

# **Draft – Analysis of Particulate Control Measures Effectiveness**

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# Overview

- v Background
- v Approach
- v Review of Individual Measures
- v Conflicts/Overlaps
- v Summary
- v Next Steps

# Background

- √ Measures needed for multiple purposes
  - ⊗ 5% annual reduction
  - ⊗ Modeling attainment demonstration
  - ⊗ Achieve attainment at monitors
- √ History of PM<sub>10</sub> control measure analysis
  - ⊗ Particulate Control Measure Feasibility (1997)
  - ⊗ Most Stringent Measure Analysis (1998)
  - ⊗ Salt River Plan (2004)
  - ⊗ MCDOT Control Measure Analysis (2006)

# Background (con't)

- √ Most sources of fugitive dust are currently regulated
  - ⊗ Low hanging fruit largely picked
  - ⊗ Rule effectiveness needs to be improved

# Approach

- ∨ Contact agencies implementing proposed measures
- ∨ Contact local agencies implementing current programs
- ∨ Review of dust control literature
- ∨ Review of 2005 Periodic Inventory for PM<sub>10</sub>
- ∨ Prepare cost effectiveness estimates
- ∨ Interpret results
- ∨ Information currently available for many measures is incomplete

# Measure #1: Public Education and Outreach with Assistance from Local Governments

- √ Comprehensive outreach programs in place in several nonattainment areas
  - ⊗ Spare the Air (Sacramento)
  - ⊗ Dust Campaign (Clark County)
  - ⊗ Bring Back Blue (Maricopa County)
- √ Educate public on
  - ⊗ health effects
  - ⊗ sources of emissions
  - ⊗ options to reduce emissions

# Measure #1: Public Education and Outreach with Assistance from Local Governments (con't)

- √ Outreach accomplished through
  - ⊗ TV
  - ⊗ radio
  - ⊗ print
  - ⊗ billboards
  - ⊗ website
  - ⊗ etc.
- √ Limited quantification of program benefits available

# Measure #1: Public Education and Outreach with Assistance from Local Governments (con't)

- ✓ Travel reduction credits may conflict with County TRP benefits
- ✓  $PM_{10}$  reduction of 0.4/tons per day
- ✓ Cost Effectiveness of \$7,900/ton of  $PM_{10}$  removed
- ✓ Compliance is voluntary
- ✓ EPA limits credits for benefits of voluntary mobile source reductions

## Measure #2: Extensive Dust Control Training Program

- √ Goal is to adopt a Clark County type program
- √ Maricopa County currently offers non mandatory training
  - ⊗ dust control application (monthly)
  - ⊗ Rule 310 (monthly)
  - ⊗ on-site presentations (frequently)
  - ⊗ pre-construction inspections (frequently)
  - ⊗ courtesy inspections (frequently)
- √ Clark County provides mandatory training

## Measure #2: Extensive Dust Control Training Program (con't)

- √ All on site supervisors and foreman are required to have a dust card
- √ Dust cards issued after successfully passing exam at end of course
- √ Cards remain valid for 3 years, recertification required
- √ Cost of course recovered through a nominal fee
- √ No measure of training program benefits available

## Measure #2: Extensive Dust Control Training Program (con't)

- √ Analysis assumed education would lead to an increase in on site watering
  - ⊖ control efficiency increased from 50% to 70%
- √ Cost effectiveness estimated to be \$12,494/ton of PM<sub>10</sub> removed
- √ Not clear if additional enforcement would be required to implement the program

## Measure #3: Core Dust Control Training Program With Video Distribution

- √ Goal is to develop core set of training materials to augment existing training program (i.e., train the trainer concept)
  - ⊗ brochures
  - ⊗ manuals
  - ⊗ tests
  - ⊗ videos
- √ Clark County program currently distributes training videos
  - ⊗ shortened to minimize length
  - ⊗ some subjects not covered

## Measure #3: Core Dust Control Training Program With Video Distribution (con't)

- √ No measure of training program benefits available
- √ Analysis assumed that increased education would lead to an increase in on site watering
  - ⊖ control efficiency increased from 50% to 62%
- √ Cost effectiveness estimated to be \$9,990/ton of PM<sub>10</sub> removed
- √ Analysis assumed that videos are distributed free of charge

