2021 Regional Haze Four Factor Initial Control Determination

Nonpoint Source: Paved and Unpaved Roads

Air Quality Division
December 2, 2020

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1.1 ADEQ Initial Control Determination for Paved and Unpaved Roads

ADEQ's initial decision is to find that it is reasonable to require additional paved road controls and reasonable not to require additional unpaved road controls during this planning period in order to make reasonable progress toward natural visibility conditions. ADEQ proposes the following paved road controls as being reasonable based on review of the four statutory factors:

1. Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads with average daily trips (ADT) exceeding 2700.
2. Provide for traffic rerouting or rapid cleanup of temporary (and not readily preventable) sources of dust on paved roads (water erosion, runoff, mud/dirt track-out areas, material spills, and skid control sand) with an ADT exceeding 2700.

1.2 ADEQ Control Determination Finalization Timeline

In order to meet the State rulemaking process timeframe for proposed rule inclusion in the July 31st, 2021 Regional Haze state implementation plan (SIP) submittal, ADEQ must finalize all four factor analyses as expeditiously as possible. To provide an opportunity for interested stakeholders to review and comment on ADEQ's initial decision prior to finalization, the department intends to post initial decisions on the agency webpage along with the original source submitted four factor analyses. Once ADEQ has reviewed relevant stakeholder comments, the agency will revise its initial decisions if necessary and post final decisions (see Figure 1). ADEQ welcomes feedback on these initial decisions and invites any interested party to send their comments by **December 31st 2020** to:

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Please note that this review and feedback opportunity does not constitute an official state implementation plan or state rulemaking comment period. The agency intends to provide an official 30 day comment period on any proposed SIP or rulemaking action in accordance with Arizona Revised Statutes §§ 41-1023, 49-425, and 49-444.

Figure 1: Four Factor Control Determination Process Map

2 ADEQ Four Factor Analysis

2.1 Summary

Air Quality Improvement Planning (AQIP) value stream staff evaluated control strategies to mitigate PM_{10}[1] emissions from paved and unpaved roads that are located within 50 kilometers (km) of the Chiricahua National Monument (NM) and Wilderness Area, Galiuro Wilderness Area, Saguaro National Park (NP), and Superstition Wilderness Area.

Based on a review of available controls and consideration of stakeholder input on the required four statutory factors, AQIP staff present the following paved road control options as technically feasible and generally cost effective. ADEQ's initial determination for unpaved roads is that it is reasonable not to require additional controls during this planning period.

Table 1: Proposed Measures for Paved Roads

Measure Description and Applicability
Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads
Provide for traffic rerouting or rapid cleanup of temporary (and not readily preventable) sources of dust on paved roads (water erosion, runoff, mud/dirt track-out areas, material spills, and skid control sand)

2.2 ADEQ Source Screening Methodology

2.2.1 Significantly Contributing PM Species

To screen out particulate matter (PM) species that make only a small contribution to overall anthropogenic light extinction at Class I areas within the State of Arizona, ADEQ evaluated the impacts of particulate species[2] on the 20% most impaired days.[3] The results of this analysis showed that sulfate, nitrate, and coarse mass [i.e., PM_{10}] account for 72% - 89% (average 80%) of anthropogenic light extinction in these areas. ADEQ determined that these three species should be further evaluated for source controls during this planning period in order to maximize the benefit of any potential new control strategies.

[1] Particulate matter 10 micrometers or less in diameter (PM_{10}).
[2] Species evaluated included ammonium sulfate (sulfate), ammonium nitrate (nitrate), organic mass carbon (OMC), light absorbing carbon (LAC), [fine] soil, and coarse mass (CM).
[3] See *ADEQ 2021 Regional Haze State Implementation Plan Source Screening Methodology*, August 16, 2019.

2.2.2 Nonpoint Source Screening Methodology

ADEQ employed the following approach when screening nonpoint sources for the four-factor analysis:[4]

1. Gather 2014 EPA NEIv2[5] county-level nonpoint datasets for the State of Arizona.
2. Isolate source classification code (SCC) annual emissions (tons/year) for PM_{10}-primary, nitrogen oxides, and sulfur dioxide.
3. Remove PM_{10}-primary emissions from consideration for those counties that are not located within 50 km of a Class I area since PM_{10} does not generally experience high transport distances.
4. Sum the remaining SCC-specific PM_{10} primary, nitrogen oxides, and sulfur dioxide annual emissions to calculate "Q".
5. Sort all SCCs from highest to lowest "Q".
6. Determine the "Q"-threshold which achieved inclusion of the SCCs with the largest "Q's" until >80% of total "Q" emissions across all SCCs are accounted for (i.e. "Q" >13,500 tons per year includes 6 sectors which account for 81.6% of the total statewide nonpoint "Q").
7. Isolate those sources with a "Q" value greater than 13,500 tpy.

Based on the approach outlined above, the nonpoint source sectors that were screened into a 4-factor analysis are presented in *Table 3*.

