reduction in 2008 uncontrolled paved road emissions in the MAG 2007 Five Percent Plan.
9. Measure benefit includes only the projects that paved unpaved roads in 2008.

5.6 Summary of particulate emissions from onroad mobile sources

Table 5.6–1 summarizes the annual emissions and the average daily emissions for PM_{10}, $PM_{2.5}$, NO_x, SO_x, and NH_3 from all onroad mobile sources in Maricopa County in 2008. Similar data for the PM_{10} NAA are presented in Table 5.6–2.

Table 5.6–1. Annual and average daily emissions from all onroad mobile sources in Maricopa County.

Emission	Annual emissions (tons/year)					Average daily emissions (lbs/day)				
Category	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Exhaust, tire wear, and brake wear	1,601.53	999.17	51,609.08	309.83	3,330.43	8,752.0	5,459.7	282,017.2	1,692.6	18,199.0
Paved road fugitive dust	18,556.4	617.4	—	—	—	101,401.2	3,373.8	—	—	—
Unpaved road and alley fugitive dust	12,358.2	1,233.6	—	—	—	67,530.9	6,741.0	—	—	—
Totals:	**32,516.13**	**2,850.17**	**51,609.08**	**309.83**	**3,330.43**	**177,684.1**	**15,574.5**	**282,017.2**	**1,692.6**	**18,199.0**

Table 5.6–2. Annual and average daily emissions from all onroad mobile sources in the PM_{10} NAA.

Emission	Annual emissions (tons/year)					Average daily emissions (lbs/day)				
Category	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Exhaust, tire wear, and brake wear	1,529.54	954.23	49,142.49	295.90	3,180.66	8,357.7	5,213.8	268,538.4	1,616.4	17,380.4
Paved road fugitive dust	17,245.1	547.9	—	—	—	94,235.7	2,994.2	—	—	—
Unpaved road and alley fugitive dust	11,710.7	1,169.0	—	—	—	63,993.1	6,387.8	—	—	—
Totals:	**30,485.34**	**2,671.13**	**49,142.49**	**295.90**	**3,180.66**	**166,586.5**	**14,595.8**	**268,538.4**	**1,616.4**	**17,380.4**

5.7 Quality assurance process

5.7.1 VMT estimates

Normal quality assurance procedures, including automated and manual consistency checks, were conducted by MAG in developing the 2008 TransCAD traffic assignment network used to generate the VMT data. The VMT estimates using the MAG travel demand model have been validated against approximately 2,200 traffic counts collected in 2006–2008.

5.7.2 Emission factor estimates

The quality assurance process performed on the MOBILE6.2 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 changes were then rechecked by the reviewer.

5.7.3 Draft particulate matter emissions inventory

The draft onroad mobile source portion of the 2008 periodic ozone precursor emissions inventory 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.

5.8 References

MAG, 2007. MAG 2007 Five Percent Plan for PM_{10} for the Maricopa County Nonattainment Area, December 2007.

MAG, 2009. MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa Nonattainment Area, February 2009.

MAG, 2010. *VMT Estimation for the 2009 MAG Unpaved Road Inventory*. Memorandum prepared by Cathy Arthur, MAG Air Quality Policy Manager. January 26, 2010.

US EPA, 1991. Emission Inventory Requirements for Ozone State Implementation Plans, EPA-450/4-91-010, March 1991.

US EPA, 1992a. Procedures for Emission Inventory Preparation Volume IV: Mobile Sources, EPA-450/4-81-026d (Revised), 1992.

US EPA, 1992b. Quality Review Guidelines for 1990 Base Year Emission Inventories, EPA-454/R-92-007, July 1992.

US EPA, 2002. Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation, January 2002.

US EPA, 2003. User's Guide to MOBILE6.1 and MOBILE6.2 (Mobile Source Emission Factor Model), EPA420-R-03-010, August 2003.

US EPA, 2006. Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Vol. I: Stationary, Point and Area Sources. Section 13.2.1: Paved Roads and Section 13.2.2: Unpaved Roads. November 2006 (http://www.epa.gov/ttn/chief/ap42/ch13/index.html).

6. Biogenic Sources

6.1 Introduction

Biogenic emissions have been estimated for the 2008 Periodic Emissions Inventory for particulate matter in Maricopa County (9,223 square miles) and the PM_{10} Nonattainment Area (NAA) (2,887 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 MEGAN2.04 (Guenther, 2007) compared to previous versions (Guenther, 2006, 2006a and 2006b). MEGAN2.04 was applied to compute biogenic emissions in Maricopa County and the PM_{10} NAA. Among the chemical species included in MEGAN, only nitric oxide (NO) is attributable to particulate matter formation. Therefore, only NO_x emissions are included in the 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 2008 Periodic Emission Inventory for particulate matter, the 4-km and 12-km modeling domains developed for the MAG eight-hour ozone plans for the Maricopa Nonattainment Area (MAG, 2007 and 2009), were employed for the PM_{10} NAA and Maricopa County, respectively. The definitions of these two domains in the Universal Transverse Mercator (UTM) coordinate system are presented in Table 6.2–1. Since MEGAN estimates biogenic emissions for entire modeling domains rather than specific areas, additional input files, masking areas covered by the PM_{10} NAA 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 PM_{10} NAA and Maricopa County were extracted from MEGAN runs for the masked grid cells in the 4-km and 12-km modeling domains, respectively.

Table 6.2–1. Two modeling domains defined in the UTM coordinate system.

Grid Horizontal Resolution	Grid Size	Domain Range (km)	Target Area
4-km	50 × 29	(297,3652) to (497,3768)	PM_{10} NAA
12-km	111 × 84	(-275, 3188) to (1057,4196)	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, and monthly average leaf index (LAI) for 12 months for 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.

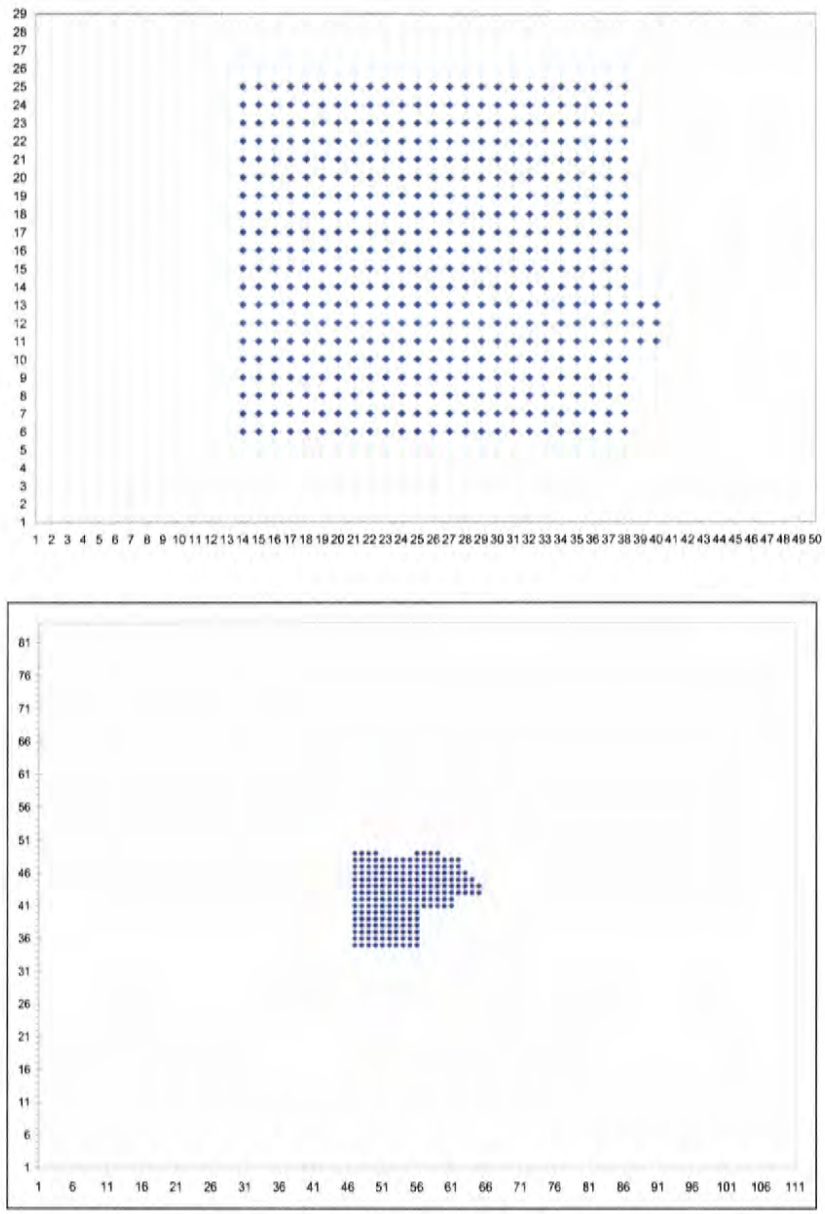

Figure 6.3–1. Mask of the PM_{10} NAA in the 4-km modeling domain (top) and mask of Maricopa County in the 12-km modeling domain (bottom).

6.3.1 Land cover data

The land cover data, including the monthly LAI, 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 a base resolution of 30 seconds latitude by 30 seconds longitude (~1×km^2) in ArcGIS format (http://acd.ucar.edu/~guenther/MEGAN/MEGAN.htm). For the MEGAN runs, however, the default land cover data during the summer season (June to August) were replaced by local datasets, which were developed by a field study conducted by Dr. Guenther in June 2006 (ENVIRON, 2006). The substitution was made because the default database systematically underestimated the LAIs in Maricopa County.

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 which is located in northern Phoenix (33.83° N, 112.17° W, denoted by red star in Figure 6.3–2), and is operated by the Phoenix Federal Correction Institution (PFCI). 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 2008, and a netCDF file representing 24-hour data for each month was prepared for MEGAN inputs.

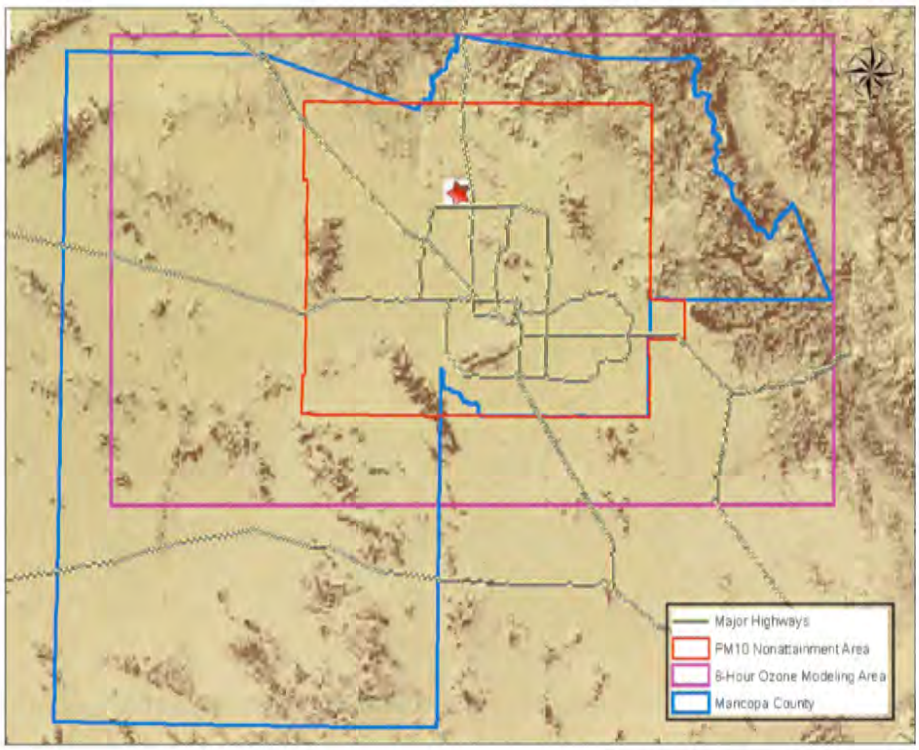

Figure 6.3–2. Boundaries of the PM_{10} NAA (red line), the 4-km eight-hour ozone modeling domain (pink line), Maricopa County (blue line), and the meteorological observation site (red star).

Biogenic NO is mainly emitted from wetted soil. The emission rate is dependent not only upon temperature and downward short wave radiation but also on soil moisture. Due to dry conditions year round in Maricopa County, the NO flux from the surface is very low compared to other states with higher precipitation. Only moisture delivery by Arizona monsoons leads to precipitation during the summer. This precipitation, in turn, increases soil moisture and humidity. According to weather records at the Phoenix Sky Harbor International Airport, the precipitation

in the Phoenix area was 0.0 and 2.15 inches in June and July 2008, respectively. Therefore, maximum monthly NO emissions occurred in July 2008. In general, however, NO emissions in the Maricopa County area are temperature and radiation dominated during the year. Figure 6.3–3 shows annual mean diurnal cycles of temperature and radiation. The peak temperature around 4:00-5:00 pm lags 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 hourly emission rates take place in the afternoon because the emission rates are positively related to both temperature and short wave radiation (Guenther, 2006).

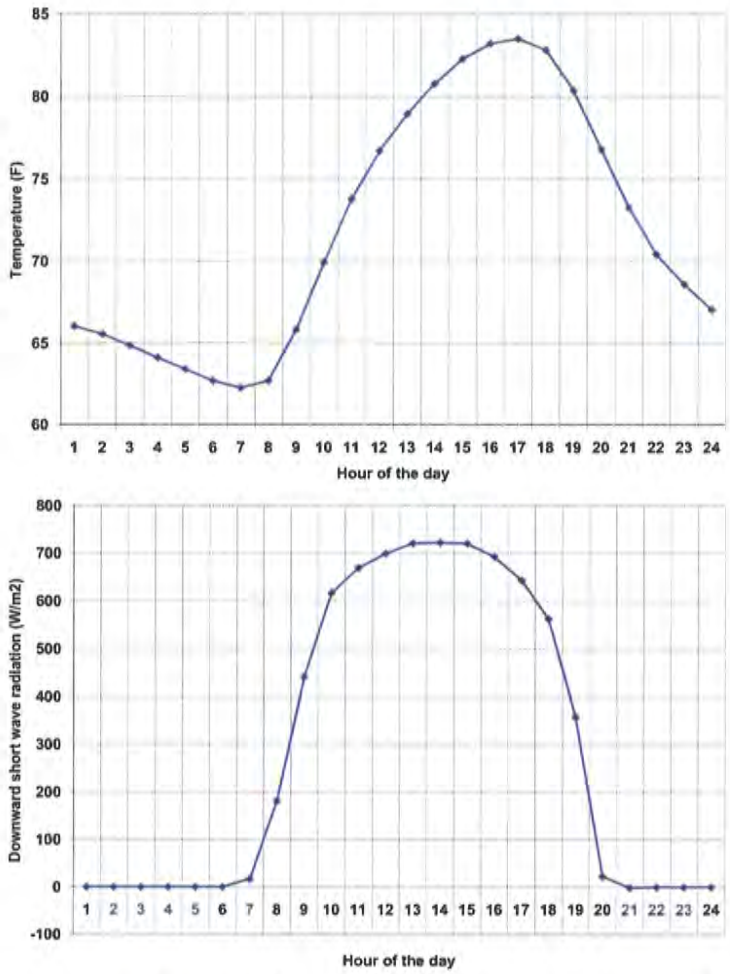

Figure 6.3–3. Annual mean diurnal cycles of measured temperature (top panel) and downward short wave radiation (bottom panel) in 2008.

6.4 Emissions estimation

MEGAN runs for the two modeling domains provide hourly emission outputs for the year 2008. Daily mean emissions for each month in 2008 were 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 of 2008 are shown in Table 6.4–1.

Table 6.4–1. Daily mean biogenic emissions of NO_x in the PM_{10} NAA and Maricopa County, by month.

	PM_{10} NAA		Maricopa County	
Month	**kg/day**	**lbs/day**	**kg/day**	**lbs/day**
January	127.2	280.4	355.2	783.1
February	168.0	370.4	480.9	1,060.2
March	413.3	911.2	1,131.0	2,493.4
April	601.7	1,326.5	1,658.8	3,657.0
May	721.0	1,589.5	1,923.1	4,239.7
June	1,818.8	4,009.8	4,729.4	10,426.5
July	1,878.7	4,141.8	4,930.0	10,868.8
August	1,702.0	3,752.3	4,485.1	9,888.0
September	1,331.9	2,936.3	3,784.7	8,343.8
October	651.1	1,435.4	1,839.9	4,056.3
November	328.5	724.2	910.8	2,008.0
December	138.6	305.6	388.0	855.4

Monthly mean emissions for Maricopa County and the PM_{10} NAA are illustrated in Figure 6.4–1. Monthly emission values are presented in Table 6.4–2. It can be seen that the monthly NO_x emissions reached the highest values in July. This is because biogenic emissions of nitric oxide (NO) are mainly from wetted soil. Thus, the NO emission rate depends not only on temperature and radiation, but also on soil moisture, which is related to precipitation. As discussed in Section 6.3, there were 2.15 inches of precipitation in July, but no precipitation in June, 2008. There is also one more day in July than June; therefore, the total NO_x monthly emissions in July are higher than in June.

