ARIZONA DEPARTMENT
OF
ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007
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Janice K. Brewer
Governor

Henry R. Darwin
Director

SUBMITTED VIA EMAIL AND FEDEX

May 3, 2013

Mr. Jared Blumenfeld
Regional Administrator
U.S. Environmental Protection Agency, Region IX
Mail Code: ORA-1
75 Hawthorne Street
San Francisco, CA 94105

RE: Proposed Revision to Arizona Regional Haze State Implementation Plan

Dear Mr. Blumenfeld,

Consistent with the provisions of Arizona Revised Statutes §§ 49-104, 49-106, 49-404, and 49-425 (Enclosure 1), and the Code of Federal Regulations (CFR) Title 40, §§ 51.102 through 51.104, the Arizona Department of Environmental Quality (ADEQ) hereby adopts and submits to the U.S. Environmental Protection Agency (EPA) the *"Arizona State Implementation Plan Revision Under Section 308 of the Federal Regional Haze Rule, May 2013"* as a revision to the Arizona State Implementation Plan (SIP).

On February 28, 2011, ADEQ adopted and submitted to EPA, *Arizona's State Implementation Plan for Regional Haze under Section 308 of the Federal Regional Haze Rule*. On December 5, 2012, EPA took final action on elements of Arizona's Regional Haze SIP relating to three coal fired power plants. On December 21, 2012, EPA proposed to approve in part and disapprove in part the remaining elements of Arizona's Regional Haze SIP (77 FR 75704) that were not addressed in the action from December 5, 2012. In previous comments regarding EPA's proposed action, ADEQ noted that the Clean Air Act contemplates a single action on each submitted plan. As evidenced in the comments ADEQ received on its proposed SIP revision, multiple actions on a single SIP creates confusion and unnecessary complexity for ADEQ and EPA staff when addressing proposed disapprovals and creates challenges communicating the precise air pollution reduction strategies to the public.

To address EPA's proposed deficiencies, ADEQ has revised the sections as noted in the table below. These chapters/sections supersede those in the 2011 Regional Haze SIP as submitted on February 28, 2011.

Chapters/Sections in 2013 Regional Haze SIP Revision	Chapters/Sections Superseded in 2011 Regional Haze SIP
Chapter 8, Sections 8.6 through 8.9	New sections added to SIP.
Chapter 10, Sections 10.4, 10.7, 10.8	Superseding corresponding sections.
Chapter 11, Sections 11.1 through 11.11	Superseding Chapter 11 in its entirety; all sections (11.1 through 11.5).
Appendix D, Sections VI (C), VII, IX, XII (B & C), XIII (B, C, & D)	Superseding corresponding sections to address EPA's NPRM from December 21, 2012 (77 FR 75704); ADEQ is not revising/superseding sections addressed in EPA NFRM from December 5, 2012 (77 FR 72511).

The SIP revision consists of copies of the authorizing statutes cited above (Enclosure 1). ADEQ is submitting the authorizing statutes in Enclosure 1 as supporting information. The following statutes have been approved by EPA: A.R.S. § 49-104 (77 FR 66398); A.R.S. § 49-106 (77 FR 66398); A.R.S. § 49-404 (65 FR 36353); and A.R.S. § 49-425 (77 FR 66398). Enclosure 2 contains the SIP Completeness Checklist demonstrating that this submission satisfies the requirements of 40 C.F.R. Part 51 Appendix V. Enclosure 3 contains the SIP revisions as described in the table above (Enclosure 3). Two paper copies and an electronic exact duplicate of the hard copy on CD are included with this letter. If you have any questions, please contact me at (602) 771-2288.

Sincerely,

Eric C. Massey, Director
Air Quality Division

cc. Colleen McKaughan, EPA
Gregory Nudd, EPA
Tom Webb, EPA

Janice K. Brewer
Governor

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007
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Henry R. Darwin
Director

February 25, 2011

TO: Eric Massey
Division Director
Air Quality Division

Under A.R.S. §49-104(D)(2), I authorize you, Eric Massey, Division Director, Air Quality Division, Arizona Department of Environmental Quality, to perform any act, including execution of any pertinent documents, which I as Director of the Arizona Department of Environmental Quality am authorized or required to do by law with respect to A.R.S. Title 49, chapters 1 and 3 and any other acts relating to air quality including personnel actions. This authority shall remain in effect until it is revoked or you resign. You may further delegate this authority in the best interest of the agency, however, those delegations must be in writing and you must forward a copy of any further delegations to me.

This delegation is effective February 25, 2011. I ratify all acts performed by you as Air Quality Division Director concerning the duties and functions in this delegation letter.

Henry R. Darwin
Director

Northern Regional Office
1801 W. Route 66 • Suite 117 • Flagstaff, AZ 86001
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ENCLOSURE 1

Arizona Revised Statutes
§§ 49-104, 49-106, 49-404, and 49-425

(Submitted for informational purposes only.)

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49-104. Powers and duties of the department and director

A. The department shall:

1. Formulate policies, plans and programs to implement this title to protect the environment.

2. Stimulate and encourage all local, state, regional and federal governmental agencies and all private persons and enterprises that have similar and related objectives and purposes, cooperate with those agencies, persons and enterprises and correlate department plans, programs and operations with those of the agencies, persons and enterprises.

3. Conduct research on its own initiative or at the request of the governor, the legislature or state or local agencies pertaining to any department objectives.

4. Provide information and advice on request of any local, state or federal agencies and private persons and business enterprises on matters within the scope of the department.

5. Consult with and make recommendations to the governor and the legislature on all matters concerning department objectives.

6. Promote and coordinate the management of air resources to assure their protection, enhancement and balanced utilization consistent with the environmental policy of this state.

7. Promote and coordinate the protection and enhancement of the quality of water resources consistent with the environmental policy of this state.

8. Encourage industrial, commercial, residential and community development that maximizes environmental benefits and minimizes the effects of less desirable environmental conditions.

9. Assure the preservation and enhancement of natural beauty and man-made scenic qualities.

10. Provide for the prevention and abatement of all water and air pollution including that related to particulates, gases, dust, vapors, noise, radiation, odor, nutrients and heated liquids in accordance with article 3 of this chapter and chapters 2 and 3 of this title.

11. Promote and recommend methods for the recovery, recycling and reuse or, if recycling is not possible, the disposal of solid wastes consistent with sound health, scenic and environmental quality policies. Beginning in 2014, the department shall report annually on its revenues and expenditures relating to the solid and hazardous waste programs overseen or administered by the department.

12. Prevent pollution through the regulation of the storage, handling and transportation of solids, liquids and gases that may cause or contribute to pollution.

13. Promote the restoration and reclamation of degraded or despoiled areas and natural resources.

14. Assist the department of health services in recruiting and training state, local and district health department personnel.

15. Participate in the state civil defense program and develop the necessary organization and facilities to meet wartime or other disasters.

16. Cooperate with the Arizona-Mexico commission in the governor's office and with researchers at universities in this state to collect data and conduct projects in the United States and Mexico on issues that are within the scope of the department's duties and that relate to quality of life, trade and economic development in this state in a manner that will help the Arizona-Mexico commission to assess and enhance the economic competitiveness of this state and of the Arizona-Mexico region.

17. Unless specifically authorized by the legislature, ensure that state laws, rules, standards, permits, variances and orders are adopted and construed to be consistent with and no more stringent than the corresponding federal law that addresses the same subject matter. This provision shall not be construed to adversely affect standards adopted by an Indian tribe under federal law.

B. The department, through the director, shall:
1. Contract for the services of outside advisers, consultants and aides reasonably necessary or desirable to enable the department to adequately perform its duties.
2. Contract and incur obligations reasonably necessary or desirable within the general scope of department activities and operations to enable the department to adequately perform its duties.
3. Utilize any medium of communication, publication and exhibition when disseminating information, advertising and publicity in any field of its purposes, objectives or duties.
4. Adopt procedural rules that are necessary to implement the authority granted under this title, but that are not inconsistent with other provisions of this title.
5. Contract with other agencies, including laboratories, in furthering any department program.
6. Use monies, facilities or services to provide matching contributions under federal or other programs that further the objectives and programs of the department.
7. Accept gifts, grants, matching monies or direct payments from public or private agencies or private persons and enterprises for department services and publications and to conduct programs that are consistent with the general purposes and objectives of this chapter. Monies received pursuant to this paragraph shall be deposited in the department fund corresponding to the service, publication or program provided.
8. Provide for the examination of any premises if the director has reasonable cause to believe that a violation of any environmental law or rule exists or is being committed on the premises. The director shall give the owner or operator the opportunity for its representative to accompany the director on an examination of those premises. Within forty-five days after the date of the examination, the department shall provide to the owner or operator a copy of any report produced as a result of any examination of the premises.
9. Supervise sanitary engineering facilities and projects in this state, authority for which is vested in the department, and own or lease land on which sanitary engineering facilities are located, and operate the facilities, if the director determines that owning, leasing or operating is necessary for the public health, safety or welfare.
10. Adopt and enforce rules relating to approving design documents for constructing, improving and operating sanitary engineering and other facilities for disposing of solid, liquid or gaseous deleterious matter.
11. Define and prescribe reasonably necessary rules regarding the water supply, sewage disposal and garbage collection and disposal for subdivisions. The rules shall:
(a) Provide for minimum sanitary facilities to be installed in the subdivision and may require that water systems plan for future needs and be of adequate size and capacity to deliver specified minimum quantities of drinking water and to treat all sewage.
(b) Provide that the design documents showing or describing the water supply, sewage disposal and garbage collection facilities be submitted with a fee to the department for review and that no lots in any subdivision be offered for sale before compliance with the standards and rules has been demonstrated by approval of the design documents by the department.
12. Prescribe reasonably necessary measures to prevent pollution of water used in public or semipublic swimming pools and bathing places and to prevent deleterious conditions at such places. The rules shall prescribe minimum standards for the design of and for sanitary conditions at any public or semipublic swimming pool or bathing place and provide for abatement as public nuisances of premises and facilities that do not comply with the minimum standards. The rules shall be developed in cooperation with the director of the department of health services and shall be consistent with the rules adopted by the director of the department of health services pursuant to section 36-136, subsection H, paragraph 10.
13. Prescribe reasonable rules regarding sewage collection, treatment, disposal and reclamation systems to prevent the transmission of sewage borne or insect borne diseases. The rules shall:
(a) Prescribe minimum standards for the design of sewage collection systems and treatment, disposal and reclamation systems and for operating the systems.
(b) Provide for inspecting the premises, systems and installations and for abating as a public nuisance any collection system, process, treatment plant, disposal system or reclamation system that does not comply with the minimum standards.
(c) Require that design documents for all sewage collection systems, sewage collection system extensions, treatment plants, processes, devices, equipment, disposal systems, on-site wastewater treatment facilities and reclamation systems be submitted with a fee for review to the department and may require that the design documents anticipate and provide for future sewage treatment needs.
(d) Require that construction, reconstruction, installation or initiation of any sewage collection system, sewage collection system extension, treatment plant, process, device, equipment, disposal system, on-site wastewater treatment facility or reclamation system conform with applicable requirements.
14. Prescribe reasonably necessary rules regarding excreta storage, handling, treatment, transportation and disposal. The rules shall:
(a) Prescribe minimum standards for human excreta storage, handling, treatment, transportation and disposal and shall provide for inspection of premises, processes and vehicles and for abating as public nuisances any premises, processes or vehicles

that do not comply with the minimum standards.
(b) Provide that vehicles transporting human excreta from privies, septic tanks, cesspools and other treatment processes shall be licensed by the department subject to compliance with the rules. The department may require payment of a fee as a condition of licensure. After the effective date of this amendment to this section, the department shall establish by rule a fee as a condition of licensure, including a maximum fee. As part of the rule making process, there must be public notice and comment and a review of the rule by the joint legislative budget committee. After September 30, 2013, the department shall not increase that fee by rule without specific statutory authority for the increase. The fees shall be deposited, pursuant to sections 35-146 and 35-147, in the solid waste fee fund established by section 49-881.
15. Perform the responsibilities of implementing and maintaining a data automation management system to support the reporting requirements of title III of the superfund amendments and reauthorization act of 1986 (P.L. 99-499) and title 26, chapter 2, article 3.
16. Approve remediation levels pursuant to article 4 of this chapter.
17. Establish or revise fees by rule pursuant to the authority granted under title 44, chapter 9, article 8 and chapters 4 and 5 of this title for the department to adequately perform its duties. All fees shall be fairly assessed and impose the least burden and cost to the parties subject to the fees. In establishing or revising fees, the department shall base the fees on:
(a) The direct and indirect costs of the department's relevant duties, including employees salaries and benefits, professional and outside services, equipment, in-state travel and other necessary operational expenses directly related to issuing licenses as defined in title 41, chapter 6 and enforcing the requirements of the applicable regulatory program.
(b) The availability of other funds for the duties performed.
(c) The impact of the fees on the parties subject to the fees.
(d) The fees charged for similar duties performed by the department, other agencies and the private sector.
C. The department may:
1. Charge fees to cover the costs of all permits and inspections it performs to ensure compliance with rules adopted under section 49-203, except that state agencies are exempt from paying the fees. Monies collected pursuant to this subsection shall be deposited, pursuant to sections 35-146 and 35-147, in the water quality fee fund established by section 49-210.
2. Contract with private consultants for the purposes of assisting the department in reviewing applications for licenses, permits or other authorizations to determine whether an applicant meets the criteria for issuance of the license, permit or other authorization. If the department contracts with a consultant under this paragraph, an applicant may request that the department expedite the application review by requesting that the department use the services of the consultant and by agreeing to pay the department the costs of the consultant's services. Notwithstanding any other law, monies paid by applicants for expedited reviews pursuant to this paragraph are appropriated to the department for use in paying consultants for services.
D. The director may:
1. If the director has reasonable cause to believe that a violation of any environmental law or rule exists or is being committed, inspect any person or property in transit through this state and any vehicle in which the person or property is being transported and detain or disinfect the person, property or vehicle as reasonably necessary to protect the environment if a violation exists.
2. Authorize in writing any qualified officer or employee in the department to perform any act that the director is authorized or required to do by law.

49-106. Statewide application of rules

The rules adopted by the department apply and shall be observed throughout this state, or as provided by their terms, and the appropriate local officer, council or board shall enforce them. This section does not limit the authority of local governing bodies to adopt ordinances and rules within their respective jurisdictions if those ordinances and rules do not conflict with state law and are equal to or more restrictive than the rules of the department, but this section does not grant local governing bodies any authority not otherwise provided by separate state law.

49-404. State implementation plan

A. The director shall maintain a state implementation plan that provides for implementation, maintenance and enforcement of national ambient air quality standards and protection of visibility as required by the clean air act.

B. The director may adopt rules that describe procedures for adoption of revisions to the state implementation plan.

C. The state implementation plan and all revisions adopted before September 30, 1992 remain in effect according to their terms, except to the extent otherwise provided by the clean air act, inconsistent with any provision of the clean air act, or revised by the administrator. No control requirement in effect, or required to be adopted by an order, settlement agreement or plan in effect, before the enactment of the clean air act in any area which is a nonattainment or maintenance area for any air pollutant may be modified after enactment in any manner unless the modification insures equivalent or greater emission reductions of the air pollutant. The director shall evaluate and adopt revisions to the plan in conformity with federal regulations and guidelines promulgated by the administrator for those purposes until the rules required by subsection B are effective.

49-425. Rules; hearing

A. The director shall adopt such rules as he determines are necessary and feasible to reduce the release into the atmosphere of air contaminants originating within the territorial limits of the state or any portion thereof and shall adopt, modify, and amend reasonable standards for the quality of, and emissions into, the ambient air of the state for the prevention, control and abatement of air pollution. Additional standards shall be established for particulate matter emissions, sulfur dioxide emissions, and other air contaminant emissions determined to be necessary and feasible for the prevention, control and abatement of air pollution. In fixing such ambient air quality standards, emission standards or standards of performance, the director shall give consideration but shall not be limited to the relevant factors prescribed by the clean air act.

B. No rule may be enacted or amended except after the director first holds a public hearing after twenty days' notice of such hearing. The proposed rule, or any proposed amendment of a rule, shall be made available to the public at the time of notice of such hearing.

C. The department shall enforce the rules adopted by the director.

D. All rules enacted pursuant to this section shall be made available to the public at a reasonable charge upon request.

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ENCLOSURE 2

State Implementation Plan Completeness Checklist

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STATE IMPLEMENTATION PLAN COMPLETENESS CHECKLIST

Submittal of

Arizona State Implementation Plan Revision Under Section 308 of the Federal Regional Haze Rule, May 2013

40 CFR Part 51, Appendix V, *Criteria for Determining the Completeness of Plan Submissions*, contains the "minimum criteria for determining whether a State Implementation Plan submitted for consideration by EPA is an official submission for purposes of review under §51.103," *Submission of plans, preliminary review of plans*. Appendix V requires the following to be included in plan submissions for review by EPA:

1. **"A formal letter of submittal from the Governor or his designee, requesting EPA approval of the plan or revision thereof (hereafter ''the plan'')."** [Appendix V, 2.1(a)]

   See cover letter.

2. **"Evidence that the State has adopted the plan in the State code or body of regulations; or issued the permit, order, consent agreement (hereafter ''document'') in final form. That evidence shall include the date of adoption or final issuance as well as the effective date of the plan, if different from the adoption/issuance date."** [Appendix V, 2.1(b)]

   See cover letter.

3. **"Evidence that the State has the necessary legal authority under State law to adopt and implement the plan."** [Appendix V, 2.1(c)]

   See Enclosure 1.

4. **"A copy of the actual regulation, or document submitted for approval and incorporation by reference into the plan, including indication of the changes made (such as, redline/strikethrough) to the existing approved plan, where applicable ..."** [Appendix V, 2.1(d)]

   See Enclosure 3.

5. **"Evidence that the State followed all of the procedural requirements of the State's laws and constitution in conducting and completing the adoption/issuance of the plan."** [Appendix V, 2.1(e)]

   See cover letter and Enclosure 3, Appendix E – Supplement – Public Process Documentation for Arizona State Implementation Plan Revision Under Section 308 of the Federal Regional Haze Rule, May 2013.

6. **"Evidence that public notice was given of the proposed change consistent with procedures approved by EPA, including the date of publication of such notice."** [Appendix V, 2.1(f)]

   See Enclosure 3, Appendix E.

7. **"Certification that public hearing(s) were held in accordance with the information provided in the public notice and the State's laws and constitution, if applicable and consistent with the public hearing requirements in 40 CFR 51.102."** [Appendix V, 2.1(g)]

   See Enclosure 3, Appendix E.

8. **"Compilation of public comments and the State's response thereto."** [Appendix V, 2.1(h)]

   See Enclosure 3, Appendix E.

9. **"Identification of all regulated pollutants affected by the plan."** [Appendix V, 2.2(a)]

   Sulfur dioxide (SO_2), Oxides of Nitrogen (NO_X), Organic Carbon (OC), Elemental Carbon (EC), Fine Soil, Coarse Mass, and Sea Salt

10. **"Identification of the locations of affected sources including the EPA attainment/nonattainment designation of the locations and the status of the attainment plan for the affected areas(s)."** [Appendix V, 2.2 (b)]

    Not applicable for current submission (Arizona State Implementation Plan Revision Under Section 308 of the Federal Regional Haze Rule, May 2013). See Chapters 2, 4, and 6 of Arizona's Regional Haze SIP Submitted February 28, 2011.

11. **"Quantification of the changes in plan allowable emissions from the affected sources; estimates of changes in current actual emissions from affected sources or, where appropriate, quantification of changes in actual emissions from affected sources through calculations of the differences between certain baseline levels and allowable emissions anticipated as a result of the revision."** [Appendix V, 2.2(c)]

    Not applicable.

12. **"The State's demonstration that the national ambient air quality standards, prevention of significant deterioration increments, reasonable further progress demonstration, and visibility, as applicable, are protected if the plan is approved and implemented. For all requests to redesignate an area to attainment for a national primary ambient air quality standard, under section 107 of the Act, a revision must be submitted to provide for the maintenance of the national primary ambient air quality standards for at least 10 years as required by section 175A of the Act."** [Appendix V, 2.2(d)]

    See Enclosure 3 – Chapter 10 and Chapter 11 of current submission (Arizona State Implementation Plan Revision Under Section 308 of the Federal Regional Haze Rule, May 2013). See Chapters 12 of Arizona's Regional Haze SIP Submitted February 28, 2011.

13. **"Modeling information required to support the proposed revision, including input data, output data, models used, justification of model selections, ambient monitoring data used, meteorological data used, justification for use of offsite data (where used), modes of models used, assumptions, and other information relevant to the determination of adequacy of the modeling analysis."** [Appendix V, 2.2(e)]

    See Enclosure 3 - Chapter 11 and Arizona Regional Haze State Implementation Plan Revision Technical Support Document.

14. **"Evidence, where necessary, that emission limitations are based on continuous emission reduction technology."** [Appendix V, 2.2(f)]

    Not applicable.

15. **"Evidence that the plan contains emission limitations, work practice standards and recordkeeping/reporting requirements, where necessary, to ensure emission levels."** [Appendix V, 2.2(g)]

    Not applicable.

16. **"Compliance/enforcement strategies, including how compliance will be determined in practice."** [Appendix V, 2.2(h)]

    See Enclosure 3 - Chapter 10, Chapter 11 and Appendix D.

17. **"Special economic and technological justifications required by any applicable EPA policies, or an explanation of why such justifications are not necessary."** [Appendix V, 2.2(i)]

    No known deviation from U.S. EPA policy.

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ENCLOSURE 3

Arizona State Implementation Plan Revision

Arizona State Implementation Plan
Under Section 308 of the Federal Regional Haze Rule
May 2013

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ADEQ
Arizona Department
of Environmental Quality

Arizona State Implementation Plan Revision

Regional Haze Under Section 308 Of the Federal Regional Haze Rule

Air Quality Division
May 2013

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CHAPTER 6

ARIZONA CLASS ONE AREA BASELINE, NATURAL CONDITIONS, AND UNIFORM RATE OF PROGRESS

The following table has been revised and replaces the corresponding table in Chapter 6 of Arizona's 2011 Regional Haze SIP.

Table 6.1 – Baseline Conditions for 20% Worst Days		
Mandatory Federal Class I Area	**IMPROVE Monitor**	**Baseline Conditions for 20% Worst Visibility Days (dv)**
Mount Baldy Wilderness	BALD1	11.85
Chiricahua National Monument, Chiricahua Wilderness, Galiuro Wilderness	CHIR1	13.43
Grand Canyon National Park	GRCA2	11.66
Mazatzal Wilderness, Pine Mountain Wilderness	IKBA1	13.35
Petrified Forest National Park	PEFO1	13.21
Saguaro National Park – West Unit	SAWE1	16.22
Saguaro National Park – East Unit	SAGU1	14.83
Sierra Ancha Wilderness	SIAN1	13.67
Sycamore Canyon Wilderness	SYCA1	15.25
Superstition Wilderness	TONT1	14.16

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CHAPTER 8

SOURCES OF VISIBILITY IMPAIRMENT

The following sections (8.6 to 8 9) are added to Chapter 8 of Arizona's 2011 Regional Haze SIP.

8.6 2002 & 2008 Emission Inventories

As noted in Section 8.4, CFR 40.51.308(d)(4)(v) requires a statewide emission inventory (EI) of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area. This Section of the RHR further requires that the statewide inventory include the most recent data available. The 2011 Arizona Regional Haze Submittal included the 2002 Emissions Inventory as developed by the state and the Western Regional Air Partnership (WRAP).

On December 21, 2012, the Environmental Protection Agency (EPA), proposed to approve and disapprove parts of Arizona's 2011 Regional Haze SIP as it pertained to sources of visibility impairment and emission inventories. Specifically, EPA proposed to disapprove Arizona's 2011 Regional Haze Submittal because it did not include the 2008 emissions inventory. To fulfill the requirement of the Regional Haze Rule and the proposed disapproval, ADEQ is submitting a 2008 EI calculated and compiled by the Western Regional Air Partnership (WRAP) and the Arizona Department of Environmental Quality (ADEQ).

8.6.1 2002 Arizona Emission Inventory

The 2002 Arizona EI and calculation methodology is presented in Chapter 8 of Arizona's 2011 Regional Haze SIP. The 2002 inventory served as the baseline inventory for the 2018 emission inventory estimation. The methodology for this estimation can also be found in Arizona's 2011 Regional Haze SIP.

8.6.2 2008 Arizona Emission Inventory

The 2008 EI was created by WRAP, Air Resource Specialists (ARS), and ADEQ. The 2008 inventory was calculated as part of the WRAP WestJump Project to create statewide inventories for all of the western U.S. states in order to satisfy 40 CFR §51.308(g)(4), which requires states to analyze and track the changes in emissions of visibility impairing pollutants every five years. It contains the most current data and calculations of pollutant emissions from all identified sources that were available by the completion of the enclosed Technical Support Document (TSD). The inventory was calculated using the 2008 EPA National Emissions Inventory (NEI) and other emission models and techniques.

These inventories were created as part of the WRAP WESTJUMP project, which created statewide inventories for all of the western U.S. States.

The 2002 EI was based on the most readily available and accurate source data and methods at the time of preparation; however, many of the calculated source category emissions methodologies and input data changed between the 2002 and 2008 EI preparations in order to enhance the accuracy of estimated statewide emissions. For this reason, many of the source category emission differences between the 2002 and 2008 inventories presented in this document should be viewed as a mixture of methodology, input data, and actual emissions changes. Furthermore, since the Arizona 2018 EI was estimated through the

adjustment of the 2002 baseline Arizona EI, emissions from these two inventories are more readily comparable than emissions from the 2008 EI due to the aforementioned methodology and source data differences.

8.7 2002 and 2008 Emissions

A summary of the 2002 and 2008 Arizona EIs is presented below. Text highlighted in yellow in the tables below indicates significant methodology differences between the 2002 and 2008 EIs. An overview of the methodologies for the 2002 and 2008 inventory is included in the enclosed TSD.

8.7.1 SO_2 Emissions

Table 8.9 – Arizona SO_2 Emission Inventory (2002 & 2008)

Source Category	Sulfur Dioxide Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	94,716	79,015	-15,700
Area	2,677	3,678	1,001
On-Road Mobile	2,715	812	-1,904
Off-Road Mobile	4,223	673	-3,550
Area Oil and Gas	0	0	0
Fugitive and Road Dust	0	0	0
Anthropogenic Fire*	NA	NA	NA
Wind Blown Dust	NA	0	NA
Total Anthropogenic	**104,330**	**84,177**	**-20,153 (-19%)**
Natural Sources			
Natural Fire*	4,559	607	-3,952
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**4,559**	**607**	**-3,952 (-87%)**
All Sources			
Total Emissions	**108,890**	**84,784**	**-24,105 (-22%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

8.7.2 NO_X Emissions

Table 8.10 – Arizona NO_X Emission Inventory (2002 & 2008)			
Source Category	**Nitrogen Oxides Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	69,968	60,759	-9,209
Area	9,049	39,403	30,354
On-Road Mobile	178,009	137,555	-40,453
Off-Road Mobile	66,414	33,857	-32,557
Area Oil and Gas	17	0	-17
Fugitive and Road Dust	0	0	0
Wind Blown Dust	NA	0	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**323,458**	**271,575**	**-51,882 (-16%)**
Natural Sources			
Natural Fire*	17,218	3,513	-13,704
Biogenic	27,664	15,256	-12,408
Wind Blown Dust	0	0	0
Total Natural	**44,881**	**18,769**	**-26,112 (-58%)**
All Sources			
Total Emissions	**368,339**	**290,344**	**-77,995 (-21%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

8.7.3 Organic Carbon (Primary Organic Aerosol) Emissions

Table 8.11 – Arizona Organic Carbon Emission Inventory (2002 & 2008)			
Source Category	**Primary Organic Aerosol Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	276	410	134
Area	4,728	6,445	1,718
On-Road Mobile	1,583	2,666	1,083
Off-Road Mobile	2,006	1,383	-624
Area Oil and Gas	0	0	0

Table 8.11 – Arizona Organic Carbon Emission Inventory (2002 & 2008)			
Source Category	**Primary Organic Aerosol Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Fugitive and Road Dust	535	1,393	858
Windblown Dust	NA	0	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**9,128**	**12,298**	**3,169 (35%)**
Natural Sources			
Natural Fire*	48,625	5,669	-42,957
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**48,625**	**5,669**	**-42,957 (-88%)**
All Sources			
Total Emissions	**57,754**	**17,966**	**-39,787 (-69%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

8.7.4 Elemental Carbon Emissions

Table 8.12 – Arizona Elemental Carbon Emission Inventory (2002 & 2008)			
Source Category	**Elemental Carbon Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	26	283	257
Area	449	1,337	889
On-Road Mobile	1,761	5,559	3,798
Off-Road Mobile	2,752	1,813	-940
Area Oil and Gas	0	0	0
Fugitive and Road Dust	39	47	8
Windblown Dust	NA	0	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**5,027**	**9,039**	**4,012 (80%)**
Natural Sources			
Natural Fire*	9,719	412	-9,307
Biogenic	0	0	0
Wind Blown Dust	0	0	0

Table 8.12 – Arizona Elemental Carbon Emission Inventory (2002 & 2008)			
Source Category	**Elemental Carbon Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Total Natural	**9,719**	**412**	**-9,307 (-96%)**
All Sources			
Total Emissions	**14,745**	**9,450**	**-5,295 (-36%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

8.7.5 PM Fine Emissions

Table 8.13 – Arizona PM Fine Emission Inventory (2002 & 2008)			
Source Category	**Fine Particulate Matter Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	632	4,434	3,801
Area	4,223	7,906	3,684
On-Road Mobile	1,080	511	-569
Off-Road Mobile	0	97	97
Area Oil and Gas	0	0	0
Fugitive and Road Dust	10,072	24,592	14,520
Windblown Dust	NA	67	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**16,007**	**37,607**	**21,600 (>100%)**
Natural Sources			
Natural Fire*	3,945	1,938	-2,006
Biogenic	0	0	0
Wind Blown Dust	6,422	9,647	2,885
Total Natural	**10,367**	**11,585**	**1,218 (12%)**
All Sources			
Total Emissions	**26,374**	**49,192**	**22,818 (87%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

8.7.6 Coarse Mass Emissions

Table 8.14 – Arizona Coarse Mass Emission Inventory (2002 & 2008)			
Source Category	**Coarse Particulate Matter Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	8,473	5,260	-3,214
Area	1,384	2,389	1,005
On-Road Mobile	1,004	5,597	4,593
Off-Road Mobile	0	162	162
Area Oil and Gas	0	0	0
Fugitive and Road Dust	79,316	141,117	61,801
Windblown Dust	NA	604	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**90,178**	**155,129**	**64,951 (72%)**
Natural Sources			
Natural Fire*	10,125	1,692	-8,433
Biogenic	0	0	0
Wind Blown Dust	57,796	86,827	29,031
Total Natural	**67,921**	**88,519**	**20,598 (30%)**
All Sources			
Total Emissions	**158,099**	**243,648**	**85,549 (54%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

8.7.7 Ammonia Emissions

Table 8.15 – Arizona Ammonia Emission Inventory (2002 & 2008)			
Source Category	**Ammonia Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	531	971	440
Area	32,713	34,878	2,165
On-Road Mobile	5,035	2,377	-2,658
Off-Road Mobile	48	40	-8
Area Oil and Gas	0	0	0

Table 8.15 – Arizona Ammonia Emission Inventory (2002 & 2008)			
Source Category	**Ammonia Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Fugitive and Road Dust	0	0	0
Anthropogenic Fire*	NA	NA	NA
Windblown Dust	NA	0	NA
Total Anthropogenic	**38,326**	**38,265**	**-61 (0%)**
Natural Sources			
Natural Fire*	3,878	0	-3,878
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**3,878**	**0**	**-3,878 (-100%)**
All Sources			
Total Emissions	**42,203**	**38,265**	**-3,939 (-9%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

8.7.8 Volatile Organic Compounds (VOC) Emissions

Table 8.16 – Arizona Volatile Organic Compound Emission Inventory (2002 & 2008)			
Source Category	**Volatile Organic Compound Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	5,464	3,489	-1,975
Area	102,918	100,256	-2,661
On-Road Mobile	110,424	54,589	-55,834
Off-Road Mobile	56,901	42,297	-14,604
Area Oil and Gas	46	12	-34
Fugitive and Road Dust	0	0	0
Windblown Dust	NA	0	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**275,753**	**200,644**	**-75,109 (-27%)**
Natural Sources			
Natural Fire*	37,232	4,989	-32,243
Biogenic	1,576,698	686,255	-890,443

Table 8.16 – Arizona Volatile Organic Compound Emission Inventory (2002 & 2008)			
Source Category	**Volatile Organic Compound Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Wind Blown Dust	0	0	0
Total Natural	**1,613,930**	**691,243**	**-922,686 (-57%)**
All Sources			
Total Emissions	**1,889,682**	**891,887**	**-997,795 (-53%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

8.7.9 Summary of 2008 Emissions Inventory

Sulfur Dioxide (SO_2)

In the 2008 EI, all source categories of pollutants, except area, showed a decrease in emissions when compared to the 2002 EI. The largest decrease occurred in point sources (Table 8.9)

Nitrogen Dioxide (NO_X)

All source categories for NO_X showed lower emissions in the 2008 EI in comparison to the 2002 EI, except for area sources. The largest decrease occurred in mobile sources, showing 30% lower emissions for on- and off-road mobile emissions combined (Table 8.10).

It should be noted that Arizona is the second lowest contributor to emissions from annual U.S. oil production. In 2008, oil production from Arizona totaled 52,000 barrels or 0.003% of the national total[1]. Therefore, calculated and reported NO_X emissions from Oil and Gas production are negligible in comparison to other source categories.

Organic Carbon (Primary Organic Aerosol)

Overall, organic carbon emissions decreased by 69% in the 2008 EI (Table 8.11). Emissions of organic carbon from fire were lower in 2008 when compared with 2002. It should be noted that current year inventories represent only snapshots of fire emissions for the year 2008.

Elemental Carbon

In the 2008 EI, total elemental carbon decreased by approximately 36% (Table 8.12). Most of the decrease occurred in fire emissions. It should be noted however, that on-road mobile emissions were higher in the 2008 EI than in the 2002 EI.

[1] U.S. Energy Information Administration. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm.

PM Fine & Coarse Mass

Emissions of both fine particulate matter (PM fine) and coarse mass were larger for windblown, fugitive dust, and road dust in the 2008 EI as compared to the 2002 EI (Tables 8.13 and 8.14). The increase in windblown dust is thought to be partly due to enhancements in dust inventory methodology. The 2008 EI was also slightly higher for area and point sources for PM fine as compared to the 2002 EI.

Ammonia

Total ammonia emissions were fairly consistent between the 2008 EI and 2002 EI (Table 8.15). Area sources show slightly higher emissions in the 2008 EI. However, on-road mobile sources show lower emission in the 2008 EI when compared to the 2002 EI.

Volatile Organic Compound (VOC)

The 2008 EI shows significantly lower emissions of VOCs in 2008 in comparison to the 2002 EI (Table 8.16). This is likely due to enhancements in biogenic inventory methodology. It should be noted that Arizona represents the second lowest contributing State to annual U.S. oil production. Oil production in Arizona in 2008 totaled 52,000 barrels or 0.003% of the national total[2]. Therefore, calculated and reported VOC emissions from Oil and Gas production are negligible in comparison to other source categories.

8.8 Summary of Input & Methodological Changes

8.8.1 Estimates of Population Changes

The Arizona Department of Administration (ADOA) has provided estimates of State and County population data for each year dating to 1980[3]. For the years of 2002 and 2008, ADOA estimates Arizona state-wide populations to be 5,470,720 and 6,629,455 respectively, which is a 21.2% increase in state-wide population. An increase in population may lead to pollutant emission changes for a number of source categories; however, the degrees to which certain pollutants change for given source categories indicate that population increases are likely not the sole cause for emission changes between the 2002 and 2008 EIs.

8.8.2 Methodological Changes

As noted in Section 8.7.9, there are several differences in the emissions between the 2002 EI and 2008 EI. There are many changes in methodology, input data, and model resolution that likely contribute to these differences in emissions. The list below summarizes the changes that have potentially affected the 2008 EI.

1. ADEQ has reviewed emission estimates to understand the drastic changes in Area Source SO_X and NO_X emissions between the 2002 and 2008 EIs. This review indicated that these changes are due to a mixture of methodological changes and data completion issues. Therefore, ADEQ believes a more accurate indicator of NO_X and SO_X changes between the baseline and progress

[2] ibid
[3] Arizona Department of Administration (ADOA).
http://www.workforce.az.gov/pubs/demography/Estimates1980_2009With2000CensusWithNotes.xls

periods can be obtained through an analysis of the IMPROVE data. Some identified issues between 2002 and 2008 Area Source NO_X and SO_X estimated.

- When extracting Area source emissions data from the 2008 NEI by SCC code for the State of Arizona, several reported emissions contained neither physical descriptors nor SCC codes. It is possible that these unidentified sources could represent sources which are being double counted in another portion of the inventory. All 2002 data was resolved by SCC code and physical descriptors, eliminating the possibility of double counting.
- When extracting area source NO_X emissions data from the 2008 NEI by SCC code, data can be sorted by the submitting agency or agencies. Submitting agencies include: AZDEQ, EPA, railroad companies, "AgFire", and "Multiple". The "Multiple" submitting agency label submitted 25 unidentifiable NO_X area emission categories for the 15 Arizona counties. These NO_X emissions totaled 23,371 tons. EPA confirmed these emissions originated from Locomotive and Railroad activities. The 2008 EPA NEI designated locomotive emissions as an Area source where previous inventories categorized it as an Off-road source[4]. This emission relocation is likely to account for the majority of emission changes between 2002 and 2008 Area source and Off-road source emissions for NO_x and SO_x and, to a lesser degree, other pollutants listed above.
- NO_X area source emissions reported to the NEI increased from 4,736 tons in 2002 to 13,563 tons in 2008 for Maricopa County alone. Direct contact with Maricopa County revealed that the county was presenting a more accurate fuel burning emission inventory in 2008 and that the County raised the emission limit of point source classification to more accurately reflect the CERR definition in 2008. In 2002 they reported 145 point sources and in 2008 they only reported 25 point source facilities, with the remaining sources becoming Area Source emitters.

2. Biogenic emission differences for NO_X and VOCs are primarily due to methodology, source data, and modeling resolution enhancements between 2002 and 2008.
3. Ammonia emission differences for On-road Mobile are primarily due to a switch from the MOBILE6 model to the MOVES model. The 2008 EPA NEI Technical Support Document (TSD)[5] reported a 54% decrease in highway vehicle NH_3 for 2008.
4. VOC emission differences for On-road Mobile are primarily due to a switch from the MOBILE6 model to the MOVES model.
5. On-road Elemental Carbon (EC) and Coarse Particulate Matter (CM) emission differences are primarily due to the switch between MOBILE6 and MOVES (which estimates higher PM emissions).
6. Reported Point Source Fines emissions exhibit a dramatic increase between 2002 and 2008, while CM decreases between 2002 and 2008. In theory, these two pollutants should track fairly closely to one another. ADEQ internal review revealed that many, if not most, sources within the State of Arizona were not reporting $PM_{2.5}$ prior to 2006 which likely explains the drastic change in Fines emissions between the 2002 and 2008 EIs.
7. Area source Fines emission differences are partially due to NEI changes. Calculation methodology changes resulted in an overall increase in Agricultural Tilling and Livestock emissions of 67% for the 2008 NEI.
8. Fugitive and Road Dust Fines and CM emission differences are primarily due to NEI changes. Calculation methodology changes resulted in an overall increase in Paved Road Dust emission of 128% for the 2008 NEI.

[4] EPA. 2012. 2008 National Emissions Inventory v. 2 Technical Support Document. http://www.epa.gov/ttn/chief/net/2008neiv2/2008_neiv2_tsd_draft.pdf

[5] ibid

9. Windblown Dust Fines and CM emission differences are primarily due to the WRAP windblown dust (WBD) Model enhancing meteorological inputs and model resolution between the 2002 and 2008 emissions calculations. Appendix A gives a more complete overview of how Windblown Dust emissions were partitioned into natural and anthropogenic sources. 2002 windblown emissions were not partitioned into natural and anthropogenic sources and are thus presented only as natural emissions above.

8.9 Regional Inventory Trends

As described in Section 8.8, most of the differences in emissions inventories can be attributed to changes in input data origination or calculation methodologies for emission estimations by sector. These inventories were estimated as part of the WRAP WESTJUMP project, which created statewide inventories for all of the western U.S. States. All of these inventories were estimated using similar methodologies, therefore it is reasonable to assert that the qualifying statements in Section 8.8 would hold true for all of the compiled emission inventories.

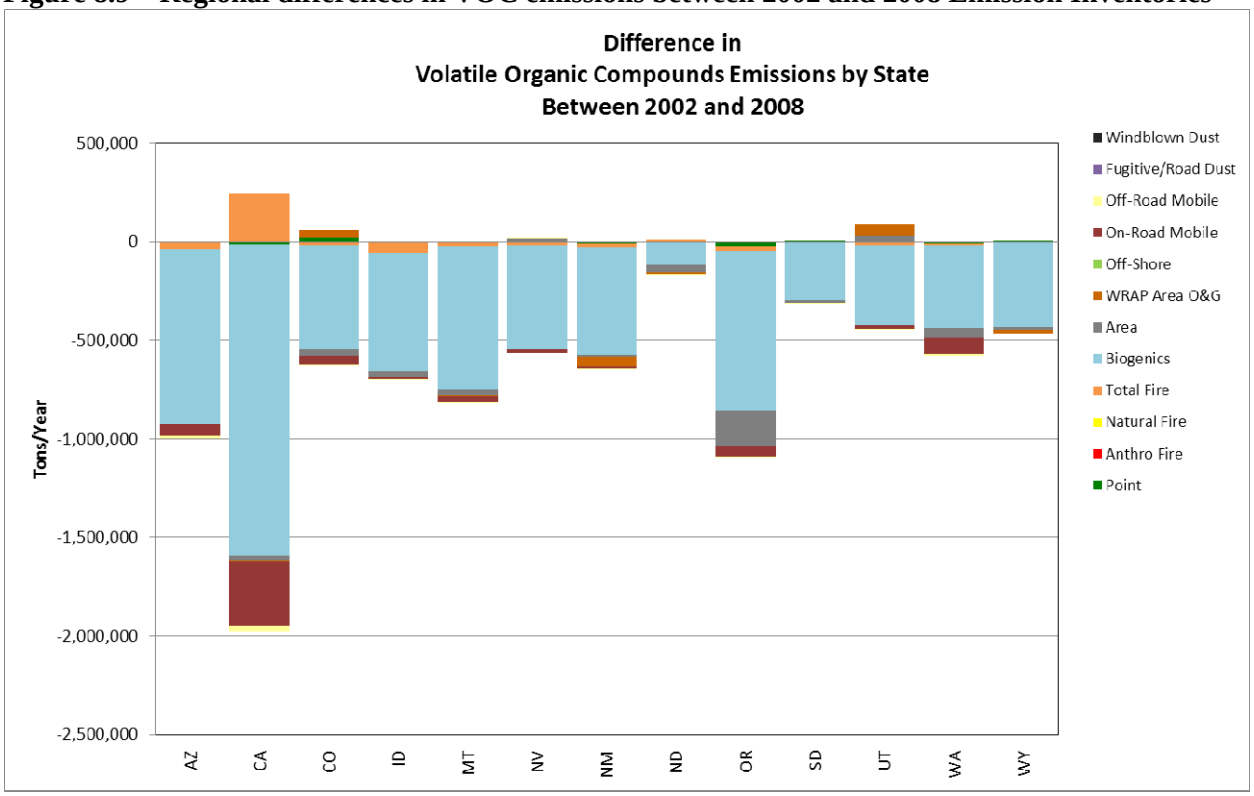
This section presents information and figures developed by WRAP and ARS showing differences in the 2002 and 2008 emission inventories by state for three pollutants to determine if the qualifiers hold true. The graphs split state emissions into source categories to identify trends for the calculated or reported sources.

Figure 8.9 shows VOC emissions by state in the Western U.S. and illustrates qualifiers #2 and #4 from Section 8.8.2. The trend of decreasing biogenic emissions for each state supports qualifier #2 and shows that differences in biogenic VOC emissions are primarily due to improvement in calculation methodology.

This figure also shows the large decreases in on-road mobile emissions for each state (Figure 8.9). While EPA reports a decrease of national VMT by 0.8% for 2005-2008[6], it is unlikely that this small decrease in VMT would be seen in every state. Arizona showed a 21.2% population increase between 2002 and 2008, which would likely result in a substantial VMT increase. Therefore, it is reasonable to believe that VOC decreases are likely due to a switch from the MOBILE6 model to the MOVES model (Section 8.8.2, #4).

[6] EPA. 2012. 2008 National Emissions Inventory v. 2 Technical Support Document. http://www.epa.gov/ttn/chief/net/2008neiv2/2008_neiv2_tsd_draft.pdf

Figure 8.9 – Regional differences in VOC emissions between 2002 and 2008 Emission Inventories



Coarse mass emissions for states in the western U.S. are shown in Figure 8.10 and illustrates trends on a regional basis. Emissions of coarse mass are due to physical disturbance of an area of land by anthropogenic activities (e.g. construction, driving on unpaved roadways, etc), natural activities (e.g. animal movement or burrowing), or a mixture of the natural and anthropogenic activities (e.g. wind suspension of dust from a cleared area). Activities that create the emissions may vary and change the magnitude of emissions created are primarily dependant on the local environment. Meteorology, soil characteristics, and vegetation coverage also play a large role in the magnitude of emissions produced from a certain area. Therefore, it is important to group the States which have a similar local environment. Arizona, South-eastern California, Nevada, New Mexico, and Utah comprise the southwestern U.S. which is characterized by its arid nature, in turn leading to sparse vegetation coverage. Figure 8.2 shows that local environmental factors play a large role in how windblown dust emissions differed between the 2002 and 2008 EIs.

Arizona, South-eastern California, Nevada, New Mexico, and Utah exhibit similar emission differences for windblown dust, fugitive dust, and road dust. Windblown dust emissions from the southwestern U.S. states are likely to be more affected by WRAP WBD model resolution increases and the decreased precipitation, as reported in Table 1 of the enclosed TSD, than surrounding states due to higher local wind speeds increasing dust suspension into the atmosphere from dry, unvegetated soils.

Emissions in road dust are likely responsible for the emission changes seen in the fugitive and road dust category. The 2008 NEI reports that road dust emissions increased by 128% over the 2005 NEI. Since the 2008 NEI version 1.5 was used for this source category, it is believed that this is the reason for the difference between 2002 and 2008 emissions for the combined categories of fugitive and road dust. Furthermore, the aridity of the southwestern U.S. likely result in road dust calculation disparities being maximized in this region, as compared to other regions of the U.S.

Fines (Figure 8.11) show similar regional trends as coarse mass for windblown dust and fugitive/road dust for the arid southwestern U.S. This supports the theory that particulate matter emission differences are partially due to changes in calculation methodology. This does not prove qualifying statement #7 (Section 8.8.2); however, the lack of a regional trend helps support the assertion that PM fine does not originate from point sources.

Figure 8.10 – Regional differences in Coarse Mass emissions between 2002 and 2008 Emission Inventories

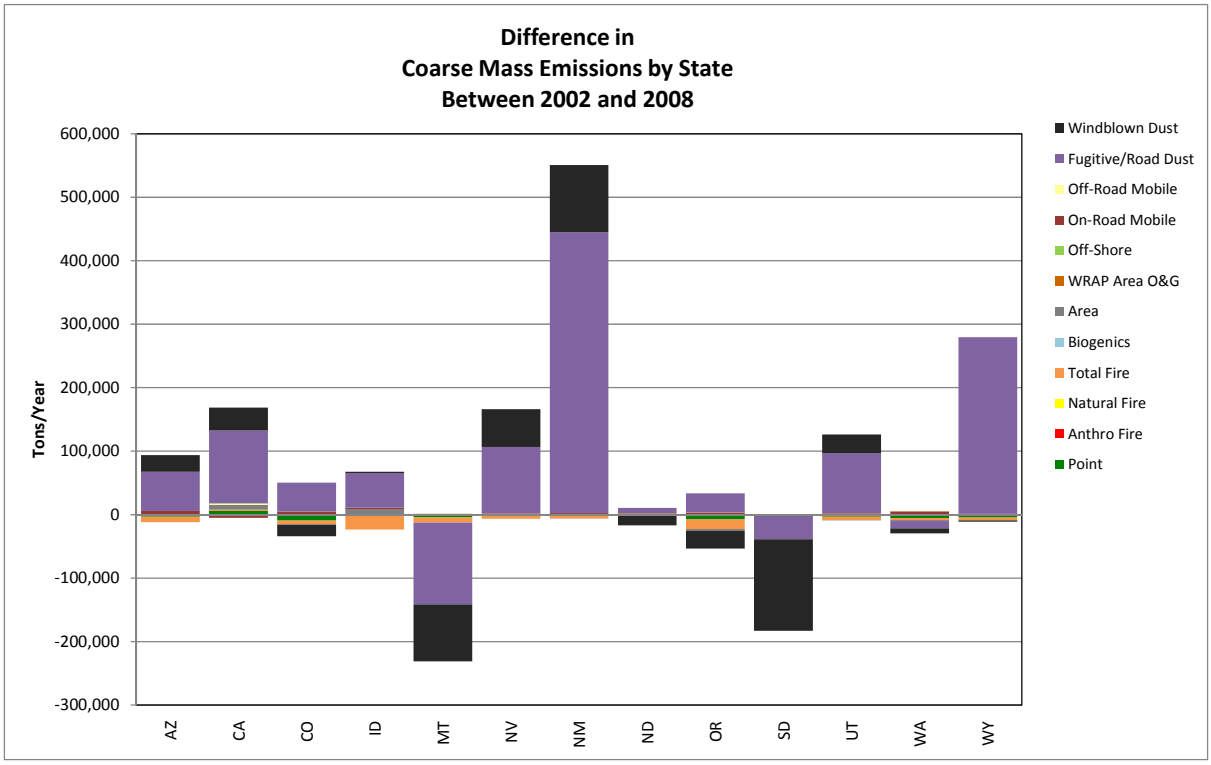
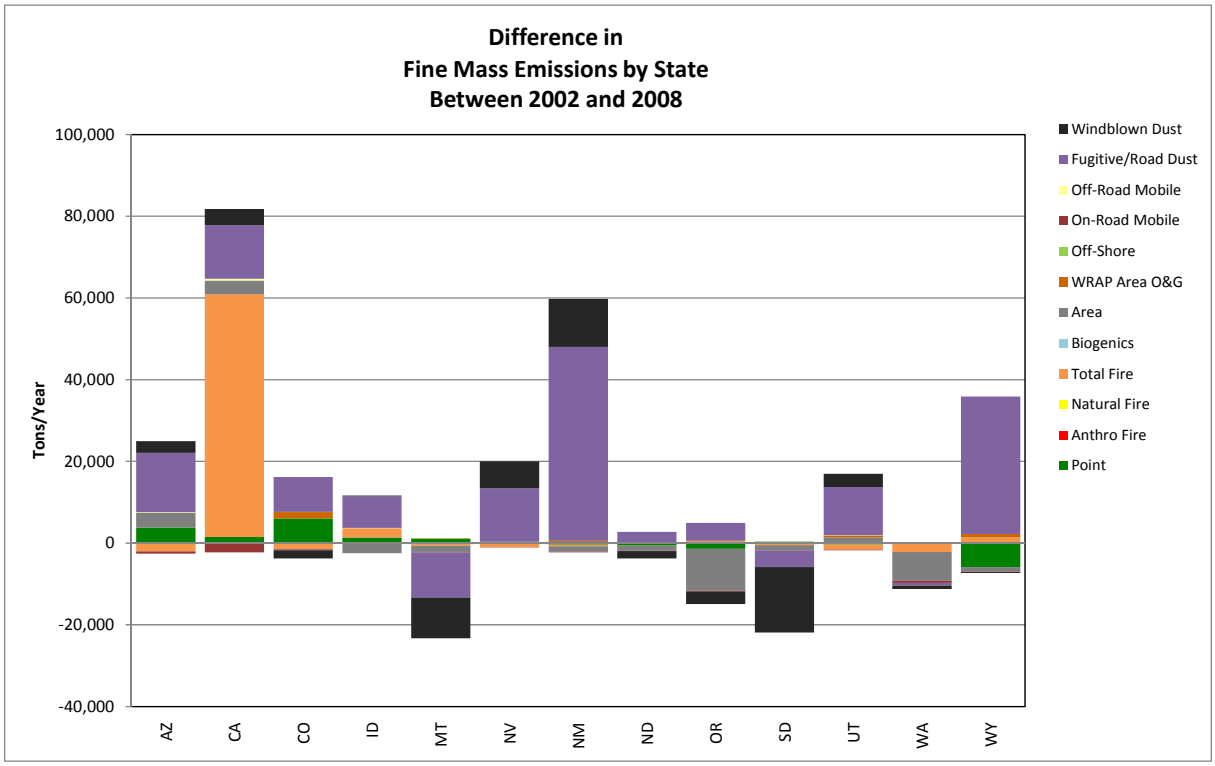


Figure 8.11 – Regional differences in Fine Mass emissions between 2002 and 2008 Emission Inventories



CHAPTER 10

BEST AVAILABLE RETROFIT TECHNOLOGY EVALUATION

ADEQ has revised and is formally superseding Chapter 10, Sections 10.4, 10.7, and 10.8. ADEQ is not revising/superseding sections addressed in EPA's NFRM from December 5, 2012 (77 FR 72511).

10.1 Background and History

Title 40 CFR §§ 51.300 through 309 (the "regional haze rules") implement §§ 169A and 169B of the Clean Air Act and require States to submit state implementation plans (SIPs) to address regional haze visibility impairment in the 156 Class I areas. These SIPs are intended to be the first in a series of actions that will become long term regional haze strategies to demonstrate reasonable further progress toward the goal that Congress set. One of the tools provided to the States to address reasonable further progress is called Best Available Retrofit Technology (BART).

The BART process consists of three steps: 1) determining BART eligibility; 2) determining if a source is "subject to BART" by conducting modeling of Class I visibility impacts; and 3) conducting an analysis of BART controls (retrofitting) for those sources subject to BART that contribute to regional haze.

The regional haze rules use the term "BART-eligible source" to describe the sources that are potentially subject to this program. BART-eligible sources are those sources that have the potential to emit 250 tons or more of a visibility-impairing air pollutant; were constructed between August 7, 1962 and August 7, 1977, and whose operations fall within one or more of the 26 specifically listed source categories. Once a facility has been determined to be BART-eligible, air dispersion modeling tools are used to determine if that facility causes or contributes to regional haze. If a state determines that the facility "emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area," then the facility is deemed to be subject-to-BART. The visibility impairing pollutants addressed by facilities subject-to-BART include emissions of oxides of nitrogen (NO_X), sulfur dioxide (SO_2) and particulate matter (PM). The term "particulate matter" includes particles with an aerodynamic diameter that is less than 10 microns (μm), and particles with an aerodynamic diameter that is less than 2.5 μm.

There have been several challenges to the provisions of the Regional Haze Rule and the methodologies prescribed or accepted by EPA. In 1999, EPA explained in its preamble to the rules that the BART requirements demonstrated Congress' intent to focus attention directly on the problem of pollution from a specific set of sources which, as determined by a State, emit any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in a Class I area.

Specifically, EPA concluded that if a potentially-subject-to-BART source was located within an area upwind from a downwind Class I area, that source "may reasonably be anticipated to cause or contribute" to visibility impairment in the Class I area. The regional haze rules address visibility impairment resulting from emissions from a multitude of sources that are located across a wide geographic area. The problem of regional haze is caused in large part by the long-range transport of emissions from multiple sources. Therefore, EPA had also concluded that when weighing the factors set forth in the statute for determining BART, a state should consider the collective impact of BART sources on visibility. In particular, when considering the degree of visibility improvement that could reasonably be anticipated to result from the use air pollution control technology, EPA explained that the state should consider the degree of improvement in visibility that would result from the cumulative impact of applying controls to

all sources subject-to-BART. EPA then proposed that the states should use this analysis to determine the appropriate BART emission limitations for specific sources.

In American Corn Growers v. EPA, in addition to other challenges to the rules, industry petitioners challenged EPA's interpretations that any source with any potential impacts in any Class I area should be subject-to-BART, and that BART should be applied after considering the collective impacts of BART sources on Class I areas. In 2002, the court concluded that the BART provisions in the 1999 regional haze rule were inconsistent with the provision in the Clean Air Act, as the Act gave the "states broad authority over BART determinations." 291 F.3d at 8.

With respect to the test for determining whether a source is subject-to-BART, the court held that the method that EPA had prescribed for determining which eligible sources are subject-to-BART illegally constrained the authority Congress had conferred to the States. Although the court did not decide whether EPA's proposed general collective contribution approach to determining BART was inconsistent with the Clean Air Act, the court did state that "[i]f the [regional haze rule] contained some kind of a mechanism by which a state could exempt a BART-eligible source on the basis of an individual contribution determination, then perhaps the plain meaning of the Act would not be violated. But the [regional haze rule] contains no such mechanism." Id, at 12.

With respect to EPA's interpretation that the Clean Air Act required the States to consider the degree of improvement in visibility that would result from the cumulative impact of applying controls in determining BART, the court also found that EPA was inconsistent with the language of the Act. 291 F.3d at 8. Based on its review of the statute, the court concluded that the five statutory factors in section 169A(g)(2) "were meant to be considered together by the states." Id. At 8.

On July 6, 2005, EPA took action to address the court's vacatur of the requirement in the regional haze rule requiring States to assess visibility impacts on a cumulative basis in determining which sources are subject-to-BART. Because this requirement was found only in the preamble to the 1999 regional haze rule, EPA concluded that no changes to the regulations were required. Instead, this issue was ultimately addressed by the BART guidelines, which provided States with different techniques and methods for determining which BART-eligible sources "may reasonably be anticipated to cause or contribute to any impairment of visibility in any mandatory Class I Federal area."

The July 6, 2005, amendments to the rules also required states to consider the degree of visibility improvement resulting from a source's installation and operation of retrofit technology, along with the other statutory factors set out in Clean Air Act § 169A(g)(2), when making a BART determination. This was accomplished by listing the visibility improvement factor with the other statutory BART determination factors in 40 CFR 51.308(e)(91)(A), so that states are now required to consider all five factors, including visibility impacts, on an individual source basis when making each source's BART determination.

10.2 BART Eligibility Determination

On June 15, 2005, EPA published final regulatory text and guidelines for implementing BART, including methodologies that are to be used to establish whether or not emissions units at a facility are truly BART-eligible. According to the language of the guidelines, there are three steps for determining which emissions units at a facility are considered to be BART-eligible. Those three steps are summarized as follows:

Step 1: Determine whether the plant contain emissions units in one or more of the 26 source categories:
a. If no, then emissions units are not BART-eligible.
b. If yes, proceed to Step 2.

Step 2: Identify the start-up dates of emissions units identified in Step 1. Determine whether the emissions units had begun operation after August 7, 1962 and were in existence on August 7, 1977:
a. If no, then emissions units are not BART-eligible.
b. If yes, proceed to Step 3.

Step 3: Compare the potential emissions from all emissions units identified in Steps 1 and 2. Determine whether the combined potential emissions of visibility impairing pollutants from these emissions units are greater than 250 tons per year:
a. If no, then emissions units are not BART-eligible.
b. If yes, then emissions units are BART-eligible.

10.3 Potentially Subject-to-BART

After determining BART-eligibility, a state must then determine whether the air pollution emission unit is "potentially-subject-to-BART". EPA finalized several options that allowed states flexibility when making the determination of whether a source "emits any pollutants which may reasonably be anticipated to cause or contribute to any visibility impairment."

Option 1: All BART-eligible sources are Subject-to-BART

EPA provided states with the discretion to consider all BART-eligible sources within a state to be "reasonably anticipated to cause or contribute" to some degree of visibility impairment in a Class I area. EPA held that this option is consistent with the American Corn Growers court's decision, as it would be an impermissible constraint of State authority for the EPA to force states to conduct individualized analyses in order to determine that a BART eligible source "emits any air pollutant which may reasonably anticipated to cause or contribute to any impairment of visibility in any [Class I] area."

Option 2: All BART-Eligible Sources Do Not Cause or Contribute to Regional Haze

EPA also provided states with the option of performing an analysis to show that the full group of BART-eligible sources in a state may not, as a whole, be reasonably anticipated to cause or contribute to any visibility impairment in Class I areas. Although the option was provided, EPA did also state that it anticipated that in most, if not all, states BART-eligible-sources are likely to cause or contribute to some level of visibility impairment in at least one Class I area.

Option 3: Case-by-Case BART Analysis

The final option that was provided to states was to consider the individual contributions of a BART-eligible source to determine whether the facility is subject-to-BART. Specifically, EPA allowed states to choose to undertake an analysis of each BART-eligible source in a state in considering whether each such source "emit[s] any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any [Class I] area." Alternatively, states may choose to presume that all BART-eligible sources within a state meet this applicability test, but provide sources with the ability to demonstrate on a case-by-case basis that this is not the case.

When considering the options provided by EPA, ADEQ determined that the third option is the most consistent with the American Corn Growers case, as this option provides a rebuttable method for the evaluation of the visibility impact from a single source. If the air dispersion modeling analysis shows that a facility causes or contributes to Regional Haze, then it is required to address BART. A state is also provided with flexibility under this option, as it may exempt from BART any source that is not reasonably anticipated to cause or contribute to visibility degradation in a Class I area.

Appendix H of the April 4, 2005, draft Stationary Sources Joint Forum (SSJF) report that identified potentially BART-eligible sources in the WRAP Region specifically recognized a list of sources under the jurisdiction of ADEQ, the Maricopa Air Quality Department (MCAQD), the Pima County Department of Environmental Quality (PDEQ) and the Pinal County Air Quality Control District (PCAQCD). Using this list as a basis, ADEQ concluded that 14 distinct sources comprised of 42 separate emissions units in Arizona were "potentially-BART-eligible". On June 9, 2006, ADEQ provided potential emissions information along with stack parameters for each potentially-BART-eligible facility to the WRAP's Regional Modeling Center, which performed a CALPUFF modeling analysis to determine the predicted visibility impairment apportioned to each facility.

On June 7, 2007, the WRAP's Regional Modeling Center provided ADEQ with the results of the CALPUFF modeling analysis. Based upon the CALPUFF modeling results, ADEQ determined that if a "potentially-BART-eligible" source's twenty-second highest (98th percentile) visibility impact across the three years of modeling was greater than 0.5 deciviews (dv) in any Class I area less than 300 kilometers away, the facility would be considered to contribute to impairment of visibility in that Class I area. Similarly, if the "potentially-BART-eligible" source's impact was found to be greater than 1.0 dv in any Class I area less than 300 kilometers away, the facility would be considered to cause impairment of visibility in that Class I area. In every case where a "potentially-BART-eligible" source was found to have emissions that contributed to, or caused, impairment of visibility in a Class I area, ADEQ determined that the facility was "potentially-subject-to-BART." In some cases where a facility's contributions to impairment of visibility in a Class I area were within 20% of 0.5 dv, ADEQ requested that the source provide further information demonstrating that the facility was not "potentially-subject-to-BART." As a result, eight BART-eligible facilities were determined to be potentially-subject-to-BART, and one facility was recommended for further evaluation.

On July 13, 2007, the eight sources that were potentially-subject-to-BART and the source that was recommended for further evaluation were provided with a set of three options: (i) demonstrate that the facility is not BART-eligible; (ii) demonstrate that while the facility is BART-eligible, it is not potentially-subject-to-BART as the facility does not cause or contribute to regional haze; or (iii) agree that the facility is potentially-subject-to-BART and conduct a BART analysis for the facility.

10.4 Subject-to-BART Determination

Once the "universe" of potentially-BART-eligible sources has been set, a state must make a determination about which of these sources are truly subject-to-BART. In order for a source to be subject-to-BART, a state must conclude that emissions of visibility impairing pollution from a BART-eligible source may reasonably be anticipated to cause or contribute to any visibility impairment in a mandatory Class I area.

ADEQ's process only resulted in the determination that certain facilities are potentially-subject-to-BART. The cause for this intermediate step was that ADEQ was unable to access emissions and stack parameter information that is recommended by the EPA BART guidelines for analyzing a facility. Instead, ADEQ relied on information that was publicly available through the Title V permit applications for each of the facilities. Each of the facilities found to be potentially-subject-to-BART was provided with the

opportunity to conduct a modeling analysis using emissions estimates that are reflective of steady-state operating conditions during periods of high capacity utilization. In other words, in accordance with the EPA July 6, 2005, BART guidelines, facilities were provided with the option of using of an emissions rate based on the maximum actual emissions over a 24-hour period for the most recent five year periods as an appropriate gauge of a source's potential impact. EPA explained that this would ensure that peak emission conditions are reflected, but would not overestimate a source's potential impact on any given day.

In its analysis of potentially BART-eligible sources, ADEQ identified one facility that appeared to be BART-eligible but deferred sending a letter to that facility, as representatives of the facility were already engaged in dialogue regarding the facility's BART eligibility. Ultimately, the facility chose to demonstrate that it was never BART-eligible.

Arizona Sources That Chose to Demonstrate "Not BART-Eligible":

- TEP Irvington Generating Station

Of the nine facilities that received ADEQ's July 13, 2007, letter, five facilities provided documentation that argued that while the facility was BART-eligible, it was not potentially-subject-to-BART. Those five facilities are as follows:

Arizona Sources That Chose to Demonstrate Not "Potentially-Subject-to-BART":

- Arizona Portland Cement Company
- APS West Phoenix
- ASARCO Hayden Smelter
- Chemical Lime Nelson Lime Plant
- Freeport McMoRan Miami Smelter

Of the facilities that received ADEQ's July 13, 2007, letter, four responded that the facilities were indeed subject-to-BART and provided a BART-analysis for the BART-eligible equipment. Those four facilities are as follows:

Arizona Sources that Agreed To Be Subject-to-BART:
Catalyst Paper (This facility has been permanently shutdown since September 2012. A BART analysis is not being conducted for the facility)

-
- AEPCO
- APS Cholla Power Plant
- SRP Coronado Generating Station

10.5 The BART Determination Process

Clean Air Act § 169A(g)(7) directs states to consider five factors in making BART determinations. The regional haze rule codified these factors in 40 CFR § 51.308(e)(1)(ii)(B), which directs states to identify the "best system of continuous emissions control technology" taking into account "the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use at the source, and the remaining useful life of the source."

The visibility BART regulations define BART as meaning "…an emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by … [a BART-eligible source]. The emission limitation must be

established on a case-by-case basis, taking into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control requirement in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology."

In its guidance, EPA was clear that each state must determine the appropriate level of BART control for each source that is determined to be subject-to-BART. In making a BART determination, a state must consider the following factors:

1. The costs of compliance;
2. The energy and non-air quality environmental impacts of compliance;
3. Any existing pollution control technology in use at the source;
4. The remaining useful life of the source; and
5. The degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

ADEQ concluded that the concept of BART is similar to the concept of Best Available Control Technology (BACT). Both control technology requirements are based upon similar concepts, including the fact that both are conducted on a case-by-case basis, and both may constitute the application of production processes or available methods, systems and techniques to reduce air pollution emissions. The most significant difference between the two appears to be that BART must accommodate issues associated with retrofitting existing equipment with new air pollution controls that were not included in the initial design of the facility. Since the concepts between the two technology requirements are reasonably similar, ADEQ has determined that it is reasonable method for conducting a BART analysis is following the BACT methodology, taking specific care to address all five of the BART factors.

The framework that ADEQ used for making a BART analysis will follow a similar format, and comprises the following seven key steps:

1. Identify the existing control technologies in use at the source (BART factor 3);
2. Identify all available retrofit control technologies with practical potential for application to the specific emission unit for the regulated pollutant under evaluation;
3. Eliminate all technically infeasible control technologies;
4. Evaluate control effectiveness of remaining technologies;
5. Evaluate energy and non-air quality environmental impacts and document results (BART factors 1, 2 and 4); and
6. Evaluate visibility impacts (BART factor 5).
7. Select BART

Materials considered by the applicant and by ADEQ in identifying and evaluating available control options include the following:

- Entries in the RACT/BACT/LAER Clearinghouse (RBLC) maintained by EPA, is the most comprehensive and up-to-date listing of control technology determinations available;
- Information provided by pollution control equipment vendors;
- Information provided by industry representatives; and
- Information provided by other Regional Planning Organizations and state permitting authorities.

10.5.1 Summary of Arizona's Seven-Step Process

Step 1: Identify the Existing Control Technologies in Use at the Source

This step is in addition to the five steps that are recommended in EPA's BART guidelines (40 CFR Part 51, Appendix Y). Of the four facilities that have agreed that they are "potentially-subject-to-BART", two are already in a process of designing or installing new air pollution control devices on emissions units that are "potentially-subject-to-BART". Since the installation of these controls was not required by BART, ADEQ determined that it was appropriate to include a step that described the existing control technologies that provide the baseline against which BART will be judged.

Step 2: Identify All Available Retrofit Control Options

This step is functionally equivalent to Step 1 in EPA's BART guidelines.

At the outset of any BART analysis, EPA's guidelines suggest that states should consider all control options that have potential application to the emissions unit, regardless of technical feasibility. This includes having an understanding of other required controls, including those technologies that are required under BACT or Lowest Achievable Emissions Rate (LAER) determinations, pollution prevention practices, the use of other add-on controls, and upgrades to existing air pollution controls that are already in place. As with BACT and LAER determinations, control alternatives can also take into account technology transfer of controls that have been applied to similar source categories. Unlike some permitting authorities' BACT and LAER procedures, however, BART does not contain a requirement to redesign the source when considering available control alternatives. For example, an existing pulverized-coal-fired electricity generating facility should not be required to consider integrated gasification coal combustion during the BART process, as BART focuses on technologies that can be retrofitted to the existing equipment.

In BACT and LAER determinations, any New Source Performance Standard (NSPS) or National Emissions Standard for Hazardous Air Pollutants (NESHAP) that exists for a source category is considered to the "floor" level of control, meaning that any proposed emission rate or control technology that is less stringent than the NSPS or NESHAP is not acceptable. Because BART involves retrofitting technology to existing emissions units that are not undergoing a major modification, it is possible, albeit unlikely, that an NSPS or NESHAP for a source category might not be the "floor" control for BART. Regardless, where a NSPS or NESHAP exists for a source category, EPA has directed States to include a level of control equivalent to the NSPS or NESHAP as one of the control options to be considered.

For some emissions units that are subject-to-BART controls, the actual control measures or devices that comprise BART may already be in place. In such instances, the BART analysis should consider improvements to the existing controls or emissions limitations for those emissions units, and should not be limited to consideration of only the control devices themselves.

Finally, in some cases, if a state determines that a BART source already has controls in place which are the most stringent controls available, then it may not be necessary to comprehensively complete each following step of the BART analysis. EPA's guidance states that as long as the most stringent controls are made federally enforceable for the purposes of implementing BART for that source, a state may skip the remaining analyses, including the visibility analyses. Likewise, if a source commits to the most stringent level of BART control at the outset, then EPA's guidance suggests that there is no need to complete the remaining steps of the BART process.

Step 3: Eliminate All Technically Infeasible Control Options

This step is functionally equivalent to Step 2 in EPA's BART guidelines. In this step, states are to evaluate the technical feasibility of the control options that were identified in Step 1. EPA's guidance generally considers a control option to be technically feasible if the controls have either: (1) been installed and operated successfully under similar conditions for the type of source under review, or (2) are available and could be applicable to the source under review. EPA's guidance states that a technology should be considered to be available if the source owner may obtain the control device through commercial channels, or the control is otherwise available within the common sense meaning of the term. Similarly, EPA considers an available control technology to be "applicable" if the control can be reasonably installed and operated on the source type that is under review. If a technology is considered to be both available and applicable, a state should consider the technology to be technically feasible.

If a technology is determined to be technically infeasible, then the state should provide documentation that demonstrates that the control is technically infeasible. EPA's guidance suggests that documentation that would be considered acceptable includes an explanation, based on physical, chemical, or engineering principles, as to why the control is technically infeasible and a discussion regarding why technical difficulties would preclude the successful use of the control option on the emissions unit under review.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

This step is functionally equivalent to Step 3 in EPA's BART guidelines. EPA's guidelines state that there are two key issues that must be addressed in this step:

(1) States should ensure that the degree of control is expressed using a metric that ensures an "apples to apples" comparison of emissions performance levels among the options; and
(2) States should give appropriate treatment and consideration of control techniques that can operate over a wide range of emission performance levels.

When choosing an appropriate metric, EPA recommends selecting a metric that properly allows for the comparison of an inherently lower polluting process with a process that can only be addressed through the application of additional pollution controls. As a result, EPA has suggested that it is generally most effective to express emissions performance as an average steady state emissions level per unit of product produced or processed (i.e., pounds per million BTU, or pounds per ton of cement produced).

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

This step is functionally equivalent to Step 4 in EPA's BART guidelines. After identifying the available and technically feasible control technology options, states are expected to analyze the following when making a BART determination:

- Costs of Compliance
- Energy Impacts
- Non-air Quality Environmental Impacts
- Remaining Useful Life

Each state is responsible for presenting an evaluation of each impact along with appropriate supporting information. States should discuss and, where possible, quantify both beneficial and adverse impacts. In general, the analysis should focus on the direct impact of the control alternatives.

Costs of Compliance

In the regional haze rules and its BART guidance document, EPA has stated that states have flexibility in how costs are calculated. EPA has expressed its position that the Control Cost Manual provides a good reference tool for cost calculations, but also provided some flexibility in this matter. If there are elements or sources that are not addressed by the Control Cost Manual, or if there are additional cost methods that were not considered in the BART guidance document, EPA determined that these methods could serve as useful supplemental information.

EPA's guidance also explains that states should consider both the average and incremental annualized costs of a control, as both provide information that is helpful when making a control determination. EPA took great care to explain, however, that these kinds of calculations can be misused, and that both numbers should be reviewed carefully.

In its guidance, EPA provided an example where a state may be faced with choosing between two available control options. The first control option (Option A) achieves a good level of control for a reasonable cost. The second control (Option B) achieves a slightly greater emissions reduction at a significantly increased cost. In this scenario, EPA explained that if only the average costs for Options A and B were considered, the overall costs associated with Options and B would be considered reasonable. EPA stated that while this may seem sufficient, a state should continue to look at the cost associated with a small increase in pollution control for a significantly greater price. EPA called this cost the "incremental cost" and explained that it can be determined through the following equation:

$$\frac{[CostOptionA - CostOptionB]}{[TotalAnnualEmissionsOptionA - TotalAnnualEmissionsOptionB]}$$

EPA explained that by considering this incremental cost, a state may determine that the incremental cost per unit of pollution removed that is associated with Option B may be greater than the benefit of requiring the control. As a result, even though the average cost associated with both controls might be reasonable, the incremental cost may make one option more desirable than the other.

As stated earlier, ADEQ sees the BART determination process as being substantially similar to the BACT processes. While BACT has components that address visibility, the principal cost decisions are generally charged only to the pollutant that is being reduced. Visibility impacts, on the other hand, are quantified and considered as an environmental impact, rather than an economic impact. As a result, the most useful cost metric for comparing control technologies under BACT and LAER ends up being dollars-per-ton-of-pollutant-removed (dollars per ton).

Although the BART determination process is substantially similar to methodologies that are used to establish BACT and LAER, the entire purpose behind BART is to support Congress' goal of reducing visibility impairment in Class I areas. In addition, BART differs from BACT and LAER in that the environmental impacts of the selected control can only address issues that are not related to air quality. As a result, ADEQ has determined that in addition to a dollar per ton metric, the BART determination process should also provide lesser consideration to a dollar-per-deciview-improvement metric.

Energy Impacts

In its guidance, EPA suggests that states should also examine the energy requirements of the control technology to determine whether the use of that technology will result in energy penalties or benefits. For instance, if a control technology is required to remediate an emissions stream that is rich in volatile

organic compounds, a facility might benefit by using this combustion process to reduce energy costs. Conversely, a facility that installs a wet scrubber may suffer an energy penalty due to the increased power necessary to overcome the increased air flow resistance through the scrubber.

It should be noted that unless there is ample justification, only direct energy benefits or penalties should be considered in this analysis. Indirect energy costs should not be considered unless there is something unusual or significant enough to warrant further consideration. It is appropriate for energy impact analyses to consider the local availability (or scarcity) of specific fuels, as well as the potential differences between locally or regionally available coals.

It is also important to note that adverse energy impacts are not enough, in and of themselves, to disqualify a technology from consideration. If such penalties or benefits exist, however, it is appropriate to document these and include them in this section so that the results of all of the analyses required in this Step can be considered as a whole.

Non-Air Quality Environmental Impacts

This portion of the analysis is to focus on impacts to environmental media other than air quality. Examples of common environmental impacts include hazardous waste generation, hazardous waste discharges, and discharges of polluted water from a control device.

All non-air quality environmental impacts should be reviewed using site-specific circumstances when possible. Should a state propose to adopt the most stringent BART option then it is not necessary to perform this analysis of environmental impacts for the entire list of technologies that were ranked in the previous Step. In general, the analysis only needs to address those control alternatives with any significant or unusual environmental impacts that have the potential to affect the selection of a control alternative, or to eliminate a more stringent control technology.

In general, states should identify and document any direct or indirect, significant or unusual environmental impacts that are associated with a specific control alternative. For example, a wet scrubber will release effluent that has the potential to affect water or land use. Other examples might include disposal of spent catalyst, or contaminated carbon from a filtration device. Such types of environmental impacts could become even more important with the potential for sensitive site-specific receptors, or when comparing control technologies that have similar or marginal air quality improvements but result in substantial environmental impacts.

Remaining Useful Life

The remaining useful life of a source should be considered in the evaluation of the different controls, as it has the potential to impact the overall cost analysis. If the remaining useful life represents a relatively short period of time, then the annualized costs associated with the application of a control technology will increase significantly. EPA explained in its guidelines that the remaining useful life is the difference between the date that controls will be put into place and the date that the facility permanently stops operations.

If the remaining useful life of the facility affects the BART determination, then this date should be placed into a federally or state-enforceable restriction that prevent further operation of that facility after that date. If a source wants to have the flexibility to continue operating after the date upon which operations are expected to cease, then the BART analysis may account for the option, but it must maintain consistency with the statutory requirement to install BART within 5 years. In addition, if the remaining useful life changes the BART decision as a result of adverse cost impacts, then the BART determination should

identify the more stringent level of control that would be required as BART if there was no assumption that reduced the remaining useful life of the facility.

Step 6: Evaluate Visibility Impacts

This step is functionally equivalent to Step 5 in EPA's BART guidelines. Once a state has determined that its source or sources are subject-to-BART, a visibility improvement determination for the source(s) must be conducted as part of the BART determination. States have the flexibility in setting absolute thresholds, target levels of improvement, or de minimis levels for visibility improvement since the deciview improvement must be weighed among the five factors. States are also free to determine the weight and significance to be assigned to each factor. For example, a 0.3 dv improvement may merit a stronger weighting in one case versus another. As a result, EPA does not recommend a "bright line" analysis to be used across all facilities that are subject-to-BART.

EPA's guidelines recommend the use of CALPUFF or another appropriate dispersion model to determine the visibility improvement expected at a Class I area from the potential BART control technology applied to the source. Modeling should be conducted for NOx emissions, direct PM emissions (PM2.5 or PM10), and SO2 emissions. If the source is making the visibility determination, States should review and approve or disapprove the source's analysis before making the expected improvement determination.

Arizona instituted a portion of this process by asking sources for a modeling protocol for each of the BART analyses that were submitted. Each source was then asked to run its model at pre-control and post-control emission rates using the accepted methodology in the protocol. Sources used the 24-hour average actual emissions rate from the highest emitting day of the meteorological period modeled, and calculated the model results for each receptor as the change in deciviews compared against natural visibility conditions. Post-control emissions rates were then calculated as a percentage of pre-control emissions rates.

Step 7: Select BART

This step is in addition to the five steps that are recommended in EPA's BART guidelines. States have discretion to determine the order in which they should evaluate control options for BART. EPA's guidance states that whatever the order, states should always address the five factors. In addition, states should provide a justification for whatever control option is selected. ADEQ has determined that the contents of the TSD will provide the necessary explanations.

10.6 Arizona Sources that Chose to Demonstrate "Not BART-Eligible"

<u>TEP – Irvington Generating Station</u>

On June 9, 2006, ADEQ sent a letter to the Western Regional Air Partnership's (WRAP's) Regional Modeling Center (RMC) requesting assistance in performing a CALPUFF modeling analysis for all BART-eligible sources. In the letter and supporting attachments, ADEQ identified Steam Unit I4 at Tucson Electric Power Company's (TEP's) Irvington Generating Station as potentially-BART-eligible emissions unit. The attachment to the letter went on to describe Unit I3 as also potentially-BART-eligible, as the emissions unit appeared to have been in existence in 1961, and the "in-service" date for the unit was not well documented in the files that ADEQ had reviewed.

On January 2, 2007, TEP submitted a letter to ADEQ providing information about the BART-eligibility of both Units I3 and I4. The letter explained that the issues to which it was specifically responding were:

- For Unit I3 – the date the unit began "operation"; and
- For Unit I4 – whether the coal conversion project effectively moved its "in existence" date to later than August 7, 1977.

Regarding Unit I3, TEP noted that in order for an emissions unit to be considered BART-eligible, the unit had to be "in existence" on August 7, 1977, but not "in operation" before August 7, 1962. According to the letter, Unit I3 commenced commercial operation on June 26, 1962. As documentation, TEP provided a work log from June 29, 1962, which indicates that "…Unit [I3] was placed in commercial operation on Tuesday, June 26, 1962." After reviewing this documentation, ADEQ agrees that Unit I3 was "in operation" prior to August 7, 1962, and is, therefore, not BART-eligible.

Regarding Unit I4, TEP stated that during the 1980s, Unit I4 was converted to burn coal in accordance with a prohibition order that was issued pursuant to Section 301(c) of the Power Plant and Industrial Fuel Use Act of 1978. The Final Prohibition Order became effective on September 21, 1981, as noted in Federal Register Vol. 46, p. 37960. In its January 2, 2007, letter, TEP stated that compliance with the Final Prohibition Order required TEP to reconstruct Unit I4. According to 40 CFR 51.301, Reconstruction is defined as follows:

Reconstruction will be presumed to have taken place where the fixed capital cost of the new component exceeds 50 percent of the fixed capital cost of a comparable entirely new source. Any final decision as to whether reconstruction has occurred must be made in accordance with the provisions of § 60.15(f)(1) through (3) of this title.

TEP stated that because Unit I4 was reconstructed after August 7, 1977, the Unit was not "in existence" before August 7, 1977, and, therefore, must be considered "not BART-eligible".

In an electronic mail that was sent to a representative of TEP on May 15, 2007, ADEQ requested that TEP provide additional documentation that demonstrated that Unit I4 was reconstructed in the 1980s. On July 3, 2007, TEP submitted a supplemental letter to ADEQ, with the documentation that ADEQ had requested.

According to the July 3, 2007, the total cost for the Unit I4 coal conversion was reported in the 1987 FERC Form No. 1 to be approximately $125 million dollars, including the Unit I4 portion of the facilities that are shared by Units I3 and I4 (i.e., coal handling facility, water treatment, ash storage and disposal, etc.). In January of 1988, Unit I4 was sold in a leaseback arrangement for $152 million, which TEP argues approximates the fair market value for the Unit. TEP stated that because Unit I4 was essentially in new condition following the coal conversion, it is reasonable to conclude that the construction of a comparable new unit would not be significantly greater than $152 million. Based upon this information, TEP stated that the coal conversion cost was significantly greater than 50% of the fixed capital cost of a comparable, entirely new unit. As a result, TEP concluded that Unit I4 was reconstructed in the 1980s, effectively changing the "in existence" date to after August 7, 1977. As a result, TEP concluded that Unit I4 was "not BART-eligible".

After reviewing the information that was provided by TEP, including the relevant portions of the December 31, 1987, FERC Form No. 1 Annual Report of Major Electric Utilities, Licensees and Others, TEP's 1987 Annual Report, and a work sheet entitled "Estimated Cost of Irvington Unit 4 Coal Conversion", ADEQ concurs that the cost of modifying TEP Irvington's Unit I4 is greater than 50 percent of the fixed capital cost of a comparable, entirely new source, and that Unit I4 was reconstructed in the 1980s.

In Federal Register, Vol. 70, No. 128, Wednesday, July 6, 2005, pages 39110-39112, EPA discusses Step 2 in determining whether a facility is BART-eligible. According to the background statement in the guidance:

"Step 2 also addresses the treatment of 'reconstruction' and 'modifications.' Under the definition of BART-eligible facility, sources which were in operation before 1962 but reconstructed during the 1962 to 1977 time period are treated as new sources as of the time of reconstruction."

The footnote attached to this statement goes on to state:

"However, sources reconstructed after 1977, which reconstruction had gone through NSR/PSD permitting, are not BART-eligible."

At the time of TEP's 1987 reconstruction of Unit I4, reconstruction of most units at the Irvington Generating Station would have normally triggered the New Source Review (NSR) or Prevention of Significant Deterioration (PSD) permitting process. As TEP points out in its correspondence, however, TEP only commenced the reconstruction as a result of the an order that was issued pursuant to Section 301(c) of the Power Plant and Industrial Fuel Use Act of 1978. Arizona's PSD rule (Arizona Administrative Code, Title 9, Article 3, Rule 304 or A.A.C. R9-3-304) was approved into the State Implementation Plan in 1983. According to the PSD rule, all "major modifications" were required to obtain a PSD permit prior to construction and operation of the facility. The definitions that support this rule were found in A.A.C. R9-3-101. According to R9-3-101(91)[7] a major modification is defined as follows:

"Major modification" means any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under this Chapter.

a. …

b. For the purposes of this definition the following shall not be considered a physical change or change in the method of operation:

i. …

ii. Use of an alternative fuel or raw material by reason of an order under Sections 2 (a) and (b) of the Energy Supply and Environmental Coordination Act of 1974 (or any superseding legislation) or by reason of a natural gas curtailment plan pursuant to the Federal Power Act;

iii. …

iv. …

v. …

vi. …

vii. …"

Pursuant to A.A.C. R9-3-101(90)(b)(ii), TEP's reconstruction of Unit I4 did not constitute a major modification at the time that the reconstruction occurred, and therefore Arizona's PSD rule did not apply. TEP's January 2, 2007, letter states that "TEP believes that PSD is immaterial to BART eligibility, as Reconstruction under the RHR makes no mention of PSD or any of its provisions. In fact, no where in its rules[footnote omitted] governing BART eligibility, does it state that being subject to PSD is a condition of Reconstruction under the RHR."

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7 http://yosemite.epa.gov/R9/r9sips.nsf/AgencyProvision/ABAB0C337F5775248825698C0064E741/$file/az+deq+r9-3-101.pdf?OpenElement

ADEQ has reviewed 40 CFR Part 51 Appendix Y, Section II.A.2 and has determined that EPA has addressed this issue:

"What is a 'reconstructed source?"

1. Under a number of CAA programs, an existing source which is completely or substantially rebuilt is treated as a new source. Such 'reconstructed' sources are treated as new sources as of the time of the reconstruction. Consistent with this overall approach to reconstruction, the definition of BART-eligible facility (reflected in detail in the definition of 'existing stationary facility') includes consideration of sources that were in operation before August 7, 1962, but were reconstructed during the August 7, 1962 to August 7, 1977 time period.
2. …
3. …
4. The 'in-operation' and 'in existence' tests apply to reconstructed sources. If an emissions unit was reconstructed and began actual operation before August 7, 1962, it is not BART-eligible. Similarly, any emissions unit for which a reconstruction 'commenced' after August 7, 1977, is not BART-eligible." (emphasis added)

ADEQ has determined that EPA's guidance does not specifically address situations where a facility was reconstructed after August 7, 1977, but was exempted from PSD review at the time that reconstruction occurred. ADEQ concludes, however, that the plain reading of EPA's guidance is most appropriate, and has determined that it is appropriate to treat reconstructed sources as new sources as of the time of the reconstruction. As a result, ADEQ concurs that the reconstructed Unit I4 at TEP's Irvington Generating Station was not "in existence" prior to August 7, 1977. Therefore, ADEQ has determined that there are no BART-eligible emissions units at TEP's Irvington Generating Station.

10.7 Arizona Sources that Chose to Demonstrate Not "Potentially-Subject-to-BART"

Arizona Portland Cement Company

On June 13, 2007, ADEQ sent a letter to Arizona Portland Cement Company (APCC) indicating that Kiln 4 was "potentially-subject-to-BART" for NO_X and PM emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the February 28, 2002, Amended Application for a Class I Permit, the 2005 Significant Revision Application, and observations from performance testing results which indicated that Kiln 4 had the following potential NO_X and PM emissions:

Table 10.1 - Kiln 4 Emissions

Emissions Unit	NO_X emissions (lb/hr)	PM emissions (lb/hr)
Kiln 4	540.10	11.39

According to the letter, the WRAP's Regional Modeling Center conducted an air dispersion modeling analysis using CALPUFF which demonstrated that the maximum 98th percentile three-year average total impact from the facility was 0.40 dv. These visibility impacts were expected to occur in both the Saguaro National Monument and the Galiuro Wilderness area.

On September 10, 2007, APCC submitted a letter to ADEQ stating that it agreed that Kiln 4 was the only emissions unit that was in operation at the facility that was BART-eligible. The letter went on to state

that because the 98th percentile three-year average total impact from this emissions unit was 0.40 dv, concluded that Kiln 4 does not "cause" or "contribute to" visibility impairment in any Class I area.