Table 2 Arizona Nonpoint Source Sectors with a Q >13,500 tons/year (tpy)

SCC	NO_x	PM_{10}	SO_2	Q	Sector
2285002006	18,045	541	11	18,597	Mobile - Locomotives
2294000000	0	14,501	0	14,501	Dust - Paved Road Dust
2296000000	0	107,924	0	107,924	Dust - Unpaved Road Dust
2311020000	0	15,536	0	15,536	Dust – Industrial/Commercial/Institutional Construction Dust
2325000000	0	44,753	0	44,753	Industrial Processes - Mining
2701220000	13,912	0	0	13,912	Biogenics - Vegetation and Soil

The evaluation of emissions reduction strategies for nonpoint sources during this planning cycle is focused on potential dust control measures for the paved and unpaved roads, mining and

[4] *Ibid*.
[5] National Emissions Inventory, version 2.

quarrying, and non-residential construction source sectors. Locomotive and Biogenic NOx emissions were not considered in this round because these sectors are generally controlled at the federal level or are mostly uncontrollable. Additionally, to make the best use of limited resources ADEQ chose to focus on the four source sectors with the highest likelihood of presenting achievable control measures at the state level.

2.3 Emissions Control Evaluation Areas

For the period 2013-2017 anthropogenic coarse mass emissions were found to have the highest impacts (on most impaired days) on the following IMPROVE monitoring sites and corresponding Class I areas.[6, 7]

- Chiricahua NM and Wilderness Area (IMPROVE Site: Chiricahua NM, CHIR1)
- Galiuro Wilderness Area (IMPROVE Site: Chiricahua NM, CHIR1)
- Saguaro NP (IMPROVE Site: Saguaro NP – East Unit, SAGU1)
- Superstition Wilderness Area (IMPROVE Site: Tonto NM, TONT1)

Since PM_{10} does not generally experience high transport distances, evaluation of emissions reduction strategies for paved and unpaved roads, mining and quarrying, and non-residential construction is limited to nonpoint sources within 50 km of these Class I areas.

2.4 Source Sector Overview

Consideration of potential controls for the highest contributing sources is based on the location of the emitting sources (i.e., are they within 50 km of the “high impact” Class I areas) and on the emitting activities used to calculate sector emissions for these areas. According to NEI documentation, emissions estimates for paved roads are based on the following activities.[8]

- Re-entrained road dust emissions from paved road surfaces
  - Re-entrained road dust emissions from unpaved shoulders of paved roads
  - Re-entrained road dust emissions from medians of paved roads
  - Re-entrained road dust emissions and track out from access points where unpaved traffic surfaces adjoin paved roads
  - Re-entrained road dust emissions from material spills

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[6] See *ADEQ 2021 Regional Haze State Implementation Plan Source Screening Methodology*, August 16, 2019.
[7] Each of these sites exhibited coarse mass impacts on the most impaired days of > 10% of the total anthropogenic extinction (Mm-1) during the 2013-2017 period.
[8] See EPA’s “*Fugitive Dust from Paved Roads* (2014_Paved_Roads_2294000000_documentation_v2.3 (4).docx).”

Emissions estimates for unpaved roads are based on the following emitting activity.[9]

- Re-entrained road dust emissions from unpaved roads

2.5 Analysis of Available PM10 Control Measures

To begin the evaluation of potential new measures for control of PM_{10} emissions from paved and unpaved roads, ADEQ developed a list of "available" measures from review of EPA guidance and control strategies adopted by state and local agencies. The list includes measures contained in the 1990 Clean Air Act (CAA) Preamble, *Appendix C1 Available Fugitive Dust Control Measures* (57 FR 18070 18077, April 28, 1992) and reasonably available control measures (RACM) incorporated into the 1999 Federal Implementation Plan (FIP) for the Phoenix, Arizona PM_{10} planning area (40 CFR 52.128). ADEQ also reviewed best available control measures (BACM) evaluated as part of the control strategies in PM_{10} nonattainment area plans developed by numerous jurisdictions in the U.S. Southwest including the following.

- Pinal County Air Quality Control District, Arizona
- Maricopa County Air Quality Department, Arizona
- San Joaquin Valley Air Pollution Control District (SJVAPCD), California
- Imperial County Air Pollution Control District (ICAPCD), California
- Clark County Department of Air Quality, Nevada
- South Coast Air Quality Management District (SCAQMD), California

Each of the listed measures were evaluated for technical feasibility and the four statutory factors required under the Regional Haze Rule.[10] The list of measures and a summary table of the technical feasibility and four-factor analysis conclusions are included in Section VI.A. Discussion of the reasons for including or rejecting individual measures, in whole or in part, from the Long Term Strategy (LTS) follows in Sections VI.B and VI.C.

[9] See EPA's *Fugitive Dust from Unpaved Roads* (2014_Unpaved_Roads_2296000000_documentation (5).docx).
[10] See Final Rule: Protection of Visibility: Amendments to Requirements for State Plans, 82 FR 3078, January 10, 2017