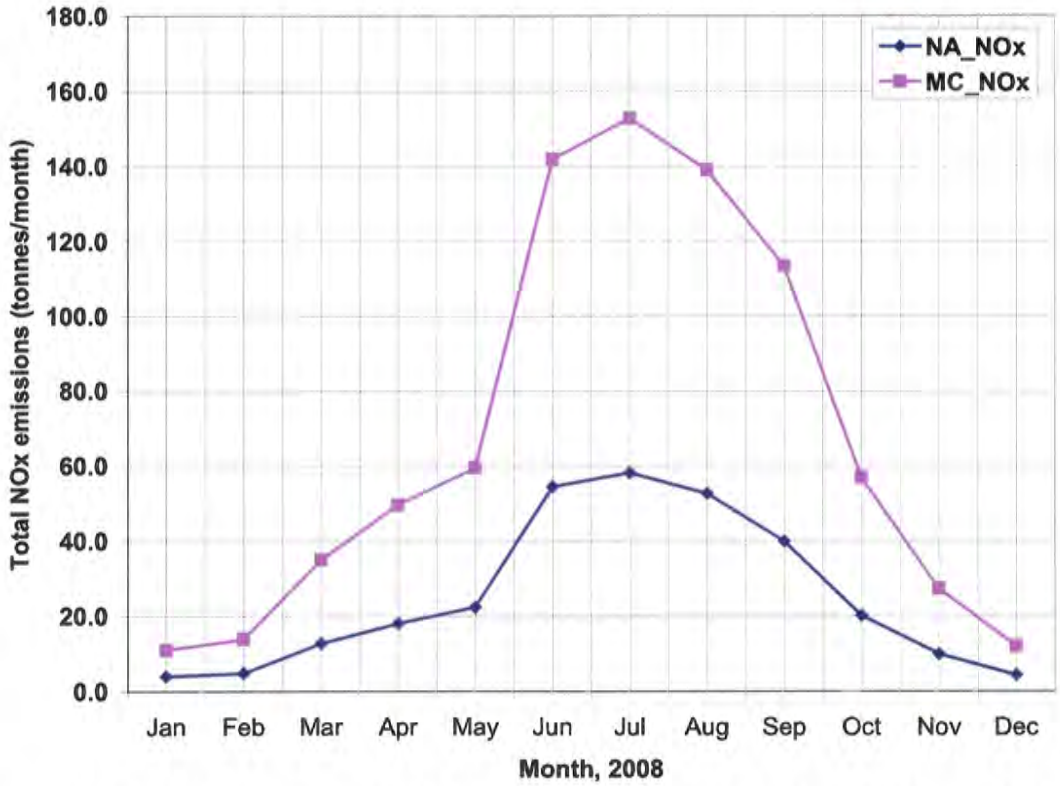

Figure 6.4–1. Monthly emissions of NO_x in Maricopa County (pink solid line, abbreviated as "MC") and the PM_{10} NAA (blue solid line, abbreviated as "NA").

Table 6.4–2. Monthly biogenic emissions of NO_x in the PM_{10} NAA and Maricopa County.

	PM_{10} NAA		Maricopa County	
Month	**Metric tons/mo**	**Tons/mo**	**Metric tons/mo**	**Tons/mo**
January	3.94	4.35	11.01	12.14
February	4.87	5.37	13.95	15.37
March	12.81	14.12	35.06	38.65
April	18.05	19.90	49.76	54.85
May	22.35	24.64	59.62	65.72
June	54.56	60.15	141.88	156.40
July	58.24	64.20	152.83	168.46
August	52.76	58.16	139.04	153.27
September	39.96	44.05	113.54	125.16
October	20.18	22.26	57.04	62.87
November	9.86	10.86	27.32	30.12
December	4.30	4.74	12.03	13.26
Totals:	**301.88**	**332.77**	**813.08**	**896.27**

6.5 Summary of biogenic source emissions

Daily mean and annual total biogenic NO_x emissions for Maricopa County and the PM_{10} NAA in 2008 are summarized in Table 6.5–1. 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 2008 data shown in Table 6.5–1 represent a substantial improvement over previous biogenic emission estimates for Maricopa County and the PM_{10} NAA.

Table 6.5–1. Daily mean and annual total NO_x emissions from biogenic sources.

	Daily mean		Annual total	
Geographic Area	**kg/day**	**lbs/day**	**Metric tons/yr**	**Tons/yr**
Maricopa County	2,218.1	4,890.0	813.08	896.27
PM_{10} NAA	823.4	1,815.3	301.88	332.77

6.6 References

ENVIRON International Corp., 2006. Final Report, Maricopa Association of Governments 2006 Biogenics Study.

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.

Guenther, A., 2006a. User's Guide to Processing Driving Variables for Model of Emissions of Gases and Aerosols from Nature (MEGAN).

Guenther, A., 2006b. User's Guide to the Model of Emissions of Gases and Aerosols from Nature (MEGAN) Version MEGAN-VBA-2.0.

Guenther, 2007. Corrigendum to "Estimates of global terrestrial isoprene emissions using MEGAN (Model of Emissions of Gases and Aerosols from Nature)" *Atmos. Chem. Phys.*, 6, 3181–3210, 2006, *Atmos. Chem. Phys.*, 7, p. 4327.

MAG, 2007. Eight-Hour Ozone Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments, Phoenix AZ

MAG, 2009. MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa Nonattainment Area. Maricopa Association of Governments, Phoenix AZ.

Maricopa County Air Quality Department

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FOR IMMEDIATE RELEASE

Emissions Inventory Public Review Draft Released

Document details sources of air pollution emissions within Maricopa County; public workshop to be held May 14

The Maricopa County Air Quality Department announced today the release of its draft 2008 Periodic Emissions Inventory for PM_{10} for the Maricopa County PM_{10} Nonattainment Area. The document is now available for an informal 30-day public review period. The PM_{10} emissions inventory includes emissions estimates for PM_{10} and $PM_{2.5}$ as well as three particulate matter precursors: nitrogen oxides (NO_x), sulfur oxides (SO_x) and ammonia (NH_3).

The inventory provides emission estimates from point, area, nonroad mobile, onroad mobile and biogenic sources. The report is divided into six chapters, as follows:

Chapter 1: Introduction
Chapter 2: (Stationary) point sources (large manufacturing facilities, power plants)
Chapter 3: Area (non-point) sources (widespread, similar sources, such as fuel combustion, fires, etc.)
Chapter 4: Nonroad mobile sources (aircraft, locomotives, lawn movers, tractors, etc.)
Chapter 5: Onroad mobile sources (cars, trucks, other vehicles)
Chapter 6: Biogenic sources (crops, indigenous vegetation, landscaping, etc.)

The latter two chapters were prepared by the Maricopa Association of Governments (MAG).

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 Air Quality Department will hold a public workshop to discuss the draft 2008 Periodic Emissions Inventory for PM_{10}. The workshop will be held at 9 AM at the department's offices at 1001 N. Central Ave., Suite 560, on Friday, May 14, 2010.

(continued on next page)

The department is also accepting written comments on the draft inventory through Wednesday, May 26, 2010, 5:00 PM. Comments may be submitted to:

Maricopa County Air Quality Department
Emissions Inventory Unit
1001 N. Central Avenue, Suite 595
Phoenix, AZ 85004
E-mail: EmisInv@mail.maricopa.gov

Questions may be addressed to Bob Downing at bdowning@mail.maricopa.gov.

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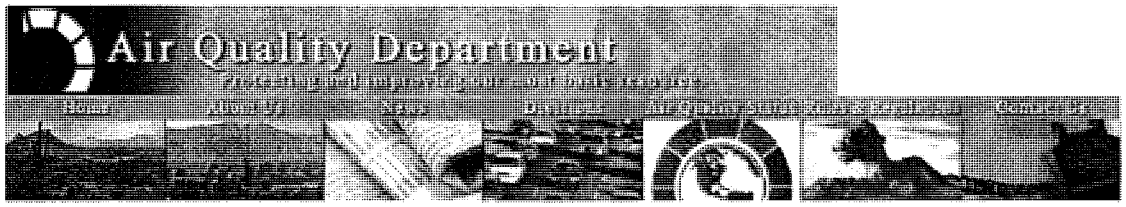
About Maricopa County Air Quality Department

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.



CLEAN AIR MAKE MORE

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16	17	18	19	20	21	22
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Calendar

Emissions Inventory Public Review Draft Workshop

Air Quality

Public Review 30-day Period Now Open

The Maricopa County Air Quality Department announces the release of its draft 2008 Periodic Emissions Inventory for PM10 for the Maricopa County PM10 Nonattainment Area. The document is now available for an informal 30-day public review period.

The PM10 emissions inventory includes emissions estimates for PM10 and PM2.5 as well as three particulate matter precursors: nitrogen oxides (NOx), sulfur oxides (SOx) and ammonia (NH3). 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 Air Quality Department will hold a public workshop to discuss the draft 2008 Periodic Emissions Inventory for PM10. The workshop will be held at 9 AM at the department's offices at 1001 N. Central Ave., Suite 560, on Friday, May 14, 2010. (continued on next page) The department is also accepting written comments on the draft inventory through Wednesday, May 26, 2010, 5:00 PM. Comments may be submitted to: Maricopa County Air Quality Department Emissions Inventory Unit 1001 N. Central Avenue, Suite 595 Phoenix, AZ 85004 E-mail: EmisInv@mail.maricopa.gov Questions may be addressed to Bob Downing at bdowning@mail.maricopa.gov.

Date: 5/14/2010
Time: 9:00 AM
Registration Required: No
Fee: None

More Info: http://www.maricopa.gov/pr_detail.aspx?releaseID=1424
Contact: Bob Downing
bdowning@mail.maricopa.gov
Location: Maricopa County Air Quality Department

Address:
1001 North Central Ave, suite 595
Phoenix, AZ 85004

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Maricopa County
Air Quality Department

INSTRUCTIONS

FOR REPORTING 2008

ANNUAL AIR POLLUTION EMISSIONS

January 2009

Emissions Inventory Unit
1001 North Central Avenue, Suite 595
Phoenix, Arizona 85004
(602) 506-6790
(602) 506-6179 (Fax)

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 2008?

Reporting forms:

- 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 use 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 that your reporting forms match the preprinted forms.**

Miscellaneous:

- **If this is the first emissions inventory for your permit and your business did not operate in 2008, you must still submit a completed Business Form and a signed Data Certification Form stating that there were no operations at your facility during 2008.**

- In accordance with Maricopa County Air Pollution Control Rule 280 (Fees), the 2008 annual emission fee for Title V sources only is $38.25/ton. **NOTE:** Only 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 2008 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:

MCAQD One Stop Shop
Emissions Inventory Intake
501 N. 44th St. Suite 200
Phoenix AZ 85008-6538

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 One Stop Shop at (602) 506-6464 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 visit our web site at:
http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx
or call (602) 506-6790.

- 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: Indicating a change in ownership or business location on the Business Form will ***not*** serve to transfer the permit ownership or location. You must contact the MCAQD One Stop Shop at (602) 506-6464 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.

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: N33.5276 Long: W112.2626
2	V	14 ft	200 °F		19,186	40			thermal oxidizer, Bldg. 2 Lat:N33.5259 Long:W112.2611

* 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 2008. 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 2008.

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 **2008**

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 **2008**

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		70	6	7200 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 2008. 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 2008

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	paint thinner	707	gl	VOC	7.0	gal		%		%		4,949
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 2008

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 2008

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 2008? 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	2008 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 2008

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 2008 Annual Emissions:	(1) Totals from Process Forms	(2) + Accidental Releases	(3) = TOTAL 2008 Emissions
CO	2,113	0	2,113
NH_x	0	0	0
Lead	0	0	0
HAP&NON	0	0	0
VOC	24,220	0	24,220
NO_x	9,815	0	9,815
SO_x	645	0	645
PM_{10}	7,891	0	7,891

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 Department, One Stop Shop, Emissions Inventory Intake, 501 N. 44th Street, Suite 200, Phoenix, AZ 85008-6538. 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 **$38.25**, and enter the result on line 8. This is your 2008 emission fee.

EXAMPLE (for Title V sources only)

Data Certification/Fee Calculation Form 2008

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 2008 Annual Emissions:		(1) Totals from Process Forms	(2) + Accidental Releases	(3) = TOTAL 2008 Emissions
	CO	2,113	0	2,113
	NH_x	0	0	0
	Lead	0	0	0
	PM_{10} (non-billable; see page 22)	7,200	0	7,200
Emissions fees are based on your emissions of the following pollutants ONLY:				
1	HAP&NON	0	0	0
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:**			35,371 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 **$ 38.25**. This is your **2008 ANNUAL EMISSION FEE.**			$ 688.50

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, One Stop Shop, Emissions Inventory Intake, 501 N. 44th Street, Suite 200, Phoenix, AZ 85008-6538. 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

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Appendix 3. Rule Effectiveness (RE) Studies

Executive Summary

Rule effectiveness (RE) studies are methods 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. Rule effectiveness studies adjust the emissions from subject facilities and source categories to account for times of non-compliance and control device equipment failure. Of particular importance to Maricopa County are those rules that control particulate matter release and ozone formation, since parts of the county have been designated as nonattainment areas in regards to US EPA PM_{10} and 8-hour ozone standards. Consequently, the rule effectiveness studies presented here deal with the control of criteria pollutants PM_{10}, $PM_{2.5}$, and the precursors to ozone formation (VOC, NO_x and CO).

In general, rule effectiveness studies incorporate compliance history at regulated facilities and sources, along with agency programs and policies (i.e., inspection frequencies, enforcement penalties, public outreach efforts, etc.), to ascribe a percentage rate (RE rate) at which the subject rule(s) attains the intended emissions reductions. For these studies, data from inspections conducted from July 2008 through June 2009 was used to determine the rate of compliance of subject facilities and source categories with the rules. The resulting compliance rate was then combined with data on the effectiveness of Maricopa County Air Quality Department (MCAQD) programs and policies to derive a final rule effectiveness rate, which has then been used to adjust the emissions inventory estimates.

Both source-specific and multi-source rule effectiveness studies were undertaken as part of this project. Source-specific studies address Rule 310 (fugitive dust from dust-generating operations), Rule 310.01 (fugitive dust from non-traditional sources of fugitive dust), Rule 316 (nonmetallic mineral processing), and agricultural activities (best management practices). For all other regulated processes that control particulates and the formation of ozone, multi-source RE rates were calculated separately for Title V and non-Title V permitted facilities. Final compliance rates and RE rates are listed in Table A3–1 below.

Table A3–1. Compliance and rule effectiveness rates, by rule or source category.

Rule/Source Category	Compliance Rate	Rule Effectiveness (RE) Rate
Rule 310	87.01%	82.99%
Rule 310.01	95.15%	80.87%
Rule 316	35.29%	49.62%
Agricultural Activities	Unknown	55.33%
Title V Facilities	89.14% *	90.94%
Non-Title V Facilities	81.00% *	84.27%

** Compliance rates for both Title V and Non-Title V facilities are based upon 2008-2009 inspection data, and reflect compliance self-monitoring recordkeeping practice, in addition to violation data.*

The resulting RE rates shown above have been applied to relevant point and area source inventory categories and are reflected in the emission estimates presented in applicable sections of Chapters 2 and 3.

Background

The US EPA has provided a number of guidance documents that detail the use and formulation of rule effectiveness studies (US EPA, 2005; 1994; 1992). The most recent of these documents states, "First and foremost, an agency responsible for emissions inventory preparation should attempt to obtain facility specific data from as many sources as possible, and use the collected information to make a refined source or source category RE determination" (US EPA, 2005). Given this directive, MCAQD developed a rule effectiveness study methodology that utilizes all available compliance and department programmatic data to produce a RE rate that best reflects the field effectiveness of the rule. By using the entire population of data for the prescribed time period, (July 2008 – June 2009) the statistical validity of the RE rate greatly improves. This approach deviates from previous rule effectiveness studies conducted by MCAQD that were based upon a small sample pool of targeted inspections (MCAQD, 2007).

The RE rates presented here are developed from statistical examination of recorded inspection data, supplemented with data on department programs and policies that impact the enforcement and creation of the rules under study. Assessment of inspection records provides the major component of the RE rate known as a compliance rate. This is the rate at which inspection staff is observing facility and source category compliance in the field. While this provides the most direct measure of rule effectiveness, it is still an incomplete picture of overall rule effectiveness.

In actuality, the observed compliance rate is 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 with a compliance rate that has a high statistical measure of accuracy, it fails 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. MCAQD used these suggested factors as the base structure for creating the RE matrices contained in Appendices 3A through 3F.

In brief, the compliance rate developed from inspection data (labeled "Compliance History" in the matrix) accounts for 70% of the overall RE rate, while all other factors account for the remaining 30%. (An exception to these values applies in the case of agricultural activities.) 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 rule or source category for which rule effectiveness was addressed, are contained in Appendices 3A through 3F.

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 after 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 hindrance to the application of a blanket RE percentage rate occurs when the control device efficiency reported is high. Control device efficiencies are routinely reported 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, MCAQD evaluated the affected processes on a case-by-case basis to determine the appropriateness of applying an RE adjustment.

A total of six distinct rule effectiveness rates were calculated for use in this emissions inventory: four source-specific rule effectiveness determinations (Rule 310, Rule 310.01, Rule 316 and agricultural activities) along with two multi-rule determinations (Title V and non-Title V permitted facilities). The following sections describe in further detail the data and methods used in the development of each of these RE factors.

Calculation of Rule Effectiveness (RE) Rates

A. Rule 310 RE Rate:

Sources subject to MCAQD Rule 310 (Fugitive Dust from Dust-Generating Operations) are most often those construction sites where the disturbance of earth is occurring. The RE rate for Rule 310 sources is developed as a weighted average between the observed compliance rate of permitted sites and the effectiveness of department programs and policies related to Rule 310 implementation. The complete RE matrix for Rule 310 is shown in Appendix 3A.

The compliance rate for Rule 310 sources uses inspection data of issued dust permits between July 2008 and June 2009. Only inspections that result in a finding of compliance or non-compliance (i.e., "in violation") are considered in the compliance rate. Inspections conducted solely to confirm the closing of a permit, or inspections where a compliance determination could not be made, were not including in the development of the compliance rate. Using these criteria, a total of 12,290 inspections were conducted on 5,458 issued permits, out of a possible pool of 7,974 issued permits. Dust Control Permits are only valid for 12 months, and expire on the anniversary of their issue date; for instance a permit issued on July 22, 2007 expired on July 22, 2008. This permit would therefore only have "operated" 22 days in the inspection period on which this compliance data is based. Some issued permits also experience limited operations, perhaps only a month or two, but in most cases these permits are left open by the permit holder for the entire 12 months. Given these realities, it is not unexpected that 2,516 out of the pool of 7,974 permits received no compliance determination inspection during the 12-month period of July 2008–June 2009. Conversely, over 58% of all issued permits were inspected two or more times, with some sites receiving as many as 13 compliance determination inspections during the time period.

Of the inspected sources listed above, individual compliance rates are determined on a permit by permit basis. Any permit that received at least one violation during any conducted inspection in July 2008 through June 2009 received a compliance rate of 0%. Permitted sites that had no recorded violations during the study period received a compliance rate of 100%. Of the violations noted, 42% of the violations were emissions-related (track-out, visible emissions, silt content, etc.), with the remaining 58% of the violations being procedural (recordkeeping, inadequate dust control plan, etc.). The permit-specific compliance rates were summed and averaged to produce an overall grouped compliance rate of 87.01%. Applying this 87.01% compliance rate into the matrix shown in Appendix 3A yields an overall RE rate of 82.99% for this category of sources.

B. Rule 310.01 RE Rate:

The majority of sources subject to Rule 310.01 (Fugitive Dust from Non-Traditional Sources of Fugitive Dust) are vacant lots. It is estimated that there are presently more than 100,000 vacant lots in Maricopa County. Rule 310.01 sources generally do not require a permit, unlike Rule 310 and Rule 316 sources. The RE rate for Rule 310.01 sources is calculated based upon vacant lot inspection compliance rates, as well as the effectiveness of department policies and programs that address Rule 310.01 implementation. The complete matrix for Rule 310.01 is contained in Appendix 3B.