When weighing APCC's response, ADEQ also gave consideration to additional extenuating circumstances regarding Kiln 4. In 1998, APCC obtained a significant permit revision from ADEQ, allowing the company to modify portions of Kiln 4 in an effort to increase the amount of clinker that the company could produce while taking limitations designed to ensure that there was not a significant net emissions increase as a result of the project. After completing Phase I of the changes to Kiln 4, APCC determined that it was not realizing the additional clinker production projected to occur as a result of the modification. In 2002 and 2003, APCC approached ADEQ with a new application for a permit revision, requesting the authority to construct a new Kiln 5 rather than finalizing the modifications to Kiln 4.

In 2003, during its review of a proposed Title V permit that would have provided APCC with the flexibility to choose between three operating scenarios, including the construction of Kiln 5, EPA identified an error in APCC's fugitive dust emissions calculations. According to EPA's calculations, the modifications that were completed in 1998 should have gone through New Source Review. As a result, EPA issued a Notice of Violation to APCC, alleging that the company avoided New Source Review when completing modifications to Kiln 4 in 1998. EPA also objected to the issuance of the proposed Title V permit, but later lifted its objection after ADEQ removed the alternative operating scenarios that would have allowed for further modification of the facility. A consent decree is being finalized between APCC and EPA to resolve the issue.

In 2008, ADEQ issued a new permit to APCC which would have allowed the facility to stop operations at all four existing kilns and construct and operate a new Kiln 6. The 18 month construction window ended in June 2010 and APCC has since reapplied for a permit for the Kiln 6 expansion.

Based upon the consideration of the history of this facility, and the maximum 98th percentile three-year average impact from all pollutants is less than 0.5. dv, ADEQ concurs that APCC is not subject-to-BART.

APS West Phoenix

On June 13, 2007, ADEQ sent a letter to the Arizona Power Service Company's West Phoenix Generating Station indicating that three emissions units, Combined Cycle Units 1 through 3, were "potentially-subject-to-BART" for NO_X emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the July 2000 Title V Operating Permit Application, and February 24, 2006 Significant Revision Application which showed that the facility had potential NO_X emissions as follows:

Table 10.2 – APS West Phoenix NO_X Emissions

Emissions Unit	NO_X emissions (lb/hr)	NO_X emissions (tons/year)
Combined Cycle Unit 1 (NG)[a]	255.80	1,120
Combined Cycle Unit 2 (NG)[a]	255.80	1,120
Combined Cycle Unit 3 (SR app)[c]	405.10	1,774
Combined Cycle Unit 1 (oil)[b]	763.00	3,342
Combined Cycle Unit 2 (oil)[b]	763.00	3,342
Combined Cycle Unit 3 (SR app)[c]	405.10	1,774

a. NG indicated potential emissions while burning natural gas.

Table 10.2 – APS West Phoenix NO_X Emissions		
Emissions Unit	**NO_X emissions (lb/hr)**	**NO_X emissions (tons/year)**

b. Oil indicates potential emissions while burning oil.

c. SR app means that the potential emission were to be limited as proposed in a significant permit revision application that was submitted on February 24, 2006.

On July 30, 2007, APS West Phoenix provided documentation to ADEQ demonstrating that the facility had accepted federally enforceable conditions in Maricopa County Air Quality Permit Number V95-006 that placed limits on emissions of air pollutants from the facility. Specifically, the permit states in Table 1 that the "Allowable Combined Emissions for CC3, CC4, CC5, the CC4 and CC5 Cooling Towers, and the Clayton Boiler Emissions Units" for NOx was 405.1 tons per year. The same permit also limits the short term NO_X emissions for Combined Cycle Unit 3 to no more than 34.3 pounds per hour.

On September 6, 2007, APS West Phoenix submitted a letter to ADEQ identifying errors in the underlying assumptions that were the basis of ADEQ's June 13, 2007, letter. Specifically, the facility identified the following issues:

- The data used as the pound per hour emission rate for Combined Cycle Unit 3 were actually tons per year emissions limitations for multiple emissions units, rather than a pound per hour emission rate for that same unit;
- Combined Cycle Unit 3 is equipped with a Selective Catalytic Reduction (SCR) unit;
- Combine Cycle Unit 3's stack height was assumed to be 54 feet, whereas the actual stack height for the unit is 82 feet; and
- The air dispersion modeling analysis used West Phoenix emissions rates associated with fuel oil combustion. MCAQD prohibits the combustion of fuel oil except during periods of natural gas curtailments, and should not have been considered as a normal operating scenario.

APS West Phoenix stated that it would fix each of these assumptions, and resubmit an air dispersion modeling analysis that was performed by the WRAP's Regional Modeling Center with the adjusted values.

On October 7, 2007, APS West Phoenix submitted a second letter to ADEQ. In that letter, APS West Phoenix explained that it agreed with ADEQ's assessment that the Combined Cycle Units CC1, CC2 and CC3 were BART-eligible. APS West Phoenix stated, however, that after correcting the air dispersion modeling analysis using the assumptions identified above, the 98th percentile visibility impacts that ADEQ had predicted in the Superstition Wilderness and the Mazatzal Wilderness areas dropped from 0.69 dv and 0.64 dv, to 0.24 dv and 0.31 dv respectively.

Based on the revised air dispersion modeling analysis that was submitted on October 7, 2007, APS West Phoenix stated that it did not cause or contribute to regional haze in a Class I area, and therefore was not subject-to-BART. Based upon its review of the information that has been submitted, and a review of the conditions in Maricopa County Air Quality Permit V95-006, ADEQ concurs that this facility is not subject-to-BART.

ASARCO Hayden Smelter

On June 13, 2007, ADEQ sent a letter to the ASARCO Hayden Smelter indicating that Converters 1 through 5, and Anode Furnaces 1 through 3 were "potentially-subject-to-BART" for SO_2 and PM

emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the 1994 Application for a Class I Permit which showed that the facility had potential SO2 and PM emissions as follows:

Table 10.3 – ADEQ Modeled Emissions for ASARCO Hayden		
Emissions Unit	**SO_2 emissions (lb/hr)**	**PM emissions (lb/hr)**
Acid Plant Main Stack (Converters 1-5, Anode Furnace 1-3)	114,000	115.83
Annulus Main Stack (bypass for main stack)	114,000	115.83
Flash Furnaces and Converter Fugitives	2,991	230.00

In Attachment 3 to the June 13, 2007, letter, ADEQ also identified the equipment that, according to Title V Permit 1000042, was potentially BART-eligible. That equipment included the following:

- Converters (5) – constructed in 1969
- Anode furnaces (1-3) – constructed in 1971

Finally, ADEQ's analysis revealed that in 2004, the actual emissions of PM_{10} from the facility was 157.3 tons per year. Because ADEQ was uncertain whether this number was representative of overall emissions of PM_{10} from the ASARCO Hayden Smelter through the years, the potential emission rate information for both SOx and PM was submitted to the WRAP's Regional Modeling Center. Based upon the information that ADEQ submitted, the WRAP's Regional Modeling Center provided ADEQ with the following modeled impacts:

Table 10.4 – WRAP Modeled Impact from ASARCO Hayden		
Class I Area	**98th % 3 Yr Avg. PM_{10} Impact (dv)**	**98th % 3 Yr Avg. SO_2 Impact (dv)**
Galiuro Wilderness	0.53	2.23
Superstition Wilderness	0.41	2.39
Sierra Ancha Wilderness	0.13	1.46
Saguaro NM	0.23	1.64
Mazatzal Wilderness	0.09	1.22
Mount Baldy Wilderness	0.04	0.76
Pine Mountain Wilderness	0.05	0.93
Chiricahua NM	0.13	1.39
Gila Wilderness	0.05	0.78
Petrified Forrest NP	0.04	0.78
Sycamore Canyon	0.03	0.70

As a result, ADEQ determined that the facility was BART-eligible for PM_{10} and SO_2 emissions.

On October 1, 2007, ASARCO LLC submitted a letter to ADEQ stating that the company has already installed BART-equivalent controls on the necessary emissions units, and that further control was not necessary.

In its review of ADEQ's analysis, ASARCO pointed out that errors were made in ADEQ's identification of the BART-eligible source. According to their own research, ASARCO determined that the BART-eligible emissions units at their facility were as follows:

- Converters (3)
  - Three converters were in operation prior to 1962;
  - One converter was enlarged from 13 x 32 feet to 13 x 35 feet in 1965
  - Converters #1 and #4 were added in 1968.
- Anode Furnaces #1 and #2 – Constructed in 1972
  - Anode Furnace #0 was constructed in 2001

As a result, ASARCO went on to state that it concluded that only two or three of the converters were considered to be BART-eligible. ASARCO stated that because the air dispersion modeling analysis was performed based upon the use of the potential to emit from the entire facility, the predicted impacts from the facility were overstated. Instead, ASARCO stated that the following emissions should have been modeled:

Table 10.5 – ASARCO Modeled Emissions for ASARCO Hayden

Unit	NO_x (tpy)	PM_{10} (tpy)	SO_2 (tpy)
Total for BART-eligible Emission Units	21.4[a] 23.3[b]	61.1[a] 70.0[b]	6,903[a] 10,337[b]

a. 2 converters
b. 3 converters

ASARCO stated that "[i]f [PM] emissions from the BART-eligible units alone are modeled the visibility impact would be below the 0.5 dv threshold. Therefore, BART determination is necessary only for SO_2."

ADEQ has reviewed its documentation, and ASARCO's arguments regarding BART eligibility, and ADEQ agrees with ASARCO's assessment of its BART-eligible emissions unit, with the clarification that the converter that was modified in 1965 is considered BART-eligible.

At the time that ADEQ was assessing BART eligibility, ADEQ based its analysis on the potential emissions from the entire facility, as it was not possible for ADEQ staff to apportion emissions to the specific emissions units based upon the information that had been submitted by ASARCO. As a result, ADEQ provided all of the potential PM and SO_2 emissions to the Regional Modeling Center, understanding that ASARCO would have the expertise necessary to apportion emissions to each emissions unit that was BART-eligible.

ASARCO's October 1, 2007, letter, however, lacked documentation that demonstrated how ASARCO apportioned the emissions to the BART-eligible equipment. ADEQ's analysis of the table only revealed that the apportionment of emissions to the emissions units is not linear, making it too difficult for ADEQ to replicate the submitted calculations. ADEQ, however, is in the process of reviewing ASARCO's application for renewing its existing Title V permit. As part of its review, ADEQ's staff has estimated the potential emissions from the emissions units at the facility. ADEQ's calculations reveal that the potential to emit PM_{10} from the entire primary copper smelter process is 213 tons per year. As noted above, only three converters and two anode furnaces are considered to be BART-eligible emissions units at the facility. Each of these emissions units is located within the primary copper smelting process. Since non-BART-eligible emissions units contribute to the total potential emissions of 213 tons per year, ADEQ concluded that the BART-eligible equipment at the ASARCO Hayden Primary Copper Smelter is not

capable of emitting more than 250 tons per year of PM10. As a result, ADEQ determined that the emissions units at the ASARCO smelter are not BART-eligible for PM10 emissions.

With respect to SO_2 emissions, ASARCO stated the following:

> "During the deliberations of the Market Trading forum [sic] of the Western Regional Air Partnership (WRAP), all parties involved including ADEQ and the U. S. Environmental Protection Agency (EPA), agreed that the controls and emissions limitation for primary copper smelters already met BART for SO_2."

ADEQ understands that there may have been, at one time, a general principle to which U.S. EPA, ADEQ, and perhaps other parties agreed regarding the controls and emissions limitation for primary copper smelters. According to ADEQ's interpretation of the Regional Haze Rules, and its application of EPA's BART guidelines, however, general principles are not enough to exempt a facility from a BART analysis. Instead, ADEQ has determined that it is necessary to evaluate ASARCO's facility for the potential applicability of BART.

In its letter to EPA dated March 6, 2013, ASARCO provided additional information regarding BART-eligibility for its converter units. ASARCO's review of its engineering and purchasing records has shown that Converter #2 was installed in the 1949/1950 timeframe and as such predates the BART-eligibility period. Consequently, Converter #2 will not be analyzed through the BART process.

Chemical Lime Company-Nelson Lime Plant

On June 13, 2007, ADEQ sent a letter to Chemical Lime Company's (CLC's) Nelson lime plant indicating that Kilns 1 and 2 were "potentially-subject-to-BART" for NOx and SO2 emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the November 30, 2001, Amended Application for a Class I permit, as well as air quality control permit number 36425 which showed that the facility had potential NOx and SO2 emissions as follows:

Table 10.6 – ADEQ Modeled Emissions for CLC Nelson

Emissions Unit	SO_2 emissions (lb/hr)	NO_X emissions (lb/hr)
Kiln 1	215.59	122.14
Kiln 2	484.27	182.78

Using these emissions rates, and modeling information about the facility from the sources identified above, the WRAP's Regional Modeling Center provided ADEQ with the following modeled impacts:

Table 10.7 – WRAP Modeled Impact from CLC Nelson

Class I Area	98th % 3 Yr Avg. NOx Impact (dv)	98th % 3 Yr Avg. SO2 Impact (dv)	98th % 3 Yr Avg. Total Impact (dv)
Grand Canyon NP	0.38	0.32	0.74
Sycamore Canyon WA	0.06	0.13	0.18
Zion NP	0.10	0.11	0.20
Pine Mountain Wilderness	0.03	0.08	0.10

Table 10.7 – WRAP Modeled Impact from CLC Nelson			
Class I Area	**98th % 3 Yr Avg. NOx Impact (dv)**	**98th % 3 Yr Avg. SO2 Impact (dv)**	**98th % 3 Yr Avg. Total Impact (dv)**
Mazatzal Wilderness	0.03	0.08	0.11
Bryce Canyon NP	0.05	0.07	0.11
Joshua Tree NM	0.03	0.12	0.14
Sierra Ancha Wilderness	0.02	0.06	0.07
Superstition Wilderness	0.02	0.07	0.08

On September 21, 2007, CLC submitted a letter to ADEQ along with a new modeling analysis indicating that "…the 3-year average of the 8th highest visibility change is less than 0.5 dv in all Class I areas." Based upon its review of the new modeling analysis, Chemical Lime concluded that the Nelson facility did not cause or contribute to visibility impairment in any Class I area, and that the emissions units were, therefore, not subject-to-BART.

According to the documentation submitted in support of the new modeling analysis, Chemical Lime estimated its emission rates of NO_X, SO_2 and PM for the BART applicability modeling analysis using the maximum production rates achieved by each kiln during the meteorological period that was modeled (a method which can result in the over prediction of actual impacts on an annual basis), and from using representative emissions factors that were derived from source testing performed at the Nelson facility. The emission rates that CLC modeled are as follows:

Table 10.8 – CLC Modeled Emissions for CLC Nelson		
Emissions Unit	**SO_2 Emissions (lb/hr)**	**NO_X Emissions (lb/hr)**
Kiln 1	117.8	95.23
Kiln 2	375.5	99.20

According to ADEQ's review of the modeling analysis, none of the other fixed parameters (i.e., elevation, stack height, stack diameter, exhaust gas velocity, and exit temperature) were significantly modified in CLC's analysis. The only difference noted was that the elevation of the facility used by ADEQ was 1,570.7 meters above sea level, whereas the company reported the elevation to be 1,570.3 meters above sea level. Because the difference between the two parameters was less than half of a meter (approximately 1.5 feet) ADEQ determined that the change was not significant.

The resulting modeling impacts from the screening assessment performed by CLC, as documented in the September 21, 2007, submission and a May 28, 2009, electronic mail to ADEQ, were as follows:

Table 10.9 – Modeled Impact from CLC Nelson			
Class I Area	**98th % 3 Yr Avg. NOx Impact (dv)**	**98th % 3 YR Avg. SO2 Impact (dv)**	**98th % 3 Yr Avg. Total Impact (dv)**
Grand Canyon NP	0.291	0.205	0.498
Sycamore Canyon WA	0.015	0.107	0.123
Zion NP	0.054	0.081	0.136

Table 10.9 – Modeled Impact from CLC Nelson			
Class I Area	**98th % 3 Yr Avg. NOx Impact (dv)**	**98th % 3 YR Avg. SO2 Impact (dv)**	**98th % 3 Yr Avg. Total Impact (dv)**
Pine Mountain Wilderness	0.003	0.069	0.072
Mazatzal Wilderness	0.017	0.056	0.073
Bryce Canyon NP	0.026	0.048	0.074
Joshua Tree NM	0.014	0.093	0.108
Sierra Ancha Wilderness	0.010	0.039	0.049
Superstition Wilderness	0.009	0.045	0.054

As can be seen from the table above, the company's modeling analysis showed that the 98th percentile, three-year average total impact from the plant was predicted to be less than 0.5 dv for every Class I area within 300 kilometers of the facility. The company also recognized, however, that the predicted impacts within the Grand Canyon were marginally below 0.5 dv. As a result, the company stated that "[a]lthough the maximum visibility change obtained in the screening modeling analysis is not equal to or greater than the 0.5 dv contribution threshold, a refined analysis was performed in which light extinction in the Grand Canyon National Park was calculated using the CALPOST-IMPROVE implementation of the revised light extinction algorithm…" Based upon the refined analysis, the 98th percentile (8th highest) Visibility Change in the Grand Canyon was calculated to be as follows (Table 10.10):

Table 10.10 – Modeled Impact from CLC Nelson at the Grand Canyon NP				
Class I Area	**98th Percentile (8th highest) Visibility Change (dv)**			
	2001	**2002**	**2003**	**Average**
Grand Canyon NP	0.417	0.379	0.585	0.460

Based upon its refined visibility change analysis, CLC determined that the visibility change attributable to the Nelson facility is below 0.5 dv, and it concluded that the facility does not significantly contribute to visibility impairment within the Grand Canyon National Park. As a result, CLC determined that the results of the analysis indicated that the 3-year average of the 8th highest visibility change was less than 0.5 dv in all Class I areas within 300 km of the facility, and concluded that its Nelson facility was not-subject-to-BART.

Based upon the consideration of the analysis performed for this facility, CLC's conservative approach for estimating emissions impacts during the meteorological period, and the maximum 98th percentile three-year average impact from all pollutants is less than 0.5 dv, ADEQ concurs that the Chemical Lime Company's Nelson Lime Plant is not subject-to-BART.

Freeport McMoRan Miami Smelter

On June 13, 2007, ADEQ sent a letter to Freeport McMoRan Miami Inc (FMMI) indicating that the Miami Smelter Converters 1 through 5; the Remelt Vessel and the Acid Plant were "potentially-subject-to-BART" for SO2 and PM emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the Air Quality Permit

Number 1000046, and the application for Air Quality Permit Number 1000046 which showed that the facility had potential SO2 and PM emissions as follows:

10.11 – ADEQ Modeled Emissions from FMMI		
Emissions Unit	**SO_2 emissions (lb/hr)**	**PM emissions (lb/hr)**
Acid Plant Tailgas Stack (Converters 1-5)	820.0	20.40
Vent Fume Stack (Electric Furnace Stack)	312.0	56.30
Shaft Furnace Stack	0.030	4.110
Smelter Fugitives	1288	48.55
Rod Plant Fugitives	0.000	0.100

On July 17, 2007, FMMI responded stating that "although, we do not disagree with the results that the Miami facility is subject-to-BART, because the visibility impact was greater than 0.5 dv at the Superstition Wilderness area, we would like to point out some corrections in the emissions points and emissions used in the modeling." According to the letter, FMMI disputed the stack height, diameter and velocity values that were used for the Vent Fume Stack and the emissions release point and temperature for fugitive emissions from the smelter that ADEQ provided to the WRAP's RMC in its June 9, 2006, letter. FMMI also reported that the Rod Plant shaft furnace should not have been included as part of the smelter, and the acid plant preheater was installed in 1991 as part of the company's ISA modification.

On August 3, 2007, FMMI provided another letter to ADEQ, presenting several bases for streamlining the BART review for the FMMI Smelter. According to the letter, FMMI stated that it believed that only the following emissions units at the facility constituted the "source subject-to-BART":

- The electric furnace (installed in1974);
- The four Hoboken Converters (Converters # 2-5) (installed in 1974); and
- The remelt/mold pouring vessel (installed approximately 1974).

FMMI then provided ADEQ with information regarding the five steps that EPA proposed in its BART guidance, but indicated that EPA provided the option for streamlining the review. According to FMMI's letter, EPA's guidance at 40 CFR Part 51, Appendix Y, § IV(C) states:

> "For VOC and PM sources subject to MACT standards, States may streamline the analysis by including a discussion of the MACT controls and whether any major new technologies have been developed subsequent to the MACT standards."

FMMI's letter goes on to provide a "streamlined review" of emissions from relevant emissions units at the FMMI smelter, and justification for the Rod Plant Shaft Furnace being separated from the BART-eligible source, as this furnace is not part of a listed source category.

After verbal discussions with ADEQ staff regarding the August 3, 2007, letter, FMMI submitted a final letter regarding the matter to ADEQ on November 29, 2007. In this letter, FMMI provided additional information to supplement the August 3, 2007, letter. In the letter, FMMI provides additional citations for the streamlined BART reviews for SO2 and PM emissions at the Miami Smelter.

FMMI has also provided information (through its March 6, 2013 letter to EPA on the proposed rulemaking) that the remelt furnace was actually installed prior to 1962 and should not be considered a BART-eligible unit. Additionally, FMMI has provided emission estimates for NOX from the BART-eligible units documenting that the total is below 40 tons per year.

After reviewing the information that was submitted by FMMI, ADEQ agrees it is necessary to evaluate FMMI's facility for the potential applicability of BART through its process for conducting a BART analysis.

10.8 Arizona Sources that Required a BART Analysis

Pursuant to the discussion in the previous Section, the following six facilities were identified as having to conduct a BART analyses. Due to the case-by-case nature of the BART analyses, ADEQ has included specific sections in this technical support documents for each of these facilities. A brief summary of the circumstances leading to ADEQ's subject-to-BART determinations are as follows:

Catalyst Paper (Snowflake) Inc. (CPSI) formerly Abitibi Consolidated

This facility was permanently shutdown in September 2012. If the facility is rebuilt, it will be required to go through New Source Review at that time. A BART analysis is not being conducted for the facility.

Arizona Electric Power Cooperative, Inc. – Apache Generating Station

On June 13, 2007, ADEQ sent a letter to Arizona Electric Power Cooperative Inc.'s (AEPCO's) Apache Generating Station indicating that Steam Units 1 through 3 were "potentially-subject-to-BART" for NO_X and SO_2 emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the Air Quality Permit Number 35043, and the January 6, 2005, application for Class I Permit Renewal, which showed that the facility had potential NO_X and SO_2 emissions as follows:

Table 10.13 – ADEQ Modeled Emissions from AEPCO

Emissions Unit	NO_X emissions (lb/hr)	SO_2 emissions (lb/hr)
Steam Unit #1	264.90	0.57
Steam Unit #2	576.47	1.24
Steam Unit #3	576.47	1.24

In July of 2007, AEPCO scheduled a meeting with ADEQ to discuss its concurrence that the facility was subject-to-BART. In the meeting, AEPCO indicated that the information that was provided to the WRAP's RMC was based upon Steam Units #2 and #3 burning natural gas, rather than coal. AEPCO discussed a proposed modeling protocol with ADEQ, and explained that when modeling its baseline conditions, AEPCO would use the emission rates associated with burning coal at the facility.

On January 2, 2008, AEPCO provided its BART analysis to ADEQ. ADEQ's analysis and BART determination for AEPCO's can be found in Section XI of this document.

APS Cholla Power Plant

On June 13, 2007, ADEQ sent a letter to Arizona Public Service's (APS's) Cholla Generating Station indicating that Steam Units 1 through 4 were "potentially-subject-to-BART" for NO_X, PM, and SO_2

emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association, and its review of the application for Air Quality Permit Number 46353:

Table 10.14 – ADEQ Modeled Emissions from APS Cholla			
Emissions Unit	**NO_X emissions (lb/hr)**	**PM emissions (lb/hr)**	**SO_2 emissions (lb/hr)**
Unit #1	279.40	38.10	304.8
Unit #2	646.40	293.80	705.10
Unit #3	644.40	87.90	351.50
Unit #4	1,086.80	384.10	3,414.40

In August of 2007, representatives of APS's Cholla Generating Station met with representatives of ADEQ to discuss some outstanding questions that the company had regarding ADEQ's analysis. During the course of that meeting, APS provided a copy of Arizona Public Service Company Correspondence that was sent to Gus Hansen, Supt. at Cholla S.E.S. entitled "Operating Notes For May 1962". According to information provided by this document, "[o]n Tuesday, May 1, 1962, unit [#1] placed into commercial operation." As a result, APS argued that Unit #1 was "in operation" prior to August 7, 1962, and therefore was not BART-eligible. After reviewing this documentation, ADEQ concurs that Unit #1 was never BART-eligible. On September 13, 2007, APS provided a letter to ADEQ providing a schedule for the submission of a modeling protocol and conducting a BART analysis with the goal of providing the final BART analysis on December 14, 2007. In December of 2007, ADEQ received the BART analysis. ADEQ's analysis and BART determination for the APS Cholla Power Plant can be found in Appendix D.

ASARCO Hayden Smelter

ADEQ has determined that a BART analysis regarding SO_2 emissions from this facility must be completed. ADEQ's review and determination based upon its own analysis of the facts and the information that ASARCO had provided can be found in Appendix D.

Freeport-McMoRan Miami Smelter

ADEQ has determined that a BART analysis regarding PM and SO_2 emissions from this facility must be completed. ADEQ's review and determination based upon its own analysis of the facts and the information that Freeport-McMoRan Miami Inc. had provided can be found in Appendix D.

SRP Coronado Generating Station

On June 13, 2007, ADEQ sent a letter to Salt River Project's (SRP's) Coronado Generating Station indicating that Units 1 and 2 were "potentially-subject-to-BART" for PM, SO_2 and NO_X emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association, and its review of the August 21, 2003 Application for Class I Permit Renewal which showed that the facility had potential NO_X, PM, and SO_2 emissions as follows:

Table 10.15 – ADEQ Modeled Emissions for SRP Coronado			
Emissions Unit	**NO_X emissions (lb/hr)**	**PM emissions (lb/hr)**	**SO_2 emissions (lb/hr)**
Unit #1	3,303	472	3,775
Unit #2	3,303	472	3,775

On August 22, 2007, representatives of SRP's Coronado Generating Station met with ADEQ to discuss issues that were unique to the Coronado Generating Station, including a potential settlement with EPA regarding alleged New Source Review violations that would address NOx and SO2 emissions. In addition, the company provided a proposed response to ADEQ's request for a BART analysis.

In February 2008, SRP provided its BART analysis to ADEQ. On August 12, 2008, EPA announced a "…major Clean Air Act (CAA) New Source Review (NSR) settlement agreement with [SRP]…" EPA explained that "[u]nder the settlement, SRP will spend over $400 million between now and June 2014, to install state-of-the-art pollution control technology for the reduction of sulfur dioxide (SO2) and nitrogen oxides (NO_X)."

ADEQ's analysis and BART determination for the SRP Coronado Generating Station can be found in Appendix D.

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CHAPTER 11

REASONABLE PROGRESS GOAL DEMONSTRATION

Chapter 11 revises and supersedes the corresponding Chapter in its entirety
From Arizona's Regional Haze SIP as Submitted in 2011

11.1 Reasonable Progress Requirements

40 CFR 51.308(d)(1) requires that for each Class I area, the state must establish goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions in 2018 and to 2064. The reasonable progress goals (RPGs) must provide for improvement in visibility for the most-impaired (20% worst visibility) days over the period of the SIP and ensure no degradation in visibility for the least-impaired (20% best visibility) days over the same period.

In establishing RPGs, the state must estimate the 2018 URP at each Class I area. The state must consider the URP and the emission reductions needed to achieve it for the period covered by the plan. If the state ultimately establishes a RPG that provides for a slower rate of visibility improvement than would be required to meet natural conditions by 2064, the state must demonstrate how the URP is not reasonable at this time and that the state's goal is reasonable given current conditions, based on the four-factors. In addition, the state must provide to the public an assessment of the number of years it would take to achieve natural conditions if improvement continues at the rate selected by the state.

Four factors must be considered when establishing the RPGs: the costs of compliance; the time necessary for compliance; the energy and non-air quality environmental impacts of compliance; and the remaining useful life of any potentially affected sources. The state must also include a demonstration showing how factors were taken into consideration in selecting the goals.

11.2 The Process for Determining Reasonable Progress

The following steps were followed in setting the RPGs for each Arizona Class I area:

1. Compare Baseline to Natural Conditions

For each Class I area, identify baseline (2000-2004) visibility and natural conditions in 2064 for the 20% worst and best days. See Chapter 6.

2. Identify the Uniform Rate of Progress

For each Class I area, calculate the URP glide path from baseline to 2064, including the 2018 planning milestone for the 20% worst days. Show the URP glide path in both total deciview and by pollutant in deciview. Next, identify the improvement needed by 2018 and 2064, respectively. See Chapter 6.

3. Identify the Contributing Pollutants

For each Class I area, identify the pollutant species that are contributing to visibility impairment on the current (baseline) 20% worst and 20% best days. See Chapter 7.

4. Identify the Major Emission Sources within the State and Trends

Using the WRAP Emission Inventory for 2002 and 2018, describe statewide emissions by source category and pollutant, and identify projected emission trends from current (2002) to the 2018 planning milestone. See Chapter 8.

5. Analyze the Larger Sources Categories Contributing to Impairment

For each Class I area, determine the relative contribution of anthropogenic and nonanthropogenic sources in Arizona and neighboring states to the 20% worst and 20% best days using monitoring data, source apportionment and modeling results. Compare these results to baseline (2000-2004) to 2018 on-the-books emissions reductions expected. Review these results by pollutant. See Chapter 9.

6. Document the Emission Reductions from BART

Describe the results of the BART process and identify the emissions reductions that will be achieved from BART and other measures. See Chapter 10.

7. Identify the Projected Visibility Change in 2018 from "on-the-books" Controls and BART

For each Class I area, determine the visibility improvement expected in 2018 from on-the-books controls and BART using the WRAP CMAQ modeling results for the 20% worst and 20% best days. Identify the extent of visibility improvement related to the 2018 URP milestone in total deciview and in extinction by pollutant. See Chapter 9.

8. Identify Sources or Source Categories that are Major Contributors and Conduct the Four-Factor Analysis

As a result of the analysis under step 5, for each Class I area, determine key pollutant species and source categories that have the greatest affect on visibility in Arizona Class I areas. Analyze using the four-factor analysis. See Chapter 11.

9. Describe the Results of the Four-Factor Analysis

Section 11.3 describes the results of the four-factor analysis.

10. Set the Reasonable Progress Goals (RPG) Based on Steps 7, 8, and 9

Set the RPG for each Class I area in deciview, based on the improvement in 2018 for the 20% worst and best days, from on-the-books controls, BART, and the results of the four-factor analysis on major source categories. See Section 11.4.

11. Compare RPG to the 2018 URP Milestone. Provide an Affirmative Demonstration that Reasonable progress is being made based pollutant trends, Emission Reductions, and Improvements Expected under the Long-Term-Strategy.

For each Class I area, compare the RPG developed in Step 10 to the 2018 URP milestone. Provide an affirmative demonstration that reasonable progress is being made based on pollutant treads, emissions reductions from major anthropogenic source categories, and on-the-books controls. Describe the results of the four-factor analysis in step 9 above, and how future actions identified in the Long-Term Strategy are expected to improve visibility in the next 10 years to the 2018 milestone and beyond.

11.3 Summary of the Four-Factor Analysis

Section 308(d)(1)(i)(A) of the Regional Haze Rule requires that states consider the following factors and demonstrate how they were taken into consideration in selecting the reasonable progress goals:

- costs of compliance
- time necessary for compliance
- energy and non-air quality environmental impacts of compliance, and
- remaining useful life of any potentially affected sources.

In conducting this four-factor analysis, EPA guidance indicates that states have "considerable flexibility" in how these factors are taken into consideration, in terms of what sources or source categories should be included in the analysis, and what additional control measures are reasonable.

11.3.1 Rationale and Scope of the Four-Factor Analysis

The state considered certain source categories in applying the four factors. The following rationale was used for the four-factor analysis:

1. Focus on 20% worst visibility days.

Since the Regional Haze Rule primarily focuses on demonstrating reasonable progress for the 20% worst days, the four-factor analysis in this section addresses only the worst days. It is a reasonable assumption that emission reductions benefiting the worst days also benefits the best days. The CMAQ modeling projections in Chapter 9 and reasonable progress demonstration in this chapter both indicated that the 20% best days are maintained for most of the Class I areas in Arizona.

2. Focus on anthropogenic sources.

Since the purpose of this analysis is to evaluate certain sources or source categories for potential control, the four-factor analysis in the section addresses only anthropogenic sources, on the assumption that the focus should be on sources that are "controllable". Although nonanthropogenic sources such as wildfire and dust are major contributors to regional haze, ADEQ has determined this analysis is not applicable to these sources. In considering which anthropogenic sources or source categories to apply the statutory factors, ADEQ considered point, area, mobile, and fire (controlled burning).

For mobile sources, there are major emissions reductions projected by 2018 based on numerous "on-the-books" federal and state regulations, as described in detail in Section 11.4 and in Section 12.5 as part of on-going implementation under the LTS. There are also significant visibility improvements projected by 2018 due to these reductions, as Chapter 9 PSAT results indicate. Based on the above findings, ADEQ does not believe applying the four-factor analysis to mobile sources is necessary.

For fire sources, forestry and agricultural burning are large anthropogenic sources. as described in detail in Section 12, both of these activities are controlled under state-run smoke management programs that meet all of the requirements for an Enhanced Smoke Management Program (ESMP), and as such represent an advanced level of smoke management. Both of these activities are also addressed under the Arizona Visibility Program. In Section 12, ADEQ has identified future efforts to evaluate new methods of protecting Class I areas from forestry burning. Based on current controls and future efforts, ADEQ did not believe applying the four-factor analysis to forestry and agricultural burning was needed.

As a result of the above consideration, ADEQ elected to focus the four-factor analysis on point and area sources only. Additional details are provided in the following sections.

3. Focus on SO_2 and NO_X pollutants.

Although there are six visibility impairing pollutants, SO_2 and NO_X (sulfate and nitrate) are typically associated with anthropogenic sources. As noted in Chapter 8, sulfates and nitrates are about three times more effective at impairing visibility than $PM_{2.5}$. Since a large component of particulate (both fine and course is associated with nonanthropogenic sources, such as wildfire and natural windblown dust, this pollutant was not included in the analysis.

11.3.2 Identification of Point and Area Sources for the Four-Factor Analysis

ADEQ maintains the focus on point and area sources of SO_2 and NO_X for applying the four-factor analysis is consistent with EPA guidance, in terms of flexibility to consider which major source categories are "reasonable" to evaluate for the first planning period of the regional haze plan.

As described in Chapter 8 and 9, it is important to note that there are reductions projected in 2018 in SO_2 and NO_X emissions and effects from point and area sources. This trend was a consideration in the four-factor analysis, in terms of what source categories ADEQ considered for this analysis. Large reductions in SO_2 and NO_X were also used as supporting evidence in the demonstration that the reasonable progress goals selected were "reasonable".

The first step in the four-factor analysis is to identify the sulfate and nitrate contribution within Arizona. Table 11.1 shows the modeled sulfate and nitrate effects on the 20% worst days in 2018, based on PSAT modeling results, at each Class I area in Arizona. This table shows that the range of the Arizona portion on the worst days is from 6-24% for sulfate, and 7-54% for nitrate. The 2018 modeled concentration is used here to show projected contribution, in order to assess what further emission reductions would be beneficial in achieving reasonable progress.

Table 11.1 – Arizona Share of Modeled Sulfate and Nitrate in 2018 on 20% Worst Days

Arizona Class I Area	Sulfate			Nitrate		
	2018 Total Sulfate (ug/m^3)	2018 Arizona Sulfate (ug/m^3)	2018 Arizona Sulfate Share (%)	2018 Total Nitrate (ug/m^3)	2018 Arizona Nitrate (ug/m^3)	2018 Arizona Nitrate Share (%)
Chiricahua NM, Chiricahua W, Galiuro W	0.92	0.06	6.52%	0.14	0.01	7.14%
Grand Canyon NP	0.62	0.06	9.68%	0.17	0.06	35.29%
Mazatzal W, Pine Mountain W	0.82	0.09	10.98%	0.28	0.13	46.43%
Mount Baldy W	0.77	0.14	18.18%	0.13	0.05	38.46%
Petrified NP	0.80	0.19	23.75%	0.12	0.01	8.33%
Saguaro NP – West Unit	1.0	0.13	13.00%	0.45	0.22	48.89%
Saguaro NP – East Unit	1.2	0.17	14.17%	0.28	0.15	53.57%
Sierra Ancha W	0.91	0.12	13.19%	0.11	0.04	36.36%
Superstition W	0.93	0.16	17.20%	0.38	0.20	52.63%
Sycamore Canyon W	0.58	0.05	8.62%	0.26	0.11	42.31%

The next step in the analysis is to identify the larger point and area source categories within the state. Table 11.2 shows the sulfate and nitrate point and area categories in Arizona, based on their projected emissions in 2018, as identified in Chapter 8 (the PRP18b emission inventory). These categories are external combustion boilers, industrial processes, internal combustion engines, stationary fuel combustion, and waste disposal. The table shows the tons per year of each pollutant, as the extent of the contribution. Excluded from these source categories are sources evaluated under BART.

Table 11.2 – 2018 Projected Emissions from Arizona's Largest Source Categories

Pollutant	Type	Source Category	Extent of Contribution (tons per year)
SO_2	Point	External Combustion Boilers	15,871
	Point	Internal Combustion Engines	185
	Point	Industrial Processes	41,118
	Area	Stationary Source Fuel Combustion	3,127
	Area	Waste Disposal, Treatment, and Recovery	272
NO_X	Point	External Combustion Boilers	48,062
	Point	Internal Combustion Engines	11,068
	Point	Industrial Processes	9,510
	Area	Stationary Source Fuel Combustion	10,190
	Area	Waste Disposal, Treatment, and Recovery	2,357

11.3.3 Non-BART Sources

In its analysis of non-BART sources, ADEQ included all sources that had actual emissions over 40 tons per year of NO_X and SO_2. In analyzing the inventory of sources, ADEQ determined that the evaluation could be meaningfully conducted by categorizing the inventory based on the significant emission units involved. The table below summarizes the categories that were considered:

Table 11.3 - Non-BART Source Categories

Source Type	Number of Facilities
Internal Combustion Engines and Turbines	31
Boilers	7
Asphalt Plants	3
Lime Plants	2
Portland Cement Plants	2
Primary Copper Smelters	2
Nitric Acid Plants	1

It should be noted that the first two categories, internal combustion engines and turbines and boilers, cover a large number of equipment both in the subsequent categories and at facilities not listed above. For example, many asphalt plants use internal combustion engines as a power source.

Emission sources subject-to-BART were not included since source-specific determinations were made for those sources. However, non-BART emission units at facilities that were identified as subject to BART were included in the evaluation. In this section, significant source categories are evaluated. Visibility impacts from these source categories were not estimated.

1. Internal Combustion Engines/Combustion Turbines

This category includes commercial and institutional sources, electric generation, industrial engines, and engine testing. The primary sources are engines burning natural gas, which include natural gas-fired reciprocating internal combustion engines and natural gas-fired turbines, and engines burning diesel fuel. Generally speaking, low-emission combustion, steam injection, selective catalytic reduction, and selective non-catalytic reduction are considered potentially-viable NO_X control strategies. It should be noted that most of these engines are fueled by fuel oil or natural gas. Emissions of SO_2 from the burning of natural gas are expected to be negligible. At this time, fuel oil combusted in these units is expected to have very low sulfur in it. In many cases, it amounts to 15 ppm of sulfur. Consequently, the SO_2 emissions resulting from these units are expected to be minimal.

In the Department's evaluation of this category, it was determined that a significant number of engines are portable in how they operate. Since these emission units are portable, it is difficult to perform a site-specific analysis addressing visibility impacts for these units. Portable equipment can stay at one site for as little as week before moving to another site. Additionally, many of the engines considered are not used as process-support engines but solely for backup purposes when commercial power supply is interrupted. In that regard, it can reasonably be presumed that the actual emissions from emergency backup engines will be minimal (typically emergency engines are run for one hour each week to check the operability of the engine).

There are multiple state and federal regulations that apply to this source category. These regulations are technology-based requirements that stipulate emission limitations and operational restrictions to ensure that emissions of NO_X and SO_2 are minimized.

The following list identifies potentially applicable federal requirements:

- 40 CFR 60 Subpart IIII (Standards of Performance for Reciprocating Internal Combustion Engines)
- 40 CFR 60 Subpart JJJJ (Standards of Performance for Spark Ignition Engines)
- 40 CFR 60 Subpart GG (Standards of Performance for Stationary Gas Turbines)
- 40 CFR 60 Subpart KKKK (Standards of Performance for New Stationary Gas Turbines)
- 40 CFR 63 Subpart ZZZZ (National Emission Standards for Internal Combustion Engines)
- 40 CFR 63 Subpart YYYY (National Emission Standards for Combustion Turbines)

In addition, for older engines and turbines, Arizona Administrative Code R18-2-719 (Standards of Performance for Existing Stationary Rotating Machinery) applies.

As part of this assessment, the Department reviewed the information in the report titled "Supplementary Information for Four Factor Analyses by WRAP States" dated May 4, 2009. In review of the document, the Department was not able to ascertain the viability of the control options for a variable range of engine and turbine vintage and size. Additionally, the cost computations for the various technology options appeared to be derived from a generic costing tool called AIRControlNet. The Department has determined that the information presented in the report cannot be meaningfully adapted for the purposes of developing a four-factor analysis. In this regard, the Department has determined that an exhaustive facility-by facility review to evaluate each unit and therefore no further analysis was conducted.

2. External Combustion Boilers

This source category consists of electricity generating, industrial, and commercial boilers.

Generally speaking, low-NO_X burners, over-fire air systems, flue gas recirculation, SCR and SNCR are considered viable NO_X control strategies for this source category. Spray dry absorber flue gas desulfurization systems, and the use of low sulfur fuel are considered viable control strategies for sulfur dioxide emissions.

There are multiple state and federal regulations that apply to this source category. These regulations s are technology based standards that stipulate emission limitations and operational restrictions to ensure that emissions of NO_X and SO_2 are minimized.

The following list identifies potentially applicable federal requirements:

- 40 CFR 60 Subpart D, Da, Db, Dc (Standards of Performance for Fossil Fuel-fired Steam Generators and Electric Utility Steam Generating Units)
- 40 CFR 63 Subpart DDDDD (National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters at Major Sources proposed on June 4, 2010)
- 40 CFR 63 Subpart JJJJJJ (Area Source Boiler MACT proposed June 4, 2010)
- Additionally a comprehensive rule under 40 CFR 63 is expected for electric utilities by November 2011.

In addition, for older boilers, A.A.C. R18-2-703 and 724 (Standards of Performance for Fossil Fuel fired Steam Generators and General Fuel-burning Equipment) applies.

As part of this assessment, the Department reviewed the information in the report titled "Supplementary Information for Four Factor Analyses by WRAP States" dated May 4, 2009. In review of the document, the Department was not able to ascertain the viability of the control options for a variable range of boiler vintage and size. Additionally, the cost computations for the various technology options appeared to be derived from a generic costing tool called AIRControlNet. The Department has determined that the information presented in the report cannot be meaningfully adapted for the purposes of developing a four-factor analysis. In this regard, the Department has determined that it is not possible to complete a exhaustive facility-by facility review to evaluate each unit and therefore no further analysis was conducted. The Department will revisit this decision in the next planning period.

3. Asphalt Plants

This source category includes facilities that produce asphaltic concrete. The main sources of NO_X and SO_2 emissions are the drum dryer and supporting internal combustion engines. The engines are addressed in Section 11.3.3.1. Many asphalt plants in Arizona are portable sources. These facilities typically only operate at a single location for a limited duration, depending on contractual obligations and product demand. Since many of these emission units are portable, it is difficult to perform a site-specific analysis addressing visibility impacts for these units.
Asphalt plants in Arizona are permitted as minor sources of emissions. Typically, each facility accepts an hourly, production, or emissions limit that reduces the emissions of NO_X and SO_2 emitted into the atmosphere. Most modern drum dryers are equipped with low-NO_X burners and other combustion technology that reduce NO_X emissions.

Cost of Compliance

In review of literature for retrofitting existing drum dryers with low- NO_X burner technology, the cost for such retrofits is estimated at about 3,000 dollars per ton of NO_X reduced.

Time Necessary for Compliance

Considering the portable nature of this source category and the low- NO_X burners typically available in most modern drum dryers, no additional controls were identified for this source category.

Energy and Non-Air Quality Environmental Impacts of Compliance

Considering the portable nature of this source category, and the various controls already operated by modern drum dryers, no additional controls were identified for this source category and no energy or non-air quality impacts were identified.

Remaining Useful Life of Affected Sources

It is difficult to estimate the remaining life of any potentially affected source in this category. Remaining life is specific to the facility for which controls are considered.

4. Lime Plants

This source category includes facilities that produce lime. There are two lime plants that operate in Arizona: Chemical Lime Nelson and Chemical Lime Douglas.

The Nelson facility is located in Northern Arizona between Kingman and Flagstaff. Both kilns at this facility were identified as BART-eligible for NO_X and SO_2. Based on a modeling analysis performed by Chemical Lime, it was determined that the facility does not cause or contribute to visibility impairment at any nearby Class I areas. Additional details on the modeling results can be found in Section VI.D of the BART Technical Support Document (TSD) in Appendix D of this plan. As a result of the dispersion modeling, no further analysis was conducted.

Due to economic conditions, the Douglas facility has been in care and maintenance mode since January 2009, and the Department has received no indication of when the facility will resume normal operations. Due to the lack of operation and economic conditions, no further analysis was conducted as part of this first Regional Haze SIP. The Department will revisit this decision in the next planning period.

5. Portland Cement Plants

There are two operating Portland cement plants in Arizona: California Portland Cement and Phoenix Cement.

The California Portland Cement plant is located 20 miles north of Tucson. The facility operates four cement kilns. Kiln 4 was identified as BART-eligible. Based on a modeling analysis performed by the WRAP, it was determined that Kiln 4 does not cause or contribute to visibility impairment at any nearby Class I areas. Additional details on the modeling results can be found in Section VI.A of the BART TSD in Appendix D. Pursuant to EPA guidance for setting RP goals, determining the sources that contribute to visibility impairment in a Class I area is a pre-requisite to conducting a 4-factor analysis. From that

perspective, the modeling has shown Kiln 4 is not a contributor to visibility impairment and as such, should be excluded from the requirement for a 4-factor analysis. Additionally, the facility obtained a New Source Review/Prevention of Significant Deterioration (NSR/PSD) permit to construct and operate a modern, state-of-the-art kiln that would replace all 4 existing kilns. Due to economic conditions the facility was unable to commence construction on the new kiln within 18 months as required by law, but has resubmitted an application for re-approval. Due to the same economic conditions, Kilns 1-3 have been in care and maintenance mode since 2008 (as documented in a CPC letter dated March 19, 2013) and the Department has received no indication of when the facility will resume normal operations. Due to the lack of operation and economic conditions, no further analysis was conducted for Kilns 1-3 as part of this first Regional Haze SIP. The Department will revisit this decision in the next planning period.

The Phoenix Cement plant is located near Clarkdale. The facility operates a single kiln that commenced operation in the early 2000s. The operations are covered by a comprehensive air permit that includes facility-wide limits on NO_X and SO_2. The permit also includes limits from the federal NSPS (Subpart F) and NESHAP (Subpart LLL). The modeling analysis conducted as part of the permit that authorized construction of the modern kiln included visibility modeling to ensure that the new kiln does not appreciably diminish or impair visibility.

The operating kilns at both the facilities employ preheater/pre-calciner technology to optimize fuel consumption patterns and consequently result in reduced nitrogen oxides emission levels relative to kilns that are not equipped with the technology. With the technology, more fuel is typically combusted at lower temperatures prior to the high-heat burning zone in the main kiln burner and consequently, the potential for thermal NOX generation is significantly reduced. Low NOX emission performance is enhanced by employing staged combustion. The purpose of staged combustion is to burn the fuel in 2 stages. Staged air combustion suppresses the formation of NOX by operating under fuel rich reducing conditions in the flame or primary zone where most of the NOX is potentially formed. This zone is followed by oxygen-rich conditions in a downstream secondary zone where CO is oxidized at a lower temperature with minimal NOX formation.

It should be noted very minimal SO2 emissions are expected from these two cement plant operations. The principal ingredient in the manufacturing process is limestone, which provides an inherent scrubbing opportunity and is maximized by the preheater/precalciner process. Due to this scrubbing, and to the fact that the sulfur content of the fuel and feed is very minimal, the resultant effect is low SO2 emissions at the stack.

In addition to the above, a 4-factor analysis was presented by Phoenix Cement to address the possibility of installation of Selective Non-Catalytic Reduction (SNCR) for the kiln. The Department agreed with the analysis provided.

Cost of Compliance

ADEQ has considered different estimates of the costs of installing and operating SNCR at PCC. Based in part on estimates provided by the EPA and PCC, which are incorporated in PCC's March 6, 2013 comments, and applicable cost-estimate guidance, ADEQ finds that the cost of installing SNCR at PCC would be in excess of $1,700,000 and the cost of operating SNCR at PCC would be in excess of $1,200,000 annually. Although incremental cost-effectiveness in $/Δdv or $/ton is not necessarily a required feature of a reasonable progress analysis for non-BART sources, such as PCC, ADEQ has considered the visibility modeling issues incorporated in PCC's March 6, 2013 comments and concludes that changes to visibility impairment in the Sycamore Canyon Wilderness Area that might be achieved by the installation and operation of SNCR at PCC are not warranted in light of these costs and given the

revised reasonable progress demonstration for the Sycamore Canyon Wilderness Area. As demonstrated elsewhere in this SIP, reasonable progress will already be achieved for the Sycamore Canyon Wilderness Area.

Time Necessary for Compliance

Considering ADEQ's conclusions regarding the Cost of Compliance, above, no additional controls are identified for PCC. However, even if additional controls were identified, they would not need to be installed by 2018, because the 5-year requirement at CAA § 169A(g)(4), 42 U.S.C. § 7491(g)(4), applies only to sources subject to BART, which PCC is not, and because reasonable progress will already be achieved for the Sycamore Canyon Wilderness Area significantly in excess of the corresponding URP, as demonstrated elsewhere in this SIP.

Energy and Non-Air Quality Environmental Impacts of Compliance

The installation and operation of SNCR at PCC would require increased energy usage at PCC. Non-air quality environmental impacts associated with SNCR include the hazards of transporting and storing urea or ammonia, especially if anhydrous ammonia is used; and ammonia slip at potentially problematic levels, especially if urea is used.

Remaining Useful Life

ADEQ concludes that Kiln 4 has a remaining useful life for approximately the next 50 years. This is based on design information provided by PCC, the fact that Kiln 4 has been in operation for only 10 years, and lifetime projections of PCC's quarry and raw materials. However, the question of whether the installation and operation of SNCR at PCC is warranted as a function of the remaining useful life of the kiln implicates reasonably foreseeable changes at PCC that diminish or eliminate the need to impose the requirement of SNCR under this SIP. For these reasons as well, ADEQ finds that it is not reasonable to require the installation and operation of SNCR at PCC as part of this SIP. The Department will revisit this decision in the next planning period.

6. Primary Copper Smelters

This source category includes two primary copper smelters that are operated in Arizona: Freeport McMoRan's Miami Smelter and ASARCO's Hayden Smelter.

Both smelters have equipment that was identified as subject-to-BART for SO_2 (see Section VI.C and E of the BART TSD). For each facility, the double contact sulfuric acid plant was determined as BART. The emissions from equipment not subject to BART (specifically some converters and the flash furnaces) are also routed to the acid plant and therefore will be subject to the same BART limits. No additional analysis was determined to be necessary for SO_2.

These operations also emit NO_X. Freeport Miami obtained a PSD permit for the installation of the Isasmelt furnace in the early 1990s and that permit contains BACT limits for NO_X for affected emission units. Based on an emission analysis for FMMI, it has been concluded that the potential emissions from the BART-subject units is less than 40 tpy thus rendering the outcome that those units should not be subject to a BART analysis for NOX. Additionally, the WRAP modeling documented that the highest NOX impact from the FMMI operations at the Superstition Wilderness area with a threshold impact of

0.11 dv. When the threshold impact is indiscernible, it can be very reasonably construed that cost-effective visibility improvement strategies are not viable from a NOX emissions perspective. The Department will revisit this decision in the next planning period.

7. Nitric Acid Plants

This category includes one source (Apache Nitrogen Products in Benson, Arizona) that manufactures nitric acid for sale and for use in manufacturing of fertilizer products. The main sources of NO_X emissions in this category are the nitric acid plants and internal combustion engines. The emissions from the engines are discussed in 11.3.3.1.

There are multiple state and federal regulations that will apply to nitric acid production. These standards are technology based standards that stipulate emission limitations and operational restrictions to ensure that emissions of NO_X are minimized. Emissions of SO_2 from nitric acid plants are minimal.

The following list identifies applicable federal and state requirements:

- 40 CFR 60 Subpart G (Standards of Performance for Nitric Acid Plants)
- A.A.C. R18-2-706 (Standards of Performance for Existing Nitric Acid Plants)

The facility is covered by a permit that requires the operation of NO_X controls including Selective Catalytic Reduction (SCR), absorption towers, and scrubbers to reduce NO_X emissions.

Cost of Compliance

Considering that the applicable NSPS standard has a NO_X limit, and the various controls already operated by the facility, no additional controls were identified for this source.

Time Necessary for Compliance

Considering that the applicable NSPS standard has a NO_X limit, and the various controls already operated by the facility, no additional controls were identified for this source.

Energy and Non-Air Quality Environmental Impacts of Compliance

Considering that the applicable NSPS standard has a NO_X limit, and the various controls already operated by the facility, no additional controls were identified for this source.

Remaining Useful Life of Affected Sources

The remaining useful life of the nitric acid plant was not available.

11.3.4 Conclusions from the Four-Factor Analysis

Based on the above analysis, ADEQ has concluded that it is not reasonable to require additional controls for these source categories at this time. ADEQ will be developing guidance for conducting a comprehensive review of individual non-BART stationary sources over the next five years, to identify any additional emission reductions that could improve Class I area visibility by end of this planning period covered by this submittal. This review will identify possible controls for non-BART sources and a schedule for implementation.

11.4 Determination of Reasonable Progress Goals

Under Section 308(d)(1) of the Regional Haze Rule states must "establish goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions" for each Class I area. These reasonable progress goals (RPGs) are interim goals that must provide for incremental visibility improvement for the most impaired visibility days, and ensure no degradation for the least impaired visibility days.

11.4.1 Reasonable Progress Goals from Arizona's Regional Haze SIP Submitted in 2011

The RPGs for the first planning period are visibility goals for the year 2018. Based on the steps outlined in Section 11.2, ADEQ established RPGs for each Class I area in Arizona.

The RPGs presented in Table 11.3 are those submitted in the 2011 Regional Haze SIP. These were based on ADEQ's evaluation and consideration of the following: the results of the Community Multiscale Air Quality (CMAQ) modeling described in Section 9.3, which includes "on-the-books" controls and other emission inputs (see Appendix C for list of CMAQ model emission inputs), the results of the four-factor analysis described in Section 11.3.3, and the BART review described in Chapter 10. The RPGs provide for visibility improvement at all Class I areas in Arizona on 20% worst days (Table 11.3); however, the goals do not meet the uniform rate of progress (URP). It is important to note that the URP represents the mathematical annual average deciview necessary each year to move from the baseline condition to the natural condition for any given Class I area. This annual average decrease does not take into account existing or real world conditions and are not achievable in every instance.

Table 11.3 shows that for all but two monitors, there is no degradation on 20% best days. For those areas with no degradation, there is an improvement in visibility conditions in 2018 on best days. ADEQ attributes this predicted improvement to a combination of factors: the numerous "on-the-books" controls included in the CMAQ modeling and significant reductions in mobile sources emissions (as described in Section 11.4.3). The two monitors showing degradation on best days are CHIR1 and SAGU1, representing four Class I areas.

Table 11.3 – Reasonable Progress Goals for 20% Worst and Best Days for Arizona Class I Areas

Arizona Class I Area	20% Worst Days			20% Best Days	
	Baseline (dv)	2018 URP (dv)	2018 Reasonable Progress (dv)	Baseline (dv)	2018 Reasonable Progress (dv)
Chiricahua NM, Chiricahua W, Galiuro W	13.43	11.98	13.35	4.91	4.94
Grand Canyon NP	11.66	10.58	11.14	2.16	2.12
Mazatzal W, Pine Mountain W	13.35	11.79	12.76	5.40	5.17
Mount Baldy W	11.85	10.54	11.52	2.98	2.86
Petrified NP	13.21	11.64	12.85	5.02	4.73
Saguaro NP – West Unit	16.22	13.90	15.99	8.58	8.34
Saguaro NP – East Unit	14.83	12.88	14.82	6.94	7.04
Sierra Ancha W	13.67	12.02	13.17	6.16	5.88
Superstition W	14.16	12.38	13.89	6.46	6.22

Table 11.3 – Reasonable Progress Goals for 20% Worst and Best Days for Arizona Class I Areas					
Arizona Class I Area	20% Worst Days			20% Best Days	
	Baseline (dv)	2018 URP (dv)	2018 Reasonable Progress (dv)	Baseline (dv)	2018 Reasonable Progress (dv)
Sycamore Canyon W	15.25	13.25	15.00	5.58	5.49

On December 21, 2012, EPA proposed to partially approve and partially disapprove elements of Arizona's Regional Haze SIP, including the RPGs for all Arizona Class I areas (77 FR 75704). The following sections address those deficiencies.

11.4.2 Baseline and Progress Period Visibility

As discussed in Chapter 8, Section 8.8, comparisons between the 2002 and 2008 EIs are problematic, primarily due to methodology changes. As a result, ADEQ is using IMPROVE monitoring data as surrogates for assessing visibility at Arizona's Class I areas. ADEQ is also presenting a more robust 10-year trend analysis to illustrate how alternative methods of visibility trend analysis may affect the conclusions. The alternative method utilized the Theil Trend to calculate an annual trend for the 10-year period of interest and is an EPA accepted method for annual pollutant trend analysis[8]. For more details on the Theil Trend results, see Section III of the enclosed TSD. Additionally, alternative analyses are presented to illustrate the effects of singular events (e.g. wildfires) and anomalous years that occurred in the middle of the 10 year period (e.g. 2005).

Table 11.4 shows the comparison of the baseline conditions (2000-2004) to the progress period (2005-2009). The progress period visibility was calculated in the same manner as the baseline conditions using data from the IMPROVE monitors for both 20% worst and best days and is shown in deciviews (dv). For the 20% worst days, all but two IMRPOVE monitors (GRCA2 and IKBA1) show improved visibility for the progress period compared with the baseline. There is no degradation on best days from baseline conditions to the progress period (Table 11.4). This analysis of monitored data indicates that visibility on best days for all sites is improving, while GRCA2 is showing no change. The Theil method showed similar results for both the 20% worst and 20% best days, though the method generally indicated that visibility degradation seen at some of the sites were not statistically significant, meaning that the differences seen in the baseline and progress periods do not represent an actual trend, but instead is a result of natural variation. For more details on the Theil Trend results, see Section III of the enclosed TSD.

Table 11.4 – Comparison of Deciview for 20% Worst and Best Days for Arizona Class I Areas for the Baseline and Progress Period (2005-2009)				
Arizona Class I Area	20% Worst Days		20% Best Days	
	Baseline (dv)	2005-2009 Progress Period (dv)	Baseline (dv)	2005-2009 Progress Period (dv)
Chiricahua NM, Chiricahua W, Galiuro W	13.4	12.2	4.9	4.4

[8] EPA. Trends in Monitored Concentrations of Carbon Monoxide. National Air Quality and Emissions Trends Report, 2003.

Table 11.4 – Comparison of Deciview for 20% Worst and Best Days for Arizona Class I Areas for the Baseline and Progress Period (2005-2009)				
Arizona Class I Area	20% Worst Days		20% Best Days	
	Baseline (dv)	2005-2009 Progress Period (dv)	Baseline (dv)	2005-2009 Progress Period (dv)
Grand Canyon NP	11.7	12.0	2.2	2.2
Mazatzal W, Pine Mountain W	13.3	13.4	5.4	5.1
Mount Baldy W	11.8	11.8	3.0	2.9
Petrified NP	13.2	13.0	5.0	4.6
Saguaro NP – West Unit	16.2	14.9	8.6	8.0
Saguaro NP – East Unit	14.8	13.6	6.9	6.7
Sierra Ancha W	13.7	13.0	6.2	5.3
Superstition W	14.2	13.8	6.5	5.7
Sycamore Canyon W	15.3	15.2	5.6	5.1

As noted above, two monitors (GRCA2 and IKBA1) show decreasing visibility on worst days for the progress period (Table 11.4). These are the two monitors representing the Grand Canyon National Park (GRCA2), Mazatzal Wilderness (IKBA1), and Pine Mountain Wilderness (IKBA1). The deciview increase at both monitors can be explained by analyzing the contribution of individual pollutants. Table 11.5 shows the relative contribution of visibility impairing pollutants on 20% worst day at all Arizona Class I areas.

Table 11.5 – Relative Contribution of Pollutants on 20% Worst Days for the Progress Period (2005-2009)									
Site	Class I Area	Deciview (dv)	Percent Contribution (% of Mm^{-1}) and Rank						
			Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BALD1	Mount Baldy W	11.8	25% (2)	4% (6)	42% (1)	8% (4)	6% (5)	16% (3)	0% (7)
CHIR1	Chiricahua NM, Chiricahua W, Galiuro W	12.2	36% (1)	5% (5)	16% (3)	5% (6)	10% (4)	27% (2)	1% (7)
GRCA2	Grand Canyon NP	12.0	22% (2)	7% (5)	**41% (1)**	11% (4)	6% (6)	12% (3)	0% (7)
IKBA1	Mazatzal W, Pine Mountain W	13.4	26% (2)	8% (5)	**29% (1)**	8% (6)	8% (4)	21% (3)	1% (7)
PEFO1	Petrified NP	13.0	23% (2)	5% (6)	31% (1)	11% (4)	8% (5)	21% (3)	1% (7)

Table 11.5 – Relative Contribution of Pollutants on 20% Worst Days for the Progress Period (2005-2009)									
Site	Class I Area	Deciview (dv)	Percent Contribution (% of Mm^{-1}) and Rank						
			Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
SAGU1	Saguaro NP – East Unit	13.6	25% (2)	9% (5)	18% (3)	8% (6)	11% (4)	28% (1)	1% (7)
SAWE1	Saguaro NP – West Unit	14.9	21% (2)	11% (5)	16% (3)	8% (6)	13% (4)	31% (1)	1% (7)
SIAN1	Sierra Ancha W	13.0	25% (2)	6% (6)	33% (1)	9% (4)	8% (5)	19% (3)	1% (7)
SYCA1	Sycamore Canyon W	15.2	15% (4)	4% (6)	29% (1)	9% (5)	15% (3)	28% (2)	0% (7)
TONT1	Superstition W	13.8	28% (1)	8% (5)	21% (3)	7% (6)	9% (4)	26% (2)	1% (7)

For GRCA2 and IKBA1, the primary pollutant contributing to visibility impairment is organic carbon (particulate organic mass). In June 2009, three lightning sparked wildfires burned in close proximity to the GRCA2 monitor. The two visibility components associated with wildfire are organic carbon and elemental carbon. Observations regarding these two components are given below and results indicate that the visibility changes at GRCA2 were partially due to the 2009 wildfires:

- Elemental carbon showed a fairly large increase in visibility extinction using the RHR method; however, annual average elemental carbon measurements did not show increasing trends using the Theil method.
- Organic carbon showed an increase in extinction using the Regional Haze Rule method; however, annual average elemental carbon measurements did not show increasing trends using the Theil method.
- A separate analysis was performed that replaced the elemental and organic carbon extinction values for 2009 with longer term average extinction values to exclude the extreme effect of the wildfires from June 2009. The average baseline period (2000-2004) was compared to the average altered progress period (2005-2009) total extinction. The results of this analysis showed a decrease from 34.6 Mm-1 for the baseline period to 32.8 Mm-1 for the altered progress period. This provides evidence that the 2009 fires played an important role in the increased extinction when using the RHR method. A similar analysis was conducted replacing the elemental carbon and organic carbon values for 2003 with longer term averages, which acted to increase the total extinction change from 32.9 Mm-1 in the adjusted baseline period to 35.1 Mm-1 in the progress period. A summary of these results can be found in Table 11.5. These results illustrate how specific fire events can have a significant effect on the trends as determined by the RHR method.

The overall deciview increase at IKBA1 was affected by high measurements in 2005. The main components that contributed to this increase were organic carbon and ammonium sulfate. This increase is attributed to the following:

- Organic carbon showed a large increase in extinction using the Regional Haze Rule method, but did not show an increasing trend using the Theil method. The increase in organic carbon was strongly controlled by a large wildfire in July of 2005.

- Ammonium sulfate showed a large increase in extinction using the Regional Haze Rule method, but did not show an increasing trend using the Theil method. This large increase in ammonium sulfate using the Regional Haze Rule method was a regional trend. See Section III of the enclosed TSD for more information on ammonium sulfate trends.
- A separate analysis was performed that replaced the elemental and organic carbon extinction values for 2005 with longer term average extinction values to exclude the extreme effect of the wildfire from July 2005. The average baseline period (2000-2004) was compared to the average altered progress period (2005-2009) total extinction. The results of this analysis showed a decrease from 38.9 Mm-1 for the baseline period to 37.7 Mm-1 for the altered progress period (Table 11.6). This provides evidence that the 2005 fire played an important role increases in extinction when using the Regional Haze Rule method.

Table 11.6 – Alternative RHR Analysis Results for 20% Worst Days at GRCA2 (2003 & 2009) and IKBA1 (2005)*

Site	Year Adjusted	Total Extinction (Mm-1)					
		Baseline	Adjusted Baseline	Progress	Adjusted Progress	Standard Change	Adjusted Change
GRCA2	2003	34.6	32.9	35.1	--	**0.5**	**2.2**
GRCA2	2009	34.6	--	35.1	32.8	**0.5**	**-1.8**
IKBA1	2005	38.9	--	39.2	37.7	**0.3**	**-1.2**

* EC and POM visibility extinctions are replaced by ten-year average for 2003 and 2009 (GRCA2) and 2005 (IKBA1)

11.4.3 Visibility Trend Analysis: 2000 – 2009

The comparison between baseline conditions and the progress period show that overall visibility on worst and best days is either improving or unchanged at Arizona's Class I areas. This section presents visibility progress from 2000 to 2009 using two previously discussed methodologies: 1) the Regional Haze Rule method and 2) the Theil method.

Table 11.7 shows the deciview change and the change in extinction using the Regional Haze Rule method between the baseline period (2000 – 2004) and the progress period for each Class I area. This analysis shows changes in extinction for ammonium sulfate, organic carbon, elemental carbon, fine soil, coarse mass, and sea salt.

Table 11.7: Difference in Aerosol Extinction by Component between the Baseline Period (2000-2004) and the Progress Period (2005-2009) on 20% Worst Days

Site	Deciview (dv)			Change in Extinction by Component (Mm^{-1})*						
	Baseline	Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	OC	EC	Soil	CM	Sea Salt
BALD1	11.8	11.8	0.0	**+0.3**	**-0.1**	**-2.1**	**-0.7**	**+0.4**	**+1.3**	**+0.1**
CHIR1	13.4	12.2	**-1.2**	**+1.0**	**-0.1**	**-3.2**	**-0.5**	**-0.3**	**-1.9**	**+0.2**
GRCA2	11.7	12.0	**+0.3**	**+0.5**	**-0.4**	**+0.1**	**+0.5**	**+0.1**	**-0.3**	0.0
IKBA1	13.3	13.4	**+0.1**	**+1.0**	**-1.2**	**+0.7**	0.0	**-0.3**	0.0	**+0.1**

Table 11.7: Difference in Aerosol Extinction by Component between the Baseline Period (2000-2004) and the Progress Period (2005-2009) on 20% Worst Days										
Site	Deciview (dv)			Change in Extinction by Component (Mm^{-1})*						
	Baseline	Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	OC	EC	Soil	CM	Sea Salt
PEFO1	13.2	13.0	-0.2	+0.5	-0.3	-1.4	+0.5	+0.6	-1.0	+0.1
SAGU1	14.8	13.6	-1.2	-0.1	-3.2	-4.1	-0.9	-0.1	+1.2	+0.2
SAWE1	16.2	14.9	-1.3	-0.7	-2.3	-1.9	-0.5	-1.4	-2.2	+0.2
SIAN1	13.7	13.0	-0.7	+0.7	-0.3	-2.5	+0.1	+0.1	-0.6	+0.2
SYCA1	15.3	15.2	-0.1	+0.7	-0.7	-0.5	+0.4	-1.0	+1.4	0.0
TONT1	14.2	13.8	-0.4	+1.3	-0.5	-3.5	-0.6	+0.4	+0.5	+0.2

For the 20% worst days, the Regional Haze Rule method exhibited an increase in deciview between the baseline and progress periods at GRCA2 and IKBA1 sites and decreases at all other Arizona IMPROVE monitors. Using the Theil method, there were no significant increases in deciview at any monitors from 2000 to 2009. Significant decreasing deciview metric trends occurred at all sites except BALD1, GRCA2, IKBA1, PEFO1, and SYCA1 (Table 11.9). Notable differences for individual component extinctions on the 20% worst are as follows:

- All sites except GRCA2 and IKBA1 measured decreases in organic carbon using the RHR method. No sites showed significant increasing trends using the Theil method and four sites showed significant decreasing trends.
- The Regional Haze Rule method analysis of ammonium sulfate showed increased extinction at all Arizona site except SAGU1 and SAWE1, with the largest increases in ammonium sulfate at the CHIR1, IKBA1 and TONT1. In contrast, no statistically significant ($p < 0.15$) increasing annual trends in ammonium sulfate were measured using the Theil method. Decreasing annual ammonium sulfate trends on the order of about 0.1 Mm^{-1}/year were measured at BALD1, CHIR1, SAGU1 and SAWE1 sites. Anomalously high ammonium sulfate occurred in 2005 at most Arizona sites, which influenced the increases noted using the RHR method.
- The Regional Haze Rule method analysis of ammonium nitrate extinction showed decreases at all Arizona sites for the 20% worst days. Analysis of all measured days showed no increasing trends, and decreasing trends on the order of 0.1 Mm^{-1}/year at the IKBA1, SAGU1, SAWE1, SIAN1 and TONT1.
- The Regional Haze Rule method analysis of coarse mass revealed increasing extinction values at BALD1, SAGU1, SYCA1, and TONT1. However, only BALD1 showed a statistically significant increasing trend for coarse mass for all measured days on the order of approximately 0.1 Mm^{-1}/year ($p < 0.15$).
- The Regional Haze Rule method showed decreases in PM fine (soil) at five IMPROVE sites from the baseline to the progress period while showing the highest increases at PEFO1, BALD1, and TONT1 for the 20% worst days. Theil method analysis showed increasing trends at only two Arizona sites for the 20% worst days (BALD1 and PEFO1) while SYCA1 showed a significantly decreasing trend.
- Increases in deciview at GRCA2 using the RHR method were due to increases in ammonium sulfate and elemental carbon and the lack of a decreasing particulate organic mass extinction that occurred at most other Arizona Class 1 areas. Higher progress period measurements at GRCA2 were influenced by large events between June and August of 2009. These increases were

partially offset by decreases in ammonium nitrate and coarse mass. GRCA2 did not show significantly increasing ammonium sulfate trends using the Theil method.

- Increases in deciview at IKBA1 were mostly due to increased ammonium sulfate and organic carbon. Higher measurements during the progress period at IKBA1 were influenced by large events in July 2005. These increases were partially offset by decreases in ammonium nitrate and soil. This site did not show significantly increasing ammonium sulfate trends using the Theil method.

For the 20% best days, the Regional Haze Rule method showed a decrease deciview at all sites except GRCA2, where the deciview remained the same (Table 11.9). Notable differences for individual component averages on the 20% best days were as follows:

- The greatest decreases in deciview are attributable to decreases in organic carbon, which decreased at all sites except IKBA1 (using the RHR method). Theil method analysis revealed significant decreasing trends at seven IMPROVE monitors (Table 11.9).
- Ammonium sulfate decreased at most sites, but increased slightly at GRCA2, SAGU1 and SYCA1 using the RHR method. Theil methodology revealed no statistically significant increasing site trends and three sites experienced statistically significant decreases in ammonium sulfate trends ($p < 0.15$) (Table 11.9).
- Ammonium nitrate decreased at all but GRCA2 using the RHR method and four of those decreases were statistically significant using the Theil method ($p < 0.15$) (Table 11.9).

Table 11.8: Difference in Aerosol Extinction by Component between the Baseline Period (2000-2004) and the Progress Period (2005-2009) on the 20% Best Days

Site	Deciview (dv)			Change in Extinction by Component (Mm^{-1})*						
	Baseline Period	Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	OC	EC	Soil	CM	Sea Salt
BALD1	3.0	2.9	-0.1	-0.1	-0.1	-0.1	0.0	0.0	+0.1	0.0
CHIR1	4.9	4.4	-0.5	-0.2	-0.1	-0.5	-0.1	0.0	0.0	0.0
GRCA2	2.2	2.2	0.0	+0.1	0.0	-0.1	0.0	0.0	0.0	0.0
IKBA1	5.4	5.1	-0.3	-0.3	-0.2	+0.1	0.0	-0.1	-0.1	+0.1
PEFO1	5.0	4.6	-0.4	-0.1	-0.2	-0.4	0.0	+0.1	0.0	0.0
SAGU1	6.9	6.7	-0.2	+0.1	-0.2	-0.2	-0.1	-0.3	+0.3	+0.1
SAWE1	8.6	8.0	-0.6	-0.2	-0.1	-0.5	-0.4	-0.3	+0.2	+0.2
SIAN1	6.2	5.3	-0.9	-0.3	-0.4	-0.7	-0.1	0.0	0.0	0.0
SYCA1	5.6	5.1	-0.5	+0.1	-0.1	-0.6	-0.2	-0.1	+0.1	0.0
TONT1	6.5	5.7	-0.8	-0.2	-0.2	-0.5	-0.2	-0.1	-0.2	+0.1

*Change is calculated as progress period average minus baseline period average. Values in red indicate increases in extinction, values in blue indicate decreases.

Table 11.9 presents a ten-year trend analysis of extinction for individual visibility impairing pollutants using the Theil method. Only averages with p-value statistics less than 0.15 (85% confidence level) are presented; increasing slopes are noted in red and decreasing slopes in blue. The Regional Haze Rule requires states to look at changes in extinction for the 20% worst and best days. As an alternative, ADEQ

is presenting trend statistics for an average of all sampled days. Selection of the 20% worst and best days can vary seasonally from year to year, so the annual average of all sampled days may provide a better representation actual aerosol component trends.

Table 11.9: Statistically Significant 2000-2009 Annual Average Trends for Aerosol Extinction by Component for Arizona Class I area IMPROVE Sites

Site	Group	Annual Trend* (Mm^{-1}/year)							
		Site Total (dv)	Amm. Sulfate	Amm. Nitrate	OC	EC	Soil	Coarse Mass	Sea Salt
BALD1	20% Best	--	--	0.0	--	0.0	--	0.0	0.0
	20% Worst	--	-0.2	--	--	--	0.1	0.3	0.0
	All Days	--	-0.1	0.0	--	--	--	0.1	0.0
CHIR1	20% Best	-0.1	0.0	0.0	-0.1	0.0	--	0.0	0.0
	20% Worst	-0.3	--	--	-0.7	-0.1	--	--	0.0
	All Days	-0.2	-0.1	0.0	-0.2	-0.1	--	-0.1	0.0
GRCA2	20% Best	--	--	--	--	0.0	--	--	0.0
	20% Worst	--	--	-0.1	--	--	--	--	--
	All Days	--	--	0.0	--	--	--	--	--
IKBA1	20% Best	-0.2	-0.1	-0.1	0.0	0.0	0.0	--	0.0
	20% Worst	--	--	--	--	0.0	--	--	0.0
	All Days	--	--	-0.1	--	0.0	--	--	0.0
PEFO1	20% Best	-0.1	--	0.0	-0.1	--	--	--	0.0
	20% Worst	--	--	--	--	--	0.1	--	0.0
	All Days	-0.1	--	0.0	--	--	0.0	0.1	0.0
SAGU1	20% Best	-0.2	--	-0.1	-0.1	--	--	--	--
	20% Worst	-0.3	-0.4	-0.5	-0.6	-0.3	--	--	0.1
	All Days	-0.2	-0.1	-0.1	-0.2	-0.1	--	--	0.0
SAWE1	20% Best	-0.2	0.0	0.0	-0.1	-0.1	-0.1	--	0.0
	20% Worst	-0.3	-0.3	-0.6	-0.5	--	--	--	0.0
	All Days	-0.2	-0.1	-0.1	-0.3	-0.1	--	--	0.0
SIAN1	20% Best	-0.2	-0.1	-0.1	-0.1	0.0	--	--	0.0
	20% Worst	-0.2	--	--	--	--	--	--	0.0

Table 11.9: Statistically Significant 2000-2009 Annual Average Trends for Aerosol Extinction by Component for Arizona Class I area IMPROVE Sites									
Site	Group	Annual Trend* (Mm^{-1}/year)							
		Site Total (dv)	Amm. Sulfate	Amm. Nitrate	OC	EC	Soil	Coarse Mass	Sea Salt
	All Days	-0.2	--	-0.1	-0.4	-0.1	--	--	0.0
SYCA1	20% Best	-0.1	--	--	-0.1	--	--	--	0.0
	20% Worst	--	--	--	--	0.1	-0.3	--	--
	All Days	-0.1	--	0.0	--	--	-0.1	--	--
TONT1	20% Best	-0.2	-0.1	-0.1	-0.1	-0.1	--	-0.1	0.0
	20% Worst	-0.2	--	-0.1	-0.8	-0.2	--	--	0.1
	All Days	-0.1	--	-0.1	-0.2	-0.1	--	--	0.0

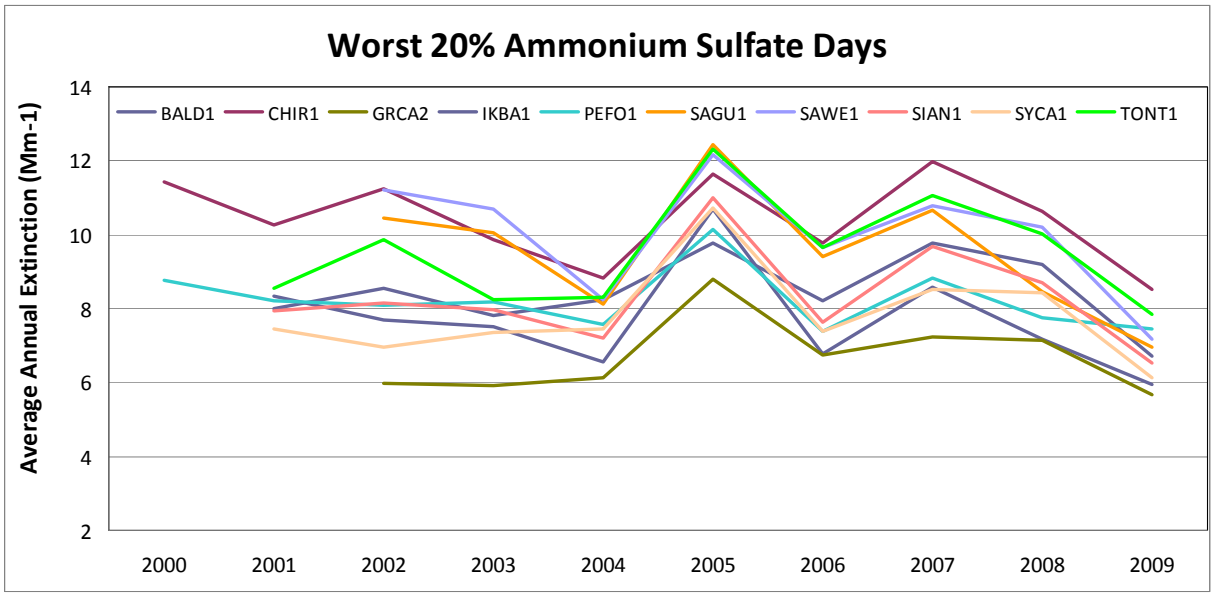
Ammonium Sulfate

Several of the tables in the preceding section have examined how ammonium sulfate extinction has changed within the 2000-2009 period at IMPROVE monitoring sites in Arizona. The comparison and analysis of baseline conditions and the progress period show increases in ammonium sulfate extinction at Arizona's IMPROVE monitors when using the Regional Haze Rule method, while showing no significant trends or decreasing Theil statistic trends for the 20% worst days, 20% best days, and all days.

To provide evidence of decreasing extinction at IMRPOVE monitors, ADEQ and Air Resource Specialists (ARS) performed an alternate analysis in which the 20% worst ammonium sulfate days were isolated, average annually, and averaged for the baseline and progress period. This analysis allows for a better understanding of how the visibility on 20% worst days for a specific pollutant can change between the baseline and progress period.

The analysis required by the Regional Haze Rule can cause seasonal shifts in the days chosen from the baseline and progress periods, which in turn can overlook seasonal highs for individual pollutants. Extinction from ammonium sulfate decreases between 2000 – 2004 (Figure A). In 2005 and 2007, extinction from ammonium sulfate increased, which is followed by decreasing extinction from 2007 – 2009 (Figure A).

Figure A: Average Annual Ammonium Sulfate Extinction (mM-1) for the 20% Worst Days



Regional Haze Rule analysis and Theil statistics trend analysis were performed for each monitor on the annually averaged 20% worst days for 2000 - 2009. When the baseline and progress period extinction averages are compared, all IMPROVE sites show increasing ammonium sulfate extinctions except SAWE1 (Table 11.10). However, when looking at the 20% worst days for ammonium sulfate from 2000 – 2009, no IMPROVE monitors show increasing trends. Statistically significant decreasing trends are found at BALD1, CHIR1, PEFO1, SAGU1, and SAWE1. The extreme differences are strongly influenced by ammonium sulfate concentrations measured in 2005. Since 2005 can be considered a mid-point, the data have a more neutral effect using the Theil method ($p < 0.15$). To illustrate the affect of 2005, ADEQ presents the results of an analysis in Table 11.10 where the Regional Haze Rule method is altered to include 2005 in the baseline period rather than the progress period. This altered Regional Haze Rule method resulted in reduced ammonium sulfate extinction values between the altered progress period (2006-2009) when compared to the altered baseline period (2000-2005) for all sites, except TONT1. This illustrates the strong affect that one outlier year can have in the Regional Haze Rule methodology.

Table 11.10: 2000-2009 Ammonium Sulfate Extinction (mM^{-1}) Trends, Baseline (2000-2004) vs. Progress (2005-2009) Period Comparisons, and Altered Baseline (2000-2005) vs. Altered Progress (2005-2009) Period Comparisons the 20% Worst Ammonium Sulfate Days

Site	Slope	p-value	Baseline (2000-2004)	Period 1 (2005-2009)	Difference	Altered Baseline (2000-2005)	Altered Period 1 (2006-2009)	Difference
BALD1	**-0.18**	**0.08**	7.52	7.84	**0.32**	8.15	7.13	**-1.02**
CHIR1	**-0.15**	**0.14**	10.33	10.51	**0.18**	10.55	10.22	**-0.32**
GRCA2	-0.05	0.24	6.39	7.12	**0.73**	6.87	6.70	**-0.17**
IKBA1	-0.09	0.36	8.16	8.73	**0.57**	8.48	8.47	**-0.02**
PEFO1	**-0.15**	**0.03**	8.16	8.31	**0.15**	8.49	7.86	**-0.64**
SAGU1	**-0.29**	**0.13**	9.54	9.58	**0.05**	10.26	8.87	**-1.39**

Table 11.10: 2000-2009 Ammonium Sulfate Extinction (mM^{-1}) Trends, Baseline (2000-2004) vs. Progress (2005-2009) Period Comparisons, and Altered Baseline (2000-2005) vs. Altered Progress (2005-2009) Period Comparisons the 20% Worst Ammonium Sulfate Days								
Site	**Slope**	**p-value**	**Baseline (2000-2004)**	**Period 1 (2005-2009)**	**Difference**	**Altered Baseline (2000-2005)**	**Altered Period 1 (2006-2009)**	**Difference**
SAWE1	**-0.33**	**0.09**	10.05	10.00	**-0.05**	10.58	9.45	**-1.13**
SIAN1	-0.07	0.30	7.81	8.71	**0.90**	8.45	8.14	**-0.31**
SYCA1	-0.04	0.43	7.30	8.24	**0.94**	7.99	7.62	**-0.37**
TONT1	0.00	0.50	8.75	10.18	**1.43**	9.46	9.65	**0.19**

Regional Ammonium Sulfate Trends

While Arizona's Regional Haze SIP only addresses the pollutant emissions and progress goals for areas within Arizona's State boundary, it is important to analyze regional trends in pollutants in order to better understand which phenomena are more representative of State issues and which extend beyond State boundaries to surrounding areas. This type of analysis allows for a better understanding of which emission increases are locally based in origin and which may be more representative of a regional trend and thus may be due to some uncontrollable external factor (e.g. NO_x emissions originating from a point source located within another State or Country, PM emission increases which are seen in regional trends and thus may be related to environmental factors, etc.). In this section we analyze regional maps of IMPROVE monitor aerosol extinction changes between baseline and progress periods in order to determine if previously identified State of Arizona ammonium sulfate trends may be regional phenomena.

Figure B shows only those aerosol extinction components which have increased for the 20% most impaired days between the baseline (2000-2004) and progress (2005-2009) periods for all IMPROVE monitors in the western United States. Note that individual sites can show increases in specific aerosol components, but still show decreases in overall deciview values. There are fairly widespread increases in POM across much of the northwestern U.S. and substantial increases in ammonium sulfate across the State of Arizona, State of New Mexico, western Texas, and south-central Colorado. (Figure B). While the ammonium sulfate increases seen in this figure appear to be a regional phenomenon, it is difficult to determine an origination point and the specific sources that may be responsible for the regional trends. However, ADEQ has evaluated transport episodes for at least one specific event and has included a summary of this analysis in section III.C.3.

Figure B: Magnitude of Visibility Component Extinctions Increasing Between Baseline Average (2000-2004) and First Progress Period Average (2005-2009) for 20% Worst Days

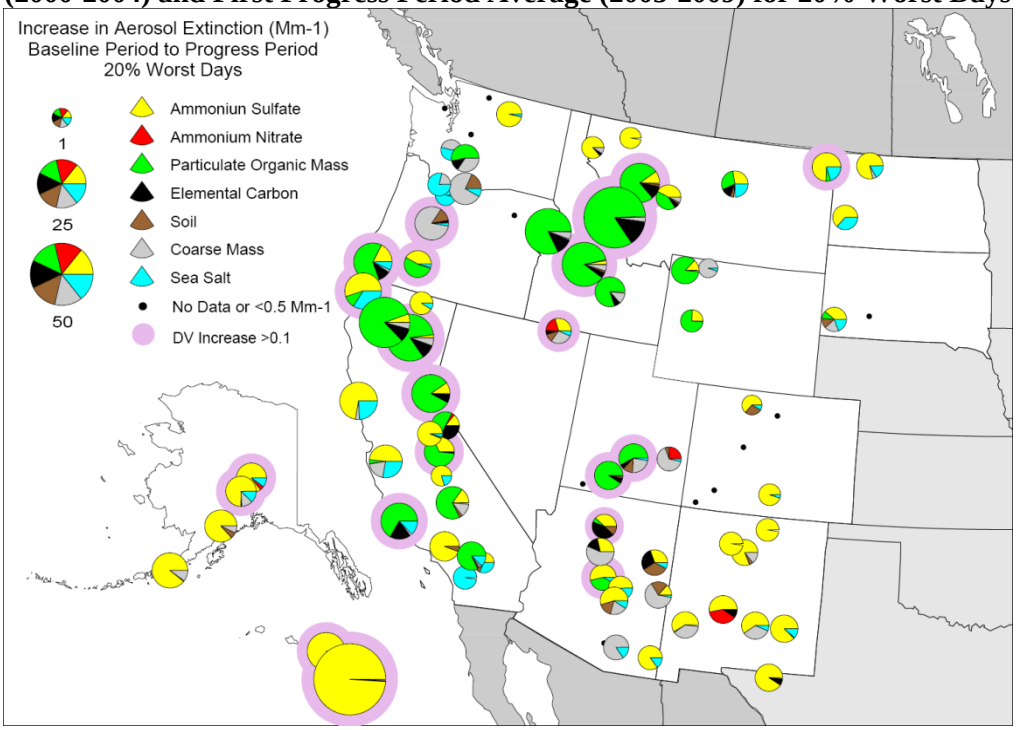


Figure B shows that extinction due to ammonium sulfate increased regionally between baseline and progress periods. The ammonium sulfate trends for the 20% worst days (Figure C) and all days (Figure D) were analyzed using Theil method statistics and found that there was either 1) no statistically significant trends at IMPROVE monitors within the four corners region (i.e. Arizona, Utah, Colorado, and New Mexico) or 2) the 10-year annual average ammonium sulfate extinction trends at these IMPROVE monitors exhibited statistically significant decreases ($p < 0.15$). Similar to what was previously reported for Arizona, regional Theil method trends disagree with the Regional Haze Rule method of a five year average comparison of the 20% worst days between the baseline and progress period (Table 11.9). Furthermore, this agreement between Arizona and south-western United States regional trends may indicate that 2005 and 2007 were outlier years for ammonium sulfate extinction within the entire four corners region and the Regional Haze Rule method does not reflect more recent visibility extinction improvements for ammonium sulfate.