## Measure #4: Dust Managers Required at Construction Sites of 50 Acres and Greater

- √ Goal is to adopt Clark County Dust Control Monitor requirements
- √ Clark County requires full time Dust Control Monitor for
  - ⊗ projects with 50 acres of actively disturbed soil
  - ⊗ can apply to multiple sites
- √ Dust Control Monitor training requirements include
  - ⊗ completion of day long class
  - ⊗ obtain Visual Emissions Evaluation certificate
- √ Monitor cards issued after successfully passing exam at end of course

## Measure #4: Dust Managers Required at Construction Sites of 50 Acres and Greater (con't)

- ✓ Cards remain valid for 3 years, recertification required
- ✓ Cost of course recovered through a \$500 fee
- ✓ No measure of training program benefits available
- ✓ Analysis assumed education would lead to an increase in on site watering
  - ⊗ control efficiency increased from 50% to 70% (same as Measure 2)
- ✓ Cost effectiveness estimated to be \$14,285/ton of PM<sub>10</sub> removed

## Measure #4: Dust Managers Required at Construction Sites of 50 Acres and Greater (con't)

- ✓ Centralized dust control planning responsibility is expected to provide better Rule 310 compliance than Measures 2 and 3

# Measure #5: Dedicated Enforcement Coordinator For Unpaved Roads and Vacant Lots

- ✓ Goal is to establish a position focused solely on unpaved roads and parking lots
- ✓ Responsibility for unpaved roads and parking lots currently distributed across inspection staff
  - ⊗ vacant lot enforcement is proactive
  - ⊗ unpaved road enforcement is complaint driven
- ✓ Clark County has placed substantial emphasis on controlling emissions from unpaved roads and vacant lots
  - ⊗ significant portion of supervisors time and related staff focused on these sources

## Measure #5: Dedicated Enforcement Coordinator For Unpaved Roads and Vacant Lots (con't)

- √ Unpaved roads are a significant source of emissions in 2005 Periodic Inventory for PM<sub>10</sub>
  - ⊗ 9.3% of total inventory
  - ⊗ estimates assume the source is uncontrolled
- √ Rule 310.01 requires unpaved roads with 150 vehicle/day to be controlled
  - ⊗ pave
  - ⊗ apply dust suppressants
  - ⊗ uniformly apply and maintain surface gravel

# Measure #5: Dedicated Enforcement Coordinator For Unpaved Roads and Vacant Lots (con't)

- √ Two elements of cost
  - ⊗ enforcement
  - ⊗ compliance with Rule 310.01 requirements
- √ MCDOT study recently indicates palliatives have attractive cost effectiveness
- √ Cost effectiveness is estimated to be \$534/ton of PM<sub>10</sub> removed

# Measure #5: Dedicated Enforcement Coordinator For Unpaved Roads and Vacant Lots (con't)

## v Several concerns

- ⊗ Not clear if palliatives can withstand higher traffic levels without multiple applications
- ⊗ Stabilized roads will induce higher speeds
- ⊗ Higher speeds will bring increased liability
- ⊗ Distribution of traffic levels on unpaved roads unclear

# Measure #6: Strengthen Stringency and Enforcement of the Trackout Provisions of Rule 310 and Rule 310.01

- √ Goal is to improve rule effectiveness of provisions addressing trackout
- √ Trackout is a significant source of emissions
  - ⊗ paved roads responsible for 15% of PM<sub>10</sub> emitted in 2005 Inventory
- √ Rule 310 requires
  - ⊗ immediate removal of trackout/spillage exceeding 50 feet
  - ⊗ daily removal of visible trackout less than 50 feet

# Measure #6: Strengthen Stringency and Enforcement of the Trackout Provisions of Rule 310 and Rule 310.01 (con't)

- √ This measure would
  - ⊗ reduce allowable trackout/spillage distance by 50% and
  - ⊗ increase frequency of inspections at locations with history of violations
- √ Two elements of cost
  - ⊗ increased enforcement
  - ⊗ frequent sweeping
- √ Cost effectiveness estimated to \$2.5 million/ton