During the study period (July 2008 – June 2009), MCAQD inspectors performed a total of 12,370 inspections of vacant lots in Maricopa County. The primary purpose of a Rule 310.01 inspection is to verify whether or not the vacant lot in question has a stabilized surface. If the surface is determined to be stable (through a variety of tests), the lot is deemed to be in compliance. Conversely, if the lot's surface is deemed to be unstable, then a violation of Rule 310.01 has occurred. As with Rule 310, a compliance rate is determined individually for each vacant lot, and then summed and averaged to produce a group compliance rate. The overall compliance rate for Rule 310.01 sites is 95.15%. All the violations noted by inspectors were emissions-related violations, as all the violations are for unstable soil conditions. Factoring this compliance rate into the matrix shown in Appendix 3B, yield an overall RE rate for this category of sources of 80.87%.

C. Rule 316 RE Rate:

Facilities subject to Rule 316 (Nonmetallic Mineral Processing) include industries involved in the mining of sand and gravel and the production of concrete products. All Rule 316 sites are required to have either a Title V or non-Title V permit issued by MCAQD. At present, all facilities that are subject to Rule 316 have only non-Title V permits. (One class of sources that is an exception to this has long been made for portable sources that may operate in more than one county during the life of the permit; thus these sources are issued permits by the Arizona Department of Environmental Quality. The RE rate for Rule 316 sites is determined in a similar fashion as for Rules 310 and 310.01 – developing a weighted average between the observed compliance rate of permitted sites and the effectiveness of departmental programs and policies related to Rule 316 implementation. The completed matrix for Rule 316 is contained in Appendix 3C.

Inspection data for the period July 2008 through June 2009 reveal that there were 136 issued permits for Rule 316 facilities. All of these facilities were inspected at least once during this study period, with a compliance determination made for each facility. Overall, 525 inspections that resulted in a compliance determination were performed during the study period. As with Rules 310 and 310.01, a compliance rate is computed for each facility, and then summed and averaged for the group, resulting in an overall compliance rate of 35.29%. Of the violations noted, 44% were emissions-related, with the remaining 56% primarily procedural in nature. This compliance rate is factored into the RE matrix contained in Appendix 3C to yield an overall RE rate of 49.62%.

D. Agricultural Activities RE Rate:

Agricultural activities in most parts of Maricopa County are subject to the Best Management Practices program administered by the Arizona Department of Environmental Quality (ADEQ). This program is largely a self-monitoring program, in which participants indicate which management practices were chosen to be used during various operations (e.g., harvesting, tilling). No compliance rate estimates for this program were noted during the study period. ADEQ does indicate that after a site has been visited, 100% of the sources return to compliance. Since compliance with this program is verified only on a complaint-driven basis, the weight given to compliance history was lowered, from 70% to 25%, in the matrix contained in Appendix 3D, which indicates an overall RE rate of 55.30% for agricultural activities.

E. Title V and Non-Title V RE Rates:

For the remaining emission processes (not regulated by Rules 310, 310.01 and/or 316) that include a control device or technique that limits particulate matter or ozone formation, a separate multi-rule RE rate has been developed for permitted Title V and non-Title V facilities. Factor-based matrices similar to those developed for Rules 310, 310.01 and 316 have been utilized to develop RE rates for Title V and non-Title V facilities. Compliance rates for these sources is based upon two full years of data (2008 through 2009), 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 combination of monitoring data and inspection data comprise the 'compliance rate' section of the RE calculation matrix, and still account for 70% of the overall RE rate. The combined compliance rate for Title V facilities is 89.14% and 81.00% for non-Title V facilities. Appendices 3E and 3F indicate RE rates of 90.94% and 84.27% for Title V and non-Title V facilities, respectively.

References

MCAQD, 2007. 2005 Periodic Emissions Inventory for PM_{10} for the Maricopa County, Arizona, Nonattainment Area.

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.

APPENDIX 3A. Rule Effectiveness Matrix for Rule 310

A. Most important factor (1 criterion, assigned weighting of 70% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Compliance History	86%	100%	93%	Over 90% of facilities inspected in the source category are in compliance.			
	70%	85%	78%	Over 75% of facilities inspected in the source category are in compliance.	70%	87%	**60.91%**
		< 70%	35%	Over 60% of facilities inspected in the source category are in compliance.			

B. Other important factors (6 criteria, each assigned weighting of 4% of total):

Compliance Certifications	86%	100%	93%	Source is subject to some type of compliance certification.			
	70%	85%	78%	Source is subject to some type of compliance certification.			
		< 70%	35%	Source is not subject to any type of compliance certification.	4%	0%	**0.00%**
Type of Inspection	86%	100%	93%	Inspections are thorough and detailed, and include close examination of control equipment, and a detailed records review.			
	70%	85%	78%	Inspections consist of a records review, and sometimes inspection of control equipment.	4%	78%	**3.12%**
		< 70%	35%	Inspections generally consist of a records review only.			
Inspection Frequency/ Percentage	86%	100%	93%	Percent of facilities inspected in the sector in a given year is 25% or greater.	4%	93%	**3.72%**
	70%	85%	78%	Percent of facilities inspected in the sector in a given year is 15% or greater.			
		< 70%	35%	Percent of facilities inspected in the sector in a given year is less than 15%.			
Unannounced Inspections	86%	100%	93%	Unannounced inspections are sometimes done.	4%	93%	**3.72%**
	70%	85%	78%	Unannounced inspections are done, but infrequently.			
		< 70%	35%	Unannounced inspections are never done.			
Enforcement Penalties	86%	100%	93%	Agency takes prompt enforcement action, including monetary fines, against violators.			
	70%	85%	78%	Agency usually takes enforcement action, including monetary fines, against violators.	4%	78%	**3.12%**
		< 70%	35%	Agency usually does not take enforcement action against violators.			
Compliance Assistance	86%	100%	93%	A compliance assistance program exists and is adequately staffed, and includes such things as workshops, mailings, web-based tutorials, etc.			
	70%	85%	78%	A compliance assistance program exists and is minimally staffed. The program occasionally makes workshops, mailings, web-based tutorials, etc., available.	4%	78%	**3.12%**
		< 70%	35%	A compliance assistance program does not exist.			

C. Other factors (3 criteria, each assigned weighting of 2% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring Requirements	86%	100%	93%	Monitoring requirements exist and must be reported to regulatory agency at least once a year.			
	70%	85%	78%	Monitoring requirements exist but records don't have to be filed with regulatory agency.	2%	78%	**1.56%**
		< 70%	35%	Monitoring requirements do not exist.			
Follow-up Inspections	86%	100%	93%	Follow-up inspections are done when violations are noted most (>75%) of the time.	2%	93%	**1.86%**
	70%	85%	78%	Follow-up inspections are done when violations are noted some of the time.			
		< 70%	35%	Follow-up inspections are not routinely done.			
Media Publicity	86%	100%	93%	Media publicity of enforcement actions is routinely conducted.	2%	93%	**1.86%**
	70%	85%	78%	Media publicity of enforcement actions is sometimes done.			
		< 70%	35%	Media publicity of enforcement actions is rarely done.			

Overall rule effectiveness score for Rule 310 sites: **82.99%**

APPENDIX 3B. Rule Effectiveness Matrix for Rule 310.01

A. Most important factor (1 criterion, assigned weighting of 70% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Compliance History	86%	100%	93%	Over 90% of facilities inspected in the source category are in compliance.	70%	95%	**66.61%**
	70%	85%	78%	Over 75% of facilities inspected in the source category are in compliance.			
		< 70%	35%	Over 60% of facilities inspected in the source category are in compliance.			

B. Other important factors (6 criteria, each assigned weighting of 4% of total):

Compliance Certifications	86%	100%	93%	Source is subject to some type of compliance certification.			
	70%	85%	78%	Source is subject to some type of compliance certification.			
		< 70%	35%	Source is not subject to any type of compliance certification.	4%	0%	**0.00%**
Type of Inspection	86%	100%	93%	Inspections are thorough and detailed, and include close examination of control equipment, and a detailed records review.			
	70%	85%	78%	Inspections consist of a records review, and sometimes inspection of control equipment.	4%	78%	**3.12%**
		< 70%	35%	Inspections generally consist of a records review only.			
Inspection Frequency/ Percentage	86%	100%	93%	Percent of facilities inspected in the sector in a given year is 25% or greater.			
	70%	85%	78%	Percent of facilities inspected in the sector in a given year is 15% or greater.			
		< 70%	35%	Percent of facilities inspected in the sector in a given year is less than 15%.	4%	35%	**1.40%**
Unannounced Inspections	86%	100%	93%	Unannounced inspections are sometimes done.			
	70%	85%	78%	Unannounced inspections are done, but infrequently.	4%	78%	**3.12%**
		< 70%	35%	Unannounced inspections are never done.			
Enforcement Penalties	86%	100%	93%	Agency takes prompt enforcement action, including monetary fines, against violators.			
	70%	85%	78%	Agency usually takes enforcement action, including monetary fines, against violators.			
		< 70%	35%	Agency usually does not take enforcement action against violators.	4%	35%	**1.40%**
Compliance Assistance	86%	100%	93%	A compliance assistance program exists and is adequately staffed, and includes such things as workshops, mailings, web-based tutorials, etc.			
	70%	85%	78%	A compliance assistance program exists and is minimally staffed. The program occasionally makes workshops, mailings, web-based tutorials, etc., available.			
		< 70%	35%	A compliance assistance program does not exist.	4%	35%	**1.40%**

C. Other factors (3 criteria, each assigned weighting of 2% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring Requirements	86%	100%	93%	Monitoring requirements exist and must be reported to regulatory agency at least once a year.			
	70%	85%	78%	Monitoring requirements exist but records don't have to be filed with regulatory agency.	2%	78%	**1.56%**
		< 70%	35%	Monitoring requirements do not exist.			
Follow-up Inspections	86%	100%	93%	Follow-up inspections are done when violations are noted most (>75%) of the time.			
	70%	85%	78%	Follow-up inspections are done when violations are noted some of the time.	2%	78%	**1.56%**
		< 70%	35%	Follow-up inspections are not routinely done.			
Media Publicity	86%	100%	93%	Media publicity of enforcement actions is routinely conducted.			
	70%	85%	78%	Media publicity of enforcement actions is sometimes done.			
		< 70%	35%	Media publicity of enforcement actions is rarely done.	2%	35%	**0.70%**

Overall rule effectiveness score for Rule 310.01 sites: 80.87%

APPENDIX 3C. Rule Effectiveness Matrix for Rule 316

A. Most important factor (1 criterion, assigned weighting of 70% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Compliance History	86%	100%	93%	Over 90% of facilities inspected in the source category are in compliance			
	70%	85%	78%	Over 75% of facilities inspected in the source category are in compliance			
		< 70%	35%	Over 60% of facilities inspected in the source category are in compliance	70%	35%	**24.70%**

B. Other important factors (6 criteria, each assigned weighting of 4% of total):

Compliance Certifications	86%	100%	93%	Source is subject to some type of compliance certification;			
	70%	85%	78%	Source is subject to some type of compliance certification;	4%	78%	**3.12%**
		< 70%	35%	Source is not subject to any type of compliance certification;			
Type of Inspection	86%	100%	93%	Inspections are thorough and detailed, and include close examination of control equipment, and a detailed records review			
	70%	85%	78%	Inspections consist of a records review, and sometimes inspection of control equipment;	4%	78%	**3.12%**
		< 70%	35%	Inspections generally consist of a records review only;			
Inspection Frequency/ Percentage	86%	100%	93%	Percent of facilities inspected in the sector in a given year is 25% or greater;	4%	86%	**3.44%**
	70%	85%	78%	Percent of facilities inspected in the sector in a given year is 15% or greater;			
		< 70%	35%	Percent of facilities inspected in the sector in a given year is less than 15%			
Unannounced Inspections	86%	100%	93%	Unannounced inspections are sometimes done;	4%	93%	**3.72%**
	70%	85%	78%	Unannounced inspections are done, but infrequently;			
		< 70%	35%	Unannounced inspections are never done;			
Enforcement Penalties	86%	100%	93%	Agency takes prompt enforcement action, including monetary fines, against violators;			
	70%	85%	78%	Agency usually takes enforcement action, including monetary fines, against violators;	4%	78%	**3.12%**
		< 70%	35%	Agency usually does not take enforcement action against violators;			
Compliance Assistance	86%	100%	93%	A compliance assistance program exists and is adequately staffed, and includes such things as workshops, mailings, web-based tutorials, etc.			
	70%	85%	78%	A compliance assistance program exists and is minimally staffed. The program occasionally makes workshops, mailings, web-based tutorials, etc., available.	4%	78%	**3.12%**
		< 70%	35%	A compliance assistance program does not exist			

C. Other factors (3 criteria, each assigned weighting of 2% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring Requirements	86%	100%	93%	Monitoring requirements exist and must be reported to regulatory agency at least once a year;			
	70%	85%	78%	Monitoring requirements exist but records don't have to be filed with regulatory agency;	2%	78%	**1.56%**
		< 70%	35%	Monitoring requirements do not exist;			
Follow-up Inspections	86%	100%	93%	Follow-up inspections are done when violations are noted most (>75%) of the time;	2%	93%	**1.86%**
	70%	85%	78%	Follow-up inspections are done when violations are noted some of the time;			
		< 70%	35%	Follow-up inspections are not routinely done;			
Media Publicity	86%	100%	93%	Media publicity of enforcement actions is routinely conducted.	2%	93%	**1.86%**
	70%	85%	78%	Media publicity of enforcement actions is sometimes done.			
		< 70%	35%	Media publicity of enforcement actions is rarely done.			

Overall rule effectiveness score for Rule 316 sites: **49.62%**

APPENDIX 3D. Rule Effectiveness Matrix for Agricultural Activities

A. Most important factor (1 criterion, assigned weighting of 25% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Compliance History	86%	100%	93%	Over 90% of facilities inspected in the source category are in compliance	25%	93%	**23.25%**
	70%	85%	78%	Over 75% of facilities inspected in the source category are in compliance			
		< 70%	35%	Over 60% of facilities inspected in the source category are in compliance			
Type of Inspection	86%	100%	93%	Inspections are thorough and detailed, and include close examination of control equipment, and a detailed records review			
	70%	85%	78%	Inspections consist of a records review, and sometimes inspection of control equipment;			
		< 70%	35%	Inspections generally consist of a records review only;	10%	35%	**3.5%**

B. Other important factors (6 criteria, each assigned weighting of 10% of total):

Compliance Certifications	86%	100%	93%	Source is subject to some type of compliance certification;			
	70%	85%	78%	Source is subject to some type of compliance certification;			
		< 70%	35%	Source is not subject to any type of compliance certification;	10%	35%	**3.5%**
Inspection Frequency/ Percentage	86%	100%	93%	Percent of facilities inspected in the sector in a given year is 25% or greater;			
	70%	85%	78%	Percent of facilities inspected in the sector in a given year is 15% or greater;			
		< 70%	35%	Percent of facilities inspected in the sector in a given year is less than 15%	10%	35%	**3.5%**
Unannounced Inspections	86%	100%	93%	Unannounced inspections are sometimes done;			
	70%	85%	78%	Unannounced inspections are done, but infrequently;			
		< 70%	35%	Unannounced inspections are never done;	10%	35%	**3.5%**
Enforcement Penalties	86%	100%	93%	Agency takes prompt enforcement action, including monetary fines, against violators;			
	70%	85%	78%	Agency usually takes enforcement action, including monetary fines, against violators;			
		< 70%	35%	Agency usually does not take enforcement action against violators;	10%	35%	**3.5%**
Compliance Assistance	86%	100%	93%	A compliance assistance program exists and is adequately staffed, and includes such things as workshops, mailings, web-based tutorials, etc.	10%	93%	**9.3%**
	70%	85%	78%	A compliance assistance program exists and is minimally staffed. The program occasionally makes workshops, mailings, web-based tutorials, etc., available.			
		< 70%	35%	A compliance assistance program does not exist			

C. Other factors (3 criteria, each assigned weighting of 5% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring Requirements	86%	100%	93%	Monitoring requirements exist and must be reported to regulatory agency at least once a year;			
	70%	85%	78%	Monitoring requirements exist but records don't have to be filed with regulatory agency;			
		< 70%	35%	Monitoring requirements do not exist;	5%	35%	**1.75%**
Follow-up Inspections	86%	100%	93%	Follow-up inspections are done when violations are noted most (>75%) of the time;			
	70%	85%	78%	Follow-up inspections are done when violations are noted some of the time;			
		< 70%	35%	Follow-up inspections are not routinely done;	5%	35%	**1.75%**
Media Publicity	86%	100%	93%	Media publicity of enforcement actions is routinely conducted.			
	70%	85%	78%	Media publicity of enforcement actions is sometimes done.			
		< 70%	35%	Media publicity of enforcement actions is rarely done.	5%	35%	**1.75%**

Overall rule effectiveness score for agricultural activities: **55.30%**

APPENDIX 3E. 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.			
	87%	93%	90%	Source specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency every 6 to 9 months.	35%	90%	**31.5%**
	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%	10 of 19 facilities	**17.9%**
	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 19 facilities	**12.4%**
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.		1 of 19 facilities	**0.6%**
						Sum:	**30.9%**

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.			
	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%	**2.9%**
	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: 90.94%

APPENDIX 3F. 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%	156 of 298 facilities	**17.8%**
	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.		10 of 298 facilities	**1.1%**
	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.		130 of 298 facilities	**11.5%**
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.		2 of 298 facilities	**0.1%**
						Sum:	**30.4%**

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%	**1.5%**
		< 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 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 non-Title V facilities: 84.27%