Figure C: 10-year annual average ammonium sulfate extinction trends for 20% worst days at CIA IMPROVE sites in the WRAP region.

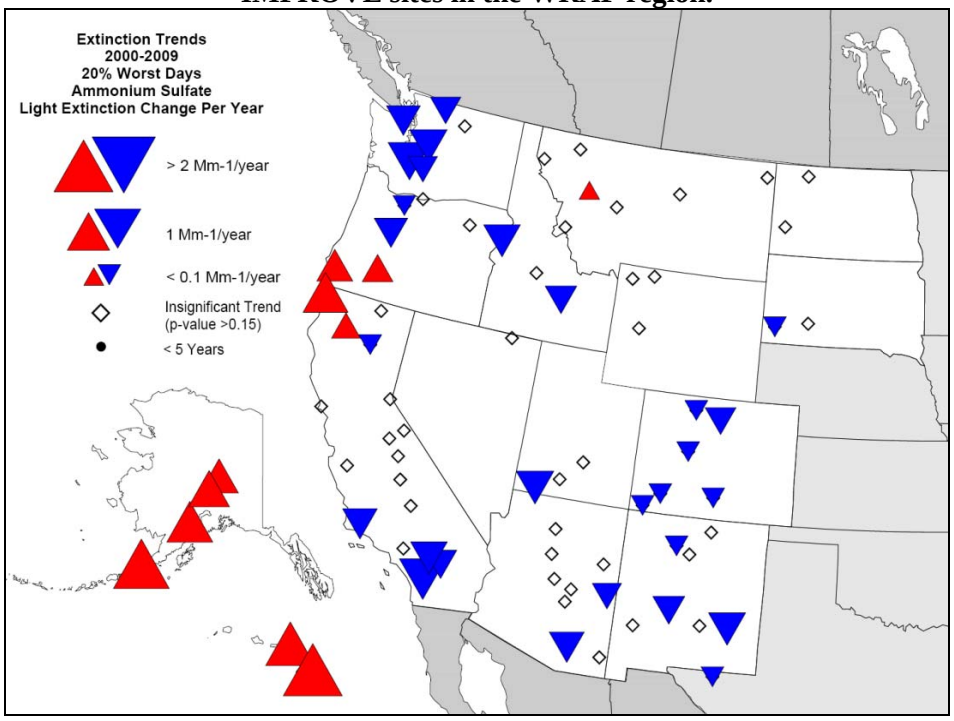
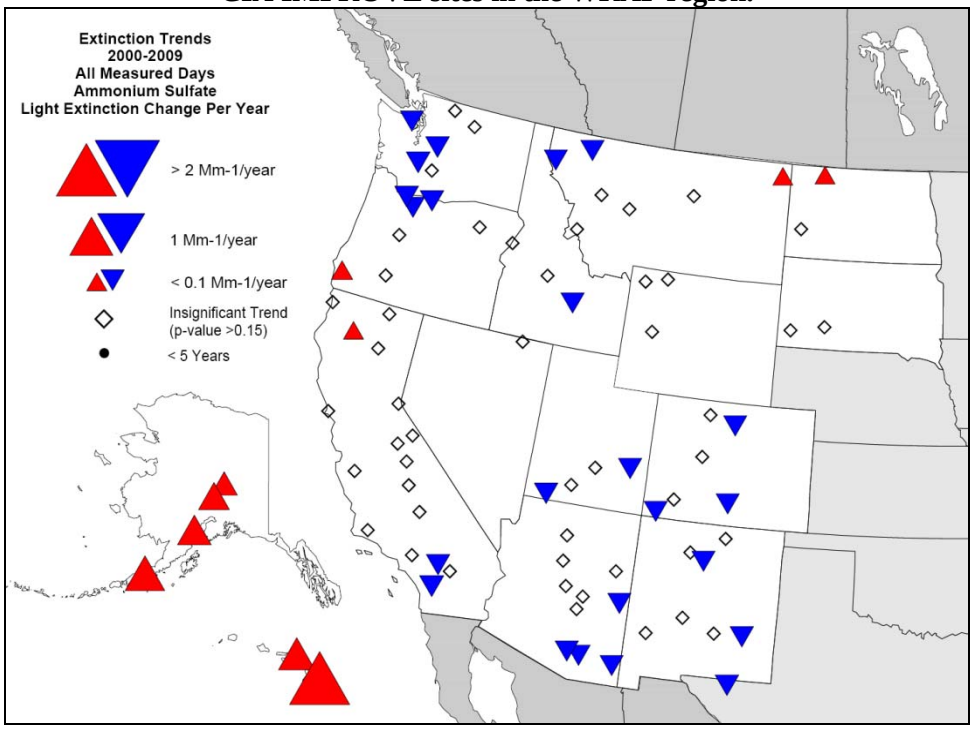


Figure D: 10-year annual average ammonium sulfate extinction trends for all measured days at CIA IMPROVE sites in the WRAP region.

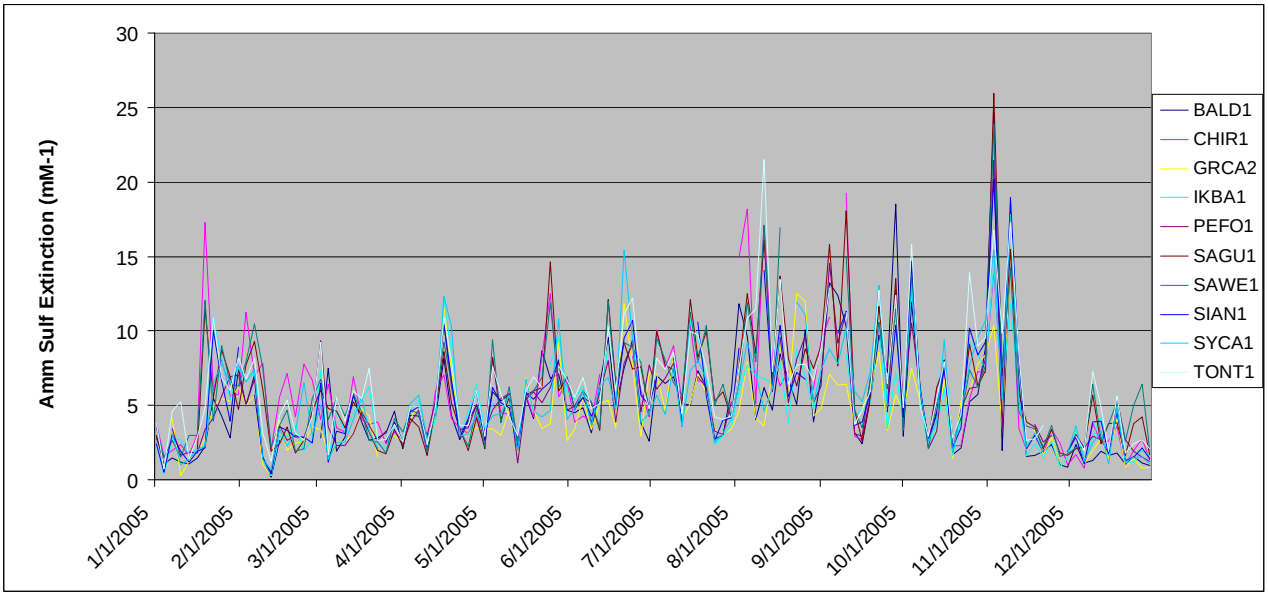


11.4.4 2005 and 2007 Ammonium Sulfate Analysis

As can be seen in Figure A, peaks in ammonium sulfate annual average extinction for the 20% most impaired ammonium sulfate days occurred for the years 2005 and 2007. In this section, ADEQ provides analysis of these years in an attempt to gain a better understanding of the cause of such peaks. In this analysis, ADEQ attempted to isolate, where appropriate, events within a single year that would result in an annual spike of ammonium sulfate extinction for the 20% most impaired ammonium sulfate days. While elevated baseline extinction may be due to a number of different factors which are likely beyond ADEQ's ability to identify, single large event signatures are much more easily isolated and identifiable.

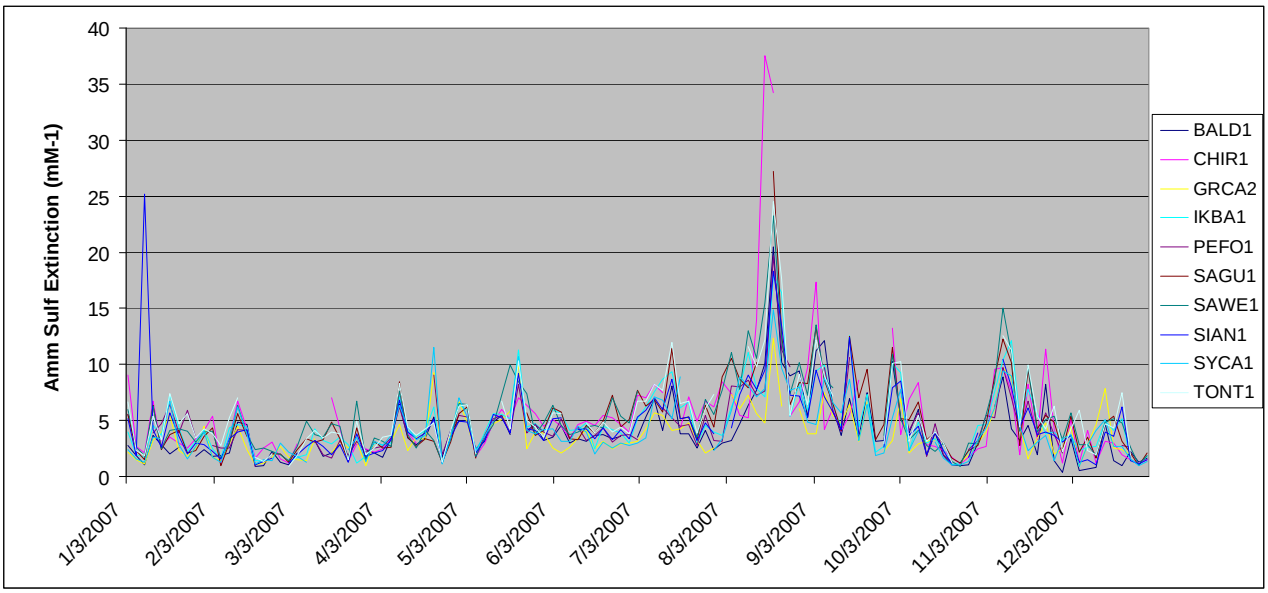
Sources of 2005 ammonium sulfate formation are difficult to differentiate due to the ubiquity of medium to large sized single events (Figure E); however, in general, concentrations are higher in the summer months when temperatures are also maximized. Figure E shows that the year of 2005 experienced frequent ammonium sulfate event spikes during the summer and fall months; however, the frequency of these events was exceptional when compared to other years resulting in ADEQ's inability to identify sources of ammonium sulfate for the year of 2005.

Figure E: 2005 Ammonium Sulfate Extinction (mM-1) reported every 3 days at all Arizona Class I areas



In contrast to 2005, the 2007 ammonium sulfate annual average extinctions for the 20% worst days at Arizona Class I areas were dominated by one event which resulted in elevated observed concentrations throughout Arizona between the dates of 8/16 and 8/22 (Figure F). Figure F shows slight increases in ammonium sulfate extinctions leading up to this event followed by extreme peaks of ammonium sulfate extinction on 8/16/2007 and 8/19/2007 at Arizona Class I areas.

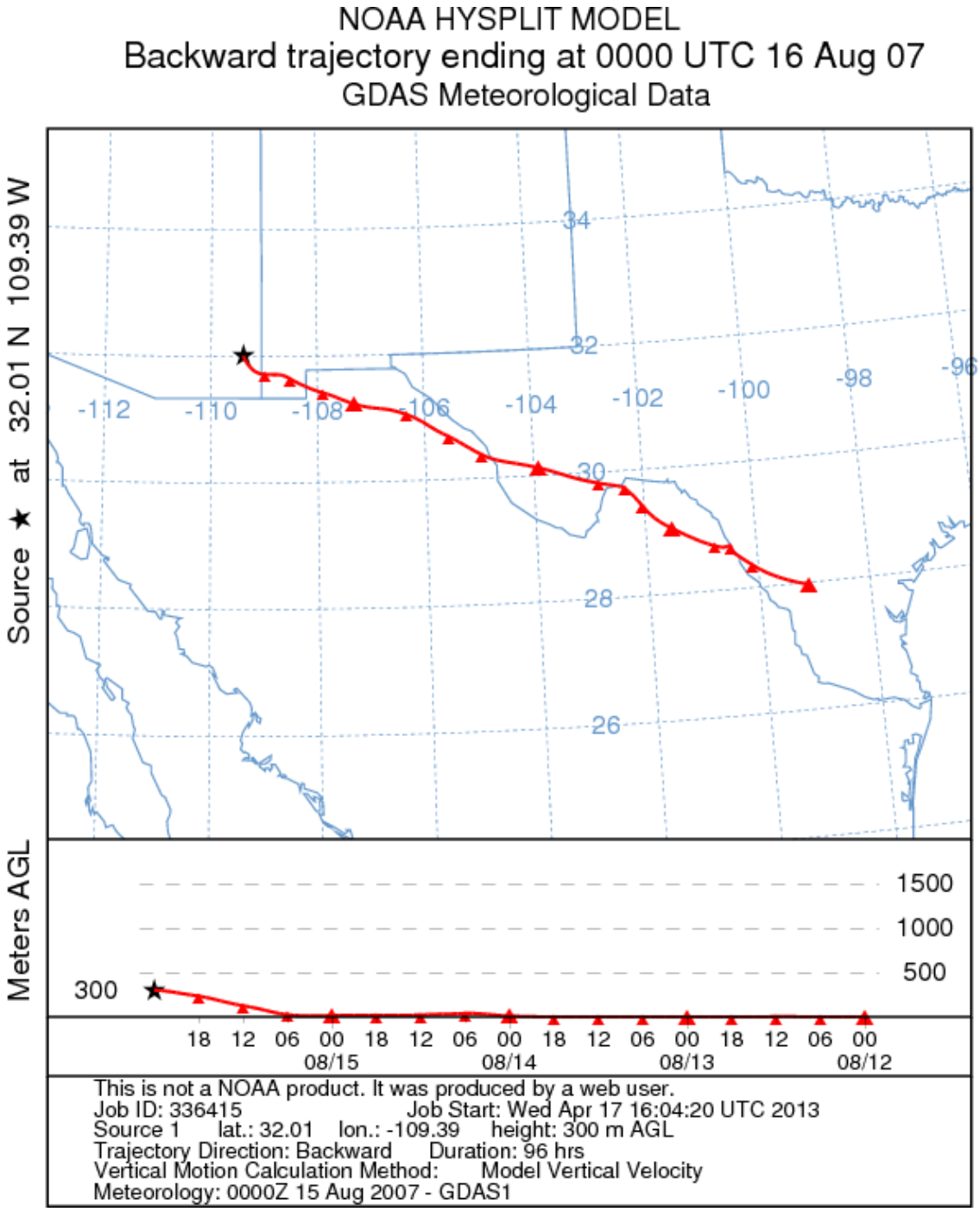
Figure F: 2007 Ammonium Sulfate Extinction (mM-1) reported every 3 days at all Arizona Class I areas.



ADEQ examined observed ammonium sulfate extinction measurements for all Class I area monitors located within Arizona and found that the IMPROVE monitor with the earliest recorded peak for this event was at CHIR1 (8/16/2007). All other sites peaked on 8/19/2007. CHIR1 experienced the largest peak ammonium sulfate extinction values recorded in the State for this event. CHIR1 represents the most southeasterly Class I area IMPROVE monitor located in the State of Arizona. ADEQ next used National Oceanic and Atmospheric Administration's (NOAA) Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT)9 to determine the wind back trajectory for a 96-hour period leading up to the 8/16/2007 peak ammonium sulfate extinction values recorded at CHIR1 in order to determine a possible origination direction for this event. Figure G shows that winds originated southeasterly from the CHIR1 IMPROVE monitor for the 4 days leading up to the 8/16/2007 peak. This information indicates that the event was likely to occur either within the southeastern portion of Arizona around 8/16/2007 and spread throughout the State or originated outside of Arizona from a southeasterly direction.

[9] National Oceanic and Atmospheric Administration – Air Research Laboratory. http://www.arl.noaa.gov/HYSPLIT_info.php

Figure G: 96 hour, 300 m AGL back trajectory for the winds contributing to the 8/16/2007 extreme ammonium sulfate event peak at CHIR1.



ADEQ then examined ammonium sulfate extinction for IMPROVE monitors near the U.S.-Mexico border for the year of 2007 in order to determine if the event was a regional phenomenon. Figures H-L show ammonium sulfate extinction for all southern Arizona, southern New Mexico, and western Texas IMPROVE monitoring sites during the progression of the above mentioned event and extending from 8/13/2007 – 8/25/2007. Figure H shows that western Texas and eastern New Mexico sites are

experiencing elevated ammonium sulfate extinction in relation to other regional monitors on 8/13/2007. On 8/16/2007, both west Texas monitors, all New Mexico monitors, and CHIR1 peak in ammonium sulfate extinctions for the event spanning over this twelve day period (Figure I). On 8/19/2007 all remaining Arizona monitors peak for the event while CHIR1, all New Mexico monitors, and west Texas monitors begin to show some reductions in extinction values (Figure J). On 8/22/2007 (Figure K) all eastern monitors are continuing to show reducing ammonium sulfate extinctions as Arizona monitors begin to reduce in measured extinctions following the 8/19/2007 peak extinctions. Finally on 8/25/2007 all monitors show near background levels of ammonium sulfate across the region (Figure L). The progression of ammonium sulfate peak concentrations temporally from east to west is consistent with the wind back trajectory shown in Figure G and supports this ammonium sulfate event originating outside of the State of Arizona.

Next, ADEQ assessed the effect of this single event on the annual average extinction for the 20% worst ammonium sulfate days. In order to do so, ADEQ removed the dates of 8/16-8/22 as possible dates for the 20% worst ammonium sulfate day analysis and recalculated the annual average by the substitution of these days with the next highest days for ammonium sulfate extinction for the year 2007 where needed. Table 16 shows annual ammonium sulfate average extinctions at each site for the 20% worst ammonium sulfate days for the years 2000-2010, where 2007adj is the 2007 annual average adjusted to exclude the 8/16-8/22 event. As can be seen in the table below, the 2007adj values are much more in line with typical averages from other years. It is apparent that the regional transport of ammonium sulfate that occurred on 8/16 – 8/22 had a large influence on the overall 20% worst days average for 2007. Furthermore, when calculating the altered 2006 – 2010 progress period (i.e. using 2007adj) in place of the unadjusted 2007 ammonium sulfate annual average, all sites showed reductions in the five-year averaged ammonium sulfate extinction values. When comparing the progress period worst 20% ammonium sulfate annual average extinction (2006-2010) with 2007adj substitution to the baseline period worst 20% ammonium sulfate annual average extinction, all sites except GRCA2 and TONT1 showed reductions in the five-year averages (Table 11.11).

ADEQ has identified a similar event that occurred in late September of 2008 where ammonium sulfate concentrations were approximately three times that of other maximums throughout the year (similar signature shown in Figure F). The back-trajectory for the September, 2008 event was very similar to that of the 2007 event in that the trajectory showed a southeast to northwest movement of air parcels. ADEQ staff have not been able to perform detailed analyses (as was done for the August, 2007 event) of all of these events, however, it is possible that some, if not most, elevated ammonium sulfate extinction values are due to events that have origins outside the state of Arizona. If ammonium sulfate contains a strong regional transport signature, this could be partially or wholly responsible for the increasing trend in ammonium sulfate extinction in Arizona and New Mexico as shown in Figure B. This notion is further supported by the fact that SO_2 emissions from four major power plants and two major smelters within the state of Arizona have generally decreased over the 2000 – 2010 period, consistent with the decrease shown in the 2002 and 2008 statewide emission inventory for SO_2. Additional time and effort would be needed to fully verify that regional transport of ammonium sulfate may be responsible for any increases in ammonium sulfate extinction measured at the IMPROVE monitors.

Figure H: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/13/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

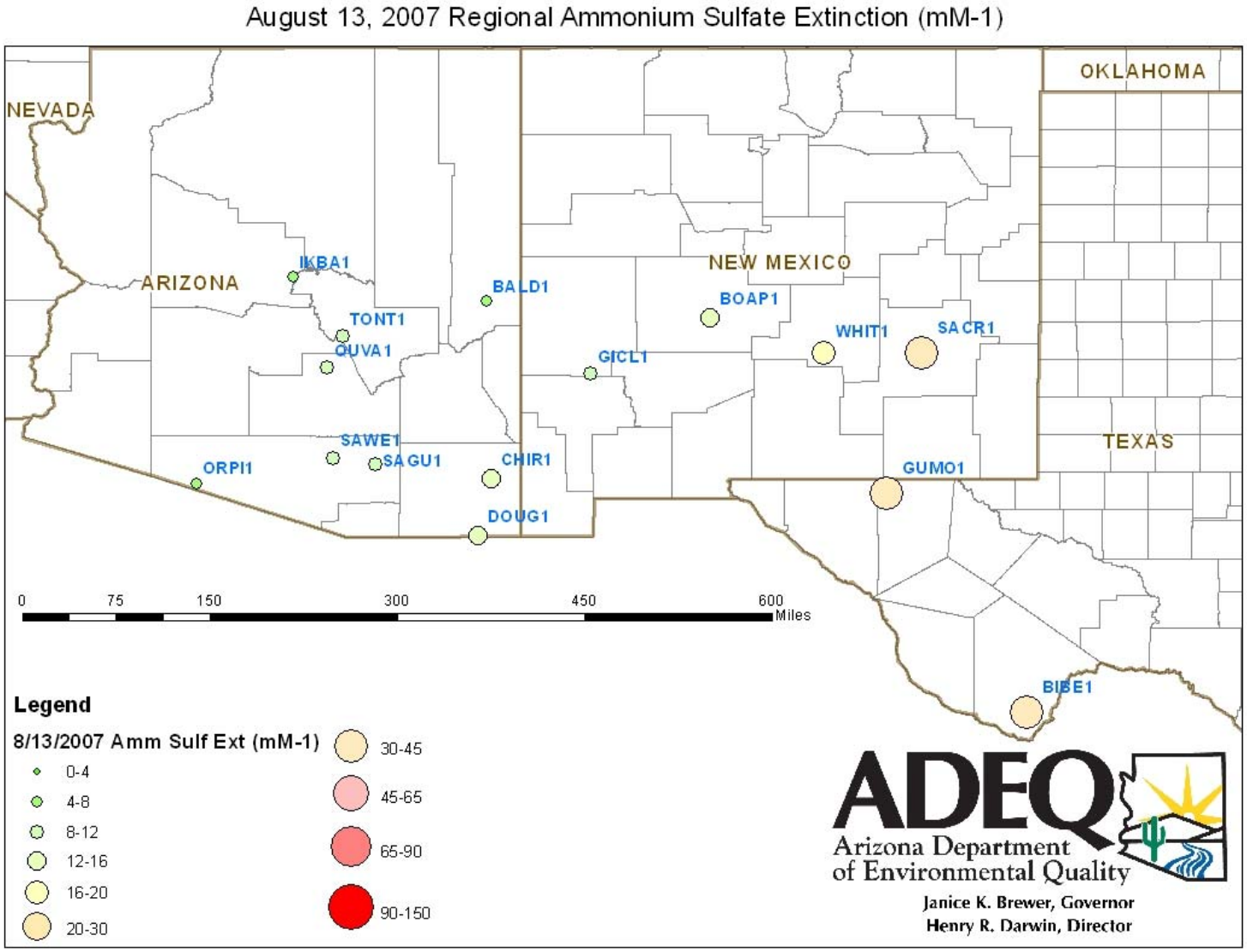


Figure I: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/16/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

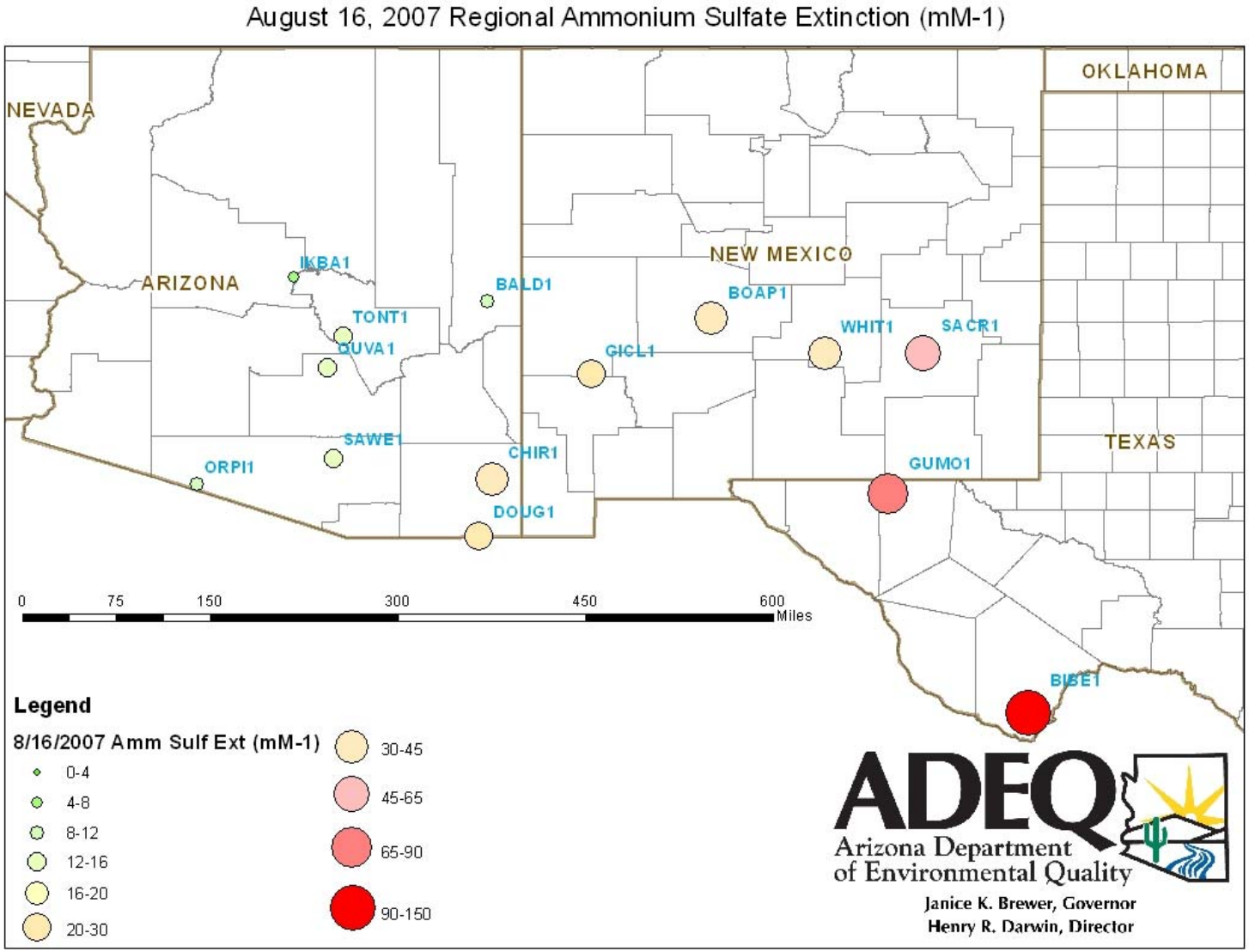


Figure J: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/19/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

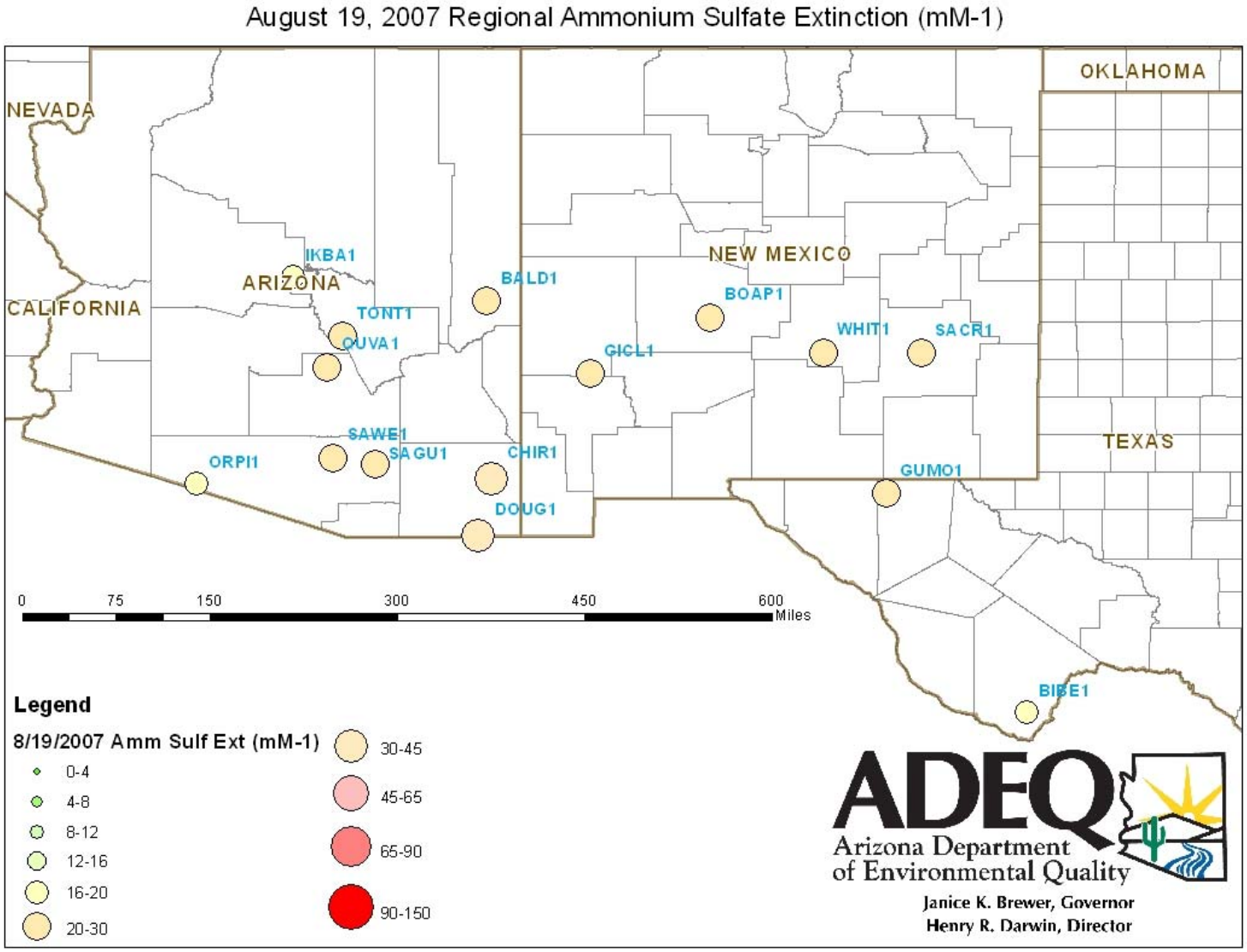


Figure K: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/22/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

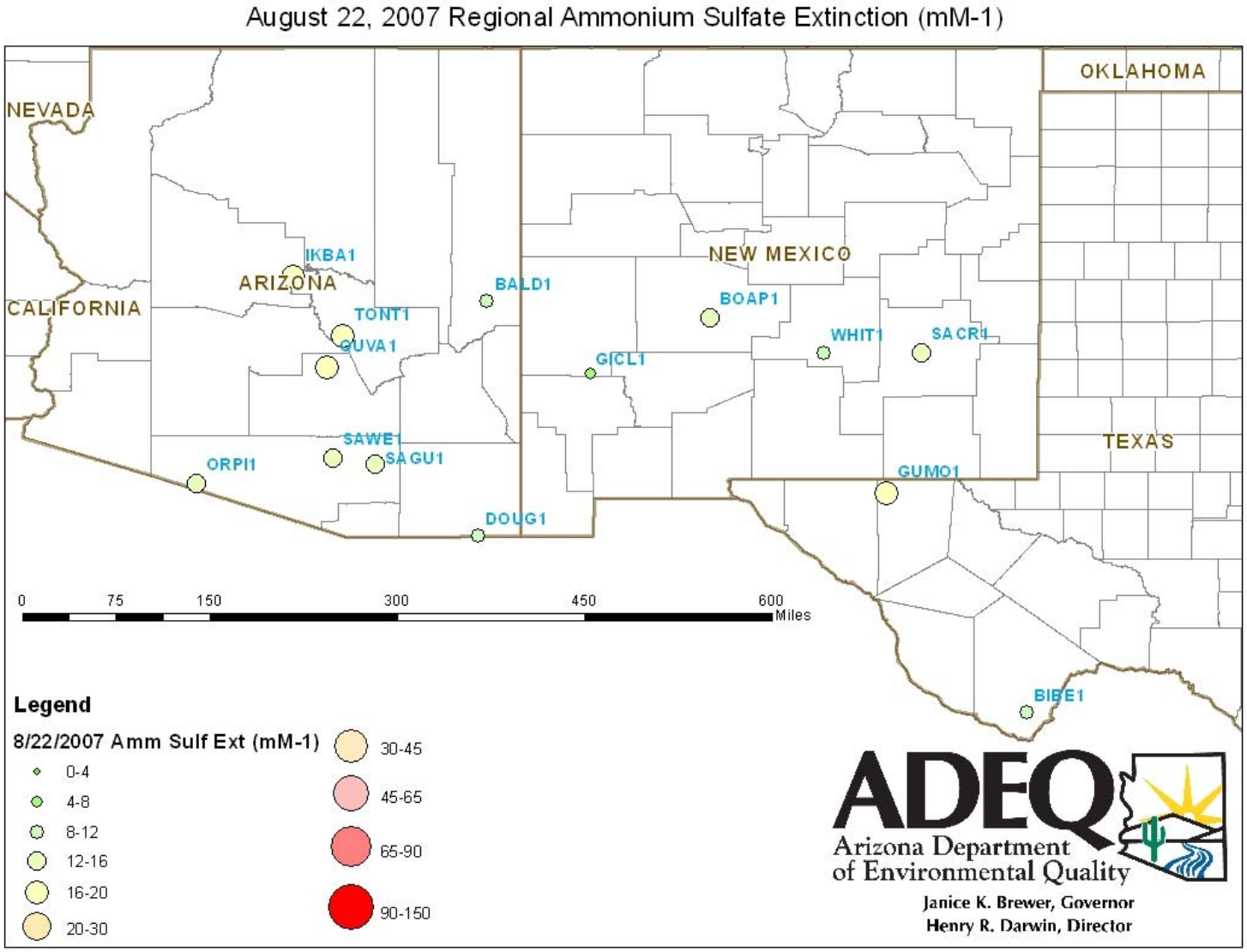


Figure L: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/25/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

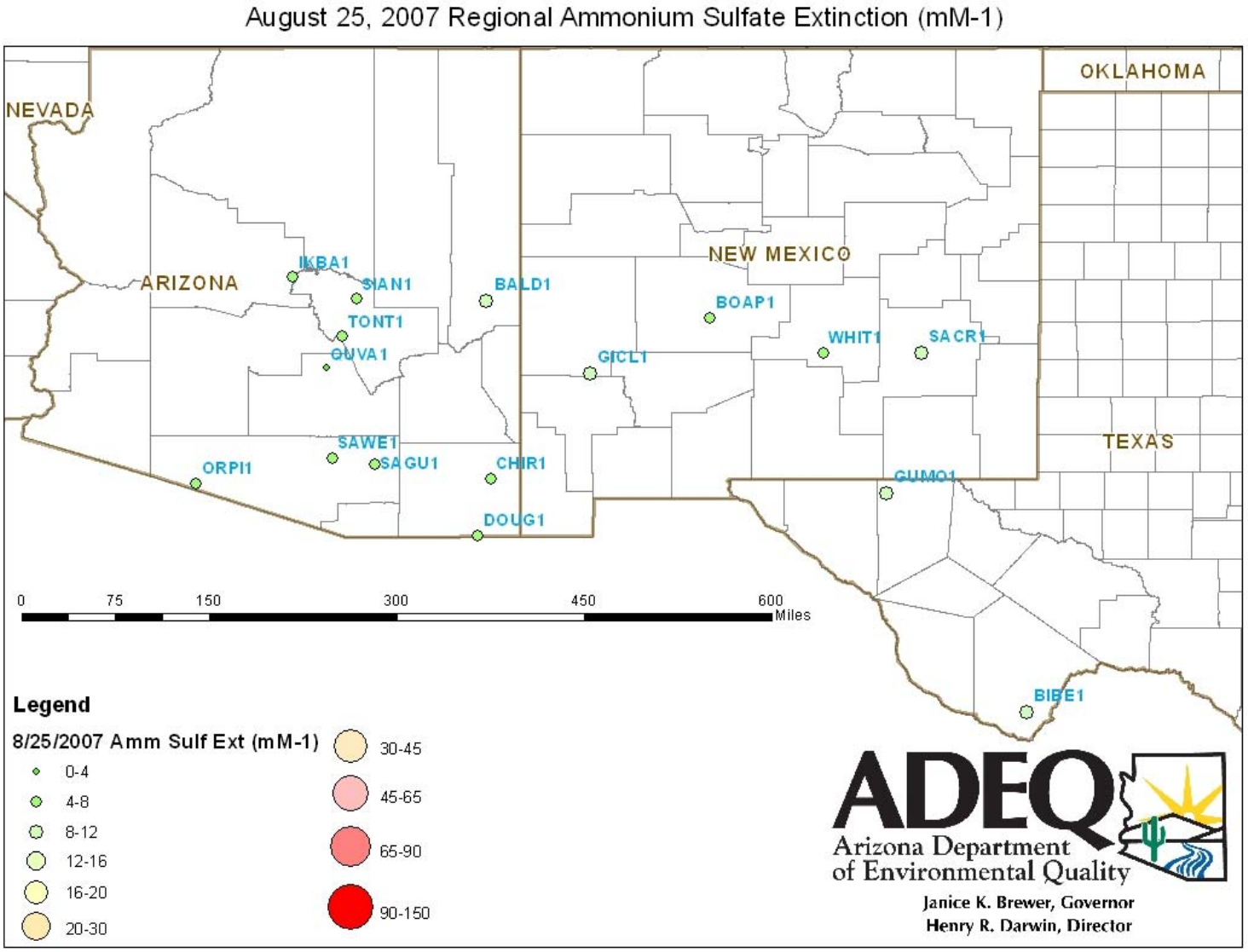


Table 11.11: 20% Most Impaired Ammonium Sulfate Days – 2007 adjusted values (2007adj) are calculated excluding the 8/16-8/22/2007 period. Progress Period averages are calculated using years 2006 - 2010 annual averages. Altered Progress Period averages are calculated as the average of years 2006, 2007adj, 2008, 2009, and 2010 annual averages.																
Site	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2007 adj**	**2008**	**2009**	**2010**	**Baseline (2000-2004)**	**Progress Period (2006-2010)**	**Altered Progress Period (2006-2010, using 2007adj)**	**Progress Period Difference (Adjusted Progress - Progress)**
BALD1		8.35	7.68	7.51	6.55	10.68	6.79	8.59	7.45	7.19	5.96	6.73	7.52	7.05	6.82	-0.23
CHIR1	11.43	10.27	11.24	9.87	8.82	11.65	9.77	11.99	9.24	10.63	8.51	8.93	10.33	9.97	9.42	-0.55
GRCA2	7.54		5.99	5.91	6.13	8.79	6.76	7.24	6.87	7.14	5.67	5.85	6.39	6.53	6.46	-0.07
IKBA1		8.01	8.56	7.82	8.25	9.79	8.21	9.76	8.80	9.18	6.72	7.10	8.16	8.19	8.00	-0.19
PEFO1	8.76	8.21	8.08	8.17	7.57	10.15	7.39	8.83	7.72	7.75	7.45	6.68	8.16	7.62	7.40	-0.22
SAGU1			10.44	10.05	8.11	12.44	9.41	10.67	9.50	8.45	6.96	8.64	9.54	8.82	8.59	-0.23
SAWE1			11.22	10.68	8.24	12.17	9.67	10.79	9.48	10.19	7.16	8.61	10.05	9.28	9.02	-0.26
SIAN1		7.93	8.14	7.96	7.22	11.00	7.64	9.67	8.61	8.72	6.53	7.47	7.81	8.01	7.79	-0.21
SYCA1		7.44	6.96	7.34	7.46	10.74	7.38	8.53	7.91	8.44	6.13	6.56	7.30	7.41	7.28	-0.12
TONT1		8.55	9.86	8.26	8.32	12.31	9.67	11.07	9.44	10.01	7.86	8.51	8.75	9.42	9.10	-0.33

11.4.5 Coarse Mass Analysis

Coarse particulate matter is generally recognized as having origination sources that are locally based. Analyses of coarse mass were conducted to gain a better understanding of trends between the baseline and progress periods. ADEQ presents an alternate approach in selecting the 20% worst days, which is similar to the analysis performed for ammonium sulfate (Section 11.4.3). Furthermore, a qualitative analysis of the location of IMPROVE sites in relation to major PM_{10} emitting point sources was performed to determine if an evident pattern exists between point source location and IMPROVE monitor location.

20% Worst Coarse Mass Days

Several analyses have been conducted to examine how coarse mass extinction has changed within the 2000 – 2010 period at IMPROVE monitoring sites in Arizona. When examining the state as a whole, coarse mass has shown no discernable spatial trends at the IMPROVE sites between the baseline period and progress period averages for the 20% worst days (Table 11.6). Furthermore, Theil statistic trends for the 20% worst days only resulted in the BALD1 site exhibiting the only statistically significant trend between 2000-2009, where an increase has been noted (Table 11.9). However, when 2010 data were added to the analysis, the PEFO1 monitor also exhibited a statistically significant increasing trend, while GRCA2 and SYCA1 indicated statistically significant decreasing trends.

In this section, ADEQ presents an alternate analysis performed by Air Resource Specialists (ARS) in which the 20% most impaired coarse mass days were isolated, averaged annually and then averaged for the baseline and progress periods. This analysis was performed in order to better understand how the worst 20% visibility days for a particular pollutant change between the baseline and progress periods rather than examining the 20% worst visibility days for all combined pollutants. The combination analysis required by the RHR can cause seasonal shifts in the days chosen within the baseline and progress periods which in turn can miss seasonal highs for certain pollutant classes. A Theil statistics trend analysis is also performed for each monitor on the annually averaged 20% most impaired days for the period of 2000-2010. This trend analysis was extended past prior analyses (2000-2009) to include 2010 since this year was shown to include the most recently available dataset at the time of analysis.

When comparing the baseline period to the progress period for the 20% worst coarse mass visibility days (Table 11.11) all monitors except BALD1, SAGU1, SYCA1 and TONT1 recorded decreased extinction. Furthermore, the CHIR1, PEFO1, SAWI1, and SIAN1 monitors exhibited decreases in CM extinction for the 20% most impaired CM days which exceeded 15% of baseline period averages. Theil statistics over the 11 year period showed decreasing trends at all sites except three; however, only GRCA2 and SYCA1 showed statistically significant decreases, while PEFO exhibited a statistically significant increasing trend for CM on the 20% most impaired CM days ($p < 0.15$).

Figure M: Average Annual Coarse Mass Extinction (mM-1) at each IMPROVE Site for the 20% Worst Coarse Mass Days.

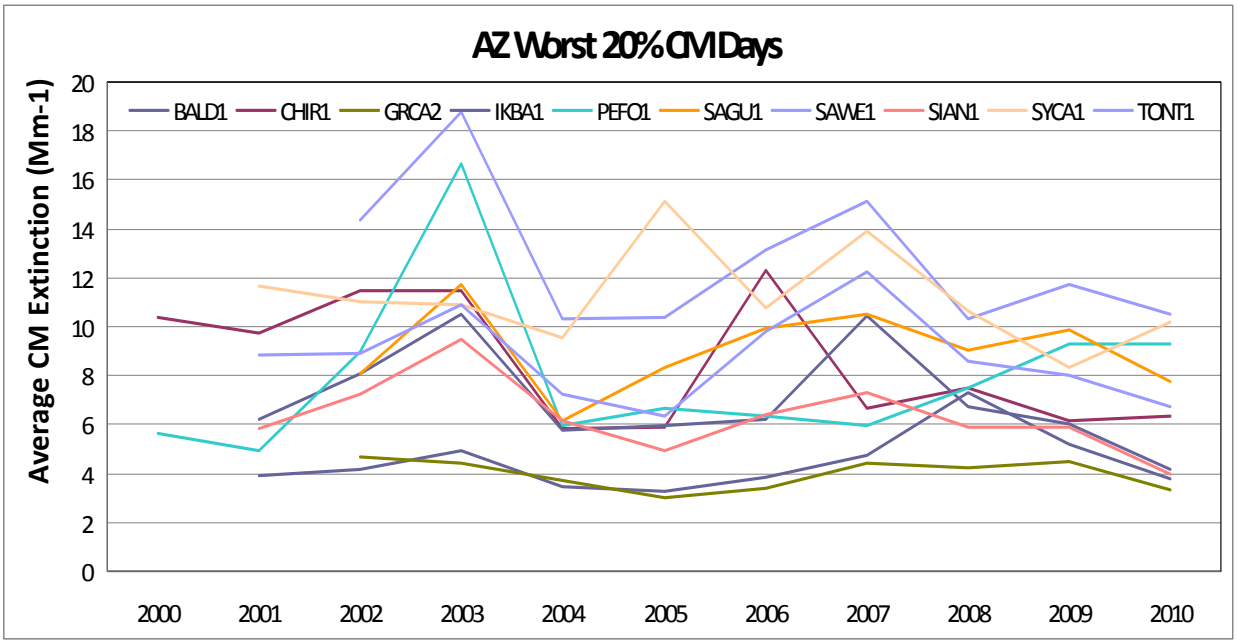


Table 11.12: 2000-2010 Coarse Mass Visibility Extinction (mM-1) Trends and Baseline vs. Progress Period Comparisons for the 20% Worst Coarse Mass Days					
Site	**11-year trend (2000-2010)**	**p-value**	**Baseline (2000-2004)**	**Period 1 (2005-2009)**	**Period Difference**
BALD1	0.12	0.30	4.12	4.87	**0.75**
CHIR1	-0.40	0.22	9.78	7.72	**-2.06**
GRCA2	**-0.10**	**0.11**	4.49	3.92	**-0.58**
IKBA1	-0.14	0.24	7.64	7.08	**-0.56**
PEFO1	**0.28**	**0.08**	8.42	7.15	**-1.27**
SAGU1	0.03	0.54	8.65	9.52	**0.87**
SAWE1	-0.42	0.24	14.48	12.15	**-2.34**
SIAN1	-0.20	0.19	7.18	6.09	**-1.09**
SYCA1	**-0.15**	**0.05**	10.77	11.76	**0.99**
TONT1	-0.13	0.24	8.98	9.00	**0.02**

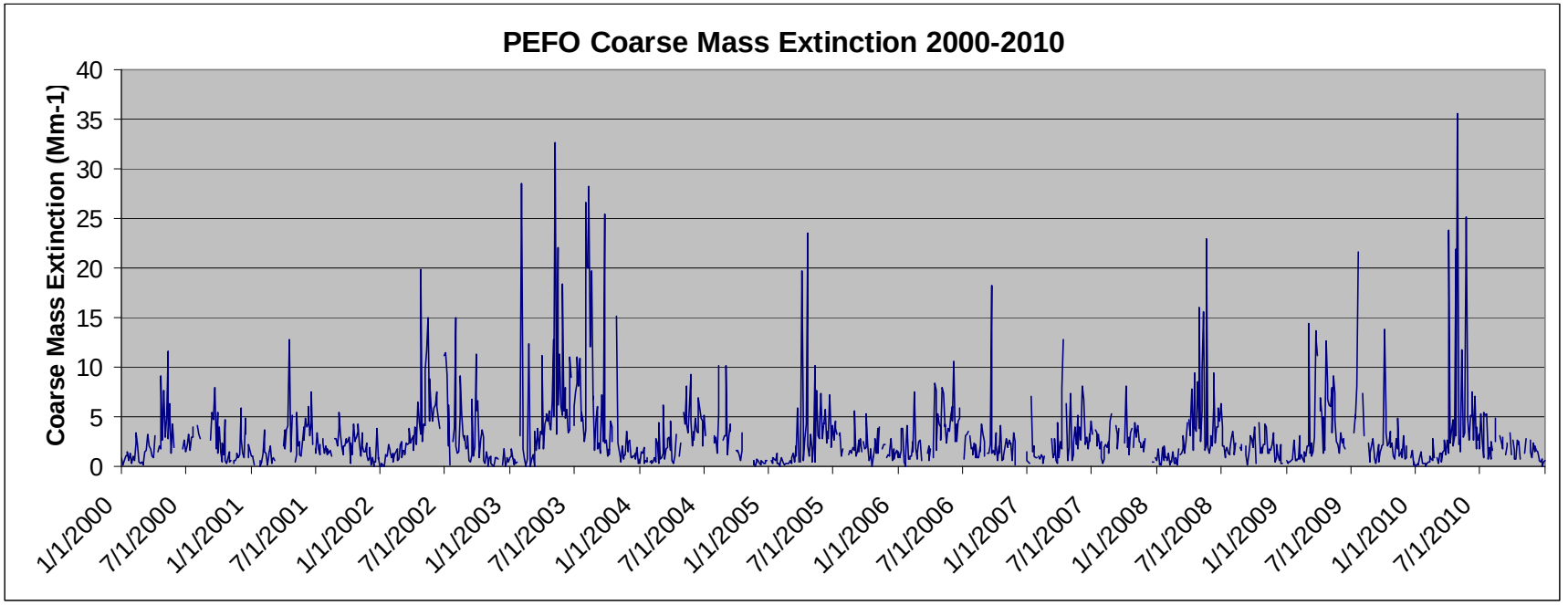
11.4.6 PEFO1 Coarse Mass Analysis

While average five-year visibility extinction decreased between the baseline and progress period for the 20% worst coarse mass days, Theil trends showed statistically significant increasing coarse mass visibility extinction trends from 2000 to 2010 (Table 11.12) at the Petrified Forest (PEFO1) monitor. Figure N shows Coarse Mass extinction at the PEFO1 monitor between the years of 2000 and 2010. When attempting to understand annual CM extinction variability for the 20% most impaired CM days at PEFO1 (Figure M), the frequency and magnitude of extreme daily CM extinction for each year should be considered for performing an inter-annual qualitative assessment of Figure N. Figure M shows that

annually averaged CM extinction on the 20% worst CM days increased from 2007-2010. This is reflected in the higher magnitude of high CM extinction events when analyzing the 2008 against the 2007 data presented in Figure M, the higher frequency of high CM extinction events when comparing 2009 extinctions to 2008, and the higher magnitude of high CM extinction events in 2010 versus 2009.

ADEQ examined available datasets in order to determine the possible sources of individual coarse mass events which may be leading to the observed increase in coarse mass event frequency and severity from 2008 to 2010. In particular, ADEQ examined meteorological data for the four highest CM readings at the PEFO1 IMPROVE monitor for the year of 2010. These high CM days occurred during the late March to early June time frame (Table 11.13), a period which climatologically favors windy, dry conditions. ADEQ felt that these events were of highest priority because these are the events which most contribute to elevated annual CM extinction average for the 20% worst CM days of the most recently available dataset of 2010. These events also act as representative days between the years of 2008 and 2010, for those high CM events which have contributed to the elevated CM extinction on the 20% most impaired CM visibility days occurred during the same late March to early June period (Figure N).

Figure N: Coarse Mass Extinction at Petrified Forest between 2000 and 2010 as calculated from PEFO1 IMPROVE monitor measurements, measured every 3 days.



The four highest measured CM extinction days at Petrified Forest for the year of 2010 were April 29th (35.6 mM^{-1}), May 23rd (25.2 mM^{-1}), April 5th (23.8 mM^{-1}), and April 23rd (21.9 mM^{-1}), Each of these four days experienced exceptionally high max wind speeds of 49 mph, 34 mph, 37 mph, and 41 mph respectively (Table 11.13). These high wind speeds indicate CM spikes on these days were due to windblown dust; however, wind back trajectories were created in an attempt to qualitatively assess the possible contribution from large point sources in the region. ADEQ utilized the National Oceanic and Atmospheric Administration's (NOAA) Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT)[10] to map hourly back trajectories for high winds on the days of these events (>12 mph). Each hourly back trajectory was mapped for a period equal to the length of the sustained high wind period. These back trajectories helped to determine whether large point sources in the upwind contributing areas could have contributed to the high CM extinction.

ADEQ identified three large PM_{10} point sources within ~100 km of the PEFO1 monitor: 1) Arizona Public Service Co – Cholla Power Plant (51 km WSW of the PEFO1 monitor), 2) Salt River Project Co – Coronado Generating Station (72 km SE of the PEFO1 monitor), and 3) Tucson Electric Power Co – Springerville (101 km SE of the PEFO1 monitor). As previously discussed, spatially inconsistent CM worst day trends throughout the State indicate local influences on each IMPROVE monitor; therefore, point sources of >100 km distance from the PEFO monitor were assumed to have a negligible effect on PEFO CM extinction. Figures O-R show back trajectories for each high wind hour of the four worst CM days in 2010. Only high wind hours were plotted as these represent the hours capable of sustained CM atmospheric suspension from sources >50 km from the PEFO monitor. Of the four highest wind days, only 4/29/2010 had high winds which originated from the direction of one of the three previously mentioned major point sources (i.e. Arizona Public Service Co – Cholla Power Plant). However, the lack of consistent winds overlapping point sources on the four worst CM days of 2010 indicates that wind speed, and thus windblown dust is a more likely culprit of high CM extinctions on these days as opposed to point sources in the region.

Table 11.13: Four highest CM extinction days for 2010. Determination of Point Source Influence was based on the wind back trajectories shown in Figures 33 – 36.

Date	Max CM Extinction (mM-1)	Max WS (mph)	>12mph wind hours	Possible Point Source Influence?
4/05/2010	23.8	49	0000-2000	No
4/23/2010	21.9	34	1200-2400	No
4/29/2010	35.6	37	0900-1900	Yes
5/23/2010	25.2	41	0800-2300	No

[10] National Oceanic and Atmospheric Administration – Air Research Laboratory. http://www.arl.noaa.gov/HYSPLIT_info.php

Figure O: High wind back trajectories for April 5th, 2010 for the sustained high wind hours of 0 - 2000 hours. Statewide IMPROVE monitors are depicted with green triangles and point sources with > 100 tpy of CM emitted in 2010 are depicted by red stars. Each hourly back trajectory extends to a distance equivalent to 21 hours of travel time.

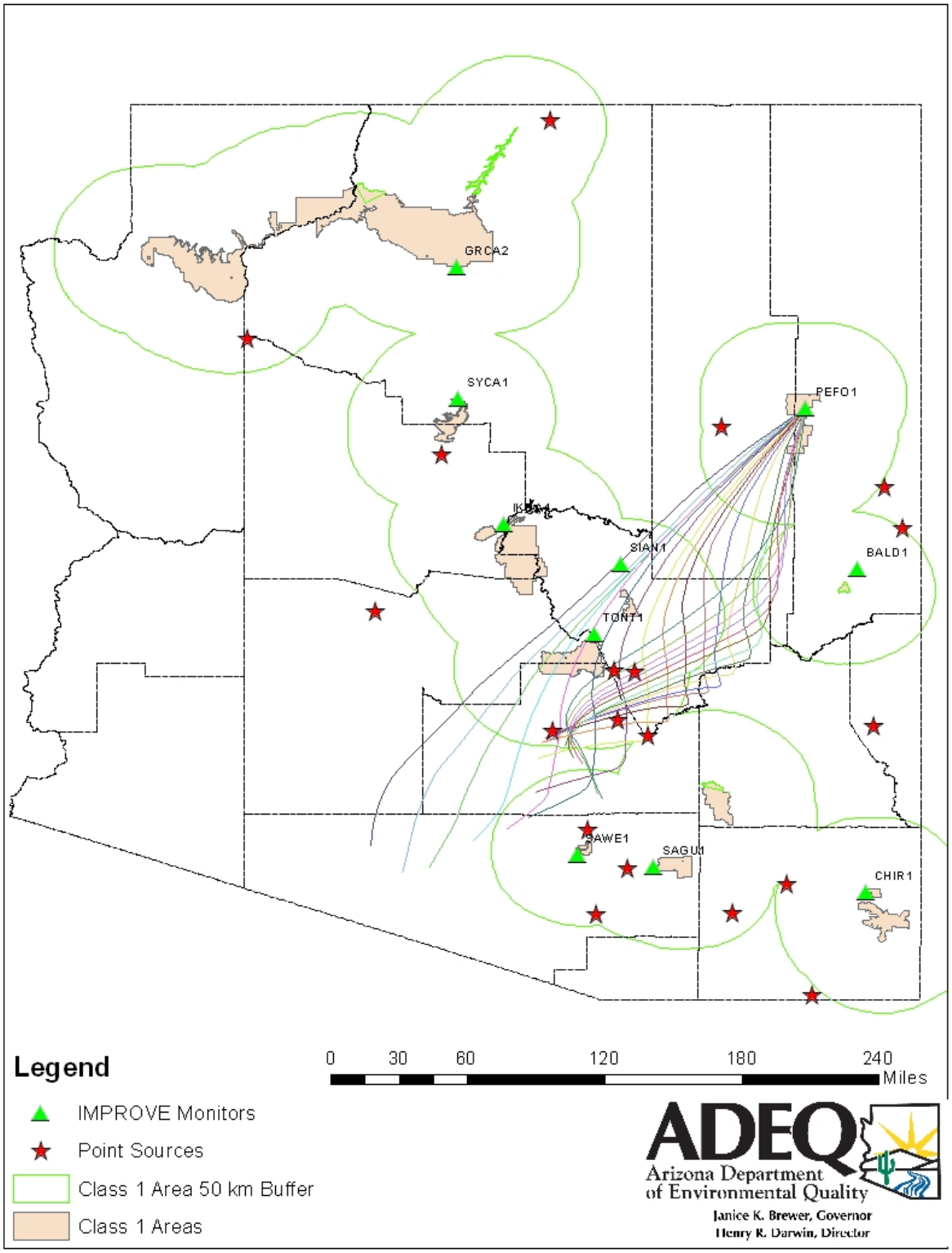


Figure P: High wind back trajectories for April 23rd, 2010 for the sustained high wind hours of 1200 - 2400 hours. Statewide IMPROVE monitors are depicted with green triangles and point sources with > 100 tpy of CM emitted in 2010 are depicted by red stars. Each hourly back trajectory extends to a distance equivalent to 13 hours of travel time.

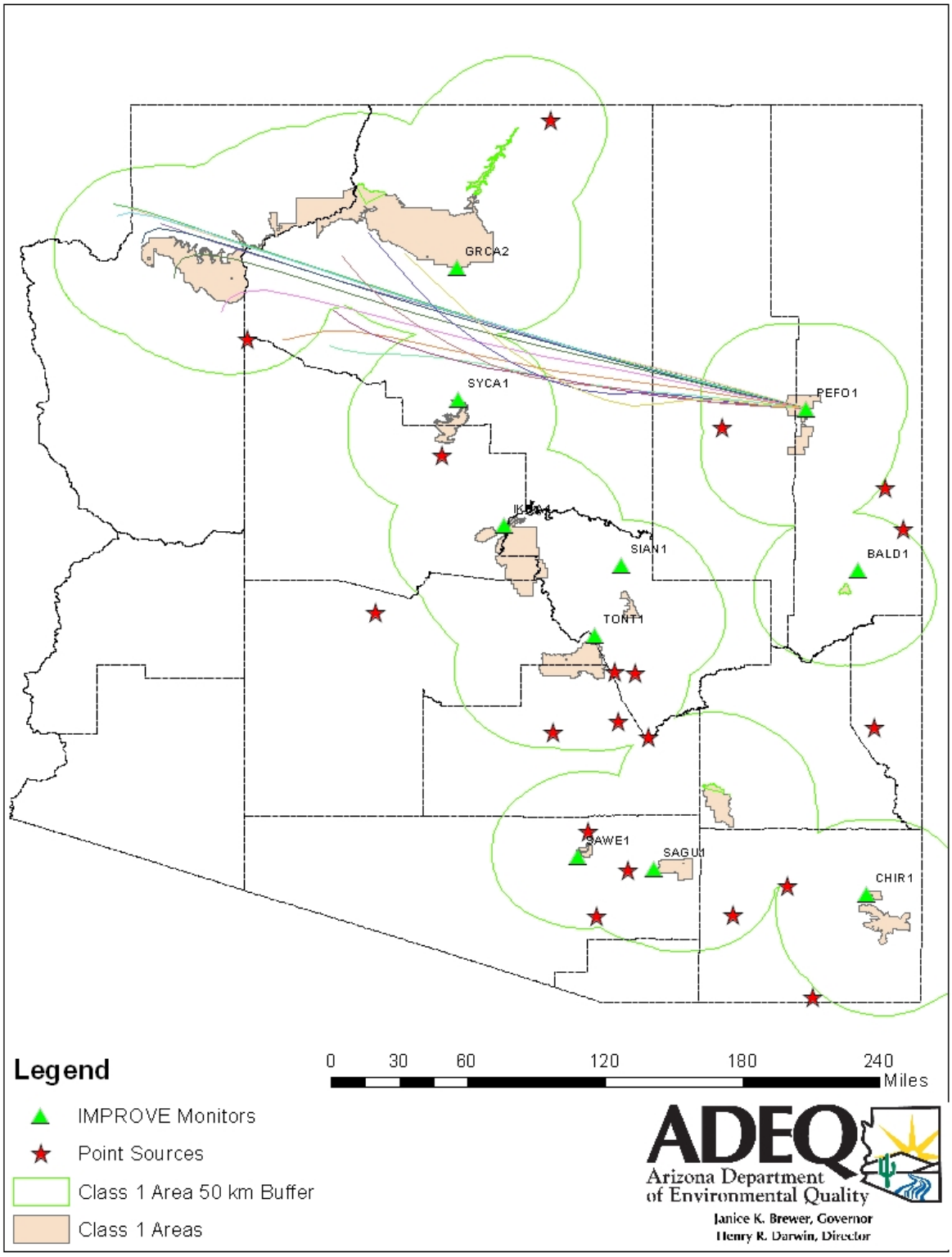


Figure Q: High wind back trajectories for April 29th, 2010 for the sustained high wind hours of 0900 - 1900 hours. Statewide IMPROVE monitors are depicted with green triangles and point sources with > 100 tpy of CM emitted in 2010 are depicted by red stars. Each hourly back trajectory extends to a distance equivalent to 11 hours of travel time.

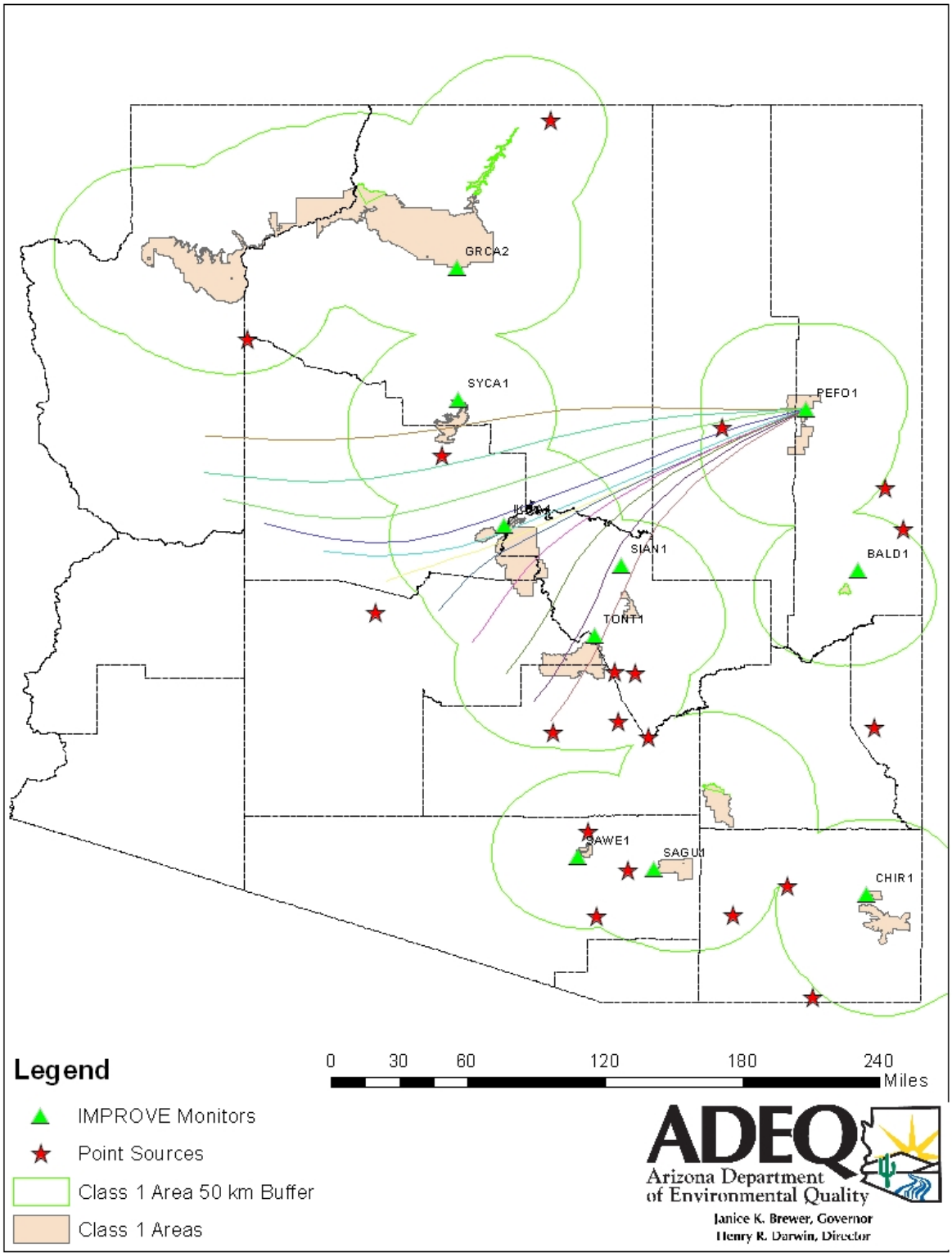
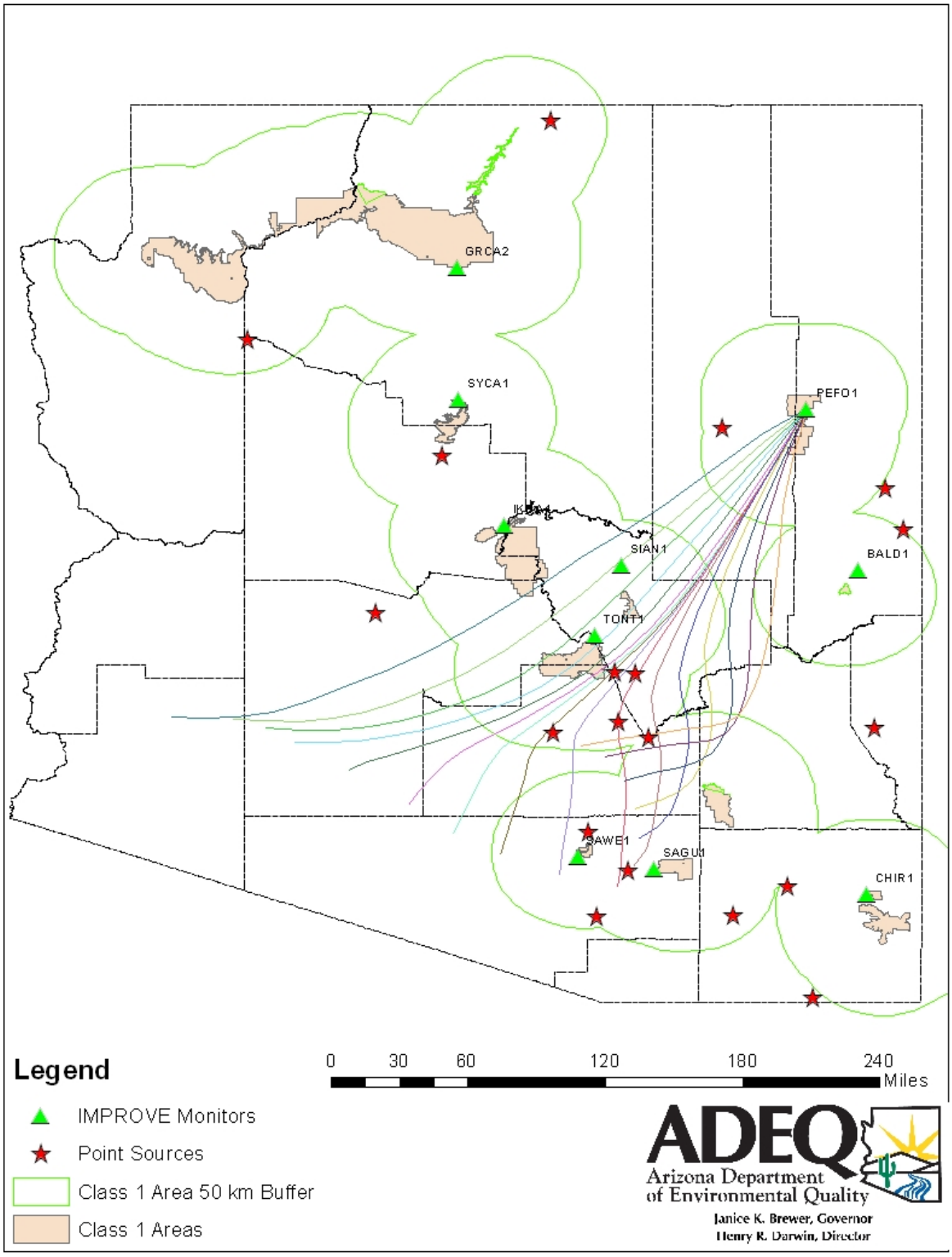


Figure R: High wind back trajectories for May 23rd, 2010 for the sustained high wind hours of 0800 - 2300 hours. Statewide IMPROVE monitors are depicted with green triangles and point sources with > 100 tpy of CM emitted in 2010 are depicted by red stars. Each hourly back trajectory extends to a distance equivalent to 16 hours of travel time.



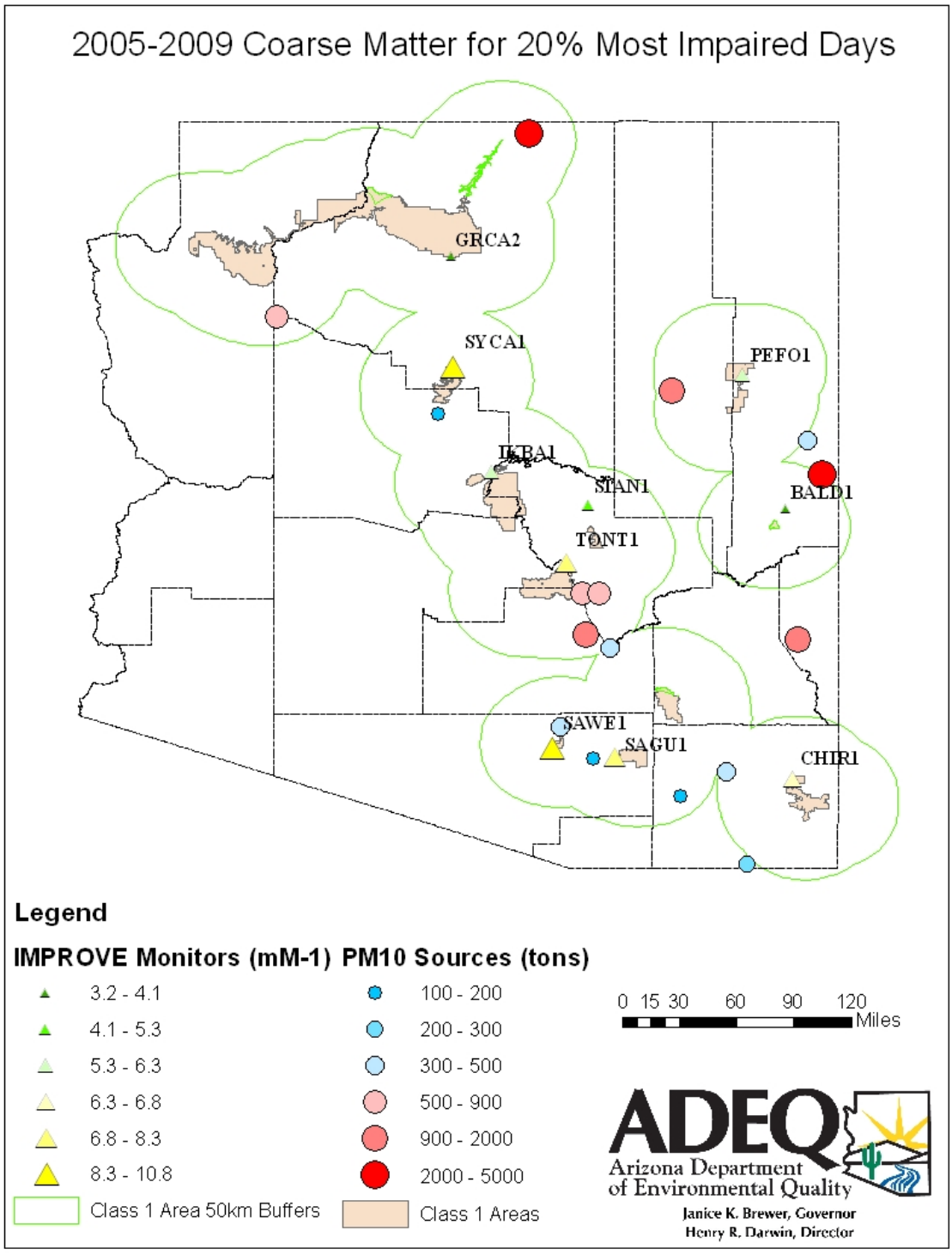
11.4.7 Large Point Source Locations

The analyses of coarse mass extinction between 2000 – 2009 and 2000 - 2010 show mixed results; however, there is evidence suggesting that coarse mass emissions originate from areas close to the individual IMPROVE monitors. Table 11.12 presents baseline vs. progress period differences that generally show decreasing trends across the state; however, it is difficult to discern regional trends from monitors within close proximity of one another.

There are three monitors (IKBA1, SIAN1, and TONT1) that are centrally located within the state and are, relatively speaking, in close proximity to one another. These three monitors show a small decrease, large decrease, and small increase in coarse mass extinction for the 20% worst coarse mass days. Similarly, SAWE1 and SAGU1 are the two monitors of closest proximity to each other within the state, but these two monitors show drastically different coarse mass extinction baseline averages. To investigate this issue, ADEQ qualitatively examined the location of all National Emissions Inventory reported major PM_{10} emitting sources within the state against the location of individual IMPROVE monitors to determine if there are any trends. This analysis could provide insight into whether locally driven point source emissions are related to disparities in regional coarse matter trends.

Figure S shows the location and the 2008 annual emissions for each point source in Arizona emitting over 100 tons per year. It also presents the progress period (2005-2009) average extinction (mM^{-1}) for coarse mass for the 20% worst days (using the EPA 20% most impaired day methodology). This map shows that the 20% worst days at some monitors may be affected by local PM_{10} sources, while other sites show little to no affect on extinction due to coarse mass from large PM_{10} sources. Three monitors (TONT1, SAWE1, and SAGU1) show relatively high extinction due to coarse mass and are located relatively close to several large PM_{10} emitting point sources. However, SYCA1 recorded high extinction values for the 20% worst days over the progress period and it is located near only one large source, which is a relatively small PM_{10} emitter in comparison with other large sources on the map. Also, PEFO1 and BALD1 are located near very large PM_{10} emitting sources yet have some of the lowest coarse mass extinction values for the 20% worst days recorded over the progress period. Overall, it is difficult to discern a visual relationship between large PM_{10} point sources and CM extinctions for the 20% worst days. A finer scale emission inventory around each monitor may provide a better understanding of individual site trends for coarse mass extinction. In general, ADEQ's analysis of CM monitoring data indicates an inverse relationship with precipitation patterns throughout the state, which suggests that CM extinction may be strongly associated with area sources rather than point sources. This notion is supported in the statewide emission inventories for CM as well.

Figure S: Arizona Class I areas, Class I area 50 km buffers, Class I area IMPROVE monitors, and Large Point Source Emitters of PM_{10} (>100 tons/year). IMPROVE site values correspond to Visibility Extinction (mM-1) of Coarse Mass averaged over the progress period (2005-2009)



11.5 Demonstration of Reasonable Progress Goals for 20% Worst Days

EPA guidance indicates that "States may establish a RPG that provides for greater, lesser, or equivalent visibility improvement as that described by the glidepath." The 2018 RPGs identified in Table 11.3 for 20% worst days show an improvement in visibility; however, they are short of the 2018 URP. Under the Regional Haze Rule, a state can demonstrate reasonable progress, using the four-factor analysis in Section 11.3 and other evidence and documentation. ADEQ maintains that the RPGs presented are justified and "reasonable".

On December 21, 2012, EPA proposed to disapprove Arizona's Reasonable Progress Goals (RPGs) for 2018 based on the reasoning that the state did not demonstrate that the goals constitute reasonable progress by 2018 and the expectation that actual visibility conditions in 2018 should be better than predicted by the state as a result of the economic recession and EPA required controls (77 FR 75704). Based on the analysis in the preceding sections, ADEQ presents reasonable progress towards reaching the previously presented RPGs as interpreted through IMPROVE monitor data. ADEQ chose to present IMPROVE data trends, as opposed to surrogate measures such as emission inventory trends, as monitoring data is a more accurate measure of visibility changes within a region. However, ADEQ also provides analysis relating trends seen at the IMPROVE monitors to those noted within the emission inventories where appropriate. Finally, ADEQ compares state-wide extinction trends for individual visibility impairment components to regional trends. It should be noted that the monitoring data analysis presented within this section is not intended to serve as ADEQ's RPG analysis, but instead is intended to support the original RPG and provide a comparison of current monitoring trends to the RPGs and URPs.

The analysis in this section compares the rate of progress between the baseline and progress periods towards the goal of natural visibility at each of the Arizona IMPROVE monitors and how that rate compares to the RPGs and URPs for the 20% worst and best days. An alternate analysis of reasonable progress is also included illustrating the effect that one single year has on the original results. Furthermore, additional analyses are provided which show 1) how specific uncontrollable fire events can have a large impact on the baseline vs. progress period comparison and 2) ammonium nitrate trends for specific Class I areas that may have the potential for being impacted by nearby large sources of NO_X.

11.5.1 Reasonable Progress as Determined by IMPROVE Monitoring Data

Tables 11.12 and 11.15 present the baseline visibility, 2005-2009 progress period visibility, URP for 2018 (not included in Table 11.15), and the 2018 RPGs for each of the IMPROVE monitor sites for the 20% worst days and the 20% best days, respectively. The Tables also present 2018 projected visibility based on the rate of change in visibility between the baseline period and progress periods. The 2018 projected visibility was calculated for each IMPROVE monitoring site using the following equation:

$$PV = BP - 16 * \left(\frac{(BP - PP)}{5} \right)$$

where:

PV = 2018 projected visibility (dV)
BP = Average baseline period visibility (dV)
PP = Average progress period visibility (dV)

This equation assumes a linear rate of progress between the baseline and progress period that can be extrapolated to 2018, that the average baseline period visibility is the visibility for the midpoint year of

the baseline period (2002), and that the average progress period visibility is the visibility for the midpoint year of the progress period. The 2018 projected visibility values can be utilized in two ways: 1) comparison with the RPGs as submitted in 2011, or 2) comparison with the URPs as submitted in 2011. This is a rather simplistic method but ADEQ asserts that is more representative of actual progress compared to utilization of a highly uncertain emission inventory.

Table 11.14 presents the projected visibility for each IMPROVE site as compared to the RPGs and URPs for the 20% worst days. Six monitoring locations (shown in blue) are expected to surpass the RPGs for 2018 (as submitted in 2011). Furthermore, CHIR1, SAWE1, SAGU1, and SIAN1 are projected to surpass the URPs calculated for these sites for 2018. While BALD1 and SYCA1 are expected to experience visibility improvements by 2018, these improvements are not expected to meet the RPGs calculated by ADEQ. Two sites are projected to experience visibility degradation by 2018 when compared to 2002; these sites are GRCA2 and IKBA1 (shown in red).

Table 11.14: Arizona Class I Area Reasonable Progress Goals Comparison to 2005 – 2009 Progress Period Visibility for the 20% Worst Days. '2018 Projected Visibility' was extrapolated based on the rate of Visibility change between the Baseline and Progress Period Visibilities

Reasonable Progress Goals for 20% Worst Days for Arizona Class I Areas						
Arizona Class I Area	**Site ID**	**Baseline (dv)**	**Progress (dV)**	**URP based 2018 visibility**	**2018 RPG (dV)**	**2018 Projected visibility**
Chiricahua NM, Chiricahua W, Galiuro W	CHIR1	13.4	12.2	12.0	13.4	9.6
Grand Canyon NP	GRCA2	11.7	12.0	10.6	11.1	12.7
Mazatzal W, Pine Mountain W	IKBA1	13.4	13.4	11.8	12.8	13.4
Mount Baldy W	BALD1	11.9	11.8	10.5	11.5	11.6
Petrified NP	PEFO1	13.2	13.0	11.6	12.9	12.6
Saguaro NP - West Unit	SAWE1	16.2	14.9	13.9	16.0	12.0
Saguaro NP - East Unit	SAGU1	14.8	13.6	12.9	14.8	11.0
Sierra Ancha W	SIAN1	13.7	13.0	12.0	13.2	11.5
Superstition W	TONT1	14.2	13.8	12.4	13.9	12.9
Sycamore Canyon W	SYCA1	15.3	15.2	13.3	15.0	15.1

Table 11.15 presents the projected visibility for each IMPROVE site as compared to the ADEQs RPGs for the 20% least impaired days. None of the sites are projected to experience visibility degradation on the 20% least impaired days. Furthermore, all sites except GRCA2 are projected to surpass 2018 RPGs for the 20% least impaired days.

Table 11.15: Arizona Class I Area Reasonable Progress Goals Comparison to 2005 – 2009 Progress Period Visibility for the 20% Best Days. '2018 Projected Visibility' was extrapolated based on the rate of Visibility change between the Baseline and Progress Period Visibilities

Reasonable Progress Goals for 20% Best Days for Arizona Class I Areas					
Arizona Class I Area	**Site ID**	**Baseline (dV)**	**2005 – 2009 Progress (dV)**	**2018 RPG (dV)**	**2018 Projected visibility**
Chiricahua NM, Chiricahua W, Galiuro W	CHIR1	4.9	4.4	4.9	3.3
Grand Canyon NP	GRCA2	2.2	2.2	2.1	2.2
Mazatzal W, Pine Mountain W	IKBA1	5.4	5.1	5.2	4.4
Mount Baldy W	BALD1	3.0	2.9	2.9	2.7
Petrified NP	PEFO1	5.0	4.6	4.7	3.7
Saguaro NP - West Unit	SAWE1	8.6	8.0	8.3	6.7
Saguaro NP - East Unit	SAGU1	6.9	6.7	7.0	6.3
Sierra Ancha W	SIAN1	6.2	5.3	5.9	3.3
Superstition W	TONT1	6.5	5.7	6.2	3.9
Sycamore Canyon W	SYCA1	5.6	5.1	5.5	4.0

Visibility degradation for the 20% most impaired days at GRCA2 and IKBA1 are most accurately explained through large, singular wildfire events which skew RHR method results for the 20% most impaired days. Within this document ADEQ has shown evidence of the effect individual events at an IMPROVE monitoring location can have in misrepresenting visibility trends when using the RHR method. Table 11.16 supplements previously overviewed data to show this issue more clearly. Table 11.16 presents an analysis where two years' (2003 and 2009) EC and POM visibility extinction data from GRCA2 are adjusted to ten-year averages in order to reduce the effects of wildfires located near the monitor. In the year of 2003, total extinction for the GRCA2 monitor was recalculated using the ten-year average extinction values for EC (2.7 Mm^{-1}) and POM (10.7 Mm^{-1}). This was repeated for the year of 2009. Both years, 2003 and 2009, experienced large wildfire events near the GRCA2 monitor and this substitution method was utilized in an attempt to illustrate the effects of these wildfire events on the overall trends of the RHR method. Table 11.16 shows that without substitution, total visibility extinction increases by 0.5 mM^{-1} using the RHR method, while EC and POM extinction normalization for the year of 2003 caused this degradation to increase to 2.2 Mm^{-1}, and 2009 extinction normalization caused the trend to reverse with total visibility improvement on the order of 1.8 Mm^{-1} at GRCA2. A similar analysis was performed on IKBA1 IMPROVE data where 2005 EC and POM extinction values were replaced with ten-year average values (2.3 Mm^{-1} and 8.0 Mm^{-1}, respectively). This exercise expresses the degree to which one large event can skew long-term visibility trends for the 20% most impaired days.

Table 11.16: Alternative method for the 20% Most Impaired Days at GRCA2 and IKBA1. EC and POM visibility extinctions are replaced by ten-year average for 2003 and 2009 (GRCA2) and 2005 (IKBA1)							
		Total Extinction (Mm-1)					
Site	Year Adjusted	Baseline	Adjusted Baseline	Progress	Adjusted Progress	Standard Change	Adjusted Change
GRCA2	2003	34.6	32.9	35.1	--	0.5	2.2
GRCA2	2009	34.6	--	35.1	32.8	0.5	-1.8
IKBA1	2005	38.9	--	39.2	37.7	0.3	-1.2

The previous analysis shows that individual events can skew results and the same can be said for individual years. In prior sections of this document ADEQ has discussed the exceptionality of the year of 2005 when compared to other years' visibility. To address this issue ADEQ additionally analyzed IMPROVE monitoring data at Class I areas throughout the State of Arizona for the year of 2010 in order to assess visibility changes for a more recent Progress Period. In Table 11.17, ADEQ performed an updated RHR method analysis where the baseline period was compared to a more recent progress period (2006-2010) which included the most recently available IMPROVE monitoring data. This table presents the data in a format similar to Table 11.14 in order to see how these updated trends track to the year 2018 for comparison with RPGs and URPs. It is evident from the information contained in Tables 11.14 and 11.17 that the year 2005 has a strong effect on the overall trends. In the more recent progress period analysis (Table 11.17), all IMPROVE monitor sites are not just on pace to meet Arizona's previously set RPG values, but all except GRCA2 and SYCA1 are on pace to surpass URPs by 2018. Again, this analysis shows the limitations of the RHR methodology as one year near the mid-point has a strong influence on the overall trends.

Table 11.17: Arizona Class I Area RPGs Adjusted Comparison to the Altered Progress Period Visibility (2006-2010) for the 20% Worst Days. '2018 Projected Visibility' was extrapolated based on the rate of visibility change between the Baseline and Progress Period Visibilities (In this case the Progress Period was adjusted to the years 2006-2010. Sites with visibility projected to exceed the URP are in dark blue and those expected to exceed Arizona's calculated 2018 RPG are in light blue.)						
Adjusted Reasonable Progress Goals for 20% Worst Days for Arizona Class I Areas						
Arizona Class I Area	Site ID	2000-2004 Baseline (dV)	2006-2010 Progress (dV)	URP based 2018 visibility	2018 RPG (dV)	2018 Projected visibility
Chiricahua NM, Chiricahua W, Galiuro W	CHIR1	13.4	11.8	12.0	13.4	9.1
Grand Canyon NP	GRCA2	11.7	11.4	10.6	11.1	11.0
Mazatzal W, Pine Mountain W	IKBA1	13.4	12.6	11.8	12.8	11.4
Mount Baldy W	BALD1	11.9	11.1	10.5	11.5	9.9
Petrified NP	PEFO1	13.2	12.5	11.6	12.9	11.3
Saguaro NP - W Unit*	SAWE1	16.2	14.8	13.9	16.0	12.4

Table 11.17: Arizona Class I Area RPGs Adjusted Comparison to the Altered Progress Period Visibility (2006-2010) for the 20% Worst Days. '2018 Projected Visibility' was extrapolated based on the rate of visibility change between the Baseline and Progress Period Visibilities (In this case the Progress Period was adjusted to the years 2006-2010. Sites with visibility projected to exceed the URP are in dark blue and those expected to exceed Arizona's calculated 2018 RPG are in light blue.)						
Adjusted Reasonable Progress Goals for 20% Worst Days for Arizona Class I Areas						
Arizona Class I Area	**Site ID**	**2000-2004 Baseline (dV)**	**2006-2010 Progress (dV)**	**URP based 2018 visibility**	**2018 RPG (dV)**	**2018 Projected visibility**
Saguaro NP - E Unit	SAGU1	14.8	13.3	12.9	14.8	**10.8**
Sierra Ancha W	SIAN1	13.7	12.3	12.0	13.2	**10.0**
Superstition W	TONT1	14.2	13.3	12.4	13.9	**11.9**
Sycamore Canyon W	SYCA1	15.3	14.7	13.3	15.0	**13.8**

*2010 data was not included for this unit do to uncertainty of data's accuracy.

