



Proposed

Arizona State Implementation Plan

*Maricopa County PM₁₀
Serious Area Nonattainment Area*

Agricultural Best Management Practices

**Air Quality Division
September 2009**

(This page intentionally left blank.)

TABLE OF CONTENTS

EXECUTIVE SUMMARY4

CHAPTER 1.0 INTRODUCTION6

 1.1 Physical and Meteorological Description of the Maricopa County PM₁₀ Serious Nonattainment Area6

 1.2 The Maricopa County PM₁₀ Nonattainment Area History8

 1.3 Maricopa Association of Governments (MAG) 2007 Five Percent Plan for PM₁₀ for the Maricopa County Nonattainment Area10

 1.4 Agricultural Best Management Practices SIP Revision.....13

CHAPTER 2.0 AGRICULTURAL BEST MANAGEMENT PRACTICES SELECTION PROCESS14

 2.1 Actions of the Governor’s Agricultural Best Management Practices Committee...14

 2.2 Senate Bill 1552 and Committee Actions15

CHAPTER 3.0 ADDITIONAL AGRICULTURAL BEST MANAGEMENT PRACTICES ...18

 3.1 Cessation of Night Tillage on High Pollution Advisory Days18

 3.2 Green Chop18

 3.3 Integrated Pest Management.....18

 3.4 Precision Farming19

 3.5 Transgenic Crops 19

CHAPTER 4.0 OUTREACH.....20

 3.1 Public Outreach Activities20

CHAPTER 5.0 CONCLUSION.....22

LIST OF FIGURES

CHAPTER 1.0

Figure 1: Maricopa County PM₁₀ Nonattainment Area.....7

Figure 2: Annual 2005 PM₁₀ Emissions in the PM₁₀ Nonattainment Area12

CHAPTER 2.0

Figure 3: Map of PM₁₀ Nonattainment Area and Area A16

LIST OF APPENDICES

APPENDIX A (AgBMP Rule)

APPENDIX B (Technical Support)

APPENDIX C (Booklet and Pocket Guide)

APPENDIX D (Public Process)

EXECUTIVE SUMMARY

The purpose of this State Implementation Plan (SIP) revision is to address the contribution from agricultural practices to the Maricopa County Nonattainment area for particulate matter pollution. The Maricopa County PM₁₀ Serious Nonattainment area encompasses the Phoenix metropolitan area and the surrounding cities. The area has remained in violation of the federal health standards for particulate matter of 10 microns or less (PM₁₀) emissions since the standard was adopted in 1987. To address the problem numerous emission control programs have been adopted. Among the many sources of PM₁₀ emissions contributing to nonattainment, agricultural activities have been required to be subject to controls. On August 4, 1997, the Environmental Protection Agency (EPA) approved in part the *Plan for Attainment of the 24-hour PM₁₀ Standard – Maricopa County PM₁₀ Nonattainment Area* and disapproved the demonstrations for several source categories of PM₁₀, including agricultural sources. In order to address agricultural sources of PM₁₀, the Arizona Legislature created the Governor's Agricultural Best Management Practices Committee (Committee) in 1998 to develop requirements of an agricultural general permit and alternative best management practices (BMPs) for controlling dust.

Arizona has made several submittals to address the Clean Air Act (CAA) requirements for serious PM₁₀ nonattainment area plans in the Phoenix area. These include documents submitted by the Arizona Department of Environmental Quality (ADEQ) and the Maricopa Association of Governments (MAG). The EPA views these submittals collectively as the full serious area PM₁₀ plan for the Phoenix area, with the *Revised Maricopa Association of Governments 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area* as the primary document (67 FR 48718). Parts of the 1999 plan were approved by EPA on July 25, 2002, and the attainment deadline was extended to December 31, 2006. The nonattainment area was unable to reach attainment by this extended deadline, which subjected the area to Clean Air Act requirements stipulating that PM₁₀ emissions in the nonattainment area be reduced by five percent per year until the PM₁₀ standard is attained. To address agricultural sources of PM₁₀ emissions and contribute to the required five percent reductions, the Committee adopted new agricultural BMPs to reduce PM₁₀ emissions from agricultural activities. Senate Bill (SB) 1552 also addressed agricultural sources of PM₁₀ by requiring the use of two BMPs per agricultural category and expanding the applicable area of BMPs to include the Maricopa County portions of Area A.

This document revises the *Agricultural Best Management Practices, Maricopa County PM₁₀ Serious Area State Implementation Plan* submitted in 2001, to reflect additional BMPs, an increase in the number of required BMPs from one to two per agricultural category, and an extended area of implementation. Chapter 1.0 contains a brief history of the nonattainment area. Chapter 2.0 contains a description of the review and analysis process used by the Committee and the results of this process. Descriptions of the BMPs adopted by the Committee are included in Chapter 3.0. Chapter 4.0 contains a description of the public outreach activities that were held to inform the agricultural community of the changes to the BMP Program.

With this submittal, ADEQ requests that EPA approve this SIP Revision to the 2001 Agricultural Best Management Practices, Maricopa County PM₁₀ Serious Area State Implementation Plan.

(This page intentionally left blank.)

CHAPTER 1.0 INTRODUCTION

The Maricopa County Planning Area has a long history of air quality challenges. Due in part to its location in the heart of the Sonoran Desert as well as the complexity attributed to any large and still growing metropolitan area, air quality has been affected by numerous sources and activities, both man-made and natural. This State Implementation Plan (SIP) Revision outlines local conditions as well as the related regulatory history for pollution from particulate matter (suspended particles 10 micrometers or smaller in diameter, also known as PM₁₀) for activities in the Maricopa County Planning Area related to agriculture. Agricultural activities have been regulated in the Maricopa County Planning Area since 1998; however, the agricultural community continues to evaluate and commit to revise or add new practices that decrease concentrations of PM₁₀ as demonstrated in this SIP Revision.

1.1 Physical and Meteorological Description of the Maricopa County PM₁₀ Serious Nonattainment Area

The Maricopa County PM₁₀ Serious Nonattainment Area contains portions of the municipal planning areas for 22 cities and towns in Maricopa County, all of the Fort McDowell, part of the Gila River, and all of the Salt River Pima-Maricopa Indian Communities, as well as unincorporated areas under the jurisdiction of Maricopa County (Figure 1). ADEQ does not have the authority to require the implementation of controls in Indian Country, but the Tribes can implement their own controls. The nonattainment area also contains a 36-square mile section of Pinal County, which encompasses a portion of the City of Apache Junction and includes unincorporated areas under the jurisdiction of Pinal County.

Figure 1: Maricopa County PM₁₀ Nonattainment Area

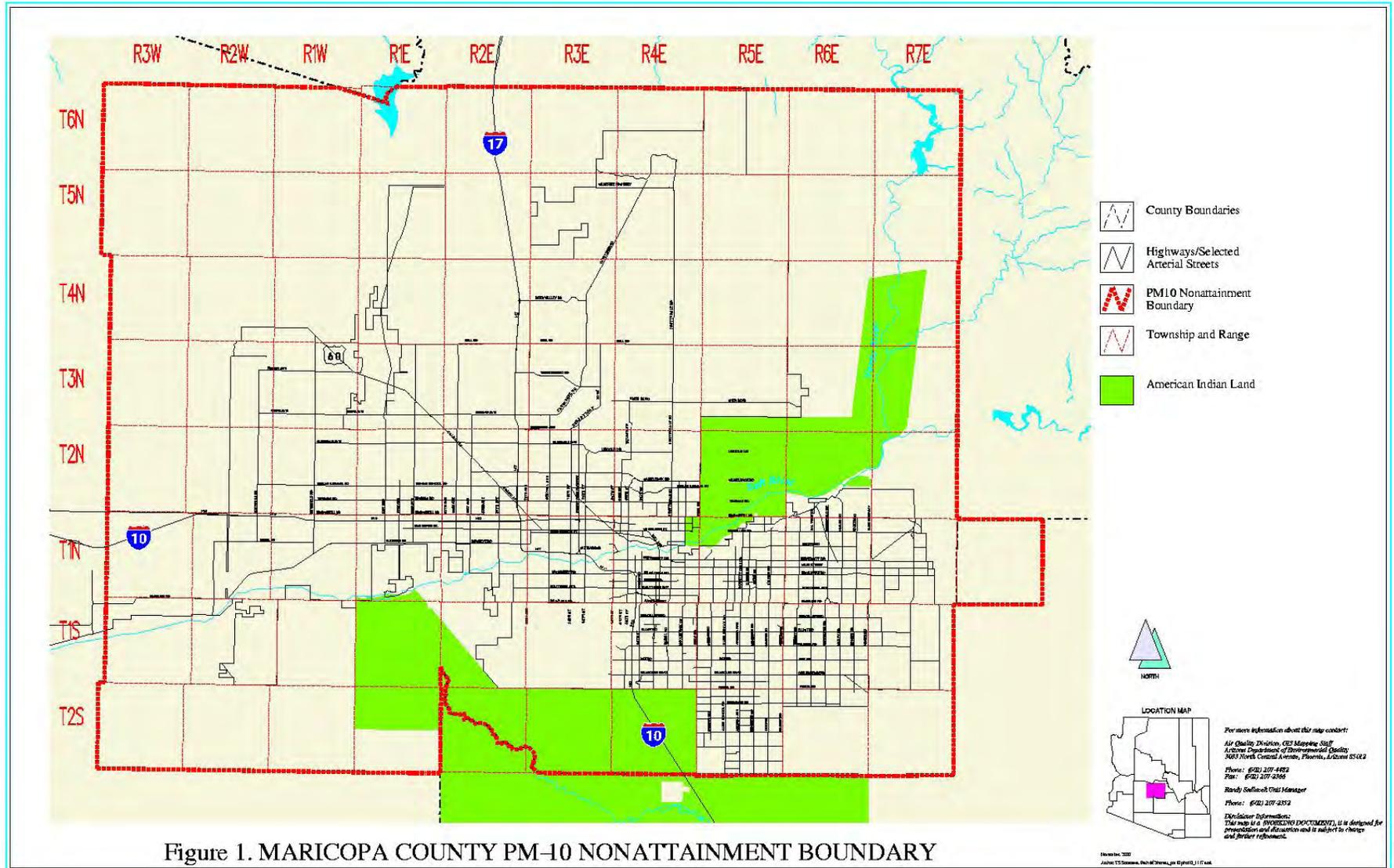


Figure 1. MARICOPA COUNTY PM-10 NONATTAINMENT BOUNDARY

The area receives about 300 days of sunshine per year, while average annual rainfall is less than eight inches, with overall low humidity. Phoenix has two separate rainfall seasons. One season is represented by the winter months, November through March, when the Valley is subject to storms from the Pacific Ocean. The other rainfall season, known as the “monsoon” season, occurs during summer and early fall (the National Weather Service defines Arizona Monsoon dates as June 15 through September 30). This season is dominated by southeasterly winds carrying moisture from the Gulf of Mexico and thunderstorms, spawned by this moisture and desert heat.

Two meteorological conditions have the potential to contribute to high concentrations of PM₁₀: high winds and stagnation. Conditions for both of these events can occur in the nonattainment area, with high winds occurring predominantly in the spring and summer seasons, and stagnation occurring predominantly in the fall and winter seasons. High wind conditions are either short term events (less than one hour) generally a result of downdrafts from monsoon thunderstorms or strong pressure gradients associated with passage of a trough or cold front (usually 6-10 hours). Stagnation conditions are longer term events (six to 12 hours; occasionally multi-day events). During stagnation events, the air is very stable and has little vertical mixing. Temperature inversions (increasing air temperature with height) also are common during stagnation events. An inversion traps pollutants close to the ground, adding to any already existing concentrations of particulate matter.

1.2 The Maricopa County PM₁₀ Nonattainment Area History

In 1991, the Environmental Protection Agency (EPA) designated portions of Maricopa County and Pinal County as a moderate PM₁₀ nonattainment area under the Clean Air Act (CAA) Amendments of 1990. The Maricopa Association of Governments (MAG) submitted the moderate area plan, the *MAG 1991 Particulate Plan for PM-10*, to EPA on November 15, 1991. In accordance with Section 188 of the CAA, the deadline for the State to demonstrate attainment of the PM₁₀ National Ambient Air Quality Standards (NAAQS) for this area was December 31, 1994; however, Arizona demonstrated to EPA that it was impracticable for this area to attain the annual PM₁₀ NAAQS by the specified deadline. No demonstration was made for the 24-hour PM₁₀ NAAQS because at that time an accurate assessment of the causes of the historical exceedances, which appeared to be highly localized, was not possible.

On March 4, 1992, EPA determined that the plan did not meet criteria for completeness, which began an 18-month sanctions clock and 24-month clock to issue a moderate area PM₁₀ Federal Implementation Plan (FIP) [57 FR 19906; 5/8/92]. In August 1993, MAG submitted the *MAG 1991 Particulate Plan for PM-10 for the Maricopa County Area and 1993 Revisions*. On September 7, 1993, EPA determined the plan to be complete.

In June 1994, the Arizona Center for Law in the Public Interest (ACLPI) sued to enforce the FIP obligation which became subject to enforcement action on March 4, 1994. EPA settled the case with an agreement to act on the moderate area PM₁₀ plan by March 1, 1995 (*Ober v. Browner*, No. CIV 94-1318 PHX, PGR, Consent Decree, March 6, 1995).

On April 10, 1995, EPA approved the Moderate Area Plan (60 FR 18010). In response to EPA's approval, ACLPI filed suit (*Ober v. Browner*) on April 27, 1995, challenging EPA's approval of Arizona's 1991 moderate area particulate plan, due to, among other things, the plan's failure to address the 24-hour PM₁₀ NAAQS. The suit requested the Court require EPA to issue a FIP. Amidst the discussions and litigation concerning the approvability of the plan, EPA reclassified the Maricopa County PM₁₀ Nonattainment Area to serious effective June 10, 1996, based upon its finding that the area failed to attain the PM₁₀ NAAQS by the December 31, 1994, deadline (61 FR 21372). The action allowed Arizona 18 months to develop a new SIP providing for attainment of the PM₁₀ NAAQS by December 31, 2001, the CAA attainment date for serious nonattainment areas (CAA § 188(c)(2)).

On May 14, 1996, the Court of Appeals for the Ninth Circuit found that the Moderate Area Plan failed to address the 24-hour PM₁₀ standard as required by the CAA [*Ober v. EPA*, 84 F3d 304 (9th Cir. 1996)]. As a result, the Court mandated that EPA require "the State to submit a separate demonstration of the implementation of all 'reasonably available control measures' targeting the 24-hour standard violations; attainment and 'reasonable further progress' for the 24-hour standard." In September 1996, in response to the Court's mandate, EPA and ADEQ agreed that ADEQ would submit a "Limited" Serious Area PM₁₀ Plan to EPA by April 18, 1997 and a "Full" Serious Area Plan by December 10, 1997. The limited plan would address the 24-hour standard violations at specific monitors and must meet the requirements for adoption and expedited implementation of best available control measures (BACM), all reasonably available control measures (RACM), and other measures as necessary to provide for reasonable further progress (RFP) along with expeditious attainment at those monitors. The full plan would represent the balance of the serious nonattainment area plan and the additional moderate area elements required by the Court. The full Plan titled *MAG Serious Area Committed Particulate Control Measures for PM10 and Support Technical Analysis* was submitted to EPA by MAG on December 11, 1997.

ADEQ developed the Phoenix PM₁₀ Microscale Field Study (Microscale Study) in 1994 to address the specific causes of and necessary controls for 24-hour exceedances, which was conducted throughout 1995 and became the basis of the limited Serious Area PM₁₀ Plan. The Microscale Study addressed exceedances of the 24-hour PM₁₀ NAAQS at four PM₁₀ monitoring locations: Salt River, Maryvale, Gilbert, and West Chandler. The 24-hour exceedances at the Salt River site were due to fugitive dust from earth moving, industrial haul roads, unpaved parking lots, and unpaved roads. At the Maryvale site the exceedances were due to emissions from disturbed cleared areas. Exceedances at the Gilbert site were due to emissions from agricultural field aprons and unpaved parking lots. At the Chandler site, exceedances were due to emissions from agricultural fields, agricultural field aprons, vacant lots, and disturbed cleared areas. The SIP revision included a number of controls to address all sources of emissions with the exception of agriculture; as such attainment was modeled for Salt Rivers and Maryvale, but not for Chandler and Gilbert.

ADEQ developed and submitted to EPA the limited plan titled, *Plan for Attainment of the 24-hour PM₁₀ Standard* (24-Hour Plan), on May 7, 1997. The plan showed attainment by committing to implement reasonable available control measures (RACM) and best available control measures (BACM) for the significant sources of PM₁₀. On August 4, 1997, EPA

approved in part and disapproved in part the 24-hour Plan (62 FR 41856). EPA approved the attainment demonstration at two monitoring locations (Salt River and Maryvale), and several county and city control measures addressing fugitive dust. EPA disapproved the RACM/BACM demonstrations for the monitoring locations at West Chandler and Gilbert for the sources categories of vacant lands, unpaved parking lots, unpaved roads, agricultural fields, and agricultural aprons.

On August 3, 1998, EPA issued a FIP (63 FR 41326) addressing the moderate area PM₁₀ requirements for the Phoenix PM₁₀ nonattainment area. For both the annual and 24-hour PM₁₀ standards, EPA included a demonstration that RACM would be implemented as soon as possible, a demonstration that it is impracticable for the area to attain the standards by the statutory attainment deadline, and a demonstration that RFP is being met. As part of the FIP, EPA also promulgated a fugitive dust rule to control PM₁₀ emissions from vacant lots, unpaved parking lots and unpaved roads, and also promulgated an enforceable commitment to ensure that RACM for agricultural sources would be proposed by September 1999, finalized by April 2000 and implemented by June 2000. The FIP included a final disapproval of the RACM and attainment demonstration for the full Moderate Area PM₁₀ Plan.

To address PM₁₀ emissions from agricultural activities, the Governor's Agricultural Best Management Practices Committee (Committee) was created in 1998 by Arizona Revised Statute (A.R.S.) §49-457; the statute was modeled after the FIP requirement for agricultural sources. The Committee was charged with developing an agricultural PM₁₀ general permit and to research and adopt best management practices (BMPs) for regulated agricultural activities. On September 4, 1998, ADEQ submitted A.R.S. §49-457 to EPA for inclusion in the Arizona State Implementation Plan (SIP) for the Maricopa County PM₁₀ nonattainment area as meeting the RACM requirements and requested that EPA approve the legislation to replace the FIP commitment. EPA removed the portion of the FIP for agriculture on June 29, 1999 (64 FR 34726). ADEQ developed and submitted to EPA a SIP revision for the Maricopa County PM₁₀ Serious Area, which included the general permit and the BMPs in July 2001. The *Maricopa County PM₁₀ Serious Area State Implementation Plan Revision – Agricultural Best Management Practices*, was approved by EPA as a revision to the Arizona SIP September 10, 2001, effective November 13, 2001 (66 FR 51869). ACLPI filed suit in the U.S. Court of Appeals for the Ninth Circuit challenging, among other things, the use of BMPs as BACM. On May 10, 2004, the Court upheld the approval of BMPs as BACM and remanded to EPA for further consideration the other issues brought by the suit, *Vigil v. Leavitt*, 366 F.3d 1025, amended at 381 F. 3d 826 (9th Cir. 2004).

1.3 Maricopa Association of Governments (MAG) 2007 Five Percent Plan for PM₁₀ for the Maricopa County Nonattainment Area

On February 16, 2000, MAG submitted the *Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area*. This plan contained approximately seventy-seven committed control measures from the State and local agencies. The plan demonstrated attainment of the PM₁₀ standard by December 31, 2006. On January 8, 2002,

Arizona submitted revisions addressing roadways (paved and unpaved), parking areas, vacant lots, and industrial source emissions.

On July 25, 2002, EPA approved the full Serious Area Particulate Matter (PM-10) Plan for the Maricopa County portion of the nonattainment area (67 FR 48717, effective August 25, 2002). The full plan is a compilation of submittals by ADEQ¹, MAG², and a number of rules.³ EPA approved the BACM and most stringent measure (MSM) demonstrations in the plan and granted the State's request for an attainment date extension for the area. Due to continued exceedances of the PM₁₀ standard, the Maricopa County PM₁₀ Nonattainment Area was unable to meet attainment of the federal standard by the December 31, 2006 Clean Air Act deadline. EPA issued a notice regarding the failure of the Maricopa County PM₁₀ Nonattainment Area to attain the PM₁₀ NAAQS on May 25, 2007 (72 FR 31183).

As a result of the failure to attain the standard, MAG began developing a Five Percent Plan for Maricopa County as required under the Clean Air Act Section 189(d). The Five Percent Plan requires the reduction of PM₁₀ emissions by at least five percent per year until the standard is attained, and no violations occur at previously violating PM₁₀ monitors. To develop the plan, MAG conducted a study to determine the sources of PM₁₀ emissions contributing to violations of the PM₁₀ standard at monitors in the nonattainment area during stagnant conditions and to characterize the deposition of PM₁₀ particles emitted by these sources. The study identified a number of sources of PM₁₀ emissions including: trackout, dragout from unpaved or poorly maintained paved roads or parking lots, unpaved shoulders, unpaved roads, open burning, agriculture, and vehicle activity on unpaved parking areas and vacant lots. Preliminary results from the study were used to evaluate control measures and the final results were used in the modeling demonstration.