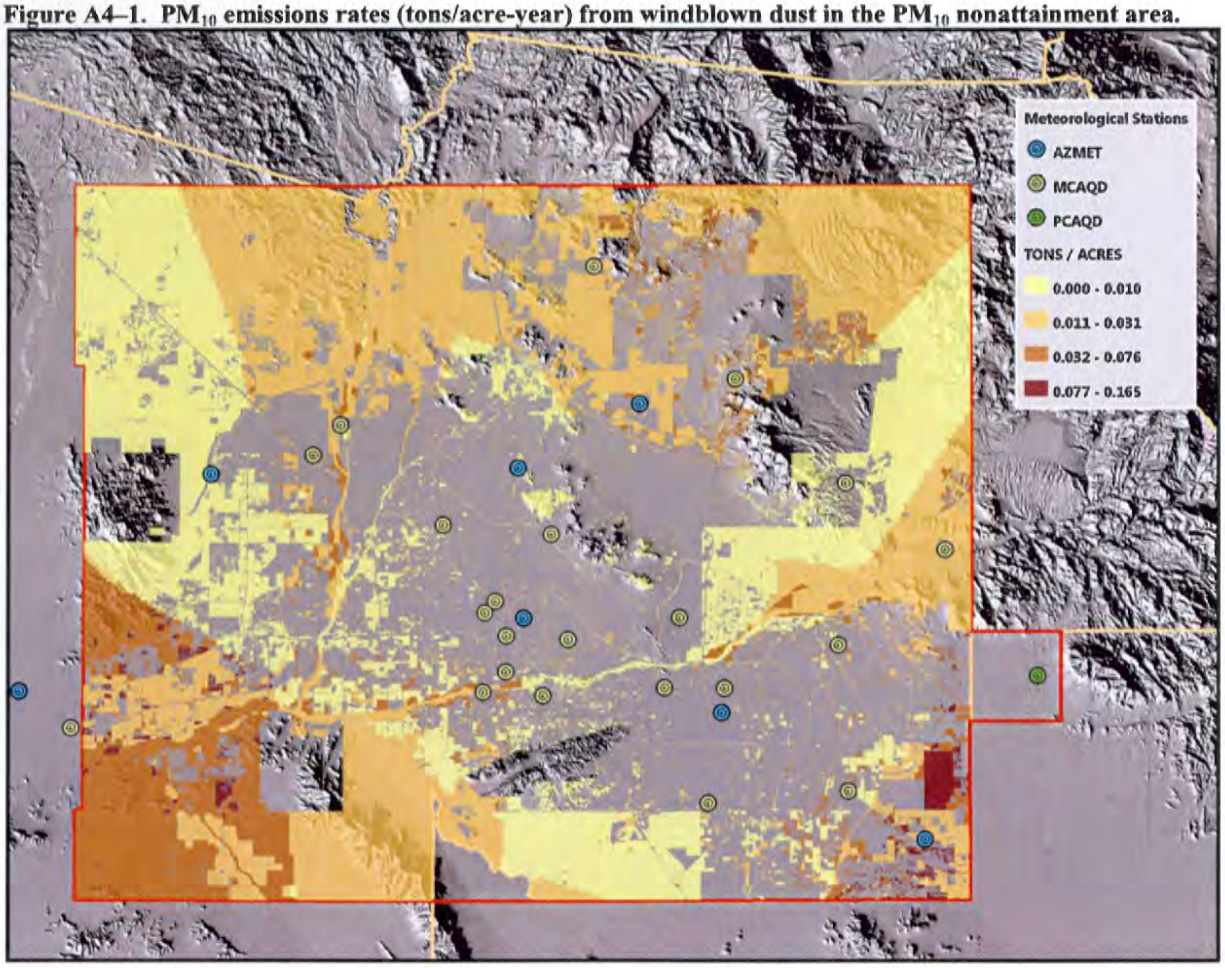
Appendix 4. Windblown Dust Emission Estimation Methodology

Introduction

Emissions from windblown dust occur through an intricate relationship between wind speeds and the physical characteristics of the subject soils. Several methodologies for estimating windblown dust emissions have been developed to try and express these complex relationships (WGA, 2006). For this analysis, a GIS-based approach was developed that utilizes location-specific data on wind speed, precipitation, land use and locally developed emission factors. GIS was chosen as the driver of the methodology to help reflect the wide range of wind speeds, soil types and land uses that occur in an area as large as Maricopa County. A GIS-based method also allows for the mapping of PM_{10} emissions from windblown dust, as opposed to simply "smearing" a single emission value across the entire county (or nonattainment area).

Emissions mapping can assist in the development of microscale emission inventories, modeling exercises, and can focus rule development and compliance activities in known problem areas. As an example, Figure A4–1 depicts the estimated annual PM_{10} emissions across the PM_{10} non-attainment area that result by applying the methods described herein.

Figure A4–1. PM_{10} emissions rates (tons/acre-year) from windblown dust in the PM_{10} nonattainment area.

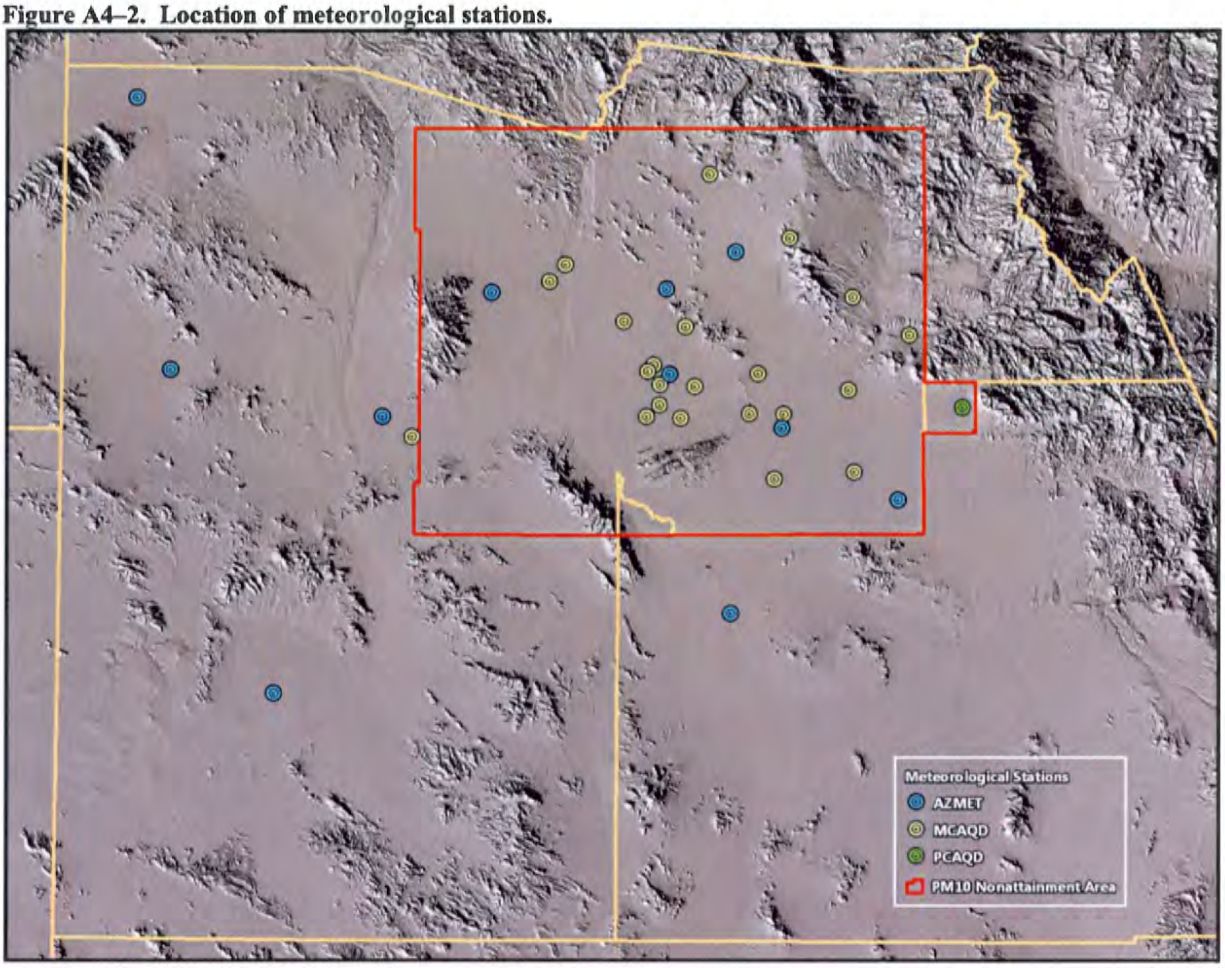


The following sections describe the meteorological, land use, and emission rate (vertical fluxes) data used to develop PM_{10} emissions from windblown dust in Maricopa County and the PM_{10} nonattainment area. A review of all emissions is included in the section entitled Emissions Summary.

Meteorological Data

A total of 34 meteorological stations encompass the source of calendar year 2008 wind speed and precipitation data used in this inventory of windblown dust. This includes 11 stations operated by the Arizona Meteorological Network (AZMET), 22 stations operated by the Maricopa County Air Quality Department (MCAQD), and 1 station operated by the Pinal County Air Quality Control District (PCAQCD). Stations operated by the National Weather Service (NWS) in and around Maricopa County were not chosen for inclusion in this analysis due to differences in wind speed data collection methods that preclude "apples-to-apples" comparisons with data from those meteorological stations included in this work[1]. Figure A4–2 displays the location of the included meteorological stations.

Figure A4–2. Location of meteorological stations.



1. National Weather Service (NWS) stations report wind speeds in 2-minute averages at the time of posting, while AZMET, MCAQD and PCAQCD all report wind speed in hourly averages at the top of each hour.

Wind Speed Data

For this analysis, 5-minute average wind speeds form the basis of the wind data used in calculating windblown dust emissions. Data recorded as a 5-minute average was chosen over hourly average data because the finer time resolution allows a better representation of potential emissions caused by wind gusts that can create significant emissions, yet be overshadowed in hourly data. This approach also allows for the computation of emissions by wind speed bin classes: 15–20 mph, 20–25 mph, 25–30 mph and 30–35 mph. As compared to hourly data, the 5-minute bin classes better reflect the change in emission rates (vertical fluxes) as a function of increasing wind speeds. Outlined below are the steps necessary to prepare the wind speed data for inclusion in windblown dust emission calculations.

As an initial step wind speeds were uniformly adjusted to speeds at 10 meters (to account for the difference in anemometer heights) through use of a standard wind profile power-law equation:

$$U_z = U_r(Z/Z_r)^p$$

where U_z is wind speed (in mph) at 10 meters, U_r is wind speed (in mph) at referenced anemometer height, Z is 10 meters, Z_r is the height (in meters) of the reference anemometer, and p is the power-law exponent. Determination of p was made by comparing wind speeds at neighboring stations with different anemometer heights (e.g., AZMET's Buckeye station at 3 meters compared with MCAQD's Buckeye station at 10 meters) through a simple adaptation of the power-law equation:

$$p = \frac{\ln(U) - \ln(U_r)}{\ln(Z) - \ln(Z_r)}$$

Comparison of hourly average wind speeds greater than 9 mph yielded an average value for p of 0.06 for urban stations and 0.12 for rural stations. (Only those hours with average winds speeds greater than 9 mph were chosen, as applying the approach described above for hours with calm winds tends to over-inflate the value of p.) Table A4–1 lists the frequency of hourly average wind speeds over 15 mph (after adjustment to 10 meters) for all meteorological stations.

In addition to correcting for height, adjustments to wind speed were performed to gap-fill missing data and interpolate 5-minute average values as necessary. All of the meteorological stations report hourly average wind speeds at the top of each hour. In addition, 13 of the MCAQD stations also report 5-minute average wind speeds, with data completion rates of 75% or better. The data from these stations were (1) counted and assigned to one of four wind speed "bin classes" of 15–20 mph, 20–25 mph, 25–30 mph, and 30–35 mph; and (2) "grown" to compensate for missing data, based upon the data completion rate of each station. Thus (e.g.) a station that reported 124 hourly periods that were assigned to a bin with a data completion rate of 90.63%, would result in a "grown" bin value of 137 [124 periods divided by 90.63%]). Table A4–2 presents the 5-minute values and the resulting bin class assignments, for each of the 13 MCAQD meteorological stations that were considered.

Table A4–1. Number of hours in 2008 with average wind speeds greater than 15 mph (at uniform height of 10 meters), by site.

Station Name	Number of hourly average wind speeds > 15 mph	Anemometer height (m)
AZMET Aguila	284	3
AZMET Buckeye	149	3
AZMET Desert Ridge	70	3
AZMET Harquahala	274	3
AZMET Maricopa	118	3
AZMET Mesa	5	3
AZMET Paloma	224	3
AZMET Phoenix Encanto	1	3
AZMET Phoenix Greenway	6	3
AZMET Queen Creek	161	3
AZMET Waddell	4	3
MCAQD Blue Point	60	10
MCAQD Buckeye	146	10
MCAQD Cave Creek	69	10
MCAQD Central Phoenix	43	15
MCAQD Coyote Lakes	54	10
MCAQD Durango Complex	50	10
MCAQD Dysart	64	10
MCAQD Falcon Field	58	13
MCAQD Fountain Hills	1	10
MCAQD Glendale	19	13
MCAQD Greenwood	1	10
MCAQD Higley	42	10
MCAQD Mesa	42	10
MCAQD North Phoenix	4	10
MCAQD Pinnacle Peak	51	16
MCAQD South Phoenix	6	10
MCAQD South Scottsdale	3	10
MCAQD Tempe	0	10
MCAQD West 43rd Ave	65	10
MCAQD West Chandler	23	10
MCAQD West Indian School	19	10
MCAQD West Phoenix	5	10
PCAQCD Apache Junction	134	10

For the stations that do not record 5-minute average wind speeds[2], regression equations were developed (based upon those MCAQD stations that do report 5-minute average wind speeds) to interpolate 5-minute average values. The equations were derived by regressing each bin class (dependent [y]) against hourly average wind speeds over 15 mph (independent [x]). All of the regression equations proved to be statistically significant at the 95% confidence level. The results of the regression equations for each bin class are shown in Table A4–3. The resulting 5-minute average wind speeds (by bin class) for all meteorological stations in this study are shown in Table A4–4.

2. AZMET and PCAQCD stations report average wind speed only on an hourly basis, and another nine MCAQD stations that measure wind speed on a 5-minute average had data completion rates less than 75% for 2008.

Table A4–2. Number of recorded and grown 5-minute average wind speeds, by bin category and station.

MCAQD Station	Recorded 5-minute averages 15–20 mph	20–25 mph	25–30 mph	30–35 mph	Data completeness	Grown 5-minute averages 15–20 mph	20–25 mph	25–30 mph	30–35 mph
Buckeye	1679	296	54	12	99.62%	1685	297	54	12
Coyote Lakes	840	77	1	0	98.71%	851	78	1	0
Durango Complex	618	33	10	1	96.39%	641	34	10	1
Dysart	784	92	6	0	78.16%	1003	118	8	0
Falcon Field	758	95	2	1	76.77%	987	124	3	1
Greenwood	124	11	1	0	90.63%	137	12	1	0
Higley	766	50	8	1	91.02%	842	55	9	1
North Phoenix	80	8	2	0	77.59%	103	10	3	0
South Phoenix	169	9	0	1	99.19%	170	9	0	1
Tempe	5	0	0	0	86.38%	6	0	0	0
West Chandler	515	42	3	1	99.09%	520	42	3	1
West Forty-third	1042	83	13	6	98.44%	1059	84	13	6
West Phoenix	111	8	1	0	92.47%	120	9	1	0

Table A4–3. Regression equation, *p*-value, and R^2 for interpolating 5-minute average wind speeds, by bin.

5-minute average wind speed bin	Regression equation	*p*-value	R^2
15–20 mph	$y = 150.05 + 11.92x$	0.00000006	93.77%
20–25 mph	$y = -8.34 + 1.39x$	0.00000021	92.09%
25–30 mph	$y = -4.20 + 0.31x$	0.00009300	76.42%
30–35 mph	$y = -0.99 + 0.07x$	0.00047000	68.57%

Table A4–4. Number of interpolated 5-minute average wind speeds, by station and wind speed bin. (Shaded cells denote interpolated values.)

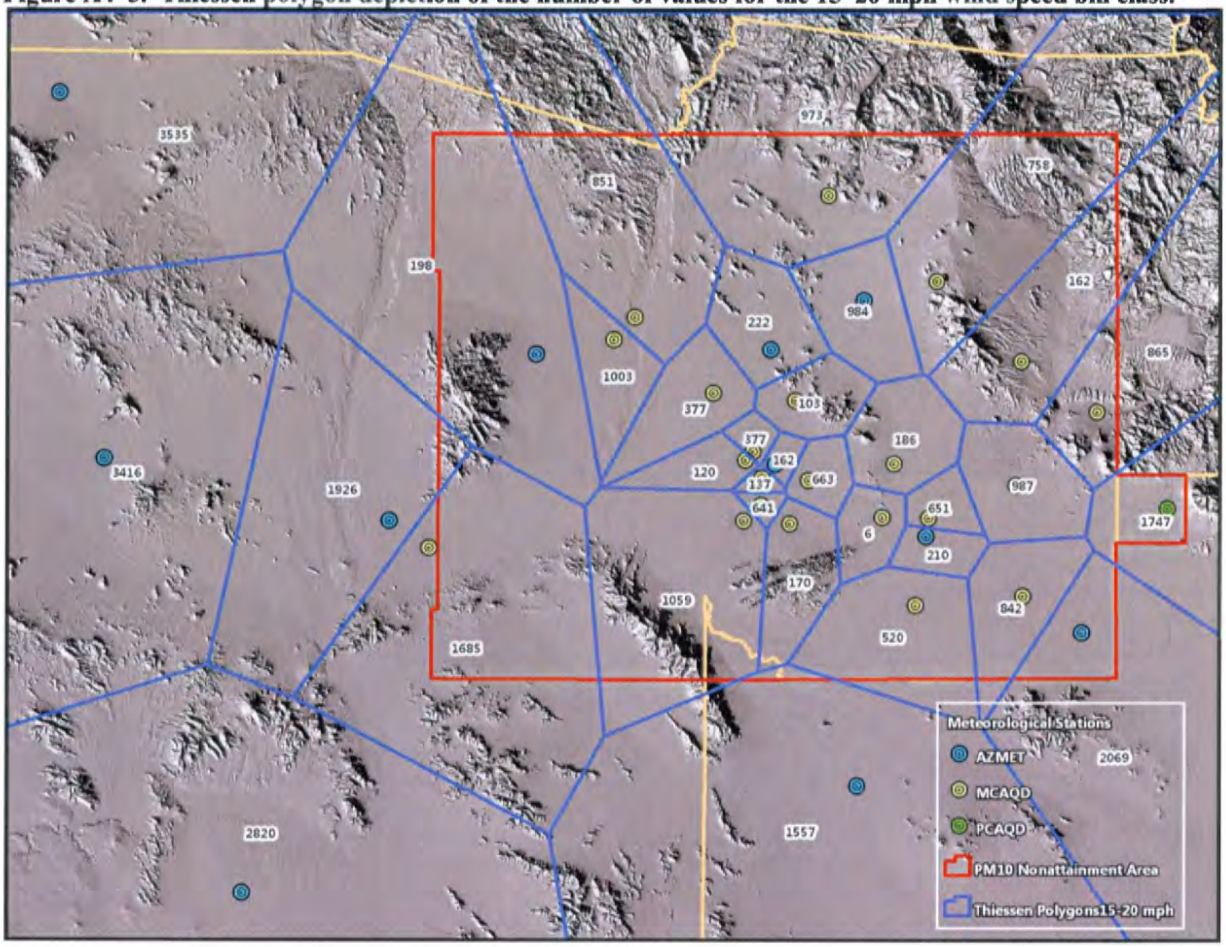
Station Name	Number of hourly average values > 15 mph	Number of 5-minute average values between: 15–20 mph	20–25 mph	25–30 mph	30–35 mph
AZMET Aguila	284	3535	386	84	19
AZMET Buckeye	149	1926	199	42	9
AZMET Desert Ridge	70	984	89	18	4
AZMET Harquahala	274	3416	373	81	18
AZMET Maricopa	118	1557	156	32	7
AZMET Mesa	5	210	0	0	0
AZMET Paloma	224	2820	303	65	15
AZMET Phoenix Encanto	1	162	0	0	0
AZMET Phoenix Greenway	6	222	0	0	0
AZMET Queen Creek	161	2069	215	46	10
AZMET Waddell	4	198	0	0	0
MCAQD Blue Point	60	865	75	14	3
MCAQD Buckeye	146	1685	297	54	12
MCAQD Cave Creek	69	973	88	17	4
MCAQD Central Phoenix	43	663	51	9	2
MCAQD Coyote Lakes	54	851	78	1	0
MCAQD Durango Complex	50	641	34	10	1
MCAQD Dysart	64	1003	118	8	0
MCAQD Falcon Field	58	987	124	3	1
MCAQD Fountain Hills	1	162	0	0	0
MCAQD Glendale	19	377	18	2	0
MCAQD Greenwood	1	137	12	1	0
MCAQD Higley	42	842	55	9	1
MCAQD Mesa	42	651	50	9	2
MCAQD North Phoenix	4	103	10	3	0

Table A4–4 (continued). Number of interpolated 5-minute average wind speeds, by meteorological station and wind speed bin. (Shaded cells denote interpolated values.)