2.6 Four-Factor Analysis Review – Paved and Unpaved Roads

2.6.1 Four-Factor Analysis Summary

Table 3: List of Available PM10 Control Measures

List of Available PM_{10} Control Measures						
Available PM_{10} Control Measure for Consideration	Technically Feasible	[1] Cost of Compliance		[2] Time Necessary for Compliance	[3] Energy and Non-AQ Environmental Impacts of Compliance	[4] Remaining Useful Life of Potentially Affected Sources
		Capital-Implementation Costs	Cost Effectiveness ($/ton)			
Paved Roads						
1. Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.	Yes	$1,183/rd-mile-year-chemical stabilization	$2,760	Begin February 1st, 2023. Full compliance dependent on funding.	Dust suppressants may impact ground water and soil.	Quarterly application.
2. Require haul trucks to be covered.	Yes	$84,739/truck cover	$37,426	February 1st, 2023.	N/A	8 year
3. Provide for traffic rerouting or rapid cleanup of temporary (and not readily preventable) sources of dust on paved roads (water erosion, runoff, mud/dirt track-out areas, material spills, and skid control sand).	Yes	$682/clean up	$3,034	Within 24 hours of reported dust.	N/A	Per event
4. Require improved material specification for and reduction of usage of skid control sand or salt (e.g., require use of coarse, non-friable material during snow and ice season).	N/A	N/A	N/A	N/A	Some materials may impact ground and soil.	N/A

List of Available PM_{10} Control Measures							
Available PM_{10} Control Measure for Consideration	Technically Feasible	[1] Cost of Compliance		[2] Time Necessary for Compliance	[3] Energy and Non-AQ Environmental Impacts of Compliance	[4] Remaining Useful Life of Potentially Affected Sources
		Capital-Implementation Costs	Cost Effectiveness ($/ton)			
5. Require curbing and pave or stabilize (chemically or with vegetation) shoulders of paved roads. Chemical Stabilization	Yes	$6,809/mile-year	$5,473	Begin February 1st, 2023. Full compliance dependent on funding.	Dust suppressants may impact ground water and soil.	4 applications/year.
6. Stabilize medians of paved roads.	Yes	$6,816/mile-year-Chemical Stabilization	$5,480	Begin February 1st, 2023. Full compliance dependent on funding.	Dust suppressants may impact ground water and soil.	4 applications/year
7. Ensure stabilization during work on unpaved shoulders of paved roads (e.g., weed abatement/vegetation management).	Yes	$16,885/year-mile	$31,877	Begin February 1st, 2023. Full compliance dependent on funding.	N/A	Maintenance cycle of four times/month.
8. Provide for storm water drainage to prevent water erosion onto paved roads.	No	N/A	N/A	N/A	N/A	N/A
9. Employ PM10 certified street sweepers on principal arterials.	Yes	$270,000/sweeper	$6,915	Begin February 1st, 2023. Full compliance dependent on funding.	N/A	8 years
10. Reduce speed limits.	No	N/A	N/A	N/A	N/A	N/A
Unpaved Roads						
1. Develop traffic reduction plans for unpaved roads. Use of speed bumps, low speed limits, etc., to encourage use of other (paved) roads.	No	N/A	N/A	N/A	N/A	N/A

List of Available PM_{10} Control Measures							
Available PM_{10} Control Measure for Consideration	Technically Feasible	[1] Cost of Compliance		[2] Time Necessary for Compliance	[3] Energy and Non-AQ Environmental Impacts of Compliance	[4] Remaining Useful Life of Potentially Affected Sources
		Capital-Implementation Costs	Cost Effectiveness ($/ton)			
2.a. Pave unpaved roads (chip-seal 800 ADT.	Yes	$102,000/chip seal-rd-mile	$15,799/chip seal	Begin February 1st, 2023. Full compliance dependent on funding.	Construction may impact ground water and soil.	7 years/chip seal 10 years/paving
2.b. Pave unpaved roads (asphalt) 800 ADT.	Yes	$255,000-$1,700,000/asphalt-rd-mile	$111,885/asphalt	Begin February 1st, 2023. Full compliance dependent on funding.	Construction may impact ground water and soil.	
3. Chemically stabilize unpaved roads (dust suppressants other than water). 800 ADT	Yes	$12,000/rd-mile	$47,999	Begin February 1st, 2023. Full compliance dependent on funding.	Dust suppressants may impact ground water and soil.	4 applications/year
4. Apply and maintain surface gravel. 800 ADT	Yes	$122,400/rd-mile	$21,171	Begin February 1st, 2023. Full compliance dependent on funding.	NA	Annual maintenance
5.a. Prohibit [limit] construction of new unpaved roads chip seal.	Yes	$102,000/chip seal-rd-mile	$15,799/chip seal	Begin February 1st, 2023. Full compliance dependent on funding.	Construction may impact ground water and soil.	7 years/chip seal
5.b. Prohibit [limit] construction of new unpaved roads asphalt.		$255,000/asphalt-rd-mile	$21,931.38/asphalt	Begin February 1st, 2023. Full compliance dependent on funding.	Construction may impact ground water and soil.	10 years/paving

2.6.2 Four-Factor Analysis Discussion – Paved Roads

2.6.2.1 Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.

2.6.2.1.1 Technical Feasibility

ADEQ has deemed controlling access points from unpaved roads to paved roads as feasible.

2.6.2.1.2 Cost of Compliance – Factor 1

ADEQ calculated the area of control to be 25 feet long with a width of a road approximately 20 feet across. Installation costs for aggregate were pulled from the 2003 San Joaquin BACM analysis and adjusted for inflation.[11,12] This value was then adjusted 4% for administrative, tax, and insurance costs. Installation costs for paving and chemical stabilization were pulled from the 2009 Imperial Valley PM10 State Implementation Plan and adjusted for inflation. ADEQ used a capital recovery factor (CRF) of .128 for all controls assuming 4.75% inflation.