## Measure #6: Strengthen Stringency and Enforcement of the Trackout Provisions of Rule 310 and Rule 310.01 (con't)

- √ Silt estimates based on trackout rate measured under dry soil summer conditions
- √ Need to update with SCAMPER data which reflects more representative loadings
- √ Analysis also assumes full compliance with Rule 310, which significantly deflates amount of material tracked-out

# Measure #9: Revise Rule 310 Tarping Requirements to Include Empty Backhaul

- √ Goal is to revise Rule 310 tarping requirements to make them more enforceable
- √ Current requirement
  - ⊗ clean interior of cargo compartment or
  - ⊗ cover cargo compartment
- √ Current practice provides uneven coverage between tarp and bed
- √ Analysis assumed compliance could be achieved by spending extra time in extending the tarp to properly cover the compartment

## Measure #9: Revise Rule 310 Tarping Requirements to Include Empty Backhaul (con't)

- ✓ Cost effectiveness estimated to be \$14,963/ton of PM<sub>10</sub>
- ✓ Discussions with Maricopa County indicate automated systems must be redesigned to comply with suggested requirements
- ✓ Higher cost of redesign will worsen cost effectiveness

# Measure #24: Ban or Discourage Use of Leaf Blowers on High Pollution Advisory Days

- ✓ Goal is to improve attainment prospects on days with high concentrations
- ✓ Leaf blowers estimated to produce 1% of PM<sub>10</sub> emitted in 2005 Inventory
- ✓ Many options to comply:
  - ⊗ delay use until a non-Advisory Day day (no annual benefit)
  - ⊗ delay use until next scheduled maintenance (annual benefit)
  - ⊗ use a broom

## Measure #24: Ban or Discourage Use of Leaf Blowers on High Pollution Advisory Days (con't)

- ✓ UC Riverside tests indicate no emission reduction for using a broom on concrete
- ✓ Cost effectiveness can only be computed for reductions on an advisory day
  - ⊖ estimated to be \$21,851/ton of PM<sub>10</sub> removed
- ✓ Dispersed nature of the activity suggests enforcement would be difficult
- ✓ Options for compliance indicate benefits are uncertain

## Measure #25: Encourage Use of Leaf Vacuums to Replace Blowers

- ✓ Goal is based on the assumption that leaf vacuums have lower emissions than leaf blowers
- ✓ Earlier analysis assumed vacuum bags have high collection efficiency
- ✓ Recent UC Riverside testing indicates leaf vacuums have same particulate emissions as leaf blowers
- ✓ Vacuum bags do not appear designed to collect dust
- ✓ There is not emissions benefit for this measure

## Measure #27: Create Fund to Provide Incentives to Retrofit Nonroad Diesel Engines and Encourage Early Replacement with Advanced Technologies

- ✓ Goal is to establish a fund that distributes incentives for voluntary repower/retrofit projects meeting specific criteria
- ✓ Many areas have established incentive programs
  - ⊞ best example is California's Carl Moyer Program
- ✓ Wide range of nonroad Diesel engines used in a variety of applications which could be retrofit or repowered

## Measure #27: Create Fund to Provide Incentives to Retrofit Nonroad Diesel Engines and Encourage Early Replacement with Advanced Technologies (con't)

- √ To illustrate potential benefits and cost effectiveness
  - ⊗ repower assumed to be meet by engines meeting EPA's Tier 3 emission standards
  - ⊗ retrofit could be achieved by either a Diesel Oxidation Catalyst or Diesel Particulate Filter
  - ⊗ target equipment included tractors, loaders and backhoes (160 hp)
- √ Retrofit costs include equipment, fuel economy penalty and increased fuel expense

## Measure #27: Create Fund to Provide Incentives to Retrofit Nonroad Diesel Engines and Encourage Early Replacement with Advanced Technologies (con't)