Station Name	Hourly average values > 15 mph	Number of 5-minute average values between:			
		15–20 mph	20–25 mph	25–30 mph	30–35 mph
AZMET Aguila	284	3535	386	84	19
MCAQD Pinnacle Peak	51	758	63	12	3
MCAQD South Phoenix	6	170	9	0	1
MCAQD South Scottsdale	3	186	0	0	0
MCAQD Tempe	0	6	0	0	0
MCAQD West 43rd Ave	65	1059	84	13	6
MCAQD West Chandler	23	520	42	3	1
MCAQD West Indian School	19	377	18	2	0
MCAQD West Phoenix	5	120	9	1	0
PCAQCD Apache Junction	134	1747	178	37	8

Lastly, in order to assign the bin class wind speeds to the underlying land use acreages, Thiessen polygons[3] were created for each bin class (after Pulugurtha and James, 2006). Figure A4–3 shows the resulting Thiessen polygon for the 5-minute average 15–20 mph wind speed bin class.

Figure A4–3. Thiessen polygon depiction of the number of values for the 15–20 mph wind speed bin class.



3. A "Thiessen polygon" depicts an area whose boundaries define the region that is closest to a given point, relative to all other given points.

Precipitation Data

AZMET meteorological station report hourly rain totals when precipitation occurs. For those MCAQD and PCAQCD stations that do not report precipitation, rain totals from the closest AZMET station was used as a surrogate. Table A4–5 lists the number of hours during which precipitation was recorded at each station.

Table A4–5. Number of hours in 2008 during which any precipitation was recorded at each station.

Station Name	Hours in 2008 with Recorded Precipitation
Aguila	140
Buckeye	91
Desert Ridge	155
Harquahala	110
Maricopa	134
Mesa	154
Paloma	90
Phx. Encanto	139
Phx. Greenway	146
Queen Creek	150
Waddell	113
Blue Point	154
Buckeye	91
Cave Creek	155
Central Phoenix	139
Coyote Lakes	113
Durango Complex	139
Dysart	113
Falcon Field	154
Fountain Hills	155
Glendale	146
Greenwood	139
Higley	150
Mesa	154
North Phoenix	146
Pinnacle Peak	155
South Phoenix	139
South Scottsdale	154
Tempe	154
West Chandler	154
West Forty Third	139
West Indian School Road	139
West Phoenix	139
Apache Junction	150
Average:	**138**

The resulting average value of 138 hours/year shown above was then used to estimate the percentage of the time during calendar year 2008 for which no windblown dust emissions are assumed to occur. (1.57%; =138 hrs ÷ 8,784 total hours in 2008).

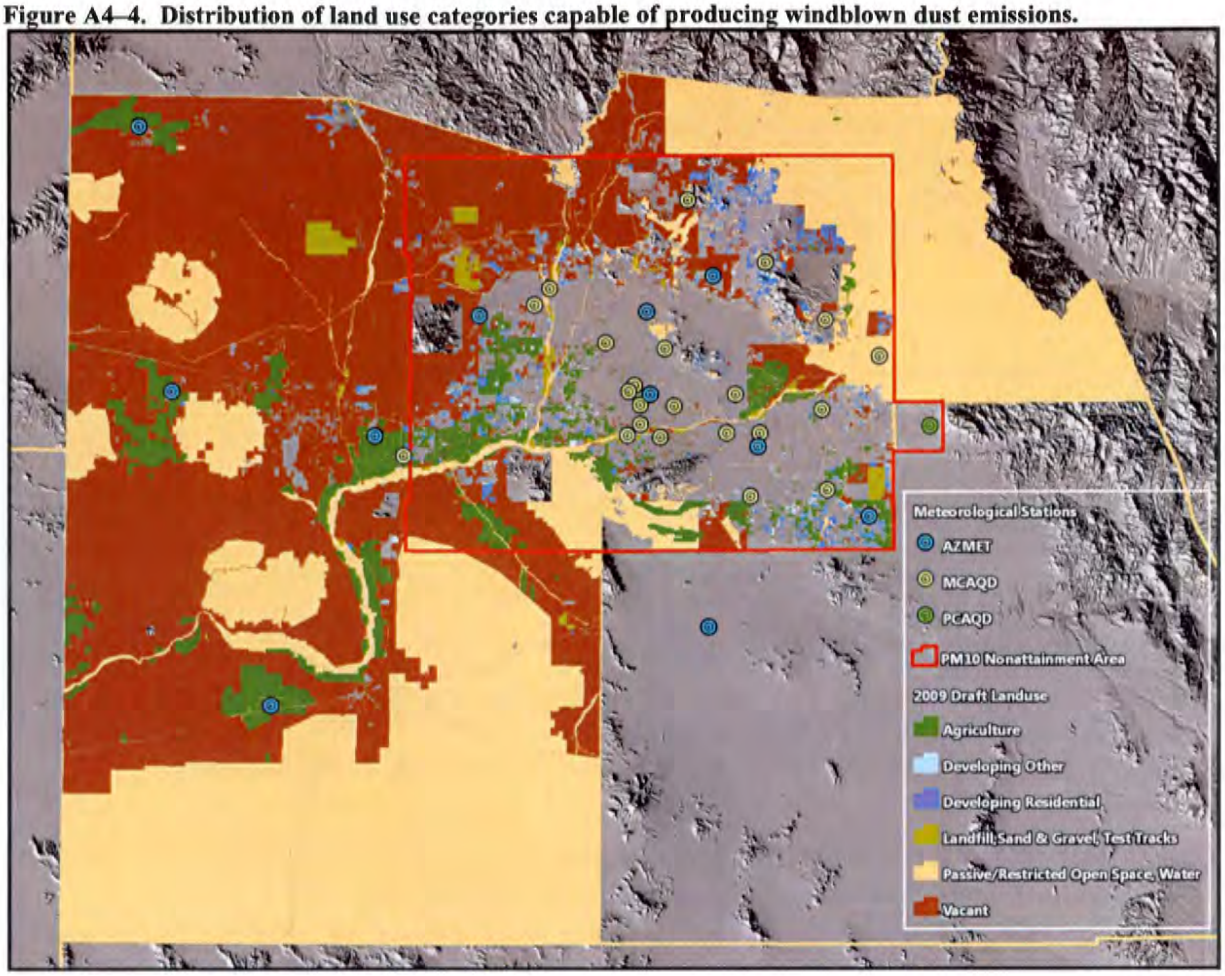
Land Use Data

The Maricopa Association of Governments (MAG) provided draft 2009 GIS data on land use coverage for use in determining the location and extent of land capable of producing windblown dust. A total of 18 land use categories were provided, six of which were deemed to have the potential to emit windblown dust. Table A4–6 lists the 18 land use categories considered, their acreages within both Maricopa County and the PM_{10} nonattainment area, and the assessment of each category's potential to produce windblown dust, considering a variety of typical characteristics for each category. Figure A4–4 depicts the extent and distribution of the six land use categories determined to have the potential to emit windblown dust.

Table A4–6. Land use categories, 2009 acreages, and factors determining potential to emit windblown dust.

MAG Land Use Category	Maricopa County acreage	PM_{10} NAA acreage	Potential to emit wind-blown dust?	Rationale for Determination
Residential	353,610	334,413	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Commercial	36,742	35,791	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Industrial	25,933	26,028	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Office	8,289	8,284	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Tourist and Visitor Accommodations	2,679	2,512	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Educational	18,216	18,099	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Institutional	12,210	12,045	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Public Facilities, Military, Special Events	35,308	22,931	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Multiple Use/Business Park	423	13,273	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Transportation and Parking	158,500	141,025	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
Airports	11,302	9,558	No	Built environment, limited presence of natural soils, limited opportunity for disturbance of soils.
General/Active Open Space/Golf Courses	228,295	223,290	No	Acreage largely parks and golf courses, limited opportunity for disturbance of natural soils.
Passive/Restricted Open Space, Water	2,373,545	302,999	**Yes**	Acreage uncovered, unbuilt. Soils subject to sporadic disturbance. Water coverage removed.
Landfill, Sand & Gravel, Automotive Test Tracks	43,924	29,011	**Yes**	Acreage uncovered, unbuilt. Soils subject to frequent disturbance.
Agriculture	295,509	130,445	**Yes**	Acreage uncovered, unbuilt. Soils subject to sporadic disturbance.
Vacant	2,227,981	472,831	**Yes**	Acreage uncovered, unbuilt. Soils subject to sporadic disturbance.
Developing Residential	55,152	50,082	**Yes**	Acreage uncovered, unbuilt. Soils subject to frequent disturbance.
Developing Non-residential	15,142	14,437	**Yes**	Acreage uncovered, unbuilt. Soils subject to frequent disturbance.

Figure A4–4. Distribution of land use categories capable of producing windblown dust emissions.



To facilitate the calculation of windblown dust emissions from these land use categories, GIS tools were used to subdivide the land use polygons into smaller, 40-acre cells. This technique allows for the land use acreage in each category to be accurately joined with the wind speed data as represented using Thiessen polygons. Each 40-acre cell is assigned the wind speed bin value of the Thiessen polygon that overlays it. Ultimately, the eligible land use acreage in each cell, combined with the overlaid wind speed values and land use-specific vertical fluxes (emission rates as explained next) produce the windblown dust emissions in each 40-acre cell.

Determination of Emission Rates

The rate at which soil produces windblown dust emissions can be described as a vertical flux. The two primary components of this vertical flux are: (1) the ***threshold friction velocity*** (i.e., the wind speed at which dust emissions are initiated) and (2) the physical characteristics of soils that allow or impede the production of windblown dust (usually termed ***surface roughness***). The equations used to determine vertical flux for the present study have been derived from wind tunnel studies (Nickling and Gillies 1986, 1989) conducted in Maricopa County as well as other parts of Arizona, and that address specific land use categories.

These wind tunnel studies resulted in land use-specific vertical flux estimates for a total of five separate land use categories: natural and disturbed desert, fluvial sites, construction sites, mine tailings, and agricultural sites. Table A4–7 below lists the vertical fluxes and the land use categories they are associated with in this analysis. For agriculture land use categories, the vertical flux values used have been applied ***only*** to those lands assumed to have been fallow for the entire year. Conversely, emissions generated from activities related to agricultural harvesting are estimated using techniques developed by the U.S. Department of Agriculture (USDA) and discussed later in the text.

Table A4–7. Vertical flux rates, by land use category (cf. Nickling and Gillies 1986, 1989).

MAG Land Use Category	Vertical Flux (in g/cm^2-sec)†
Landfill, Sand and gravel, Automotive test track facilities	Fluvial sites = $1.59 \times 10^{-13} u^{*3.32}$ Natural desert = $7.99 \times 10^{-13} u^{*2.99}$
Passive/restricted open space	Natural desert = $7.99 \times 10^{-13} u^{*2.99}$
Unharvested, fallow agriculture††	Agriculture = $3.36 \times 10^{-30} U^{6.92}$
Vacant	Natural desert = $7.99 \times 10^{-13} u^{*2.99}$
Developing, residential	Construction sites = $5.82 \times 10^{-15} u^{*4.24}$
Developing, non-residential	Construction sites = $5.82 \times 10^{-15} u^{*4.24}$

† Where u^* = threshold friction velocity (in cm/sec).
†† Applies only to ***unharvested*** agricultural lands; here U is assumed to be equal to that at 10 meters.

Category-specific estimates of threshold friction velocity (u^*) were developed based on earlier area wind tunnel studies described above (Nickling and Gillies; 1986, 1989). From these studies' descriptions of the local soil conditions, it became apparent that estimates for some land use categories were apparently based on disturbed soils, while similar estimates for certain other land use categories were clearly values recorded using stabilized soils.

In ENVIRON's work designed to developing a windblown dust model, ENVIRON developed a comparison of threshold friction velocities between disturbed and undisturbed land use categories (WGA, 2006). The resulting ratios have been used to determine threshold friction velocities for both disturbed and undisturbed land use categories for the present study. Table A4–8 below lists the averaged threshold friction velocity values from Nickling and Gillies for each land use category, at a height of 10 meters.

Table A4–8. Threshold velocities, by land use category and disturbance class.

Land Use Category	Threshold Friction Velocity for Undisturbed Areas (at 10-m. height, in mph)	Threshold Friction Velocity for Disturbed Areas (at 10-m. height, in mph)
Landfill, Sand and Gravel, Automotive Test Tracks	22 *	13
Passive/Restricted Open Space	46 *	22
Unharvested, Fallow Agriculture	40 *	17
Vacant	46 *	22
Developing, Residential	25	12 *
Developing, Non-residential	25	12 *

*These values have been developed based on the ratio of disturbed vs. undisturbed land use categories as developed by ENVIRON (in WGA, 2006).

To determine the percentage of land that was 'disturbed' vs. 'undisturbed', the appropriate rule effectiveness (RE) rate was applied to the total acreage value. (Appendix 3 provides further details about the rule effectiveness studies conducted for use in developing 2008 emission estimates.) For example, the RE value of 80.87% for sites subject to County Rule 310.01 was then used to determine the ratio of disturbed vs. undisturbed areas for land use categories 'vacant' and 'passive/restricted open space'[4]. Similarly, the Rule 310 RE value (82.99%) was used to apportion disturbed vs. undisturbed acreage for the "Developing" land use categories. To apportion "Landfill, sand and gravel, and test tracks", either the Rule 316 RE rate of 49.62% (for sand and gravel), or the Rule 310.01 RE rate of 80.87% (for landfills and test tracks) was used.

The assignment of disturbed vs. undisturbed acreage for unharvested agriculture acreage is a two-step process: first, the percentage of unharvested acreage is determined (42.88%). This value is then adjusted by the Agricultural Best Management Practices (BMP) RE value (55.33%) to produce a percentage of 19.15% for unharvested, disturbed agricultural acreage. Using the RE values to apportion disturbed and undisturbed lands maximizes the amount of disturbed acreage, as this method assumes that <u>any</u> non-compliant activity at these sites results in disturbed soils. Thus the estimates presented here reflect quite conservative estimates of windblown dust emissions.

By applying the vertical flux equations, threshold velocities, and recorded surface roughness values[5], PM_{10} emission factors for each land use category were developed for each wind speed bin. The midpoint of each wind speed bin (17.5, 22.5, 27.5, and 32.5 mph) was used to develop each bin-specific emission factor[6]. Table A4–9 lists the resulting emission factors for each wind speed bin and land use category.

Table A4–9. PM_{10} emission factors by land use type, disturbance status, and wind speed bin category.

Land Use Category(ies)	% of Land Disturbed ("D") or Undisturbed ("U")	PM_{10} emission factors (in tons/acre-5-minute)			
		15–20 mph	20–25 mph	25–30 mph	30–35 mph
Sand and gravel	49.62% (D)	n/a*	3.20×10^{-4}	6.23×10^{-4}	1.09×10^{-3}
Sand and gravel	50.38% (U)	1.39×10^{-4}	3.20×10^{-4}	6.23×10^{-4}	1.09×10^{-3}
Passive/restricted open space, Vacant, Landfill and Automotive test tracks	80.87% (U)	n/a*	n/a*	n/a*	n/a*
Passive/restricted open space, Vacant, Landfill and Automotive test tracks	19.13% (D)	n/a*	7.77×10^{-4}	1.41×10^{-3}	2.33×10^{-3}
All other agriculture	80.85% † (U)	n/a*	n/a*	n/a*	n/a*
Unharvested, fallow agriculture	19.15% (D)	4.73×10^{-6}	2.69×10^{-5}	1.08×10^{-4}	3.43×10^{-4}
All developing	82.99% (U)	n/a*	n/a*	8.94×10^{-4}	1.82×10^{-3}
All developing	17.01% (D)	1.32×10^{-4}	3.82×10^{-4}	8.94×10^{-4}	1.82×10^{-3}

* "n/a" = No threshold friction velocity value has been determined for this category/bin; see Table A4–8.
† Value includes those harvested acres for which emissions have been calculated using a different methodology.

4. The RE rate of 80.87% was used for 'Vacant' and 'Passive/restricted open space' in the PM_{10} NAA only. When applied to the county as a whole, the nominal RE rate (90.43%) was halved, since large areas outside the PM_{10} NAA include areas to which access is quite restricted (e.g., Goldwater Bombing Range, Tonto National Forest); thus the potential to disturb the soil is also limited.
5. Recorded by Nickling and Gillies (1986, 1989) during wind tunnel tests.
6. The fluid dynamics Prandtl equation: $U = \frac{u^*}{k} ln \frac{z}{z_o}$ allows for the calculation of u^* at various 10-meter wind speeds by solving for u^*: ($u^* = U \frac{k}{ln \frac{z}{z_o}}$), where U is wind speed at 10 meters, k is Von Karman's constant (0.4), z is 10 meters, and z_o is measured surface roughness value.