Annual emissions were calculated based on methodology from the 2003 San Joaquin Valley BACM Technological and Economic Feasibility Analysis[13]. Emissions were calculated from truck wake emissions and a ratio of light duty truck passes.[14] The corresponding emission rate per passing vehicle for a road with 2700 ADT. Estimated unpaved shoulder traffic was estimated at 270 light duty truck entrances per day.

ADEQ used the WRAP Fugitive Handbook control effectiveness to calculate the controlled emissions.[15]

Table 4: Control Track Out Costs

Measure Description	Capital Cost/mi	Annualized Capital Cost/mi	Annual Implementation /Maintenance Cost/mi	Total Annual Cost/mile	Control Effectiveness (%)	Cost Effectiveness ($/ton)
Aggregate	$701	$118	$1,122	$1,239.32	46	$5,077
Paving	$8,718	$1,464.10	-	$1,464	90	$3,065.38
Chemical Stabilization	$1,183	$1,183	$1,183	$1,230	84	$2,760.53

[11] San Joaquin Valley Unified Air Pollution Control District. (2003, March). Final BACM Technological and Economic Feasibility Analysis. Sierra Research.
[12] https://www.chemengonline.com/site/plant-cost-index/
[13] San Joaquin Valley Unified Air Pollution Control District. (2003, March). Final BACM Technological and Economic Feasibility Analysis. Sierra Research.
[14] EPA/600/R-01/031. (2001, April). EPA
[15] https://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf

Table 5: Control Track Out Emissions

Measure Description	Baseline Emissions with Existing Measures (tons/mile-year)	Emissions Reductions from New Measures (tons/mile-year)
Aggregate	.53	.24
Paving	.53	.48
Chemical Stabilization	.53	.45

2.6.2.1.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance dependent on funding. Due to transportation project planning timelines and budgetary constraints many municipalities will likely be unable to complete paving projects within plan deadlines.

2.6.2.1.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Potential environmental impacts from dust suppressant may include surface and ground water deterioration, soil contamination, toxicity to soil and water biota, toxicity to humans during and after applications, air pollution from collective dust suppressant components, changes in the hydrologic characteristics of the soils and impacts on native flora and fauna populations.[16] Additionally paving roads will limit the permeability of surface increasing runoff.

2.6.2.1.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

Aggregate and Chemical Stabilization both require annual maintenance. Paving has a useful life of twenty years and maintenance every ten years.

2.6.2.2 Require haul trucks to be covered.

2.6.2.2.1 Technical Feasibility

Requiring haul trucks to be covered included assessment for manual and automated covers. These are feasible options for controlling particulate matter and have been included in regulations across the region.

2.6.2.2.2 Cost of Compliance – Factor 1

ADEQ used cost estimates from the 2000 Maricopa PM10 SIP. ADEQ calculated the annualized capital cost assuming 4.75% interest and a useful life of 8 years. Administrative, tax, and insurance costs were estimated at 4% of the capital cost.

[16] Potential Environmental Impacts of Dust Suppressants: "Avoiding Another Times Beach"

ADEQ used emission factors and control efficiencies from the 2000 Maricopa PM10 SIP. Trucks were assumed to operate 95 days out of the year with a total of 160 miles per day.[17, 18] The annual emissions in the table below are for a single truck with a single control device.

Table 6: Haul Truck Cover Costs

Measure Description	Capital Cost/cover	Annualized Capital Cost/cover	Annual Implementation /Maintenance Cost/cover	Total Annual Cost/cover	Control Effectiveness (%)	Cost Effectiveness ($/ton)
Basic Cover	$84,739	$14,790	$50	$14,840	99	$37,426

Table 7: Haul Truck Cover Emissions

Baseline Emissions with Existing Measures (tons/truck cover-year)	Emissions Reductions from New Measures (tons/ truck cover-year)
0.40052	0.3965148

2.6.2.2.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance depends on enforcement and outreach.

2.6.2.2.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Generation of waste from used truck covers. No other considerations.

2.6.2.2.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

Estimated 8 years of useful life.

2.6.2.3 Provide for traffic rerouting or rapid cleanup of temporary sources of dust on paved roads.

2.6.2.3.1 Technical Feasibility

ADEQ has deemed rapid cleanup of temporary sources of dust on paved roads as feasible. This control was included in the 2003 San Joaquin Valley PM10 Plan.

2.6.2.3.2 Cost of Compliance – Factor 1

ADEQ used methodology from the 2003 San Joaquin Valley plan which includes the deposition clean up time, response driving time, with labor, equipment, and disposal costs. One grader,

[17] PM10 Control Mgt Study, HLA, 6/92
[18] Construction Control Plan Analysis, HLA, 6/94

one water truck, and one pickup truck were included in equipment rates.[19] ADEQ used 2016 labor rates from Pinal County public works including two maintenance workers and one foreman.[20]

Table 8: Rapid Clean Up Control Costs

Measure Description	Labor Costs/incident	Capital Costs/incident	Disposal Costs/incident	Total Cost/Incident	Control Effectiveness (%)	Cost Effectiveness ($/ton)
Rapid Clean up	$252.75	$390.32	$18.67	$661.73	100	$2,941

Table 9: Rapid Clean Up Control Emissions

Baseline Emissions with Existing Measures (tons/event-year)	Emissions Reductions from New Measures (tons/event-year)
.225	.225

2.6.2.3.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance is dependent on reporting and enforcement of local public works.