The Maricopa County Air Quality Department conducted a periodic PM₁₀ emission inventory for the Maricopa County Nonattainment Area in 2005. The inventory showed that agriculture contributes approximately three percent to total annual PM₁₀ emissions in the nonattainment area (Figure 2). This regional and annual emission profile does not provide any context for localized emissions that can contribute to 24-hour average PM₁₀ NAAQS exceedances. Agricultural dust

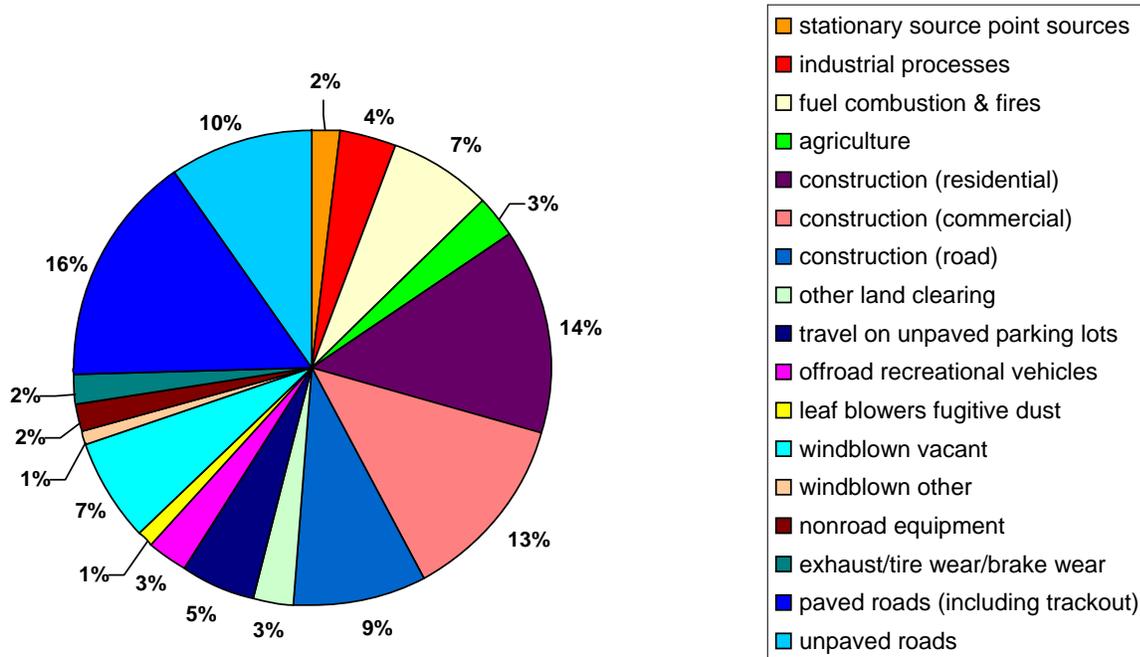
¹ *Plan for Attainment of the 24-hour PM-10 Standard—Maricopa County PM-10 Nonattainment Area*, Arizona Department of Environmental Quality (ADEQ), May, 1997, submitted May 9, 1997, approved in part and disapproved in part on August 3, 1997 (62 FR 41856). *Maricopa County PM-10 Serious Area State Implementation Plan Revision, Agricultural Best Management Practices (BMP)*, ADEQ, June 2000, submitted on June 13, 2001.

² *Serious Area Committed Particulate Control Measures for PM-10 for the Maricopa County Nonattainment Area and Support Technical Analysis*, MAG, December 1997, submitted December 11, 1997. *Revised Maricopa Association of Governments 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area*, February 2000, submitted February 16, 2000. On January 8, 2002, Arizona submitted revisions to the Maricopa County's commitments to improve its fugitive dust rule which were in this plan.

³ These include the revised Maricopa County Environmental Services Department (MCESD) Rule 310, Fugitive Dust Sources (adopted February 16, 2000) and Rule 310.01, Fugitive Dust from Open Areas, Vacant Lots, Unpaved Parking Lots, and Unpaved Roadways (adopted February 16, 2000), both submitted on March 2, 2000; the revised Maricopa County Residential Woodburning Restrictions Ordinance (adopted November 17, 1999) submitted on January 28, 2000; and the Agricultural BMP General Permit Rule submitted on July 11, 2000, approved October 11 2001 (66 FR 51869).

represents a greater proportion of the PM₁₀ emissions that contributed to 24-hour average exceedances at two sites in the nonattainment area.

Figure 2: Annual 2005 PM₁₀ Emissions in the PM₁₀ Nonattainment Area



Source: 2005 Periodic Emission Inventory for the Maricopa County, Arizona Nonattainment Area. Maricopa County Air Quality Department, May 2007.

In order to reduce PM₁₀ emissions for the contribution from agriculture, the Committee adopted additional BMPs to those already contained in the 2001 Agricultural Best Management Practices SIP. The Committee also adopted an additional requirement for two BMPs per agricultural category (for details regarding the new BMPs and additional requirements see Chapter 2.0). Concurrently, the Arizona State Legislature passed Senate Bill (SB) 1552 (Laws 2007) to address the failure to attain the PM₁₀ standard and other air quality issues. SB 1552 contained changes and additions to *A.R.S. §49-457 – Agricultural Best Management Practices Committee, Members, Powers, Permits, Definitions*. The Committee then revised *Arizona Administrative Code (A.A.C.) R18-2-610 – Definitions for R18-2-611*; and *R18-2-611 – Agricultural PM₁₀ General Permit, Maricopa PM₁₀ Nonattainment Area and Maricopa County Portion of Area A* (for rule revision details see Section 2.2).

1.4 Agricultural Best Management Practices SIP Revision

This document contains revisions to the *Maricopa County PM₁₀ Serious Area State Implementation Plan – Agricultural Best Management Practices*, originally submitted in 2001. These revisions include:

- Senate Bill 1552 requirement,
- New BMPs selected by the Committee,
- Description of BMP outreach, and
- Revisions to the BMP guidance booklet.

CHAPTER 2.0 AGRICULTURAL BEST MANAGEMENT PRACTICES SELECTION PROCESS

2.1 Actions of the Governor's Agricultural Best Management Practices Committee

The Committee met in 2006 as a proactive step to research alternatives to further reduce PM₁₀ emissions from agricultural activities. The Committee reconvened the Agricultural BMP Technical Workgroup to review and analyze similar agricultural management programs in California, the existing program in Maricopa County, and management practices proposed by the Maricopa Association of Governments (MAG).

The Workgroup invited representatives from San Joaquin Valley and Imperial Valley, California to present and discuss the Conservation Management Practices (CMP) Programs in their respective counties. Representatives from MAG were also invited to several Committee meetings to present and discuss alternative practices for use as BMPs. MAG's suggestions included calculating the emissions impacts from the elimination of plow-downs after the pink boll worm is eradicated, staggering plow-downs, cessation of tilling on high wind days, calculating the emissions impacts from the reduction of agricultural land once it converts to development, and the implementation of BMPs to Area A, a planning area larger than the nonattainment area.

The Workgroup forwarded six new BMPs to the Committee for evaluation. These BMPs included: integrated pest management (IPM), precision farming, green chop, transgenic crops, transplanting, and minimized vehicle use to ten vehicle trips per day. In addition to reviewing these practices for feasibility, the Committee requested that ADEQ staff conduct a comparison analysis of BMPs to determine potential emission reductions. The Committee also requested that the Workgroup review additional analysis from ADEQ regarding PM₁₀ emissions during stagnant air conditions prior to further discussion or action on BMPs related to cessation of tilling (for more information on both the comparison analysis and analysis of PM₁₀ emissions see Appendix B).

After reviewing the comparison analysis of the estimated emissions reductions for the six additional BMPs, the Committee selected practices that were feasible and applicable for farmers in Maricopa County. Four BMPs were initially adopted: IPM, precision farming, green chop, and transgenic crops (for descriptions of the BMPs adopted by the Committee see Chapter 3.0).

The analysis of the PM₁₀ data showed that on stagnant air days, PM₁₀ concentrations start to rise after sundown, are relatively constant until about 4:00 a.m., and reach a maximum peak around 8:00 a.m. ADEQ staff proposed several options for a time frame to cease or reduce tilling: reduce tilling on weekdays (tilling would occur on weekends), limit tilling on any day between 6:00 p.m. and 9:00 a.m., or limit tilling on any day between 6:00 p.m. and 7:00 a.m. In order to maintain economic feasibility of the BMP and contribute to reductions of PM₁₀ concentrations, the Committee agreed that establishing a time frame of 2:00 a.m. to 8:00 a.m. for the cessation of night tilling operations on stagnant air days was appropriate. The Committee adopted the cessation of night tilling from 2:00 a.m. to 8:00 a.m. during stagnant air conditions on high pollution advisory (HPA) days as a fifth additional BMP.

2.2 Senate Bill 1552 and Committee Actions

While the Technical Workgroup was conducting its review and analysis of BMPs, the Arizona Legislature revised Arizona Revised Statutes (A.R.S.) §49-457 in Section 14 of SB 1552. The Committee discussed extending the application of BMPs to the Maricopa County portion of Area A, as originally suggested by MAG (See Figure 2) and further discussed the consideration of requiring two BMPs per category versus one BMP per category as originally required. Requiring two BMPs per category (the three categories being tillage and harvest, non-cropland, and cropland) actually served to increase flexibility. Expanding the use of BMPs into the Maricopa County Portion of Area A captured monitors with data showing exceedances possibly due in part to agricultural activities located on the edges of the nonattainment area but within the Maricopa County portion of Area A.

As signed by the Governor, SB 1552 amended the statute to require two BMPs to be implemented per agricultural management category beginning December 31, 2007, and revised the definition of the regulated area for BMPs to include the Maricopa County portion of Area A (as defined in A.R.S §49-541). These changes, in addition to the newly adopted BMPs, required revisions to R18-2-610 – *Definitions for R18-2-611*; and R18-2-611 – *Agricultural PM₁₀ General Permit, Maricopa PM₁₀ Nonattainment Area and Maricopa County Portion of Area A*. The rule was developed as an exempt rule⁴ to facilitate inclusion in the *MAG 2007 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area*, submitted by ADEQ to EPA on December 21, 2007. The now codified version of R18-2-610 and 611 as it appears in the A.A.C. is submitted in this SIP Revision and can be found in Appendix A.

⁴ An exempt rulemaking in Arizona is not submitted to the Governor's Regulatory Review Council but rather submitted directly to the Secretary of State for inclusion in the Code through legislative enactment. Public comments on the exempt rule were made available as part of the public process for the Five Percent Plan.

(This page intentionally left blank.)

CHAPTER 3.0 ADDITIONAL AGRICULTURAL BEST MANAGEMENT PRACTICES

This chapter contains descriptions and percent emission reduction of the five BMPs that were selected by the Governor's Agricultural Best Management Practices Committee.

3.1 Best Management Practices

3.1.1 Cessation of Night Tillage on High Pollution Advisory Days

Cessation of night tilling during high pollution advisory days is the stopping of agricultural tillings during the early morning hours to limit the concentration of PM₁₀ emissions while still allowing for other farming activities to occur. Notification of high pollution advisory days for PM₁₀ [<http://www.azdeq.gov/ensemble.pdf>] is assisted by text messaging services provided by ADEQ [<http://www.azdeq.gov/sms.html>].

The Committee selected this BMP based on its practicality, feasibility, and efficiency regarding agricultural activities in Maricopa County. Based on an analysis conducted by ADEQ, the emission reduction is two percent for the Cessation of Night Tillage on High Pollution Advisory Days BMP.

3.1.2 Green Chop

Green chopping is a harvesting practice commonly used with forage crops. The crop is cut and simultaneously harvested, without allowing it to dry in the field, thus reducing multiple equipment passes. Fewer equipment passes reduce disturbance of the soil thus reducing the amount of PM₁₀ emitted.

The Committee selected this BMP based on its practicality, feasibility, and efficiency regarding agricultural activities in Maricopa County. Based on a comparison analysis of BMPs conducted by ADEQ, the emission reduction is between 10 and 20 percent for the Green Chop BMP.

3.1.3 Integrated Pest Management

Integrated pest management (IPM) is an agricultural-management practice that uses a combination of techniques including organic, conventional and biological farming practices to suppress pests. Implementation of IPM commonly uses a four-tiered approach: set action thresholds for an identified pest, monitor and identify pests, prevent pests from becoming a threat, and control the pest. The fourth step may require evaluation of the previous steps to determine if the implementation process is working or if additional control methods are required. Implementation of IPM results in fewer pests and thus reduces the need and/or number of passes for spraying pesticides and also the need for additional tillage.

The Committee selected this BMP based on its practicality, feasibility, and efficiency regarding agricultural activities in Maricopa County. Based on a comparison analysis of BMPs conducted by ADEQ, the emission reduction is between 12 and 19 percent for the IPM BMP.

3.1.4 Precision Farming

Precision farming is an agricultural practice that uses global position systems (GPS), sensors, satellite or aerial images, remote sensing, and geographical information systems (GIS). The use of this technology allows farmers to account for variable field conditions such as soil type, landscape characteristics, types of pests, and crop information. This information is used to precisely evaluate optimum sowing density, estimate fertilizer applications, and calculate the position of agricultural equipment in the field. A primary objective for using this practice is to determine the exact location of agricultural equipment as it operates in a field so that a farmer can treat specific areas and reduce overlap. Reduced overlap results in fewer equipment passes and reduces the amount of PM₁₀ emitted from disturbing the soil. This practice also allows a farmer to operate during inclement weather and at night since the farmer can accurately determine their exact location in the field.

The Committee selected this BMP based on its practicality, feasibility, and efficiency regarding agricultural activities in Maricopa County. Based on a comparison analysis of BMPs conducted by ADEQ, the emission reduction is 15 percent for the Precision Farming BMP.

3.1.5 Transgenic Crops

Transgenic crops are genetically modified organisms (GMOs), which are genetically engineered crops. This form of engineering alters the genetic material of the organism by inserting or transferring genes from other species to cause the expression of modified traits. There are many reasons for using transgenic crops such as pest resistance or increased yield. In Arizona, one example of the use of a transgenic crop is BT cotton. BT cotton is genetically modified to produce a toxin that kills caterpillars, particularly the pink bollworm. The use of transgenic crops can reduce the need for tillage, fertilizing, pesticide application, or other cultivation activities and, thus, reduces soil disturbance and PM₁₀ emissions.

The Committee selected this BMP based on its practicality, feasibility, and efficiency regarding agricultural activities in Maricopa County. Based on a comparison analysis of BMPs conducted by ADEQ, the emission reduction is between two and 12 percent for the Transgenic Crops BMP.

3.2 Emissions Reductions from Revisions to the BMP Program

This section discusses the emissions reductions resulting from the revision to the BMP Program. These are the reductions that may result from the additional BMPs, using two BMPs per agricultural category, and the expansion of the area of application of the BMP Program. Additional information on the emission reductions resulting from “Cessation of Night Tilling”

BMP as a second BMP in the Tilling & Harvest category and extending the Agricultural BMP program to the Maricopa County Portion of Area A outside of the Maricopa County PM₁₀ Nonattainment Area is also discussed.

3.2.1 Number of BMPs Required per Agricultural Category

The original BMP Program required growers to choose one BMP per agricultural land/use category: Tillage and Harvest, Non-Cropland, and Cropland. The revisions to A.R.S §49-541, and A.A.C. R18-2-610 and 611 increased the number of BMPs required per category from one to two BMPs. With the revised program, growers are required to select one additional BMP for each of the BMP categories (total of six BMPs). Using a second BMP per category provides greater emissions reductions than the use of a single BMP.

3.2.2 Cessation of Night Tilling

As outlined in Section 3.1.1, “Cessation of Night Tilling” in the Tillage and Harvest category, has a relatively low annual emissions reduction of only two percent; however, its actual reduction of ambient PM₁₀ concentrations is much higher. This is because the PM₁₀ emissions from night tilling occur during the most critical time of a stagnation period, 2:00 a.m. and 8:00 a.m., when lack of vertical and horizontal mixing can allow PM₁₀ concentrations to steadily increase.

The estimated 15 tons per year of PM₁₀ emission reductions from this BMP was projected to occur on the nine stagnation days (annual average) that coincide on days when agricultural tilling is done in Maricopa County. Thus, the two percent annual total emissions reduction value can be misleading since the actual emission reductions cover only nine days as opposed to 365 days.

The “Cessation of Night Tilling” BMP does not replace one of the original BMPs that is required for the Tillage & Harvest category. This BMP is in addition to the first BMP that is required for the Tillage & Harvest category. Thus, if this BMP is selected by a grower, it strengthens the Maricopa County PM₁₀ Serious Area SIP, since it provides PM₁₀ emission reductions in addition to the first BMP’s emission reductions.

3.2.3 Extension of the Agricultural BMP Program to the Maricopa County Portion of Area A

As a result of extending the area of application of the BMP Program outside of the PM₁₀ nonattainment area, it was estimated that an additional 26,004 acres of agricultural land would become subject to the Agricultural BMP Program. This is an almost 30 percent increase in agricultural land subject to the BMP Program. The projected emissions reductions from the extension take into account application of two "additional" Agricultural BMPs, instead of just one additional Agricultural BMP.

3.3 Conclusion

The revisions to the BMP Program include: five additional BMPs, two BMPs required per agricultural category, and extension of the area of application of the BMP Program. All of the practices in the BMP Program are recognized as BACM and MSM and provide a reduction in PM₁₀ emissions from agricultural activities. These revisions to the overall AgBMP Program are cumulative, and the overall impact leads to strengthening the AgBMP SIP.

CHAPTER 4.0 OUTREACH

4.1 Public Outreach Activities

After finalizing revisions to R18-2-610 – Definitions for R18-2-611; and R18-2-611 – Agricultural PM₁₀ General Permit, Maricopa PM₁₀ Nonattainment Area and Maricopa County Portion of Area A, the Committee discussed revisions to the *Guide to Agricultural PM₁₀ Best Management Practices* as well as outreach strategies to inform the agricultural community of the changes to the BMP Program. The Committee approved revisions to the Guide to include the five new BMPs, changes to the number of BMPs required for each category and the expansion of the application area for BMPs. The Committee also approved a pocket guide to be distributed along with the booklet; the pocket guide replaced the previous pamphlet version of the larger Guide. The *Pocket Guide to Agricultural PM₁₀ Best Management Practices* provides a brief overview of the BMPs that can be utilized in each agricultural category, and contains contact information for additional information regarding the BMP Program.

Once the publications were available, outreach meetings were coordinated by the Arizona Department of Agriculture (ADA) and the Arizona Farm Bureau. Two separate meetings were held during May 2008 (Estrella Mountain Community College and the Arizona Farm Bureau Office located in Gilbert). Continued outreach is maintained by the Agricultural Consultation and Testing (ACT) Program at the ADA. Representatives from the ADA also conduct on-site visits to the agricultural community in order to provide compliance assistance and training regarding implementation of the BMP program. The ADA maintains a Web site for the ACT Program, <http://www.azda.gov/ACT/act.htm>, to provide information to the public regarding their services. ADEQ also participates in outreach for the BMP Program. If complaints are reported, a representative from ADEQ will meet with the farmer, review their chosen BMPs, and discuss options to reduce PM₁₀ emissions from the agricultural activities.

(This page intentionally left blank.)

CHAPTER 5.0 CONCLUSION

The purpose of the Agricultural BMP Program is to provide farmers with alternative practices that will help reduce PM₁₀ emissions and lower concentrations of PM₁₀ in the Maricopa County Nonattainment Area. The original Program implemented in 2001 allowed farmers to pick BMPs that were both economically feasible and practicable. The additional BMPs will give farmers more Program flexibility and extend the BMP application area to include more farmland in the BMP Program and capture farmland on the periphery of the PM₁₀ nonattainment area boundary.

The revisions to the Agricultural BMP Program strengthen the existing Agricultural BMP SIP. Therefore, with this submittal, ADEQ requests that EPA approve this SIP Revision to the 2001 Agricultural Best Management Practices, Maricopa County PM₁₀ Serious Area State Implementation Plan.

APPENDIX A

Agricultural Best Management Practices Rule

excessive amounts of particulate matter from becoming airborne. Reasonable precautions shall mean wetting, chemical stabilization, revegetation or such other measures as are approved by the Director.

Historical Note

Section R18-2-608 renumbered from R18-2-408, new Section R18-2-408 adopted effective November 15, 1993 (Supp. 93-4).

R18-2-609. Agricultural Practices

A person shall not cause, suffer, allow, or permit the performance of agricultural practices outside the Phoenix and Yuma planning areas, as defined in 40 CFR 81.303, which is incorporated by reference in R18-2-210, including tilling of land and application of fertilizers without taking reasonable precautions to prevent excessive amounts of particulate matter from becoming airborne.

Historical Note

Section R18-2-609 renumbered from R18-2-409 effective November 15, 1993 (Supp. 93-4). Amended by final rulemaking at 6 A.A.R. 2009, effective May 12, 2000 (Supp. 00-2). Amended by final rulemaking at 11 A.A.R. 2210, effective July 18, 2005 (Supp. 05-2).