By combining the emission rates listed in Table A4–9, information on the land use type(s) and acreage(s) within each 40-acre grid cell, the associated wind speed bin values, and after incorporation of a correction factor for precipitation (as described earlier), emissions of windblown dust have been estimated for each land use category, with the exception of harvested agricultural fields (discussed in further detail below).

Estimating Emissions from Harvested Agricultural Areas

Windblown dust from harvested agricultural fields has been calculated using a soil erodibility formula developed by the US Department of Agriculture:

$$E_s = a\,I\,C\,K\,L'\,V'$$

where E_s equals suspended PM in tons/acre-year, a is a constant (0.0125) representing the portion of PM as PM_{10}, I is soil erodibility, C is a climatic factor, K is surface roughness, L' is unsheltered field width and V' is vegetative cover. Table A4–10 lists the crop-specific values for each variable, and is taken from the 1999 Serious Area PM-10 Plan (MAG, 2000).

Table A4–10. Harvested agricultural acreage and default values for USDA equation variables, by crop type.

Crop	2008 Acreage	a	I	C	K	L'	V'	E_s
Cotton	18,800	0.0125	63.6	0.318	0.5	0.74	0.7	0.065
Alfalfa	83,000	0.0125	63.6	0.318	1	0.76	0	0
Other hay	4,500	0.0125	63.6	0.318	0.8	0.83	0	0
Wheat	30,100	0.0125	63.6	0.318	0.6	0.77	0	0
Barley	9,900	0.0125	63.6	0.318	0.6	0.77	0	0
Corn	700	0.0125	63.6	0.318	0.6	0.77	0.44	0.051
Potatoes	1,400	0.0125	63.6	0.318	0.8	0.70	0.6	0.085
Sorghum	2,200	0.0125	63.6	0.318	0.6	0.77	0	0
Other vegetables	16,072	0.0125	63.6	0.318	0.6	0.48	0.77	0.056
Citrus	2,124	0.0125	63.6	0.318	0.6	0.48	0.77	0.056

In addition to applying the USDA formula, a control factor of 72.28% was applied to harvested agricultural emission estimates to reflect the effectiveness of the agricultural BMP program. This control factor is a combination of the rule effectiveness of the BMP program (55.33%; see Appendix 3) and the estimated control effectiveness of the BMP program (50.10%)[7], for an overall effectiveness of 27.72%.

Summary of Windblown Dust Emissions Estimates

Using the emission methodologies listed above, annual PM_{10} emissions for Maricopa County and the PM_{10} nonattainment area can be calculated. $PM_{2.5}$ emissions are assumed to be 10% of PM_{10} emissions. Daily emissions are obtained by dividing annual emissions by the number of days in calendar year 2008 (i.e., 366). Annual and daily emissions for Maricopa County and the PM_{10} nonattainment area are shown in Tables A4–11 and A4–12, respectively.

7. Derived from Table 4-2 of the Technical Support Document for Quantification of Agricultural Best Management Practices, prepared for ADEQ by URS and ERG, June 2001.

Table A4–11. Annual and daily PM_{10} and $PM_{2.5}$ emissions from windblown dust in Maricopa County, by land use category.

	Annual emissions (tons/yr)		Average daily emissions (lbs/day)	
Land use category	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Agriculture, harvested	1,711.76	171.18	9,353.9	935.4
Agriculture, unharvested	1,349.51	134.95	7,374.4	737.4
Developing	3,334.78	333.48	18,222.8	1,822.3
Landfill, sand and gravel, auto. test tracks	1,646.51	164.65	8,997.3	899.7
Passive/restricted open space	44,174.80	4,417.48	241,392.4	24,139.2
Vacant	60,570.87	6,057.09	330,988.4	33,098.8
Totals:	**112,788.23**	**11,278.82**	**616,329.1**	**61,632.9**

Table A4–12. Annual and daily PM_{10} and $PM_{2.5}$ emissions from windblown dust in the PM_{10} NAA, by land use category.

	Annual emissions (tons/yr)		Average daily emissions (lbs/day)	
Land use category	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Agriculture, harvested	755.57	75.56	4,128.8	412.9
Agriculture, unharvested	327.69	32.77	1,790.7	179.1
Developing	2,664.48	266.45	14,560.0	1,456.0
Landfill, sand and gravel, auto. test tracks	1,435.81	143.58	7,845.9	784.6
Passive/restricted open space	3,762.38	376.24	20,559.5	2,056.0
Vacant	9,522.43	952.24	52,035.2	5,203.5
Totals:	**18,468.36**	**1,846.84**	**100,920.0**	**10,092.0**

References

MAG, 2000. *Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area.* Maricopa Association of Governments, Phoenix AZ. February, 2000.

Nickling, W. G. and J. A. Gillies, 1986. Table 2.5. Threshold Data for Test Sites. *In*: Engineering-Science, Refinement of PM_{10} Emissions Inventory Data for the Maricopa and Pima Planning Areas. EPA Contract 68-02-3888, Work Assignment 69, October, 1987.

Nickling, W. G. and J. A. Gillies, 1989. Emissions of Fine-Grained Particulates from Desert Soils. *In*: Leinen, M. and M. Sarntheim (eds.), *Paleoclimatology and Paleometeorology: Modern and Past Patterns of Global Atmospheric Transport.* Kluwer Academic Publishing, Dordrecht, 1989.

Pulugurtha, S. S. and D. E. James, 2006. Estimating windblown PM-10 emissions from vacant urban land using GIS. *Journal of Hazardous Materials*, April 2006, 132:1, pp. 47–57.

WGA (Western Governors' Association), 2006. Open Area Wind Erosion. Chap. 8 *In*: WRAP Fugitive Dust Handbook, prepared by Countess Environmental, WGA Contract No. 30204–111, September, 2006. Available at: http://www.wrapair.org/forums/dejf/fdh/index.html.

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Appendix 5. MOBILE6.2 Inputs, Outputs, and Emission Factors

In order to calculate vehicle emission factors for the 2008 annual average day for the PM_{10} NAA and Maricopa County, two MOBILE6.2 runs were performed for each month as follows:

- I/M program in place
- No I/M program in place

A portion of the MOBILE6.2 input and output files for Maricopa County are provided in this appendix as examples. Scenarios for each facility type were distinguished by average speed and the roadway scenario in the input file. The MOBILE6.2 emission factors (in g/mi) produced by the runs were subsequently weighted together using the appropriate proportions as described in Section 5.5 "Emission factor estimation" in the main report.

Table A5–1. Sample of MOBILE6.2 input files.

```
MOBILE6 INPUT FILE :
PARTICULATES      :

RUN DATA

STAGE II REFUELING :
94 1 46. 46.

I/M PROGRAM       : 1 1995 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS   : 1 1967 1980
I/M VEHICLES      : 1 22222 22222222 2
I/M STRINGENCY    : 1 37.5
I/M COMPLIANCE    : 1 62.9
I/M WAIVER RATES  : 1 0.709 0.781
I/M GRACE PERIOD  : 1 5
I/M PROGRAM       : 2 1995 2050 2 T/O IM240
I/M MODEL YEARS   : 2 1981 1995
I/M VEHICLES      : 2 22222 11111111 1
I/M STRINGENCY    : 2 37.5
I/M COMPLIANCE    : 2 70.
I/M WAIVER RATES  : 2 0.709 0.781
I/M GRACE PERIOD  : 2 5
I/M CUTPOINTS     : 2 CUTPNT08.d
I/M PROGRAM       : 3 1995 2050 2 T/O FP & GC
I/M MODEL YEARS   : 3 1981 1995
I/M VEHICLES      : 3 22222 11111111 1
I/M COMPLIANCE    : 3 70.
I/M WAIVER RATES  : 3 0.709 0.781
I/M GRACE PERIOD  : 3 5
I/M PROGRAM       : 4 2002 2050 2 T/O OBD I/M
I/M MODEL YEARS   : 4 1996 2050
I/M VEHICLES      : 4 22222 11111111 1
I/M STRINGENCY    : 4 37.5
I/M COMPLIANCE    : 4 91.5
I/M WAIVER RATES  : 4 0.709 0.781
I/M GRACE PERIOD  : 4 5
I/M PROGRAM       : 5 2002 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS   : 5 1996 2050
I/M VEHICLES      : 5 22222 11111111 1
I/M COMPLIANCE    : 5 98.3
I/M WAIVER RATES  : 5 0.709 0.781
I/M GRACE PERIOD  : 5 5
I/M PROGRAM       : 6 1989 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS   : 6 1981 2050
I/M VEHICLES      : 6 11111 22222222 2
I/M STRINGENCY    : 6 37.5
I/M COMPLIANCE    : 6 95.2
I/M WAIVER RATES  : 6 0.709 0.781
I/M GRACE PERIOD  : 6 5
I/M PROGRAM       : 7 1992 2050 1 T/O GC
I/M MODEL YEARS   : 7 1981 2050
I/M VEHICLES      : 7 11111 22222222 2
I/M COMPLIANCE    : 7 94.2
I/M WAIVER RATES  : 7 0.709 0.781
I/M GRACE PERIOD  : 7 5

ANTI-TAMP PROG    :
87 75 80 22222 22222222 2 11 80.7 22111222
ANTI-TAMP PROG    :
87 81 03 11111 22222222 2 11 90.7 22111222

REG DIST          : 087Reg08.d
DIESEL FRACTIONS  :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
0.0009 0.0009 0.0009 0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004
0.0001 0.0027 0.0032 0.0097 0.0162
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0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
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0.0072 0.0082 0.0124 0.0135 0.0169
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0.1998 0.1998 0.1998 0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058
0.1756 0.1958 0.2726 0.2743 0.3004
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
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0.7488 0.7789 0.7842 0.6145 0.5139
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8606 0.8606 0.8606 0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108
0.5647 0.3178 0.2207 0.1968 0.1070
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0.1043 0.0610 0.0383 0.0333 0.0255
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0.4216 0.4734 0.4705 0.4525 0.4310
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0.8563 0.8563 0.8563 0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440
0.7184 0.7588 0.7567 0.7431 0.7261
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0.9992 0.9992 0.9992 0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979
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0.9585 0.9585 0.9585 0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710
0.7502 0.7345 0.6733 0.5105 0.3845

********************** PM10 ************************
** Rural: Principal Arterial - Interstate
SCENARIO RECORD    : I/M Rural Principal Arterial - Interstate (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 51.5 Freeway
VMT BY FACILITY    : allfwy.def
FUEL PROGRAM       : 2 S

** Rural: Principal Arterial - Other
SCENARIO RECORD    : I/M Rural Principal Arterial - Other (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 38.1 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Rural: Minor Arterial
SCENARIO RECORD    : I/M Rural Minor Arterial (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 38.1 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Rural: Major Collector
SCENARIO RECORD    : I/M Rural Major Collector (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 30.3 Arterial
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VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Rural: Minor Collector
SCENARIO RECORD    : I/M Rural Minor Collector (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 30.3 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Rural: Local
SCENARIO RECORD    : I/M Rural Local (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
VMT BY FACILITY    : allloc.def
FUEL PROGRAM       : 2 S

** Urban: Principal Arterial - Interstate
SCENARIO RECORD    : I/M Urban Principal Arterial - Interstate (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 44.4 Freeway
VMT BY FACILITY    : allfwy.def
FUEL PROGRAM       : 2 S

** Urban: Freeways & Expressways
SCENARIO RECORD    : I/M Urban Freeways & Expressways (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 44.4 Freeway
VMT BY FACILITY    : allfwy.def
FUEL PROGRAM       : 2 S

** Urban: Principal Arterial - Other
SCENARIO RECORD    : I/M Urban Principal Arterial - Other (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 30.1 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Urban: Minor Arterial
SCENARIO RECORD    : I/M Urban Minor Arterial (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 30.1 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S
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** Urban: Collector
SCENARIO RECORD    : I/M Urban Collector (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 24.2 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Urban: Local
SCENARIO RECORD    : I/M Urban Local (PM10), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
VMT BY FACILITY    : allloc.def
FUEL PROGRAM       : 2 S


********************** PM2.5 ************************
** Rural: Principal Arterial - Interstate
SCENARIO RECORD    : I/M Rural Principal Arterial - Interstate (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 51.5 Freeway
VMT BY FACILITY    : allfwy.def
FUEL PROGRAM       : 2 S

** Rural: Principal Arterial - Other
SCENARIO RECORD    : I/M Rural Principal Arterial - Other (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 38.1 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Rural: Minor Arterial
SCENARIO RECORD    : I/M Rural Minor Arterial (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 38.1 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Rural: Major Collector
SCENARIO RECORD    : I/M Rural Major Collector (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 30.3 Arterial
VMT BY FAC1LITY    : allart.def
FUEL PROGRAM       : 2 S

** Rural: Minor Collector
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SCENARIO RECORD    : I/M Rural Minor Collector (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 30.3 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Rural: Local
SCENARIO RECORD    : I/M Rural Local (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
VMT BY FACILITY    : allloc.def
FUEL PROGRAM       : 2 S

** Urban: Principal Arterial - Interstate
SCENARIO RECORD    : I/M Urban Principal Arterial - Interstate (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 44.4 Freeway
VMT BY FACILITY    : allfwy.def
FUEL PROGRAM       : 2 S

** Urban: Freeways & Expressways
SCENARIO RECORD    : I/M Urban Freeways & Expressways (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 44.4 Freeway
VMT BY FACILITY    : allfwy.def
FUEL PROGRAM       : 2 S

** Urban: Principal Arterial - Other
SCENARIO RECORD    : I/M Urban Principal Arterial - Other (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 30.1 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Urban: Minor Arterial
SCENARIO RECORD    : I/M Urban Minor Arterial (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                     101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                     24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 30.1 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Urban: Collector
SCENARIO RECORD    : I/M Urban Collector (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
```

```
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                   101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                   24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
AVERAGE SPEED      : 24.2 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S

** Urban: Local
SCENARIO RECORD    : I/M Urban Local (PM2.5), July 2008
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE      : 2.5
DIESEL SULFUR      : 4.20
CALENDAR YEAR      : 2008
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 87.0 89.0 92.0 94.0 96.0 99.0 100.0 102.0 103.0 104.0 103.0 103.0
                   101.0 99.0 97.0 95.0 93.0 91.0 90.0 89.0 88.0 88.0 87.0 86.0
RELATIVE HUMIDITY  : 45.0 41.0 37.0 34.0 30.0 27.0 25.0 23.0 22.0 21.0 23.0 23.0
                   24.0 26.0 30.0 32.0 35.0 38.0 39.0 41.0 42.0 43.0 44.0 46.0
BAROMETRIC PRES    : 28.63
FUEL RVP           : 7.1
VMT BY FACILITY    : allloc.def
FUEL PROGRAM       : 2 S

END OF RUN
```