- v Repower costs include engine and installation expenses
- v Retrofit cost effectiveness estimated to range from \$44,000 - \$52,000/ton of PM<sub>2.5</sub> removed
- v Repower cost effectiveness estimated to be \$150,000 ton of PM<sub>2.5</sub> removed
- v Incentive applications need to be carefully reviewed to ensure retrofit devices are used for appropriate vehicle applications

# Measure #28: Update the Statutes to Require Ultra-Low Sulfur Diesel Fuels for Nonroad Equipment

- √ Goal is to accelerate date at which ultra low sulfur fuel is used in nonroad equipment
- √ Current spec requires
  - ⊖ nonroad Diesel fuel to meet a 500 ppm sulfur limit
  - ⊖ onroad Diesel fuel to meet a 15 ppm sulfur limit
- √ EPA regulations require
  - ⊖ current onroad Diesel fuel meet a 15 ppm sulfur limit
  - ⊖ nonroad Diesel fuel to meet a 15 ppm sulfur limit in 2010
  - ⊖ locomotives and marine vessels to meet a 15 ppm sulfur limit in 2012

## Measure #28: Update the Statutes to Require Ultra-Low Sulfur Diesel Fuels for Nonroad Equipment (con't)

- ✓ Analysis assumed this measure would mandate 15 ppm fuel in 2008 for nonroad equipment
- ✓ Cost effectiveness estimated to be \$16,000/ton of SO<sub>2</sub> and sulfate removed
- ✓ Refining industry has indicated that there may be supply issues with accelerating the distribution of 15 ppm Diesel
- ✓ Supply limitations will lead to price increases

# Measure #30: Retrofit Onroad Diesel Engines With Particulate Filters

- √ Goal is to reduce  $PM_{10}$  emissions from onroad Diesel vehicles by retrofitting them with filters and oxidation catalysts
- √ EPA tests indicate
  - ⊗ Diesel particulate filters reduce  $PM_{2.5}$  emissions by 20-30%
  - ⊗ Diesel oxidation catalysts reduce  $PM_{2.5}$  emissions by 85-90%
- √ Retrofit costs include
  - ⊗ equipment (\$2,375 - \$11,875)
  - ⊗ fuel economy penalty (1-3%)

## Measure #30: Retrofit Onroad Diesel Engines With Particulate Filters (con't)

- √ Analysis assumed retrofit vehicles
  - ⊗ operate exclusively in the MAG region
  - ⊗ travel 70,000 miles/year
- √ Cost effectiveness estimated to range from \$107,000 - \$133,000/ton of PM<sub>2.5</sub> removed
- √ Care is needed to ensure that retrofit devices are properly matched with appropriate vehicle applications

# Measure #32: Pave or Stabilize Existing Unpaved Parking Lots

- v Goal is to apply City of Phoenix zoning requirements for off street parking to unpaved parking lots throughout the nonattainment area
- v Unpaved parking lots responsible for 3% of  $PM_{10}$  emitted in 2005 Inventory
- v Rule 310.01 requires one of following controls
  - ⊗ pave
  - ⊗ apply dust suppressants
  - ⊗ uniformly apply and maintain gravel

## Measure #32: Pave or Stabilize Existing Unpaved Parking Lots (con't)

- √ City of Phoenix zoning requires
  - ⊗ Non single family homes/duplexes – Dustproof Paving
  - ⊗ Single family homes/duplexes – Dustproof Surface
- √ Analysis evaluated paving and dust palliative options
- √ Cost effectiveness
  - ⊗ Paving (\$1,754/ton of PM<sub>10</sub> reduced)
  - ⊗ Palliative (\$11,292/ton of PM<sub>10</sub> reduced)
- √ No enforcement costs included in the analysis

# Measure #33: Pave or Stabilize Existing Dirt Roads and Alleys

- √ Goal is to extend Rule 310.01 unpaved road requirements for 150+ vehicles/day to roads with lower traffic levels
- √ Unpaved roads are a significant source of emissions in 2005 Periodic Inventory for PM<sub>10</sub>
  - ⊞ 9.3% of total inventory
  - ⊞ estimates assume the source is uncontrolled
- √ Rule 310.01 requires unpaved roads with 150 vehicle/day to be controlled
  - ⊞ pave
  - ⊞ apply dust suppressants
  - ⊞ uniformly apply and maintain surface gravel