11.5.2 Ammonium Nitrate Q/D Analysis

EPA has performed an initial Q/D (emissions/distance) analysis to determine the point sources that need to be evaluated for further controls based on NO_X emissions. In this section, ADEQ presents information showing that all of the Class I areas potentially impaired by these sources identified by EPA have exhibited decreased visibility impairment from ammonium nitrate between the baseline (2000-2004) and the progress period (2005-2009). Table 11.18 presents the initial results of EPA's Q/D analysis for those sources identified as impairing or possibly impairing Arizona Class I areas.

Table 11.18: NO_X emissions (Q) over distance (D) analysis for AZ facilities with Q/D values > 10 (Also included is the nearest Class 1 Area to the facilities.)					
Source	**Q (tpy)**	**D (km)**	**Q/D**	**Closest Class I Area**	**Class I Abbr.**
Arizona Portland Cement Co	5,635	6.99	806	Saguaro Wilderness	SAGU
ASARCO Ray Ops Mine	1,290	66.02	20	Sierra Ancha Wilderness	SIAN
Cholla Plant	34,066	31.75	1073	Petrified Forest NP	PEFO
El Paso Nat Gas (Tucson Compressor Station)	336	14.72	23	Saguaro Wilderness	SAGU
Flagstaff Comp Station	1,013	34.94	29	Sycamore Canyon Wild.	SYCA
Irvington Gen Station	5,797	15.84	366	Saguaro Wilderness	SAGU
Phoenix Cement	3,224	12.65	255	Sycamore Canyon Wild.	SYCA
Pima Co. Sewage Plant	258	12.56	21	Saguaro Wilderness	SAGU
TEP Springerville	32,973	60.46	545	Petrified Forest NP	PEFO
Williams Comp Station	1,388	19.12	73	Sycamore Canyon Wild.	SYCA

The Class I areas discussed in the Q/D analysis are: SAGU1, PEFO1, SYCA1, and SIAN1. The data from these monitors were analyzed according to the Regional Haze Rule method for changes in ammonium nitrate extinction for the 20% best and worst days (Table 11.18). All sites show improved

visibility between 8% and 44% for the 20% best days for ammonium nitrate (Table 11.18). The 20% worst days show even greater visibility improvements for ammonium nitrate with extinctions decreasing between the baseline and progress period between 15% and 55% at the four Class I Areas identified (Table 11.19). Analysis of IMPROVE monitoring data by ADEQ at the SAGU1, PEFO1, SYCA1, and SIAN1 sites indicate that these sites are showing significantly improved visibility because of reductions in extinction due to ammonium nitrate.

Table 11.19 11.17: IMPROVE monitoring ammonium nitrate trend results for Class I Areas located near facilities that exhibited high Q/D results

Change in Ammonium Nitrate Visibility Extinction			
Class I Area	**Abbreviation**	**20% Least Impaired [mM-1]**	**20% Most Impaired [mM-1]**
Saguaro Wilderness	SAGU1	-0.2 (-19%)	-3.2 (-55%)
Petrified Forest NP	PEFO1	-0.2 (-22%)	-0.3 (-17%)
Sycamore Canyon Wilderness	SYCA1	-0.1 (-8%)	-0.7 (-33%)
Sierra Ancha Wilderness	SIAN1	-0.4 (-44%)	-0.3 (-15%)

11.6 Affirmative Demonstration of Reasonable Progress

The analyses presented in this Chapter satisfy the proposed deficiencies identified by EPA regarding Arizona's reasonable progress goals (77 FR 75704). ADEQ has provided a 2008 emission inventory that is comparable to the 2002 emission inventory in some source categories for a variety of pollutants. Where this inventory is not reliably comparable to the 2002 Arizona emission inventory, ADEQ provided an overview of the methodology, input data, and model resolution enhancements that have changed between the 2002 and 2008 inventory preparations.

ADEQ presented a review of IMPROVE monitor data between the years of 2000 and 2010. This review presented standardized 20% best and worst visibility day comparisons between the baseline and progress periods as well as Theil statistical trend analysis as an alternative approach for understanding 10-year trends. The trends show that extinction due to ammonium nitrate, organic carbon, and elemental carbon is decreasing and visibility is improving within almost all Arizona Class 1 areas. Fine Soil and Coarse Mass extinction values appear to be dependant on the local environment surrounding the Class 1 areas and show no discernable increasing or decreasing spatial trends across the state. Anomalously high years (2005 and 2007) for ammonium sulfate extinction revealed increasing ammonium sulfate visibility extinction between the baseline and progress periods; however, decreasing trends in ammonium sulfate in previous and recent years resulted in Theil statistics that either showed no statistically significant visibility extinction increases or statistically significant visibility decreases across the state ($p < 0.15$). Furthermore, similar trends for ammonium sulfate were noted for the four corners region indicating that the ammonium sulfate trends noted were regional and not simply limited to Arizona. When correcting for a single regional transport event in 2007, ADEQ showed that three of the five Class I Areas which were previously believed to exhibit increasing ammonium sulfate extinction in the progress period are actually exhibiting reduced ammonium sulfate extinction. More analysis should be performed to assess the extent to which regional transport controls ammonium sulfate extinction trends within the State of Arizona.

Finally, ADEQ compared overall visibility trends at each of the IMPROVE monitor locations against previously submitted RPGs and URPs for 2018. These data indicated that if the current pace of visibility change was continued, no site would experience increased visibility impairment for the 20% least

impaired visibility days in 2018. Using a progress period of 2005-2009 six monitoring locations are expected to surpass ADEQ's previously submitted RPGs for 2018 for the 20% most impaired days. Furthermore, four sites, CHIR1, SAWE1, SAGU1, and SIAN1 are projected to surpass the previously accepted URPs for the 20% most impaired days in 2018 when projecting visibility from the progress period of 2005-2009. Only two sites are projected to experience visibility degradation for the 20% most impaired days in 2018 when compared to 2002, these sites are GRCA2 and IKBA1. However, the visibility degradation noted at these sites is most likely due to wildfires located close to these monitors during the progress period. ADEQ has shown that if EC and POM extinction values are standardized for years during which fires have occurred close to a monitor, the entire progress period trends can be altered, exhibiting how data influenced by specific events can significantly affect the overall trends when using the RHR method. ADEQ also showed that the exceptionally poor visibility year of 2005 was skewing data trends when using the RHR method. If the most recently available visibility data was used for the progress period (i.e. shifting the progress period from 2005-2009 to 2006-2010), every site is projected to surpass Arizona's RPGs and all but two sites will surpass URP visibility standards.

11.7 Major Reductions in Mobile Sources Emissions by 2018

As the largest anthropogenic source category, ADEQ believes that the trend in mobile source emission reductions from 2002 to 2018 is another factor in support of the demonstration of reasonable progress. As shown by the emission inventory information in Chapter 8, mobile sources annual emissions show a decrease from 2002 (plan02d) to 2018 (prp18b) and represent the largest emissions reductions of any single source category. This can be seen in the statewide emission inventory in Section 8.1 and the regional level emission in Section 8.2. The greatest reduction is in NO_X emissions, followed by volatile organic compounds (VOCs), and to a lesser extent SO_2. Table 11.21 shows these reductions in ton per year (tpy) and percent reduction at the statewide level, from the baseline 2002 to the projections for 2018.

Table 11.21 also shows reductions from both on- and off-road mobile sources from 2002 to 2008. Most of the emission reductions of SO_2, NO_X, and VOCs from mobile sources are close to meeting the reductions that were projected for 2002 to 2018. Reductions in NO_X from off-road mobile sources are surpassing what was projected for 2018.

Table 11.21: Mobile Source Emission Reductions in Arizona

Projected Reductions from 2002 to 2018 (% reduction)			
Source Category	**SO_2**	**NO_X**	**VOC**
On-Road Mobile	-1,953 (72%)	-124,501 (70%)	-57,552 (52%)
Off-Road Mobile	-3,677 (87%)	-23,165 (35%)	-20,868 (37%)
Actual Reductions from 2002 to 2008 (% reduction)			
On-Road Mobile	-1,904 (70%)	-40,453 (22%)	-55,834 (50%)
Off-Road Mobile	-3,550 (84%)	-32,557 (49%)	-14,604 (26%)

The mobile source emission inventory was based on the WRAP Mobile Source Emission Inventories Update. This report estimated all on-road and off-road mobile source emissions for the WRAP region for the 2002 base year and projections to 2008, 2013, and 2018. It also included emissions from aircraft, locomotives, marine shipping, and road dust. The contractor who conducted the project surveyed state and local air quality planning agencies to obtain the most up-to-date mobile source activity data and control program information. On-road mobile source emissions were estimated with EPA's MOBILE6.2

model. Emissions for most off-road mobile sources were estimated with EPA's Draft NONROAD2004 model. Locomotive emissions were estimated based on locomotive fuel consumption; aircraft emission were based on aircraft landing and takeoffs and FAA EDMS emission factors commercial marine emissions were estimated using a variety of activity data sources and EPA emission factors. For further information, see http://www.wrapair.org/forums/ef/UMSI/index.html.

The mobile source emission reductions are based on numerous "on-the-books" federal mobile source regulations that include the following:

For on-road mobile sources:

- Tier 1 light-duty vehicle standards
- National Low Emission Vehicle (NLEV) standards
- Tier 2 light-duty vehicle standards, with low sulfur gasoline
- Heavy-duty vehicle standards, with low sulfur diesel

For non-road mobile sources and equipment:

- Emission standards for new non-road spark-ignition engines below 25 horsepower
- Phase 2 emission standards for new spark ignition hand-held engines below 25 horsepower
- Phase 2 emission standards for new spark-ignition non-handheld engines below 25 horsepower
- Emission standards for new gasoline spark-ignition marine engines
- Tier 1 and 2 emission standards for new non-road compression-ignition engines below 50 horsepower including recreational marine engines
- Tier 2 and Tier 3 standards for new non-road compression-ignition engines of 50 horsepower and greater not including recreation marine engines greater than 50 horsepower
- Tier 4 emission standards for new non-road compression-ignition engines above 50 horsepower and reduced non-road diesel fuel sulfur levels

In 2004, EPA adopted the Tier 4 rule for Non-road Diesel Engines and Fuel, which took effect in 2008. These rules are expected to have major visibility benefits. Nationally, these rules are estimated to reduce emissions in 2030 from non-road engines, locomotive engines, and marine engines by 95% for $PM_{2.5}$, 90% for NO_X, and 99% for SO_2.
The visibility benefits that are projected for 2018 from these reductions can be found in Chapter 9, under the PSAT source apportionment results for sulfate and nitrate, on 20% worst days.

The extent of the mobile source emission reductions and the visibility improvements that are projected are significant factors in determining that the RPGs identified in this represent reasonable progress. It should be noted that the trend in emission reductions may likely be greater than expected. Increasing gasoline prices commonly reduce the annual vehicle miles traveled, which will lead to increased reductions in NO_X emissions. Reductions to the primary National Ambient Air Quality Standards (NAAQS) for ozone and SO_2 will also have the secondary benefit of improving visibility as a result of emissions reductions.

11.8 Emission Reductions to with Respect to Out-of-State Class I Areas

The Clean Air Act Section 110(a)(2)(D)(i)(II) requires that each SIP contain provision to prevent sources or other types of emissions activity within a state from impairing visibility at Class I areas in neighboring states. On December 21, 2012, EPA proposed to disapprove Arizona's Regional Haze SIP on the basis that it does not contain the provisions or a demonstration that it includes measures sufficient to meet the interstate transport visibility requirement.

Based on the demonstration in the preceding chapters showing reasonable progress at Arizona's Class I areas, ADEQ asserts that the measures contained in the SIP are adequate to achieve reductions necessary to prevent visibility impairment at Class I areas in neighboring states.

11.9 Additional Emission Reductions Expected by 2018 due to the Long-Term Strategy

Under the Long-Term Strategy (LTS) described in Chapter 12, additional emission reductions that will result in visibility improvements are expected by 2018. Although these new strategies have yet to be implemented, it is reasonable to expect that these visibility improvements will occur and provide greater progress toward the 2018 URP than the RPGs estimated in this submittal. The key elements of the LTS include an evaluation and possible controls for non-BART sources, new smoke management improvements for prescribed burning, review and possible revision of state open burning regulations, and expected benefits associated with the revised $PM_{2.5}$ NAAQS.

11.10 Long-Term Strategy "Next Steps" in Analyzing Major Source Categories

As described in the LTS in Chapter 12, ADEQ will take the results of the four-factor analyses for source categories and will conduct further evaluation and analysis of these source categories to determine what additional control are appropriate to achieve further reasonable progress. It is expected this evaluation will be incorporated into the work described in Section 12.6.1 of the LTS that will develop criteria and guidance for evaluating all non-BART sources. Results from this evaluation will be reported in the required 2013 plan update.

11.11 Years to Reach Natural Conditions Based on Reasonable Progress Goals

The Regional Haze Rule allows states to set reasonable progress goals for a slower rate of progress than the URP. Section 308(d)(1)(B)(ii) also requires states to provide an assessment of the number of years it will take to reach natural conditions based on the reasonable progress goals set by a state. Table 11.22 provides this information for Arizona's Class I areas.

Table 11.22: Years to Meet Natural Conditions (NC) Based on Reasonable Progress Goals

Arizona Class I Area	Baseline (dv)	2018 RPG (dv)	Annual Rate of Progress Based on RPG (dv)	Natural Conditions (dv)	Improvement Needed to Reach NC (dv)	Years to Meet NC
Chiricahua NM, Chiricahua W, Galiuro W	13.43	13.35	0.006	7.2	6.23	1,038
Grand Canyon NP	11.66	11.14	0.037	7.04	4.62	125
Mazatzal W, Pine Mountain W	13.35	12.76	0.042	6.68	6.67	159
Mount Baldy W	11.85	11.52	0.024	6.24	5.61	234
Petrified NP	13.21	12.85	0.026	6.49	6.72	258

Table 11.22: Years to Meet Natural Conditions (NC) Based on Reasonable Progress Goals						
Arizona Class I Area	**Baseline (dv)**	**2018 RPG (dv)**	**Annual Rate of Progress Based on RPG (dv)**	**Natural Conditions (dv)**	**Improvement Needed to Reach NC (dv)**	**Years to Meet NC**
Saguaro NP – West Unit	16.22	15.99	0.016	6.24	9.98	624
Saguaro NP – East Unit	14.83	14.82	0.001	6.46	8.37	8,370
Sierra Ancha W	13.67	13.17	0.036	6.59	7.08	197
Superstition W	14.16	13.89	0.019	6.54	7.62	401
Sycamore Canyon W	15.25	15.00	0.018	6.65	8.6	478

Arizona Regional Haze State Implementation Plan Revision Technical Support Document

May 2, 2013
FINAL REPORT

Arizona Department of Environmental Quality

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I. Introduction

In 2011, the State of Arizona submitted a Regional Haze State Implementation Plan (SIP) to the Environmental Protection Agency (EPA) to fulfill the requirements of 40 CFR § 51.308. On December 21, 2012 the EPA published within the Federal Register[1] a partial approval / partial disapproval of Arizona's Regional Haze State Implementation Plan. This document was created to address certain deficiencies identified by the EPA, specifically 40 CFR § 51.308(d)(4)(v) which requires submission of the most recently available Emissions Inventory in a Regional Haze SIP. Furthermore, this document presents an alternative methodology, which has been used by the EPA in previous studies, for the analysis of visibility trends and provides supplemental information to address visibility trends within the State of Arizona between the years of 2000 and 2010 and how these trends compare to Reasonable Progress Goals and Uniform Rates of Progress.

II. 2002 and 2008 Emission Inventories

The 2002 Arizona Emission Inventory (EI) was originally constructed to fulfill the requirement of 40 CFR § 51.308(d)(4)(v)[2], which states a baseline year emission inventory must be contained within a State's implementation plan for regional haze. On December 21, 2012 EPA published within the Federal Register[3] a partial disapproval of Arizona's Regional Haze State Implementation Plan. One disapproved provision was based on 40 CFR § 51.308(d)(4)(v) which further requires a submission of a statewide emission inventory for the most recent year of which data are available. In order to fulfill this requirement, the Arizona Department of Environmental Quality (ADEQ) is presenting a 2008 emission inventory calculated and compiled by the Western Regional Air Partnership (WRAP) WESTJUMP project.

The 2002 and 2008 emission inventories calculate emissions of the regional haze contributing pollutants: Sulfur Dioxide (SO_2), Nitric Oxide (NO_x), Ammonia (NH_3), Volatile Organic Compounds (VOCs), Primary Organic Aerosols (POA), Elemental Carbon (EC), Fine Particulate Matter (Fine), and Coarse Particulate Matter (CM). For the purpose of consistency, these pollutants were reported for all major source categories. Where possible these source categories were further partitioned into anthropogenic and natural sources. Source categories for both anthropogenic and natural sources are listed and described briefly here, followed by information related to the inventories.

[1] Environmental Protection Agency (EPA). Federal Register Volume 77, No. 246. Dec. 21, 2012.
[2] Environmental Protection Agency (EPA). Code of Federal Regulations Title 40 Volume 2 Section 51. 2011.
[3] Environmental Protection Agency (EPA). Federal Register Volume 77, No. 246. Dec. 21, 2012.

- *Point Sources:* These are sources that are identified by point locations, typically because they are regulated and their locations are available in regulatory reports. Point sources can be further subdivided into electric generating unit (EGU) sources and non-EGU sources, particularly in criteria inventories in which EGUs are a primary source of NO_X and SO_2. Examples of non-EGU point sources include chemical manufacturers and furniture refinishers.

- *Area Sources:* Sources that are treated as being spread over a spatial extent (usually a county or air district) and that are not movable (as compared to non-road mobile and on-road mobile sources). Because it is not possible to collect the emissions at each point of emission, they are estimated over larger regions. Examples of stationary area sources are residential heating and architectural coatings. Numerous sources, such as dry cleaning facilities, may be treated either as stationary area sources or as point sources.

- *On-Road Mobile Sources:* Vehicular sources that travel on roadways. Emissions are estimated as the product of emissions factors and activity data, vehicle miles traveled (VMT). Examples of on-road mobile sources include light-duty gasoline vehicles and heavy-duty diesel vehicles.

- *Off-Road Mobile Sources:* Off-road mobile sources are vehicles and engines that encompass a wide variety of equipment types that either move under their own power or are capable of being moved from site to site. Examples include agricultural equipment such as tractors or combines, locomotives and oil field equipment such as mechanical drilling engines.

- *Oil and Gas Sources:* Oil and gas sources consist of a number of different types of activities from engine sources for drill rigs and compressor engines, to sources such as condensate tanks and fugitive gas emissions. The variety of emissions types for sources specific to oil and gas activity can, in some cases, overlap with mobile, area or point sources, but these can also be extracted and treated separately. As can be seen in the 2008 emission inventory for Arizona, accept for fugitive emissions associated with mobile sources, oil and gas sources are virtually non-existent in Arizona. Arizona represents the second lowest contributing State to annual U.S. oil production. 2008 State oil production totaled 52,000 barrels or 0.003% of the national total[4]. Therefore, calculated and reported emissions from Oil and Gas production are negligible in comparison to other Source Categories.

- *Biogenic Emissions:* Biogenic emissions are based on the activity fluxes modeled from biogenic land use data, which characterize the types of vegetation that exist in particular areas. Emissions are generally derived using modeled estimates of biogenic gas-phase pollutants from land use

[4] U.S. Energy Information Administration. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm.

information, emissions factors for different plant species, and meteorology data.

- *Dust:* Dust emissions may have a variety of sources that could include anthropogenic sources, natural sources, and natural sources that may be influenced by anthropogenic activity. For emissions summary purposes, dust is classified here as fugitive dust and windblown dust. Fugitive dust includes sources such as road dust, agricultural operations, construction and mining operations and windblown dust from vacant lands.

- *Fire:* Fire sources are difficult to predict and control, and may have a mix of natural and anthropogenic influences. Natural sources include wildland fires, while anthropogenic sources can include agricultural and prescribed fires.

II.A. 2002 Arizona Emission Inventory Methodology

The 2002 Arizona Emission Inventory calculations and results are described in detail in the Arizona Regional Haze SIP[5]. Please refer to Chapter 8 of the document for detailed calculation methodology of the 2002 Arizona Emission Inventory.

The 2002 Arizona Emission Inventory served as the baseline inventory for the 2018 emission inventory estimation. The methodology by which 2018 emissions were estimated from the 2002 emission inventory can be found in detail in the Arizona Regional Haze SIP and an overview of these methodologies are shown in Table 1.

II.B. 2008 Arizona Emission Inventory Methodology

The creation of the 2008 State of Arizona Emission Inventory was a collection of efforts by WRAP's WESTJUMP Project and ADEQ. This inventory represents the most complete and recent calculation of pollutant emissions from all identified sources currently available at the time of this document's preparation. Portions of this inventory were derived from the 2008 EPA National Emissions Inventory, while other portions were calculated using a variety of emission models and techniques. Source data and emission estimation methodologies are discussed in the following section and compared to those methods utilized during the creation of the 2002 EI.

The 2002 emission inventory reported emissions based on the most readily available and accurate source data and methods at the time of preparation; however, many of the calculated source category emissions methodologies and input data changed between the 2002 and 2008 emission inventory preparations in order to enhance the accuracy of estimated statewide emissions. For this reason, many of the source category emission

[5] "Arizona State Implementation Plan: Regional Haze Under Section 308 of the Federal Regional Haze Rule" Arizona Department of Environmental Quality (ADEQ) Air Quality Division, 2011.

differences between the 2002 and 2008 inventories presented in this document should be viewed as a mixture of methodology, input data, and actual emissions changes. Furthermore, since the Arizona 2018 EI was estimated through the adjustment of the 2002 baseline Arizona emission inventory, emissions from these two EIs are more readily comparable than emissions from the 2008 EI presented here due to the aforementioned methodology and source data differences.

II.C. 2002 & 2008 Emission Inventory Methodology Comparisons

Table 1 presents the input data and methodologies utilized to calculate each source category for the 2002 and 2008 EIs. This table illustrates how some source category methodologies, input data, or modeling resolutions changed dramatically, which in some cases is reflected in estimated emissions between the two inventories.

Table 1: Emission Inventory Methodology Comparison for 2002 and 2008.

Inventory Sector	2002 Baseline Inventory (WRAP Plan02d)	2008 Emission Inventory (WRAP WestJump08 and DEASCO$_3$)	Comments
Point Sources	The WRAP generated point source inventories for both actual reported 2002 (Base02b) Electric Generating Units (EGU) and all other point source data, and for a 2000-2004 average of EGU point sources (Plan02d). Inventories were generated using hourly EPA CAMD CEM data for EGUs. Other point sources for both Base02b and Plan02d were developed in consultation with states by the Eastern Research Group (ERG) contractor. Plan02d emissions are used here because they are consistent with what was reported as baseline conditions for most WRAP region SIPs. More details are available here: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx and http://www.wrapair.org/forums/ssjf/pivot.html	2008 inventories were generated using hourly EPA Clean Air Markets Division (CAMD) Continuous Emissions Monitor (CEM) data for EGUs. Other point sources are from the 2008 NEI v2. More details are available here: http://wrapair2.org/WestJumpAQMS.aspx	Baseline conditions presented here represent a 5-year average for EGUs, while progress period conditions are represented with 2008 data.
Area Sources	Plan02d emissions inventories were developed in consultation with Arizona Regional Planning Organizations (RPOs) by the ERG contractor. More details are available here: http://vista.cira.colostate.edu/TSS/Results/Emissio	Arizona reported area sources from the 2008 NEI v2. More details are available here:	Note that area oil and gas sources are reported separately. For the 2008 EPA NEI, Locomotive emissions were designated as Area source emissions where previously

Inventory Sector	2002 Baseline Inventory (WRAP Plan02d)	2008 Emission Inventory (WRAP WestJump08 and DEASCO$_3$)	Comments
	ns.aspx	http://wrapair2.org/WestJumpAQMS.aspx	they were categorized as Off-road emissions.
Point Oil and Gas	State reported point oil and gas sources for 2002 are included here in the point source inventory totals. More details are available here: http://www.wrapair.org/forums/ssjf/pivot.html	Different basins are comprised of a combination of state reported point oil and gas from the 2008 NEI v2 for some areas and updated WRAP Phase III inventories for other areas. These emissions were developed separately in some cases, but are included in the point source inventory totals (see above). More details are available here: http://wrapair2.org/WestJumpAQMS.aspx	This industry has expanded and evolved considerably since 2002.
Area Oil and Gas	Developed using WRAP Phase II emissions methodologies. Emissions process estimated included:	Developed using WRAP Phase III emissions methodologies using 2008 production data. The	Note that many more source categories were counted in 2008 than in 2002.

Inventory Sector	2002 Baseline Inventory (WRAP Plan02d)	2008 Emission Inventory (WRAP WestJump08 and DEASCO$_3$)	Comments
	• Drill Rigs • Wellhead Compressor Engines • CBM Pump Engines • Heaters • Pneumatic Devices • Condensate and oil tanks • Dehydrators • Completion Venting More details are available here: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx and http://www.wrapair.org/forums/ogwg/documents/2007-10_Phase_II_O&G_Final)Report(v10-07%20rev.s).pdf	following additional categories were included in addition to those listed for 2002: • Lateral compressor engines • Workover rigs • Salt-water disposal engines • Artificial lift engines • Vapor recovery units (VRUs) • Miscellaneous or exempt engines • Flaring • Fugitive emissions • Well blowdowns • Truck loading • Amine units (and gas removal) • Water tanks More details are available here: http://wrapair2.org/WestJumpAQMS.aspx	Other differences between 2002 Phase II O&G emissions vs. Phase III/WestJumpAQMS 2008 O&G emissions:. 1) Phase III 2008 estimates included new and/or revised estimation methodologies for each of the equipment types and processes included, e.g., the surveys provided counts by device type (low-bleed vs. high-bleed) and specific information on control device efficiency, among other improvements to activity data. Phase II did not have that information available, since no surveys were made in Phase II. 2) Phase III used detailed surveys of operators in each basin to determine activities, practices, and counts of small "area-source" equipment not typically permitted by the state. WestJumpAQMS then carried forward these survey data and adjusted emissions to 2008 based on production data and any controls added after Phase III. 3) Phase III/WestJumpAQMS used the high-quality and complete IHS commercial database of O&G production data by well by basin. This was not used in Phase II, instead the state O&G Commission databases, which have been improved quite

Inventory Sector	2002 Baseline Inventory (WRAP Plan02d)	2008 Emission Inventory (WRAP WestJump08 and DEASCO$_3$)	Comments
			a bit over time, were used. 4) Phase III used more refined methodologies to estimate emissions, Phase III also asked states and operators for gas composition data by basin that greatly increased the information available about VOC emissions rates.
On-Road Mobile	EPA MOBILE6 model applied by ENVIRON contractor using National Mobile Inventory Model (NMIM) Vehicle Miles Traveled (VMT) defaults for all counties except Maricopa, for which local inputs were provided. More information is available in the Emissions Method section of the WRAP TSS documentation: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx and http://www.wrapair.org/forums/ef/UMSI/0606_WRAP_Mobile_Source_EI_Final_Report.pdf	EPA MOVES2010a model in inventory mode utilizing national default data for each county and MET4MOVES for meteorological data. More details are available here: http://wrapair2.org/WestJumpAQMS.aspx	Differences in models contributed to some differences in emissions reported, but other disparities are due to a combination of VMT changes and new controls on vehicles.
Off-Road Mobile	EPA draft NONROAD2004 model version data by ENVIRON with inputs from Arizona for vehicle population allocation and county level locomotive emissions.	State reported off-road mobile sources for 2008 (NEI08v2). More details are available	The off-road models include both emission factors and default county-level population and activity data. For the 2008 EPA NEI, Locomotive

Inventory Sector	2002 Baseline Inventory (WRAP Plan02d)	2008 Emission Inventory (WRAP WestJump08 and DEASCO$_3$)	Comments
	More details are available here: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx and http://www.wrapair.org/forums/ef/UMSI/0606_WRAP_Mobile_Source_EI_Final_Report.pdf	here: http://wrapair2.org/WestJumpAQMS.aspx	emissions were designated as Area source emissions where previously they were categorized as Off-road emissions.
Fugitive Dust and Road Dust	Emission Methodology based on AP-42 guidance and CARB procedures for the following source categories: • Agricultural Operations – County specific cropland acreage provided by the State. • Construction Operations – data obtained from the US Census Bureau and the Department of Commerce. • Road Dust – data obtained from the Federal Highway Administration and State and local datasets. Vegetative scavenging factors were applied pre-processing at the county level More details are available here: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx	Extracted from state reported area sources for 2008 (NEI08v2). Vegetative scavenging factors were applied post-processing at the higher resolution grid cell level, compared to 2002 data. More details are available here: http://wrapair2.org/WestJumpAQMS.aspx	Note that fugitive dust and road dust categories were available separately in WRAP Plan02d inventories, but are combined for summary purposes here. For the 2008 inventory, vegetative scavenging factors were applied to the combined sources; thus these source categories are not easily separated.

Inventory Sector	2002 Baseline Inventory (WRAP Plan02d)	2008 Emission Inventory (WRAP WestJump08 and DEASCO$_3$)	Comments
Windblown Dust	Generated using WRAP Windblown Dust Model and 2002 MM5 meteorology, at 36km grid cell resolution. Vegetative scavenging factors applied pre-processing at the county level More details are available here: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx	Generated using WRAP Windblown Dust Model and 2008WRF meteorology, at 4km and 12km grid cell resolution for the WRAP region. Vegetative scavenging factors applied post-processing at the grid cell level. More details are available here: http://wrapair2.org/WestJumpAQMS.aspx	Difference between 2002 and 2008 meteorology introduce factors that make judgment of progress for this category difficult. 1) MM5 vs. WRF met models – different actual meteorology in each year and increased grid cell resolution in 2008. 2) Higher resolution of grid cells leads to higher average wind speeds in individual cells, which leads to increased windblown dust emissions aggregated at the county level. 3) MM5 Layer 1 36 meter height winds vs. WRF average winds across lowest 3 layers spanning ~40 meter height. Error in 2002 WBD model application treating rainfall in cm as inches.
Biogenic	BEIS3.12 with BELD3 landuse and 2002 MM5 meteorology data, at 36km grid cell resolution. More details are available here: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx	MEGAN2.10 with 2008 WRF meteorology data, at 4 and 12 km grid cell resolution More details are available here: http://www.wrapair2.org/emissions.aspx#	Comparisons of biogenic inventories between baseline and progress years will show large differences due to methodology, and not actual changes in emissions. Examples of biogenic emissions input factors that may affect differences between the BEIS3.12 and MEGAN2.10 model outputs include: • Different meteorological years and models

Inventory Sector	2002 Baseline Inventory (WRAP Plan02d)	2008 Emission Inventory (WRAP WestJump08 and DEASCO$_3$)	Comments
			(2002 MM5 vs. 2008 WRF). • Higher temporal and spatial variability of land cover and other environmental input factors. • Improved emissions factors based on better sources of data (e.g., satellites and field studies). A model comparison study between BEIS3.12 and MEGAN2.10 was performed by WRAP and can be found at: http://wrapair2.org/pdf/Memo_9_Biogenics_May9_2012_Final.pdf
Fires	WRAP Phase III fire inventory More details are available here: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx	Current summaries use interim WESTJUMP08 fire data currently based on satellite fire data for 2008. This inventory does not separate anthropogenic from natural fire. DEASCO3 fire summaries will include separate reporting of anthropogenic and natural fires.	Baseline conditions are represented with a 5-year average of fire activity at the same locations and occurrence dates as actually occurred in 2002, while progress period conditions are represented with actual 2008 data. Comparisons between these inventories are complicated by the variable and sporadic nature of wildfires.

Inventory Sector	2002 Baseline Inventory (WRAP Plan02d)	2008 Emission Inventory (WRAP WestJump08 and DEASCO$_3$)	Comments
		More details are available here: http://www.wrapfets.org/deasco3.cfm	

II.D. 2002 and 2008 Emissions

The 2008 Arizona statewide EI was originally created by the WRAP WESTJUMP project to fulfill the requirements of 40 CFR § 51.308(g)(4) which states individual States must address the change in the emissions of pollutants which contribute to visibility impairment every 5 years for all sources and activities. ADEQ is currently submitting the WRAP WESTJUMP version of the 2008 EI to fulfill the requirement of 40 CFR § 51.308(d)(4)(v). While the WESTJUMP 2008 emission inventory provides the most consistent inventory available in relation to the baseline 2002 State of Arizona EI, Table 1 illustrates the differences which occurred during the calculation of these inventories. Inferences related to emission changes between 2002 and 2008 should not be made for many of the source sectors due to these emission changes likely resulting from model resolution, methodology, and input data enhancements. Despite this concern, general observations regarding emission differences between the two inventories are listed below.

- For sulfur dioxide, all categories except area sources exhibited lower emissions in the 2008 inventory as compared to the 2002 inventory, with the largest difference reported in point sources.

- For nitrogen dioxide, all source categories except area sources exhibited lower emissions in the 2008 inventory as compared to the 2002 inventory, with the largest difference reported for mobile sources.

- Ammonia emissions remained relatively similar between inventories, with 2008 area sources showing slightly higher estimated emissions than 2002 and 2008 on-road mobile sources showing lower estimated emissions.

- 2008 EI volatile organic compound emissions were much lower than 2002 in biogenic sector, due to enhancements in biogenic inventory methodology.

- Primary organic aerosol emissions from fire were higher in 2002 than 2008. Note that current year inventories represent only snapshots of fire emissions for the year 2008.

- Elemental carbon showed large decreases in fire emissions, but on-road mobile emissions were higher in the 2008 inventory than the 2002 inventory.

- Fine particulate matter (crustal) and coarse mass were much larger for windblown, fugitive and road dust sectors of the 2008 EI as compared to the 2002 EI. The increase in windblown dust is thought to be due in part to enhancements in dust inventory methodology. The 2008 EI was also slightly higher for area and point sources for the crustal components of fine particulate matter as compared to the 2002 EI.

II.D.1.Estimated 2002 and 2008 Arizona Emissions

Table 2 and Figure 1 present 2002 and 2008 estimated SO_2 emissions by source category. Tables 3 and Figure 2 present data for NO_x, and subsequent Tables and Figures (Tables 4 through 9 and Figures 3 through 8) present NH_3, VOCs, POA, EC, Fines and CM emissions for the years of 2002 and 2008. Source categories are qualified (yellow highlights) where methodology, input data, or modeling resolution enhancements are believed to significantly affect emission differences between the 2002 and 2008 EIs.

Table 2: Arizona Sulfur Dioxide Emissions by Source Category

Source Category	Sulfur Dioxide Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	94,716	79,015	-15,700
Area	2,677	3,678	1,001
On-Road Mobile	2,715	812	-1,904
Off-Road Mobile	4,223	673	-3,550
Area Oil and Gas	0	0	0
Fugitive and Road Dust	0	0	0
Anthropogenic Fire*	NA	NA	NA
Wind Blown Dust	NA	0	NA
Total Anthropogenic	**104,330**	**84,177**	**-20,153 (-19%)**
Natural Sources			
Natural Fire*	4,559	607	-3,952
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**4,559**	**607**	**-3,952 (-87%)**
All Sources			
Total Emissions	**108,890**	**84,784**	**-24,105 (-22%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

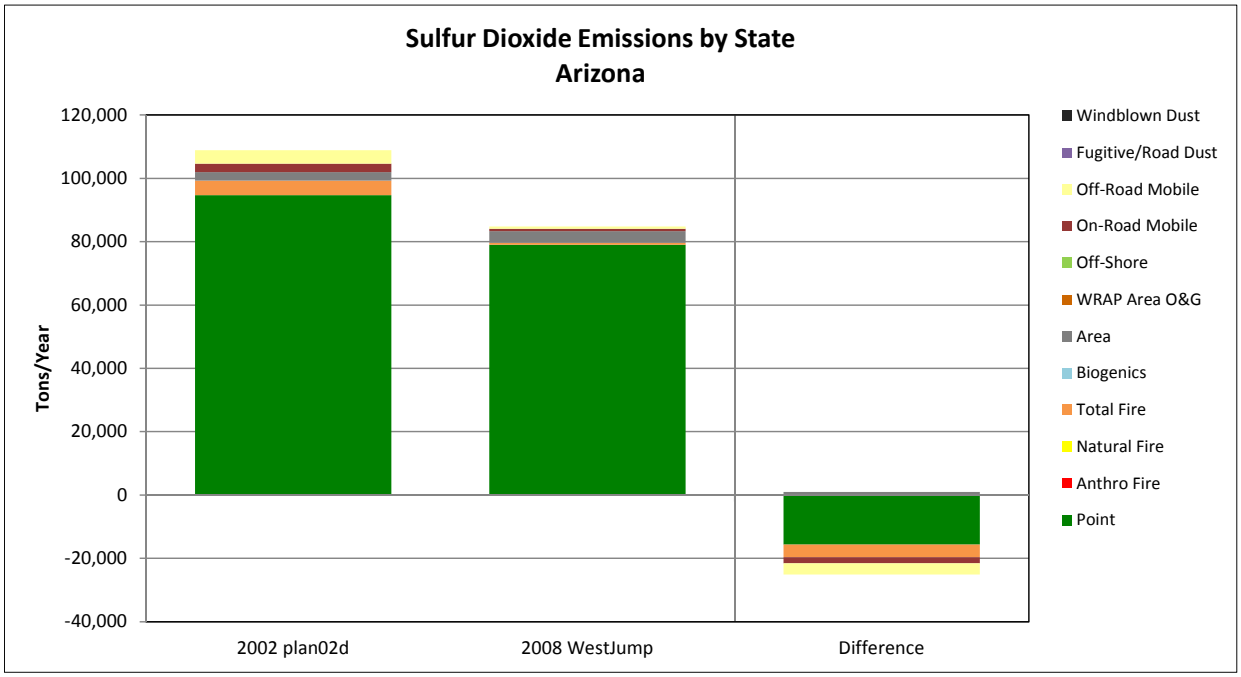


Figure 1: 2002 and 2008 Sulfur Dioxide Emissions by Source Category

Table 3: Arizona Nitrogen Oxide Emissions by Source Category

Source Category	Nitrogen Oxides Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	69,968	60,759	-9,209
Area	9,049	39,403	30,354
On-Road Mobile	178,009	137,555	-40,453
Off-Road Mobile	66,414	33,857	-32,557
Area Oil and Gas	17	0	-17
Fugitive and Road Dust	0	0	0
Wind Blown Dust	NA	0	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**323,458**	**271,575**	**-51,882 (-16%)**
Natural Sources			
Natural Fire*	17,218	3,513	-13,704
Biogenic	27,664	15,256	-12,408
Wind Blown Dust	0	0	0
Total Natural	**44,881**	**18,769**	**-26,112 (-58%)**
All Sources			
Total Emissions	**368,339**	**290,344**	**-77,995 (-21%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

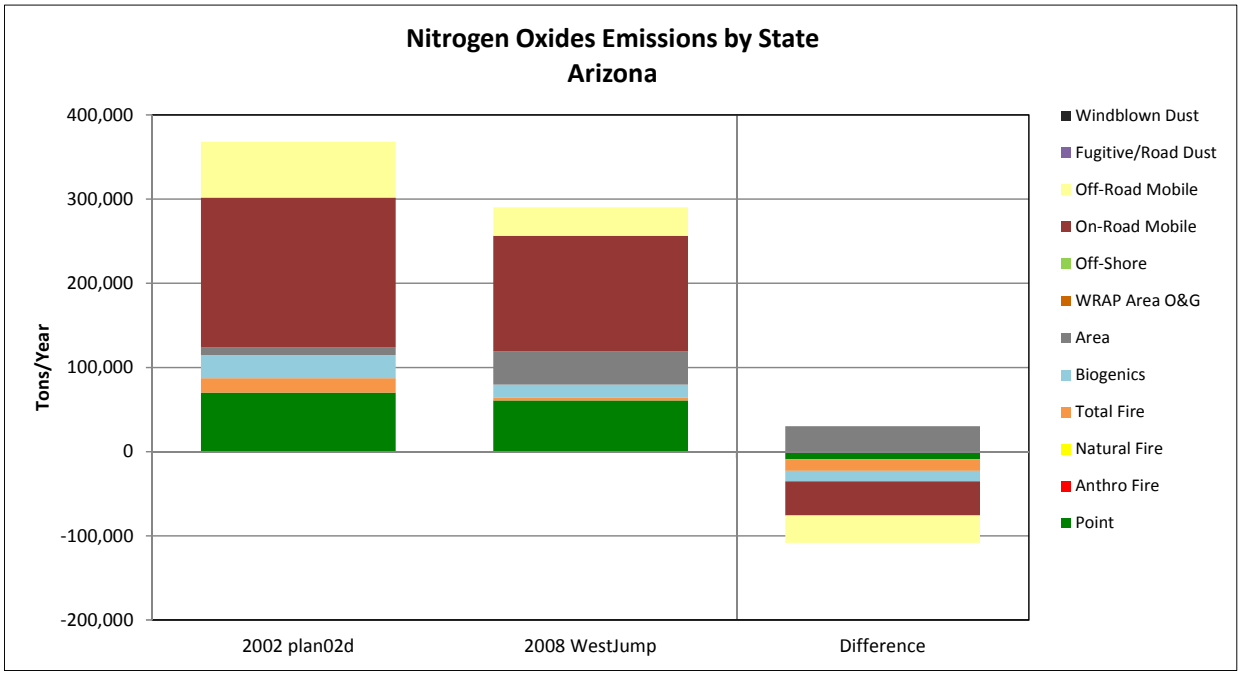


Figure 2: 2002 and 2008 Nitrogen Oxide Emissions by Source Category

Table 4: Arizona Ammonia Emissions by Source Category

Source Category	Ammonia Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	531	971	440
Area	32,713	34,878	2,165
On-Road Mobile	5,035	2,377	-2,658
Off-Road Mobile	48	40	-8
Area Oil and Gas	0	0	0
Fugitive and Road Dust	0	0	0
Anthropogenic Fire*	NA	NA	NA
Windblown Dust	NA	0	NA
Total Anthropogenic	**38,326**	**38,265**	**-61 (0%)**
Natural Sources			
Natural Fire*	3,878	0	-3,878
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**3,878**	**0**	**-3,878 (-100%)**
All Sources			
Total Emissions	**42,203**	**38,265**	**-3,939 (-9%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

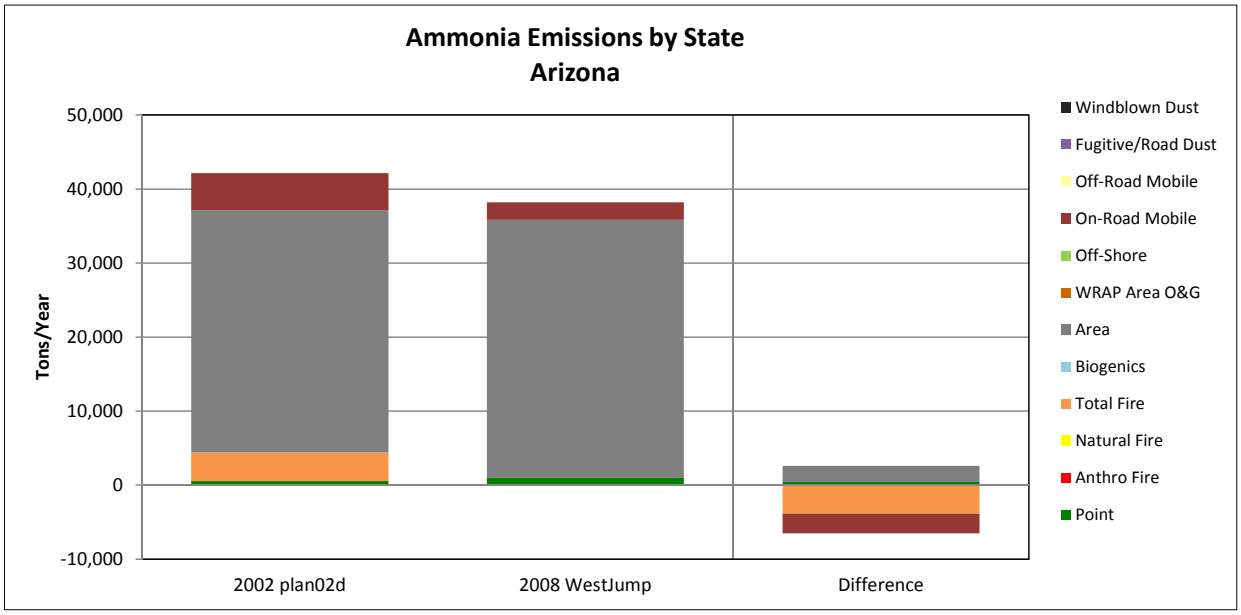


Figure 3: 2002 and 2008 Ammonia Emissions by Source Category

Table 5: Arizona Volatile Organic Compound Emissions by Source Category

Source Category	Volatile Organic Compound Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	5,464	3,489	-1,975
Area	102,918	100,256	-2,661
On-Road Mobile	110,424	54,589	-55,834
Off-Road Mobile	56,901	42,297	-14,604
Area Oil and Gas	46	12	-34
Fugitive and Road Dust	0	0	0
Windblown Dust	NA	0	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**275,753**	**200,644**	**-75,109 (-27%)**
Natural Sources			
Natural Fire*	37,232	4,989	-32,243
Biogenic	1,576,698	686,255	-890,443
Wind Blown Dust	0	0	0
Total Natural	**1,613,930**	**691,243**	**-922,686 (-57%)**
All Sources			
Total Emissions	**1,889,682**	**891,887**	**-997,795 (-53%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

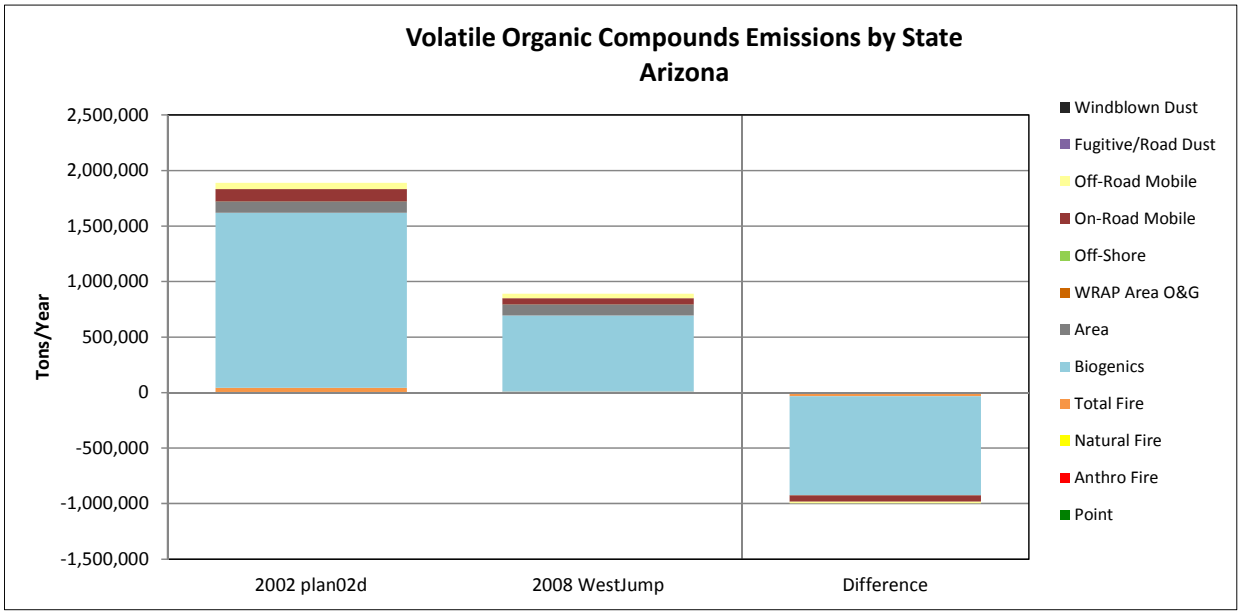


Figure 4: 2002 and 2008 Volatile Organic Compound Emissions by Source Category

Table 6: Arizona Primary Organic Aerosol Emissions by Source Category

Source Category	Primary Organic Aerosol Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	276	410	134
Area	4,728	6,445	1,718
On-Road Mobile	1,583	2,666	1,083
Off-Road Mobile	2,006	1,383	-624
Area Oil and Gas	0	0	0
Fugitive and Road Dust	535	1,393	858
Windblown Dust	NA	0	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**9,128**	**12,298**	**3,169 (35%)**
Natural Sources			
Natural Fire*	48,625	5,669	-42,957
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**48,625**	**5,669**	**-42,957 (-88%)**
All Sources			
Total Emissions	**57,754**	**17,966**	**-39,787 (-69%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

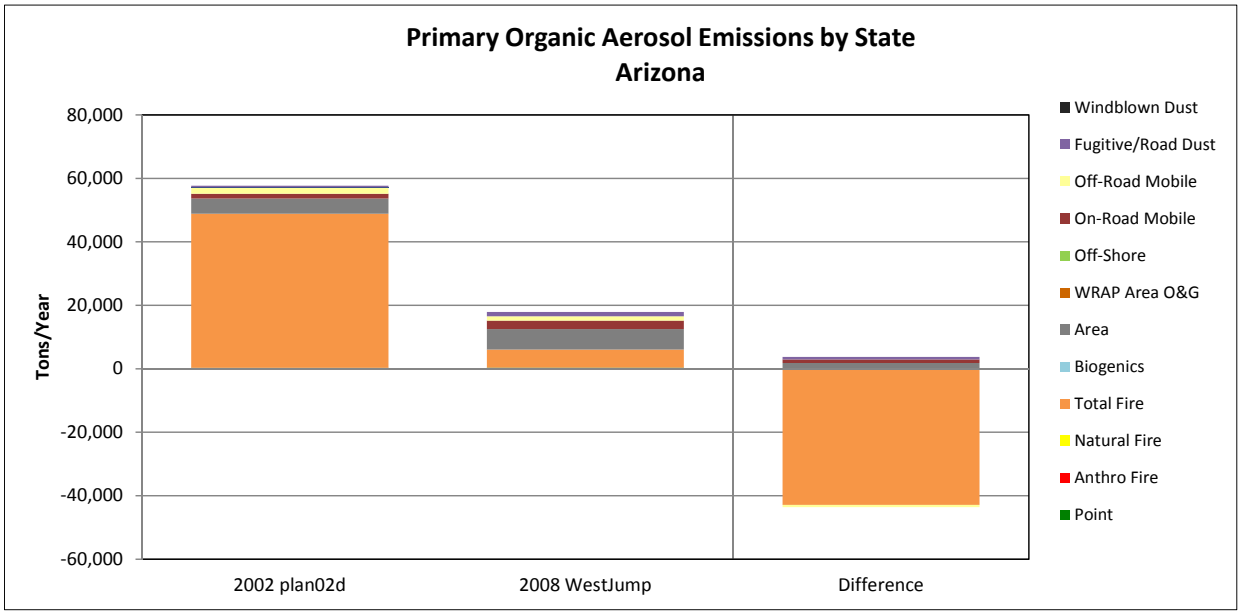


Figure 5: 2002 and 2008 Primary Organic Aerosol Emissions by Source Category

Table 7: Arizona Elemental Carbon Emissions by Source Category

Source Category	Elemental Carbon Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	26	283	257
Area	449	1,337	889
On-Road Mobile	1,761	5,559	3,798
Off-Road Mobile	2,752	1,813	-940
Area Oil and Gas	0	0	0
Fugitive and Road Dust	39	47	8
Windblown Dust	NA	0	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**5,027**	**9,039**	**4,012 (80%)**
Natural Sources			
Natural Fire*	9,719	412	-9,307
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**9,719**	**412**	**-9,307 (-96%)**
All Sources			
Total Emissions	**14,745**	**9,450**	**-5,295 (-36%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

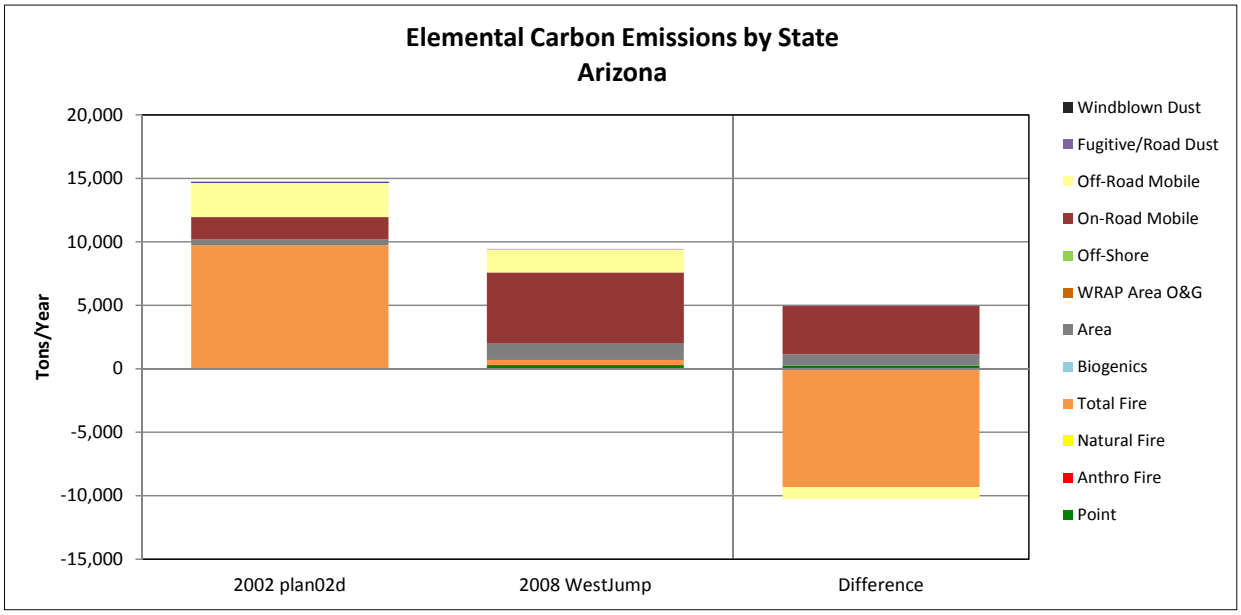


Figure 6: 2002 and 2008 Elemental Carbon Emissions by Source Category

Table 8: Arizona Fine Particulate Matter Emissions by Source Category

Source Category	Fine Particulate Matter Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	632	4,434	3,801
Area	4,223	7,906	3,684
On-Road Mobile	1,080	511	-569
Off-Road Mobile	0	97	97
Area Oil and Gas	0	0	0
Fugitive and Road Dust	10,072	24,592	14,520
Windblown Dust	NA	67	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**16,007**	**37,607**	**21,600 (>100%)**
Natural Sources			
Natural Fire*	3,945	1,938	-2,006
Biogenic	0	0	0
Wind Blown Dust	6,422	9,647	2,885
Total Natural	**10,367**	**11,585**	**1,218 (12%)**
All Sources			
Total Emissions	**26,374**	**49,192**	**22,818 (87%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

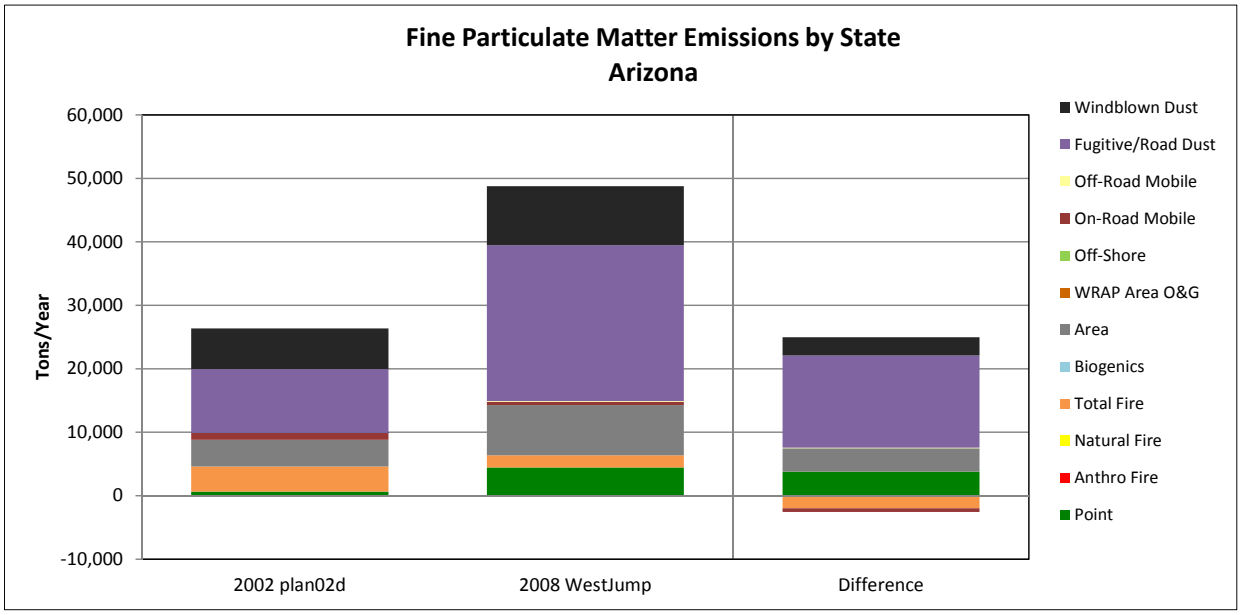


Figure 7: 2002 and 2008 Fine Particulate Matter Emissions by Source Category

Table 9: Arizona Coarse Particulate Matter Emissions by Source Category

Source Category	Coarse Particulate Matter Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	8,473	5,260	-3,214
Area	1,384	2,389	1,005
On-Road Mobile	1,004	5,597	4,593
Off-Road Mobile	0	162	162
Area Oil and Gas	0	0	0
Fugitive and Road Dust	79,316	141,117	61,801
Windblown Dust	NA	604	NA
Anthropogenic Fire*	NA	NA	NA
Total Anthropogenic	**90,178**	**155,129**	**64,951 (72%)**
Natural Sources			
Natural Fire*	10,125	1,692	-8,433
Biogenic	0	0	0
Wind Blown Dust	57,796	86,827	29,031
Total Natural	**67,921**	**88,519**	**20,598 (30%)**
All Sources			
Total Emissions	**158,099**	**243,648**	**85,549 (54%)**

*Natural fire totals for the 2008 inventory include both anthropogenic and natural sources. Updated data distinguishing these sources are expected.

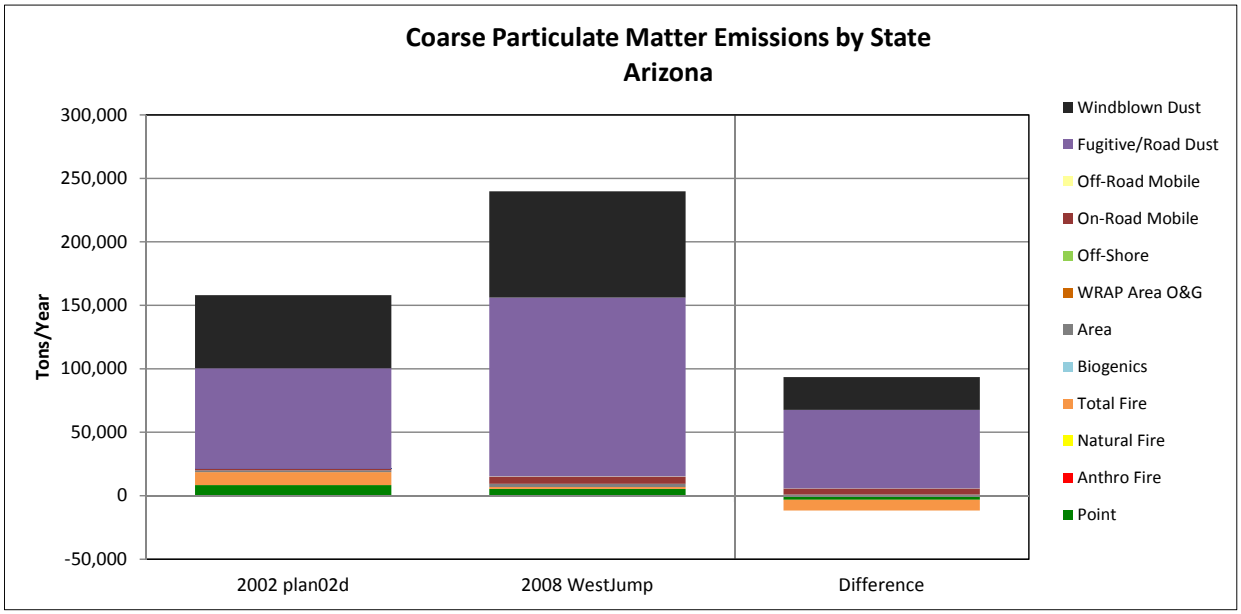


Figure 8: 2002 and 2008 Coarse Particulate Matter Emissions by Source Category

II.D.2.Summary of Major Methodological Changes

The Arizona Department of Administration (ADOA) provides publicly available records of State and County estimated populations for each year dating to 1980[6]. For the years of 2002 and 2008, ADOA estimates Arizona state-wide populations to be 5,470,720 and 6,629,455 respectively. This is an increase in state-wide population of 21.2%. An increase in population this significant will undoubtedly lead to pollutant emission changes for a number of source categories; however, the extreme degree to which certain pollutants change for given source categories indicate that population increases are not solely responsible for emission changes between the 2002 and 2008 EIs. Below is a list of methodology, input data, and model resolution changes which are believed to significantly contribute to emission differences between the 2002 and 2008 EIs. This list describes the possible changes which could affect all qualified data from Tables 2-9.

1. ADEQ has reviewed emission estimates to understand the drastic changes in Area Source SO_2 and NO_x emissions between the 2002 and 2008 EIs. This review indicated that these changes are due to a mixture of methodological changes and data completion issues. Therefore, ADEQ believes a more accurate indicator of NO_x and SO_2 emission changes between the baseline and progress periods can be obtained through an analysis of the IMPROVE data. Some identified issues between 2002 and 2008 Area Source NO_x and SO_2 emission estimates are presented below.
    - When extracting Area source emissions data from the 2008 NEI by SCC code for the State of Arizona, several reported emissions contained neither physical descriptors nor SCC codes. It is possible that these unidentified sources could represent sources which are being double counted in another portion of the inventory. All 2002 data were resolved by SCC code and physical descriptors, eliminating the possibility of double counting.
    - When extracting area source NO_x emissions data from the 2008 NEI by SCC code, data can be sorted by the submitting agency or agencies. Submitting agencies include: AZDEQ, EPA, Railroad Companies, "AgFire", and "Multiple". The "Multiple" submitting agency label submitted 25 unidentifiable NO_x area emission categories for the 15 Arizona counties. These NO_x emissions totaled 23,371 tons. EPA confirmed these emissions originated from Locomotive and Railroad activities. The 2008 EPA NEI designated locomotive emissions as an Area source where previous inventories categorized it as an Off-road source[7]. This emission relocation is likely to account for the majority of emission changes between 2002 and 2008 Area source and Off-road source emissions for NO_x and SO_x and, to a lesser degree, other pollutants listed above.
    - NO_x area source emissions reported to the NEI increased from 4,736 tons in 2002 to 13,563 tons in 2008 for Maricopa County alone. Direct contact with

[6] Arizona Department of Administration (ADOA). http://www.workforce.az.gov/pubs/demography/Estimates1980_2009With2000CensusWithNotes.xls

[7] EPA. 2012. 2008 National Emissions Inventory v. 2 Technical Support Document. http://www.epa.gov/ttn/chief/net/2008neiv2/2008_neiv2_tsd_draft.pdf

Maricopa County revealed that the county was presenting a more accurate fuel burning emission inventory in 2008 and that the County raised the emission limit of point source classification to more accurately reflect the CERR definition in 2008. In 2002 they reported 145 point sources and in 2008 they only reported 25 point source facilities, with the remaining sources becoming Area Source emitters.

2. Biogenic emission differences for NO_x and VOCs are primarily due to methodology, source data, and modeling resolution enhancements between 2002 and 2008.
3. Ammonia emission differences for On-road Mobile are primarily due to a switch from the MOBILE6 model to the MOVES model. The 2008 EPA NEI Technical Support Document (TSD)[8] reported a 54% decrease in highway vehicle NH_3 for 2008.
4. VOC emission differences for On-road Mobile are primarily due to a switch from the MOBILE6 model to the MOVES model.
5. On-road Elemental Carbon (EC) and Coarse Particulate Matter (CM) emission differences are primarily due to the switch between MOBILE6 and MOVES (which estimates higher PM emissions).
6. Reported Point Source Fines emissions exhibit a dramatic increase between 2002 and 2008, while CM decreases between 2002 and 2008. In theory, these two pollutants should track fairly closely to one another. ADEQ internal review revealed that many, if not most, sources within the State of Arizona were not reporting $PM_{2.5}$ prior to 2006 which likely explains the drastic change in Fines emissions between the 2002 and 2008 EIs.
7. Area source Fines emission differences are partially due to NEI changes. Calculation methodology changes resulted in an overall increase in Agricultural Tilling and Livestock emissions of 67% for the 2008 NEI.
8. Fugitive and Road Dust Fines and CM emission differences are primarily due to NEI changes. Calculation methodology changes resulted in an overall increase in Paved Road Dust emission of 128% for the 2008 NEI.
9. Windblown Dust Fines and CM emission differences are primarily due to the WRAP Windblown Dust (WBD) Model enhancing meteorological inputs and model resolution between the 2002 and 2008 emissions calculations. Appendix A gives a more complete overview of how windblown dust emissions were partitioned into natural and anthropogenic sources. 2002 windblown emissions were not partitioned into natural and anthropogenic sources and are thus presented only as natural emissions above.

[8] EPA. 2012. 2008 National Emissions Inventory v. 2 Technical Support Document. http://www.epa.gov/ttn/chief/net/2008neiv2/2008_neiv2_tsd_draft.pdf

II.D.3.Regional Inventory Trends for Emissions

Most of the emission difference qualifying statements ADEQ presents in Section V.D.2. are attributable to changes in input data origination or calculation methodologies for emission estimations by sector. Since the WRAP WESTJUMP project created statewide emission inventories for all of the western US using similar methodology, it is reasonable to believe that these qualifying statements would hold true for all of the compiled emission inventories. In this section ADEQ presents WRAP and Air Resource Specialists, Inc (ARS) produced figures of differences in 2002 and 2008 emission inventories by state for three different pollutants to determine if the previously mentioned qualifiers hold true. These graphs split State emissions into emitting source categories to identify trends for each of the calculated or reported sources.

VOC emissions by State are presented in Figure 9. This figure easily illustrates qualifiers #2 and #4 from Section V.D.2. The most evident trend in this figure is the drastic decrease in Biogenic emissions for each State. These decreases are extreme and ubiquitous throughout the region. This trend supports qualifier #2, that Biogenic VOC emission differences are primarily due to enhancements in calculation methodology. In addition, On-road Mobile emissions show reasonably large decreases for each State. While EPA reports a decrease of national VMT by 0.8% for 2005-2008[9], it is unlikely that this small decrease in VMT would be seen in every state. The state of Arizona showed a 21.2% population increase between 2002 and 2008, which would likely result in a substantial VMT increase. Therefore, it is reasonable to believe that qualifier #4, that VOC decreases are likely due to a switch from the MOBILE6 model to the MOVES model, is true.

Figure 10 presents State emissions for CM for the western US. The trends within this figure are more regionally based, rather than characteristic of the entire western US. Coarse Mass emissions are due to physical disturbance of an area of land by anthropogenic activities (e.g. construction, driving on unpaved roadways, etc), natural activities (e.g. animal movement or burrowing), or a mixture of the natural and anthropogenic activities (e.g. wind suspension of dust from a cleared area). While the activity which creates the emissions may change, the magnitude of emissions created is going to be primarily dependant on the local environment. Meteorology, soil characteristics, and vegetation coverage are going to play a large role in the magnitude of emissions produced from a certain area. Therefore, when examining Figure 10, it is important to group the States which have a similar local environment. Arizona, South-eastern California, Nevada, New Mexico, and Utah comprise the southwestern US which is characterized by its arid nature, in turn leading to sparse vegetation coverage. When examining Figure 10 for these five states, it is evident that local environmental factors play a large role in how Windblown Dust emissions differed between the 2002 and 2008 EIs. All five southwestern US States exhibit similar emission differences for Windblown Dust and Fugitive and Road Dust. Southwestern US State Windblown Dust emissions

[9] EPA. 2012. 2008 National Emissions Inventory v. 2 Technical Support Document. http://www.epa.gov/ttn/chief/net/2008neiv2/2008_neiv2_tsd_draft.pdf

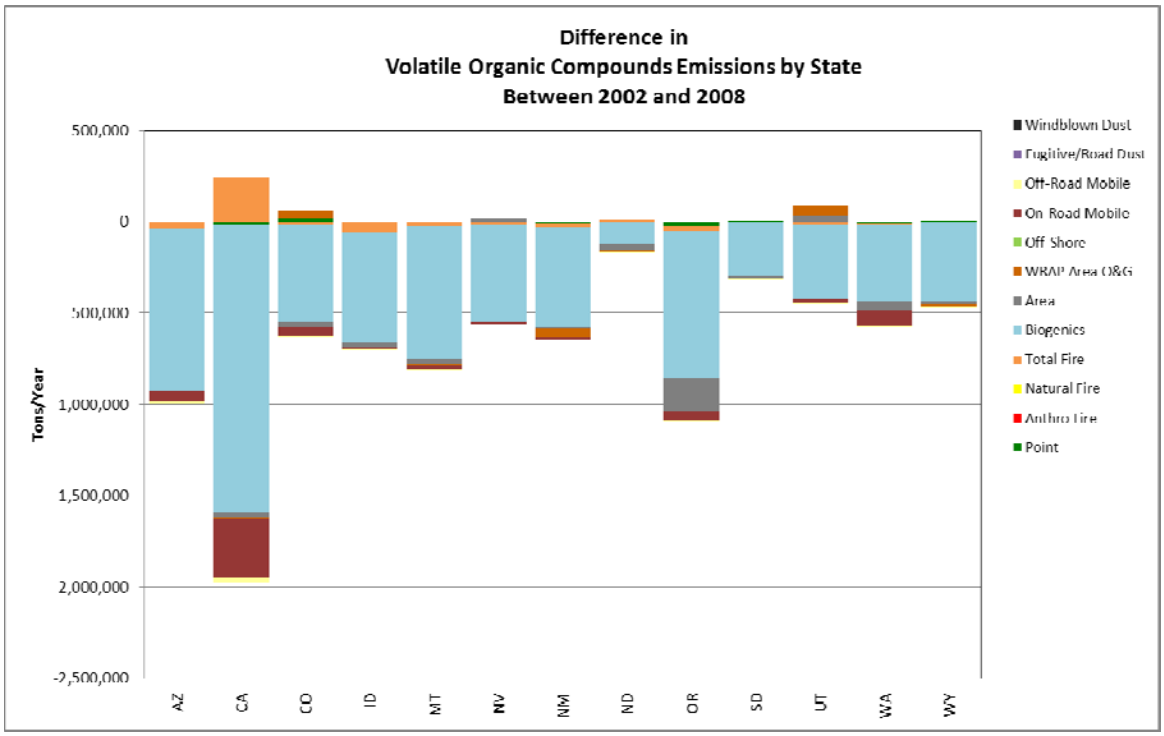


Figure 9: Regional differences in VOC emissions between 2002 and 2008 Emission Inventories

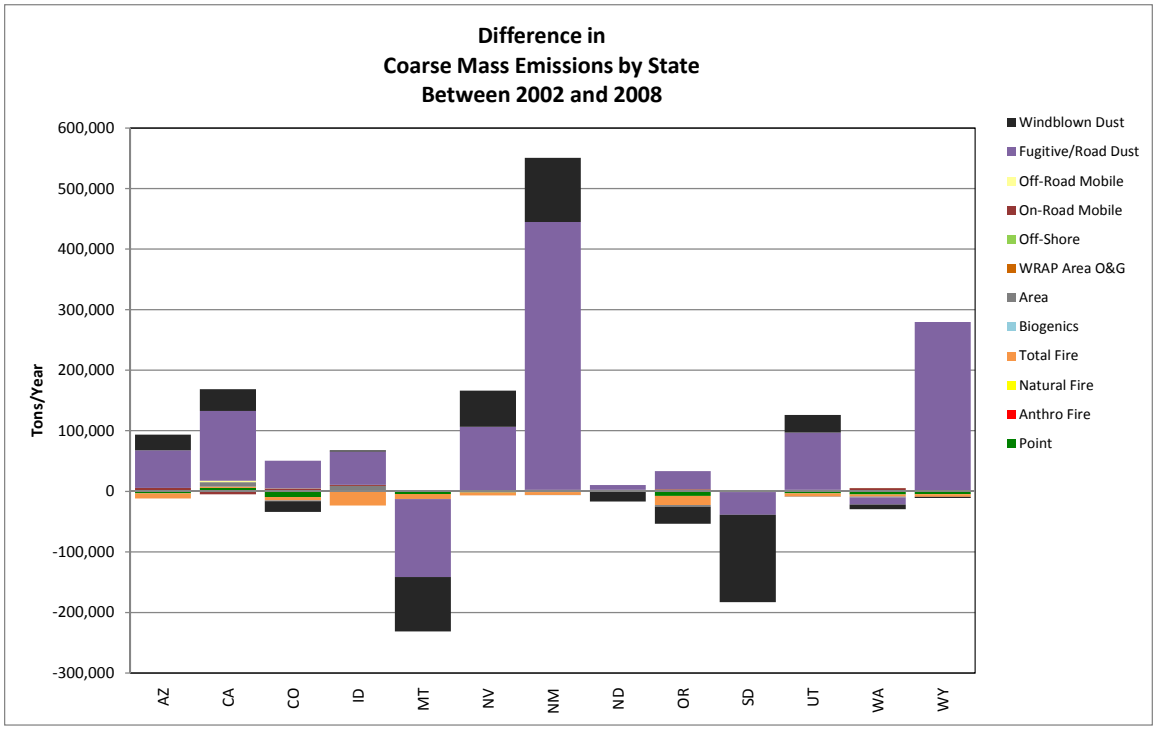


Figure 10: Regional differences in Coarse Mass emissions between 2002 and 2008 Emission Inventories

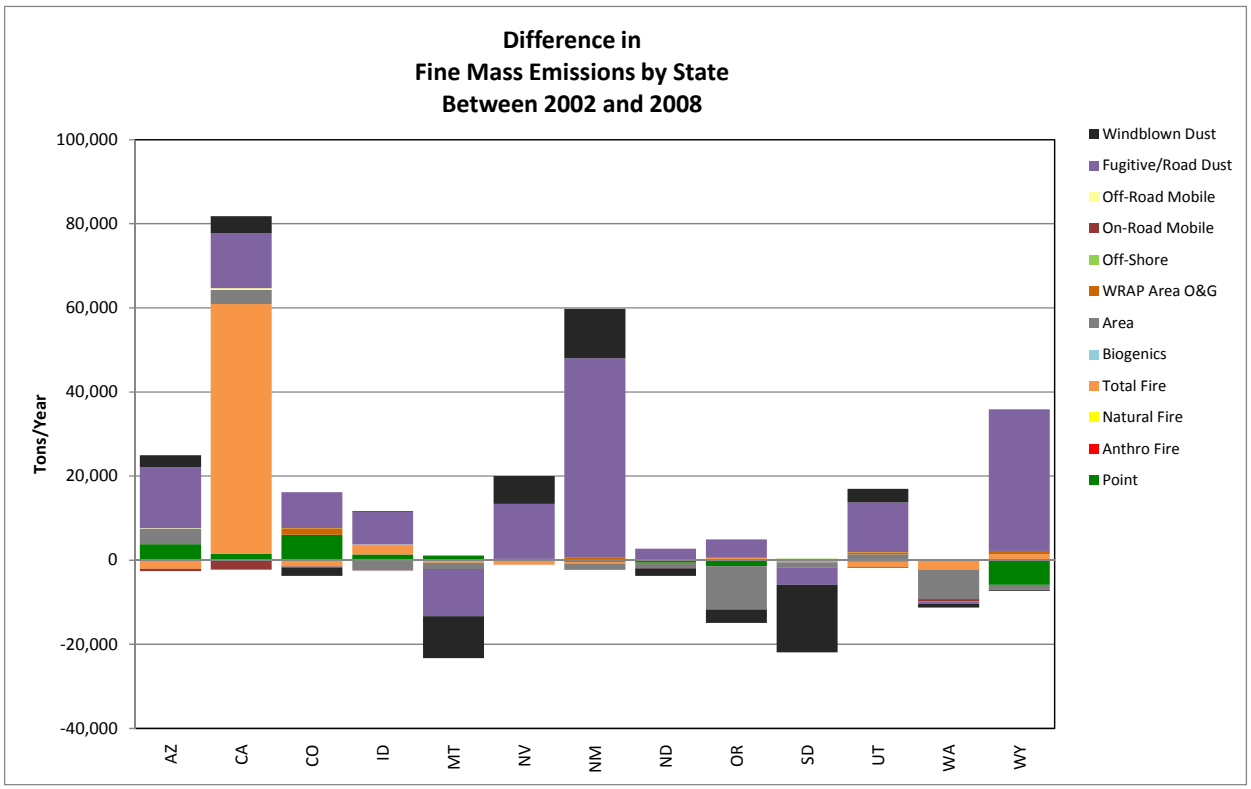


Figure 11: Regional differences in Fine Mass emissions between 2002 and 2008 Emission Inventories

are likely to be more affected by WRAP WBD model resolution increases and the decreased precipitation, as reported in Table 1, than surrounding States due to higher local wind speeds increasing dust suspension into the atmosphere from dry, unvegetated soils. ADEQ believes that Road Dust is primarily responsible for the emission changes seen in the Fugitive and Road Dust category. The 2008 NEI reports that road dust emissions increased by 128% over the previous NEI for the US. Since the 2008 NEI v1.5 was used for this source category, it is believed that this is the reason for the difference between 2002 and 2008 emissions for the combined categories of Fugitive and Road Dust. Furthermore, the aridity of the southwestern US would likely result in road dust calculation disparities being maximized in this region, when compared to other regions of the US. Fines (Figure 11) show similar regional trends for Windblown Dust and Fugitive and Road Dust for the arid southwestern US as was reported for CM, further supporting the theory that particulate matter emission differences are at least partially due to calculation methodology changes. While not proving qualifying statement #7, the lack of a regional trend for Fines originating from Point sources provides credence to this point.

III. IMPROVE Monitoring Data

As discussed in Section II, comparisons between the 2002 and 2008 State of Arizona EIs are problematic due to source data and methodology changes. Therefore, ADEQ has determined that IMPROVE monitoring data are more appropriate surrogates for assessing visibility change due to emission increases or decreases within the State of Arizona. Comparisons between the baseline (2000-2004) and progress periods are presented in this document in order to address EPA's assessment within the Federal Register that the State of Arizona Reasonable Progress Goals (RPGs) are not acceptable for reaching the 2064 natural visibility standards[10]. For most cases, data between the years of 2000 and 2009 were relied upon to perform the monitoring data analysis; however, in some instances, ADEQ incorporated more recent data from 2010 to supplement previous analyses and to provide an update for the most current progress period (2006 – 2010). In this section we present IMPROVE data comparisons between the baseline and progress periods, trend analyses using the Theil method, and supplemental analyses for ammonium sulfate and coarse mass. A discussion of how these baseline and progress period data compare to RPGs is presented in Section IV.

III.A. Data Completeness Requirements

The following information was gathered directly from ARS and describes IMPROVE data completeness for the State of Arizona. Furthermore, it outlines the steps and methods utilized to gap fill missing data sets.

Progress for the Regional Haze Rule (RHR) is determined using 5-year average visibility conditions. EPA's guidance for tracking Regional Haze progress[11] includes data completeness requirements designed to ensure that calculated averages include enough data to sufficiently represent each daily, annual and 5-year period. The guidance specifies that the 2000-2004 baseline period and each subsequent 5-year average progress period meet the following conditions:

- Individual samples must contain all species required for the calculation of light extinction (amm. sulfate, amm. nitrate, POM, EC, soil, coarse mass, and sea salt)
- Calendar seasons must contain at least 50% of all possible daily samples
- Calendar years must contain at least 75% of all possible daily samples
- Calendar years must not contain more than 10 consecutive missing daily samples
- The 5-year baseline and each 5-year progress period averages must contain at least 3 complete years of data

[10] Environmental Protection Agency (EPA). Federal Register Volume 77, No. 246. Dec. 21, 2012.
[11] EPA. 2003. Guidance for Tracking Progress Under the Regional Haze Rule.

RHR guidance specifies that if a 5-year period has less than three complete years of data, then estimates should be prepared through consultation with EPA/OAQPS. For the state of Arizona, the 2005-2009 progress period did not have complete data available for one site. The SIAN1 site, the Sierra Ancha Wilderness Area, did not meet RHR data completeness criteria for the years 2006, 2007 and 2008, which interrupted the requirement for 3 complete years required for a 5-year average. Substitution methodology was consistent with methodology previously applied to the 2000-2004 baseline period for seven WRAP sites.

The data substitution methods include estimating missing species from other on-site measurements and appropriately scaling data collected at a nearby site which demonstrated favorable long-term comparisons. Only years deemed incomplete under RHR guidance were candidates for additional data substitutions, which included for the SIAN1 the years 2006, 2007 and 2008. Years deemed complete were not changed, although there may have been missing samples during those years. Substitution methodology is described in detail below.

III.A.1. SIAN1 Site data substitution methodology

The first substitution method applied uses organic hydrogen as a surrogate for organic carbon (OC) and elemental carbon (EC), which are collected on the IMPROVE C module. Hydrogen (H) is measured on the A module filter, and is assumed to be primarily associated with organic carbon and inorganic compounds such as ammonium sulfate. Therefore, OC can be estimated using the historical comparison between estimated organic H and OC. Organic H is estimated by subtracting the portion of H that is assumed to be associated with the inorganic compounds from the total H ($Org\_H = H - 0.25*S$). Linear regression statistics were used to correlate all organic H and OC mass collected at the SIAN1 site during the 2005-2009 period, and regression statistics were applied to organic H to estimate OC on days where organic H was available, but OC was not. OC and EC correlations for the period were then used to calculate EC from OC. Regression statistics for these substitutions were calculated and applied quarterly to account for seasonal variations.

Because the carbon data substitution methods were not sufficient to complete the required years, a second method was applied that involved scaling data from the closest neighboring IMPROVE site, TONT1. This site had previously been determined to have favorable long-term comparisons and similar regional characteristics for substitutions performed on the 2000-2004 baseline period, when the SIAN1 site was selected, in consultation with the state of Arizona, as a donor site for TONT1. Species specific correlations between SIAN1 and TONT1 of mass data collected during the 2005-2009 period were calculated quarterly, and applied to adjust TONT1 data to apply to missing SIAN1 days.

Figure 12 presents bar charts showing daily SIAN1 extinction data, including substituted data, for the 2005-2009 progress period years. Original RHR data in blue and substituted

data by species in the standard IMPROVE colors. Substituted days are also indicated by a black bar underneath the day, and the red line indicates the threshold above which days are counted in the 20% worst days for that year. Note that some of the missing extinction days had partial data available and only individual species missing in a given sample were substituted. Figure 13 presents similar bar charts indicating speciation of all data, with days in which all or part of the day was substituted indicated by a black bar underneath the day. Note that very few of the substituted days were counted among the 20% worst days for the substituted years. All summaries for the SIAN1 site in this progress report support document include these substituted data, and substituted data and detailed methodology information will also be made available on the WRAP TSS website (http://vista.cira.colostate.edu/tss/).

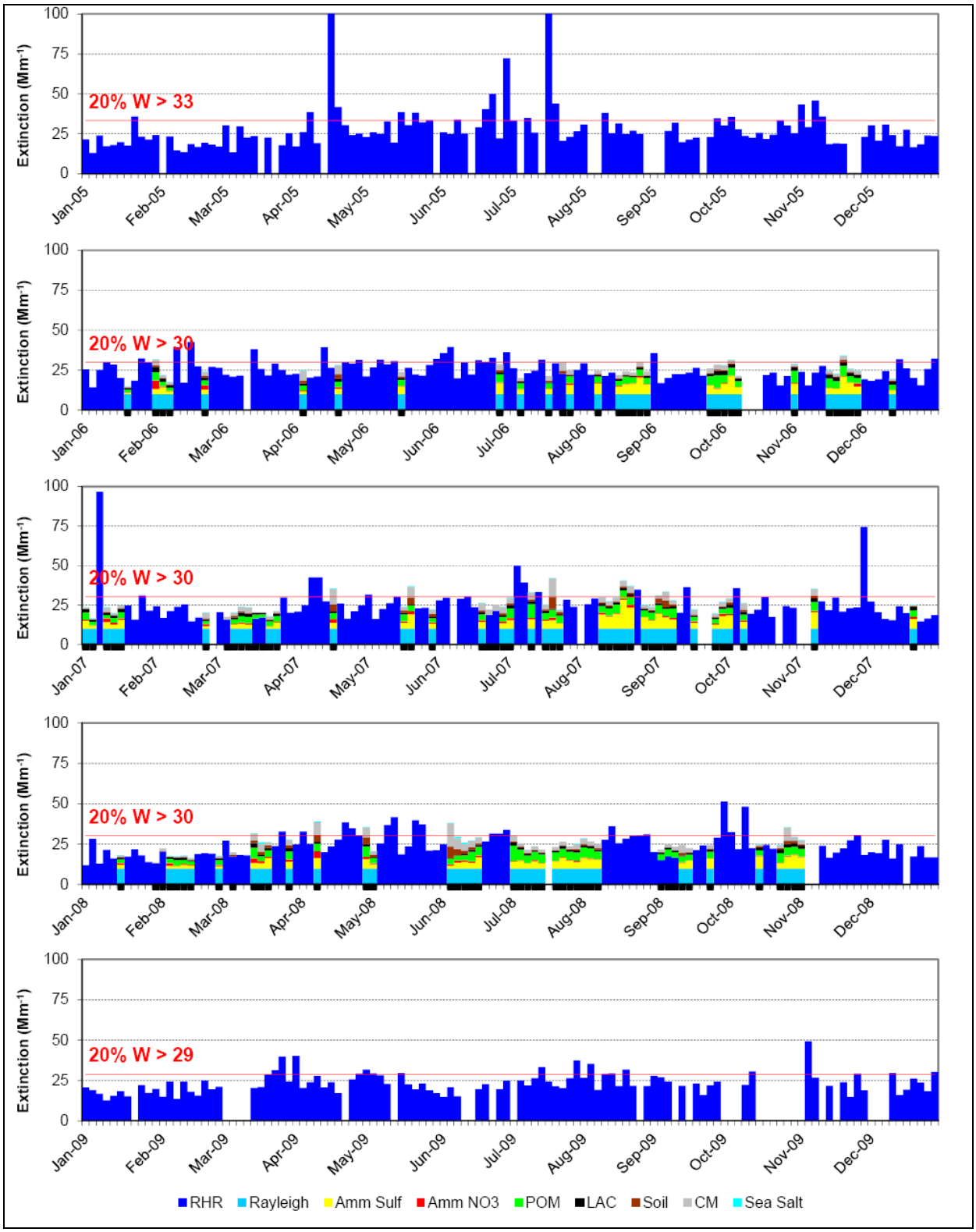


Figure 12: IMPROVE SIAN1 data collected during the 2005-2009 progress period, where original SIAN1 RHR data are depicted in dark blue, and substituted data are depicted with separate colors by species.

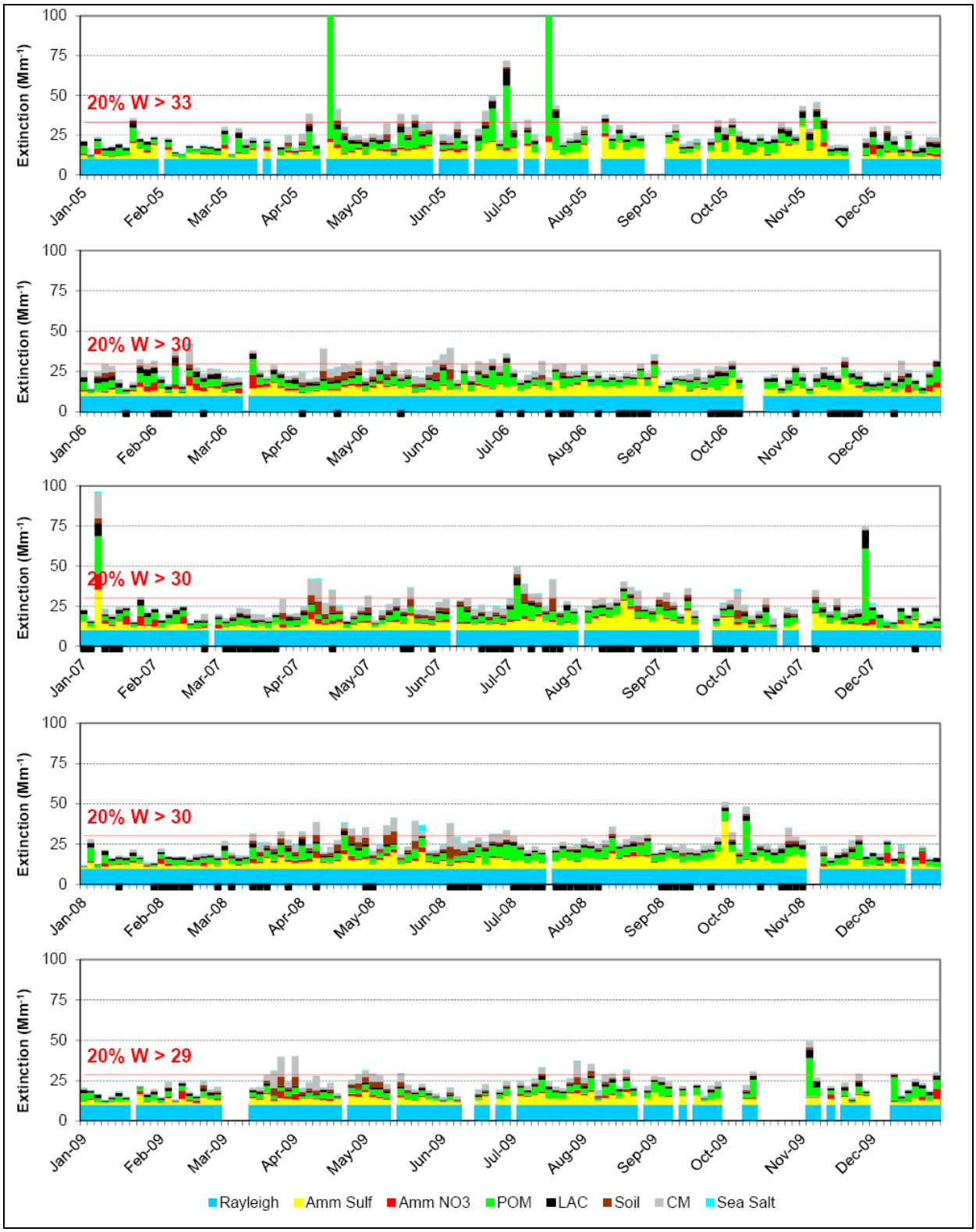


Figure 13: IMPROVE SIAN1 data collected during the 2005-2009 progress period, where substituted days are depicted with a black bar beneath the data.