Table A5–2. Sample of MOBILE6.2 output files.

```
* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Principal Arterial - Interstate (PM10), July 2008
* File 13, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                        Calendar Year:  2008
                                Month:  July
            Gasoline Fuel Sulfur Content:   30. ppm
              Diesel Fuel Sulfur Content:    4. ppm
                   Particle Size Cutoff: 10.00 Microns
                      Reformulated Gas:  Yes

      Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
             GVWR:             <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
             Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
            GASPM:   0.0041   0.0043   0.0043   0.0043   0.0392   ------   ------   ------   0.0205   0.0052
          ECARBON:   ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
          OCARBON:   ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
              SO4:   0.0002   0.0005   0.0005   0.0005   0.0018   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0043   0.0048   0.0047   0.0048   0.0410   0.0918   0.0561   0.1332   0.0206   0.0200
            Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
             Tire:   0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
         Total PM:   0.0249   0.0253   0.0253   0.0253   0.0622   0.1123   0.0766   0.1721   0.0371   0.0425
              SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
              NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Principal Arterial - Other (PM10), July 2008
* File 13, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                        Calendar Year:  2008
                                Month:  July
            Gasoline Fuel Sulfur Content:   30. ppm
              Diesel Fuel Sulfur Content:    4. ppm
                   Particle Size Cutoff: 10.00 Microns
                      Reformulated Gas:  Yes

      Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
             GVWR:             <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
             Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
            GASPM:   0.0041   0.0043   0.0043   0.0043   0.0392   ------   ------   ------   0.0205   0.0052
          ECARBON:   ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
          OCARBON:   ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
              SO4:   0.0002   0.0005   0.0005   0.0005   0.0018   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0043   0.0048   0.0047   0.0048   0.0410   0.0918   0.0561   0.1332   0.0206   0.0200
            Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
             Tire:   0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
         Total PM:   0.0249   0.0253   0.0253   0.0253   0.0622   0.1123   0.0766   0.1721   0.0371   0.0425
              SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
              NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Minor Arterial (PM10), July 2008
* File 13, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                        Calendar Year:  2008
                                Month:  July
            Gasoline Fuel Sulfur Content:   30. ppm
              Diesel Fuel Sulfur Content:    4. ppm
                   Particle Size Cutoff: 10.00 Microns
                      Reformulated Gas:  Yes

      Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
             GVWR:             <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
             Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
            GASPM:   0.0041   0.0043   0.0043   0.0043   0.0392   ------   ------   ------   0.0205   0.0052
          ECARBON:   ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
          OCARBON:   ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
              SO4:   0.0002   0.0005   0.0005   0.0005   0.0018   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0043   0.0048   0.0047   0.0048   0.0410   0.0918   0.0561   0.1332   0.0206   0.0200
            Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
             Tire:   0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
         Total PM:   0.0249   0.0253   0.0253   0.0253   0.0622   0.1123   0.0766   0.1721   0.0371   0.0425
              SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
              NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Major Collector (PM10), July 2008
* File 13, Run 1, Scenario 4.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                        Calendar Year:  2008
                                Month:  July
            Gasoline Fuel Sulfur Content:   30. ppm
              Diesel Fuel Sulfur Content:    4. ppm
                   Particle Size Cutoff: 10.00 Microns
                      Reformulated Gas:  Yes

      Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
```

```
           GVWR:            <6000    >6000    (All)
                          ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:        0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:    0.0041   0.0043   0.0042   0.0043   0.0392   ------   ------   ------   0.0205   0.0052
        ECARBON:    ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
        OCARBON:    ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
            SO4:    0.0003   0.0005   0.0005   0.0005   0.0016   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0044   0.0048   0.0047   0.0048   0.0409   0.0918   0.0561   0.1332   0.0206   0.0200
          Brake:    0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:    0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
       Total PM:    0.0249   0.0253   0.0253   0.0253   0.0621   0.1123   0.0766   0.1721   0.0371   0.0425
            SO2:    0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:    0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Minor Collector (PM10), July 2008
* File 13, Run 1, Scenario 5.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:  30. ppm
            Diesel Fuel Sulfur Content:   4. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas: Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
           GVWR:               <6000    >6000    (All)
                          ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:        0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:    0.0041   0.0043   0.0042   0.0043   0.0392   ------   ------   ------   0.0205   0.0052
        ECARBON:    ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
        OCARBON:    ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
            SO4:    0.0003   0.0005   0.0005   0.0005   0.0016   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0044   0.0048   0.0047   0.0048   0.0409   0.0918   0.0561   0.1332   0.0206   0.0200
          Brake:    0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:    0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
       Total PM:    0.0249   0.0253   0.0253   0.0253   0.0621   0.1123   0.0766   0.1721   0.0371   0.0425
            SO2:    0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:    0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Local (PM10), July 2008
* File 13, Run 1, Scenario 6.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:  30. ppm
            Diesel Fuel Sulfur Content:   4. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas: Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
           GVWR:               <6000    >6000    (All)
                          ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:        0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:    0.0040   0.0042   0.0042   0.0042   0.0394   ------   ------   ------   0.0205   0.0051
        ECARBON:    ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
        OCARBON:    ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
            SO4:    0.0005   0.0006   0.0006   0.0006   0.0012   0.0000   0.0001   0.0003   0.0002   0.0006
  Total Exhaust PM:   0.0045   0.0048   0.0048   0.0048   0.0406   0.0918   0.0561   0.1332   0.0207   0.0201
          Brake:    0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:    0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
       Total PM:    0.0250   0.0254   0.0253   0.0254   0.0619   0.1123   0.0766   0.1721   0.0372   0.0426
            SO2:    0.0067   0.0087   0.0114   0.0095   0.0167   0.0008   0.0016   0.0037   0.0033   0.0081
            NH3:    0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Principal Arterial - Interstate (PM10), July 2008
* File 13, Run 1, Scenario 7.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:  30. ppm
            Diesel Fuel Sulfur Content:   4. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas: Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
           GVWR:               <6000    >6000    (All)
                          ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:        0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:    0.0041   0.0043   0.0043   0.0043   0.0392   ------   ------   ------   0.0205   0.0052
        ECARBON:    ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
        OCARBON:    ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
            SO4:    0.0002   0.0005   0.0005   0.0005   0.0018   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0043   0.0048   0.0047   0.0048   0.0410   0.0918   0.0561   0.1332   0.0206   0.0200
          Brake:    0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:    0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
       Total PM:    0.0249   0.0253   0.0253   0.0253   0.0622   0.1123   0.0766   0.1721   0.0371   0.0425
            SO2:    0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:    0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------------
```

```
* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Freeways & Expressways (PM10), July 2008
* File 13, Run 1, Scenario 8.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2008
                           Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:    4. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:               <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0041   0.0043   0.0043   0.0043   0.0392   ------   ------   ------   0.0205   0.0052
        ECARBON:   ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
        OCARBON:   ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
            SO4:   0.0002   0.0005   0.0005   0.0005   0.0018   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0043   0.0048   0.0047   0.0048   0.0410   0.0918   0.0561   0.1332   0.0206   0.0200
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
       Total PM:   0.0249   0.0253   0.0253   0.0253   0.0622   0.1123   0.0766   0.1721   0.0371   0.0425
            SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Principal Arterial - Other (PM10), July 2008
* File 13, Run 1, Scenario 9.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2008
                           Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:    4. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:               <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0041   0.0043   0.0042   0.0043   0.0392   ------   ------   ------   0.0205   0.0052
        ECARBON:   ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
        OCARBON:   ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
            SO4:   0.0003   0.0005   0.0005   0.0005   0.0016   0.0000   0.0001   0.0003   0.0001   0.0005
  Total Exhaust PM:   0.0044   0.0048   0.0047   0.0048   0.0409   0.0918   0.0561   0.1332   0.0206   0.0200
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
       Total PM:   0.0249   0.0253   0.0253   0.0253   0.0621   0.1123   0.0766   0.1721   0.0371   0.0425
            SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Minor Arterial (PM10), July 2008
* File 13, Run 1, Scenario 10.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2008
                           Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:    4. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:               <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0041   0.0043   0.0042   0.0043   0.0392   ------   ------   ------   0.0205   0.0052
        ECARBON:   ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
        OCARBON:   ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
            SO4:   0.0003   0.0005   0.0005   0.0005   0.0016   0.0000   0.0001   0.0003   0.0001   0.0005
  Total Exhaust PM:   0.0044   0.0048   0.0047   0.0048   0.0409   0.0918   0.0561   0.1332   0.0206   0.0200
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
       Total PM:   0.0249   0.0253   0.0253   0.0253   0.0621   0.1123   0.0766   0.1721   0.0371   0.0425
            SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Collector (PM10), July 2008
* File 13, Run 1, Scenario 11.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2008
                           Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:    4. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:               <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
```

```
-----------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0040   0.0043   0.0042   0.0042   0.0393   ------   ------   ------   0.0205   0.0051
        ECARBON:   ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
        OCARBON:   ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
            SO4:   0.0004   0.0006   0.0006   0.0006   0.0014   0.0000   0.0001   0.0003   0.0001   0.0005
  Total Exhaust PM:   0.0044   0.0048   0.0048   0.0048   0.0407   0.0918   0.0561   0.1332   0.0206   0.0200
           Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
            Tire:   0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
        Total PM:   0.0250   0.0254   0.0253   0.0254   0.0620   0.1123   0.0766   0.1721   0.0372   0.0425
             SO2:   0.0068   0.0087   0.0115   0.0096   0.0167   0.0008   0.0016   0.0037   0.0033   0.0081
             NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Local (PM10), July 2008
* File 13, Run 1, Scenario 12.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:    4. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
            GVWR:            <6000    >6000     (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0040   0.0042   0.0042   0.0042   0.0394   ------   ------   ------   0.0205   0.0051
        ECARBON:   ------   ------   ------   ------   ------   0.0716   0.0230   0.0882   ------   0.0095
        OCARBON:   ------   ------   ------   ------   ------   0.0202   0.0330   0.0448   ------   0.0049
            SO4:   0.0005   0.0006   0.0006   0.0006   0.0012   0.0000   0.0001   0.0003   0.0002   0.0006
  Total Exhaust PM:   0.0045   0.0048   0.0048   0.0048   0.0406   0.0918   0.0561   0.1332   0.0207   0.0201
           Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
            Tire:   0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0263   0.0040   0.0100
        Total PM:   0.0250   0.0254   0.0253   0.0254   0.0619   0.1123   0.0766   0.1721   0.0372   0.0426
             SO2:   0.0067   0.0087   0.0114   0.0095   0.0167   0.0008   0.0016   0.0037   0.0033   0.0081
             NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
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* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Principal Arterial - Interstate (PM2.5), July 2008
* File 13, Run 1, Scenario 13.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:    4. ppm
                 Particle Size Cutoff:  2.50 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
            GVWR:            <6000    >6000     (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0038   0.0039   0.0039   0.0039   0.0352   ------   ------   ------   0.0142   0.0047
        ECARBON:   ------   ------   ------   ------   ------   0.0658   0.0211   0.0812   ------   0.0087
        OCARBON:   ------   ------   ------   ------   ------   0.0186   0.0304   0.0412   ------   0.0045
            SO4:   0.0002   0.0005   0.0005   0.0005   0.0018   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0040   0.0044   0.0044   0.0044   0.0370   0.0845   0.0516   0.1226   0.0143   0.0184
           Brake:   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053
            Tire:   0.0020   0.0020   0.0020   0.0020   0.0022   0.0020   0.0020   0.0066   0.0010   0.0025
        Total PM:   0.0114   0.0117   0.0117   0.0117   0.0445   0.0918   0.0589   0.1345   0.0206   0.0262
             SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
             NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Principal Arterial - Other (PM2.5), July 2008
* File 13, Run 1, Scenario 14.
* # # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:    4. ppm
                 Particle Size Cutoff:  2.50 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
            GVWR:            <6000    >6000     (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0038   0.0039   0.0039   0.0039   0.0352   ------   ------   ------   0.0142   0.0047
        ECARBON:   ------   ------   ------   ------   ------   0.0658   0.0211   0.0812   ------   0.0087
        OCARBON:   ------   ------   ------   ------   ------   0.0186   0.0304   0.0412   ------   0.0045
            SO4:   0.0002   0.0005   0.0005   0.0005   0.0018   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0040   0.0044   0.0044   0.0044   0.0370   0.0845   0.0516   0.1226   0.0143   0.0184
           Brake:   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053
            Tire:   0.0020   0.0020   0.0020   0.0020   0.0022   0.0020   0.0020   0.0066   0.0010   0.0025
        Total PM:   0.0114   0.0117   0.0117   0.0117   0.0445   0.0918   0.0589   0.1345   0.0206   0.0262
             SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
             NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Minor Arterial (PM2.5), July 2008
```

```
* File 13, Run 1, Scenario 15.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:  30. ppm
            Diesel Fuel Sulfur Content:   4. ppm
                 Particle Size Cutoff: 2.50 Microns
                    Reformulated Gas: Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
            GVWR:            <6000    >6000    (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0038   0.0039   0.0039   0.0039   0.0352   ------   ------   ------   0.0142   0.0047
        ECARBON:   ------   ------   ------   ------   ------   0.0658   0.0211   0.0812   ------   0.0087
        OCARBON:   ------   ------   ------   ------   ------   0.0186   0.0304   0.0412   ------   0.0045
            SO4:   0.0002   0.0005   0.0005   0.0005   0.0018   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0040   0.0044   0.0044   0.0044   0.0370   0.0845   0.0516   0.1226   0.0143   0.0184
          Brake:   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053
           Tire:   0.0020   0.0020   0.0020   0.0020   0.0022   0.0020   0.0020   0.0066   0.0010   0.0025
       Total PM:   0.0114   0.0117   0.0117   0.0117   0.0445   0.0918   0.0589   0.1345   0.0206   0.0262
            SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Major Collector (PM2.5), July 2008
* File 13, Run 1, Scenario 16.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:  30. ppm
            Diesel Fuel Sulfur Content:   4. ppm
                 Particle Size Cutoff: 2.50 Microns
                    Reformulated Gas: Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
            GVWR:            <6000    >6000    (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0037   0.0039   0.0039   0.0039   0.0353   ------   ------   ------   0.0142   0.0047
        ECARBON:   ------   ------   ------   ------   ------   0.0658   0.0211   0.0812   ------   0.0087
        OCARBON:   ------   ------   ------   ------   ------   0.0186   0.0304   0.0412   ------   0.0045
            SO4:   0.0003   0.0005   0.0005   0.0005   0.0016   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0041   0.0044   0.0044   0.0044   0.0369   0.0845   0.0516   0.1226   0.0143   0.0184
          Brake:   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053
           Tire:   0.0020   0.0020   0.0020   0.0020   0.0022   0.0020   0.0020   0.0066   0.0010   0.0025
       Total PM:   0.0114   0.0118   0.0117   0.0117   0.0444   0.0918   0.0589   0.1345   0.0206   0.0262
            SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Minor Collector (PM2.5), July 2008
* File 13, Run 1, Scenario 17.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:  30. ppm
            Diesel Fuel Sulfur Content:   4. ppm
                 Particle Size Cutoff: 2.50 Microns
                    Reformulated Gas: Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
            GVWR:            <6000    >6000    (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0037   0.0039   0.0039   0.0039   0.0353   ------   ------   ------   0.0142   0.0047
        ECARBON:   ------   ------   ------   ------   ------   0.0658   0.0211   0.0812   ------   0.0087
        OCARBON:   ------   ------   ------   ------   ------   0.0186   0.0304   0.0412   ------   0.0045
            SO4:   0.0003   0.0005   0.0005   0.0005   0.0016   0.0000   0.0001   0.0003   0.0001   0.0004
  Total Exhaust PM:   0.0041   0.0044   0.0044   0.0044   0.0369   0.0845   0.0516   0.1226   0.0143   0.0184
          Brake:   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053
           Tire:   0.0020   0.0020   0.0020   0.0020   0.0022   0.0020   0.0020   0.0066   0.0010   0.0025
       Total PM:   0.0114   0.0118   0.0117   0.0117   0.0444   0.0918   0.0589   0.1345   0.0206   0.0262
            SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Local (PM2.5), July 2008
* File 13, Run 1, Scenario 18.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year: 2008
                           Month: July
          Gasoline Fuel Sulfur Content:  30. ppm
            Diesel Fuel Sulfur Content:   4. ppm
                 Particle Size Cutoff: 2.50 Microns
                    Reformulated Gas: Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
            GVWR:            <6000    >6000    (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
```

GASPM:	0.0036	0.0039	0.0038	0.0039	0.0354	------	------	------	0.0142	0.0046
ECARBON:	------	------	------	------	------	0.0658	0.0211	0.0812	------	0.0087
OCARBON:	------	------	------	------	------	0.0186	0.0304	0.0412	------	0.0045
SO4:	0.0005	0.0006	0.0006	0.0006	0.0012	0.0000	0.0001	0.0003	0.0002	0.0006
Total Exhaust PM:	0.0042	0.0045	0.0044	0.0045	0.0367	0.0845	0.0516	0.1226	0.0144	0.0184
Brake:	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053
Tire:	0.0020	0.0020	0.0020	0.0020	0.0022	0.0020	0.0020	0.0066	0.0010	0.0025
Total PM:	0.0115	0.0118	0.0118	0.0118	0.0442	0.0918	0.0589	0.1345	0.0207	0.0263
SO2:	0.0067	0.0087	0.0114	0.0095	0.0167	0.0008	0.0016	0.0037	0.0033	0.0081
NH3:	0.1017	0.1009	0.1008	0.1009	0.0451	0.0068	0.0068	0.0270	0.0113	0.0904

```
* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Principal Arterial - Interstate (PM2.5), July 2008
* File 13, Run 1, Scenario 19.
* # # # # # # # # # # # # # # # # # # # # # # # # # #
```

Calendar Year: 2008
Month: July
Gasoline Fuel Sulfur Content: 30. ppm
Diesel Fuel Sulfur Content: 4. ppm
Particle Size Cutoff: 2.50 Microns
Reformulated Gas: Yes

Vehicle Type: GVWR:	LDGV	LDGT12 <6000	LDGT34 >6000	LDGT (All)	HDGV	LDDV	LDDT	HDDV	MC	All Veh
VMT Distribution:	0.3626	0.3400	0.1439		0.0392	0.0004	0.0022	0.1069	0.0048	1.0000
Composite Emission Factors (g/mi):										
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0038	0.0039	0.0039	0.0039	0.0352	------	------	------	0.0142	0.0047
ECARBON:	------	------	------	------	------	0.0658	0.0211	0.0812	------	0.0087
OCARBON:	------	------	------	------	------	0.0186	0.0304	0.0412	------	0.0045
SO4:	0.0002	0.0005	0.0005	0.0005	0.0018	0.0000	0.0001	0.0003	0.0001	0.0004
Total Exhaust PM:	0.0040	0.0044	0.0044	0.0044	0.0370	0.0845	0.0516	0.1226	0.0143	0.0184
Brake:	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053
Tire:	0.0020	0.0020	0.0020	0.0020	0.0022	0.0020	0.0020	0.0066	0.0010	0.0025
Total PM:	0.0114	0.0117	0.0117	0.0117	0.0445	0.0918	0.0589	0.1345	0.0206	0.0262
SO2:	0.0068	0.0088	0.0115	0.0096	0.0166	0.0008	0.0016	0.0037	0.0033	0.0082
NH3:	0.1017	0.1009	0.1008	0.1009	0.0451	0.0068	0.0068	0.0270	0.0113	0.0904

```
* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Freeways & Expressways (PM2.5), July 2008
* File 13, Run 1, Scenario 20.
* # # # # # # # # # # # # # # # # # # # # # # # # # #
```

Calendar Year: 2008
Month: July
Gasoline Fuel Sulfur Content: 30. ppm
Diesel Fuel Sulfur Content: 4. ppm
Particle Size Cutoff: 2.50 Microns
Reformulated Gas: Yes

Vehicle Type: GVWR:	LDGV	LDGT12 <6000	LDGT34 >6000	LDGT (All)	HDGV	LDDV	LDDT	HDDV	MC	All Veh
VMT Distribution:	0.3626	0.3400	0.1439		0.0392	0.0004	0.0022	0.1069	0.0048	1.0000
Composite Emission Factors (g/mi):										
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0038	0.0039	0.0039	0.0039	0.0352	------	------	------	0.0142	0.0047
ECARBON:	------	------	------	------	------	0.0658	0.0211	0.0812	------	0.0087
OCARBON:	------	------	------	------	------	0.0186	0.0304	0.0412	------	0.0045
SO4:	0.0002	0.0005	0.0005	0.0005	0.0018	0.0000	0.0001	0.0003	0.0001	0.0004
Total Exhaust PM:	0.0040	0.0044	0.0044	0.0044	0.0370	0.0845	0.0516	0.1226	0.0143	0.0184
Brake:	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053
Tire:	0.0020	0.0020	0.0020	0.0020	0.0022	0.0020	0.0020	0.0066	0.0010	0.0025
Total PM:	0.0114	0.0117	0.0117	0.0117	0.0445	0.0918	0.0589	0.1345	0.0206	0.0262
SO2:	0.0068	0.0088	0.0115	0.0096	0.0166	0.0008	0.0016	0.0037	0.0033	0.0082
NH3:	0.1017	0.1009	0.1008	0.1009	0.0451	0.0068	0.0068	0.0270	0.0113	0.0904

```
* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Principal Arterial - Other (PM2.5), July 2008
* File 13, Run 1, Scenario 21.
* # # # # # # # # # # # # # # # # # # # # # # # # # #
```

Calendar Year: 2008
Month: July
Gasoline Fuel Sulfur Content: 30. ppm
Diesel Fuel Sulfur Content: 4. ppm
Particle Size Cutoff: 2.50 Microns
Reformulated Gas: Yes

