PM_{10} RESEARCH FOR DEVELOPING EDUCATIONAL TOOLS AND OUTREACH PROGRAMS

Final Report 519

Prepared by:
Peter M. Lima, Ph.D., P.E.
Robert H. Bohannan
Lima & Associates
7250 North 16th Street, Suite 300
Phoenix, Arizona 85016
Cathy D. Arthur

October 2003

Prepared for:
Arizona Department of Transportation
206 South 17th Avenue
Phoenix, Arizona 85007
In cooperation with
U.S. Department of Transportation
Federal Highway Administration

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Arizona Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation. Trade or manufacturers' names which may appear herein are cited only because they are considered essential to the objectives of the report. The U.S. Government and the State of Arizona do not endorse products or manufacturers.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-AZ-03-519		

4. Title and Subtitle	5. Report Date
PM_{10} Research for Developing Educational Tools and Outreach Programs	October 2003
	6. Performing Organization Code

7. Authors	8. Performing Organization Report No.
Peter M. Lima, Ph.D., P.E., Robert H. Bohannan, Cathy D. Arthur	

9. Performing Organization Name and Address	10. Work Unit No.
Lima & Associates 7250 North 16th Street, Suite 300 Phoenix, AZ 85020	11. Contract or Grant No. T0149D0001

12. Sponsoring Agency Name and Address	13. Type of Report & Period Covered
Arizona Department of Transportation 206 S. 17th Avenue Phoenix, Arizona 85007	FINAL REPORT Start August 2001 End October 2003
ADOT Project Manager: Estomih Kombe, Ph.D., P.E.	14. Sponsoring Agency Code SPR-PL-1-(59)519

15. Supplementary Notes

16. Abstract

More than 3 million persons reside in Maricopa County, Arizona, one of the fastest growing urban areas in the country. The urbanized portion of the county has been designated a nonattainment area for PM_{10}, by the U.S. Environmental Protection Agency for levels of particulate matter that exceed the National Ambient Air Quality Standards. In response, Maricopa County has enacted Rule 310 that contains measures to mitigate the generation of fugitive dust. Construction activities are estimated to generate nearly 40 percent of airborne particulates in the area. The Arizona Department of Transportation contracted with Lima & Associates and Cathy D. Arthur to develop an educational outreach program with the purpose of training construction industry personnel on the importance of controlling fugitive dust and the methods of so doing. This report summarizes the background leading up to the enactment of Rule 310 and the subsequent development of the outreach program. Elements of the program are described, and an implementation plan is provided. This report is accompanied by appendices that contain prototype elements of the training program that have been developed. These prototypes are intended to illustrate the results of the research only, and are not current training instruments.

17. Key Words	18. Distribution Statement	23. Registrant's Seal
Environment, Air Quality, Fugitive Dust Control, Particulate Matter, PM_{10}, Maricopa County Rule 310, Education, Training, Outreach, Construction Industry		

19. Security Classification	20. Security Classification	21. No. of Pages	22. Price
		290	

SI (MODERN METRIC) CONVERSION FACTORS*

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	Inches	25.4	millimeters	mm
ft	Feet	0.305	meters	m
yd	Yards	0.914	meters	m
mi	Miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	Acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	Gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
	NOTE: Volumes greater than 1000L shall be shown in m^3.			
		MASS		
oz	Ounces	28.35	grams	g
lb	Pounds	0.454	kilograms	kg
T	short tons (2000lb)	0.907	megagrams (or "metric ton")	mg (or "t")
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5(F-32)/9 or (F-32)/1.8	Celsius temperature	°C
		ILLUMINATION		
fc	foot candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE AND PRESSURE OR STRESS		
lbf	Poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	Square millimeters	0.0016	square inches	in^2
m^2	Square meters	10.764	square feet	ft^2
m^2	Square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	Square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	Cubic meters	35.315	cubic feet	ft^3
m^3	Cubic meters	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (or "metric ton")	1.102	short tons (2000lb)	T
		TEMPERATURE (exact)		
°C	Celsius temperature	1.8C + 32	Fahrenheit temperature	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE AND PRESSURE OR STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

Page

LIST OF FIGURES

LIST OF FIGURES (Continued)

Page

LIST OF ACRONYMS

ABA	Arizona Builders Alliance
ACA	Arizona Contractors Association
ACE	Construction Alliance for Construction Excellence
ACERP	Arizona Comparative Environmental Risk Project
ADEQ	Arizona Department of Environmental Quality
ADEMA	Arizona Department of Emergency and Military Affairs
ADOSH	Arizona Department of Safety and Health
ADOT	Arizona Department of Transportation
AGC	Associated General Contractors
BACM	Best Available Control Measure
BMP	Best Management Practices
CAA	Clean Air Act
CARB	California Air Resources Board
CFR	Code of Federal Regulations
CMAQ	Congestion Mitigation and Air Quality Improvement
EPA	United States Environmental Protection Agency
FCD	Maricopa County Flood Control District
FHWA	Federal Highway Administration
H.B.	House Bill—an act passed by the Arizona Legislature originally introduced in the House of Representatives
HBACA	Homebuilders Association of Central Arizona
LTAP	Local Technical Assistance Program
MAG	Maricopa Association of Governments
MCDOT	Maricopa County Department of Transportation
MCESD	Maricopa County Environmental Services Department
MSA	Mesa Staging Area
MSM	Most Stringent Measure
MOE	Measure of Effectiveness
NAAQS	National Ambient Air Quality Standards
NO_x	Nitrogen Oxides
OSHA	Occupational Safety & Health Administration
PAVI	Phoenix Area Visibility Index
PM_{10}	Particulate Matter less than 10 microns in diameter
$PM_{2.5}$	Particulate Matter less than 2.5 microns in diameter
PVCC	Paradise Valley Community College
SBEAP	Small Business Environmental Assistance Program
SIP	State Implementation Plan
TAC	Technical Advisory Committee
VOC	Volatile Organic Compound
$\mu g/m^3$	Micrograms per cubic meter

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Project Purpose

The project developed an educational outreach and certification program for the Maricopa County PM_{10} nonattainment area. A program for construction industry personnel was developed to increase construction industry awareness of the provisions of Maricopa County Rule 310 and provide tools to assist construction workers in reducing fugitive dust. The program builds upon educational outreach work already done by the Arizona Department of Transportation (ADOT) and Maricopa County. Ideas were solicited from contractors and peer agencies concerning the most feasible and effective dust mitigation practices.

Background Research

The "Revised MAG 1999 Serious Area Particulate Plan for PM_{10} for the Maricopa County Nonattainment Area" submitted to Environmental Protection Agency (EPA) by the Maricopa Association of Governments (MAG) in 2000 indicates that 43 percent of PM_{10} emissions in 1995 were from sources such as construction/earthmoving dust, construction trackout, nonroad engine exhaust, and construction windblown dust. Most of the control measures contained in the plan address control of fugitive dust from these sources and were implemented through the enactment of Maricopa County Rule 310.

Most stringent control measures and best management practices for controlling fugitive dust were identified, and agency experience with various dust palliatives was documented.

Identification of Outreach Materials, Audiences, and Appropriate Message

As a guide to identifying effective outreach materials and methods, existing outreach and educational programs of selected regional agencies were reviewed and documented. Different outreach methods are effective with different audiences. Construction industry corporate management, job site management, and job site labor comprise the complete target audience, and appropriate approaches for specific construction industry circumstances were identified.

The project team concluded that language based on Rule 310 provisions would need to be drafted to explain each concern in terms that are easily understood, provide realistic "rules of thumb" for determining when control measures are needed, and provide easy to follow directions for implementing the control measures. Adherence to the provisions of Rule 310 during construction earthmoving activities and controlling "trackout" onto paved roads were identified as the two most effective ways of controlling fugitive dust.

Following the review of dust control practices outreach efforts of other jurisdictions and the collateral material used in these efforts, the project team developed a draft outreach program

with input from the Technical Advisory Committee. The prototype components developed are:

- "Blue Skies" program name and logo.
- Bilingual program brochure and bilingual "Guide to Construction Dust Control Measures" designed to promote the Blue Skies program to prospective participants
- Bilingual "Quick Reference Guide."
- Fact sheet handouts designed to be widely distributed at job sites.
- Opacity chart designed to aid in estimating the opacity of dust plumes.
- Dust control training course and certification program.

Dust Control Training Course and Certification Program

Training modules have been developed for training construction personnel in understanding dust problems and dust control measures. Upon completion of the course the trainee will have the following skills:

- Basic understanding of dust problems and measures to mitigate dust at construction sites.
- Ability to identify dust problems.
- Ability to implement actions to reduce dust at construction sites.

The course is designed for anyone working in the construction field, and site superintendents, water truck and water pull drivers, and subcontractors are highly encouraged to attend. In addition to lectures, the course includes class discussion and review of actual field case studies.

The course is designed to be presented in a half-day format. The course begins with a 10-minute Rule 310 overview video developed by the Maricopa County Environmental Services Department. The course can be tailored to the needs of specific groups by eliminating modules or parts of modules. Summaries of the six training modules are presented below:

Module 1 - Background will cover the reasons that dust control is needed, and the causes of PM_{10}. Both natural and man-made sources of fugitive dust will be identified, and actions that have already been taken to reduce PM_{10} emissions will be explained. Control measures implemented in these areas, such as the Rule 310 in Maricopa County, will be discussed.

Module 2 - Construction Dust Control Requirements will explore in detail the construction dust control requirements in effect for the jurisdiction in which the course is being presented. Dust control measures for construction-related activities will be explained.
Module 3 - Enforcement of Dust Control at Construction Sites will cover jurisdictional enforcement, including the characteristics of the dust control enforcement program, inspection criteria, enforcement procedures, and penalties for violations, as appropriate for the jurisdiction in which the course is being presented.

Module 4 - Strategies to Assist Construction Activities in Controlling Dust will examine dust control strategies including project design and site planning. A case study of a construction project will be included.

Module 5 – Visible Emissions Evaluation at Construction Sites will describe the techniques used to identify the opacity levels of dust generated by construction activities. The script and slides for this module will be developed by the Arizona Department of Environmental Quality (ADEQ), which provides Visible Emissions Evaluations Training.

Module 6 - Information Resources and Reinforcements will discuss additional information that supplements and reinforces the material covered in class. Participants will be given a final exam that can be used for certification purposes.

Each of the modules has been structured as a PowerPoint presentation containing text and graphics as training aids. An accompanying "Dust Control Course Trainer's Guide" contains suggested step-by-step commentary for each module, as well as examples of a dust control log and earthmoving permit for reproduction and distribution to class attendees.

Certification Program

The goal of the certification program is to establish minimum standards for mastering and teaching information on construction dust control problems and measures. The certification program is designed for construction industry management and job-supervisory personnel. Two levels of certification are offered:

Certified Dust Control Specialist - An individual who completes dust control training and passes an exam covering the subject matter presented in the course with a grade of 75 percent or better, may receive designation as a Certified Dust Control Specialist. To maintain certification, a specialist must take the dust control training and pass the final exam once every two years.

Certified Dust Control Instructor - To be certified as a dust control instructor, an individual must complete both dust control training and ADEQ Visible Emissions Evaluations Training and must act as a student trainer.

A Blue Skies program coordinator will establish standards that must be met in order to receive instructor certification. The program coordinator would keep the instructors apprised of changes in the course material. Instructors would keep the coordinator informed about classes being taught, attendance levels, and collateral materials required (i.e., toolkits and certification cards).

Implementing the Program

The implementation of the Blue Skies program consists of five major components:

- Establish institutional framework.
- Finalize and publish collateral material.
- Initiate outreach and education campaign.
- Establish certification program.
- Continue campaign/training.

Successful implementation of the Blue Skies program will require a strong institutional arrangement among the key agency and construction stakeholders. ADOT is a strong candidate for the lead agency to implement the Blue Skies program.

Potential sources of funding, personnel and other resources for the program include ADOT, Maricopa County, EPA, Western Regional Air Partnership, ADEQ, and Congestion Mitigation and Air Quality Improvement (CMAQ) funds received by the MAG. Opportunities for linking the Blue Skies program with other outreach programs having similar target audiences exist.

A Blue Skies coordinator must be selected to manage the program and finalize the development and dissemination of collateral material, and a workshop presentation or kickoff event should be held to initiate the training program.

Measuring Program Effectiveness

The Blue Skies program activities must be continuously monitored in order to determine the success of the program in educating the general public and construction industry as well as reducing dust at construction sites. A framework has been developed to measure the success of the Blue Skies program. Elements of a strong performance measurement process would include the following step-by-step procedure:

- Identify outreach goals.
- Identify and define measures of effectiveness to measure goals.
- Identify data sources.
- Develop mechanisms to collect data.
- Establish base line data for each measure.
- Tabulate and graph measures of effectiveness.
- Evaluate the performance of the program.

SECTION ONE

OUTREACH PROGRAM AND EDUCATIONAL TOOLS

1. INTRODUCTION

BACKGROUND

Maricopa County is the most populous county in Arizona, home to approximately 60 percent of the state's residents. More than three million people currently reside in the cities of Phoenix, Mesa, Glendale, Scottsdale, Tempe, and Chandler, 18 smaller municipalities, two Indian communities, and the unincorporated areas of the county. Maricopa County spans nearly 9,300 square miles, most of which is vacant undisturbed desert.

Over the last two decades, the county has grown at an average annual rate of about 4 percent, and is one of the fastest growing areas of the country. Residents and jobs have more than doubled in 20 years, and daily vehicle travel has nearly tripled over this period. This rapid growth in population has also been accompanied by unprecedented levels of residential construction. Both the increased vehicle mileage and the construction activity have contributed to levels of particulate matter and other air pollutants that have periodically exceeded the National Ambient Air Quality Standards (NAAQS) established by the Environmental Protection Agency (EPA).

Nonattainment Area

The urbanized portion of Maricopa County was designated a moderate nonattainment area for particulate matter less than 10 microns in diameter (PM_{10}) by the 1990 Clean Air Act Amendments. Between 1991 and 1996, several revisions of a PM_{10} plan for this area were submitted to the EPA. In May 1997 the Arizona Department of Environmental Quality (ADEQ) submitted a 24-hour PM_{10} plan to EPA. After a number of lawsuits, EPA did not approve parts of the ADEQ Plan and promulgated a PM_{10} Federal Implementation Plan on July 18, 1998. Due to a failure to attain the NAAQS by the end of 1994, the Maricopa County PM_{10} nonattainment area was redesignated to "Serious" in 1996, with a new attainment date of December 31, 2001.[1]

In February 2000, the Maricopa Association of Governments (MAG) submitted a "Revised MAG 1999 Serious Area Particulare Plan for PM-10 for the Maricopa County Nonattainment Area" (Serious Area PM_{10} Plan) to EPA. The Serious Area PM_{10} Plan shows that attainment of the PM_{10} standards by 2001 is infeasible and requests a five-year extension, as allowed in the Clean Air Act. The plan demonstrates attainment of the PM_{10} standards by December 31, 2006, based on implementation of 77 control measures. The plan indicates that the largest share (38 percent) of PM_{10} emissions in 1995 was caused by construction and earthmoving activities.[2]

Maricopa County Rule 310

Maricopa County Rules 310 and 310.01, the county's comprehensive fugitive dust control rules, are the cornerstone of the Serious Area PM_{10} Plan. Eighty percent of the reduction in emissions necessary to attain the standards by 2006 is due to the strengthening and increased enforcement of Rules 310 and 310.01.

Rules 310 and 310.01 were enacted by the Maricopa County Board of Supervisors in 2000 to limit the emission of particulate matter from property, operations or activities that may serve as a source of fugitive dust. These rules mandate the use of measures to mitigate the generation of fugitive dust, specifically PM_{10}. Rule 310.01 addresses activities that do not require a permit, such as unpaved roads, unpaved parking lots, and vacant disturbed areas. Rule 310 requires that a permit be obtained prior to undertaking any earthmoving activity that disturbs more than one-tenth of an acre. Rule 310 further requires that persons or entities engaged in earthmoving activities keep accurate records of the measures used to prevent or reduce fugitive dust. Rule 310 is enforced by county inspectors and violations can result in monetary penalties. A detailed discussion of the control measures contained in Rule 310 that address construction sources is included in chapter 6.

The Governor's Brown Cloud Summit

In 2000, Governor Hull appointed community, industrial and public leaders to study the highly visible "brown cloud" in the Phoenix metropolitan area. The Governor's Brown Cloud Summit met from March 15, 2000 until January 16, 2001. A table of the summit's recommended measures for mitigating the brown cloud is presented in chapter 5. A review of ADEQ data showed that visibility in the Valley declined between 1994 and 1998, despite improvements in some of the invisible air pollutants (i.e., Carbon monoxide and ozone) during the same period. The summit devised a visibility measure called "Blue Sky Days," A "Blue Sky Day" is defined as one in which the visibility is at least 25 miles during six hours or more.[3]

A key recommendation of the Governor's summit was to:

> *...develop and implement a standardized dust control certification program for construction companies and other stakeholders in Maricopa County to enhance compliance with Maricopa County Rule 310. Participation in the training and certification would be required for a construction company to obtain a county permit.*

Prior to the release of the summit's findings, the Arizona Department of Transportation (ADOT) had already committed resources and was working with Maricopa County and Arizona State University to develop dust control educational materials, (Dust Devil Academy Manual) and sponsor a construction dust workshop. The latter was held on September 18, 2000. ADOT also participated actively in summit meetings. A major objective of this research project has been to develop a dust control training and certification program for the construction industry in Maricopa County, as recommended by the Governor's Brown Cloud Summit.

REPORT ORGANIZATION

The report consists of two sections: In section one, chapter 1 establishes the context in which the project has been conducted, and chapters 2 and 3 explain the development of the outreach, training, and certification programs and recommend procedures for implementation. Chapters in section two detail the findings of the early tasks, such as the documentation of pollutants and mitigation practices, as well as the text of the training modules developed near the conclusion of the project.

RESEARCH OBJECTIVES

ADOT sponsored this research on PM_{10} educational tools and outreach in order to assist affected jurisdictions in the nonattainment area in meeting the Federal air quality standards. Construction activity is a significant source of the fugitive dust contributing to PM_{10} violations in Maricopa County. Although the county has hired inspectors and attorneys to enforce Rule 310, a need still exists to increase industry awareness of the provisions of the rule and provide tools to assist construction workers in reducing fugitive dust and improving ambient air quality in the region.

At the outset of the project, a Technical Advisory Committee (TAC) composed of key individuals from Federal, State, county and local agencies and the private sector was assembled. The TAC reviewed and commented on the technical memoranda, the training modules and other components of the training and certification program, and other products developed by the project team during the course of the project. The members of the TAC are listed in Table 1.

TABLE 1. TECHNICAL ADVISORY COMMITTEE

Kelly McMullen, Maricopa County Department of Transportation
Estomih Kombe, ADOT Arizona Transportation Research Center
Christine Zielonka, City of Mesa Environmental Programs
Richard Polito, Program Manager Maricopa County Small Business Environmental Assistance Program
Jo Crumbaker, Maricopa County Environmental Services
Ed Stillings, Federal Highways Administration (FHWA)
Pat Cupell, ADOT
Johnnie Mata, Markham Contracting
Jeff Lange, Kitchell Contracting

The objectives of this project have been:

- To identify, evaluate, and develop a standardized educational and outreach dust mitigation certification program for construction contractors and other stakeholders.
- To build upon work already done by ADOT and Maricopa County, such as the Dust Devil Academy Manual and the Paradise Valley Community College (PVCC) course summarized in chapter 8 of this report.[4,5]
- To solicit ideas from real-world practitioners including contractors, employees, and construction experts, concerning the most feasible and effective dust mitigation practices.
- To investigate practices employed in other PM_{10} nonattainment areas.
- To explore new forums for communicating the dust mitigation practices and certification program to a larger audience, emulating Occupational Safety and Health Administration (OSHA) courses, and utilizing audiovisual tapes and other electronic media, including compact discs and Web sites.
- To create an effective outreach, training, and certification program targeting the construction industry in the Maricopa County nonattainment Area.
- To develop a plan for implementing the program.

Subsequent to the initiation of the project, an additional objective—that of developing ongoing measures of effectiveness for the program—was added.

SUMMARY OF AIRBORNE POLLUTANTS

This section provides a brief overview of airborne pollutants, and summarizes the processes of monitoring and evaluating the effects of particulate matter. Particulate matter and other airborne pollutants and the findings of the monitoring procedures are described in detail in chapter 5. Carbon monoxide (CO), ozone and particulates are the three criteria pollutants for which Maricopa County is currently designated a nonattainment area. Since the focus of the ADOT research is reducing fugitive dust, this report includes a more detailed discussion of the sources and control measures associated with PM_{10}.

CO is a colorless, odorless, and tasteless gas produced by the incomplete combustion of carbon in fossil fuels. Most carbon monoxide is emitted in the tailpipe exhaust of vehicles traveling on roads, with a smaller contribution from nonroad engines, such as construction equipment, trains, and airplanes. CO emissions are also a byproduct of commercial and residential heating. Ozone in the upper atmosphere occurs naturally and protects life on the earth's surface from harmful ultraviolet radiation. In contrast, ground-level ozone is a poisonous, pungent-smelling gas. Ozone is not emitted by any source, but is formed by the photochemical reaction of volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of sunlight. Onroad vehicles and nonroad engines are major sources of the ozone precursors, VOC and NO_x emissions.

Prolonged exposure to high levels of either CO or ozone can cause or aggravate serious health problems, including cardiovascular and respiratory diseases. As a result of measures such as tighter Federal standards for new car emission controls, an enhanced vehicle-emissions inspection program, and seasonal adjustments in fuel formulas, CO and ozone concentrations have declined since the 1980s.

Particulate Matter Defined

Particulates are solid particles and liquid droplets that are small enough to remain airborne, such as dust, soil, and soot. The Federal standards address two sizes of particulates: coarse particulates and fine particulates. The origin of coarse particulates (between 2.5 and 10 microns in diameter) is generally geologic, including reentrained dust from paved and unpaved roads and soil disturbed by earthmoving and construction activities. These are referred to as $PM_{10.}$ The finer particulates (less than 2.5 microns in diameter) are usually emitted by combustion sources or formed by gases. These are referred to as $PM_{2.5.}$ These particles can be inhaled into the lungs where they decrease breathing efficiency and increase the occurrence of asthma and other lower and upper respiratory ailments. Particulate pollution has been ranked as one of the highest environmental risks in the state by the Arizona Comparative Environmental Risk Project[6], a project initiated by Governor Symington in 1993 to determine the State's most serious environmental problems.

Monitoring and Evaluating Particulate Matter

To comply with the 1990 Clean Air Act Amendments, the Arizona Legislature has enacted a number of air quality measures that apply to the urbanized portion of Maricopa County (referred to as "Area A"). These measures include provisions for the inspection and maintenance of vehicles, the seasonal sale of oxygenated fuels, and the establishment of "no burn" days where use of fireplaces and woodburning stoves is limited based on monitored levels of air pollutants. Over time, and in reflection of the metropolitan Phoenix area's rapid growth during the decade of the 1990s, Area A has been expanded to include the outlying communities of Buckeye and Surprise on the west, as well as a small portion of adjoining Pinal County on the southeast. An array of monitoring sites was established throughout the urbanized area to measure the levels of $PM_{10.}$ Data obtained from these monitors facilitates the evaluation of PM_{10} levels that exceed the NAAQS established by the EPA; where and why these high levels occur; and how they relate to the season, the weather, and area construction or industrial activities.

Two national standards exist for PM_{10}: a 24-hour standard and an annual standard. An exceedance of the 24-hour standard is defined as a monitored daily value greater than 150 micrograms per cubic meter ($\mu g/m^3$). An exceedance of the annual PM_{10} standard occurs when the annual average concentration at a monitor exceeds 50 $\mu g/m^3$. A detailed discussion of the standards and factors contributing to concentrations of particulates exceeding the standards is presented in chapter 5. The current boundary of Area A and the locations of PM_{10} monitors are shown in figure 1.

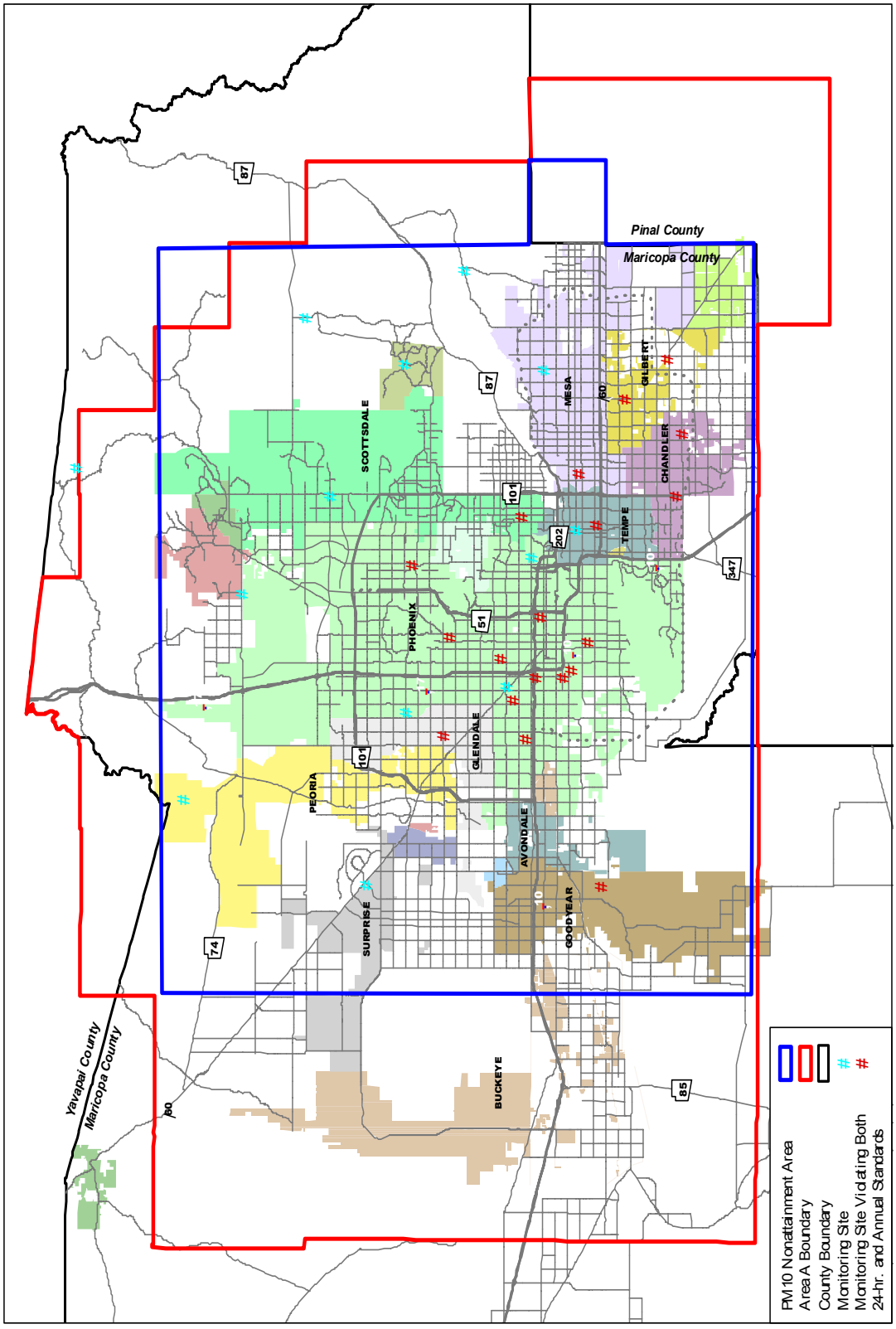


FIGURE 1. AREA BOUNDARIES AND PM_{10} MONITORING SITE LOCATIONS

PM_{10} Designations and Plans

The boundaries of the PM_{10} nonattainment area in Maricopa County are also illustrated in figure 1. MAG submitted to the EPA a "Moderate Area PM_{10} Plan"[2] for this nearly 3,000 square mile area to EPA in 1991 and revisions to this plan, in 1993 and 1994. The area was reclassified from "Moderate" to "Serious" in June 1996 due to a failure to attain the standards by December 31, 1994. Since then, a series of revisions and legal challenges have occurred. The cumulative effect has been to emphasize the seriousness of the area's air quality conditions, particularly with respect to particulate matter, and the heightened importance of educating the public and target industries in order to attain the NAAQS standards by December 2006, the current deadline.

PM_{10} Sources

The apportionment of annual PM_{10} emissions among sources in the Maricopa County nonattainment area in 1995 is illustrated in figure 2.[2,6] On an average annual basis, construction and earthmoving activities contribute the largest share of emissions at 38 percent. The next most significant source, contributing 18 percent, is reentrainment of dust by vehicles traveling on paved roads. Agricultural operations create 14 percent of the PM_{10} emissions, and unpaved roads another 13 percent. Other source categories each contribute less than 5 percent of the emissions. Note that onroad vehicle exhaust is responsible for just 2 percent of PM_{10} emissions.

PM_{10} Control Measures

The MAG Serious Area PM_{10} Plan contains 77 control measures that reflect legally binding commitments by the State, county, cities, towns, MAG, and ADOT to reduce PM_{10}. Emission reduction credit for 12 measures was quantified in the plan; the PM_{10} emission reductions attributable to each of these measures are shown in figure 3. In combination, these 12 measures will effect a 39 percent reduction in PM_{10} emissions by December 31, 2006. The single most effective control measure in the plan is the strengthening and better enforcement of fugitive dust controls (i.e., Maricopa County Rules 310 and 310.01).

As shown in figure 3, strengthening and increased enforcement of Rules 310 and 310.01 will reduce dust from construction, vehicle "trackout," and unpaved lots. (Vehicle trackout is mud and dirt that escapes a construction site on construction vehicles) Together, these reductions represent 80 percent of the total reductions in the plan. While construction and earthmoving activities are the largest source of PM_{10} emissions, they are also the source of the largest reductions in the plan. As a result of the strengthening and better enforcement of Rule 310 on construction sites, PM_{10} emissions are expected to decline by 19 percent, almost half of the total reduction required to show attainment of the annual PM_{10} standard by December 31, 2006. Making dust suppression a standard practice on and around construction sites is essential to attain and maintain the PM_{10} standards in Maricopa County's urbanized desert environment.

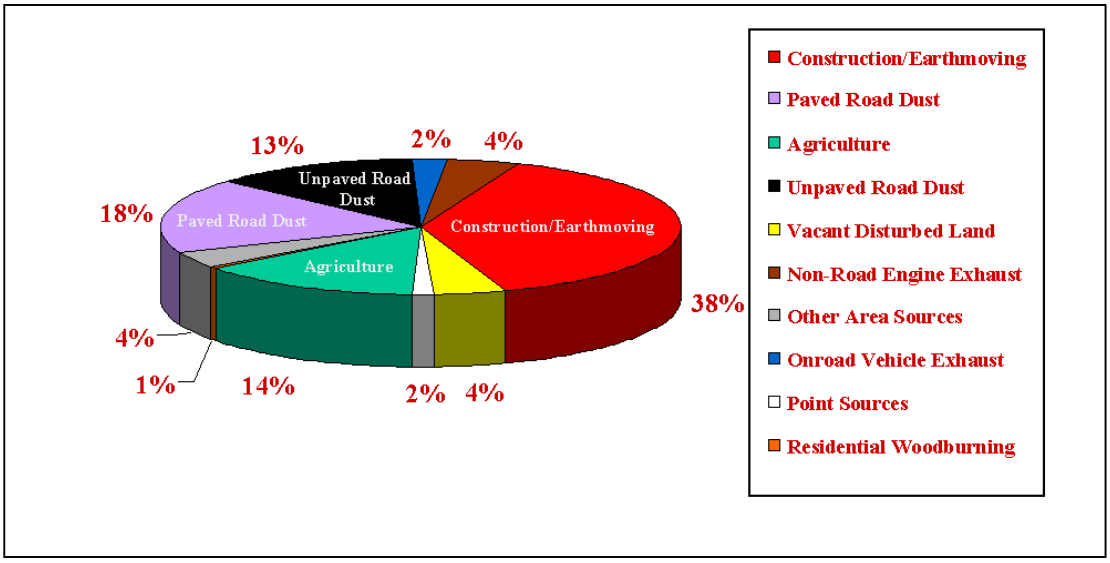


FIGURE 2. SOURCES OF PM_{10} IN MARICOPA COUNTY

Source: Maricopa Association of Governments, *Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area,* 2000. [2]

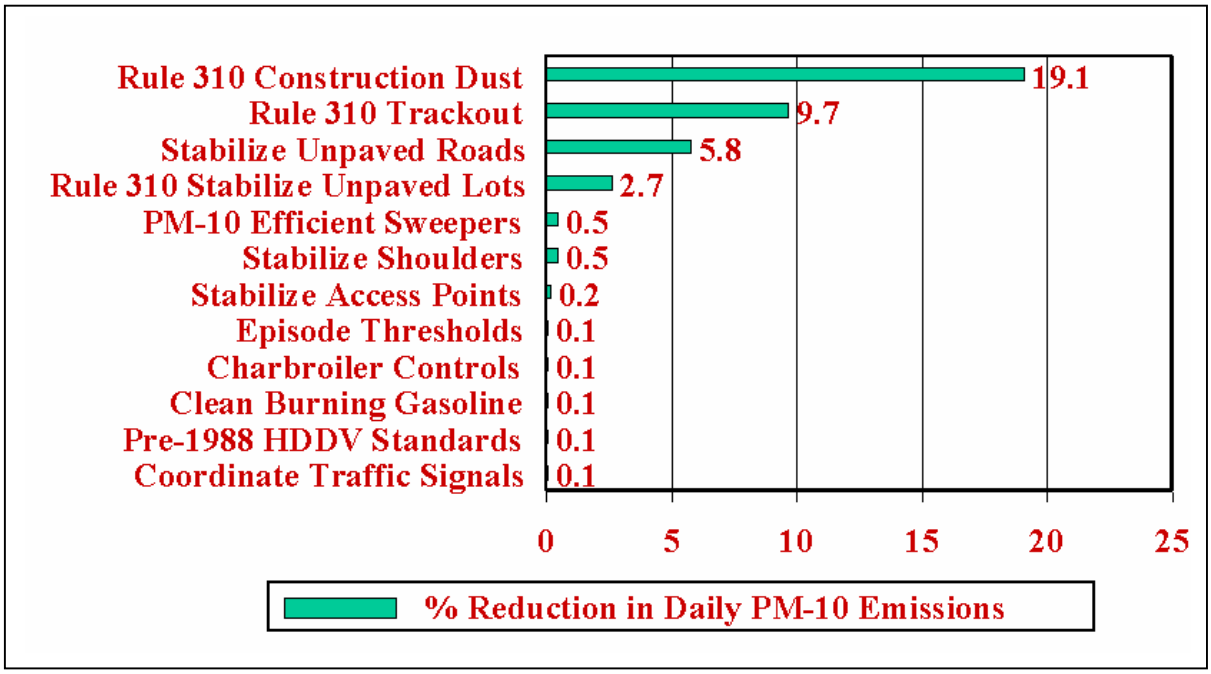


FIGURE 3. ANTICIPATED 2006 PM_{10} EMISSION REDUCTIONS FROM COMMITTED CONTROL MEASURES

Source: Maricopa Association of Governments, *Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area,* 2000. [2]

MITIGATION PRACTICES AND DUST PALLIATIVES

The scope of the project included researching the mitigation practices—including dust palliative use—of peer jurisdictions, as these practices relate to outreach efforts conducted by the jurisdictions. This section introduces mitigation practices that peer jurisdictions are employing to control fugitive dust. The practices themselves are summarized in further detail in chapter 6. The second section summarizes the application of dust palliatives, a topic described in detail in chapter 7.

Mitigation Practices

Maricopa County enacted the latest revisions to Rule 310 in February 2000 to address EPA comments made during their review of the MAG Serious Area PM_{10} Plan for the Maricopa County nonattainment area. Rule 310 requires that dust control plans be submitted by contractors and approved by the county prior to the initiation of earthmoving activities that will disturb more than one-tenth of an acre. This rule also requires that such dust control plans, once approved, be closely followed during the conduct of the dust-generating activity and provides penalties for failure to comply.

Mitigation Practices Mandated by Maricopa County Rule 310

Maricopa County Rule 310 contains control measures and requires that a dust control plan be submitted for earthmoving operations that disturb one-tenth of an acre or more. Table 2 summarizes the provisions of Rule 310 and 310.01. Chapter 6 details the dust control requirements of the rule, emphasizing those sections pertaining to construction-related activities. A table contained in chapter 6 lists dust generating activities and accompanying control measures required by the rule.

Control Measures of Other Entities

Chapter 6 also summarizes control measures of the following entities:

- Maricopa County Flood Control District (MCFCD)
- MAG
- Clark County, Nevada
- Coachella Valley, California

PERSONS INTERVIEWED DURING PROJECT RESEARCH

During the conduct of the project, the consultant team benefited from the input and assistance of a number of individuals, including the advice and oversight of Estomih Kombe of the ATRC, and Patrick Cupell from ADOT.

TABLE 2. SUMMARY OF RULE 310 AND 310.01 CONTROL MEASURES

Source Type	Summary of **Control Measures**
Vehicle Use In Open Areas And Vacant Lots:	Restrict trespass by installing signs, or install physical barriers such as curbs, fences, gates, posts, signs, shrubs, and/or trees to prevent access to the area.
Unpaved Parking Lots:	Pave, apply and maintain gravel or other suitable material, or apply a suitable dust suppressant.
Unpaved Haul/Access Roads:	Limit vehicle speed to 15 miles per hour or less and limit vehicular trips to no more than 20 per day, apply water, so that the surface is visibly moist, pave, apply and maintain gravel or other suitable material, or apply a suitable dust suppressant.
Disturbed Surface Areas - Preactivity:	Prewater site to the depth of cuts, or phase work to reduce the amount of disturbed surface areas at any one time.
Disturbed Surface Areas - During Dust Generating Operations:	Apply water or dust suppressant, as necessary to maintain a soil moisture content at a minimum of 12 percent. Construct fences or 3-foot to 5-foot high wind barriers with 50 percent or less porosity adjacent to roadways or urban areas that reduce the amount of wind blown material leaving a site.
Temporary Stabilization During Weekends, After Work Hours, And On Holidays:	Apply a suitable dust suppressant, establish vegetative ground cover, and/or restrict vehicular access to the area.
Onsite Hauling/Transporting Within The Boundaries Of The Worksite	Load all haul trucks such that the freeboard is not less than 3 inches when crossing a public roadway. Prevent spillage or loss of bulk material from the truck. Install a suitable trackout control device that controls and prevents trackout and/or removes particulate matter from tires and the exterior surfaces of haul trucks and/or motor vehicles that traverse such work site. Limit vehicular speeds to 15 miles per hour or less. Apply water to the top of the load, or cover haul trucks with a tarp or other suitable closure.
Off-Site Hauling/Transporting Onto Paved Public Roadways:	Cover haul trucks with a tarp or other suitable closure, and load all haul trucks such that the freeboard is not less than 3 inches. Prevent spillage or loss of bulk material from the truck, and clean all emptied trucks before they leave the site.
Cleanup Of Spillage, Carry Out, Erosion, And/Or Trackout:	Clean up with a street sweeper, wet broom, or by hand. Spillage or trackout areas more than 50 feet long must be cleaned up immediately
Trackout:	Pave the first 100 feet of a site access road to a width of at least 20 feet. For disturbed surfaces of 5 acres or more, install a grizzly, wheel wash system, or gravel pad at all access points.

Source: Maricopa County Rule 310

The project team maintained a continuous dialogue with TAC members and other key stakeholders throughout the course of the study. Team members also interviewed contractors, employees, and construction experts to solicit ideas on dust mitigation practices and training approaches. Tables 3 and 4 are partial lists of the many other persons who were interviewed and who contributed information and input.

TABLE 3. PERSONS INTERVIEWED ABOUT MITIGATION PRACTICES

Marty Koether, Managing Partner
EarthCare Consultants, LLC.

Mike Laybourn, Planning, Transportation, and Information Management
South Coast Air Quality Management District

Eric R. Mayer, Civil Engineering Technician
Maricopa County Department of Transportation

Jo Crumbaker, Environmental Services
Maricopa County

Robert Vitale, President
Midwest Industrial Supply, Inc.

Rick Polito, Program Manager
Maricopa County Small Business Environmental Assistance Program

Robert R. Treloar, MT, REP, CET
Director of Training, Environmental Health and Safety Technology Program
Paradise Valley Community College

Gaye Knight, Environmental Programs Specialist
City of Phoenix

Karene Gottfried, Administrative Assistant
Airmetrics

TABLE 4. PERSONS CONTACTED ABOUT OUTREACH ISSUES

Mark Minter, Executive Director
Arizona Builders Alliance

Connie Wilhelm, Executive Director
Home Builders Association of Central Arizona

Kurt Maurer, Communications Director
Arizona Department of Environmental Quality

Bob Evans
Maricopa County Environmental Services Department (MCESD)

Brent Jones
Arizona Contractors Association

David M. Martin, President, Arizona Chapter
Associated General Contractors

Lewis Wallenmeyer, Enforcement Supervisor
Clark County Department of Air Quality Management

Robert Farrell, Environmental Engineer
Pinal County Air Quality Department

2. DEVELOPING THE BLUE SKIES TRAINING PROGRAM

This chapter discusses the development of the Blue Skies training program. The first section covers the identification of outreach materials and audiences, and the second section of this chapter discusses the development of program components.

IDENTIFICATION OF OUTREACH MATERIALS AND AUDIENCES

As a guide in identifying effective outreach materials and methods, existing outreach and educational programs of selected regional agencies were reviewed and documented. A summary of these appears in chapter 8. Different outreach methods are effective with different audiences. With respect to the construction industry specifically, corporate management, jobsite management, and jobsite labor represent three distinct audiences, all of whom need to be reached in order for the program to succeed. In summary, the successful development of an outreach program faces the following challenges:

- Identifying the key elements of the message to be conveyed to the target audience.
- Identifying constituencies that comprise the complete target audience.
- Persuading construction industry decision-makers to "take ownership" of the process.
- Identifying what outreach approaches are most appropriate for specific construction industry circumstances.

Identifying the Appropriate Message

Numerous activities could be undertaken, modified, or avoided in order to reduce the amount of airborne particulates in Valley air, and identifying a few key actions will result in a clear and concise objective to be promulgated by the outreach efforts.

As figure 3 on page 10 depicts, mitigation of fugitive dust from the following construction activities will reduce anticipated emissions by about 30 percent:

- Following the provisions of Rule 310 during construction earthmoving activities.
- Following the provisions of Rule 310 to mitigate trackout from construction sites onto paved roads.

Language based on Rule 310 provisions must be drafted to:

- Explain each concern in terms that are easily understood by those positioned to take the necessary actions.
- Provide realistic "rules of thumb" for determining when control measures are needed.
- Develop a less esoteric way to explain opacity levels.
- Provide easy-to-follow directions for implementing the control measures.

The potential construction outreach audience may be divided into three segments as follows:

- Corporate, including the ownership of the construction company as well as regional project management and inspection personnel.
- Job site management, which includes supervisory personnel having direct oversight responsibilities for the conduct of a particular project.
- Job site labor, including equipment operators and manual labor personnel of both general contractor and subcontractor.

Outreach activity may be categorized as "Information and Education - Initial," "Information and Education - Ongoing," and "Message Reinforcement." The products, or "collateral," associated with each activity are of three types:

- Text-based material, which includes manuals, guide books, pocket guides, and posters.
- Multimedia, which includes cassette and video tapes, PowerPoint presentations, CD-ROMSs, and Web-based outreach.
- Reinforcement giveaways, which include collateral material such as pens, cups, clipboards designed to reinforce the message or steer persons to Web sites or guide books.

A matrix developed to assess the relationship between the different segments of the audience and the different forms of outreach is presented in table 5.

DEVELOPMENT OF PROGRAM COMPONENTS

Following the review of dust control practices outreach efforts of other jurisdictions the Project Team developed a draft outreach program. The components of the program were submitted to the TAC for review, discussion, and comment, and subsequently refined to incorporate TAC suggestions.

The components of the prototype outreach program include:

- Program name and logo as shown in figure 4.
- Bilingual program brochure.
- English and Spanish versions of a *"*Guide to Construction Dust Control Measures".
- Bilingual "Quick Reference Dust Control Guide."

TABLE 5. MATRIX OF OUTREACH AUDIENCES, METHODS, AND MEDIA

Activity	Audience		
	Corporate Outreach Methods and Media	**Job Site Management Outreach Methods and Media**	**Job Site Labor Outreach Methods and Media**
Information and Education - Initial			
Background Information	• Dust control manual • "Benefits of a Dust Control Program" stand-alone publication and/or chapter in the above guide • "Environmental Construction Management Program," which includes identifying dust control generating circumstances and methods to control	• Pocket-sized book of rules for dust control • "Effective Dust Control and Overview of Rule 310" video produced by Maricopa County • Color posters posted in site trailers showing an unacceptable dust opacity occurrence or unacceptable trackout at a site entrance	• Shirt pocket-sized laminated card or "flip book" with bullets highlighting major points of message in English and Spanish • "Effective Dust Control and Overview of Rule 310" video produced by Maricopa County
Training Workshop	• Training workbook • PowerPoint presentation designed for job site management including: ✓ Key points of dust control manual ✓ Use of book of rules and laminated cards ✓ Availability of Web site for updates ✓ Trackout control • "Effective Dust Control and Overview of Rule 310" video produced by Maricopa County	• Training workbook • "Effective Dust Control and Overview of Rule 310" video produced by Maricopa County • PowerPoint presentation and handouts for use at "safety meetings" that conveys key message and explains use of laminated card and other tools to employees • Outline for "toolbox meetings" on dust control topics such as maintenance of trackout, proper wetting and crusting of loose soils, hosing down of empty truck beds, etc.	• Training workbook • "Effective Dust Control and Overview of Rule 310" video produced by Maricopa County

TABLE 5. MATRIX OF OUTREACH AUDIENCES, METHODS, AND MEDIA (Continued)

Activity	Audience		
	Corporate Outreach Methods and Media	**Job Site Management Outreach Methods and Media**	**Job Site Labor Outreach Methods and Media**
Information and Education - Ongoing			
• Best Practices • Fulfillment of Regulatory Requirements • Response to Weather conditions	• Telephone hotline • Web site with update info • On-line peer "dust control forum" • Newsletters and fact sheets	• Telephone hotline • Web site with update info • Newsletters and fact sheets	• Bilingual telephone hotline • Bilingual flyers and posters
Message Reinforcement			
Message Reinforcement	• Peer discussions and conferences • Feature articles and statistics in trade publications	• A copy of the project dust control plan posted onsite	• Photographs depicting unacceptable opacity
Reinforcement/ Giveaways	• Calendars • Pens • Portfolios • PowerPoint CD-ROM • Small notebooks • Travel mugs • Drawings for dinners or lunches	• Calendars • Clipboards • Key chains • Lunch coolers • Pens • PowerPoint CD-ROM • Travel mugs	• Clipboards • Key chains • Lunch coolers • Pens • Travel mugs • videotapes • Lunches or dinners

FIGURE 4. BLUE SKIES PROGRAM LOGO

- Fact sheet handouts.
- Opacity chart.
- Dust control training course and certification program.

Note that these products are prototypes intended to illustrate the research and are not intended for use as actual training tools. The content of these products was current at the time that the drafts were developed. However, subsequent changes in rules, regulations, and available data may have rendered portions of the text or graphics obsolete or inaccurate. If and when the training program recommended by this research project is implemented, updated training materials may be obtained from the program coordinator.

The program brochure, and the "Guide to Construction Dust Control Measures," both of which would be available in both English and Spanish, are designed to promote the Blue Skies program to prospective participants. The brochure contains a brief summary of dust control related issues and of the purpose and design of the training course. The "Guide to Construction Dust Control Measures" provides a more in-depth view of the program and a description of the training and certification program, such as that found in this chapter. The guide is targeted toward local jurisdictions, construction-industry management, and others who will be making policy decisions about their organization's participation in the Blue Skies program. The English version of the program brochure is presented in Appendix A and the English edition of the "Guide to Construction Dust Control Measures" is presented in Appendix B.

Bilingual Quick Reference Guide, Fact Sheets, and Opacity Chart

The bilingual "Quick Reference Dust Control Guide", fact sheets, and opacity chart are designed as tools to be used by construction site labor and supervisory personnel. The quick reference guide contains briefings in both English and Spanish on the following topics:

- What is particulate matter?
- What is being done?
- Site planning.
- Why trackout must be prevented.
- Effective watering.
- Wind barriers.
- Visible Emissions and Opacity.
- The dangers of dust.
- Maricopa County Rule 310.
- What is trackout?
- Ways of controlling trackout.
- Dust palliatives.
- Material handling.

Each of the briefings is designed to be used as the topic of a five-minute "toolbox" discussion conducted by the site supervisor before beginning the day's work, or to be referred to throughout the day by any site employee. Ten of the topics are also covered on fact sheets designed to be easily reproduced and widely distributed among job site personnel as well as temporary workers or subcontractors. The bilingual "Quick Reference Dust Control Guide" is presented in Appendix C, and the fact sheets are presented in Appendix D.

A prototype opacity chart designed to aid in estimating the opacity of dust plumes is depicted in figure 5. The chart is based on the concept first introduced by 19th Century French theorist Maximilian Ringelmann that the darker a plume appears, the more opaque it is. Professor Ringelmann developed this concept to evaluate the efficiency of coal-fired boilers, determining that darker plumes of smoke contained more unburned carbon particles, signifying a less efficient boiler. The California Air Resources Board adapted this concept, originally intended to measure the opacity of smoke, to apply to the opacity of dust.[2,4] See the discussion of "Smoke School" further in this chapter.

Dust Control Training Course and Certification Program

The Blue Skies program is designed to build upon the foundation of dust control training established by the Maricopa County Small Business Environmental Assistance Program, the Arizona State University (ASU) Del E. Webb School of Construction, and the Paradise Valley Community College, this training is referred to as the Dust Devil Academy.

Training modules have been developed for training construction personnel in understanding dust problems and dust control measures. Certified instructors would teach the courses based on the training modules. Instructors would be certified by taking more intense training and completing Smoke School (see description in this chapter). The following outlines the goals, intended audience, and targeted skills of the various levels of the proposed dust control training and certification program.

The goal of the dust control training course is to train construction personnel in the understanding of dust problems and dust control measures for construction sites. The anticipated audience for the course includes all levels of construction industry personnel. Upon completion of the course the trainee will have the following skills:

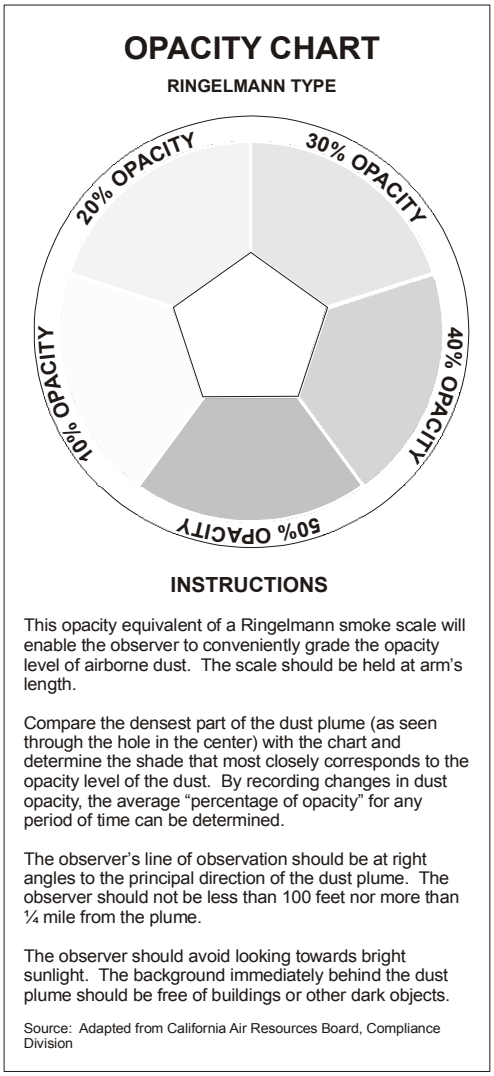


FIGURE 5. OPACITY CHART
Source: Adapted from California Air Resources Board, Compliance Division

- Basic understanding of dust problems and measures to mitigate dust at construction sites.
- Ability to identify dust problems.
- Ability to implement actions to reduce dust at construction sites.

The course is designed for anyone working in the construction field, and site superintendents, water truck and water pull drivers, and subcontractors are highly encouraged to attend. In addition to lectures, the course includes class discussion and review of actual field case studies.

Modular Lesson Plan

A basic dust control course is designed to be presented in a half-day format. The course begins with a 10-minute video developed by the Maricopa County Environmental Services Department, entitled "Effective Dust Control and Overview of Rule 310." The course will typically include six training modules, but can be tailored to the needs of specific groups by eliminating modules or parts of modules. The complete scripts of the training modules are incorporated in the training guide included as Appendix E. Summaries of the five training modules are presented below:

Module 1 - Background will cover the reasons that dust control is needed, and the causes of PM_{10}. Both natural and man-made sources of fugitive dust will be identified and actions that have already been taken to reduce PM_{10} emissions will be explained. Control measures implemented in these areas, such as the Rule 310 in Maricopa County, will be discussed.

Module 2 - Construction Dust Control Requirements will explore in detail the construction dust control requirements in effect for the jurisdiction in which the course is being presented. Dust control measures for construction-related activities will be explained.

Module 3 - Enforcement of Dust Control at Construction Sites will cover jurisdictional enforcement, including the characteristics of the dust control enforcement program, inspection criteria, enforcement procedures, and penalties for violations, as appropriate for the jurisdiction in which the course is being presented.

Module 4 - Strategies to Assist Construction Activities in Controlling Dust will examine dust control strategies including project design and site planning. A case study of a construction project will be included.

Module 5 – Visible Emissions Evaluation at Construction Sites will describe the techniques used to identify the opacity levels of dust generated by construction activities. The script and slides for this module will be developed by ADEQ, which provides Visible Emissions Evaluations Training.

Module 6 - Information Resources and Reinforcements will discuss additional information that supplements and reinforces the material covered in class. Participants will be given a final exam that can be used for certification purposes.

Each of the modules has been structured as a PowerPoint presentation containing text, graphs, charts, and figures as training aids. An accompanying "Dust Control Course Trainer's Guide" contains suggested step-by-step commentary for each module, as well as examples of a dust control log and earthmoving permit for reproduction and distribution to class attendees.

Certification Program

The goal of the certification program is to establish minimum standards for mastering and teaching information on construction dust control problems and measures. The certification program is designed for construction industry management and job supervisory personnel. Two levels of certification are offered:

Certified Dust Control Specialist - An individual who completes dust control training and passes an exam covering the subject matter presented in the course with a grade of 75 percent or better, may receive designation as a Certified Dust Control Specialist. To maintain certification, a specialist must take the dust control training and pass the final exam once every two years.

Certified Dust Control Instructor - To be certified as a dust control instructor, an individual must complete the following:

- Dust control training.
- Visible Emission Evaluation Training (Smoke School).
- Co-teach a dust control training course under the supervision of another certified instructor.

Before teaching the dust control course, an individual would have to be certified as a construction dust control instructor by the Blue Skies coordinator. The coordinator will establish standards that must be met in order to receive instructor certification—for example, passing the final exam with a grade of 75 percent or better and receiving visible emissions training certification every six months.

Certified instructors would be required to teach a half-day course utilizing the training modules provided by the Blue Skies coordinator. The Blue Skies coordinator would keep the instructors apprised of changes in the course material. Instructors would keep the Blue Skies coordinator informed about classes being taught, attendance levels, and collateral materials required (i.e., toolkits and certification cards).

Visible Emissions Evaluations Training (Smoke School)

Visible Emissions Evaluations Training, or Smoke School, trains qualified observers in the determination of Plume Opacity. The school is taught in accordance with EPA methods for determining opacity of visible emissions, as presented in Federal Reference Method 9. The ADEQ conducts Smoke School at least twice a year in various locations around the state. These classes are offered at no charge and include both lectures and field training. A private vendor also offers classes periodically in Phoenix and Tucson.

Visible emissions training typically covers the following topics:

- The principles of opacity measurement.
- Opacity standards in control of particulate emissions.
- Sources and characteristics of visible emissions.
- Aspects of Method 9, including proper field observation procedures and documentation.
- Special field viewing problems.
- Legal aspects of visible emission inspections.
- Compliance determination.

Smoke School is a two-day event comprising two elements. A classroom session held the morning of the first day is followed by a testing session lasting the remainder of the event. During the testing session, participants evaluate several sets of black-and-while smoke readings.

3. IMPLEMENTING THE PROGRAM

This chapter outlines an implementation plan for the Blue Skies program, including suggestions for an institutional framework, a series of recommended steps to initiate the outreach program, and a description of the certification and training program.

RECOMMENDATIONS FOR PROGRAM IMPLEMENTATION

Based on the research of practices of peer institutions and in consideration of the outreach efforts already underway to encourage fugitive dust control related to construction activities, the following recommendations are made:

- Successful implementation of the Blue Skies program will require a strong institutional arrangement among the key agency and construction stakeholders.
- ADOT is a strong candidate for the lead agency to implement the Blues Skies program.
- Potential sources of funding, personnel and other resources for the program include ADOT, Maricopa County, EPA, Western Regional Air Partnership, ADEQ, and Congestion Mitigation and Air Quality Improvement (CMAQ) funds received by the Maricopa Association of Governments.
- A Blue Skies coordinator must be selected to manage the program and finalize the development and dissemination of collateral material.
- Workshop presentation or kickoff event should be held to initiate the training program.
- Opportunities exist for linking the Blue Skies program with other outreach programs having similar target audiences.
- The outreach activities must be continuously monitored in order to determine the success of the program in educating the general public and construction industry, as well as reducing dust at construction sites.

ESTABLISHING INSTITUTIONAL FRAMEWORK

A draft plan has been developed as a framework for implementing the Blue Skies program. The overall implementation presented here contains definite actions and responsibilities to carry out the Blue Skies program. The keystones of the plan are:

- Strong institutional framework with centralized coordination.
- Strong agency and construction industry support.
- Strong resource commitments including funding, personnel, advertising, and donated materials and services.

- Well-developed, focused outreach materials and tools.
- Well-publicized high-level Kickoff event.
- Comprehensive training and certification program.
- Continuous monitoring and implementation.

Figure 6 depicts a flow chart of the major activities necessary to initiate and continue the outreach program.