III.B. Baseline and Progress Period Visibility

This section summarizes IMPROVE monitoring data comparing the 2000-2004 baseline period to the current 2005-2009 progress period for the state of Arizona, in line with regulatory requirements for periodic progress (CFR 51.308(g)(3)(iii)). Furthermore, a more robust 10 year trend analysis is presented to determine how an alternate method of visibility trend analysis may affect the conclusions drawn from IMPROVE monitoring data analysis.

Arizona has 12 mandatory Federal Class I areas with associated IMPROVE monitors. The basic premise of the RHR is to ensure that visibility on the 20% worst days continues to improve at each Federal CIA, and that visibility on the 20% best days does not get worse, as measured in units of deciviews (dv) calculated from data collected at representative Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring sites. In addition to presenting the results of EPA standardized 20% worst and 20% best days comparisons (RHR method), ADEQ submits an alternative method of assessing visibility changes at State of Arizona IMPROVE monitoring sites between the years of 2000 and 2009. This method utilizes Theil statistics (Theil method) to calculate an annual trend for the 10 year period of interest and is an EPA accepted method for annual pollutant trend analysis[12]. More description of the Theil method is given in Section III.B.2.

Some of the major implications from the analysis of IMPROVE monitoring data presented in Section III are listed below, with more detailed information provided in the subsequent sub-sections.

- For RHR method analysis of the 20% best days, the 5-year average deciview metric decreased at all Arizona sites, except GRCA2 which saw no change. The Theil method showed the same results.

- For RHR method analysis of the 20% worst days, the 5-year average deciview metric decreased at most sites, but increased at the GRCA2 and IKBA1 sites. The Theil method showed similar results, except no statistically significant increasing trends ($p < 0.15$). GRCA2 and PEFO1 showed no statistically significant change when analyzed using the Theil method.

    - All sites experienced visibility extinction decreases of ammonium nitrate using the RHR method. The Thiel method showed no significant increasing trends and four sites with significant decreasing trends. Central and northern Arizona sites showed statistically significant ($p < 0.15$) decreasing annual average trends in ammonium nitrate using the Theil method.

[12] EPA. Trends in Monitored Concentrations of Carbon Monoxide. National Air Quality and Emissions Trends Report, 2003.

- RHR method analysis showed that ammonium sulfate increased at most sites, though 20% worst days for ammonium sulfate showed no increases using the Theil method. Observations regarding ammonium sulfate were as follows:

    - Ammonium sulfate RHR method increases were primarily due to higher than average ammonium sulfate measured in 2005.

    - When selecting the 20% worst days for ammonium sulfate alone, no sites showed increases when using the Theil method, and five sites showed statistically significant decreasing trends ($p < 0.15$).

- RHR method analysis exhibited decreases in visibility extinction from particulate organic mass at all sites except GRCA2 and IKBA1. Theil method analysis showed statistically significant particulate organic mass decreases at four Arizona sites and no statistically significant increasing trends at any of the other sites ($p < 0.15$).

- An overall visibility deciview increase at the GRCA2 site was seen when analyzing the data using the RHR method. Two visibility components contributing to this increase were particulate organic mass and elemental carbon. In June 2009, the GRCA2 was in close proximity to 3 simultaneous, lightening induced wildfires. Observations regarding two visibility components associated with wildfire emissions are given below. These results indicate GRCA2 visibility deciview changes were at least partially due to the 2009 wildfires:

    - Elemental carbon showed a fairly large increase in visibility extinction using the RHR method; however, annual average elemental carbon measurements did not show increasing trends using the Theil method.

    - GRCA2 showed an increase in visibility extinction using the RHR method for particulate organic mass; however, annual average particulate organic mass measurements did not show increasing trends using the Theil method.

    - ADEQ performed a separate analysis for the GRCA2 site where the EC and POM extinction values for 2009 were replaced with longer term average extinction values in an attempt to exclude the extreme effect of the above mentioned fires. The average baseline period (2000-2004) was then compared to the average altered progress period (2005-2009) total extinction (Mm^{-1}). A decrease from 34.6 Mm^{-1} for the baseline period to 32.8 Mm^{-1} for the altered progress period was seen. This is further evidence that the 2009 fires played an important role in the increases seen using

the RHR method. A similar analysis was conducted replacing the EC and POM values for 2003 with longer term averages, which acted to increase the total extinction change from 32.9 Mm^{-1} in the adjusted baseline period to 35.1 Mm^{-1} in the progress period. A summary of these results can be found in Table 19. These results illustrate how specific fire events can have a significant effect on the trends as determined by the RHR method.

- The overall visibility deciview increase at IKBA1 was affected by high measurements in 2005. POM and ammonium sulfate are the primary contributing visibility components to the overall increasing deciview trend. These two visibility components are discussed below:

  - Particulate organic mass showed a large increase visibility extinction using the RHR method, but did not show an increasing trend using the Theil method. Particulate matter increases were strongly controlled by a large wildfire in July of 2005.

  - Ammonium sulfate showed a large increase in visibility extinction using the RHR method, but did not show an increasing trend using the Theil method. This large increase in ammonium sulfate using the RHR method was a regional trend (discussed later).

  - ADEQ performed a separate analysis for the IKBA1 site where the EC and POM extinction values for 2005 were replaced with longer term extinction values in an attempt to exclude the extreme effect of the above mentioned fire. The average baseline period (2000-2004) was then compared to the average altered progress period (2005-2009) total extinction (Mm^{-1}). A decrease from 38.9 Mm^{-1} for the baseline period to 37.7 Mm^{-1} for the altered progress period was seen. A summary of these results can be found in Table 19. This is further evidence that the 2005 fire played an important role in the increases seen using the RHR method.

III.B.1. Progress Period (2005-2009) Visibility

This section addresses the regulatory question, ***what are the current visibility conditions for the most impaired and least impaired days (40 CFR 51.308 (g)(3)(i))?*** RHR guidance specifies that 5-year averages be calculated over successive 5-year periods, i.e. 2000-2004, 2005-2009, 2010-2014, etc. (EPA 2003). Current visibility conditions are represented here as the most recent successive 5-year average period available, or the 2005-2009 period average, although the most recent IMPROVE monitoring data currently available includes 2010.

Tables 10 and 11 present the calculated deciview values for each site, along with the percent contribution to extinction from each aerosol component for the 20% most impaired and 20% least impaired days for each of the Federal CIA IMPROVE monitors in Arizona. Figure 14 presents 5-year average extinction for the current progress period for both 20% most impaired and 20% least impaired days.

Specific observations for the current visibility conditions on the 20% most impaired days are as follows:

- The largest contributors to aerosol extinction on the 20% most impaired days at Arizona sites were particulate organic mass, ammonium sulfate and coarse mass.

- The highest aerosol extinction (15.2 dv) was measured at the SYCA1 site, where particulate organic mass was the largest contributor to aerosol extinction, followed by coarse mass. The lowest aerosol extinction (11.8 dv) was measured at the BALD1 site.

Specific observations for the current visibility conditions on the 20% least impaired days are as follows:

- Rayleigh, or the background visibility impairment due to atmospheric gases in clean air, was the largest contributor to light extinction at all sites for the 20% least impaired days. Average extinction for the least impaired visibility days at the Arizona sites ranged between 2.2 deciview (GRCA2) and 8.0 deciview (SAWE1).

- For all Arizona sites except SIAN1 and SAWE1, ammonium sulfate was the largest contributor to aerosol extinction for the 20% least impaired days.

- At the SIAN1 site, particulate organic mass was the largest contributor to aerosol extinction for the best days, followed by ammonium sulfate. At the SAWE1 site, coarse mass was the largest contributor, followed by ammonium sulfate.

Table 10: Relative Contribution of Pollutants to Visibility Conditions on the 20% Most Impaired Days at Arizona Class I area IMPROVE Sites for the Progress Period (2005-2009).

Site	Deciviews (dv)	Percent Contribution by Component (% of Mm^{-1}) and Rank*						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BALD1	11.8	25% (2)	4% (6)	**42% (1)**	8% (4)	6% (5)	16% (3)	0% (7)
CHIR1	12.2	**36% (1)**	5% (5)	16% (3)	5% (6)	10% (4)	27% (2)	1% (7)
GRCA2	12.0	22% (2)	7% (5)	**41% (1)**	11% (4)	6% (6)	12% (3)	0% (7)
IKBA1	13.4	26% (2)	8% (5)	**29% (1)**	8% (6)	8% (4)	21% (3)	1% (7)
PEFO1	13.0	23% (2)	5% (6)	**31% (1)**	11% (4)	8% (5)	21% (3)	1% (7)
SAGU1	13.6	25% (2)	9% (5)	18% (3)	8% (6)	11% (4)	**28% (1)**	1% (7)
SAWE1	14.9	21% (2)	11% (5)	16% (3)	8% (6)	13% (4)	**31% (1)**	1% (7)
SIAN1	13.0	25% (2)	6% (6)	**33% (1)**	9% (4)	8% (5)	19% (3)	1% (7)
SYCA1	15.2	15% (4)	4% (6)	**29% (1)**	9% (5)	15% (3)	28% (2)	0% (7)
TONT1	13.8	**28% (1)**	8% (5)	21% (3)	7% (6)	9% (4)	26% (2)	1% (7)

*Highest contribution per site is highlighted in bold.

Table 11: Relative Contribution of Pollutants to Visibility Conditions on the 20% Least Impaired Days at Arizona Class I area IMPROVE Sites for the Progress Period (2005-2009).

Site	Deciviews (dv)	Percent Contribution by Component (% of Mm^{-1}) and Rank*						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BALD1	2.9	**35% (1)**	7% (5)	26% (2)	13% (4)	5% (6)	13% (3)	1% (7)
CHIR1	4.4	**38% (1)**	7% (5)	17% (3)	10% (4)	6% (6)	21% (2)	1% (7)
GRCA2	2.2	**45% (1)**	13% (4)	15% (2)	9% (5)	4% (6)	14% (3)	1% (7)
IKBA1	5.1	**29% (1)**	10% (5)	28% (2)	12% (4)	5% (6)	14% (3)	1% (7)
PEFO1	4.6	**31% (1)**	9% (5)	21% (2)	19% (3)	6% (6)	14% (4)	0% (7)
SAGU1	6.7	**28% (1)**	8% (6)	20% (3)	12% (4)	8% (5)	21% (2)	2% (7)
SAWE1	8.0	24% (2)	8% (6)	18% (3)	11% (4)	10% (5)	**26% (1)**	2% (7)
SIAN1	5.3	27% (2)	7% (5)	**32% (1)**	17% (3)	5% (6)	13% (4)	1% (7)
SYCA1	5.1	**27% (1)**	10% (5)	23% (2)	17% (3)	7% (6)	15% (4)	1% (7)
TONT1	5.7	**33% (1)**	9% (5)	23% (2)	12% (4)	6% (6)	16% (3)	1% (7)

*Highest contribution per site is highlighted in bold.

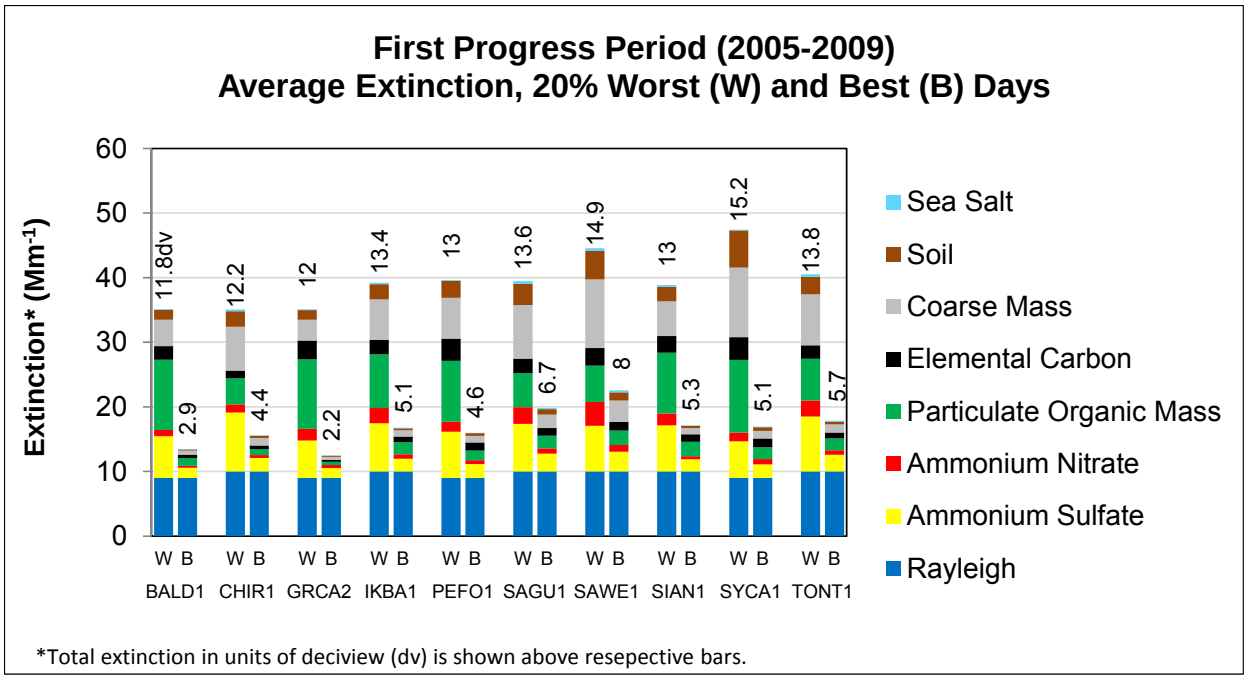


Figure 14: Average Extinction for Current Progress Period (2005-2009) for the Worst (Most Impaired) and Best (Least Impaired) Days Measured at Arizona Class I area IMPROVE Sites.

III.B.2. Visibility Trend Analyses

This section addresses the regulatory question, ***what is the difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions (40 CFR 51.308 (g)(3)(ii))?*** Baseline visibility conditions are the basis against which improvements in worst day visibility, and lack of degradation for the best day visibility, are judged. Included here are comparisons between the 5-year average baseline conditions (2000-2004) and the current progress period extinction (2005-2009). ADEQ refers to this method as the RHR method within this document.

ADEQ further presents an alternative analysis for visibility trend analysis for the 2000-2009 period. The alternative methodology is presented to better understand how anomalous years may have affected visibility changes as measured at Arizona Class I Areas. The Theil method was chosen to characterize visibility trends, as this method has been generally accepted by EPA in previous trend analyses, most notably in previously prepared EPA National Air Quality and Emissions Trends Reports[13]. While the RHR method is the important metric for RHR regulatory purposes, trend statistics (e.g. the Theil Method) may be of value to understand and address visibility impairment issues for planning purposes.

[13] EPA. Trends in Monitored Concentrations of Carbon Monoxide. National Air Quality and Emissions Trends Report, 2003.

III.B.2.i. Theil Trend

Ten-year visibility trends were analyzed for the State or Arizona in order to better understand how anomalous years may have affected visibility changes as measured at Arizona Class I Areas. The Theil method was chosen to characterize visibility trends, as this method has been generally accepted by EPA in previous trend analyses, most notably in previously prepared EPA National Air Quality and Emissions Trends Reports[14].
EPA described the statistical method as follows:

"The Theil test is a nonparametric statistical test that can be used instead of regression-based methods for discerning a monotonic trend. It examines whether the concentration from year to year tends to increase or decrease consistently, making it a test of monotonicity. This test is not concerned with the magnitude of the year-to-year differences. The null hypothesis is that there is no monotonic trend in the data.

The first step in the test is to examine all possible [n(n-1)/2] pairs of data points from a given monitor, where n = 8, 9, 10, or 11. Next, a count is taken of all the pairs that show an increasing or decreasing trend. The null hypothesis will be rejected and the test results will indicate a significant monotonic increasing (or decreasing) trend if this count of the data point pairs is greater than (or less than) a certain critical value. A large positive value indicates a positive trend, and a large negative value indicates a negative trend.

The Theil test was applied for two reasons. First, it is appropriate when the errors from a linear regression are not normally, or close to normally, distributed. The data here may not meet the normality assumption. Second, this test was recommended to EPA for determining whether an area has a significant trend. Therefore, this test is used in EPA's annual Trends Reports."[15]

Annual trends reported here were calculated by ARS for the years 2000-2009, with a trend defined as the slope derived using the Thiel method. Trend statistics are useful in analyzing changes in air quality data, because these statistics can show the overall tendency of measurements over long periods of time to increase or decrease, while minimizing the effects of the year-to-year fluctuations which are common in air quality data. The significance of the trend is represented using p-values calculated using Mann-Kendall trend statistics. Determining a significance level helps to distinguish random variability in data from a tendency to increase or decrease over time, where lower p-values indicate higher confidence levels in the computed slopes. In some cases, trends may show decreasing tendencies where the difference between the 5-year averages do not. In these cases, the 5-year average is the important metric for RHR regulatory purposes, but trend statistics may be of value to understand and address visibility impairment issues for planning purposes.

[14] EPA. Trends in Monitored Concentrations of Carbon Monoxide. National Air Quality and Emissions Trends Report, 2003.
[15] ibid

III.B.2.ii. 2000-2009 Visibility Trend Analyses Results

This section presents visibility progress between 2000-2009 through the use of the two previously discussed methodologies: 1) the RHR method and 2) the Theil method.

Table 12 presents the differences between the 2000-2004 baseline period average and the 2005-2009 progress period average for each site in Arizona for the 20% most impaired days by use of the RHR method, and Table 13 presents similar data for the least impaired days. Averages that increased are depicted in red text and averages that decreased in blue. Figure 15 presents the 5-year average extinction for the baseline and current progress period averages for 20% most impaired days and Figure 16 presents the differences in averages by component, with increases represented above the zero line and decreases below the zero line. Figures 17 and 18 present similar plots for the 20% least impaired days using the RHR method.

Ten-year trends for individual visibility extinction components using the Theil method are presented in Table 14. Only averages with p-value statistics less than 0.15 (85% confidence level) are presented in Table 14, with increasing slopes in red and decreasing slopes in blue. The regional haze regulations refer specifically to changes in extinction for the 20% most impaired and least impaired days, but trend statistics are also presented in Table 14 for an average of all sampled days. Selection of the most impaired and least impaired days can vary seasonally from year to year, so in some cases the annual average of all sampled days may better represent actual aerosol component trends over time.

Some general observations regarding changes in visibility impairment at sites in Arizona are as follows:

For the 20% most impaired days, the RHR method exhibited deciview metric increases between the 2000-2004 and 2005-2009 periods at the GRCA2 and IKBA1 sites and decreases at all other Arizona sites. Theil method analysis showed no sites with significant increasing deciview metric trends between 2000 and 2009. Significant decreasing deciview metric trends occurred at all sites except BALD1, GRCA2, IKBA1, PEFO1, and SYCA1. Notable differences for individual components extinctions (mM^{-1}) on the 20% most impaired days were as follows:

- All sites except GRCA2 and IKBA1 measured decreases in particulate organic mass using the RHR method. No sites showed significant increasing trends using the Theil method and four sites showed significant decreasing trends.

- The RHR method analysis of ammonium sulfate showed increased extinction at all Arizona sites except SAGU1 and SAWE1, with the largest increases in ammonium sulfate occurring at the CHIR1, IKBA1 and TONT1 sites. In contrast, no statistically significant ($p < 0.15$) increasing annual trends in ammonium sulfate were measured using the Theil method.

Decreasing annual ammonium sulfate trends on the order of about 0.1 Mm^{-1}/year were measured at the BALD1, CHIR1, SAGU1 and SAWE1 sites. Anomalously high ammonium sulfate occurred in 2005 at most Arizona sites, which influenced the increases noted using the RHR method.

- RHR method analysis of ammonium nitrate extinction showed decreases at all Arizona sites for the 20% most impaired days. Analysis of all measured days showed no increasing trends, and decreasing trends on the order of 0.1 Mm^{-1}/year at the IKBA1, SAGU1, SAWE1, SIAN1 and TONT1 sites.

- RHR method analysis of coarse mass revealed increasing extinction values at BALD1, SAGU1, SYCA1, and TONT1. However, only the BALD1 site showed a statistically significant increasing trend for coarse mass for all measured days on the order of approximately 0.1 Mm^{-1}/year ($p < 0.15$).

- Soil progress and baseline average differences decreased for five sites using the RHR method while measuring highest at the PEFO1, BALD1, and TONT1 sites for the 20% most impaired days. Theil method analysis showed increasing trends at only two Arizona sites for the 20% most impaired days (BALD1 and PEFO1) while SYCA1 showed a significant decreasing trend.

- Increases in deciview at the GRCA2 site using the RHR method were mostly due to increases in ammonium sulfate and elemental carbon and the lack of a decreasing particulate organic mass extinction which occurred at most other Arizona Class 1 Areas. Higher progress period measurements at GRCA2 were influenced by large wildfire events between June and August of 2009. These increases were partially offset by decreases in ammonium nitrate and coarse mass. This site did not show significant increasing ammonium sulfate trends using the Theil method.

- Increases in deciview at the IKBA1 site were mostly due to increased ammonium sulfate and particulate organic mass measurements. Higher progress period measurements at IKBA1 were influenced by large events in July 2005. These increases were partially offset by decreases in ammonium nitrate and soil. This site did not show significant increasing ammonium sulfate trends using the Theil method.

Table 12: Difference in Aerosol Extinction by Component between the Baseline Period (2000-2004) and the Progress Period (2005-2009) on the 20% Most Impaired Days for Arizona Class I IMPROVE Sites.

Site	Deciview (dv)			Change in Extinction by Component (Mm^{-1})*						
	2000-2004 Baseline Period	2005-2009 Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	POM	EC	Soil	CM	Sea Salt
BALD1	11.8	11.8	0.0	+0.3	-0.1	-2.1	-0.7	+0.4	+1.3	+0.1
CHIR1	13.4	12.2	-1.2	+1.0	-0.1	-3.2	-0.5	-0.3	-1.9	+0.2
GRCA2	11.7	12.0	+0.3	+0.5	-0.4	+0.1	+0.5	+0.1	-0.3	0.0
IKBA1	13.3	13.4	+0.1	+1.0	-1.2	+0.7	0.0	-0.3	0.0	+0.1
PEFO1	13.2	13.0	-0.2	+0.5	-0.3	-1.4	+0.5	+0.6	-1.0	+0.1
SAGU1	14.8	13.6	-1.2	-0.1	-3.2	-4.1	-0.9	-0.1	+1.2	+0.2
SAWE1	16.2	14.9	-1.3	-0.7	-2.3	-1.9	-0.5	-1.4	-2.2	+0.2
SIAN1	13.7	13.0	-0.7	+0.7	-0.3	-2.5	+0.1	+0.1	-0.6	+0.2
SYCA1	15.3	15.2	-0.1	+0.7	-0.7	-0.5	+0.4	-1.0	+1.4	0.0
TONT1	14.2	13.8	-0.4	+1.3	-0.5	-3.5	-0.6	+0.4	+0.5	+0.2

*Change is calculated as progress period average minus baseline period average. Values in red indicate increases in extinction, values in blue indicate decreases.

For the 20% least impaired days, the RHR method exhibited decreasing deciview metrics at all sites except GRCA2, where the measured deciview average remained the same. Notable differences for individual component averages on the 20% least impaired days were as follows:

- The largest decreases were due to particulate organic mass, which decreased at all sites except IKBA1 using the RHR method. Theil method analysis revealed significant decreasing trends at seven of the sites.

- Ammonium sulfate decreased at most sites, but increased slightly at the GRCA2, SAGU1 and SYCA1 sites using the RHR method. Theil methodology revealed no statistically significant increasing trends and three sites experienced statistically significant decreases in ammonium sulfate trends ($p < 0.15$).

- Ammonium nitrate decreased at all but the GRCA2 site using the RHR method and four of the decreasing sites were found to be statistically significant using the Theil method ($p < 0.15$).

Table 13: Difference in Aerosol Extinction by Component between the Baseline Period (2000-2004) and the Progress Period (2005-2009) on the 20% Least Impaired Days for Arizona Class I IMPROVE Sites.

Site	Deciview (dv)			Change in Extinction by Component (Mm^{-1})*						
	2000-2004 Baseline Period	2005-2009 Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	POM	EC	Soil	CM	Sea Salt
BALD1	3.0	2.9	**-0.1**	**-0.1**	**-0.1**	**-0.1**	0.0	0.0	**+0.1**	0.0
CHIR1	4.9	4.4	**-0.5**	**-0.2**	**-0.1**	**-0.5**	**-0.1**	0.0	0.0	0.0
GRCA2	2.2	2.2	0.0	**+0.1**	0.0	**-0.1**	0.0	0.0	0.0	0.0
IKBA1	5.4	5.1	**-0.3**	**-0.3**	**-0.2**	**+0.1**	0.0	**-0.1**	**-0.1**	**+0.1**
PEFO1	5.0	4.6	**-0.4**	**-0.1**	**-0.2**	**-0.4**	0.0	**+0.1**	0.0	0.0
SAGU1	6.9	6.7	**-0.2**	**+0.1**	**-0.2**	**-0.2**	**-0.1**	**-0.3**	**+0.3**	**+0.1**
SAWE1	8.6	8.0	**-0.6**	**-0.2**	**-0.1**	**-0.5**	**-0.4**	**-0.3**	**+0.2**	**+0.2**
SIAN1	6.2	5.3	**-0.9**	**-0.3**	**-0.4**	**-0.7**	**-0.1**	0.0	0.0	0.0
SYCA1	5.6	5.1	**-0.5**	**+0.1**	**-0.1**	**-0.6**	**-0.2**	**-0.1**	**+0.1**	0.0
TONT1	6.5	5.7	**-0.8**	**-0.2**	**-0.2**	**-0.5**	**-0.2**	**-0.1**	**-0.2**	**+0.1**

*Change is calculated as progress period average minus baseline period average. Values in red indicate increases in extinction, values in blue indicate decreases.

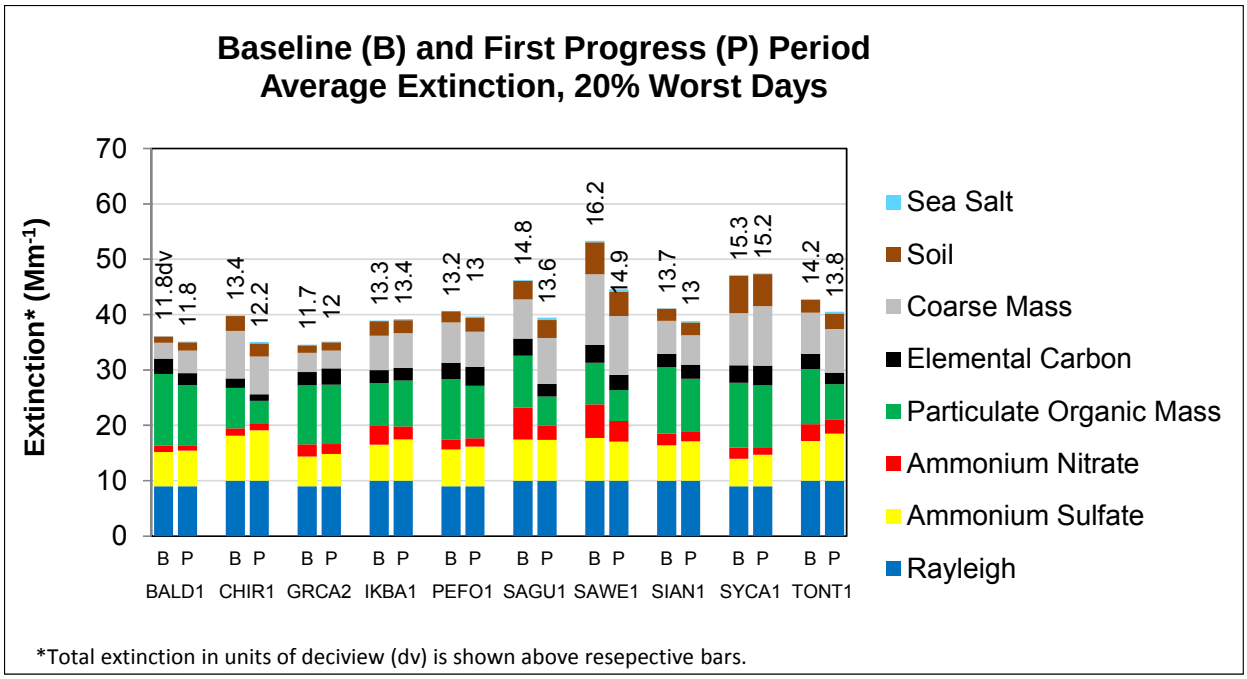


Figure 15: Average Extinction for Baseline and Progress Period Extinction for Worst (Most Impaired) Days Measured at Arizona Class I area IMPROVE Sites.

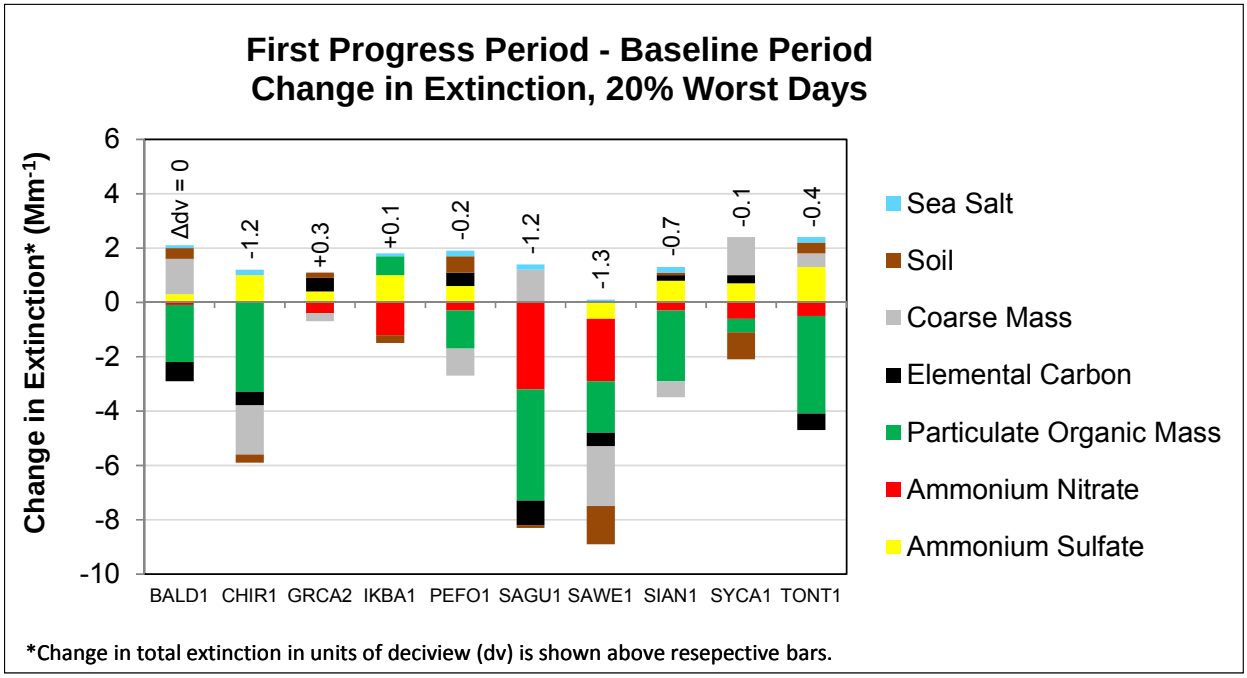


Figure 16: Difference between Average Extinction for Current Progress Period (2005-2009) and Baseline Period (2000-2004) for the Worst (Most Impaired) Days Measured at Arizona Class I area IMPROVE Sites.

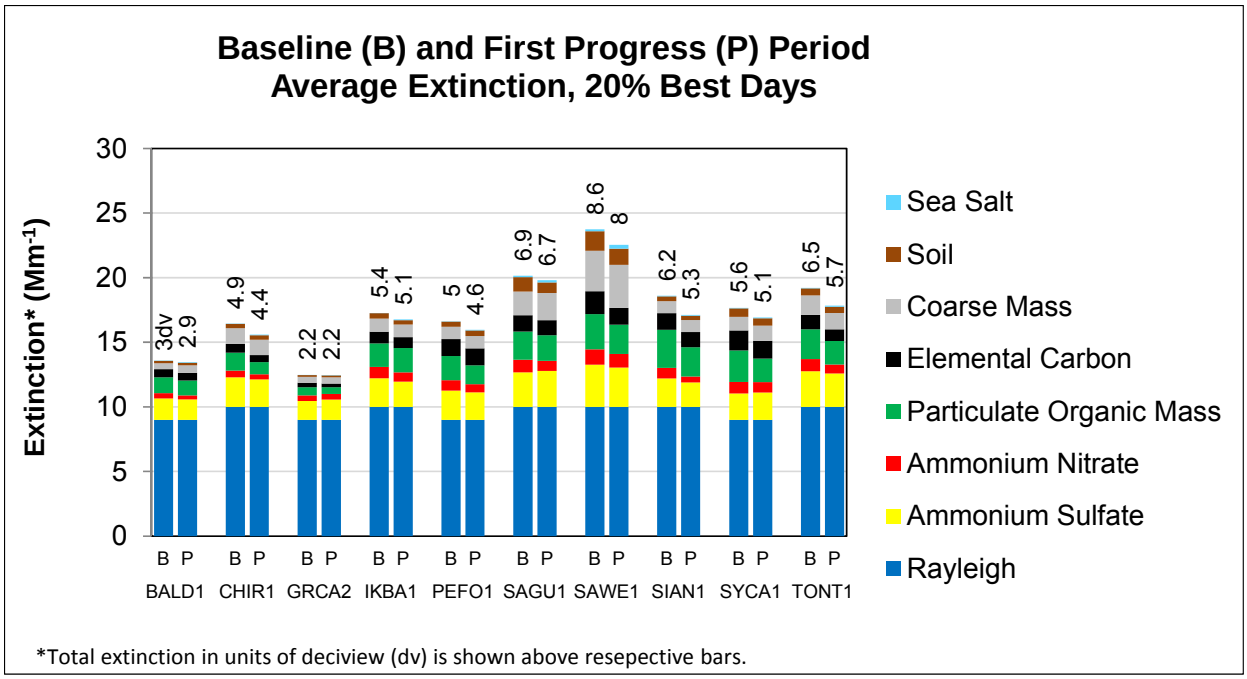


Figure 17: Average Extinction for Baseline and Progress Period Extinction for Best (Least Impaired) Days Measured at Arizona Class I area IMPROVE Sites.

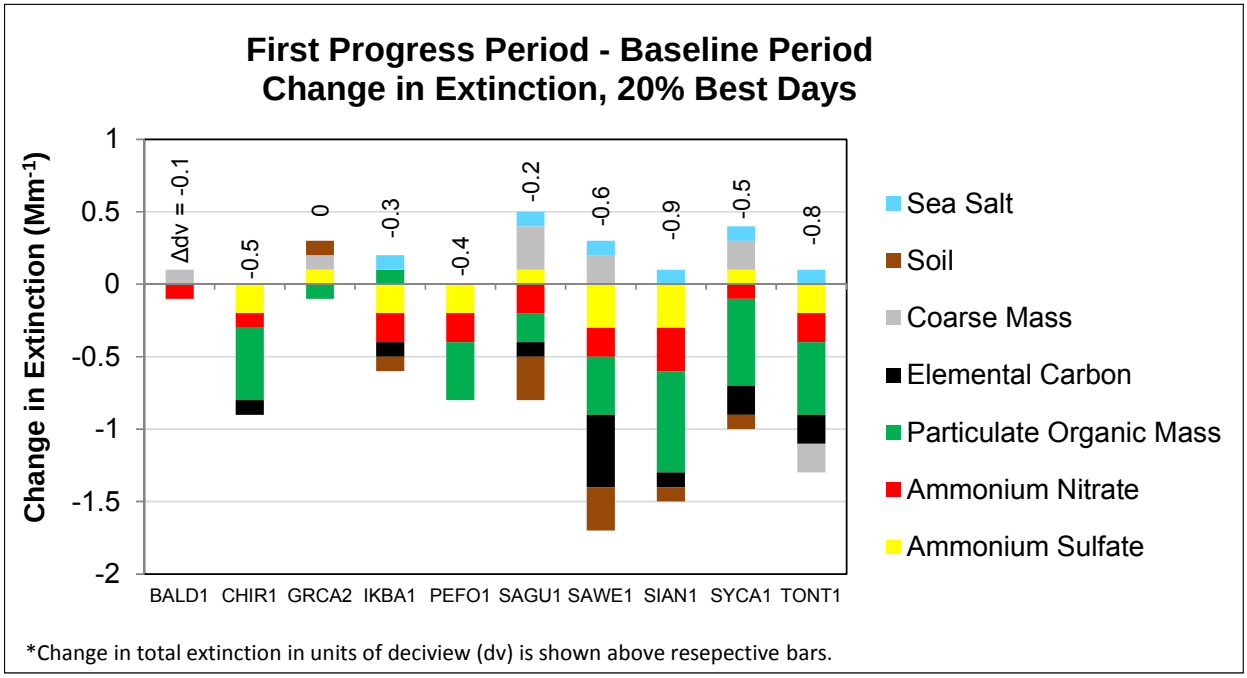


Figure 18: Difference between Average Extinction for Current Progress Period (2005-2009) and Baseline Period (2000-2004) for the Best (Least Impaired) Days Measured at Arizona Class I area IMPROVE Sites.

Table 14: Statistically Significant 2000-2009 Annual Average Trends for Aerosol Extinction by Component for Arizona Class I area IMPROVE Sites.

Site	Group	Annual Trend* (Mm^{-1}/year)							
		Site Total (dv)	Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BALD1	20% Best	--	--	0.0	--	0.0	--	0.0	0.0
	20% Worst	--	-0.2	--	--	--	0.1	0.3	0.0
	All Days	--	-0.1	0.0	--	--	--	0.1	0.0
CHIR1	20% Best	-0.1	0.0	0.0	-0.1	0.0	--	0.0	0.0
	20% Worst	-0.3	--	--	-0.7	-0.1	--	--	0.0
	All Days	-0.2	-0.1	0.0	-0.2	-0.1	--	-0.1	0.0
GRCA2	20% Best	--	--	--	--	0.0	--	--	0.0
	20% Worst	--	--	-0.1	--	--	--	--	--
	All Days	--	--	0.0	--	--	--	--	--
IKBA1	20% Best	-0.2	-0.1	-0.1	0.0	0.0	0.0	--	0.0
	20% Worst	--	--	--	--	0.0	--	--	0.0
	All Days	--	--	-0.1	--	0.0	--	--	0.0
PEFO1	20% Best	-0.1	--	0.0	-0.1	--	--	--	0.0
	20% Worst	--	--	--	--	--	0.1	--	0.0
	All Days	-0.1	--	0.0	--	--	0.0	0.1	0.0
SAGU1	20% Best	-0.2	--	-0.1	-0.1	--	--	--	--
	20% Worst	-0.3	-0.4	-0.5	-0.6	-0.3	--	--	0.1
	All Days	-0.2	-0.1	-0.1	-0.2	-0.1	--	--	0.0
SAWE1	20% Best	-0.2	0.0	0.0	-0.1	-0.1	-0.1	--	0.0
	20% Worst	-0.3	-0.3	-0.6	-0.5	--	--	--	0.0
	All Days	-0.2	-0.1	-0.1	-0.3	-0.1	--	--	0.0
SIAN1	20% Best	-0.2	-0.1	-0.1	-0.1	0.0	--	--	0.0

Site	Group	Annual Trend* (Mm^{-1}/year)							
		Site Total (dv)	Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
	20% Worst	-0.2	--	--	--	--	--	--	0.0
	All Days	-0.2	--	-0.1	-0.4	-0.1	--	--	0.0
SYCA1	20% Best	-0.1	--	--	-0.1	--	--	--	0.0
	20% Worst	--	--	--	--	0.1	-0.3	--	--
	All Days	-0.1	--	0.0	--	--	-0.1	--	--
TONT1	20% Best	-0.2	-0.1	-0.1	-0.1	-0.1	--	-0.1	0.0
	20% Worst	-0.2	--	-0.1	-0.8	-0.2	--	--	0.1
	All Days	-0.1	--	-0.1	-0.2	-0.1	--	--	0.0

*(--) Indicates statistically insignificant trend (<85% confidence level).

III.C. Ammonium Sulfate Analysis

Several analyses have been presented in this document to examine how ammonium sulfate extinction has changed within the 2000-2009 period at IMPROVE monitoring sites within the State of Arizona. When examining the State as a whole and incorporating the RHR method, ammonium sulfate has shown increases at the IMPROVE sites between the 2000 – 2004 baseline period and 2005 – 2009 progress period averages for the 20% most impaired days. However, no statistically significant increasing trends were observed using the Theil method and several sites saw statistically significant decreasing Theil statistic trends for the 20% most impaired, least impaired, and all days (Section III.B.2.). In some instances, ADEQ incorporated more recent data from 2010 to supplement previous analyses and to provide an update for the most current progress period (2006 – 2010). ADEQ has also attempted to analyze specific events that caused high ammonium sulfate extinction at IMPROVE sites throughout the state and has included a summary of potential origination points for these events and the impact these events have on long term averages.

III.C.1. 20% Most Impaired Ammonium Sulfate Days

In this section ADEQ presents an alternate analysis performed by ARS in which the 20% most impaired ammonium sulfate days were isolated, averaged annually and then averaged for the baseline and progress periods. This analysis was performed in order to better understand how the worst 20% visibility days for a particular pollutant change between the baseline and progress periods rather than examining the 20% worst visibility days for all combined pollutants. The combination analysis required by the RHR can cause seasonal shifts in the days chosen within the baseline and progress periods which in turn can miss seasonal highs for certain pollutant classes. A Theil statistics trend analysis is also performed for each monitor on the annually averaged 20% most impaired days for the period of 2000-2009. Figure 19 presents the annual average of the 20% most impaired days. Extinction decreases between 2000 and 2004, while the years of 2005 and 2007 show exceptionally high ammonium sulfate averages, followed by consecutive decreasing years between 2007 and 2009. When baseline and progress period extinction averages are compared, all IMPROVE sites show increasing ammonium sulfate extinctions except SAWE1. However, when 2000-2009 worst 20% ammonium sulfate days trends are analyzed, no sites show increasing trends (Figure 21). BALD1, CHIR1, PEFO1, SAGU1, and SAWE1 all exhibit statistically significant decreasing ammonium sulfate extinction trends. The extreme differences are strongly influenced by ammonium sulfate concentrations measured in 2005. Since this year is more like a midpoint, the data have a more neutral effect using the Theil method ($p < 0.15$). To illustrate the effect of the 2005 year, ADEQ presents the results of an analysis in Table 15 where the RHR method is altered to include the year 2005 in the baseline period rather than the progress period. This altered RHR method resulted in reduced ammonium sulfate extinction values between the altered progress period (2006-2009) when compared to the altered baseline period (2000-2005) for all sites except TONT1 for the 20% most impaired ammonium sulfate days. This illustrates the strong effect that one year can have in the RHR methodology.

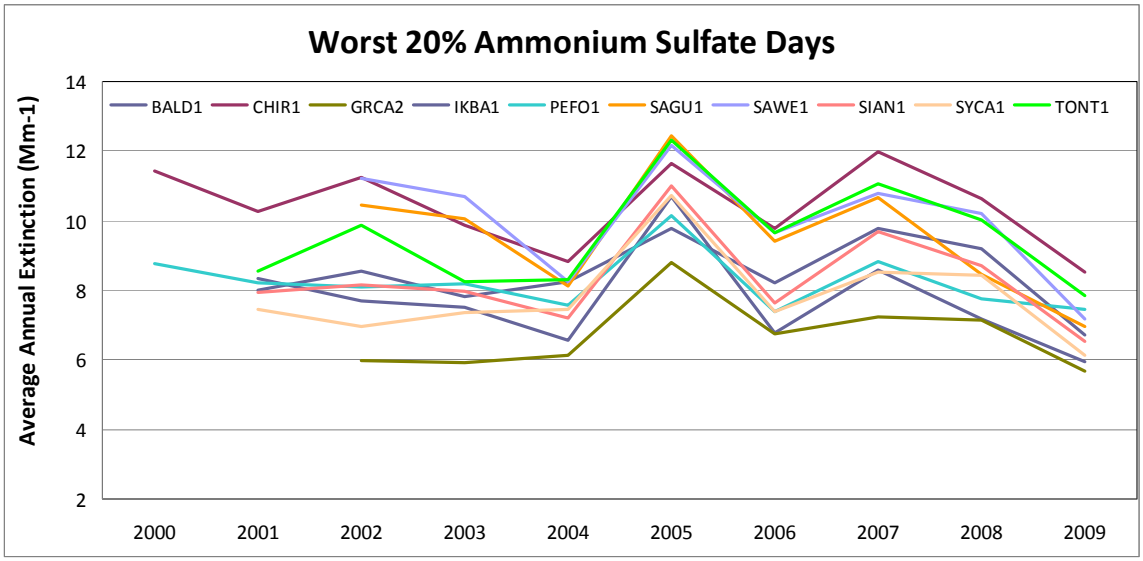


Figure 19: Average Annual Ammonium Sulfate Extinction (mM^{-1}) at each Arizona Class I area IMPROVE Site for the 20% Worst Ammonium Sulfate Days.

Table 15: 2000-2009 Ammonium Sulfate Visibility Extinction (mM^{-1}) Trends, Baseline (2000-2004) vs. Progress (2005-2009) Period Comparisons, and Altered Baseline (2000-2005) vs. Altered Progress (2005-2009) Period Comparisons at each Arizona Class I area IMPROVE Site for the 20% Worst Ammonium Sulfate Days.

SiteCode	Slope	p-value	Baseline (2000-2004)	Period 1 (2005-2009)	Difference	Altered Baseline (2000-2005)	Altered Period 1 (2006-2009)	Difference
BALD1	**-0.18**	**0.08**	7.52	7.84	**0.32**	8.15	7.13	**-1.02**
CHIR1	**-0.15**	**0.14**	10.33	10.51	**0.18**	10.55	10.22	**-0.32**
GRCA2	-0.05	0.24	6.39	7.12	**0.73**	6.87	6.70	**-0.17**
IKBA1	-0.09	0.36	8.16	8.73	**0.57**	8.48	8.47	**-0.02**
PEFO1	**-0.15**	**0.03**	8.16	8.31	**0.15**	8.49	7.86	**-0.64**
SAGU1	**-0.29**	**0.13**	9.54	9.58	**0.05**	10.26	8.87	**-1.39**
SAWE1	**-0.33**	**0.09**	10.05	10.00	**-0.05**	10.58	9.45	**-1.13**
SIAN1	-0.07	0.30	7.81	8.71	**0.90**	8.45	8.14	**-0.31**
SYCA1	-0.04	0.43	7.30	8.24	**0.94**	7.99	7.62	**-0.37**
TONT1	0.00	0.50	8.75	10.18	**1.43**	9.46	9.65	**0.19**

III.C.2. Regional Ammonium Sulfate Trends

While the State of Arizona SIP only addresses the pollutant emissions and progress goals for areas within Arizona's State boundary, it is important to analyze regional trends in pollutants in order to better understand which phenomena are more representative of State issues and which extend beyond State boundaries to surrounding areas. This type of analysis allows for a better understanding of which emission increases are locally based in origin and which may be more representative of a regional trend and thus may be due to some uncontrollable external factor

(e.g. NO_x emissions originating from a point source located within another State or Country, PM emission increases which are seen in regional trends and thus may be related to environmental factors, etc.). In this section we analyze regional maps of IMPROVE monitor aerosol extinction changes between baseline and progress periods in order to determine if previously identified State of Arizona ammonium sulfate trends may be regional phenomena.

Figure 20 shows only those aerosol extinction components which have increased for the 20% most impaired days between the baseline (2000-2004) and progress (2005-2009) periods for all IMPROVE monitors in the western United States. Note that individual sites can show increases in specific aerosol components, but still show decreases in overall deciview values. Figure 20 shows fairly ubiquitous and substantial increases in POM across much of the northwestern U.S. and substantial increases in ammonium sulfate across the State of Arizona, State of New Mexico, western Texas, and south-central Colorado. While the ammonium sulfate increases seen in this figure appear to be a regional phenomenon, it is difficult to determine an origination point and the specific sources that may be responsible for the regional trends. However, ADEQ has evaluated transport episodes for at least one specific event and has included a summary of this analysis in section III.C.3.

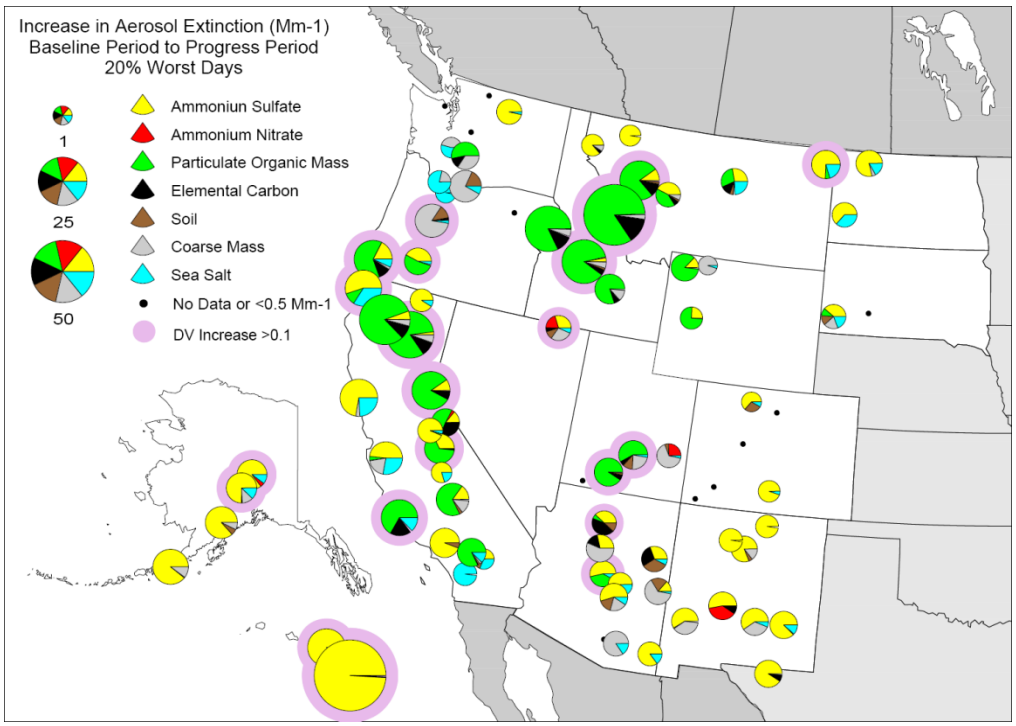


Figure 20: Magnitude of visibility component extinctions that have increased between the baseline average (2000-2004) and the first progress period average (2005-2009) for the 20% worst visibility days.

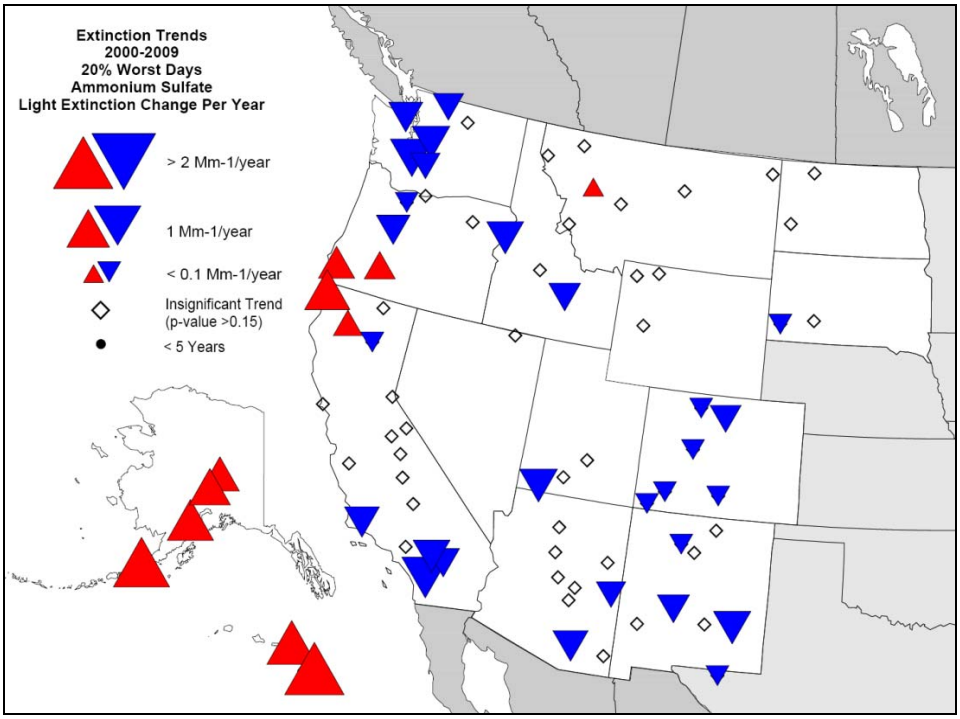


Figure 21: 10-year annual average ammonium sulfate extinction trends for 20% worst days at CIA IMPROVE sites in the WRAP region.

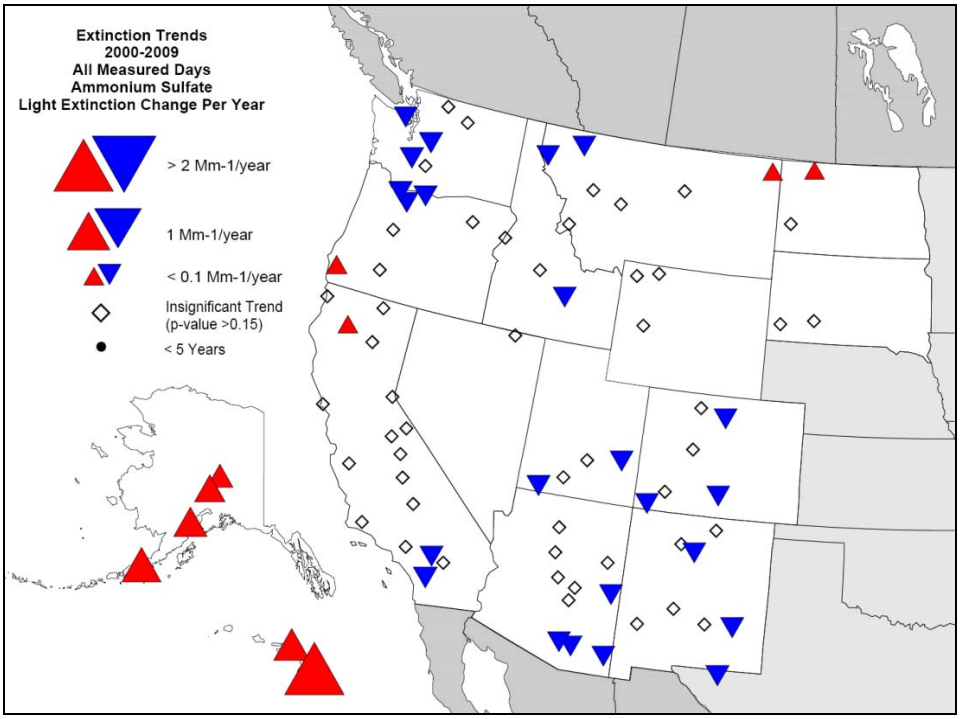


Figure 22: 10-year annual average ammonium sulfate extinction trends for all measured days at CIA IMPROVE sites in the WRAP region.

While average changes in ammonium sulfate visibility extinction increased regionally between baseline and progress periods using the standard RHR method, Theil method statistical analysis of ammonium sulfate extinction trends within the south-western US for both the 20% most impaired days (Figure 21) and all days (Figure 22) found that there was either: 1) no statistically significant trends at IMPROVE monitors within the four corners region (i.e. Arizona, Utah, Colorado, and New Mexico) or 2) the ten year annual average ammonium sulfate extinction trends at these IMPROVE monitors exhibited statistically significant decreases ($p < 0.15$). Similar to what was previously reported for the State of Arizona, regional Theil method trends disagree with the RHR method of a five-year average comparison of the 20% most impaired days between baseline and progress periods. Furthermore, this agreement between State of Arizona and south-western US regional trends may indicate that 2005 and 2007 were outlier years for ammonium sulfate extinction within the entire four corners region and the RHR method does not reflect more recent visibility extinction improvements for this aerosol.

III.C.3. 2005 and 2007 Ammonium Sulfate Analysis

As can be seen in Figure 19, peaks in ammonium sulfate annual average extinction for the 20% most impaired ammonium sulfate days occurred for the years 2005 and 2007. In this section, ADEQ provides analysis of these years in an attempt to gain a better understanding of the cause of such peaks. In this analysis, ADEQ attempts to isolate, where appropriate, that/those events within a single year which would result in an annual spike of ammonium sulfate extinction for the 20% most impaired ammonium sulfate days. While elevated baseline extinction may be due to a number of different factors which are likely beyond ADEQ's ability to identify, single large event signatures are much more easily isolated and identifiable.

Sources of 2005 ammonium sulfate formation are difficult to differentiate due to the ubiquity of medium to large sized single events (Figure 23); however, in general, concentrations are higher in the summer months when temperatures are also maximized. Figure 23 shows that the year of 2005 experienced frequent ammonium sulfate event spikes during the summer and fall months; however, the frequency of these events was exceptional when compared to other years resulting in ADEQ's inability to identify sources of ammonium sulfate for the year of 2005.

In contrast to 2005, the 2007 ammonium sulfate annual average extinctions for the 20% worst days at Arizona Class I areas were dominated by one event which resulted in elevated observed concentrations throughout the State of Arizona between the dates of 8/16 and 8/22 (Figure 24). Figure 24 shows slight increases in ammonium sulfate extinctions leading up to this event followed by extreme peaks of ammonium sulfate extinction on 8/16/2007 and 8/19/2007 at Arizona Class I areas.

ADEQ examined observed ammonium sulfate extinction measurements for all Class I area monitors located within Arizona and found that the IMPROVE monitor with the earliest recorded peak for this event was at CHIR1 (8/16/2007). All other sites peaked on 8/19/2007. CHIR1 experienced the largest peak ammonium sulfate extinction values recorded in the State for this event. CHIR1 represents the most southeasterly Class I area IMPROVE monitor located in the State of Arizona. ADEQ next used National Oceanic and Atmospheric Administration's

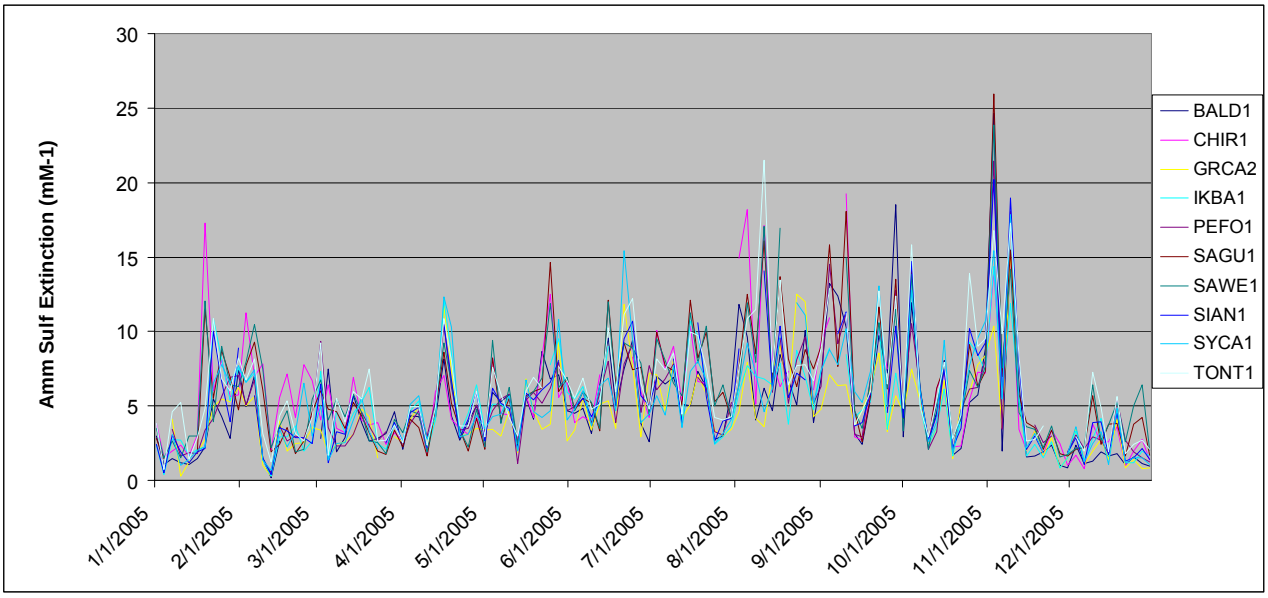


Figure 23: 2005 Ammonium Sulfate Extinction (mM-1) reported every 3 days at all Arizona Class I areas.

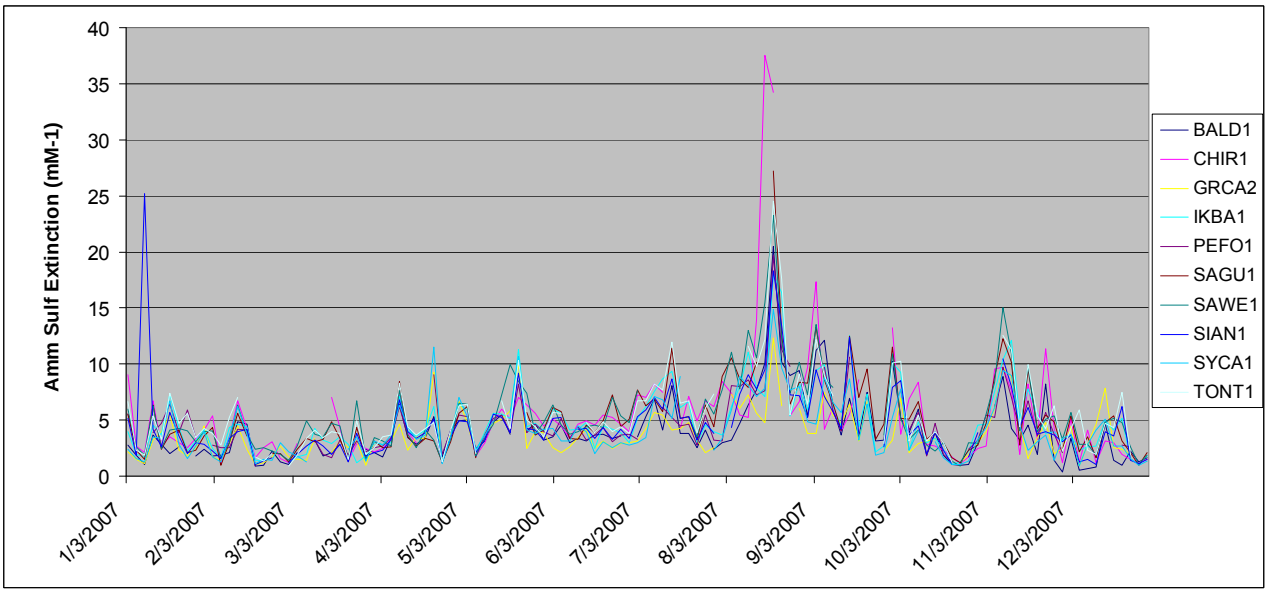


Figure 24: 2007 Ammonium Sulfate Extinction (mM-1) reported every 3 days at all Arizona Class I areas.

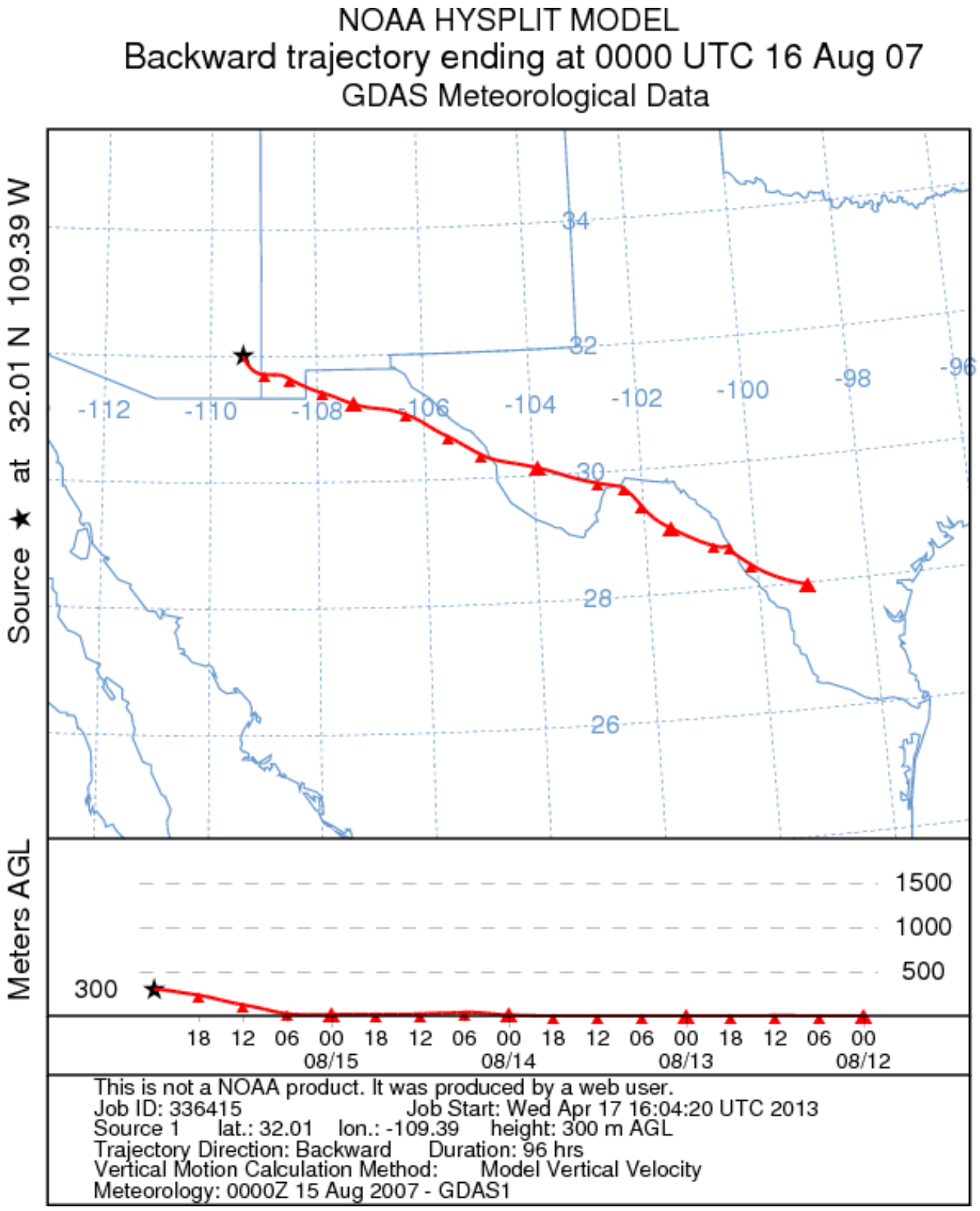


Figure 25: 96 hour, 300 m AGL back trajectory for the winds contributing to the 8/16/2007 extreme ammonium sulfate event peak at CHIR1.

(NOAA) Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT)[16] to determine the wind back trajectory for a 96-hour period leading up to the 8/16/2007 peak ammonium sulfate extinction values recorded at CHIR1 in order to determine a possible origination direction for this event. Figure 25 shows that winds originated southeasterly from the CHIR1 IMPROVE monitor for the 4 days leading up to the 8/16/2007 peak. This information indicates that the event was likely to occur either within the southeastern portion of Arizona around 8/16/2007 and spread throughout the State or originated outside of Arizona from a southeasterly direction.

ADEQ then decided to examine ammonium sulfate extinction for IMPROVE monitors near the U.S.-Mexico border for the year of 2007 in order to determine if the event was a regional phenomenon. Figures 26-30 show ammonium sulfate extinction for all southern Arizona, southern New Mexico, and western Texas IMPROVE monitoring sites during the progression of the above mentioned event and extending from 8/13/2007 – 8/25/2007. Figure 26 shows that western Texas and eastern New Mexico sites are experiencing elevated ammonium sulfate extinction in relation to other regional monitors on 8/13/2007. On 8/16/2007 both west Texas monitors, all New Mexico monitors, and CHIR1 peak in ammonium sulfate extinctions for the event spanning over this twelve day period (Figure 27). On 8/19/2007 all remaining Arizona monitors peak for the event while CHIR1, all New Mexico monitors, and west Texas monitors begin to show some reductions in extinction values (Figure 28). On 8/22/2007 (Figure 29) all eastern monitors are continuing to show reducing ammonium sulfate extinctions as Arizona monitors begin to reduce in measured extinctions following the 8/19/2007 peak extinctions. Finally on 8/25/2007 all monitors show near background levels of ammonium sulfate across the region (Figure 30). The progression of ammonium sulfate peak concentrations temporally from east to west is consistent with the wind back trajectory shown in Figure 25 and supports this ammonium sulfate event originating outside of the State of Arizona.

Next, ADEQ assessed the effect of this single event on the annual average extinction for the 20% worst ammonium sulfate days. In order to do so, ADEQ removed the dates of 8/16-8/22 as possible dates for the 20% worst ammonium sulfate day analysis and recalculated the annual average by the substitution of these days with the next highest days for ammonium sulfate extinction for the year 2007 where needed. Table 16 shows annual ammonium sulfate average extinctions at each site for the 20% worst ammonium sulfate days for the years 2000-2010, where 2007_{adj} is the 2007 annual average adjusted to exclude the 8/16-8/22 event. As can be seen in the table below, the 2007_{adj} values are much more in line with typical averages from other years. It is apparent that the regional transport of ammonium sulfate that occurred on 8/16 – 8/22 had a large influence on the overall 20% worst days average for 2007. Furthermore, when calculating the altered 2006 – 2010 progress period (i.e. using 2007_{adj}) in place of the unadjusted 2007 ammonium sulfate annual average, all sites showed reductions in the five-year averaged ammonium sulfate extinction values. When comparing the progress period worst 20% ammonium sulfate annual average extinction (2006-2010) with 2007_{adj} substitution to the baseline period worst 20% ammonium sulfate annual average extinction, all sites except GRCA2 and TONT1 showed reductions in the five-year averages (Table 16).

ADEQ has identified a similar event that occurred in late September of 2008 where ammonium sulfate concentrations were approximately three times that of other maximums throughout the year (similar signature shown in Figure 24). The back-trajectory for the September, 2008 event

[16] National Oceanic and Atmospheric Administration – Air Research Laboratory. http://www.arl.noaa.gov/HYSPLIT_info.php

was very similar to that of the 2007 event in that the trajectory showed a southeast to northwest movement of air parcels. ADEQ staff have not been able to perform detailed analyses (as was done for the August, 2007 event) of all of these events, however, it is possible that some, if not most, elevated ammonium sulfate extinction values are due to events that have origins outside the state of Arizona. If ammonium sulfate contains a strong regional transport signature, this could be partially or wholly responsible for the increasing trend in ammonium sulfate extinction in Arizona and New Mexico as shown in Figure 20. This notion is further supported by the fact that SO_2 emissions from four major power plants and two major smelters within the state of Arizona have generally decreased over the 2000 – 2010 period, consistent with the decrease shown in the 2002 and 2008 statewide emission inventory for SO_2. Additional time and effort would be needed to fully verify that regional transport of ammonium sulfate may be responsible for any increases in ammonium sulfate extinction measured at the IMPROVE monitors.

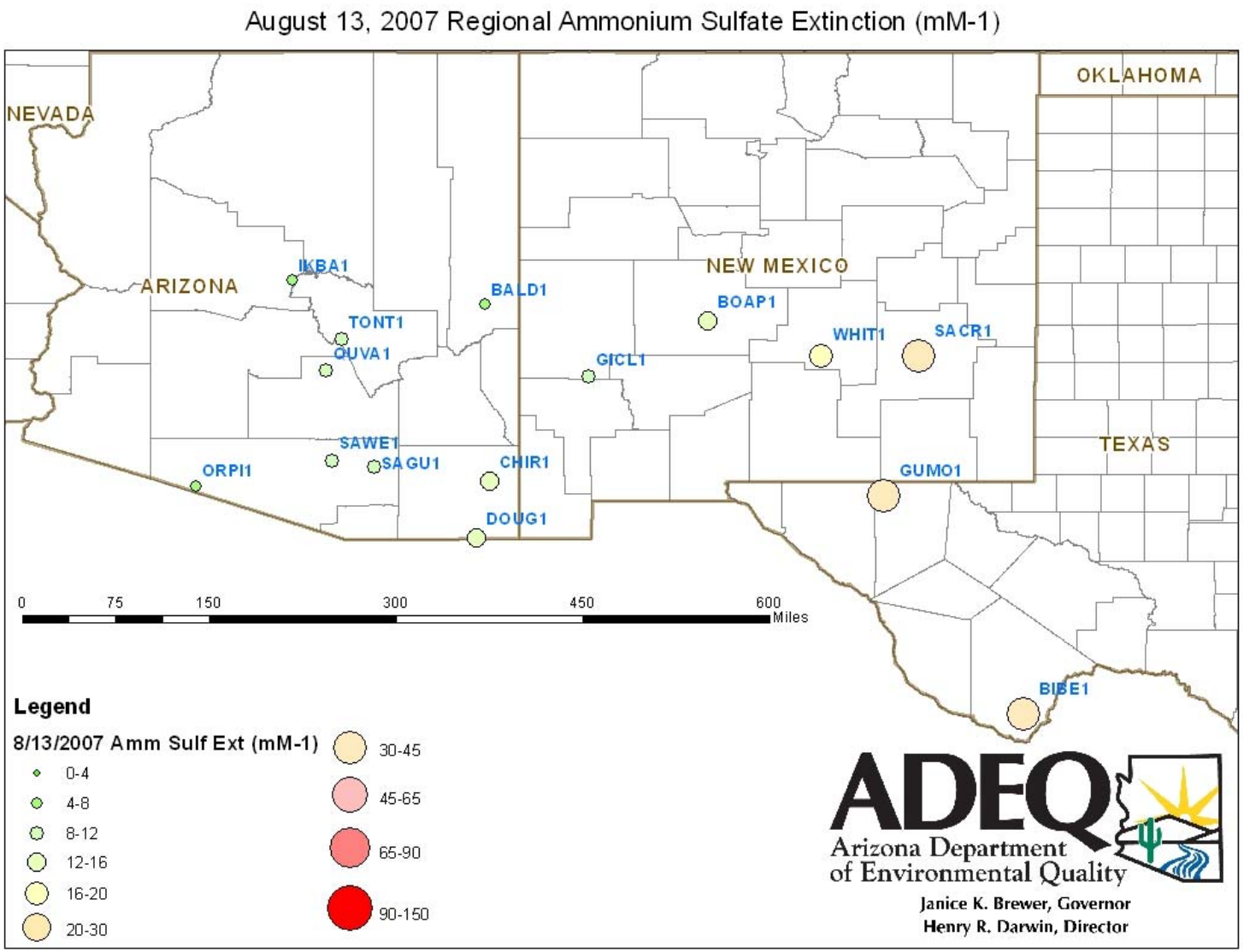


Figure 26: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/13/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

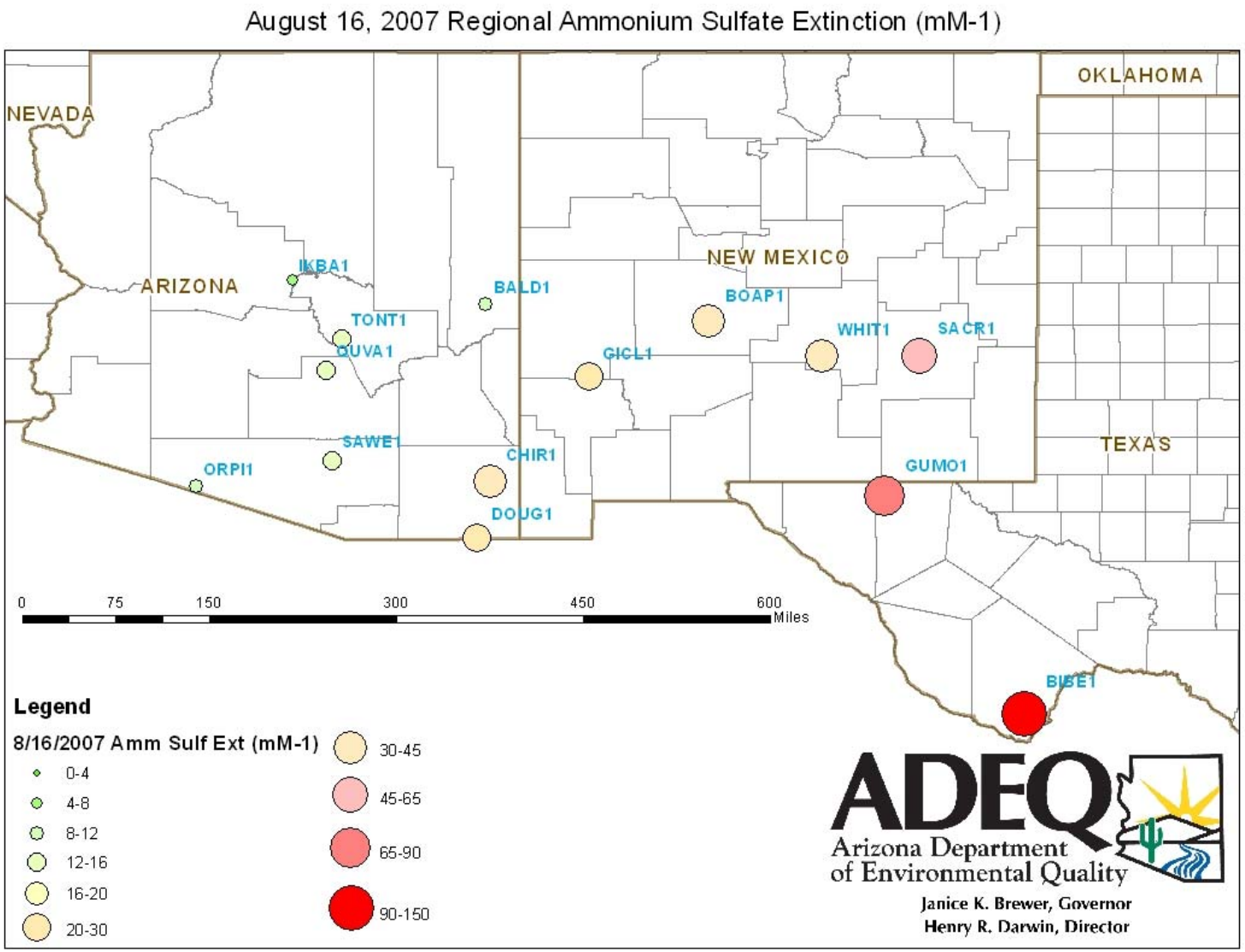


Figure 27: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/16/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

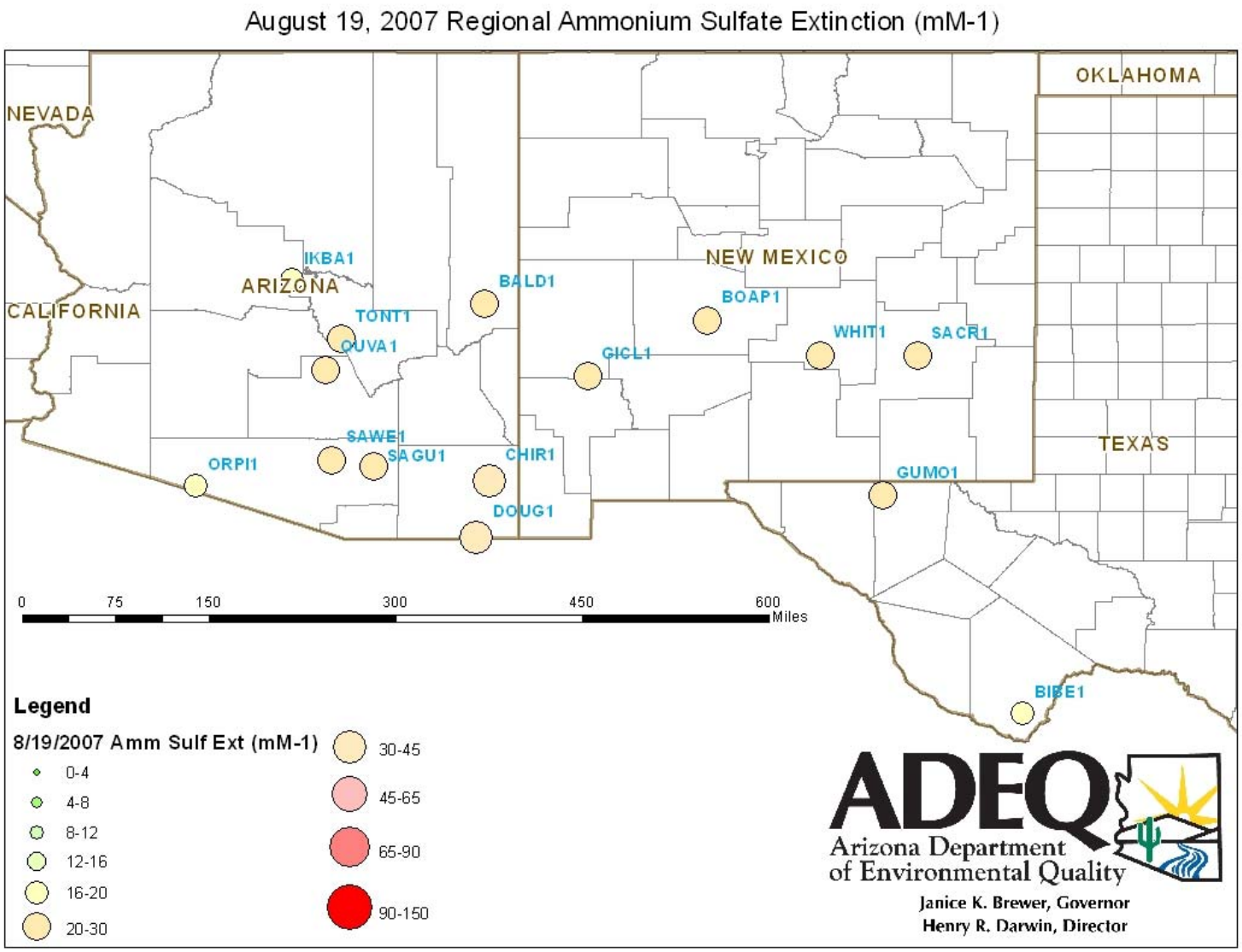


Figure 28: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/19/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

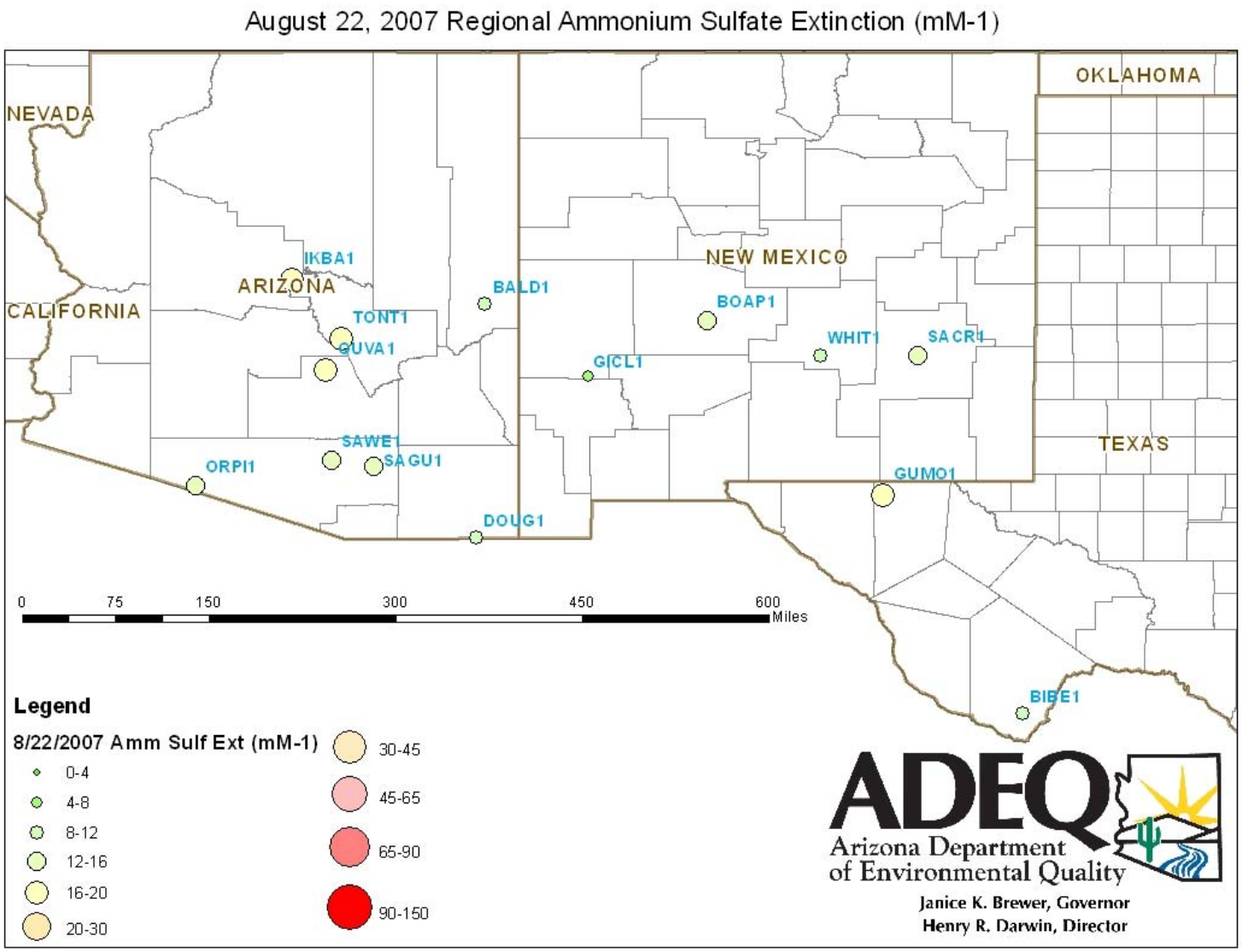


Figure 29: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/22/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

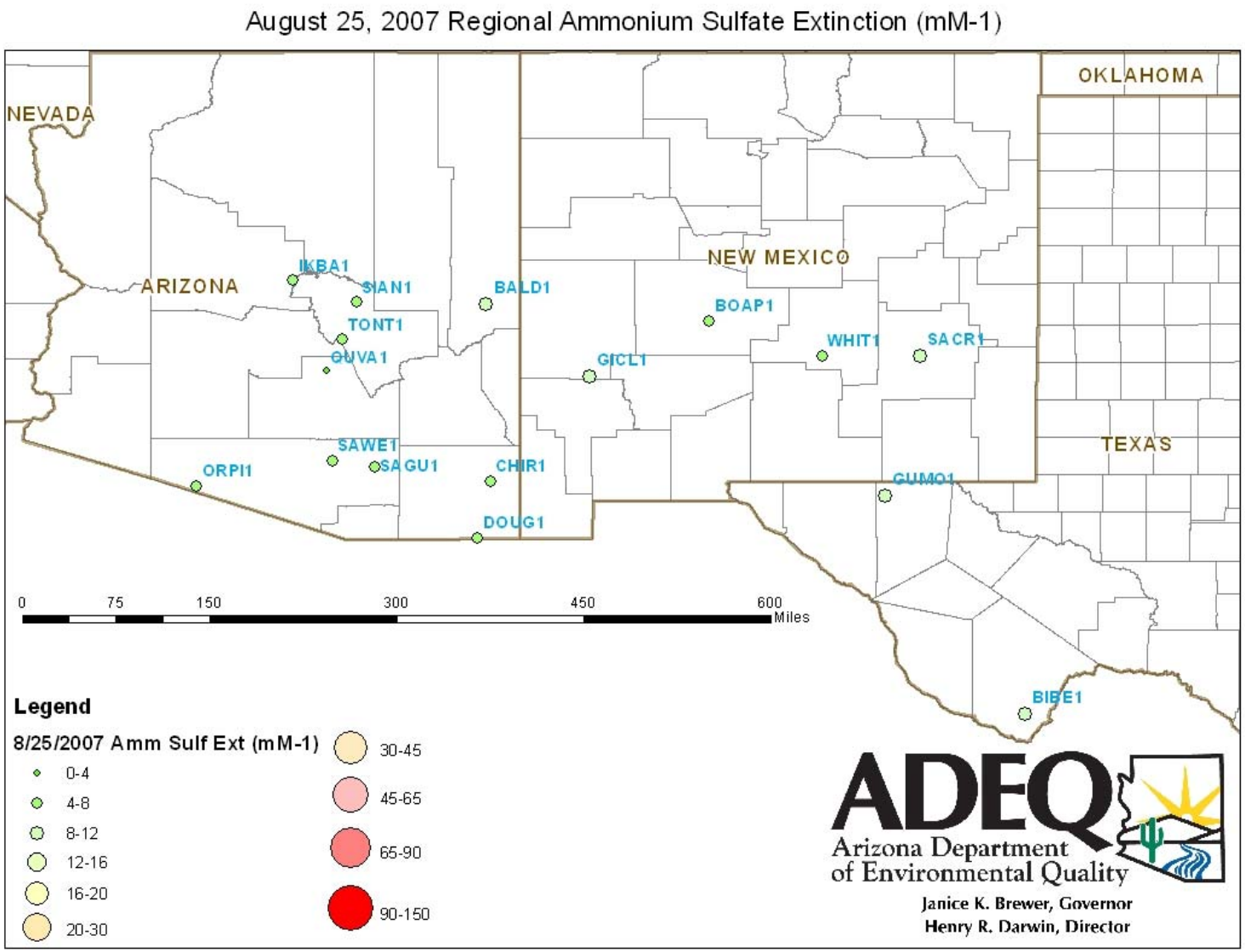


Figure 30: Ammonium Sulfate Extinction (mM-1) at all sites in southern Arizona, southern New Mexico, and western Texas for 8/25/2007. Any site not included on this map did not have ammonium sulfate extinction data for this date.