R18-2-610. Definitions for R18-2-611

The definitions in Article 1 of this Chapter and the following definitions apply to R18-2-611:

1. "Access restriction" means restricting or eliminating public access to noncropland with signs or physical obstruction.
2. "Aggregate cover" means gravel, concrete, recycled road base, caliche, or other similar material applied to noncropland.
3. "Area A" means the area delineated according to A.R.S. § 49-541(1).
4. "Artificial wind barrier" means a physical barrier to the wind.
5. "Best management practice" means a technique verified by scientific research, that on a case-by-case basis is practical, economically feasible, and effective in reducing PM₁₀ emissions from a regulated agricultural activity.
6. "Chemical irrigation" means applying a fertilizer, pesticide, or other agricultural chemical to cropland through an irrigation system.
7. "Cessation of Night Tilling" means the discontinuation of night tilling on high pollution advisory days during stagnant air conditions.
8. "Combining tractor operations" means performing two or more tillage, cultivation, planting, or harvesting operations with a single tractor or harvester pass.
9. "Commercial farm" means 10 or more contiguous acres of land used for agricultural purposes within the boundary of the Maricopa PM₁₀ nonattainment area and Maricopa County portion of Area A.
10. "Commercial farmer" means an individual, entity, or joint operation in general control of a commercial farm.
11. "Committee" means the Governor's Agricultural Best Management Practices Committee.
12. "Cover crop" means plants or a green manure crop grown for seasonal soil protection or soil improvement.
13. "Critical area planting" means using trees, shrubs, vines, grasses, or other vegetative cover on noncropland.
14. "Cropland" means land on a commercial farm that:
 - a. Is within the time-frame of final harvest to plant emergence;
 - b. Has been tilled in a prior year and is suitable for crop production, but is currently fallow; or
 - c. Is a turn-row.
15. "Cross-wind ridges" means soil ridges formed by a tillage operation.
16. "Cross-wind strip-cropping" means planting strips of alternating crops within the same field.
17. "Cross-wind vegetative strips" means herbaceous cover established in one or more strips within the same field.
18. "Equipment modification" means modifying agricultural equipment to prevent or reduce particulate matter generation from cropland.
19. "Forage Crop" means a product grown for consumption by any domestic animal.
20. "Genetically Modified" means a living organism whose genetic material has been altered, changing one or more of its characteristics.
21. "GMO: Genetically Modified Organism" means a plant that has been altered by a genetic exchange with another organism.
22. "GPS: Global Position Satellite System" means using a satellite navigation system on farm equipment to calculate position in the field.
23. "Green Chop" means the harvesting of a forage crop without allowing it to dry in the field.
24. "High Pollution Advisory" means a public notification issued by the Department when the ambient concentrations of PM₁₀ may exceed the federal health standard.
25. "Integrated Pest Management" means the use of a combination of techniques including organic, conventional, and biological farming practices.
26. "Limited activity during a high-wind event" means performing no tillage or soil preparation activity when the measured wind speed at 6 feet in height is more than 25 mph at the commercial farm site.
27. "Manure application" means applying animal waste or biosolids to a soil surface.
28. "Maricopa PM₁₀ nonattainment area" means the Phoenix planning area as defined in 40 CFR 81.303, which is incorporated by reference in R18-2-210.
29. "Mulching" means applying plant residue or other material that is not produced onsite to a soil surface.
30. "Multi-year crop" means a crop, pasture, or orchard that is grown, or will be grown, on a continuous basis for more than one year.
31. "Noncropland" means any commercial farm land that:
 - a. Is no longer used for agricultural production;
 - b. Is no longer suitable for production of crops;
 - c. Is subject to a restrictive easement or contract that prohibits use for the production of crops; or
 - d. Includes a private farm road, ditch, ditch bank, equipment yard, storage yard, or well head.
32. "Night Tilling" means preparing the land for the raising of crops between the hours of 2:00 a.m. and 8:00 a.m.
33. "Organic Farming Practices" means using biological or non-chemical agricultural methods.

Department of Environmental Quality – Air Pollution Control

34. “Permanent cover” means a perennial vegetative cover on cropland.
35. “Planting based on soil moisture” means applying water to soil before performing planting operations.
36. “Precision Farming” means using GPS to precisely guide farm equipment in the field.
37. “Reduce vehicle speed” means operating farm vehicles or farm equipment on unpaved private farm roads at speeds not to exceed 20 mph.
38. “Reduced harvest activity” means reducing the number of harvest passes using a mechanized method to cut and remove crops from a field.
39. “Reduced tillage system” means reducing the number of tillage operations used to produce a crop.
40. “Regulated agricultural activity” means a commercial farming practice that may produce PM₁₀ within the Maricopa PM₁₀ nonattainment area and Maricopa County portion of Area A.
41. “Residue management” means managing the amount and distribution of crop and other plant residues on a soil surface.
42. “Sequential cropping” means growing crops in a sequence that minimizes the amount of time bare soil is exposed on a field.
43. “Surface roughening” means manipulating a soil surface to produce or maintain clods.
44. “Stagnant Air Conditions” means a meteorological regime where warm air aloft overlies cooler air near the surface and little if any vertical mixing occurs.
45. “Synthetic particulate suppressant” means a manufactured product such as lignosulfate, calcium chloride, magnesium chloride, an emulsion of a petroleum product, an enzyme product, and polyacrylamide that is used to control particulate matter.
46. “Tillage and harvest” means any mechanical practice that physically disturbs cropland or crops on a commercial farm.
47. “Tillage based on soil moisture” means applying water to soil before or during tillage, or delaying tillage to coincide with precipitation.
48. “Timing of a tillage operation” means performing tillage operations at a time that will minimize the soil’s susceptibility to generate PM₁₀.
49. “Track-out control system” means a device to remove mud or soil from a vehicle before the vehicle enters a paved public road.
50. “Transgenic Crops” means the use of plants that are genetically modified.
51. “Tree, shrub, or windbreak planting” means providing a woody vegetative barrier to the wind.
52. “Watering” means applying water to noncropland.
- R18-2-611. Agricultural PM₁₀ General Permit; Maricopa PM₁₀ Nonattainment Area and Maricopa County Portion of Area A**
- A.** A commercial farmer shall comply with this Section by December 31, 2007.
- B.** A commercial farmer, who begins a regulated agricultural activity after December 31, 2000, shall comply with this Section within 18 months of beginning the regulated agricultural activity.
- C.** A commercial farmer shall implement at least two best management practices from each of the following categories:
1. Tillage and harvest, subsection (E);
 2. Noncropland, subsection (F); and
 3. Cropland, subsection (G). A commercial farmer may implement more than one best management practice for one or more of the categories.
- D.** A commercial farmer shall ensure that the implementation of all selected best management practices does not violate any other local, state, or federal law.
- E.** A commercial farmer shall implement at least two of the following best management practices to reduce PM₁₀ emissions during tillage and harvest activities:
1. Chemical irrigation,
 2. Combining tractor operations,
 3. Equipment modification,
 4. Green Chop,
 5. Integrated Pest Management,
 6. Limited activity during a high-wind event,
 7. Multi-year crop,
 8. Cessation of Night Tilling,
 9. Planting based on soil moisture,
 10. Precision Farming,
 11. Reduced harvest activity,
 12. Reduced tillage system,
 13. Tillage based on soil moisture,
 14. Timing of a tillage operation, or
 15. Transgenic Crops.
- F.** A commercial farmer shall implement at least two of the following best management practices to reduce PM₁₀ emissions from noncropland:
1. Access restriction;
 2. Aggregate cover;
 3. Artificial wind barrier;
 4. Critical area planting;
 5. Manure application;
 6. Reduce vehicle speed;
 7. Synthetic particulate suppressant;
 8. Track-out control system;
 9. Tree, shrub, or windbreak planting; or
 10. Watering.
- G.** A commercial farmer shall implement at least two of the following best management practices to reduce PM₁₀ emissions from cropland:
1. Artificial wind barrier;
 2. Cover crop;
 3. Cross-wind ridges;
 4. Cross-wind strip-cropping;
 5. Cross-wind vegetative strips;
 6. Integrated Pest Management;
 7. Manure application;
 8. Mulching;
 9. Multi-year crop;
 10. Permanent cover;
 11. Planting based on soil moisture;
 12. Precision Farming;
 13. Residue management;

Historical Note

Former Section R18-2-610 renumbered to R18-2-612; new Section R18-2-610 adopted by final rulemaking at 6 A.A.R. 2009, effective May 12, 2000 (Supp. 00-2). Amended by exempt rulemaking at 13 A.A.R. 4326, effective November 14, 2007 (Supp. 07-4).

APPENDIX B

Technical Support Document



*Maricopa County PM₁₀
Serious Area Nonattainment Area*

Agricultural Best Management Practices

Technical Support Document

**Air Quality Division
July 2009**

(this page is intentionally blank)

TABLE OF CONTENTS

1.1 INTRODUCTION.....	1
1.2 COMPARISON OF MARICOPA COUNTY BMPs AND SAN JOAQUIN CMPs.....	1
1.2.1 Methodology.....	1
1. Estimation of Crop Acres in Maricopa County PM ₁₀ Nonattainment Area.....	1
2. Calculation of Uncontrolled PM ₁₀ Emissions in Maricopa County PM ₁₀ Nonattainment Area.....	2
3. Calculation of PM ₁₀ Emissions Reduction by Crop and Control Measure.....	2
1.2.2 Summary of Emissions Reductions.....	4
1.3 AGRICULTURAL BMPS IN SENATE BILL 1552.....	10
1.3.1 Effect of One Additional Agricultural BMP in Maricopa County PM-10 Nonattainment Area.....	10
1. Percent Emission Reduction by Agricultural BMP Category.....	10
2. Projected Crop Acreage in Maricopa County.....	12
3. Rate of Change Factors.....	13
4. Projected Agricultural Emissions in Maricopa County PM ₁₀ Nonattainment Area.....	13
5. Projected Emission Reductions in Maricopa County PM ₁₀ Nonattainment Area.....	14
1.3.2 Extending Agricultural BMP Program to Maricopa County Portion of Area A.....	16
1. Percent Agricultural Land In Maricopa County.....	16
2. Land in MC Portion of Area A.....	16
3. Agricultural Land in MC Portion of Area A.....	16
4. Agricultural Land in Maricopa County PM ₁₀ Nonattainment Area.....	17
5. Ratio of Agricultural Land in MC Portion of Area A to Agricultural Land in NAA.....	17
6. Projected Emission Reduction in MC Portion of Area A.....	17
7. Emission Reductions Due to Revised Agricultural BMP Program in Senate Bill 1552.....	19
1.3.3 Cessation of Night Tillage on High Pollution Advisory Days.....	21
1. Comparison of Occurrence of Stagnation Days with Tillage Days for Maricopa County.....	21
2. Uncontrolled Tillage Emissions in NAA for Year 2005.....	22
3. Controlled Tillage Emissions in NAA for Year 2005.....	22
4. Uncontrolled and Controlled Tillage Emissions in NAA for Years 2008 - 2010.....	23
5. Uncontrolled and Controlled Tillage Emissions in MC Portion of Area A for Years 2008 - 2010.....	24
6. Uncontrolled and Controlled Tillage Emissions in Area A for Years 2008 - 2010.....	24
7. Controlled Tillage Emissions in Area A by Crop for Years 2008 - 2010.....	25
8. Emission Reductions from Banning Tilling on HPAs in Area A.....	26
9. Emission Reductions from Banning Tilling from 2 AM to 8 AM on HPAs in Area A.....	27
10. Percent Emission Reduction from Banning Tilling from 2 AM to 8 AM on HPAs in Area A.....	27
1.3.4 Summary of Emissions Reductions from Senate Bill 1552.....	28
1.4 REFERENCES.....	29
ATTACHMENT #1.....	Attachment-1

LIST OF TABLES

Table 1	Emission Factors and Adjustment Factors	4
Table 2	Ranking of Emission Reductions From Maricopa County BMPs and San Joaquin CMPs	5
Table 3	Calculation of Percent Emission Reductions by Ag BMP Group	11
Table 4	Historical and Projected Crop Acreage in Maricopa County	13
Table 5	Rate of Change Factors for Agricultural Land in Maricopa County	13
Table 6	PM ₁₀ Emissions for Maricopa County PM ₁₀ Nonattainment Area.....	14
Table 7	Emission Reductions for Maricopa County PM ₁₀ Nonattainment Area.....	15
Table 8	Emission Reductions for MC Portion of Area A.....	18
Table 9	Emission Reductions from Agricultural BMP Program in Senate Bill 1552	19
Table 10	Year 2005 Stagnation Days and Potential Tillage Days in Maricopa County	21
Table 11	Uncontrolled Tillage Emissions in NAA - Year 2005	22
Table 12	Controlled Tillage Emissions in NAA - Year 2005	23
Table 13	Projected Uncontrolled and Controlled Tillage Emissions (2 BMPs) in NAA	23
Table 14	Projected Uncontrolled and Controlled (2 BMPs) Tillage Emissions in MC Portion of Area A	24
Table 15	Projected Uncontrolled and Controlled Tillage Emissions in Area A (Maricopa County).....	25
Table 16	Projected Controlled Tillage (2 BMP) Emissions in Area A (Maricopa County) by Crop.....	25
Table 17	Emission Reductions from Banning Tilling on HPAs in Area A (Maricopa County)	26
Table 18	Potential Emission Reductions from Banning Tilling from 2 AM to 8 AM on HPAs.....	27
Table 19	Summary of Potential Emission Reductions	28
Table 20	Percent Emission Reductions of Agricultural Control Measures in Senate Bill 1552.....	28
Table A-1	Potential PM ₁₀ Emission Reductions by Control Measure and Associated Crop.....	Attachment-1

LIST OF FIGURES

Figure 1.	Ranking of Maricopa County Agricultural BMPs and San Joaquin CMPs.....	9
-----------	--	---

1.0 TECHNICAL ANALYSIS OF AGRICULTURAL BMPs

1.1 INTRODUCTION

This chapter presents the methodology, assumptions, and data used in selecting and assessing the effectiveness of agricultural best management practices (BMPs) that are not included in the current set of Maricopa County Agricultural PM₁₀ Best Management Practices (Governor’s Agricultural BMP Committee 2001). The chapter is divided into two sections. The first section (1.2) compares the current Maricopa County Agricultural BMPs with the San Joaquin Valley Air Pollution Control District Conservation Management Practices (CMPs). The second section (1.3) summarizes potential PM₁₀ emission reductions from agricultural BMPs listed in Senate Bill 1552: (1) Requiring growers to use one additional BMP per Maricopa County BMP category, and (2) Banning agricultural tilling on high pollution advisory days.

1.2 COMPARISON OF MARICOPA COUNTY BMPs AND SAN JOAQUIN CMPs

At the request of the Agricultural Best Management Practices Workgroup (2006 – 2007), ADEQ Air Quality Division staff performed an analysis comparing potential PM₁₀ emissions reductions from implementation of San Joaquin CMPs with existing Maricopa County Agricultural BMPs for the Maricopa County PM₁₀ Nonattainment Area (ADEQ 2007a). This comparison was done to determine if there were San Joaquin CMPs that have the potential to reduce agricultural PM₁₀ emissions in the Maricopa County PM₁₀ Nonattainment Area. The San Joaquin CMP program was selected for this analysis based on a literature search of other states’ agricultural control measures.

The sources of data for the CMPs and BMPs:

- “Conservation Management Practices Program Report for 2005”, San Joaquin Valley Air Pollution Control District, January 19, 2006; and
- “Technical Support Document for Quantification of Agricultural Best Management Practices, Revised Final Draft”, ADEQ Contract No. 98-0159-BF, URS Corporation and Eastern Research Group, Inc., June 8, 2001.

1.2.1 Methodology

The following steps were used to estimate potential uncontrolled PM₁₀ emissions and potential PM₁₀ emission reductions from implementation of Maricopa County Agricultural BMPs and San Joaquin CMPs.

1. Estimation of Crop Acres in Maricopa County PM₁₀ Nonattainment Area (NAA):

$$\text{Crop}_{\text{Nonattainment Area}} = \text{Crop}_{\text{Maricopa County}} * (\text{Ag Acres}_{\text{Nonattainment Area}} / \text{Ag Acres}_{\text{Maricopa County}})$$

Where:

Crop_{NAA} = Area of a specific crop in the Maricopa County PM₁₀ NAA (acres)

$\text{Crop}_{\text{Maricopa County}}$ = Area of a specific crop in Maricopa County (acres)
(Source: USDA, Arizona Agricultural Statistics - Year 2004)

$\text{Ag Acres}_{\text{NAA}}$ = Total agricultural area in Maricopa County PM₁₀ NAA (acres)
(Source: 2004 MAG Land Use Data)

$\text{Ag Acres}_{\text{Maricopa County}}$ = Total agricultural area in Maricopa County (acres)
(Source: USDA, Arizona Agricultural Statistics – Year 2004)

Example - Acres of Cotton in Maricopa County PM₁₀ NAA:

Given:

$$\begin{aligned} \text{Crop}_{\text{NAA}} &= \text{Acres of cotton in the Maricopa County PM}_{10} \text{ NAA} \\ \text{Crop}_{\text{Maricopa County}} &= 20,500 \text{ acres of cotton in Maricopa County} \\ \text{Ag Acres}_{\text{NAA}} &= 223,624 \text{ total agricultural acres in Maricopa County PM}_{10} \text{ NAA} \\ \text{Ag Acres}_{\text{Maricopa County}} &= 465,833 \text{ total agricultural acres in Maricopa County} \end{aligned}$$

Then:

$$\begin{aligned} \text{Crop}_{\text{NAA}} &= \text{Crop}_{\text{Maricopa County}} * (\text{Ag Acres}_{\text{NAA}} / \text{Ag Acres}_{\text{Maricopa County}}) \\ \text{Cotton}_{\text{NAA}} &= 20,500 \text{ acres} * (223,624 \text{ acres} / 465,833 \text{ acres}) \\ \text{Cotton}_{\text{NAA}} &= 20,500 \text{ acres} * 0.48005 = 9,841 \text{ acres} \end{aligned}$$

2. Calculation of Uncontrolled PM₁₀ Emissions by Crop & Agricultural Activity in Maricopa County PM₁₀ Nonattainment Area:

$$E_{\text{Crop Activity}} = EF_{\text{Crop Activity}} * A$$

Where:

$$\begin{aligned} E_{\text{Crop Activity}} &= \text{Emissions for a specific crop and activity (lbs PM}_{10} / \text{ year)} \\ EF_{\text{Crop Activity}} &= \text{Emission factor for a specific crop and activity (lbs PM}_{10} / \text{ acre / year)} \\ A &= \text{Area of crop (acres)} \end{aligned}$$

Example – Land Preparation / Cultivation for Cotton:

Given:

$$\begin{aligned} E_{\text{Crop Activity}} &= \text{Emissions for land preparation / cultivation for cotton in Maricopa County PM}_{10} \text{ Nonattainment Area (lbs PM}_{10} / \text{ year)} \\ EF_{\text{Crop Activity}} &= 8.90 \text{ lbs PM}_{10} / \text{ acre / year for land preparation for cotton} \\ A &= 9,841 \text{ acres of cotton in Maricopa County PM}_{10} \text{ Nonattainment Area} \end{aligned}$$

Then:

$$\begin{aligned} E_{\text{Crop Activity}} &= EF_{\text{Crop Activity}} * A \\ &= 8.90 \text{ lbs PM}_{10} / \text{ acre / year} * 9,841 \text{ acres} \\ &= 87,585 \text{ lbs PM}_{10} / \text{ year} \end{aligned}$$

3. Calculation of PM₁₀ Emissions Reduction by Crop and Control Measure:

$$ER = E_{\text{Uncontrolled Emissions}} * CE$$

Where:

$$ER = \text{Emissions reduction for a specific crop and activity after application of a control measure (lbs PM}_{10}\text{/ year)}$$

$$E_{\text{Uncontrolled Emissions}} = \text{Uncontrolled emissions for a specific crop and activity (lbs PM}_{10}\text{/ year)}$$

$$CE = \text{Control effectiveness of a specific control measure (decimal reduction, e.g. 0.25 = 25\% reduction)}$$

Example – Integrated Pest Management Control Measure Applied to Cotton Tilling:

Given:

$$ER = \text{Emissions reduction for cotton land preparation / cultivation tilling after application of Integrated Pest Management control measure (lbs PM}_{10}\text{/ year)}$$

$$E_{\text{Uncontrolled Emissions}} = \text{Uncontrolled Emissions for cotton land preparation / cultivation (lbs PM}_{10}\text{/ year)}$$

$$CE = 19\% = 0.19$$

Then:

$$ER = E_{\text{Uncontrolled Emissions}} * CE$$

$$ER = 87,585 \text{ lbs PM}_{10}\text{/ year} * 0.19$$

$$ER = 16,641 \text{ lbs PM}_{10}\text{/ year}$$

Table 1 lists the emission factors and adjustment factors that were used to estimate potential PM₁₀ emissions by crop and agricultural activities for comparison of Maricopa County BMPs with San Joaquin CMPs. Note: the emission factors listed in Table 1 are composite emission factors that combine data from a number of emission generating activities into one emission factor by crop and category. For example, the composite emission factor for the Land Preparation / Cultivation category for Cotton combines emission factors for the following agricultural activities: rip field, primary discing, list beds, make ditch, spray and incorporate herbicide, irrigate, close ditch, cultivate preplant, plant, uncap beds, and cultivate. (See Table A-1 in Attachment #1 for a list of individual emission factors and emission reductions by crop activity, crop, and control measure.)

Table 1 – Emission Factors and Adjustment Factors								
Crop Type	Land Preparation ¹ (lbs PM ₁₀ / acre/yr)	Harvest ¹ (lbs PM ₁₀ / acre/yr)	Wind Erosion ²	Wind Erosion ²	Wind Erosion ²	Unpaved Road and Unpaved Vehicle / Equipment Areas ¹		
			Cropland (lbs PM ₁₀ / acre/yr)	Non Cropland (lbs PM ₁₀ / acre/yr)	Unpaved Roads (lbs PM ₁₀ / acre/yr)	Vehicle Miles Traveled (VMT) ¹ (VMT/acre/yr)	VMT Emission Factor ¹ (lbs PM ₁₀ / VMT)	Vehicle Travel Emission Factor ³ (lbs PM ₁₀ / acre/yr)
Alfalfa	4.00	0.24	0	0.33	4.31	0.40	2	0.80
Citrus	0.07	0.14	122.24	1.33	2.88	1.23	2	2.46
Corn	6.90	0.43	108.05	1.33	2.88	0.4	2	0.8
Cotton	8.90	3.37	128.84	3.33	3.60	0.4	2	0.8
Onions	6.50	1.68	122.24	1.33	2.88	2.4	2	4.8
Wheat	4.45	3.45	0	1.33	2.88	1.4	2	2.8
Barley	4.45	3.45	0	1.33	2.88	1.4	2	2.8
Lettuce	12.75	0.23	122.24	1.33	2.88	2.4	2	4.8
Melons	5.70	0.23	122.24	1.33	2.88	2.4	2	4.8
Vegetables	9.05	0.23	122.24	1.33	2.88	2.4	2	4.8
Data Sources:								
¹ “Conservation Management Practices Program Report for 2005”, San Joaquin Valley Air Pollution Control District, January 19, 2006.								
² “Technical Support Document For Quantification Of Agricultural Best Management Practices, Final”, Prepared for Arizona Department of Environmental Quality by URS Corporation and Eastern Research Group, Inc., June 8, 2001.								
³ Vehicle Travel Emission Factor was calculated by multiplying Vehicle Miles Traveled by VMT Emission Factor.								