# Measure #33: Pave or Stabilize Existing Dirt Roads and Alleys (con't)

- √ Analysis assumed no additional enforcement expense (to distinguish from Measure 5)
- √ Compliance assumed roads with 120 vehicles/day would use palliatives
- √ Cost effectiveness estimated to be \$159/ton
- √ Several concerns
  - ⊗ Not clear if palliatives can withstand higher traffic levels without multiple applications
  - ⊗ Stabilized roads will induce higher speeds
  - ⊗ Higher speeds will bring increased liability
  - ⊗ Distribution of traffic levels on unpaved roads unclear

# Measure #34: Limit Speeds to 15 Miles Per Hour on High Traffic Dirt Roads

- √ Goal is to reduce fugitive dust on unpaved roads by reducing vehicle speeds
- √ Unpaved roads are a significant source of emissions in 2005 Periodic Inventory for  $PM_{10}$ 
  - ⊞ 9.3% of total inventory
  - ⊞ estimates assume the source is uncontrolled
- √ Rule 310 requires owners/operators of unpaved roads to haul roads that have not been stabilized to restrict speeds to 15 mph
- √ This measure would extend those requirements to roads with 120+ vehicles per day

# Measure #34: Limit Speeds to 15 Miles Per Hour on High Traffic Dirt Roads (con't)

- √ There are two elements of cost
  - ⊞ signage (every ¼ mile)
  - ⊞ enforcement (sheriff issuing 4 tickets/day)
- √ Cost effectiveness estimated to be \$3,337/ton of PM<sub>10</sub> reduced
- √ Numerous implementation issues
  - ⊞ MCDOT policy not to post speed limits on unpaved roads
  - ⊞ State and other counties have similar positions
  - ⊞ Speed bumps not used because of liability concerns
  - ⊞ Not a priority for law enforcement

# Measure #35: Prohibit New Dirt Roads Including Those Associated With Lot Splits

- √ Goal eliminate growth in miles of unpaved roads
- √ No restrictions on construction of new unpaved roads
- √ Several PM<sub>10</sub> nonattainment areas have banned growth
  - ⊖ Clark County (2000)
  - ⊖ San Joaquin Valley (2004)
- √ Analysis assumed compliance through paving

## Measure #35: Prohibit New Dirt Roads Including Those Associated With Lot Splits (cont')

- ✓ Cost effectiveness is estimated to be \$2,464/ton of PM<sub>10</sub> reduced
- ✓ High cost of paving may encourage use palliatives in developments if stabilization is allowed as an alternative compliance method

# Measure #36: Pave or Stabilize Unpaved Shoulders

- √ Goal is to decrease inventory of unpaved shoulders along paved roads
- √ Fugitive dust from unpaved shoulders comes from
  - ⊗ bow wakes of moving vehicles
  - ⊗ trackout from vehicles crossing onto paved roads
- √ Recent MCDOT analysis examined benefits of alternate shoulder treatments
- √ Most cost effective measure selected for analysis (8-foot paved shoulders)

## Measure #36: Pave or Stabilize Unpaved Shoulders (con't)

- ∨ Cost effectiveness is estimated to be \$18,452/ton of PM<sub>10</sub> reduced
- ∨ Little data on bow wake emissions, assumptions required to evaluate control measure benefits

# Measure #37: Pave or Stabilize Unpaved Access to Paved Roads

- √ Goal is to reduce fugitive dust from trackout
- √ Trackout is a significant source of emissions
  - ⊞ paved roads responsible for 15% of PM<sub>10</sub> emitted in 2005 Inventory
- √ Rule 310 requires owners to clean up trackout exceeding 50 feet
- √ To prevent trackout, Rule 310 requires owners to
  - ⊞ install a grizzly or wheel wash at each access point
  - ⊞ install a gravel pad (50 feet)
  - ⊞ pave point of access (100 feet)