Table 16: 20% Most Impaired Ammonium Sulfate Days – 2007 adjusted values (2007adj) are calculated excluding the 8/16-8/22/2007 period. Progress Period averages are calculated using years 2006 - 2010 annual averages. Altered Progress Period averages are calculated as the average of years 2006, 2007adj, 2008, 2009, and 2010 annual averages.

Site	2000	2001	2002	2003	2004	2005	2006	**2007**	**2007adj**	2008	2009	2010	Baseline (2000-2004)	Progress Period (2006-2010)	Altered Progress Period (2006-2010, using 2007adj)	Progress Period Difference (Adjusted Progress - Progress)
BALD1		8.35	7.68	7.51	6.55	10.68	6.79	**8.59**	**7.45**	7.19	5.96	6.73	7.52	7.05	6.82	**-0.23**
CHIR1	11.43	10.27	11.24	9.87	8.82	11.65	9.77	**11.99**	**9.24**	10.63	8.51	8.93	10.33	9.97	9.42	**-0.55**
GRCA2	7.54		5.99	5.91	6.13	8.79	6.76	**7.24**	**6.87**	7.14	5.67	5.85	6.39	6.53	6.46	**-0.07**
IKBA1		8.01	8.56	7.82	8.25	9.79	8.21	**9.76**	**8.80**	9.18	6.72	7.10	8.16	8.19	8.00	**-0.19**
PEFO1	8.76	8.21	8.08	8.17	7.57	10.15	7.39	**8.83**	**7.72**	7.75	7.45	6.68	8.16	7.62	7.40	**-0.22**
SAGU1			10.44	10.05	8.11	12.44	9.41	**10.67**	**9.50**	8.45	6.96	8.64	9.54	8.82	8.59	**-0.23**
SAWE1			11.22	10.68	8.24	12.17	9.67	**10.79**	**9.48**	10.19	7.16	8.61	10.05	9.28	9.02	**-0.26**
SIAN1		7.93	8.14	7.96	7.22	11.00	7.64	**9.67**	**8.61**	8.72	6.53	7.47	7.81	8.01	7.79	**-0.21**
SYCA1		7.44	6.96	7.34	7.46	10.74	7.38	**8.53**	**7.91**	8.44	6.13	6.56	7.30	7.41	7.28	**-0.12**
TONT1		8.55	9.86	8.26	8.32	12.31	9.67	**11.07**	**9.44**	10.01	7.86	8.51	8.75	9.42	9.10	**-0.33**

III.D. Coarse Mass Analysis

Coarse Particulate matter is generally recognized as having origination sources which are locally based. In this section, Coarse Mass (CM) is analyzed more closely in order to gain more insight into trends for this particular pollutant seen between the baseline and progress period for all IMPROVE sites around the State. This section presents the results of an alternate approach in selecting the 20% most impaired day analysis, similar to the trend performed for ammonium sulfate in Section III.C. Furthermore, a qualitative analysis of IMPROVE site location in relation to major PM_{10} emitting point sources is performed in order to determine if an evident pattern exists between point source location and IMPROVE monitor location.

III.D.1. Worst 20% Coarse Mass Days

Several analyses have been presented in this document to examine how Coarse Mass extinction has changed within the 2000-2010 period at IMPROVE monitoring sites within the State of Arizona. When examining the State as a whole, coarse mass has shown no discernable spatial trends at the IMPROVE sites between the baseline period and progress period averages for the 20% most impaired days (Section III.B.2.). Furthermore, Theil statistic trends for the 20% most impaired days only resulted in the BALD1 site exhibiting a statistically significant trend between 2000-2009, where an increase has been noted (Section III.B.2.). However, when 2010 data were added to the analysis, the PEFO1 monitor also exhibited a statistically significant increasing trend, while GRCA2 and SYCA1 indicated statistically significant decreasing trends (Table 17).

In this section ADEQ presents an alternate analysis performed by ARS in which the 20% most impaired coarse mass days were isolated, averaged annually and then averaged for the baseline and progress periods. This analysis was performed in order to better understand how the worst 20% visibility days for a particular pollutant change between the baseline and progress periods rather than examining the 20% worst visibility days for all combined pollutants. The combination analysis required by the RHR can cause seasonal shifts in the days chosen within the baseline and progress periods which in turn can miss seasonal highs for certain pollutant classes. A Theil statistics trend analysis is also performed for each monitor on the annually averaged 20% most impaired days for the period of 2000-2010. This trend analysis was extended past prior analyses (2000-2009) to include 2010 since this year was shown to include the most recently available dataset at the time of analysis. When comparing the baseline period to the progress period for the 20% worst coarse mass visibility days (Table 17) all monitors except BALD1, SAGU1, SYCA1 and TONT1 recorded decreased extinction. Furthermore, the CHIR1, PEFO1, SAWI1, and SIAN1 monitors exhibited decreases in CM extinction for the 20% most impaired CM days which exceeded 15% of baseline period averages. Theil statistics over the 11 year period showed decreasing trends at all sites except three; however, only GRCA2 and SYCA1 showed statistically significant decreases, while PEFO exhibited a statistically significant increasing trend for CM on the 20% most impaired CM days ($p < 0.15$).

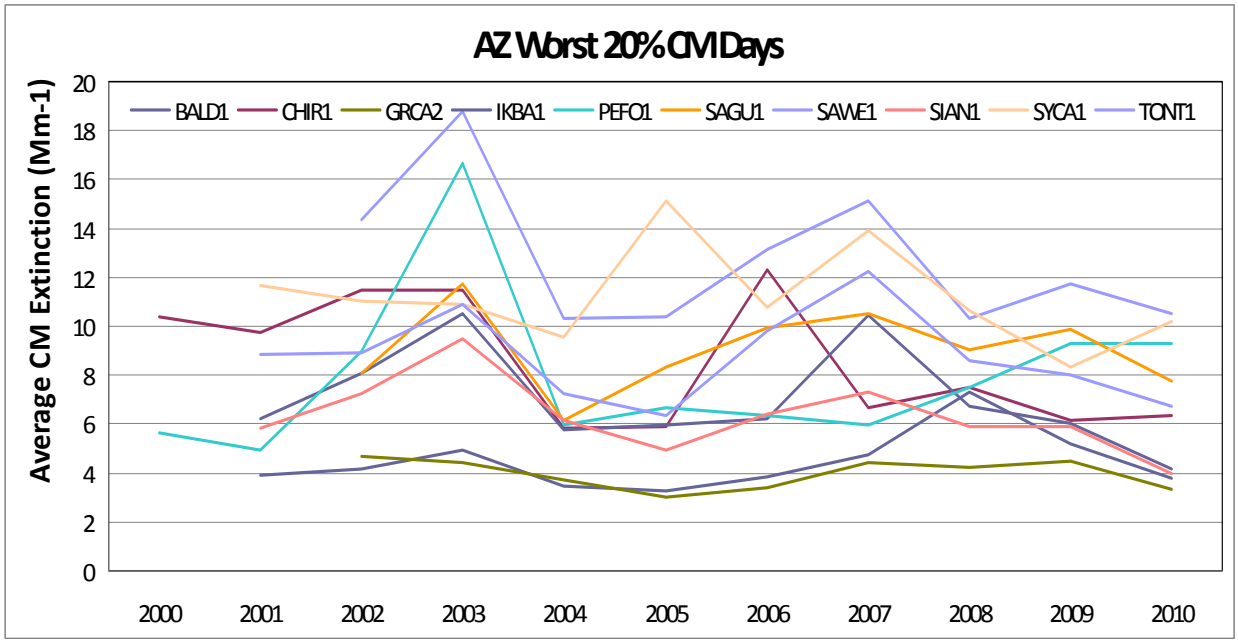


Figure 31: Average Annual Coarse Mass Extinction (mM-1) at each Arizona Class I area IMPROVE Site for the 20% Worst Coarse Mass Days.

Table 17: 2000-2010 Coarse Mass Visibility Extinction (mM^{-1}) Trends and Baseline vs. Progress Period Comparisons at each Arizona Class I area IMPROVE Site for the 20% Worst Coarse Mass Days.

SiteCode	11-year trend (2000-2010)	p-value	Baseline (2000-2004)	Progress Period (2005-2009)	Period Difference
BALD1	0.12	0.30	4.12	4.87	**0.75**
CHIR1	-0.40	0.22	9.78	7.72	**-2.06**
GRCA2	**-0.10**	**0.11**	4.49	3.92	**-0.58**
IKBA1	-0.14	0.24	7.64	7.08	**-0.56**
PEFO1	**0.28**	**0.08**	8.42	7.15	**-1.27**
SAGU1	0.03	0.54	8.65	9.52	**0.87**
SAWE1	-0.42	0.24	14.48	12.15	**-2.34**
SIAN1	-0.20	0.19	7.18	6.09	**-1.09**
SYCA1	**-0.15**	**0.05**	10.77	11.76	**0.99**
TONT1	-0.13	0.24	8.98	9.00	**0.02**

III.D.1.i. PEFO1 Coarse Mass Analysis

While average five-year visibility extinction decreased between the baseline and progress period for the 20% worst coarse mass days, Theil trends showed statistically significant increasing coarse mass visibility extinction trends from 2000 to 2010 (Table 17) at the Petrified Forest (PEFO1) monitor. Figure 32 shows Coarse Mass extinction at the PEFO1 monitor between the years of 2000 and 2010. When attempting to understand annual CM extinction variability for the 20% most impaired CM days at PEFO1 (Figure 31), the frequency and magnitude of extreme daily CM extinction for each year should be considered for performing an inter-annual qualitative assessment of Figure 32. Figure 31 shows that annually averaged CM extinction on the 20% worst CM days increased from 2007-2010. This is reflected in the higher magnitude of high CM extinction events when analyzing the 2008 against the 2007 data presented in Figure 31, the higher frequency of high CM extinction events when comparing 2009 extinctions to 2008, and the higher magnitude of high CM extinction events in 2010 versus 2009.

ADEQ examined available datasets in order to determine the possible sources of individual coarse mass events which may be leading to the observed increase in coarse mass event frequency and severity from 2008 to 2010. In particular, ADEQ examined meteorological data for the four highest CM readings at the PEFO1 IMPROVE monitor for the year of 2010. These high CM days occurred during the late March to early June time frame (Table 18), a period which climatologically favors windy, dry conditions. ADEQ felt that these events were of highest priority because these are the events which most contribute to elevated annual CM extinction average for the 20% worst CM days of the most recently available dataset of 2010. These events also act as representative days between the years of 2008 and 2010, for those high CM events which have contributed to the elevated CM extinction on the 20% most impaired CM visibility days occurred during the same late March to early June period (Figure 32).

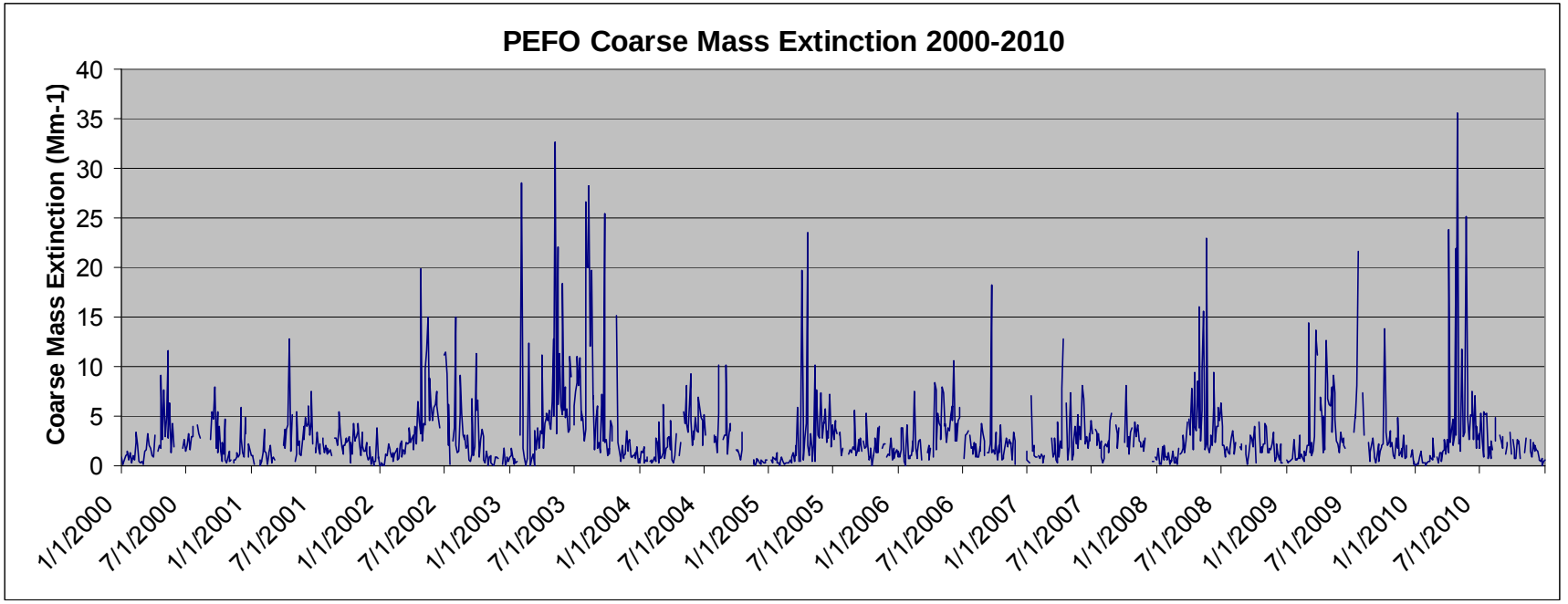


Figure 32: Coarse Mass Extinction at Petrified Forest between 2000 and 2010 as calculated from PEFO1 IMPROVE monitor measurements, measured every three days.

The four highest measured CM extinction days at Petrified Forest for the year of 2010 were April 29th (35.6 mM^{-1}), May 23rd (25.2 mM^{-1}), April 5th (23.8 mM^{-1}), and April 23rd (21.9 mM^{-1}), Each of these four days experienced exceptionally high max wind speeds of 49 mph, 34 mph, 37 mph, and 41 mph respectively (Table 18). These high wind speeds indicate CM spikes on these days were due to windblown dust; however, wind back trajectories were created in an attempt to qualitatively assess the possible contribution from large point sources in the region. ADEQ utilized the National Oceanic and Atmospheric Administration's (NOAA) Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT)[17] to map hourly back trajectories for high winds on the days of these events (>12 mph). Each hourly back trajectory was mapped for a period equal to the length of the sustained high wind period. These back trajectories helped to determine whether large point sources in the upwind contributing areas could have contributed to the high CM extinction.

ADEQ identified three large PM_{10} point sources within ~100 km of the PEFO1 monitor: 1) Arizona Public Service Co – Cholla Power Plant (51 km WSW of the PEFO1 monitor), 2) Salt River Project Co – Coronado Generating Station (72 km SE of the PEFO1 monitor), and 3) Tucson Electric Power Co – Springerville (101 km SE of the PEFO1 monitor). As previously discussed, spatially inconsistent CM worst day trends throughout the State indicate local influences on each IMPROVE monitor; therefore, point sources of >100 km distance from the PEFO monitor were assumed to have a negligible effect on PEFO CM extinction. Figures 33-36 show back trajectories for each high wind hour of the four worst CM days in 2010. Only high wind hours were plotted as these represent the hours capable of sustained CM atmospheric suspension from sources >50 km from the PEFO monitor. Of the four highest wind days, only 4/29/2010 had high winds which originated from the direction of one of the three previously mentioned major point sources (i.e. Arizona Public Service Co – Cholla Power Plant). However, the lack of consistent winds overlapping point sources on the four worst CM days of 2010 indicates that wind speed, and thus windblown dust is a more likely culprit of high CM extinctions on these days as opposed to point sources in the region.

Table 18: Four highest CM extinction days for 2010. Determination of Point Source Influence was based on the wind back trajectories shown in Figures 33-36.

	Max CM Extinction (mM-1)	Max WS (mph)	>12mph wind hours	Possible Point Source Influence?
4/05/2010	23.8	49	0000-2000	No
4/23/2010	21.9	34	1200-2400	No
4/29/2010	35.6	37	0900-1900	Yes
5/23/2010	25.2	41	0800-2300	No

[17] National Oceanic and Atmospheric Administration – Air Research Laboratory. http://www.arl.noaa.gov/HYSPLIT_info.php

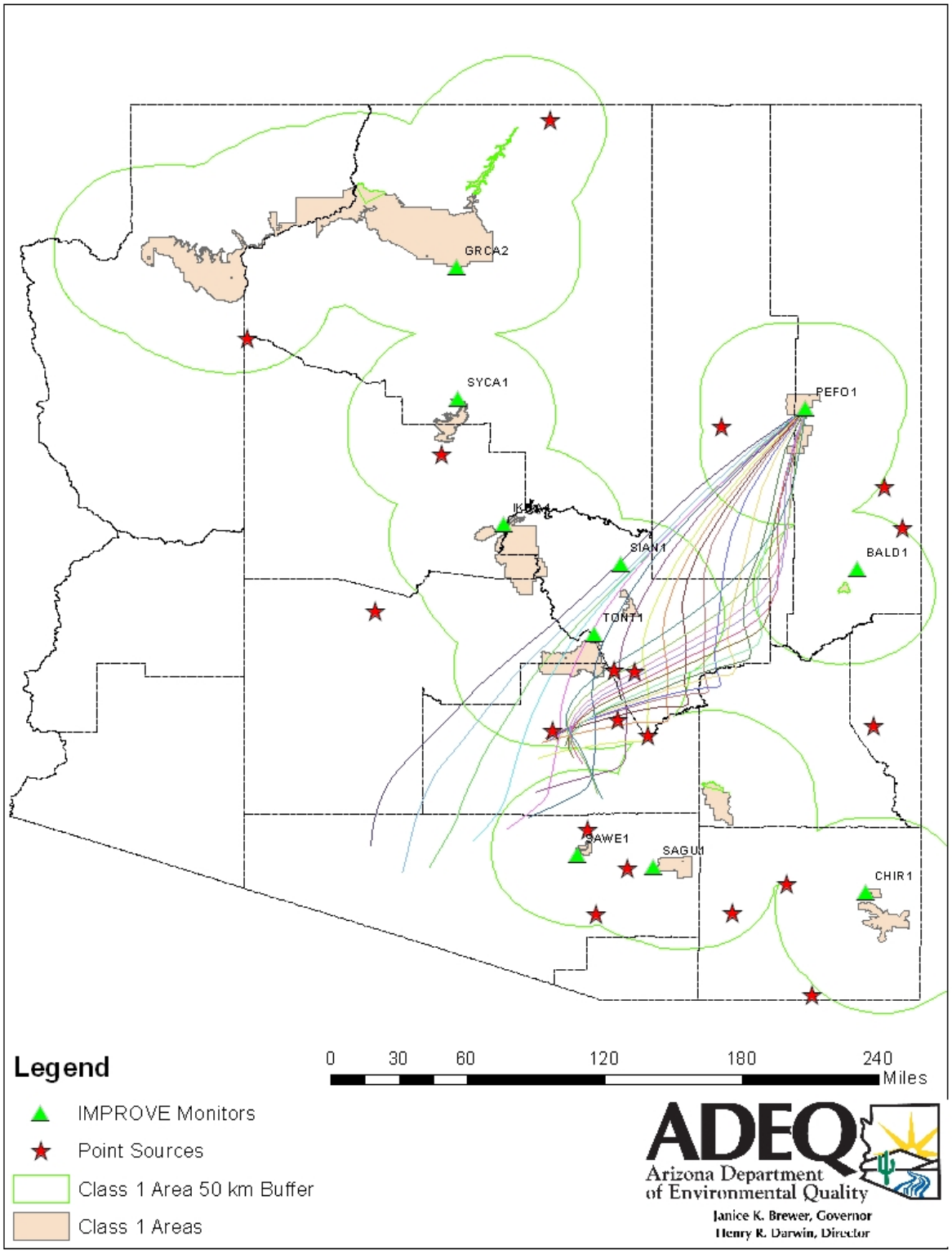


Figure 33: High wind back trajectories for April 5th, 2010 for the sustained high wind hours of 0 - 2000 hours. Statewide IMPROVE monitors are depicted with green triangles and point sources with > 100 tpy of CM emitted in 2010 are depicted by red stars. Each hourly back trajectory extends to a distance equivalent to 21 hours of travel time.

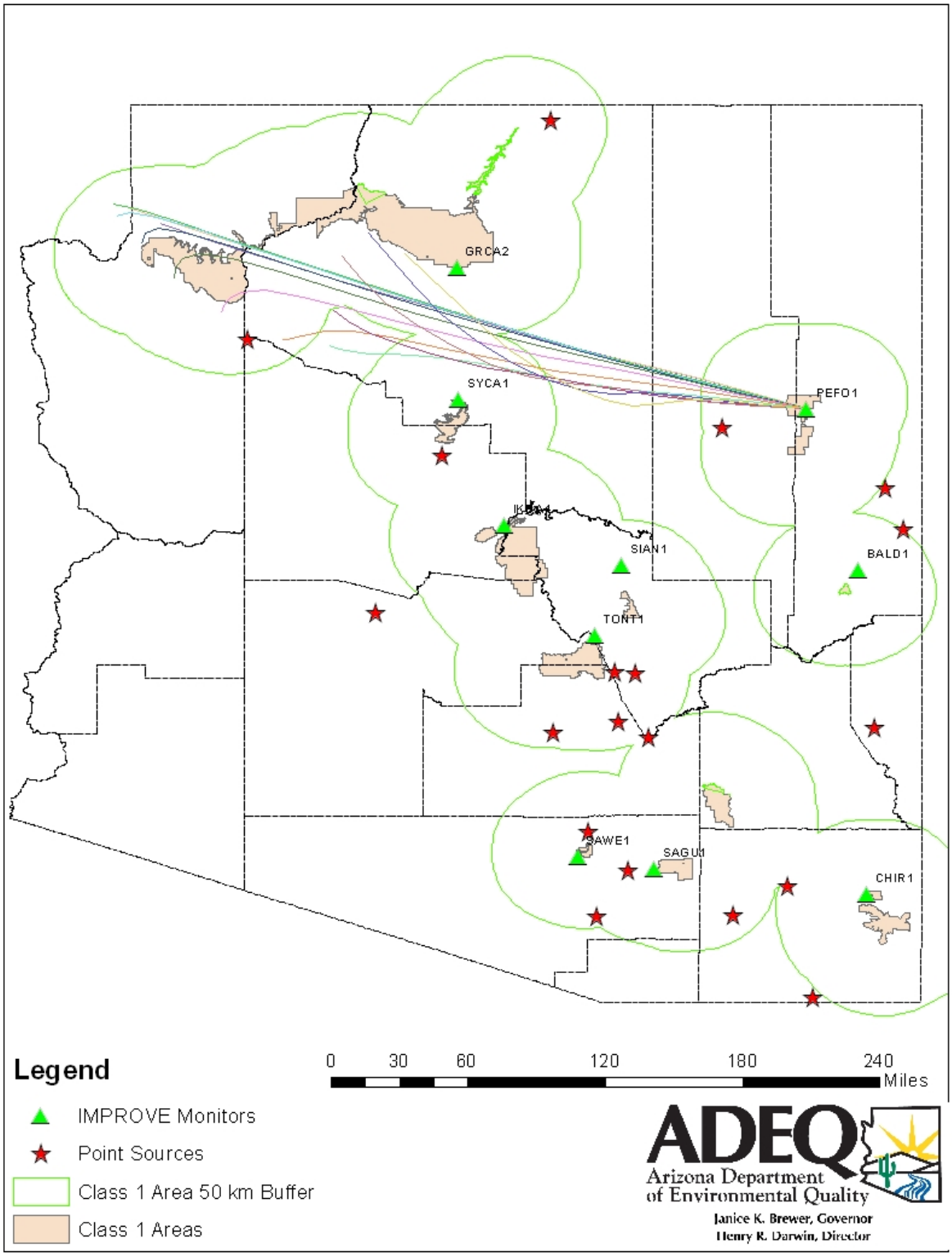


Figure 34: High wind back trajectories for April 23rd, 2010 for the sustained high wind hours of 1200 - 2400 hours. Statewide IMPROVE monitors are depicted with green triangles and point sources with > 100 tpy of CM emitted in 2010 are depicted by red stars. Each hourly back trajectory extends to a distance equivalent to 13 hours of travel time.

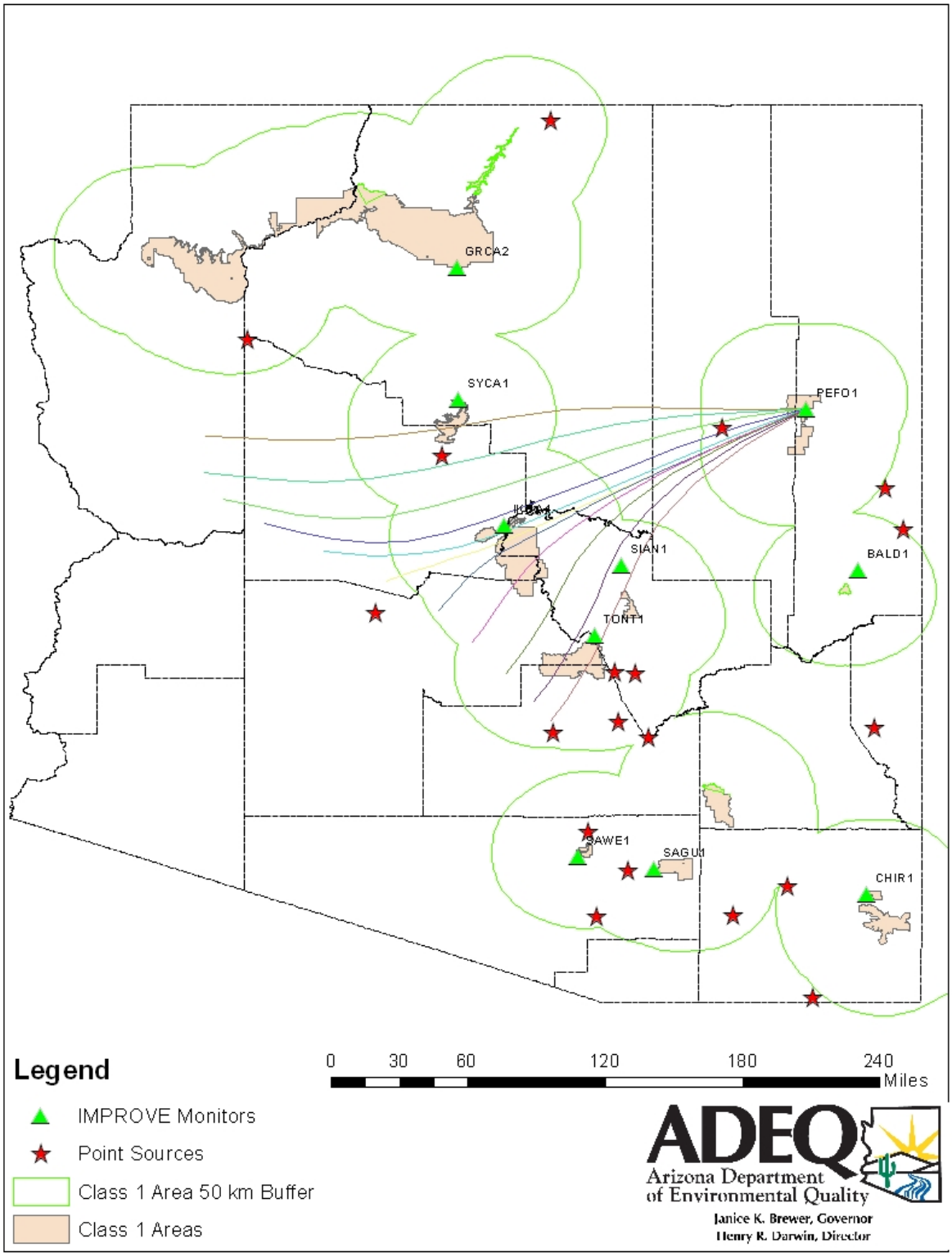


Figure 35: High wind back trajectories for April 29th, 2010 for the sustained high wind hours of 0900 - 1900 hours. Statewide IMPROVE monitors are depicted with green triangles and point sources with > 100 tpy of CM emitted in 2010 are depicted by red stars. Each hourly back trajectory extends to a distance equivalent to 11 hours of travel time.

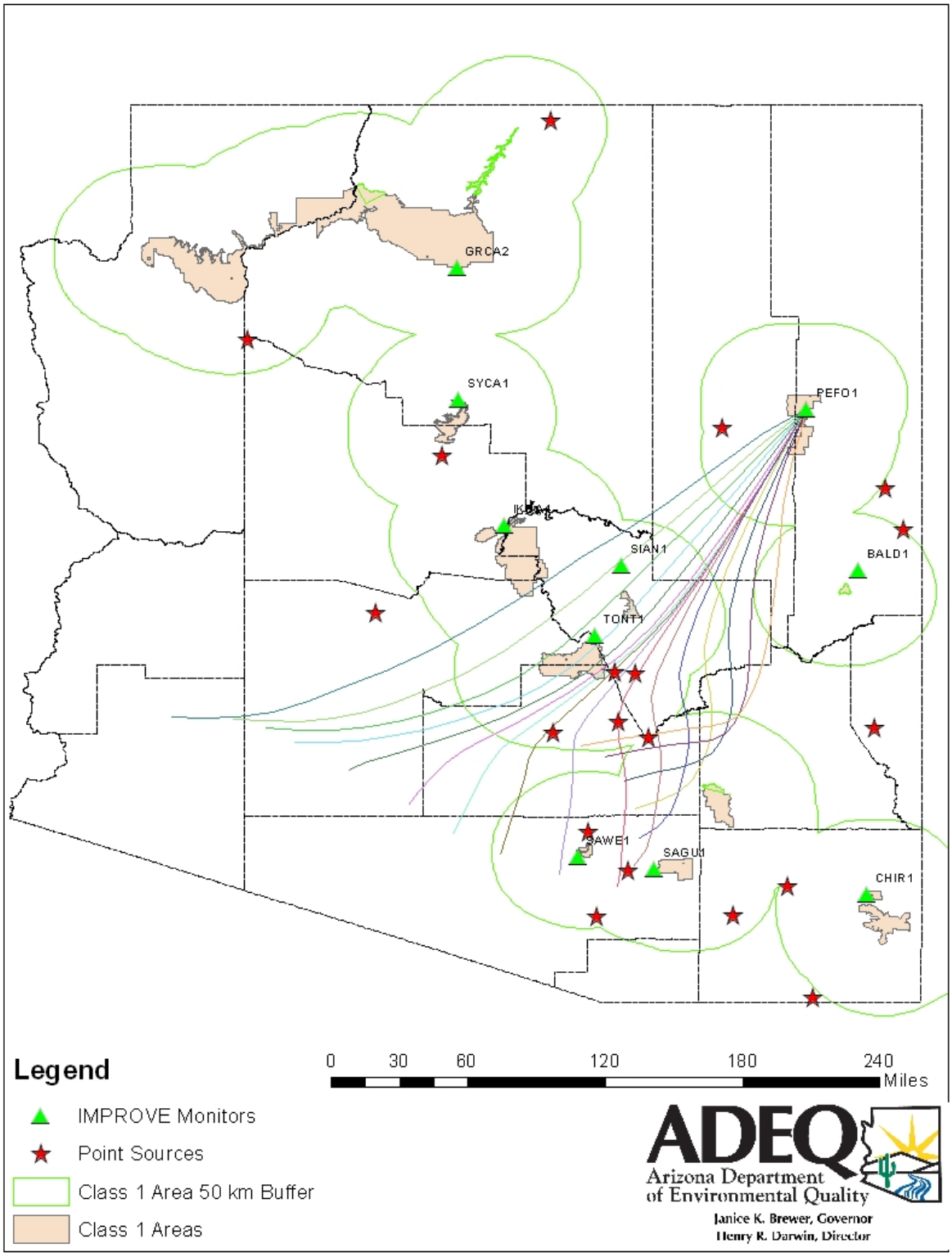


Figure 36: High wind back trajectories for May 23rd 2010 for the sustained high wind hours of 0800 - 2300 hours. Statewide IMPROVE monitors are depicted with green triangles and point sources with > 100 tpy of CM emitted in 2010 are depicted by red stars. Each hourly back trajectory extends to a distance equivalent to 16 hours of travel time.

III.D.2. Large Point Source Locations

Previous analyses of coarse mass extinction between 2000 and 2009/2010 have shown fairly mixed results; however, there is evidence which suggests coarse mass emissions originate from areas close to the individual IMPROVE monitors. Table 17 presents baseline vs. progress period differences which show decreasing trends at most sites across the state, but it is difficult to discern regional trends from monitors within close proximity of one another. IKBA1, SIAN1, and TONT1 are three monitors which are centrally located within the state within relatively close proximity; however, these three show a respective small decrease, large decrease, and small increase in CM extinction for the 20% most impaired CM days. Similarly, SAWE1 and SAGU1 are the two monitors of closest proximity within the State, but these two monitors show drastically different CM extinction baseline period averages. Therefore, ADEQ qualitatively examined the location of all NEI reported major PM_{10} emitting sources within the State against the location of individual IMPROVE monitors to determine if there is an evident trend. This analysis could prove to answer questions regarding whether locally driven point source emissions are related to disparities in regional coarse matter trends discussed above.

Figure 37 presents the location and the 2008 annual emissions for each point source in Arizona which emitted >100 tons of PM_{10}. The figure also presents the progress period (2005-2009) average extinction (mM^{-1}) for CM for the 20% most impaired days (using the EPA 20% most impaired day methodology as opposed to the 20% most impaired CM days presented in Section III.D.1.). This map indicates that the 20% most impaired days may be impacted by local PM_{10} sources at some monitors, while other sites show little to no effect on CM extinction from large PM_{10} sources. TONT1, SAWE1, and SAGU1 are all monitors which show relatively high CM extinction values over the progress period and are located relatively close to several large PM_{10} emitting point sources. However, SYCA1 is a monitor which recorded high extinction values for the 20% most impaired days over the progress period and it is only located near one large source, which is a relatively small PM_{10} emitter in comparison with other large sources on the map. Also, PEFO1 and BALD1 are located near very large PM_{10} emitting sources, yet have some of the lowest CM extinction values for the 20% most impaired days recorded over the progress period. Overall, it is difficult to discern a visual relationship between large PM_{10} point sources and IMPROVE monitor CM extinctions for the 20% most impaired days in the State of Arizona. A finer scale EI around each monitor site may be needed in order to better understand individual site trends for CM extinction. In general, ADEQ's analysis of CM monitoring data indicates an inverse relationship with precipitation patterns throughout the state, which suggests that CM extinction may be strongly associated with area sources rather than point sources. This notion is supported in the statewide emission inventories for CM as well.

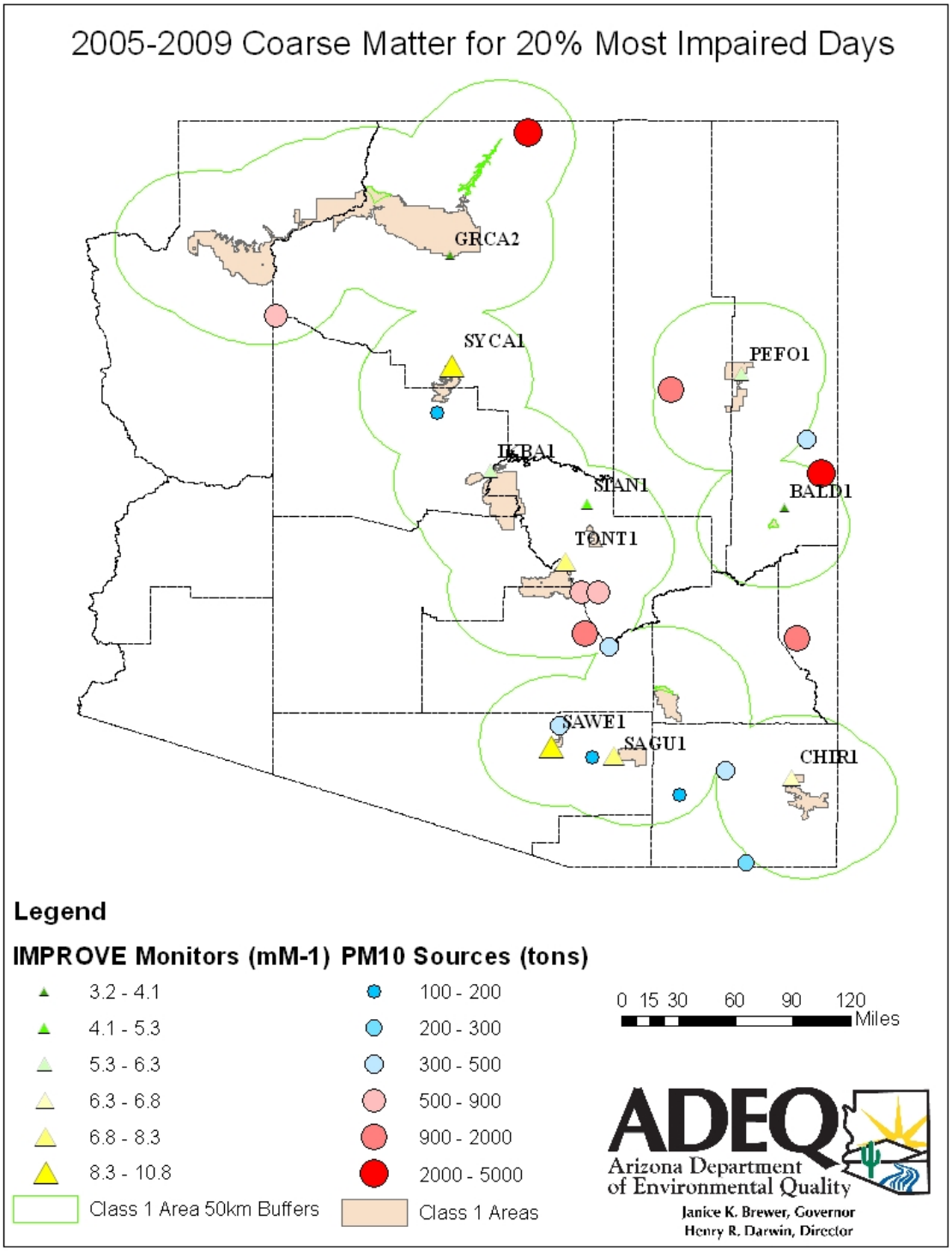


Figure 37: Locations of Arizona Class I areas, Class I area 50 km buffers, Class I area IMPROVE monitors, and Large Point Source Emitters of PM10 (>100 tons/year). IMPROVE site values correspond to Visibility Extinction (mM-1) of Coarse Mass averaged over the progress period (2005-2009).

III.E. Method Comparison Summary

The basic premise of the RHR is to ensure that visibility on the 20% worst days continues to improve, and that visibility on the 20% best days does not get worse, as measured in units of deciviews (dv) calculated using data measured at IMPROVE monitoring sites. Progress is measured in discreet five-year average increments, beginning with the 2000-2004 baseline average, and proceeding with each subsequent five-year average (e.g. 2005-2009, 2010-2014, etc.). Some of the more subtle, but important, considerations for RHR calculations using IMPROVE data measurements are described below.

Compiling visibility deciview measurements into five-year averages can result in anomalous years, experiencing extreme events, having a significant affect on long-term trends in visibility change which due not truly exist, specifically for the 20% worst day comparisons. As an example, this is evident in data presented in this document for the State of Arizona GRCA2 site. This site experienced high 2005 and 2007 ammonium sulfate extinction values (a regional trend) and high 2009 elemental carbon extinction values (wildfire related) for the 20% most impaired days resulting in overall elevated visibility progress period deciview averages for the site. In contrast, when the Theil statistical method was utilized over the ten year period to analyze extinction trends for overall deciviews at the site and extinction trends for individual visibility impairment components, no significant increases were seen. In this case, anomalous years for individual visibility component extinctions, due to extreme events, presented visibility degradation using the RHR method, while a more standardized statistical trend method (the Theil method) showed no significant increasing visibility degradation trends ($p < 0.15$). This is merely one case where ADEQ, WRAP, and ARS have shown that outlier data can significantly alter the data progress interpretations when using the RHR method when compared to other standardized statistical trends which better account for anomalous years.

Furthermore, to determine the five-year average of the 20% best and worst days, the highest and lowest 20% of days for each complete year are first selected and averaged on an annual basis, with a five-year average calculated from these annual averages. The selection of the 20% best and worst days may be significantly influenced by large episodic events, and as such, may not represent the same time period from year to year. This selection of days may affect the averages for individual species in ways that are independent from actual increases or decreases from one five-year period to the next.

Visibility impairment is the result of the cumulative effect of several different particle pollutant types. Many of these pollutants have consistent seasonal patterns. For example, ammonium nitrate is temperature sensitive, with formation often favored during colder winter months, while ammonium sulfate formation may be favored during warmer summer months. Other pollutants, such as particulate organic mass, may be impacted by large and variable episodic events such as wildland fires. Variable occurrence of large episodic events may cause high extinction measurements that will drive selection of 20% worst days to coincide with the episodic events, effectively introducing the possibility that the worst days occur at different times each year.

As an illustration of events driving the selection of the worst days, consider daily average aerosol extinction calculated from IMPROVE data at the CHIR1 site in Arizona. Figures 38 and 39

present daily aerosol extinction measurements for 2002 and 2008 at CHIR1, with the 20% worst days represented by an orange box with an "x" below the day. For 2002, large wildfire events in June and July contributed to high POM measurements, resulting in more of the worst days selected during this period. In 2008, more of the worst days were selected in August and October.

As an illustration of the seasonal patterns of individual compounds, consider the monthly averages of aerosol extinction calculated from IMPROVE data at the CHIR1 site. Figure 40 presents monthly average aerosol pollution for CHIR1 measured during 2002, and Figure 41 presents monthly averages in 2008. For both years, plots show that ammonium sulfate is highest between July and September. The monthly plots also show the higher POM that coincided with wildfire events in 2002, which affected the selection of more of the worst days between May and July in 2002, and more worst days in August and October in 2008. The seasonal patterns of ammonium sulfate mean that even if annual ammonium sulfate stayed the same, worst days in May and July will have higher ammonium sulfate than worst days that occur between August and October.

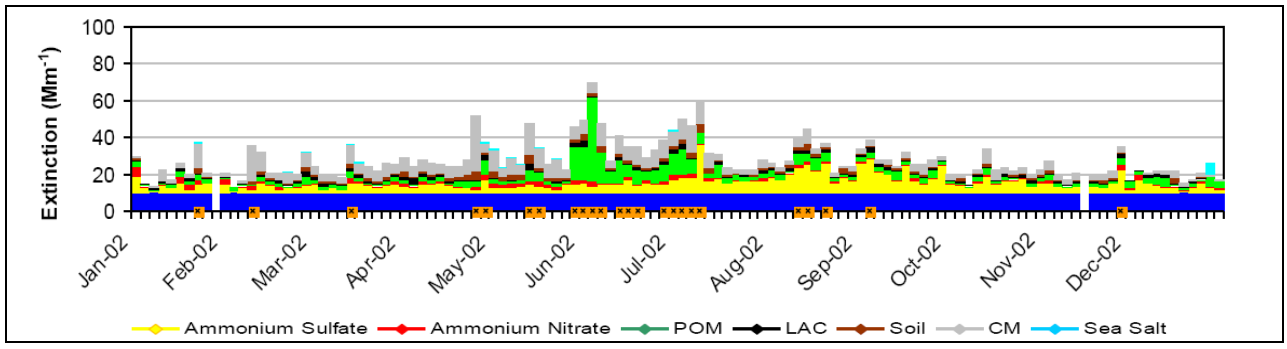


Figure 38: Daily Aerosol Extinction measured by the Chiricahua CHIR1 IMPROVE monitor during 2002.

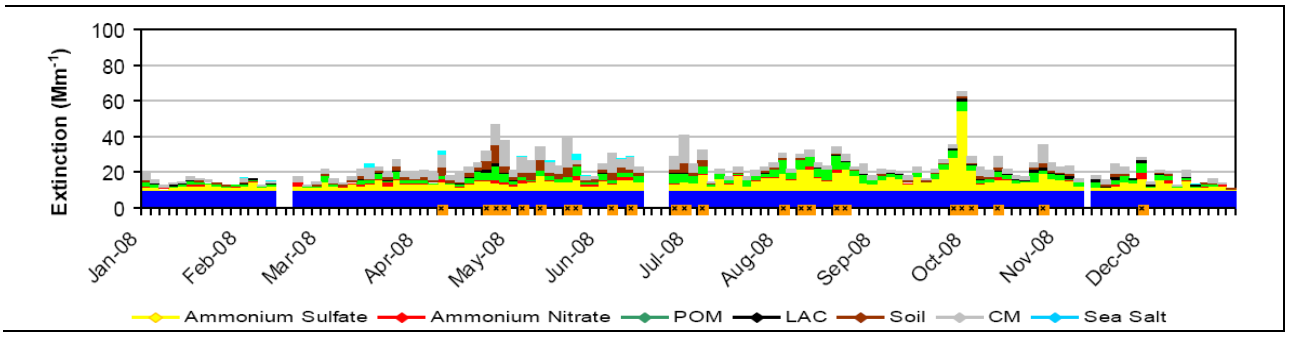


Figure 39: Daily Aerosol Extinction measured by the Chiricahua CHIR1 IMPROVE monitor during 2008.

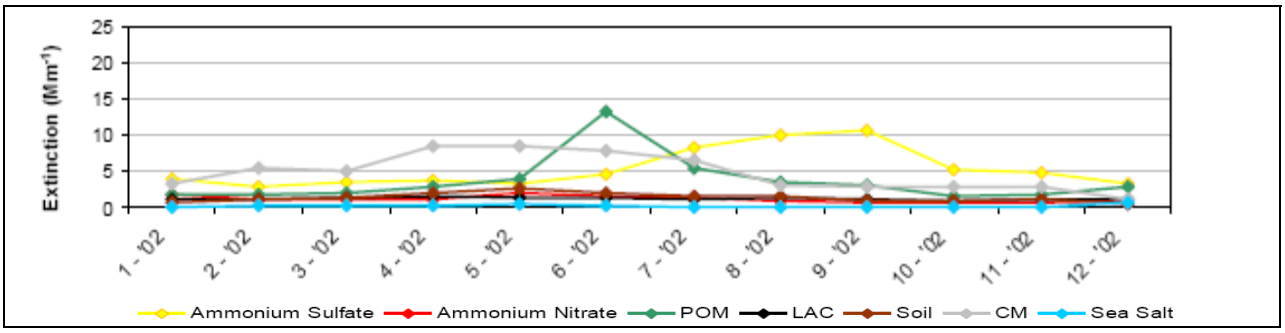


Figure 40: Monthly Average Aerosol Extinction measured by the CHIR1 IMPROVE monitor in 2002.

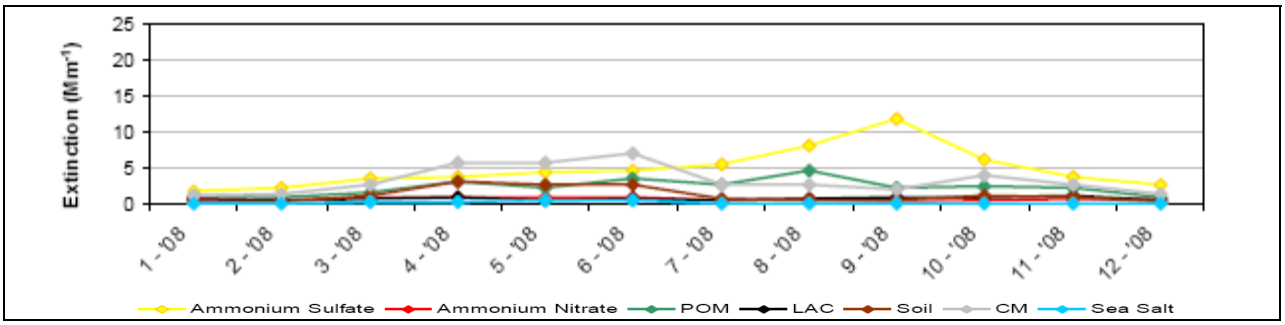


Figure 41: Monthly Average Aerosol Extinction measured by the CHIR1 IMPROVE monitor in 2008.

Table 19: CHIR1 IMPROVE Site comparison of Baseline and Progress Period Ammonium Sulfate Averages for All Days and the 20% Worst Days

Year	All Days Amm. Sulfate Average (Mm^{-1})	20% Worst Days Amm. Sulfate Average (Mm^{-1})
2002	5.3	7.8
2008	4.9	9.0
Difference	-0.4 Mm^{-1}	+2.2 Mm^{-1}

For this case, Table 19 presents the annual averages of ammonium sulfate for both the 20% worst days and all measured days. For these years, the annual average of ammonium sulfate extinction decreases, while the 20% worst day average actually increased.

Within this document ADEQ, WRAP, and ARS have presented several different methods of analyzing IMPROVE data in order to best understand the trends which are occurring at each of the IMPROVE sites between the years of 2000-2009. These methods are slight alterations in how the analyzed data are chosen (i.e. choosing the 20% most/least impaired days particular to a certain pollutant rather than for the entire suite of pollutants) and how the variability inevitably

seen with pollution data can be analyzed to account for the effects of large individual events which may skew overall pollution trends (i.e. the utilization of the Theil statistical trend analysis). ADEQ contests that these analyses represent logical methods which are comparable to and in some ways improve upon the standardized methodology required by the RHR. Furthermore, these methods are not drastically different from previous EPA methodology, and in the case of Theil statistical comparison, actually represent previously utilized EPA methodology for similar comparisons.

IV. Reasonable Progress Goals

IV.A. Overview

EPA proposed to disapprove Arizona's Reasonable Progress Goals (RPGs) for 2018 based on the reasoning that they did not feel ADEQ demonstrated that the goals constituted reasonable progress[18]. In this section ADEQ presents Arizona's progress towards reaching the previously presented RPGs and Uniform Rates of Progress (URPs) as interpreted through IMPROVE monitoring data. ADEQ chose to present IMPROVE data trends, as opposed to surrogate measures such as Emission Inventory trends, as monitoring data most accurately measure visibility changes within a region. However, ADEQ also provides analysis within this section relating trends seen at the IMPROVE monitors to those noted within the emission inventories where appropriate. Finally, ADEQ compares State-wide extinction trends for individual visibility impairment components to regional trends. It should be noted that the monitoring data analysis presented within this section is not intended to serve as ADEQ's RPG analysis, but instead is intended to support the original RPG and provide a comparison of current monitoring trends to the RPGs and URPs.

This section compares the rate of progress between the baseline and progress periods towards the goal of natural visibility at each of the Arizona IMPROVE monitors and how that rate compares to RPGs and URPs for the 20% most impaired and least impaired days. An alternate analysis of RP is also included which illustrates the effect that the anomalous year of 2005 has on the original results. Furthermore, additional analyses are provided which show 1.) how specific fire events can have a large impact on the baseline versus progress period comparison and 2.) ammonium nitrate trends for specific Class I areas that may have the potential for being impacted by nearby large sources of NO_x.

IV.B. Reasonable Progress as Determined by IMPROVE Monitoring Data

Tables 20 and 21 present the baseline visibility, 2005 – 2009 progress period visibility, URP visibility for 2018 (not included in Table 21), and the 2018 RPGs for each of the IMPROVE monitor sites for the 20% most impaired days and the 20% least impaired days, respectively.

[18] Environmental Protection Agency (EPA). Federal Register Volume 77, No. 246. Dec. 21, 2012.

The Tables further present 2018 projected visibility based on the visibility rate of change between the baseline period and progress periods. The 2018 projected visibility was calculated for each IMPROVE monitoring site using the following equation:

$$PV = BP - 16 * \left(\frac{(BP - PP)}{5} \right)$$

where:

PV = 2018 projected visibility (dV)
BP = Average baseline period visibility (dV)
PP = Average progress period visibility (dV)

This equation assumes a linear rate of progress between the baseline and progress period that can be extrapolated to 2018, that the average baseline period visibility is the visibility for the midpoint year of the baseline period (2002), and that the average progress period visibility is the visibility for the midpoint year of the progress period. The 2018 projected visibility values can be utilized in two ways: 1) comparison with ADEQ's previously calculated RPGs, or 2) comparison with ADEQ's previously calculated URPs. This is a rather simplistic method but is believed to be more representative of actual progress compared to utilization of a highly uncertain EI.

Table 20 presents the projected visibility for each IMPROVE site as compared to ADEQ's RPGs and URPs for the 20% most impaired days. Six monitoring locations (shown in blue) are expected to surpass ADEQ's RPGs for 2018. Furthermore, CHIR1, SAWE1, SAGU1, and SIAN1 are projected to surpass the URPs calculated for these sites for 2018. While BALD1 and SYCA1 (shown in black) are expected to experience visibility improvements by 2018, these improvements are not expected to meet the RPGs calculated by ADEQ. Two sites are projected to experience visibility degradation by 2018 when compared to 2002 (shown in red); these sites are GRCA2 and IKBA1.

Table 21 presents the projected visibility for each IMPROVE site as compared to the ADEQs RPGs for the 20% least impaired days. None of the sites are projected to experience visibility degradation on the 20% least impaired days. Furthermore, all sites except GRCA2 are projected to surpass 2018 RPGs for the 20% least impaired days.

Table 20: Arizona Class I Area Reasonable Progress Goals Comparison to 2005 – 2009 Progress Period Visibility for the 20% Worst Days. '2018 Projected Visibility' was extrapolated based on the rate of Visibility change between the Baseline and Progress Period Visibilities.

Reasonable Progress Goals for 20% Worst Days for Arizona Class I Areas						
Arizona Class I Area	**Site ID**	**Baseline (dV)**	**2005 – 2009 Progress (dV)**	**URP based 2018 visibility**	**2018 RPG (dV)**	**2018 Projected visibility**
Chiricahua NM, Chiricahua W, Galiuro W	CHIR1	13.4	12.2	12.0	13.4	9.6
Grand Canyon NP	GRCA2	11.7	12.0	10.6	11.1	12.7
Mazatzal W, Pine Mountain W	IKBA1	13.4	13.4	11.8	12.8	13.4
Mount Baldy W	BALD1	11.9	11.8	10.5	11.5	11.6
Petrified NP	PEFO1	13.2	13.0	11.6	12.9	12.6
Saguaro NP - West Unit	SAWE1	16.2	14.9	13.9	16.0	12.0
Saguaro NP - East Unit	SAGU1	14.8	13.6	12.9	14.8	11.0
Sierra Ancha W	SIAN1	13.7	13.0	12.0	13.2	11.5
Superstition W	TONT1	14.2	13.8	12.4	13.9	12.9
Sycamore Canyon W	SYCA1	15.3	15.2	13.3	15.0	15.1

Table 21: Arizona Class I Area Reasonable Progress Goals Comparison to 2005 – 2009 Progress Period Visibility for the 20% Best Days. '2018 Projected Visibility' was extrapolated based on the rate of Visibility change between the Baseline and Progress Period Visibilities.

Reasonable Progress Goals for 20% Best Days for Arizona Class I Areas					
Arizona Class I Area	**Site ID**	**Baseline (dV)**	**2005 – 2009 Progress (dV)**	**2018 RPG (dV)**	**2018 Projected visibility**
Chiricahua NM, Chiricahua W, Galiuro W	CHIR1	4.9	4.4	4.9	3.3
Grand Canyon NP	GRCA2	2.2	2.2	2.1	2.2
Mazatzal W, Pine Mountain W	IKBA1	5.4	5.1	5.2	4.4
Mount Baldy W	BALD1	3.0	2.9	2.9	2.7
Petrified NP	PEFO1	5.0	4.6	4.7	3.7
Saguaro NP - West Unit	SAWE1	8.6	8.0	8.3	6.7
Saguaro NP - East Unit	SAGU1	6.9	6.7	7.0	6.3
Sierra Ancha W	SIAN1	6.2	5.3	5.9	3.3
Superstition W	TONT1	6.5	5.7	6.2	3.9
Sycamore Canyon W	SYCA1	5.6	5.1	5.5	4.0

Visibility degradation for the 20% most impaired days at GRCA2 and IKBA1 are most accurately explained through large, singular wildfire events which skew RHR method results for the 20% most impaired days. Within this document ADEQ has shown evidence of the effect individual events at an IMPROVE monitoring location can have in misrepresenting visibility trends when using the RHR method. Table 22 supplements previously overviewed data to show this issue more clearly. Table 22 presents an analysis where two years' (2003 and 2009) EC and POM visibility extinction data from GRCA2 are adjusted to ten-year averages in order to reduce the effects of wildfires located near the monitor. In the year of 2003, total extinction for the GRCA2 monitor was recalculated using the ten-year average extinction values for EC (2.7 Mm^{-1}) and POM (10.7 Mm^{-1}). This was repeated for the year of 2009. Both years, 2003 and 2009, experienced large wildfire events near the GRCA2 monitor and this substitution method was utilized in an attempt to illustrate the effects of these wildfire events on the overall trends of the RHR method. Table 22 shows that without substitution, total visibility extinction increases by 0.5 mM^{-1} using the RHR method, while EC and POM extinction normalization for the year of 2003 caused this degradation to increase to 2.2 Mm^{-1}, and 2009 extinction normalization caused the trend to reverse with total visibility improvement on the order of 1.8 Mm^{-1} at GRCA2. A similar analysis was performed on IKBA1 IMPROVE data where 2005 EC and POM extinction values were replaced with ten-year average values (2.3 Mm^{-1} and 8.0 Mm^{-1}, respectively). This exercise expresses the degree to which one large event can skew long-term visibility trends for the 20% most impaired days.

Table 22: Alternative method for the 20% Most Impaired Days at GRCA2 and IKBA1. EC and POM visibility extinctions are replaced by ten-year average for 2003 and 2009 (GRCA2) and 2005 (IKBA1).

Alternative RHR Analysis Results for the 20% Worst Days at GRCA2 (2003 & 2009) and IKBA1 (2005)							
		Total Extinction (Mm-1)					
Site	Year Adjusted	Baseline	Adjusted Baseline	2005 – 2009 Progress	Adjusted Progress	Standard Change	Adjusted Change
GRCA2	2003	34.6	32.9	35.1	--	0.5	2.2
GRCA2	2009	34.6	--	35.1	32.8	0.5	-1.8
IKBA1	2005	38.9	--	39.2	37.7	0.3	-1.2

Table 23: Arizona Class I Area RPGs Adjusted Comparison to the Altered Progress Period Visibility (2006-2010) for the 20% Worst Days. '2018 Projected Visibility' was extrapolated based on the rate of visibility change between the Baseline and Progress Period Visibilities. In this case the Progress Period was adjusted to the years 2006-2010. Sites with visibility projected to exceed the URP are in dark blue and those expected to exceed Arizona's calculated 2018 RPG are in light blue.

Adjusted Reasonable Progress Goals for 20% Worst Days for Arizona Class I Areas						
Arizona Class I Area	Site ID	2000-2004 Baseline (dV)	2006-2010 Progress (dV)	URP based 2018 visibility	2018 RPG (dV)	2018 Projected visibility
Chiricahua NM, Chiricahua W, Galiuro W	CHIR1	13.4	11.8	12.0	13.4	**9.1**
Grand Canyon NP	GRCA2	11.7	11.4	10.6	11.1	**11.0**
Mazatzal W, Pine Mountain W	IKBA1	13.4	12.6	11.8	12.8	**11.4**
Mount Baldy W	BALD1	11.9	11.1	10.5	11.5	**9.9**
Petrified NP	PEFO1	13.2	12.5	11.6	12.9	**11.3**
Saguaro NP - W Unit*	SAWE1	16.2	14.8	13.9	16.0	**12.4**
Saguaro NP - E Unit	SAGU1	14.8	13.3	12.9	14.8	**10.8**
Sierra Ancha W	SIAN1	13.7	12.3	12.0	13.2	**10.0**
Superstition W	TONT1	14.2	13.3	12.4	13.9	**11.9**
Sycamore Canyon W	SYCA1	15.3	14.7	13.3	15.0	**13.8**

*2010 data was not included for this unit do to uncertainty of data's accuracy.

While individual events can cause skewed results, the same can be said for individual years. In previous sections of this document ADEQ has discussed the exceptionality of the year of 2005 when compared to other years' visibility. To address this issue ADEQ additionally analyzed IMPROVE monitoring data at Class I areas throughout the State of Arizona for the year of 2010 in order to assess visibility changes for a more recent Progress Period. In Table 23, ADEQ performed an updated RHR method analysis where the baseline period was compared to a more recent progress period (2006-2010) which included the most recently available IMPROVE monitoring data. This table presents the data in a format similar to Table 20 in order to see how these updated trends track to the year 2018 for comparison with RPGs and URPs. It is evident from the information contained in Tables 20 and 23 that the year 2005 has a strong effect on the overall trends. In the more recent progress period analysis (Table 23), all IMPROVE monitor sites are not just on pace to meet Arizona's previously set RPG values, but all except GRCA2 and SYCA1 are on pace to surpass URPs by 2018. Again, this analysis shows the limitations of the RHR methodology as one year near the mid-point has a strong influence on the overall trends.

IV.C. Ammonium Nitrate Q/D Analysis

EPA has performed an initial Q/D analysis for the determination of those Point Sources which need to be evaluated further for controls based on NO_x emissions. In this section ADEQ presents information which shows that all Class I Areas identified by EPA as potentially impaired by these identified sources have exhibited decreased visibility impairment from ammonium nitrate between the baseline period (2000-2004) and the progress period (2005-2009). Table 24 presents the initial results of EPA's Q/D analysis for those sources identified as impairing or possibly impairing Arizona Class I Areas. This analysis presented four Arizona Class 1 Areas which were possibly impacted by NO_x emissions from Point Sources, including: SAGU1, PEFO1, SYCA1, and SIAN1. IMPROVE data from all four areas were analyzed according to the RHR method for changes in ammonium nitrate extinction for the 20% least and most impaired days (Table 25). Table 25 shows that all sites exhibited improved visibility between 8% and 44% for the 20% least impaired days for ammonium nitrate. The 20% most impaired days exhibited even greater visibility improvements for ammonium nitrate with extinctions decreasing between the baseline and progress period between 15% and 55% at the four Class I Areas identified. Analysis of IMPROVE monitoring data by ADEQ at the SAGU1, PEFO1, SYCA1, and SIAN1 sites indicate that these sites are showing significantly improved visibility directly due to ammonium nitrate extinction reductions.

Table 24: NOx emissions (Q) over distance (D) analysis for AZ facilities with Q/D values > 10. Also included is the nearest Class 1 Area to the facilities.

Source	Q (tpy)	D (km)	Q/D	Closest Class I Area	Class I Abbr.
Arizona Portland Cement Co	5,635	6.99	806	Saguaro Wilderness	SAGU
ASARCO Ray Ops Mine	1,290	66.02	20	Sierra Ancha Wilderness	SIAN
Cholla Plant	34,066	31.75	1073	Petrified Forest NP	PEFO
El Paso Nat Gas (Tucson Compr Station)	336	14.72	23	Saguaro Wilderness	SAGU
Flagstaff Comp Stn	1,013	34.94	29	Sycamore Canyon Wild.	SYCA
Irvington Gen Stn	5,797	15.84	366	Saguaro Wilderness	SAGU
Phoenix Cement	3,224	12.65	255	Sycamore Canyon Wild.	SYCA
Pima Co. Sewage Plant	258	12.56	21	Saguaro Wilderness	SAGU
TEP Springerville	32,973	60.46	545	Petrified Forest NP	PEFO
Williams Comp Stn	1,388	19.12	73	Sycamore Canyon Wild.	SYCA

Table 25: IMPROVE monitoring ammonium nitrate trend results for Class I Areas located near facilities that exhibited high Q/D results.

Change in Ammonium Nitrate Visibility Extinction			
Class I Area	**Abbreviation**	**20% Least Impaired [mM-1]**	**20% Most Impaired [mM-1]**
Saguaro Wilderness	**SAGU1**	**-0.2 (-19%)**	**-3.2 (-55%)**
Petrified Forest NP	**PEFO1**	**-0.2 (-22%)**	**-0.3 (-17%)**
Sycamore Canyon Wilderness	**SYCA1**	**-0.1 (-8%)**	**-0.7 (-33%)**
Sierra Ancha Wilderness	**SIAN1**	**-0.4 (-44%)**	**-0.3 (-15%)**

V. Conclusions

This document fills the required EPA Regional Haze SIP deficiency for the State of Arizona regarding the submission of a complete and recent emission inventory. In this document ADEQ presents a 2008 Emission Inventory which is comparable to the 2002 EI in some Source Categories for a variety of pollutants. Where this inventory is not reliably comparable to the 2002 State of Arizona EI, ADEQ has provided an overview of the methodology, input data, and model resolution enhancements that have changed between the 2002 and 2008 inventory preparations.

ADEQ has also included a review of IMPROVE monitor data between the years of 2000 and 2010. This review presented standardized 20% best and worst visibility day comparisons between the baseline and progress periods, as well as Theil statistical trend analyses as an alternative approach for understanding ten-year trends. Visibility aerosol extinction indicates that ammonium nitrate, organic mass, and elemental carbon extinctions are improving within almost all Arizona Class 1 areas. Fine Soil and Coarse Mass extinction values seem dependant of the local environment surrounding the Class 1 Areas and show no discernable increasing or decreasing spatial trends across the State. Anomalously high years (2005 and 2007) for

ammonium sulfate extinction revealed increasing ammonium sulfate visibility extinction between the baseline and progress periods; however, decreasing trends in ammonium sulfate in previous and more recent years resulted in Theil statistics which either showed no statistically significant visibility extinction increases or statistically significant visibility decreases across the State ($p < 0.15$). ADEQ has also shown that regional transport strongly influences ammonium sulfate trends at Arizona Class I Areas. Furthermore, similar trends for ammonium sulfate were noted for the four corners region indicating that the ammonium sulfate trends noted were regional and not simply limited to the State of Arizona. When correcting for a single regional transport event in 2007, ADEQ showed that three of the five Class I Areas which were previously believed to exhibit increasing ammonium sulfate extinction in the progress period are actually exhibiting reduced ammonium sulfate extinction. More analysis should be performed to assess the extent to which regional transport controls ammonium sulfate extinction trends within the State of Arizona.

Finally, ADEQ compared overall visibility trends at each of the IMPROVE monitor locations against previously submitted RPGs and URPs for 2018. These data indicated that if the current pace of visibility change was continued, no site would experience increased visibility impairment for the 20% least impaired visibility days in 2018. Using a progress period of 2005-2009 six monitoring locations are expected to surpass ADEQ's previously submitted RPGs for 2018 for the 20% most impaired days. Furthermore, four sites, CHIR1, SAWE1, SAGU1, and SIAN1 are projected to surpass the previously accepted URPs for the 20% most impaired days in 2018 when projecting visibility from the progress period of 2005-2009. Only two sites are projected to experience visibility degradation for the 20% most impaired days in 2018 when compared to 2002, these sites are GRCA2 and IKBA1. However, the visibility degradation noted at these sites is most likely due to wildfires located close to these monitors during the progress period. ADEQ has shown that if EC and POM extinction values are standardized for years during which fires have occurred close to a monitor, the entire progress period trends can be altered, exhibiting how data influenced by specific events can significantly affect the overall trends when using the RHR method. ADEQ also showed that the exceptionally poor visibility year of 2005 was skewing data trends when using the RHR method. If the most recently available visibility data was used for the progress period (i.e. shifting the progress period from 2005-2009 to 2006-2010), every site is projected to surpass Arizona's RPGs and all but two sites will surpass URP visibility standards.

Appendix A: Windblown Dust Partitioning

The following information was provided to ADEQ by ENVIRON, the consultant which performed the windblown analysis for the 2008 emission inventory. ADEQ requested a separate analysis from the company to partition windblown dust emissions into natural and anthropogenic sources. Methodology and results are given below.

Windblown Methodology

As part of the West-wide Jump-start Air Quality Modeling Study (WestJumpAQMS[19]), the WRAP Wind Blown Dust (WBD) model (Mansell et al., 2006[20,21,22,23]) was used with the WestJumpAQMS 2008 WRF meteorological model output (ENVIRON and Alpine, 2012[24]) to generate WBD fugitive dust emissions inputs for the 36 km CONUS, 12 km WESTUS and 4 km IMWD modeling domains. The WRAP WBD model uses threshold friction velocities (u_*) as a function of surface roughness above which the surface playa is assumed to start emitting WBD emissions. The approach of Marticorena (1997) is used that matches wind tunnel measurements fairly well (see Figure 2-1 of Mansell et al., 2006[2]). The friction velocity (u_*) depends on the surface roughness (z_0) and the WRF surface wind speed (u_z) at height z above the ground using the following relationship:

$u_z/u_* = 1/k * \ln(z/z_0)$

where k is the von Karmen constant (0.4).

There are separate emissions factors as a function of friction velocity for four soil groups based upon the estimated geometric mean diameter of the soil particles. WBD emissions are calculated for each grid cell using the fractional coverage of each land cover type within the grid cell, friction velocity, surface roughness and WBD emissions factor for soil groups. Fugitive Dust Transport Factors (FDTFs) are then applied to reduce the WBD emissions to account for the fact that some WBD emissions are deposited locally in the grid cell where they are emitted and are not transported. For example, barren land has a FDTF of 0.0 that means all WBD emissions are transported, whereas forested land has a FDTF of 1.0 that means all of the emissions are deposited locally and none are transported away from the cell where they are emitted. The WRAP WBD model has 6 land cover types with Agricultural and Urban assumed to have disturbed land and the other four categories assumed to have un-disturbed land. Table 26 describes the key parameters for the six land use land cover (LULC) types in the WRAP WBD model. These assumptions about disturbance were implemented for the Regional Haze planning process, where Class I area IMPROVE monitoring sites are generally distant from urban and

[19] http://www.wrapair2.org/WestJumpAQMS.aspx
[20] http://www.wrapair.org/forums/dejf/documents/WRAP_WBD_PhaseII_Final_Report_050506.pdf
[21] http://www.wrapair.org/forums/dejf/documents/AppendixA.pdf
[22] http://www.wrapair.org/forums/dejf/documents/AppendixB.pdf
[23] http://www.wrapair.org/forums/dejf/documents/WRAP_DEJF_WBDust_smry_060606.pdf
[24] http://www.wrapair2.org/pdf/WestJumpAQMS_2008_Annual_WRF_Final_Report_February29_2012.pdf

Table 26: Parameters and assumptions used in the WRAP WBD PM Emissions model.

LULC	FDTF	Disturbed	Z_0 (cm)
Barren	1.0	Un-Disturbed	0.0020
Agricultural	0.75	Disturbed	0.0310
Grassland	0.75	Un-Disturbed	0.1000
Scrubland	0.75	Un-Disturbed	0.0500
Forest	0.0	Un-Disturbed	50.0
Urban	0.0	Disturbed	50.0

other highly disturbed areas. In reality, all land cover types would have some level of disturbance at some time, whether from naturally or anthropogenically dominated causes. The level of disturbance varies in space and time, and is not explicitly known for the WestJumpAQMS 2008 study period.

WBD emissions can occur naturally in nature. However, human activities can affect WBD emissions either through stabilization of the ground surface (e.g., paving) or through disturbing or changing the ground surface. The classification of WBD emissions as anthropogenic versus natural depends on how human activity affects the land cover. We classify three levels of human activity that can affect land cover and consequently WBD emissions as follows.

Level 1: Anthropogenic Land Cover

This category includes LULC types that are clearly man-made. In Table 26 Agricultural and Urban land cover types would fall into this category.

Level 2: Human Caused Disturbed Land

Human activity can disturb a land cover type making it more emissive. For example All-Terrain Vehicles (ATVs or OHVs) can disturb a land so that it becomes emissive at and lower wind speed and has higher WBD emissions. Note that in Table 26 the four non-anthropogenic LULCs assumed un-disturbed land so these extra anthropogenic WBD emissions are not accounted for in the current WRAP WBD model simulations.

Level 3: Human Caused LULC Changes

Like Level 1, this category covers human changes in LULC from one category to another. However, in this case the changes are from one "natural" category to another "natural" category. An example of this is clear cutting for timber harvesting that turns forest land into grassland.

Due to the complexity and subjectivity of partitioning levels 2 and 3 above, ENVIRON was only able to partition land uses as either anthropogenic or natural to Level 1. This is the simplest approach using the former method above to update the Urban LULC category FDTF from 0.0 to 0.5 and classify the Agricultural and Urban LULC categories WBD PM emissions as anthropogenic and the other four LULC categories as natural (i.e., Level 1 division). The results

of this analysis are presented below in Tables 27 and 28. Figure 42 shows a spatial distribution map of windblown emissions throughout the State of Arizona.

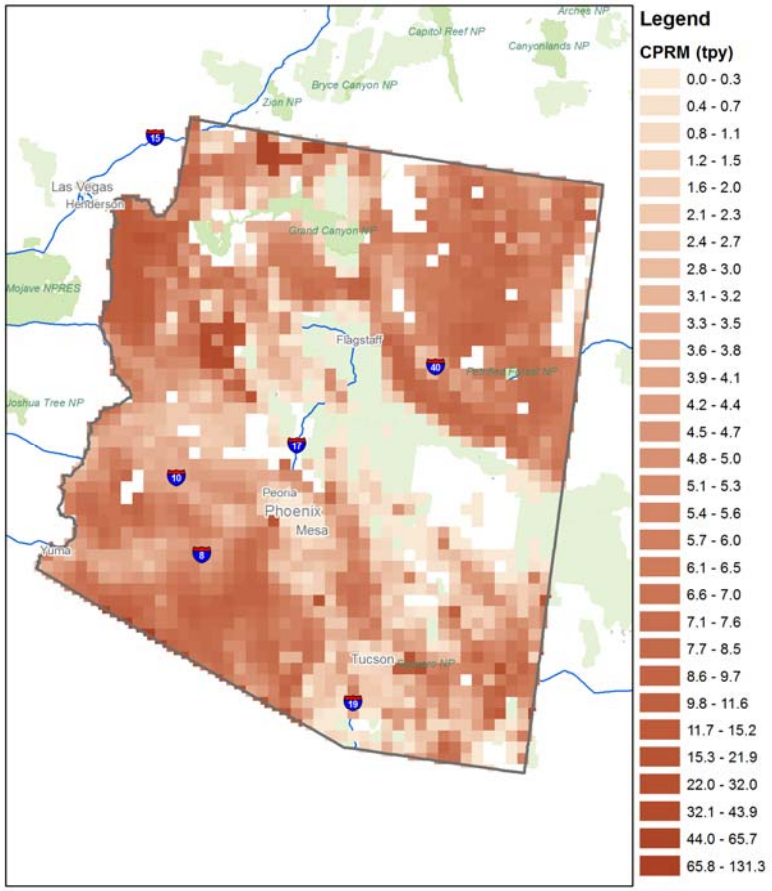
Windblown Partitioning Results

Table 27: Partitioning of 2008 Arizona Coarse and Fine PM emissions to six land use categories.

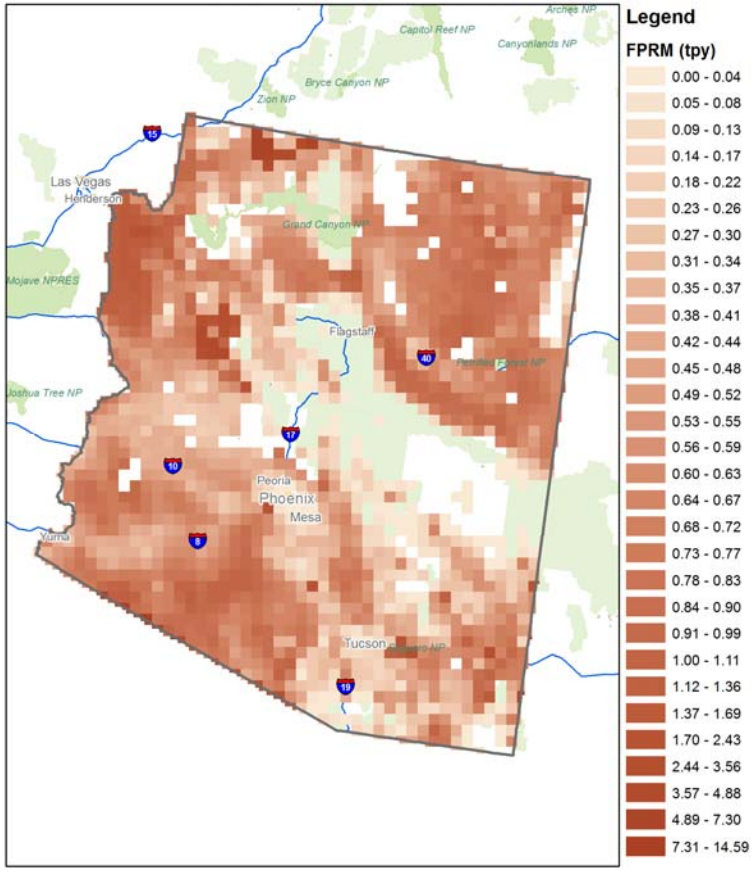
	Emissions (tpy)			
Landuse	**PMC**	**PMFINE**	**Landuse Category**	**Landuse Percent**
Agricultural	604	67	Anthropogenic	0.31%
Grassland	1,796	200	Natural	4.45%
Shrubland	78,815	8,757	Natural	62.52%
Barren	6,216	691	Natural	6.09%
Urban	0.112	0.012	Anthropogenic	0.34%
Other (forest/water)			Natural	26.29%

Table 28: Arizona Statewide Coarse and Fine PM emissions by landuse category.

Landuse Category	**PMC**	**PMFINE**	**Land use**
Natural	86,827	9,647	99.35%
Anthropogenic	604	67	0.65%



CPRM



FPRM

Figure 42: Arizona 2008 windblown dust emission

APPENDIX D

Arizona Best Available Retrofit Technology (BART) Analysis and Determination

The following sections have been revised and supersede the corresponding sections in Appendix D of Arizona's Regional Haze SIP as Submitted in 2011.

Sections VI (C), VII, IX, XII (B & C), XIII (B, C, & D)

ADEQ is <u>not revising/superseding</u> sections addressed in EPA's NFRM from December 5, 2012 (77 FR 72511).

Arizona Department of Environmental Quality Technical Support Document

May 2013

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I. EXECUTIVE SUMMARY

Sections 169A and 169B of the Clean Air Act were promulgated by Congress in the 1990 Clean Air Act Amendments with the intent of preventing any future, and remedying any existing, impairment of visibility caused by manmade sources in 156 mandatory Class I areas. Through this requirement, Congress set the goal of achieving natural visibility conditions in the Class I areas by 2064. In the interim, States are required to make reasonable progress towards the achievement of this national goal.

Title 40 CFR §§ 51.300 through 309 (the "regional haze rules") implement §§ 169A and 169B of the Clean Air Act and require States to submit state implementation plans (SIPs) to address regional haze visibility impairment in the 156 Class I areas. These SIPs are intended to be the first in a series of actions that will become long term regional haze strategies to demonstrate reasonable further progress toward the goal that Congress set. One of the tools provided to the States to address reasonable further progress is called Best Available Retrofit Technology, or BART.

The regional haze rules use the term "BART-eligible source" to describe the sources that are potentially subject to this program. BART-eligible sources are those sources that have the potential to emit 250 tons or more of a visibility-impairing air pollutant; were constructed between August 7, 1962 and August 7, 1977, and whose operations fall within one or more of the 26 specifically listed source categories. Once a facility has been determined to be BART-eligible, air dispersion modeling tools are used to determine if that facility causes or contributes to regional haze. If a State determines that the facility "emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area," then the facility is deemed to be subject-to-BART. Visibility impairing pollutants include emissions of oxides of nitrogen (NOx), sulfur dioxide (SO2) and particulate matter (PM). The term "particulate matter" includes particles with an aerodynamic diameter that is less than 10 microns (μm), and particles with an aerodynamic diameter that is less than 2.5 μm.

On June 9, 2006, ADEQ provided potential emissions information along with stack parameters for each potentially-BART-eligible facility to the Western Regional Air Partnership's (WRAP's) Regional Modeling Center, which performed a CALPUFF modeling analysis to determine the predicted visibility impairment apportioned to each facility.

On June 7, 2007, the WRAP's Regional Modeling Center provided ADEQ with the results of the CALPUFF modeling analysis. Based upon the CALPUFF modeling results, ADEQ determined that if a "potentially-BART-eligible" source's twenty-second highest (98th percentile) visibility impact across the three years of modeling was greater than 0.5 deciviews (dv) in any Class I area less than 300 kilometers away, the facility would be considered to contribute to impairment of visibility in that Class I area. Similarly, if the "potentially-BART-eligible" source's impact was found to be greater than 1.0 dv in any Class I area less than 300 kilometers away, the facility would be considered to cause impairment of visibility in that Class I area. In most cases where a "potentially-BART-eligible" source was found to have emissions that contributed to, or caused, impairment of visibility in a Class I area, ADEQ determined that the facility was "potentially-subject-to-BART." In some cases where a facility's contributions to impairment of visibility in a Class I area were within 20% of 0.5 dv, ADEQ requested that the source provide further information demonstrating that the facility was not "potentially-subject-to-BART." As a result, nine BART-eligible facilities were determined to be potentially-subject-to-BART, and one facility was recommended for further evaluation.

On July 13, 2007, eight sources that were potentially-subject-to-BART and another source that was recommended for further evaluation were provided with a set of three options: (i) demonstrate that the facility is not BART-eligible; (ii) demonstrate that while the facility is BART-eligible, it is not potentially-subject-to-BART as the facility does not cause or contribute to regional haze; or (iii) agree that the facility is potentially-subject-to-BART and conduct a BART analysis for the facility. The one potentially-subject-to-BART facility that did not receive a letter from ADEQ (Tucson Electric Power Company's Irvington Generating Station) was also subject to additional scrutiny. Due to on-going conversations and information that Tucson Electric Power (TEP) had already submitted, ADEQ did not provide that facility a letter on July 13, 2007. The ten facilities and the options that were chosen are as follows:

Option 1: Demonstrate that the facility is not BART-eligible:
TEP - Irvington Generating Station

Option 2: Demonstrate that while the facility is BART-eligible, it is not subject-to-BART:
Arizona Portland Cement Company
APS West Phoenix
ASARCO Hayden Smelter
Chemical Lime Nelson Lime Plant
Freeport-McMoRan Miami Smelter (formerly Phelps Dodge Miami Smelter)

Option 3: Conduct a BART analysis:
Catalyst Paper (Snowflake) Inc. (formerly Abitibi Consolidated) (This facility has been permanently shutdown since September 2012. A BART analysis is not being conducted for the facility)
Arizona Electric Power Cooperative (AEPCO)
APS Cholla Power Plant
SRP Coronado Generating Station

ADEQ analysis of the information that was submitted by each of the companies listed above resulted in the following determinations:

Arizona Sources That Chose to Demonstrate "Not BART-Eligible":
TEP - Irvington Generating Station

Arizona Sources That Chose to Demonstrate Not "Potentially-Subject-to-BART":
Arizona Portland Cement Company
APS West Phoenix
Chemical Lime Nelson Lime Plant

Facilities That Required a BART Analysis:
AEPCO
APS Cholla Power Plant
ASARCO Hayden Smelter
Freeport-McMoRan Miami Smelter
SRP Coronado Generating Station

With the exceptions of the ASARCO Hayden Smelter and the Freeport-McMoRan Miami Smelter, those facilities which were determined to be subject-to-BART agreed with ADEQ's June 13, 2007, letter, and submitted their own analyses of what BART should be for each facility. The Freeport-McMoRan Miami Smelter also provided information about BART applicability to its facility. While the company agreed that BART was applicable to specific emissions units, it provided arguments that the existing controls and

emissions limitations at the facility comprised BART. ADEQ reviewed these arguments and, with some supplementary information, was able to conclude that the same arguments applied to the ASARCO Hayden Smelter. After reviewing the analyses submitted, ADEQ determined that the following controls and emissions limitations constituted BART:

Table 1.1 – NO_X BART		
Facility	**BART Control**	**BART Limit**
AEPCO *	**ST1:** LNB with Flu Gas Recirculation (FGR) **ST2:** LNB with OFA **ST3:** LNB with OFA	**ST1:** 0.056 lb/MMBtu **ST2:** 0.31 lb/MMBtu **ST3:** 0.31 lb/MMBtu
APS Cholla Power Plant	**Unit 2:** LNB with Separate Over Fire Air (SOFA) **Unit 3:** LNB with SOFA **Unit 4:** LNB with SOFA	**Unit 2:** 0.22 lb/MMBtu **Unit 3:** 0.22 lb/MMBtu **Unit 4:** 0.22 lb/MMBtu
ASARCO Hayden Smelter	Not Applicable	Not Applicable
Freeport-McMoRan Miami Smelter	Not Applicable	Not Applicable
SRP Coronado Generating Station	**Unit 1:** LNB with OFA **Unit 2:** LNB with OFA	**Unit 1:** 0.32 lb/MMBtu **Unit 2:** 0.32 lb/MMBtu

* It should be noted that the proposed BART limit for ST1 will apply when ST1 operates alone or if ST1 and GT1 are operated as a combined cycle operation. The proposed BART limit does not apply to (a) GT1 in stand-alone simple cycle operation or (b) ST1/GT1 when ST1 burners are shut off and ST1 is not producing electricity.

Table 1.2 – PM_{10} BART		
Facility	**BART Control**	**BART Limit**
AEPCO *	**ST1:** Combustion of Pipeline Natural Gas (PNG) and #2 Fuel Oil **ST2:** Electro Static Precipitator (ESP) Upgrades **ST3:** ESP Upgrades	**ST1:** 0.0075 lb/MMBtu for PNG / 0.0015 lb/MMBtu for #2 Fuel Oil **ST2:** 0.03 lb/MMBtu **ST3:** 0.03 lb/MMBtu
APS Cholla Power Plant	**Unit 2:** Fabric Filter **Unit 3:** Existing Fabric Filter **Unit 4:** Existing Fabric Filter	**Unit 2:** 0.015 lb/MMBtu **Unit 3:** 0.015 lb/MMBtu **Unit 4:** 0.015 lb/MMBtu
ASARCO Hayden Smelter	Not Applicable	Not Applicable
Freeport-McMoRan Miami Smelter	Existing Controls - Primary Copper Smelting NESHAP	Primary Copper Smelting NESHAP
SRP Coronado Generating Station	Existing Hot Side ESPs	0.03 lb/MMBtu

* It should be noted that the proposed BART limit for ST1 will apply when ST1 operates alone or if ST1 and GT1 are operated as a combined cycle operation. The proposed BART limit does not apply to (a) GT1 in stand-alone simple cycle operation or (b) ST1/GT1 when ST1 burners are shut off and ST1 is not producing electricity.