1.2.2 Summary of Emissions Reductions

The methodology used in Section 1.2.1 was used to estimate and compare the potential emission reductions that would result from application of Maricopa County BMPs and San Joaquin CMPs in the Maricopa County PM₁₀ Nonattainment Area. Table 2 ranks the sixty-seven Maricopa County Agricultural BMPs and San Joaquin CMPs from largest to smallest potential PM₁₀ emission reductions for the Maricopa County PM₁₀ Nonattainment Area. As can be seen from Table 2, those control measures that reduce wind erosion on cropland have the highest potential PM₁₀ emission reductions, ranging from 1,034 tons to 453 tons of PM₁₀ reduced per year. It should be noted that there were no wind erosion control measures in the San Joaquin CMPs. This is the reason that the Maricopa County BMPs had the most effective PM₁₀ emission reductions.

The cross reference column in Table 2 refers to the corresponding control measure listed in Table A-1 of Attachment #1 (e.g., “CO – 8” refers to the Cross Wind Ridges control measure with data for its eight associated crop types). Table A-1 provides greater detail on the control measures, specific crops affected by the

control measures, emission factors, emissions, and emissions reductions of the control measures that were evaluated. Figure 1 displays those Maricopa County Agricultural BMPs and San Joaquin CMPs that have annual PM₁₀ emission reductions of 10 tons or more. The Agricultural BMP Technical Workgroup and Governor’s Agricultural Best Management Practices Committee reviewed the comparison of the Maricopa County BMPs’ and San Joaquin CMPs’ emission reductions and the Committee selected six control measures based on their feasibility and potential emission reductions.

Caveat: The emissions and emissions reduction data listed in this section are for comparison purposes only to evaluate the potential effectiveness of different agricultural control measures. These estimated are not a substitute for an emissions inventory for agricultural operations contained in the MAG 5% Plan, which documents the emission reduction from the Agricultural BMP Program.

Table 2 - Ranking of PM₁₀ Emission Reductions From Maricopa County Agricultural BMPs and San Joaquin CMPs					
	Organization	Control Measure Category	Cross Reference to Table A-1	Control Measure	PM₁₀ Emission Reduction (Tons/Year)
1	Maricopa County BMP	Cropland - Other Activities	CO-8	Cross-Wind Ridges (reduces wind erosion on cropland)	1,034
2	Maricopa County BMP	Cropland - Other Activities	CO-28	Surface Roughening (reduces wind erosion of cropland)	816
3	Maricopa County BMP	Cropland - Other Activities	CO-30a	Wind Barrier – Artificial (reduces wind erosion of cropland)	816
4	Maricopa County BMP	Cropland - Other Activities	CO-30b	Wind Barrier – Natural (reduces wind erosion of cropland)	453
5	San Joaquin CMP	Cropland - Other Activities	CO-11	Grinding / Chipping / Shredding	130
6	San Joaquin CMP	Cropland - Other Activities	CO-26	Soil Incorporation	130
7	Maricopa County BMP	Cropland - Other Activities	CO-24	Sequential Cropping	102
8	Maricopa County BMP	Unpaved Roads & Non Cropland	CU-8	Wind Barrier - Artificial (reduces wind erosion of unpaved roads and non cropland)	87
9	Maricopa County BMP	Cropland - Land Prep / Cultivation	CL-6	Conservation Tillage	83
10	Maricopa County BMP	Cropland - Land Prep / Cultivation	CL-21	Time of Planting	73
11	San Joaquin CMP	Unpaved Roads & Non Cropland	CU-3	Paving	70
12	San Joaquin CMP	Cropland - Other Activities	CO-1	Alternate Tilling	66
13	Maricopa County BMP	Cropland - Land Prep / Cultivation	CL-8	Equipment Changes/Technological Improvements	66

Table 2 - Ranking of PM₁₀ Emission Reductions From Maricopa County Agricultural BMPs and San Joaquin CMPs

	Organization	Control Measure Category	Cross Reference to Table A-1	Control Measure	PM₁₀ Emission Reduction (Tons/Year)
14	Maricopa County BMP	Unpaved Roads & Non Cropland	CU-6	Track Out Control	64
15	San Joaquin CMP	Unpaved Roads & Non Cropland	CU-1d	Road Oil	54
16	San Joaquin CMP	Unpaved Roads & Non Cropland	CU-1c	Polymers	52
17	Maricopa County BMP	Unpaved Roads & Non Cropland	CU-7	Water Application	51
18	Maricopa County BMP	Unpaved Roads & Non Cropland	CU-9	Wind Barrier – Natural (reduces wind erosion of unpaved roads and non cropland)	49
19	Maricopa County BMP	Cropland - Other Activities	CO-15	Mulching	47
20	San Joaquin CMP	Cropland - Other Activities	CO-25	Soil Amendments	41
21	San Joaquin CMP	Unpaved Roads & Non Cropland	CU-1f	Gravel	33
22	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-17	Organic Practices	32
23	San Joaquin CMP	Cropland - Other Activities	CO-20	Organic Practices	32
24	Maricopa County BMP	Unpaved Roads & Non Cropland	CU-5a-d	Reducing speed on unpaved roads	30
25	Maricopa County BMP	Cropland – Harvest	CH-4	Equipment Changes/Technological Improvements	26
26	Maricopa County BMP	Cropland - Land Prep / Cultivation	CL-12	Limited Activity During a High-Wind Event	25
27	Maricopa County BMP	Cropland - Other Activities	CO-16	Multi-Year Crop	24
28	San Joaquin CMP	Unpaved Roads & Non Cropland	CU-1a	Chips/mulch	24
29	San Joaquin CMP	Unpaved Roads & Non Cropland	CU-1b	Organic materials/vegetation	24
30	San Joaquin CMP	Unpaved Roads & Non Cropland	CU-1e	Sand	24

Table 2 - Ranking of PM₁₀ Emission Reductions From Maricopa County Agricultural BMPs and San Joaquin CMPs

	Organization	Control Measure Category	Cross Reference to Table A-1	Control Measure	PM₁₀ Emission Reduction (Tons/Year)
31	San Joaquin CMP	Cropland – Land Prep / Cultivation	CL-19	Precision Farming	20
32	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-20	Tillage Based on Soil Moisture	20
33	San Joaquin CMP	Cropland - Other Activities	CO-12	Integrated Pest Management	19
34	San Joaquin CMP	Cropland - Other Activities	CO-2	Application Efficiencies	19
35	San Joaquin CMP	Cropland - Other Activities	CO-29	Transgenic Crops	18
36	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-5	Conservation Irrigation	17
37	San Joaquin CMP	Cropland - Other Activities	CO-6	Conservation Irrigation	17
38	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-2	Bed/Row Size or Spacing	16
39	Maricopa County BMP	Cropland - Land Prep / Cultivation	CL-14	Multi-Year Crop	16
40	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-15	Night Farming	13
41	Maricopa County BMP	Cropland – Harvest	CH-2	Combined Operations	13
42	San Joaquin CMP	Cropland – Harvest	CH-14	Shuttle System / Larger Carrier	13
43	San Joaquin CMP	Cropland – Harvest	CH-7	Green Chop	13
44	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-13	Mulching	12
45	Maricopa County BMP	Cropland - Land Prep / Cultivation	CL-22	Timing of Tillage Operation	12
46	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-23	Transgenic Crops	11
47	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-11	Integrated Pest Management	11
48	Maricopa County BMP	Cropland - Land Prep / Cultivation	CL-4	Combining land preparation operations	9
49	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-3	Chemigation/Fertigation	9
50	San Joaquin CMP	Cropland - Other Activities	CO-5	Chemigation/Fertigation	9

Table 2 - Ranking of PM₁₀ Emission Reductions From Maricopa County Agricultural BMPs and San Joaquin CMPs

	Organization	Control Measure Category	Cross Reference to Table A-1	Control Measure	PM₁₀ Emission Reduction (Tons/Year)
51	San Joaquin CMP	Cropland – Harvest	CH-1	Baling/Large Balers	7
52	San Joaquin CMP	Cropland - Other Activities	CO-3	Baling/Large Balers	7
53	Maricopa County BMP	Cropland - Other Activities	CO-23	Residue Management	7
54	San Joaquin CMP	Unpaved Roads & Non Cropland	CU-4	Restricted Access	7
55	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-16	Non-Tillage/Chemical Tillage	6
56	San Joaquin CMP	Cropland - Other Activities	CO-19	Non-Tillage/Chemical Tillage	6
57	San Joaquin CMP	Cropland – Harvest	CH-9	Night Harvesting	5
58	Maricopa County BMP	Cropland – Harvest	CH-12	Reduced Harvest Activity	5
59	San Joaquin CMP	Cropland - Other Activities	CO-17	Night Farming / Night Harvesting	3
60	San Joaquin CMP	Cropland – Harvest	CH-11	Pre-Harvest Soil Preparation	2
61	San Joaquin CMP	Cropland - Land Prep / Cultivation	CL-24	Transplanting	1
62	San Joaquin CMP	Cropland – Harvest	CH-8	Hand Harvesting	1
63	San Joaquin CMP	Cropland – Harvest	CH-13	Shed Packing	0.14
64	Maricopa County BMP	Cropland - Land Prep / Cultivation	CL-7	Cover Crops	0.07
65	San Joaquin CMP	Cropland - Other Activities	CO-7	Cover Crops	0.04
66	San Joaquin CMP	Cropland - Other Activities	CO-22	Reduced Pruning	0.01
67	Maricopa County BMP	Cropland - Land Prep / Cultivation	CL-18	Planting Based on Soil Moisture	0.01

Ranking of Maricopa County BMPs and San Joaquin CMPs PM10 Emission Reductions (Tons/Year)

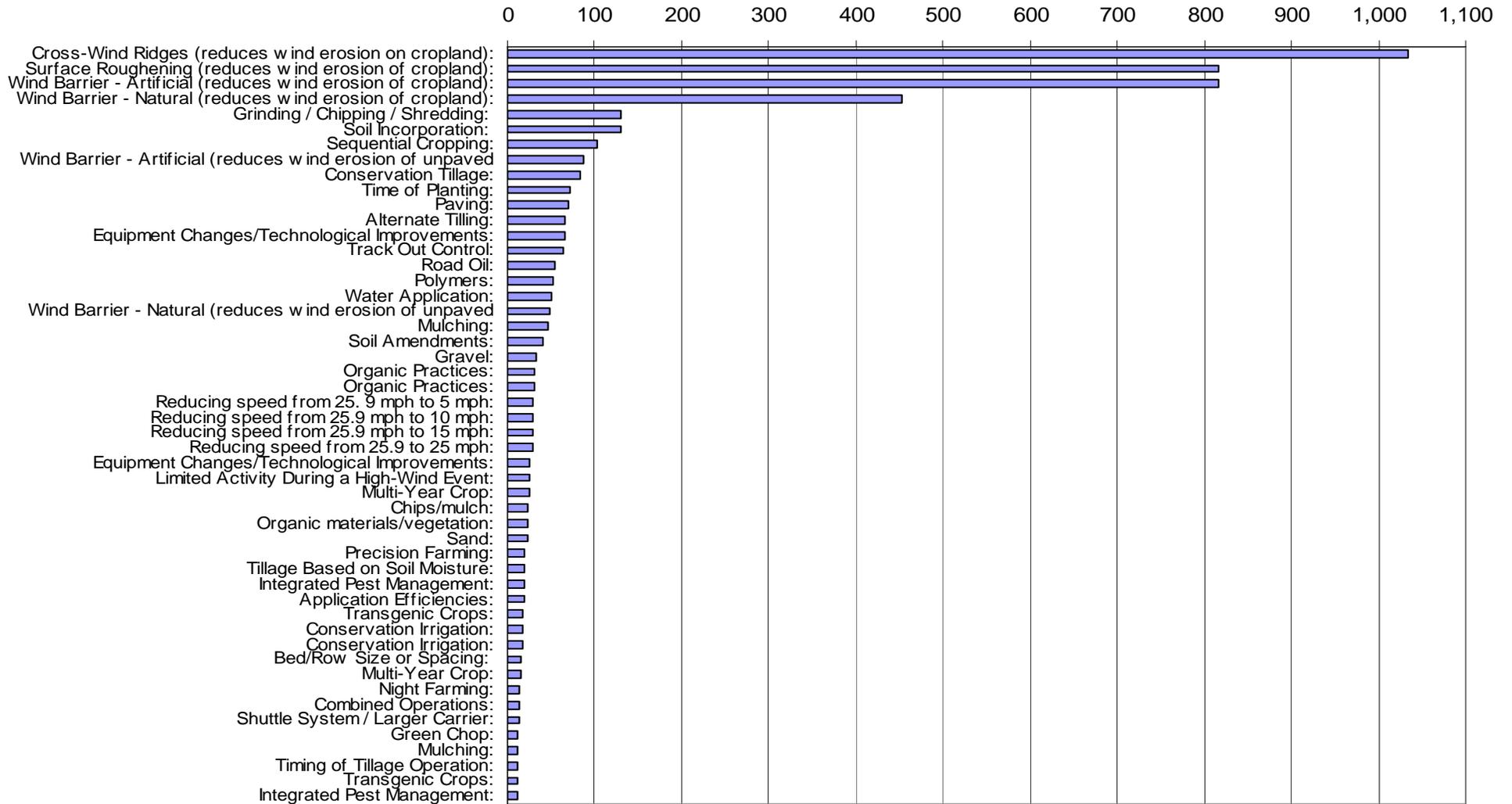


Figure 1. Ranking of Maricopa County Agricultural BMPs and San Joaquin CMPs

1.3 AGRICULTURAL BMPS IN SENATE BILL 1552

ADEQ Air Quality Division staff performed an analysis to estimate potential PM₁₀ emissions reductions from agricultural BMPs language contained in Senate Bill 1552 (2007 session). Specifically, the following two agricultural BMPs were evaluated: (1) Expanding the number of Best Management Practices (BMPs) that growers must apply from one to two for each of the three BMP categories and extending the applicability of the Maricopa County BMPs to the Maricopa County portion of Area A outside of the Maricopa County PM₁₀ Nonattainment Area, and (2) Implementing a ban on tillage in Area A on any day for which ADEQ has issued a High Pollution Advisory.

1.3.1 Effect of One Additional Agricultural BMP in Maricopa County PM₁₀ Nonattainment Area

The following section discusses the methodology, data, and assumptions used to estimate potential PM₁₀ emissions reductions in the Maricopa County PM₁₀ Nonattainment Area (NAA) from requiring growers to apply one additional agricultural BMP per category listed in the Maricopa County Agricultural BMPs. The section is arranged by the steps used to estimate the potential PM₁₀ emission reductions.

1. Percent Emission Reduction by Agricultural BMP Category - The percent emission reductions for the following three Agricultural BMP categories - Tillage & Harvest, Non-cropland (Unpaved Farm Roads), and Cropland (Windblown Agriculture) were estimated for the NAA for Year 2005 using the following methodology:

Tillage & Harvest BMPs and Non-cropland / Unpaved Farm Roads BMPs

The Maricopa County Air Quality Department's (MCAQD) 2005 Periodic PM₁₀ Emission Inventory (PEI) lists annual uncontrolled and controlled PM₁₀ emissions from tillage and harvest operations, and travel on unpaved agricultural roads in Maricopa County. MCAQD used the BMP control efficiencies listed in Table 4-2 of the URS and ERG report: "Technical Support Document of Agricultural Best Management Practices, June 2001" to calculate controlled PM₁₀ emissions for tillage, harvest, and unpaved farm roads. However, MCAQD used a compliance rate of 59 percent rather than the 80 percent listed in the URS and ERG report. The 59 percent compliance rate was used to ensure consistency with MCAQD's rule effectiveness study of the agricultural BMPs that was used in the development of the MCAQD 2005 PEI.

The percent emission reduction for the Tillage & Harvest BMPs and the Non-cropland / Unpaved Farm Roads BMPs were calculated as follows:

$$\% \text{ BMP Reduction}_{\text{Ag Source}} = (\text{Uncontrolled Emissions}_{\text{Ag Source}} - \text{Controlled Emissions}_{\text{Ag Source}}) / \text{Uncontrolled Emissions}_{\text{Ag Source}}$$

Where:

$\% \text{ BMP Reduction}_{\text{Ag Source}}$ = Percent reduction in PM₁₀ emissions from application of one agricultural BMP.

$\text{Uncontrolled Emissions}_{\text{Ag Source}}$ = Uncontrolled PM₁₀ emissions from agricultural source without agricultural BMP. (Source: MCAQD 2005 PEI)

$\text{Controlled Emissions}_{\text{Ag Source}}$ = Controlled PM₁₀ emissions from agricultural source with one agricultural BMP. (Source: MCAQD 2005 PEI)

Example - Percent Emission Reduction from Tillage BMPs – Year 2005:

Given:

$$\text{Uncontrolled Emissions}_{\text{Tillage}} = 1,556 \text{ tons PM}_{10} / \text{year}$$

Note: Agricultural emissions in NAA = Maricopa County agricultural emissions * 48.005% (Percent of Maricopa County agricultural land in NAA)

$$\text{Controlled Emissions}_{\text{Tillage}} = 1,229 \text{ tons PM}_{10} / \text{year}$$

Then:

$$\begin{aligned} \% \text{ BMP Reduction}_{\text{Tillage}} &= (\text{Uncontrolled Emissions}_{\text{Tillage}} - \text{Controlled Emissions}_{\text{Tillage}}) / \text{Uncontrolled Emissions}_{\text{Tillage}} \\ &= (1,556 \text{ tons / year} - 1,229 \text{ tons / year}) / 1,556 \text{ tons} \\ &= 21.0\% \end{aligned}$$

The percent emission reductions for Harvest BMPs and Non-cropland BMPs were calculated in a similar fashion to the percent emission reduction for tillage. A weighted average percent emission reduction was calculated for the Tillage & Harvest BMP category based on the percent emission reductions calculated for Tillage BMPs and Harvest BMPs .

Cropland / Windblown Agriculture BMPs

The percent emission reduction for the Cropland / Windblown Agriculture BMP category was derived from the Maricopa Association of Government’s (MAG) technical support document: “Technical Support Document in Support of the MAG 2007 Five Percent Plan for PM₁₀ for the Maricopa County Nonattainment Area”. MAG used the U.S. Department of Agriculture’s (USDA) wind erosion equation to calculate PM₁₀ emissions from wind erosion of agricultural fields in Maricopa County and in the Maricopa County PM₁₀ Nonattainment Area. Hourly wind speeds and annual totals of harvested acres by crop in Maricopa County were input to the USDA wind erosion equation for years 2001 through 2005 to produce estimates of annual PM₁₀ emissions. A five-year average of the annual PM₁₀ emissions due to Cropland / Windblown Agriculture was then calculated.

Table 3 lists the emissions and percent emission reductions for the three agricultural BMP categories.

Table 3 - Calculation of Percent PM₁₀ Emission Reductions by Ag BMP Group			
Agricultural BMP Group	Maricopa County Year 2005	% County Ag Land in PM₁₀ NAA¹	PM-10 NAA Year 2005
Tillage:			
Uncontrolled tillage emissions (tons/year) ¹	3,241.12	48.005%	1,555.90
Controlled tillage emissions (tons/year) ¹			1,228.67
Emission Reduction (tons/year)			327.23
Percent Reduction due to one Tillage BMP			21.0%
Harvest:			
Uncontrolled harvest emissions (tons/year) ¹	166.36	48.005%	79.86
Controlled harvest emissions (tons/year) ¹			58.99
Emission Reduction (tons/year)			20.87
Reduction due to one Harvest BMP			26.1%

Table 3 - Calculation of Percent PM₁₀ Emission Reductions by Ag BMP Group			
Agricultural BMP Group	Maricopa County Year 2005	% County Ag Land in PM₁₀ NAA¹	PM-10 NAA Year 2005
Tillage & Harvest:			
% Weighted reduction for one Tillage & Harvest BMP			21.3%
Non-cropland / Unpaved Farm Roads:			
Uncontrolled farm road emissions (tons/year) ¹	2,175.39	48.005%	1,044.30
Controlled farm road emissions (tons/year) ¹			910.64
Emission Reduction (tons/year)			133.66
% Reduction due to one Non-Cropland BMP			12.8%
Cropland / Windblown Agriculture:			
Uncontrolled windblown agricultural emissions (tons/year) ²			1,614
Controlled windblown agricultural emissions (tons/year) ²			1,128
Emission Reduction (tons/year)			486
% Reduction due to one Cropland BMP ³			30.1%
Data Sources:			
¹ "2005 Periodic PM ₁₀ Emission Inventory", MCAQD, May 2007.			
² "Technical Support Document in Support of the MAG 2007 Five Percent Plan for PM ₁₀ for the Maricopa County Nonattainment Area", Maricopa Association of Governments, December 2007. (Windblown agricultural emissions were derived from data in the MAG 2007 TSD's Appendix II, Exhibit 3: "Windblown Dust Emission Calculations for PM ₁₀ Nonattainment Area for the Years 2001 - 2005".)			
³ Derived from Table 4-2 of the "Technical Support Document for Quantification of Agricultural Best Management Practices, Revised Final Draft", ADEQ Contract No. 98-0159-BF. URS Corporation and Eastern Research Group, Inc., June 8, 2001. Note: The compliance rate of 0.80 listed in the TSD for Quantification of Ag BMPs was converted to 0.59 by MCAQD in the development of their 2005 PEI.			

2. Projected Crop Acreage in Maricopa County

The Arizona Agricultural Statistics Bulletins for years 2000 through 2004 were reviewed to determine trends in crop acreages in Maricopa County. Based on these crop acreage data, the trend for harvested acres of field crops is a 4.6 percent decline per year and the trend for harvested acres of all crops (includes grapes and citrus) is a 4.9 percent decline per year. These annual trends were used to project years 2007 through 2010 crop acreage for field crops (-4.6% per year) and all crops (-4.9% per year) as follows:

Example – Field Crop Acreage – Year 2006:

$$\begin{aligned} \text{Projected Crop Acres} &= \text{Year 2005 Crop Acres} \times \text{Annual Decrease} \\ \text{Projected Crop Acres}_{\text{Field Crops}} &= 172,340 \text{ Harvested Acres Field Crops} \times (1 - 0.046) \\ &= 164,412 \text{ Harvested Acres Field Crops in 2006} \end{aligned}$$

Table 4 lists historical and projected crop acreage for Maricopa County.