2.6.2.3.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Non-applicable.

2.6.2.3.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

This is a control measure that is used in the incidence of an event, there is no remaining useful life.

2.6.2.4 Require improved material specification for and reduction of usage of skid control sand or salt.

2.6.2.4.1 Technical Feasibility

Not feasible as very few roads require skid control in regional haze buffer zones due to temperatures and arid to semi-arid climate. Further no stakeholders commented on materials used to control skid on road surfaces.

[19] https://www.phoenix.gov/publicworkssite/Documents/094753.pdf

[20] https://www.pinalcountyaz.gov/HR/Documents/salaries.pdf

2.6.2.5 Require curbing and pave or stabilize (chemically) shoulders of paved roads.

2.6.2.5.1 Technical Feasibility

This control was deemed feasible although many municipalities already require curbing and/or paving of road shoulders in the regional haze buffer zones.

2.6.2.5.2 Cost of Compliance – Factor 1

ADEQ used the ADOT CMAQ methodology for calculating control efficiency for paving a 4 foot shoulder of roads with 5000 ADT.[21] ADEQ accounted for a useful life of 20 years with a CRF of 0.078. Paved roads require a maintenance chip seal every 10 years with a capital recover factor of .163.[22] Baseline emissions were not calculated due to the CMAQ methodology which uses an emission reduction factor. ADEQ used the 2006 Cost Effectiveness of Selected PM Control Measures for MCDOT to estimate the construction costs for 4' paved shoulders adjusting for inflation.[23]

When calculating control efficiency for chemical stability ADEQ assumed roads with 2700 ADT. Calculations included emissions from unpaved shoulder traffic and track-out from unpaved shoulders.[24] Shoulder treatment with chemical stability assumes the same 4 foot area as paving. Costs were adjusted for inflation from the 2003 San Joaquin Valley PM10 SIP.[25]

Table 10: Shoulder Control Costs

Measure Description	Capital Cost/mile	Annualized Capital Cost/mile	Annual Implementation /Maintenance Cost/mile	Total Annual Cost/mile	Control Effectiveness (%)	Cost Effectiveness ($/ton)
4' Shoulder	$126,461	$9,934	$366	$10,712	90	$10,044
Chemical Stabilization	-	-	$6,554	$6,816	84	$5,480

Table 11: Shoulder Control Emissions

Baseline Emissions with Existing Measures (tons/mile-year)	Emissions Reductions from New Measures (tons/mile-year)
-	1.07
1.01	.93

[21] ADOT CMAQ Guidelines https://azdot.gov/sites/default/files/2019/05/cmaq-guidelines-update-083017.pdf
[22] ibid
[23] https://www.chemengonline.com/site/plant-cost-index/
[24] San Joaquin Valley Unified Air Pollution Control District. (2003, March). Final BACM Technological and Economic Feasibility Analysis. Sierra Research.
[25] ibid

2.6.2.5.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance dependent on funding. Due to transportation project planning timelines and budgetary constraints many municipalities will likely be unable to complete paving projects within plan deadlines.

2.6.2.5.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Potential environmental impacts from dust suppressant may include surface and ground water deterioration, soil contamination, toxicity to soil and water biota, toxicity to humans during and after applications, air pollution from collective dust suppressant components, changes in the hydrologic characteristics of the soils and impacts on native flora and fauna populations. Additionally paving roads will limit the permeability of surface increasing runoff.

2.6.2.5.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

Paved roads have a useful life of 20 years requiring maintenance approximately every ten years. Dust suppression requires quarterly application.

2.6.2.6 Stabilize medians of paved roads.

2.6.2.6.1 Technical Feasibility

ADEQ deemed stabilizing medians of paved roads feasible. The analysis only looked at chemical stabilization which has been used in San Joaquin PM_{10} control plans.

2.6.2.6.2 Cost of Compliance – Factor 1

ADEQ assumed roads with 2700 ADT. Calculations included emissions from unpaved shoulder traffic and track-out from unpaved shoulders. Median treatment with chemical stability assumes 4 foot from the edge of the road. Costs were adjusted for inflation from the 2003 San Joaquin Valley PM10 SIP.[26]

Table 12: Stabilize Medians Control Costs

Measure Description	Capital Cost/mile	Annualized Capital Cost	Annual Implementation /Maintenance Cost	Total Annual Cost/mile	Control Effectiveness (%)	Cost Effectiveness ($/ton)
Chemical Stabilization	-	-	$6,554	$6,816	80-84	$5,480

[26] San Joaquin Valley Unified Air Pollution Control District. (2003, March). Final BACM Technological and Economic Feasibility Analysis. Sierra Research.

Table 13: Stabilize Medians Control Emissions

Baseline Emissions with Existing Measures (tons/mile-year)	Emissions Reductions from New Measures (tons/mile-year)
1.01	.93

2.6.2.6.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance dependent on funding. Due to transportation project planning timelines and budgetary constraints many municipalities will likely be unable to complete paving projects within plan deadlines.