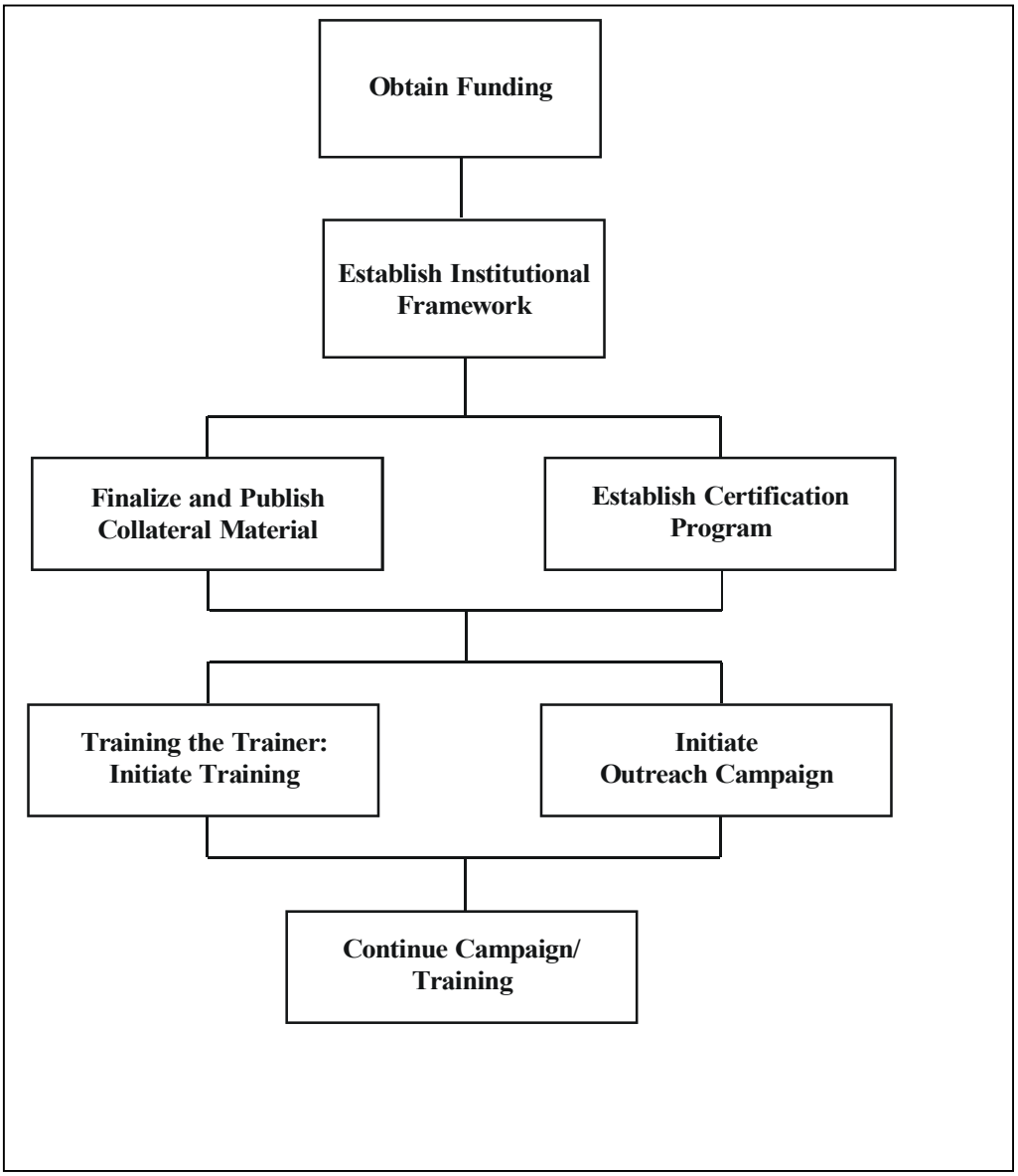


FIGURE 6. IMPLEMENTATION PLAN FLOW CHART

General Model of Institutional Framework

The successful implementation of the Blue Skies program depends on a strong institutional arrangement among the key agency and construction stakeholders. A first step toward the implementation of the Blue Skies program has been taken with the establishment of a TAC for this study to develop PM_{10} educational material and an outreach program. This committee is composed of representatives from ADOT, Maricopa County, cities, the construction industry, and the college community. The members of the TAC were listed in table 1 in chapter 2 of this report. However, more formal arrangements among the stakeholders are needed to implement the day-to-day outreach and education activities. Figure 7 presents a general model for the institutional arrangements required for successful implementation of the Blue Skies program.

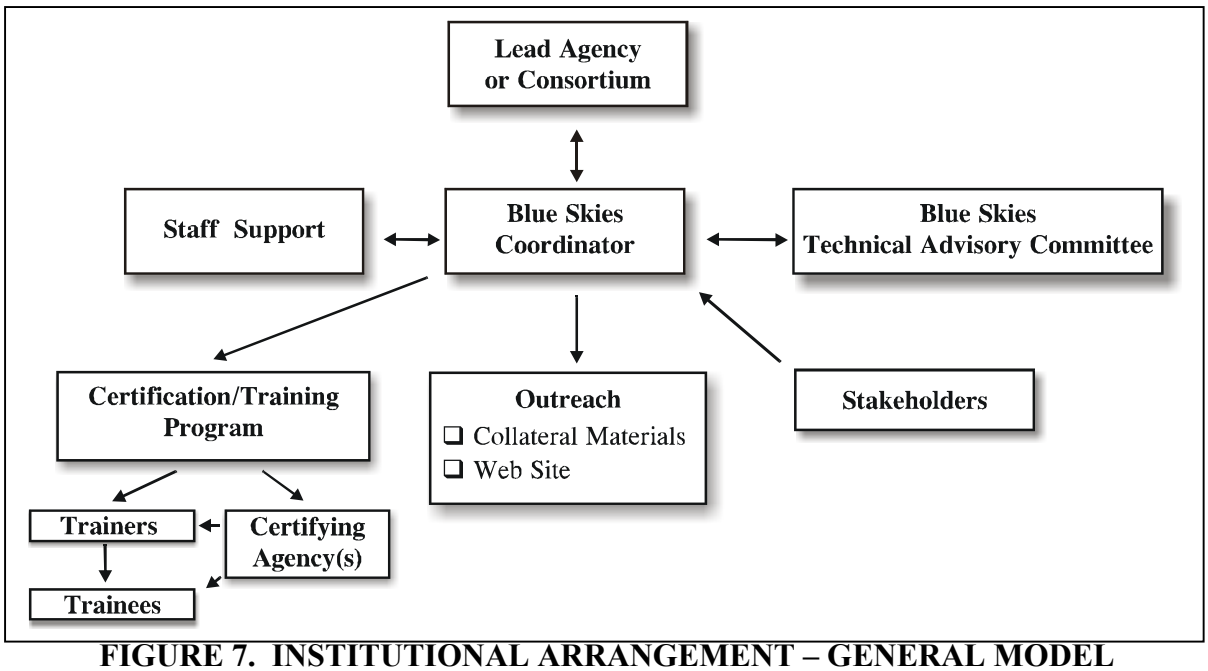


FIGURE 7. INSTITUTIONAL ARRANGEMENT – GENERAL MODEL

Key stakeholders in the process are shown in table 6. Each stakeholder has a certain vested interest in the outreach program. A coordinator should be designated to coordinate the daily activities. Intergovernmental agreements should be developed among the agencies.

Establish Coordinator

Through discussions with the TAC, ADOT was identified as a strong candidate for the lead agency to implement the Blue Skies program. For this institutional model, the ADOT Air Quality Policy Group will take the primary lead in the implementation of the

TABLE 6. STAKEHOLDER ROLES

Stakeholder	Role	Description
Arizona Department of Transportation	Lead Funding	Lead implementation and coordination Stewardship role Major owner of construction projects
Contractors and subcontractors	Support Funding	Responsible for planning, implementing and scheduling PM_{10} measures Train construction workers
Engineers and architects	Support	Outreach audience Provide technical advice Incorporate PM_{10} measures into the design
Environmental Projection Agency	Support, Funding	
Arizona Department of Environmental Quality	Support, Funding	
Maricopa County Environmental Services	Support, Funding	Implement and enforce Rule 310
Maricopa County Small Business Economic Assistance Program	Support	Dust Devil Academy, Web based training Assist in producing outreach material
Maricopa Community Colleges	Teaching, Advice	Teach dust control classes Provide technical advice
ASU Del E. Webb School of Construction	Teaching, Advice	Assist in Dust Devil Academy Provide training
Maricopa Association of Governments	Support, Funding	Include Blue Skies training and certification in standard specifications for public works construction
Local Jurisdictions	Support, Funding	In-house programs in response to Rule 310 Monitor employee activities In-house construction
Arizona Chapter, Association of General Contractors	Support , Funding	Conduct in-house programs
Home Builders Association of Central Arizona	Support, Funding	Conduct in-house programs
Arizona Builders Alliance	Support, Funding	Conduct in-house programs
General Public	Audience	Obtain health, welfare, and visibility benefits of dust control efforts on construction sites
LTAP	Support, Training	Host Web page Provide training

program in coordination with other stakeholders. A TAC similar to those who served on this project will provide advice and support to the Air Quality Policy Group.

In this institutional model, ADOT will provide financial and staff resources to implement the program and take the primary lead. Individual jurisdictions and private organizations provide financial and in-kind support for the preparation, publication, and distribution of materials and organizations through intergovernmental agreements. Similar private sector agreements could be developed between stakeholders from the private sector, such as construction companies and trade associations, and the lead agency or consortium sponsoring the outreach program.

Funding and Other Resource Commitments

Potential sources of funding, personnel, and other resources for the program include public agencies such as ADOT and Maricopa County. Grants for air quality outreach programs may also be available from EPA, the Western Regional Air Partnership, and ADEQ. The program may also be eligible for CMAQ funds received by MAG.

Other in-kind support, such as instructors, supplies, and clerical may be available from stakeholder agencies, trade associations, and participating "Blue Skies contractors" (see description below). The individual training would be performed by certified instructors who would charge a fee to cover the cost of course materials plus labor. In addition, a portion of the fees generated from dust control enforcement activities could be used to fund the program.

INITIATING OUTREACH CAMPAIGN

Coordinate with Stakeholders

The outreach coordinator will work closely with the key stakeholders to build support for the outreach campaign. The coordinator and key stakeholders will contact managers of cities, towns, and the county to generate support at top levels of government. The coordinator and key stakeholders will also make presentations to various government bodies to ask for the support.

In addition, the coordinator and key stakeholders will make presentations to the upper level management of construction, engineering, and architecture firms to get their buy-in to the program. Presentations should also be made to trade associations such as the Arizona Chapter of Associated General Contractors, the Home Builders Association of Central Arizona, and the Arizona Builders Alliance. Contractors would be urged to sign up as "Blue Skies" contractors who would show their support for the program by having their personnel trained, encouraging others to support the program, and displaying the Blue Skies logo on their letterhead and/or equipment.

Finalize and Publish Outreach Material

The Blue Skies coordinator would direct the finalization and publishing of the outreach material including the following:

- Web page.
- PowerPoint presentations.
- Dust control measures guide.
- Fact sheets.
- Quick reference guide.
- Training guide and modules.

The ADOT Air Quality Policy Group would administer and maintain the Web site. As an option, the Web site domain could be developed and maintained outside the ADOT Web site, but linked to the ADOT site. Other sites could also be linked to the domain.

Kickoff Event

A kickoff reception or workshop presentation should be held to initiate the program. The reception would be a major press event. For maximum impact, it is suggested that the Arizona governor host the event. Blue Skies contractors and other major stakeholders should be invited. Elements of the event would include:

- Governor'skickoff speech.
- Materials.
- Questions from the press.
- Sponsors.
- Presentation of program elements.

ESTABLISHING CERTIFICATION AND TRAINING

The Blue Skies program coordinator would oversee and facilitate the establishment and ongoing presentation of the dust control training and certification programs. Course instructors will be identified and assigned, and course content and materials will be provided and modified as necessary to maintain currency. Changes in Maricopa County Rule 310, for example, or the enactment of new legislation that supplements or supplants Rule 310, will necessitate the restructuring of some course elements.

The coordinator would also establish standards and procedures for sponsoring organizations to certify dust control specialists at construction dust control courses taught by their instructors. Qualified sponsoring organizations would be authorized to certify individuals who attend a half-day course and pass the final exam with a grade of 75 percent or better. Final exams for course certification would be provided by the Blue Skies coordinator. The instructor would be authorized to sign the certification cards. Certification could be maintained by attending training and passing the exam every two years.

Course Delivery Options

Three potential options for delivering dust control courses are: 1) single agency delivery, 2) multiple agency delivery, and 3) hierarchy of delivery. The three options are described below and the advantages and disadvantages of each option are shown in table 7.

TABLE 7. POTENTIAL COURSE DELIVERY MODELS

Delivery Model	Advantages	Disadvantages
Single Delivery Point	Easier to maintain consistency with directions of program. Easier to maintain consistency and quality of material presented.	Fewer opportunities for stakeholders. Single focus of resources.
Multiple Delivery Points	Use full resources of academic and private community.	Difficult to coordinate. Difficult to maintain consistency and quality of material presented. Difficult to maintain consistency with direction of program.
Hierarchy of Delivery	Controls the quality and consistency of training the trainer. Use full resources of academic and private community.	Difficult to coordinate multiple agencies.

Single Agency Delivery

In the single agency delivery model, dust control courses would be delivered by one agency. The Blue Skies coordinator would certify only one agency. The intent of this option is to focus the training on one delivery point in order to ensure quality and consistency in teaching the dust control course. This agency could be a university, college, community college, or local or state agency. The Local Transportation Assistance Program (LTAP) provided by ADOT is another possible agency to deliver dust control courses. Teaching the course could also be contracted to an agency or private provider.

Multiple Agency Delivery

For this option, the Blue Skies coordinator would contact public agencies, Arizona State University, other colleges, private businesses, and trade associations to identify sponsors for the construction dust training program. The intent would be to maximize dissemination of the information provided in the training modules and encourage voluntary certification of as many construction personnel as possible. To achieve this objective, the coordinator will host periodic "train-the-trainer" sessions for representatives from sponsoring organizations.

Hierarchy of Delivery

This model of delivery would combine the first two options. A single agency would certify the trainers and the dust control specialists. The certified trainers would then offer the dust control course through various agencies. Quality and consistency in teaching the dust control course would be maintained through the certification of trainers by one agency.

Linkages to Other Programs

Many other education or outreach programs have attained the level of public acceptance and industry participation that the Blue Skies program must achieve in order to be successful. For example, no significant excavation activity takes place without having the area "blue staked" to identify the location of underground utilities, or adhering to safety procedures required by the Occupational Safety and Health Administration (OSHA). Existing programs could be identified that target audiences similar to those to be targeted by the Blue Skies program or that deal with similar issues.

In October 2002, for example, the Arizona Department of Occupational Safety and Health (ADOSH) initiated a program designed to increase awareness of the dangers of inhaled silica—a common particulate. The ADOSH is targeting highway contractors because of the risks of silica exposure inherent in highway construction activities such as drilling, blasting, and tunneling. The Blue Skies program will explain the health risks of dust inhalation to highway contractors and others, and a clear synergy exists between the ADOSH program and the proposed Blue Skies program.

Methods of Linking Programs

Once the desirability of linking the Blue Skies program with another outreach program has been determined, methods of linking the programs could include:

- Exchanging links on program Web sites.
- Exchanging contact lists.
- Including both program brochures in mailings.
- Joint participation in trade shows and exhibits.
- Cross-referencing of program goals and objectives in training material and presentations.
- Citing each other's program as a resource in training materials or during class.
- Combining training and presentations before a single class or audience.

The best method to employ will depend upon a number of factors including the level of synergy between programs, the extent of target audience convergence, and the course delivery model chosen for the Blue Skies program together with that used by the other program. For example, ADOSH silica-related information could be included in Blue Skies training, or information concerning the availability of Blue Skies training could be included in the ADOSH material disseminated as part of their silica awareness effort.

ADOT's LTAP also conducts training that can be linked with Blue Skies programs. The LTAP offers a Heavy Equipment Training and Certification Program that trains personnel from local jurisdictions within Arizona in the proper use of bulldozers, backhoes, and other earthmoving equipment. Prospective operators of such equipment—particularly employees of those jurisdictions located in nonattainment areas—should be briefed on dust control issues and encouraged to seek Blue Skies training as well.

The LTAP should be considered a prospective source of Blue Skies instruction and certification. The LTAP has established itself as a resource for environmentally oriented training, and during 2002 conducted four workshops on Floodplain and Floodway Delineation in Riverine Environments. In addition, organizations involved in the Blue Skies program and the Dust Devil Academy are already represented on the LTAP Board of Directors, including ADOT, FHWA, Arizona Chapter of the Associated General Contractors, and the ASU Del E. Webb School of Construction.

OVERVIEW OF OUTREACH IMPLEMENTATION

The implementation of the Blue Skies program consists of five major components:

- Establish institutional framework.
- Finalize and publish collateral material.
- Initiate outreach campaign.
- Establish certification program.
- Continue campaign/training.

For each component, the project team has developed a list of actions needed to implement the program. The specific actions for implementing the program are listed in chronological order in table 8. Table 8 is structured as a template to be used in assigning responsibilities and milestones for each of the program components.

Once the institutional framework has been established, the program coordinator, a coordination team, or TAC can oversee and assign the action items included in the other components. When milestones and responsibilities for each of the action items in table 8 have been identified, a Gantt chart can then be developed to highlight the interdependencies of the various components and track the progress of program implementation.

TABLE 8. DUST CONTROL OUTREACH IMPLEMENTATION PLAN TEMPLATE

Action	Responsibility	Schedule
Establish Institutional Framework		
Designate Lead Agency/Staff		
Establish Blue Skies Coordinator		
Establish Coordination Team		
Finalize and Publish Collateral Material		
Brochure		
Guide To Construction Dust Control Measures		
Quick Reference Guide		
Other Collateral Material		
Blue Skies Stickers		
Web Site		
Slide Presentations		
Initiate Outreach Campaign		
Get Buy-in from Cites, County, MAG		
Get Buy-in from Blue Skies Contractors		
Issue Press Release (Media Blitz)		
Hold Kickoff Reception		
Hold Press Conference		
Present Overview of Blue Skies Program		
Conduct Speaking Engagements:		
Association of Contractors		
American Society of Civil Engineers		
Association of County Engineers		
Chambers of Commerce		
Public Works Directors		
Establish Certification Program		
Finalize and Adopt Certification Program		
Train the Trainer Notebook		
Training Materials		
Train the Trainers		
Identify Certifiers		
Identify Trainers and Locations		
Train the PM_{10} Trainers		
Conduct Certification Sessions (by Trainers)		
Certify Trainees (by Certifiers)		
Conduct Other Training (by Contractors)		
Monitor Training (Certifiers)		
Continue Campaign/Training		
Monitor Measures of Effectiveness Annually		
Update Outreach Products As Needed		

4. MEASURING THE PERFORMANCE OF THE PROGRAM

A critical question in the implementation of the Blue Skies program is: How will the performance of the Blue Skies program be measured? This chapter first discusses the challenge facing agencies in measuring program effectiveness and then discusses the performance measurement framework, including the general characteristics of measures of effectiveness (MOEs). Next, the chapter reviews how outreach programs of peer jurisdictions have measured outreach effectiveness. The following section describes the recommended MOEs designed to quantitatively measure the success of the Blue Skies program. The final section discusses implementing the MOEs to evaluate the performance of the Blue Skies program.

THE CHALLENGE

The ultimate goal of the Blue Skies program is to reduce dust at construction sites by improving dust control through outreach to the construction industry. However, measuring the success of the program in reducing dust is a difficult challenge. Two questions need to be addressed to measure success. First, what is the success of the outreach program in raising the education level of construction personnel in applying dust control practices? Second, has the improvement in education levels of construction personnel in fact resulted in reduced fugitive dust at construction sites? The first question may be easier to answer than the second question. Direct measures can be constructed for measuring participation and knowledge levels achieved in the Blue Skies program. However, linking the Blues Skies program to a reduction in PM_{10} at construction sites is much more difficult.

What needs to be ultimately accomplished is to relate the level of outreach to the reduction in fugitive dust, as illustrated in figure 8. The measurement of performance will be looking at the incremental changes in PM_{10} emissions and other indicators with the Blue Skies program in place. However, other activities and other programs aimed at reducing PM_{10} will be simultaneously occurring. What is the contribution of the Blue Skies program in reducing fugitive dust? How does one separate the effect of the Blue Skies program from that of another? In addition, the Blue Skies program will have multiple activities such as a training course, a Web site, media spots, and the like. What is the contribution of each activity or collective activities to reduction in PM_{10}?

MEASUREMENT FRAMEWORK

The May-June 2002 edition of TR News contained an article titled "Measuring the Effectiveness of Public Involvement Approaches" that emphasizes the importance of developing a framework for both the public involvement activities themselves and the methods for measuring the effectiveness of these activities.[7] A framework has been developed to meet the challenge of measuring the success of the Blue Skies program. The

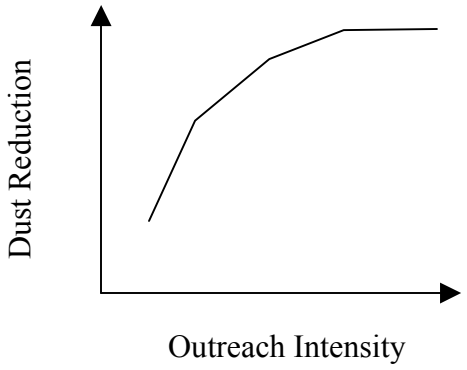


FIGURE 8. RELATIONSHIP BETWEEN THE LEVEL OF OUTREACH AND THE AMOUNT OF FUGITIVE DUST REDUCTION

step-by-step procedure shown in figure 9 is recommended for measuring the performance of the Blue Skies program. MOEs have been developed by this research to address the goals of reducing dust at construction sites and increasing participation in the Blue Skies program by quantitatively measuring the effectiveness of the Blue Skies program. Elements of performance measurement are presented in table 9. The MOEs developed for this study are discussed in more detail following a review of how other agencies measure performance of air quality outreach programs.

MEASURES OF EFFECTIVENESS EMPLOYED BY PEER JURISDICTIONS

The project team conducted an extensive search by Internet, e-mail, and telephone in an effort to identify peer jurisdictions that are employing methods to measure the effectiveness of their outreach programs. Where possible, the persons responsible for employing the MOEs were interviewed. In some cases, colleagues in other departments—or in other peer agencies—were the source of the information. A concurrent literature search was conducted, and candidate contacts in peer jurisdictions were identified in the process of reviewing the literature. Table 10 lists the persons contacted.

Nearly all the agencies contacted are conducting one or more periodic and/or ongoing outreach programs. All the agencies are also monitoring the levels of some or all of the criteria pollutants. All are tracking the trends of benchmarks such as numbers of days containing exceedances, number of complaints received about fugitive dust, numbers of violations issued, and so forth. However, in most instances, the agencies are not undertaking formal efforts to connect the outreach activity with the air quality levels.

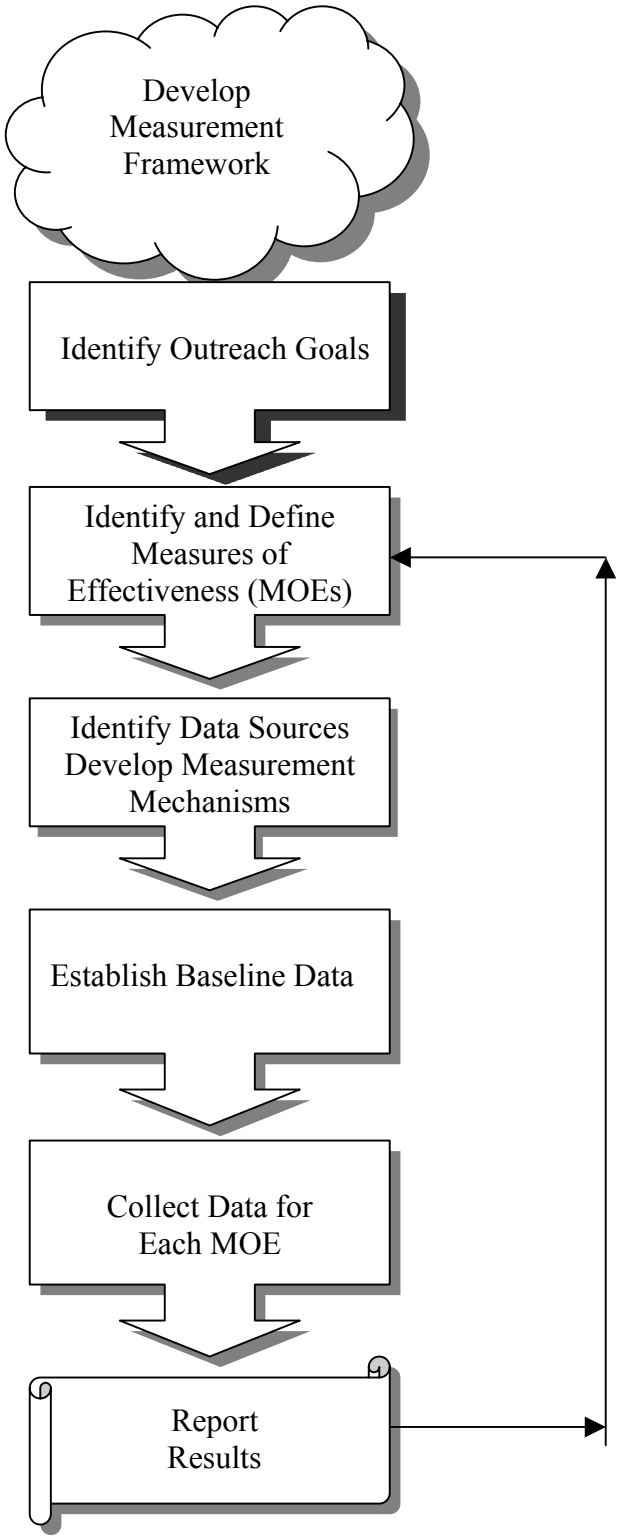


FIGURE 9. FLOW CHART OF PERFORMANCE MEASUREMENT

TABLE 9. ELEMENTS OF PERFORMANCE MEASUREMENT

Why Have Performance Measurement?
• Set goals and standards • Detect and correct problems • Manage, describe, and improve processes • Document accomplishments
In general, a good measure:
• Is accepted by and meaningful to the customer • Tells how well goals and objectives are being met • Is simple, understandable, logical, and repeatable • Shows a trend • Is unambiguously defined • Allows for economical data collection • Is timely • Is sensitive
A successful performance measurement system:
• Comprises a balanced set of a limited vital few measures • Produces timely and useful reports at a reasonable cost • Displays and makes readily available information that is shared, understood, and used by an organization • Supports the organization's values and the relationship the organization has with customers, suppliers, and stakeholders
A typical definition of a measure includes:
• A specific goal or objective • Data requirements, such as the population the metric will include, the frequency of measurement, and the data source • The calculation methodology, including required equations and precise definition of key terms • Reports in which the data will appear and the graphic presentation that will eventually be used to display the data • Any other relevant rationale for the measure
A clear data collection plan helps streamline the data collection process:
• Identify how much data needs to be collected, the population from which the data will come, and the length of time over which to collect the data. • Identify the charts and graphs to be used, the charting frequency, the type of comparison to be made, and the calculation methodology. • Identify the characteristics of the data to be collected: attribute data are things that can be counted; variable data are things that can be measured. • If the performance measure is new, try to identify existing data sources or create new sources. All data sources need to be credible and cost effective.

Source: Office of the Vice President, *National Performance Review, Serving the American Public: Best Practices in Performance Measurement*, June 1997[8], as cited by the US DOT Office of Operations

TABLE 10. PERSONS CONTACTED ABOUT MEASURES OF EFFECTIVENESS

Agency	Person Contacted
Clark County Department of Air Quality Management	Will Cates, Chuck Richter, and Ron Smolinski
Larry Walker Associates	Betsy Elzufon
Minnesota Pollution Control Agency	Rebecca Helgesen
Oregon Department of Environmental Quality	Kathleen Craig, Agency Toxics Coordinator
Puget Sound Clean Air Agency	Rick D. Hess, Supervising Inspector
San Diego Air Pollution Control District	Anita Tinsley, Public Information Officer
San Diego County Association of Governments	Elisa Arias, Senior Transportation Planner
San Joaquin Valley Air Quality Management District	Charlie Goldberg
South Coast Air Quality Management District	Michael Laybourn
Southwest (Washington State) Clean Air Agency	Kathy Carlson, Public Information Specialist
Spokane County Air Pollution Control Authority	Lisa Woodard, Public Information Officer
Texas Commission on Environmental Quality	Israel Anderson, Director, Small Business and Economic Assistance Kim Herndon, Strategic Assessment Division

Information learned from the interviews conducted with the persons listed in table 10, regarding their agencies' outreach programs, are presented in the following summaries.

California Air Quality Agencies

The San Joaquin Valley is the Nation's largest air basin and also experiences some of the Nation's worst air quality. The San Joaquin Air Quality Management District conducts a comprehensive educational outreach program using the Web, radio, television, and print media, and partners with both local public jurisdictions and private sector industry. A consortium of environmental consulting firms developed "Quantification Methods for Identifying Emission Reductions Resulting from Seasonal and Episodic Public Education Programs" (quotes sted itals)for a number of California air quality agencies.[9] The project was funded by the California Air Resources Board (CARB), and the final research report was published on April 30, 2003. The San Joaquin Valley Air Quality Management District and the Sacramento Metropolitan Air Quality Management District participated in the project.
The project reviewed "Spare the Air" outreach programs conducted in Sacramento, the Bay Area, and the San Joaquin Valley, and assessed conclusions from prior evaluations of the

programs. The previous methods for measuring the effectiveness of these programs were evaluated, and modified methods were developed. The project concluded that surveying the target audience—in this case the general public—was an effective means of measuring the effectiveness of the programs provided the surveys were conducted properly. The exact wording of the survey questions and the order in which the questions were asked were both deemed critical to the validity of the survey.

The method that was developed involved the following steps:

- Identify the target audience of the outreach program.
- Identify, through surveying, two groups.
  - ✓ Members of the audience that respond to the program's message.
  - ✓ A control group of audience members that ignore the program's message.
- Gather, through surveying, data about the activities of both groups that will document the behavior (such as driving) targeted for modification by the outreach program.
- Structure the wording of the survey questions and the order in which the questions are asked to avoid "tipping off" the interviewees about the purpose of the survey until the end.
- As a final question, ask questions designed to determine the interviewee's level of awareness with respect to the outreach program.

The method involved was tested on drivers in the Sacramento area during 1999 and 2000. Surveys of drivers were conducted by telephone in the evenings following a "Spare the Air" air quality alert as well as on days without air quality alerts ("non-alert days"). Two sample populations were identified: First, a group of drivers who said that they intentionally modify their driving habits because of the alerts ("reducers"), and second, a control group who ignored the outreach efforts ("nonreducers"). By conducting surveys of both groups on both air quality alert days and nonalert days, the two sets of data could be compared.

The Sacramento experiment appeared to validate the proposed method and also revealed that the outreach program was successful in significantly reducing vehicle miles traveled during ozone-alert days. A "*Quantification Method Reference Manua*l" also prepared for the CARB documents the recommended method.[10]

Clark County Department of Air Quality Management

Clark County Department of Air Quality Management enforcement officers respond to complaints and also spot check jobsites to ensure that Rule 94, Clark County's fugitive dust control ordinance, is being complied with. The department coordinates with the industry, and proactively seeks industry input on which outreach efforts are most effective. County planners attend monthly meetings of construction industry associations to share information about revisions to regulations and new construction projects. The department just completed

a comprehensive revision of Rule 94, and used focus groups and public open houses to obtain input from the construction industry and the general public.

Levels of criteria pollutants in Clark County are constantly monitored, and the number of exceedances per year are tracked. However, the monitoring data is not directly correlated with outreach efforts.

Maricopa County Environmental Services Department (MCESD)

The MCESD recently completed a "Rule Effectiveness Study for Salt River PM_{10} Study" to review implementation and enforcement of county regulations concerned with control of airborne particulates, including Maricopa County Rule 310.[11] The study team visited earthmoving sites in the study area, and conducted inspection procedures consistent with those proposed to be implemented in order to determine:

- Whether MCESD and the ADEQ inspection procedures are adequate to identify and reconcile compliance with rule requirements.
- The effect that the rule has had on reducing fugitive dust.

The sites inspected were found to be an average of 90 percent in compliance with Rule 310.

The study documented EPA guidelines with respect to the conduct of surveys designed to gather representative data. The study team concluded that inspecting 15 of the 300—or 5 percent—earthmoving sites in the study area resulted in a sample size that would comply with the guidelines obtained from the EPA.

Minnesota Pollution Control Agency

Minnesota is in attainment for all the criteria pollutants; however, the Minnesota Pollution Control Agency is concerned about potential ozone exceedances. The agency is just beginning to develop educational programs in an effort to avoid ozone nonattainment and will be interested in air quality sustainability programs developed by peer agencies. Prior to now, no funds have been spent on outreach or education and, as a consequence, no MOEs have been considered, developed, or applied in Minnesota with respect to air quality outreach.

Oregon Department of Environmental Quality

The State of Oregon, including the Portland area, is in attainment for all criteria pollutants including particulates, and the construction industry in the State is not regulated with respect to fugitive dust generation. Currently, no outreach programs are conducted by the Oregon Department of Environmental Quality. However, the agency is considering the implementation of air quality sustainability programs in the future due to concerns about the increased incidence of asthma in certain areas of Portland. No measures of effectiveness are used by the agency.

Puget Sound Clean Air Agency (PSCAA)

The PSCAA is responsible for the maintenance and enforcement of air quality standards for four Seattle-area counties. The local chapter of the Associated General Contractors (AGC) complained to the agency about the number of Notices of Violation (NOVs) that were being issued for fugitive dust generation during the hot summer months. The PSCAA partnered with the AGC to produce a 24-page "Guide to Handling Fugitive Dust from Construction Projects" that explains the need for fugitive dust control and the best practices. Approximately 3,000 of the guides have been printed and distributed. The AGC originally paid for the design of the brochure, but the PSCAA is currently paying for the printing.

The PSCAA does not spot check sites. When a complaint about fugitive dust generation is received, the site is inspected. If the amount of fugitive dust being generated exceeds that allowed by the regulations of the local jurisdiction in which the site is located, then an NOV is issued.

Rick Hess, supervising inspector of the PSCAA, has also made approximately two one-hour presentations per month to construction industry personnel over the past two years. During each presentation, every participant receives a copy of the guide. So far, he has spoken to more than 2,000 members of the industry.

The effectiveness of the outreach program has been measured by tracking the numbers of complaints received annually, as well as the number of NOVs issued. The rate of compliance is higher since the program began, and the average number of complaints received annually has dropped from 300 to less than 100.

San Diego Air Pollution Control District

The San Diego Air Pollution Control District has found that surveys are the best tool for obtaining feedback from the public. Recipients of collateral material from the Agency often respond to disguised surveys by joining a "Clean Air Club" or completing other actions that enable the Agency to track which literature was read or what Web page was visited. The effectiveness of Agency programs are not measured specifically with respect to outreach activities conducted by the Agency. However, each Agency department tracks the programs for which that department is responsible. For example, the Complaint Department tracks the trend of complaints from year to year, and the Vehicle Buy-Back Program tracks the cost-

effectiveness of its program. All departments participate in an annual review, where goals and objectives are established based on the prior year's performance of each department.

Southwest [Washington State] Clean Air Agency

The Southwest Clean Air Agency, which has jurisdiction over air quality in several counties in Southwest Washington State, in the suburban Portland area, conducts a number of outreach programs including a comprehensive Web site, newsletters, and brochures. At public events that the agency sponsors or at events in which the agency participates, the agency keeps track of which brochures and handouts seem more popular by counting the inventory of collateral material at the end of the day.

One innovation implemented by the agency is the creation of four portable kiosks that can be transported to area schools and libraries. The kiosks can be accessed like computer terminals and disseminate air quality information in entertaining ways, including an "Air Quality Jeopardy" game that can be played by a user. The agency tracks the usage of these kiosks by requesting demographic information from each user and tying that data to the location of the kiosk at the time the information was entered. The kiosks have proved popular with school administrators and others, and are reserved in advance for visits averaging several weeks.

While the kiosks are targeting primarily young persons, the agency is also involved in another outreach effort in a small town whose residents are mostly senior retirees. The community does not have a trash recycling program, and many of the residents are in the habit of burning trash. The agency is educating the residents on the health hazards of trash burning and is encouraging residents to turn in their "burn barrels." As an incentive, the agency is working with a local office supply store to provide discounts for the purchase of a paper shredder by anyone who has surrendered a burn barrel. The effectiveness of the program is being measured by the number of burn barrels being collected, as well as the trend in the numbers of complaints received from neighbors of trash burners.

Spokane County Air Pollution Control Authority

The Spokane County Air Pollution Control Authority (Spokane APCA) has created written tools for communicating fugitive dust concerns to the construction industry, including a widely distributed guidebook and brochure. In addition, the Washington State AGC developed a manual for AGC members. However, the Spokane APCA has not developed any measures of effectiveness for these outreach efforts. According to Spokane APCA officials, field reviews suggest that area contractors are cognizant with fugitive dust-related regulations and are for the most part complying with the rules. In any event, the Spokane APCA experiences very few repeat violators.

Several strategies have been employed in the Spokane area to meet and maintain the PM_{10} standard; however, fugitive dust from construction activities was not found to be a major contributor to PM_{10}.

Texas Commission on Environmental Quality

The Texas Commission on Environmental Quality conducts a number of outreach efforts including an annual Environmental Trade Fair and Conference. The commission has obtained a copy of the "Quantification Method Reference Manual" prepared for the CARB, and is evaluating the possible development of MOES modeled after those recommended to the CARB.

Other Resources

In addition to the interviews conducted and summarized above, two other resources provide additional information regarding the effectiveness of outreach programs.

Texas Transportation Institute

In 2001, the Texas Transportation Institute (TTI) conducted a "National Public Outreach Program Audit Update" that examined the outreach programs being conducted by agencies located in nonattainment areas nationwide.[12] Agencies interviewed were asked which outreach activities were most effective and which were not. Key conclusions of the audit were:

- Broadcasting is perceived to be the most effective way to generate public awareness of air quality and the air quality program message.
- Web sites are another effective way to convey air quality information such as ozone alerts and forecasts, and also provide a means of incorporating an interactive component into the program.
- Program representatives felt that where possible, the program should have a "live" presence in the community (i.e., appearance of program personnel at community events).

Followup surveys conducted by several of the agencies confirmed the effectiveness of broadcasting, Web sites, and participation in live events. A number of the agencies surveyed by TTI have been measuring the performance of their programs in some manner. A matrix of these agencies and their performance measures is shown in table 11.

Commonwealth of Virginia Department of Planning and Budget

Virginia's Department of Planning and Budget provides an online "Guide to Virginia's Performance Budgeting Process" for use by all Virginia agencies.[13] Section 3 of this

TABLE 11. MATRIX OF MEASURES OF EFFECTIVENESS USED BY PEER AGENCIES

Program Title	Agency	Components	Audience	Measure of Effectiveness	Message
Spare the Air	Sacramento Metro Air Quality Management District (AQMD)	Advertising • Brochures E-mail • Fax • ITS* Special Events • Web site	Employers General public Youth	No. of companies participating	Use alternate modes on ozone action days
Spare the Air	Bay Area AQMD	Advertising • Brochures E-mail • Fax • ITS Special Events • Web site	Employers General public	Level of public involvement	Smart commuter choices can improve air quality
Air Quality Public Education	Regional Air Quality Council – Denver	Advertising • Brochures E-mail • Press releases Special Events	Employers General public	Level of employer/ commuter participation	Practice trip reduction (telecommute, carpool, mass transit) on ozone action days
Clean Air Campaign	Georgia State Environmental Agency	Advertising	Employers General public	No. of members	Focus on traffic congestion
Clean Air Updates	Nebraska DEQ	Workshops • Seminars Direct mail	General public Technical Professional	No. of attendees	How to stay in attainment
Smoking Vehicle Program	Nevada Dept. of Motor Vehicles and Public Safety	Billboards • Advertising Promotional materials Phone hotline• Press releases Direct mail	General public	No. of complaints	Cleaning up our air is a call away
Clean Air Fair	Washoe County District Health Department	Advertising • Flyers Promotional materials Special events	General public	No. of attendees	General air quality
Don't Burn Against the Light	Washoe County District Health Dept.	Brochures • Phone hotline Promotional materials Press releases • advertising	General public	Followup surveys	Use alternative transportation on no-burn days
Ozone Action Partnership	Pennsylvania Dept. of Environmental Protection	Billboards • Special Events Press releases • Web site • Brochures Phone hotline E-mail	Employers General public	Followup surveys	Health impacts of ozone – what individuals can do to help
Air Watch Northwest	Puget Sound Clean Air Agency	Advertising • Brochures	Employers General public	Followup surveys	Help people understand relationships between their own actions, the weather, and air quality
Ozone Action Days	Wisconsin Dept. of Natural Resources	Press releases • Press releases• ITS • Fax • E-mail • Phone hotline • Web site	Employers General public	Followup surveys	Tips on what individuals can do – every little bit can help or hurt

Source: "National Public Outreach Program Audit Update," Texas Transportation Institute, 2001[12], *Intelligent Transportation Systems

guide addresses performance measurement and provides comprehensive guidance with respect to measuring the performance of various agency activities. The document provides rationale for and benefits of a system of performance measurement including:

- Charting strategic plan implementation progress.
- Obtaining feedback on constituent satisfaction and demands.
- Indicating the level of achievement of an activity or program.
- Enhancing public understanding of a program.
- Linking the cost of the program to results.
- Assessing how well the agency is meeting established standards.

According to the Virginia Department of Planning and Budget, a successful performance measurement system will have the following characteristics:

- Included in a strategic planning process.
- Focuses on outcomes or results, not processes.
- Uses a few balanced, key indicators to measure performance.
- Generates data consistently over time.
- Includes both internal and external comparisons.
- Reports regularly and publicly.
- Informs both policy and program decisions.
- Promotes swift feedback to managers and front-line employees who can use the information to improve operations.

The Virginia document includes an extensive discussion concerning the implementation of performance measures, including the conduct of a pilot program that is discussed in detail in a subsequent section of this chapter.

ADOT

ADOT itself is conducting surveys that can provide some baseline data and provide as model elements of a future performance measurement program. For example, concurrent with construction and earthmoving work related to the improvement of State Route (SR) 51, residents in the freeway corridor are being surveyed to determine how the freeway construction is affecting them. Postcard survey forms enclosed in plastic sleeves are left on doors in the neighborhood for residents to complete and return to ADOT. Included among the questions asked is whether "Crews have done a good job of controlling construction dust." The findings of the survey are published in a newsletter and mailed to area residents.[14] Extra copies of the newsletter are also provided to local merchants for distribution to customers.

The experiences of peer agencies were reviewed and evaluated in the process of developing recommended measures of effectiveness. These recommended measures are discussed in the following section.

RECOMMENDED MEASURES OF EFFECTIVENESS

This section recommends MOEs that could be used to assess the proposed Blue Skies program.

Table 12 lists potential MOEs, which are grouped under two categories: 1) reducing fugitive dust; and 2) educating the construction industry. Some of the measures will require that new mechanisms be implemented to collect data while other measures could use existing data-collection mechanisms.

TABLE 12. OUTREACH PROGRAM MOES

Measure
Reducing Fugitive Dust
• Annual change in the Phoenix area visibility index. • Trends in annual PM_{10} concentrations at monitors located near construction dust sources. • Number of construction dust complaints per acre. • Number of Rule 310 corrective actions issued per earthmoving site inspection. • Weighted percent compliance with Rule 310 at inspected earthmoving sites and reduction in PM_{10} emissions from earthmoving activities. • Percent of survey respondents who feel that construction sites are doing a [good/better] job of controlling dust.
Educating the Construction Industry
• Number of Blue Skies contractors. • Number of dust control specialists certified. • Number of dust control instructors certified. • Number of individuals completing training. • Number of unique visitors to the Web Site. • Number of toolkits handed out. • Number of brochures handed out. • Percent of construction company [owners/employees/supervisors] who feel that their firms are doing a [good/better] job of controlling dust. • Percent of Blue Skies program trainees who feel that their construction firms are doing a [good/better] job of controlling dust.

Normalizing the Data

Care should be taken in interpreting MOEs, even if they have been normalized. For example, annual rainfall amounts will affect the visibility index. Should the number of complaints be evaluated per acre under construction, or per number of construction permits issued? The sections labeled "Other Potential Factors Influencing the MOE" under each of the MOE discussions below identify some of the external influences that make it difficult to quantify the effectiveness of the Blue Skies program.

GOAL: REDUCING FUGITIVE DUST

The MOEs discussed in this section have been developed to gauge the success of the Blue Skies program in terms of the ultimate goal, which is to reduce construction dust so that particulate air pollution (PM_{10}) is minimized. As previously discussed, measuring the reduction in PM_{10} directly attributable to the Blues Skies program is challenging, due to parallel and confounding influences, such as other PM_{10} education and outreach efforts, changes to Rule 310 and its enforcement, and serendipitous natural events (i.e., precipitation, high winds, drought conditions). Despite these difficulties, it is important to quantify the effectiveness of the program, to the extent possible, in terms of real-world reductions in pollution.

Each of the following MOEs alone is an indirect measure of the effectiveness of the Blue Skies program in reducing construction dust and PM_{10}. Taken in aggregate, however, the MOEs provide a more reliable picture of the general trends in reducing dust and PM_{10} at construction sites. Baseline measurements will be taken before the Blue Skies program is initiated, and positive trends in a majority of the MOEs each year thereafter could be at least partially attributed to the Blue Skies program. If the trends in a majority of the MOEs when compared with the previous year are negative, then this would signal a need to strengthen the Blue Skies program (i.e., hold more classes, obtain additional funding, and encourage broader industry participation and certification).

MOE – Annual Change in the Phoenix Area Visibility Index

Description of MOE

Executive Order 2000-3 directed the Governor's Brown Cloud Summit "to establish options for a visibility standard or other method to track progress in improving visibility in the Phoenix area." In January 2001, the summit recommended an interim visibility measure called "Blue Sky Days," defined as six hours or more with at least 25-mile visibility. The summit set targets to increase the number of Blue Sky Days in the Phoenix metropolitan area from 250 in 2001 to 275 in 2003. The summit recognized that "Blue Sky Days" was an imprecise visibility measure and recommended that another index be developed utilizing a public participation process. This process called for a representative cross-section of residents of the Phoenix metropolitan area to determine what visual air quality is desirable, what visual range is acceptable, and how often the combination of acceptable visual range and air quality is preferred.

In 2001, House Bill 2538 acted upon the summit's recommendation and required the ADEQ director to establish a daily visibility index to evaluate and report current visibility conditions and progress towards visibility improvement goals in Area A—the urbanized portion of Maricopa and Pinal Counties. In 2002, ADEQ formed the Visibility Index Oversight Committee and hired a contractor to develop and conduct a public survey.

In May 2003, the committee recommended a Phoenix Area Visibility Index (PAVI) for Area A, based on the results of the public survey. The PAVI is based on the highest daily 4-hour rolling average visibility, and is measured in deciviews. Particulate matter absorbs or deflects light waves in the atmosphere, resulting in a measurable loss—or extinction—of light. A deciview could be defined as the smallest change in the light level (due to the presence of particulate matter) that would be discernable to the human eye.[15]

The visibility index will be reported as follows: 14 deciviews or less will be classified as Excellent; 15-20 deciviews, Good; 21-24 deciviews, Fair; 25-28 deciviews, Poor; and 29 or more deciviews, Very Poor. The committee recommended the following visibility goals:[16]

- Show continued progress through 2018.
- Move days in the poor/very poor categories up to the fair category.
- Move days in the fair category up to the good/excellent categories.
- Progress assessment to be conducted every five years through 2018.

ADEQ is currently in the process of measuring visibility with transmissometers and will post PAVI values on their Web site. When compared on an annual basis, the PAVI provides a rolling measure of changes in visibility. If the number of days in the higher categories (fair and above) increase by a substantial margin, then visibility has improved, relative to the previous year. Conversely, if the days in the poor and very poor categories increase significantly, then visibility has deteriorated. There would need to be a significant change (i.e., at least 20 percent) in the number of days in these categories in order to signal a human-induced change in visibility, since weather and other uncontrollable conditions (i.e., wild fires) could result in normal annual fluctuations.

While PM_{10} in general, and construction dust in particular, is a minor contributor to regional visibility impairment, significant changes in the PAVI could be a trigger for improvements in the Blue Skies program. If the PAVI worsens, especially in tandem with negative trends in a majority of other dust reduction MOEs, then this could serve as an indicator that the Blue Skies program needs to be strengthened. On the other hand, if the index shows no change or a visibility improvement in a given year, no adjustment to the Blue Skies program would be warranted, at least on the basis of its impact on visibility.

Data Collection

ADEQ is collecting data and will post the information necessary to determine the annual rate of change in the PAVI. A date should be chosen to assess the change each year, for example, January 1. If the number of days in the poor and very poor categories increases significantly (i.e., by more than 20 percent) relative to the previous year, then it could be assumed that visibility is deteriorating and action to strengthen the Blue Skies program should be considered. Otherwise, visibility is either not changing significantly or is improving, in which case, no action to improve the Blue Skies program would be indicated.

Other Potential Factors Influencing the MOE

Other factors potentially affecting the annual change in PAVI include:

- Climate.
- Forest fires.
- Increased enforcement of Rules 310 and 310.01.
- Other PM_{10} control measures.
- Stricter Federal standards for light duty and heavy duty tailpipe emissions.
- New measures that may be implemented to reduce regional haze in Class I wilderness areas (i.e., the Superstitions).
- Stationary source emissions (i.e., SO_2 from power plants).
- Transport of air pollutants from elsewhere (i.e., California, Texas, Mexico or Asia).

MOE –Trends in 24-Hour PM_{10} Concentrations at Monitors Located Near Construction Dust Sources

Description of MOE

Currently, the PM_{10} monitors in the Phoenix Metropolitan region located closest to sources of construction dust are the West Chandler monitor, near the construction of the San Tan Freeway, and the Higley monitor, near the growing town of Gilbert. The average 24-hour PM_{10} concentration each year at these monitors would be an indirect measure of the effect that the Blue Skies program is having on construction dust, especially if a concerted effort is made to provide training and outreach to personnel working on construction projects near the monitors.

Data Collection

Maricopa County collects PM_{10} data every sixth day at the West Chandler and Higley monitors. The annual average PM_{10} concentrations at these two monitors (and others that might be influenced by local construction activity) are provided in an annual report by the MCESD. If these annual values improve each year, then no further action need be taken. However, if these averages worsen, then additional steps should be taken to ensure that dust control training is provided to all employees working at construction sites near the monitors. As employees in these areas are trained, it will be useful to observe the monitored values in subsequent years, keeping in mind that other sources besides construction may be influencing the readings. Providing training to construction employees working near the monitors will reduce the possibility that high PM_{10} readings are caused by these sources.

Other Potential Factors Influencing the MOE

Factors potentially affecting trends in 24-hour PM_{10} monitors include:

- Nonconstruction sources of PM_{10} located near the monitors such as
  - ✓ Agriculture.
  - ✓ Dirt roads.
  - ✓ Reentrainment created by vehicles on paved roads.
  - ✓ Unpaved parking lots.
  - ✓ Other vacant, disturbed areas.
- Increased compliance with Rule 310.
- Climate (i.e., level of precipitation, number of high wind events).

MOE – Number of Construction Dust Complaints Per Acre

Description of MOE

Tracking the number of construction dust complaints is a measure of the effectiveness of the Blue Skies program, as well as efforts on the part of the construction industry and Maricopa County to increase compliance with Rule 310. To correct for normal fluctuations in regional economic activity, this measure should be normalized to (divided by) the total number of acres for which earthmoving permits have been pulled in any given year.

Reductions in the number of construction dust complaints per acre would indicate that efforts such as the Blue Skies program are successful in reducing dust. Increases in this MOE, especially if accompanied by negative trends in a majority of other MOEs, would indicate a need to strengthen the Blue Skies program, as well as Rule 310 enforcement efforts by Maricopa County.

Data Collection

MCESD would be the source for annual statistics on the number of construction dust complaints and the number of acres covered by active earthmoving permits.

Other Potential Factors Influencing the MOE

Other factors potentially influencing the number of construction dust complaints per acre are:

- Increased compliance with Rule 310 due to factors other than the Blue Skies program such as:
  - ✓ Other PM_{10} training and outreach initiatives.
  - ✓ Increased enforcement by Maricopa County.
  - ✓ Efficacy of environmental management systems conducted by the construction companies.
- Heightened public awareness of the Maricopa County Dust Hotline.

MOE – Number of Rule 310 Corrective Actions Issued Per Earthmoving Site Inspection

Description of MOE

The number of corrective actions (Notice to Correct, Compliance Status Notification or Notice of Violation) issued by Maricopa County on earthmoving site inspections is one measure of the level of construction industry compliance with Rule 310. To correct for variations in the number of inspectors and site visits, this measure should be normalized to the total number of construction site inspections conducted in any given year.

Decreases in the number of corrective actions per inspection would indicate that construction sites are complying more effectively with Rule 310. This could be a result of the Blue Skies program and/or other concurrent educational and enforcement efforts on the part of the construction industry and Maricopa County. Increases in this MOE, especially in concert with negative trends in a majority of other MOEs, would signal a need for strengthening the Blue Skies program.

Data Collection

MCESD would be the source for annual statistics on the number of Rule 310 corrective actions issued and the number of earthmoving site inspections performed.

Other Potential Factors Influencing the MOE

Other factors potentially influencing this MOE include:

- Increased compliance with Rule 310 due to factors other than the Blue Skies program such as:
  - ✓ Other PM_{10} training and outreach initiatives.
  - ✓ Increased enforcement by Maricopa County.

- ✓ Efficacy of environmental management system conducted by the construction companies.

- Heightened public awareness of the Maricopa County Dust Hot-Line

MOE – Weighted Percent Compliance with Rule 310 at Inspected Earthmoving Sites and Reduction in PM_{10} Emissions From Earthmoving Activities

Description of MOE

This MOE measures annual compliance with Rule 310 based on construction site inspections. MCESD recently completed a Rule 310 effectiveness study for the Salt River area. As part of this study, 32 earthmoving sites were inspected in December 2002 and the spring of 2003.[10] An inspection team visited each site and completed a Maricopa County Earthmoving Site Inspection Form; points were then assigned to each of the Rule 310 requirements as shown in table 13. If a corrective action was necessary for any of the first eight requirements in the table, the points were reduced. If a Notice to Correct was issued, the points were reduced by 50 percent. For a Compliance Status Notification, the points were cut by 75 percent. For a Notice of Violation, no points were awarded. For the last four requirements in the table, either "yes" (all points) or "no" (no points) were assigned.

TABLE 13. RULE 310 RULE EFFECTIVENESS STUDY POINT SYSTEM

Requirements	Points
Unpaved haul/access roads	10.00
Disturbed surface areas	10.00
Trenching operations	10.00
Trackout control device	10.00
Trackout along a paved public roadway (≤ 50 ft., >50 ft)	10.00
Bulk material handling onsite within boundaries or work site	10.00
Bulk material handling offsite onto paved public roadways	10.00
Water supply/availability	10.00
Permit onsite	1.25
Dust control records onsite	1.25
Project information sign posted	1.25
Visible emissions evaluation conducted	1.25
Total	85.00

Source: MCESD, *Rule Effectiveness Study for Salt River PM_{10} Study*, 2003[10]

For this MOE, the weighting scheme described above could be applied to all or a statistically-significant random sample of earthmoving inspections conducted by Maricopa County each year. This would provide an annual measure of construction site compliance with Rule 310. A year-to-year comparison of Rule 310 effectiveness for earthmoving activities would indicate whether efforts such as the Blue Skies program, together with other educational and enforcement activities, are having a positive impact on compliance levels. In addition, if there is an increase in effectiveness, this measure can be used to estimate the total annual reduction in PM_{10} emissions attributable to improved compliance at construction sites.

Data Collection

The MCESD could calculate the weighted average Rule 310 effectiveness using all (or a sample) of the Earthmoving Site Inspection Forms completed by their inspectors each year. The PM_{10} emissions reduction attributable to increased compliance with Rule 310 at earthmoving sites could be estimated using the PM_{10} emissions inventories shown in the *Revised MAG 1999 Serious Area Particulate Plan for PM_{10} for the Maricopa County Nonattainment Area*, February 2000. Daily PM_{10} emissions in 2001 are shown in Table II-2 of this plan.[2] For the construction-related emissions in this table, the Rule 310 compliance rate was assumed to be 30 percent. Daily PM_{10} emissions in 2006, assuming implementation of the 77 control measures in the PM_{10} plan, are shown in Table VI-1 of this plan. With strengthening and increased enforcement of Rule 310, Table VI-1 assumes that the compliance rate among construction activities increases from 30 to 80 percent in 2006.

Other Potential Factors Influencing the MOE

Other factors potentially influencing this MOE include increased compliance with Rule 310 due to factors other than the Blue Skies program such as:

- Other PM_{10} training and outreach initiatives.
- Increased enforcement by Maricopa County.
- Efficacy of environmental management systems conducted by the construction companies.

MOE – Percent of Survey Respondents Who Feel that Construction Sites are Doing a Good Job of Controlling Dust

Description of MOE

This MOE addresses public perceptions of the efforts that the construction industry is making to reduce dust. It would be optimal if a survey could be performed before the Blue Skies program begins, in order to establish a baseline of public opinion. Each year, the responses could be tallied to determine if the percent of respondents who feel that construction sites are doing a good or excellent job of controlling dust has changed. Ideally, the annual survey responses will show that construction sites are doing a better job of controlling dust over

time. If so, this improvement could be partially attributable to the Blue Skies program. If there is no improvement in the public's perception, then this would indicate a need to strengthen the Blue Skies program, especially the outreach dimension.

Data Collection

To be statistically valid, this information would be collected annually as part of a formal public opinion survey using a randomly selected set of interviewees. The question might be posed as follows: "Construction sites in my area are doing a _____ job of controlling dust." The choices to complete the sentence would be: excellent, good, fair, poor, and very poor, or much better, better, about the same, worse, much worse.

The number of survey respondents who perceive that construction sites are doing a "good" or "excellent" (or "better" or "much better") job would be divided by the total number of survey responses to calculate the MOE.

Other Potential Factors Influencing the MOE

Factors that potentially affect this MOE include:

- Increased compliance with Rule 310 due to factors other than the Blue Skies program such as:
  - ✓ Other PM_{10} training and outreach initiatives.
  - ✓ Increased enforcement by Maricopa County.
  - ✓ Efficacy of environmental management systems conducted by the construction companies.
- Environmental conditions, i.e., high winds, drought, water shortages.
- Economic conditions, i.e., slowdown in regional construction activity; jump in cost of water and dust palliatives.

GOAL: EDUCATING THE CONSTRUCTION INDUSTRY

Measures of effectiveness discussed in this section measure the success of the PM_{10} outreach program in educating the construction industry in dust control at construction sites. These measures fall into three categories: those that involve the evaluation of statistical data; those that involve the review of collateral material inventories; and those that involve the conduct of surveys. Discussions of the three categories of MOEs designed to measure the success of educating the construction industry follow.

Measures of Effectiveness Involving the Evaluation of Statistical Data

Measures involving the evaluation of statistical data include:

- Number of Blue Skies contractors.
- Number of dust control specialists certified.
- Number of dust control instructors certified.
- Number of individuals completing training.
- Number of unique visitors to the Web site.