	2003	2004	2005	2006	2007	2008	2009	2010
Harvested Acres of Field Crops ¹	169,750	180,650	172,340	164,412	156,849	149,634	142,751	136,184
Harvested Acres of All Crops ²	179,050	189,950	180,642	171,791	163,373	155,368	147,755	140,515
Data Sources:								
¹ Based on data from 2000-2004 Arizona Agricultural Statistics Bulletins; excludes grapes & citrus. Average annual acreage decrease between 2000 and 2004 = -4.6%.								
² Based on data from 2000-2004 Arizona Agricultural Statistics Bulletins; includes grapes & citrus; average annual acreage decrease between 2000 and 2004 = -4.9%.								

3. *Rate of Change Factors*

The years 2007 through 2010 projected crop acreage for harvested acres of field crops and harvested acres of all crops (Table 4) were divided by year 2005 crop acreage to produce rate of change factors for years 2006 through 2010 for harvested acres of field crops and harvested acres of all crops as follows:

Example – Rate of Change for Field Crops – Year 2006:

$$\begin{aligned} \text{Rate of Change Factor} &= \text{Year 2006 Crop Acres} / \text{Year 2005 Crop Acres} \\ \text{Rate of Change Factor}_{\text{Field Crops}} &= 164,412 \text{ Harvested Acres Field Crops} / 172,340 \text{ Harvested Acres Field Crops} \\ &= 0.954 \text{ for 2006} \end{aligned}$$

Table 5 lists rate of change factors for years 2006 through 2010.

	2006	2007	2008	2009	2010
Harvested Acres of Field Crops <ul style="list-style-type: none"> ● Used to estimate future emission reductions from 2nd additional Tillage & Harvest BMP. ● Year 2005 is base year for calculation. 	0.954	0.910	0.868	0.828	0.790
Harvested Acres of All Crops <ul style="list-style-type: none"> ● Used to estimate future emission reductions from 2nd additional Noncropland / Unpaved Farm Roads BMP. ● Year 2005 is base year for calculation. 	0.951	0.904	0.860	0.818	0.778
Harvested Acres of Field Crops <ul style="list-style-type: none"> ● Used to estimate future emission reductions from 2nd additional Cropland / Windblown Ag BMP. ● Year 2003 is base year for calculation. 	0.969	0.924	0.881	0.841	0.802

4. *Projected Agricultural Emissions in Maricopa County PM₁₀ Nonattainment Area*

The year 2005 uncontrolled emissions and controlled emissions (Table 3, based on MCAQD 2005 PEI) were multiplied by the rate of change factors (Table 5) to produce projected uncontrolled and

controlled emission reductions, by agricultural BMP category, for years 2006 through 2007. The “harvested acres of field crops” rate of change factor was used to develop projected uncontrolled and controlled emissions for the Tillage & Harvest BMPs and Non-cropland / Unpaved Farm Roads BMPs, while the “harvested acres of all crops” rate of change factor was used to develop projected emissions for the Cropland / Windblown Agriculture BMPs. These emissions are listed in Table 6 and the following example shows the calculation of the projected emissions.

Example – Uncontrolled Tillage & Harvest Emissions – Year 2006:

$$\begin{aligned} \text{Projected Emissions} &= \text{Year 2005 Emissions} \times \text{Rate of Change Factor} \\ \text{Projected Emissions}_{\text{Tillage \& Harvests}} &= 1,636 \text{ tons / year Uncontrolled Tillage \& Harvest} \times 0.954 \\ &= 1,561 \text{ tons / year Uncontrolled Tillage \& Harvest} \end{aligned}$$

Table 6 - PM₁₀ Emissions for Maricopa County PM₁₀ Nonattainment Area (tons / year)						
BMP Category	2005	2006	2007	2008	2009	2010
Tillage & Harvest:						
• Uncontrolled	1,636	1,561	1,489	1,420	1,355	1,292
• Controlled (21.3% reduction)	1,288	1,229	1,172	1,118	1,066	1,018
Non-cropland / Unpaved Farm Roads:						
• Uncontrolled	1,044	993	944	898	854	812
• Controlled (12.8% reduction)	911	866	824	783	745	709
Cropland / Windblown Agriculture:						
• Uncontrolled	1,614	1,564	1,491	1,422	1,357	1,294
• Controlled (30.1% reduction)	1,128	1,093	1,042	994	949	905

5. Projected Agricultural Emission Reductions in Maricopa County PM₁₀ Nonattainment Area

- **One Agricultural BMP** - The uncontrolled agricultural emissions (Table 6) for years 2006 through 2010 were multiplied by the percent emission reductions for the three agricultural BMP categories (Table 1: Tillage & Harvest = 21.3%, Non-cropland / Unpaved Farm Roads = 12.8%, Cropland / Windblown Agriculture = 30.1%) The resulting emission reductions represent the application of one agricultural BMP per BMP category. These emission reductions are listed in Table 7 and the following example shows the calculation of the emission reductions.

Example – Tillage & Harvest Emissions Reduction – Year 2006:

$$\begin{aligned} \text{Emission Reductions} &= \text{Annual Emissions} \times \% \text{ BMP Emission Reduction} \\ \text{Emissions Reduction}_{\text{Tillage \& Harvest}} &= 1,561 \text{ tons / year Uncontrolled Tillage \& Harvest} \times 0.213 \\ &= 332 \text{ tons / year} \end{aligned}$$

- **Second Additional Agricultural BMP** – Years 2006 through 2010 controlled agricultural emissions (Table 6) were multiplied by the percent emission reductions for the three agricultural BMP categories (Table 3). The resulting emission reductions represent the application of a second additional agricultural BMP per BMP category. These emission reductions are listed in Table 7.

It was assumed that the control effectiveness of the second additional agricultural BMP per BMP category would be at least as effective as the first set of agricultural BMPs. It should be noted that the percent emission reductions for the second additional BMP were applied to controlled agricultural emissions to account for the emission reductions that had already occurred from application of the first set of agricultural BMPs to the uncontrolled agricultural emissions.

- **Total Agricultural Emission Reductions** – The above emission reductions resulting from application of the first agricultural BMP and the second additional agricultural BMP for each of the three agricultural BMP categories (Tillage & Harvest, Non-cropland / Unpaved Farm Roads, Cropland / Windblown Agriculture) were summed to give total agricultural emission reductions for years 2006 through 2010, by BMP category, for the Maricopa County PM₁₀ Nonattainment Area. These emission reductions are listed in Table 7.

Table 7 - Emission Reductions for Maricopa County PM₁₀ Nonattainment Area (tons/year)						
BMP Category	2005	2006	2007	2008	2009	2010
Tillage & Harvest:						
• First BMP Applied	348	332	317	303	289	275
• Second BMP Applied	274	262	250	238	227	217
• Total	622	594	567	541	516	492
Non-cropland / Unpaved Farm Roads:						
• First BMP Applied	134	127	121	115	109	104
• Second BMP Applied	117	111	105	100	95	91
• Total	251	238	226	215	204	195
Cropland / Windblown Agriculture:						
• First BMP Applied	486	471	449	428	408	389
• Second BMP Applied	340	329	314	299	286	272
• Total	826	800	763	727	694	661
Notes:						
1. PM ₁₀ Emission Reduction from 1st Ag BMP = % Emission Reduction * Uncontrolled Emissions (e.g., Year 2005 Tillage & Harvest: 1,636 tons PM ₁₀ / Year 2005 * 21.3% = 348 tons PM ₁₀ reduced / Year 2005).						
2. It was assumed that the control effectiveness of requiring that a second BMP be implemented for each of the three BMP categories - Tillage & Harvest, Cropland, and Noncropland - would be at least as effective in reducing PM ₁₀ emissions as implementing the first set of BMPs for each of the three BMP categories.						
3. PM ₁₀ Emission Reduction from 2nd Ag BMP = % Emission Reduction * Controlled Emissions after 1st Ag BMP has been implemented (e.g., Year 2007 Tillage & Harvest: 1,172 tons PM ₁₀ / year * 21.3% = 250 tons PM ₁₀ reduced / year).						

1.3.2 Extending Agricultural BMP Program to Maricopa County Portion of Area A outside the Maricopa County PM₁₀ Nonattainment Area

The following section discusses the methodology, data, and assumptions used to estimate potential PM₁₀ emission reductions for the Maricopa County portion of Area A outside of the Maricopa County PM₁₀ Nonattainment Area (hereafter referred to as “MC Portion of Area A”) of requiring growers to apply two agricultural BMPs per category. The rationale for evaluating the effect of two agricultural BMPs per category for the MC Portion of Area A is that this area had previously not been subject to the Agricultural BMP Program (only the Maricopa County PM₁₀ Nonattainment Area had been subject to the Agricultural BMP Program). The section is arranged by the steps used to estimate the potential PM₁₀ emission reductions and will build on the agricultural emission reduction data that were calculated in the previous section for the Maricopa County PM₁₀ Nonattainment Area.

1. **Percent Agricultural Land In Maricopa County** - The percent agricultural land in Maricopa County was calculated by dividing the total acres of agricultural land in Maricopa County, listed in the 2004 Arizona Agriculture Statistics Bulletin for Maricopa County, by the total acres of land in Maricopa County as follows:

Example – Percent Agricultural Land:

$$\begin{aligned} \text{Percent Ag Land in County} &= \text{Total Ag Acres in County} / \text{Total Acres in County} \\ &= 189,950 \text{ acres} / 5,889,941 \text{ acres} \\ &= 3.225\% \end{aligned}$$

2. **Land in MC Portion of Area A** - Spatial analysis, using GIS, was used to determine the number of acres in the MC Portion of Area A and the percentage of the MC Portion of Area A in Maricopa County. The results of the GIS analysis were that there are 806,333 acres in the MC Portion of Area A and the percentage of the MC Portion of Area A that is in Maricopa County is 13.69% (based on spatial analysis by ADEQ GIS staff).

3. **Agricultural Land in MC Portion of Area A** – Was calculated by multiplying “Percent Agricultural Land in Maricopa County” (Step #1) by “Land in MC Portion of Area” (Step #2) as follows:

Example – Agricultural Land in MC Portion of Area A:

$$\begin{aligned} \text{Ag Land in MC Portion of Area A} &= \text{Percent Ag Land in County} \times \text{Land in MC Portion of Area A} \\ &= 3.225\% \times 806,333 \text{ acres} \\ &= 26,004 \text{ acres} \end{aligned}$$

4. ***Agricultural Land in Maricopa County PM₁₀ Nonattainment Area*** - Was calculated by multiplying the “Percent County Agricultural Land in Maricopa County PM₁₀ Nonattainment Area” (MCAQD, 2007) by total agricultural acres in Maricopa County (USDA, 2005) as follows:

Example – Agricultural Land in Maricopa County PM₁₀ Nonattainment Area:

$$\begin{aligned}
 \text{Ag Land in PM}_{10} \text{ Nonattainment Area} &= \text{Percent County Ag Land in NAA} \times \text{Ag Land in Maricopa County} \\
 &= 48.005\% \times 189,950 \text{ acres} \\
 &= 91,185 \text{ acres}
 \end{aligned}$$

5. ***Ratio of Agricultural Land in MC Portion of Area A to Agricultural Land in Maricopa County PM₁₀ Nonattainment Area*** – Was calculated by dividing acres of “Agricultural Land in MC Portion of Area A” (Step #3) by acres of “Agricultural Land in Maricopa County PM₁₀ Nonattainment Area” (Step #4) as follows:

Example – Ratio of Agricultural Land:

$$\begin{aligned}
 \text{Ratio of Ag Land} &= \text{Ag Land in MC Portion of Area A} / \text{Ag Land in PM}_{10} \text{ Nonattainment Area} \\
 &= 26,004 \text{ acres} / 91,185 \text{ acres} \\
 &= 0.285
 \end{aligned}$$

6. ***Projected Emission Reductions in MC Portion of Area A*** – The agricultural emission reductions resulting from application of the first BMP and the second additional BMP, by agricultural BMP category, in the Maricopa County PM₁₀ Nonattainment Area for years 2008 through 2010 (totals shown in Table 7) were multiplied by the ratio of agricultural land (Step #5) to produce projected agricultural emission reductions for the MC Portion of Area A for years 2008 through 2010. It should be noted that the MC Portion of Area A was not previously subject to the Maricopa County Agricultural BMP program. That is the reason that both the first agricultural BMP and the second additional agricultural BMP, per BMP category, were applied to the MC Portion of Area A to estimate emission reductions.

The projected emission reductions for the MC Portion of Area A were calculated as follows:

$$\text{MC Portion Area A ER}_{\text{Ag Source}} = \text{Nonattainment Area ER}_{\text{Ag Source}} \times \text{Ratio of Ag Land}$$

Where:

MC Portion Area A $ER_{Ag\ Source}$ = Emission reduction, by agricultural source (Tillage & Harvest, Non-cropland / Unpaved Farm Roads, Cropland / Windblown Agriculture), in the Maricopa County Portion of Area A Outside of the Maricopa County PM_{10} Nonattainment Area.

Nonattainment Area $ER_{Ag\ Source}$ = Emission reduction, by agricultural source (Tillage & Harvest, Non-cropland / Unpaved Farm Roads, Cropland / Windblown Agriculture), in the Maricopa County PM_{10} Nonattainment Area. Note: These are total emission reductions due to application of original one agricultural BMP per category and application of second additional agricultural BMP category (Second agricultural BMP required by Senate Bill 1552).

Ratio of Ag Land = Ag Land in MC Portion of Area A / Ag Land in PM_{10} Nonattainment Area.

Example - Emission Reduction from Tillage & Harvest BMP for Year 2008:

Given:

Nonattainment Area $ER_{Tillage\ \&\ Harvest}$ = 541 tons / year

Ratio of Ag Land = 0.285

Then:

MC Portion Area A $ER_{Tillage\ \&\ Harvest}$ = Nonattainment Area $ER_{Tillage\ \&\ Harvest}$ x Ratio of Ag Land

= 541 tons / year x 0.285

= 154 tons / year

Table 8 lists the emission reductions for the MC Portion of Area A, by BMP category, for the years 2008 through 2010.

Table 8 - Emission Reductions for MC Portion of Area A (tons/year)						
Ag BMP Category (1st and 2nd BMPs)	2008		2009		2010	
	Nonattainment Area	Area A Outside NAA	Nonattainment Area	Area A Outside NAA	Nonattainment Area	Area A Outside NAA
Tillage & Harvest	541	154	516	147	492	140
Non-cropland / Unpaved Farm Roads	215	61	204	58	195	56
Cropland / Windblown Agriculture	727	207	694	198	661	188
Notes:						
1. It was assumed that the crop mix is homogeneous throughout Maricopa County.						
2. Emission reduction in MC Portion of Area A = NAA Emission Reduction * (Ag land in MC Portion of Area A / Ag land in NAA).						
3. Emission reductions in Nonattainment Area (for this table) = Emission Reduction from First BMP + Emission Reduction from Second BMP (see totals for each BMP category in Table 7). This assumption was used in calculating the MC Portion of Area A emissions because the MC Portion of Area A had not previously been subject to the Agricultural BMP program (only the Maricopa County PM_{10} Nonattainment Area had the Ag BMP Program), thus its projected emission reductions are due to two "additional" Ag BMPs, instead of just one additional Ag BMP, when						

extending the Agricultural BMP program to the MC Portion of Area A.

7. **Emission Reductions Due to Revised Agricultural BMP Program in Senate Bill 1552** - The Senate Bill 1552 revisions to the Agricultural BMP Program included: (a) Second additional Agricultural BMP in the Maricopa County PM₁₀ Nonattainment Area, and (b) Extending the Agricultural BMP Program to the Maricopa County Portion of Area A Outside of the Maricopa County PM₁₀ Nonattainment Area (two new agricultural BMPs). To determine the total projected emission reductions from the revised Agricultural BMP Program, the projected emission reductions for the MC Portion of Area A (see “Area A Outside NAA” columns in Table 8) were added to the projected emission reductions for the Maricopa County PM₁₀ Nonattainment Area (see “Second BMP Applied” rows in Table 7). The total PM₁₀ emission reductions due to the revised agricultural BMP program in Senate Bill 1552 were calculated as follows:

Example – Emission Reductions from Tillage & Harvest BMP for Year 2008:

$$\begin{aligned}
 ER_{\text{Tillage \& Harvest}} &= \text{MC Portion of Area A } ER_{\text{Tillage \& Harvest}} + \text{Nonattainment Area } ER_{\text{Tillage \& Harvest}} \\
 &= 154 \text{ tons/year} + 238 \text{ tons/year} \\
 &= 392 \text{ tons/year}
 \end{aligned}$$

Table 9 lists the total projected emission reductions from the revised agricultural BMP program in Senate Bill 1552: (1) Second additional agricultural BMP in the Maricopa County PM₁₀ Nonattainment Area, and (2) Extending the Agricultural BMP program from the Maricopa County PM₁₀ Nonattainment Area to the Maricopa County portion of Area A outside of the Maricopa County PM₁₀ Nonattainment Area.

Table 9 – Emission Reductions from Agricultural BMP Program in Senate Bill 1552 (tons/year)			
Ag BMP Category	2008	2009	2010
Tillage & Harvest BMP (21.3% Reduction)	392	374	357
Non-cropland / Unpaved Farm Roads BMP (12.8% Reduction)	161	153	147
Cropland / Windblown Agriculture BMP (30.1% Reduction)	506	484	460
Total Emission Reductions: 1. Maricopa County PM₁₀ Nonattainment Area (one new BMP for this area). 2. MC Portion of Area A (two new BMPs for this area).	1,059	1,011	964
Emission Reductions from 2nd BMP in Maricopa County PM₁₀ NAA	637	608	580
Emission Reductions from 1st BMP and 2nd BMP in MC Portion of Area A	422	403	384
Notes: Revised Agricultural BMP Program in Senate Bill 1552 included: <ul style="list-style-type: none"> • Maricopa County PM₁₀ NAA - Second additional Ag BMP per category. • Extending Agricultural BMP program from Maricopa County PM₁₀ Nonattainment Area to MC Portion of Area A (i.e., require two new BMPs per category in MC Portion of Area A). Projected Emission Reductions = (Emission Reductions for MC Portion of Area A) + (Emission Reductions for Maricopa County PM ₁₀ Nonattainment Area).			

Caveats:

1. **Crop Data** - The actual number of acres for specific crops in the Maricopa County PM₁₀ Nonattainment Area and Area A is not available. These data were estimated from the Maricopa County crop acre data listed in the USDA, “Arizona Agricultural Statistics – 2004”. The crop mix was assumed to be homogeneous in the Maricopa County PM₁₀ Nonattainment Area and MC Portion of Area A.
2. **Selection of Agricultural BMPs** – The actual BMPs that have been selected by growers in the Maricopa County PM₁₀ Area are not known since growers are not required to submit these data to government agencies. Thus, MCAQD assumed an average PM₁₀ emission reduction for each BMP category during the development of the MCAQD 2005 Periodic PM₁₀ Emissions Inventory.

1.3.3 Cessation of Night Tillage on High Pollution Advisory Days

This control measure bans agricultural tilling from 2 AM to 8 AM on High Pollution Advisory Days (HPAs) forecast by ADEQ that are air stagnation days. The following section discusses the methodology, data, and assumptions used to estimate potential PM₁₀ emission reductions from implementation of this control measure in the Maricopa County portion of Area A [hereafter referred to as “Area A (Maricopa County)”]. The section is arranged by the steps used to estimate the potential PM₁₀ emission reductions and will build on the agricultural emissions and emission reduction data that were calculated in the previous sections for the Maricopa County PM₁₀ Nonattainment Area and MC Portion of Area A.

1. **Comparison of Occurrence of Stagnation Days with Tillage Days for Maricopa County** - The crop calendar of agricultural practices in Maricopa County, listed in the in the Salt River PM₁₀ Technical Support Document (ADEQ, 2005), was compared with the Year 2005 – 2006 ADEQ summary report of PM₁₀ exceedances and associated weather conditions (ADEQ, 2007b) to determine which crops were being tilled during months with stagnation days. The comparison showed that cotton, corn, and vegetables were being tilled during the months of January and February which have stagnation days. Table 10 lists data on the months when tillage and stagnation days occur and the percent of stagnation days that occur during tillage days by crop.

Table 10 - Year 2005 Stagnation Days and Potential Tillage Days in Maricopa County				
Crop	Tillage Months¹	Potential Tillage Days	Stagnation Days²	Stagnation Days / Tillage Days (percent)
Cotton	January, February, March	59	9	15%
Corn	January, February	59	9	15%
Vegetables	February	28	5	18%
Data Sources:				
¹ Crop Calendar in ADEQ Salt River PM10 TSD (ADEQ. 2005. <i>Revised PM10 State Implementation Plan for the Salt River Area, Technical Support Document. Air Quality Division, Arizona Department of Environmental Quality. September 2005. http://azdeq.gov/environ/air/plan/download/sr-tds.pdf</i>).				
² ADEQ analysis of the occurrence of Stagnation Days in Year 2005: 4 days in January, 5 days in February , 0 days in March (ADEQ. 2007b. <i>2005-2006 Forecast Season PM10 Exceedance Report for Maricopa County. Air Quality Division, Arizona Department of Environmental Quality. January 2007</i>).				
Notes:				
1. Potential Tillage Days: There were no stagnation days listed for March in ADEQ's analysis (only in January and February), that is why 59 instead of 90 "Potential Tillage Days" were considered for cotton tillage emissions.				
2. Stagnation Days: Total stagnation days were based on January and February stagnation days since ADEQ's analysis did not list any stagnation days for March.				