Table 1.3 – SOx BART

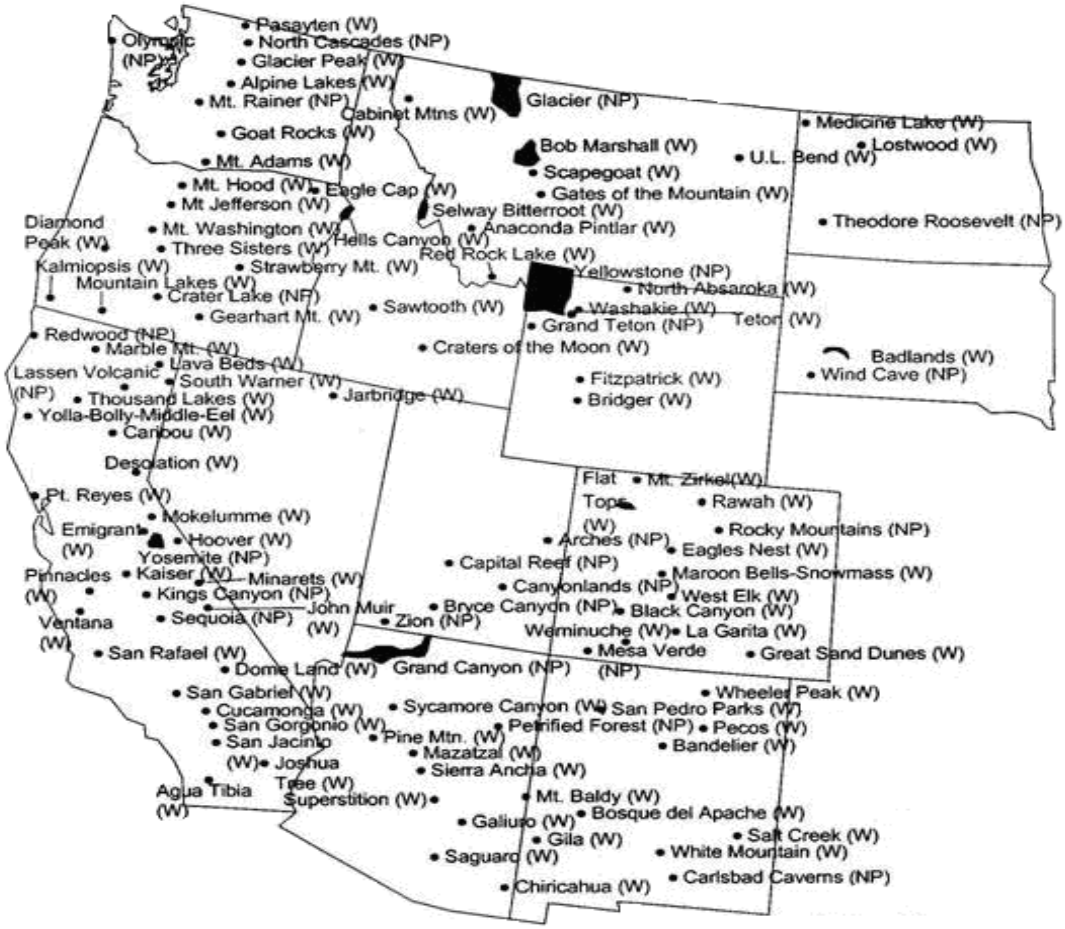
Facility	BART Control	BART Limit
AEPCO *	**ST1:** Use only PNG or #2 Fuel Oil **ST2:** Existing Wet Limestone Scrubber **ST3:** Existing Wet Limestone Scrubber	**ST1:** 0.00064 lb/MMBtu for PNG / 0.051 lb/MMBtu for #2 Fuel Oil **ST2:** 0.15 lb/MMBtu **ST3:** 0.15 lb/MMBtu
APS Cholla Power Plant	**Unit 2:** Wet Lime Scrubber **Unit 3:** Wet Lime Scrubber **Unit 4:** Wet Lime Scrubber	**Unit 2:** 0.15 lb/MMBtu **Unit 3:** 0.15 lb/MMBtu **Unit 4:** 0.15 lb/MMBtu
ASARCO Hayden Smelter	Existing Controls - Double Contact Acid Plant	Existing Controls
Freeport-McMoRan Miami Smelter	Existing Controls – Double Contact Acid Plant	Existing Controls
SRP Coronado Generating Station	**Unit 1:** Wet FGD **Unit 2:** Wet FGD	**Unit 1:** 0.08 lb/MMBtu **Unit 2:** 0.08 lb/MMBtu

* It should be noted that the proposed BART limit for ST1 will apply when ST1 operates alone or if ST1 and GT1 are operated as a combined cycle operation. The proposed BART limit does not apply to (a) GT1 in stand-alone simple cycle operation or (b) ST1/GT1 when ST1 burners are shut off and ST1 is not producing electricity.

II. Regional Haze Background

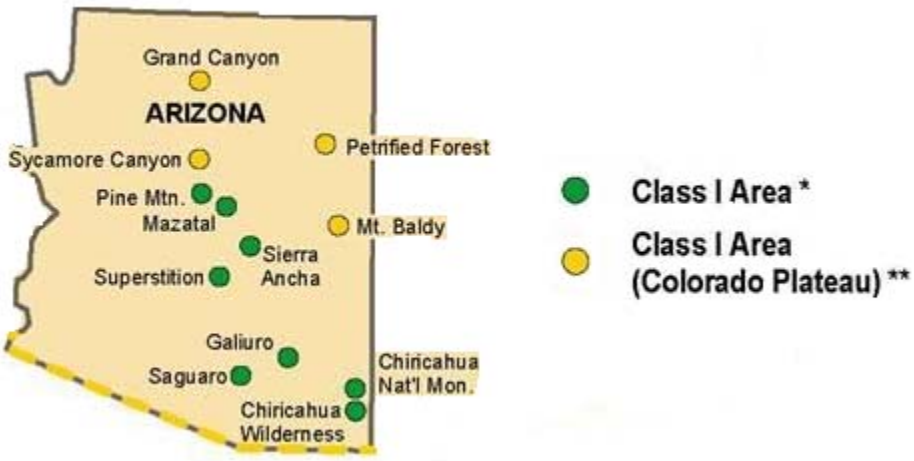
As noted in Section I, there are 156 mandatory, Federally-protected parks and wildernesses throughout the United States that make up Class I areas throughout the country. Of these Class I areas, more than 70 percent (110) are in the Western Continental United States (see Figure 2.1).

Figure 2.1: Class I Areas in the Western Continental United States



Arizona is home to 12 Class I Areas, including the Grand Canyon and Petrified Forest National Parks; the Mount Baldy, Sycamore Canyon, Pine Mountain, Mazatzal, Sierra Ancha, Superstition, Galiuro, Saguaro, and Chiricahua Wilderness Areas; and the Chiricahua National Monument (see Figure 2.2).

Figure 2.2: Arizona Class I Areas



In 1999, EPA adopted regional haze rules that address Congress' stated intent to remedy the existing visibility impairment, and to prevent future visibility impairment in the mandatory Class I areas. Congress also stated its goal that visibility in the Class I areas return to natural conditions by the year 2064. To achieve this, EPA's rules required the States to submit SIPs to address visibility impairment. Arizona's SIP must provide reasonable progress towards the national goal for the 12 Class I areas within the state, as well as address progress in those Class I areas outside Arizona that are impacted by emissions of visibility impairing pollutants originating within the State.

Title 40 CFR 51 §§ 308 and 309 both require States to address visibility impairing pollutant emissions from stationary sources. The principal tool for addressing such emissions is the requirement for specific stationary sources to install BART

III. BACKGROUND FOR BART

Clean Air Act Sections 169A(b)(2) and (g)(7) use the term "major stationary source" to describe those sources that are the focus of the BART requirement. Because this term introduces some potential confusion with other Clean Air Act requirements which also use the term "major stationary source", EPA's regional haze rules coined the term "BART-eligible source" to describe the sources that might be subject to this program. BART-eligible sources are those sources which have the potential to emit 250 tons or more of a visibility-impairing air pollutant, were put into place between August 7, 1962, and August 7, 1977, and whose operations fall within one or more of the 26 specifically listed source categories.

Once a facility has been determined to be BART-eligible, an air dispersion modeling tool is used to determine if that facility causes or contributes to regional haze. If a State determines that the facility "emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area," then the facility is deemed to be subject-to-BART. Visibility impairing pollutants include emissions of oxides of nitrogen (NOx), sulfur dioxide (SO2) and particulate matter (PM). The term particulate matter includes particles with an aerodynamic diameter that is less than 10 microns (μm), and particles with an aerodynamic diameter that is less than 2.5 μm.

The regional haze rules at 40 CFR 51.308(e)(1)(ii) require States to address any BART-eligible existing source that is determined by the State to emit any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in a Class I area. In addressing BART, the Clean Air Act requires the State to consider the following factors:

- The costs of compliance;
- The energy and non-air quality environmental impacts of compliance;
- Any existing pollution control technology already in use at the source;
- The remaining useful life of the source; and
- The degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

Over the course of the regional haze rules, there have been a number of challenges to the provisions of the rules and the methodologies prescribed or accepted by EPA. In 1999, EPA explained in its preamble to the rules that the BART requirements demonstrated Congress' intent to focus attention directly on the problem of pollution from a specific set of sources which, as determined by a State, emit any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in a Class I area.

Specifically, EPA concluded that if a potentially-subject-to-BART source was located within an area upwind from a downwind Class I area, that source "may reasonably be anticipated to cause or contribute" to visibility impairment in the Class I area. The regional haze rules address visibility impairment resulting from emissions from a multitude of sources that are located across a wide geographic area. The problem of regional haze is caused in large part by the long-range transport of emissions from multiple sources. Therefore, EPA had also concluded that when weighing the factors set forth in the statute for determining BART, the States should consider the collective impact of BART sources on visibility. In particular, when considering the degree of visibility improvement that could reasonably be anticipated to result from the use air pollution control technology, EPA explained that the State should consider the degree of improvement in visibility that would result from the cumulative impact of applying controls to all sources subject-to-BART. EPA then proposed that the States should use this analysis to determine the appropriate BART emission limitations for specific sources.

In American Corn Growers v. EPA, in addition to other challenges to the rules, industry petitioners challenged EPA's interpretations that any source with any potential impacts in any Class I area should be subject-to-BART, and that BART should be applied after considering the collective impacts of BART sources on Class I areas. In 2002, the court concluded that the BART provisions in the 1999 regional haze rule were inconsistent with the provision in the Clean Air Act, as the Act gave the "states broad authority over BART determinations." 291 F.3d at 8.

With respect to the test for determining whether a source is subject-to-BART, the court held that the method that EPA had prescribed for determining which eligible sources are subject-to-BART illegally constrained the authority Congress had conferred to the States. Although the court did not decide whether EPA's proposed general collective contribution approach to determining BART was inconsistent with the Clean Air Act, the court did state that "[i]f the [regional haze rule] contained some kind of a mechanism by which a state could exempt a BART-eligible source on the basis of an individual contribution determination, then perhaps the plain meaning of the Act would not be violated. But the [regional haze rule] contains no such mechanism." Id, at 12.

With respect to EPA's interpretation that the Clean Air Act required the States to consider the degree of improvement in visibility that would result from the cumulative impact of applying controls in determining BART, the court also found that EPA was inconsistent with the language of the Act. 291 F.3d at 8. Based on its review of the statute, the court concluded that the five statutory factors in section 169A(g)(2) "were meant to be considered together by the states." Id. At 8.

On July 6, 2005, EPA took action to address the court's vacatur of the requirement in the regional haze rule requiring States to assess visibility impacts on a cumulative basis in determining which sources are subject-to-BART. Because this requirement was found only in the preamble to the 1999 regional haze rule, EPA concluded that no changes to the regulations were required. Instead, this issue was ultimately addressed by the BART guidelines, which provided States with different techniques and methods for determining which BART-eligible sources "may reasonably be anticipated to cause or contribute to any impairment of visibility in any mandatory Class I Federal area."

The July 6, 2005, amendments to the rules also required the States to consider the degree of visibility improvement resulting from a source's installation and operation of retrofit technology, along with the other statutory factors set out in Clean Air Act § 169A(g)(2), when making a BART determination. This was accomplished by listing the visibility improvement factor with the other statutory BART determination factors in 40 CFR 51.308(e)(91)(A), so that States are now required to consider all five factors, including visibility impacts, on an individual source basis when making each source's BART determination.

IV. ARIZONA "POTENTIALLY-SUBJECT-TO-BART" DETERMINATION PROCESS

A. Identification of Potentially-BART-Eligible Emissions Units

On April 4, 2005, the Stationary Sources Joint Forum (SSJF) of the WRAP published a draft report identifying BART-eligible sources in the WRAP region[1]. This report took a broad-brush approach to reviewing existing stationary sources of air pollution in order to determine whether or not emissions units at the facility could be considered to be BART-eligible. The report explains that the following series of steps were used to identify potentially BART-eligible facilities in the WRAP region:

Step 1: Identify the facilities that are categorical sources (i.e., one of the 26 source categories);

Step 2: Identify whether or not any of the emissions units at the facility are within the date range of BART;

Step 3: Determine whether or not the potential emissions of the entire facility (all emissions units) are greater than 250 tons per year of visibility-impairing pollutants.

B. BART-Eligibility Determination

On June 15, 2005, EPA published final regulatory text and guidelines for implementing BART, including methodologies that are to be used to establish whether or not emissions units at a facility are truly BART-eligible. According to the language of the guidelines, there are three steps for determining which emissions units at a facility are considered to be BART-eligible. Those three steps are summarized as follows:

Step 1: Determine whether the plant contain emissions units in one or more of the 26 source categories:
- a. If no, then emissions units are not BART-eligible.
- b. If yes, proceed to Step 2.

Step 2: Identify the start-up dates of emissions units identified in Step 1. Determine whether the emissions units had begun operation after August 7, 1962 and were in existence on August 7, 1977:
- a. If no, then emissions units are not BART-eligible.
- b. If yes, proceed to Step 3.

Step 3: Compare the potential emissions from all emissions units identified in Steps 1 and 2. Determine whether the combined potential emissions of visibility impairing pollutants from these emissions units are greater than 250 tons per year:
- a. If no, then emissions units are not BART-eligible.
- b. If yes, then emissions units are BART-eligible.

Appendix H of the April 4, 2005, draft SSJF report that identified potentially BART-eligible sources in the WRAP Region specifically recognized a list of sources under the jurisdiction of the Arizona Department of Environmental Quality (ADEQ), the Maricopa Air Quality Department (MCAQD), the

[1] See: http://www.wrapair.org/forums/ssjf/bartsources.html

Pima County Department of Environmental Quality (PDEQ) and the Pinal County Air Quality Control District (PCAQCD). Using this list as a basis, ADEQ concluded that 14 distinct sources comprised of 42 separate emissions units in Arizona were "potentially-BART-eligible".

C. Potentially Subject-to-BART

1. Background

After determining BART-eligibility, the State must then determine whether the air pollution emission unit is "potentially-subject-to-BART". EPA finalized several options that allowed States flexibility when making the determination of whether a source "emits any pollutants which may reasonably be anticipated to cause or contribute to any visibility impairment."

Option 1: All BART-eligible sources are Subject-to-BART

EPA provided the States with the discretion to consider all BART-eligible sources within the State to be "reasonably anticipated to cause or contribute" to some degree of visibility impairment in a Class I area. EPA held that this option is consistent with the American Corn Growers court's decision, as it would be an impermissible constraint of State authority for the EPA to force States to conduct individualized analyses in order to determine that a BART eligible source "emits any air pollutant which may reasonably anticipated to cause or contribute to any impairment of visibility in any [Class I] area."

Option 2: All BART-Eligible Sources Do Not Cause or Contribute to Regional Haze

EPA also provided States with the option of performing an analysis to show that the full group of BART-eligible sources in a State may not, as a whole, be reasonably anticipated to cause or contribute to any visibility impairment in Class I areas. Although the option was provided, EPA did also state that it anticipated that in most, if not all, States BART-eligible-sources are likely to cause or contribute to some level of visibility impairment in at least one Class I area.

Option 3: Case-by-Case BART Analysis

The final option that was provided to the States was to consider the individual contributions of a BART-eligible source to determine whether the facility is subject-to-BART. Specifically, EPA allowed States to choose to undertake an analysis of each BART-eligible source in the State in considering whether each such source "emit[s] any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any [Class I] area." Alternatively, States may choose to presume that all BART-eligible sources within the State meet this applicability test, but provide sources with the ability to demonstrate on a case-by-case basis that this is not the case.

2. Arizona Process

When considering the options provided by EPA, ADEQ determined that the third option is the most consistent with the American Corn Growers case, as this option provides a rebuttable method for the evaluation of the visibility impact from a single source. If the air dispersion modeling analysis shows that a facility causes or contributes to Regional Haze, then it is required to address BART. A State is also provided with flexibility under this option, as it may exempt from BART any source that is not reasonably anticipated to cause or contribute to visibility degradation in a Class I area.

As noted in Section IV.B above, fourteen Arizona facilities were determined to be potentially-BART-eligible. On June 9, 2006, ADEQ provided potential emissions information along with stack parameters for each potentially-BART-eligible facility to the WRAP's Regional Modeling Center, which performed a CALPUFF modeling analysis to determine the predicted visibility impairment apportioned to each facility.

On June 7, 2007, the WRAP's Regional Modeling Center provided ADEQ with the results of the CALPUFF modeling analysis. Based upon the CALPUFF modeling results, ADEQ determined that if a "potentially-BART-eligible" source's twenty-second highest (98th percentile) visibility impact across the three years of modeling was greater than 0.5 deciviews (dv) in any Class I area less than 300 kilometers away, the facility would be considered to contribute to impairment of visibility in that Class I area. Similarly, if the "potentially-BART-eligible" source's impact was found to be greater than 1.0 dv in any Class I area less than 300 kilometers away, the facility would be considered to cause impairment of visibility in that Class I area. In every case where a "potentially-BART-eligible" source was found to have emissions that contributed to, or caused, impairment of visibility in a Class I area, ADEQ determined that the facility was "potentially-subject-to-BART." In some cases where a facility's contributions to impairment of visibility in a Class I area were within 20% of 0.5 dv, ADEQ requested that the source provide further information demonstrating that the facility was not "potentially-subject-to-BART." As a result, eight BART-eligible facilities were determined to be potentially-subject-to-BART, and one facility was recommended for further evaluation.

On July 13, 2007, the eight sources that were potentially-subject-to-BART and the source that was recommended for further evaluation were provided with a set of three options: (i) demonstrate that the facility is not BART-eligible; (ii) demonstrate that while the facility is BART-eligible, it is not potentially-subject-to-BART as the facility does not cause or contribute to regional haze; or (iii) agree that the facility is potentially-subject-to-BART and conduct a BART analysis for the facility.

D. Subject-to-BART Determination

Once the "universe" of potentially-BART-eligible sources has been set, the State must make a determination about which of these sources are truly subject-to-BART. In order for a source to be subject-to-BART, a State must conclude that emissions of visibility impairing pollution from a BART-eligible source may reasonably be anticipated to cause or contribute to any visibility impairment in a mandatory Class I area.

As noted in Section V.C above, ADEQ's process only resulted in the determination that certain facilities are potentially-subject-to-BART. The cause for this intermediate step was that ADEQ was unable to access emissions and stack parameter information that is recommended by the EPA BART guidelines for analyzing a facility. Instead, ADEQ relied on information that was publicly available through the Title V permit applications for each of the facilities. Each of the facilities found to be potentially-subject-to-BART was provided with the opportunity to conduct a modeling analysis using emissions estimates that are reflective of steady-state operating conditions during periods of high capacity utilization. In other words, in accordance with the EPA July 6, 2005, BART guidelines, facilities were provided with the option of using of an emissions rate based on the maximum actual emissions over a 24-hour period for the most recent five year periods as an appropriate gauge of a source's potential impact. EPA explained that this would ensure that peak emission conditions are reflected, but would not overestimate a source's potential impact on any given day.

In its analysis of potentially BART-eligible sources, ADEQ identified one facility that appeared to be BART-eligible but deferred sending a letter to that facility, as representatives of the facility were already

engaged in dialogue regarding the facility's BART eligibility. Ultimately, the facility chose to demonstrate that it was never BART-eligible.

Arizona Sources That Chose to Demonstrate "Not BART-Eligible":

- TEP Irvington Generating Station

Of the nine facilities that received ADEQ's July 13, 2007, letter, five facilities provided documentation that argued that while the facility was BART-eligible, it was not potentially-subject-to-BART. Those five facilities are as follows:

Arizona Sources That Chose to Demonstrate Not "Potentially-Subject-to-BART":

- Arizona Portland Cement Company
- APS West Phoenix
- ASARCO Hayden Smelter
- Chemical Lime Nelson Lime Plant
- Freeport McMoRan Miami Smelter

Of the facilities that received ADEQ's July 13, 2007, letter, four responded that the facilities were indeed subject-to-BART and provided an BART-analysis for the BART-eligible equipment. Those four facilities are as follows:

Arizona Sources that Agreed To Be Subject-to-BART:

- Catalyst Paper
- AEPCO
- APS Cholla Power Plant
- SRP Coronado Generating Station

V. ARIZONA SOURCES THAT CHOSE TO DEMONSTRATE "NOT BART-ELIGIBLE"

A. TEP – Irvington Generating Station

On June 9, 2006, ADEQ sent a letter to the Western Regional Air Partnership's (WRAP's) Regional Modeling Center (RMC) requesting assistance in performing a CALPUFF modeling analysis for all BART-eligible sources. In the letter and supporting attachments, ADEQ identified Steam Unit I4 at Tucson Electric Power Company's (TEP's) Irvington Generating Station as potentially-BART-eligible emissions unit. The attachment to the letter went on to describe Unit I3 as also potentially-BART-eligible, as the emissions unit appeared to have been in existence in 1961, and the "in-service" date for the unit was not well documented in the files that ADEQ had reviewed.

On January 2, 2007, TEP submitted a letter to ADEQ providing information about the BART-eligibility of both Units I3 and I4. The letter explained that the issues to which it was specifically responding were:

- For Unit I3 – the date the unit began "operation"; and
- For Unit I4 – whether the coal conversion project effectively moved its "in existence" date to later than August 7, 1977.

Regarding Unit I3, TEP noted that in order for an emissions unit to be considered BART-eligible, the unit had to be "in existence" on August 7, 1977, but not "in operation" before August 7, 1962. According to the letter, Unit I3 commenced commercial operation on June 26, 1962. As documentation, TEP provided a work log from June 29, 1962, which indicates that "…Unit [I3] was placed in commercial operation on Tuesday, June 26, 1962." After reviewing this documentation, ADEQ agrees that Unit I3 was "in operation" prior to August 7, 1962, and is, therefore, not BART-eligible.

Regarding Unit I4, TEP stated that during the 1980s, Unit I4 was converted to burn coal in accordance with a prohibition order that was issued pursuant to Section 301(c) of the Power Plant and Industrial Fuel Use Act of 1978. The Final Prohibition Order became effective on September 21, 1981, as noted in Federal Register Vol. 46, p. 37960. In its January 2, 2007, letter, TEP stated that compliance with the Final Prohibition Order required TEP to reconstruct Unit I4. According to 40 CFR 51.301, Reconstruction is defined as follows:

> *Reconstruction* will be presumed to have taken place where the fixed capital cost of the new component exceeds 50 percent of the fixed capital cost of a comparable entirely new source. Any final decision as to whether reconstruction has occurred must be made in accordance with the provisions of § 60.15(f)(1) through (3) of this title.

TEP stated that because Unit I4 was reconstructed after August 7, 1977, the Unit was not "in existence" before August 7, 1977, and, therefore, must be considered "not BART-eligible".

In an electronic mail that was sent to a representative of TEP on May 15, 2007, ADEQ requested that TEP provide additional documentation that demonstrated that Unit I4 was reconstructed in the 1980s. On July 3, 2007, TEP submitted a supplemental letter to ADEQ, with the documentation that ADEQ had requested.

According to the July 3, 2007, the total cost for the Unit I4 coal conversion was reported in the 1987 FERC Form No. 1 to be approximately $125 million dollars, including the Unit I4 portion of the facilities that are shared by Units I3 and I4 (i.e., coal handling facility, water treatment, ash storage and disposal,

etc.). In January of 1988, Unit I4 was sold in a leaseback arrangement for $152 million, which TEP argues approximates the fair market value for the Unit. TEP stated that because Unit I4 was essentially in new condition following the coal conversion, it is reasonable to conclude that the construction of a comparable new unit would not be significantly greater than $152 million. Based upon this information, TEP stated that the coal conversion cost was significantly greater than 50% of the fixed capital cost of a comparable, entirely new unit. As a result, TEP concluded that Unit I4 was reconstructed in the 1980s, effectively changing the "in existence" date to after August 7, 1977. As a result, TEP concluded that Unit I4 was "not BART-eligible".

After reviewing the information that was provided by TEP, including the relevant portions of the December 31, 1987, FERC Form No. 1 Annual Report of Major Electric Utilities, Licensees and Others, TEP's 1987 Annual Report, and a work sheet entitled "Estimated Cost of Irvington Unit 4 Coal Conversion", ADEQ concurs that the cost of modifying TEP Irvington's Unit I4 is greater than 50 percent of the fixed capital cost of a comparable, entirely new source, and that Unit I4 was reconstructed in the 1980s.

In Federal Register, Vol. 70, No. 128, Wednesday, July 6, 2005, pages 39110-39112, EPA discusses Step 2 in determining whether a facility is BART-eligible. According to the background statement in the guidance:

> "Step 2 also addresses the treatment of 'reconstruction' and 'modifications.' Under the definition of BART-eligible facility, sources which were in operation before 1962 but reconstructed during the 1962 to 1977 time period are treated as new sources as of the time of reconstruction."
>
> The footnote attached to this statement goes on to state:
>
> "However, sources reconstructed after 1977, which reconstruction had gone through NSR/PSD permitting, are not BART-eligible."

At the time of TEP's 1987 reconstruction of Unit I4, reconstruction of most units at the Irvington Generating Station would have normally triggered the New Source Review (NSR) or Prevention of Significant Deterioration (PSD) permitting process. As TEP points out in its correspondence, however, TEP only commenced the reconstruction as a result of the an order that was issued pursuant to Section 301(c) of the Power Plant and Industrial Fuel Use Act of 1978. Arizona's PSD rule (Arizona Administrative Code, Title 9, Article 3, Rule 304 or A.A.C. R9-3-304) was approved into the State Implementation Plan in 1983. According to the PSD rule, all "major modifications" were required to obtain a PSD permit prior to construction and operation of the facility. The definitions that support this rule were found in A.A.C. R9-3-101. According to R9-3-101(91)2 a major modification is defined as follows:

> "Major modification" means any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under this Chapter.
>
> a. …
> b. For the purposes of this definition the following shall not be considered a physical change or change in the method of operation:

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2 http://yosemite.epa.gov/R9/r9sips.nsf/AgencyProvision/ABAB0C337F5775248825698C0064E741/$file/az+deq+r9-3-101.pdf?OpenElement

i. …
ii. Use of an alternative fuel or raw material by reason of an order under Sections 2 (a) and (b) of the Energy Supply and Environmental Coordination Act of 1974 (or any superseding legislation) or by reason of a natural gas curtailment plan pursuant to the Federal Power Act;
iii. …
iv. …
v. …
vi. …
vii. …"

Pursuant to A.A.C. R9-3-101(90)(b)(ii), TEP's reconstruction of Unit I4 did not constitute a major modification at the time that the reconstruction occurred, and therefore Arizona's PSD rule did not apply. TEP's January 2, 2007, letter states that "TEP believes that PSD is immaterial to BART eligibility, as Reconstruction under the RHR makes no mention of PSD or any of its provisions. In fact, no where in its rules[footnote omitted] governing BART eligibility, does it state that being subject to PSD is a condition of Reconstruction under the RHR."

ADEQ has reviewed 40 CFR Part 51 Appendix Y, Section II.A.2 and has determined that EPA has addressed this issue:

"What is a 'reconstructed source?'

1. Under a number of CAA programs, an existing source which is completely or substantially rebuilt is treated as a new source. **Such 'reconstructed' sources are treated as new sources as of the time of the reconstruction.** Consistent with this overall approach to reconstruction, the definition of BART-eligible facility (reflected in detail in the definition of 'existing stationary facility') includes consideration of sources that were in operation before August 7, 1962, but were reconstructed during the August 7, 1962 to August 7, 1977 time period.

2. …

3. …

4. The 'in-operation' and 'in existence' tests apply to reconstructed sources. If an emissions unit was reconstructed and began actual operation before August 7, 1962, it is not BART-eligible. Similarly, any emissions unit for which a reconstruction 'commenced' after August 7, 1977, is not BART-eligible." (emphasis added)

ADEQ has determined that EPA's guidance does not specifically address situations where a facility was reconstructed after August 7, 1977, but was exempted from PSD review at the time that reconstruction occurred. ADEQ concludes, however, that the plain reading of EPA's guidance is most appropriate, and has determined that it is appropriate to treat reconstructed sources as new sources as of the time of the reconstruction. As a result, ADEQ concurs that the reconstructed Unit I4 at TEP's Irvington Generating Station was not "in existence" prior to August 7, 1977. Therefore, ADEQ has determined that there are no BART-eligible emissions units at TEP's Irvington Generating Station.

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VI. ARIZONA SOURCES THAT CHOSE TO DEMONSTRATE NOT "POTENTIALLY-SUBJECT-TO-BART"

A. Arizona Portland Cement Company

On June 13, 2007, ADEQ sent a letter to Arizona Portland Cement Company (APCC) indicating that Kiln 4 was "potentially-subject-to-BART" for NOx and PM emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the February 28, 2002, Amended Application for a Class I Permit, the 2005 Significant Revision Application, and observations from performance testing results which indicated that Kiln 4 had the following potential NO_X and PM emissions (Table 6.1):

Table 6.1 – Kiln 4 Emissions

Emissions Unit	NO_X Emissions (lb/hr)	PM Emissions (lb/hr)
Kiln 4	540.10	11.39

According to the letter, the WRAP's Regional Modeling Center conducted an air dispersion modeling analysis using CALPUFF which demonstrated that the maximum 98th percentile three-year average total impact from the facility was 0.40 dv. These visibility impacts were expected to occur in both the Saguaro National Monument and the Galiuro Wilderness area.

On September 10, 2007, APCC submitted a letter to ADEQ stating that it agreed that Kiln 4 was the only emissions unit that was in operation at the facility that was BART-eligible. The letter went on to state that because the 98th percentile three-year average total impact from this emissions unit was 0.40 dv, concluded that Kiln 4 does not "cause" or "contribute to" visibility impairment in any Class I area.

When weighing APCC's response, ADEQ also gave consideration to additional extenuating circumstances regarding Kiln 4. In 1998, APCC obtained a significant permit revision from ADEQ, allowing the company to modify portions of Kiln 4 in an effort to increase the amount of clinker that the company could produce while taking limitations designed to ensure that there was not a significant net emissions increase as a result of the project. After completing Phase I of the changes to Kiln 4, APCC determined that it was not realizing the additional clinker production projected to occur as a result of the modification. In 2002 and 2003, APCC approached ADEQ with a new application for a permit revision, requesting the authority to construct a new Kiln 5 rather than finalizing the modifications to Kiln 4.

In 2003, during its review of a proposed Title V permit that would have provided APCC with the flexibility to choose between three operating scenarios, including the construction of Kiln 5, EPA identified an error in APCC's fugitive dust emissions calculations. According to EPA's calculations, the modifications that were completed in 1998 should have gone through New Source Review. As a result, EPA issued a Notice of Violation to APCC, alleging that the company avoided New Source Review when completing modifications to Kiln 4 in 1998. EPA also objected to the issuance of the proposed Title V permit, but later lifted its objection after ADEQ removed the alternative operating scenarios that would have allowed for further modification of the facility. A consent decree is being finalized between APCC and EPA to resolve the issue.

In 2008, ADEQ issued a new permit to APCC which would have allowed the facility to stop operations at all four existing kilns and construct and operate a new Kiln 6. The 18 month construction window ended in June 2010 and APCC has since reapplied for a permit for the Kiln 6 expansion.

Based upon the consideration of the history of this facility, and the maximum 98th percentile three-year average impact from all pollutants is less than 0.5 dv, ADEQ concurs that APCC is not subject-to-BART.

B. APS West Phoenix

On June 13, 2007, ADEQ sent a letter to the Arizona Power Service Company's West Phoenix Generating Station indicating that three emissions units, Combined Cycle Units 1 through 3, were "potentially-subject-to-BART" for NO_X emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the July 2000 Title V Operating Permit Application, and February 24, 2006 Significant Revision Application which showed that the facility had potential NO_X emissions as follows:

Table 6.2 – APS West Phoenix NO_X Emissions

Emissions Unit	NO_X Emissions (lb/hr)	NO_X Emissions (tons/year)
Combined Cycle Unit 1 (NG)[a]	255.80	1,120
Combined Cycle Unit 2 (NG)[a]	255.80	1,120
Combined Cycle Unit 3 (SR app)[c]	405.10	1,774
Combined Cycle Unit 1 (oil)[b]	763.00	3,342
Combined Cycle Unit 2 (oil)[b]	763.00	3,342
Combined Cycle Unit 3 (SR app)[c]	405.10	1,774

a. NG indicates potential emissions while burning natural gas
b. Oil indicates potential emissions while burning oil
c. SR app means that the potential emissions were to be limited as proposed in a significant permit revision application that was submitted on February 24, 2006.

On July 30, 2007, APS West Phoenix provided documentation to ADEQ demonstrating that the facility had accepted federally-enforceable conditions in Maricopa County Air Quality Permit Number V95-006 that placed limits on emissions of air pollutants from the facility. Specifically, the permit states in Table 1 that the "Allowable Combined Emissions for CC3, CC4, CC5, the CC4 and CC5 Cooling Towers, and the Clayton Boiler Emissions Units" for NO_X was 405.1 tons per year. The same permit also limits the short term NO_X emissions for Combined Cycle Unit 3 to no more than 34.3 pounds per hour.

On September 6, 2007, APS West Phoenix submitted a letter to ADEQ identifying errors in the underlying assumptions that were the basis of ADEQ's June 13, 2007, letter. Specifically, the facility identified the following issues:

- The data used as the pound per hour emission rate for Combined Cycle Unit 3 were actually tons per year emissions limitations for multiple emissions units, rather than a pound per hour emission rate for that same unit;
- Combined Cycle Unit 3 is equipped with a Selective Catalytic Reduction (SCR) unit;

- Combined Cycle Unit 3's stack height was assumed to be 54 feet, whereas the actual stack height for the unit is 82 feet;
- The air dispersion modeling analysis used West Phoenix emissions rates associated with fuel oil combustion. The Maricopa County Air Quality Department prohibits the combustion of fuel oil except during periods of natural gas curtailments, and should not have been considered the normal operating scenario.

APS West Phoenix stated that it would fix each of these assumptions, and resubmit an air dispersion modeling analysis that was performed by the WRAP's Regional Modeling Center with the adjusted values.

On October 7, 2007, APS West Phoenix submitted a second letter to ADEQ. In that letter, APS West Phoenix explained that it agreed with ADEQ's assessment that the Combined Cycle Units CC1, CC2 and CC3 were BART-eligible. APS West Phoenix stated, however, that after correcting the air dispersion modeling analysis using the assumptions identified above, the 98th percentile visibility impacts that ADEQ had predicted in the Superstition Wilderness and the Mazatzal Wilderness areas dropped from 0.69 dv and 0.64 dv, to 0.24 dv and 0.31dv respectively.

Based on the revised air dispersion modeling analysis that was submitted on October 7, 2007, APS West Phoenix stated that it did not cause or contribute to regional haze in a Class I area, and therefore was not subject-to-BART. Based upon its review of the information that has been submitted, and a review of the conditions in Maricopa County Air Quality Permit V95-006, ADEQ concurs that this facility is not subject-to-BART.

C. ASARCO Hayden Smelter

On June 13, 2007, ADEQ sent a letter to the ASARCO Hayden Smelter indicating that Converters 1 through 5, and Anode Furnaces 1 through 3 were "potentially-subject-to-BART" for SO_2 and PM emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the 1994 Application for a Class I Permit which showed that the facility had potential SO_2 and PM emissions as follows (Table 6.3):

Table 6.3 – ADEQ Modeled Emissions for ASARCO Hayden

Emissions Unit	SO_2 emissions (lb/hr)	PM emissions (lb/hr)
Acid Plant Main Stack (Converters 1-5, Anode Furnace 1-3)	114,000	115.83
Annulus Main Stack (bypass for main stack)	114,000	115.83
Flash Furnaces and Converter Fugitives	2,991	230.00

In Attachment 3 to the June 13, 2007, letter, ADEQ also identified the equipment that, according to Title V Permit 1000042, was potentially BART-eligible. That equipment included the following:

- Converters (5) – constructed in 1969
- Anode Furnaces 1-3 – constructed in 1971

Finally, ADEQ's analysis revealed that in 2004, the actual emissions of PM_{10} from the facility was 157.3 tons per year. Because ADEQ was uncertain whether this number was representative of overall emissions of PM_{10} from the ASARCO Hayden Smelter through the years, the potential emission rate information for both SO_x and PM was submitted to the WRAP's Regional Modeling Center. Based upon the information that ADEQ submitted, the WRAP's Regional Modeling Center provided ADEQ with the following modeled impacts:

Table 6.4 – WRAP Modeled Impact from ASARCO Hayden

Class I Area	98th % 3 Yr Avg. PM_{10} Impact (dv)	98th % 3 Yr Avg. SO_2 Impact (dv)
Galiuro Wilderness	0.53	2.23
Superstition Wilderness	0.41	2.39
Sierra Ancha Wilderness	0.13	1.46
Saguaro NM	0.23	1.64
Mazatzal Wilderness	0.09	1.22
Mount Baldy Wilderness	0.04	0.76
Pine Mountain Wilderness	0.05	0.93
Chiricahua NM	0.13	1.39
Gila Wilderness	0.05	0.78
Petrified Forest NP	0.04	0.78
Sycamore Canyon	0.03	0.70

As a result, ADEQ determined that the facility was BART-eligible for PM_{10} and SO_2 emissions.

On October 1, 2007, ASARCO LLC submitted a letter to ADEQ stating that the company has already installed BART-equivalent controls on the necessary emissions units, and that further control was not necessary.

In its review of ADEQ's analysis, ASARCO pointed out that errors were made in ADEQ's identification of the BART-eligible source. According to their own research, ASARCO determined that the BART-eligible emissions units at their facility were as follows:

- Converters (3)
  - Three converters were in operation prior to 1962;
  - One converter was enlarged from 13 x 32 feet to 13 x 35 feet in 1965
  - Converters #1 and #4 were added in 1968.
- Anode Furnaces #1 and #2 – Constructed in 1972
  - Anode Furnace #0 was constructed in 2001

As a result, ASARCO went on to state that it concluded that only two or three of the converters were considered to be BART-eligible. ASARCO stated that because the air dispersion modeling analysis was performed based upon the use of the potential to emit from the entire facility, the predicted impacts from the facility were overstated. Instead, ASARCO stated that the following emissions should have been modeled (Table 6.5):

Table 6.5 – ASARCO Modeled Emissions for ASARCO Hayden			
Unit	**NO_x (tpy)**	**PM_{10} (tpy)**	**SO_2 (tpy)**
Total for BART-eligible Emission Units	21.4[a] 23.3[b]	61.1[a] 70.0[b]	6,903[a] 10,337[b]

a. 2 converters
b. 3 converters

ASARCO stated that "[i]f [PM] emissions from the BART-eligible units alone are modeled the visibility impact would be below the 0.5 dv threshold. Therefore, BART determination is necessary only for SO_2."

ADEQ has reviewed its documentation, and ASARCO's arguments regarding BART eligibility, and ADEQ agrees with ASARCO's assessment of its BART-eligible emissions unit, with the clarification that the converter that was modified in 1965 is considered BART-eligible.

At the time that ADEQ was assessing BART eligibility, ADEQ based its analysis on the potential emissions from the entire facility, as it was not possible for ADEQ staff to apportion emissions to the specific emissions units based upon the information that had been submitted by ASARCO. As a result, ADEQ provided all of the potential PM and SO_2 emissions to the Regional Modeling Center, understanding that ASARCO would have the expertise necessary to apportion emissions to each emissions unit that was BART-eligible.

With respect to PM10, the Department has determined that the PM10 potential to emit from the BART-eligible units exceeds 15 tons per year. As documented in ADEQ's comments dated March 6, 2013 on EPA's proposed rulemaking, each emission unit has to be evaluated individually against the 15 tpy threshold to assess BART applicability. Since the average PTE for each of the BART-eligible units is below 15 tpy, the units should not be subject to a BART analysis. However, Asarco has gone ahead and completed a BART analysis. ADEQ has analyzed the proposal and is incorporating it as part of this SIP.

With respect to SO2 emissions, ASARCO stated the following:

> "During the deliberations of the Market Trading forum [sic] of the Western Regional Air Partnership (WRAP), all parties involved including ADEQ and the U. S. Environmental Protection Agency (EPA), agreed that the controls and emissions limitation for primary copper smelters already met BART for SO_2."

ADEQ understands that there may have been, at one time, a general principle to which U.S. EPA, ADEQ, and perhaps other parties agreed regarding the controls and emissions limitation for primary copper smelters. According to ADEQ's interpretation of the Regional Haze Rules, and its application of EPA's BART guidelines, however, general principles are not enough to exempt a facility from a BART analysis. Instead, ADEQ has determined that it is necessary to evaluate ASARCO's facility for the potential applicability of BART.

In its letter to EPA dated March 6, 2013, ASARCO provided additional information regarding BART-eligibility for its converter units. ASARCO's review of its engineering and purchasing records has shown that Converter #2 was installed in the 1949/1950 timeframe and as such predates the BART-eligibility period. Consequently, Converter #2 will not be analyzed through the BART process.

D. Chemical Lime Company – Nelson Lime Plant

On June 13, 2007, ADEQ sent a letter to Chemical Lime Company's (CLC's) Nelson lime plant indicating that Kilns 1 and 2 were "potentially-subject-to-BART" for NO_X and SO_2 emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the November 30, 2001, Amended Application for a Class I permit, as well as air quality control permit number 36425 which showed that the facility had potential NO_X and SO_2 emissions as follows (Table 6.6):

Table 6.6 – ADEQ Modeled Emissions for CLC Nelson

Emissions Unit	SO_2 Emissions (lb/hr)	NO_X Emissions (lb/hr)
Kiln 1	215.59	122.14
Kiln 2	484.27	182.78

Using these emissions rates, and modeling information about the facility from the sources identified above, the WRAP's Regional Modeling Center provided ADEQ with the following modeled impacts (Table 6.7):

Table 6.7 – WRAP Modeled Impact from CLC Nelson

Class I Area	98th % 3 Yr Avg. NO_X Impact (dv)	98th % 3 Yr Avg. SO_2 Impact (dv)	98th % 3 Yr Avg. Total Impact (dv)
Grand Canyon NP	0.38	0.32	0.74
Sycamore Canyon WA	0.06	0.13	0.18
Zion NP	0.10	0.11	0.20
Pine Mountain Wilderness	0.03	0.08	0.10
Mazatzal Wilderness	0.03	0.08	0.11
Bryce Canyon NP	0.05	0.07	0.11
Joshua Tree NM	0.03	0.12	0.14
Sierra Ancha Wilderness	0.02	0.06	0.07
Superstition Wilderness	0.02	0.07	0.08

On September 21, 2007, CLC submitted a letter to ADEQ along with a new modeling analysis indicating that "…the 3-year average of the 8th highest visibility change is less than 0.5 dv in all Class I areas." Based upon its review of the new modeling analysis, Chemical Lime concluded that the Nelson facility did not cause or contribute to visibility impairment in any Class I area, and that the emissions units were, therefore, not subject-to-BART.

According to the documentation submitted in support of the new modeling analysis, Chemical Lime estimated its emission rates of NOx, SO_2 and PM for the BART applicability modeling analysis using the maximum production rates achieved by each kiln during the meteorological period that was modeled (a method which can result in the over prediction of actual impacts on an annual basis), and from using representative emissions factors that were derived from source testing performed at the Nelson facility. The emission rates that CLC modeled are as follows (Table 6.8):

Table 6.8 – CLC Modeled Emissions for CLC Nelson		
Emissions Unit	**SO_2 Emissions (lb/hr)**	**NO_X Emissions (lb/hr)**
Kiln 1	117.8	95.23
Kiln 2	375.5	99.20

According to ADEQ's review of the modeling analysis, none of the other fixed parameters (i.e., elevation, stack height, stack diameter, exhaust gas velocity, and exit temperature) were significantly modified in CLC's analysis. The only difference noted was that the elevation of the facility used by ADEQ was 1,570.7 meters above sea level, whereas the company reported the elevation to be 1,570.3 meters above sea level. Because the difference between the two parameters was less than half of a meter (approximately 1.5 feet) ADEQ determined that the change was not significant.

The resulting modeling impacts from the screening assessment performed by CLC, as documented in the September 21, 2007, submission and a May 28, 2009, electronic mail to ADEQ, were as follows (Table 6.9):

Table 6.9 – Modeled Impact from CLC Nelson			
Class I Area	**98^{th} % 3 Yr Avg. NO_X Impact (dv)**	**98^{th} % 3 YR Avg. SO_2 Impact (dv)**	**98^{th} % 3 Yr Avg. Total Impact (dv)**
Grand Canyon NP	0.291	0.205	0.498
Sycamore Canyon WA	0.015	0.107	0.123
Zion NP	0.054	0.081	0.136
Pine Mountain Wilderness	0.003	0.069	0.072
Mazatzal Wilderness	0.017	0.056	0.073
Bryce Canyon NP	0.026	0.048	0.074
Joshua Tree NM	0.014	0.093	0.108
Sierra Ancha Wilderness	0.010	0.039	0.049
Superstition Wilderness	0.009	0.045	0.054

As can be seen from the table above, the company's modeling analysis showed that the 98th percentile, three-year average total impact from the plant was predicted to be less than 0.5 dv for every Class I area within 300 kilometers of the facility. The company also recognized, however, that the predicted impacts within the Grand Canyon were marginally below 0.5 dv. As a result, the company stated that "[a]lthough the maximum visibility change obtained in the screening modeling analysis is not equal to or greater than the 0.5 dv contribution threshold, a refined analysis was performed in which light extinction in the Grand Canyon National Park was calculated using the CALPOST-IMPROVE implementation of the revised light extinction algorithm…" Based upon the refined analysis, the 98th percentile (8th highest) Visibility Change in the Grand Canyon was calculated to be as follows (Table 6.10):

Table 6.10 – Modeled Impact from CLC Nelson at the Grand Canyon NP				
Class I Area	98th Percentile (8th highest) Visibility Change (dv)			
	2001	2002	2003	Average
Grand Canyon NP	0.417	0.379	0.585	0.460

Based upon its refined visibility change analysis, CLC determined that the visibility change attributable to the Nelson facility is below 0.5 dv, and it concluded that the facility does not significantly contribute to visibility impairment within the Grand Canyon National Park. As a result, CLC determined that the results of the analysis indicated that the 3-year average of the 8th highest visibility change was less than 0.5 dv in all Class I areas within 300 km of the facility, and concluded that its Nelson facility was not-subject-to-BART.

Based upon the consideration of the analysis performed for this facility, CLC's conservative approach for estimating emissions impacts during the meteorological period, and the maximum 98th percentile three-year average impact from all pollutants is less than 0.5 dv, ADEQ concurs that the Chemical Lime Company's Nelson Lime Plant is not subject-to-BART.

E. Freeport McMoRan Miami Smelter

On June 13, 2007, ADEQ sent a letter to Freeport McMoRan Miami Inc (FMMI) indicating that the Miami Smelter Converters 1 through 5; the Remelt Vessel and the Acid Plant were "potentially-subject-to-BART" for SO_2 and PM emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the Air Quality Permit Number 1000046, and the application for Air Quality Permit Number 1000046 which showed that the facility had potential SO_2 and PM emissions as follows (Table 6.11):

6.11 – ADEQ Modeled Emissions from FMMI		
Emissions Unit	SO_2 Emissions (lb/hr)	PM Emissions (lb/hr)
Acid Plant Tailgas Stack (Converters 1-5)	820.0	20.40
Vent Fume Stack (Electric Furnace Stack)	312.0	56.30
Shaft Furnace Stack	0.030	4.110
Smelter Fugitives	1288	48.55
Rod Plant Fugitives	0.000	0.100

On July 17, 2007, FMMI responded stating that "although, we do not disagree with the results that the Miami facility is subject-to-BART, because the visibility impact was greater than 0.5 dv at the Superstition Wilderness area, we would like to point out some corrections in the emissions points and emissions used in the modeling." According to the letter, FMMI disputed the stack height, diameter and velocity values that were used for the Vent Fume Stack and the emissions release point and temperature for fugitive emissions from the smelter that ADEQ provided to the WRAP's RMC in its June 9, 2006, letter. FMMI also reported that the Rod Plant shaft furnace should not have been included as part of the smelter, and the acid plant preheater was installed in 1991 as part of the company's ISA modification.

On August 3, 2007, FMMI provided another letter to ADEQ, presenting several bases for streamlining the BART review for the FMMI Smelter. According to the letter, FMMI stated that it believed that only the following emissions units at the facility constituted the "source subject-to-BART":

- The Electric Furnace (installed in 1974)
- The four Hoboken Converters (Converters Nos. 2-5) (installed in 1974) ; and
- The Remelt/mold pouring Vessel (installed in approx. 1974)

FMMI then provided ADEQ with information regarding the five steps that EPA proposed in its BART guidance, but indicated that EPA provided the option for streamlining the review. According to FMMI's letter, EPA's guidance at 40 CFR Part 51, Appendix Y, § IV(C) states:

> "For VOC and PM sources subject to MACT standards, States may streamline the analysis by including a discussion of the MACT controls and whether any major new technologies have been developed subsequent to the MACT standards."

FMMI's letter goes on to provide a "streamlined review" of emissions from relevant emissions units at the FMMI smelter, and justification for the Rod Plant Shaft Furnace being separated from the BART-eligible source, as this furnace is not part of a listed source category.

After verbal discussions with ADEQ staff regarding the August 3, 2007, letter, FMMI submitted a final letter regarding the matter to ADEQ on November 29, 2007. In this letter, FMMI provided additional information to supplement the August 3, 2007, letter. In the letter, FMMI provides additional citations for the streamlined BART reviews for SO_2 and PM emissions at the Miami Smelter.

FMMI has also provided information (through its March 6, 2013 letter to EPA on the proposed rulemaking) that the remelt furnace was actually installed prior to 1962 and should not be considered a BART-eligible unit. Additionally, FMMI has provided emission estimates for NOX from the BART-eligible units documenting that the total is below 40 tons per year.

After reviewing the information that was submitted by FMMI, ADEQ agrees it is necessary to evaluate FMMI's facility for the potential applicability of BART through its process for conducting a BART analysis.

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VII. ARIZONA SOURCES THAT REQUIRED A BART ANALYSIS

Pursuant to the discussion in the previous Section, the following six facilities were identified as having to conduct a BART analyses. Due to the case-by-case nature of the BART analyses, ADEQ has included specific sections in this technical support documents for each of these facilities. A brief summary of the circumstances leading to ADEQ's subject-to-BART determinations are as follows:

A. Catalyst Paper (Snowflake) Inc. (CPSI) formerly Abitibi Consolidated

This facility was permanently shutdown in September 2012. If the facility is rebuilt, it will be required to go through New Source Review at that time. A BART analysis is not being conducted for the facility.

B. Arizona Electric Power Cooperative, Inc. - Apache Generating Station

On June 13, 2007, ADEQ sent a letter to Arizona Electric Power Cooperative Inc.'s (AEPCO's) Apache Generating Station indicating that Steam Units 1 through 3 were "potentially-subject-to-BART" for NO_X and SO_2 emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the Air Quality Permit Number 35043, and the January 6, 2005, application for Class I Permit Renewal, which showed that the facility had potential NO_X and SO_2 emissions as follows (Table 7.2):

Table 7.2 – ADEQ Modeled Emissions from AEPCO

Emissions Unit	NO_X Emissions (lb/hr)	SO_2 Emissions (lb/hr)
Steam Unit #1	264.90	0.57
Steam Unit #2	576.47	1.24
Steam Unit #3	576.47	1.24

In July of 2007, AEPCO scheduled a meeting with ADEQ to discuss its concurrence that the facility was subject-to-BART. In the meeting, AEPCO indicated that the information that was provided to the WRAP's RMC was based upon Steam Units #2 and #3 burning natural gas, rather than coal. AEPCO discussed a proposed modeling protocol with ADEQ, and explained that when modeling its baseline conditions, AEPCO would use the emission rates associated with burning coal at the facility.
On January 2, 2008, AEPCO provided its BART analysis to ADEQ. ADEQ's analysis and BART determination for AEPCO's can be found in Section XI of this document.

C. APS Cholla Power Plant

On June 13, 2007, ADEQ sent a letter to Arizona Public Service's (APS's) Cholla Generating Station indicating that Steam Units 1 through 4 were "potentially-subject-to-BART" for NO_X, PM, and SO_2 emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association, and its review of the application for Air Quality Permit Number 46353 (Table 7.3):

Table 7.3 – ADEQ Modeled Emissions from APS Cholla			
Emissions Unit	**NO_X Emissions (lb/hr)**	**PM Emissions (lb/hr)**	**SO_2 Emissions (lb/hr)**
Unit #1	279.40	38.10	304.8
Unit #2	646.40	293.80	705.10
Unit #3	644.40	87.90	351.50
Unit #4	1,086.80	384.10	3,414.40

In August of 2007, representatives of APS's Cholla Generating Station met with representatives of ADEQ to discuss some outstanding questions that the company had regarding ADEQ's analysis. During the course of that meeting, APS provided a copy of Arizona Public Service Company Correspondence that was sent to Gus Hansen, Supt. at Cholla S.E.S. entitled "Operating Notes for May 1962". According to information provided by this document, "[o]n Tuesday, May 1, 1962, unit [#1] placed into commercial operation." As a result, APS argued that Unit #1 was "in operation" prior to August 7, 1962, and therefore was not BART-eligible. After reviewing this documentation, ADEQ concurs that Unit #1 was never BART-eligible.

On September 13, 2007, APS provided a letter to ADEQ providing a schedule for the submission of a modeling protocol and conducting a BART analysis with the goal of providing the final BART analysis on December 14, 2007. In December of 2007, ADEQ received the BART analysis. ADEQ's analysis and BART determination for the APS Cholla Power Plant can be found in Section XI of this document.

D. ASARCO Hayden Smelter

As discussed in Section VI.C of this document, ADEQ has determined that a BART analysis regarding SO_2 emissions from this facility must be completed. ADEQ's review and determination based upon its own analysis of the facts and the information that ASARCO had provided can be found in Section XII of this document.

E. Freeport-McMoRan Miami Smelter

As discussed in Section VI.E of this document, ADEQ has determined that a BART analysis regarding PM and SO_2 emissions from this facility must be completed. ADEQ's review and determination based upon its own analysis of the facts and the information that Freeport-McMoRan Miami Inc. had provided can be found in Section XIII of this document.

F. SRP Coronado Generating Station

On June 13, 2007, ADEQ sent a letter to Salt River Project's (SRP's) Coronado Generating Station indicating that Units 1 and 2 were "potentially-subject-to-BART" for PM, SO_2 and NO_X emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association, and its review of the August 21, 2003 Application for Class I Permit Renewal which showed that the facility had potential NO_X, PM, and SO_2 emissions as follows (Table 7.4):

Table 7.4 – ADEQ Modeled Emissions for SRP Coronado			
Emissions Unit	**NO_X Emissions (lb/hr)**	**PM Emissions (lb/hr)**	**SO_2 Emissions (lb/hr)**
Unit #1	3,303	472	3,775
Unit #2	3,303	472	3,775

On August 22, 2007, representatives of SRP's Coronado Generating Station met with ADEQ to discuss issues that were unique to the Coronado Generating Station, including a potential settlement with EPA regarding alleged New Source Review violations that would address NO_X and SO_2 emissions. In addition, the company provided a proposed response to ADEQ's request for a BART analysis.

In February 2008, SRP provided its BART analysis to ADEQ. On August 12, 2008, EPA announced a "…major Clean Air Act (CAA) New Source Review (NSR) settlement agreement with [SRP]…" EPA explained that "[u]nder the settlement, SRP will spend over $400 million between now and June 2014, to install state-of-the-art pollution control technology for the reduction of sulfur dioxide (SO_2) and nitrogen oxides (NO_x)."

ADEQ's analysis and BART determination for the SRP Coronado Generating Station can be found in Section XIV of this document.

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VIII. ARIZONA BART DETERMINATION PROCESS

Clean Air Act § 169A(g)(7) directs States to consider five factors in making BART determinations. The regional haze rule codified these factors in 40 CFR § 51.308(e)(1)(ii)(B), which directs States to identify the "best system of continuous emissions control technology" taking into account "the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use at the source, and the remaining useful life of the source."

The visibility BART regulations define BART as meaning "…an emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by … [a BART-eligible source]. The emission limitation must be established on a case-by-case basis, taking into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control requirement in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology."

In its guidance, EPA was clear that each State must determine the appropriate level of BART control for each source that is determined to be subject-to-BART. In making a BART determination, a State must consider the following factors:

- The costs of compliance;
- The energy and non-air quality environmental impacts of compliance;
- Any existing pollution control technology in use at the source;
- The remaining useful life of the source; and
- The degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

It appears to ADEQ that BART is a close kin to Best Available Control Technology (BACT). Both control technology requirements are based upon similar concepts, including the fact that both are conducted on a case-by-case basis, and both may constitute the application of production processes or available methods, systems and techniques to reduce air pollution emissions. The most significant difference between the two appears to be that BART must accommodate issues associated with retrofitting existing equipment with new air pollution controls that were not included in the initial design of the facility. Since the concepts between the two technology requirements are reasonably similar, ADEQ has determined that it is reasonable method for conducting a BART analysis is following the BACT methodology, taking specific care to address all five of the BART factors.

The Department's framework for performing a BART analysis comprises the following seven key steps:

1. Identify the existing control technologies in use at the source (BART factor 3);
2. Identify all available retrofit control technologies with practical potential for application to the specific emission unit for the regulated pollutant under evaluation;
3. Eliminate all technically infeasible control technologies;
4. Evaluate control effectiveness of remaining technologies;
5. Evaluate energy and non-air quality environmental impacts and document results (BART factors 1, 2 and 4); and
6. Evaluate visibility impacts (BART factor 5).
7. Select BART

Materials considered by the applicant and by the Department in identifying and evaluating available control options include the following:

- Entries in the RACT/BACT/LAER Clearinghouse (RBLC) maintained by the U.S. EPA, is the most comprehensive and up-to-date listing of control technology determinations available;
- Information provided by pollution control equipment vendors;
- Information provided by industry representatives; and
- Information provided by other Regional Planning Organizations and State permitting authorities.

Step 1: Identify the Existing Control Technologies in Use at the Source

This step is in addition to the five steps that are recommended in Section IV.D of 40 CFR Part 51, Appendix Y ("EPA's BART guidelines"). Of the four facilities that have agreed that they are "potentially-subject-to-BART", two are already in a process of designing or installing new air pollution control devices on emissions units that are "potentially-subject-to-BART". Since the installation of these controls was not required by BART, ADEQ determined that it was appropriate to include a step that described the existing control technologies that provide the baseline against which BART will be judged.

Step 2: Identify All Available Retrofit Control Options

This step is functionally equivalent to Step 1 in EPA's BART guidelines.

At the outset of any BART analysis, EPA's guidelines suggest that States should consider all control options that have potential application to the emissions unit, regardless of technical feasibility. This includes having an understanding of other required controls, including those technologies that are required under BACT or Lowest Achievable Emissions Rate (LAER) determinations, pollution prevention practices, the use of other add-on controls, and upgrades to existing air pollution controls that are already in place. As with BACT and LAER determinations, control alternatives can also take into account technology transfer of controls that have been applied to similar source categories. Unlike some permitting authorities' BACT and LAER procedures, however, BART does not contain a requirement to redesign the source when considering available control alternatives. For example, an existing pulverized-coal-fired electricity generating facility should not be required to consider integrated gasification coal combustion during the BART process, as BART focuses on technologies that can be retrofitted to the existing equipment.

In BACT and LAER determinations, any New Source Performance Standard (NSPS) or National Emissions Standard for Hazardous Air Pollutants (NESHAP) that exists for a source category is considered to the "floor" level of control, meaning that any proposed emission rate or control technology that is less stringent than the NSPS or NESHAP is not acceptable. Because BART involves retrofitting technology to existing emissions units that are not undergoing a major modification, it is possible, albeit unlikely, that an NSPS or NESHAP for a source category might not be the "floor" control for BART. Regardless, where a NSPS or NESHAP exists for a source category, EPA has directed States to include a level of control equivalent to the NSPS or NESHAP as one of the control options to be considered.

For some emissions units that are subject-to-BART controls, the actual control measures or devices that comprise BART may already be in place. In such instances, the BART analysis should consider

improvements to the existing controls or emissions limitations for those emissions units, and should not be limited to consideration of only the control devices themselves.

Finally, in some cases, if a State determines that a BART source already has controls in place which are the most stringent controls available, then it may not be necessary to comprehensively complete each following step of the BART analysis. EPA's guidance states that as long as the most stringent controls are made federally enforceable for the purposes of implementing BART for that source, a State may skip the remaining analyses, including the visibility analyses. Likewise, if a source commits to the most stringent level of BART control at the outset, then EPA's guidance suggests that there is no need to complete the remaining steps of the BART process.

Step 3: Eliminate All Technically Infeasible Control Options

This step is functionally equivalent to Step 2 in EPA's BART guidelines.

In this step, States are to evaluate the technical feasibility of the control options that were identified in Step 1. EPA's guidance generally considers a control option to be technically feasible if the controls have either: (1) been installed and operated successfully under similar conditions for the type of source under review, or (2) are available and could be applicable to the source under review. EPA's guidance states that a technology should be considered to be available if the source owner may obtain the control device through commercial channels, or the control is otherwise available within the common sense meaning of the term. Similarly, EPA considers an available control technology to be "applicable" if the control can be reasonably installed and operated on the source type that is under review. If a technology is considered to be both available and applicable, a State should consider the technology to be technically feasible.

If a technology is determined to be technically infeasible, then the State should provide documentation that demonstrates that the control is technically infeasible. EPA's guidance suggests that documentation that would be considered acceptable includes an explanation, based on physical, chemical, or engineering principles, as to why the control is technically infeasible and a discussion regarding why technical difficulties would preclude the successful use of the control option on the emissions unit under review.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

This step is functionally equivalent to Step 3 in EPA's BART guidelines. EPA's guidelines state that there are two key issues that must be addressed in this step:

(1) States should ensure that the degree of control is expressed using a metric that ensures an "apples to apples" comparison of emissions performance levels among the options; and

(2) States should give appropriate treatment and consideration of control techniques that can operate over a wide range of emission performance levels.

When choosing an appropriate metric, EPA recommends selecting a metric that properly allows for the comparison of an inherently lower polluting process with a process that can only be addressed through the application of additional pollution controls. As a result, EPA has suggested that it is generally most effective to express emissions performance as an average steady state emissions level per unit of product produced or processed (i.e., pounds per million BTU, or pounds per ton of cement produced).

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

This step is functionally equivalent to Step 4 in EPA's BART guidelines. After identifying the available and technically feasible control technology options, States are expected to analyze the following when making a BART determination:

- Costs of Compliance
- Energy Impacts
- Non-air Quality Environmental Impacts
- Remaining Useful Life.

Each State is responsible for presenting an evaluation of each impact along with appropriate supporting information. States should discuss and, where possible, quantify both beneficial and adverse impacts. In general, the analysis should focus on the direct impact of the control alternatives.

Costs of Compliance

In the regional haze rules and its BART guidance document, EPA has stated that States have flexibility in how costs are calculated. EPA has expressed its position that the Control Cost Manual provides a good reference tool for cost calculations, but also provided some flexibility in this matter. If there are elements or sources that are not addressed by the Control Cost Manual, or if there are additional cost methods that were not considered in the BART guidance document, EPA determined that these methods could serve as useful supplemental information.

EPA's guidance also explains that States should consider both the average and incremental annualized costs of a control, as both provide information that is helpful when making a control determination. EPA took great care to explain, however, that these kinds of calculations can be misused, and that both numbers should be reviewed carefully.

In its guidance, EPA provided an example where a State may be faced with choosing between two available control options. The first control option (Option A) achieves a good level of control for a reasonable cost. The second control (Option B) achieves a slightly greater emissions reduction at a significantly increased cost. In this scenario, EPA explained that if only the average costs for Options A and B were considered, the overall costs associated with Options and B would be considered reasonable. EPA stated that while this may seem sufficient, a State should continue to look at the cost associated with a small increase in pollution control for a significantly greater price. EPA called this cost the "incremental cost" and explained that it can be determined through the following equation:

$$\frac{[CostOptionA - CostOptionB]}{[TotalAnnualEmissionsOptionA - TotalAnnualEmissionsOptionB]}$$

EPA explained that by considering this incremental cost, a State may determine that the incremental cost per unit of pollution removed that is associated with Option B may be greater than the benefit of requiring the control. As a result, even though the average cost associated with both controls might be reasonable, the incremental cost may make one option more desirable than the other.

As stated in the introduction to this Section, ADEQ sees the BART determination process as being substantially similar to the BACT processes. While BACT has components that address visibility, the principal cost decisions are generally charged only to the pollutant that is being reduced. Visibility

impacts, on the other hand, are quantified and considered as an environmental impact, rather than an economic impact. As a result, the most useful cost metric for comparing control technologies under BACT and LAER ends up being dollars-per-ton-of-pollutant-removed (dollars per ton).

Although the BART determination process is substantially similar to methodologies that are used to establish BACT and LAER, the entire purpose behind BART is to support Congress' goal of reducing visibility impairment in Class I areas. In addition, BART differs from BACT and LAER in that the environmental impacts of the selected control can only address issues that are not related to air quality. As a result, ADEQ has determined that in addition to a dollar per ton metric, the BART determination process should also provide lesser consideration to a dollar-per-deciview-improvement metric.

Energy Impacts

In its guidance, EPA suggests that States should also examine the energy requirements of the control technology to determine whether the use of that technology will result in energy penalties or benefits. For instance, if a control technology is required to remediate an emissions stream that is rich in volatile organic compounds, a facility might benefit by using this combustion process to reduce energy costs. Conversely, a facility that installs a wet scrubber may suffer an energy penalty due to the increased power necessary to overcome the increased air flow resistance through the scrubber.

It should be noted that unless there is ample justification, only direct energy benefits or penalties should be considered in this analysis. Indirect energy costs should not be considered unless there is something unusual or significant enough to warrant further consideration. It is appropriate for energy impact analyses to consider the local availability (or scarcity) of specific fuels, as well as the potential differences between locally or regionally available coals.

It is also important to note that adverse energy impacts are not enough, in and of themselves, to disqualify a technology from consideration. If such penalties or benefits exist, however, it is appropriate to document these and include them in this section so that the results of all of the analyses required in this Step can be considered as a whole.

Non-Air Quality Environmental Impacts

This portion of the analysis is to focus on impacts to environmental media other than air quality. Examples of common environmental impacts include hazardous waste generation, hazardous waste discharges, and discharges of polluted water from a control device.

All non-air quality environmental impacts should be reviewed using site-specific circumstances when possible. Should a State propose to adopt the most stringent BART option then it is not necessary to perform this analysis of environmental impacts for the entire list of technologies that were ranked in the previous Step. In general, the analysis only needs to address those control alternatives with any significant or unusual environmental impacts that have the potential to affect the selection of a control alternative, or to eliminate a more stringent control technology.

In general, States should identify and document any direct or indirect, significant or unusual environmental impacts that are associated with a specific control alternative. For example, a wet scrubber will release effluent that has the potential to affect water or land use. Other examples might include disposal of spent catalyst, or contaminated carbon from a filtration device. Such types of environmental impacts could become even more important with the potential for sensitive site-specific receptors, or

when comparing control technologies that have similar or marginal air quality improvements but result in substantial environmental impacts.

Remaining Useful Life

The remaining useful life of a source should be considered in the evaluation of the different controls, as it has the potential to impact the overall cost analysis. If the remaining useful life represents a relatively short period of time, then the annualized costs associated with the application of a control technology will increase significantly. EPA explained in its guidelines that the remaining useful life is the difference between the date that controls will be put into place and the date that the facility permanently stops operations.

If the remaining useful life of the facility affects the BART determination, then this date should be placed into a federally or State-enforceable restriction that prevent further operation of that facility after that date. If a source wants to have the flexibility to continue operating after the date upon which operations are expected to cease, then the BART analysis may account for the option, but it must maintain consistency with the statutory requirement to install BART within 5 years. In addition, if the remaining useful life changes the BART decision as a result of adverse cost impacts, then the BART determination should identify the more stringent level of control that would be required as BART if there was no assumption that reduced the remaining useful life of the facility.

Step 6: Evaluate Visibility Impacts

This step is functionally equivalent to Step 5 in EPA's BART guidelines.

Once a State has determined that its source or sources are subject-to-BART, a visibility improvement determination for the source(s) must be conducted as part of the BART determination. States have the flexibility in setting absolute thresholds, target levels of improvement, or de minimis levels for visibility improvement since the deciview improvement must be weighed among the five factors. States are also free to determine the weight and significance to be assigned to each factor. For example, a 0.3 dv improvement may merit a stronger weighting in one case versus another. As a result, EPA does not recommend a "bright line" analysis to be used across all facilities that are subject-to-BART.

EPA's guidelines recommend the use of CALPUFF or another appropriate dispersion model to determine the visibility improvement expected at a Class I area from the potential BART control technology applied to the source. Modeling should be conducted for NO_X emissions, direct PM emissions ($PM_{2.5}$ or PM_{10}), and SO_2 emissions. If the source is making the visibility determination, States should review and approve or disapprove the source's analysis before making the expected improvement determination.

Arizona instituted a portion of this process by asking sources for a modeling protocol for each of the BART analyses that were submitted. Each source was then asked to run its model at pre-control and post-control emission rates using the accepted methodology in the protocol. Sources used the 24-hour average actual emissions rate from the highest emitting day of the meteorological period modeled, and calculated the model results for each receptor as the change in deciviews compared against natural visibility conditions. Post-control emissions rates were then calculated as a percentage of pre-control emissions rates.

Step 7: Select BART

This step is in addition to the five steps that are recommended in EPA's BART guidelines.

States have discretion to determine the order in which they should evaluate control options for BART. EPA's guidance states that whatever the order, States should always address the five factors. In addition, States should provide a justification for whatever control option is selected. ADEQ has determined that the contents of the TSD will provide the necessary explanations.

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IX. CATALYST PAPER (SNOWFLAKE) INC. (CPSI) FORMERLY ABITIBI CONSOLIDATED) BART ANALYSIS AND DETERMINATION

This facility was officially shutdown in September 2012. If the facility is rebuilt, it will be required to go through New Source Review at that time. A BART analysis is not being conducted for this facility.

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X. ARIZONA ELECTRIC POWER COOPERATIVE – APACHE GENERATING STATION BART ANALYSIS AND DETERMINATION

A. Process Description

The Apache Generating Station consists of seven electric generating units (two coal/natural gas-fired steam electric units, a natural gas/fuel oil-fired steam electric, combined cycle unit, and four natural gas/fuel oil-fired turbines) with a total generating capacity of 560 megawatts (MW). The power plant is located approximately 3 miles southeast of the town of Cochise in the Wilcox Basin in Cochise County, Arizona. Apache Steam Unit 1 is a wall-fired steam electric generating unit that can burn natural gas and numbers 2 through 6 fuel oils. The unit is permitted to produce up to a maximum capacity of 85 MW of electricity. Steam Units 2 and 3 are 195 MW natural gas and coal-fired steam electric generating units equipped with dry-bottom turbo-fired coal boilers manufactured by Riley Stoker.

The remaining four units at the Apache Generating Station are simple cycle gas turbines. Steam Unit 1 and Gas Turbine 1 can be operated separately or in a combined cycle configuration.

B. Description of Emissions Units Subject to Best Available Retrofit Technology (BART)

Apache Generating Station Units 1, 2, 3 are potentially subject-to-BART because:

1. These units belong to one of the 26 categorical sources;
2. These units were in existence on August 7, 1977;
3. Emissions of visibility impairing pollutants from all BART-eligible emissions units - nitrogen oxides (NO_X), sulfur dioxide (SO_2), and particulate matter (PM) – are greater than 250 tons per year for each pollutant.

The simple cycle gas turbines at the Apache Generating Station are not BART-eligible, and therefore were not considered as part of this analysis.

C. Impact on Visibility

CALPUFF modeling was performed at nine Class I areas that are located within 300 kilometers of the Apache Generating Station. Table 10.1 provides the baseline maximum impact on visibility in deciview (98th percentile, 3-year average).

Table 10.1 – Modeled Baseline Impact on Visibility

Affected Class I Area	Unit 1 (dv)	Unit 2 (dv)	Unit 3 (dv)
Chiricahua NM	2.75	2.47	2.37
Galiuro Wilderness	1.58	1.92	1.75
Saguaro NP	1.98	1.69	1.55
Gila Wilderness	0.45	0.76	0.69
Superstition	0.98	1.49	1.35

Table 10.1 – Modeled Baseline Impact on Visibility			
Affected Class I Area	**Unit 1 (dv)**	**Unit 2 (dv)**	**Unit 3 (dv)**
Wilderness			
Mt. Baldy Wilderness	0.32	0.45	0.41
Sierra Ancha Wilderness	0.62	0.89	0.80
Mazatzal Wilderness	0.81	0.85	0.76
Pine Mountain Wilderness	0.68	0.68	0.61

The impact of Units 1, 2, and 3 on the visibility in at least one Class I area is more than 0.5 Deciviews. Therefore, per 40 CFR Part 51, Appendix Y, these units cause or contribute to visibility impairment and are subject-to-BART.

D. Steam Unit 1 (ST1)

D.1 NO_X BART Analysis

NO_X formation in fossil fuel-fired boilers is a complex process that is dependent on a number of variables, including operating conditions, equipment design, and fuel characteristics. A NO_X BART analysis was completed for the cases when ST1 burns 100 percent pipeline natural Gas (PNG), 100 percent No. 6 fuel oil (this was done as a test case, as AEPCO has never combusted No. 6 fuel oil in the unit), and 100 percent No. 2 fuel oil.

Formation of NO_X

During combustion, NO_X forms in three different ways: thermal NO_X, fuel NO_X, and prompt NO_X. When combusting PNG, the most dominant source of NO_X is from thermal NO_X, which results from high-temperature fixation of atmospheric nitrogen in the combustion air. Because PNG generally contains small quantities of nitrogen, the overall contribution from fuel NO_X is small, whereas a significant amount of fuel NO_X can be generated from fuel oil combustion. A very small amount of NO_X is called "prompt" NO_X. Prompt NO_X results from an interaction of hydrocarbon radicals, nitrogen, and oxygen.

Step 1: Identify the Existing Control Technologies in Use at the Source

There is no NO_X emissions control equipment installed on ST1.

Step 2: Identify All Available Retrofit Control Options

The second step of the BART process is to evaluate NO_X control technologies with practical potential for application to ST1, including those control technologies identified as BACT or LAER by permitting

agencies across the United States. ST1 NO_X emissions are currently controlled through the use of good combustion practices.

The following potential NO_X control technology options were considered:

- New LNBs with OFA
- Flue Gas Recirculation (FGR)
- Rotating Opposed Fire Air (ROFA)
- LNBs with selective non-catalytic reduction system (SNCR and Rotamix)
- LNBs with selective catalytic reduction system (SCR)
- Neural Net Controls

New LNBs with OFA System. The mechanism used to lower NO_X with LNBs is to stage the combustion process and provide a fuel-rich condition in the initial stages of combustion; this is so oxygen needed for combustion is not diverted to combine with nitrogen resulting in the formation of NO_X. Fuel-rich conditions favor the conversion of fuel nitrogen to nitrogen dioxide (N2) instead of NO_X. Additional air (or OFA) is then introduced downstream in a lower temperature zone to burn out the char, or remaining uncombusted fuel. Both LNBs and OFA are considered to be a capital cost, combustion technology retrofit that may require water wall tube replacement.

FGR. FGR generally extracts flue gas from downstream of the economizer or air heater and is mixed into the combustion air duct. This recirculation can be achieved with a new FGR fan or by using the existing forced-draft fan to inject the flue gas into the combustion air (induced flue gas recirculation [IFGR]). Flue gas recirculation adds oxygen-lean, heat-absorbing mass to the combustion air, thus lowering the combustion temperature and reducing thermal NOx emissions.

ROFA. Mobotec markets ROFA as an improved, second-generation OFA system. Mobotec states that "the flue gas volume of the furnace is set in rotation by asymmetrically placed air nozzles. Rotation is reported to prevent laminar flow, so that the entire volume of the furnace can be used more effectively for the combustion process. In addition, the swirling action reduces the maximum temperature of the flames and increases heat absorption. The combustion air is also mixed more effectively."

A typical ROFA installation will have a booster fan(s) to supply the high velocity air to the ROFA boxes. Mobotec would propose one 700 horsepower fan for ST1. Mobotec's budgetary proposals included expected NOx emission rates for PNG and No. 2 and No. 6 fuel oils, and are presented in Table 2. While a typical installation does not require modifying an installed LNB system, and the existing OFA ports are not used, results of computational fluid dynamics modeling will determine the quantity and location of new ROFA ports. Although not specifically identified, Mobotec generally includes bent tube assemblies for OFA port installation if required. Mobotec does not provide installation services, because they believe that the owner can more cost-effectively contract for these services. However, they do provide one onsite construction supervisor during installation and startup.

SNCR. SNCR is generally used to achieve modest NOx reductions on smaller units. With SNCR, an amine-based reagent such as ammonia—or more commonly urea—is injected into the furnace within a temperature range of 1,600 degrees Fahrenheit (°F) to 2,100°F, where it reduces NO_X to nitrogen and water. NO_X reductions of up to 60 percent have been achieved, although 20 to 40 percent is a more realistic expectation for most applications. Reagent utilization, which is a measure of the efficiency with which the reagent reduces NO_X, can range from 20 to 60 percent, depending on the amount of reduction, unit size, operating conditions, and allowable ammonia slip. With low-reagent utilization, low temperatures, or inadequate mixing, ammonia slip occurs, allowing unreacted ammonia to create

problems downstream. Typical problems include rendering the fly ash unsellable, reacting with sulfur to foul heat exchange surfaces, or creating a visible stack plume. Reagent utilization can have a significant impact on economics in that each incrementally higher level of NO_X reduction generally results in lower reagent utilization and higher operating cost.

Reductions from higher baseline concentrations (inlet NO_X) are lower in cost per ton, but result in higher operating costs, due to greater reagent consumption. Budgetary proposals were received from Mobotec for their Rotamix system, and previous Fuel Tech proposal information for other projects was used.

SCR. SCR works on the same chemical principle as SNCR but instead uses a catalyst to promote the chemical reaction. Ammonia is injected into the flue-gas stream, where it reduces NO_X to nitrogen and water. Unlike the high temperatures required for SNCR, in SCR the reaction takes place on the surface of a vanadium/titanium-based catalyst at a temperature range between 580°F and 750° F. Due to the catalyst, the SCR process is more efficient than SNCR and results in lower NO_X emissions.

Neural Net Controls. Information regarding neural net controls was received from NeuCo, Inc. While NeuCo offers several neural net products, CombustionOpt and SootOpt provide the potential for NOx reduction. NeuCo stated that these products can be used on most control systems and can be effective even in conjunction with other NO_X reduction technologies. NeuCo predicts that CombustionOpt can reduce NO_X by 15 percent, and SootOpt can provide an additional 5 to 10 percent. Because NeuCo does not offer guarantees on this projected emission reduction, a nominal reduction of 15 percent was assumed for evaluation purposes.

Because NeuCo does not guarantee NO_X reduction, ADEQ has determined that the estimated emission reduction levels provided cannot be considered as reliable projections. Therefore, neural net should be considered as a supplementary or "polishing" technology, but not on a "stand-alone" basis.

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the identified control technologies are technically feasible.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

Table 10.2 lists the various control technologies and estimated emissions rates.

Table 10.2 – NO_X Control Technology Emission Rate Ranking

Technology	Source of Estimated Emissions	Estimated Emission Rate[4] (PNG)	Estimated Emission Rate (No. 6 Fuel Oil)[d]	Estimated Emission Rate (No. 2 Fuel Oil)[d]
LNB with FGR[e]	Coen	0.056	0.15	0.06
ROFA[b]	Mobotec	0.08	0.16	0.08
ROFA with Rotamix[b]	Mobotec	0.06	0.11	0.06
LNB with FGR, SNCR	Coen & Fuel Tech	0.06[c]	0.11[c]	0.05[c]
SCR[a]	CH2M Hill	0.07	0.07	0.07

[a] SCR estimated NO_X emissions rate is the same for all scenarios. Operating cost would be affected by inlet NO_X levels.
[b] Calculated from Mobotec proposal information fuel baselines (47 percent reduction for ROFA and additional 30 percent for Rotamix)
[c] From Previous Fuel Tech Proposal at 25 percent reduction
[d] Results are in lb/MMBtu
[e] From Coen Proposal

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

This step involves the consideration of energy, environmental, and economic impacts associated with each control technology. The remaining useful life of the plant is also considered during the evaluation.

Energy Impacts

Installation of LNBs is not expected to significantly impact the boiler efficiency or forced-draft fan power usage. Therefore, these technologies will not have energy impacts. The Mobotec ROFA system requires installation and operation of one 700 horsepower ROFA fan (522 kilowatts [kW] total). An estimated auxiliary power requirement for an SNCR system for an 85-MW (with the 10-MW combustion turbine included) unit is estimated at 85 kW. The same estimate was used for Rotamix. SCR retrofit impacts the existing flue gas fan systems, due to the additional pressure drop associated with the catalyst, which is typically a 6- to 8-inch water gage increase.

Environmental Impacts

Environmental impacts associated with SCR and SNCR involve the hazards associated with the storage of ammonia, especially if anhydrous ammonia is used, and the transportation of the ammonia to the power plant site.

Economic Impacts

Costs and emissions estimates for the LNBs, SNCR, and SCR were obtained from equipment vendors. Costs for the ROFA and Rotamix systems were obtained from Mobotec. A comparison of the technologies on the basis of costs, design control efficiencies, and tons of NO_X removed is summarized in Table 10.3. The capital costs shown in Table 3 are applicable for all of the fuels under consideration, and No. 6 fuel oil was used as the basis to determine worst-case emission levels. For example, if LNBs are installed for PNG, the burner costs include the capability to burn both PNG and No. 2 and 6 fuel oils (with only minor equipment modification, atomization changes, and burner control revisions). Similarly, the cost information for any of the NO_X reduction technologies listed in Table 3 will apply for the fuel alternatives under consideration. Costs for LNBs are presented with FGR because this scenario is representative of current operation of ST1 when it is operated in combined cycle with Gas Turbine #1. Costs for LNBs without FGR would be lower. The complete Economic Analysis is contained in Appendix A of the AEPCO BART submittal.

Table 10.3: NO_x Control Cost Comparison					
Factor	**ROFA[c]**	**LNB with FGR**	**LNB with FGR & SNCR[b]**	**ROFA with Rotamix**	**LNB with SCR[a]**
Total installed capital cost (Million $)	$2.700	$1.184	$4.584	$4.457	$25.50
Total installed capital cost + additional owner costs (Million $)	$4.725	$2.072	$5.730	$7.800	$31.88
Total first year fixed and variable O&M costs (Million $)	$0.145	$0.204	$0.116	$0.195	$0.346
Total first year annualized cost	$0.939	$0.552	$1.079	$1.506	$5.705
Power consumption (MW)	0.52	0.85	0.09	0.52	0.43
Annual power usage (Million kW-hr/yr)	1.9	3.1	0.3	1.9	1.5
NOx design control efficiency	46.8%	50.2%	63.5%	63.5%	76.7%
Tons NOx removed per year	278	297	376	376	455
First year average control cost ($/ton removed)	$3,382	$1,856	$2,870	$4,004	$12,542
Incremental control cost ($/ton removed)	-$19,659	$1,856	$1,425	---[d]	$53,311

[a] Based on $300 per kW SCR factored estimate for 85 megawatts
[b] Based on $40 per kW SNCR factored estimate for 85 megawatts
[c] ROFA has a negative incremental control cost because when compared with LNB with FGR the technology costs more and removes less tons of NO_x
[d] The incremental control cost for ROFA with Rotamix when compared with LNB with FGR and SNCR results in a non number as the two technologies have the same NO_x removal in tons per year

Step 6: Evaluate Visibility Impacts

Table 10.4 below shows the total deciview reduction for the most impacted Class I area. For ST1, the most impacted Class I area is the Chiricahua Wilderness Area and National Monument.

Table 10.4 – Control Technologies and Respective Deciview Reduction			
Control	**Deciview Reduction**	**Total Annualized Cost (Million $)**	**Cost per deciview reduced (Million $/deciview reduced)**
LNB with FGR	0.194	0.552	2.845
ROFA	0.256	0.939	3.668
ROFA with Rotamix	0.240	1.506	6.274

Table 10.4 – Control Technologies and Respective Deciview Reduction			
Control	**Deciview Reduction**	**Total Annualized Cost (Million $)**	**Cost per deciview reduced (Million $/deciview reduced)**
LNB with FGR and SNCR	0.240	1.079	4.497
SCR	0.409	5.705	13.948

Step 7: BART Determination

After review reviewing the company's BART analysis, and based upon the information above ADEQ has determined that, for Unit 1, BART for NO_X is the installation of LNB with FGR (which will also burn No. 2 fuel oil with minor equipment change out) with a NO_X emissions limit of 0.056 lb/MMBtu when burning PNG, and 0.06 lb/MMBtu when burning No. 2 fuel oil. It should be noted that the proposed BART limit for ST1 will apply when ST1 operates alone or if ST1 and GT1 are operated as a combined cycle operation. The proposed BART limit does not apply to (a) GT1 in stand-alone simple cycle operation or (b) ST1/GT1 when ST1 burners are shut off and ST1 is not producing electricity.

D.2 PM_{10} BART Analysis

The PM_{10} BART analysis is only completed for the case when ST1 burns 100 percent No. 6 fuel oil. This was done for comparison only, as AEPCO has never combusted No. 6 fuel oil in the unit).

Step 1: Identify the Existing Control Technologies in Use at the Source

There is no emissions control equipment installed on ST1.

Step 2: Identify All Available Retrofit Control Options

The following retrofit control technologies have been identified for PM_{10} control on ST1:

- Use of low-sulfur fuel oil (No. 2 fuel oil)
- Switch to PNG
- New LNBs/particulate matter burner
- Dry electrostatic precipitator (ESP)
- Wet ESP
- Fabric filter

Low Sulfur Distillate Oil. Particulate matter emissions would be reduced with the switching of fuel oil grades from No. 6 to No. 2. PM_{10} emissions while burning No. 2 fuel oil are estimated at 0.0143 lb/MMBtu.

Switch to PNG. Expected PM_{10} emissions when burning PNG are estimated at 0.0075 lb/MMBtu.

New LNBs/Particulate Matter Burner. With the Coen LNB, particulate matter emissions are also reduced. From the budgetary information received from Coen, particulate matter emissions are estimated at less than 0.03 lb/MMBtu and 0.0015 lb/MMBtu while burning No. 6 fuel oil (with LNB and IFGR), and No. 2 fuel oil (LNB), respectively.

Dry ESP. A dry ESP operates by first placing a charge on the particulates though a series of electrodes, and then capturing the charged particulates on collection plates. While an ESP can be designed for high-particulate removal, operation is susceptible to particle resistivity, which denotes a collected particle's ability to ultimately discharge to the collection plate. Low-resistivity particles can be easily charged but may quickly lose their charge at the collection plate and tend to be re-entrained into the flue gas stream. Higher resistivity particles may form a "back corona," which is caused by a layer of non-conductive particles being formed on the collection plate. Back corona may prevent other charged gas stream particles from migrating to the collection plate. Particle resistivity is also influenced by flue gas temperature. ESP sizing is in large part determined by particulate size, with larger ESP size required when smaller particulates are expected. In addition, the particulates from an oil-fired unit tend to be small and sticky, and if a Spray Dryer Absorber is used for SO_2 reduction, there will be a greatly increased inlet particulate loading to the ESP. Because of the uncertainty in chemical and physical characteristics of the oil-fired particulate, ADEQ determined that a dry ESP is not a good technological match for ST1.

Wet ESP. While wet ESP operation is similar to the dry ESP through the charging and collection of flue gas particulates, the wet technology has significant advantages. The wet ESP is not sensitive to particulate resistivity and can accommodate changes in particulate loading more easily than a dry ESP. Collection plates can be created from metal or fabric, and the collected particulate is washed off the plates with water.

Wet ESPs have successfully been demonstrated on similar oil particulate or chemical mist applications. However, flue gas leaving the wet ESP will be saturated and may result in a visual steam plume exiting the stack. The wet ESP will use water to collect and remove the particulates, and will produce a wastewater byproduct. While the wet ESP PM_{10} emission level is estimated to be similar to a fabric filter without SDA operation, increased particulate loading from an SDA may not allow a wet ESP to meet required collection efficiency. Therefore, ADEQ has determined that a wet ESP is not a technically acceptable alternative when matched with an SDA.

Fabric Filter. Fabric filter technology achieves particulate reduction through the filtration of the flue gas through filter bags. The collected particles are periodically removed from the bag through a pulse jet or reverse flow mechanism. A pulse jet filtration system would likely be selected for installation on ST1, because this fabric filter technology results in lower capital cost and a smaller required footprint.

Because of the somewhat sticky particles produced during oil firing, using an appropriate fabric or coating bags with a suitable pre-coat material is imperative. If fabric bags become "blinded" by allowing hard-to-remove particulates to become embedded in the fabric structure, total bag replacement may be necessary. Blinded bags will continue to provide excellent filtration efficiencies; however, the pressure drop across the fabric may exceed system draft capability.