Descriptions of MOEs

The number of contractors that have signed up as Blue Skies contractors measures both awareness and support by contractors. The second, third, and fourth MOEs measure the number of construction personnel that have attained specific levels of training in dust control. The final MOE in this category tracks one aspect of awareness of the program by identifying the numbers of persons visiting the Web site.

Data Collection

Data collection for the first four MOEs entails the tabulation and reporting of statistics collected as Blue Skies contractors sign up, dust control specialists/inspectors are certified, and trainees complete training. The data for these measures should be evaluated biannually.

Online services exist that are able to monitor the traffic of a particular Web site and track the number of unique visits to the site, as recommended by the fifth MOE. For a nominal fee, the program could subscribe to such a service. Depending upon the level of detail desired, data such as the internet domain of each site visitor can be tracked, facilitating a statistical analysis of the audience that the site is reaching.

Other Potential Factors Influencing the MOE

External events, such as an air quality-related policy or regulation change or controversy, could make the outreach program a hot-button issue, resulting in a sudden spike in program participation as well as Web site visits. While this increased participation will be welcomed, a subsequent defusing of the issue—whether caused by genuine resolution of the air quality issue itself or by the media turning its attention elsewhere—will inevitably result in reduced program participation and site visits. Data collected that reflects these spikes will need to be footnoted so that the real trend of program participation measured by each of these MOEs over time will be evident.

Measures of Productivity Involving the Review of Collateral Material Inventories

Measures involving the review of collateral material inventories are:

- Number of toolkits handed out.
- Number of brochures handed out.

Descriptions of MOEs

Tracking the volume of collateral material consumed by training sessions or otherwise distributed to interested persons is an additional indicator of the level of interest in the program. Such tracking will need to be conducted routinely by the program coordinator in order to ensure adequate inventories of the material, and these MOEs will require little additional effort.

Data Collection

Supply counts will be made before and after each event where material is to be distributed and the amount consumed will be logged. Additional information tracked can include the types of events—trade shows, presentations to construction industry groups, and so on—where different brochures seem most popular. The log could be set up as an electronic spreadsheet into which information was entered after each training session or event where material was used. The spreadsheet could be set up so that data entered only once would serve both for inventory control and statistical tracking. As patterns of program participation at periodic events such as presentations to specific organizations become established, comparisons with prior years could be made.

Other Potential Factors Influencing the MOE

In the formative months and years of the program, collateral materials will be modified and adopted following feedback received from trainees and others to whom they are distributed. Different brochure styles and headlines will appeal to different individuals—perhaps intentionally so. External events, such as an air quality-related policy or regulation change or controversy, could make the subject of a particular brochure—or of the entire outreach program—a hot-button issue, accelerating the consumption of collateral.

Measures of Effectiveness Involving the Conduct of Surveys

Measures involving the conduct of surveys are:

- Percent of construction company [owners/employees/supervisors] who feel that their firms are doing a [good/better] job of controlling dust.

- Percent of Blue Skies program trainees who feel that their construction firms are doing a [good/better] job of controlling dust.

Descriptions of MOEs

The objectivity of persons directly involved in the activity that is the subject of the outreach program could be questioned. Nevertheless, the perceptions of these individuals provide useful feedback. Construction personnel might be overly optimistic about the performance of their firms with respect to fugitive dust control. Conversely, if construction personnel themselves perceive that elements of the program are ineffective, chances are that the general public will share that view.

Data Collection

The data would be collected annually in a telephone survey. The interviewees would be selected randomly from lists of licensed contractors and from lists of program trainees. The question to the contractors might be posed as follows:

> "Compared with last year, our firm's ability to control fugitive dust during earthmoving operations has _____."

Where the choices are: improved/ remained the same/ gotten worse/don't know.

Questions to program trainees could include the same question posed to the contractors as well as:

> "With respect to your firm's ability to control fugitive dust during earthmoving operations: In your opinion, the Blue Skies training you received has proved very _____."

Where the choices are: beneficial/somewhat beneficial/of little benefit/don't know.

Other Potential Factors Influencing the MOE

As with the other MOEs designed to measure the effectiveness of industry education, the timing of the surveys with respect to external events will be critical. If air quality is a front page issue at the time of the surveys, interviewees will more likely be willing to participate in the first place, and will be more likely to give optimistic responses regarding the performance of their firms. In the early part of the program, the number of individuals who have already completed training would likely represent too small a sample to render statistically valid data. However, surveying 5 percent of the contractors would fall within EPA guidelines[10] and, at some point at least 5 percent of area construction personnel will have taken the training.

IMPLEMENTING PERFORMANCE MEASUREMENT

This section of the chapter covers the implementation of the measures of effectiveness. First, the initial groundwork for performance measurement implementation is discussed. Next, the concept of a pilot performance measurement program is presented. Finally, the initiation of long-term tracking is discussed.

Laying the Groundwork

At the same time that the Blues Skies outreach and training program itself is being implemented, the groundwork needs to be laid for implementing the procedures for measuring the performance of the program. This groundwork will consist of the following steps:

- Final selection of the performance measures.
- Identification of the types of data needed for the conduct of the measurements selected.
- Identification and development of the procedures for gathering data.
  - ✓ Measurement mechanisms for gathering baseline data.
  - ✓ Measurement mechanisms for long-term tracking.
  - ✓ Establishment of measurement periods for each MOE.
- Establishment of baseline data.
- Development of budgets for surveys, data collection, and analysis.

Table 14 presents a schedule of the recommended MOEs with suggested measurement mechanisms and measurement periods for each.

Prototype Performance Measurement Program

One means of implementing performance measurement that has been used successfully in Virginia agencies is the conduct of a pilot program, testing one or more measures of effectiveness that are a subset of the ultimate array that has been selected.[12] One approach would be to identify those measures, such as those listed in the "Reducing Fugitive Dust" section of Table 12, for which baseline data may be readily available. Conversely, baseline data for the MOEs concerned with construction industry training will not become available until some training has already taken place. Just as a prototype training class will be conducted to fine tune the program itself, prototype performance measurement activity can be conducted to assess the complexity and time required for collecting and analyzing different sets of data.

TABLE 14. MEASUREMENT SCHEDULE

Measure	Measurement Mechanism	Measurement Period
Reducing Fugitive Dust		
• Measured improvements in the Visibility Index	• Obtain from ADEQ	Annually
• Declining trends in annual PM-10 concentrations at monitors located near construction dust sources • Reduction in number of construction dust complaints per construction permit, per acre • Reduction in number of violations by construction companies per construction permit, per acre • Increased compliance with Rule 310 at construction sites	• Obtain from MCESD	Annually
• Increase in the number of survey respondents who feel that construction sites are doing a better job of controlling dust	• Public opinion survey	Annually
Educating the Construction Industry		
• Number of Blue Skies contractors • Number of dust control specialists certified • Number of dust control instructors certified • Number of individuals completing training	• Collect and Tabulate Statistics	Biannually
• Number of Web site visits unique visitors	• Obtain from on-line vendor	Biannually
• Number of toolkits/brochures handed out	• Collect and Tabulate Statistics	After each session or event
• Percent of construction company [owners/ employees/supervisors] who feel that their firms are doing a [good/better] job of controlling dust • Percent of Blue Skies program trainees who feel that their construction firms are doing a [good/better] job of controlling dust	• Survey, Collect and Tabulate Statistics	Annually

In addition to facilitating budget refinement for the performance measurement process, the prototype performance measurement activity may suggest additional measures of effectiveness and also suggest appropriate target goals for program performance. The program coordinator, or a staff member who will ultimately be responsible for conducting the performance measurement over the long-term, should perform the prototype measurements

and document each procedure. Elements of the process that should be noted and described include:

- The amount of time, per record, required to conduct each measurement.
- The cost, per question asked, of any surveying performed by a contract firm.
- The availability of data needed for each MOE tested.
- Any issues with respect to the willingness of the sources of data to provide the data, of candidate interviewees to be surveyed, and so forth.
- Any pertinent feedback and suggestions received from data sources or survey interviewees that could be used to improve the process.

Following data collection, the prototype data analysis will include both a statistical evaluation of the data itself and a logic check of the future usefulness of the measure tested. This determination will take into consideration the time involved, anticipated budget constraints, and any difficulties encountered during the data gathering. The findings from the prototype performance measurement exercise will be used to define the procedures for long-term tracking and to develop a budget for the ongoing performance measurement process.

Initiation of Long-term Tracking Process

After the MOEs have been fine tuned subsequent to the prototype exercise, and as the baseline data for each MOE become available, the measurement process for each MOE can be activated as its measurement period occurs. Performance targets should be set for those elements of program performance over which the program has significant control, such as the numbers of persons trained or certified. At the end of the first year of performance measuring, the performance measurement routine itself should be evaluated, and MOEs added, dropped, or modified as needed to enhance the significance of the process.

The findings of the performance measurement process represent an important tool for building and maintaining the political constituency needed to fund ongoing program operations. These findings should be presented in a clear and concise style appropriate for the stakeholders upon whom the program depends.

SECTION ONE REFERENCES

1. Environmental Protection Agency (EPA), *40 CFR Part 52, Approval and Promulgation of Implementation Plans; Arizona – Maricopa County PM-10 Nonattainment Area: Serious Area Plan for Attainment of the Annual PM-10 Standard*, 2000.
2. Maricopa Association of Governments*, Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area,* 2000.
3. Governor's Brown Cloud Summit*, Final Report,* 2001.
4. Maricopa County Small Business Environmental Assistance Program.
5. Paradise Valley Community College, Environmental Health and Safety Technology Program.
6. *Arizona Comparative Environmental Risk Project,* 1995.
7. Szyliowicz, Joseph S., "Measuring the Effectiveness of Public Involvement Approaches," *TR News*, May-June 2002, pp. 35-38.
8. Office of the Vice President, *National Performance Review, Serving the American Public: Best Practices in Performance Measurement*, June 1997.
9. California Air Resources Board, *Quantification Methods for Identifying Emission Reductions Resulting from Seasonal and Episodic Public Education Programs*, 2003.
10. California Air Resources Board, *Quantification Method Reference Manual – A Method to Measure Travel and Emissions Impacts of Ozone Action Public Education Programs*, 2003.
11. Maricopa County Environmental Services Department – Air Quality Division: Planning and Analysis Section, *Rule Effectiveness Study for Salt River PM_{10} Study*, 2003.
12. Texas Transportation Institute, *National Public Outreach Program Audit Update*, 2001.
13. Commonwealth of Virginia Department of Planning and Budget, *Guide to Virginia's Performance Budgeting Process - Section 3: Performance Measurement*, 2002.
14. Arizona Department of Transportation, *SR 51 Construction Alert Progress Update*, June 2003.
15. U.S. Environmental Protection Agency – Office of Air Quality Planning and Standards, *Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information, Appendix G: Measures of Visibility Impairment and Light Extinction,* Research Triangle Park, NC, 1996.
16. Neuroth, Gary R., Air Pollution Evaluations & Solutions, *Presentation of Possible Forms for a Phoenix Area Visibility Index*, Visibility Index Oversight Committee, January 2003.

SECTION TWO

BACKGROUND
AND PROJECT CONTEXT

5. CRITERIA POLLUTANTS IN MARICOPA COUNTY

INTRODUCTION

The purpose of this chapter is to describe carbon monoxide, ozone, and particulates—the three criteria pollutants for which Maricopa County is currently designated a nonattainment area. The characteristics, health effects, and trends for these pollutants are discussed, as well as relevant designations, plans, and studies. While Federal standards also exist for three other criteria pollutants, namely, nitrogen dioxide, sulfur dioxide, and lead, the county does not violate these standards. Since the focus of the ADOT research is reducing fugitive dust, this chapter includes a more detailed discussion of the sources and control measures associated with PM_{10}.

Over the last two decades, the County has grown at an average annual rate of about 4 percent, representing one of the fastest growing areas of the country. Figure 10 illustrates that the residents and jobs have more than doubled in twenty years. Daily vehicle travel grew at an even brisker pace over this period, nearly tripling, as shown in figure 11.

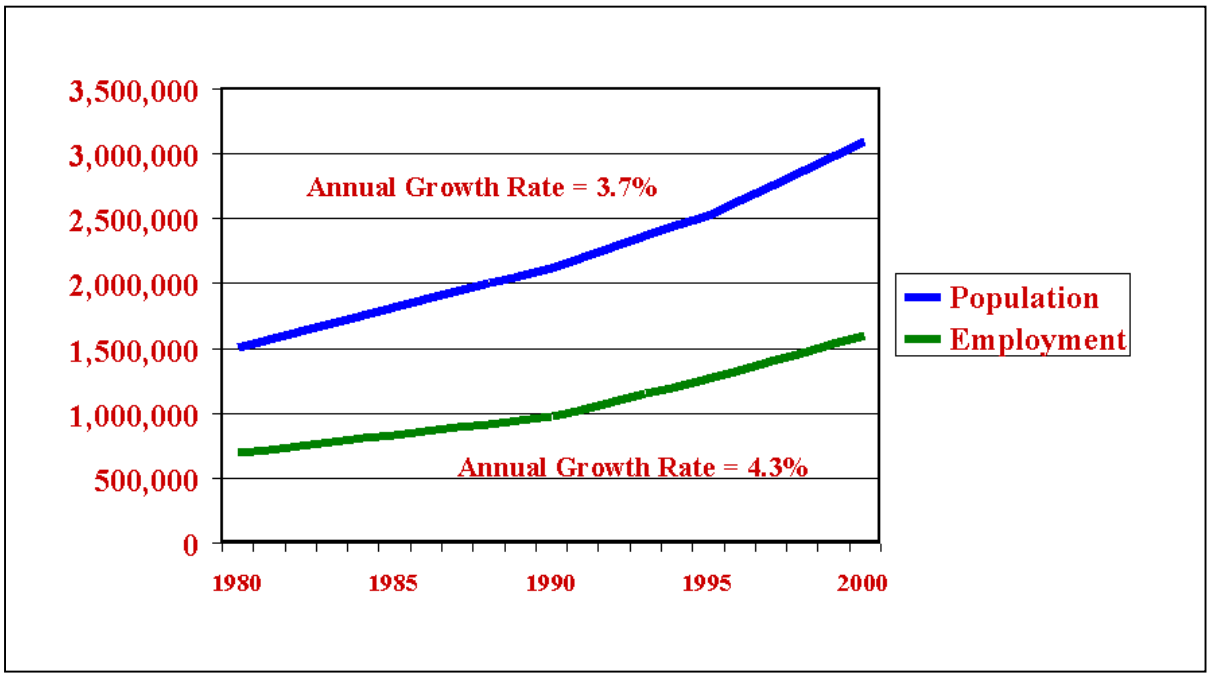


FIGURE 10. DEMOGRAPHIC TRENDS – MARICOPA COUNTY POPULATION AND EMPLOYMENT

Source: Maricopa Association of Governments [1]

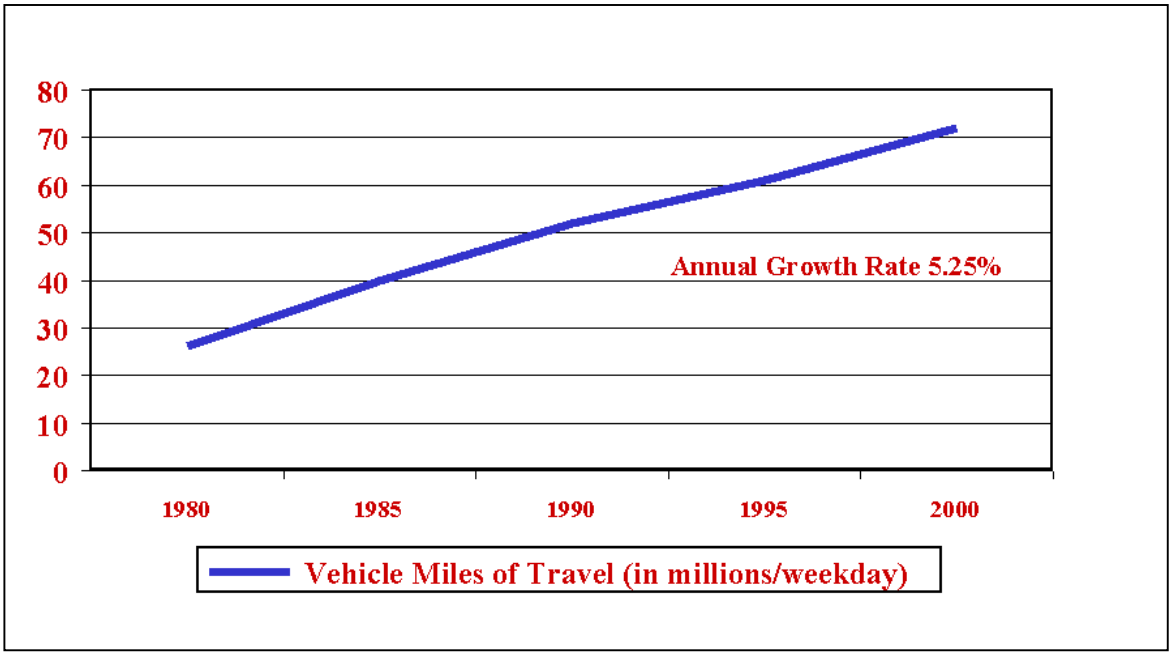


FIGURE 11. DEMOGRAPHIC TRENDS – MARICOPA COUNTY VEHICLE TRAVEL

Source: Maricopa Association of Governments [1]

CARBON MONOXIDE

Carbon monoxide (CO) is produced by the incomplete combustion of carbon in fossil fuels. Most carbon monoxide is emitted in the tailpipe exhaust of vehicles traveling on roads, with a smaller contribution from nonroad engines, such as construction equipment, trains, and airplanes. CO emissions are also a byproduct of commercial and residential heating. Peak concentrations typically occur along roadways and near intersections with high levels of traffic and congestion. Calm winds during the late fall and winter, coupled with night and morning ground-based temperature inversions, cause stagnant weather conditions that can result in the buildup of CO concentrations.

CO is a colorless, odorless, and tasteless gas that, when inhaled, interferes with the delivery of oxygen to human organs and tissues. Long exposure at high levels poses the greatest risk to those with cardiovascular disease, but healthy individuals may also experience dizziness, headaches, fatigue, and visual impairment from high exposure to CO.

CO Trends

As a result of measures such as tighter Federal standards for new car emission controls, a centralized and enhanced vehicle emissions inspection program, and winter oxygenated fuels, local carbon monoxide concentrations have declined dramatically since the 1980s, as shown in figure 12. It is especially interesting to note that the maximum concentration in 2000 was only 7.4 ppm, less than 85 percent of the standard. The sizeable reduction in peak

concentrations between 1999 and 2000 (i.e., 30 percent) may be partially attributable to the requirement that only California Air Resources Board (CARB) Phase 2 reformulated gasoline with 3.5 percent oxygenate can be sold at service stations in the winter, beginning on November 1, 2000.

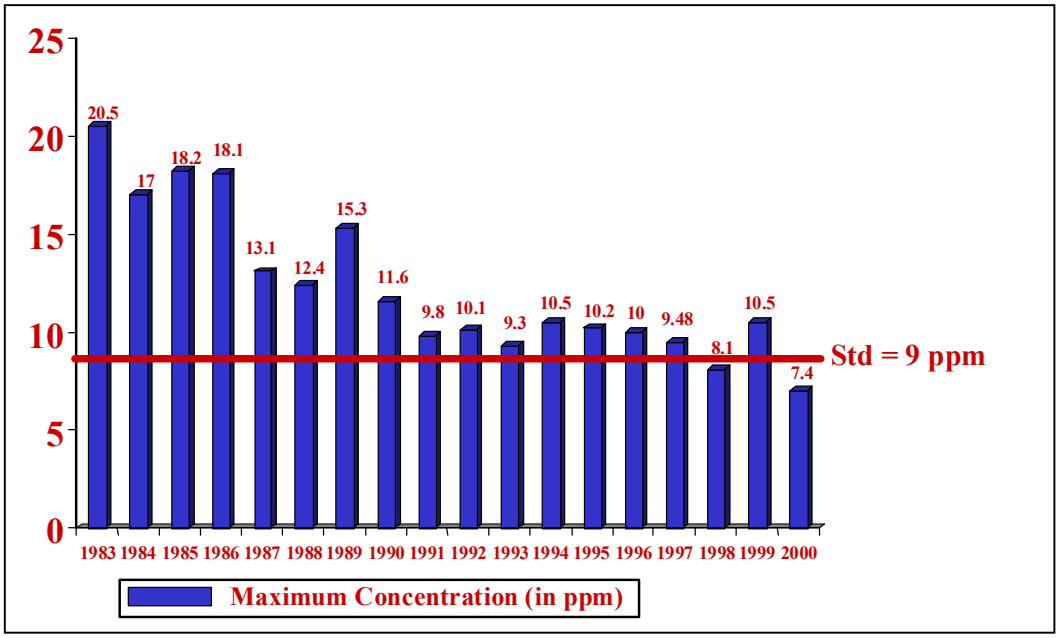


FIGURE 12. CARBON MONOXIDE TRENDS – MAXIMUM EIGHT-HOUR CONCENTRATIONS

Source: Arizona Department of Environmental Quality, *Appendix I, Air Quality Report*, 2000, Maricopa County Environmental Services Department (MCESD), Air Quality Division, *2000 Network Review,* 2000.[2,3]

Figure 13 indicates that the number of days exceeding the CO standard also plummeted during the 1990s. In fact, since 1996, only one exceedance has occurred, at the monitor located near the six-legged intersection of Thomas Road, Grand Avenue, and 27th Avenue. In order to cause a violation of the eight-hour standard, the second highest CO reading over a two-year period must be 9.5 ppm or higher. Although the Thomas Road monitor exceeded the standard on November 20, 1999, no additional exceedances were recorded at that monitor in 1998-2000 and therefore, no violation of the standard occurred. Attainment is achieved when there are no violations of the standard. [2,3]

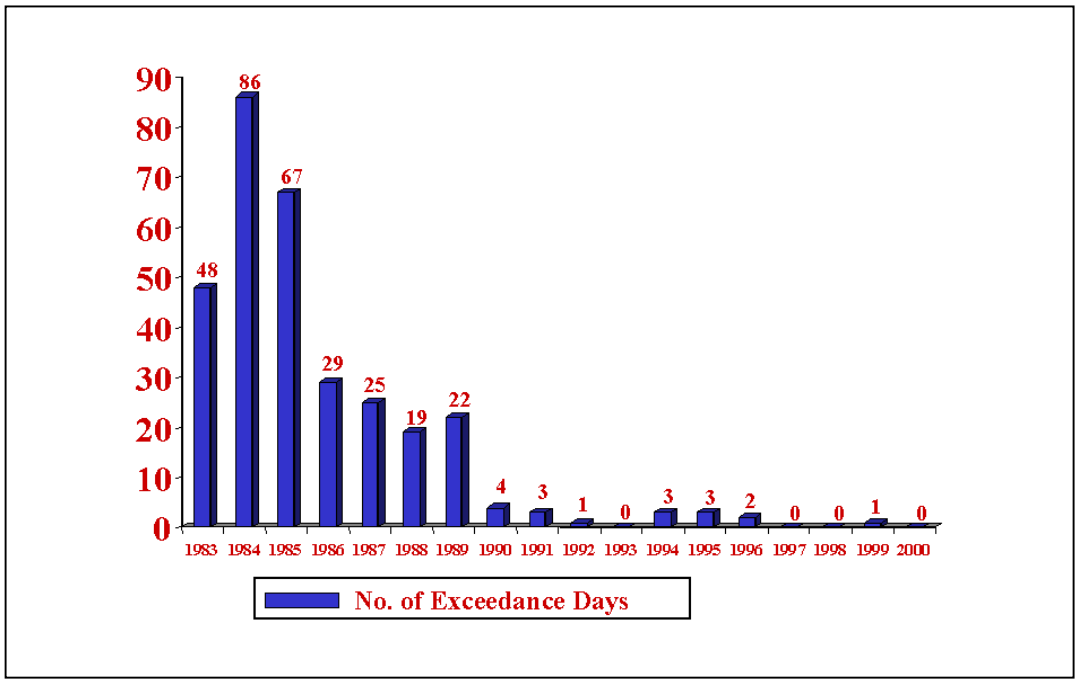


FIGURE 13. CARBON MONOXIDE TRENDS – DAYS EXCEEDING THE EIGHT-HOUR STANDARD

Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.[2,3]

CO Designations and Plans

The CO nonattainment area encompasses nearly 2,000 square miles, including the urbanized portion of Maricopa County. This area was reclassified from Moderate to Serious in August 1996, due to a failure to attain the eight-hour CO standard by December 31, 1995. Serious CO nonattainment areas are required to demonstrate attainment of the CO standard by December 31, 2000. The CO monitoring data in figure 4 indicates that no violations of the eight-hour standard have occurred since 1996.

In order to be redesignated to an attainment area, a Serious CO nonattainment area must satisfy a number of Federal requirements, including two years of "clean" data at all monitors and federally-approved plans showing attainment (in 2000) and maintenance (at least 10 years from the redesignation date) of the standard, using air quality models. The Maricopa Association of Governments prepared the Serious Area CO attainment plan that was submitted to EPA in July 1999.

Prior to 2000, Arizona had enacted a Remote Sensing ("Smog Dog") Program whose components were set up to sense the passage of a vehicle emitting high levels of CO and photograph the license plate of the offending vehicle. When the Arizona Legislature repealed the Remote Sensing Program during its 2000 legislative session, EPA requested that MAG redo the attainment demonstration. The updated MAG air quality modeling showed that the standard would be attained without the "smog dog" program and the revised CO plan

was submitted to EPA in March 2001.[4] EPA is expected to approve this revised plan in 2003. MAG is in the process of preparing the maintenance plan that demonstrates the CO standard can be maintained through 2015. It is anticipated that the maintenance plan and request for redesignation to attainment will be submitted to EPA in May 2003.

OZONE

Ozone in the upper atmosphere occurs naturally and protects life on the earth's surface from harmful ultraviolet radiation. In contrast, ground-level ozone is a poisonous, pungent-smelling gas. Ozone is not emitted by any source, but is formed by the photochemical reaction of volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of sunlight. Ground level ozone is the major constituent of smog. Peak concentrations of ozone typically occur in the summer, when ambient temperatures exceed 90 degrees Fahrenheit. Onroad vehicles and nonroad engines are major sources of the ozone precursors, VOC and NO_x emissions.

At ambient concentrations prevalent in many urban areas, ozone can cause choking, coughing, and irritated eyes. Prolonged exposure can lead to chest pain, headache, nasal congestion, and sore throat. At high concentrations, ozone can damage lung tissue, aggravate respiratory disease, and make individuals more susceptible to respiratory infections. Children and those with existing lung disease are especially vulnerable. Ozone also reduces agricultural yields and increases tree and plant susceptibility to disease.

Ozone Trends

Due to measures such as tighter Federal standards for new car emissions controls, a centralized enhanced vehicle emissions inspection program, and summer reformulated fuels, one-hour ozone concentrations have declined since the 1980s, as shown in figures 14 and 15. No monitor in Maricopa County has exceeded the one-hour ozone standard since 1996. An exceedance is defined as a monitored value of 0.125 ppm or higher. A violation occurs when the expected number of days with concentrations of 0.125 ppm or higher is greater than one, averaged over a three-year period. Attainment is achieved when there are no violations of the standard.

Although Maricopa County no longer violates the one-hour ozone standard, monitors in the county frequently record exceedances of the eight-hour ozone standard, as evidenced by figure 16. Monitoring data on eight-hour average ozone concentrations have been collected in Maricopa County since 1997. An exceedance of the eight-hour standard is defined as a monitored value of 0.85 ppm or more. A violation occurs when the fourth highest eight-hour concentration in three consecutive years is 0.85 ppm or higher. Figure 17 indicates that violations of the eight-hour ozone standard are occurring at monitors located in various parts of Maricopa County.

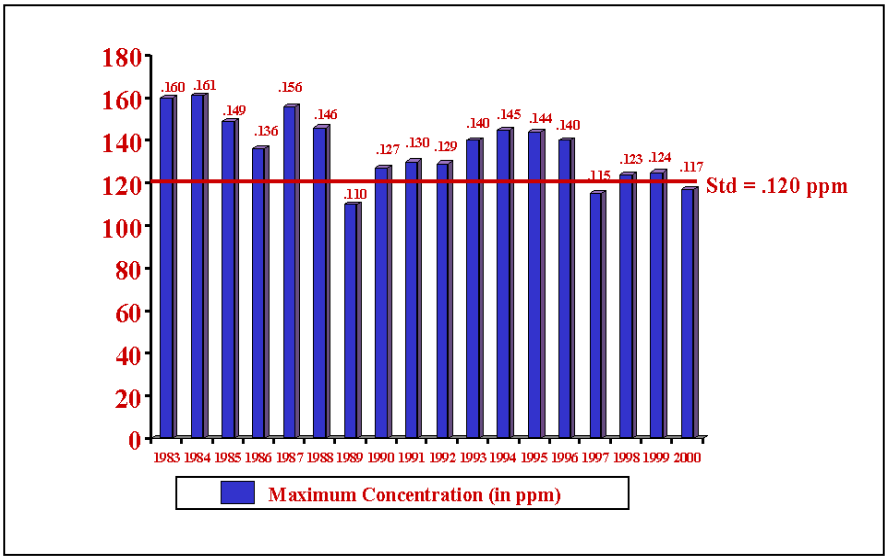


FIGURE 14. OZONE TRENDS – MAXIMUM ONE-HOUR CONCENTRATIONS

Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.[2,3]

During 2000 seven monitors in Maricopa County violated the eight-hour ozone standard. Most of these monitors were located in the East Valley (i.e., Blue Point, Fountain Hills, Mount Ord, Pinnacle Peak), but sites in West Phoenix, North Phoenix and on top of Humboldt Mountain also recorded violations of the eight-hour standard.[2,3]

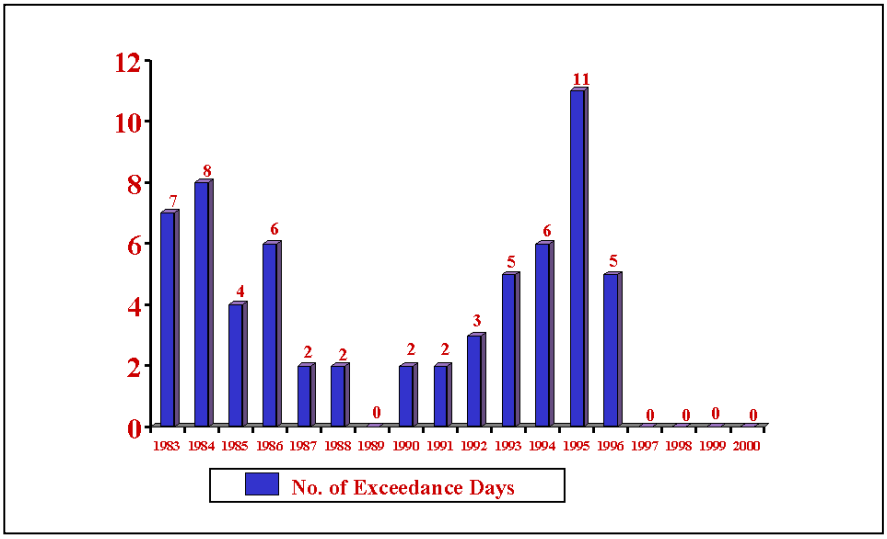


FIGURE 15. OZONE TRENDS – DAYS EXCEEDING THE ONE-HOUR STANDARD

Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.[2,3]

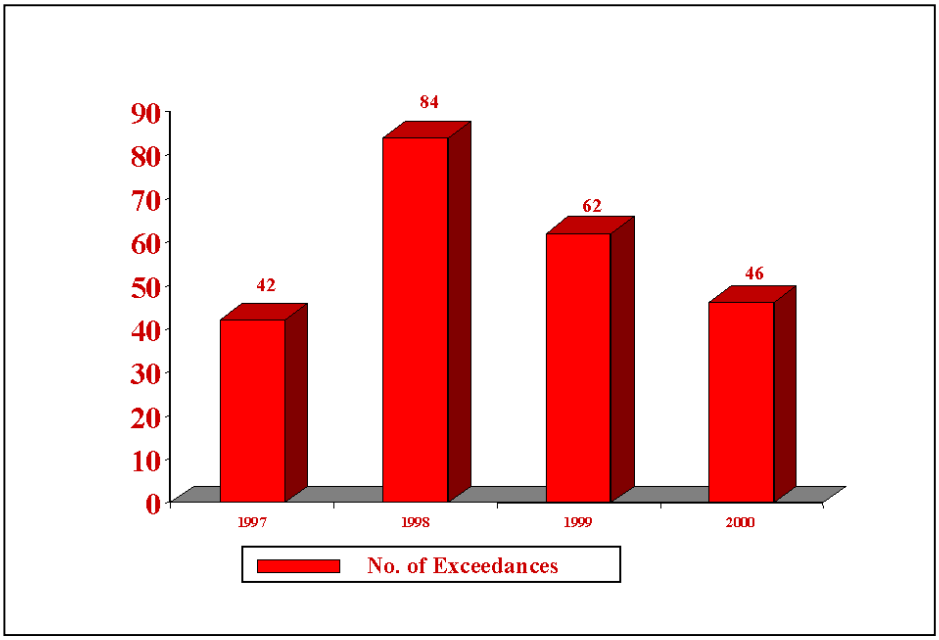


FIGURE 16. OZONE TRENDS – EXCEEDANCES OF THE EIGHT-HOUR STANDARD

Source: Op. Cit, Arizona Department of Environmental Quality, 2000; Maricopa County Environmental Services Department, 2000.[2,3]

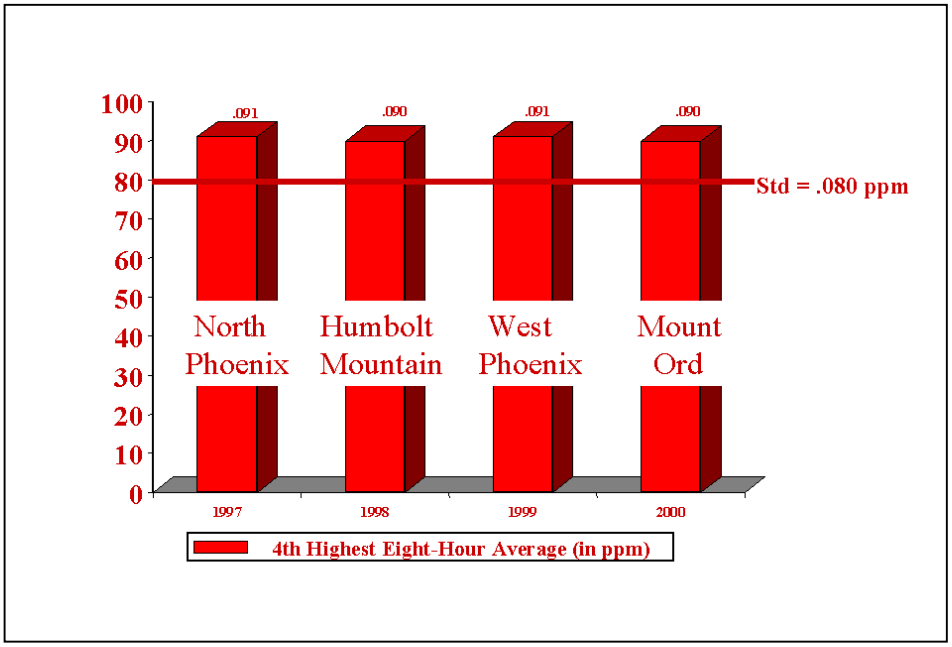


FIGURE 17. OZONE TRENDS – FOURTH HIGHEST EIGHT-HOUR CONCENTRATIONS

Source: Op. Cit, Arizona Department of Environmental Quality, 2000; Maricopa County Environmental Services Department, 2000.[2,3]

Ozone Designations and Plans

The ozone nonattainment area encompasses approximately 2,000 square miles, including the urbanized portion of Maricopa County. The ozone and CO nonattainment area boundaries are coterminous. The ozone nonattainment area was reclassified from Moderate to Serious in February 1998, due to a failure to attain the one-hour standard by November 19, 1996. At that time, the new ozone attainment date was set to November 19, 1999. This standard was subsequently attained, since there were no exceedances of the one-hour ozone standard at any monitor in 1997, 1998, and 1999.

In response to a court case filed by the Arizona Center for Law in the Public Interest, EPA promulgated a 15 percent Rate of Progress Federal Implementation Plan (FIP) for the Maricopa County ozone nonattainment area, which became effective in August 1999. Although this FIP does not require implementation of any new ozone control measures, it establishes a mobile source emissions budget for VOCs that must be used in regional air quality conformity analyses performed by MAG.

In order to be redesignated to attainment, a serious nonattainment area for ozone must satisfy a number of Federal requirements, including three years of "clean" data at all monitors, an EPA-approved Serious Area State Implementation Plan (SIP) and an EPA-approved maintenance plan. The SIP was prepared by the Arizona Department of Environmental Quality (ADEQ) and submitted to EPA in June 2000. MAG is in the process of preparing the plan that shows maintenance of the one-hour ozone standard through 2015, using air quality models. It is anticipated that the maintenance plan will be submitted to EPA in late 2003. EPA issued a final determination of attainment, based on the three years of "clean" monitoring data, on May 30, 2001.

On the basis of epidemiological evidence indicating that long exposures to high ozone concentrations are a higher risk, EPA promulgated a new eight-hour ozone standard in 1997 to replace the one-hour standard. On May 14, 1999, the U.S. Appeals Court for the District of Columbia Circuit, in the case of *American Trucking Association v. EPA*, remanded the new eight-hour ozone standard back to EPA on the basis that it represented an unconstitutional delegation of legislative power. The District Court did not challenge the science behind the new standard, but ruled that the new standard was not enforceable. The District Court decision was appealed and on February 27, 2001, the U.S. Supreme Court upheld the eight-hour ozone standard, but ruled that EPA must reconsider its implementation plan. As a result, it is likely to be several years before EPA issues additional guidance on the eight-hour standard. In the meantime, the county will continue to collect monitoring data for the eight-hour ozone standard.[3]

PARTICULATES

Particulates are solid particles and liquid droplets that are small enough to remain airborne, such as dust, soil, and soot. Particulates can be emitted directly from a source or formed by gaseous emissions of sulfur dioxide (which can convert to sulfates), NO_x (which can convert

to nitrates) or VOCs (which can convert to organic carbon). The Federal standards address two sizes of particulates: PM_{10} (particulate matter less than 10 microns in diameter) and $PM_{2.5}$ (less than 2.5 microns in diameter). In comparison, a human hair is approximately 70-80 microns in thickness.

The origin of coarse particulates (between 2.5 and 10 microns) is generally geologic, including reentrained dust from paved and unpaved roads and soil disturbed by earth-moving and construction activities. The finer particulates (under 2.5 microns) are usually emitted by combustion sources or formed by gases.

High PM_{10} concentrations can occur in any season or location, if there are sources of disturbed geologic material nearby and strong, gusty winds. $PM_{2.5}$ concentrations tend to peak in the central portions of urban areas where traffic is highest and during periods of poorest dispersion, i.e., from sunset to midmorning in the late fall and winter months. $PM_{2.5}$ is also a major contributor to the valley's urban haze, or "brown cloud," problem.

When inhaled, coarse particles are deposited in the upper respiratory tract. Fine particles can be deposited lower, in the pulmonary tissues and invade the alveoli of the lungs. These smaller, more invasive particles can decrease breathing efficiency and alter the body's defense systems. Epidemiological studies have shown causal relationships between high particulate concentrations and increased mortality and morbidity. Sensitive groups include the elderly, asthmatics, and children.

In 1995 the Arizona Comparative Environmental Risk Project ranked particulate pollution as one of the highest environmental risks in the State. This conclusion was based on increased hospital admissions for respiratory problems, asthma, and lower and upper respiratory symptoms, due to high annual ambient PM_{10} concentrations during 1991. In the same study, premature deaths due to PM_{10} in Arizona were estimated to approach nearly 1,000 per year.[5]

$PM_{2.5}$ Trends

ADEQ operates seven $PM_{2.5}$ monitors in Maricopa County. These monitors have not recorded any violations of the $PM_{2.5}$ standards and are not expected to do so in the future. An exceedance of the annual standard is defined as a concentration greater than 15.0 $\mu g/m^3$. To violate the annual standard, the three-year average of annual means must be greater than 15.0 $\mu g/m^3$.[2] It is interesting to note that background concentrations of $PM_{2.5,}$ measured at Organ Pipe National Monument in the pristine southwestern Arizona desert, are typically about 30 percent of the annual standard.

$PM_{2.5}$ Studies

ADEQ conducted extensive $PM_{2.5}$ monitoring in Maricopa County during the period April 1995 through December 1997. The ADEQ study concluded that the maximum concentrations of $PM_{2.5}$ occur in an area bounded by Camelback and McDowell Roads on the north and south and I-17 and 59th Avenue on the east and west. This is also the area experiencing the highest levels of traffic congestion in the region, and the highest CO concentrations.[2]

In 1999 MAG published the results of *The 1999 Brown Cloud Project for the Maricopa Association of Governments Area* performed by Sonoma Technology.[6] The project concluded that the principal cause of the urban haze is light scattering caused by $PM_{2.5}$. The principal reason for the brown color of the haze is that light is absorbed by elemental carbon in the air. $PM_{2.5}$ is composed of approximately 20 percent elemental carbon. About one-half of $PM_{2.5}$ is emitted in gasoline exhaust; diesel exhaust contributes another 15 percent of the $PM_{2.5}$ emissions. Sulfates and nitrates also contribute to the brown cloud. Older and poorly tuned vehicles and cold startups in the fall and winter months are the major sources of $PM_{2.5}$ in Maricopa County.[6]

The control measures recommended by the MAG brown cloud project[6] to reduce $PM_{2.5}$ and the brown cloud were:

- Implement clean diesel fuel for onroad vehicles and nonroad engines.
- Retrofit or replace nonroad diesel engines and equipment.
- Strengthen voluntary diesel vehicle retirement program.
- Set up a pilot program to test the feasibility of electrifying truck stops.
- Implement a toll-free smoking vehicle hotline.
- Institute a smoking vehicle identification and citation program.

Maricopa County already operates a dust control hotline, (602) 506-6616, but the MAG brown cloud project recommended that this be converted to a toll free number. The Legislature set up a voluntary program in 2001, as a part of (House Bill) H.B. 2538, to encourage use of ultra-low sulfur fuel and retrofitting diesel engines with three-way catalysts and particulate traps. By Federal law, ultra-low sulfur fuel will be available nationwide in mid-2006, while stricter standards for new diesel engines will go into effect beginning in model year 2007. The MAG recommendation to implement a smoking vehicle identification and citation program would involve use of Department of Public Safety officers to identify and cite offenders.

Widespread public interest in reducing the highly visible brown cloud hanging over the valley on some fall and winter days precipitated an Executive Order by Governor Jane Dee Hull to convene a Brown Cloud Summit. The summit of community, industrial and public leaders met from March 15, 2000 until January 16, 2001 to study the visibility problem and formulate recommendations to Governor Hull. A review of ADEQ data showed that visibility in the valley declined between 1994 and 1998, despite improvements in some of the invisible air pollutants (i.e., CO and ozone) during the same period. The summit devised a

visibility measure called "Blue Sky Days," defined as six hours with at least 25-mile visibility.[7]

The voluntary and mandatory measures recommended by the Brown Cloud Summit are summarized in table 15.[7] Table 9 also identifies the measures that were implemented in H.B. 2538. All of the measures in H.B. 2538 apply to Area A, the boundaries of which are illustrated in figure 18. H.B. 2538 extended Area A 100 square miles to the west, to include all of Buckeye and Surprise.

TABLE 15. GOVERNOR'S BROWN CLOUD SUMMIT RECOMMENDED MEASURES

Recommended Measures	Addressed in H.B. 2538
Voluntary Measures	
1. Continue light duty vehicle repair / retrofit program	X
2. Clean fleets and equipment businesses program	
3. Accelerated purchase of Tier 2/3 equipment[1]	X
4. Onroad diesel vehicle repair / retrofit	X
5. Ultra-low sulfur diesel fuel with oxidation catalysts and particulate filters for vehicle fleets	X
6. Encourage use of truck bypass on poor visibility days	X
7. Low emission airport ground support equipment	
8. Air quality alert days	X
Mandatory Measures	
1. Ban leaf blowers	
2. California test for new 2005/2006 heavy duty diesel trucks	
3. Vehicle idling restrictions	X
4. Implement roadside diesel testing	X
5. Electric powered generators at construction sites	X
6. Additional funding for PM_{10} efficient street sweepers	
7. Increase funds for Maricopa and Pinal County dust control programs	
8. Expand Area A to include all of Buckeye and Surprise	X
9. Only CARB diesel fuel to be sold in Area A[2]	

1. I.e, encourage accelerated replacement of old offroad diesel equipment with less polluting newer equipment that meets the Federal Tier 2 or Tier 3 emissions standards.
2. Diesel fuel conforming to California Air Resources Board specifications

Source: Governor's Brown Cloud Summit*, Final Report,* 2001.

One of the measures in table 15 that was not addressed by H.B. 2538 is dust control training for contractors. The recommendation of the Governor's Summit was as follows:

> This measure would develop and implement a standardized dust control certification program for construction companies and other stakeholders in Maricopa County to enhance compliance with Maricopa County Rule 310. Participation in the training and certification would be required for a construction company to obtain a county permit.

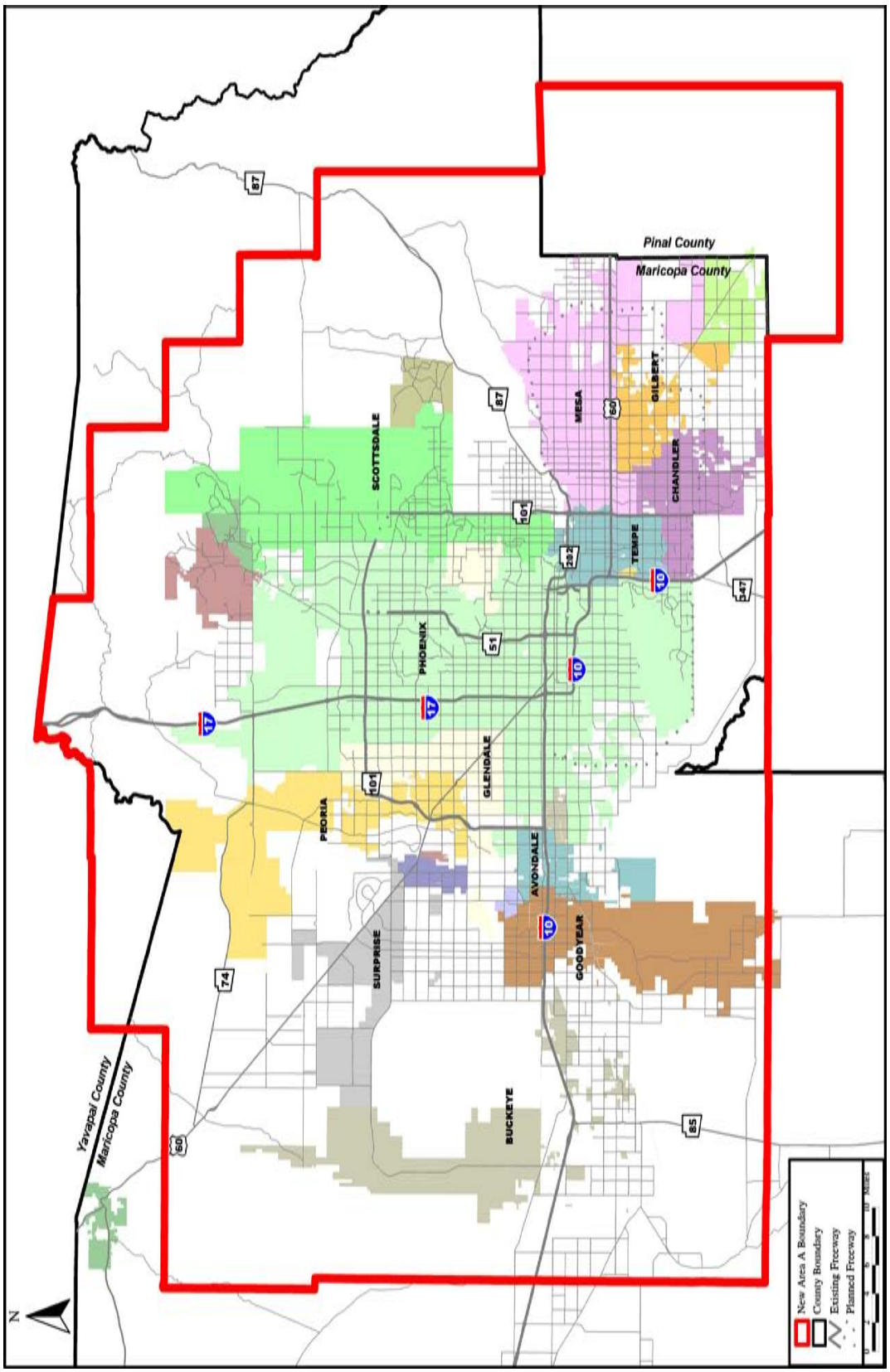


FIGURE 18. AREA A

Prior to the release of the summit's findings, ADOT had already committed resources and was working with Maricopa County and Arizona State University to develop a Dust Devil Academy Manual and sponsor a construction dust workshop. The latter was held on September 18, 2000. ADOT also participated actively in summit meetings. The ADOT assistant director served on the executive committee and Pat Cupell, ADOT Planner, attended executive committee and subcommittee meetings and contributed directly to control measure development and evaluation. Summit recommendations indicate that ADOT would make another $150,000 available to assist in implementing dust control training for contractors. A major objective of ADOT Research Project SPR-519 is to develop this dust control certification program for the construction industry in Maricopa County, as recommended by Governor Hull's Brown Cloud Summit.

PM_{10} Trends

Unlike $PM_{2.5}$, which is emitted primarily by onroad vehicle and nonroad engine exhaust, the major sources of PM_{10} are construction and earthmoving operations, reentrainment of fugitive dust on paved roads, vehicles driving on unpaved roads, agricultural activities, and vacant disturbed lots. There are two national standards for PM_{10}: a 24-hour standard and an annual standard. Winds greater than 15 mph can contribute to exceedances of the 24-hour standard at the monitors. An exceedance of the 24-hour standard is defined as a monitored daily value greater than 150 $\mu g/m^3$. Monitors record 24-hour PM_{10} concentrations every six days.[2]

Figure 19 illustrates the trends in PM_{10} for the 24-hour standard.[2] Note that there is no apparent downward trend in the number of exceedance days. Most exceedances of the 24-hour standard in the nonattainment area are recorded at the special purpose monitor located at the Salt River Service Center, near 22nd Avenue and Lower Buckeye Road. This industrial area has a large number of potential PM_{10} sources, including two landfills, a sand and gravel operation, a pre-stressed concrete manufacturing yard, a bus storage depot, unpaved roads, unpaved shoulders, and vacant disturbed lots.

Although the Salt River site is responsible for most of the exceedances of the 24-hour standard, six monitors located in other parts of the nonattainment area also indicated 24-hour exceedances during 2000, as illustrated in figure 18. Six monitors (Chandler, Durango, Greenwood, Maryvale, Salt River and South Phoenix) exceeded the standard on August 22, 2000, due to wind gusts in excess of 25 mph. Durango (January 19) and Greenwood (January 13) each exceeded the standard on one other day in 2000. The Higley monitor recorded the highest concentration, more than double the standard, on June 17. In addition to the high wind event on August 22, the Salt River monitor indicated exceedances on five other days—January 7 and 13, July 17, September 15, and November 20.[3] It is clear from this data that exceedances of the 24-hour PM_{10} standard can occur at any time of the year and at various locations throughout the nonattainment area. With the exception of August 22, the exceedances are correlated more with dust-generating activities near the monitors, than with high wind events.

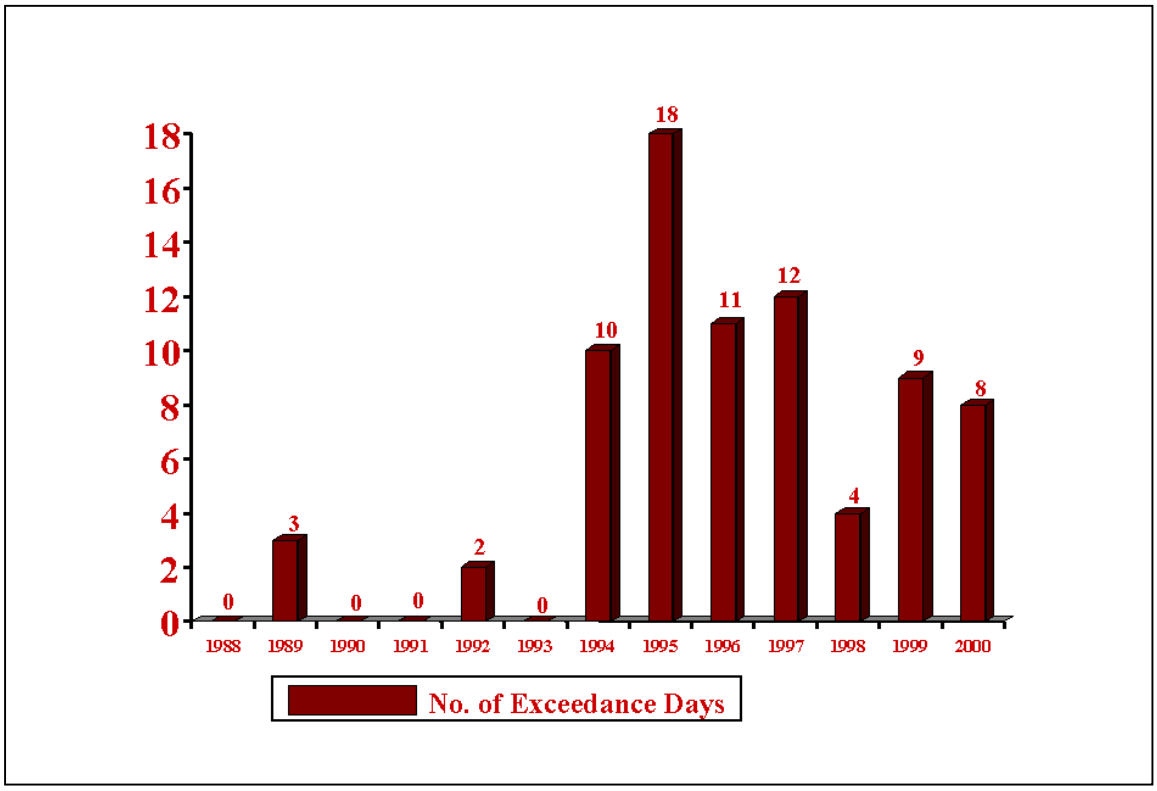


FIGURE 19. PM_{10} TRENDS – DAYS EXCEEDING THE 24-HOUR STANDARD
Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.[2,3]

The Salt River monitor was discontinued in January 2003. A replacement monitor is operating in a similar area at 43rd Avenue and Broadway Road.

A violation of the 24-hour standard occurs when the expected exceedance rate of monitored samples greater than 150 $\mu g/m^3$ over three years is greater than one. Although seven monitors exceeded the 24-hour standard in 2000, the only site that *violated* this standard, based on 1998-2000 data, is the Salt River monitor. It should be noted, however, that the Durango and Higley monitors did not have three years of complete data in 2000 and these sites may also violate the standard, when three years of complete data become available.[3]

An exceedance of the annual PM_{10} standard occurs when the annual average concentration at a monitor exceeds 50 $\mu g/m^3$. Figure 20 indicates that there has not been a decline in the number of monitors exceeding the standards over time. As shown in figures 21 and 22, seven monitors exceeded the annual standard in 2000.