2.6.2.6.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Potential environmental impacts from dust suppressant may include surface and ground water deterioration, soil contamination, toxicity to soil and water biota, toxicity to humans during and after applications, air pollution from collective dust suppressant components, changes in the hydrologic characteristics of the soils and impacts on native flora and fauna populations.

2.6.2.6.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

Chemical stabilization requires quarterly maintenance.

2.6.2.7 Ensure stabilization during work on unpaved shoulders of paved roads (e.g., weed abatement/vegetation management).

2.6.2.7.1 Technical Feasibility

ADEQ has deemed stabilization of unpaved shoulders during maintenance work as feasible.

2.6.2.7.2 Cost of Compliance – Factor 1

ADEQ used the water control measure for stabilizing road shoulders from the West Pinal SIP, total treatment cost for an area four feet wide and one mile long the annual cost was $15,505 in 2015, which was adjusted for inflation to 2020.[27]

Table 14: Maintenance Stabilization Control Costs

Measure Description	Capital Cost	Annualized Capital Cost	Annual Implementation /Maintenance Cost/mile	Total Annual Cost	Control Effectiveness (%)	Cost Effectiveness ($/ton)
Stabilization	-	-	$16,885		100	$31,877

[27] 2015 West Pinal State Implementation Plan Appendix F and I

Table 15: Maintenance Stabilization Emissions

Baseline Emissions with Existing Measures (tons/maintenance-mi)	Emissions Reductions from New Measures (tons/maintenance-mi)
.53	.53

2.6.2.7.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance should be immediate.

2.6.2.7.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Non-applicable.

2.6.2.7.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

This is a control applied four times a month.[28]

2.6.2.8 Provide for storm water drainage to prevent water erosion onto paved roads.

2.6.2.8.1 Technical Feasibility

This control was not evaluated since ADEQ determined storm water drainage is already implemented by municipalities through flood control plans and practices.[29,30,31,32]

2.6.2.9 Employ PM10 certified street sweepers on principal arterials and freeways.

2.6.2.9.1 Technical Feasibility

ADEQ deems PM10 certified street sweepers as feasible. Sweepers are already used in the Maricopa County PM10 Nonattainment Area.

2.6.2.9.2 Cost of Compliance – Factor 1

ADEQ used purchase costs from the 2020 MAG sweeper applications to estimate the price of a PM10 certified sweeper in Arizona. ADEQ used for a capital recovery factor of .1516, assuming 4.75% interest rate, and a useful life of eight years. ADEQ included the cost of taxes, insurance and administrative costs at approximately 4% of capital costs, $10,800.

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[28] ibid
[29] http://apps.fcd.maricopa.gov/projects/projects-structures.aspx?FilterLocation=&FilterPhase=Construction
[30] https://www.cochise.az.gov/engineering-natural-resources/floodplain-division
[31] https://webcms.pima.gov/government/flood_control/
[32] https://www.pinalcountyaz.gov/publicworks/floodcontrol/pages/home.aspx

ADEQ calculated emissions using CMAQ methodology, which includes a sweeping schedule of 14 days per circuit along freeways and principal arterials.[33] ADEQ assumed 11,250 ADT for freeways and 5250 ADT for principal arterials. The CMAQ methodology only calculates the annual emissions reduction for street sweeping.

Table 16: Street Sweeper Control Costs

Measure Description	Capital Cost	Annualized Capital Cost	Annual O&M Cost[34]	Total Annual Cost	Control Effectiveness (%)	Cost Effectiveness ($/ton)
PM10 Certified Street Sweeper	$270,000	$40,932	$120,000	$171,732	16-26	$6,898

Table 17: Street Sweeper Control Emissions

Baseline Emissions with Existing Measures	Emissions Reductions from New Measures (tons/sweeper-year)
-	24.9

2.6.2.9.3 Time Necessary for Compliance – Factor 2

Full compliance dependent on local and CMAQ funding.

2.6.2.9.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Non-applicable.

2.6.2.9.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

Street sweeper has a useful life of 8 years.

2.6.2.10 Reduce speed limits.

2.6.2.10.1 Technical Feasibility

ADEQ deemed reducing speed limits as infeasible. Stakeholder feedback stated that counties cannot enforce lower speed limits due to absence of enforcement officers, and that the state already sets basic speed limits and basic standards of reasonable and prudent speed.[35]

[33] https://www.azmag.gov/Portals/0/Documents/CMAQ_2011-04-05_Final-CMAQ-Methodologies_3-31-2011.pdf?ver=2017-04-06-110853-827
[34] https://www.nrdc.org/sites/default/files/oce_13082701a.pdf
[35] Maricopa Air Quality stakeholder comments, 16 June 2020 email from Johanna Kuspert

2.6.3 Four-Factor Analysis Discussion – Unpaved Roads

2.6.3.1 Develop traffic reduction plans for unpaved roads. Use of speed bumps, low speed limits, etc., to encourage use of other (paved) roads.