Vehicle Type: GVWR:	LDGV	LDGT12 <6000	LDGT34 >6000	LDGT (All)	HDGV	LDDV	LDDT	HDDV	MC	All Veh
VMT Distribution:	0.3626	0.3400	0.1439		0.0392	0.0004	0.0022	0.1069	0.0048	1.0000
Composite Emission Factors (g/mi):										
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0037	0.0039	0.0039	0.0039	0.0353	------	------	------	0.0142	0.0047
ECARBON:	------	------	------	------	------	0.0658	0.0211	0.0812	------	0.0087
OCARBON:	------	------	------	------	------	0.0186	0.0304	0.0412	------	0.0045
SO4:	0.0003	0.0005	0.0005	0.0005	0.0016	0.0000	0.0001	0.0003	0.0001	0.0005
Total Exhaust PM:	0.0041	0.0044	0.0044	0.0044	0.0369	0.0845	0.0516	0.1226	0.0143	0.0184
Brake:	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053
Tire:	0.0020	0.0020	0.0020	0.0020	0.0022	0.0020	0.0020	0.0066	0.0010	0.0025
Total PM:	0.0114	0.0118	0.0117	0.0117	0.0444	0.0918	0.0589	0.1345	0.0206	0.0262
SO2:	0.0068	0.0088	0.0115	0.0096	0.0166	0.0008	0.0016	0.0037	0.0033	0.0082
NH3:	0.1017	0.1009	0.1008	0.1009	0.0451	0.0068	0.0068	0.0270	0.0113	0.0904

```
* # # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Minor Arterial (PM2.5), July 2008
* File 13, Run 1, Scenario 22.
* # # # # # # # # # # # # # # # # # # # # # # # # # #
```

```
                    Calendar Year:  2008
                           Month:  July
        Gasoline Fuel Sulfur Content:   30. ppm
          Diesel Fuel Sulfur Content:    4. ppm
             Particle Size Cutoff:  2.50 Microns
                Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:               <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0037   0.0039   0.0039   0.0039   0.0353   ------   ------   ------   0.0142   0.0047
       ECARBON:    ------   ------   ------   ------   ------   0.0658   0.0211   0.0812   ------   0.0087
       OCARBON:    ------   ------   ------   ------   ------   0.0186   0.0304   0.0412   ------   0.0045
            SO4:   0.0003   0.0005   0.0005   0.0005   0.0016   0.0000   0.0001   0.0003   0.0001   0.0005
  Total Exhaust PM:   0.0041   0.0044   0.0044   0.0044   0.0369   0.0845   0.0516   0.1226   0.0143   0.0184
          Brake:   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053
           Tire:   0.0020   0.0020   0.0020   0.0020   0.0022   0.0020   0.0020   0.0066   0.0010   0.0025
       Total PM:   0.0114   0.0118   0.0117   0.0117   0.0444   0.0918   0.0589   0.1345   0.0206   0.0262
            SO2:   0.0068   0.0088   0.0115   0.0096   0.0166   0.0008   0.0016   0.0037   0.0033   0.0082
            NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Collector (PM2.5), July 2008
* File 13, Run 1, Scenario 23.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2008
                           Month:  July
        Gasoline Fuel Sulfur Content:   30. ppm
          Diesel Fuel Sulfur Content:    4. ppm
             Particle Size Cutoff:  2.50 Microns
                Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:               <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0037   0.0039   0.0038   0.0039   0.0354   ------   ------   ------   0.0142   0.0047
       ECARBON:    ------   ------   ------   ------   ------   0.0658   0.0211   0.0812   ------   0.0087
       OCARBON:    ------   ------   ------   ------   ------   0.0186   0.0304   0.0412   ------   0.0045
            SO4:   0.0004   0.0006   0.0006   0.0006   0.0014   0.0000   0.0001   0.0003   0.0001   0.0005
  Total Exhaust PM:   0.0041   0.0045   0.0044   0.0044   0.0368   0.0845   0.0516   0.1226   0.0143   0.0184
          Brake:   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053
           Tire:   0.0020   0.0020   0.0020   0.0020   0.0022   0.0020   0.0020   0.0066   0.0010   0.0025
       Total PM:   0.0114   0.0118   0.0117   0.0118   0.0443   0.0918   0.0589   0.1345   0.0207   0.0262
            SO2:   0.0068   0.0087   0.0115   0.0096   0.0167   0.0008   0.0016   0.0037   0.0033   0.0081
            NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Local (PM2.5), July 2008
* File 13, Run 1, Scenario 24.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2008
                           Month:  July
        Gasoline Fuel Sulfur Content:   30. ppm
          Diesel Fuel Sulfur Content:    4. ppm
             Particle Size Cutoff:  2.50 Microns
                Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:               <6000    >6000     (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3626   0.3400   0.1439            0.0392   0.0004   0.0022   0.1069   0.0048   1.0000
-----------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0036   0.0039   0.0038   0.0039   0.0354   ------   ------   ------   0.0142   0.0046
       ECARBON:    ------   ------   ------   ------   ------   0.0658   0.0211   0.0812   ------   0.0087
       OCARBON:    ------   ------   ------   ------   ------   0.0186   0.0304   0.0412   ------   0.0045
            SO4:   0.0005   0.0006   0.0006   0.0006   0.0012   0.0000   0.0001   0.0003   0.0002   0.0006
  Total Exhaust PM:   0.0042   0.0045   0.0044   0.0045   0.0367   0.0845   0.0516   0.1226   0.0144   0.0184
          Brake:   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053   0.0053
           Tire:   0.0020   0.0020   0.0020   0.0020   0.0022   0.0020   0.0020   0.0066   0.0010   0.0025
       Total PM:   0.0115   0.0118   0.0118   0.0118   0.0442   0.0918   0.0589   0.1345   0.0207   0.0263
            SO2:   0.0067   0.0087   0.0114   0.0095   0.0167   0.0008   0.0016   0.0037   0.0033   0.0081
            NH3:   0.1017   0.1009   0.1008   0.1009   0.0451   0.0068   0.0068   0.0270   0.0113   0.0904
-----------------------------------------------------------------------------------------------------------------
```

Table A5–3. MOBILE6.2 Emission Factors for Maricopa County (by month, in g/mi)

January 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.153	0.021
	NO_x	0.635	0.978	1.092	2.588	0.850	0.806	8.196	1.930
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.153	0.021
	NO_x	0.586	0.915	1.029	2.338	0.670	0.633	5.959	1.660
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.153	0.021
	NO_x	0.586	0.915	1.029	2.338	0.670	0.633	5.959	1.660
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.153	0.021
	NO_x	0.588	0.918	1.033	2.198	0.665	0.627	5.911	1.580
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.153	0.021
	NO_x	0.588	0.918	1.033	2.198	0.665	0.627	5.911	1.580
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.153	0.021
	NO_x	0.561	0.888	1.005	1.889	0.883	0.838	7.391	1.320
	SO_x	0.007	0.009	0.011	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.153	0.021
	NO_x	0.614	0.950	1.064	2.452	0.719	0.680	7.025	1.710
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.153	0.021
	NO_x	0.614	0.950	1.064	2.452	0.719	0.680	7.025	1.710
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.153	0.021
	NO_x	0.588	0.919	1.034	2.194	0.665	0.628	5.913	1.580
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.153	0.021
	NO_x	0.588	0.919	1.034	2.194	0.665	0.628	5.913	1.580
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.153	0.021
	NO_x	0.616	0.959	1.077	2.092	0.701	0.662	6.233	1.480
	SO_x	0.007	0.009	0.012	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.192	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.153	0.021
	NO_x	0.561	0.888	1.005	1.889	0.883	0.838	7.391	1.320
	SO_x	0.007	0.009	0.011	0.017	0.003	0.006	0.014	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

February 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.610	0.939	1.048	2.581	0.850	0.806	8.196	1.860
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.563	0.877	0.986	2.332	0.670	0.633	5.959	1.600
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.563	0.877	0.986	2.332	0.670	0.633	5.959	1.600
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.564	0.880	0.990	2.193	0.665	0.627	5.911	1.520
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.564	0.880	0.990	2.193	0.665	0.627	5.911	1.520
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.538	0.850	0.962	1.884	0.883	0.838	7.391	1.270
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.590	0.911	1.021	2.446	0.719	0.680	7.025	1.650
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.590	0.911	1.021	2.446	0.719	0.680	7.025	1.650
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.565	0.880	0.991	2.189	0.665	0.628	5.913	1.520
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.565	0.880	0.991	2.189	0.665	0.628	5.913	1.520
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.590	0.918	1.032	2.086	0.701	0.662	6.233	1.430
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.538	0.850	0.962	1.884	0.883	0.838	7.391	1.270
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

March 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.609	0.926	1.033	2.543	0.850	0.806	8.196	1.820
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.567	0.868	0.976	2.298	0.670	0.633	5.959	1.570
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.567	0.868	0.976	2.298	0.670	0.633	5.959	1.570
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.571	0.873	0.983	2.160	0.665	0.627	5.911	1.490
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.571	0.873	0.983	2.160	0.665	0.627	5.911	1.490
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.555	0.849	0.961	1.856	0.883	0.838	7.391	1.250
	SO_x	0.007	0.009	0.011	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.591	0.901	1.008	2.410	0.719	0.680	7.025	1.620
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.591	0.901	1.008	2.410	0.719	0.680	7.025	1.620
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.572	0.873	0.983	2.156	0.665	0.628	5.913	1.490
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.572	0.873	0.983	2.156	0.665	0.628	5.913	1.490
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.600	0.911	1.025	2.056	0.701	0.662	6.233	1.400
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.555	0.849	0.961	1.856	0.883	0.838	7.391	1.250
	SO_x	0.007	0.009	0.011	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

April 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.608	0.945	0.969	2.316	0.820	0.736	7.524	1.740
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.573	0.892	0.920	2.093	0.646	0.578	5.494	1.500
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.573	0.892	0.920	2.093	0.646	0.578	5.494	1.500
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.582	0.897	0.927	1.968	0.641	0.573	5.450	1.420
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.582	0.897	0.927	1.968	0.641	0.573	5.450	1.420
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.580	0.882	0.915	1.691	0.852	0.765	6.851	1.190
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.593	0.922	0.948	2.195	0.693	0.621	6.440	1.540
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.593	0.922	0.948	2.195	0.693	0.621	6.440	1.540
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.582	0.898	0.928	1.964	0.641	0.573	5.452	1.420
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.582	0.898	0.928	1.964	0.641	0.573	5.452	1.420
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.614	0.939	0.968	1.872	0.676	0.605	5.748	1.340
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.580	0.882	0.915	1.691	0.852	0.765	6.851	1.190
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

May 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.584	0.903	0.925	2.344	0.820	0.736	7.524	1.610
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.553	0.851	0.877	2.118	0.646	0.578	5.494	1.390
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.553	0.851	0.877	2.118	0.646	0.578	5.494	1.390
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.564	0.858	0.885	1.991	0.641	0.573	5.450	1.320
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.564	0.858	0.885	1.991	0.641	0.573	5.450	1.320
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.570	0.845	0.876	1.711	0.852	0.765	6.851	1.100
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.571	0.880	0.904	2.221	0.693	0.621	6.440	1.430
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.571	0.880	0.904	2.221	0.693	0.621	6.440	1.430
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.565	0.858	0.885	1.987	0.641	0.573	5.452	1.310
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.565	0.858	0.885	1.987	0.641	0.573	5.452	1.310
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.599	0.898	0.927	1.895	0.676	0.605	5.748	1.240
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.570	0.845	0.876	1.711	0.852	0.765	6.851	1.100
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

June 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.636	0.953	0.976	2.309	0.820	0.736	7.524	1.400
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.612	0.902	0.930	2.086	0.646	0.578	5.494	1.210
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.612	0.902	0.930	2.086	0.646	0.578	5.494	1.210
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.631	0.912	0.942	1.961	0.641	0.573	5.450	1.150
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.631	0.912	0.942	1.961	0.641	0.573	5.450	1.150
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.663	0.911	0.945	1.685	0.852	0.765	6.851	0.960
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.625	0.931	0.957	2.188	0.693	0.621	6.440	1.240
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.625	0.931	0.957	2.188	0.693	0.621	6.440	1.240
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.632	0.913	0.943	1.957	0.641	0.573	5.452	1.140
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.632	0.913	0.943	1.957	0.641	0.573	5.452	1.140
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.677	0.959	0.989	1.866	0.676	0.605	5.748	1.080
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.663	0.911	0.945	1.685	0.852	0.765	6.851	0.960
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.005	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

July 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.560	0.832	0.852	2.309	0.820	0.736	7.524	1.180
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.539	0.784	0.809	2.086	0.646	0.578	5.494	1.020
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.539	0.784	0.809	2.086	0.646	0.578	5.494	1.020
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.557	0.793	0.819	1.961	0.641	0.573	5.450	0.970
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.557	0.793	0.819	1.961	0.641	0.573	5.450	0.970
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.590	0.791	0.821	1.685	0.852	0.765	6.851	0.820
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.551	0.811	0.834	2.188	0.693	0.621	6.440	1.050
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.551	0.811	0.834	2.188	0.693	0.621	6.440	1.050
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.558	0.794	0.820	1.957	0.641	0.573	5.452	0.970
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.558	0.794	0.820	1.957	0.641	0.573	5.452	0.970
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.602	0.836	0.863	1.866	0.676	0.605	5.748	0.910
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.590	0.791	0.821	1.685	0.852	0.765	6.851	0.820
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.004	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

August 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.547	0.813	0.833	2.307	0.820	0.736	7.524	1.170
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.525	0.764	0.789	2.084	0.646	0.578	5.494	1.020
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.525	0.764	0.789	2.084	0.646	0.578	5.494	1.020
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.543	0.774	0.799	1.959	0.641	0.573	5.450	0.960
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.543	0.774	0.799	1.959	0.641	0.573	5.450	0.960
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.574	0.771	0.801	1.684	0.852	0.765	6.851	0.810
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.538	0.792	0.814	2.186	0.693	0.621	6.440	1.050
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.538	0.792	0.814	2.186	0.693	0.621	6.440	1.050
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.544	0.775	0.800	1.956	0.641	0.573	5.452	0.960
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.544	0.775	0.800	1.956	0.641	0.573	5.452	0.960
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.587	0.816	0.842	1.864	0.676	0.605	5.748	0.910
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.574	0.771	0.801	1.684	0.852	0.765	6.851	0.810
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

September 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.582	0.874	0.895	2.304	0.820	0.736	7.524	1.340
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.558	0.824	0.850	2.082	0.646	0.578	5.494	1.150
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.558	0.824	0.850	2.082	0.646	0.578	5.494	1.150
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.575	0.833	0.860	1.957	0.641	0.573	5.450	1.100
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.575	0.833	0.860	1.957	0.641	0.573	5.450	1.100
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.600	0.828	0.859	1.682	0.852	0.765	6.851	0.920
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.571	0.852	0.876	2.183	0.693	0.621	6.440	1.190
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.045	0.092	0.059	0.135	0.021
	NO_x	0.571	0.852	0.876	2.183	0.693	0.621	6.440	1.190
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.576	0.834	0.860	1.953	0.641	0.573	5.452	1.090
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.576	0.834	0.860	1.953	0.641	0.573	5.452	1.090
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.617	0.877	0.903	1.862	0.676	0.605	5.748	1.030
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.062	0.112	0.077	0.172	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.044	0.092	0.059	0.135	0.021
	NO_x	0.600	0.828	0.859	1.682	0.852	0.765	6.851	0.920
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

October 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.605	0.900	1.005	2.556	0.850	0.806	8.196	1.630
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.571	0.847	0.953	2.309	0.670	0.633	5.959	1.410
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.571	0.847	0.953	2.309	0.670	0.633	5.959	1.410
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.582	0.854	0.961	2.171	0.665	0.627	5.911	1.330
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.582	0.854	0.961	2.171	0.665	0.627	5.911	1.330
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.586	0.839	0.950	1.866	0.883	0.838	7.391	1.120
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.590	0.877	0.983	2.422	0.719	0.680	7.025	1.450
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.590	0.877	0.983	2.422	0.719	0.680	7.025	1.450
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.582	0.854	0.962	2.167	0.665	0.628	5.913	1.330
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.582	0.854	0.962	2.167	0.665	0.628	5.913	1.330
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.617	0.895	1.007	2.066	0.701	0.662	6.233	1.250
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.586	0.839	0.950	1.866	0.883	0.838	7.391	1.120
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

November 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.590	0.898	1.002	2.542	0.850	0.806	8.196	1.770
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.548	0.840	0.945	2.297	0.670	0.633	5.959	1.530
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.548	0.840	0.945	2.297	0.670	0.633	5.959	1.530
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.552	0.844	0.950	2.159	0.665	0.627	5.911	1.450
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.552	0.844	0.950	2.159	0.665	0.627	5.911	1.450
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.534	0.819	0.928	1.855	0.883	0.838	7.391	1.210
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.572	0.872	0.978	2.409	0.719	0.680	7.025	1.570
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.572	0.872	0.978	2.409	0.719	0.680	7.025	1.570
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.552	0.845	0.951	2.155	0.665	0.628	5.913	1.450
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.552	0.845	0.951	2.155	0.665	0.628	5.913	1.450
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.579	0.882	0.993	2.055	0.701	0.662	6.233	1.360
	SO_x	0.007	0.009	0.012	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.534	0.819	0.928	1.855	0.883	0.838	7.391	1.210
	SO_x	0.007	0.009	0.011	0.017	0.001	0.002	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011

December 2008 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT12	LDGT34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.623	0.959	1.070	2.592	0.850	0.806	8.196	1.890
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.575	0.897	1.008	2.342	0.670	0.633	5.959	1.630
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.575	0.897	1.008	2.342	0.670	0.633	5.959	1.630
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Major Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.576	0.899	1.012	2.202	0.665	0.627	5.911	1.550
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Minor Collector	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.576	0.899	1.012	2.202	0.665	0.627	5.911	1.550
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Rural Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.550	0.869	0.984	1.892	0.883	0.838	7.391	1.300
	SO_x	0.007	0.009	0.011	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Interstate	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.602	0.931	1.043	2.457	0.719	0.680	7.025	1.680
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Freeway & Expressway	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.049	0.096	0.065	0.152	0.021
	NO_x	0.602	0.931	1.043	2.457	0.719	0.680	7.025	1.680
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Principal Arterial – Other	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.577	0.900	1.013	2.198	0.665	0.628	5.913	1.550
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Minor Arterial	PM_{10}	0.025	0.025	0.025	0.067	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.011	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.577	0.900	1.013	2.198	0.665	0.628	5.913	1.550
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Collector	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.603	0.938	1.055	2.095	0.701	0.662	6.233	1.450
	SO_x	0.007	0.009	0.012	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011
Urban Local	PM_{10}	0.025	0.025	0.025	0.066	0.116	0.083	0.191	0.037
	$PM_{2.5}$	0.012	0.012	0.012	0.048	0.096	0.065	0.152	0.021
	NO_x	0.550	0.869	0.984	1.892	0.883	0.838	7.391	1.300
	SO_x	0.007	0.009	0.011	0.017	0.001	0.003	0.006	0.003
	NH_3	0.102	0.101	0.101	0.045	0.007	0.007	0.027	0.011