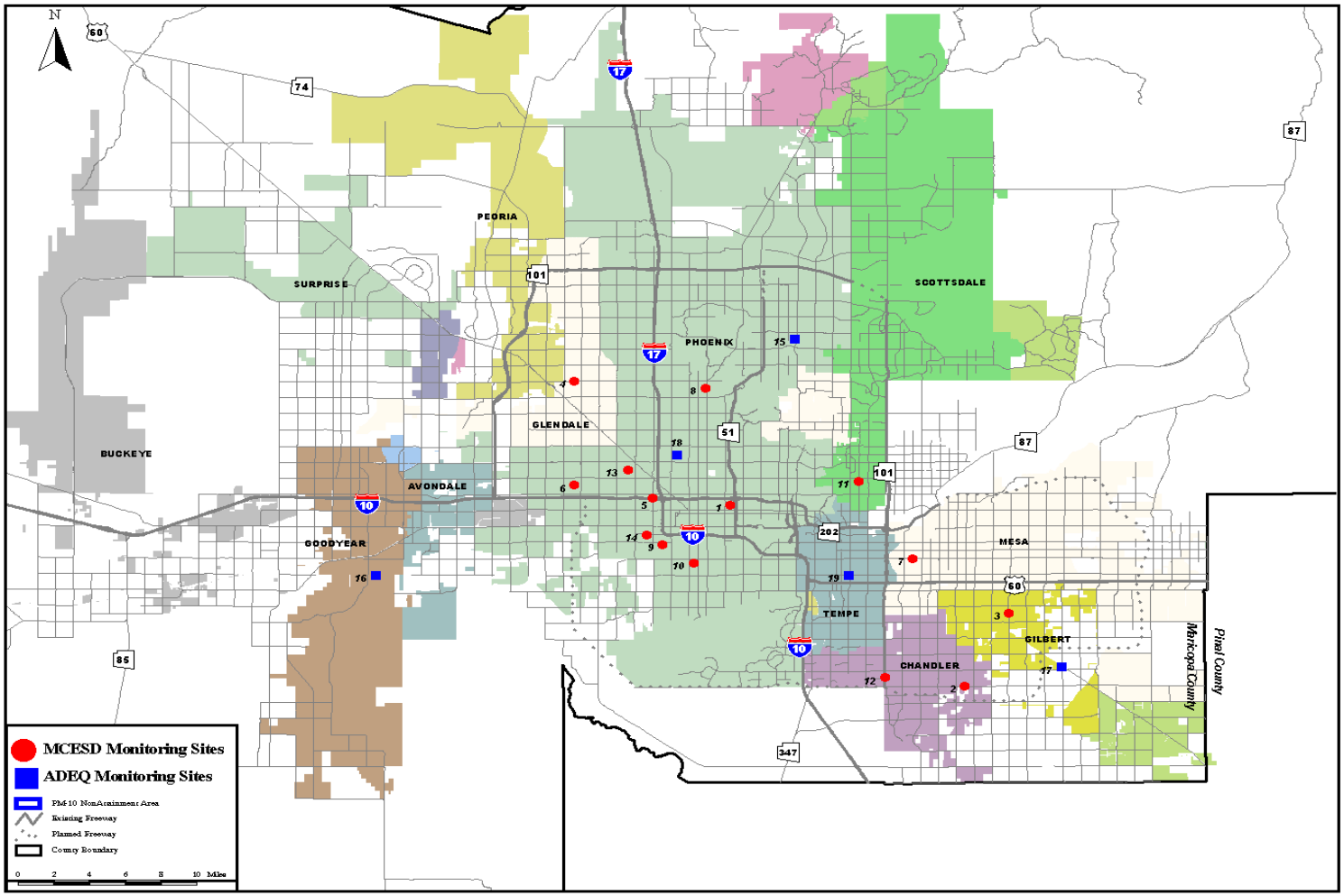


FIGURE 20. PM_{10} MONITORING SITES EXCEEDING THE 24-HOUR STANDARD IN 2000

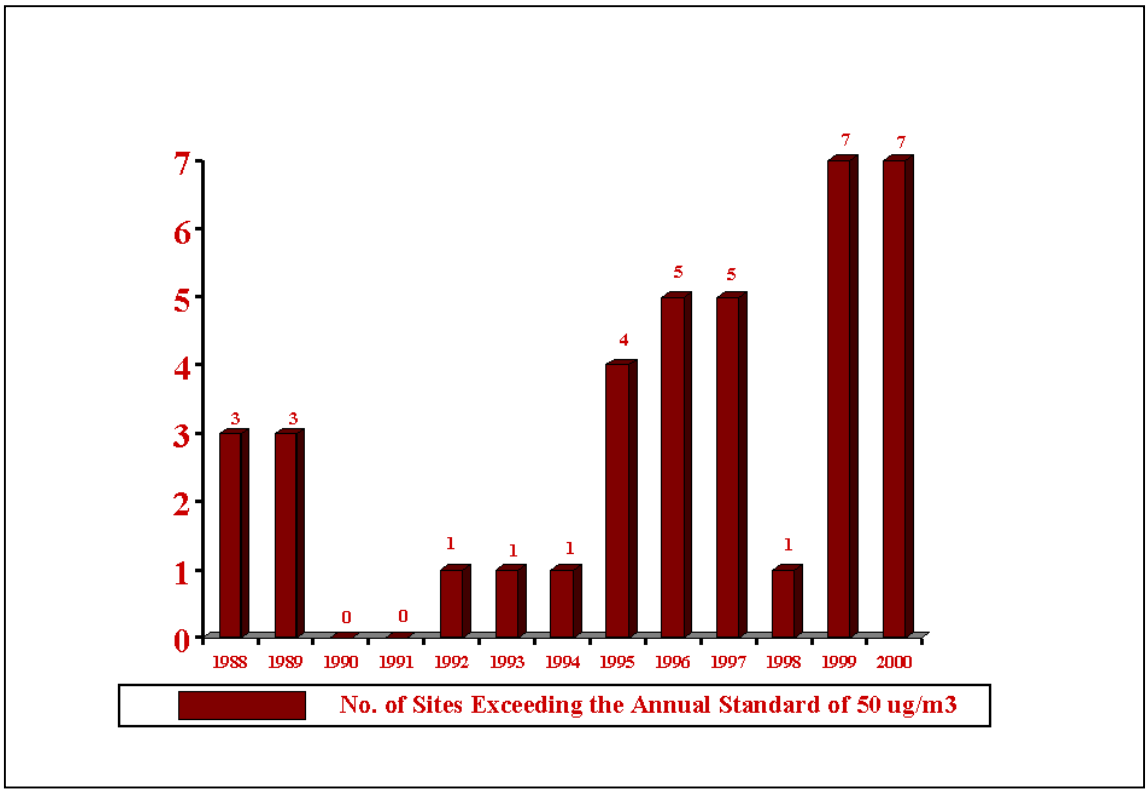


FIGURE 21. PM_{10} TRENDS – SITES EXCEEDING THE ANNUAL STANDARD
Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.[2,3]

These are the same sites that exceeded the 24-hour standard in 2000, except that South Phoenix is included, and Maryvale is not. The highest annual concentration in 2000 of 101 µg/m^3, more than double the standard, was recorded at the Salt River monitor. Excluding this monitor, the next highest concentrations were 72 µg/m3 at Higley and 70 µg/m^3 at Durango. Figure 23 indicates that the maximum annual concentrations over the past 13 years do not show a favorable trend, even if the Salt River monitor is not considered.[3]

A violation of the annual standard occurs when the three-year average annual mean at a monitor is greater than 50 µg/m^3. On the basis of complete 1998-2000 data, three monitors violated the annual standard: Chandler, Greenwood, and Salt River. The Higley monitor may also violate the annual standard, when complete three-year average data become available.[2]

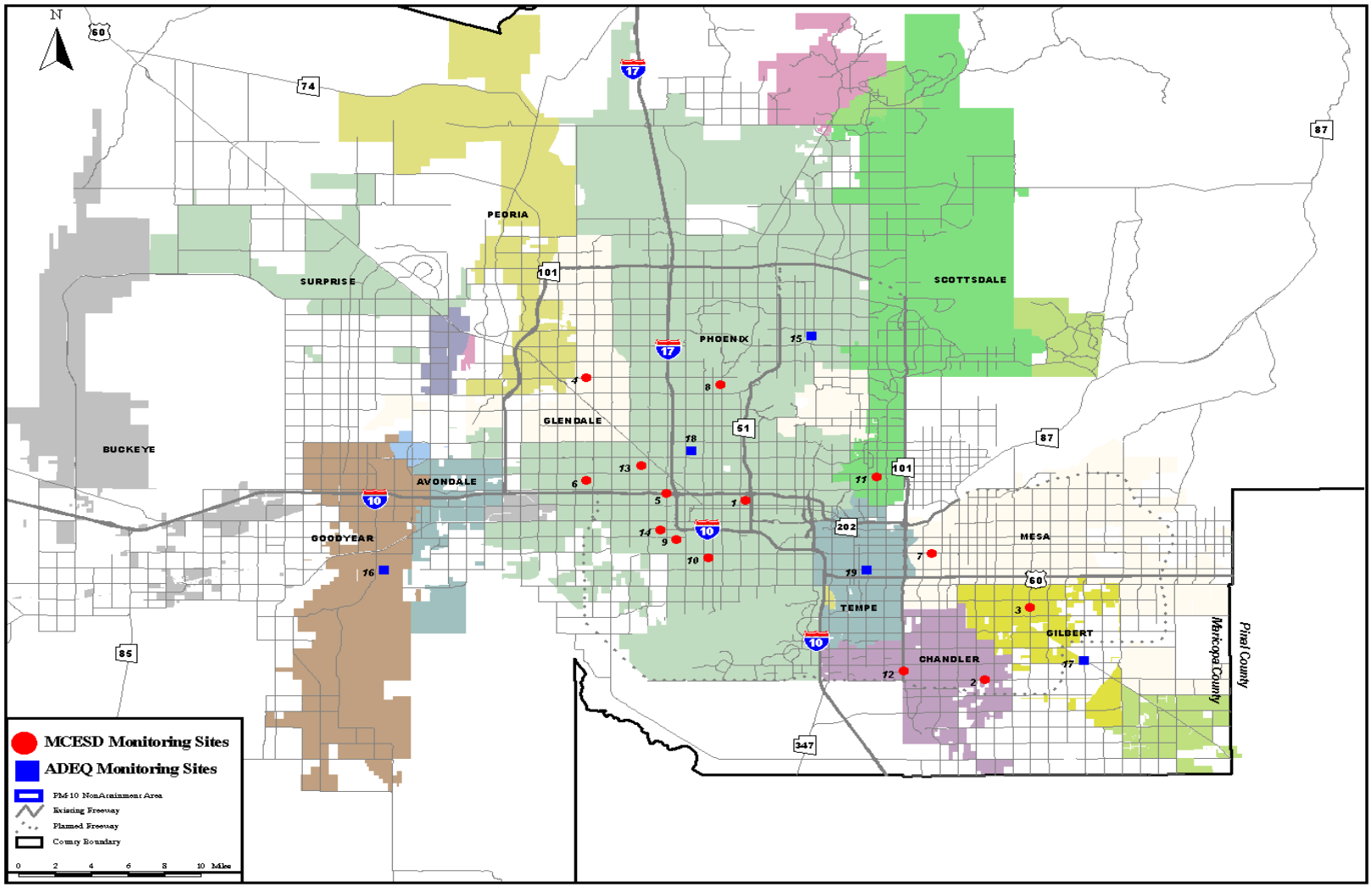


FIGURE 22. PM_{10} MONITORING SITES EXCEEDING THE ANNUAL STANDARD IN 2000

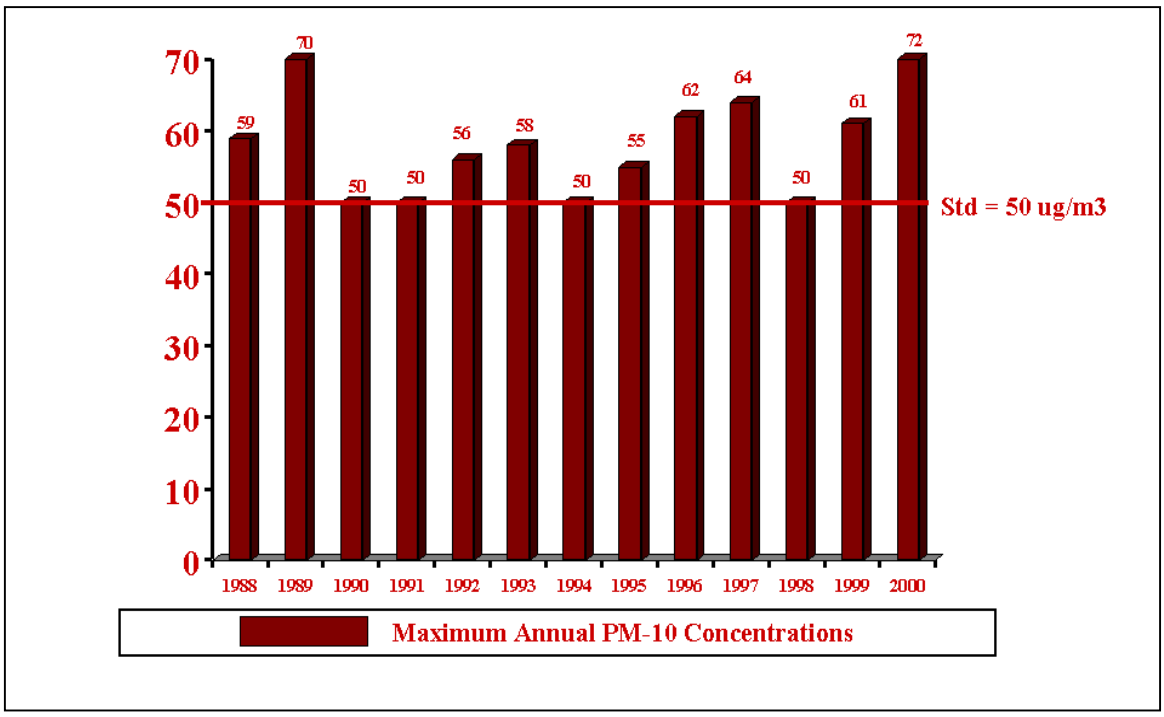


FIGURE 23. PM_{10} TRENDS – MAXIMUM ANNUAL CONCENTRATIONS EXCLUDING SALT RIVER MONITOR

Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.][2,3]

PM_{10} SOURCES

The apportionment of annual PM_{10} emissions among sources in the Maricopa County nonattainment area in 1995 is illustrated in figure 24. On an average annual basis, construction and earthmoving activities contribute the largest share of emissions, at 38 percent. The next most significant source, contributing 18 percent, is reentrainment of dust by vehicles traveling on paved roads. Agricultural operations create 14 percent of the PM_{10} emissions, and unpaved roads another 13 percent. Other source categories each contribute less than 5 percent of the emissions.

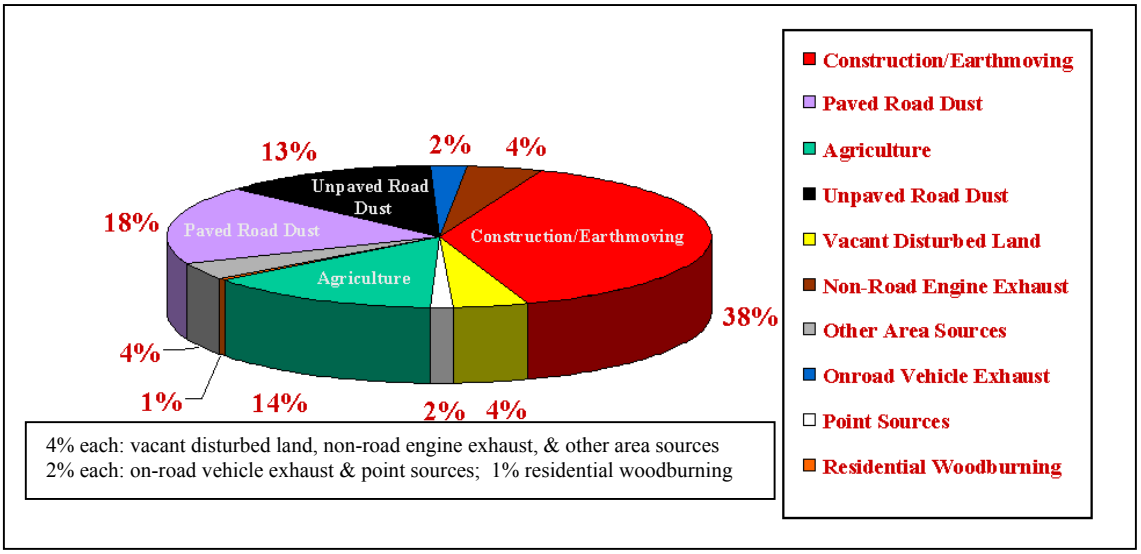


FIGURE 24. SOURCES OF PM_{10} IN MARICOPA COUNTY

Source: Maricopa Association of Governments, *Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area,* 2000.[8]

PM_{10} DESIGNATIONS AND PLANS

The boundaries of the PM_{10} nonattainment area in Maricopa County are illustrated in figure 25. This nearly 3,000 square mile area was reclassified from Moderate to Serious in June 1996 due to a failure to attain the standards by December 31, 1994. Attainment would have been achieved if no monitor had violated the annual or 24-hour standard, based on 1992-1994 data. When the area was reclassified to Serious, a new attainment date of December 31, 2001 was established.

MAG submitted a Moderate Area PM_{10} Plan to EPA in 1991 and revisions to this plan, in 1993 and 1994. EPA initially approved the plan on April 10, 1995; however, in 1998, EPA disapproved the reasonably available control measure demonstration for the annual standard, on the basis that a number of significant sources, such as unpaved roads, were not addressed in the plan. EPA's partial disapproval of the Moderate Area PM_{10} Plan became effective on September 2, 1998, which started sanction clocks described in Clean Air Act Section 179(a).

A State has 18 months to correct the deficiency before the first of two sanctions goes into effect. If the deficiency is still in place after 24 months, the second sanction is imposed. Because the Serious Area PM_{10} Plan and commitments addressing the deficiencies were not submitted in time, the two-for-one offsets sanction was triggered on March 2, 2000. The offsets sanction mandates that an industrial source requiring a permit reduce twice the amount of PM_{10} emissions that any proposed new or modified facility would emit. After all required pieces of the Serious Area PM_{10} Plan were received, EPA took action to stay the sanction clock on April 13, 2000. If the sanction clock had not

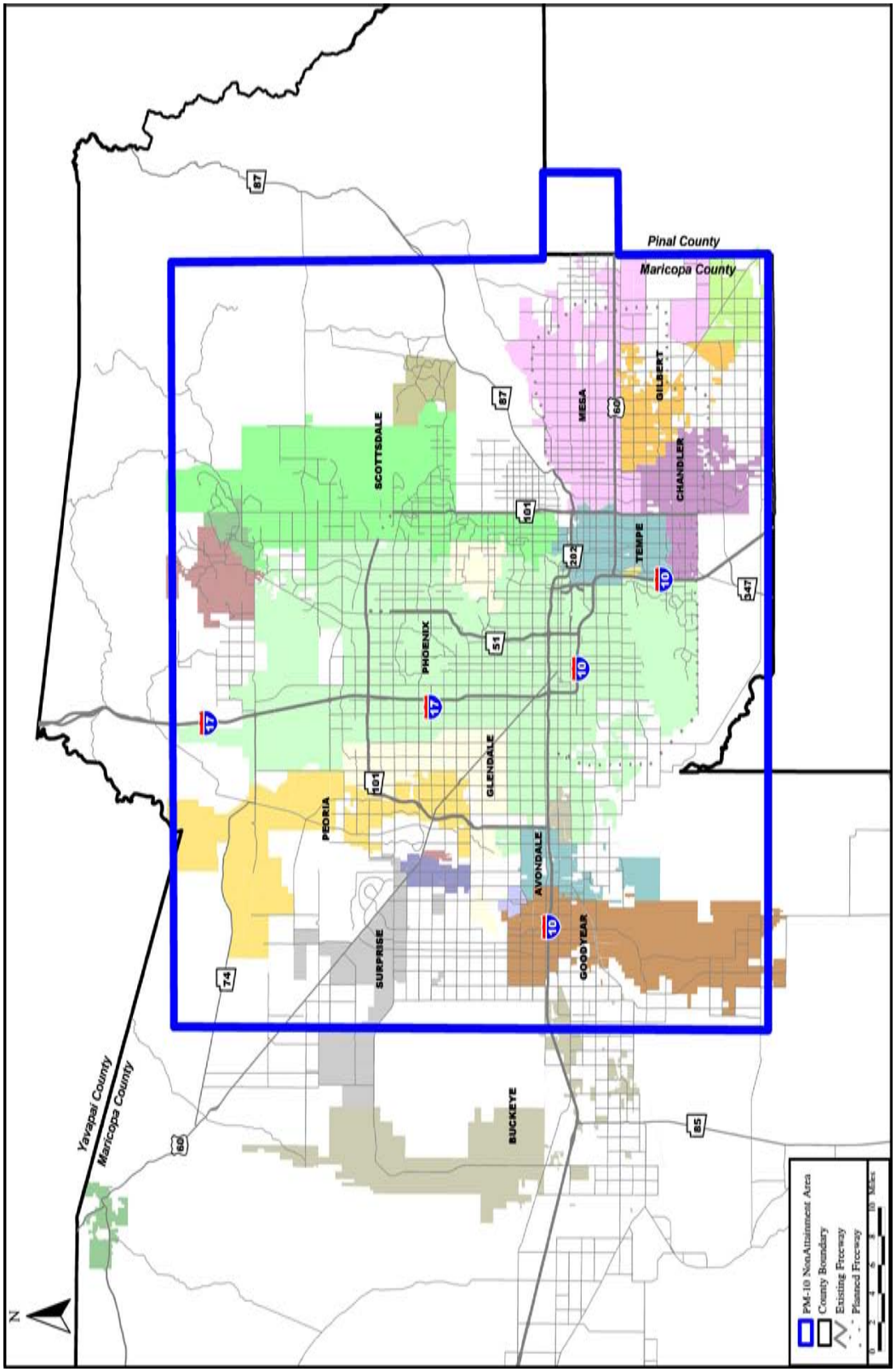


FIGURE 25. PM_{10} NONATTAINMENT AREA

been stopped, most transportation project approvals and grants by the U.S. Department of Transportation would have been halted on September 2, 2000. In the future, if parts of the Serious Area PM_{10} Plan are not approved, or their approval is subsequently overturned in court, the sanctions clock will be turned on again, about five months away from the imposition of the highway sanctions.

On May 14, 1996,the Ninth Circuit Court of Appeals, in the case of *Ober v. EPA*, vacated EPA's 1995 approval of the Moderate Area PM_{10} Plan, due in part to a failure to address the 24-hour standard. In response to this ruling, ADEQ prepared a 24-hour microscale plan that was submitted to EPA in December 1997. The microscale plan demonstrated that the Salt River and Maryvale monitors would attain the 24-hour standard by December 31, 2001. However, the plan was unable to show that the Gilbert and West Chandler monitors would demonstrate attainment of the 24-hour standard by that date. As a result, EPA disapproved parts of the microscale plan and, on August 3, 1998, issued a Federal Implementation Plan to control unpaved roads, unpaved parking lots, vacant disturbed lots, and agricultural fields and aprons, the primary sources of PM_{10} in the vicinity of the Gilbert and West Chandler monitors.[8]

During preparation of the Serious Area PM_{10} Plan in 1997, MAG determined that it was not possible to show attainment of the annual and 24 hour standards by December 31, 2001, despite implementation of all best available control measures. Therefore, the MAG Serious Area PM_{10} Plan submitted to EPA in February 2000 requests a five-year extension of the attainment date, to December 31, 2006, as allowed in the Clean Air Act (CAA). One of the CAA requirements for requesting a five-year extension is to implement the most stringent control measures that are contained in any implementation plan or achieved in practice in any state that can be feasibly implemented in the area. The MAG Serious Area PM_{10} Plan contains commitments to implement the most stringent measures that are feasible for implementation in Maricopa County, including PM_{10} efficient street sweepers, PM_{10} episode thresholds, and restaurant charbroiler controls.[8]

EPA approved the MAG Serious Area PM_{10} Plan and extension request on July 25, 2002. It is anticipated that EPA will withdraw its Moderate Area Federal Implementation Plan sometime after this date.

PM_{10} CONTROL MEASURES

The MAG Serious Area PM_{10} Plan contains 77 control measures that represent legally binding commitments by the State, county, cities, towns, MAG and ADOT to reduce PM_{10}. Emission reduction credit for 12 measures was quantified in the plan; the PM_{10} emission reductions attributable to each of these measures are shown in figure 26. In combination, these 12 measures will effect a 39 percent reduction in PM_{10} emissions by December 31, 2006. The single most effective control measure in the plan is the strengthening and better enforcement of fugitive dust controls (i.e., Maricopa County Rules 310 and 310.01). As shown in figure 26, this measure will reduce dust from

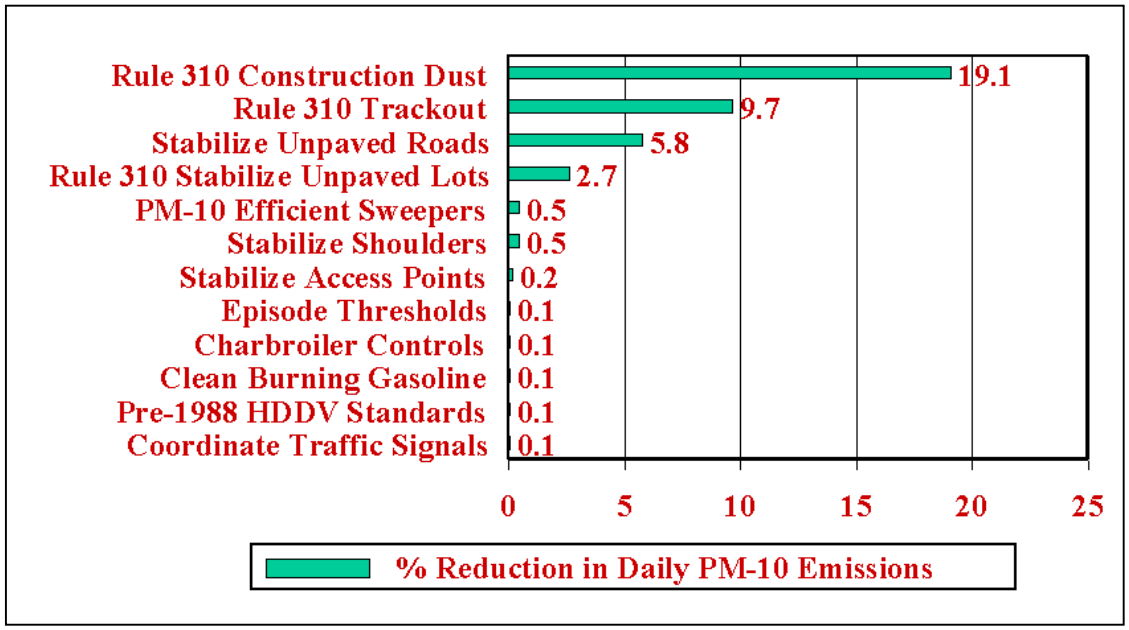


FIGURE 26. 2006 PM_{10} EMISSION REDUCTIONS FROM COMMITTED CONTROL MEASURES

Source: Maricopa Association of Governments, *Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area,* 2000.[8]

construction, vehicle trackout, and unpaved lots; together, these reductions represent 80 percent of the total reductions in the plan. While construction and earthmoving activities are the largest source of PM_{10} emissions, they are also the source of the largest reductions in the plan. As a result of the strengthening and better enforcement of Rule 310 on construction sites, PM_{10} emissions are expected to decline by 19 percent, almost half of the total reduction required to show attainment of the annual PM_{10} standard by December 31, 2006.[8] Since reductions in dust generated by construction and earthmoving operations represent a large share of total control measure efficacy in the PM_{10} Plan, it is essential that these cuts be realized in order for the annual and 24-hour standards to be attained by 2006.

By conducting research into educational tools and outreach programs for PM_{10}, ADOT is demonstrating support for the MAG Serious Area PM_{10} Plan, the recommendations of the Governor's Brown Cloud Summit, and ongoing efforts by Maricopa County to strengthen and enforce Rule 310. This research will identify practical and cost-effective tools to control fugitive dust at work sites and develop methods and materials to ensure that information, training and certification programs are disseminated to construction superintendents and workers. Making dust suppression a standard practice on and around construction sites will be essential to attain and maintain the PM_{10} standards in Maricopa County's urbanized desert environment.

6. CONTROL MEASURES AND MITIGATION DEVICES

A portion of Maricopa County was classified as a serious PM_{10} nonattainment area after failing to meet the NAAQS by the Clean Air Act deadline of December 31, 1994. In response to this classification, and in an attempt to meet the standards by the new deadline of December 31, 2006, the county adopted Rule 310, most recently revised on February 16, 2000. This chapter contains a summary of Rule 310, followed by summaries of mitigation practices of other jurisdictions for comparison.

MARICOPA COUNTY

Summary of Rule 310

Maricopa County Rule 310, Fugitive Dust Sources, is the cornerstone of the *Revised MAG 1999 Serious Area PM_{10} Plan* submitted to EPA in February 2000. The plan contains 77 control measures and demonstrates attainment of the 24-hour and annual PM_{10} standards by December 31, 2006. Eighty percent of the reductions in emissions required to attain the standards by 2006 are attributable to the strengthening and increased enforcement of Rule 310.

According to Rule 310, a dust control plan must be submitted for earthmoving operations that disturb one-tenth of an acre or more. Construction sites of at least five acres must also post a project information sign with the project name, the names and phone numbers of the individuals responsible for the project, and the phone number for the Maricopa County Environmental Services Department dust complaint line. [9]

The source type and control measures directly related to construction activities in Rule 310 are summarized in table 16. At least one dust control measure in each source type must be implemented if applicable to the earthmoving or construction project; a second measure must be selected as a contingency measure. Some measures are mandatory and these are noted in the table.

Maricopa County Flood Control District

During 1992, The Maricopa County FCD published a *Best Management Practices (BMP) and Erosion Control Manual* to assist agencies, engineers, and contractors in complying with the EPA regulations then in effect with respect to the discharge of stormwater from construction sites. At the time the document was published, the FCD stated their intent that its BMP provisions be adopted by the MAG and other agencies. This document is now referred to as the *Drainage Design Manual for Maricopa County, Arizona, Volume III, Erosion Control*.[10]

TABLE 16. RULE 310 SOURCE TYPE AND CONTROL MEASURES DIRECTLY RELATED TO CONSTRUCTION ACTIVITIES

Source Type and Control Measures
Vehicle Use In Open Areas And Vacant Lots:
1A Restrict trespass by installing signs.
2A Install physical barriers such as curbs, fences, gates, posts, signs, shrubs, and/or trees to prevent access to the area.
Unpaved Parking Lots:
1B Pave.
2B Apply and maintain gravel, recycled asphalt, or other suitable material, in compliance with subsection 302.1 of this rule.
3B Apply a suitable dust suppressant, in compliance with subsection 302.1 of this rule.
Unpaved Haul/Access Roads:
1C Limit vehicle speed to 15 miles per hour or less and limit vehicular trips to no more than 20 per day.*
2C Apply water, so that the surface is visibly moist and subsection 302.2 of this rule is met.*
3C Pave.*
4C Apply and maintain gravel, recycled asphalt, or other suitable material, in compliance with subsection 302.2 of this rule.*
5C Apply a suitable dust suppressant, in compliance with subsection 302.2 of this rule.*
Disturbed Surface Areas:
Pre-Activity:
1D Pre-water site to the depth of cuts.
2D Phase work to reduce the amount of disturbed surface areas at any one time.
During Dust Generating Operations:
3D Apply water or other suitable dust suppressant, in compliance with Section 301 of this rule.
4D Apply water as necessary to maintain a soil moisture content at a minimum of 12%, as Determined by ASTM Method D2216-98*** or other equivalent as approved by the control officer and the administrator of EPA. For areas which have an optimum moisture content for compaction of less than 12%, as determined by ASTM Method D1557***-91(1998) or other equivalent approved by the Control Officer and the Administrator of EPA, maintain at least 70% of the optimum soil moisture content.
5D Construct fences or 3 foot - 5 foot high wind barriers with 50% or less porosity adjacent to roadways or urban areas that reduce the amount of windblown material leaving a site. If constructing fences or wind barriers, must also implement 3D or 4D above.
Temporary Stabilization During Weekends, After Work Hours, And On Holidays:
6D Apply a suitable dust suppressant, in compliance with subsection 302.3 of this rule.
7D Establish vegetative ground cover in sufficient quantity, in compliance with subsection 302.3 of this rule.
8D Restrict vehicular access to the area, in addition to either of the control measures described in 6D and 7D above.

TABLE 16. RULE 310 SOURCE TYPE AND CONTROL MEASURES DIRECTLY RELATED TO CONSTRUCTION ACTIVITIES (Continued)

Source Type and Control Measures
Bulk Material Hauling/Transporting:
When Onsite Hauling/Transporting Within The Boundaries Of The Work Site When Crossing A Public Roadway Upon Which The Public Is Allowed To Travel While Construction Is Underway:
1G Load all haul trucks such that the freeboard is not less than 3 inches when crossing a public roadway upon which the public is allowed to travel while construction is underway;* and
2G Prevent spillage or loss of bulk material from holes or other openings in the cargo compartment's floor, sides, and/or tailgate(s); and
3G Install a suitable trackout control device that controls and prevents trackout and/or removes particulate matter from tires and the exterior surfaces of haul trucks and/or motor vehicles that traverse such work site. Examples of trackout control devices are described in Table 1 (Trackout 1J, 2J, 3J) of this rule; and
When Onsite Hauling/Transporting Within The Boundaries Of The Work Site But Not Crossing A Public Roadway Upon Which The Public Is Allowed To Travel While Construction Is Underway:
4G Limit vehicular speeds to 15 miles per hour or less while traveling on the work site; or
5G Apply water to the top of the load such that the 20% opacity standard, as described in Section 301 of this rule, is not exceeded, or cover haul trucks with a tarp or other suitable closure.
Offsite Hauling/Transporting Onto Paved Public Roadways:
6G Cover haul trucks with a tarp or other suitable closure;* and
7G Load all haul trucks such that the freeboard is not less than 3 inches;* and
8G Prevent spillage or loss of bulk material from holes or other openings in the cargo compartment's floor, sides, and/or tailgate(s);* and
9G Before the empty haul truck leaves the site, clean the interior of the cargo compartment or cover the cargo compartment.*
Cleanup Of Spillage, Carry Out, Erosion, And/Or Trackout:
1H Operate a street sweeper or wet broom with sufficient water, if applicable, at the speed recommended by the manufacturer and at the frequency(ies) described in subsection 308.3 of this rule; or
2H Manually sweep-up deposits.
Trackout:**
1J Install a grizzly or wheel wash system at all access points.
2J At all access points, install a gravel pad at least 30 feet wide, 50 feet long, and 6 inches deep.*
3J Pave, starting from the point of intersection with a paved public roadway and extending for a centerline distance of at least 100 feet and a width of at least 20 feet.

Source: Maricopa County Rule 310

*Mandatory Provisions

**These measures apply to "Worksites with at least 5 acres of disturbed surface area or 100 cubic yards of material hauled per day."

***American Society for Testing and Materials standard test methods for measuring moisture content of soil.

The focus of this document is the management of stormwater. However, four of the BMPs discussed in the document are directly related to dust control: stabilized construction

entrance, construction road stabilization, dust control, and silt fence. The applicability of these four BMPs, as depicted in the manual, is shown in figure 27.

Best Management Practice	Perimeter Control/Diversion	Slope Protection	Sediment Trapping	Drainageway and Stream Protection	Temporary Stabilization	Permanent Stabilization	Non-sediment Pollution Control
Stabilized Construction Entrance			●		●		
Construction Road Stabilization	●				●		
Dust Control			●		●		
Silt Fence	●		●				

FIGURE 27. MATRIX OF FLOOD CONTROL DISTRICT BEST MANAGEMENT PRACTICES RELATED TO DUST CONTROL
Source: Maricopa County Flood Control District, *Drainage Design Manual for Maricopa County, Arizona, Volume III, Erosion Control*

Stabilizing Construction Site Entrances and Preventing Trackout

The Flood Control District is interested in preventing trackout from construction sites—referred to in FCD material as "sediment"—from entering and potentially clogging storm drains. Air quality officials underscore the concern that after trackout has dried on top of pavement the finer particles it contains are easily ejected into the air by passing vehicles to become fugitive dust. Stabilizing the entrances and exits to construction sites addresses both these issues. The FCD manual contains specifications for a stabilized construction entrance depicted in figure 28. Note that the specifications depicted in figure 28 are identical to those contained in Rule 310, which specifies a "gravel pad at least 30 feet wide, 50 feet long, and 6 inches deep" (see table 16).

The FCD presents specifications for a "wash rack" (referred to in Rule 310 as a "wheel wash system") designed to remove sediment from the tires of haul trucks and other vehicles leaving a construction site. The wash rack specifications are shown in figure 29. The alternative is a "grizzly," or device with elements somewhat resembling a cattle guard, with bars placed perpendicular to the direction of vehicle travel and spaced so as to cause the vehicles traveling over the device to shake vigorously enough to remove trackout from the tires and the undercarriage. Grizzlies, also referred to as "shakers," are used by an increasing number of contractors in the area, and an example is shown in figure 30.

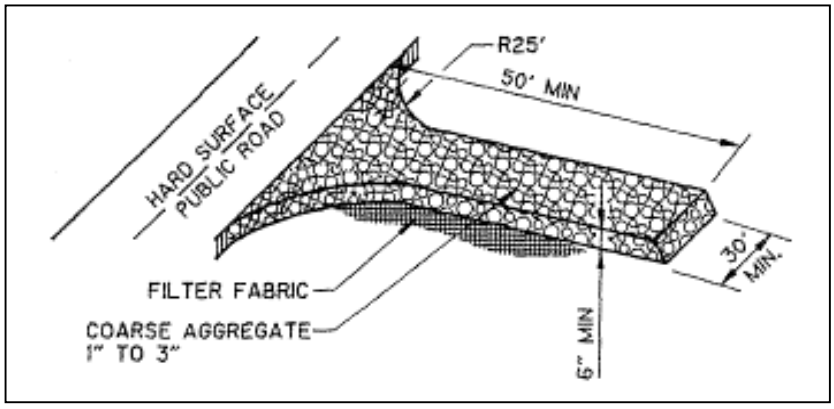


FIGURE 28. STABILIZED CONSTRUCTION ENTRANCE SPECIFICATIONS

Source: Maricopa County Flood Control District, *Drainage Design Manual for Maricopa County, Arizona, Volume III, Erosion Control*

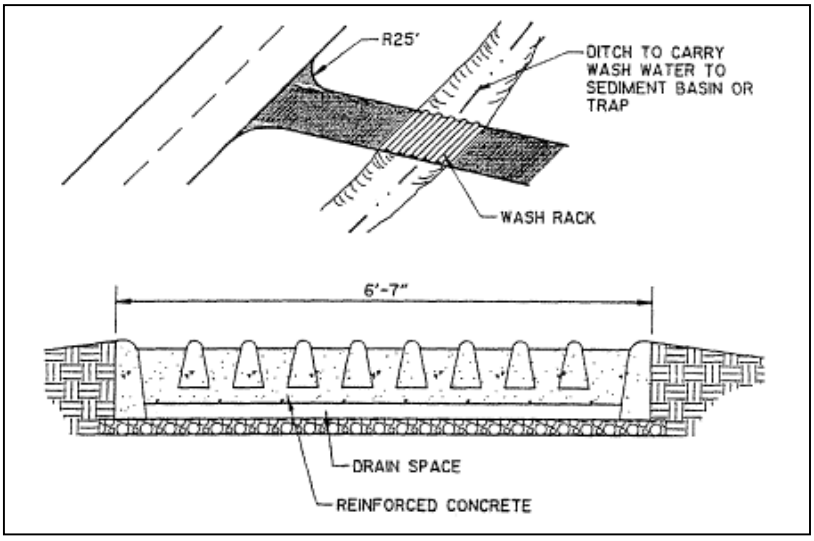


FIGURE 29. SPECIFICATIONS FOR WASH RACK

Source: Maricopa County Flood Control District, *Drainage Design Manual for Maricopa County, Arizona, Volume III, Erosion Control*

FIGURE 30. EXAMPLE OF SHAKER DEVICE
Source: Kitchell Contracting, Jeff Lange photo

Construction Road Stabilization

The FCD promotes the stabilization of construction roads as a means of mitigating erosion. However, the characteristics that make an area susceptible to erosion are similar to those that generate dust.

Rule 310 discusses access roads or haul roads in terms of maximum allowable opacity of fugitive dust emissions from vehicle operations, the amount of allowable silt loading per square foot of roadway surface, or the percentage of silt content. The Construction Road Stabilization BMP contained in Volume III of the FCD drainage design manual, however, provides design and sizing criteria for the roadways summarized as follows:

- Constructed of a 6-inch course of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course, to be applied immediately after grading or after completion of utility installation within the right-of-way.
- A 4-inch course of aggregate base course may be used in place of the crushed rock.
- Chemical stabilization (dust palliatives) may be used upon compacted native sub-grade.
- Roads should follow the contour of the natural terrain as much as possible.
- Slope should not exceed 15 percent.
- Roadway must be graded to drain transversely.
- Drainage swales (bar ditches) must be provided on each side of the roadway in the case of a normal crown section, or on the downstream site of a superelevated section.
- Simple gravel berms may be used in place of the bar ditches.

- Installed drainage inlets shall be protected to prevent sediment-laden water from entering the drain sewer system.

Note that the Rule 310 provisions and those of the FCD BMP are complementary. The BMP stipulates that roads are to be inspected regularly, especially "after large storm events," and additional gravel or rock added as needed. Dust palliatives are to be applied in accordance with the manufacturer's specifications. The Manual contains a more detailed discussion of dust palliatives in the "Dust Control" section.

Dust Control and Silt Fences

The FCD is concerned with dust control because dust that is either tracked out onto pavement or windblown onto pavement may be carried into the storm sewer system by stormwater runoff. In volume III of the drainage control manual, the FCD includes a table of dust control BMPs for given site situations, which it refers to as "Dust Control Applicators." This table is presented in table 17 and includes a BMP for silt fences employed by the Maricopa County FCD. BMPs also used by the Metropolitan Nashville FCD are shown for comparison purposes.

Maricopa Association of Governments

Sierra Research, Inc., of Sacramento, California conducted two studies for the MAG, which were reviewed in the course of this task. The *Particulate Control Measure Feasibility Study* was published in January 1997 and the *Most Stringent PM_{10} Control Measure Analysis* was published in April 1998. Both of these studies were used in developing control measures for the Revised MAG Serious Area PM_{10} Plan submitted to EPA in February 2000. The "Most Stringent Measure Analysis" was included as chapter 10 of that Plan.[11,12]

Particulate Control Measure Feasibility Study

Sierra Research conducted this study to identify PM_{10} sources that significantly impact standard violations as recorded at the monitoring stations, to select applicable measures to control these sources, and to analyze the costs and cost-effectiveness of the measures.

The methodology used for the project consisted of the following four steps:

1. Identification of significant sources of PM_{10}.
2. Review of applicable control measures
3. Review of analysis guidance.
4. Quantification of emission reductions, costs, and cost-effectiveness.

TABLE 17. DUST CONTROL BMPs FOR GIVEN SITE CONDITIONS

Field Condition	Dust Control BMPs								
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt Surfacing	Silt or Sand Fences	Temporary Gravel Construction Entrances/Equipment Wash Down	Haul Truck Covers	Minimize Extent of Area Disturbed
Disturbed Areas not Subject to Traffic	MN	MN	MN	MN	MN				N
Disturbed Areas Subject to Traffic			MN	MN	MN				N
Material Stock Pile Stabilization			MN	MN		MN			N
Demolition			MN				MN	MN	
Clearing/ Excavation			MN	MN					MN
Truck Traffic on Unpaved Roads			MN	MN	MN			MN	
Mud/Dirt Carry-Out					MN		MN		

Source: Maricopa County Flood Control District, *Drainage Design Manual, Volume III Erosion Control*, January 1993[10]

MN = BMP checked by both Metropolitan Nashville - Davidson County and Maricopa County Flood Control District[10,13]

N = BMP checked by Metropolitan Nashville - Davidson County only[13]

Construction-related sources of PM_{10} identified as potentially significant include paved road travel (atmospheric ejection of trackout), unpaved road travel, industrial paved road travel, and construction site preparation. The critical source parameters of these sources are listed in table 18. The source parameters were then screened (Step 2) to eliminate those related to stationary and industrial sources, because applicable laws for controlling these already existed at the time of the project. The source parameters related to nitrogen oxide emissions were also eliminated because EPA had determined that reducing such emissions might adversely impact ozone attainment.

TABLE 18. CRITICAL SOURCE PARAMETERS OF CONSTRUCTION-RELATED POTENTIALLY SIGNIFICANT SOURCES OF PM_{10}

Significant Source	Critical Source Parameters
Paved Road Travel	Total Dust Loading Silt Content of Dust Loading Vehicle Miles Traveled
Unpaved Road Travel	Soil Silt Content Average Vehicle Speed Average Vehicle Weight Vehicle Miles Traveled
Industrial Paved Road Travel	Total Dust Loading Silt Content of Dust Loading Vehicle Miles Traveled
Construction Site Preparation	Soil Silt Content Soil Moisture Content Vehicle Miles Traveled

Source: Sierra Research, Inc., *Particulate Control Feasibility Study*, Sacramento, California, January 1997.

In Step 3, available guidelines from MAG and EPA were reviewed to determine the appropriate methodologies for use in quantifying the emissions. An earlier MAG report titled *Feasibility and Cost-Effectiveness Study of New Air Pollution Control Measures Pertaining to Mobile Sources* was used as a resource for the methodologies. Nonattainment areas classified as "serious" are required to select from the Best Available Control Measures (BACMs). In Step 4, "...baseline emission rates were computed over a 24-hour averaging period using the most appropriate emission factor models and local activity data available." In this way, the potential pounds of PM_{10} emissions reduced per day per control measure was estimated. Finally the cost of each control measure per pound reduced, including overhead costs such as administration and enforcement, was calculated. The cost-effectiveness of each of the control measures pertaining to PM_{10} generating activities related to construction is shown in table 19.

TABLE 19. PROJECTED COST EFFECTIVENESS OF PM_{10} CONTROL MEASURES FOR MAG REGION IN 2001

Control Methods		Cost Effectiveness of PM_{10} Reduction in 2001 ($/lb)
22(b)	Traffic Reduction/Speed Control Plans for Unpaved Roads	$0.12
22(c)	Prohibition of Unpaved Haul Roads, and Parking or Staging Areas	$0.20
22(a)	Surface Treatment to Reduce Dust From Unpaved Roads and Alleys (e.g., Paving, Chemically Stabilizing, or Watering)	$0.35
22(d)	Surface Treatment to Reduce Dust From Unpaved Driveways and Parking Lots	$0.92
2 1(c)	Control of Emissions Due to Material Transport (e.g., Truck Covers, Freeboard Requirements, Material Dampening, or Responsibility for Clean Up of Spills)	$1.25
21(d)	Frequent Routine Sweeping or Cleaning of Paved Roads	$1.31
23(a)	Dust Control Plans for Construction, Demolition, Land Clearing, and Industrial Sites (Including Active Landfills)	$1.71
21(f)	Traffic Rerouting or Rapid Cleanup of Temporary Sources of Dust on Paved Roads (e.g., Due to Spills or Runoff)	$1.91
2 1(b)	Curbing, Paving, or Stabilizing Shoulders on Paved Roads (Includes Painting Stripe on Outside of Travel Lane)	$6.05
2 1(e)	Intensive Street Cleaning Requirements for Industrial Paved Roads and Streets Providing Access to Construction or Industrial Sites	$18.37
23(b)	Dust Control Measures for Material Storage Piles	$28.26
2 1(a)	Paving, Vegetating, and Chemically Stabilizing Unpaved Access Points Onto Paved Roads (Especially Adjacent to Construction or Industrial Sites)	$28.95
23(c)	Require Dust Control Plans for All Grading Permit Activities	$71.39
24(b)	Dust Mitigation Plan Submission and Implementation by Property Owner for Vacant Parcels Greater Than 10 Acres	$106.25
Measures for Which Cost Effectiveness Calculations Are Not Available		
23(d)	Mitigation Bond Requirement for Construction and Development Projects to Provide Funding for Agencies to Control Project Emissions in the Event of Contractor Noncompliance	Insufficient Information: Costs and Benefits of New Program in California Not Yet Available from Implementing Agency
24(a)	Prohibition Against Increase of PM10 Greater Than 50 Mg/m3 Across Property Line	Already Addressed Through Other Existing Regulations

Source: Sierra Research, Inc., *Particulate Control Feasibility Study*, Sacramento, California, January 1997.[{XXX}]

Most Stringent PM_{10} Control Measure Analysis

Section 188(e) of the Clean Air Act (CAA) provides for the extension of serious area attainment dates for up to five years—December 31, 2006, in the case of Maricopa County—provided certain requirements are met. Among these, is the requirement that the PM_{10} Plan document the most stringent PM_{10} control measures included in a State Implementation Plan (SIP), or achieved in practice, in any state that can feasibly be implemented in an area. MAG contracted with Sierra Research, Inc., of Sacramento, California, to prepare an analysis comparing the Most Stringent Measures (MSMs) of other jurisdictions to the measure currently in effect in Maricopa County that addresses an analogous dust generating activity. The report for that project, *Most Stringent PM_{10} Control Measure Analysis*, published in May 1998, compared the MSMs with the corresponding Maricopa measures. Those comparisons addressing construction related activities are excerpted and presented in table 20.

Table 20 indicates that the construction dust control measures in Rule 310 are at least as stringent as measures found anywhere else in the country. In some cases, there are minor differences between the Maricopa measure and others, i.e. 3-inch freeboard requirement for Rule 310 vs. 6-inch for South Coast. At the time the MSM analysis was conducted, two of the measures contained in Rule 310 were more stringent than any other comparable measures in the country: traffic rerouting (21f) and dust control plans for residential construction (23a). The Maricopa measures shown in table 20 are all implemented in the February 2000 version of Rule 310 that was included in the Serious Area PM_{10} Plan and SIP revision for Maricopa County.

CONTROL MEASURE PRACTICES OF OTHER JURISDICTIONS

The remainder of this chapter documents dust control provisions of other jurisdictions that are related to—or could be applied to—construction activity. Many of these measures pre-date Rule 310 and were likely reviewed in the process of drafting Rule 310.

Clark County

In June 2001, the Clark County Comprehensive Planning Department submitted an updated PM_{10} SIP to EPA, designed to meet all of the Federal Clean Air Act requirements relating to serious PM_{10} nonattainment areas.[14] This plan was approved by EPA in January 2003. During 2001, Clark County also developed an interim policy on dust palliative use that will be discussed in chapter 3.

The SIP contains an extensive section related to BACMs for construction activities. Potential BACM for fugitive dust caused by construction were identified and evaluated. These measures were expected to reduce the amount of fugitive dust generated by construction activities in Clark County by 34 percent in 2001 and by 68 percent when fully implemented in 2003. The BACM for construction activities that were identified, evaluated, and selected in Clark County are shown in table 21.

TABLE 20. DETERMINATION OF THE MOST STRINGENT CONTROL MEASURE

Measure			Maricopa Nonattainment Area Measure	Rule	Most Stringent Measure Either in or Under Consideration for Inclusion in Another SIP	Rule
21	a	Paving, vegetating and chemically stabilizing unpaved access points	Limit fugitive dust emissions to 20% opacity; implement RACMs for earthmoving or dust- generating projects greater than 0.1 acres in size	200.305 310.302 310.401.3a	Limit fugitive dust emissions to 20% opacity at property line; implement I3 ACMs for earthmoving/construction/ demolition/vehicle movement projects greater than 0.5 acres in size	SC 403d I; SC 403d2
			Remove soil from exterior surfaces of vehicles exiting work sites using RACMs	310.311.Ia	Remove bulk material trackout within 1 hour chemically stabilize 100' by 20' of access road and remove bulk material trackout daily or whenever visible deposits extend beyond 50' in length	SC 403d5
			Remove bulk material deposits spilling from vehicles onto paved roads or parking staging areas within 6 hours using RACMs that do not cause violation of 20% opacity limit	310.311.lb; 310.311.1c; 310.311.Id	Remove bulk material trackout within I hour or chemically stabilize 100' by 20' of access road and remove bulk material trackout daily and whenever visible deposits extend beyond 50' in length	SC 403d5
21	c	Control of emissions due to material transport	Maintenance of 3" freeboard on bulk material haul trucks	310.311.2b	Maintain 6" freeboard on aggregate haul trucks	CVC 23114
			Clean or cover truck beds when cargo residue is capable of producing fugitive dust	310.311.2c	Clean and/or wash cargo compartments of all haul trucks at delivery site after removal of bulk material with silt content greater than 5% or maintain 6" freeboard on bulk material haul trucks	IC VIII.F6; IC VIII.1.5
21	f	Traffic Rerouting or rapid cleanup of dust deposits on paved roads	**Removal of bulk material deposits spilling from vehicles onto paved roads or parking/staging areas within 6 hours using RACMs that do not cause violation of 20% opacity limit**	310.311.1b: 310.311.1c; 310.311.1d	Clean up construction/demolition project-related spills on publicly maintained paved surfaces within 24 hours	MD 403.2C2
22	c	Prohibition of work site unpaved haul roads/parking/ staging areas	Apply dust suppressants or gravel to haul roads longer than 100 ft or carrying more than 20 ADT at speeds in excess of 15 mph	310.307	Apply dust suppressants to disturbed surface areas in sufficient quantity to limit visible dust emissions to 20% opacity or water at least 80% of the unstabilized area 2 times per day for project greater than 100 acres in size or moving more than 10,000 cubic yards of material per day on more than 3 days each year	SC 403fl

TABLE 20. DETERMINATION OF THE MOST STRINGENT CONTROL MEASURE (Continued)

Measure			Maricopa Nonattainment Area Measure	Rule	Most Stringent Measure Either in or Under Consideration for Inclusion in Another SIP	Rule
23	a	Dust control plans for construction/ land clearing	**Develop and implement dust control plans for non residential construction/demolition projects disturbing more than 0.1 acre**	310.302; 200.305	Develop and implement dust control plans for all non- residential construction/demolition projects which maintain natural topography to the extent possible during grading, specify construction of paved roads and parking lots first, and specify construction of upwind structures prior to downwind structures	MD 403.1C3 Searles Valley only)
			Develop and implement dust control plans for residential construction/demolition projects disturbing more than 0.1 acre	310.302; 200.305	Develop and implement dust control plans for projects greater than 100 acres in size or for projects moving more than 10,000 cubic yards of material per day on more than 3 days each year	SC 403f1
23	b	Dust control measures for material storage piles	Develop and implement dust control plans for projects disturbing more than 0.1 acre	310.302; 200.305	Apply water 3 times daily, apply chemical dust suppressants, or install wind breaks within 24 hours to stabilize new man-made deposits of bulk material with a surface area greater than 2,500 ft^2	SC 403.1 d2; SC 403.lh2B (Coachella Valley Blowsand Area only)
23	c	Require dust control plans for all grading permit activities	Develop and implement dust control plans for projects disturbing more than 0.1 acre	310.302; 200.305	Develop and implement dust control plans for projects greater than 100 acres in size or for projects moving more than 10,000 cubic yards of material per day on more than 3 days each year	SC 403f1

Source: *Most Stringent PM10 Control Measure Analysis*, Maricopa Association of Governments, 1998

Note: IC = Imperial County (California) Air Pollution Control District, MD = Mojave Desert (California) Air Quality Management District, CVC = California Vehicle Code, SC = South Coast (California) Air Quality Management District , WAC = Washington Administrative Code

Maricopa measures in boldface are MSMs

BACM=Best Available Control Measure; RACM=Reasonably Available Control Measure; MSM=Most Stringent Measure; ADT=Average Daily Traffic

TABLE 21. SELECTED BEST AVAILABLE CONTROL MEASURES FOR CONSTRUCTION ACTIVITIES IN CLARK COUNTY

Control Measure	Implemented
Strengthen requirements of existing fugitive dust control rules	Yes
Provide for better enforcement of fugitive dust control rules	Yes
Mitigation bond requirement to ensure implementation of dust control plan	Yes
Dust control plans for construction/land clearing and demolition	Yes
Dust control monitor required for construction sites having more than 50 acres of actively disturbed area	Yes
Trackout control	Yes
Staging areas, equipment storage, and material storage areas	Yes
Use of surfactants or tackifiers	Yes
High-wind operating restrictions	Yes
Phasing land development	Yes -- Partial
Stabilized disturbed inactive surfaces	Yes
Dust controls for blasting of soil and rock	Yes
Dust controls for abrasive blasting	Yes
Dust controls for crushing	Yes
Dust controls for landscaping	Yes
Dust controls for paving/subgrade preparation	Yes
Dust controls for screening	Yes
Dust controls for construction traffic	Yes
Dust controls for trenching	Yes
Dust controls for truck loading	Yes
Dust controls for stockpiles	Yes
Require visible emission limits not to exceed 20% opacity	Yes
Limit visible emissions to 100 feet	Yes
Prevent visible emissions from crossing property line	Proposed

Source: June *2001 PM_{10} State Implementation Plan*, Clark County Comprehensive Planning Department[14]

Coachella Valley

Coachella Valley, California, is also currently designated as a serious PM_{10} nonattainment area. The valley is an approximately 2,500 square mile area located between the Salton Sea and Banning Pass in South Central California. Like Clark and Maricopa Counties, Coachella Valley has had to develop a supplemental SIP to comply with the NAAQS for PM_{10}. The SIP documents the air quality within the valley, the development of a current emissions inventory and a projected future emissions inventory, and an air quality maintenance plan. The document also includes a redesignation request and a natural events action plan.[15]

The valley has a dry desert climate that is even hotter and dryer on average than that of Clark and Maricopa Counties. In addition, Coachella Valley has a more frequent occurrence of high winds and blowing sand. Both the annual average and 24-hour levels of PM_{10} at both Coachella Valley monitoring sites were just within compliance with the NAAQS standards established by the EPA for the 1992-1995 period. A summary of 1990 "Coachella Valley State Implementation Plan PM_{10} Control Measures" is shown in table 22.

TABLE 22. SUMMARY OF 1990 COACHELLA VALLEY STATE IMPLEMENTATION PLAN PM_{10} CONTROL MEASURES FOR CONSTRUCTION/DEMOLITION

1990 Coachella Valley State Implementation Plan Control Measures	No.	Implementation Status
Construction/Demolition Emissions		
Require watering of all active construction projects: a1) with multiple daily applications, if necessary, to assure proper dust control a2) through the use of reclaimed or agricultural canal water	5a	Local jurisdictions have adopted ordinances implementing section 1-5 (1) of the model dust control ordinance. This section requires submittal of a dust control plan for all projects that require issuance of a grading permit. Watering is the primary control option for earthmoving activities.
Require the chemical treatment of unattended construction areas: b1) Defined as disturbed lands within construction projects which have been or are expected to be unused for at least four consecutive days	5b	Local jurisdictions have adopted ordinances implementing section 1-5 of the model dust control ordinance. This section requires the stabilization of inactive construction sites. Such stabilization must be sufficient to prevent visible emissions from crossing the property line.
Prohibit all construction grading activities on days when wind gusts exceed or are forecast to exceed 30 mph	5c	Implemented via District Rule 403.1. Refer to discussion under control measure number 1d.
Require trucks to maintain at least two feet of freeboard	5d	Provisions established under California Vehicle Code section 23114 require the covering of haul vehicles or, as an alternative, maintaining a minimum freeboard of six inches.
Require all trucks hauling dirt, sand soil, or other specified loose dirt material to be covered	5e	Rule 403, Table 1, Item (1E) and (2E) require haul vehicles to be covered or comply with the vehicle freeboard requirements.
Require planting of tree windbreaks: f1) on the windward perimeter of construction projects; f2) only if adjacent to open lands or lots	5f	Refer to discussion under control measure 1b.
Encourage the planting of vegetative ground cover as soon as possible on construction sites	5g	Local jurisdictions have adopted ordinances implementing section 1-5 (1) of the model dust control ordinance. This section encourages the revegetation of inactive construction sites. Additionally, Rule 403, Table 2, Item (3c) encourages revegetation of construction sites as a cost-effective alternative to chemical stabilization.

Source: *Coachella Valley PM_{10} Attainment Redesignation Request and Maintenance Plan*, South Coast Air Quality Management District, December 13, 1996[15]

In compliance with Section 175A(d) of the CAA, the Coachella Valley Air Quality Management District has adopted several contingency measures as a part of the proposed air quality maintenance plan. Two of these measures, "minimal trackout" and "chemical stabilization of unpaved road shoulders," are construction activity related. The minimal Trackout measure proposes four methods of control:

- Paving the last 100 feet from an unpaved roadway connection with a paved road.
- Chemical stabilization of the last 100 feet from an unpaved roadway connection with a paved road at sufficient frequency and concentration to maintain a stabilized surface at all times.
- Installation of dirt removal devices, such as grizzlies.
- Cleaning of public paved road surface when visible trackout occurs.

The proposed method for stabilizing unpaved road shoulders is the use of chemical stabilizers. Alternatives include the use of recycled asphaltic road base and revegetation. Asphaltic road base has a low silt content and a single application, if undisturbed, would last for a number of years. Revegetation is only practical where there is adequate rainfall or an existing irrigation system. The estimated relative cost-effectiveness of both the trackout mitigation and road shoulder stabilization measures, as presented in the SIP, is shown in table 13.

TABLE 23. RELATIVE COST OF PROPOSED CONTROL OPTIONS FOR COACHELLA VALLEY

Control Option	Costs
Trackout	
Paving	$8,496/access connection
Chemical stabilization	$984/access connection
Track-clean system	$4,800/access connection
Street cleaning	$29,970/facility
Stabilization of Unpaved Road Shoulders	
Chemical stabilization	$2,980 per mile
Asphaltic road base	$8,500 per mile

Source: *Coachella Valley PM_{10} Attainment Redesignation Request and Maintenance Plan*, South Coast Air Quality Management District, December 13, 1996[15]

7. DUST PALLIATIVE USE

Many of the mitigation practices discussed in the previous chapter included references to the application of dust palliatives or chemical dust suppressants, or discussed chemical stabilization. This chapter reviews the most commonly used palliatives and introduces some recent analysis with respect to their relative effectiveness. The most common approaches appear to be the two extremes: watering and paving. A wide variety of dust suppressants have been tested, but even the manufacturers of the palliatives themselves agree that more research needs to take place with respect to the comparative cost-effectiveness of the different chemicals and their applicability in different weather and soil conditions.