2.6.3.1.1 Technical Feasibility

ADEQ deemed this control infeasible, stakeholder feedback stated that counties do not post speed limits on unpaved roadways, cannot enforce speed limits due to absence of enforcement officers, and state law sets basic speed limits and basic standards of reasonable and prudent speed. Additionally, speed bumps are difficult to maintain on unpaved roads.[36, 37]

2.6.3.2 Pave unpaved roads (e.g., asphalt concrete, concrete, chip-seal).

2.6.3.2.1 Technical Feasibility

ADEQ deemed paving unpaved roads technically feasible, although stakeholder feedback stated that road improvement projects include challenging capital funding and time frames, may trigger safety and property rights issues, utility relocation consideration and funding not considered in the current evaluation.[38]

2.6.3.2.2 Cost of Compliance – Factor 1

ADEQ calculated emissions using AP-42 equations. ADEQ assumed a high ADT of 800 for a rural unpaved road from a survey of unpaved roads in the state, with an average speed of 30 miles per hour used for rural minor collectors in the EPA 2017 NEI Unpaved Roads emission calculations. ADEQ used silt loading value of 3.51125 and moisture content of 0.5 from Pima County soil loading surveys.[39] ADEQ replicated the EPA 2017 NEI Paved Road calculations for emission reductions.

The cost of paving varies greatly in Arizona, ADEQ used values from Pinal County, adjusted for inflation for both paving, and a current paving estimate from Maricopa County.[40, 41] Pinal County estimates were adjusted by 4% administrative charges while the Maricopa County estimates included scoping, design, and construction. ADEQ used a CRF of approximately .0786 road paving, calculated using an interest rate of 4.75% and a 20 year useful life. Maintenance assumes chip sealing every 10 years for asphalt roads.[42]

ADEQ used chip sealing estimates from Pinal County. Pinal County estimates were adjusted by 4% administrative charges. ADEQ used a CRF of approximately .171 to calculate the annualized capital cost. Chip sealing has a life span of approximately 7 years.

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[36] ibid
[37] Pima County DEQ stakeholder comments, 22 June 2020 email from Rupesh Patel
[38] Maricopa Air Quality stakeholder comments, 16 June 2020 email from Johanna Kuspert
[39] Pima County Soil Loading Survey
[40] 2015 Pinal County PM10 State Implementation Plan Appendix F
[41] Maricopa Air Quality stakeholder comments, 16 June 2020 email from Johanna Kuspert
[42] https://pdfs.semanticscholar.org/d233/72282d307081202f01eb09b69844ed41217.pdf

ADEQ used a control effectiveness of 90% for both paved and chip-sealing.[43]

Measure Description	Capital Cost/mile	Annualized Capital Cost	Annual Implementation /Maintenance Cost	Total Annual Cost	Control Effectiveness (%)	Cost Effectiveness ($/ton)
Chip Seal	$100,000	$21,126	-	$21,126	90	$15,799
Pave Road (Pinal)	$250,000	$24,638	$1913	$31,170	90	$26,227
Pave Road (Maricopa)	$1,700,000	$133,536	$1913	$135,448	90	$135,448

Measure Description	Baseline Emissions with Existing Measures (tons/mile-year)	Emissions Reductions from New Measures (tons/mile-year)
Chip Seal	1.2143	1.2106
Pave Road (Pinal)	1.2143	1.2106
Pave Road (Maricopa)	1.2143	1.2106

2.6.3.2.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance dependent on funding. Due to transportation project planning timelines and budgetary constraints many municipalities will likely be unable to complete paving projects by the end of the current Regional Haze planning period.

2.6.3.2.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Paving roads will limit the permeability of surface increasing runoff.[44]

2.6.3.2.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

Paved roads have a usable life of 20 years with maintenance. Chip sealing has a usable life of 7 years.

[43] https://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf
[44] Maricopa Air Quality stakeholder comments, 16 June 2020 email from Johanna Kuspert

2.6.3.3 Chemically stabilize unpaved roads (dust suppressants other than water).

2.6.3.3.1 Technical Feasibility

ADEQ deemed chemically stabilizing unpaved roads as technically feasible. This control measure has been used in multiple dust control plans throughout the region.

2.6.3.3.2 Cost of Compliance – Factor 1

ADEQ calculated emissions using AP-42 equations. ADEQ assumed an average high ADT of 800 for a rural unpaved road from an average survey of unpaved roads in the state, with an average speed of 30 miles per hour used for rural minor collectors in the EPA 2017 NEI Unpaved Roads emission calculations. ADEQ used silt loading value of 3.51125 and moisture content of 0.5 from Pima County soil loading surveys.

ADEQ applied the control efficiency of 84% as reported in the WRAP Fugitive Dust Handbook for chemical stabilization.

Table 18: Chemical Stabilization Control Costs

Measure Description	Capital Cost/mile	Administrative Charges/quarter	Maintenance Cost/quarter	Total Annual Cost/mile	Control Effectiveness (%)	Cost Effectiveness ($/ton)
Chemical Dust Suppressant	$12,000	$240	$12,000	$48,960	84	$47,998

Table 19: Chemical Stabilization Control Emissions

Baseline Emissions with Existing Measures (tons/mile-year)	Emissions Reductions from New Measures (tons/mile-year)
1.2143	1.020

2.6.3.3.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance dependent on funding. Due to transportation project planning timelines and budgetary constraints many municipalities will likely be unable to complete control measures by deadlines.