2. **Uncontrolled Tillage Emissions in NAA for Year 2005** - Were calculated by multiplying the annual uncontrolled tillage emissions for cotton, corn, and vegetables, listed in the PEI, by the percent county agricultural land in the NAA as follows:

Example – Uncontrolled Cotton Tillage Emissions – Year 2005:

$$\begin{aligned} \text{Uncontrolled Tillage Emissions} &= \text{Uncontrolled County Tillage Emissions} \times \% \text{ County Ag Land in NAA} \\ \text{Uncontrolled Tillage Emissions}_{\text{Cotton}} &= 1,140.09 \text{ tons/year} \times 48.005\% \\ &= 547 \text{ tons/year} \end{aligned}$$

Table 11 lists the uncontrolled tillage emissions by crop and percent of the total tillage emissions by crop in the NAA for Year 2005.

Table 11 - Uncontrolled Tillage Emissions in NAA - Year 2005				
Crop	Maricopa County Uncontrolled Emissions¹ (tons/year)	Percent County Ag Land in NAA¹	NAA Uncontrolled Emissions (tons/year)	NAA Uncontrolled Emissions (percent)
Cotton	1,140.09	48.005%	547	68%
Corn	333.90		160	20%
Vegetables	201.87		97	12%
Total	1,675.86		804	100%
Data Source:				
¹ MCAQD 2005 Periodic PM ₁₀ Emissions Inventory.				
Notes:				
MCAQD 2005 Periodic PM ₁₀ Emission Inventory lists the following vegetables as having tillage emissions: Dry Onions (23.66 tons/year), Carrots (73.93 tons/year), and Broccoli (104.28 tons/year). These three crops' tillage emissions were added together to produce uncontrolled emissions of 201.87 tons / year for "Vegetables".				

3. **Controlled Tillage Emissions in NAA for Year 2005** - Were calculated by multiplying the annual uncontrolled tillage emissions for cotton, corn, and vegetables in the NAA (Step #2) by the result of 1 - Tillage BMP Percent Control Reduction (see Table 3) as follows:

Example – Controlled Cotton Tillage Emissions – Year 2005:

$$\begin{aligned} \text{Controlled Tillage Emissions} &= \text{Uncontrolled NAA Tillage Emissions} \times \% \text{ BMP Control Reduction} \\ \text{Controlled Tillage Emissions}_{\text{Cotton}} &= 547 \text{ tons/year} \times (1 - 0.21) \\ &= 432 \text{ tons/year} \end{aligned}$$

Table 12 lists the controlled tillage emissions by crop in the NAA and percent of total emissions, after application of the first and second tillage BMPs from the Tillage & Harvest BMP category, for the Year 2005.

Table 12 - Controlled Tillage Emissions in NAA - Year 2005					
Crop	Uncontrolled Emissions¹ (tons/year)	BMP Control Reduction² (percent)	Controlled Emissions (tons/year)		Controlled Emissions 2nd BMP (percent)
			1st BMP	2nd BMP	
Cotton	547	21%	432	341	68%
Corn	160		126	100	20%
Vegetables	97		77	61	12%
Total	804		635	502	100%
Data Sources:					
¹ MCAQD 2005 Periodic PM ₁₀ Emissions Inventory.					
² Table 3 of this report.					
Notes:					
Controlled Emissions from 2nd Tillage BMP = Controlled Emissions from 1st Tillage BMP x (1 - 0.21).					

4. **Projected Uncontrolled and Controlled Tillage Emissions in NAA for Years 2008 - 2010** - Were calculated by multiplying the Year 2005 totals for uncontrolled and controlled tillage emissions in the NAA (Step #3) by the rate of change factors that were developed in Section 1.3.1 of this report (see Table 5) as follows:

Example – Projected Controlled Tillage Emissions – Year 2010:

$$\text{Projected Controlled Tillage Emissions} = \text{Controlled NAA Tillage Emissions}_{2005} \times \text{Rate of Change Factor}_{\text{Year}}$$

$$\text{Projected Controlled Tillage Emissions}_{2010} = 502 \text{ tons/year} \times 0.790$$

$$= 397 \text{ tons/year}$$

Table 13 lists the projected uncontrolled and controlled tillage emissions in the NAA for Years 2008 - 2010.

Table 13 - Projected Uncontrolled and Controlled Tillage Emissions (2 BMPs) in NAA		
Year 2008 Rate of Change¹	Year 2009 Rate of Change¹	Year 2010 Rate of Change¹
0.868	0.828	0.790
Year 2008 Uncontrolled Emissions (tons/yr)	Year 2009 Uncontrolled Emissions (tons/yr)	Year 2010 Uncontrolled Emissions (tons/yr)
698	666	635
Year 2008 Controlled² Emissions (tons/yr)	Year 2009 Controlled² Emissions (tons/yr)	Year 2010 Controlled² Emissions (tons/yr)
436	416	397
Data Sources:		
¹ Table 5 of this report.		
² Controlled Emissions from application of 1st original tillage BMP (21% emissions reduction) and second additional tillage BMP from Tillage & Harvest BMP category (21% emissions reduction applied to controlled emissions from 1st tillage BMP). Note: Does not include emission reduction from “Cessation of Night Tillage during High Pollution Advisory Days” BMP.		

5. **Projected Uncontrolled and Controlled Tillage Emissions in MC Portion of Area A for Years 2008 - 2010** - Were calculated by multiplying the projected uncontrolled and controlled tillage emissions in the NAA (Step #4) by the ratio of agricultural land in the MC Portion of Area A to agricultural land in the NAA (see Section 1.3.2, Step #5) as follows:

Example – Projected Controlled Tillage Emissions – Year 2010:

$$\begin{aligned} \text{Projected Controlled Tillage Emissions} &= \text{Controlled NAA Tillage Emissions} \times \text{Ratio of Ag Land} \\ \text{Projected Controlled Tillage Emissions}_{2010} &= 397 \text{ tons/year} \times 0.285 \\ &= 113 \text{ tons/year} \end{aligned}$$

Table 14 lists the projected uncontrolled and controlled tillage emissions in the MC Portion of Area A.

Table 14 - Projected Uncontrolled and Controlled (2 BMPs) Tillage Emissions in MC Portion of Area A			
Year 2008 Uncontrolled Emissions (tons/yr)	Year 2009 Uncontrolled Emissions (tons/yr)	Year 2010 Uncontrolled Emissions (tons/yr)	Ratio of Ag Land: MC Portion of Area A / Nonattainment Area¹
199	190	181	0.285
Year 2008 Controlled Emissions (tons/yr)	Year 2009 Controlled Emissions (tons/yr)	Year 2010 Controlled Emissions (tons/yr)	
124	119	113	
Data Source:			
¹ Section 1.3.2, Step #5 of this report.			
Notes:			
1. "MC Portion of Area A" is the portion of Area A in Maricopa County that is outside of the Maricopa County PM ₁₀ Nonattainment Area (i.e., does not include portion of Area A that is in Pinal County).			
2. Controlled Emissions are from application of 2 Tillage BMPs from Tillage & Harvest BMP category. It does not include emission reduction from "Cessation of Night Tillage during High Pollution Advisory Days" BMP.			

6. **Projected Uncontrolled and Controlled Tillage Emissions in Area A (Maricopa County) for Years 2008 - 2010** - Were calculated by adding the uncontrolled and controlled tillage emissions for the NAA (step #4) with the uncontrolled and controlled tillage emissions from the MC Portion of Area A (step #5) for Years 2008 – 2010 as follows:

Example – Projected Controlled Tillage Emissions – Year 2010:

$$\begin{aligned} \text{Projected Controlled Tillage Emissions} &= \text{NAA Controlled Tillage Emissions} + \text{MC Portion of Area A} \\ &\quad \text{Controlled Tillage Emissions} \\ \text{Projected Controlled Tillage Emissions}_{2010} &= 397 \text{ tons/year} + 113 \text{ tons/year} \\ &= 510 \text{ tons/year} \end{aligned}$$

Table 15 lists the projected uncontrolled and controlled tillage emissions in Area A (Maricopa County) for Years 2008 – 2010.

Year 2008 Uncontrolled Emissions (tons/yr)	Year 2009 Uncontrolled Emissions (tons/yr)	Year 2010 Uncontrolled Emissions (tons/yr)
897	856	816
Year 2008 Controlled Emissions (tons/yr)	Year 2009 Controlled Emissions (tons/yr)	Year 2010 Controlled Emissions (tons/yr)
560	535	510
Notes:		
1. "Area A (Maricopa County)" does not include Pinal County portion of Area A. Area A (Maricopa County) is comprised of Maricopa County PM ₁₀ Nonattainment Area and MC Portion of Area A (portion of Area A in Maricopa County that is outside of the nonattainment area).		
2. Controlled Tillage Emissions in Area A (Maricopa County) = Controlled Emissions in NAA (from 1st and 2nd Tillage BMPs) + Controlled Emissions in MC Portion of Area A (from 1st and 2nd Tillage BMPs).		

7. **Projected Controlled Tillage Emissions in Area A (Maricopa County) by Crop for Years 2008 - 2010** - Were calculated by multiplying the uncontrolled and controlled tillage emissions in Area A (Maricopa County) from Step #6 by the percent tillage emissions by crop (see "Controlled Emissions, 2nd BMP" column of Table 12) as follows:

Example – Projected Controlled Tillage Emissions – Cotton in Year 2010:

$$\begin{aligned} \text{Projected Controlled Tillage Emissions}_{\text{Crop}} &= \text{Controlled NAA Tillage Emissions} \times \% \text{ Tillage Emissions}_{\text{Crop}} \\ \text{Projected Controlled Tillage Emissions}_{\text{Cotton}} &= 510 \text{ tons/year} \times 68\% \\ &= 347 \text{ tons/year} \end{aligned}$$

Table 16 lists the projected uncontrolled and controlled tillage emissions, by crop, in Area A (Maricopa County) for Years 2008 – 2010.

Crop	Year 2008 Emissions¹ (tons/yr)	Year 2009 Emissions¹ (tons/yr)	Year 2010 Emissions¹ (tons/yr)
Cotton	381	364	347
Corn	112	107	102
Vegetables	67	64	61
Total	560	535	510
Notes:			
¹ Tillage Emissions by Crop = (Tillage Emissions in Area A, Maricopa County) x (Percent Tillage Emissions by crop).			

8. **Emission Reductions from Banning Tilling on HPAs in Area A (Maricopa County) for Years 2008 – 2010** - Were calculated by multiplying controlled tillage emissions, by crop, in Area A (Maricopa County) from Step #7 by the ratio of stagnation days to tillage days (see “Stagnation Days / Tillage Days” column of Table 10) as follows:

Example – Emissions Reduction from Banning Tilling during HPAs – Corn in Year 2010:

$$\begin{aligned} \text{Emissions Reduction}_{\text{Crop}} &= \text{Controlled Tillage Emissions}_{\text{Crop}} \times \text{Stagnation Days} / \text{Tillage Days}_{\text{Crop}} \\ \text{Emissions Reduction}_{\text{Corn}} &= 102 \text{ tons/year} \times 15\% \\ &= 15 \text{ tons/year} \end{aligned}$$

Table 17 lists the potential emission reductions from banning tilling on HPAs (stagnation days) in Area A (Maricopa County) for Years 2008 -2010.

Crop	Year 2008 Emission Reductions (tons/year)	Year 2009 Emission Reductions (tons/year)	Year 2010 Emission Reductions (tons/year)
Cotton	38	36	34
Corn	17	16	15
Vegetables	12	12	11
Total	67	64	60
Notes:			
<p>1. It has been observed that dust can remain suspended in the air for extended periods on a stagnation day. An assumption was made that dust resulting from agricultural tilling will remain suspended twice as long on a stagnation day as on a "non-stagnation day" and this will have an effect on air quality / emissions which is equivalent to an additional agricultural tilling day. Thus, banning tilling on a HPA, that is a stagnation day, was assumed to reduce one day's equivalent of agricultural tilling emissions.</p>			
<p>2. Tilling Emission Reductions from Banning Tilling on HPAs = (Controlled Emissions from application of 2 Tillage BMPS from Tillage & Harvest BMP category) x (Stagnation Days / Potential Tillage Days).</p>			
<p>3. Cotton Emission Reductions: ADEQ's analysis of PM₁₀ exceedance and stagnation days indicated that stagnation days do not typically occur in March. Thus, the March tillage emissions for cotton were not included in the Ban Tilling on HPAs emissions reduction calculation for cotton. A ratio of 59 days / 90 days, or 0.66, was used to adjust the 3-month total of January, February, and March cotton tillage emissions to a 2-month total of January and February cotton tillage emissions. Example: Year 2010 cotton tillage emission reductions from Banning Tilling on HPAs = 347 tons/year x 15% x 0.66 = 34 tons/year.</p>			

9. **Emission Reductions from Banning Tilling from 2 AM to 8 AM on HPAs in Area A (Maricopa County) for Years 2008 – 2010** - Were calculated by multiplying emission reductions, by crop, in Area A (Maricopa County) from Step #8 by the ratio of 6 hours / 24 hours as follows:

Example – Emissions Reduction from Banning Tilling from 2 AM to 8 AM during HPAs – Cotton - Year 2010:

$$\begin{aligned} \text{Emissions Reduction}_{\text{Crop}} &= \text{Emissions Reduction}_{\text{Crop}} \times \text{Ratio of Tilling Ban Hours per Day} \\ \text{Emissions Reduction}_{\text{Cotton}} &= 34 \text{ tons/year} \times 6 \text{ hours} / 24 \text{ hours} \\ &= 9 \text{ tons/year} \end{aligned}$$

Table 18 lists the potential emission reductions from banning tilling from 2 AM to 8 AM on HPAs (stagnation days) in Area A (Maricopa County) for Years 2008 – 2010.

Table 18 - Potential Emission Reductions from Banning Tilling from 2 AM to 8 AM on HPAs				
Crop	Year 2008 Emission Reductions (tons/year)	Year 2009 Emission Reductions (tons/year)	Year 2010 Emission Reductions (tons/year)	Percent HPA Day 2 AM to 8 AM (6 hours / 24 hours)
Cotton	10	9	9	25%
Corn	4	4	4	
Vegetables	3	3	3	
Total	17	16	16	
Notes:				
1. It was assumed that agricultural tilling does not vary by hour on an agricultural tilling day (based on conversations with growers on Governor's Ag BMP Committee who said that they often have two or three shifts of workers operating farm machinery per day. These growers recommended 2 AM to 8 AM ban on tilling on HPAs).				
2. Emission Reductions from Banning Tilling from 2 AM to 8 AM on HPAs = (Emission Reductions on HPAs) x Percent HPA Day.				
3. This control measure is referred to as "Cessation of Night Tillage on High Pollution Advisory Days" in Agricultural Best Management Practices SIP.				

10. **Percent Emission Reduction from Banning Tilling from 2 AM to 8 AM on HPAs in Area A (Maricopa County) for Year 2010** - Was calculated by dividing the Year 2010 tillage emission reduction for Area A (Maricopa County) from Step #9 by the Year 2010 uncontrolled tillage emissions (see Table 15) as follows:

Example – Percent Emission Reduction from Banning Tilling from 2 AM to 8 AM during HPAs – Year 2010:

$$\begin{aligned} \text{Percent Emission Reduction} &= \text{Emissions Reduction} / \text{Uncontrolled Tillage Emissions} \\ &= (16 \text{ tons/year} / 816 \text{ tons/year}) \times 100\% \\ &= 2.0\% \end{aligned}$$

1.3.4 Summary of Agricultural Emission Reductions from Senate Bill 1552

Table 19 lists the potential emission reductions from implementation of the two agricultural control measure packages listed in Senate Bill 1552.

Table 19 - Summary of Potential PM₁₀ Emission Reductions from Agricultural Control Measures in Senate Bill 1552 (tons / year)			
Control Measure Category	2008	2009	2010
Require One Additional BMP Per Category and Extend Agricultural BMP Program to Maricopa County Portion of Area A Outside of the PM₁₀ Nonattainment Area:			
• Tillage and Harvest BMP	392	374	357
• Non-Cropland / Unpaved Farm Roads BMP	161	153	147
• Cropland / Windblown Agriculture BMP	506	484	461
Total	1,059	1,011	965
Ban Agricultural Tilling from 2 AM to 8 AM on HPAs (Cessation of Night Tillage on High Pollution Advisory Days)	17	16	16
Total Agricultural Emission Reductions From Senate Bill 1552	1,076	1,027	981

Table 20 lists the percent emission reductions by agricultural control measure in Senate Bill 1552.

Table 20 - Percent Emission Reductions of Agricultural Control Measures in Senate Bill 1552	
Agricultural Control Measure	Emission Reduction (percent)
Revised Agricultural BMP Program:	
• Tillage and Harvest BMPs	21.3%
• Noncropland / Farm Roads BMPs	12.8%
• Cropland / Windblown Agriculture BMPs	30.1%
Ban Agricultural Tilling from 2 AM to 8 AM on HPAs ¹ (Cessation of Night Tillage on High Pollution Advisory Days)	2.0%
Notes:	
¹ Emission Reduction Percent for Year 2010.	

1.4 REFERENCES

- ADEQ. 2005. *Revised PM₁₀ State Implementation Plan for the Salt River Area, Technical Support Document*. Air Quality Division, Arizona Department of Environmental Quality. September 2005. <http://azdeq.gov/environ/air/plan/download/sr-tsd.pdf>
- ADEQ. 2007a. *Comparison Of Potential PM₁₀ Emissions Reductions From Implementation Of Maricopa County Agricultural BMPs and San Joaquin Conservation Measure Practices*. Air Quality Division, Arizona Department of Environmental Quality. January 22, 2007. <http://www.azda.gov/ACT/Emissions%20Comparison%20Report.pdf>
- ADEQ. 2007b. *2005-2006 Forecast Season PM₁₀ Exceedance Report for Maricopa County*. Air Quality Division, Arizona Department of Environmental Quality. January 2007.
- Governor's Agricultural BMP Committee. 2001. *Guide to Agricultural PM₁₀ Best Management Practices, Maricopa County PM₁₀ Nonattainment Area*. <http://www.azda.gov/ACT/bmpguide.pdf>
- MAG. 2004. *MAG 2004 Existing Land Use Data*. Maricopa Association of Governments.
- MAG. 2007. *MAG 2007 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area; Appendices Volume 3 and 4; Technical Document in Support of the MAG 2007 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area*. Maricopa Association of Governments. December 2007. <http://magwww.mag.maricopa.gov/detail.cms?item=8072>
- MCAQD. 2007. *2005 Periodic Emissions Inventory for PM₁₀ for the Maricopa County, Arizona, Nonattainment Area*. Maricopa County Air Quality Department. May 2007. http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/reports/Default.aspx
- San Joaquin Valley APCD. 2006. *Conservation Management Practices Program Report for 2005*. San Joaquin Valley Air Pollution Control District. January 19, 2006. http://www.valleyair.org/farmpermits/updates/cmp_program_report_for_2005.pdf
- URS. 2001. *Technical Support Document for Quantification of Agricultural Best Management Practices, Revised Final Draft*. ADEQ Contract No. 98-0159-BF. URS Corporation and Eastern Research Group, Inc. June 8, 2001. http://www.azda.gov/ACT/AgBMP_SIP_TSD-URSrpt6-01.pdf
- USDA. 2002. *The Census of Agriculture – Year 2002*. United States Department of Agriculture, National Agricultural Statistics Service. http://www.agcensus.usda.gov/Publications/2002/Census_by_State/Arizona/index.asp
- USDA. 2005. *Arizona Agricultural Statistics – Year 2004*. United States Department of Agriculture, National Agricultural Statistics Service. September 2005. http://www.nass.usda.gov/Statistics_by_State/Arizona/index.asp

ATTACHMENT #1

Table A-1 provides detailed data on the individual control measures, specific crops affected by the control measures, emission factors, emissions, control efficiencies, and potential emissions reductions from the Maricopa County BMPs and San Joaquin CMPs that were evaluated.