Table 24 shows the source and functional mechanisms of the most common suppressants, and table 25 summarizes their performance and environmental considerations.

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION (MCDOT)

The Maricopa County Department of Transportation (MCDOT) conducted tests of eight dust palliative products during the 1996-1999 period:

- Soil-Sement, an Acrylic Co-Polymer
- Polytac, an Acrylic Co-Polymer
- Dustac, Calcium Lignosulfonate
- Timet, Magnesium Chloride
- Pennzsuppress D, a Petroleum Resin
- Coherex, a Petroleum Resin
- Road Oyl, Tall Oil Pitch
- EB001, an Organic Acid

A dust palliative report prepared by MCDOT documents the results of the testing and makes recommendations with respect to product choices and application methods.[16]

Methodology

The MCDOT staff developed an in-house vacuum powered dust-collecting unit mounted on a pickup truck with a scoop extending below the rear bumper. The set-up is depicted in figure 31. The truck is driven at 35 mph for one-half mile and the dust raised by the moving vehicle is captured by a filter within the dust-collecting unit for subsequent weighing. Three vehicle runs were made and the amount of dust collected each time weighed. The three results were then averaged to obtain an average sample size in grams, which was called the dust rating.

TABLE 24. SOURCES AND FUNCTIONAL MECHANISMS OF CHEMICAL DUST SUPPRESSANTS

Types and Brand Names	Source	Functional Mechanism
Freshwater	From surface or ground water sources (need water right permit)	Moisture wets particles, increasing their mass and binding them together
Calcium Chloride (Generically available as flakes or pellets)	Byproduct of ammonia-soda (solvary) process; also produced from natural salt brine	Deliquescent and hygroscopic; i.e., attracts and retains moisture at a relative humidity equal to or greater than 29% (77 F)
Magnesium Chloride: *DustGard* *Dust-Off*	Produced from natural salt brine; by-product of potash production; produced from the reaction of magnesium hydroxide (from sea water or dolomite) with hydrochloric acid	Deliquescent and hygroscopic; i.e., attracts and retains moisture at a relative humidity equal to or greater than 29% (77 F)
Lignin Derivatives: *Dustac* *(Lignosite)* *Road Binder*	Paper-making industry byproduct containing lignin and carbohydrates in solution. Specific composition depends on chemicals and processes used to extract cellulose	Act as adhesives, binding soil particles together
Tree Resin Emulsions: *Road Oil* *Enduraseal 200 (ENTAC)* *Dustbinder* *DustControlE (RESTAC)* *Dustrol EX (J-30EX)*	Emulsions produced from pine tree resins	Act as adhesives, binding soil particles together
Synthetic Polymer Emulsions: *Soil Sement,* *Soil Seal* *Top Seal (Dust-Seal) ECO-CF (Sand Glue)* *Soil Master WR-RSB* *Aerospray 70A Marloc*	Synthetic formulations composed of polyvinyl acetates, vinyl acrylic copolymer methacryl methacrylates, polybutadiene, et. al.	Bind soil particles together by forming a polymerizing matrix; function similar to adhesives
Bituments, Tars, and Resins: *Residual Fuel Oil Technical White Oils* *Fuel oils #4, #5, #6* *Asphotac* *DL-10, CSS-1, CMS-2S* *Arcadia oil, PEP* *Pennzsuppress D*	Petroleum, coal, and plastics industry byproducts	Asphalt and resinous products are adhesive, binding soil particles together. Petroleum oil products coat soil particles, increasing their mass and binding them together
Geotextiles: *Trevira* *Spunbond* *Amoco*	Manufactured polypropylene and polyethylene fabrics	Provide and maintain drainage; improve load supporting properties; prevent upward migration of subgrade fines; separate road materials

Source: Paradise Valley Community College, Environmental Health and Safety Technology Program[17]

TABLE 25. PERFORMANCE AND ENVIRONMENTAL CONSIDERATIONS OF DUST SUPPRESSANTS

Types and Brand Names	Performance Advantages	Performance Limitations	Environmental Considerations
Freshwater	Usually readily available, low material cost, easy to apply.	Frequent light applications may be necessary during hot, dry weather; therefore, potentially labor intensive. Overapplication may result in loss of traction, erosion, or points of road failure.	Minimal environmental hazard. If applied excessively, may result in tracking onto paved roadways, requiring prompt cleanup. Supply may be limited in some areas.
Calcium Chloride (Generically available as flakes or pellets)	Reduces evaporation rate of surface moisture 3.4 times; lowers freezing point of water to -60 degrees F (30% solution) minimizing frost heave and reducing freeze-thaw cycles; increases compacted density of road material; effectiveness retained after reblading.	Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to aluminum alloys; slightly corrosive to steel. Solubility results in leaching during heavy precipitation. Releases heat when mixed in water.	Repeated applications and long-term use may harm adjacent and nearby vegetation. (Contact dust suppressant product vendors for additional product-specific information.)
Magnesium Chloride: *DustGard Dust-Off*	Reduces evaporation rate of surface moisture 3.1 times, lowers freezing point of water to -27 degree F (22% solution) minimizing frost heave and reducing freeze-thaw cycles; increases compacted density of road material, more so than calcium chloride; effectiveness retained after reblading.	Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to steel, though inhibitions can be added. Solubility results in leaching during heavy precipitation.	Repeated applications and long-term use may harm adjacent and nearby vegetation. (Contact dust suppressant product vendors for additional product-specific information.)
Lignin Derivatives: *Dustac (Lignosite) Road Binder*	Greatly increases dry strength of soil; not humidity-dependent; imparts some plasticity to road surfaces; lowers freezing point of road surface and base, effectiveness retained after reblading.	High solubility results in leaching during heavy precipitation, corrosive to aluminum alloys due to acidity (CaCO3 added ingredient, can neutralize acidity). Proper aggregate mix (4-8% fines) important to performance. Becomes slippery when wet, brittle when dry.	Lignin products have a high BOD (biological oxygen demand) in aquatic systems. Spills or runoff into surface or groundwater may create low dissolved oxygen conditions resulting in fish kills or increases in groundwater concentrations of iron, sulfur compounds, and other pollutants. (Contact dust suppressant product vendors for additional product-specific information.)

TABLE 25. PERFORMANCE AND ENVIRONMENTAL CONSIDERATIONS OF DUST SUPPRESSANTS (Continued)

Types and Brand Names	Performance Advantages	Performance Limitations	Environmental Considerations
Tree Resin Emulsions: *Road Oil* *Enduraseal200 (ENTAC)* *Dustbinder* *DustControlE (RESTAC)* *Dustrol EX (J-30EX)*	Low solubility after curing, minimizes leaching and provides degree of surface waterproofing. Imparts some plasticity to road surfaces. High bonding strength; noncorrosive.	Requires proper weather and time to cure. No residual effectiveness after reblading. Equipment requires prompt cleanup to avoid curing of resin in hoses and pipes.	Contact dust suppressant product vendors for additional product-specific information.
Synthetic Polymer Emulsions: *Soil Sement, Soil Seal* *Top Seal (Dust-Seal) ECO-CF (Sand Glue)* *Soil Master WR-RSB* *Aerospray 70A* *Marloc*	Applicable to a range of emission sources; functions well in sandy soil conditions. Some types allow seeded vegetation to grow through the polymer matrix.	Requires proper weather conditions and time to cure, may be subject to UV (sunlight) degradation; application equipment requires timely cleaning; no residual effectiveness after reblading.	Contact dust suppressant product vendors for additional product-specific information.
Bitumens, Tars, and Resins: *Residual Fuel Oil* *Technical White Oils* *Fuel Oils #4, #5, #6* *Asphotac* *DL-10, CSS-1, CMS-2S* *Arcadia oil, PEP* *Pennzsuppress D*	Water insoluble when dry; provides a degree of surface waterproofing. Good residual effectiveness.	Surface crusting, fracturing and potholing may develop with some of these products; long-term application of some of these products may cause road to become too hard for reblading; won't lower freezing point; petroleum oil products lack adhesive characteristics.	Use of used oils is prohibited. Some petroleum-based products may contain carcinogenic polycyclic aromatic hydrocarbons (PAHs). (Contact dust suppressant product vendors for additional product-specific information.)
Geotextiles: *Trevira Spunbond* *Amoco*	Flexible, durable, water permeable, and resists soil chemicals; reduces amount of aggregate required during initial construction; lower maintenance costs.	High material cost; material degrades in sunlight, if exposed.	None

Source: Paradise Valley Community College, Environmental Health and Safety Technology Program[17] and "Techniques for Dust Prevention and Suppression," Washington State Dept. of Ecology Publication Number 96-433 [18]

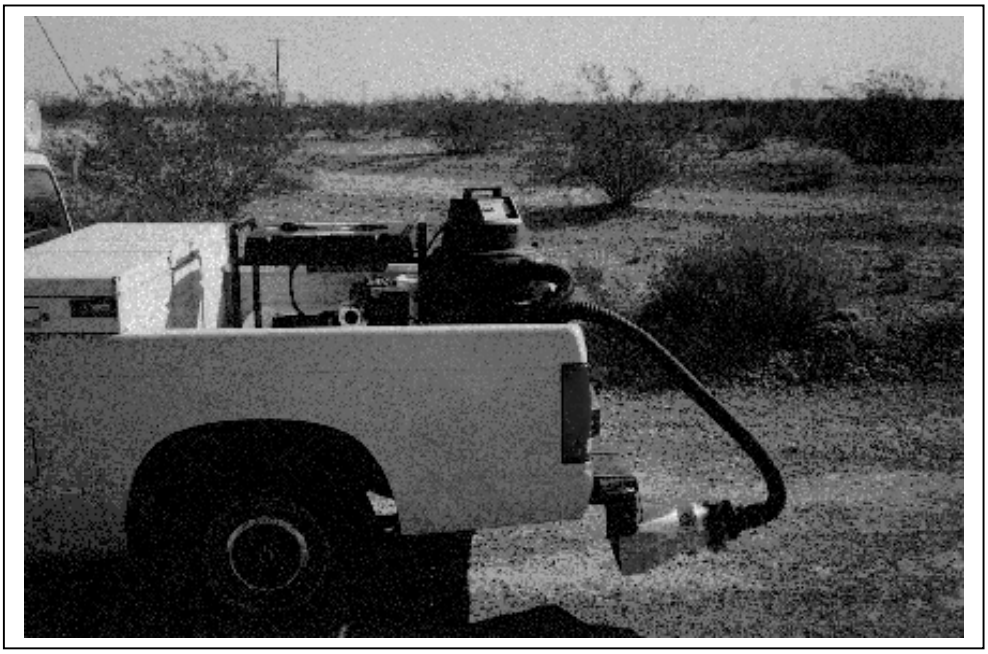


FIGURE 31. MCDOT DUST COLLECTING PROCEDURE
Source: Maricopa County Department of Transportation

The half-mile of roadway to be tested was graded and compacted, and a series of runs was made to obtain a preapplication rating. After the palliative product was applied, runs were made at two months, three months, six months, eight months, and one year after the applications. After a series of runs, the percentage of dust reduction compared with the preapplication test was calculated. The costs of the different products were also tabulated, and are presented in table 26.

URS CORPORATION STUDY

The URS Corporation conducted six-month and 12-month evaluations of fugitive dust control measures for the Arizona Department of Emergency and Military Affairs (ADEMA). The purpose of the project was to evaluate the effectiveness of two dust palliatives, EnviroClean®, a synthetic hydrocarbon emulsion (clear oil) palliative and Soil Sement®, an acrylic polymer type palliative to suppress dust at two locations within the Florence Military Reservation (FMR) in Central Arizona.[19, 20]

Project Approach

The locations tested were the Mesa Staging Area (MSA) and the Main Supply Route, which both experience heavy traffic with an assortment of vehicle types. After the initial application of the palliatives, evaluations were performed at each site at three intervals:

TABLE 26. DUST PALLIATIVE COSTS

Dust Palliatives	Product Application Per Mile**						Total Cost	
	Product Cost ($) (product concentrate)	Total Product (gallons concentrate)	Total Liquid (diluted gallons)	Delivery Charge (30 mile radius)	Application Charge (2 hours on site)	Total Cost Per Mile + Tax (7.05%)	Application Frequency Per Year	Total Cost Per Year/Per Mile
Soil-Sement™	$3.12	1151.74	11,517.4	$0.00	$0.00	$3846.77	1	$3846.77
Dustac®	$1.18	220	1760	$0.00	$0.00	$277.90	3	$833.70
Timet™	$0.32	1760	1760	$0.00	$0.00	$602.91	3	$1808.73
Soil Master WR™	$7.25	158.4	2534.4	$79.20	$150.00	$1,474.72	3	$4,424.16
Coherex®	$1.30	704	3520	$127.54	$170.00	$1,298.24	3	$3,894.71
Road Oyl®	$2.09	1056	6336	$261.26	$200.00	$2,856.42	3	$8,569.25
Pennzsuppress D®	$3.60	1196.8	9574.4	$0.00	$0.00	$4,612.23	3	$13,836.68
Ligno 10™	$0.43	352	1760	$54.98	$150.00	$381.46	4	$1,525.85

Source: Maricopa County Department of Transportation, *Dust Palliative Testing*, 1998[16]

Notes:

1) All cost figures are for dust palliatives delivered and applied by vendor.
2) Total Miles = All Major and Minor Arterial Roads (Class 3, 4, 8, and 9) within Maricopa County's nonattainment area.
3) Product Costs for Soil-Sement, Dustac, and Timet reflect prices on Article 3 Materials Contract effective July 1, 1998.

** The dust palliative was used on 6-foot shoulders, both sides of the road = 7040 sq yards.

within two weeks of the application, approximately six months after the application, and approximately 12 months after the application.

The effectiveness of each of the products, at the time of each evaluation, was assessed with respect to the provisions of Air Pollution Control Regulation 2-8-300 of Pinal County, within which both the FMR and the ADEMA scope of work are located. Both of these provisions limit the opacity of air pollutant emission to 20 percent at the fence line or property line. The ADEMA scope of work also provides that opacity from any site within the property would not exceed 25 percent. The effectiveness of the palliatives in mitigating the migration of dust plumes from the test sites toward the Florence Gardens community located west of the FMR was also assessed.

URS consultant team members performed opacity observations in accordance with the EPA Reference Method 9 as codified in the Code of Federal Regulations (CFR) Volume 40, Part 60, Appendix A. Reference Method 9 provides for the performance of a series of 24 observations every 15 seconds over a 6-minute period. Such a method is also known as the 6-minute rolling average method. However, the traffic on the study areas during the observation periods was too intermittent to facilitate the conduct of 6-minute rolling averages. A 3-minute rolling average was agreed to by all parties prior to the performance of the observations.

Conclusions and Recommendations

Following the six-month evaluation, the following conclusions were made:

- The opacities of the dust plumes generated by the vehicles on both the EnviroKleen® and Soil-Sement® treated areas were all below 20 percent at the property line as required.
- The combined application of coarse rock material and EnviroKleen® at the MSA appear to provide excellent control of fugitive dust.
- Both palliatives appear to tolerate traffic by heavy vehicles of both rubber tired and the tracked types.
- Rubber-tired vehicles eject more fugitive dust than tracked vehicles.

Similar conclusions were drawn following the 12-month observations. In addition, the consultant team concluded that Soil-Sement® was more effective than EnviroKleen® in mitigating dust opacity at wash crossings. Downstream edges of the crossings should be treated with additional Soil-Sement at the expected discharge points to reduce or eliminate erosion. In addition, riprap material could be used to control erosion.

CLARK COUNTY

On February 22, 2001, the Clark County District Board of Health issued a document titled *Section 94 Handbook - Interim Policy On Dust Palliative Use In Clark County, Nevada.* The objective of the interim policy is ensure that air quality fugitive dust controls are implemented in ways that do not adversely impact other aspects of the environment by contaminating the soil or the groundwater.[21]

Specifically, the policy document is intended to provide guidance on the use of dust palliatives and to prevent the use for dust suppressing purposes of chemical agents that have already been banned for other uses such as pest control. The policy also expressly prohibits the use of any materials containing dioxins, asbestos, or polychlorinated biphenyls in any measurable amount. The interim recommendations are based on existing Nevada statutes that address contamination of soil, groundwater, and surface water, the definition of "hazardous waste" and "used oil," regulations for combining and disposing used oil and hazardous waste, and compliance with Federal regulations.

The interim policy provides requirements regarding the usage of various palliatives in the vicinity of open bodies of water, wells, natural washes, and flood control channels. Additional topics covered include the dilution of dust palliatives and the cleaning of tanks in which palliatives have been stored, the application of palliatives in traffic and nontraffic areas, and the joint application of palliatives and pesticides.

MARICOPA ASSOCIATION OF GOVERNMENTS

The MAG has published a 2001 update to their "Uniform Standard Specifications for Public Works Construction". Section 230 of the specifications addresses the application of dust palliatives and includes rules pertaining to equipment to be used, surface preparation, and weather conditions. Section 792 provides specifications of the palliatives including the different types of materials used, typical dilution ratios and application rates, and applicable environmental criteria.[22]

Both the MAG Uniform Standard Specifications 2001 update and the Clark County interim policy covered in the previous section include dilution ratios and application rates for common dust suppressants. A comparison of the provisions of the two jurisdictions is shown in table 27.

TABLE 27. COMPARISON OF MAG AND CLARK COUNTY DILUTION RATIOS AND APPLICATION RATES FOR DUST SUPPRESSANTS

Product Type	Use/Treatment	Dilution Ratio				Application Rate	
		Maricopa		Clark		Maricopa	Clark
		Range	Typical	Range	Typical	(gal/sq. yd.)	(gal/sq. yd.)
Acrylic Copolymer	Topical - road or parking lot	20:1 to 4:1	9:1	12:1 to 4:1	9:1	0.20 to 0.10	0.5
	Topical - road shoulder	20:1 to 4:1	15:1	12:1 to 4:1	9:1	0.16 to 0.09	0.5
	Surface course (per inch of depth)	20:1 to 4:1	9:1	12:1 to 4:1	9:1	0.10 to 0.06	0.25 to 0.50
Petroleum Resin Emulsified	Topical - road or parking lot	4:1	4:1	8:1	4:1	0.15 to 0.10	0.50
	Topical - road shoulder	10:1 to 7:1	8:1	10:1	7:1	0.15 to 0.07	0.25
	Surface course (per inch of depth)	4:1	4:1	8:1	4:1	0.11 to 0.07	0.40
Lignin-Based Type (Lignosulfonate)	Topical - road or parking lot	1:1	1:1	1:1	1:1	0.10 to 0.05	0.50 to 1.00
	Topical - road shoulder	7:1 to 4:1	4:1	7:1 to 4:1	4:1	0.05 to 0.03	0.15 to 0.20
	Surface course (per inch of depth)	1:1	1:1	1:1	1:1	0.30 to 0.10	0.25 to 0.50
Organic Resin	Topical - all	10:1 to 2:1	5:1	10:1 to 2:1	5:1	0.25 to 0.15	1.00
	Surface course (per inch of depth)	2:1 to 1:1	1:1	2:1 to 1:1	1:1	0.15 to 0.10	0.15

Source: Maricopa Association of Governments, *Uniform Standard Specifications for Public Works Construction, 2001 Update*, Section 792[22]
Clark County District Board of Health, *Section 94 Handbook - Interim Policy On Dust Palliative Use In Clark County, Nevada,* February 2001[21]

8. SUMMARY OF OUTREACH EFFORTS

This chapter presents summaries of existing efforts in the region to inform and educate the public and the construction industry about the consequences of continuing nonattainment status, the urgent need for dust control, and successful ways of mitigating fugitive dust generation. Air quality related outreach efforts being conducted outside Maricopa County, as well as outreach programs oriented towards workplace safety and other goals, are also documented. These outreach efforts contain elements and concepts that could be adapted for use in a PM_{10} outreach program for the Maricopa County nonattainment area.

MARICOPA COUNTY SMALL BUSINESS ENVIRONMENTAL ASSISTANCE PROGRAM (SBEAP)

The Maricopa County SBEAP has developed guidelines for the control of fugitive dust at construction projects and to assist contractors in preparing sites for compliance inspections. Construction activities that cause fugitive dust to be ejected into the atmosphere include earthmoving, land clearing, loading, storage piles, vehicular trackout, and haul roads. Dust control practices are discussed in detail on the SBEAP Web site and also are taught in community college courses.[23]

Community College Courses

The Environmental Health and Safety Technology program at Paradise Valley Community College offers a Reducing Air Pollution from Construction course that briefly surveys PM_{10} and other air quality issues. The course is offered each semester on campus. In addition, the half-day course can be scheduled for presentation to large groups of employees of an organization onsite. A sample seminar agenda is shown in table 28.

TABLE 28. SAMPLE AGENDA - REDUCING AIR POLLUTION FROM CONSTRUCTION SEMINAR

Time Allotted	Agenda Topics
9:00 a.m. - 9:05 a.m.	Review of resource materials and course objectives
9:05 a.m. - 9:10 a.m.	Background information
9:10 a.m. - 9:50 a.m.	Overview of reducing air pollution from construction
9:50 a.m. - 10:00 a.m.	Break
10:00 a.m. - 10:15 a.m.	Continuation of overview
10:15 a.m. - 10:30 a.m.	Permit form and fees
10:40 a.m. - 10:50 a.m.	Survey of guidebook
10:50 a.m. - 11:00 a.m.	Break
11:50 a.m. - 12:00 Noon	Q & A and awarding of certificates

Source: Paradise Valley Community College, Environmental Health and Safety Technology Program

Attendees receive a bound handout that includes the text of Maricopa County Rule 310 and Earthmoving Permit application forms. The handout also includes the September 2000 version of the Dust Devil Academy handbook, including background information on PM_{10}, useful Web sites, and other related information. Attendees receive a Certificate of Completion suitable for framing.

Mr. Robert R. Treloar, who conducts the seminar for the college, indicates that the agenda for the session varies depending on the makeup of the class. During the first hour, PM_{10} standards developed by the EPA are discussed, together with the health effects of PM_{10} and various regulatory options and approaches. During the second hour, Maricopa County air quality staff discuss the construction permit form and fees and the Rule 310 that governs fugitive dust emissions in the county. In the third hour, a slide show presents examples of both acceptable and unacceptable construction activities with respect to fugitive dust emission and control.

Mr. Treloar also instructs an Introduction to Hazardous Materials Technology (HMT 101) course at the college. The one semester, three-credit course is designed to introduce the student to the environmental hazardous materials technology area. The course consists of 11 modules, one of which pertains to air quality. This course is part of the Dust Devil Academy (see below).

Dust Devil Academy

The Dust Devil Academy is a joint effort of ADOT, SBEAP, ASU Del E. Webb School of Construction Alliance for Construction Excellence (ACE), and Del E. Webb School of Construction's Industry Advisory Council. The Dust Devil Academy consists of a three-section document that is accessible through both the SBEAP and ACE Web sites. In addition, key elements of the document are available for online viewing on the SBEAP site, together with supportive interactive elements suited to the Web environment such as an online quiz and an animated depiction of 20 percent opacity. The community college course described in the preceding section is considered part of the Dust Devil Academy, as well. The Dust Devil Academy represents a significant effort at outreach with respect to the PM_{10} issue. This ADOT outreach research project builds upon the Dust Devil Academy work done previously by ASU and SBEAP.

The Dust Devil Academy Document

The 154-page document is presented on both the ACE and SBEAP Web sites in Adobe Acrobat format and is available for downloading. The first section contains the following subsections:

- Executive Summary.
- Background. This section explains the status of the Maricopa County Nonattainment Area and the sources of PM_{10}.
- What is PM_{10}?.
- How Does PM_{10} Affect Us?
- What Can I Do to Prevent Fugitive Dust?
- What Am I Legally Required To Do? –This section introduces the concepts of formulating and implementing dust control plans and maintaining a log of earthmoving activity.
- Whom Do I Call If I Have Questions?
- Consequences of Noncompliance.
- Common Violations Found During Inspections.
- Glossary.
- Maricopa County Air Pollution Control Rules and Regulations. –This section introduces Rules 100, 110, 200, and 310.
- Compliance Strategies. This section discusses issues such as trackout, watering, the use of palliatives, bulk material handling, and site maintenance.

Section 2 includes Appendices 1 through 8. Appendix 1 contains instructions for completing an Earthmoving Permit application, and Appendix 2 is a blank Dust Control Log form. Appendix 3 discusses the use of soil stabilizers and dust palliatives, Appendix 4 contains formulas for calculating the surface area of storage piles, and Appendix 5 describes aggregate-hauling vehicle requirements. Appendices 6, 7, and 8, are the texts of Rules 100, 110, and 200.

Section 2 contains the text of Rule 310 and Appendix C, which addresses test methods for stabilization and the visual determination of opacity.

The county has also produced a video "Effective Dust Control and Overview of Rule 310," which has been used to introduce the Dust Devil Academy material.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

The Arizona Department of Environmental Quality (ADEQ) has not officially adopted an outreach program, however, ADEQ has an outreach procedure to which it adheres. Whenever a regulatory change, such as a modification to a SIP, is called for, a list of affected stakeholders is first identified and compiled. Stakeholders are typically individuals representing regulated sources of air pollution.

The ADEQ has a contract with a communications company that faxes notices of the stakeholder meeting with background material on the proposed regulation, to each of the stakeholders. The meetings are conducted in one of two ways:

- An open forum where participants are provided with hard copies of the regulation with the proposed changes underlined. Stakeholders discuss the changes and make recommendations. After the meeting, ADEQ personnel edit the regulation to incorporate the changes agreed upon and distribute to the stakeholders.
- A regulation-modifying charrette where, by means of a laptop computer and an attached projector, the language to be modified is projected using a word processing application with the "track edits" feature enabled. Proposed changes are entered into the document "live" and discussed during the meeting. After a consensus is reached, the meeting adjourns, and participants are subsequently mailed a hard copy.

After the stakeholders meeting, the regulatory changes are posted on the ADEQ Web site for future reference and further dissemination.

Governor's Agricultural Best Management Practices Committee

In 1998, the Arizona Legislature created an Agricultural Best Management Practices Committee consisting of the ADEQ Director, the director of the Department of Agriculture, a soil specialist from the University of Arizona College of Agriculture, and representative producers of citrus, vegetables, cotton, alfalfa, and grain. In May 2000, the committee adopted a set of best management practices to control fugitive dust produced by agricultural activities within the Maricopa County PM_{10} nonattainment area. The committee developed an outreach document, "Guide to Agricultural PM_{10} Best Management Practices," that effectively summarizes the PM_{10} issue and, in clear and concise terms, presents the best management practices for a variety of agricultural activities. This document could serve as a model for a "Guide to Construction PM_{10} Best Management Practices" developed along similar lines.

The committee also produced a two-page brochure called "How Agriculture is Improving Maricopa County's Air Quality." This brochure addresses the following questions: What is PM_{10}? Why Should I Be Concerned About PM_{10}? How Can We Reduce the Levels of Dust in Maricopa County? What Does the General Permit Require? When Will Farmers Have to Comply with the General Permit? Where Can I Learn More?

In addition, the Natural Resources Conservation District and other stakeholders sponsored two workshops to inform Maricopa County farmers of the new PM_{10} requirements. A brochure called "Farmers Must Comply...New Air Quality Regulations" was prepared to invite local farmers to attend the workshops. The topics addressed in this brochure were: What is PM_{10}? What Do the New Regulations Require? Why? Who Has to Comply? When? Workshops were conducted in Mesa on February 20, 2000, for East Valley farmers and in Avondale on March 1, 2000, for West Valley farmers. More than 300 farmers attended these two events.

ARIZONA LOCAL TECHNICAL ASSISTANCE PROGRAM

The National LTAP was established in 1981 as the Rural Technical Assistance Program by the Federal Highway Administration (FHWA) to help local transportation agencies learn about maintaining and improving their roads and about state-of-the-art technology in the construction and maintenance of roadways and bridges.

ADOT partners with the FHWA to provide technology transfer assistance for local road and bridge agencies through Arizona's LTAP.

The LTAP program has the following objectives:

1. To establish a system to improve the exchange of information between local agencies, ADOT, FHWA, private transportation entities and universities.
2. To encourage implementation of effective procedures and technology at the local level.

Arizona LTAP provides the following outreach services:

- A membership database for newsletter and technical material distribution.
- The bimonthly *Tapping In* newsletter and informational brochures.
- A library with publications and more than 500 videos covering every aspect of the road and bridge profession, with particular emphasis on safety. The dust control-related videos in the LTAP library are listed in table 29.
- Professional training in many formats.
- A local agency link between state, national, and international pending, current and completed research.
- The development, participation in, and coordination of the distribution of a variety of transportation safety-related programs and products
- Web site and online discussion group

CONSTRUCTION INDUSTRY OUTREACH

An essential part of preparing an outreach effort targeting a specific industry is the assessment of industry attitudes toward the proposed outreach messages, as well as the documentation of outreach efforts currently being conducted by the industry itself. Project team members interviewed executives of the following construction industry organizations:

- Arizona Builders Alliance.
- Arizona Contractors Association.
- Home Builders Association of Central Arizona.
- Arizona Chapter, Associated General Contractors.

TABLE 29. DUST CONTROL-RELATED VIDEOS IN ARIZONA LTAP VIDEO LIBRARY

Video No.	Title	Source	Length	Synopsis
DR09	Soil Erosion and Sediment Control	Illinois Environmental Inc.	16 Minutes	Erosion of sediments from construction jobs is causing problems for our environment. Failure to control this erosion results in higher construction costs. This tape will show proper procedures in controlling and minimizing soil erosion and to control runoff of sediments.
EV02	Controlling Dust on Unpaved Roads	Costal	30 Minutes	This video covers the problems that lost dust can create to dirt roads over time, such as rutting and potholes. After numerous tests, calcium chloride is found to be more effective than other dust control agents and how it will minimize maintenance and maintenance costs.
EV03	Dust Control	New Mexico LTAP	16 Minutes	This video shows how controlling dusty roads, proper drainage, and proper crowning will be effective and efficient in keeping roads in better condition for a longer time.
EV04	Dust Control with Calcium	Dow Chemical Company	16 Minutes	This video covers the problems that lost dust can create to dirt roads over time, such as rutting and potholes. After numerous tests, calcium chloride is found to be more effective than other dust control agents.
GI01	Air Quality Conformity in Transportation Planning	Federal Highway Administration	20 Minutes	This video describes types of air pollution in general and specifically transportation related air pollutants. The video emphasizes conformity with state air pollution control plans and how lapses in conformity can impact Federal funding for transportation related projects.
GI41	Technology Update: Road Oyl Resin Modified Emulsion Soil Stabilization	Soil Stabilization Products Company Inc.	15 Minutes	This video explains the newest road oyl resin. This product is used as a soil stabilizer. It can be used in either unpaved or paved roads.
GV07	Stabilization, Holding the Road	Iowa State University	22 Minutes	This video shows how to build a high grade, soil stabilized road that will last longer with less dust.

Source: Arizona Local Technical Assistance Program

In addition to the outreach being conducted by construction industry organizations, some construction firms are conducting their own outreach efforts. Kitchell Contractors, which is represented on the Technical Advisory Committee by Jeff Lange, provides an example of these efforts. Summaries of the findings from the team interviews of the four associations and Kitchell Contractors follow.

Arizona Builders Alliance (ABA)

Mark Minter, the Executive Director of the ABA, was interviewed concerning the PM_{10} outreach project. Mr. Minter believes that the most effective outreach tools would be:

- A comprehensive Web site that clearly explained the basics of Rule 310 and provided instructions for implementing the best practice for each dust generating activity.
- Supporting materials to "drive persons" to the Web site.

The ABA contends that outreach, per se, is only part of the issue. The association believes that dust control procedures must be included in the design of projects. Contractors wishing to comply with new regulations are leery of submitting a bid that includes the extra cost of dust control for fear of being underbid by those planning to cut corners. The architect, engineering, and development communities have a responsibility to require dust control in all plans just as safety has become the norm since creation of the Occupational Safety and Health Administration.

According to Mr. Minter, the emphasis, with respect to enforcement, should be on whether best practices have been adhered to, not opacity levels. Dust control is analogous to safety. If all safety measures are taken as required and an injury still occurs, the contractor is not held accountable by OSHA. The same should be true in dust control. However, should it prove possible to develop a practical and affordable means of objectively estimating opacity, the industry would be receptive.

Project team members attended an ABA Safety Committee meeting to brief Safety Committee members on the scope and progress of the project and to obtain feedback and suggestions with respect to outreach. Many of the comments received from committee members present reinforced the assertions made by Mr. Minter during his interview. The top management of construction companies need to be "sold" on the importance of complying with Rule 310, both to avoid being fined and to assist the nonattainment area in achieving compliance by the deadline in accordance with the Serious Area PM_{10} Plan approved by the EPA on January 14, 2002. Committee members reiterated the need for dust control to be integrated into all of the aspects of project development, including the design and engineering phases, analogous to what has taken place in the safety arena since the adoption of OSHA regulations. Dust control provisions should be incorporated into architectural and engineering drawings as are provisions for stormwater pollution prevention.
Specific outreach suggestions made by ABA Safety Committee members included widespread use of the new "Effective Dust Control and Overview of Rule 310" videos, as well as the design of a poster outlining the "Dirty Dozen" actions to avoid, in pursuit of dust

control. The outreach message should be couched in terms of "here is what we are trying to achieve and here is how to achieve it."

Arizona Contractors Association (ACA)

Mr. Brent Jones, director of governmental affairs and safety, for the ACA was interviewed by telephone. In the past several years, members of the ACA have had thousands of dollars levied against them for apparent dust control violations. According to Mr. Jones, contractors found to be in violation have been willing to comply with dust control standards set by Maricopa County, but have lacked sufficient information on procedures and practices for mitigating the generation of fugitive dust at their construction sites.

The Association was contacted by its member contractors with their concerns and asked for help. The Association responded by contacting the county and requesting information on how to help its members comply with the rules and regulations set by the county. Through diligent coordination, the Arizona Contractors Association and Maricopa County set up a "Membership Mixer" for Association members and county officials to discuss in a relaxed atmosphere the issues surrounding PM_{10} dust control compliance.

In addition, the Association scheduled other meetings to educate its members on PM_{10} by inviting county officials to lead discussions on the subject. The Association makes use of its newsletter to inform its members on PM_{10} issues as changes in regulation or management practices occur. The ACA obtains current information from various public sector Web sites for dissemination to its membership by means of the newsletter, word-of-mouth, and other methods. Pinal County contacted the Association and volunteered information on its standards for PM_{10} that was also conveyed to ACA members.

The ACA does not have a structured outreach program, as such, but makes use of membership mixers, other meetings, newsletters, and Web sites to inform its members.

Home Builders Association of Central Arizona (HBACA)

Project team members interviewed Ms. Connie Wilhelm, executive director of the HBACA. The HBACA does not conduct a formal outreach program targeting dust control, but has implemented a comprehensive general outreach program including a 17-week superintendent training program addressing issues such as safety, legal issues, and industry practices into which a dust control module could possibly be incorporated. The association has developed both English and Spanish versions of a "pocket flip book" containing basic job site safety rules and procedures illustrated with cartoons.
The association recently received a supply of the "Effective Dust Control and Overview of Rule 310" videos to distribute to HBACA members on request. The HBACA has also been proactively involved in resolving dust control disputes involving members who have been fined.

Ms. Wilhelm makes the following recommendations concerning dust control outreach:

- The dust control classes must be taught in both English and Spanish.
- The classes must be offered in different parts of the Valley near where the laborers live.
- Outreach must be verbal or graphic in nature to reach personnel who are illiterate.

Associated General Contractors (AGC)—Arizona Chapter

Members of the project team interviewed Mr. David Martin, president of the Arizona Chapter, Associated General Contractors. Nearly all of the firms that perform contract work for ADOT are members of the AGC, and AGC anticipates that its membership will be more immediately impacted by ADOT adoption and implementation of a dust control outreach program than those of other construction industry associations.

Mr. Martin suggested that the project team become familiar with the outreach approach used by the National Safety Council. He explained that the AGC currently conducts safety-related outreach training as a service to AGC membership for a fee, which represents supplemental income to the AGC. Assuming that the county is the entity that retains jurisdiction over the enforcement of dust control, the county could establish training guidelines and a curriculum for the training course, AGC and the other construction industry associations could offer the course program to their members.

Mr. Martin suggested that a series of five-minute video modules, available in English and Spanish, be developed as components in the outreach effort, covering topics such as "What is Particulate Matter" and "Health effects of PM_{10}," for presentation to personnel.

Kitchell Contractors

Mr. Jeff Lange, safety and risk manager for Kitchell Contractors, is a member of the TAC for this project. He is also a member of the ABA Safety Committee. Project team members have interviewed him in person, by telephone, and by e-mail concerning the extensive dust control outreach that he has been conducting on Kitchell's behalf.

Figure 30 on page 94, "Example of Shaker Device," depicts and discusses a trackout control device designed by Mr. Lange for use on Kitchell projects. The device is portable, reusable, can be transported by pickup truck, is easy to assemble, and can have any number of sections added to it to extend its length. The device can be secured with gravel or can be staked to the ground or to a paved surface. Additional information is available at www.trackoutcontrol.com.

In addition to developing and promoting the trackout control device, Jeff Lange has guided the development of an "Environmental Construction Management Program" (ECMP).[24] This program was developed in cooperation with the Maricopa County Environmental

Services Department in association with the ADEQ and the EPA. Kitchell indicates that the ECMP will generate the following benefits for the construction industry:

- Add value to the community.
  - ✓ Avoid complaints.
  - ✓ Promote a "good neighbor" approach to construction.
- Aid in identifying avoidable costs.
  - ✓ Remediation fees.
  - ✓ Litigation fees.
  - ✓ Down-time losses.
  - ✓ Avoid liquidated damages.
  - ✓ Insurance premiums.
  - ✓ Workers compensation.
  - ✓ Loss time.
- Minimize the health risks associated with dust and airborne particulates.
- Protect the community's environment.

The ECMP will consist of six prime areas of focus: air quality, hazardous waste, solid waste, wastewater, education and training, and tracking. The air quality element includes the implementation of dust control measures. The education and training element provides for use of site safety plans, the publishing of a corporate safety manual, and the incorporation of ECMP training into safety meetings. A "Dust Control (Minimize Airborne Dust)" matrix included in the plan is shown in table 30.

Mr. Lange is also in the process of developing a PowerPoint presentation that addresses the dust control elements of the ECMP with emphasis on the use of the trackout control device he designed.

YAVAPAI AIR AWARE

In 1999, the Yavapai Area Governments and Prescott College participated in a pilot air quality sustainability study, sponsored by ADOT that identified an educational/outreach program as an important strategy to sustain clean air in Central Yavapai County.

TABLE 30. DUST CONTROL (MINIMIZE AIRBORNE DUST) MATRIX INCLUDED IN KITCHELL ECMP PLAN

Item	Activity	Objective	Measurable Targets	Operational Control
1.	Vehicles and mobile equipment	• Stabilize all offroad traffic and parking areas • Stabilize all haul routes • Designate and control traffic flow in and around the site • Do not drag soil offsite • Identify locations of access, lay-down yards, and roads to minimize airborne dust, noise, exhaust, surrounding lighting pollution, and vibration	• Limit vehicle speeds to 15 mph • Apply paving as soon as possible to all future roadway areas • Apply water to haul roads • Restrict access to site as soon as possible by installing signs, curbs, fences, gates, posts, shrubs, and/or trees • Construct fences or 3'-5' high wind barriers with fence fabric adjacent to roadways or urban areas that reduce the amount of windblown material leaving a site • Load all haul trucks such that the freeboard is not less than 3 inches • Prevent spillage of material from haul trucks • Whether empty or loaded, before the haul truck leaves the site, cover the cargo compartment	• Train all personnel • Give a copy of the project site rules to haul truck drivers and to commercial drivers/operators
2.	Excavation	• Minimize airborne dust	• Reduce the amount of devegetation on each site • Leave live perennial vegetation and desert pavement, where possible, for areas without continuing construction • Prewater site with water truck • Spray, hose, or wet dirt prior to loading trucks with dirt • Use water hose when loading truck with dirt • Crust spoils while waiting for caisson or while waiting to spread footings	• Train all personnel • Give a copy of the project site rules to subcontractors, supervisors, and onsite personnel • Post a copy of the project site rules in English and in Spanish where rules will be visible • Phase project, so soil disturbance is minimized • Limit the amount of area graded at any one time
3.	Trenching and compaction	• Minimize airborne dust	• Spray, hose, or wet dirt before digging trench • Damp, moist, or crust spoils pile while digging trench • Damp, moist, or crust spoils pile after trench has been dug	• Train all personnel • Phase project, so soil disturbance is minimized • Give a copy of the project site rules to subcontractors, supervisors, and onsite personnel • Post a copy of the project site rules in English and in Spanish where rules will be visible

TABLE 30. DUST CONTROL (MINIMIZE AIRBORNE DUST) MATRIX INCLUDED IN KITCHELL ECMP PLAN
(Continued)

Item	Activity	Objective	Measurable Targets	Operational Control
4.	Install trackout control device	• Prevent mud, silt, and soil trackout onto paved roads • Clean up trackout immediately, if spill extends more than 50 feet • Clean up trackout by end of workday, if spill extends less than 50 feet	• Reduce the number of haul trucks entering and exiting sites by 10% each year for 3 years and reevaluate • Install effective protective barriers on unprotected routes • Maintain trackout control device in effective condition. Install gravel pads consisting of 1" to 3" rough diameter, clean, well-graded gravel or crushed rock (location of gravel pads must be identified on dust control plan). Minimum dimensions must be 30 feet wide by 3 inches deep, and, at minimum, 50' or the length of the longest haul truck, whichever is greater • Rescreen, wash, or apply additional rock in gravel pad to maintain effectiveness. • Pave construction activities roadways as early as possible	• Train all personnel • Monitor the number of haul trucks entering and exiting sites • Develop semipermanent staging areas to reduce the amount of disturbed area
5.	Backfill	• Minimize airborne dust	• Water backfill material to maintain material moisture or to form crust, when not actively handling • Cover or enclose backfill material, when not actively handling • Mix backfill soil with water, prior to moving • Dedicate water truck or large hose to backfilling equipment and apply water as needed • Water to form crust on soil immediately following backfilling • Empty loader slowly • Minimize drop height from loader bucket	• Train all personnel

Source: Kitchell Contractors, *Environmental Construction Management Program*[24]

Yavapai County "Air Aware," also funded by ADOT, is the effort to develop and implement the educational/outreach program recommended by the pilot air quality sustainability study. The program is sponsored by Central Yavapai County governments, including the City of Prescott, the Towns of Prescott Valley and Chino Valley, and the Yavapai-Prescott Indian Tribe. Air Aware encourages voluntary efforts on the part of individuals, businesses, and local governments to keep the air of the area clean, even as significant population growth in the region is anticipated over the next 20 years. The goal is to avoid the adverse medical, environmental, lifestyle, and economic impacts of unhealthy air.

Outreach tools developed—or being developed—by Yavapai Air Aware include:

- A comprehensive Web site hosted by ADOT.
- Mass mailings.
- Curriculum materials for educators.
- Public service announcements.
- Field manuals.
- Speakers' bureau.
- Outreach database.
- Press releases.

Area jurisdictions represented are also encouraged to adopt an ordinance that would ban wood-burning fireplaces (unless they are clean-burning by EPA standards) in new residential construction. Additional Air Aware sponsors include the Central Yavapai Transportation Planning Organization, the Prescott Chamber of Commerce, and Prescott Alternative Transportation, a private-sector advocacy group.

PINAL COUNTY

In 1967, the Pinal County Board of Supervisors formed the Pinal County Air Quality Control District (PCAQCD), which bears primary responsibility for the administration of the county's air quality program. The PCAQCD is an operating division of the Pinal County Health and Human Services Department.

In 1994, Pinal County adopted a "synthetic minor" permit program that allows a source of emissions to "apply voluntarily for limits on emissions, production or operation to be placed in its permit to limit the source's total potential emissions."[25]

Since 1997, the PCAQCD has developed an "exceptional events policy" in accordance with EPA guidance intended to prevent naturally occurring dust storms and other wind events from triggering a "nonattainment" designation for particulate matter in the agricultural areas of the county. The district also petitioned the EPA Administrator to correct the inclusion of Apache Junction in the Phoenix planning area PM_{10} nonattainment area.
"Area A" refers to the portion of urbanized Maricopa County for which a number of air quality measures apply. A portion of Pinal County adjacent to the Maricopa County nonattainment area, is also designated as being in nonattainment status for PM_{10}. Effective

December 31, 2000, in accordance with Arizona Revised Statutes (A.R.S.) Section 49-541, Area A was expanded to include the area north of Arizona Farms Road and extending 12 miles east from the Maricopa/Pinal county line in the Apache Junction area. Area A includes Apache Junction, Gold Canyon, Queen Creek, San Tan Mountains, and most of what is characterized as Johnson Ranch. The following programs were implemented in Area A of Pinal County:

- An earthmoving activity program, which helps minimize local nuisances and possible impacts to Area A and the particulate matter concentrations.
- A Trip Reduction Program, which helps major employers in Area A to implement reductions in vehicle miles traveled by employees.
- A "No Burn Ordinance" in Area A for days when the CO levels in adjacent Maricopa County may exceed the NAAQS for CO. This restriction applies to residential wood combustion and permitted open burning.
- A fireplace restriction ordinance that requires clean burning fireplace standards for new fireplaces or woodstoves.
- Stage I and stage II vapor recovery systems are required at some gas dispensing sites
- Mandatory emission testing for all vehicles used by residents in Area A and those who commute to work in Area A.

Those who inquire about PM_{10} issues or earthmoving permits are provided with a packet of information including a “Dust Control” brochure, and a brochure of information about the “Reducing Air Pollution from Construction” classes (Dust Devil Academy) offered at Paradise Valley Community College. Also included in the packet are a hardcopy of the home page of the PCAQCD Web site, a map of Area A, a hardcopy of a PowerPoint presentation explaining an Earthmoving Activity Registration Orientation Program available to area contractors, applicable county regulations, and a registration application.

Pinal County’s air quality Web site home page contains links to the following:

- A or B Permit Procedures.
- Air Quality Status.
- Asbestos Program (PDF File).
- Definitions.
- Nonattainment Map.
- Organizational Chart.
- What's New?
- Accomplishments.
- Area A Map.
- Code of Regulations.
- Legal Authority.
- Objectives.
- Programs.
- Workload/Performance.

In addition, the following forms are available for downloading in either Adobe Acrobat or Microsoft Word format:

- Earthmoving Registration.
- Class A or B Permit.
- Asbestos Notification.
- Burn Permit Application.
- Emission Source form.

CLARK COUNTY DEPARTMENT OF AIR QUALITY MANAGEMENT

The Clark County Department of Air Quality Management has conducted a class on "Fugitive Dust Control for Construction Activities" since September 1997. The course includes a description of particulate pollution, health and quality of life impacts, sources, regulations and plans, specific requirements of the Clark County dust control rule for construction, test methods, and enforcement, as well as sample dust control permits and mitigation plans.

Construction site supervisors, foremen, and other designated onsite representatives of the project developer, as well as the water truck/pull drivers, are required to successfully complete the dust control class. All required personnel must sign up for the class within seven days of dust control permit issuance and attend within 30 days. Dust class certificates/cards, issued upon successful completion of the course, are valid for three years. Although the course was initially free, $30 is now charged to defray the cost of materials.

Dust control enforcement officers can require onsite representatives to repeat the class. Classes are scheduled on the average of twice each week. If 15 or more individuals require training, classes can be scheduled at special times and places, such as the contractor's site. More than 8,000 people have attended the three-hour course in the past four years.

Examples of those attending the training in Clark County include: homebuilders, building inspectors, public works directors, Nevada Department of Transportation, city rapid response/neighborhood service teams, utility companies, grading companies, dust suppressant vendors, U.S. Occupational Health Services, water districts, and environmental groups. The course is also offered as continuing education credit for construction management personnel. Exhibits on dust control have been set up at expos and trade shows sponsored by such groups as the homebuilders and water authority.

The class was originally developed for Clark County by a consultant, using an outline, photographs, and other materials provided by the Department of Air Quality Management. Since its initial development, the class syllabus has been updated periodically to reflect changes in regulations. The class was completely redesigned recently to coordinate with provisions of the revised SIP for particulates, submitted to EPA in July 2001.

ARIZONA BLUE STAKE

Since its inception, Blue Stake has been successful in achieving widespread recognition among the general public and almost complete penetration of the construction industry market. Ms. Kristen Ouwerkerk, the director of public services for Arizona Blue Stake, was interviewed by telephone to learn of specific outreach approaches that Blue Stake has used and to obtain suggestions based on Blue Stake's experience.

Blue Stake is owned by the utility industries and was developed as a means of avoiding inconvenient or even dangerous accidents caused by inadvertent cutting of water, gas, electrical, and communications lines during excavation activity. Persons planning to excavate are asked to call Blue Stake 48 hours in advance. Blue Stake, in turn, advises the utilities that serve the property where the excavation is planned. The utilities then mark the location of their lines in the area so that the property owner or contractor can avoid them.

As a part of the utility industry, Blue Stake has had the resources from the beginning to promote the Blue Stake concept and has consistently carried out relatively intense advertising and promotion activities. Blue Stake also targets the construction industry. Ms. Ouwerkerk mentioned the following activities as being effective in reaching Blue Stake's audience:

- Maintenance of a Web site.
- Conduct of targeted mailings.
- Maintenance of database of property owners who have requested blue staking.
- Maintenance of database of contractors obtained from the Registrar of Contractors Web site.
- Participation in industry-related forums such as safety committees and associates meetings sponsored by the Arizona Chapter of the Associated General Contractors and the Utility and Transportation Contractors Association (UTCA).

Ms. Ouwerkerk reports that the AGC have been very supportive of Blue Stake efforts to inform AGC membership about changes in regulations such as, for example, a recent decision to use the color purple to designate lines carrying reclaimed water. The AGC has faxed Blue Stake-related announcements to its members and has included announcements in newsletters as needed. Other potential audiences for Blue Stake (and dust control) include construction industry associations such as the Arizona Builders Alliance, landscaping associations, and employee meetings of the larger developers.

Blue Stake has also been successful using giveaways to reinforce the message of its presentations. Items imprinted with a Blue Stake message or slogan and a phone number for information that appear to be popular with construction industry personnel include:

- Pens.
- Lunch coolers.
- Clipboards.
- Small tools.
- Small notebooks.
- Travel mugs.
- Portfolios.

Caps and hats are less effective because persons tend to wear a favorite cap regardless of the slogan it carries and may prefer one with their company's own logo. In addition, slogans on caps are not visible to the wearer during use.

SAFETY-RELATED OUTREACH

OSHA was established by the federal government in 1971 and has helped drastically reduce workplace-related deaths and injuries during the 30 years that have passed since its formation. Many of these workplace safety accomplishments are directly related to outreach efforts developed or mandated by OSHA. The market penetration of OSHA safety standards and practices has been almost complete, and safety-related outreach efforts are worth examining as possible models for PM_{10} outreach.

Arizona Division of Occupational Safety and Health (ADOSH)

The Arizona Division of Occupational Safety and Health is a division of the Industrial Commission of Arizona and has been authorized by the U.S. Department of Labor to oversee all occupational safety and health issues within Arizona, except those pertaining to mining operations, tribal communities, and Federal employees. The ADOSH responsibilities cover approximately 1.8 million employees and 104,000 public and private establishments.

The ADOSH efforts address four specific areas: safety and health compliance, consultation and training, elevators, and boilers.

The Consultation and Training Programs of the ADOSH

The ADOSH provides free consultation to employers who request assistance in attaining compliance with occupational safety and health standards. Employers may request these services for a specific operation or for the entire workplace.

ADOSH also provides free training programs to businesses and organizations within the State. Organizations and businesses may also check out films from the ADOSH film library to supplement their own safety and health programs.

The ADOSH also administers the OSHA's Voluntary Protection Program (VPP) in Arizona. The VPP star program recognizes employers who have provided and maintained excellent safety and health programs at their workplaces. The ADOSH maintains an informative Web site and currently offers safety and health-related courses at various locations throughout Arizona. The courses are listed in Table 31.

Arizona Contractors Association

In addition to its fugitive dust control efforts, the ACA offers a variety of safety outreach products shown in Table 32. Many of these products, such as the bilingual videos and posters, clearly suggest analogous dust control products.

TABLE 31. ARIZONA OCCUPATIONAL SAFETY AND HEALTH 2002 OUTREACH COURSES

Date	Course	Location	Date	Course	Location
1/8	Excavation Safety Awareness	Phoenix	2/14	Forklift Train-the-trainer	Phoenix
1/9	Forklift Train-the-Trainer	Tucson	2/15	OSHA in the Medical Office	Flagstaff
1/15	Excavation Safety Awareness	Prescott	2/20	OSHA in the Medical Office	Tempe
1/22	Forklift Train-the-trainer	Avondale	2/21	OSHA in the Medical Office	Tucson
1/22	Back Injury Prevention	Prescott	2/28	Respiratory Protection	Avondale
1/24	Forklift Train-the-trainer	Flagstaff	2/28	Record Keeping	Tucson
1/24	Record Keeping	Tucson	2/7	Excavation Safety Awareness	Tucson
1/29	Safety Management	Sedona	2/7	Fall Protection	Phoenix
1/30	Excavation Safety Awareness	Tucson	2/12	Scaffold Safety	Prescott
2/6	Safety Management	Tucson	2/20	Scaffold Safety	Tucson
2/7	Excavation Safety Awareness	Yuma	2/21	Construction SafetyManagement	Lake Havasu City
2/12	OSHA in the Medical Office	Yuma	2/28	Record Keeping	Tucson
2/13	Forklift Train-the-Trainer	Tucson			

Source: Industrial Commission of Arizona, Division of Occupational Safety and Health

TABLE 32. ARIZONA CONTRACTORS ASSOCIATION SAFETY PRODUCTS*

• ACA Bilingual Booklet for Safe Work Practices, $15 per copy for members.
• All-In-One Safety Poster (available in Spanish), $20 per poster.
• All-In-One Labor Law Poster (available in Spanish), $20 per poster.
• 1996 OSHA Construction Industry Standards, $20 per copy.
• Hazard Communication Program, $75.
• Toolbox Talks (available in Spanish).
• ACA Injury & Illness Prevention Program, $200. (Requires a visit with ACA safety director.)
• Informal Work Site Visits. (Performed by ACA staff).
• Company Safety Program Analysis.
• Safety Audits.

*Products are available to ACA Members only.
Source: Arizona Contractors Association

Associated Safety Engineers of Arizona (ASEA)

The ASEA consists of safety professionals, consultants, safety coordinators, and business managers concerned and involved with safety and injury prevention in the workplace. The structure of ASEA suggests another approach to fugitive dust control outreach, the creation of an organization dedicated to fugitive dust control made up of representatives of industries engaged in regulated dust generating activities. Such a group need not necessarily be limited to representatives of the construction industry, but could also include agricultural and mining members, as well as persons representing regulatory agencies such as ADEQ and the county.

The ASEA publishes a monthly newsletter that is mailed to ASEA members and is also available online in Adobe Acrobat format at the ASEA Web site at www.azsafety.org. The December 2001 issue of the newsletter has an article entitled "Effective Safety and Health Training," which could serve as a template for the development of effective fugitive dust control training.

According to ASEA, the key elements of effective training are:

- Job analysis. Conduct a "needs analysis" before any training, to determine what employee's duties and hazards are involved in the job.
- Thorough evaluation and testing. After training is completed, you should confirm the employees learned the material.
- Ongoing evaluation and motivation. Ensure that your workers learned the material and ensure they are following the training given.

The ASEA recommends the following seven-step training guidelines:

1. Determining if training is needed.
2. Identifying training needs.
3. Identifying goals and objectives.
4. Developing learning activities.
5. Conducting the training.
6. Evaluating program effectiveness.
7. Improving the program.

Arizona Training Partnership in Occupational Health and Safety

Through the Arizona Training Partnership in Occupational Health and Safety, it is possible to obtain a professional certificate in Occupational Health and Safety from the University of California at San Diego, by taking classes in Phoenix. All courses that comprise the two-year certification program are offered through the OSHA Training Institute Region IX Education Center at various locations in Phoenix.

The partnership is sponsored by the following organizations:

- American Society of Safety Engineers.
- Arizona Chapter of Associated General Contractors.
- Arizona Division of Occupational Safety and Health.
- Associated Safety Engineers of Arizona.
- Environmental Training Center.
- GateWay Community College (Maricopa County District).
- National Safety Council.
- Southwest Safety Training Alliance.

Safety courses offered by the Partnership in 2002 are shown in table 33.

TABLE 33. 2002 ARIZONA TRAINING PARTNERSHIP SAFETY COURSES

Course Title	Dates	Sponsor
OSHA #521: OSHA Guide to Industrial Hygiene	February 11-14	ETC
OSHA #500: Trainer Course in Occupational Safety & Health Standards for the Construction Industry	March 18-21	ASSE
Workplace Safety Inspection Techniques	May 16-17	ETC
OSHA #501: Trainer Course in Occupational Safety & Health Standards for General Industry	June 17-20	ASSE
OSHA #500: Trainer Course in Occupational Safety & Health Standards for the Construction Industry	August 19-22	ASSE
OSHA #204A: Machinery and Machine Guarding Standards	September 16-19	NSC
OSHA #501: Trainer Course in Occupational Safety & Health Standards for General Industry	October 28-31	ASSE
OSHA #201A: Hazardous Materials	November 18-21	ETC

The courses cost between $295 and $595 depending on the length of the course and the nature of the take-home materials provided.