# Measure #37: Pave or Stabilize Unpaved Access to Paved Roads (con't)

- √ This measure would
  - ⊖ reduce length requiring rapid cleanup by 50%
  - ⊖ double length of gravel pad
  - ⊖ combine gravel pad & grizzly
- √ Analysis assumed each facility only has only one access point
- √ Cost effectiveness estimated to be
  - ⊖ Rapid Cleanup (\$2.25 million/ton of PM<sub>10</sub> reduced)
  - ⊖ Doubled Gravel Pad (\$179,133/ton of PM<sub>10</sub> reduced)
  - ⊖ Gravel Pad & Grizzly (\$168,025/ton of PM<sub>10</sub> reduced)

## Measure #37: Pave or Stabilize Unpaved Access to Paved Roads (con't)

- √ Silt estimates based on trackout rate measured under dry soil summer conditions
- √ Need to update with SCAMPER data which reflects more representative loadings
- √ Analysis also assumes full compliance with Rule 310, which significantly deflates amount of material tracked-out

# 2007 MAG PM-10 Control Measures Ranked by Increasing Cost-Effectiveness

| Measure No. | Class  | Cost-Effect. (\$/ton PM-10) |
|-------------|--|-----------------------------|
| 33          | Pave or Stabilize Existing Dirt Roads & Alleys                                       | \$109                       |
| 5           | Dedicated Coordinator for Unpaved Road & Vacant Lots                                 | \$534                       |
| 32          | Pave or Stabilize Existing Unpaved Parking Lots (Including Strengthened Enforcement) | \$1,754                     |
| 35          | Prohibit New Dirt Roads Including Those Associated With Lot Splits                   | \$2,646                     |
| 34          | Limit Speeds to 15 mph on High Traffic Dirt Roads                                    | \$3,337                     |
| 1           | Public Education & Outreach With Local Government Assistance                         | \$7,898                     |
| 3           | Core Dust Control Training Program   | \$9,986                     |
| 2           | Extensive Dust Control Training Program  | \$12,494                    |
| 4           | Dust Managers at Construction Sites of 50+ Disturbed Acres                           | \$14,285                    |
| 9           | Better Defined Rule 310 Tarping Requirements That Include Bed Enclosure              | \$14,963                    |
| 36          | Pave or Stabilize Unpaved Shoulders  | \$18,452                    |
| 24          | Ban or Discourage Leaf Blower Use on High Pollution Advisory Days                    | \$21,851                    |
| 37c         | Pave or Stabilize Unpaved Access to Paved Roads - Require Grizzly & Gravel Pad       | \$168,025                   |
| 37b         | Pave or Stabilize Unpaved Access to Paved Roads - Increase Size of Gravel Pad        | \$179,133                   |
| 37a         | Pave or Stabilize Unpaved Access to Paved Roads - Reduce Rapid Cleanup Length        | \$2,250,221                 |
| 6           | Strengthen Stringency & Enforcement of Trackout Provisions                           | \$2,499,750                 |
| 25          | Encourage Use of Leaf Vacuums to Replace Blowers                                     | Infinity                    |

# Conflicts/Overlaps

## v Unpaved Roads

- ⊖ #5 – Dedicated coordinator for unpaved roads and vacant lots
- ⊖ #33 – Pave or stabilize existing dirt roads and alleys
- ⊖ #34 – Limit speeds to 15 mph on high traffic roads
- ⊖ #35 – Prohibit new dirt roads including those with lot splits

## v Further Work on High Cost Measures?

- ⊖ #37 – Pave or stabilize unpaved access points to paved roads
- ⊖ #9 – Better defined Rule 310 tarping requirements

## Conflicts/Overlaps (con't)

- v Measures with Little or No Benefit
  - ⊖ #24 – Ban or discourage leaf blower access on high pollution advisory days
  - ⊖ #25 – Encourage use of leaf vacuums to replace blowers
- v Need to set assumptions about starting points for rule effectiveness

# Next Steps

- v Continue data collection/analysis
- v Revise analysis of measures presented as appropriate
- v Document results
- v Presentation of findings at next workshop