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CL	CROPLAND – LAND PREPARATION / CULTIVATION							
CL-2	Bed/Row Size or Spacing:		(EF - Land Prep)					32,696
	Citrus	4,464	0.07	312	0%	9%	0	28
	Corn	6,241	6.90	43,063	0%	12%	0	5168
	Cotton	9,841	8.90	87,585	0%	9%	0	7883
	Onions	336	6.50	2,184	0%	12%	0	262
	Wheat	18,200	4.45	80,990	0%	16%	0	12958
	Barley	7,537	4.45	33,540	0%	16%	0	5366
	Lettuce	96	12.75	1,224	0%	6%	0	73
	Melons	6,529	5.70	37,215	0%	2%	0	744
	Vegetables	2,352	9.05	21,286	0%	1%	0	213
CL-3	Chemigation /Fertiligation:		(EF - Land Prep)		No data at this time			17,555
	Alfalfa	36,004	4.00	144,016	0%	2%	0	2880
	Citrus	4,464	0.07	312	0%	9%	0	28
	Corn	6,241	6.90	43,063	0%	1%	0	431
	Cotton	9,841	8.90	87,585	0%	9%	0	7883
	Onions	336	6.50	2,184	0%	6%	0	131

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Wheat	8,737	4.45	38,880	0%	8%	0	3110
	Barley	7,537	4.45	33,540	0%	8%	0	2683
	Lettuce	96	12.75	1,224	0%	3%	0	37
	Melons	6,529	5.70	37,215	0%	1%	0	372
CL-4	Combined Operations:						18,621	
	Combining land preparation operations		(EF - Land Prep)					
	Cotton	9,841	8.9	87,585	8%	0%	7007	0
	Wheat	8,737	4.45	38,880	8%	0%	3110	0
	Barley	7,537	4.45	33,540	8%	0%	2683	0
	Corn	6,241	6.9	43,063	8%	0%	3445	0
	Vegetables	2,352	9.05	21,286	11%	0%	2341	0
	Citrus	4,464	0.07	312	11%	0%	34	0
CL-5	Conservation Irrigation:		(EF - Land Prep)					34,599
	Alfalfa	36,004	4.00	144,016	0%	6%	0	8641
	Citrus	4,464	0.07	312	0%	9%	0	28
	Corn	6,241	6.90	43,063	0%	12%	0	5168
	Cotton	9,841	8.90	87,585	0%	9%	0	7883
	Onions	336	6.50	2,184	0%	12%	0	262
	Wheat	8,737	4.45	38,880	0%	16%	0	6221
	Barley	7,537	4.45	33,540	0%	16%	0	5366
	Lettuce	96	12.75	1,224	0%	6%	0	73
	Melons	6,529	5.70	37,215	0%	2%	0	744
	Vegetables	2,352	9.05	21,286	0%	1%	0	213

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CL-6	Conservation Tillage:		(EF - Land Prep)		(25% - 100% Reduced Tillage)		166,935	60,270
	Corn	6,241	6.90	43,063	63%	35%	27,130	15072
	Cotton	9,841	8.90	87,585	63%	28%	55178	24524
	Onions	336	6.50	2,184	63%	4%	1376	87
	Wheat	8,737	4.45	38,880	63%	16%	24494	6221
	Barley	7,537	4.45	33,540	63%	16%	21130	5366
	Lettuce	96	12.75	1,224	63%	5%	771	61
	Melons	6,529	5.70	37,215	63%	4%	23446	1489
	Vegetables	2,352	9.05	21,286	63%	35%	13410	7450
CL-7	Cover Crops:		(EF - Land Prep)				134	
	Citrus	4,464	0.07	312	43%	27%	134	84
CL-8	Equipment Changes/Technological Improvements:		(EF - Land Prep)		50%	50%	132,644	132,644
	Citrus	4,464	0.07	312	50%	50%	156	156
	Corn	6,241	6.90	43,063	50%	50%	21531	21531
	Cotton	9,841	8.90	87,585	50%	50%	43792	43792
	Onions	336	6.50	2,184	50%	50%	1092	1092
	Wheat	8,737	4.45	38,880	50%	50%	19440	19440
	Barley	7,537	4.45	33,540	50%	50%	16770	16770
	Lettuce	96	12.75	1,224	50%	50%	612	612
	Melons	6,529	5.70	37,215	50%	50%	18608	18608
	Vegetables	2,352	9.05	21,286	50%	50%	10643	10643

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CL-11	Integrated Pest Management:		(EF - Land Prep)					21,809
	Corn	6,241	6.90	43,063	0%	12%	0	5168
	Cotton	9,841	8.90	87,585	0%	19%	0	16641
CL-12	Limited Activity During a High-Wind Event:		(EF - Land Prep)				49,887	
	Cotton	9,841	8.9	87,585	9%	0%	7883	0
	Wheat	8,737	4.45	38,880	9%	0%	3499	0
	barley	7,537	4.45	33,540	9%	0%	3019	0
	Corn	6,241	6.9	43,063	9%	0%	3876	0
	Alfalfa	36,004	4	144,016	20%	0%	28803	0
	Vegetables	2,352	9.05	21,286	13%	0%	2767	0
	Citrus	4,464	0.07	312	13%	0%	41	0
CL-13	Mulching:		(EF - Land Prep)					23,930
	Corn	6,241	6.9	43,063	0%	12%	0	5,168
	Onions	336	6.5	2,184	0%	18%	0	393
	Wheat	8,737	4.45	38,880	0%	0.80%	0	311
	Barley	7,537	4.45	33,540	0%	8%	0	2683
	Lettuce	96	12.75	1,224	0%	9%	0	110
	Melons	6,529	5.7	37,215	0%	21%	0	7815
	Vegetables	2,352	9.05	21,286	0%	35%	0	7450
CL-14	Multi-Year Crop:		(EF - Land Prep)				32,491	

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Cotton	9,841	8.9	87,585	16%	0%	14014	0
	Wheat	8,737	4.45	38,880	16%	0%	6221	0
	Barley	7,537	4.45	33,540	16%	0%	5366	0
	Corn	6,241	6.9	43,063	16%	0%	6890	0
CL-15	Night Farming:		(EF - Land Prep)					26,529
	Citrus	4,464	0.07	312	0%	10%	0	31
	Corn	6,241	6.90	43,063	0%	10%	0	4306
	Cotton	9,841	8.90	87,585	0%	10%	0	8758
	Onions	336	6.50	2,184	0%	10%	0	218
	Wheat	8,737	4.45	38,880	0%	10%	0	3888
	Barley	7,537	4.45	33,540	0%	10%	0	3354
	Lettuce	96	12.75	1,224	0%	10%	0	122
	Melons	6,529	5.70	37,215	0%	10%	0	3722
	Vegetables	2,352	9.05	21,286	0%	10%	0	2129
CL-16	Non-Tillage/Chemical Tillage:		(EF - Land Prep)					11,615
	Alfalfa	36,004	4	144,016	0%	8%	0	11521
	Citrus	4,464	0.07	312	0%	30%	0	94
CL-17	Organic Practices:		(EF - Land Prep)					63,398
	Alfalfa	36,004	4.00	144,016	0%	9%	0	12961
	Citrus	4,464	0.07	312	0%	14%	0	44
	Corn	6,241	6.90	43,063	0%	17%	0	7321
	Cotton	9,841	8.90	87,585	0%	18%	0	15765

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use	PM₁₀ Emission Factor	Uncontrolled PM₁₀ Emissions	Maricopa BMP Control Efficiency	San Joaquin CMP Control Efficiency	PM₁₀ Emission Reduction From Maricopa BMPs	PM₁₀ Emission Reduction From San Joaquin CMPs
		(Maricopa County PM₁₀ Nonattainment Area)	(lbs / acre /yr)	(lbs/yr)	(%)	(%)	(lbs/yr)	(lbs/yr)
	Onions	336	6.50	2,184	0%	18%	0	393
	Wheat	8,737	4.45	38,880	0%	16%	0	6221
	Barley	7,537	4.45	33,540	0%	16%	0	5366
	Lettuce	96	12.75	1,224	0%	5%	0	61
	Melons	6,529	5.70	37,215	0%	21%	0	7815
	Vegetables	2,352	9.05	21,286	0%	35%	0	7450
CL-18	Planting Based on Soil Moisture:		(EF - Land Prep)		30%		19	
	Citrus	4,464	0.07	312	6%	0%	19	0
	Corn	6,241	6.90	43,063	0%	0%	0	0
	Cotton	9,841	8.90	87,585	0%	0%	0	0
	Onions	336	6.50	2,184	0%	0%	0	0
	Wheat	8,737	4.45	38,880	0%	0%	0	0
	Barley	7,537	4.45	33,540	0%	0%	0	0
	Lettuce	96	12.75	1,224	0%	0%	0	0
	Melons	6,529	5.70	37,215	0%	0%	0	0
	Vegetables	2,352	9.05	21,286	0%	0%	0	0
CL-19	Precision Farming:		(EF - Land Prep)					39,793
	Citrus	4,464	0.07	312	0%	15%	0	47
	Corn	6,241	6.90	43,063	0%	15%	0	6459
	Cotton	9,841	8.90	87,585	0%	15%	0	13138
	Onions	336	6.50	2,184	0%	15%	0	328
	Wheat	8,737	4.45	38,880	0%	15%	0	5832
	Barley	7,537	4.45	33,540	0%	15%	0	5031
	Lettuce	96	12.75	1,224	0%	15%	0	184
	Melons	6,529	5.70	37,215	0%	15%	0	5582
	Vegetables	2,352	9.05	21,286	0%	15%	0	3193

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CL-20	Tillage Based on Soil Moisture:		(EF - Land Prep)					39,793
	Citrus	4,464	0.07	312	0%	15%	0	47
	Corn	6,241	6.90	43,063	0%	15%	0	6459
	Cotton	9,841	8.90	87,585	0%	15%	0	13138
	Onions	336	6.50	2,184	0%	15%	0	328
	Wheat	8,737	4.45	38,880	0%	15%	0	5832
	Barley	7,537	4.45	33,540	0%	15%	0	5031
	Lettuce	96	12.75	1,224	0%	15%	0	184
	Melons	6,529	5.70	37,215	0%	15%	0	5582
	Vegetables	2,352	9.05	21,286	0%	15%	0	3193
CL-21	Time of Planting:		(EF - Land Prep)		(50 % - 60% Timing of Tillage Operation)	No data at this time	145,737	
	Corn	6,241	6.90	43,063	55%	0%	23685	0
	Cotton	9,841	8.90	87,585	55%	0%	48172	0
	Onions	336	6.50	2,184	55%	0%	1201	0
	Wheat	8,737	4.45	38,880	55%	0%	21384	0
	Barley	7,537	4.45	33,540	55%	0%	18447	0
	Lettuce	96	12.75	1,224	55%	0%	673	0
	Melons	6,529	5.70	37,215	55%	0%	20468	0
	Vegetables	2,352	9.05	21,286	55%	0%	11707	0
CL-22	Timing of Tillage Operation:		(EF - Land Prep)				23,928	
	Cotton	9,841	8.9	87,585	10%	0%	8758	0

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop

ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM ₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Wheat	8,737	4.45	38,880	15%	0%	5832	0
	Barley	7,537	4.45	33,540	15%	0%	5031	0
	Corn	6,241	6.9	43,063	10%	0%	4306	0
CL-23	Transgenic Crops:		(EF – Land Prep)					21,823
	Alfalfa	36,004	4	144,016	0%	2%	0	2880
	Corn	6,241	6.90	43,063	0%	12%	0	5168
	Cotton	9,841	8.90	87,585	0%	9%	0	7883
	Onions	336	6.50	2,184	0%	12%	0	262
	Wheat	8,737	4.45	38,880	0%	4%	0	1555
	Barley	7,537	4.45	33,540	0%	4%	0	1342
	Lettuce	96	12.75	1,224	0%	6%	0	73
	Melons	6,529	5.70	37,215	0%	2%	0	744
	Vegetables	2,352	9.05	21,286	0%	9%	0	1916
CL-24	Transplanting:		(EF – Land Prep)					2,996
	Onions	336	6.5	2,184	0%	12%	0	262
	Lettuce	96	12.75	1,224	0%	6%	0	73
	Melons	6,529	5.7	37,215	0%	2%	0	744
	Vegetables	2,352	9.05	21,286	0%	9%	0	1916
CH	CROPLAND – HARVEST							
CH-1	Baling/Large Balers:		(EF - Harvest)					14,987
	Alfalfa	36,004	0.24	8,641	0%	11%	0	951

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Wheat	8,737	3.45	30,143	0%	25%	0	7536
	Barley	7,537	3.45	26,003	0%	25%	0	6501
CH-2	Combined Operations:		(EF - Harvest)				26,036	
	Cotton	9,841	3.37	33,164	17%	0%	5638	0
	Wheat	8,737	3.45	30,143	34%	0%	10249	0
	Barley	7,537	3.45	26,003	34%	0%	8841	0
	Corn	6,241	0.43	2,684	34%	0%	912	0
	Vegetables	2,352	0.23	541	34%	0%	184	0
	Citrus	4,464	0.14	625	34%	0%	212	0
CH-4	Equipment Changes/Technological Improvements:		(EF - Harvest)				51,674	51,674
	Alfalfa	36,004	0.24	8,641	50%	50%	4320	4320
	Citrus	4,464	0.14	625	50%	50%	312	312
	Corn	6,241	0.43	2,684	50%	50%	1342	1342
	Cotton	9,841	3.37	33,164	50%	50%	16582	16582
	Onions	336	1.68	564	50%	50%	282	282
	Wheat	8,737	3.45	30,143	50%	50%	15071	15071
	Barley	7,537	3.45	26,003	50%	50%	13001	13001
	Lettuce	96	0.23	22	50%	50%	11	11
	Melons	6,529	0.23	1,502	50%	50%	751	751
CH-7	Green Chop:		(EF - Harvest)					25,025
	Alfalfa	36,004	0.24	8,641	0%	10%	0	864
	Corn Grain and Silage	13,000	0.43	5,590	0%	17%	0	922

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop

ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM ₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Dry Beans, Cereal Grains, Safflower, Wheat, and Barley	33,900	3.45	116,955	0%	20%	0	23239
CH-8	Hand Harvesting:		(EF - Harvest)					1,959
	Citrus	4,464	0.14	625	0%	33%	0	206
	Corn	6,241	0.43	2,684	0%	33%	0	886
	Onions	336	1.68	564	0%	33%	0	186
	Lettuce	96	0.23	22	0%	33%	0	7
	Melons	6,529	0.23	1,502	0%	33%	0	496
	Vegetables	2,352	0.23	541	0%	33%	0	179
CH-9	Night Harvesting:		(EF - Harvest)					10,335
	Alfalfa	36,004	0.24	8,641	0%	10%	0	864
	Citrus	4,464	0.14	625	0%	10%	0	62
	Corn	6,241	0.43	2,684	0%	10%	0	268
	Cotton	9,841	3.37	33,164	0%	10%	0	3316
	Onions	336	1.68	564	0%	10%	0	56
	Wheat	8,737	3.45	30,143	0%	10%	0	3014
	Barley	7,537	3.45	26,003	0%	10%	0	2600
	Lettuce	96	0.23	22	0%	10%	0	2
	Melons	6,529	0.23	1,502	0%	10%	0	150
CH-11	Pre-Harvest Soil Preparation:		(EF - Harvest)					4,919
	Alfalfa	36,004	0.24	8,641	0%	7%	0	605
	Citrus	4,464	0.14	625	0%	10%	0	62
	Corn	6,241	0.43	2,684	0%	5%	0	134

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Cotton	9,841	3.37	33,164	0%	12%	0	3980
	Onions	336	1.68	564	0%	10%	0	56
	Wheat	8,737	3.45	30,143	0%	0%	0	0
	Barley	7,537	3.45	26,003	0%	0%	0	0
	Lettuce	96	0.23	22	0%	0%	0	0
	Melons	6,529	0.23	1,502	0%	0%	0	0
	Vegetables	2,352	0.23	541	0%	15%	0	81
CH-12	Reduced Harvest Activity:		(EF - Harvest)				10,089	
	Cotton	9,841	3.37	33,164	20%	0%	6633	0
	Alfalfa	36,004	0.24	8,641	40%	0%	3456	0
CH-13	Shed Packing:		(EF - Harvest)					274
	Onions	336	1.68	564	0%	12%	0	68
	Lettuce	96	0.23	22	0%	7%	0	2
	Melons	6,529	0.23	1,502	0%	10%	0	150
	Vegetables	2,352	0.23	541	0%	10%	0	54
CH-14	Shuttle System / Larger Carrier:		(EF - Harvest)					25,289
	Alfalfa	36,004	0.24	8,641	0%	17%	0	1469
	Citrus	4,464	0.14	625	0%	17%	0	106
	Corn	6,241	0.43	2,684	0%	17%	0	456
	Cotton	9,841	3.37	33,164	0%	40%	0	13266
	Onions	336	1.68	564	0%	17%	0	96
	Wheat	8,737	3.45	30,143	0%	17%	0	5124
	Barley	7,537	3.45	26,003	0%	17%	0	4420
	Lettuce	96	0.23	22	0%	17%	0	4

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Melons	6,529	0.23	1,502	0%	17%	0	255
	Vegetables	2,352	0.23	541	0%	17%	0	92
CO	CROPLAND ACTIVITIES - OTHER							
CO-1	Alternate Tilling:		(EF - Land Prep)					132,922
	Alfalfa	36,004	4	144,016	0%	32.50%	0	46805
	Corn	6,241	6.90	43,063	0%	32.50%	0	13995
	Cotton	9,841	8.90	87,585	0%	32.50%	0	28465
	Onions	336	6.50	2,184	0%	32.50%	0	710
	Wheat	8,737	4.45	38,880	0%	32.50%	0	12636
	Barley	7,537	4.45	33,540	0%	32.50%	0	10900
	Lettuce	96	12.75	1,224	0%	32.50%	0	398
	Melons	6,529	5.70	37,215	0%	32.50%	0	12095
	Vegetables	2,352	9.05	21,286	0%	32.50%	0	6918
CO-2	Application Efficiencies:		(EF - Land Prep)					37,451
	Alfalfa	36,004	4	144,016	0%	8%	0	11521
	Corn	6,241	6.90	43,063	0%	12%	0	5168
	Cotton	9,841	8.90	87,585	0%	9%	0	7883
	Onions	336	6.50	2,184	0%	12%	0	262
	Wheat	8,737	4.45	38,880	0%	16%	0	6221
	Barley	7,537	4.45	33,540	0%	16%	0	5366
	Lettuce	96	12.75	1,224	0%	6%	0	73
	Melons	6,529	5.70	37,215	0%	2%	0	744
	Vegetables	2,352	9.05	21,286	0%	1%	0	213

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CO-3	Baling/Large Balers:		(EF - Harvest)					14,987
	Alfalfa	36,004	0.24	8,641	0%	11%	0	951
	Wheat	8,737	3.45	30,143	0%	25%	0	7536
	Barley	7,537	3.45	26,003	0%	25%	0	6501
CO-5	Chemigation /Fertigation:		(EF - Land Prep)					17,555
	Alfalfa	36,004	4.00	144,016	0%	2%	0	2880
	Citrus	4,464	0.07	312	0%	9%	0	28
	Corn	6,241	6.90	43,063	0%	1%	0	431
	Cotton	9,841	8.90	87,585	0%	9%	0	7883
	Onions	336	6.50	2,184	0%	6%	0	131
	Wheat	8,737	4.45	38,880	0%	8%	0	3110
	Barley	7,537	4.45	33,540	0%	8%	0	2683
	Lettuce	96	12.75	1,224	0%	3%	0	37
	Melons	6,529	5.70	37,215	0%	1%	0	372
	Vegetables	2,352	9.05	21,286	0%	0%	0	0
CO-6	Conservation Irrigation:		(EF - Land Prep)					34,599
	Alfalfa	36,004	4.00	144,016	0%	6%	0	8641
	Citrus	4,464	0.07	312	0%	9%	0	28
	Corn	6,241	6.90	43,063	0%	12%	0	5168
	Cotton	9,841	8.90	87,585	0%	9%	0	7883
	Onions	336	6.50	2,184	0%	12%	0	262
	Wheat	8,737	4.45	38,880	0%	16%	0	6221
	Barley	7,537	4.45	33,540	0%	16%	0	5366
	Lettuce	96	12.75	1,224	0%	6%	0	73
	Melons	6,529	5.70	37,215	0%	2%	0	744
	Vegetables	2,352	9.05	21,286	0%	1%	0	213

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CO-7	Cover Crops:		(EF - Land Prep)		(20% - 66%)			84
	Citrus	4,464	0.07	312	43%	27%	134	84
CO-8	Cross-Wind Ridges (reduces wind erosion on cropland):		(EF - Wind Erosion Cropland)		20% - 93%		2,067,022	
	Citrus	4,464	122.24	545,679	57%	0%	311037	0
	Corn	6,241	108.05	674,340	57%	0%	384374	0
	Cotton	9,841	128.84	1,267,914	57%	0%	722711	0
	Onions	336	122.24	41,073	57%	0%	23411	0
	Wheat	8,737	0	0	57%	0%	0	0
	Barley	7,537	0	0	57%	0%	0	0
	Lettuce	96	122.24	11,735	57%	0%	6689	0
	Melons	6,529	122.24	798,105	57%	0%	454920	0
	Vegetables	2,352	122.24	287,508	57%	0%	163880	0
CO-11	Grinding / Chipping / Shredding:		(EF - Land Prep)					260,109
	Citrus	4,464	0.07	312	0%	90%	0	283
	Cotton	9,841	8.9	87,585	0%	90%	0	79221
	Alfalfa (under soil incorporation)	36,004	4	144,016	0%	97%	0	139033
	Corn (under soil incorporation)	6,241	6.9	43,063	0%	97%	0	41573
CO-12	Integrated Pest Management:		(EF - Land Prep)					37,479
	Alfalfa	36,004	4.00	144,016	0%	8%	0	11521
	Citrus	4,464	0.07	312	0%	9%	0	28
	Corn	6,241	6.90	43,063	0%	12%	0	5168

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Cotton	9,841	8.90	87,585	0%	9%	0	7883
	Onions	336	6.50	2,184	0%	12%	0	262
	Wheat	8,737	4.45	38,880	0%	16%	0	6221
	Barley	7,537	4.45	33,540	0%	16%	0	5366
	Lettuce	96	12.75	1,224	0%	6%	0	73
	Melons	6,529	5.70	37,215	0%	2%	0	744
	Vegetables	2,352	9.05	21,286	0%	1%	0	213
CO-15	Mulching:		(EF - Land Prep)		(50% - 55%)		94,017	57,652
	Corn	6,241	6.9	43,063	53%	32.50%	22823	13995
	Onions	336	6.5	2,184	53%	32.50%	1158	710
	Wheat	8,737	4.45	38,880	53%	32.50%	20606	12636
	Barley	7,537	4.45	33,540	53%	32.50%	17776	10900
	Lettuce	96	12.75	1,224	53%	32.50%	649	398
	Melons	6,529	5.7	37,215	53%	32.50%	19724	12095
	Vegetables	2,352	9.05	21,286	53%	32.50%	11281	6918
CO-16	Multi-Year Crop:		(EF - Land Prep)				48,736	
	Cotton	9,841	8.9	87,585	24%	0%	21020	0
	Wheat	8,737	4.45	38,880	24%	0%	9331	0
	Barley	7,537	4.45	33,540	24%	0%	8050	0
	Corn	6,241	6.9	43,063	24%	0%	10335	0
CO-17	Night Farming / Night Harvesting:		(EF - Harvest)					5,194
	Alfalfa	36,004	0.24	8,641	0%	5%	0	432
	Citrus	4,464	0.14	625	0%	5%	0	31
	Corn	6,241	0.43	2,684	0%	5%	0	134