SECTION TWO REFERENCES

1. Maricopa Association of Governments
2. *Arizona Department of Environmental Quality (ADEQ), Appendix I, Air Quality Report, 2000.*
3. Maricopa County Environmental Services Department (MCESD), Air Quality Division, *2000 Network Review,* 2000.
4. Maricopa Association of Governments, *Revised MAG 1999 Serious Area Carbon Monoxide Plan for the Maricopa County Nonattainment Area,* 2001.
5. *Arizona Comparative Environmental Risk Project,* 1995
6. Maricopa Association of Governments, *The 1999 Brown Cloud Project for the Maricopa Association of Governments Area,* 1999.
7. Governor's Brown Cloud Summit, *Final Report, 2001.*
8. Environmental Protection Agency (EPA), *40 CFR Part 52, Approval and Promulgation of Implementation Plans; Arizona – Maricopa County PM-10 Nonattainment Area: Serious Area Plan for Attainment of the Annual PM-10 Standard,* 2000.
9. Maricopa County Rule 310
10. Maricopa County Flood Control District, *Drainage Design Manual, Volume III Erosion Control*, January 1993
11. Maricopa Association of Governments, *Most Stringent PM_{10} Control Measure Analysis*, 1998
12. Sierra Research, Inc., *Particulate Control Feasibility Study*, Sacramento, California, January 1997.
13. Metropolitan Nashville - Davidson County *Stormwater Management Manual Volume 4—Best Management Practices*, March 2000
14. Clark County Comprehensive Planning Department, *June 2001 PM_{10} State Implementation Plan*,
15. *Coachella Valley PM_{10} Attainment Redesignation Request and Maintenance Plan*, South Coast Air Quality Management District, December 13, 1996
16. Maricopa County Department of Transportation, *Dust Palliative Testing*, 1998
17 Paradise Valley Community College, Environmental Health and Safety Technology Program
18 Washington State Dept. of Ecology Publication Number 96-433, "Techniques for Dust Prevention and Suppression,"
19 *12-Month Evaluation Report, Implement Fugitive Dust Control Measures Project, Florence Military Reservation, Florence, Arizona*, URS, May 16, 2001
20 *6-Month Evaluation Report, Implement Fugitive Dust Control Measures Project, Florence Military Reservation, Florence, Arizona*, URS, May 16, 2001

REFERENCES (Continued)

21. Clark County District Board of Health, *Section 94 Handbook - Interim Policy On Dust Palliative Use In Clark County, Nevada,* February 22, 2001

22. Maricopa Association of Governments, *Uniform Standard Specifications for Public Works Construction, 2001 Update*

23. Maricopa County Small Business Environmental Assistance Program

24. Kitchell Contractors, *Environmental Construction Management Program*

25 Environmental Protection Agency (EPA), "Approval and Promulgation of Implementation Plans; Arizona State Implementation Plan Revision, Pinal County Air Quality Control District; and Section 112(l) Approval of Pinal County Air Quality Control District Program for the Issuance of Permits Containing Voluntarily Accepted Federally Enforceable Conditions," *Federal Register*, May 2, 1995

APPENDIX A

PROTOTYPE PROGRAM BROCHURE

NOTE: This is a prototype product provided for illustration purposes only. This product is not intended to be used for actual dust control training. The content of this product was current at the time that the draft was created. However, subsequent changes in rules, regulations, and available data may have rendered portions of the text or graphics obsolete or inaccurate. If and when the training program recommended by this research project is implemented, updated training materials may be obtained from the program coordinator.

What is PM_{10}?

PM_{10} stands for particulate matter that measures ten microns or less in diameter. (A human hair is about 70 microns.) Particulate matter is a mixture of dirt, soil dust, pollens, molds, ashes, soot and aerosols that remain suspended in the air we breathe. In Arizona, most PM_{10} is caused by construction and earthmoving operations, vehicles moving on paved roads, dirt roads, unpaved parking lots, disturbed soil on vacant lots, and agricultural activities. Contrary to popular opinion, PM_{10} does not reach unhealthy levels in the natural desert, but rather, in areas of the desert that have been disturbed by human activity.

Why should I be concerned?

PM_{10} particles are so small that they can penetrate deep into the lungs and cause a wide variety of harmful health effects, especially for children, the elderly, and people with respiratory or cardiovascular disease.

In 1995, the Arizona Comparative Environmental Risk Project reported that nearly 700 people die prematurely each year in Maricopa County due to PM_{10} and concluded that particulate pollution represents one of the highest environmental risks to this state.

PM_{10} also contributes to the unattractive "brown cloud" in urban valleys. Urban haze reduces visibility, obscures Arizona's blue skies, and can ultimately have a deterrent effect on tourism and economic growth. PM_{10} from urban areas may also be contributing to the regional haze observed at the Grand Canyon and other wilderness areas in Arizona.

What am I required to do?

Some parts of the State do not meet the federal standards for PM_{10}. In Maricopa County, new regulations for control of construction-related PM_{10} require that an earthmoving permit be obtained for most construction projects.

Regulations in some jurisdictions require that a contractor or sub-contractor planning any activity that will create dust implement and adhere to a dust control plan approved by the jurisdiction.

How can I help?

- Join the “Blue Skies” Campaign!
- Be an industry leader in adopting effective practices to control PM_{10}
- Send your employees to a dust control class
- Make sure your subcontractors are trained and practicing dust control
- Find out how to become a certified "Blue Skies" contractor

Working together, we can help restore blue skies over our neighborhoods, our urban areas, and our State.

Sign me up!

I’d like to learn more about how I can participate in the “Blue Skies” Campaign and help Arizona achieve cleaner and healthier air.

Name: _____

Position: _____

Firm Name: _____

Address: _____

_____

City: _____ Zip: _____

Phone: _____

FAX: _____

E-mail: _____

- o I am interested in attending a dust control class
- o I would like for my employees to receive training on effective dust control practices
- o I would like to learn more about becoming a certified "Blue Skies" contractor
- o I would like to be sent additional information
- o Comments:

Blue Skies

DUST CONTROL CAMPAIGN
Arizona Department of Transportation
206 South 17th Avenue
Phoenix, AZ 85007

Help Build Bluer Skies and Cleaner Air in Arizona!

Initial funding provided by

Arizona

What is the

Blue Skies

Campaign?

The "Blue Skies" Campaign is one of several initiatives in Arizona being implemented to reduce the risk to human health represented by airborne dust. These efforts will also help the state meet the Federal air quality standards for fine particulates, or PM_{10}.

The goals of the campaign are to:

- Encourage and facilitate participation by the construction industry in practices that reduce fugitive dust.
- Educate contractors, subcontractors, equipment operators, laborers, and others about the importance of dust control and the work practices that will help clear the air.
- Provide all sectors of the construction industry with information and guidance on implementing effective dust control practices.
- Tell the general public what the construction industry in

APPENDIX B

PROTOTYPE GUIDE TO CONSTRUCTION DUST CONTROL IN MARICOPA COUNTY

NOTE: This is a prototype product provided for illustration purposes only. This product is not intended to be used for actual dust control training. The content of this product was current at the time that the draft was created. However, subsequent changes in rules, regulations, and available data may have rendered portions of the text or graphics obsolete or inaccurate. If and when the training program recommended by this research project is implemented, updated training materials may be obtained from the program coordinator.

Guide to Construction Dust Control Measures
in Maricopa County, Arizona

Prepared for
Arizona Transportation Research Center

L & A LIMA & ASSOCIATES
Transportation - G.I.S.

Cathy D. Arthur

Guide to Construction Dust Control Measures
In Maricopa County, Arizona

DRAFT

Prepared for

The Arizona Department of Transportation

ADOT Project SPR-519
PM_{10} Research for Developing Educational Tools and Outreach Programs

August 22, 2003

The intent of this guide is to provide information on how to implement effective dust control practices. It is based on the best information currently available; later publications may be issued to update this document.

First Edition Spring 2003

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION

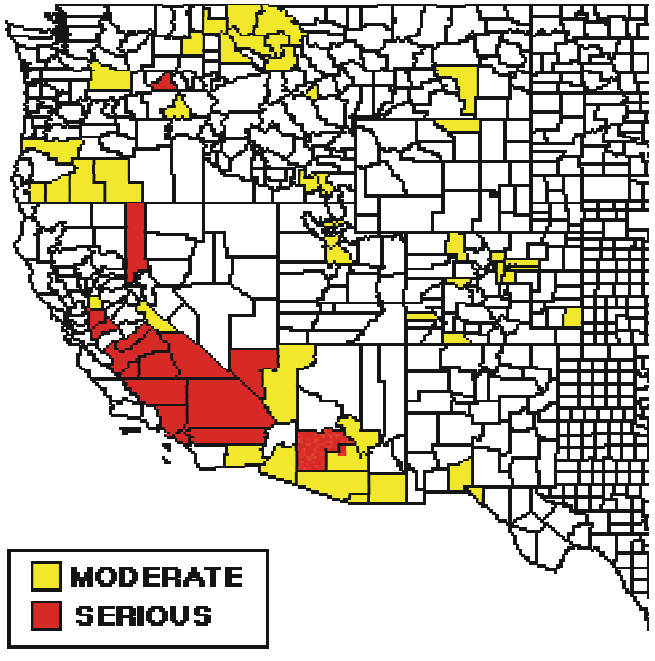
WHY THIS GUIDE IS NEEDED

This chapter summarizes the reasons for dust control and the dust control regulations that have been enacted. Subsequent chapters explain how PM_{10} is created and measured and describe dust control measures in detail. The Blue Skies Training and Certification Program is introduced, and examples of an earthmoving permit application and a sample daily recordkeeping log are provided.

The Federal Clean Air Act requires that emissions from all significant sources in areas not meeting the national ambient air quality standards be controlled through effective programs. Part of Maricopa County is classified as a serious nonattainment area because it does not meet the federal standards for particulate matter (PM_{10}). In February 2000, the Maricopa Association of Governments (MAG) submitted an air quality plan to the U. S. Environmental Protection Agency (EPA) that identified construction activities as a major source of PM_{10} in the Maricopa County nonattainment area.

PM_{10} is particulate matter that is 10 micrometers or less in diameter, about one-seventh the size of a human hair. These particles are very small and can invade the natural defense mechanism of the human respiratory tract penetrating deep into the lungs. Consequently, PM_{10} can cause a wide variety of harmful health effects, especially for children, the elderly, and people with pre-existing respiratory or cardiovascular disease.

With this potential threat to human health, several groups in the Phoenix metropolitan area are implementing programs to help the area meet the Federal Clean Air Act standards for PM_{10}.



PM_{10} Nonattainment Areas in the Western U.S.
—Source: U. S. EPA data

The intent of this guide is to:

- Provide construction industry management and labor with information and guidance for effectively implementing dust control measures.
- Inform the public about the efforts being made by the construction industry to improve air quality in the Phoenix metropolitan area.

WHY DUST CONTROL RULES WERE CREATED

The Phoenix metropolitan area has not met the Federal standards for PM_{10} since the Clean Air Act was revised in 1990. The particulate plan approved by EPA on July 25, 2002, shows that Maricopa County will attain the PM_{10} standards by December 31, 2006. The control measure in the plan most effective in reducing PM_{10} by 2006 is the strengthening and increased enforcement of Maricopa County's Fugitive Dust Control Rule 310.

WHO MUST COMPLY WITH THE DUST CONTROL RULES

Construction activities disturbing the soil within Maricopa County are regulated by the Maricopa County Environmental Services Department. Although Rule 310 requires the minimizing of emissions from all soil disturbing activities—earthmoving activities on one-tenth of an acre or more require a county permit.

A valid permit must be obtained before the soil is disturbed. If the project continues for more than one year, the permit must be renewed.

WHAT A CONTRACTOR MUST DO

The property owner, lessee, developer, or general/prime contractor who engages in earthmoving operations that disturb a total surface area of one-tenth acre (4,356 square feet) is responsible for meeting all of the legal requirements outlined below.

Formulate a Dust Control Plan

Obtain an Earthmoving Permit and have a Dust Control Plan approved by Maricopa County. Instructions for filling out an earthmoving permit application are provided in Chapter 5 of this Guide. The Dust Control Plan must ensure compliance with Rule 310, which prohibits visible emissions from exceeding 20 percent opacity anywhere on site. *A copy of the approved Dust Control Plan must be*

onsite at all times. This Dust Control Plan must contain, at a minimum, all of the following information:

- Name, address, and phone number of the person(s) responsible for the dust generating operation and for the submittal and implementation of the Dust Control Plan.

- A drawing, 8½" x 11" or larger, showing:
  - ✓ Site boundaries of the entire project.
  - ✓ Acres to be disturbed, including linear dimensions.
  - ✓ Locations of the nearest public roads.
  - ✓ Planned exit locations onto paved public roadways.

- Control measures to be applied to all actual and potential fugitive dust sources, before, during and after conducting any dust generating operation, including nonwork hours and nonwork days.

- Dust suppressants to be applied, including the following information:
  - ✓ Product specifications, including the Material Safety Data Sheet.
  - ✓ Label instructions including recommended method, frequency, and intensity of application.
  - ✓ Type, number, and capacity of application equipment.
  - ✓ Information on environmental impacts and approvals or certifications related to appropriate and safe use for ground application.

- Specific surface treatment(s) and/or control measures utilized to control material trackout and sedimentation where unpaved and/or access points join paved public roadways.

- A contingency plan consisting of at least one contingency measure for each activity occurring on the site in case the primary control measures prove inadequate.

Implement the Dust Control Plan

The control measures in a Dust Control Plan must be implemented during all phases of construction. They are not effective when used after a dust problem arises. If the plan is not implemented consistently, poor working conditions begin to escalate. Equally important is that prevention measures be in place when the site is temporarily inactive.

Arizona's dry climate does not make excessive airborne dust inevitable. Not all arid regions have poor air quality from particulate matter. In Maricopa County, excess particulate matter is generated from human disturbance of the desert soil and the lack of stabilization during and after construction. Good dust control measures prevent soil erosion and fugitive dust emissions. Proper planning and use of control measures before, during, and after construction, minimizes fugitive dust emissions and protects public health in the surrounding community. Once the permit is issued, the person responsible for implementing the Dust Control Plan and the person(s) responsible for the dust generating operations on a site must maintain dust control measures at all times.

Each job site must have its own permit and plan. All those who will be working on the site must fully understand the responsibilities in the Dust Control Plan. The permit and Dust Control Plan must be available at the job site. Subcontractors should ask for a copy of the Dust Control Plan and Earthmoving Permit before starting to work.

Keep a Log

A daily log must be kept. This log is used to monitor the application, implementation, and effectiveness of control measures. A sample format for this daily log is included in chapter 6 of this guide. Notes on the effectiveness of dust control strategies used should be made.

WHAT HAPPENS IF A CONTRACTOR DOES NOT COMPLY

Any person who violates any Maricopa County air pollution rule or any permit condition (including a Dust Control Plan incorporated into a permit) may be subject to an order of abatement, a civil action for injunctive relief or civil penalties, or may be found guilty of a Class 1 Misdemeanor. Maricopa County Rules consider the property owner, lessee, developer, or general/prime contractor to be the parties responsible for acquiring Earthmoving Permits and Dust Control Plans. Thus, if the general contractor fails to comply, the developer may also be held responsible for the violation.

Uncovered loads of earth will create dust during hauling.
—Maricopa Small Business Environmental Assistance Program photo

The county's mission is to protect and improve the quality of life through responsive and effective environmental management. The county achieves consistent enforcement of air quality laws and regulations using the following process:

- A Notice of Violation (NOV) is issued, when the County discovers that a person, business, corporation, or enterprise fails to comply with provisions of Federal, State, or Maricopa County air quality laws and regulations.
- An Order of Abatement is issued following the issuance of an NOV when compliance is not attained within a reasonable amount of time.

Trackout from construction sites onto adjacent paved roadways is a significant source of fugitive dust.

—Maricopa Small Business Environmental Assistance Program photos

Additional enforcement action may be initiated when documented evidence reveals that any of the following conditions have occurred:

- The violation results in actual harm or a potential for harm to public health or the environment.
- The violation constitutes a knowing or willful violation of air quality control laws and regulations.
- The violation involves a major deviation from an air quality standard or requirement.
- Repeat violations occur after receiving a Notice of Violation.

The additional enforcement actions that may be taken include:

- Filing a Class I Misdemeanor Criminal Complaint (Citation) pursuant to Arizona Revised Statutes (A.R.S.) 49-502 in Justice Court.
- Filing a Civil Complaint in Superior Court.
- Filing an action for violations, which are classified as a Class I Misdemeanor, Class 2 Felony, Class 5 Felony, or Class 6 Felony.
- Filing an action for Injunctive Relief.

The County uses the "Maricopa County Air Pollution Control Penalty Policy" to determine appropriate penalties for resolving both Criminal and Civil Complaints. These penalties range from $2,500 to $10,000 per day per violation, depending on the severity and circumstance of the violation.

2. HOW PM_{10} IS CREATED AND MEASURED

WHAT IS PM_{10}?

Particulate matter is finely divided solid or liquid material smaller than 10 micrometers (µm) in diameter. These particles are commonly referred to as dust or fugitive dust.

Particulate matter can be comprised of solid or liquid substances that are either visible or invisible. These particles vary in shape and size, ranging from large drops of liquid to microscopic dust particles to tobacco smoke to aerosols. The particles affect visibility and can be transported for long distances by winds. These particles are small enough to be dangerous to human health because they can pass through nostril hairs and enter the lungs. The smaller the particle, the deeper it can penetrate into the lungs and become lodged and not easily, if ever, expelled.

The potential for soil to release dust into the atmosphere depends largely on the soil particle, its size, and the condition of the soil surface. Particles capable of being suspended in the atmosphere exist in most natural soils, although particles in the PM_{10} size range are often bonded tightly to other particles, making large aggregates. Increased wind speed and/or traffic over the soil surface will break the aggregates into smaller sized particles, enabling the particles to be ejected into the atmosphere as fugitive dust. PM_{10} can be suspended, while particles greater than 80 µm rarely stay in suspension because they are too heavy.

Soils have four main constituents: mineral matter, organic matter, air, and water. Minerals are the major constituent in Arizona soils and are derived from the parent material by weathering. Organic matter is derived mostly from decaying plant material that is broken down and decomposed by animals and microorganisms living in the soil. Arizona soils generally contain relatively small amounts of organic matter due to limited plant growth and rapid decomposition of dead plant matter. Air and water fill the pore spaces found between the mineral and organic matter in soils.

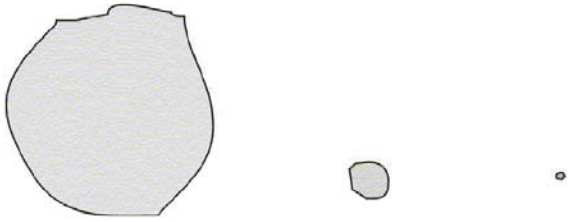
Mineral particles range in size from 2,000 µm to less than 2 µm and are the bases upon which soil texture is determined. Soil mineral particles can be classified as sand (2000 to 50 µm), silt (50 to 2 µm) or clay (less than 2 µm). The relative sizes of soil minerals are depicted in figure 1.

The textural class of a soil is determined by estimating the particle size distribution in the field by the "feel method" or analytically through laboratory measurement. Once the percentages of soil particles are decided, the soil textural triangle (see figure 2) is used to classify the soil further. Interestingly, field determinations are commonly within three percent of laboratory derived values. Local soil surveys made available by the Natural Resources Conservation Service contain these textural classes.

PM_{10} originating from soil is composed of clay particles and large silt particles. Soils with high amounts of these particles have a strong potential to generate PM_{10}. High clay soils always have the potential to generate PM_{10} under the right conditions. The quantity of PM_{10} that is actually generated is closely linked to the management of those soils or the amount of mechanical disturbance. Soil disturbance changes soil structure. Soil structure is an important physical characteristic of any soil. It is produced by the aggregation of particles of sand, silt, and clay into larger units called "peds." A soil with a large amount of clay particles may generate low levels of PM_{10} if disturbance is limited or soil moisture levels are elevated. However, a soil with low clay and silt contents could generate high levels of PM_{10} if frequently disturbed under dry conditions by traffic or earthmoving equipment.

When the natural soil structure is manipulated or disturbed by earthmoving, animals, weathering or vehicular traffic, the structure can be destroyed, which allows particles less

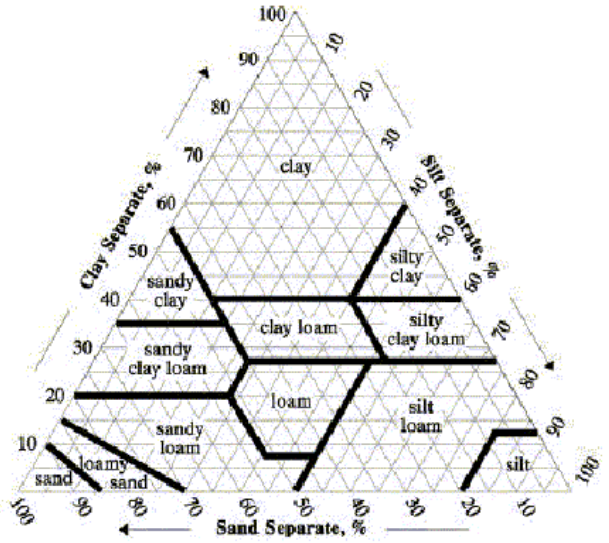
Figure 1. Relative Sizes of Soil Minerals



Sand (2000 - 50 µm) | Silt (50 - 2 µm) | Clay <2 µm

Source: Governor's Agricultural BMP Committee, *Guide to Agricultural PM_{10} Best Management Practices*, 2001

Figure 2. Soil Textural Triangle



Source: Governor's Agricultural BMP Committee, *Guide to Agricultural PM_{10} Best Management Practices*, 2001

than 10 µm in size to be suspended in the air easily. As soil aggregates break away from larger aggregates and become smaller, their ability to be suspended in the air increases significantly. Increased traffic or soil surface manipulation increases the potential for those smaller particles to become fugitive dust. Clay content, relative humidity, soil moisture, wind speed and direction, as well as other elements, can affect the bonding strength between particles, which, in effect, determines the amount of PM_{10} generated.

A soil texture map that depicts the approximate locations of various soil texture types in the in the Maricopa County PM_{10} nonattainment area can be found on the Blue Skies Web site at www.azblueskies.org/soils.html. The map illustrates the relationship between soil types and their contribution to the formation of PM_{10} air pollution.

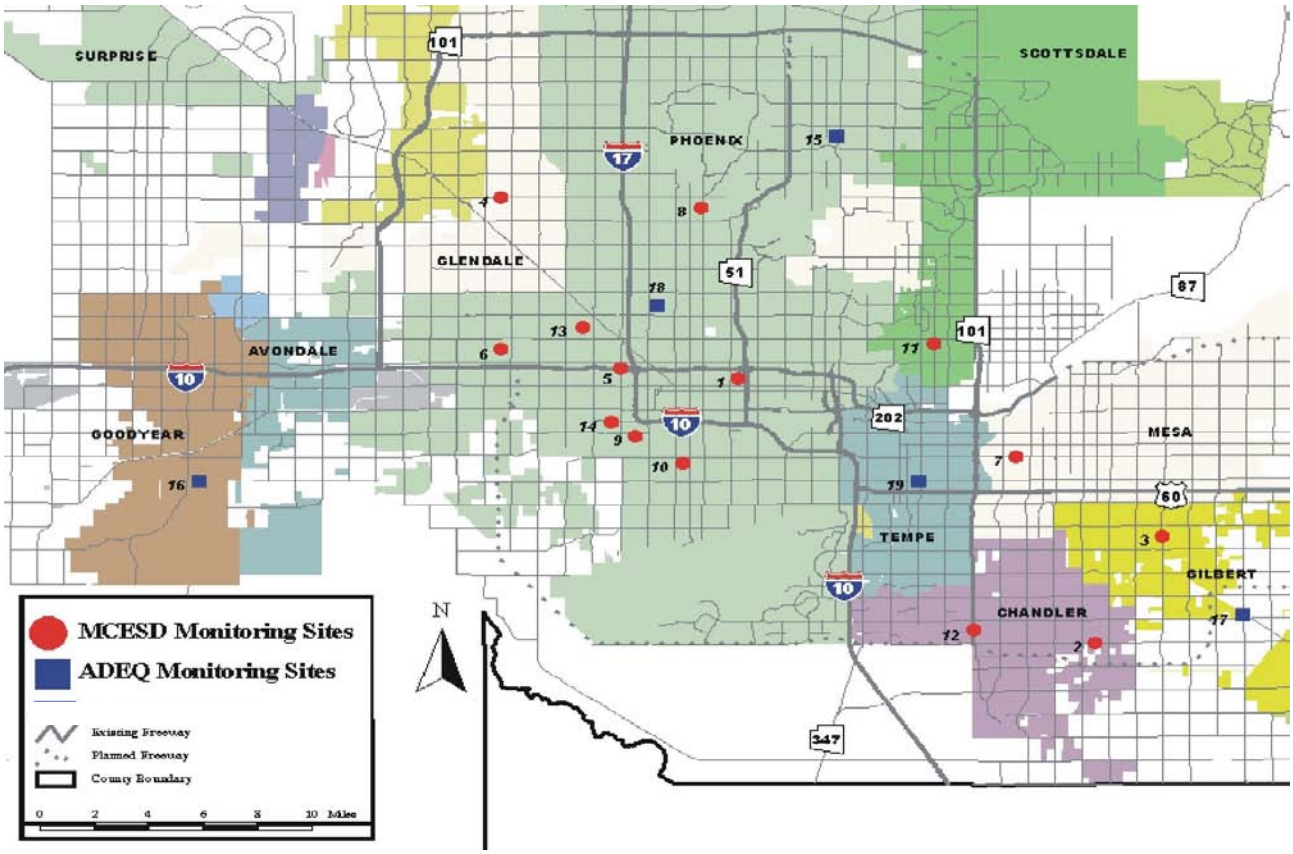
HOW PM_{10} IS MEASURED

Two national ambient air quality standards (NAAQS) for PM_{10} are designed to protect the public health: a 24-hour standard and an annual standard. Maricopa County currently violates both of these standards. In 2000, there were eight days on which the 24-hour standard was exceeded and seven monitors exceeded the annual standard. The MAG PM_{10} Serious Area Plan shows that Maricopa County will meet both of these standards by 2006 if control measures in the Plan are implemented. By far, the most effective control measure in the plan is the strengthening and increased enforcement of Maricopa County Rule 310.

Concentrations of PM_{10} in the ambient air are measured at monitoring stations located through the valley. Figure 3 illustrates the location of these monitors. The monitors measure PM_{10} concentrations for 24-hour periods every six days. These daily samples are averaged over a calendar year to calculate the average annual concentrations at each monitor.

On a construction site, PM_{10} is measured in terms of opacity readings. Rule 310 requires that dust generating operations must not produce fugitive dust exceeding 20 percent opacity. The opacity from sources of visible emissions is measured by an individual who has received certification as a qualified observer by completing Visible Emissions Evaluation Training, or "Smoke School." Additional information about Smoke School is contained in Chapter 4 of this guide.

Figure 3. PM_{10} Monitor Locations



3. DUST CONTROL MEASURES

VEHICLE USE

Open Areas and Vacant Lots

To control fugitive dust from open areas and vacant lots on which no activity is occurring, whether or not work is underway at other locations on the site, use one of the following methods:

- Apply water effectively to form a crusted surface
- Prevent motor vehicle and/or offroad vehicle trespassing, parking, and/or access, by installing barriers, curbs, fences, gates, posts, signs, shrubs, trees, or other effective control measures.
- Uniformly apply and maintain surface gravel or soil stabilizers to all areas that have been disturbed by motor vehicles or off-road vehicles.
- Pave the area.
- Restore the area such that the vegetative ground cover and soil characteristics are similar to adjacent or nearby undisturbed native conditions.

Unpaved Parking Lots

Unpaved parking lots are defined as any area larger than 5,000 square feet that is not paved and that is used for parking, maneuvering, or storing motor vehicles. These areas must be maintained using one of the options below:

- Apply and maintain surface gravel.
- Apply and maintain an effective dust suppressant.

Unpaved Haul and Access Roads

On a site that has unpaved surfaces used for vehicular traffic, vehicle speed must not exceed 15 mph and the number of trips using these surfaces must not exceed 20 per day unless one of the following work practices is used:

- Apply water so that the surface is visibly moist.
- Apply and maintain surface gravel.
- Apply and maintain a dust suppressant.

DISTURBED SURFACE AREAS

Before Earthmoving Operations

Use advance planning to minimize the likelihood of generating excessive fugitive dust. When earthmoving activities commence, use the following control measures:

- Water the work site to the planned depth of cuts.

—Midwest Industrial Supply Photo

- Proceed in stages to minimize the amount of disturbed surface area present at any given time.

During Earthmoving Operations

During dust generating operations such as land clearing, earthmoving, weed abatement by discing or blading, excavating, grading, demolition, or other construction activity, these control measures should be observed:

- Apply water or another dust suppressant to the work area.
- Construct fences or 3- to 5-foot high wind barriers adjacent to roadways or urban areas.

When the area under construction is one acre or larger, water must be applied during earthmoving operations as well as prior to commencement of operations. Note that the use of fences or wind barriers does not substitute for the use of water or other dust suppressant.

Temporary Stabilization After Earthmoving Operations

Dust generated from disturbed surface areas on which no activity is occurring, whether at a work site that is under construction or at a work site that is temporarily or permanently inactive, must be controlled by the following methods:

- Apply and maintain a dust suppressant.
- Prevent motor vehicle and/or offroad vehicle trespassing, parking, and/or access.

Permanent Stabilization

Disturbed surface areas on which no activity has occurred for eight months must be permanently stabilized whether or not the entire site is inactive. One of the following measures must be employed:

- Restore areas with vegetation and soil characteristics similar to adjacent or nearby undisturbed areas
- Pave, or apply gravel or dust suppressants
- Establish permanent vegetative ground cover

MATERIAL HAULING

Bulk material handling, storage and/or transporting operations are defined as the loading, unloading, conveying, transporting, piling, stacking, screening, grading, or the moving of bulk materials capable of producing fugitive dust. Advance planning and properly implemented control measures can control fugitive dust. The following practices should be used:

Onsite

When hauling bulk material on-site that involves crossing a public roadway which is open during construction:

- Load all haul trucks such that the freeboard is not less than three inches.
- Prevent spillage or loss of bulk material from holes or other openings in the cargo compartment's floor, sides, and/or tailgates.
- Control of trackout is required.

When hauling bulk material on-site, completely within site boundaries:

- Limit vehicular speeds to 15 mph.
- Apply water to the top of the load to prevent fugitive dust emissions that exceed the 20 percent opacity limit.

Offsite

When hauling bulk material offsite onto paved public roadways:

- Load all haul trucks such that the freeboard is not less than three inches.
- Prevent spillage or loss of bulk material from holes or other openings in the cargo compartment's floor, sides, and/or tailgates.
- Cover all haul trucks with a tarp or other suitable closure.
- Before the empty haul truck leaves the site, either clean the interior of the cargo compartment or cover it.
- Control of trackout is required.

SPILLAGE AND TRACKOUT

Trackout, including carryout and spillage, refers to bulk materials that adhere to the exterior surfaces of or are spilled from motor vehicles and/or equipment and subsequently fall onto a paved public roadway.

Control of trackout is required for all work sites with a disturbed surface area of five acres or more and from all work sites from which 100 cubic yards of bulk materials are hauled per day. Control of trackout can be accomplished using any of the control devices described and shown below:

Gravel Pad - A stabilized construction entrance, designed to remove mud and dirt from the tires of vehicles as they leave the construction site. The gravel pad should be at least 30 feet wide by 50 feet long, and a minimum of six inches deep. One to three-inch diameter, washed well-graded gravel or crushed rock should be used. The gravel pad should be properly graded.

Grizzly - A device using rails, pipes or grates to dislodge mud, dirt and debris from the tires and undercarriage of vehicles prior to leaving the work site. An example of a grizzly is the "shaker" invented by Jeff Lange for Kitchell Contracting. This device is reusable, transportable by pickup truck, easy to assemble, and can be expanded to accommodate various sizes of haul vehicles. More information about the shaker device can be obtained at www.trackoutcontrol.com.

Grizzlies are designed to cause vehicles driving across them to shake off mud, dirt, and other debris that would otherwise be carried from a construction site onto an adjoining roadway. **—Kitchell Contracting photo**

Paving - The paved surface must extend from the point of intersection with a paved public roadway at least 100 feet back onto the site and have a width of at least 20 feet.

In addition, cleanup of trackout must be done immediately, if it extends 50 linear feet or more onto the paved public road. Otherwise, the trackout must be cleaned up by the end of the workday. Cleanup may be performed with a street sweeper or wet broom or by manually sweeping up the deposits.

4. TRAINING AND CERTIFICATION

As part of the Blue Skies campaign, a Dust Control Training Course and Certification Program have been developed. The goal of the training course is to familiarize construction personnel with common dust control problems and solutions. The course is designed for anyone working in the construction field, and site superintendents, water truck and water pull drivers, and subcontractors are strongly encouraged to attend. In addition to lectures, the course includes class discussion and review of example case studies.

At the completion of the course, the attendee will have a basic understanding of why controlling construction dust is important, should be familiar with dust control regulations, and be able to identify and solve dust control problems at construction sites.

Modular Lesson Plan

This basic dust control course is designed to be presented in a half-day format. Prior to beginning Module 1, the class should be shown the 10-minute video developed by the Maricopa County Environmental Services Department, entitled "Effective Dust Control and Overview of Rule 310." The course can be tailored to the needs of specific groups or jurisdictions by eliminating modules or parts of modules. The six training modules are:

Module 1 - Background will cover the reasons that dust control is needed, and the causes of PM_{10}. Both natural and man-made sources of fugitive dust will be identified and actions that have already been taken to reduce PM_{10} emissions will be explained.

Module 2 - Construction Dust Control Requirements will explore in detail the construction dust control requirements in effect for the jurisdiction in which the course is being presented. Dust control measures for construction-related activities will be explained.

Module 3 - Enforcement of Dust Control at Construction Sites will cover jurisdictional enforcement, including the characteristics of the dust control enforcement program, inspection criteria, enforcement procedures, and penalties for violations, as appropriate for the jurisdiction in which the course is being presented.

Module 4 - Strategies to Assist Construction Activities in Controlling Dust will examine dust control strategies, including project design and site planning. A case study of a construction project will be included.

Module 5 – Visible Emissions Evaluation at Construction Sites will describe the techniques used to identify the opacity levels of dust generated by construction activities. The script and slides for this module are being developed by the Arizona Department of Environmental Quality (ADEQ).

Module 6 - Information Resources and Reinforcements will discuss additional information that supplements and reinforces the material covered in class. Participants will be given a final exam that can be used for certification purposes.

Voluntary Certification Program

The goal of the voluntary certification program is to train construction personnel and supervisors to identify dust problems and proactively implement measures to control dust at construction sites. This program is designed for construction industry management and job supervisory personnel. Upon certification, each individual will receive a Dust Control Specialist or Instructor certificate.

Two levels of certification are offered:

Certified Dust Control Specialist - An individual who completes Dust Control Training and passes an exam covering the subject matter presented in the course with a grade of 75 percent or better may receive designation as a Certified Dust Control Specialist. To maintain certification, a Specialist must take the Dust Control Training and pass the final exam once every two years.

Certified Dust Control Instructor – A Certified Dust Control Specialist who has successfully completed Visible Emissions Evaluation Training and has taught a Dust Control Training course under the supervision of another Certified Instructor, may be designated as a Certified Dust Control Instructor. To maintain certification, an Instructor must receive Smoke School certification every six months and pass the final exam for Dust Control Training (with a score of 75 percent or better) at least once a year.

Visible Emissions Evaluation Training (Smoke School) is offered by the ADEQ twice a year in various parts of the state. This training is a two-day event comprising a classroom session in the morning of the first day, followed by a testing session lasting the remainder of the event. During the testing session, participants evaluate sets of black and white smoke readings to learn to recognize levels of opacity that exceed the standards.

Additional information on the availability of training classes and requirements for certification may be obtained from the Blue Skies coordinator at (602) 712-7487.

5. EARTHMOVING PERMIT APPLICATION

GUIDANCE FOR FILLING OUT AN APPLICATION FOR AN EARTHMOVING PERMIT

Section 1 – Applicant Information

Submit the Appropriate Fee for your Earthmoving Permit application, according to the following:

- If total surface area disturbed is 0.1 acre to less than 1 acre, submit $75.
- If total surface area disturbed is 1 acre or more, submit $36/acre plus $110 per site

Make checks payable to "Maricopa County Environmental Services Department" or "M.C.E.S.D."

A Responsible Official is one of the following:

- For a corporation, a corporate officer or any other person who performs similar policy or decision making functions for the corporation, or a duly authorized representative of such person, if the representative is responsible for the earthmoving operations in the subject application. Delegation of authority to such representative shall be approved in advance by the permitting authority.
- For a partnership or sole proprietorship, a general partner or the proprietor, respectively.
- For a municipality, state, federal, or other public agency, the principle executive officer or ranking elected official of that entity.

Section 2 – Project Information - Drawing

This section is self-explanatory. However, please remember, when calculating the amount of disturbed area for trenching, include the dimensions of the trench, stockpiling areas, and staging areas.

Section 3 – Dust Control Plan

An Earthmoving Permit must contain a Dust Control Plan. You may fill out Section 3 of the Application For An Earthmoving Permit and submit it as your Dust Control Plan or you may write your own Dust Control Plan describing all control measures to be used during the project and submit it as your Dust Control Plan.

Water: Sources of fugitive dust, listed in Section 3, that include "Apply water" as a control measure require specifics about water availability and water application. If you choose to apply water as a control measure, you must fill in the blanks, under both Water Availability and Water Application. For Water Availability, indicate which of the following will be utilized: water storage tank onsite; metered hydrant onsite; water not onsite (describe water source and state the distance from site to water source); water provided through irrigation; other (specify source). For Water Application, indicate which of the following will be utilized: apply water using a water truck (state number of trucks and number of gallons per truck); apply water using hoses; apply water using sprinklers.

Dust Suppressants: If you choose the control measure "dust suppressant(s) other than water", you must describe the method of dust suppressant(s) application. Express frequency in terms of how often the surface will receive a complete application of dust suppressant(s) (i.e., the frequency may be three applications per day). Express intensity in units such as gallons per minute. Also, include as an attachment:

- Product specifications or label instructions for approved usage.
- Information on environmental impacts and approvals or certifications related to appropriate and safe use for ground application.

Describing Major Project Phases: You may use the Project Information Drawing in Section 2 to show the various project phases, along with a timeline depicting relative start and stop times. Indicate on the line provided for describing major project phases that you have shown the various project phases on the Project Information Drawing.

Bulk Material Handling And Hauling: Rule 310 defines "bulk material handling, storage, and/or transporting operation" as the use of equipment, haul trucks, and/or motor vehicles, such as but not limited to the loading, unloading, conveying, transporting, piling, stacking, screening, grading, or moving of bulk materials, which are capable of producing fugitive dust at an industrial, institutional, commercial, governmental, construction, and/or demolition site. When designing your Dust Control Plan, you must choose control measures for all bulk material handling and bulk material hauling that you will do onsite within the boundaries of the work site and that you will do offsite onto paved public roadways.

Open Storage Piles: The control measure options for open storage piles are included with bulk material handling control measure options, because an open storage pile is any accumulation (by stacking, loading, and unloading) of bulk material with a 5 percent or greater silt content that in any one point attains a height of three feet and covers a total surface area of 150 square feet or more. If you choose to construct wind barriers around open storage piles, as a control measure, you must construct the wind barriers around three sides of the open storage pile. The sides' length must be no less than equal to the length of the pile; the sides' distance from the pile must be no more than twice the height of the pile; the sides' height must be equal to the pile

height, and the material of which the sides are made must be no more than 50% porous.

Spillage, Carry-Out, Erosion, And/Or Trackout: Rule 310, Subsection 308.3(b) requires spillage, carryout, erosion, and/or trackout to be cleaned up at least at the end of the work day, immediately if it extends more than 50 feet along a paved public roadway. You must specify, on the Dust Control Plan for any site that exits onto a paved public road, the control measures that you will use for both immediate cleanup and after-the-work-day cleanup.

Weed Abatement By Discing Or Blading: Watering, both prior to and during weed abatement by discing or blading, has been predesignated as the primary control measure, since both are required by Rule 310, Subsection 308.8. You must choose a contingency control measure and at least one control measure to be implemented following weed abatement by discing or blading.

Vegetative Ground Cover: If you choose to "Establish vegetative ground cover" as a control measure, you must comply with the standards in Rule 310, Subsection 302.3:

- Maintain a flat vegetative cover (i.e., attached (rooted) vegetation or unattached vegetative debris lying on the surface with a predominant horizontal orientation that is not subject to movement by wind) that is equal to at least 50 percent; or
- Maintain a standing vegetative cover (i.e., vegetation that is attached (rooted) with a predominant vertical orientation) that is equal to or greater than 30%; or
- Maintain a standing vegetative cover (i.e., vegetation that is attached (rooted) with a predominant vertical orientation) that is equal to or greater than 10% and where the threshold friction velocity is equal to or greater than 43 cm/second when corrected for non-erodible elements; or
- Maintain a percent cover that is equal to or greater than 10% for non-erodible elements.

Surface Gravel, Recycled Asphalt, Or Other Suitable Material: If you choose to "apply and maintain surface gravel, recycled asphalt, or other suitable material" as a control measure for unpaved haul/access roads, you must comply with the standards in Rule 310, Subsection 302.2:

- Do not allow visible dust emissions to exceed 20 percent opacity and either do not allow silt loading to be equal to or greater than 0.33 oz/ft_2 or do not allow silt content to exceed 6 percent.

If you choose to "Apply and maintain surface gravel, recycled asphalt, or other suitable material" as a control measure for unpaved parking lots, you must comply with the standards in Rule 310, Subsection 302.1:

Do not allow visible fugitive dust emissions to exceed 20 percent opacity and either do not allow silt loading to be equal to or greater than 0.33 oz/ft_2 or do not allow silt content to exceed 8 percent.

An approved Application for an Earthmoving Permit is reproduced on the following pages.

Maricopa County
Environmental Services Department
Air Quality Division

1001 North Central Avenue
Phoenix, AZ 85004
(602) 506-6700 FAX (602) 506-6862

PLEASE SUBMIT IN TRIPLICATE

Application for an Earthmoving Permit

In order for Maricopa County to process an application for an Earthmoving Permit, all questions must be answered and the appropriate fee must be submitted.

FOR OFFICE USE ONLY
Dist # _____
NOV # _____
Permit # _____
Date Issued _____
Fee Paid _____
Approved By _____
PU _____ Mail _____

Section 1 – Applicant Information

1. Applicant Must Be One Of The Following. Check All That Apply:
Property Owner____Developer____General/Prime Contractor____Lessee_____

2. Legal Business Name: _____
Applicant Address: _____
City/State/Zip: _____
Phone: _____ Fax #: _____
E-Mail Address: _____

3. Property Owner/Developer, If Not Applicant: _____
Address: _____
Phone: _____ Fax #: _____
Contact Person: _____

4. Primary Project Contact: _____
Title: _____ Company Name: _____
Pager #: _____ Mobile #: _____ On-Site #: _____

5. Signature of a Responsible Official of the Applicant:
I hereby certify that, based on information and belief formed after reasonable inquiry, the statements and information in the Application For An Earthmoving Permit, including Section 1-Applicant Information, Section 2-Project Information-Drawing, and Section 3-Dust Control Plan, are true, accurate, and complete.

A Responsible Official of the Applicant is the person who will be contacted or named in any enforcement action initiated by the Maricopa County Environmental Services Department or the Office of the Maricopa County Attorney.

Signature: _____
Printed Name: _____ Title: _____

Section 2 – Project Information-Drawing

6. **Type Of Project. Check All That Apply.**
   Residential_____ Commercial/Industrial_____ Road Work_____ Temporary Storage/Yard_____
   Trenching_____ Site Preparation/Land Development_____ Weed Control_____ Demolition_____

7. **Project Street Address: _____City:_____**

8. **Nearest Major Intersection: _____**

9. **Legal Description (From Phoenix Metropolitan Map Book):**
   Township: _____ Range:_____ Section: _____

10. **Size Of Area, In Acres, That Will Be Disturbed During The Duration Of This Permit, Including Staging And Stockpile Areas**: _____

11. **Project Start Date:**_____

12. **Does The Project Include Renovation Or Demolition Activities? Yes _____No _____**
    Renovation Or Demolition Activities: All facilities scheduled for renovation or demolition must be inspected by a certified Asbestos Hazard Emergency Response Act (AHERA) accredited asbestos building inspector. You must keep a copy of any reports of inspections, including laboratory test results of samples collected, for 2 years.

    NESHAP stands for national emission standards for hazardous air pollutants. National emission standards for hazardous air pollutants are described in 40 Code Of Federal Regulations (CFR) Part 61 and Part 63 (1998). If your facility is scheduled for renovation or demolition and is subject to the requirements of these Federal regulations, you must attach, to your Application For An Earthmoving Permt, a copy of the 10-day NESHAP notification.

    Is Asbestos Present? _____

    AHERA Determination Made By: _____ Date:_____

    10-Day NESHAP Notification Submittal Date (Attach Copy Of 10-Day NESHAP Notification): _____
    Renovation Or Demolition Start Date: _____

An Earthmoving Permit will not be issued, unless a drawing is submitted. Attach a separate page (at least 8 ½" x 11") with a drawing showing all of the following elements:

- Entire project site boundaries
- Acres to be disturbed with linear dimensions
- Nearest public roads
- North arrow
- Planned exit locations onto paved public roadways

Section 3 – Dust Control Plan

- Put a check (□) in the box in front of all the following sources of fugitive dust that you anticipate from your project.
- Write the letters "NA" in the box in front of all the following sources of fugitive dust that you do not anticipate implementing during your project.
- Unless already pre-designated, write the letter "P", for primary control measures that you will implement during your project, on the line in front of at least one of the listed control measures or work practices, under each checked box/source of fugitive dust. The control measures pre-designated with the letter "P" are required to be implemented.
- Write the letter "C", for contingency control measures that you will implement during your project, on the line in front of at least one of the listed control measures or work practices, under each checked box/source of fugitive dust.

❑ Unpaved Haul/Access Roads:

❑ Limit vehicle speed to 15 miles per hour or less and limit vehicular trips to no more than 20 per day. If this is chosen as the primary control measure, indicate number of vehicles traveled on haul roads: _____

❑ Apply water at a frequency and intensity to comply with Subsection 302.2 in Rule 310 (See Guidance-"Water") Water Availability: _____
Water Application: _____

❑ Pave

❑ Apply and maintain surface gravel, recycled asphalt, or other suitable material so that the area meets the silt loading and silt content limits of Subsection 302.2 in Rule 310 (See Guidance-"Surface Gravel, Recycled Asphalt, Or Other SuitableMaterial")

❑ Apply and maintain dust suppressant(s) other than water using _____ at a frequency of_____ and an intensity of _____ (See Guidance-"Dust Suppressants")

❑ Other: _____

❑ Disturbed Surface Areas – Before Dust Generating Operations Occur:

❑ Pre-water site to the depth of cuts (See Guidance-"Water")
Water Availability:_____
Water Application: _____

❑ Phase work to reduce the amount of disturbed surface area at any one time. Describe major project phases (See Guidance-"Describing Major Project Phases")
_____

❑ Other: _____

❑ Disturbed Surface Areas – During Dust Generating Operations:

❑ Apply water (See Guidance-"Water")
Water Availability:_____
Water Application: _____

❑ Apply and maintain dust suppressant(s) other than water using _____ at a frequency of _____ and an intensity of _____ (See Guidance-"Dust Suppressants")

❑ Construct fences or 3 foot - 5 foot high wind barriers with 50% or less porosity (in combination with one of the above) Show locations on drawing in Section 2.

❑ Cease operations (as a contingency control measure only)

❑ Other: _____

❑ Disturbed Surface Areas – Temporary Stabilization Including Weekends, After Work Hours, Holidays, And Periods Up-To 8 Months:

- ❑ Apply water (See Guidance-"Water") or other dust suppressant (See Guidance-"Dust Suppressants") in sufficient quantity and frequency to establish and maintain a visible crust.
  Water Availability:_____
  Water Application: _____
- ❑ Establish vegetative ground cover that complies with Subsection 302.3 in Rule 310 (See Guidance-"Vegetative Ground Cover")
  Describe vegetative ground cover:_____
- ❑ Restrict vehicular access in combination with one of the above
- ❑ Other: _____

❑ Disturbed Surface Areas – Permanent Stabilization Required Within 8 Months Of Ceasing Dust Generating Operations:

- ❑ Restore area such that the vegetative ground cover and soil characteristics are similar to adjacent or nearby undisturbed native conditions
- ❑ Establish vegetative ground cover that complies with Subsection 302.3 in Rule 310 (See Guidance-"Vegetative Ground Cover")
  Describe vegetative ground cover:_____
- ❑ Pave or apply gravel
- ❑ Apply and maintain dust suppressant(s) other than water using _____ at a frequency of_____ and intensity of_____ (See Guidance-"Dust Suppressants")
- ❑ Other: _____

❑ Trackout From Work Sites With 5 Acres Or More Of Disturbed Surface Area Or With 100 Cubic Yards Or More Of Bulk Material Hauled On Or Off Site Per Day:

- ❑ Install a grizzly or wheel wash system at all access points
- **P** At all access points, install a gravel pad at least 30 feet wide, 50 feet long, and 6 inches deep
- ❑ Pave starting from the point of intersection with a paved public roadway and extending for a centerline distance of at least 100 feet and a width of at least 20 feet
- ❑ Other: _____

❑ Spillage, Carry-Out, Erosion, And/Or Trackout:

If Extending More Than 50 Feet Along A Paved Public Roadway, Implement IMMEDIATELY:

- ❑ Operate a street sweeper or wet broom with sufficient water, if applicable, at the speed recommended by the manufacturer
- ❑ Manually sweep-up deposits
- ❑ Other (describe in detail):_____

If Extending Less Than 50 Feet Along A Paved Public Roadway, Implement NO LATER THAN THE END OF THE WORK DAY:

- ❑ Operate a street sweeper or wet broom with sufficient water, if applicable, at the speed recommended by the manufacturer
- ❑ Manually sweep-up deposits
- ❑ Other (describe in detail):_____

❑ Vehicle Use In Open Areas:

- ❑ Restrict trespass by installing signs
- ❑ Install physical barriers such as curbs, fences, gates, posts, signs, shrubs or trees to prevent access
- ❑ Other: _____

❑ Unpaved Parking Lots:

- ❑ Apply water at a frequency and intensity to comply with Subsection 302.1 in Rule 310 (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Apply and maintain gravel, recycled asphalt, or other suitable material such that the area meets the silt loading and silt content limits of Subsection 302.1 in Rule 310 (See Guidance-"Surface Gravel, Recycled Asphalt, Or Other Suitable Material")
- ❑ Pave
- ❑ Apply and maintain dust suppressant(s) other than water using _____ at a frequency of _____ and an intensity of _____ (See Guidance-"Dust Suppressants")
- ❑ Other: _____

❑ Bulk Material Handling And Open Storage Piles:

(Choose Primary Control Measure And Secondary Control Measure For Each Of The Following 2 Situations):

During Stacking, Loading, And Unloading Operations:

- ❑ Apply water at a frequency and intensity so as not to exceed 20% opacity (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Other (describe in detail):_____

When Not Conducting Stacking, Loading, And Unloading Operations:

- ❑ Cover open storage piles with tarps, plastic, or other material
- ❑ Apply water to maintain a soil moisture content at a minimum of 12% or 70% of the optimum moisture content for compaction (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Apply water as needed to establish and maintain a visible crust (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Maintain a threshold friction velocity of at least 100 cm/sec
- ❑ Maintain vegetative cover meeting one of the requirements of Subsection 302.3 in Rule 310 (See Guidance-"VegetativeGround Cover")
- ❑ Construct wind barriers (See Guidance-"Open Storage Piles"). This control measure must be used in combination with at least one of the above control measures, except covering.
- ❑ Other: _____

❑ Bulk Material Hauling On-Site Within The Boundaries Of The Work Site:

P Load all haul trucks such that the freeboard is not less than 3 inches; and
Prevent spillage or loss of bulk material from holes or other openings in the cargo compartment's floor, sides, and/or tailgates; and
Install a trackout control device that removes particulate matter from tires and the exterior surfaces of haul trucks and/or motor vehicles that traverse the work site

❑ Limit vehicular speeds to 15 miles per hour or less while traveling on the work site

❑ Apply water to the top of the load (See Guidance-"Water")
Water Availability:_____
Water Application: _____

❑ Cover haul trucks with a tarp or other suitable closure

❑ Other: _____

❑ Bulk Material Hauling Off-Site Onto Paved Public Roadways:

P Cover haul trucks with a tarp or other suitable closure; and
Load all haul trucks such that the freeboard is not less than 3 inches; and
Prevent spillage or loss of bulk material from holes or other openings in the cargo compartment's floor, sides, and/or tailgate(s); and
Before the empty haul truck leaves the site, clean the interior of the cargo compartment or cover the cargo compartment

❑ Other: _____

❑ Earthmoving Operations On Disturbed Surface Areas 1 Acre Or Larger:

❑ Apply water, while conducting earthmoving operations (See Guidance-"Water")
Water Availability:_____
Water Application: _____

❑ Other: _____

❑ Weed Abatement By Discing Or Blading:

P Pre-water site and apply water, while weed abatement by discing or blading is occurring (See Guidance-"Water")
Water Availability:_____
Water Application: _____

❑ Other: _____

Choose At Least One of The Following, As A Primary Control Measure, To Be Implemented Following Weed Abatement By Discing Or Blading:

❑ Pave

❑ Apply gravel to establish and maintain either a threshold friction velocity of at least 100 cm/sec or a cover of at least 10% non-erodible elements

❑ Apply water (See Guidance-"Water") or other dust suppressant (See Guidance-"Dust Suppressants") to establish and maintain a visible crust
Water Availability:_____
Water Application: _____

❑ Establish vegetative ground cover meeting one of the requirements of Subsection 302.3 of Rule 310 (See Guidance-"Vegetative Ground Cover")

❑ Other: _____

6. SAMPLE DAILY RECORDKEEPING LOG FOR RULE 310

Project Name:_____**Project Location:**_____**Date:**_____

Maricopa County's Rule 310 (Fugitive Dust Sources) requires that you keep a daily log – recording the actual implementation of control measures identified in your Dust Control Plan.

Each time you visually check an area for dust control measure implementation, write the time in the shaded boxes at the top of the log and write a "Y", "N" or "NA" in all of the boxes below your recorded time.

Use the "Comments" column to record other pertinent information. For example, document the opacity of the fugitive dust or describe the corrective actions taken, such as placement of gravel for road cover or trackout control.

	Time (indicate a.m. or p.m.)								
1. Before Dust Generating Operations Occur									
A. Pre-watering to depth of cuts?									**Comments**
B. Pre-watering stockpiled material?									
C. Work phased/Disturbance minimized?									
D. Water truck being operated?									
E. Water truck being filled?									
F. Other (specify in Comments column)									
2. During Dust Generating Operations									
A. Is visible dust present?									**Comments**
B. Applying water?									
C. Applying dust suppressant(s) other than water?									
D. Fences or 3' – 5' high wind barriers with 50% porosity intact?									
E. Shut down operations?									
F. Checked control measures before leaving the work site for the day?									
G. Other (specify in Comments column)									
3. Unpaved Haul/Access Roads									
A. Is visible dust present?									**Comments**
B. Observed less than 20 vehicles travelling less than 15 miles per hour?									
C. Is road visibly moist?									
D. Is road covered with gravel, recycled asphalt, or other suitable material?									
E. Applying dust suppressant(s) other than water?									
F. Other (specify in Comments column)									
4. Loading, Unloading, And Storage Piles									
A. Is visible dust present?									**Comments**
B. Pre-watering material?									
C. Water being applied during loading and unloading?									
D. Other (specify in Comments column)									
5. Trackout/Access Points									
A. Is trackout control device intact?									**Comments**
B. Cleaned up trackout?									
C. Other (specify in Comments column)									
6. Temporary Site Stabilization									
A. Applying water?									**Comments**
B. Applying dust suppressant(s) other than water?									
C. Other (specify in Comments column)									

Total Number Of Gallons Applied:_____**Responsible Person's Signature And Title:**_____

7. SOURCES OF ADDITIONAL INFORMATION

BLUE SKIES CAMPAIGN COORDINATOR

The Arizona Blue Skies Campaign coordinator can be reached at (602) 712-7487. The Campaign Coordinator responds to inquiries from members of the construction industry and others concerning the availability of Dust control courses and Smoke School sessions, and disseminates information regarding dust control training and certification.

Certified Dust Control Trainers who have completed the Blue Skies training and certification program may obtain copies of toolkits and instructional materials for use in conducting additional dust control classes from the coordinator.

The campaign coordinator also has dust control resources available for use by schools and by volunteer organizations including copies of this Guide, program brochures, and videos.

BLUE SKIES WEB SITE

Be sure to visit our campaign Web site at [INSERT WEB ADDRESS]. The Web site contains updated information about dust control, including documents that can be downloaded and reproduced. Training materials may also be ordered online.

OTHER SOURCES OF INFORMATION

Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC, 20460.
http://www.epa.gov/

Arizona Department of Environmental Quality

Phoenix Main Office
3033 N. Central Ave.
Phoenix, AZ 85012
(602) 207-2300
Toll Free in Arizona:
(800) 234-5677

Northern Regional Office
1515 E. Cedar Ave., Suite F
Flagstaff, AZ 86004
(928) 779-0313

Southern Regional Office
400 W. Congress, Suite 433
Tucson, AZ 85701
(520) 628-6733

Maricopa County Environmental Services Department

602-506-6623

http://www.maricopa.gov/envsvc/Default.asp

Dust Devil Academy

http://www.maricopa.gov/sbeap/basepage.htm

www.azblueskies.org

APPENDIX C

PROTOTYPE BILINGUAL QUICK REFERENCE GUIDE

NOTE: This is a prototype product provided for illustration purposes only. This product is not intended to be used for actual dust control training. The content of this product was current at the time that the draft was created. However, subsequent changes in rules, regulations, and available data may have rendered portions of the text or graphics obsolete or inaccurate. If and when the training program recommended by this research project is implemented, updated training materials may be obtained from the program coordinator.

Quick Reference Dust Control Guide

Fall 2003

How to Use This Guide

This *Quick Reference Dust Control Guide* has been designed by the Blue Skies Campaign for use by persons responsible for the prevention and control of airborne dust caused by earthmoving, vehicle operation, and other construction related activities, as well as for subcontractors performing earthmoving, excavation, site watering, and other activities.

The guide is divided into 13 short subjects, each of which may be suitable for discussion with workers at construction sites. Sections in English begin on even-numbered pages. Sections in Spanish begin on odd-numbered pages.

¿Cómo Usar Esta Guía

Esta Guía de Referencia para el Control del Polvo ha sido diseñada por la organización Campaña Cielos Azules y está dirigida a personas a cargo de la prevención y el control del polvo causado por el movimiento de tierras, manejo de vehículos y otras actividades relacionadas a la construcción. También está dirigida a los sub-contratistas de la construcción que realizan trabajos de movimiento de tierras y excavación, riego de terrenos y otras actividades afines.

La guía está dividida en trece capítulos cortos que pueden ser discutidos con el personal directamente en el lugar de la obra. Las secciones en Inglés se encuentran en las páginas con números pares y las secciones en Español en las impares.

Table of Contents

Contenido

Página

What is Particulate Matter?

Particulate matter is a mixture of dirt, soil dust, pollens, molds, ashes, soot, and aerosols that remain suspended in the air that we breathe.

Coarse particulate matter, between 2.5 and 10 microns in diameter (PM_{10}), is usually caused by construction and earthmoving operations, vehicles moving on paved and unpaved roads, and agricultural activities. Fine particulate matter, measuring less than 2.5 microns, is produced primarily by the exhaust from diesel and gasoline engines.

Earthmoving operations in dry soil can generate significant amounts of airborne dust.

¿Qué es el Material Particulado?

El material particulado es una mezcla de tierra, polvo, polen, moho, cenizas, hollin y aerosoles que permanecen suspendidos en el aire que respiramos.