2.6.3.3.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Potential environmental impacts from dust suppressant may include surface and ground water deterioration, soil contamination, toxicity to soil and water biota, toxicity to humans during and after applications, air pollution from collective dust suppressant components, changes in the hydrologic characteristics of the soils and impacts on native flora and fauna populations.

2.6.3.3.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

Chemical stabilization requires quarterly maintenance.

2.6.3.4 Apply and maintain surface gravel.

2.6.3.4.1 Technical Feasibility

ADEQ has deemed the application and maintenance of surface gravel feasible. The Maricopa County PM10 NAA uses this control measure in their SIP.

2.6.3.4.2 Cost of Compliance – Factor 1

ADEQ calculated emissions using AP-42 equations. ADEQ calculated emissions using AP-42 equations. ADEQ assumed an average high ADT of 800 for a rural unpaved road from an average survey of unpaved roads in the state, with an average speed of 30 miles per hour used for rural minor collectors in the EPA 2017 NEI Unpaved Roads emission calculations. ADEQ used silt loading value of 3.51125 and moisture content of 0.5 from Pima County soil loading surveys.

ADEQ adjusted values for aggregate surface from the 2003 San Joaquin PM10 SIP for inflation including 4% administrative fees and annual maintenance. ADEQ applied the control efficiency of 84% from the WRAP Fugitive Dust Handbook for aggregate road cover. Gravel roads require annual maintenance.

Table 20: Aggregate Control Costs

Measure Description	Capital Cost/mile	Annualized Capital Cost/mile	Total Annual Cost/mile	Control Effectiveness (%)	Cost Effectiveness ($/ton)
Aggregate	$120,400	$11,826,400	$11,826	46	$21,171

Table 21: Aggregate Control Emissions

Baseline Emissions with Existing Measures (tons/mile-year)	Emissions Reductions from New Measures (tons/mile-year)
1.2143	.5586

2.6.3.4.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance dependent on funding. Due to transportation project planning timelines and budgetary constraints many municipalities will likely be unable to complete control measures by deadlines.

2.6.3.4.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Non-applicable

2.6.3.4.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

Gravel requires annual maintenance at a minimum.

2.6.3.5 Prohibit [limit] construction of new unpaved roads.

2.6.3.5.1 Technical Feasibility

ADEQ deemed paving unpaved roads technically feasible, although stakeholder feedback stated that road improvement projects include challenging capital funding and time frames, may trigger safety and property rights issues, utility relocation consideration and funding.[45]

2.6.3.5.2 Cost of Compliance – Factor 1

ADEQ calculated emissions using AP-42 equations. ADEQ calculated emissions using AP-42 equations. ADEQ assumed an average high ADT of 800 for a rural unpaved road from an average survey of unpaved roads in the state, with an average speed of 30 miles per hour used for rural minor collectors in the EPA 2017 NEI Unpaved Roads emission calculations. ADEQ used silt loading value of 3.51125 and moisture content of 0.5 from Pima County soil loading surveys. ADEQ replicated the EPA 2017 NEI Paved Road calculations for emission reductions.

The cost of paving varies greatly in Arizona, ADEQ used values from Pinal County, adjusted for inflation for both paving and chip sealing, and a current paving estimate from Maricopa County. Pinal County estimates were adjusted by 4% administrative charges while the Maricopa County estimates included scoping, design, and construction. ADEQ used a CRF of approximately .0786. Chip sealing has a life span of approximately 7 years. Maintenance assumes chip sealing every 10 years for asphalt roads.

Table 22: Paving Control Costs

Measure Description	Capital Cost/mile	Annualized Capital Cost/mile	Annual Implementation/Maintenance Cost	Total Annual Cost/mile	Control Effectiveness (%)	Cost Effectiveness ($/ton)
Chip Seal	$100,000	$19,125.73	-	$19,125.73	90	$15,799
Pave Road (Pinal)	$250,000	$31,750	$1913	$33,663	90	$21,931
Pave Road (Maricopa)	$1,700,000	$133,536	$1913	$135,448	90	$135,448

[45] Maricopa Air Quality stakeholder comments, 16 June 2020 email from Johanna Kuspert

Table 23: Paving Control Emissions

Measure Description	Baseline Emissions with Existing Measures (tons/mile-year)	Emissions Reductions from New Measures (tons/mile-year)
Chip Seal	1.2143	1.2106
Pave Road (Pinal)	1.2143	1.2106
Pave Road (Maricopa)	1.2143	1.2106

2.6.3.5.3 Time Necessary for Compliance – Factor 2

ADEQ assumed compliance would begin February 1st, 2023, the deadline for EPA action of the SIP assuming ADEQ submittal on July 31st, 2021. Full compliance dependent on funding. Due to transportation project planning timelines and budgetary constraints many municipalities will likely be unable to complete control measures by deadlines. It is also unlikely that local municipalities have active plans for new unpaved roads.

2.6.3.5.4 Energy and Non-Air Quality Environmental Impacts of Compliance – Factor 3

Paving roads will limit the permeability of surface increasing runoff.[46]

2.6.3.5.5 Remaining Useful Life of Potentially Affected Sources – Factor 4

Paved roads have a useful life of up to 20 years with regular maintenance approximately every ten years. ADEQ assumed a 7 year useful life for chip sealed roadways.

[46] Maricopa Air Quality stakeholder comments, 16 June 2020 email from Johanna Kuspert