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Cotton	9,841	3.37	33,164	0%	5%	0	1658
	Onions	336	1.68	564	0%	5%	0	28
	Wheat	8,737	3.45	30,143	0%	5%	0	1507
	Barley	7,537	3.45	26,003	0%	5%	0	1300
	Lettuce	96	0.23	22	0%	5%	0	1
	Melons	6,529	0.23	1,502	0%	5%	0	75
	Vegetables	2,352	0.23	541	0%	5%	0	27
CO-19	Non-Tillage/Chemical Tillage:		(EF - Land Prep)					11,615
	Alfalfa	36,004	4	144,016	0%	8%	0	11521
	Citrus	4,464	0.07	312	0%	30%	0	94
CO-20	Organic Practices:		(EF - Land Prep)					63,398
	Alfalfa	36,004	4.00	144,016	0%	9%	0	12961
	Citrus	4,464	0.07	312	0%	14%	0	44
	Corn	6,241	6.90	43,063	0%	17%	0	7321
	Cotton	9,841	8.90	87,585	0%	18%	0	15765
	Onions	336	6.50	2,184	0%	18%	0	393
	Wheat	8,737	4.45	38,880	0%	16%	0	6221
	Barley	7,537	4.45	33,540	0%	16%	0	5366
	Lettuce	96	12.75	1,224	0%	5%	0	61
	Melons	6,529	5.70	37,215	0%	21%	0	7815
	Vegetables	2,352	9.05	21,286	0%	35%	0	7450
CO-22	Reduced Pruning:		(EF - Land Prep)					28
	Citrus	4,464	0.07	312	0%	9%	0	28
CO-23	Residue Management:		(EF - Harvest)				14,408	

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use	PM₁₀ Emission Factor	Uncontrolled PM₁₀ Emissions	Maricopa BMP Control Efficiency	San Joaquin CMP Control Efficiency	PM₁₀ Emission Reduction From Maricopa BMPs	PM₁₀ Emission Reduction From San Joaquin CMPs
		(Maricopa County PM₁₀ Nonattainment Area)	(lbs / acre /yr)	(lbs/yr)	(%)	(%)	(lbs/yr)	(lbs/yr)
	Cotton	9,841	3.37	33,164	12%	0%	3980	0
	Wheat	8,737	3.45	30,143	18%	0%	5426	0
	Barley	7,537	3.45	26,003	18%	0%	4680	0
	Corn	6,241	0.43	2,684	12%	0%	322	0
CO-24	Sequential Cropping:		(EF - Land Prep)				204,652	
	Alfalfa	36,004	4.00	144,016	50%	0%	72008	0
	Citrus	4,464	0.07	312	50%	0%	156	0
	Corn	6,241	6.90	43,063	50%	0%	21531	0
	Cotton	9,841	8.90	87,585	50%	0%	43792	0
	Onions	336	6.50	2,184	50%	0%	1092	0
	Wheat	8,737	4.45	38,880	50%	0%	19440	0
	Barley	7,537	4.45	33,540	50%	0%	16770	0
	Lettuce	96	12.75	1,224	50%	0%	612	0
	Melons	6,529	5.70	37,215	50%	0%	18608	0
	Vegetables	2,352	9.05	21,286	50%	0%	10643	0
CO-25	Soil Amendments:		(EF - Land Prep)					81,861
	Alfalfa	36,004	4.00	144,016	0%	20%	0	28803
	Citrus	4,464	0.07	312	0%	20%	0	62
	Corn	6,241	6.90	43,063	0%	20%	0	8613
	Cotton	9,841	8.90	87,585	0%	20%	0	17517
	Onions	336	6.50	2,184	0%	20%	0	437
	Wheat	8,737	4.45	38,880	0%	20%	0	7776
	Barley	7,537	4.45	33,540	0%	20%	0	6708
	Lettuce	96	12.75	1,224	0%	20%	0	245
	Melons	6,529	5.70	37,215	0%	20%	0	7443
	Vegetables	2,352	9.05	21,286	0%	20%	0	4257

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CO-26	Soil Incorporation:		(EF - Land Prep)					260,109
	Citrus	4,464	0.07	312	0%	90%	0	283
	Cotton	9,841	8.9	87,585	0%	90%	0	79221
	Alfalfa (under soil incorporation)	36,004	4	144,016	0%	97%	0	139033
	Corn (under soil incorporation)	6,241	6.9	43,063	0%	97%	0	41573
CO-28	Surface Roughening (reduces wind erosion of cropland):		(EF - Wind Erosion Cropland)		(15% - 75%)		1,631,860	2,320,867
	Alfalfa	36,004	0	0	45%	64%	0	0
	Citrus	4,464	122.24	545,679	45%	64%	245556	349235
	Corn	6,241	108.05	674,340	45%	64%	303453	431578
	Cotton	9,841	128.84	1,267,914	45%	64%	570561	811465
	Onions	336	122.24	41,073	45%	64%	18483	26286
	Wheat	8,737	0	0	45%	64%	0	0
	Barley	7,537	0	0	45%	64%	0	0
	Lettuce	96	122.24	11,735	45%	64%	5281	7510
	Melons	6,529	122.24	798,105	45%	64%	359147	510787
	Vegetables	2,352	122.24	287,508	45%	64%	129379	184005
CO-29	Transgenic Crops:		(EF - Land Prep)					36,159
	Alfalfa	36,004	4	144,016	0%	8%	0	11521
	Corn	6,241	6.9	43,063	0%	12%	0	5168
	Cotton	9,841	8.9	87,585	0%	9%	0	7883
	Wheat	8,737	4.45	38,880	0%	16%	0	6221
	Barley	7,537	4.45	33,540	0%	16%	0	5366

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CO-30a	Wind Barrier - Artificial (reduces wind erosion of cropland):		(EF - Wind Erosion Cropland)		(0% - 90% Artificial Wind Barrier)	30%	1,631,860	1,087,906
	Alfalfa	36,004	0	0	45%	30%	0	0
	Citrus	4,464	122.24	545,679	45%	30%	245556	163704
	Corn	6,241	108.05	674,340	45%	30%	303453	202302
	Cotton	9,841	128.84	1,267,914	45%	30%	570561	380374
	Onions	336	122.24	41,073	45%	30%	18483	12322
	Wheat	8,737	0	0	45%	30%	0	0
	Barley	7,537	0	0	45%	30%	0	0
	Lettuce	96	122.24	11,735	45%	30%	5281	3521
	Melons	6,529	122.24	798,105	45%	30%	359147	239431
	Vegetables	2,352	122.24	287,508	45%	30%	129379	86253
CO-30b	Wind Barrier - Natural (reduces wind erosion of cropland):		(EF - Wind Erosion Cropland)		(Tree, Shrub, or Windbreak Planting) 25%		906,589	1,087,906
	Alfalfa	36,004	0	0	25%	30%	0	0
	Citrus	4,464	122.24	545,679	25%	30%	136420	163704
	Corn	6,241	108.05	674,340	25%	30%	168585	202302
	Cotton	9,841	128.84	1,267,914	25%	30%	316979	380374
	Onions	336	122.24	41,073	25%	30%	10268	12322
	Wheat	8,737	0	0	25%	30%	0	0
	Barley	7,537	0	0	25%	30%	0	0
	Lettuce	96	122.24	11,735	25%	30%	2934	3521
	Melons	6,529	122.24	798,105	25%	30%	199526	239431
	Vegetables	2,352	122.24	287,508	25%	30%	71877	86253

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CU	CROPLAND – UNPAVED ROADS and UNPAVED VEHICLE EQUIPMENT AREA							
CU-1	Dust Suppressants:							
CU-1a	<i>Chips/mulch:</i>		(EF - Vehicle Traffic)					47,164
	Alfalfa	36,004	0.8	28,803	0%	33%	0	9,505
	Citrus	4,464	2.46	10,981	0%	33%	0	3,624
	Corn	6,241	0.8	4,993	0%	33%	0	1,648
	Cotton	9,841	0.8	7,873	0%	33%	0	2,598
	Onions	336	4.8	1,613	0%	33%	0	532
	Wheat	8,737	2.8	24,464	0%	33%	0	8,073
	Barley	7,537	2.8	21,104	0%	33%	0	6,964
	Lettuce	96	4.8	461	0%	33%	0	152
	Melons	6,529	4.8	31,339	0%	33%	0	10,342
	Vegetables	2,352	4.8	11,290	0%	33%	0	3,726
CU-1b	<i>Organic materials/vegetation:</i>		(EF - Vehicle Traffic)				0	47,164
	Alfalfa	36,004	0.8	28,803	0%	33%	0	9,505
	Citrus	4,464	2.46	10,981	0%	33%	0	3,624
	Corn	6,241	0.8	4,993	0%	33%	0	1,648
	Cotton	9,841	0.8	7,873	0%	33%	0	2,598
	Onions	336	4.8	1,613	0%	33%	0	532
	Wheat	8,737	2.8	24,464	0%	33%	0	8,073

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop

ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM ₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Barley	7,537	2.8	21,104	0%	33%	0	6,964
	Lettuce	96	4.8	461	0%	33%	0	152
	Melons	6,529	4.8	31,339	0%	33%	0	10,342
	Vegetables	2,352	4.8	11,290	0%	33%	0	3,726
CU-1c	Polymers:		(EF - Vehicle Traffic)		(47% - 99%)		104,331	114,336
	Alfalfa	36,004	0.8	28,803	73%	80%	21,026	23,043
	Citrus	4,464	2.46	10,981	73%	80%	8,016	8,785
	Corn	6,241	0.8	4,993	73%	80%	3,645	3,994
	Cotton	9,841	0.8	7,873	73%	80%	5,747	6,298
	Onions	336	4.8	1,613	73%	80%	1,177	1,290
	Wheat	8,737	2.8	24,464	73%	80%	17,858	19,571
	Barley	7,537	2.8	21,104	73%	80%	15,406	16,883
	Lettuce	96	4.8	461	73%	80%	336	369
	Melons	6,529	4.8	31,339	73%	80%	22,878	25,071
	Vegetables	2,352	4.8	11,290	73%	80%	8,241	9,032
CU-1d	Road Oil:		(EF - Vehicle Traffic)					108,619
	Alfalfa	36,004	0.8	28,803	0%	76%	0	21,890
	Citrus	4,464	2.46	10,981	0%	76%	0	8,346
	Corn	6,241	0.8	4,993	0%	76%	0	3,795
	Cotton	9,841	0.8	7,873	0%	76%	0	5,983
	Onions	336	4.8	1,613	0%	76%	0	1,226
	Wheat	8,737	2.8	24,464	0%	76%	0	18,592
	Barley	7,537	2.8	21,104	0%	76%	0	16,039
	Lettuce	96	4.8	461	0%	76%	0	350

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop

ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM ₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
	Melons	6,529	4.8	31,339	0%	76%	0	23,818
	Vegetables	2,352	4.8	11,290	0%	76%	0	8,580
CU-1e	Sand:		(EF - Vehicle Traffic)			33%		47,164
	Alfalfa	36,004	0.8	28,803	0%	33%	0	9,505
	Citrus	4,464	2.46	10,981	0%	33%	0	3,624
	Corn	6,241	0.8	4,993	0%	33%	0	1,648
	Cotton	9,841	0.8	7,873	0%	33%	0	2,598
	Onions	336	4.8	1,613	0%	33%	0	532
	Wheat	8,737	2.8	24,464	0%	33%	0	8,073
	Barley	7,537	2.8	21,104	0%	33%	0	6,964
	Lettuce	96	4.8	461	0%	33%	0	152
	Melons	6,529	4.8	31,339	0%	33%	0	10,342
	Vegetables	2,352	4.8	11,290	0%	33%	0	3,726
CU-1f	Gravel:		(EF - Vehicle Traffic)					65,743
	Alfalfa	36,004	0.8	28,803	0%	46%	0	13,249
	Citrus	4,464	2.46	10,981	0%	46%	0	5,051
	Corn	6,241	0.8	4,993	0%	46%	0	2,297
	Cotton	9,841	0.8	7,873	0%	46%	0	3,621
	Onions	336	4.8	1,613	0%	46%	0	742
	Wheat	8,737	2.8	24,464	0%	46%	0	11,253
	Barley	7,537	2.8	21,104	0%	46%	0	9,708
	Lettuce	96	4.8	461	0%	46%	0	212
	Melons	6,529	4.8	31,339	0%	46%	0	14,416
	Vegetables	2,352	4.8	11,290	0%	46%	0	5,193

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CU-3	Paving:		(EF - Vehicle Traffic)				0	140,061
	Alfalfa	36,004	0.8	28,803	0%	98%	0	28,227
	Citrus	4,464	2.46	10,981	0%	98%	0	10,762
	Corn	6,241	0.8	4,993	0%	98%	0	4,893
	Cotton	9,841	0.8	7,873	0%	98%	0	7,715
	Onions	336	4.8	1,613	0%	98%	0	1,581
	Wheat	8,737	2.8	24,464	0%	98%	0	23,974
	Barley	7,537	2.8	21,104	0%	98%	0	20,682
	Lettuce	96	4.8	461	0%	98%	0	452
	Melons	6,529	4.8	31,339	0%	98%	0	30,712
	Vegetables	2,352	4.8	11,290	0%	98%	0	11,064
CU-4	Restricted Access:		(EF - Vehicle Traffic)				2,858	14,292
	Alfalfa	36,004	0.8	28,803	2%	10%	576	2,880
	Citrus	4,464	2.46	10,981	2%	10%	220	1,098
	Corn	6,241	0.8	4,993	2%	10%	100	499
	Cotton	9,841	0.8	7,873	2%	10%	157	787
	Onions	336	4.8	1,613	2%	10%	32	161
	Wheat	8,737	2.8	24,464	2%	10%	489	2,446
	Barley	7,537	2.8	21,104	2%	10%	422	2,110
	Lettuce	96	4.8	461	2%	10%	9	46
	Melons	6,529	4.8	31,339	2%	10%	627	3,134
	Vegetables	2,352	4.8	11,290	2%	10%	226	1,129

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CU-5	Speed Limits:							
CU-5a	<i>Reducing speed from 25.9 mph to 5 mph:</i>		(EF - Vehicle Traffic)				60,026	115,765
	Alfalfa	36,004	0.8	28,803	42%	81%	12,097	23,331
	Citrus	4,464	2.46	10,981	42%	81%	4,612	8,895
	Corn	6,241	0.8	4,993	42%	81%	2,097	4,044
	Cotton	9,841	0.8	7,873	42%	81%	3,307	6,377
	Onions	336	4.8	1,613	42%	81%	677	1,306
	Wheat	8,737	2.8	24,464	42%	81%	10,275	19,816
	Barley	7,537	2.8	21,104	42%	81%	8,864	17,094
	Lettuce	96	4.8	461	42%	81%	194	373
	Melons	6,529	4.8	31,339	42%	81%	13,162	25,385
	Vegetables	2,352	4.8	11,290	42%	81%	4,742	9,145
CU-5b	<i>Reducing speed from 25.9 mph to 10 mph:</i>		(EF - Vehicle Traffic)			58%	60,026	82,894
	Alfalfa	36,004	0.8	28,803	42%	58%	12,097	16,706
	Citrus	4,464	2.46	10,981	42%	58%	4,612	6,369
	Corn	6,241	0.8	4,993	42%	58%	2,097	2,896
	Cotton	9,841	0.8	7,873	42%	58%	3,307	4,566
	Onions	336	4.8	1,613	42%	58%	677	935
	Wheat	8,737	2.8	24,464	42%	58%	10,275	14,189
	Barley	7,537	2.8	21,104	42%	58%	8,864	12,240
	Lettuce	96	4.8	461	42%	58%	194	267
	Melons	6,529	4.8	31,339	42%	58%	13,162	18,177
	Vegetables	2,352	4.8	11,290	42%	58%	4,742	6,548

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CU-5c	<i>Reducing speed from 25.9 mph to 15 mph:</i>		(EF - Vehicle Traffic)				60,026	82,894
	Alfalfa	36,004	0.8	28,803	42%	42%	12,097	12,097
	Citrus	4,464	2.46	10,981	42%	42%	4,612	4,612
	Corn	6,241	0.8	4,993	42%	42%	2,097	2,097
	Cotton	9,841	0.8	7,873	42%	42%	3,307	3,307
	Onions	336	4.8	1,613	42%	42%	677	677
	Wheat	8,737	2.8	24,464	42%	42%	10,275	10,275
	Barley	7,537	2.8	21,104	42%	42%	8,864	8,864
	Lettuce	96	4.8	461	42%	42%	194	194
	Melons	6,529	4.8	31,339	42%	42%	13,162	13,162
	Vegetables	2,352	4.8	11,290	42%	42%	4,742	4,742
CU-5d	<i>Reducing speed from 25.9 to 25 mph:</i>		(EF - Vehicle Traffic)				60,026	4,288
	Alfalfa	36,004	0.8	28,803	42%	3%	12,097	864
	Citrus	4,464	2.46	10,981	42%	3%	4,612	329
	Corn	6,241	0.8	4,993	42%	3%	2,097	150
	Cotton	9,841	0.8	7,873	42%	3%	3,307	236
	Onions	336	4.8	1,613	42%	3%	677	48
	Wheat	8,737	2.8	24,464	42%	3%	10,275	734
	Barley	7,537	2.8	21,104	42%	3%	8,864	633
	Lettuce	96	4.8	461	42%	3%	194	14
	Melons	6,529	4.8	31,339	42%	3%	13,162	940
	Vegetables	2,352	4.8	11,290	42%	3%	4,742	339

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop								
ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CU-6	Track Out Control:		(EF - Vehicle Traffic)		(85% - 95%)	(No data at this time)	128,628	
	Alfalfa	36,004	0.8	28,803	90%	0%	25,923	0
	Citrus	4,464	2.46	10,981	90%	0%	9,883	0
	Corn	6,241	0.8	4,993	90%	0%	4,494	0
	Cotton	9,841	0.8	7,873	90%	0%	7,086	0
	Onions	336	4.8	1,613	90%	0%	1,452	0
	Wheat	8,737	2.8	24,464	90%	0%	22,017	0
	Barley	7,537	2.8	21,104	90%	0%	18,993	0
	Lettuce	96	4.8	461	90%	0%	415	0
	Melons	6,529	4.8	31,339	90%	0%	28,205	0
	Vegetables	2,352	4.8	11,290	90%		10,161	0
CU-7	Water Application:		(EF - Vehicle Traffic)		(50% - 93%)		102,902	100,044
	Alfalfa	36,004	0.8	28,803	72%	70%	20,738	20,162
	Citrus	4,464	2.46	10,981	72%	70%	7,907	7,687
	Corn	6,241	0.8	4,993	72%	70%	3,595	3,495
	Cotton	9,841	0.8	7,873	72%	70%	5,668	5,511
	Onions	336	4.8	1,613	72%	70%	1,161	1,129
	Wheat	8,737	2.8	24,464	72%	70%	17,614	17,125
	Barley	7,537	2.8	21,104	72%	70%	15,195	14,773
	Lettuce	96	4.8	461	72%	70%	332	323
	Melons	6,529	4.8	31,339	72%	70%	22,564	21,937
	Vegetables	2,352	4.8	11,290	72%	70%	8,129	7,903

Table A-1 – Potential PM₁₀ Emission Reductions by Control Measure and Associated Crop

ID	Control Measure by Associated Crop	Acres by Crop / Land Use (Maricopa County PM₁₀ Nonattainment Area)	PM₁₀ Emission Factor (lbs / acre /yr)	Uncontrolled PM₁₀ Emissions (lbs/yr)	Maricopa BMP Control Efficiency (%)	San Joaquin CMP Control Efficiency (%)	PM₁₀ Emission Reduction From Maricopa BMPs (lbs/yr)	PM₁₀ Emission Reduction From San Joaquin CMPs (lbs/yr)
CU-8	Wind Barrier - Artificial (reduces wind erosion of unpaved roads and non cropland):		(EF - Wind Erosion of Unpaved Roads & Non Cropland)		(0% - 90% Artificial Wind Barrier)	30%	174,621	116,414
	Alfalfa	36,004	4.64	167,059	45%	30%	75,176	50,118
	Citrus	4,464	4.21	18,793	45%	30%	8,457	5,638
	Corn	6,241	4.21	26,275	45%	30%	11,824	7,882
	Cotton	9,841	6.93	68,198	45%	30%	30,689	20,459
	Onions	336	4.21	1,415	45%	30%	637	424
	Wheat	8,737	4.21	36,783	45%	30%	16,552	11,035
	Barley	7,537	4.21	31,731	45%	30%	14,279	9,519
	Lettuce	96	4.21	404	45%	30%	182	121
	Melons	6,529	4.21	27,487	45%	30%	12,369	8,246
	Vegetables	2,352	4.21	9,902	45%	30%	4,456	2,971
CU-9	Wind Barrier - Natural (reduces wind erosion of unpaved roads and non cropland):		(EF - Wind Erosion of Unpaved Roads & Non Cropland)		Tree, Shrub, or Windbreak Planting) 25%		97,012	116,414
	Alfalfa	36,004	4.64	167,059	25%	30%	41,765	50,118
	Citrus	4,464	4.21	18,793	25%	30%	4,698	5,638
	Corn	6,241	4.21	26,275	25%	30%	6,569	7,882
	Cotton	9,841	6.93	68,198	25%	30%	17,050	20,459
	Onions	336	4.21	1,415	25%	30%	354	424
	Wheat	8,737	4.21	36,783	25%	30%	9,196	11,035
	Barley	7,537	4.21	31,731	25%	30%	7,933	9,519
	Lettuce	96	4.21	404	25%	30%	101	121
	Melons	6,529	4.21	27,487	25%	30%	6,872	8,246
	Vegetables	2,352	4.21	9,902	25%	30%	2,475	2,971

APPENDIX C

Agricultural Best Management Practices Guidance
Booklet and Pocket Guide
as Codified in the
Arizona Administrative Code

To view the BMP booklet please click on the following link,
<http://www.azda.gov/ACT/Best%20Management%20Practices%20Guide%20for%20web%20view%20reducec.pdf>

The booklet is also available for viewing at the
Arizona Department of Environmental Quality library.

The booklet will be put into the SIP when finalized.

APPENDIX D

Public Process