Por lo general, el material particulado grueso, midiendo entre 2.5 y 10 micrómetros (PM_{10}), es el resultado de las actividades de movimiento de tierras, vehículos que circulan en vías pavimentadas, sin pavimentar y actividades de producción agrícola. El material particulado fino, midiendo menos de 2.5 micrómetros es producido principalmente por el escape de los motores a gasolina y diesel.

Las operaciones de movimiento de tierras en terrenos secos pueden levantar grandes cantidades de polvo.

The Dangers of Dust

Particulate matter can be harmful to your health. When inhaled, the coarse particles are deposited in the upper respiratory tract of the body. The fine particles can reach the lower pulmonary tissues and invade the alveoli of the lungs.

Persons at greatest risk from exposure to particulates are the very young, the elderly, and persons with preexisting heart disease or lung ailments, such as asthma, bronchitis, or emphysema.

In 1995, the Arizona Comparative Environmental Risk Project reported that nearly 700 people die prematurely each year in Maricopa County due to particulates, and concluded that particulate pollution represents one of the highest environmental risks to this State. Fine particulate matter also contributes to the ugly brown cloud that hangs over the Valley and obscures our blue skies.

Los Peligros del Polvo

El material particulado puede ser muy dañino para la salud. Al inhalarse, las partículas gruesas se depositan en la parte superior del sistema respiratorio. Las partículas finas pueden llegar hasta los tejidos pulmonares profundos e invadir los alveolos de los pulmones.

Al exponerse a las partículas de polvo, los individuos con mayores riesgos son los niños, los ancianos y las personas con enfermedades cardíacas o respiratorias tales como: asma, bronquitis o enfisema pulmonar.

En 1995, El Proyecto De Riesgos Ambientales Comparativos informó que debido al material particulado, cerca de 700 personas mueren prematuramente cada año en el Condado de Maricopa. El estudio concluyó que la polución de partículas representa el riesgo ambiental más alto en el estado. El material particulado fino también contribuye a la formación de la "nube café" que se suspende sobre nuestro Valle de Sol y obscurece nuestros cielos.

What Is Being Done?

A 3,000 square-mile area of Maricopa and Pinal Counties has been designated a nonattainment area, because it does not meet the Federal air quality standards for particulates smaller than ten microns in diameter (PM_{10}).

In addition to negative health effects, being a nonattainment area is a stigma that can slow economic growth and development. Tourists may not visit the Valley, because they perceive it to be too polluted. Persons may avoid moving to the Phoenix area because of the perception of unhealthy air, resulting in lower demand for new housing and office buildings.

A PM_{10} Serious Area Plan for Maricopa County was approved by the U.S. Environmental Protection Agency on July 25, 2002. The plan shows how Maricopa County will attain the federal PM_{10} standards by 2006. The plan has 77 measures to reduce particulate pollution from all significant sources, including agriculture, woodburning, driving on paved and unpaved roads, vacant lots, gasoline and diesel exhaust, and earthmoving activities.

¿Qué se Está Haciendo?

Un área de 3,000 millas cuadradas en los condados de Maricopa y Pinal, ha sido identificada como "Area de no Conformidad" debido a que se exceden las normas federales de calidad de aire para partículas menores de 10 micrómetros de diámetro (PM_{10}).

Cuando una región se identifica como "Area de no Conformidad", no sólo se vé afectada por los efectos negativos a la salud sino que también se crea un estigma que puede retrasar el crecimiento y desarrollo económico. Por ejemplo, el turismo en el Valle del Sol se puede ver reducido por la percepción de ser un área muy polucionada. Cuando se percibe que una región tiene aire contaminado, hay menos influjo de población y por lo tanto menor demanda de viviendas y oficinas.

El 25 de Julio del 2002, la oficina Federal de Protección del Medio Ambiente para el Condado de Maricopa aprobó un Plan de PM_{10}. El Plan demuestra cómo se logrará calificar dentro de los niveles Federales estándares de PM_{10} en el año 2006. El Plan cuenta con 77 medidas para reducir la polución de partículas de las fuentes principales incluyendo: actividades agrícolas, incendio de maderas, circulación de vehículos en vías pavimentadas y sin pavimentar, terrenos vacíos, escape de gasolina, diesel y movimiento de tierras.

Maricopa County Rule 310

The most effective measure in reducing particulates is Maricopa County's Fugitive Dust Control Rule 310. By 2006, Rule 310 is expected to reduce fugitive dust from construction sites and other earthmoving sources by 72 percent.

Compliance with Rule 310 is essential for the Valley to meet the federal standards. If we do not, there will be serious consequences, such as the loss of Federal dollars needed to build highways and light rail. So it is important for every construction worker to do his part to comply with Rule 310 and "bust the dust."

Monitoring sites such as this one measure the concentrations of particulates and other air pollutants.

Reglamento 310 del Condado de Maricopa

La medida más efectiva para reducir las partículas es el Reglamento 310 de Control del Polvo Fugitivo establecido por el Condado de Maricopa. Se espera que al aplicar este reglamento, el polvo fugitivo se reducirá en un 72% en los terrenos en construcción y otras fuentes relacionadas con el movimiento de tierras.

Para poder calificar dentro de los límites del estándard Federal, es esencial que se cumpla el Reglamento 310. Si este regalmento no se llega a cumplir, se esperan serias consecuencias, como por ejemplo: eliminación de fondos Federales para trenes ligeros y para construir carreteras. Por lo tanto, es importante que todo trabajador de la construcción contribuya en el cumplimiento del Reglamento 310 y así poder controlar polvo fugitivo.

Estaciones de monitoreo como ésta, miden la concentración de partículas y otras substancias tóxicas.

Site Planning

Take time to consider dust control issues before beginning your project in order to save time, money, and project resources. Identify site-specific air quality and dust control issues up front and develop a consensus for addressing these issues. Phase your project and plan your site layout to minimize disturbance of the soil. Include the following action items:

- Make sure everyone working on the job knows who's in charge and all the requirements for dust control. Encourage a proactive and continuous focus on air quality issues on the job site.
- Evaluate dust control procedures periodically to identify additional issues that develop as the job progresses.
- Limit the amount of area graded at any one time. Lessening the amount of surface being disturbed at any one time reduces the amount of control required and the amount of water or dust suppressant needed.

Planificación de Terrenos

Tómese el tiempo necesario antes de de empezar la obra y considere todos los factores relacionados con el control del polvo, ésto le ahorrará tiempo, dinero y recursos. Antes de empezar, estudie el terreno e identifique los aspectos específicamente relacionados con la calidad del aire y el control de polvo. Llegue a un acuerdo general y establezca una estrategia de acción. Divida el proyecto en etapas y planifique el trazado y localización sobre el terreno de manera que se reduzca el movimiento de tierra. Se recomienda lo siguiente:

- Asegúrese de que todos los trabajadores estén enterados de todos los requisitos para controlar el polvo en el sitio de la obra y que sepan quién está a cargo. En el sitio de la obra, debe haber un enfoque contínuo y activo sobre los aspectos de calidad de aire.

- Periódicamente, evalúe los procedimientos de control de polvo que se estén utilizando para poder identificar nuevas técnicas que se requieran durante el desarrollo de la obra.

- Install wind fences or barriers (less than 50 percent porosity). Place barriers around storage piles, parking, and equipment staging areas.
- Develop semipermanent staging areas to cut down on the amount of disturbed area.
- Restrict access on unpaved areas to vehicles and equipment that are necessary that day. Limit unnecessary travel and keep the speed under 15 mph on unpaved surface areas.
- Restabilize disturbed surfaces by paving permanent roads and restoring vegetation as soon as possible.

- Cuando esté nivelando terreno, limíte el área de cada nivelación. Al reducir la cantidad de superficie perturbada, en cada nivelación se reduce la necesidad de controlar el polvo, se ahorran agua y supresores de polvo.

- Instale barreras contra viento (con menos de 50 por ciento de porosidad). Ponga las barreras alrededor de áreas de almacenaje, lugares de estacionamiento de vehículos, y lugares donde se prepara el equipo y maquinaria pesada.

- Defina áreas semi-permanentes para las actividades de preparación de equipo y maquinaria pesada para así reducir el area perturbada.

- En áreas no pavimentadas, el acceso de vehículos y maquinaria pesada se debe limitar a lo necesario durante el día en transcurso. Limíte los viajes innecesarios y también controle la velocidad de los vehículos a 15 millas por hora.

- Las superficies que han sido perturbadas deben ser re-estabilizadas lo antes posible, ya sea aplicando pavimento sobre las vías o sembrando vegetación.

What is Trackout?

Trackout is:

- Dirt, mud, or other debris tracked onto a paved public road by a vehicle leaving a construction site.
- Dirt and mud adhering to the exterior or undercarriage of a vehicle leaving a construction site that falls onto a paved public road.
- Traces of dirt or other bulk material that spill onto a paved public road from an improperly loaded haul truck leaving a construction site.

Trackout carried from a job site onto a paved road can be disturbed by vehicles driving over it and become airborne dust.

¿Qué es el Residuo o "Trackout"?

- Residuos de tierra, lodo u otros deshechos que son depositados en las vías públicas pavimentadas por las llantas de los vehículos que salen del lugar de la obra.

- La tierra u lodo que se adhiere a la parte exterior o inferior de los vehículos que salen de la obra y cae a la vía pública.

- Rastros de tierra o culaquier otro material a granel que cae a la vía pública de los compartimentos traseros de las camionetas cuando el material ha sido cargado de forma impropia.

El *residuo* de una obra que se deposita en las vías pavimentadas se levanta cuando circulan vehículos, formándose una nube de polvo.

Why Trackout Must Be Prevented

Particulate matter (PM_{10}) is caused when the material deposited on the pavement is lifted back into the atmosphere—or "reentrained"—by the tires of vehicles passing over it. A large portion of the PM_{10} in the Valley's air is caused by vehicle reentrainment.

Under Maricopa County Rule 310, control of trackout is required for all work sites having a disturbed surface area of at least five acres or from which 100 cubic yards of materials are hauled each day.

Trackout can be removed from paved roads using a wet broom or street sweeper, or by manually sweeping up the deposits.

Razones Para Prevenir el Residuo

El material particulado grueso (PM_{10}) se genera cuando el *residuo* que se ha depositado sobre el pavimento, se vuelve a levantar hacia la atmósfera debido al paso de las llantas de vehículos. Este fenómeno también se denomina: re-suspensión.

De acuerdo al reglamento 310 del Condado de Maricopa, todas la obras de construcción civil que ocupen un area de trabajo total de 5 acres o más, o que produzcan 100 yardas cúbicas de material transportable al día, deben de utilizar medidas par controlar el *residuo.*

El residuo se puede eliminar de las vías públicas pavimentadas utilizando una hídro-barredora o hídro-aspiradora o barriendo la calle manualmente para eliminar los depósitos.

Ways of Controlling Trackout

Trackout can be controlled at all exits onto paved public roads using any of the following:

Gravel Pad - A gravel pad is a stabilized construction entrance, designed to remove the mud and dirt from the tires of vehicles leaving a construction site.

Using gravel pads reduces fugitive dust caused by trackout onto paved roads and surfaces. The use of such pads may also reduce the need for street sweepers or laborers to remove trackout from paved surfaces, as well as help prevent storm water pollution.

Dust Control Plans require that stabilized construction entrances be installed at all access points if any material is to be hauled on or off the site, or if the site is larger than 5 acres.

Maneras de Controlar el Residuo

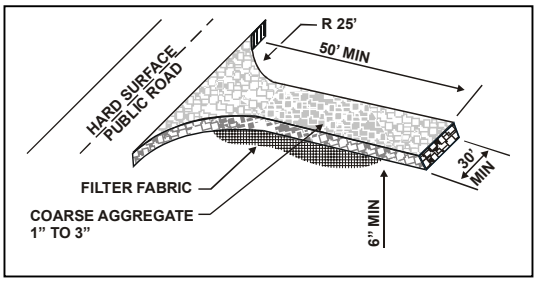
El *residuo* se puede controlar aplicando las siguientes medidas en todos los puntos de salida hacia las vías públicas pavimentadas:

Capas de gravilla - Una capa de gravilla estabilizada constituye una entrada apropiada para la obra. Las capas de gravilla estan diseñadas para separar el lodo y la tierra de las llantas de los vehículos que salen del lugar de la obra.

El uso de las capas de gravilla reduce el polvo fugitivo o re-suspendido que se produce por el *residuo* depositado en las calles y superficies pavimentadas. A su vez, el uso de las capas de gravilla puede reducir la necesidad de utilizar barredoras de calles o personal de limpieza para eliminar el *residuo* y también puede reducir la contaminación de las aguas del alcantarillado de lluvias.

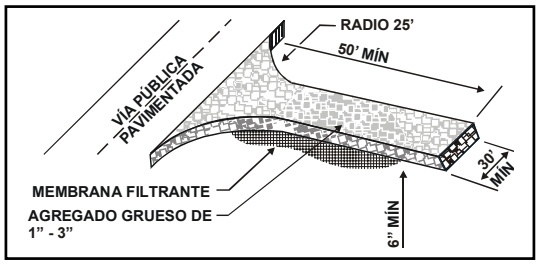
Los requisitos del Plan de Control de Polvo señalan que éste tipo de capa estabilizada se debe instalar en todas las entradas y salidas, por donde cualquier material sea transportado dentro o fuera de la obra, o si el tamaño del terreno sobrepasa los 5 acres.

Gravel Pad Design: Use one inch (1") to three inches (3") in diameter, washed, well-graded gravel or crushed rock. The gravel pad should be at least 30' wide by 50' long, and a minimum of 6" deep. When installing the gravel pad, make sure that it is properly graded.



Grizzly - A device using rails, pipes or grates to dislodge mud, dirt and debris from the tires and undercarriage of vehicles prior to leaving the work site. An example of a grizzly is the "shaker" invented by Jeff Lange for Kitchell Contracting. This device is reusable, transportable by pickup truck, easy to assemble, and can be expanded to accommodate various sizes of haul vehicles.

Diseño de la Capa de Gravilla: Utilize gravilla o roca molida de una (1") a tres (3") pulgadas de diámetro, que sea de tamaño uniforme y esté lavada. Como mínimo, la capa de gravilla debe ser de 30 pies de ancho por 50 pies de largo y tener un mínimo de 6 pulgadas de espesor. Al instalar la capa, asegúrese de que esté nivelada adecuadamente.



Parrilla "Grizzly" - Es un aparato hecho de rieles, tubos o rejillas para separar el el lodo, tierra y desperdicios de las llantas y de la parte inferior del chasis de los vehículos que salen de las obras. Un buen ejemplo de parrilla grizzly es la llamda " shaker" inventada por Jeff Lange para la Constructora Kitchell. Este aparato se puede recuperar y volver a utilizar, se puede transportar en una camioneta, es muy fácil de ensamblar y se puede instalar en varios tamaños según las dimensiones de los vehículos de carga.

More information about the shaker device used by Kitchell Contracting can be obtained at www.trackoutcontrol.com.

Paving - The paved surface must extend from the point of intersection with a paved public roadway at least 100 feet back onto the site and have a width of at least 20 feet.

In addition, cleanup of trackout must be done immediately if it extends 50 linear feet or more onto the paved public road. Otherwise, the trackout must be cleaned up by the end of the workday. Cleanup may be performed with a street sweeper or wet broom or by manually sweeping up the deposits.

Para mas información acerca de la parrilla “shaker” de Consultores Kitchell se puede visitar www.trackoutcontrol.com.

Area Pavimentada – Otra medida para controlar el *residuo* es colocar un area pavimentada que debe extenderse desde el punto de cruce con una vía pública pavimentada hasta un mínimo de 100 pies dentro de la obra. El ancho mínimo debe ser de 20 pies.

Además, si el área pavimentada se extiende 50 pies o más dentro de la vía pública, la limpieza de cualquier *residuo* ocasionado, debe ser inmediata. Si el area pavimentada se extiende menos de 50 pies, la limpieza debe efectuarse ése mismo día dentro de las horas de trabajo. La limpieza se puede realizar con una barredora de calles, con una hídro-barredora o barriendo a mano para deshacerse de los depósitos.

Effective Watering

Watering is a very effective dust suppressant. When applied regularly, water provides temporary stabilization to disturbed surface areas and reduces fugitive dust caused by earthmoving and driving on nonstabilized surface areas. Water also aids in compaction.

Maricopa County Earthmoving Permits require that fugitive dust generated from all earthmoving activities be controlled. Watering is one way to control fugitive dust.

How much watering is enough?

- Roads and disturbed surfaces visibly appear moist with minimal silt.
- Soil has a crusted surface and is not easily crumbled between your fingers.
- Soil moisture content is optimum for compaction.
- Visible emissions are less than 20 percent opacity.

Riego Efectivo

El riego es una técnica muy efectiva para suprimir el polvo. Al aplicarse regularmente sobre las áreas de terreno perturbado, el agua estabiliza la superficie temporalmente y reduce el polvo fugitivo causado por el movimiento de tierras y el movimiento de vehículos en áreas no estabilizadas. El agua también ayuda a compactar los terrenos.

Los permisos de Movimiento de Tierras que expide el Condado de Maricopa requieren que se controle el polvo fugitivo generado por todas las actividades de moviminento de tierras. El riego es una de las formas de controlar el polvo fugitivo.

¿Cuánto riego es suficiente?

- Cuando la vía y las áreas perturbadas se ven húmedas, con mínimo sedimento.
- Cuando el suelo presenta una corteza que no se quiebra al presionar con los dedos.
- Cuando la humedad del suelo se presta para la compactación.
- Cuando las emisiones del polvo visible presentan una opacidad menor del 20 porciento.

Proper site watering is an effective means of controlling dust.

Some Techniques That May Work

Prior to Any Activity on Site—

- Wet the area to depth of cuts or equipment penetration.

For Active Operations—

- Apply water 15-30 minutes before starting operations.
- Apply water at the end of the day (e.g. soak overnight the next day's work area).
- Before and after grading, water using a water truck.

El riego adecuado es una técnica efectiva para el control del polvo.

Algunas Técnicas Efectivas

Antes de Iniciar Cualquier Actividad en la Obra—

- Humedezca el terreno en las areas de excavación y en las zonas donde se traslada la maquinaria.

Para las Zonas de Actividad—

- Aplique el agua 15 – 30 minutos antes de empezar las actividades de obra.
- Aplique el agua al final del día de trabajo (por ejemplo, sature el área de trabajo desde la noche anterior).
- Riegue antes y después de la nivelación del terreno, con una camioneta de riego.

- During trenching, water using a fine spray or mist.
- During screening, mist material after it drops from the screen.

After Clearing an Area—

- Apply water in sufficient frequency to prevent visible emissions (at least every 2 hours).
- Automatic sprinkler/spray bar systems are optimal in cleared areas.

For Unpaved Haul Roads/ Access Roads/Equipment Paths—

- Apply water in sufficient quantity to maintain a moist surface.
- Do not over-water—muddy conditions increase trackout.

Water Penetration

- Surfactants or palliatives added to water increase penetration, especially in high clay soils.

- Cuando se esté abriendo trincheras, riegue con un rociador o aerosol.

- Cuando se esté tamizando, rocíe el material que cae del tamiz.

Después de Terminar las Actividades en un Área -

- Aplique agua con frecuencia (mínimo cada dos horas) para evitar las emisiones visibles.

- Para áreas despejadas, los sistemas de barras de riego/rocío automático dan los mejores resultados.

- Para las vías de acceso y descarga no pavimentadas y caminos para equipo pesado:

- Aplique el agua en cantidades suficientes, manteniendo la superficie húmeda.

- No riegue en exceso, el lodo aumenta el *residuo*.

Penetración de Agua –

- Los sufractantes o paliativos añadidos al agua aumentan la penetración del agua, especialmente en suelos arcillosos.

During trenching, water using a fine spray or mist.

If the area is inaccessible to water trucks due to slope conditions or other safety factors, watering should be conducted with water hoses or sprinkler systems. Remember that many cities have restrictions for construction on sloped areas—be sure you comply with those as well.

Durante la apertura de trincheras, aplique el agua utilizando un rociador fino.

Si las camionetas-cisterna no pueden acercarse al área de trabajo debido a la inclinación del terreno u otros factores de seguridad, el riego se debe efectuar con mangueras o sistemas de aspersores. Tenga en cuenta que muchas ciudades no permiten la construcción en terrenos muy inclinados, asegúrese de cumplir con los reglamentos en vigor.

Dust Palliatives

Dust palliatives are products that are applied to soil surfaces in order to limit the creation of fugitive dust emissions. For many projects, dust palliatives can be an effective and economical alternative to watering.

A variety of products are available, and finding one that fits your project's activities can reduce the need for regular, frequent watering, resulting in significant cost savings over the long term. In some instances, the soil stabilization from dust palliative application can last from 1 to 12 months.

Some dust palliatives are not designed for areas subject to daily disturbances, high volume traffic, or heavy equipment traffic—check with the product vendor if these conditions exist at your site.

Paliativos de Polvo

Los paliativos de polvo son productos que se aplican a las superficies del terreno para reducir la formación de emisiones de polvo fugitivo. En muchos casos, los paliativos de polvo pueden utilizarse en vez de agua, como una alternativa económica y efectiva.

Hay una variedad de productos disponibles en el mercado. Encontrar un producto que se adapte a las actividades de su obra, puede reducir la necesidad de riego frecuente y ahorrarle gastos a largo plazo. En ciertos casos, la estabilización del terreno que se logra utilizando paliativos de plovo puede durar de 1 a 12 meses.

Algunos paliativos de polvo no están diseñados para áreas que experimentan perturbaciones diarias, tráfico pesado o tráfico de maquinaria pesada – consulte con el vendedor o fabricante del producto si su terreno presenta éstas condiciones.

Be sure to ask the product vendor for the recommended dilution, application rate, and application frequency of the product you choose because these vary significantly by product. Before a weekend, holiday, or other inactive period of less than five days, a dust palliative that is diluted to not less than 1/20 of the concentration required to stabilize a surface for six months is recommended.

Maricopa County recommends the use of nontoxic, noncorrosive products. A contractor is responsible for assuring that its use of dust palliatives is in compliance with all applicable environmental laws.

Use of dust suppressants may be more cost effective than watering for areas of exposed soil that experience little or no traffic.

Asegúrese de obtener la información del vendedor acerca de las especificaciones para diluir el producto, la freccuencia y cantidad de aplicación, debido a que éstas varían mucho dependiendo del tipo de paliativo. Antes de un fin de semana, un día festivo o cualquier otro período de inactividad menor de 5 días, se recominenda utilizar un paliativo que esté diluído no menos de 1/20 de la concentracción que se requiere para estabilizar una superficie por 6 meses.

El Condado de Maricopa recomienda el uso de productos no tóxicos y no corrosivos. El contratista es el responsable de asegurar que el uso de paliativos está en cumplimiento con todos los reglamentos ambientales.

El uso de sufractantes puede llegar a ser más económico que el riego para las áreas que experimenten poco o ningún tráfico.

Wind Barriers

Dust blown by wind from a construction site is considered fugitive dust and subject to the provisions of Maricopa County Rule 310.

Wind barriers are placed along one or more sides of a job site to reduce the amount of windblown dust leaving the site. Creating a wind barrier could involve installing wind fences, constructing berms, or parking onsite equipment so that it blocks the wind. Alone, these barriers are not adequate for controlling dust. Wind barriers must be implemented together with the application of water or dust palliatives. These barriers increase the dust control effectiveness of water or palliative application.

Effective wind barriers/fences on the job site are:

- 3 to 5 feet high adjacent to roads and urban areas.
- Made of material with a porosity of 50 percent or less.

Barreras Contra Vientos

El polvo que se levanta al viento desde una obra de construcción, se denomina polvo fugitivo y está sujeto al Reglamento 310 del Condado de Maricopa.

Las barreras contra vientos se colocan a lo largo de uno o más lados del sitio de la construcción para reducir la cantidad de polvo que vuela fuera de la obra. Para crear una barrera de viento se necesita instalar cercas y construir bermas, o estacionar la maquinaria de manera que bloquee el viento. Independientemente, éstas barreras no son suficientes para controlar el polvo. Las barreras se deben utilizar conjuntamente con el riego y los productos paliativos. Estas barreras, aumentan la efectividad de las técnicas de riego y aplicación de paliativos.

Las barreras contra viento más efectivas en la obra son:

- De 3 a 5 pies de altura a lo largo de calles y zonas urbanas.
- Fabricadas de un material con porosidad de 50 por ciento o menos.

Effective wind barriers / temporary enclosures for storage piles are:

- A three-sided structure as high as the pile.
- Made of material with a porosity of 50 percent or less.

Effective wind barriers must have a porosity of 50 percent or less.

Las barreras contra viento y las cercas temporales más efectivas para cerramiento de areas de deposito de materiales son:

- Una estructura de tres lados, con una altura similar al montón de material almacenado.
- Fabricada de un material con porosidad de 50 por ciento o menos.

Las más efectivas deben tener una porosidad de 50 por ciento o menos.

Material Handling

Material handling refers to many types of earthmoving activities on construction sites, including loading and hauling. These types of activities can be significant sources of fugitive dust. However, dust control during loading and hauling can be easily achieved through careful planning and proper implementation of controls.

Loading:

- Mist material with water while stacking.
- Mix excavated material with water prior to loading.
- Empty loader slowly and keep bucket close to the truck while dumping.

Hauling:

- Tarps are required on haul trucks to prevent windblown dust.
- Do not overload the truck! Keep your load 3 to 6 inches below the freeboard to minimize spillage.

Manejo de Materiales

El manejo de materiales se refiere a varias actividades de movimento de tierras en las obras de construcción, incluyendo la carga y descarga de materiales. Este tipo de actividades generan importantes cantidades de polvo fugitivo. Sin embargo, el control del polvo durante la carga y descarga se puede lograr si se implementa un plan efectivo y se aplican adecuadamente los controles.

Carga:

- Rocíe el material con agua durante la colocación en montones.
- Mezcle el material excavado con agua antes de cargarlo.
- Vacíe el cargador de la volqueta lentamente y mantenga las cubetas cerca al vehículo durante la descarga.

Transporte:

- Se requieren cubrimientos de lona en los cargadores de las volquetas para evitar que el viento levante polvo.
- No sobrecargue la volqueta! Mantenga la carga 3 a 6 pulgadas por debajo de la caja para reducir los derrames.

- Check belly-dump truck seals regularly and remove any trapped rocks to prevent spillage

Trackout:

- Daily vacuuming or wet broom cleaning is required to control trackout.
- Install a gravel pad at the access point to your site.
- Use grizzlies to remove excess dirt from trucks.

Loaded haul trucks must be covered with tarps to prevent windblown dust during transport.

- Compruebe que los sellos de las volquetas de descarge inferior estén en buen estado y elimine todas las rocas que puedan estar atrapadas en los sellos, causando derrames.

Residuos:

- El aspirado diario o el hídro-barrido es necesario para controlar el *residuo.*
- Instale una capa de gravilla en la entrada de la obra.
- Utilize parrillas “grizzlies” para extraer el exceso de tierra en las llantas de las camionetas o volquetas.

Los cargadores de las volquetas deben de ser cubiertos con lonas para evitar que el viento levante polvo durante el transporte.

Visible Emissions and Opacity

What is Opacity?

Opacity is the reduction in visibility caused by a cloud of dust. The standard limitation for Visible Emissions within Maricopa County is 20 percent opacity.

How Much is 20 Percent Opacity?

County inspectors are trained to read opacity, but there are ways that you can estimate opacity on the job. Twenty percent (20%) opacity is a faint cloud of dust through which you can readily see background details.

Photo shows barely discernible difference between clear conditions (left) and 20 percent opacity (right).

Emisiones Visibles y Opacidad

¿Qué es Opacidad?

Opacidad es la reducción de visibilidad causada por una nube de polvo. El límite estándar de Emisiones Visibles dentro de el Condado de Maricopa es de 20 por ciento de Opacidad.

¿Cuánto es 20 Por Ciento de Opacidad?

Los inspectores del Condado estan entrenados para leer los índices de opacidad, pero hay maneras de estimarlos en el lugar de la obra. Veinte por ciento (20%) de opacidad se presenta como una nube ténue de polvo a traves de la cual Ud. puede observar detalles de fondo fácilmente.

En ésta foto se puede apreciar la marcada diferencia entre la parte izquierda - condiciones del aire limpio, y la derecha - opacidad de 20 por ciento.

When are Controls of Visible Emissions Required?

Measures controlling visible emissions must be implemented during all periods of dust generating operations. The specific dust control measures, including contingency measures, are contained in the Dust Control Plan which is part of each regulated site's earthmoving permit.

A regulated site should implement contingency measures as necessary to prevent visible emissions from reaching 20 percent opacity, rather than waiting until emissions reach that level. Additional precautions should be taken to prevent the dust cloud from crossing the property line.

When Does the Opacity Limitation Apply?

The 20 percent opacity limitation applies at all times except when the average wind speed is greater than 25 miles per hour (25 mph) provided that all reasonable available control measures contained in the approved Dust Control Plan are in place.

¿Cuándo se Necesitan Controles de Emisión Visible?

Las medidas de control de emisiones visibles se deben implementar a lo largo de la duración de las actividades que generen polvo. Tanto las medidas específicas para control de polvo, como las medidas eventuales estan incluídas en el Plan de Control de Polvo, que forma parte del permiso regulador de movimiento de tierras de cada obra.

Una obra con permiso debe implementar medidas de contingencia necesarias para evitar que las emisiones visibles lleguen a sobrepasar el límite de un 20 por ciento de opacidad. No debe esperarse hasta que las emisiones lleguen a ése nivel. Se deben tomar precauciones adicionales para prevenir que la nube de polvo cruce el límite de la propiedad.

¿Cuándo se Necesita Aplicar el Límite de Opacidad?

El límite de 20 por ciento de opacidad se aplica en todo momento, excepto cuando el promedio de la velocidad del viento es mayor a 25 millas por hora (25 mph), siempre y cuando todas las demas medidas razonables del Plan de Contol de Polvo hayan sido ejercidas.

Visible Emissions Testing

Twice a year classes are held for certification in reading visible emissions ("Smoke School"). All superintendents, project managers, and foremen are encouraged to attend these classes. Becoming certified enables you to determine opacity and your project's level of compliance with this requirement. Contact Maricopa County at (602) 506-6700 for details on class times and locations.

Participants in "Smoke School" learn to accurately estimate the level of opacity of dust plumes, such as this one caused by field plowing .

Las Pruebas de Emisiones Visibles

Los cursos de certificación en lectura de Emisiones Visibles se ofrecen dos veces al año. Se recomienda que todos los superintendentes, administradores de obras y capataces asistan a estos cursos. El personal certificado puede determinar la opacidad y el nivel de cumplimiento con el regalmento de cualquier proyecto. Comuníquese con el Condado de Maricopa, al número (602) 506-6700 para mayor información acerca de las fechas y localidades donde se ofrecen los cursos.

Los participantes de la "Escuela de Humo" aprenden a estimar con precisión el nivel de opacidad de los nubarrones de polvo como éste, causado por el arado de la tierra.

Arizona Transportation
Research Center

APPENDIX D

PROTOTYPE DUST CONTROL FACT SHEETS

NOTE: This is a prototype product provided for illustration purposes only. This product is not intended to be used for actual dust control training. The content of this product was current at the time that the draft was created. However, subsequent changes in rules, regulations, and available data may have rendered portions of the text or graphics obsolete or inaccurate. If and when the training program recommended by this research project is implemented, updated training materials may be obtained from the program coordinator.

FACT SHEET #1:

What's the Fuss About

Fugitive dust is particulate matter that does not come from tailpipes, smokestacks or other well-defined openings. Particulate matter is a mixture of dirt, soil dust, pollens, molds, ashes, soot and aerosols that remain suspended in the air that we breathe. Coarse particulate matter, under 10 microns in diameter (PM_{10}), is usually caused by construction and earthmoving operations, vehicles moving on paved and unpaved roads, and agricultural activities. Fine particulate matter, measuring less than 2.5 microns, is produced primarily by the exhaust from diesel and gasoline engines.

Particulate matter can be harmful to your health. When inhaled, the coarse particles are deposited in the upper respiratory tract of the body. The fine particles can reach the lower pulmonary tissues and invade the alveoli of the lungs. Those at greatest risk from exposure to particulate matter are the very young, the elderly, and those with preexisting heart disease or lung ailments, such as asthma, bronchitis, or emphysema.

In 1995, the Arizona Comparative Environmental Risk Project established by Governor Fife Symington reported that nearly 700 people die prematurely each year in Maricopa County due to PM_{10} and concluded that particulate pollution represents one of the highest environmental risks to this State. Fine particulate matter also contributes to the ugly brown cloud that hangs over the Valley and obscures our blue skies.

FACT SHEET #2:

What's Being Done

A 3,000 square-mile area of Maricopa and Pinal Counties has been designated a "Serious" nonattainment area, because it does not meet the Federal air quality standards for particulate matter (PM_{10}). In addition to negative health effects, being a nonattainment area is a stigma that can slow economic growth and development. For example, snowbirds may not return to the Valley next winter, because they perceive it to be too congested and polluted. This, in turn, results in lower demand for new housing.

A PM_{10} plan for Maricopa County was approved by the U.S. Environmental Protection Agency on January 14, 2002. The plan shows how Maricopa County will attain the Federal PM_{10} standards by the end of 2006. The Plan has 77 measures to reduce particulate pollution from all significant sources including agriculture, wood burning, driving on paved and unpaved roads, vacant lots, gasoline and diesel exhaust, and fast-food restaurants. But the most effective measure, by far, is Maricopa County's Fugitive Dust Control Rule 310. By 2006, Rule 310 is expected to reduce fugitive dust from construction sites and other earthmoving sources by 72 percent.

Compliance with Rule 310 is essential for the Valley to meet the Federal standards. If we don't, there will be serious consequences, such as the loss of Federal dollars needed to build highways and light rail. So it is important for every construction worker to do his part to comply with Rule 310 and "bust the dust."

FACT SHEET #3:

What is Trackout?

Trackout is:

- Dirt, mud, or other debris tracked onto a paved public road by a vehicle leaving a construction site
- Dirt and mud adhering to the exterior or undercarriage of a vehicle leaving a construction site that falls onto a paved public road
- Traces of dirt or other bulk material that spill onto a paved public road from an improperly loaded haul truck leaving a construction site

Particulate matter (PM_{10}) is caused when the material deposited on the pavement is lifted back into the atmosphere—or "re-entrained"—by the tires of vehicles passing over it. A large portion of the PM_{10} in the Valley's air is caused by vehicle re-entrainment.

Under Maricopa County Rule 310, control of trackout is required for all work sites having a disturbed surface area of at least five acres or from which 100 cubic yards of materials are hauled each day. Trackout can be controlled using any of the following at all exits onto paved public roads:

Gravel Pad - A stabilized construction entrance, designed to remove mud and dirt from the tires of vehicles as they leave the construction site. The gravel pad should be at least 30 feet wide by 50 feet long, and a minimum of six inches deep. One to three-inch diameter, washed gravel or crushed rock should be used. It is important that the gravel pad be properly graded.

Grizzly - A device using rails, pipes or grates to dislodge mud, dirt and debris from the tires and undercarriage of vehicles prior to leaving the work site. An example of a grizzly is the "shaker" invented by Jeff Lange for Kitchell Contracting. This device is reusable, transportable by pick-up truck, easy to assemble, and can be expanded to accommodate various sizes of haul vehicles. More information about the shaker device can be obtained at www.trackoutcontrol.com.

Paving - The paved surface must extend from the point of intersection with a paved public roadway at least 100 feet back onto the site and have a width of at least 20 feet.

In addition, cleanup of trackout must be done immediately, if it extends 50 linear feet or more onto the paved public road. Otherwise, the trackout must be cleaned up by the end of the workday. Cleanup may be performed with a street sweeper or wet broom or by manually sweeping up the deposits.

FACT SHEET #4:

Site Planning

Take time to consider dust control issues before beginning your project in order to save time, money, and project resources. Identify site-specific air quality and dust control issues up front and develop a consensus for addressing these issues. Phase your project and plan your site layout to minimize disturbance of the soil. Action items include:

- Make sure everyone working on the job knows who's in charge and all the requirements for dust control. Encourage a proactive and continuous focus on air quality issues on the job site.
- Evaluate dust control procedures periodically to identify additional issues that develop as the job progresses.
- Limit the amount of area graded at any one time. Lessening the amount of surface being disturbed at any one time reduces the amount of control required and the amount of water or dust suppressant needed.
- Install wind fences or barriers (less than 50 percent porosity). Place barriers around storage piles, parking, and equipment staging areas.
- Develop semipermanent staging areas to cut down on the amount of disturbed area.
- Restrict access on unpaved areas to vehicles and equipment that are necessary that day. Limit unnecessary travel on unpaved surface areas.
- Restabilize disturbed surfaces by paving permanent roads and restoring vegetation as soon as possible.

FACT SHEET #5:

Gravel Pads

A gravel pad is a stabilized construction entrance, designed to remove the mud and dirt from the tires of vehicles leaving a construction site.

Using gravel pads reduces fugitive dust caused by trackout onto paved roads and surfaces. The use of such pads may also reduce the need for street sweepers or laborers to remove trackout from paved surfaces, as well as help prevent storm water pollution.

Dust Control Plans require that stabilized construction entrances be installed at all access points if any material is to be hauled on or off the site, or if the site is larger than 5 acres.

GRAVEL PAD DESIGN:

Use one inch (1″) to three inches (3”) in diameter, washed, well-graded gravel or crushed rock. The gravel pad should be at least 30 ft. wide by 50 ft. long, and a minimum of 6 in. deep. When installing the gravel pad, make sure that it is properly graded.

FACT SHEET #6:

Effective Watering

Watering is a very effective dust suppressant. When applied regularly, water provides temporary stabilization to disturbed surface areas and reduces fugitive dust caused by earthmoving and driving on nonstabilized surface areas. Water also aids in compaction.

Maricopa County Earthmoving Permits require that fugitive dust generated from all earthmoving activities be controlled. Watering is one way to control fugitive dust (see your Dust Control Plan).

How much watering is enough?

- Roads and disturbed surfaces visibly appear moist with minimal silt.
- Soil has a crusted surface and is not easily crumbled between your fingers.
- Soil moisture content is optimum for compaction.
- Visible emissions are less than 20 percent opacity.

SOME TECHNIQUES THAT MAY WORK

Prior to Any Activity on Site:

- Wet the area to depth of cuts or equipment penetration.

For Active Operations:

- Apply water 15-30 minutes before starting operations.
- Apply water at the end of the day (e.g. soak overnight the next day's work area).
- During grading, water using a water truck.
- During trenching, water using a fine spray or mist.
- During screening, mist material after it drops from the screen.

After Clearing an Area:

- Apply water in sufficient frequency to prevent visible emissions (at least every 2 hours).
- Automatic sprinkler/spray bar systems are optimal in these areas.

For Unpaved Haul Roads/Access Roads/ Equipment Paths:

- Apply water in sufficient quantity to maintain a moist surface.
- Don't over water—muddy conditions increase trackout.

Water Penetration

- Surfactants or palliatives added to water increase penetration.

If the area is inaccessible to water trucks due to slope conditions or other safety factors, watering should be conducted with water hoses or sprinkler systems. Remember: many cities have restrictions for construction on sloped areas—be sure you comply with those as well.

FACT SHEET #7:

Dust Palliatives

Dust palliatives are products that are applied to soil surfaces in order to limit the creation of fugitive dust emissions. A variety of products are available, and finding one that fits your project's activities can reduce the amount of watering needed for dust control. Over the long term, using dust palliatives can result in significant cost savings compared to regular, frequent watering. In some instances, the resulting soil stabilization can last from 1 to 12 months.

Some dust palliatives are not designed for areas subject to daily disturbances, high volume traffic, or heavy equipment traffic—check with the product vendor if these conditions exist at your site.

Maricopa County Earthmoving Permits require that fugitive dust generated from all earthmoving activities be controlled. For many projects, dust palliatives can be an effective and economical alternative to watering.

Be sure to ask the product vendor for the recommended dilution, application rate, and application frequency of the product you choose because these vary significantly by product. Before a weekend, holiday, or other inactive period of less than five days, a dust palliative that is diluted to not less than 1/20 of the concentration required to stabilize a surface for six months is recommended.

Maricopa County recommends the use of non-toxic, non-corrosive products. A contractor is responsible for assuring that its use of dust palliatives is in compliance with all applicable environmental laws.

FACT SHEET #8:

Wind Barriers

Wind barriers are placed along one or more sides of a job site to reduce the amount of windblown dust leaving the site. Creating a wind barrier could involve installing wind fences, constructing berms, or parking onsite equipment so that it blocks the wind. Alone, these barriers are not adequate for controlling dust. Wind barriers must be implemented together with the application of water or dust palliatives. These barriers increase the dust control effectiveness of water or palliative application.

Maricopa County Earthmoving Permits require that fugitive dust generated from all earthmoving activities be controlled.

Effective wind barriers/fences on the job site are:

- 3 to 5 feet high adjacent to roads and urban areas
- Made of material with a porosity of 50 percent or less.

Effective wind barriers / temporary enclosures for storage piles are:

- A three-sided structure as high as the pile
- Made of material with a porosity of 50 percent or less.

FACT SHEET #9:

Material Handling

Material handling refers to many types of earthmoving activities on construction sites, including loading and hauling. These types of activities can be significant sources of fugitive dust. However, dust control during loading and hauling can be easily achieved through careful planning and proper implementation of controls.

Loading:

- Mist material with water while stacking.
- Mix excavated material with water prior to loading.
- Empty loader slowly and keep bucket close to the truck while dumping.

Hauling:

- Tarps are required on haul trucks to prevent windblown dust.
- Do not overload the truck! Keep your load 3 to 6 in. below the freeboard to minimize spillage.
- Check belly-dump truck seals regularly and remove any trapped rocks to prevent spillage.

Trackout:

- Daily vacuuming or wet broom cleaning is required to control trackout.
- Install a gravel pad at the access point to your site.
- Use grizzlies to remove excess dirt from trucks.

FACT SHEET #10:

Visible Emissions and Opacity

What is Opacity?

Opacity is the reduction in visibility caused by a cloud of dust. The standard limitation for visible emissions within Maricopa County is 20 percent opacity.

How Much is 20 Percent Opacity?

County inspectors are trained to read opacity, but there are ways that you can estimate opacity on the job. Twenty percent (20%) opacity is a faint cloud of dust through which you can readily see background details.

When Are Controls of Visible Emissions Required?

Measures controlling visible emissions must be implemented during all periods of dust generating operations. The specific dust control measures, including contingency measures, are contained in the Dust Control Plan which is part of each regulated site's earthmoving permit.

A regulated site should implement contingency measures as necessary to prevent visible emissions from reaching 20% opacity, rather than waiting until emissions reach that level. Additional precautions should be taken to prevent the dust cloud from crossing the property line.

When Does the Opacity Limitation Apply?

The 20 percent opacity limitation applies at all times except when the average wind speed is greater than 25 miles per hour (25 mph), provided that all reasonable available control measures contained in the approved Dust Control Plan are in place.

Visible Emissions Testing

Twice a year classes are held for certification in reading Visible Emissions. While not mandatory, all superintendents, project managers, and foremen are encouraged to attend. Becoming certified enables you to determine opacity and your project's level of compliance with this requirement. Contact Maricopa County at (602) 506-6700 for details on class times and locations.

APPENDIX E

PROTOTYPE TRAINING GUIDE

NOTE: This is a prototype product provided for illustration purposes only. This product is not intended to be used for actual dust control training. The content of this product was current at the time that the draft was created. However, subsequent changes in rules, regulations, and available data may have rendered portions of the text or graphics obsolete or inaccurate. If and when the training program recommended by this research project is implemented, updated training materials may be obtained from the program coordinator.

The draft Training Modules contained herein are structured as scripts to accompany slide presentations, prototypes of which were also developed as products of the research. The modules were not designed to be used without the accompanying slides.

Dust Control Course
Trainer's Guide

Prepared for
Arizona Transportation Research Center

L & A LIMA & ASSOCIATES
Transportation - G.I.S.

Cathy D. Arthur

Dust Control Course
Trainer's Guide

DRAFT

Prepared for

The Arizona Department of Transportation

ADOT Project SPR-519
PM_{10} Research for Developing Educational Tools and Outreach Programs

August 19, 2003

TABLE OF CONTENTS

INTRODUCTION TO THE TRAINING AND CERTIFICATION PROGRAM

Blue Skies is a voluntary dust control training and certification program being offered to the construction industry in Arizona. The goal of the training course is to familiarize construction personnel with common dust control problems and solutions. The course is designed for anyone working in the construction field, although site superintendents, water truck and water pull drivers, and subcontractors are strongly encouraged to attend. In addition to lectures, the course includes class discussion and review of example case studies.

At the completion of the course, the attendee will have a basic understanding of why controlling construction dust is important, should be familiar with dust control regulations, and be able to identify and solve dust control problems at construction sites.

Modular Lesson Plan

This basic dust control course is designed to be presented in a half-day format. Prior to beginning Module 1, the class should be shown the 10-minute video developed by the Maricopa County Environmental Services Department, entitled "Effective Dust Control and Overview of Rule 310." The course can be tailored to the needs of specific groups or jurisdictions by eliminating modules or part of modules. The six training modules are:

Module 1 - Background will cover the reasons that dust control is needed, and the causes of PM_{10}. Both natural and man-made sources of fugitive dust will be identified and actions that have already been taken to reduce PM_{10} emissions will be explained.

Module 2 - Construction Dust Control Requirements will explore in detail the construction dust control requirements in effect for the jurisdiction in which the course is being presented. Dust control measures for construction-related activities will be explained.

Module 3 - Enforcement of Dust Control at Construction Sites will cover jurisdictional enforcement, including the characteristics of the dust control enforcement program, inspection criteria, enforcement procedures, and penalties for violations, as appropriate for the jurisdiction in which the course is being presented.

Module 4 - Strategies to Assist Construction Activities in Controlling Dust will examine dust control strategies, including project design and site planning. A case study of a construction project will be included.

Module 5 – Visible Emissions Evaluation at Construction Sites will describe the techniques used to identify the opacity levels of dust generated by construction activities. The script and slides for this module are being developed by the Arizona Department of Environmental Quality and will be added to this guide when completed.

Module 6 - Information Resources and Reinforcements will discuss additional information that supplements and reinforces the material covered in class. Participants will be given a final exam that can be used for certification purposes.

Voluntary Certification Program

The goal of the voluntary certification program is to train construction personnel and supervisors to identify dust problems and proactively implement measures to control dust at construction sites. This program is designed for construction industry management and job supervisory personnel. Upon certification, each individual will receive a Dust Control Specialist or Instructor certificate.

Two levels of certification are offered:

Certified Dust Control Specialist - An individual who completes Dust Control Training and passes an exam covering the subject matter presented in the course with a grade of 75 percent or better, may receive designation as a Certified Dust Control Specialist. To maintain certification, a Specialist must take the Dust Control Training and pass the final exam once every two years.

Certified Dust Control Instructor – A Certified Dust Control Specialist who has successfully completed Visible Emissions Evaluation Training and has co-taught a Dust Control Training course under the supervision of another Certified Instructor, may be designated as a Certified Dust Control Instructor. To maintain certification, an Instructor must receive Smoke School certification every six months and pass the final exam for Dust Control Training (with a score of 75 percent or better) at least once a year.

Visible Emissions Evaluation Training is offered by the Arizona Department of Environmental Quality twice a year in various parts of the state. This training is a two-day event comprising a classroom session in the morning of the first day, followed by a testing session lasting the remainder of the event. During the testing session, participants evaluate sets of black and white smoke readings to learn to recognize levels of opacity that exceed the standards.

Additional information on the availability of training classes and requirements for certification may be obtained from the Blue Skies Coordinator at (602) 712-7487.

The Module Scripts

This *Trainer's Guide* contains example scripts for each of the modules, keyed to the slides in the accompanying PowerPoint[tm] files. In a few cases, script sections are numbered "2-10 A", "2-10 B", and so on. This numbering convention is used when the accompanying slide—such as slide No. 2-10—makes use of the PowerPoint[tm] animation feature. The scripts are intended as examples only and provide the minimum supporting information that should be conveyed to the class at the time each slide is shown.

MODULE 1 - BACKGROUND

Slide No.	Notes
1-1	**Module 1 - Why Do We Need to Control Dust?**
1-2	**Health Effects of PM** - When inhaled, coarse particles (between 2.5 and 10 microns) are deposited in the upper respiratory tract. The smaller particles (less than 2.5 microns) can be deposited lower, in the pulmonary tissues, and invade the alveoli of the lungs. These more invasive particles can bond with toxins and other airborne chemicals before they are inhaled. It is difficult for the human body to eject the fine particles, once they are deposited in the lower lungs. In the lungs, PM decreases breathing efficiency and alters the body's natural defense systems. Highly sensitive groups include the elderly, asthmatics and children. Epidemiological studies have shown causal relationships between high particulate concentrations and increased mortality and morbidity.
1-3	**Medical Data for PM_{10} -** Medical studies have shown that higher PM_{10} concentrations can be linked to an increased number of premature deaths, asthma attacks, hospital admissions, and emergency room visits, and an overall decrease in lung functioning efficiency. In 1995, the Arizona Comparative Environmental Risk Project ranked particulate pollution as one of the highest environmental risks in the state. This conclusion was based on increased hospital admissions for respiratory problems, asthma, and lower and upper respiratory symptoms, due to high annual PM_{10} concentrations. In the same study, premature deaths due to PM_{10} were estimated to approach 700 per year in Maricopa County and 1,000 per year statewide.
1-4	**One particularly dangerous form of particulates found on construction sites is crystalline silica dust.** Crystalline silica is found in common materials such as concrete, masonry, sand, quartz and granite rock. Inhaling dust produced from these materials can cause permanent lung damage, called silicosis. Silicosis is responsible for about 300 deaths per year. OSHA and the Arizona Division of Occupational Safety and Health are so concerned about the non-reversible health effects of silicosis that they are providing local training on how to control silica dust at construction sites.
1-5	**What is Particulate Matter –** Tiny solid particles or liquid droplets that remain suspended in the air, including soil dust, pollens, molds, ashes, soot and aerosols. PM_{10} is particulate matter smaller than 10 microns in diameter and PM2.5 is smaller than 2.5 microns. (For comparison, a human hair is approximately 70 microns.)
1-6	**PM_{10} is predominately geologic materials such as rock and soil particles; the soil particles are typically silt (4-10 microns in diameter), and clay (larger than 4 microns in diameter)** In urban areas, $PM_{2.5}$ particles generally represent between 25 and 30 percent of the PM_{10} based on volume. $PM_{2.5}$ is usually emitted by combustion sources and formed by gases; a smaller fraction is made up of clay soil particles.
1-7	**Soil Particle Sizes -** Relative soil particle sizes are shown here. Sand particles typically exceed ten microns in diameter and, therefore, are too big to be PM_{10}. These particles are so large that they return to the ground quickly after being

Slide No.	Notes
1-7 (continued)	airborne. Silt tends to be the predominant soil type of particles that are smaller than 10 microns (PM_{10}) but larger than 2.5 microns ($PM_{2.5}$). The smaller clay particles are usually the soil type found in $PM_{2.5}$.
1-8	**National Ambient Air Quality Standards for PM_{10} and $PM_{2.5}$ –** There are two federal standards for PM_{10} and $PM_{2.5}$: an annual and a 24-hour standard. Maricopa County does not violate either of the $PM_{2.5}$ standards, but violates both the annual and daily standards for PM_{10}.
1-9	**How PM is Monitored –** Particulate concentrations are usually measured by pulling ambient air through a filter for twenty-four hours every sixth day, weighing the filter before and after, and measuring the volume of air sampled. Regular checks of the samplers and laboratory procedures are conducted using statistical tests required by EPA. In 2000, there were seven $PM_{2.5}$ monitors and nineteen PM_{10} monitors operating in Maricopa County.
1-10	**Central Phoenix Air Monitoring Site -** This site has been measuring air pollution for over three decades. Equipment at this site measures PM_{10} continuously so that episodes (back-to-back high concentration days) can be predicted and counter-measures can be implemented in a timely manner.
1-11	**Trends in PM Concentrations –** No monitor in Maricopa County has recorded a violation of the $PM_{2.5}$ standards and this trend is expected to continue in the future, due to increasingly stringent federal controls on tailpipe emissions from new cars and trucks. However, for PM_{10}, the number of monitoring sites exceeding the annual standard and number of days exceeding the 24-hour standard have not shown a consistent downward trend.
1-12	**PM_{10} Trends -** This chart shows that 1998 and 2001 were relatively good years for PM_{10} in the Valley, but 1999 and 2000 were not.
1-13	**PM_{10} Trends -** This graph indicates that the daily standard was exceeded on six days during 2001.
1-14	**PM_{10} Monitoring Sites -** The monitoring sites that violated the 24-Hour PM_{10} standard in 2000 are highlighted in yellow. With the exception of Maryvale (site #6), all of these sites also violated the annual PM_{10} standard. They are clustered generally in South and West Phoenix, with the exception of the Chandler site.
1-15	**Quality of Life impacts of PM –** In addition to the health impacts, the smallest particulates ($PM_{2.5}$) are a constituent of the "brown cloud" that hangs over the Valley and obscures our blue skies on many mornings of the year. Scientific measurements by the Arizona Department of Environmental Quality indicate that visibility has not improved in the Phoenix metro area since 1994. $PM_{2.5}$ also contributes to the regional haze that reduces visibility at wilderness areas, parks, and other pristine areas located downwind of Maricopa County. On a more localized level, particulates from construction sites, vacant lots and fields, blowing across public or private roads can reduce visibility and increase the risk of traffic accidents. As a secondary impact, high levels of dust are also responsible for soiling clothes, vehicles, buildings, and other public and personal property and the resultant cleaning and repair costs.
1-16	**What Causes Particulate Matter?** Particulates are emitted into the air by both natural events and human activities.

Slide No.	Notes
1-16 (continued)	Natural Sources - Winds sweeping over the natural desert around us contribute some of the airborne particulates, although not as much as you might think. The vegetation in the desert and the crust that forms after rains tends to put a natural "lid" on fugitive dust. In addition, sustained high winds exceeding 15 mph only occur on a few days each year. PM measurements taken at the relatively pristine Organ Pipe Cactus National Monument in southeastern Arizona indicate that natural conditions represent about 20% of the standards. That is, about 10 $\mu g/m^3$ of the 50 ug/m3 annual standard for PM_{10} is prevalent in the atmosphere as a result of natural desert terrain. PM_{10} emitted by natural sources (i.e. dust devils, pollen from plants) is generally higher in an urban environment, usually in the range of 30-40 percent of the standard. The remaining concentrations can be attributed to human activities that have disturbed the soil or re-suspended the dust back into the air. Human Sources – People are responsible for most of the particulates present in the air that we breathe; in urban areas, humans contribute at least 60 percent of the PM_{10} air pollution problem.
1-17	**Dust Storm Development -** This slide shows time-series photos of a dust storm developing over Phoenix. Dust storms can contribute to violations of the 24-hour PM_{10} standard, but do not have a significant influence on violations of the annual PM_{10} standard, because they do not occur very often.
1-18	**Organ Pipe Cactus National Monument -** Natural desert conditions, such as those at Organ Pipe, produce PM_{10} levels that are about 20% of the national ambient air quality standards.
1-19	**Sources of $PM_{2.5}$ -** Engine exhaust from on-road vehicles and off-road equipment emits a large proportion of the smallest particles ($PM_{2.5}$). About one-half of the $PM_{2.5}$ is emitted in gasoline exhaust; another 15% comes from diesel exhaust. Emissions from older, poorly tuned vehicles and engines starting up in the colder fall and winter mornings are the major sources of $PM_{2.5}$ in Maricopa County.
1-20	**Sources of PM_{10}-** The major sources of the slightly larger, although still invisible, PM_{10} particles in the Valley are construction and earthmoving operations, re-entrainment of fugitive dust by vehicles driving on paved roads (large trucks, in particular, can create a sizable "wake"), vehicles driving on unpaved roads (especially at high speeds), agricultural activities, and vacant lots. Winds greater than 15 mph can whip-up the human-disturbed dust and cause exceedances of the 24-hour PM_{10} standard. Activities that cause persistently high PM_{10} in the same location can cause violations of the annual PM_{10} standard.
1-21	**Sources of** PM_{10}**-** According to the EPA-approved Serious Area PM_{10} Plan for Maricopa County, construction and earthmoving operations contribute the largest share of the annual PM_{10} emissions in the Maricopa County nonattainment area (38%), followed by contributions from paved roads (18%), agriculture (14%), and unpaved roads (13%). Other minor sources of PM_{10} include vacant disturbed land, residential woodburning, and industrial operations.
1-22	**Sources of PM_{10} -** In Maricopa County, monitors located near an elevated freeway (Greenwood), industrial sources and unpaved haul roads (Salt River and Durango), and agricultural fields (Higley) have repeatedly exceeded the annual PM_{10} standard.

Slide No.	Notes
1-23	**Some Sources of PM_{10} -** Agricultural tilling and vehicles on freeways can contribute to high PM_{10} concentrations.
1-24	**Natural Conditions Contributing to PM_{10} –** Years in which the annual rainfall is lower than average typically record higher annual levels of PM_{10}. However, extremely wet years are not always associated with the lowest annual PM_{10} concentrations, because more mud is tracked onto pavement, dried in the sun, and subsequently re-entrained by moving vehicles. High winds are a more reliable predictor of high concentrations of daily PM_{10}. For example, on August 22, 2000, six monitors located throughout the Valley exceeded the standard, due to wind gusts in excess of 25 mph. Other exceedances of the 24-hour standard during 2000 occurred during the months of January, June, July, September, and November. These high PM_{10} readings were measured at seven different monitors on days that were not windy. High levels of PM_{10} can occur on any day of the year and at any location.
1-25	**Natural Conditions Contributing to PM_{10}-** Another natural condition contributing to PM_{10} is the type of soil that is being turned into dust by construction, earthmoving, or agricultural activities. Sandy soils create heavier particles that, when suspended in the air, are more quickly re-deposited on the ground. Soils that are predominantly clay, when disturbed, create much smaller particles that are more likely to stay suspended in the air as PM_{10}.
1-26	**PM_{10} Soils Map -** The Natural Resources Conservation Service and the Maricopa Association of Governments have created a map that shows the general location of soils in the Valley that are most likely to produce PM_{10}, if disturbed by human activities. The dark red on this map indicates the areas in the PM_{10} nonattainment area where clay soils predominate. As we have learned earlier, these are the most likely to produce PM_{10} when disturbed by human activities such as motor vehicle operation, construction, or agriculture. This soils map may be downloaded from the Maricopa County Environmental Services Department website.
1-27	**What Happens If We Don't Meet the PM Standards? -** In addition to setting standards, EPA is responsible for enforcing requirements of the Clean Air Act. According to the Clean Air Act, areas that have not attained the national ambient air quality standards are designated as nonattainment areas. EPA has the authority to impose penalties on industries and stop federal highway funding if nonattainment areas do not meet the air quality standards or submit timely, approvable plans. In addition, EPA can impose a Federal Implementation Plan to solve the local problem.
1-28	**PM_{10} Nonattainment Area -** This 3,000 square mile area represents the Maricopa County PM_{10} Nonattainment Area. Note that there is also a small portion of Pinal County (Apache Junction) in the designated area.
1-29	**PM_{10} Control Measures in Maricopa County -** The PM_{10} Plan for the Maricopa County nonattainment area was approved by EPA in 2002. It contains 77 control measures that include PM_{10} efficient street sweepers, PM_{10} pollution alerts, and catalytic converters on charbroilers in fastfood restaurants like Wendy's and Burger King.

Slide No.	Notes
1-30	**A PM_{10} Efficient Street Sweeper -** This is one of the types of street sweepers that is being used in the Valley to reduce PM_{10} on paved streets and shoulders. A number of models of vacuum and water-assisted sweepers have been certified by the South Coast Air Quality Management District (in the LA Basin) as being PM_{10} efficient, because they do a good job of picking up dirt and do not kick-up dust during the sweeping operation (avoiding the pig-pen effect).
1-31	**PM_{10} Control Measures in Maricopa County -** PM_{10} emission reductions for twelve of the 77 measures were quantified in the Plan. The combined effect of these twelve measures is a 39% reduction in annual emissions by 2006. The single most effective measure in the Plan is the strengthening and better enforcement of fugitive dust controls in Maricopa County Rule 310 and 310.01.
1-32	**2006 PM_{10} Emission Reductions from Committed Control Measures -** The combined effectiveness of Rule 310 in controlling dust from construction, trackout and unpaved lots, (the first, second and fourth bars at the top of this graph) is more than 30 percent. This illustrates that Rule 310 reduces emissions more effectively than all other control measures combined. In comparison, stabilizing unpaved roads only reduces PM_{10} by six percent and each of the other measures reduces emissions by less than one percent.
1-33	**Effectiveness of Rule 310 -** Rule 310 reduces emissions from construction, vehicle track-out, and unpaved lots. The strengthening and better enforcement of Rule 310 is expected to decrease PM_{10} emissions from construction and earthmoving activities by 19 percent, nearly half of the total reduction required to show attainment of the annual standard by 2006. Since reductions in dust generated by construction and earthmoving operations represent such a large share of control measure efficacy in the PM_{10} Plan, it is essential for these reductions to be realized, so that the PM_{10} standards can be attained by 2006. If the standards are not met by this date, EPA could impose a Federal Implementation Plan that is likely to be far more onerous than the current Serious Area PM_{10} Plan.
1-34	**Source Contributions to Fall and Winter Visibility Impairment in Phoenix** - In the Phoenix urban area, the Brown Cloud is most visible on fall and winter days. The Brown Cloud is composed primarily of gases and fine particles emitted from combustion sources, rather than coarser particulates created by moving geologic material. The pie chart shows that 9% of the brown cloud is caused by dust. About 40% of this Dust comes from construction and earthmoving activities; the remainder is due to agricultural activities and cars traveling on paved and unpaved roads. This chart also shows that exhaust from diesel construction equipment (called Off-road Diesel) is responsible for another 11% of the Brown Cloud. In 2001, the Arizona Legislature passed House Bill 2538 that included measures to control emissions from sources contributing to the Brown Cloud.
1-35	**ADOT Initiatives to Reduce Construction Dust –** During 2001-2003 the Arizona Department of Transportation sponsored a project to research, develop and implement education tools and outreach programs for reducing construction dust in

Slide No.	Notes
1-35 (continued)	Maricopa County and other parts of Arizona. This project has identified practical and cost-effective methods to control fugitive dust at work sites and has developed materials to ensure that information, training, and certification programs are readily available to managers, site superintendents, subcontractors and other construction personnel. This Construction Dust Control Course is one product of the ADOT-sponsored research. Additional outreach and educational materials have been developed to provide follow-up information to construction personnel. A bi-lingual flipbook is available for use at construction sites, during tailgate sessions. A Construction Dust Guide, targeted at construction managers, provides an overview of Maricopa County Rule 310. A brochure is also being distributed to inform the public of the effort that the construction industry is making to reduce PM_{10}. ADOT's overall objective is to make dust suppression a standard operating practice at its own highway construction sites, as well as all other construction sites in Arizona.
1-36	**Questions? -** Does anyone have any questions about the material that has been presented?

MODULE 2 - CONSTRUCTION DUST CONTROL REQUIREMENTS

Slide No.	Notes
2-1	**Construction Dust Control Requirements under Maricopa County Rule 310 -** Previous Module 1 provided background information on air quality issues affecting Maricopa County and Arizona. That module covered the reasons that dust control is needed, and detailed the causes of PM_{10} and the natural and man-made sources of fugitive dust. Module 1 discussed the actions already taken to reduce PM_{10} emissions, including control measures that have been implemented. This Module covers construction dust control requirements and explains dust control measures for construction-related activities in Maricopa County. Subsequent modules will cover the enforcement of Rule 310 requirements and the associated penalties for non-compliance and will also examine dust control techniques for different dust generating activities.
2-2	**Requirements for Construction Activities in Maricopa County** - Rule 310 requires firms or individuals planning earthmoving activities involving 0.1 acre or more to obtain an Earthmoving Permit, submit a Dust Control Plan, and comply with specific record-keeping, site maintenance, site signage, and other requirements.
2-3	**Earthmoving Permit -** Now, we'll discuss who is required to apply for an Earthmoving Permit, and how to complete a permit application form. Refer to the sample Earthmoving Permit application form that was handed out to you.
2-4	**Who Must Apply for a Permit** - The person responsible for any earthmoving operation that will disturb a total surface area of 0.10 acre or more must submit an Earthmoving Permit application. This "Responsible Official" could be an officer or decision-maker of a corporation, a partner of a partnership, the owner of a sole proprietorship, or the principal executive officer or ranking elected official of a public sector agency.
2-5	**How to Complete a Permit Form** - The Earthmoving Permit application form consists of three sections, Applicant Information, Project Information, and Dust Control Plan. Three copies of the application must be submitted with the appropriate fee attached. For projects of between 0.1 acre and an acre in size, the fee is $75. For projects of greater than one acre, the fee is $36.00 per acre plus $110.00 per site. Be sure to fill in all the applicant information blanks. Section 2 covers the project information including the type of project, the address and legal description, the size of area, in acres, to be disturbed, and a project start date. A schematic drawing of the project with dimensions of at least 8 1/2 inches by 11 inches must be included. Section 3 contains the Dust Control Plan, which we will cover in detail.
2-6	**Elements of Earthmoving Permit Drawing** - The Permit drawing must contain the following elements: • Entire project site boundaries • Acres to be disturbed with linear dimensions • Nearest public roads • North arrow • Planned exit locations onto paved public roadways

Slide No.	Notes
2-7	**Dust Control Plan -** The Dust Control Plan is the third section of the Earthmoving Permit application. Any project that is required to obtain an Earthmoving Permit must submit a Dust Control Plan. We will discuss the requirements of a Dust Control Plan as well as the preparation of a Plan. Refer to Section 3 of your Earthmoving Permit handout.
2-8	**Dust Control Plan Requirements** - The Dust Control Plan application contains a section for each of the activities that take place during a typical construction project that has the potential for generating fugitive dust. Included with each activity are several control measures; the applicant must identify which measure will be employed as the primary measure during the conduct of that activity, and which measures will be employed as contingency measures. For some activities, Rule 310 mandates the employment of a specific primary measure. In these cases, a pre-printed "P" appears next to the measure. Note that the control measures must be employed so as to be effective at all times during the conduct of the project—on non-work days and after hours, as well as when construction activity is taking place. Control measures to be identified by the applicant include a stabilization plan for any unpaved haul or access roads. Dust suppressants to be applied, if any, must be specified, including the method, frequency, and intensity of application, the type, number and capacity of application equipment. A plan to control trackout where unpaved or access points join paved public roadways must also be included.
2-9	**How to Prepare a Dust Control Plan** - How to Prepare a Dust Control Plan: • Put a check (√) in the box in front of all the sources of fugitive dust that you anticipate • Write the letters "NA" in the box in front of all the sources of fugitive dust that you do not anticipate implementing • Write the letter "P" next to primary control measures that you will implement • Write the letter "C" next to contingency control measures that you will implement in cases where the primary measures are unavailable or inadequate Be sure to fill in the details for each control measure that you intend to use.
2-10-A	**Example Fugitive Dust Source -** The first source category listed in the Dust Control Plan form is "Unpaved Haul/Access Roads." If you think unpaved haul or access roads are a potential source of fugitive dust for your project, first...
2-10-B	• Check-mark source
2-10-C	• Next, write a "P" next to primary control measure and fill in details
2-10-D	• Finally, write a "C" next to contingency control measure(s) and fill in details
2-11	**Record-keeping Requirements** - Rule 310 requires that the recipient of an Earthmoving Permit keep daily written log detailing use of control measures agreed to and keep copies of approved Dust Control Plans. Documents must be kept for at least 6 months from end of operations, or at least 1 year total.

Slide No.	Notes
2-12-A	**How to Fill Out a Dust Control Log -** How to Fill Out a Dust Control Log: A log page must be kept for each week of the project. Each page must list all the potential dust generating activities that you have included in the Dust Control Plan. A number of formats for a Dust Control Log exist. However, the form shown here is the one EPA prefers.
2-12-B	At the top of the form, fill-in project and contractor information, and the date for each daily sheet. Note that each time you check for dust control throughout the day, you will be entering a "Y" for control measures active at that time, an "N" for those not being used at the time of the check, or an "NA" for those not applicable.
2-13-A	**How to Fill Out a Dust Control Log -** Here is a close-up of a portion of the form shown on the preceding slide.
2-13-B	Each time you check for dust control, you must fill in the time of the check, and a "Y", "N", or "NA" next to every measure in the column under the time you entered.
2-13-C	Note that the measures in use for controlling dust may change during the day. Use the "comments" space to record any pertinent action, such as the implementation of a contingency measure in response to observed increase in area opacity levels.
2-14	**General Standards -** Rule 310 provides general standards both for the level of opacity that is acceptable and the means of measuring the opacity. Opacity is the reduction in visibility caused by a cloud of dust. The standard limitation for Visible Emissions within Maricopa County is 20 percent opacity.
2-15	**20 percent Opacity Limit** - County inspectors are trained to read opacity, but there are ways that you can estimate opacity on the job. Twenty percent opacity is a faint cloud of dust through which you can readily see background details. Measures controlling visible emissions must be implemented during all periods of dust generating operations. The specific dust control measures, including contingency measures, are contained in the Dust Control Plan that is part of each regulated site's earthmoving permit.
2-16	**20 percent Opacity Limit -** A regulated site should implement contingency measures as necessary to prevent visible emissions from reaching 20 percent opacity, rather than waiting until emissions reach that level. Additional precautions should be taken to prevent the dust cloud from crossing the property line. The 20 percent opacity limitation applies at all times except when the average wind speed is greater than 25 miles per hour provided that all reasonably available control measures contained in the approved Dust Control Plan are in place. Twice a year classes are held for certification in reading Visible Emissions. While not mandatory, all superintendents, project managers, and foremen are encouraged to attend. Becoming certified enables you to determine opacity and your project's level
2-16	of compliance with this requirement. Contact Maricopa County at (602) 506-6700 for details on class times and locations.

Slide No.	Notes
2-17-A	**Sign Requirements -** Rule 310 contains regulations that govern the signage that appears on a job site of five acres in size or larger. While these signs facilitate compliance and enforcement, they also help to market the positive efforts of a project to control fugitive dust.
2-17-B	• The minimum dimensions of the sign are 4 feet wide by 4 feet high
2-17-C	• The name of the project, the name of the contractor, and the County complaint number must be provided in block letters at least 4 inches high
2-18	**Control Measures Required for Construction Activities in Maricopa County** - Now, we'll discuss other control measures provided for the Dust Control Plan application. These activities fall into the four general areas of vehicle use, disturbed surface areas, material hauling, and spillage and trackout. In Module 4, we will discuss in more detail some of the techniques that have proved successful in controlling dust generated by these activities.
2-19	**Vehicle Use -** To hold down dust on open area and vacant lots, motorized vehicle operation should be discouraged or prevented. Restrict trespassing with signs or block access with barriers. Apply water to unpaved parking lots. If possible, apply and maintain gravel, recycled asphalt, or other suitable material, or pave the lot. Use dust suppressant on unpaved lots.
2-20	**Vehicle Use** - Limit vehicle speeds on unpaved haul and access roads to 15 mph. Apply water, so that surface is visibly moist. If possible, pave the road, or apply and maintain gravel, recycled asphalt, or other suitable material. Apply dust suppressant to unpaved roads.
2-21	**Disturbed Surface Areas -** Before beginning earthmoving operations in a specific area, pre-water the area to the planned depth of cuts. Phase work to reduce the amount of disturbed surface area at any one time. During earthmoving operations, apply water or dust suppressants, construct fences or wind barriers, and be prepared to cease operations as a contingency—such as during high wind events, for example.
2-22	**Disturbed Surface Areas -** To temporarily stabilize a disturbed surface area during a project, apply water or dust suppressants, establish a vegetative ground cover, restrict vehicular access. After earthmoving operations have ended, attempt to restore area to resemble undisturbed conditions, establish vegetative ground cover, and apply and maintain dust suppressants as needed.
2-23	**Material Hauling - On-site** - When hauling material on the job site, leave a freeboard of at least three inches when loading trucks. Prevent spillage from holes or other openings in the floor, sides, or tailgate of the cargo compartment. If you do exit the site, be sure to drive over a suitable trackout control device such as a gravel pad or a grizzly.
2-24	**Material Hauling - Off-site** - When hauling material off the job site, leave a freeboard of at least three inches when loading trucks. Prevent spillage from holes or other openings in the floor, sides, or tailgate of the cargo compartment as before. In addition, cover the load with a tarp. Clean the interior of empty cargo compartment before leaving the site. Always drive over a suitable trackout control device such as a gravel pad or a grizzly.

Slide No.	Notes
2-25	**Spillage and Trackout** - To control spillage and trackout, if the disturbed area is 5 acres or larger, Rule 310 requires that you install a gravel pad at least 30 feet wide, 50 feet long, and 6 inches deep at all access points. Also consider installing a grizzly or wheel wash system at all access points or paving access roads for a distance of at least 100 feet and a width of at least 20 feet. Sweep up any trackout deposits that end up on paved public roads.
2-26	**Questions?** - Does anyone have any questions about the material that has been presented?

MODULE 3
ENFORCEMENT OF DUST CONTROL AT CONSTRUCTION SITES

Slide No.	Notes
3-1	**How Construction Dust Control is Enforced in Maricopa County** - Modules 1 and 2 explained why dust control is needed and summarized the requirements of the Maricopa County Dust Control Rule 310. This third module discusses how Rule 310 is enforced in Maricopa County
3-2	**Enforcement Objectives** – The purpose of Maricopa County's Enforcement Policies are to "provide a consistent reasonable process for documenting potential air quality violations, notifying alleged violators, and initiating enforcement action to ensure that violations are addressed in a timely and appropriate manner."
3-3	**How Violations Are Discovered and Documented -** County inspectors and enforcement officers may encounter violations of Rule 310 while conducting an inspection, investigating a complaint, or by random field reviews. When a potential violation of Rule 310 is observed, County personnel fill out a report. The report documents where, when, and how events occurred that resulted in the violation and the name, affiliation, title, and statements of people interviewed. Reports typically include evidence such as photos and analytical tests that support the failure to comply.
3-4	**How Violators Are Notified -** Notification of a violation is provided in writing to an owner, operator or other responsible official. The most common method of notification is a Notice of Violation. For minor infractions, a Compliance Status Notification may be issued, identifying the problem and requesting that it be remedied. A less common method for more severe violations is a Notice to Appear and Complaint, also called a "citation," which is a Class I Misdemeanor.
3-5	**Rule 310 Violations –** The following violations are specifically identified in the County's Enforcement Policy. a) Knowingly or willfully failing to obtain a County earthmoving permit. b) For unpaved parking lots – Opacity exceeds 20 percent and both the silt loading and silt content limitations are exceeded. **c)** For unpaved haul/access roads – More than 20 vehicle trips per day are observed passing a particular point or vehicles are exceeding 15 mph.
3-6	**d) For disturbed surface areas on which no activity is occurring & none of the following exist:** 1. Visible crust 2. Particles will not become airborne in light breeze (about 2.3 mph) 3. Flat vegetative cover of at least 50 percent 4. Standing vegetative cover of at least 30 percent 5. Standing vegetative cover of at least 10 percent and threshold friction velocity of at least 43 cm/sec **6.** More than 10 percent cover of non-erodible elements

Slide No.	Notes
3-7	e) For hauling - The freeboard on a truck is measured and determined to be less than three inches *or* a load of bulk material leaving a site is not covered *or* loss of material occurs from holes or other openings in the cargo space, *or* vehicles traversing a paved public road fail to pass over a trackout control device.
3-8	f) For trackout - 1. For work sites with a disturbed surface area of at least five acres, vehicles are observed exiting a work site onto a paved road without passing over a trackout control device. 2. Deposits extending 50 feet or more along the road are observed on a paved public road originating from a work site exit. 3. Particulate matter is observed being spilled or deposited at least 50 feet from the work site exit onto a road from the cargo compartment, tires, or other exterior surfaces of a vehicle exiting the work site.
3-9	g) For earthmoving operations – One acre or more is being disturbed, the site's Dust Control Plan designates water as the control measure, and no water is being applied while the earthmoving operation is being conducted. h) For unpaved parking lots – More than 100 vehicles are present and the (1) opacity exceeds 20 percent and the silt loading exceeds 0.33 oz/ft^2 or (2) the silt content exceeds 8 percent.
3-10	**After a Notice of a Rule 310 Violation is Issued -** After the Air Enforcement Section reviews documentation of the violation supporting evidence, the Section may • Issue a Notice of Violation • Issue an Order of Abatement • Refer the violation to the County Attorney's Office • File a Notice to Appear and Complaint, or • Send the case back to the Air Compliance Section with a written request for additional information.
3-11	**Violations Referred to the County Attorney's Office -** The County Attorney determines if there is sufficient evidence to support a complaint. If there appears to be sufficient evidence, the Attorney's Office may pursue one of three options: 1. Settlement Conference with Consent Agreement – The Attorney may request a conference with the violator/responsible party prior to filing a complaint. If an agreement is reached, the parties will enter into a written agreement that may include monetary penalties, reimbursement of costs for the investigation and prosecution, violator education, community service, and other sanctions. 2. Filing of Civil Complaint – The County Attorney may file a civil complaint seeking monetary penalties and injunctive relief. 3. Filing of Criminal Complaint – A criminal complaint may be filed if there is a reasonable likelihood of conviction.

Slide No.	Notes
3-12	**Penalties -** The purpose of the monetary penalties is to serve as a disincentive for the regulated community to commit violations of Rule 310. The amounts must be set high enough that it is more attractive to implement dust control measures than pay the fines. The amount of the penalty is determined by considering the severity of the violation, the costs of not complying, recovery of enforcement costs, and any mitigating factors. The maximum penalty allowed by state law is $10,000 per day per violation.
3-13	**Compliance Status –** In 2001, Maricopa County issued 3,608 earthmoving permits, conducted about 8,000 earthmoving inspections, and responded to 1,346 complaints about dust generation from earthmoving activities. During the same year, the County issued 919 Notices of Violation, about one-third of which were for sites not having the required permit. Another 523 Compliance Status Notifications were issued. Of these actions, 402 cases were referred to enforcement, 251 cases were referred to the County Attorney's Office, and 186 cases were settled. About $680,000 in penalties were collected between May 2000 and December 31, 2001. The County estimates that approximately 77 percent of the sources were in compliance with Rule 310 during 2001.
3-14	**What are the Most Common Rule 310 Violations?** The most common Rule 310 violations found in Maricopa County are: • Soil stabilization not maintained during non-working days or hours • Failure to obtain required permits or have them available on site • Failure to follow the Dust Control Plan • No gravel pad at construction site exits • Lack of pre-wetting of work areas and haul routes • Insufficient number of water trucks • Haul roads not stabilized or watered • Failure to clean up trackout or deposits on paved public roads • No tarps on haul trucks • Lack of recordkeeping showing implementation of the Dust Control Plan The most common violation in recent years has been a failure to have an earthmoving permit located on site.
3-15	**Frequently-Encountered Excuses –** • The water truck or the street sweeper…is on the way, broke down, got lost, etc. • The soil at this site makes dust control impossible. • Give me a break – we live in the desert! • How could I know it would be windy today? • I left my permit on my desk at the office. • What a coincidence, I was going to get my permit today! • One of the subs has the permit; you know how they are!

MODULE 4 - STRATEGIES TO ASSIST CONSTRUCTION ACTIVITIES IN CONTROLLING DUST

Slide No.	Notes
4-1	**Strategies to Assist Construction Activities in Controlling Dust -** The previous modules of the Course provided background - explained why dust control is needed, outlined the requirements of Rule 310, and discussed enforcement of Rule 310. This Module will examine dust control strategies, including project design, site planning, and available resources.
4-2	**Designing and Implementing a Construction Project to Minimize Dust -** Addressing dust control issues before beginning a project can save time, money, and project resources. Site-specific air quality and dust control issues—and appropriate ways to tackle them—should be identified before work begins. Strategies for trackout prevention, the handling, storage, and transportation of bulk materials on and off-site, dust-minimizing procedures during construction, and site maintenance should all be discussed.
4-3	**Site Planning -** Phasing the project and planning site layout carefully will result in minimized soil disturbance. Lessening the amount of surface being disturbed at any one time reduces the amount of control required and the amount of water or dust suppressant needed. Evaluate dust control procedures periodically to identify additional issues that develop as the job progresses. Install wind fences or barriers (less than 50 percent porosity). Place barriers around storage piles, parking, and equipment staging areas. Develop semi-permanent staging areas to cut down on the amount of disturbed area. Restrict access on unpaved areas to vehicles and equipment that are necessary that day. Limit unnecessary travel on unpaved surface areas. Restabilize disturbed surfaces by paving permanent roads and restoring vegetation as soon as possible. Allow time for pre-wetting areas where excavation or trenching will occur. Make sure everyone working on the job knows all the requirements for dust control and who is in charge. Encourage a proactive and continuous focus on air quality issues on the job site.
4-4	**Trackout -** Control of trackout is required for all sites with disturbed area of 5 acres or more, or sites from which 100 yards or more of bulk materials are hauled on-site or off-site per day. Trackout is controlled through the use of gravel pads, grizzlies, paving, and appropriate watering. Trackout that extends 50 linear feet or more onto a paved public road must be cleaned up immediately. Otherwise, the trackout must be cleaned up by the end of the workday. Cleanup may be performed with a street sweeper or wet broom with sufficient water, if applicable, at the speed recommended by the manufacturer or by manually sweeping up the deposits.
4-5	**Strategies for Bulk Material Handling, Storage and Transportation -** Material handling refers to many types of earthmoving activities on construction sites, including loading and hauling. These types of activities can be significant sources of fugitive dust. However, dust control during loading and hauling can be easily achieved through careful planning and proper implementation of controls. When

Slide No.	Notes
4-5 (continued)	planning a construction project involving earthmoving activity, strategies for bulk material handling, storage, and transportation that minimize dust generation must be developed. Strategies are needed for handling or hauling material off-site onto paved public roadways, completely within the boundaries of the work site, or when crossing a public roadway that is open during construction. Strategies for preventing open storage piles from creating dust are also needed.
4-6	**Bulk Material Hauling Off-site Onto Paved Public Roadways** - Allow for a freeboard of at least three inches when loading haul trucks. Prevent spillage from any openings: floor, sides, or tailgates of cargo compartment. Mist material with water while stacking. Mix excavated material with water prior to loading. Empty loader slowly and keep bucket close to the truck while dumping.
4-7	**Bulk Material Hauling Off-site Onto Paved Public Roadways -** Tarps are required on haul trucks to prevent wind blown dust. Do not overload the truck! Keep your load 3 to 6 inches below the freeboard to minimize spillage. Check belly-dump truck seals regularly and remove any trapped rocks to prevent spillage. Daily vacuuming, wet broom cleaning, or covering of cargo compartment interiors of empty trucks is required to control trackout. Have all trucks drive over a gravel pad or grizzly when leaving the site.
4-8	**Bulk Material Hauling -** When hauling bulk material within the boundaries of the work site or when crossing a public roadway open during construction, be sure to allow for a freeboard of at least three inches when loading haul trucks. Prevent material from spilling from any openings in the floor, sides, or tailgates of cargo compartment and control trackout.
4-9	**Bulk Material Hauling On site, Completely Within Site Boundaries -** When hauling bulk material completely within the site boundaries, limit vehicular speeds to 15 mph, and apply water to top of load to keep dust emissions from exceeding 20 percent opacity limit.
4-10	**Open Storage Pile -** Applicable regulations define an "open storage pile" as any accumulation of bulk material with a 5 percent or greater silt content that is 3 or more feet in height at any point and has a total surface area of 150 square feet or more. Suppliers of rock products used in construction include silt content in the specifications. The silt content of excavated soil always exceeds five percent. When adding material to the pile or removing material from the pile, apply water as needed to suppress dust. When not working with the pile, cover it with a secured tarp, water the pile to keep the moisture content of the soil at 12 percent or higher, or water until a surface crust forms that will prevent wind erosion.
4-11	**Construction Operations -** We will now discuss four areas that typically generate dust during construction work: • Disturbed surface area - pre-activity • Disturbed surface area - during construction • Earthmoving operations on disturbed surface areas 1 acre or larger • Unpaved haul and access roads

Slide No.	Notes
4-12	**Disturbed Surface Area -Pre-activity -** To minimize dust generation from disturbed areas before beginning construction, plan ahead, pre-water work site to the depth of cuts, and proceed in stages to minimize amount of disturbed surface area present at any given time.
4-13	**Disturbed Surface Area During Construction** - During construction, apply water or dust suppressant to work area and construct fences or 3 to 5 foot high wind barriers adjacent to roadways or urban areas. During grading, water using a water truck; during trenching, water using a fine spray or mist; and during screening, mist material after it drops from the screen.
4-14	**Earthmoving Operations on Disturbed Surface Areas 1 Acre or Larger** - When the area under construction is 1 acre or larger, water must be applied during earthmoving operations, if water is the chosen control measure.
4-15	**Unpaved Haul and Access Roads -** Rule 310 requires that vehicle speed over unpaved haul and access roads must not exceed 15 mph and the number of trips must not exceed 20 per day unless • Water is applied in sufficient quantity to maintain a moist surface • Gravel, recycled asphalt, or other suitable material is applied and maintained • A dust suppressant is used as directed by the manufacturer, or • The access roads are paved Be sure not to over-water—muddy conditions will increase trackout.
4-16	**Site Maintenance -** Proper maintenance of the job site will reduce fugitive dust from unpaved parking lots, open areas and vacant lots, and disturbed surface areas. Surface areas that will be disturbed again during the current project should be temporarily stabilized during non-work days and after hours. Those areas that will not be disturbed again must be permanently stabilized within eight months after dust-generating operations have ended.
4-17	**Unpaved Parking Lots -** Dust from an unpaved parking lot must be limited by applying and maintaining a gravel, recycled asphalt, or other suitable surface, by watering or using a dust suppressant, or, of course, by paving the lot.
4-18	**Open Areas and Vacant Lots -** To reduce fugitive dust from open areas and vacant lots, water the areas to form a crusted surface. Prevent motorized vehicles from entering, driving across, or parking within the areas. Uniformly apply and maintain surface gravel or soil stabilizers to all areas that have been disturbed by motor vehicles or off-road vehicles. If the area cannot be paved, Rule 310 requires that these areas be restored so that the vegetative ground cover and soil characteristics are similar to those of adjacent or nearby undisturbed native conditions.
4-19	**Disturbed Surface Areas - Temporary Stabilization -** During non-work days and after hours, surface areas that have been disturbed during construction activity must be temporarily stabilized by treating with a dust suppressant. Motorized vehicles must be prevented from entering, driving across, or parking within the areas.
4-20	**Disturbed Surface Areas - Permanent Stabilization -** Within eight months after dust -generating operations have been completed, site areas that were disturbed must

Slide No.	Notes
4-20 (continued)	be permanently stabilized. Efforts should be made to restore these areas so that the vegetative ground cover and soil characteristics are similar to those of adjacent or nearby undisturbed native conditions. Alternatively, the areas should be graveled, paved, or treated with a dust suppressant. Establish sufficient ground cover.
4-21	**Resources Available to Reduce Dust Before, During, and After Construction -** Let's review means of reducing dust before, during, and after construction. These include trackout control devices, effective watering, chemical stabilizers or dust suppressants, and wind barriers.
4-22	**Trackout Control Devices - Gravel Pad.** Dust Control Plans require that stabilized construction entrances be installed at all access points if 100 yards or more of bulk material per day is to be hauled on or off the site, or if the site is larger than 5 acres. A gravel pad is a stabilized construction entrance, designed to remove the mud and dirt from the tires of vehicles leaving a construction site. Using gravel pads reduce fugitive dust caused by trackout onto paved roads and surfaces. The use of such pads may also reduce the need for street sweepers or laborers to remove trackout from paved surfaces, as well as help prevent storm water pollution. Gravel pads are typically made from one inch to three inches in diameter, washed, well graded gravel or crushed rock. The gravel pad should be at least 30 feet wide by 50 feet long, and a minimum of 6 inches deep. When installing the gravel pad, make sure that it is properly graded.
4-23	**Trackout Control Devices - Grizzly -** A Grizzly is a device using rails, pipes or grates to dislodge mud, dirt and debris from the tires and undercarriage of vehicles that drive over it prior to leaving the work site. An example of a grizzly is the "shaker" invented by Jeff Lange for Kitchell Contracting. This device is reusable, transportable by pick-up truck, easy to assemble, and can be expanded to accommodate various sizes of haul vehicles. More information about the shaker device can be obtained at www.trackoutcontrol.com.
4-24	**Effective Watering -** Watering prior to excavation or earthmoving is an effective means of suppressing dust. When applied regularly, water provides temporary stabilization to disturbed surface areas and reduces fugitive dust caused by earthmoving and driving on non-stabilized surface areas. Watering makes roads and disturbed surfaces appear moist with minimal silt, creates a crusted surface on the soil, provides soil moisture content optimal for compaction, and prevents visible emissions from exceeding 20 percent opacity. Adequately watered soil should have a crusted surface that is not easily crumbled between your fingers. The soil moisture content should be optimal for compaction.
4-25	**Effective Watering Strategies** - Wet the area to the depth of cuts or equipment penetration 15 to 30 minutes prior to start of work. Apply water at the end of the day to soak the next day's work area overnight. During grading, apply water in sufficient quantity to maintain a moist surface using a water truck. After clearing an area, apply water frequently enough to prevent visible emissions (at least every 2 hours). Consider setting up automatic sprinkler/spray bar systems in these areas. Surfactants or palliatives added to water increase penetration.

Slide No.	Notes
4-25 (continued)	If the area is inaccessible to water trucks due to slope conditions or other safety factors, watering should be conducted with water hoses or sprinkler systems. Remember: many cities have restrictions for construction on sloped areas -- be sure you comply with those as well.
4-26	**Chemical Stabilizers -** or dust palliatives - are products that are applied to soil surfaces in order to limit the creation of fugitive dust emissions. A variety of products are available, and finding one that fits your project's activities can reduce the need for watering, which is desirable in our desert environment. Over the long term, using dust palliatives can result in significant cost savings over regular, frequent watering. In some instances, the resulting soil stabilization can last from 1 to 12 months. Some dust palliatives are not designed for areas subject to daily disturbances, high volume traffic, or heavy equipment traffic—check with the product vendor if these conditions exist at your site. Be sure to ask the product vendor for the recommended dilution, application rate, and application frequency of the product you choose because these vary significantly by product. Before a weekend, holiday, or other inactive period of less than 5 days, a dust palliative that is diluted to not less than 1/20 of the concentration required to stabilize a surface for 6 months is recommended. Maricopa County requires the use of environmentally compliant dust palliatives. Be sure to check with local authorities before choosing a dust suppressant. A contractor is responsible for assuring that its use of dust palliatives is in compliance with all applicable environmental laws.
4-27	**Wind Barriers -** Wind barriers are placed along one or more sides of a job site to reduce the amount of wind blown dust leaving the site. Creating a wind barrier could involve installing wind fences, constructing berms, or parking on-site equipment so that it blocks the wind. Alone, these barriers are not adequate for controlling dust. Wind barriers must be implemented together with the application of water or dust palliatives. These barriers increase the dust control effectiveness of water or palliative application. Effective wind barriers are 3-sided structures made of material 3 to 5 feet high with a porosity of 50 percent or less. A wind barrier for a storage pile should be as high as the top of the pile.
4-28	**Additional Benefits of Controlling Dust -** Besides avoiding violations of Rule 310, do construction companies derive any additional value by controlling dust? • Public and community "good will" • Employee health considerations • Competitive advantage for early adopters

MODULE 5 - VISIBLE EMISSIONS EVALUATION AT CONSTRUCTION SITES

This module will describe the techniques used to identify the opacity levels of dust generated by construction activities. The script and slides for this module are being developed by the Arizona Department of Environmental Quality and will be added to this guide when completed.

MODULE 6 - ADDITIONAL INFORMATION ON CONSTRUCTION DUST CONTROL

Slide No.	Notes
6-1	**Opportunities for Continuing Education on Construction Dust Control -** We have reviewed the reasons why it is important to control dust, dust control requirements, the ways in which the requirements are enforced, strategies for compliance, and how to evaluate opacity levels. The purpose of this module is to briefly introduce you to resources that supplement the training you have received today.
6-2	**Construction Dust Control Toolkit –** Before leaving today, you will be provided with a toolkit that has been developed to be useful in presenting dust control concepts to other individuals in your organization, both in a classroom setting and at on-site meetings with construction workers. The contents of the toolkit are as follows: • MCESD Video – "Effective Dust Control & Overview of Rule 310," a 10-minute VCR tape • Training Modules – A CD containing the PowerPoint presentation and script for this course can be used in a classroom setting to train others in your organization and can be tailored to the audience by removing and/or rearranging modules. • Quick Reference Dust Control Guide - This water-resistant flipbook in English and Spanish provides 5-minute topics on dust control that can be introduced at construction site tailgate meetings. • Calendars and other reinforcement items – These items are provided to be constant reminders of the need to control dust at work sites.
6-3	**Photo of Toolkit and Contents**
6-4	**Guide to Construction Dust Control Measures in Maricopa County –** In addition to the toolkit, a construction dust control measures guide has been developed. The target audience for this guide is construction company managers and employees impacted by Rule 310 as well as industry trade associations. To obtain a copy of the Guide, contact the Blue Skies Coordinator at ADOT.
6-5	**Voluntary Dust Control Certification Program -** A voluntary certification program has been established to encourage managers, superintendents and other personnel to learn about and practice effective dust control at construction sites. The certification program is being administered by the Blue Skies Coordinator at ADOT. Two levels of voluntary certification are being offered: certified dust control specialist and certified dust control instructor. Certificates will be issued to individuals meeting the requirements for either a specialist or instructor. Dust Control Specialists are required to attend the dust control course and pass an exam on the material presented in the class with a grade of 75 percent or better. To maintain dust control certification, a Specialist must meet the above requirements every two years. Dust Control Instructors are also required to attend the dust control course and pass the exam with a grade of 75 percent of better. In addition, an Instructor must teach a dust control course (Modules 1-4 and 6) under the

Slide No.	Notes
6-5 (continued)	supervision of a certified instructor. To maintain certification, an Instructor must pass the Dust Control exam every year and receive certification in Visible Emissions Evaluation (Smoke School) every six months.
6-6	**Additional Sources of Information** include: • Dust Devil Academy • Arizona Air Aware Initiatives • "Reducing Air Pollution from Construction" Course
6-7	**Dust Devil Academy -** The Maricopa County Small Business Environmental Assistance Program maintains a website www.maricopa.gov/sbeap/basepage.htm that provides valuable and up-to-date information on Rule 310 and dust control for construction sites, together with testimonials and success stories.
6-8	**Arizona Air Aware Initiatives -** The Arizona Department of Transportation maintains a website www.dot.state.az.us/ABOUT/air/index.htm devoted to air quality issues affecting the State of Arizona. Innovative programs sponsored by ADOT include an air quality outreach program in Central Yavapai County (Prescott area), a construction dust educational and outreach program for Maricopa County, and an air quality sustainability program in Coconino County.
6-9	**"Reducing Air Pollution From Construction" Course -** A course entitled, "Reducing air Pollution from Construction" is offered by Paradise Valley Community College and taught by Robert R. Treloar. Contact PVCC for a course schedule. The course is co-sponsored by the Maricopa County Small Business Environmental Assistance Program.
6-10	**Dust Control Exam** - A multiple-choice test will now be administered. This test will reinforce the most important points presented in the class today. Please write your name and contact information (address, telephone or e-mail) at the top. If you are interested in becoming certified as a dust control specialist or instructor, check "yes" at the bottom and we will notify you of the test results. You will need to answer 75% of the questions correctly in order to pass the test for certification purposes. After you have turned in your tests, I will go over the questions and the correct answers. I hope you have found the information provided in this session today to be useful. Please write any comments you may have in the space provided at the end of the exam.

EARTHMOVING PERMIT APPLICATION

GUIDANCE FOR FILLING-OUT AN APPLICATION FOR AN EARTHMOVING PERMIT

Section 1 – Applicant Information

Submit the Appropriate Fee for your Earthmoving Permit application, according to the following:

- If total surface area disturbed is 0.1 acre to less than 1 acre, submit $75.
- If total surface area disturbed is 1 acre or more, submit $36/acre plus $110 per site

Make checks payable to "Maricopa County Environmental Services Department" or "M.C.E.S.D."

A Responsible Official is one of the following:

- For a corporation, a corporate officer or any other person who performs similar policy or decision making functions for the corporation, or a duly authorized representative of such person, if the representative is responsible for the earthmoving operations in the subject application. Delegation of authority to such representative shall be approved in advance by the permitting authority.
- For a partnership or sole proprietorship, a general partner or the proprietor, respectively.
- For a municipality, state, federal, or other public agency, the principle executive officer or ranking elected official of that entity.

Section 2 – Project Information - Drawing

Section 2 – Project Information – Drawing is self-explanatory. However, please remember, when calculating the amount of disturbed area for trenching, include the dimensions of the trench, stockpiling areas, and staging areas.

Section 3 – Dust Control Plan

An Earthmoving Permit must contain a Dust Control Plan. You may fill-out Section 3 of the Application For An Earthmoving Permit and submit it as your Dust Control Plan or you may write your own Dust Control Plan describing all control measures to be used during the project and submit it as your Dust Control Plan.

Water: Sources of fugitive dust, listed in Section 3, that include "Apply water" as a control measure require specifics about water availability and water application. If you choose to apply water as a control measure, you must fill-in the blanks, under both Water Availability and Water Application. For Water Availability, indicate which of the following will be utilized: water storage tank on-site; metered hydrant on-site; water not on-site, describe water source and state the distance from site to water source; water provided through irrigation; other – specify source. For Water Application, indicate which of the following will be utilized: apply water using a water truck – state number of trucks and number of gallons per truck; apply water using hoses; apply water using sprinklers.

Dust Suppressants: If you choose the control measure "dust suppressant(s) other than water", you must describe the method of dust suppressant(s) application. Express frequency in terms of how often the surface will receive a complete application of dust suppressant(s) (i.e., the frequency may be three applications per day). Express intensity in units such as gallons per minute. Also, include as an attachment:

- Product specifications or label instructions for approved usage
- Information on environmental impacts and approvals or certifications related to appropriate and safe use for ground application

Describing Major Project Phases: You may use the Project Information Drawing in Section 2 to show the various project phases, along with a time line depicting relative start and stop times. Indicate on the line provided for describing major project phases that you have shown the various project phases on the Project Information Drawing.

Bulk Material Handling And Hauling: Rule 310 defines "bulk material handling, storage, and/or transporting operation" as the use of equipment, haul trucks, and/or motor vehicles, such as but not limited to the loading, unloading, conveying, transporting, piling, stacking, screening, grading, or moving of bulk materials, which are capable of producing fugitive dust at an industrial, institutional, commercial, governmental, construction, and/or demolition site. When designing your Dust Control Plan, you must choose control measures for all bulk material handling and bulk material hauling that you will do onsite within the boundaries of the work site and that you will do off-site onto paved public roadways.

Open Storage Piles: The control measure options for open storage piles are included with bulk material handling control measure options, because an open storage pile is any accumulation (by stacking, loading, and unloading) of bulk material with a five percent or greater silt content that in any one point attains a height of three feet and covers a total surface area of 150 square feet or more. If you choose to construct wind barriers around open storage piles, as a control measure, you must construct the wind barriers around three sides of the open storage pile. The sides' length must be no less than equal to the length of the pile; the sides' distance from the pile must be no more than twice the height of the pile; the sides' height must be equal to the pile

height, and the material of which the sides are made must be no more than 50 percent porous.

Spillage, Carry-Out, Erosion, And/Or Trackout: Rule 310, Subsection 308.3(b) requires spillage, carry-out, erosion, and/or trackout to be cleaned up at least at the end of the work day and immediately, if it extends more than 50 feet along a paved public roadway. You must specify, on the Dust Control Plan for any site that exits onto a paved public road, the control measures that you will use for both immediate clean-up and after-the-work-day clean-up.

Weed Abatement By Discing Or Blading: Watering, both prior to and during weed abatement by discing or blading, has been pre-designated as the primary control measure, since both are required by Rule 310, Subsection 308.8. You must choose a contingency control measure and at least one control measure to be implemented following weed abatement by discing or blading.

Vegetative Ground Cover: If you choose to "Establish vegetative ground cover" as a control measure, you must comply with the standards in Rule 310, Subsection 302.3:

- Maintain a flat vegetative cover (i.e., attached (rooted) vegetation or unattached vegetative debris lying on the surface with a predominant horizontal orientation that is not subject to movement by wind) that is equal to at least 50 percent; or
- Maintain a standing vegetative cover (i.e., vegetation that is attached (rooted) with a predominant vertical orientation) that is equal to or greater than 30 percent; or
- Maintain a standing vegetative cover (i.e., vegetation that is attached (rooted) with a predominant vertical orientation) that is equal to or greater than 10 percent and where the threshold friction velocity is equal to or greater than 43 cm/second when corrected for non-erodible elements; or
- Maintain a percent cover that is equal to or greater than 10 percent for non-erodible elements.

Surface Gravel, Recycled Asphalt, Or Other Suitable Material: If you choose to "apply and maintain surface gravel, recycled asphalt, or other suitable material" as a control measure for unpaved haul/access roads, you must comply with the standards in Rule 310, Subsection 302.2:

- Do not allow visible dust emissions to exceed 20 percent opacity and either do not allow silt loading to be equal to or greater than 0.33 oz/ft$_2$ or do not allow silt content to exceed 6 percent.

If you choose to "Apply and maintain surface gravel, recycled asphalt, or other suitable material" as a control measure for unpaved parking lots, you must comply with the standards in Rule 310, Subsection 302.1:

Do not allow visible fugitive dust emissions to exceed 20 percent opacity and either do not allow silt loading to be equal to or greater than 0.33 oz/ft^2 or do not allow silt content to exceed 8 percent.

An approved Application for an Earthmoving Permit is reproduced on the following pages.

Maricopa County
Environmental Services Department
Air Quality Division

1001 North Central Avenue
Phoenix, AZ 85004
(602) 506-6700 FAX (602) 506-6862

PLEASE SUBMIT IN TRIPLICATE

Application for an Earthmoving Permit

In order for Maricopa County to process an application for an Earthmoving Permit, all questions must be answered and the appropriate fee must be submitted.

FOR OFFICE USE ONLY
Dist # _____
NOV # _____
Permit # _____
Date Issued _____
Fee Paid _____
Approved By _____
PU _____ Mail _____

Section 1 – Applicant Information

1. Applicant Must Be One Of The Following. Check All That Apply:
Property Owner____Developer____General/Prime Contractor____Lessee_____

2. Legal Business Name: _____
Applicant Address: _____
City/State/Zip: _____
Phone: _____ Fax #: _____
E-Mail Address: _____

3. Property Owner/Developer, If Not Applicant: _____
Address: _____
Phone: _____ Fax #: _____
Contact Person: _____

4. Primary Project Contact: _____
Title: _____ Company Name: _____
Pager #: _____ Mobile #: _____ On-Site #: _____

5. Signature of a Responsible Official of the Applicant:
I hereby certify that, based on information and belief formed after reasonable inquiry, the statements and information in the Application For An Earthmoving Permit, including Section 1-Applicant Information, Section 2-Project Information-Drawing, and Section 3-Dust Control Plan, are true, accurate, and complete.

A Responsible Official of the Applicant is the person who will be contacted or named in any enforcement action initiated by the Maricopa County Environmental Services Department or the Office of the Maricopa County Attorney.

Signature: _____
Printed Name: _____ Title: _____

Section 2 – Project Information-Drawing

6. **Type Of Project. Check All That Apply.**
   Residential_____ Commercial/Industrial_____ Road Work_____ Temporary Storage/Yard_____
   Trenching_____ Site Preparation/Land Development_____ Weed Control_____ Demolition_____

7. **Project Street Address: _____City:_____**

8. **Nearest Major Intersection: _____**

9. **Legal Description (From Phoenix Metropolitan Map Book):**
   Township: _____ Range:_____ Section: _____

10. **Size Of Area, In Acres, That Will Be Disturbed During The Duration Of This Permit, Including Staging And Stockpile Areas**: _____

11. **Project Start Date:**_____

12. **Does The Project Include Renovation Or Demolition Activities? Yes _____No _____**
    Renovation Or Demolition Activities: All facilities scheduled for renovation or demolition must be inspected by a certified Asbestos Hazard Emergency Response Act (AHERA) accredited asbestos building inspector. You must keep a copy of any reports of inspections, including laboratory test results of samples collected, for 2 years.

    NESHAP stands for national emission standards for hazardous air pollutants. National emission standards for hazardous air pollutants are described in 40 Code Of Federal Regulations (CFR) Part 61 and Part 63 (1998). If your facility is scheduled for renovation or demolition and is subject to the requirements of these Federal regulations, you must attach, to your Application For An Earthmoving Permt, a copy of the 10-day NESHAP notification.

    Is Asbestos Present? _____

    AHERA Determination Made By: _____ Date:_____

    10-Day NESHAP Notification Submittal Date (Attach Copy Of 10-Day NESHAP Notification): _____
    Renovation Or Demolition Start Date: _____

An Earthmoving Permit will not be issued, unless a drawing is submitted. Attach a separate page (at least 8 ½" x 11") with a drawing showing all of the following elements:

- Entire project site boundaries
- Acres to be disturbed with linear dimensions
- Nearest public roads
- North arrow
- Planned exit locations onto paved public roadways

Section 3 – Dust Control Plan

- Put a check (□) in the box in front of all the following sources of fugitive dust that you anticipate from your project.
- Write the letters "NA" in the box in front of all the following sources of fugitive dust that you do not anticipate implementing during your project.
- Unless already pre-designated, write the letter "P", for primary control measures that you will implement during your project, on the line in front of at least one of the listed control measures or work practices, under each checked box/source of fugitive dust. The control measures pre-designated with the letter "P" are required to be implemented.
- Write the letter "C", for contingency control measures that you will implement during your project, on the line in front of at least one of the listed control measures or work practices, under each checked box/source of fugitive dust.

❑ Unpaved Haul/Access Roads:

❑ Limit vehicle speed to 15 miles per hour or less and limit vehicular trips to no more than 20 per day. If this is chosen as the primary control measure, indicate number of vehicles traveled on haul roads: _____

❑ Apply water at a frequency and intensity to comply with Subsection 302.2 in Rule 310 (See Guidance-"Water") Water Availability: _____
Water Application: _____

❑ Pave

❑ Apply and maintain surface gravel, recycled asphalt, or other suitable material so that the area meets the silt loading and silt content limits of Subsection 302.2 in Rule 310 (See Guidance-"Surface Gravel, Recycled Asphalt, Or Other SuitableMaterial")

❑ Apply and maintain dust suppressant(s) other than water using _____ at a frequency of_____ and an intensity of _____ (See Guidance-"Dust Suppressants")

❑ Other: _____

❑ Disturbed Surface Areas – Before Dust Generating Operations Occur:

❑ Pre-water site to the depth of cuts (See Guidance-"Water")
Water Availability:_____
Water Application: _____

❑ Phase work to reduce the amount of disturbed surface area at any one time. Describe major project phases (See Guidance-"Describing Major Project Phases")
_____

❑ Other: _____

❑ Disturbed Surface Areas – During Dust Generating Operations:

❑ Apply water (See Guidance-"Water")
Water Availability:_____
Water Application: _____

❑ Apply and maintain dust suppressant(s) other than water using _____ at a frequency of _____ and an intensity of _____ (See Guidance-"Dust Suppressants")

❑ Construct fences or 3 foot - 5 foot high wind barriers with 50% or less porosity (in combination with one of the above) Show locations on drawing in Section 2.

❑ Cease operations (as a contingency control measure only)

❑ Other: _____

❑ Disturbed Surface Areas – Temporary Stabilization Including Weekends, After Work Hours, Holidays, And Periods Up-To 8 Months:

- ❑ Apply water (See Guidance-"Water") or other dust suppressant (See Guidance-"Dust Suppressants") in sufficient quantity and frequency to establish and maintain a visible crust.
  Water Availability:_____
  Water Application: _____
- ❑ Establish vegetative ground cover that complies with Subsection 302.3 in Rule 310 (See Guidance-"Vegetative Ground Cover")
  Describe vegetative ground cover:_____
- ❑ Restrict vehicular access in combination with one of the above
- ❑ Other: _____

❑ Disturbed Surface Areas – Permanent Stabilization Required Within 8 Months Of Ceasing Dust Generating Operations:

- ❑ Restore area such that the vegetative ground cover and soil characteristics are similar to adjacent or nearby undisturbed native conditions
- ❑ Establish vegetative ground cover that complies with Subsection 302.3 in Rule 310 (See Guidance-"Vegetative Ground Cover")
  Describe vegetative ground cover:_____
- ❑ Pave or apply gravel
- ❑ Apply and maintain dust suppressant(s) other than water using _____ at a frequency of_____ and intensity of_____ (See Guidance-"Dust Suppressants")
- ❑ Other: _____

❑ Trackout From Work Sites With 5 Acres Or More Of Disturbed Surface Area Or With 100 Cubic Yards Or More Of Bulk Material Hauled On Or Off Site Per Day:

- ❑ Install a grizzly or wheel wash system at all access points
- **P** At all access points, install a gravel pad at least 30 feet wide, 50 feet long, and 6 inches deep
- ❑ Pave starting from the point of intersection with a paved public roadway and extending for a centerline distance of at least 100 feet and a width of at least 20 feet
- ❑ Other: _____

❑ Spillage, Carry-Out, Erosion, And/Or Trackout:

If Extending More Than 50 Feet Along A Paved Public Roadway, Implement IMMEDIATELY:

- ❑ Operate a street sweeper or wet broom with sufficient water, if applicable, at the speed recommended by the manufacturer
- ❑ Manually sweep-up deposits
- ❑ Other (describe in detail):_____

If Extending Less Than 50 Feet Along A Paved Public Roadway, Implement NO LATER THAN THE END OF THE WORK DAY:

- ❑ Operate a street sweeper or wet broom with sufficient water, if applicable, at the speed recommended by the manufacturer
- ❑ Manually sweep-up deposits
- ❑ Other (describe in detail):_____

❑ Vehicle Use In Open Areas:

- ❑ Restrict trespass by installing signs
- ❑ Install physical barriers such as curbs, fences, gates, posts, signs, shrubs or trees to prevent access
- ❑ Other: _____

❑ Unpaved Parking Lots:

- ❑ Apply water at a frequency and intensity to comply with Subsection 302.1 in Rule 310 (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Apply and maintain gravel, recycled asphalt, or other suitable material such that the area meets the silt loading and silt content limits of Subsection 302.1 in Rule 310 (See Guidance-"Surface Gravel, Recycled Asphalt, Or Other Suitable Material")
- ❑ Pave
- ❑ Apply and maintain dust suppressant(s) other than water using _____ at a frequency of _____ and an intensity of _____ (See Guidance-"Dust Suppressants")
- ❑ Other: _____

❑ Bulk Material Handling And Open Storage Piles:

(Choose Primary Control Measure And Secondary Control Measure For Each Of The Following 2 Situations):

During Stacking, Loading, And Unloading Operations:

- ❑ Apply water at a frequency and intensity so as not to exceed 20% opacity (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Other (describe in detail):_____

When Not Conducting Stacking, Loading, And Unloading Operations:

- ❑ Cover open storage piles with tarps, plastic, or other material
- ❑ Apply water to maintain a soil moisture content at a minimum of 12% or 70% of the optimum moisture content for compaction (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Apply water as needed to establish and maintain a visible crust (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Maintain a threshold friction velocity of at least 100 cm/sec
- ❑ Maintain vegetative cover meeting one of the requirements of Subsection 302.3 in Rule 310 (See Guidance-"VegetativeGround Cover")
- ❑ Construct wind barriers (See Guidance-"Open Storage Piles"). This control measure must be used in combination with at least one of the above control measures, except covering.
- ❑ Other: _____

❑ Bulk Material Hauling On-Site Within The Boundaries Of The Work Site:

P Load all haul trucks such that the freeboard is not less than 3 inches; and
Prevent spillage or loss of bulk material from holes or other openings in the cargo compartment's floor, sides, and/or tailgates; and
Install a trackout control device that removes particulate matter from tires and the exterior surfaces of haul trucks and/or motor vehicles that traverse the work site

- ❑ Limit vehicular speeds to 15 miles per hour or less while traveling on the work site
- ❑ Apply water to the top of the load (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Cover haul trucks with a tarp or other suitable closure
- ❑ Other: _____

❑ Bulk Material Hauling Off-Site Onto Paved Public Roadways:

P Cover haul trucks with a tarp or other suitable closure; and
Load all haul trucks such that the freeboard is not less than 3 inches; and
Prevent spillage or loss of bulk material from holes or other openings in the cargo compartment's floor, sides, and/or tailgate(s); and
Before the empty haul truck leaves the site, clean the interior of the cargo compartment or cover the cargo compartment

- ❑ Other: _____

❑ Earthmoving Operations On Disturbed Surface Areas 1 Acre Or Larger:

- ❑ Apply water, while conducting earthmoving operations (See Guidance-"Water")
  Water Availability:_____
  Water Application: _____
- ❑ Other: _____

❑ Weed Abatement By Discing Or Blading:

P Pre-water site and apply water, while weed abatement by discing or blading is occurring (See Guidance-"Water")
Water Availability:_____
Water Application: _____

- ❑ Other: _____

Choose At Least One of The Following, As A Primary Control Measure, To Be Implemented Following Weed Abatement By Discing Or Blading:

- ❑ Pave
- ❑ Apply gravel to establish and maintain either a threshold friction velocity of at least 100 cm/sec or a cover of at least 10% non-erodible elements
- ❑ Apply water (See Guidance-"Water") or other dust suppressant (See Guidance-"Dust Suppressants") to establish and maintain a visible crust
  Water Availability:_____
  Water Application: _____
- ❑ Establish vegetative ground cover meeting one of the requirements of Subsection 302.3 of Rule 310 (See Guidance-"Vegetative Ground Cover")
- ❑ Other: _____

SAMPLE DAILY RECORDKEEPING LOG FOR RULE 310

Project Name:_____**Project Location:**_____**Date:**_____

Maricopa County's Rule 310 (Fugitive Dust Sources) requires that you keep a daily log – recording the actual implementation of control measures identified in your Dust Control Plan.

Each time you visually check an area for dust control measure implementation, write the time in the shaded boxes at the top of the log and write a "Y", "N", or "NA", in all of the boxes below your recorded time.

Use the "Comments" column to record other pertinent information. For example, document the opacity of the fugitive dust or describe the corrective actions taken, such as placement of gravel for road cover or trackout control.

	Time (indicate a.m. or p.m.)								
1. Before Dust Generating Operations Occur									
A. Pre-watering to depth of cuts?									**Comments**
B. Pre-watering stockpiled material?									
C. Work phased/Disturbance minimized?									
D. Water truck being operated?									
E. Water truck being filled?									
F. Other (specify in Comments column)									
2. During Dust Generating Operations									
A. Is visible dust present?									**Comments**
B. Applying water?									
C. Applying dust suppressant(s) other than water?									
D. Fences or 3' – 5' high wind barriers with 50% porosity intact?									
E. Shut down operations?									
F. Checked control measures before leaving the work site for the day?									
G. Other (specify in Comments column)									
3. Unpaved Haul/Access Roads									
A. Is visible dust present?									**Comments**
B. Observed less than 20 vehicles travelling less than 15 miles per hour?									
C. Is road visibly moist?									
D. Is road covered with gravel, recycled asphalt, or other suitable material?									
E. Applying dust suppressant(s) other than water?									
F. Other (specify in Comments column)									
4. Loading, Unloading, And Storage Piles									
A. Is visible dust present?									**Comments**
B. Pre-watering material?									
C. Water being applied during loading and unloading?									
D. Other (specify in Comments column)									
5. Trackout/Access Points									
A. Is trackout control device intact?									**Comments**
B. Cleaned-up trackout?									
C. Other (specify in Comments column)									
6. Temporary Site Stabilization									
A. Applying water?									**Comments**
B. Applying dust suppressant(s) other than water?									
C. Other (specify in Comments column)									

Total Number Of Gallons Applied:_____**Responsible Person's Signature And Title:**_____

SOURCES OF ADDITIONAL INFORMATION

BLUE SKIES PROGRAM COORDINATOR

At the time this document was published, the duties of the Arizona Blue Skies Coordinator are being handled on an interim basis by ADOT personnel at (602) 712-7487. The Coordinator responds to inquiries from members of the construction industry and others concerning the availability of Dust Control Classes and disseminates information regarding dust control certification.

Certified Dust Control Instructors may obtain copies of toolkits and instructional materials for use in conducting dust control classes from the Coordinator.

The Coordinator also has dust control resources available for use by schools and by volunteer organizations including copies of this Guide, program brochures, and videos.

BLUE SKIES WEB SITE

Be sure to visit the interim Web site at http://tpd.az.gov/air/blueskies.htm. The Web site contains updated information about dust control, including documents that can be downloaded and reproduced. Training materials may also be ordered on-line.

OTHER SOURCES OF INFORMATION

Environmental Protection Agency

1200 Pennsylvania Avenue, NW
Washington, DC, 20460.
http://www.epa.gov/

Arizona Department of Environmental Quality

Phoenix Main Office
3033 N. Central Ave.
Phoenix, AZ 85012
(602) 207-2300
Toll Free in Arizona:
(800) 234-5677

Northern Regional Office
1515 E. Cedar Ave., Suite F
Flagstaff, AZ 86004
(928) 779-0313

Southern Regional Office
400 W. Congress, Suite 433
Tucson, AZ 85701
(520) 628-6733

Maricopa County Environmental Services Department

602-506-6623
http://www.maricopa.gov/envsvc/Default.asp

Dust Devil Academy

http://www.maricopa.gov/sbeap/basepage.htm

Pima County Department of Environmental Quality

http://www.airinfonow.org/index.asp