ADEQ has determined that while a fabric filter is not an acceptable alternative for particulate matter/PM_{10} emissions control for an oil-fired unit without using a coating material for the bags, it is anticipated to function satisfactorily with a pre-coat and the increased particulate loading from the SDA operation.

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the identified control technologies are technically feasible, with the exception of wet and dry ESPs, for the reasons discussed in Step 1 above.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

ST1 particulate matter emissions are currently estimated at 0.0737 lb/MMBtu while burning No. 6 fuel oil. The BART PM_{10} analysis will be completed only for the case of firing 100 percent No. 6 fuel oil. The PM_{10} control technology emission rates are summarized in Table 10.5. No capital costs are associated with switching to PNG.

Table 10.5 – PM_{10} Control Technology Emission Rates

Control Technology	Expected PM_{10} Emission Rate (lb/MMBtu)
Current Baseline	0.0737
Fabric Filter	0.015
New LNB[a]	0.0015
Switch to PNG	0.0075

[a] When burning No. 2 fuel oil

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

This step involves the consideration of energy, environmental, and economic impacts associated with each control technology. The remaining useful life of the plant is also considered during the evaluation.

Energy Impacts

No additional energy impact is expected from PM_{10} reduction as a result of a new LNBs/particulate matter burner retrofit or burning of low-sulfur fuel oil. A fabric filter and ductwork will add an estimated 6 to 8 inches of water pressure drop to the system and additional electrical load requirements.

Environmental Impacts

There are no negative environmental impacts from the usage of new LNBs/particulate matter burners, switching to low-sulfur diesel fuel, or using a fabric filter.

Economic Impacts

A summary of the costs and particulate matter removed for the alternatives is recorded in Table 10.6.

Table 10.6 – Particulate Matter Control Cost Comparison*			
Factor	**Fabric Filter**	**Switch to PNG**	**Switch to Low-Sulfur Fuel**
Total installed capital costs	$20,000,000[a]	$0	$1,000,000[b]
Total first year fixed and variable O&M costs	$253,592	--	--
Total first year annualized cost	$3,615,938	--	--
Power consumption (MW)	0.40	--	--
Annual power usage (Million kW-hr/year)	1.4	--	--
Particulate matter design control efficiency	79.6%	--	--
Tons particulate matter removed per year	116	--	--
First year average control cost ($/ton particulate matter removed)	$24,916	--	--
Incremental control cost ($/ton particulate matter removed)	$31,284	--	--

* LNB costs included in NOx BART analysis
[a] Based on vendor cost information
[b] From CH2M HILL database

Step 6: Evaluate Visibility Impacts

Improvements in visibility due to PM_{10} controls are minimal relative to uncontrolled emissions while combusting No. 6 fuel oil. In addition, the incremental costs related to adding a fabric filter and SDA are high. Impacts from the combustion of No. 2 fuel oil or natural gas without PM_{10} controls are expected to be less than those from the combustion of No. 6 fuel oil with emission controls.

Step 7: BART Determination

After reviewing the company's BART analysis, and based upon the information above ADEQ has determined that, for Unit 1, BART for PM_{10} is the use of PNG or No. 2 fuel oil with a PM_{10} emissions limit of 0.0075 lb/MMBtu when burning PNG, and 0.0015 lb/MMBtu when burning No. 2 fuel oil. This BART determination represents no change from the current operating scenario. It should be noted that the proposed BART limit for ST1 will apply when ST1 operates alone or if ST1 and GT1 are operated as a combined cycle operation. The proposed BART limit does not apply to (a) GT1 in stand-alone simple cycle operation or (b) ST1/GT1 when ST1 burners are shut off and ST1 is not producing electricity.

D.3 SO_2 BART Analysis

SO_2 forms in the boiler during the combustion process and is primarily dependent on natural gas and fuel oil sulfur content. Emissions indicate that BART analysis is not required when ST1 burns PNG or fuel oil No. 2. Thus, the analysis in this section is limited to the case when ST1 is burning No. 6 fuel oil.

The EPA BART guidelines require that oil-fired units consider limiting the sulfur content of the fuel oil burned. Because current requirements for low-sulfur diesel fuel limit sulfur content to 0.05 percent, fuel switching will be analyzed as an SO_2 option for this study. Also, a dry FGD system with SO_2 reduction capability similar to the fuel switch option will be considered.

Step 1: Identify the Existing Control Technologies in Use at the Source

There is no SO_2 emissions control equipment installed on ST1.

Step 2: Identify All Available Retrofit Control Options

A broad range of information sources was reviewed in an effort to identify potentially applicable emission control technologies for SO_2 at ST1, including control technologies identified as BACT or LAER by permitting agencies across the United States.

Following elimination of the PNG and fuel oil No. 2 BART engineering analysis after RLBC database review, the following potential SO_2 control technology options were considered for application when ST1 burns fuel oil No. 6:

- Use of low-sulfur distillate oil (No. 2 fuel oil)
- Switch to PNG
- SDA

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ determined that all of the identified control technologies are technically feasible.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

Table 10.7 lists the various control technologies and estimated emissions rates.

Table 10.7 – Control Technology Options Evaluated

Technology	Expected Emission Rate (lb/MMBtu)	Estimated Cost (Millions $)
Current Baseline with No. 6 Fuel Oil	0.906	--
Low-Sulfur Fuel Oil	0.051	0
SDA	0.10	20
PNG	0.00064	0

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

This step involves the consideration of energy, environmental, and economic impacts associated with each control technology. The remaining useful life of the plant is also considered during the evaluation.

Energy Impacts

There is no energy impact associated with switching to low-sulfur diesel fuel; however, additional system pressure drop equivalent to 0.4 MW at a first-year cost of $71,832 will result from the installation of an SDA.

Environmental Impacts

There is no environmental impact associated with switching to low-sulfur diesel fuel. An SDA system generates solid waste requiring disposal.

Economic Impacts

A summary of the costs and amount of SO_2 removed for fuel switching is provided in Table 10.8. The complete Economic Analysis is contained in Appendix A of the AEPCO BART submittal.

Table 10.8 – SO_2 Control Costs

Factor	SDA	Switch to PNG	Switch to Low-Sulfur Fuel
Total installed capital costs	$20,000,000[a]	$0	$0
Total first year fixed and variable O&M costs	$519,359	--	--
Total first year annualized cost	$3,811,706	--	--
Power consumption (MW)	0.40	--	--
Annual power usage (Million kW-hr/year)	1.4	--	--
SO_2 design control efficiency	89.0%	99.9%	91%
Tons SO_2 removed per year	1,587	--	--
First year average control cost ($/ton SO_2 removed)	2,446	--	--
Incremental control cost ($/ton SO_2 removed)	2,446	--	--

[a] Based on vendor cost information

Step 6: Evaluate Visibility Impacts

Improvements to deciview impacts from SO_2 controls are minimal relative to uncontrolled emissions while combusting No. 6 fuel oil. In addition, the incremental costs related to adding a fabric filter and SDA are high. Impacts from the combustion of No. 2 fuel oil or natural gas without SO_2 controls are expected to be less than those from the combustion of No. 6 fuel oil with emission controls.

Step 7: BART Determination

After reviewing the company's BART analysis and based upon the information above, ADEQ has determined that, for Unit 1, BART for SO_2 is the use of PNG or No. 2 fuel oil with an SO_2 emissions limit of 0.00064 lb/MMBtu when burning PNG, and 0.051 lb/MMBtu when burning No. 2 fuel oil. It should be noted that the proposed BART limit for ST1 will apply when ST1 operates alone or if ST1 and GT1 are operated as a combined cycle operation. The proposed BART limit does not apply to (a) GT1 in stand-alone simple cycle operation or (b) ST1/GT1 when ST1 burners are shut off and ST1 is not producing electricity.

E. Steam Units 2 and 3

Steam Units 2 and 3 are substantially similar in design, construction and electrical output. While there are physical differences between the two units that will result in different costs for the same control technology, the overall differences were determined to be minimal. As a result, ADEQ has determined that it is appropriate to consider BART for both Units in a single section.

E.1 NO_X BART Analysis

During coal combustion, NO_X forms in three ways. The dominant source of NO_X formation is the oxidation of fuel-bound nitrogen (fuel NO_X). During combustion, part of the fuel NO_X is released from the coal with the volatile matter, and part is retained in the solid portion (char). The nitrogen chemically bound in the coal is partially oxidized to nitrogen oxides (NO and NO_2) and partially reduced to molecular nitrogen (N_2). A smaller part of NO_X formation is due to high temperature fixation of atmospheric nitrogen in the combustion air (thermal NO_X). A very small amount of NO_X is called "prompt" NO_X. Prompt NO_X results from an interaction of hydrocarbon radicals, nitrogen, and oxygen.

Step 1: Identify the Existing Control Technologies in Use at the Source

Both Steam Units 2 and 3 currently use over-fired air (OFA) and under-fired air systems to control NO_X emissions.

Step 2: Identify All Available Retrofit Control Options

The second step of the BART process is to evaluate NO_X control technologies with practical potential for application to Units 2 and 3, including those control technologies identified as Best Available Control Technology (BACT) or Lowest Achievable Emission Rate (LAER) by permitting agencies across the United States. Both Steam Unit 2 and 3 NO_X emissions are currently controlled through the use of OFA and UFA systems added to the burners. The Units are dry turbo-fired boilers, with 12 Riley directional flame burners. The following potential NO_X control technology options were considered:

- New/modified state-of-the-art LNBs with advanced OFA
- Rotating opposed fire air (ROFA)
- Selective non-catalytic reduction system (Rotamix and SNCR)
- Selective catalytic reduction (SCR) system
- Neural Network Controls/Boiler Combustion Controls (Neural Net)

New LNBs with OFA System. The mechanism used to lower NO_X with LNBs is to stage the combustion process and provide a fuel-rich condition initially; this is so oxygen needed for combustion is

not diverted to combine with nitrogen and form NO_X. Fuel-rich conditions favor the conversion of fuel bound nitrogen to N_2 instead of NO_X. Additional air (OFA or UFA) is then introduced upstream or downstream in a lower temperature zone to burn out the char.

ROFA. Mobotec markets ROFA as an improved second generation OFA system. Mobotec states that "the flue gas volume of the furnace is set in rotation by asymmetrically placed air nozzles." Rotation is reported to prevent laminar flow and improve gas mixing, so that the entire volume of the furnace can be used more effectively for the combustion process. In addition, the swirling action reduces the maximum temperature of the flames and increases heat absorption. Mobotec expects that enhanced mixing will also result in reduction in hot and cold furnace zones, improved heat absorption and boiler efficiency, and lower carbon monoxide (CO) and NO_X emissions. A typical ROFA installation will have a booster fan(s) to supply the high-velocity air to the ROFA boxes. Mobotec proposed one 2,100 horsepower fan for each unit, which would provide hot air at all boiler loads.

SNCR. With SNCR, an amine-based reagent such as ammonia—or more commonly urea—is injected into the furnace within a temperature range of 1,600 degrees Fahrenheit (°F) to 2,100 °F, where it reduces NO_X to nitrogen and water. NO_X reductions of up to 40 to 60 percent have been achieved, although 15 to 30 percent is a more realistic expectation for most applications.

Reagent utilization, which is a measure of the efficiency with which the reagent reduces NO_X, can range from 20 to 60 percent, depending on the amount of reduction, unit size, operating conditions, and allowable ammonia slip. With low reagent utilization, low temperatures, or inadequate mixing, ammonia slip occurs, allowing unreacted ammonia to create problems downstream. Problems include rendering fly ash unsellable, and also reacting with sulfur to form ammonium bisulphate, which can foul heat exchanger surfaces or create a visible stack plume. Reagent utilization can have a significant impact on economics, with higher levels of NO_X reduction generally resulting in higher reagent utilization and higher operating cost. Reductions from higher baseline inlet NO_X concentrations are lower in cost per ton, but result in higher operating costs, due to greater reagent consumption.

SCR. SCR works on the same chemical principle as SNCR but instead uses a catalyst to promote the chemical reaction. Ammonia or urea is injected into the flue-gas stream, where it reduces NO_X to nitrogen and water. Unlike the high temperatures required for SNCR, in SCR the reaction takes place on the surface of a vanadium/titanium-based catalyst at a temperature range between 580° F to 750° F. Due to the catalyst, the SCR process is more efficient than SNCR and results in lower NO_X emissions. One type of SCR is the high-dust configuration, where the catalyst is located downstream from the boiler economizer and upstream of the air heater and any particulate control equipment. In this location, the SCR is exposed to the full concentration of fly ash in the flue gas that is leaving the boiler. However, for Units 2 and 3 the SCR could be installed after the hot-side ESP and before the air heater. In a full-scale SCR, the flue ducts are routed to a separate large reactor containing the catalyst. With in-duct SCR, the catalyst is located in the existing gas duct, which may be expanded in the area of the catalyst to reduce flue gas flow velocity and increase flue gas residence time. Due to the higher NO_X removal rate, a full-scale SCR was used as the basis for analysis at Units 2 and 3.

Neural Net Controls/Boiler Combustion Control. Review of neural net and improved boiler combustion control are combined for purposes of this analysis under the potential implementation of neural net boiler control system. Information regarding neural net controls was provided by NeuCo, Inc. While NeuCo offers several neural net products, CombustionOpt and SootOpt provide the potential for NO_X reduction. NeuCo stated these products can be used on most control systems, and can be effective even in conjunction with other NO_X reduction technologies. NeuCo predicts that CombustionOpt can reduce NO_X by 15 percent, and SootOpt can provide an additional 5 to 10 percent. Because NeuCo does

not offer guarantees on this projected emission reduction, a nominal reduction of 15 percent was assumed for evaluation purposes.

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the identified control technologies are technically feasible.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

Table 10.9 lists the various control technologies and estimated emissions rates.

Table 10.9 – Control Technology and Respective Emission Rates

Control Technology	Expected NO_X Emission Rate
Neural Net/Boiler Combustion Control	15% reduction
New LNBs with OFA System	0.31 lb/MMBtu
ROFA	0.26 lb/MMBtu
SNCR	0.18 lb/MMBtu
SCR	0.07 lb/MMBtu

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

This step involves the consideration of energy, non-air quality environmental, and economic impacts associated with each control technology. The remaining useful life of the plant is also considered during the evaluation.

Energy Impacts

Installation of LNBs and modification to the existing OFA and UFA systems are not expected to significantly impact the boiler efficiency or forced-draft fan power usage. Therefore, these technologies are not expected to have significant energy impacts.

The Mobotec ROFA system requires installation and operation of one 2,100 horsepower ROFA fan (1,566 kilowatts [kW] total) for each unit. Fuel Tech provided an estimate of 130 kW of additional auxiliary power, and the same estimate was used for Rotamix. SCR retrofit impacts the existing flue gas fan systems, due to the additional pressure drop associated with the catalyst, which is typically a 6- to 8-inch water gage increase.

Non-Air Quality Environmental Impacts

Mobotec generally predicts that CO emissions, and unburned carbon in the ash, commonly referred to as loss on ignition (LOI), would be the same or lower than prior levels for the ROFA system.

SNCR and SCR installation could impact the salability and disposal of fly ash due to ammonia levels. Other environmental impacts involve the potential public and employee safety hazard associated with the

storage of ammonia, especially anhydrous ammonia, and the transportation of the ammonia to the power plant site.

Economic Impacts

A comparison of the technologies on the basis of costs, design control efficiencies, and tons of NO_X removed is summarized in Table 10.10 for Unit 2 and Table 10.11 for Unit 3. The complete Economic Analysis is contained in Appendix A of the AEPCO BART submittal.

Table 10.10 – Control Technology Efficiency and Costs for Unit 2

Factor	LNB with OFA	ROFA	ROFA with Rotamix	LNB with OFA and SNCR	LNB with OFA and SCR
Major Materials Design Costs (Million $)	$2.000	$3.627	$5.441	$6.830	$29.30
Total Installed Capital Costs (Million $)	$4.760	$9.616	$12.63	$12.54	$48.74
Total First Year Fixed and Variable Costs (Million $)	$0.080	$0.750	$1.024	$0.545	$1.466
Total First Year Annualized Cost (Million $)	$0.533	$1.664	$2.225	$1.738	$6.102
Power Consumption (MW)	-	1.57	2.07	0.50	1.00
Annual Power Usage (Kilowatt-Hr/Year)	-	12.6	16.6	4.0	8.0
NO_X Design Control Efficiency	34.2%	44.8%	61.8%	51.2%	85.1%
Tons of NO_X Removed	1,305	1,710	2,358	1,953	3,250
Average Cost ($/ton)	$408	$973	$944	$890	$1,878
Incremental Cost ($/ton)	$408	$2,793	$1,203	$301	$4,350

Table 10.11: Control Technology Efficiency and Costs for Unit 3					
Factor	**LNB with OFA**	**ROFA**	**ROFA with Rotamix**	**LNB with OFA and SNCR**	**LNB with OFA and SCR**
Major Materials Design Costs (Million $)	$2.000	$3.627	$5.441	$6.830	$29.30
Total Installed Capital Costs (Million $)	$4.760	$9.616	$12.62	$12.54	$48.74
Total First Year Fixed and Variable Costs (Million $)	$0.080	$0.719	$0.981	$0.525	$1.426
Total First Year Annualized Cost (Million $)	$0.533	$1.634	$2.182	$1.718	$6.062
Power Consumption (MW)	-	1.57	2.07	0.50	1.00
Annual Power Usage (Kilowatt-Hr/Year)	-	12.0	15.8	3.8	7.7
NO_X Design Control Efficiency	27.9%	39.5%	58.1%	46.5%	83.7%
Tons of NO_X Removed	926	1,312	1,929	1,543	2,778
Average Cost ($/ton)	$575	$1,246	$1,131	$1,113	$2,183
Incremental Cost ($/ton)	$575	$2,855	$1,203	$360	$4,572

Step 6: Evaluate Visibility Impacts

Tables 10.12 and 10.13 below show the total deciview reduction for the most impacted Class I area for Units 2 and 3 respectively. For Units 2 and 3, the most impacted Class I area is the Chiricahua Wilderness Area and National Monument.

Table 10.12 – Control Technology and Visibility Impact Reduction for Unit 2				
Control	**Deciview Reduction**	**Total Annualized Cost (Million $)**	**Cost per deciview reduced (Million $/dv)**	**Average Cost ($/ton)**
Neural Net/Boiler Combustion Control	Unknown	Unknown	Unknown	Unknown
New LNB with OFA System	0.267	$0.533	$1.996	$408
ROFA	0.359	$1.664	$4.636	$973
ROFA with Rotamix	0.491	$2.225	$4.532	$944
LNB with OFA and SNCR	0.416	$1.738	$4.177	$890
LNB with OFA and SCR	0.676	$6.103	$9.028	$1,878

Table 10.13 – Control Technology and Visibility Impact Reduction for Unit 3				
Control	**Deciview Reduction**	**Total Annualized Cost (Million $)**	**Cost per Deciview Reduced (Million $/dv)**	**Average Cost ($/ton)**
Neural Net/Boiler Combustion Control	Unknown	Unknown	Unknown	Unknown
New LNB with OFA System	0.206	$0.533	$2.586	$575
ROFA	0.298	$1.634	$5.484	$1,246
ROFA with Rotamix	0.436	$2.182	$5.004	$1,131
LNB with OFA and SNCR	0.356	$1.718	$4.825	$1,113
LNB with OFA and SCR	0.633	$6.062	$9.577	$2,183

Step 7: BART Selection

After reviewing the company's BART analysis, and based upon the information above, ADEQ has determined that, for Units 2 and 3 BART for NO_X is new LNBs with OFA system with a NO_X emissions limit of 0.31 lb/MMBtu for both Units 2 and 3.

E.2 PM_{10} BART Analysis

Step 1: Identify the Existing Control Technologies in Use at the Source

Both Steam Units 2 and 3 are currently equipped with hot-side Electrostatic Precipitators (ESPs).

Step 2: Identify All Available Retrofit Control Options

Steam Units 2 and 3 are currently equipped with hot-side ESPs. Historically, outlet ESP particulate emissions on Units 2 and 3 have ranged from approximately 0.007 to 0.045 lb/MMBtu. This wide range in outlet emissions can in part be attributed to the hot-side operation, as well as the wide variety of coals being burned in the boilers. Hot-side ESP effectiveness may also be impacted by sodium content in the ash.

Three retrofit control technologies have been identified for additional particulate matter control:

- Performance upgrades to existing hot-side ESP
- Replace current ESP with a fabric filter unit
- Install a polishing fabric filter after ESP

Performance Upgrades. Modifications to the hot-side ESPs, such as improving the rapping system, controller upgrades, conversion to cold-side operation, flue gas conditioning, wide plate spacing, addition of particle pre-charging system, etc., could be implemented to improve ESP particulate collection efficiency.

Replace Current ESP with a Fabric Filter Unit. Full-size pulse jet fabric filters could be installed as a replacement for the existing ESPs on Units 2 and 3. These fabric filters would be sized for approximately 3.5 or 4:1 Air to Cloth (A/C) ratio (actual cubic feet per minute of flue gas per square foot of fabric). An A/C ratio of 4:1 was used for this analysis. Fabric filters have been proven to provide highly effective and consistent particulate emissions reduction, with outlet emissions of approximately 0.015 lb/MMBtu. The ESPs would be removed from service with these replacement fabric filters.

Install a Polishing Fabric Filter. A polishing fabric filter could be added downstream of the existing ESPs on Units 2 and 3. One such technology is licensed by the Electric Power Research Institute, and referred to as a COHPAC (Compact Hybrid Particulate Collector). The COHPAC collects the ash that is not collected by the ESP, thus acting as a polishing device. The ESPs would be kept in service for the COHPAC fabric filter to operate effectively.

The COHPAC fabric filter is about one-half to two-thirds the size of a full-size fabric filter. Because the COHPAC has a higher A/C ratio (as high as 6 to 8:1), compared to a full-size pulse jet fabric filter (3.5 to 4:1), an A/C ratio of 6:1 was used for this analysis.

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the identified control technologies are technically feasible.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

Table 10.14 lists the various control technologies and estimated emissions rates.

Table 10.14 – Control Technology and Respective Emission Rates

Control Technology	Expected PM_{10} Emission Rate
ESP Upgrades	0.03 lb/MMBtu
Full size fabric filter	0.015 lb/MMBtu
Polishing Fabric Filter	0.015 lb/MMBtu

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

This step involves the consideration of energy, non-air quality environmental, and economic impacts associated with each control technology. The remaining useful life of the plant is also considered during the evaluation.

Energy Impacts

Energy is required to overcome the additional pressure drop from both the fabric filter replacement and COHPAC fabric filter, and associated ductwork. Therefore, fan upgrades may be required for both alternatives to overcome the additional pressure drop. An estimated 6 to 8 inches of water pressure drop for the replacement fabric filter may be experienced, with 8 to 10 inches of water pressure drop likely for

the COHPAC unit. The polishing fabric filter will also result in maintaining the existing ESP in service, which will result in power consumption in addition to what is required by the fabric filter replacement option.

COHPAC fabric filters on Units 2 and 3 would require approximately 1.3 MW of power each.

Energy impacts from ESP upgrades are unknown and would vary depending on the precipitator upgrade applied.

Non-Air Quality Environmental Impacts

There are no negative environmental impacts from precipitator upgrades, the addition of a replacement or COHPAC polishing fabric filter.

Economic Impacts

A comparison of the costs and PM_{10} removed for a replacement fabric filter or COHPAC polishing fabric filter are shown in Table 10.15 and 10.16 for Units 2 and 3 respectively. Specific costs for the precipitator upgrades were not evaluated as AEPCO has yet to evaluate the upgrades that may be applicable to Units 2 and 3. Capital cost information was provided by Alstom for both the polishing and replacement fabric filters. The complete Economic Analysis is contained in Appendix A of the AEPCO BART submittal.

Table 10.15 – Control Technology Efficiency and Costs for Unit 2

Factor	ESP Upgrades	Polishing Fabric Filter	Full Size Fabric Filter
Major Materials Design Costs	Unknown	$6,666,667	$10,000,000
Total Installed Capital Costs	Unknown	$15,866,667	$23,800,000
Total First Year Fixed and Variable Costs	Unknown	$708,050	$623,824
Total First Year Annualized Cost	Unknown	$2,217,411	$2,887,867
Power Consumption (MW)	Unknown	1.30	1.00
Annual Power Usage (Kilowatt-Hr/Year)	Unknown	10.5	8.0
PM_{10} Design Control Efficiency	Unknown	66.67%	66.67%
Tons of PM_{10} Removed	Unknown	243	243
Average Cost ($/ton)	Unknown	$9,121	$11,878
Incremental Cost ($/ton)	Unknown	$9,121	$11,878

Table 10.16 – Control Technology Efficiency and Costs for Unit 3			
Factor	**ESP Upgrades**	**Polishing Fabric Filter**	**Full Size Fabric Filter**
Major Materials Design Costs	Unknown	$6,666,667	$10,000,000
Total Installed Capital Costs	Unknown	$15,866,667	$23,800,000
Total First Year Fixed and Variable Costs	Unknown	$682,996	$604,552
Total First Year Annualized Cost	Unknown	$2,192,357	$2,868,595
Power Consumption (MW)	Unknown	1.30	1.00
Annual Power Usage (Kilowatt-Hr/Year)	Unknown	10.0	7.7
PM_{10} Design Control Efficiency	Unknown	66.67%	66.67%
Tons of PM_{10} Removed	Unknown	231	231
Average Cost ($/ton)	Unknown	$9,471	$12,393
Incremental Cost ($/ton)	Unknown	$9,471	$12,393

Step 6: Evaluate Visibility Impacts

Tables 10.17 and 10.18 below show the total deciview reduction for the most impacted Class I area for Units 2 and 3 respectively. For Units 2 and 3, the most impacted Class I area is the Chiricahua Wilderness Area and National Monument.

Table 10.17 – Control Technology and Visibility Impact Reduction for Unit 2				
Control	**Deciview Reduction**	**Total Annualized Cost (Million $)**	**Cost per Deciview Reduced (Million $/dv)**	**Average Cost ($/ton)**
ESP Upgrades	Unknown	Unknown	Unknown	Unknown
Polishing Fabric Filter	0.085	$2.217	$26.09	$9,121
Full Size Fabric Filter	0.085	$2.888	$33.98	$11,880

Table 10.18 – Control Technology and Visibility Impact Reduction for Unit 3				
Control	**Deciview Reduction**	**Total Annualized Cost (Million $)**	**Cost per Deciview Reduced (Million $/dv)**	**Average Cost ($/ton)**
ESP Upgrades	Unknown	Unknown	Unknown	Unknown
Polishing Fabric Filter	0.094	$2.192	$23.32	$9,471
Full Size Fabric Filter	0.094	$2.869	$30.52	$12,390

Step 7: BART Selection

Based upon its review of the analysis provided by AEPCO, and the information provided above, ADEQ has determined that BART for PM_{10} emissions is upgrades to the existing ESP and a PM_{10} emissions limit

of 0.03 lb/MMBtu for both Units 2 and 3. The upgrades to the existing ESP will involve a possible installation of a flue gas conditioning system, improvements to the scrubber bypass damper system, and implementing programming optimization measures for ESP automatic voltage controls.

D.3 SO_2 BART Analysis

SO_2 forms in the boiler during the combustion process from the oxidation of the sulfur present in the coal, and is primarily dependent on coal sulfur content. The BART analysis for SO_2 emissions on Units 2 and 3 is described below.

Step 1: Identify the Existing Control Technologies in Use at the Source

Steam Units 2 and 3 currently have wet limestone scrubbers installed for SO_2 removal.

Step 2: Identify All Available Retrofit Control Options

The following potential SO_2 control technology option was considered:

- Enhancement of current wet limestone scrubber or SDAS

Units 2 and 3 currently operate wet limestone scrubbers for SO_2 removal, with current emissions of 0.184 lb/MMBtu and 0.151 lb/MMBtu respectively. The EPA BART guidelines state that for existing units with SO_2 controls achieving at least 50 percent SO_2 removal, cost-effective scrubber upgrades should be considered. EPA has recommended consideration of the following potential upgrades:

- Elimination of bypass reheat
- Installation of liquid distribution rings
- Installation of perforated trays
- Use of organic acid additives
- Improve or upgrade scrubber auxiliary system equipment
- Redesign spray header or nozzle

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the identified control technology upgrades are technically feasible.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

When evaluating the control effectiveness of SO_2 reduction technologies, each option can be compared against benchmarks of performance. In its BART analysis, AEPCO chose to compare its proposed technology upgrades to EPA's presumptive BART emission limitations. According to EPA's BART guidance documents, the presumptive limit for SO_2 on a BART-eligible coal-burning unit, used here as a point of reference, is 95 percent removal, or 0.15 lb/MMBtu.

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

Over the past several years AEPCO has completed several scrubber upgrades to improve performance, including the following:

- Elimination of flue gas bypass
- Splitting the limestone feed to both the absorber feed tank and tower sump
- Upgrade of the mist eliminator system
- Installation of suction screens at pump intakes
- Automation of pump drain valves
- Replacement of scrubber packing with perforated stainless steel trays

Dibasic acid additive was tested; however results did not show significantly higher SO_2 removal.

Energy Impacts

Upgraded operation of the existing wet limestone scrubber or SDAS system is not expected to result in any additional power consumption.

Environmental Impacts

There will be incremental additions to scrubber waste disposal and makeup water requirements and a reduction of the stack gas temperature if there is elimination of flue gas bypass.

Economic Impacts

There are no anticipated cost impacts attributable to upgraded scrubber operation.
Step 6: Evaluate Visibility Impacts

A Visibility Impact Analysis was not performed for SO_2 since the existing scrubbers are proposed as BART.

Step 7: BART Selection

After reviewing the company's BART analysis, and based upon the information above, ADEQ has determined that BART for SO_2 emissions is no new controls and an emission limit of 0.15 lb/MMBtu.

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XI. APS CHOLLA GENERATING STATION BART ANALYSIS AND DETERMINATION

A. Process Description

The APS Cholla Power Plant ("APS Cholla") consists of the following four electric generating units with a total generating capacity of 1,150 megawatts (MW).

- Unit 1: 125 MW
- Unit 2: 300 MW
- Unit 3: 300 MW
- Unit 4: 425 MW

Each unit is a coal-fired steam generating unit equipped with a tangentially-fired, dry-bottom boiler. Each of these Units burns bituminous or sub-bituminous coal to generate super-heated steam. This steam is then used to drive turbines/generators for producing electricity. Cholla purchases coal from the Lee Ranch and El Segundo mines.

B. Description of Emissions Units Subject to Best Available Retrofit Technology (BART)

Units 2, 3 and 4 are potentially subject-to-BART because:

1. These units belong to one of the 26 categorical sources;
2. These units were in existence on August 7, 1977;
3. Combined emissions of visibility impairing pollutants from all three of these Units - nitrogen oxides (NO_X), particulate matter less than 10 microns (PM_{10}), and sulfur dioxide (SO_2) - are greater than 250 tons per year for each pollutant.

C. Impact on Visibility

CALPUFF modeling was performed at 13 Class I areas that are located within 300 kilometers of Cholla Power Plant. The following table provides the baseline maximum impact on visibility in deciview.

Table 11.1 – Modeled Baseline Impact on Visibility

Affected Class I Area	Unit 2	Unit 3	Unit 4
Capital Reef NP	1.25	2.70	2.40
Grand Canyon NP	1.45	2.45	2.65
Petrified Forest NP	1.40	3.00	3.40
Sycamore Canyon WA	1.62	2.50	2.70
Gila WA	0.68	2.10	2.20
Mount Baldy WA	1.12	2.25	2.25
Sierra Ancha WA	0.91	1.90	2.15
Mazatzal WA	1.02	1.72	1.85

Table 11.1 – Modeled Baseline Impact on Visibility			
Affected Class I Area	**Unit 2**	**Unit 3**	**Unit 4**
Pine Mountain WA	1.20	1.75	1.88
Superstition WA	0.95	1.95	2.15
Galiuro WA	0.57	1.18	1.28
Mesa Verde NP	0.81	1.45	1.40
Saguaro NP	0.43	0.95	1.15

D. Nitrogen Oxides (NO_x) BART Analysis and Determination for Units 2, 3 and 4

Step 1: Identify the Existing Control Technologies in Use at the Source

The Cholla BART Analysis was completed in late 2007. At that time, the Units were equipped with Close-coupled Overfire Air (COFA). Overfire air is used to reduce NO_X by reducing excess air in the combustion zone. In a COFA system, air nozzles are immediately above the burners.

Low NO_X Burner (LNBs) and Seperated Overfire Air (SOFA) were installed on Units 2, 3 and 4 in March 2008, May 2009 and May 2008 respectively. LNBs and SOFAs are utilized for increased NO_X reduction.

Step 2: Identify All Available Retrofit Control Options

APS Cholla has identified the following available retrofit control technologies for NO_X control in Units 2, 3 and 4.

- LNB with Separate Overfire Air (SOFA) System
- LNB with SOFA and Selective Non-Catalytic Reduction (SNCR) System
- Rotating Opposed Flow Air system (ROFAs)
- ROFA with Rotary Mixing of Additives (Rotamix)
- LNB with SOFA and Selective Catalytic Reduction (SCR)

LNB with Separate Overfire Air (SOFA) System. Initial combustion takes place in fuel-rich condition so that the oxygen needed for combustion is not diverted to form NO_X. Additional air (separate overfire air) is then introduced in a lower temperature zone to burn out the char.

LNB with SOFA and Selective Non-Catalytic Reduction (SNCR) System. SNCR systems reduce NO_x by injecting reagent (ammonia or urea) into the furnace within a temperature range of 1600º to 2100º F. NO_X reduction of 40% to 60% can be achieved. Reagent utilization is a measure of efficiency with which the reagent reduces NO_X. Ammonia slip may occur due to lower temperatures, or inadequate mixing causing problems downstream. Potential problems include: rendering fly ash unsalable and reacting with sulfur to form ammonium bisulphate which can foul exchangers. The combination of LNB and SOFA with SNCR may achieve lower emission reductions than can be achieved by the individual technologies alone.

Rotating Opposed Flow Air System (ROFA). ROFA is an improved overfire air system. In this technology, the flue gas volume of the furnace is set in rotation by asymmetrically placed air nozzles. This rotation prevents laminar flow and improves gas mixing. As a result, the entire volume of the furnace is used more effectively for combustion process. A typical ROFA system requires a booster fan to supply high velocity air to the ROFA boxes.

ROFA with Rotary Mixing of Additives (Rotamix). ROFA along with Rotamix system provides enhanced mixing in the combustion chamber for optimal conditions to achieve multi-pollutant reduction. The turbulent mixing created by ROFA and Rotamix improves the efficiency of pollutant capture and reduces the stoichiometric amount of sorbent needed to reduce pollutants emissions.

LNB with SOFA and Selective Catalytic Reduction (CR). In SCR systems, vaporized ammonia (NH_3) injected into the flue gas stream acts as a reducing agent, achieving NO_X emission reductions when the gas stream is passed over a vanadium/titanium-based catalyst. The NO_X and ammonia react to form nitrogen and water vapor. The SCR ammonia-catalytic reaction requires a temperature range of 580-750° F.

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the options identified above are technically feasible.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

The following table provides the NO_X emission rates that will be achieved with different feasible NO_X control technologies for Units 2, 3 and 4.

Table 11.2 – Achievable NO_X Emissions Rates By Technology

Control Technology	NO_X Emissions		
	Unit 2	Unit 3	Unit 4
	Pounds per MMBtu	Pounds per MMBtu	Pounds per MMBtu
LNB with COFA (Baseline)	0.50	0.410	0.415
LNB with SOFA	0.22	0.22	0.22
LNB with SOFA and SNCR	0.17	0.17	0.17
ROFA	0.16	0.16	0.16
ROFA with Rotamix	0.12	0.12	0.12
LNB with SOFA and SCR	0.07	0.07	0.07

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

Economic Impacts

The following Tables 3, 4 and 5 present the cost of compliance for the feasible technologies for Units 2, 3 and 4. The tables also report the predicted impact of these technologies on visibility [98th percentile deciview (dv)] reduction.

Energy Impacts

ROFA system will require a 3,300 HP fan for the supply of high-velocity air. Thus, there will be an additional power requirement of 130 KW.

SCR retrofit will cause additional pressure drop (6-8 inches water gauge) in the flue gas system due to catalyst.

LNBs and SOFA systems do not significantly impact boiler efficiency or power usage.

Non-Air Quality Environmental Impacts

SNCR and SCR installations could impact the salability and disposal of fly ash due to ammonia levels. At this time, APS Cholla sells its fly ash, and if sellability of the fly ash is impacted, costs associated with the proposed controls will increase. SCR and SNCR may also involve potential safety hazard associated with handling of anhydrous ammonia, and transportation of ammonia to the plant site.

Remaining Useful Life

Units 2, 3 and 4 have projected remaining lives of 40 years at each unit.

Step 6: Evaluate Visibility Impacts

CALPUFF modeling was performed at 13 Class I areas that are located within 300 kilometers of Cholla Power Plant the degree of that may be reasonably expected from the use of BART. The impacts are modeled for different NO_X control scenarios, combined with SO_2 and PM_{10} technologies. Since, as shown in Table 11.1, the Petrified Forest National Park is the most impacted area out of all the 13 Class I areas, Tables 11.3, 11.4 and 11.55 present the improvement in visibility (in deciview) in that area.

Table 11.3: Unit 2 Cost and Visibility Analysis							
NO_X Control Technologies	Emission Rate	NO_X Removal	Annualized Cost	1st yr Avg. Cost	Incremental Control Cost	Dv Impact for Max. Impacted Area (Petrified Forest NP)	
	lb/MMBtu	Tons/year	Million $	$/ton	$/ton	98th percentile dv reduction	million $/dv reduced
LNB with COFA (Baseline)	0.503	-	-	-	-	-	-
LNB with SOFA	0.22	3,314	$0.635	$192	$192	0.187	$3.40
LNB with SOFA and SNCR	0.17	3,900	$2.175	$558	$2,628	0.218	$9.98
ROFA	0.16	4,017	$2.297	$572	$1,043	0.232	$9.90
ROFA with Rotamix	0.12	4,485	$3.384	$755	$2,323	0.261	$12.97
LNB with SOFA and SCR	0.07	5,071	$9.625	$1,898	$10,650	0.287	$33.54

Table 11.4 – Unit 3 Cost and Visibility Analysis							
NO_X Control Technologies	Emission Rate	NO_X Removal	Annualized Cost	1st yr Avg. Cost	Incremental Control Cost	Dv Impact for Max. Impacted Area (Petrified Forest NP)	
	lb/MMBtu	Tons/year	Million $	$/ton	$/ton	98th percentile dv reduction	million $/dv reduced
LNB with COFA (Baseline)	0.41	-	-	-	-	-	-
LNB with SOFA	0.22	2,096	$0.635	$303	$303	0.126	$5.04
LNB with SOFA and SNCR	0.17	2,648	$2.157	$814	$2,756	0.164	$13.15
ROFA	0.16	2,758	$2.243	$813	$786	0.169	$13.27
ROFA with Rotamix	0.12	3,200	$3.308	$1,034	$2,409	0.198	$16.71
LNB with SOFA and SCR	0.07	3,751	$9.569	$2,551	$11,363	0.230	$41.61

Table 11.5 – Unit 4 Cost and Visibility Analysis							
NO_X Control Technologies	**Emission Rate**	**NO_X Removal**	**Annualized Cost**	**1st yr Avg. Cost**	**Incremental Control Cost**	**Dv Impact for Max. Impacted Area (Petrified Forest NP)**	
	lb/MMBtu	**tons/year**	**Million $**	**$/ton**	**$/ton**	**98th percentile dv reduction**	**million $/dv reduced**
LNB with COFA (Baseline)	0.42	-	-	-	-	-	-
LNB with SOFA	0.22	3,390	$0.820	$242	$242	0.207	$3.96
LNB with SOFA and SNCR	0.17	4,259	$2.852	$670	$2,338	0.265	$10.76
ROFA	0.16	4,433	$3.179	$717	$1,877	0.281	$11.31
ROFA with Rotamix	0.12	5,129	$4.537	$885	$1,951	0.336	$13.50
LNB with SOFA and SCR	0.07	5,998	$13.23	$2,206	$10,007	0.408	$32.43

Step 7: BART Selection

According to the Regional Haze Rule, only dV changes in excess of 1.0 dV are perceptible.

A review of the data presented in Tables 11.3, 11.4, and 11.5 indicates that CALPUFF model-predicted visibility improvements (delta dV) for all five NO_x control scenarios are less than 0.5 dV. For example, in the case of Unit 3, the dV changes range from 0.126 dV for the LNB with SOFA (Scenario 1) to 0.230 dV for LNB with SOFA and SCR (Scenario 5). The change in dV between the least expensive and most expensive NO_x control technologies (the two noted above) is only 0.104 dV. The corresponding capital costs are $5.4 million for LNB/SOFA and $82.8 million for LNB/SOFA with SCR.

Based on these facts and the five-factor analysis discussed above, ADEQ has concluded that LNB with SOFA constitute BART for NO_x emissions for Cholla Units 2, 3, and 4.

E. PM_{10} BART

Step 1: Identify the Existing Control Technologies in Use at the Source

Unit 2 currently has a mechanical dust collector for control of PM_{10} emissions. Additional particulate matter control is provided by a venturi scrubber. Cholla 2 is currently able to achieve emission rate of 0.020 lb/MMBtu.

Unit 3 was previously equipped with a hot-side ESP and was able to achieve an emission rate of 0.015 lb/MMBtu of PM_{10}. The facility completed installation of a fabric filter in May 2009. With the installation of the fabric filter, the facility expects to consistently achieve an emission rate of 0.015 lb/MMBtu for PM_{10}.

Unit 4 was previously equipped with a hot-side ESP and was able to achieve an emission rate of 0.024 lb/MMBtu of PM_{10}. The facility completed installation of a fabric filter in May 2008. With the installation of the fabric filter, the facility expects to consistently achieve an emission rate of 0.015 lb/MMBtu for PM_{10}.

Step 2: Identify All Available Retrofit Control Options

Since Units 3 and 4 will be equipped with fabric filters, and fabric filters are considered the top control technology for reducing PM emissions. As a result, no other technology is considered for these two Units. The following retrofit technologies are considered for Unit 2:

- Electrostatic Precipitators
- Fabric Filters

Electrostatic Precipitator. An ESP operates by placing a charge on the particles through electrodes, and then capturing the charged particles on collection plates.

Fabric Filter. The flue gas passes through the bags to remove particulate matter. The bags are cleaned by initiating a pulse of air into the top of the bag. The pulse causes a ripple effect along the length of the bag and releases the dust cake from the bag surface into a hopper.

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that both fabric filters and electrostatic precipitators are technically feasible options.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

Electrostatic Precipitator. ESPs are capable of achieving an emission rate of 0.015 lb/MMBtu. However, ESP operation is susceptible to particle resistivity. Particle resistivity is influenced by flue gas temperature. Thus, operational variations may not result in consistent compliance with the emission limit.

Fabric Filter. Fabric filters are proven to be highly effective and provide a consistent particulate matter reduction. The emissions at the outlet of fabric filter are expected to be less than 0.015 lb/MMBtu.

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

Economic Impact

Since Units 3 and 4 are already equipped with bag filters, no economic impact analysis is required. For Unit 2, since the facility has already decided to install a new bag filter in 2015, this is the only option considered for the economic analysis.

Table 11.6 – Economic Impacts for Unit 2

Control	Emission Rate (lb/ MMbtu)	Total Emission (Tons/ Yr)	Total Emission Reduction (Tons)	Annualized Cost ($MM)	Cost/ Ton ($)	Incremental Cost/ton ($/ton)
Baseline (no control)	0.020	234	-	-	-	-
Fabric Filter	0.015	176	58	9.40	160,747	160,747

Energy Impacts

Since Units 3 and 4 are already equipped with bag filters, no energy impact analysis is required. For Unit 2, the installation of new fabric filter will result in additional pressure drop across the filter and associated duct work. Thus, additional power will be required. This is likely to be offset by the removal of mechanical dust collector and venturi scrubber.

Non-Air Quality Environmental Impacts

There are no negative environmental impacts from the installation of new fabric filter.

Step 6: Evaluate Visibility Impacts

The installation of a fabric filter is the only option considered for BART for all the 3 units.

Step 7: BART Selection

Based upon its review of the company's BART analysis and the information provided above, the Department has determined that, fabric filter with an associated emission limit of 0.015 lb/MMBtu is the BART for control of PM_{10} for Units 2, 3 and 4.

F. Sulfur Dioxide (SO_2) BART

Step 1: Identify the Existing Control Technologies in Use at the Source

Unit 2. This unit is equipped with four venturi flooded disc scrubbers/absorber with lime reagent for SO_2 control. Currently, APS Cholla is able to achieve 0.14 lb/MMBtu to 0.25 lb/MMBtu of SO_2 on Unit 2.

Unit 3. This unit did not have any SO_2 control technology when the BART analysis was completed in late 2007. The facility installed a new wet lime scrubber in May 2009 to capture and treat all flue gases. This will result in Unit 3 consistently meeting an emission limit of 0.15 lb/MMBtu.

Unit 4. This Unit was previously operating with 36% flue gas scrubbing with emission rate of 0.734 lb/MMBtu. The facility installed a new wet lime scrubber in May 2008 to capture and treat all flue gases. This will result in Unit 4 consistently meeting an emission limit of 0.15 lb/MMBtu.

Step 2: Identify All Available Retrofit Control Options

Unit 2. The facility plans to remove the venturi section of the scrubber and considered a wet lime scrubber section for possible operational upgrades. Installation of bag filter as a part of BART will improve the performance of scrubber due to decreased plugging of scrubber. The facility expects to achieve 0.15 lb/MMBtu consistently with these operational upgrades.

Unit 3. In late 2007, APS Cholla identified the following available retrofit control technologies for SO_2 control in Unit 3:

- Dry Flue Gas Desulfurization (FGD) System
- Dry Sodium Sorbent Injection
- Wet Lime Scrubber

Dry Flue Gas Desulfurization (FGD) System. Dry FGD is based on the spray drying of lime slurry into flue gas. The SO_2 is absorbed into the fine spray droplets and reacts with the calcium to form dry calcium sulfite or sulfate. This is collected by the particulate control device along with fly ash.

Dry Sodium Sorbent Injection. Dry duct injection of sodium carbonate or sodium bicarbonate into the flue gas is utilized to remove SO_2. Unreacted/reacted sorbent is collected by the particulate control device along with fly ash.

Wet Lime Scrubber. SO_2 laden flue gas enters a scrubber where it is sprayed with lime slurry. The SO_2 reacts with the calcium to form calcium sulfite or sulfate which is removed and disposed off as scrubber waste, or reclaimed as gypsum.

Subsequently, Cholla intalled a new Wet Lime Scrubber on Unit 3 in May 2009. Therefore, the new wet lime scrubber, as described above, is the only retrofit control technology considered for this unit.

Unit 4. The wet lime scrubber, as described above, is the only retrofit control technology considered for this unit.

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the control options identified above are technically feasible.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

Dry FGD System. This technology is estimated to achieve 90% control efficiency. Thus the achievable emission rate with this technology is 0.25 lb/MMBtu.

Dry Sodium Sorbent Injection. Maximum SO_2 removal efficiency for this technology is 75%. Thus, for an initially uncontrolled emission rate of 2.5 pounds/MMBtu, the achievable emission rate with this technology is 0.625 lb/MMBtu.

Wet Lime Scrubber. Wet lime scrubbers are capable of very high SO_2 removal efficiency. Based on a 95% control efficiency, the wet lime scrubber can achieve the emission rate of 0.15 lb/MMBtu.

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

Economic Impact

Unit 2. Only operational upgrades will be done on the existing wet lime scrubber. Hence there is no economic impact.

Unit 3. The installation of a new wet lime scrubber was completed in May 2009. This technology provides the maximum reduction in SO_2 emissions. The wet lime scrubber is the only option considered for economic analysis.

Table 11.7 – Economic Impacts for Unit 3

Control	Emission Rate (lb/ MMbtu)	Total Emission (Tons/ Yr)	Total Emission Reduction (Tons)	Annualized Cost (Million$)	Cost/ Ton ($)	Incremental Cost/ton ($/ton)
Baseline (no control)	1.00	11,033	-	-	-	-
Wet Lime scrubber	0.15	1,655	9,378	$8.80	936	$936

Unit 4. The facility has completed the installation of a new wet lime scrubber in May 2008. Thus, there is no economic impact that needs to be assessed.

Energy Impacts

There will be no energy impact for Units 2, 3, and 4 as these scrubbers are already in place.

Non-Air Quality Environmental Impacts

There will be no non-air quality environmental impact for Units 2, 3, and 4 as these scrubbers are already in place.

Step 6: Evaluate Visibility Impacts

Wet lime scrubber is the only option considered for BART for Units 2, 3 and 4.

Step 7: BART Selection

Based upon its review of the BART analysis provided by the company, and the information provided above, the Department has determined that wet lime scrubbers with an associated emission limit of 0.15 lb/MMBtu is the BART for control of SO_2 for Units 2, 3 and 4.

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XII. ASARCO HAYDEN SMELTER BART ANALYSIS AND DETERMINATION

A. Process Description

According to EPA's Air Pollution Manual (AP-42) Section 12.3.1, copper mining produces ores that contain less than 1 percent copper. In order to produce copper, the mined ore must be concentrated through crushing, grinding and flotation purification, which results in an enriched ore that contains approximately 15 to 35 percent copper. This is often times referred to as "concentrate".

A typical pyrometallurgical copper smelting process includes 4 steps: roasting, smelting, concentrating and fire refining. Ore concentrate is first roasted to reduce the number of impurities in the concentrate, including sulfur and some heavy metals. The Hayden Smelter introduces a dried concentrate feed, along with combustion oxygen, into an INCO oxygen flash furnace. In this process, the charge of concentrate is mixed with a siliceous flux (often times a low-grade copper ore) and then heated in air to approximately 650 °C (1200 °F). This process eliminates 20 to 50 percent of the sulfur in the concentrate by converting the sulfur into sulfur dioxide (SO_2). The remaining material that leaves the INCO oxygen flash furnace is typically called matte, which is tapped from the furnace, flowing down ventilated launders into ladles that are staged below the furnace's floor. Matte typically contains 35 to 65 percent copper. Once the ladles are filled, they are moved to the converter aisle for transferring the molten matte into the converters. The slag produced by this process is skimmed and removed to a slag pot for delivery to the slag cooling area.

In its converter aisle, the Hayden smelter utilize five Pierce-Smith batch converters in order to produce blister copper by eliminating the remaining iron and sulfur that is present in the material. The ladles filled with matte from the furnace process are carried by crane into the converter aisle, and are then used to dump the molten material into the converters. Once filled, air is blown through the molten matte. Flux (silica) and other materials are added at various times during the process in order to regulate the temperature, and to facilitate the chemical reactions that allow the formation of an iron/silica slag.

The molten bath is allowed to "blow" until sufficient slag has formed on the surface. Operators will then roll the converter out in order to skim the slag off of the top. Additional matte, siliceous flux and scrap metal will again be added to the bath, and then the converter will be rolled back in to continue blowing. After several skimming processes, the converter will be filled with an adequate amount of relatively pure white metal. A final air blast will then be used to oxidize the copper sulfide to produce SO_2 and blister copper which is generally 98 to 99 percent pure copper. Impurities in blister copper often includes gold, silver, antimony, arsenic, bismuth, iron, lead, nickel, selenium, sulfur, tellurium, and zinc.

Each converter at the Hayden smelter is equipped with primary and secondary hooding systems. The primary hooding systems are designed to capture the SO_2 emissions that are emitted while the converters are "rolled-in". These SO_2 gases are then routed through a dust removal system, and then sent to the acid plant for treatment and conversion into sulfuric acid. The secondary hooding systems are designed to capture fugitive gases that escape the primary hood, or are emitted when the converter is "rolled-out" for skimming and charging. Gases that are collected by the secondary hooding are directed to a baghouse for dust removal, and are then exhausted to the atmosphere via the facility's 1,000 foot stack.

Once the blister copper has been produced, the Hayden smelter transfers the blister copper to the anode furnaces via ladle and overhead crane. The anode casting furnace accepts two to three charges from the converter aisle. Once filled, air is introduced into the flash furnace in order to further refine the copper. Impurities within the copper bath form an oxide slag which is removed from the furnace and returned to the converters. After the slag is removed and is no longer forming, natural gas is bubbled through the molten bath to remove any excess oxygen. The resultant purified copper (approximately 99% pure) is

then cast into specifically designed shapes and shipped by rail cars and trucks to off-site refineries for final processing.

B. Description of Emissions Units Subject-to-Best Available Retrofit Technology (BART)

On July 13, 2007, the Arizona Department of Environmental Quality sent a letter to ASARCO, Inc. identifying the following emissions as potentially subject-to-BART:

Table 12.1 – ADEQ Identified Potentially Subject-to-BART Pollutants and Emissions Units

Emissions Unit(s)	Pollutants Potentially Subject-to-BART
Converters 1,3,4 and 5	SO_2, PM_{10}
Anode Furnaces 1-3	SO_2, PM_{10}

As noted Section VI.C ADEQ determined that the potential emissions of PM_{10} were not sufficient to determine that the ASARCO Hayden smelter was subject-to-BART for that pollutant. Emissions of SO_2 from the facility, on the other hand, were determined to be subject-to-BART.

C. STREAMLINED SO_x BART ANALYSIS

Step 1: Identify the Existing Control Technologies in Use at the Source

According to Air Quality Permit 1000042, issued by ADEQ on October 9, 2001, the ASARCO Hayden smelter has installed and operates the following control technologies on the equipment subject-to-BART (Table 12.2):

Table 12.2 – Current Air Pollution Control Equipment and Emission Limits for Equipment Subject-to-BART at the Hayden Smelter

Emissions Units Subject-to-BART	Current Control	SO_x Emission Limit
Converters (four)	1. Primary hooding 2. Secondary hooding 3. Double contact acid plant	1. Multi Point Roll Back Rule [A.A.C. R18-2-715(F)(2)(b)]
Anode Furnaces #1 and #4	No controls	1. Multi Point Roll Back Rule [A.A.C. R18-2-715(F)(2)(b)]

In addition to identifying the above controls for the BART-eligible equipment at the Hayden primary copper smelter, ADEQ also determined that it is important to note the process changes and control equipment that have been installed over time at the facility.

According to ADEQ's *Final Hayden Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan*, dated June 2002, prior to 1971, all smelting operations process gasses from the facility were emitted into the atmosphere after electrostatic precipitators removed the particulate matter from the gases. In 1971, however, the company installed an acid plant as an SO_2 control for primary converter

gases. According to sulfur balance information from the time period, SO_2 emissions from the facility were well in excess of 100,000 tons per year.

In 1983, the company undertook a series of additional improvements, including the replacement of twelve multiple-hearth roasters and two reverberatory furnaces, replacing them with an INCO Flash smelting furnace. At the same time, ASARCO installed a 650 ton per day oxygen plant that would enrich the smelting process gasses. Based upon this addition, the company was able to replace the existing single contact acid plant with a new double-contact acid plant. The emissions reductions resulting from these projects were estimated to be 63,584 tons per year of SO_2. According to ASARCO's calculations, the double-absorption acid plant recovers 99.81 percent of the SO_2 emissions that are vented to it.

In 1992, ASARCO made a modification to the smelter's existing gas handling system, and installed an $18.4 million wet gas handling system. This modification allowed the flash furnace off gas to be treated at temperatures that are less than 200° F, approximately 400° F less than the previous system. Due to the lower temperatures, the volume of gas being vented from the flash furnace was reduced, enabling the acid plant to provide additional ventilation to the converters. This additional ventilation allowed the secondary hoods to draw capture more SO_2 emissions from the converter building.

According to ADEQ's *Final Hayden Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan*, dated June 2002, the complete list of SO_2 Process and Control Technologies employed by the Hayden primary copper smelter throughout the years is as follows (Table 12.3):

Table 12.3 – Implementation of SO_2 Process and Control Technology

Year	Equipment
1971	Installation of No. 1 Acid Plant.
1972	Acid Plant Mist Precipitator Modification. Installation of Reverberatory Vent Fans to improve ventilation.
1973	Installation of Acid Coolers (Crane) for improved acid plant performance and Matte Fume Vent to improve the capture of fugitive emissions.
1974	Installation of Converter Spray Chamber for particulate removal and Plate Heat Exchanger.
1975	Matte Fume Enclosing to improve the capture of fugitive emissions.
1976	Installation of Separator - Demister to improve acid plant performance.
1978	Installation of Flue Gas Sampling Station.
1980	Installation of secondary hooding on the converters to minimize release of fugitive emissions directly to atmosphere.
1983	Replacement of multiple-hearth roasters and reverberatory furnaces with an Inco flash smelting furnace and gas handling equipment including slag skimming hoods, matte tapping hoods, and slag return hoods at the flash furnace for improved sulfur recovery. Installation of gas cleaning mist precipitators.
1983/1984	Installation of Monsanto acid plant No. 2 for treatment of all primary process gases.
1988	Installation of acid plant APV Heat Exchanger to improve gas cleaning performance.

Table 12.3 – Implementation of SO_2 Process and Control Technology	
Year	**Equipment**
1989	Electric slag cleaning vessel with an SO_2 control device; a caustic scrubber that controls a portion of the overall SO_2.
1991	Shutdown of acid plant No.1. Repair of a gas-to-gas heat exchanger leak at the acid plant. Repaired converter flues; replaced primary converter hoods and jackets; rebuilt all units in the Cottrell electrostatic precipitator; installed concrete sumps and improved sprays in the gas spray chamber of the acid plant to reduce fugitive SO_2 emissions.
1993	Upgrade of acid plant mist precipitator and acid plant intermediate fan.
1993	Modification of flash furnace uptake and replacement of cooling fins on the settling chamber to prevent the generation of fugitive emissions caused by inadequate cooling.
1995	Replacement of acid plant heat exchanger and retube of cold heat exchanger.
1997	Retube of Tail Gas Reheater Heat Exchanger.
1998	Installation of wet gas handling system for improved treatment of furnace emissions. Installation of new Hot IP Heat Exchanger; Cold IP Heat Exchanger; SX Distribution in IP Absorbing Tower; Foxboro IA distributive process control
1999/2000	Redesign of converter primary hood doors. The gaps in the primary hoods at the converter mouths were redesigned and a flexible seal installed to minimize the escape of fugitive emissions to the secondary hooding system.
2000	CEM Upgrade (Stack Monitors)

Step 2 - 6: Streamlined Analysis

On October 1, 2007, ASARCO submitted a letter stating:

"During the deliberations of the Market Trading forum of the Western Regioanl Air Partnership (WRAP), all parties involved including ADEQ and the U.S. Environmental Protection Agency (EPA), agreed that the controls and emissions limitation for primary copper smelters already met BART for SO_2. This was reflected in the milestones included in the State Implementation Plan (SIP) that ADEQ submitted to EPA under 40 CFR 51.309 (Section 309 SIP). The milestones being proposed for inclusion in the model 308 SIP currently being developed by the WRAP include an allowance of 26,000 tons of SO_2 for the Hayden smelter and are based on the fact that the smelter is at or beyond the BART requirements."

On November 27, 2007, the only other batch primary copper smelting operation in the Western United States, Phelps Dodge Miami Incorporated, submitted a letter to ADEQ indicating that in December 2003, the Western Regional Air Partnership (WRAP) had made a finding that "[a] double-contact acid plant will be considered the appropriate retrofit control equipment…" for SO_2 emissions. In support, PDMI referred ADEQ to a December 2002 report from E.H. Pechan & Associates, Inc. entitled *WRAP Market Trading Forum Non-Utility Sector Allocations Final Report from the Allocations Working Group*.

ADEQ reviewed the December 2002 report, and found that, at the time the report was published, the WRAP did state that "[a] double contact acid plant is considered the appropriate retrofit control equipment (all smelters in the western States are currently equipped with double contact acid plants.)" In addition, the report noted that there were six primary copper smelters in the WRAP region. Of the six, five were near copper mines in the southwest United States and use a batch process to produce copper. Of these five, only two of the smelters were producing copper, "…(the ASARCO smelter in Hayden, Arizona and the Phelps Dodge smelter in Miami, Arizona.)"

The WRAP's report also stated that the sixth smelter, Kennecott Utah Copper Corporation's operation near Garfield, Utah, was constructed in the mid 1990's and that it uses a flash copper converting technology. This flash copper converting technology allows copper to be produced in a continuous process.

ADEQ's analysis of the copper smelting industry in 2009 in the United States has revealed that there are currently three operating copper smelters. Those smelters are the ASARCO smelter in Hayden, Arizona, the Freeport McMoRan (formerly Phelps Dodge) smelter in Miami, Arizona, and the Kennecot Utah Copper Corporation's facility near Garfield, Utah. No other copper smelters have operated since the time that the WRAP's report has been published, and ADEQ is unaware of any plans to restart any of those smelters in the near future.

As previously noted, ADEQ's review of the Kennecott Utah Copper Corporation's operation has led to the determination that the continuous production of blister copper is a fundamentally different process than the process employed by ASARCO's Hayden Smelter. ADEQ has also determined that BART does not contain a requirement that the source be redesigned when the Agency considers the available control alternatives. As a result, ADEQ has concluded that it is not necessary to consider the use of Kennecott Utah Copper Corporation's process as a potential BART alternative.

Emissions from the Hayden smelter have varied over the years due to a number of factors, including the price of, and demand for, copper. According to the *2018 SO_2 Emissions Evaluation For Non-Utility Sources Final Report* provided by Pechan to the WRAP's Stationary Sources Joint Forum, historical SO_2 emissions from the ASARCO Hayden smelter are as follows:

Table 12.4 – Annual SO_2 Emissions from the ASARCO Hayden Smelter.

Year	SO_2 Emissions (Tons Per Year)
1990	29,814
1996	33,124
1998	22,077
2000	16,753
2003	18,977
2004	19,395

As noted in Table 12.4, SO_2 emissions from the Hayden smelter have varied since 1990. The ASARCO Hayden smelter is considered a custom smelter, and while it obtains some feed of concentrates from its own mines, it also processes materials from other copper mines within the region. The variability of the SO_2 emissions appears to be correlated with the price of copper, which was low in the late 1990s and early 2000s. By 2003, however, copper prices had recovered, accounting for the increasing emissions noted in 2003 and 2004.

According to ADEQ's *Final Hayden Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan*, dated June 2002, the process changes and installation of air pollution controls through the years has resulted in an increased overall SO_2 control efficiency at the Hayden primary copper smelter. Since the 1970s, the SO_2 control rate has risen from approximately 32% to approximately 42% with the installation of the double contact acid plant in the mid-1970s, to approximately 92% as a result of the activities identified in Table 5. Conversely, estimated SO_2 emissions from the facility fell from approximately 200,000 tons per year in the early 1970s, to less than 25,000 tons per year at the current time.

A review of EPA's RACT/BACT/LAER Clearinghouse (RBLC) revealed that there are no emission limitations or air pollution control devices that have been approved for anode furnace operations. Additionally, there are no emission limitations or air pollution control devices that have been approved for copper converters since the installation of the Double Contact Acid Plant in 1974. In addition, the only two remaining primary copper smelting operations that use batch converters are in Arizona and are subject to ADEQ's jurisdiction. Since the installation of the Double Contact Acid Plant there have been no changes at either the ASARCO Hayden smelter or the Freeport McMoRan Miami smelter that have triggered Prevention of Significant Deterioration review for sulfur oxides (SO_x). As a result, ADEQ has determined that the most stringent control available to control SO_x emissions from primary copper smelting operations is the Double Contact Acid Plant.

It should also be noted that EPA non-attainment designations for the new 1-hour SO2 standard are required to be completed in June 2013. EPA has proposed to accept the Governor's recommendation to designate the Hayden area as non-attainment for the new standard. This designation will result in an obligation for the State of Arizona to work on a State Implementation Plan to prescribe control strategies to bring the area to compliance with the 1-hour SO2 standard within 5 years of designation. That timeline will ensure that additional SO2 emission reductions that are necessary to protect human health will be in place prior to the end of the BART period, which will be no sooner than July 15, 2018. It clearly creates certainty with both regulatory processes where the establishment of any new controls to achieve compliance with the NAAQS will essentially translate into significant improvement from a visibility perspective. It should be noted that the control technology evaluation from a NAAQS compliance standpoint does not have built-in cost considerations. From that standpoint, that process will result in emission reductions that may otherwise be considered cost-prohibitive in a conventional BART analysis. Asarco has currently submitted a permit revision application for the installation of new converters and capture systems with a projected cost of more than 100 million dollars.

Step 7: Select BART

Based upon ADEQ's review of all of the above, ADEQ concurs with ASARCO's conclusion that the installation and operation of the double contact acid plant with the New Source Performance Standard of 650 ppm constitutes BART for SO_2.

PARTICULATE BART ANALYSIS

Step 1: Identify the Existing Control Technologies in Use at the Source

Asarco-Hayden Smelter has installed and operates the following control technologies on the equipment subject-to-BART:

- Converters #1, #3, #4 and #5: Primary hoods routed to cyclones, wet scrubbers, wet gas cleaning section, and acid plant
- Secondary hoods routed to secondary hood baghouse

- Anode furnaces #1 and #2: No controls (during baseline period)

Asarco has made the following modifications for particulate matter emissions control since 1977.

- In 1998, Asarco made a modification to the existing gas handling system, and installed an $18.4 million wet gas handling system. This modification allowed the flash furnace off gas to be treated at temperatures that are less than 200° F, approximately 400° F less than the previous system. Due to the lower temperatures, the volume of gas being vented from the flash furnace has reduced, enabling the acid plant to provide additional ventilation to the converters, allowing the secondary hoods to capture more particulate matter emissions from the converter building.

- Asarco installed the anode furnace baghouse in late 2011 to reduce lead emissions as the Hayden Smelter is located in an area that was being considered for lead Non-attainment designation. Asarco intends to rely on emissions reductions from the anode furnace baghouse project to facilitate the converter aisle retrofit, a beyond-BART project aimed at achieving attainment of the 1-hour SO_2 NAAQS.

Steps 2: Identify all available retrofit control technologies with practical potential for application to the specific emission unit for the regulated pollutant under consideration

The following technologies are potentially available for particulate matter control from the converters and anode furnaces:

- Double contact acid plant (existing on converter primary)
- Baghouse (existing on converter secondary)
- Wet scrubbing
- Hot electrostatic precipitator (ESP)
- Cyclone/multiclone

Step 3: Eliminate all technically infeasible control technologies.

The converter primary off-gas stream is controlled by cyclones, wet scrubbers, and the acid plant. Further controls are not deemed feasible due to the highly corrosive nature of the off-gas and the fineness of the particulate that may be escaping.

The converter secondary off-gas stream is controlled by the secondary hood baghouse, which represents the most effective of available technologies, and addition of a less effective control thereafter is judged technically infeasible and unnecessary.

Acid plants are not technically feasible for the converter secondary gas stream, converter tertiary ventilation, or the anode furnaces due to the low concentration of SO_2 present (estimated to be well below 1%).

An ESP is considered technically infeasible for the tertiary ventilation system because of very low inlet particulate loading.

An ESP is considered technically infeasible for the anode furnaces because of the explosion hazard that would result during poling operations when natural gas is introduced into the furnaces and subsequently evacuated to the baghouse.

Step 4: Ranking of Control Effectiveness

Primary off-gas System

Asarco utilizes cyclone, wet scrubber and double contact acid plant system for primary off gas system which is the best available technology. Therefore, no other technologies are considered for the primary off-gas stream.

Secondary off-gas System

Asarco utilizes secondary hood baghouse for the secondary off-gas system which is the most effective control technology. Hence, no other technologies are considered for secondary off-gas stream.

The remaining technologies considered for converter fugitives and the anode furnace particulate emissions are as follows:

Tertiary Ventilation System:

- Baghouse (99.5% control efficiency)
- Wet Scrubber (90% control efficiency)

Anode Furnaces:

- Baghouse (99.5% control efficiency)
- Wet Scrubber (90% control efficiency)

Steps 5-7

(5) Evaluate energy and non-air quality environmental impacts; (6) Evaluate visibility impacts; and (7) select BART.

Primary Off-gas System

The existing combination of cyclones, wet scrubbers, and double contact double absorption acid plant represents BART for the primary off-gas stream because it represents the best current technology. BART is therefore selected as no further control beyond the cyclones, wet scrubbers, double contact double absorption acid plant system.

Secondary Off-gas System

The existing secondary hood baghouse is determined to be the best retrofit technology for the secondary off-gas. BART is therefore selected as no further controls beyond the secondary hood baghouse.

Tertiary Ventilation System

ADEQ has evaluated whether the addition of a tertiary collection and control system would reduce particulate matter emissions from the converters and correspondingly reduce visibility impacts.. Installation of a tertiary ventilation system would require addition of side walls to the converter aisle, installation of canopy hoods over the converters, installation of duct work and a fan to create a draft, and additional ductwork to the existing stack or a new stack. Asarco

conducted a review of a tertiary ventilation system for the proposed converter aisle retrofit project, which utilizes only three converters instead of the existing five.. Cost of the sheeting, ductwork, foundation and supports, induced draft fan, and connection to the main stack annulus is estimated at $19 million. Operating costs are estimated at $400,000 a year. The total annualized cost of the tertiary ventilation system, before any control device is added, is $1.35 million. It is estimated by Asarco that approximately 17.34 tons of particulate matter/year are lost to the atmosphere through fugitive emissions, based on the highest emissions in 2001-2003. Based on this, the cost of installing the ventilation system would be $77,854/ton.

The modeled impact of the Hayden Smelter on the most affected Class I area is 0.04 dv. Thus, cost per deciview is approximately $33.75 million/dv. Given the extremely small visibility impact and the magnitude of the costs incurred, ADEQ has determined that tertiary ventilation control as BART is not a feasible option

Anode Furnaces

In 1977 through 2011, the anode furnaces were uncontrolled. Asarco installed the anode furnace baghouse in late 2011 to reduce lead emissions as the Hayden Smelter is located in an area that was being considered for lead Non-attainment designation.

Capital cost of anode furnace capture ducting:$5,700,000
Annualized capital cost (20 year amortization): $ 285,000
Operating cost of anode furnace capture system: $ 350,000
Annualized total cost for capture system only: $ 635,000
Total uncontrolled particulate matter emissions: 80.06 tons/yr
Total controlled particulate matter emissions (at 0.003 gr/scf): 7.85 tons/yr
Tons particulate matter controlled (assumes baghouse): 72.21 tons/yr
Maximum possible dv impact, any area: 0.04 dv
Cost, $/ton, for capture system only : $8,794/ton
Cost, $/dv, for capture system only: $15,875,000/dv

The cost of a baghouse, wet scrubber, or cyclone/multiclone would be in addition to the costs listed above. For example, the "beyond RACT" baghouse cost approximately $3 million (total project cost: $8.7 million) and if this were added, the costs would increase to approximately $10,870/ton and $19.6 million/dv.

Wet scrubbers also have a number of operational and environmental impacts. Initially, a wet scrubber would require approximately 25-50 gpm of scrubbing liquid. In addition to the water itself, the resulting sludge mixture must be treated and the solids either landfilled or recycled into the system. Establishing a sludge drying system would add to the cost and could add emissions if drying requires more than air assist. Natural gas drying adds to the emissions impacts, partially offsetting the benefits. Electric drying would be costly and would increase emissions elsewhere. Scrubbing reagents may render material less amenable to reprocessing. Based on the number and types of adverse environmental effects from wet scrubbing, it does not appear to be a desirable option for controlling this exhaust gas stream at the Hayden smelter.

Based on the foregoing evaluation, ADEQ believes that the benefits of control, which amount to at most 0.04 dv, are outweighed by the substantial costs and, for wet scrubbers, by the adverse environmental effects of water consumption and sludge management. The particulate matter reductions achieved by the anode furnace baghouse project were undertaken to prepare for the converter aisle retrofit project, which is relying in part upon the emissions reductions in the anode furnace project. The converter aisle retrofit

project is anticipated to bring additional particulate matter reductions through a redesign of the converter aisle, which should provide "beyond BART" levels of control. BART is therefore determined to be no controls for the anode furnaces.

XIII. FREEPORT-MCMORAN MIAMI INC (FMMI) SMELTER (FMMI SMELTER) BART ANALYSIS AND DETERMINATION

A. Process Description

According to EPA's Air Pollution Manual (AP-42) Section 12.3.1, copper mining produces ores that contain less than 1 percent copper. In order to produce copper, the mined ore must be concentrated through crushing, grinding and flotation purification, which results in an enriched ore that contains approximately 15 to 35 percent copper. This is often referred to as "concentrate". In general, most concentrates processed at the FMMI primary copper smelter are equal parts (e.g., one third) sulfur, copper and iron.

At the FMMI smelter, the pyrometallurgical copper smelting process is a four step process consisting of smelting, slag separation, converting and fire refining. The concentrates are fed to the IsaSmelt ® vessel with enriched air, fluxes and natural gas. In this step, the concentrate is converted from a solid feed to a molten metal mix of matte (impure copper) and slag at a temperature of approximately 2300 F (1260 C). This mixture is composed of copper sulfide, copper oxide, iron sulfide, iron oxide, iron silicate and small amounts of trace metals such as gold, silver, lead and other metals. This mix is then transferred to an electric furnace where the matte and slag are separated.

In the electric furnace, electrical resistance is used to maintain temperature and facilitate the separation of slag from the matte by material density and retention time. The electrodes are submersed into the bath and a current is passed through the bath. Periodically, the slag is removed from the electric furnace and transferred to the slag stockpile. Concurrently, the matte (approximately 55% copper) is periodically transferred to the Hoboken Converters for further refining.

The FMMI smelter is the only copper smelter in the United States to use Hoboken converters. This type of converter is fitted with an inverted, u-shaped, side flue at one end that allows the siphoning of gases from the interior of the converter directly into an off gas collection system. This siphoning will also result in a slight vacuum at the mouth of the converter.

In the converters, the matte is converted to blister copper (approximately 99.7% copper) through a two step process of slag separation and oxidation. In the first step, the slag separation (or slag blow), the converters are charged with matte and periodic additions of silica fluxes to facilitate the separation of the residual iron and other impurities from the matte while blast air is introduced to oxidize the impurities. The slag generated in the converter (converter slag) is less dense than the copper portion of the matte, and "floats" on top. This converter slag can then be "skimmed" from the converter by rolling the converter out and pouring the slag into a ladle. The converter slag, which contains recoverable amounts of copper, is transferred to the electric furnace to ensure recovery of the copper values, from the slag. Throughout the slag blow, SO_2 is generated and captured. The captured SO_2 is transported via duct work to a sulfuric acid plant.

In the second stage of processing the matte, large quantities of enriched air (23+% oxygen) are blown into the matte to oxidize the copper sulfide, producing copper, copper oxide and sulfur dioxide. This step is also known as the copper blow. While the metals remain in the converter, the sulfur dioxide generated during the copper blow is transported via duct work to a sulfuric acid plant, which controls sulfur dioxide emissions by converting it to sulfuric acid. After several hours of oxidizing the matte, the sulfur levels are low enough that the matte is converted to blister copper (a mixture of primarily copper with some copper oxide and trace copper sulfide. The blister is then transferred to the Anode vessels for the final pyrometallurgical (fire) refining step.

During both the slag blow and the copper blow, secondary materials and scrap copper may be added to the converter for temperature control and to recover the copper values. Both slag and copper blows are highly exothermic, and the additions of secondary materials and scrap copper are important to control the temperature of the bath throughout the blowing cycles to prevent damage to the refractory and vessel.

In the anode vessels, the fire refining is a three step process of oxidation, slagging and reduction. In the oxidation step, air is introduced to the bath to remove residual sulfur. During the oxidations step, residual iron which may be present in low levels will be oxidized and create a high copper slag. This slag is skimmed from the anode vessel and returned to a converter to recover copper. After the skimming the slag, the bath is then reduced using a mixture of steam and natural gas. The natural gas removes excess oxygen from the molten copper to acceptable limits, while the steam prevents soot formation. After completion of the oxidation step, the copper is classified as anode copper (99.8+% copper) and is ready for casting into anodes, which are subsequently shipped from the smelter for electrolytic refining.

FMMI also operates a remelt/mold casting vessel. This vessel is similar to the anode vessel in that it has natural gas and steam injection installed for the control of oxidation of copper placed in it. The primary purpose of this vessel is to remelt scrap copper (copper foil, pipe and other grade 1 scrap), reduce oxygen to appropriate levels and pour molds used in the anode plant. The oxygen levels of the copper used in the molds must be very low to ensure that the molds can perform properly during the anode casting cycle. The natural gas and steam injection is used for oxygen control and prevention of soot formation. The vessel is also used as a holding vessel for molten blister copper in the event that there are operational issues at the anode plant with one of the two vessels. Typically, the blister is stored in the vessel, kept in a molten state in the event of an anode vessel having operational issues or taking longer for the fire refining cycle.

B. Description of Emissions Units Subject-to-Best Available Retrofit Technology (BART)

On August 3, 2008, FMMI provided a letter to ADEQ, presenting several bases for streamlining the BART review for the FMMI Smelter. According to the letter, FMMI stated that it believed that only the following emissions units at the facility constituted the "source subject-to-BART":

- The Electric Furnace (installed in 1974)
- The four Hoboken Converters (Converters Nos. 2-5) (installed in 1974) ; and

C. Streamlined PM_{10} BART Analysis

Step 1: Identify the Existing Control Technologies in Use at the Source

In an earlier letter dated July 17, 2007, FMMI, stated that "we do not disagree with the results that the Miami facility is subject-to-BART, because the visibility impact was greater than 0.5 dv at the Superstition Wilderness area…"

On August 3, 2008, FMMI provided another letter to ADEQ, presenting several bases for streamlining the BART review for the FMMI Smelter. According to the letter, FMMI stated that it believed that only the following emissions units at the facility constituted the "source subject-to-BART":

- The Electric Furnace (installed in 1974)
- The four Hoboken Converters (Converters Nos. 2-5) (installed in 1974)

The FMMI smelter is a major source of Hazardous Air Pollutants (HAPs), and is therefore subject to the requirements of 40 CFR 63 Subpart QQQ, National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Primary Copper Smelting. According to Section 2.1 of the *National Emissions Standard for Hazardous Air Pollutants (NESHAP) for Primary Copper Smelters – Background Information for Promulgated Standards*, dated December 2001, the HAP emissions from primary copper smelters are primarily from metal impurities that naturally occur in copper ore concentrates. During the smelting process, the HAP metal species are eliminated in the molten slag that is tapped from the process vessels, or are vaporized and discharged in the process vessel off-gas. Upon the cooling of the off-gas, the volatilized HAP metal species condense, form aerosols, and behave as particulate matter.

The composition and concentration of HAP metals in the materials processed by the smelter tends to vary due to the different geological formations from where the copper ore was mined, and due to the different slag and scrap materials added during the processes. This inherent variability and unpredictability of the metal HAP compositions in the copper ores affects the amount of emissions of HAPs during the smelting process. As a result, EPA determined that prescribing individual numeric emissions limits for specific HAP metals was impractical, if not impossible.

EPA's alternative to promulgating specific HAP metal limitations in the NESHAP for Primary Copper Smelting was to use particulate matter as a surrogate pollutant for the HAP metals. All primary copper smelters and other smelter source categories are similar in the fact that the metal HAP compounds are a component of the particulate matter contained in the process off-gas discharged from the smelting and converting operations. In addition, controlling particulate matter process fugitive emissions will also result in the control of the metal HAPs that are contained in those emissions. Consequently, EPA determined that the emission limitations that are established to achieve a good control of particulate matter will also have the result of achieving a good control of metal HAP emissions. Therefore, EPA determined that it was appropriate to regulate particulate matter emissions as a surrogate for HAPs.

According to ADEQ Air Quality Permit Number 29622, the following particulate matter controls or emission limits apply to the emissions units that are subject-to-BART:

Table 13.1 – Current Air Pollution Control Equipment and Emission Limits for Equipment Subject-to-BART at the FMMI Smelter

Emissions Units Subject-to-BART	Current Control	Nonsulfuric Acid PM Emission Limit
Electric Furnace (Process Gases)	Acid plant tail gas system	6.2 mg/dscm (40 CFR 63.1444(b))
Electric Furnace (Captured Fugitive Emissions)	Wet scrubber and wet electrostatic precipitator	23 mg/dscm (40 CFR 63.1444(b)(2)(ii))
Hoboken Converters (Process Gases)	Acid plant tail gas system	6.2 mg/dscm (40 CFR 63.1444(b))
Hoboken Converters (Fugitive Emissions)	Copper converter capture system	4% opacity (40 CFR 63.1444(d)(4))

When setting the particulate matter limits in the NESHAP, EPA determined that it was most appropriate to set the limitation based upon the particulate matter concentrations that do not include sulfuric acid. When sampling sulfuric acid plant tail gas using Method 5, condensed sulfuric acid mist and waters of hydration that were not driven off at the sampling temperature are included in the probe wash and filter catch, along with any metal HAP contained in the tail gas. As a result, EPA agreed that establishing and determining compliance with a total particulate matter emission limit based on Method 5 may include

sulfuric acid mist condensables that are not related to the control or emission of metal HAPs. Given the gas stream characteristics of sulfuric acid plant tail gas, it was EPA's conclusion that Method 5B was the most appropriate test method to use for setting a particulate matter concentration limit that serves as a surrogate for metal HAP emissions contained in the tail gas from sulfuric acid plants.

Step 2 - 6: Streamlined Analysis

Section 2.3 of the *National Emissions Standard for Hazardous Air Pollutants (NESHAP) for Primary Copper Smelters – Background Information for Promulgated Standards*, dated December 2001, stated that Section 112(d)(2) of the Clean Air Act allows EPA to select as MACT, an alternative that is more stringent that the MACT floor. In order to select an alternative, EPA must take into consideration the cost and any non-air quality health and environmental impacts and energy requirements. EPA stated that the objective is to achieve a maximum degree of HAP emissions reductions without imposing unreasonable economic or other impacts.

In response to public comments on the matter, EPA stated that it was aware that there were a number of process modifications and changes for refining copper ores as of December 2001. EPA went on to state, however, that the application of the available modifications and processes were either not applicable to, or not commercially viable for, the existing primary copper smelters that use batch copper converting.

The first alternative that EPA was encouraged to consider was a requirement that all existing primary copper smelting facilities be required to replace their existing batch converters with continuous flash converters. After considering the arguments, however, EPA stated that in its "…judgment that even though a beyond-the-floor alternative requiring the existing batch converters to be dismantled and replaced with continuous flash copper technology may be technically feasible to implement at some or all of the existing smelters potentially subject to the rule, it is not an economically viable alternative. The total cost paid for building the new Kennecott smelter using continuous flash copper converting technology is on the order of one billion dollars. Even using as much of the existing smelter equipment as possible, the total capital investment of replacing the existing batch copper converting process at a smelter with the new continuous flash copper converting process would be in hundreds of millions of dollars. Given the current economic condition of the copper industry in the United States and the fact that none of the companies operating primary copper smelters using batch copper converting plans to change to flash copper converting, a regulatory requirement to do so would impose an enormous economic burden on these smelters." (at p. 2-8)

Other alternatives that EPA considered at the time of the NESHAP proposal included the use of a solvent extraction process and material substitution. After considering these options, however, EPA determined that they were technically infeasible. The solvent extraction process is designed to work for copper oxide ores, not copper sulfide ores. Material substitution is not an option as the HAP emissions from smelters are primarily related to impurities in the copper ores processed by smelter. ADEQ's analysis has revealed that EPA's logic continues to hold true. With respect to material substitution, although the HAP content might be impacted, it is not expected to have any impact on overall particulate matter emissions from the facility.

EPA did specifically address beyond-the-floor alternatives for copper converter departments based upon the control technologies that were used at the ASARCO El Paso smelter. When the El Paso smelter was operating, however, it utilized Pierce-Smith converters which are fundamentally different in design than Hoboken converters. Each of the smelters that employ the Pierce-Smith converters has a system of primary and secondary hoods that are used to capture emissions that emanate out of the mouths of the converters. Hoboken converters, on the other hand, utilize twiers inside the molten bath. In addition to providing the air necessary to oxidize the metals in the molten bath, the movement of the air within the

converter, and the draw from the acid plant creates a vacuum at the mouth of the Hoboken converter. This redirects emissions that emanate from the interior of the converter to the acid plant, reducing the amount of fugitive emissions that are allowed to escape from the Hoboken converter. As a result, ADEQ determined that EPA's beyond-the-floor alternatives for the copper converter departments to be non-transferable to the FMMI smelter.

EPA also considered several other beyond-the-floor alternative controls for all of the primary copper smelters. The other options that were considered included the use of air curtain hoods for each batch converter, and to use a converter building evacuation system. In each of these alternatives, EPA proposed that the captured emissions would be vented to a baghouse control device. To support the analysis of the beyond-the-floor alternatives, EPA prepared estimates of the additional HAP emission reduction and the additional costs associated with implementing each of the two alternatives in place. Taking into consideration the costs of implementing either of the alternative, beyond-the-MACT-floor versus the level of additional emissions reductions that were estimated to be achieved, EPA concluded that there are no reasonable alternatives beyond the MACT floor for the control of process fugitive HAP emissions from existing batch converters. Although the HAP emissions make up only a portion of the particulate matter emissions from the smelter, ADEQ has determined that both options are also not appropriate for consideration for BART.

In Appendix A of the *National Emissions Standard for Hazardous Air Pollutants (NESHAP) for Primary Copper Smelters – Background Information for Promulgated Standards*, dated December 2001, EPA estimated the costs for both beyond-the-floor alternatives for the FMMI smelter as follows (Table 13.2):

Table 13.2 – 2001 Capital and Annual Costs for Alternative Control Strategies

Air Pollution Control Equipment	Estimated Costs (2001 Dollars)	
	Capital Costs	Annual Costs
1A. Air curtain hood vented to existing PM control device	$10 million	$3 million
1B. Air curtain hood vented to new baghouse	$16 million	$5 million
2. Building evacuation system vented through separate baghouse	$23 million	$8 million

The Bureau of Labor Statistics is responsible for, among other things, compiling information regarding inflation so that costs from previous years can be compared to modern day costs. On its Web site, the BLS has provided an inflation calculator[3]. According to the calculator's description: "the CPI inflation calculator uses the average Consumer Price Index for a given calendar year. This data represents changes in prices of all goods and services purchased for consumption by urban households. This index value has been calculated every year since 1913. For the current year, the latest monthly index value is used." Using this calculator, EPA's estimated costs in 2009 dollars would be as follows:

Table 13.3 – 2009 Capital and Annual Costs for Alternative Control Strategies

Air Pollution Control Equipment	Estimated Costs (2009 Dollars)	
	Capital Costs	Annual Costs
1A. Air curtain hood vented to existing PM control device	$12.2 million	$3.6 million
1B. Air curtain hood vented to new baghouse	$19.5 million	$6.1 million

[3] http://data.bls.gov/cgi-bin/cpicalc.pl

Table 13.3 – 2009 Capital and Annual Costs for Alternative Control Strategies		
Air Pollution Control Equipment	**Estimated Costs (2009 Dollars)**	
	Capital Costs	**Annual Costs**
2. Building evacuation system vented through separate baghouse	$28.0 million	$9.7 million

At the time that the FMMI Smelter was modeled for PM emissions, ADEQ estimated potential smelter fugitive particulate matter emissions to be 48.55 pounds per hour, or a maximum of 212 tons per year. Given the relatively small amount of particulate matter reductions and the high costs associated with achieving those reductions, ADEQ has determined that the two alternative approaches considered by EPA remain overly burdensome due to costs alone.

Finally, according to Section 6.1 of the *National Emissions Standard for Hazardous Air Pollutants (NESHAP) for Primary Copper Smelters – Background Information for Promulgated Standards*, dated December 2001, EPA reviewed the estimated costs for the primary copper smelters to comply with the standards under the final rule. Although EPA concluded that some of the smelters would need to install additional air pollution control equipment to meet the standards, EPA did state that the FMMI smelter, which operates Hoboken converters, was believed to be able to meet the standards under the final rule without having to install additional air pollution control equipment (at p. 6-2). Through inspections and performance testing that has been conducted at the FMMI smelter since the time that the NESHAP was promulgated, ADEQ has confirmed that the smelter is capable of being operated in compliance with the non-sulfuric acid particulate matter emission limitations in the NESHAP.

After the EPA promulgated the NESHAP for Primary Copper Smelting, there have been significant changes to the industry. Of the six primary copper smelting facilities that were potentially covered by the NESHAP, only three remain: the Kennecott Smelter in Utah, the ASARCO smelter in Hayden, Arizona, and the FMMI smelter in Miami, Arizona. The other facilities have been shut down or permanently dismantled.

As noted before, the Kennecott Smelter's continuous flash converter process is considered a different subcategory of primary copper smelting, and inherently different from the batch converter process. As a result, the controls and emissions limitations for the Kennecott Smelter are not considered to be transferable to FMMI smelter.

A review of EPA's RACT/BACT/LAER Clearinghouse (RBLC) revealed that no emission limitations or air pollution control devices have been approved for copper smelters since the institution of the NESHAP for Primary Copper Smelting. In addition, the only two remaining primary copper smelting operations that use batch converters are in Arizona and are subject to ADEQ's jurisdiction. Since the implementation of the NESHAP for Primary Copper Smelting there have been no changes at either the ASARCO Hayden smelter or the FMMI smelter that have triggered Prevention of Significant Deterioration review. As a result, ADEQ has determined that the most stringent controls for particulate matter emissions is the NESHAP for Primary Copper Smelting.

Step 7: Select BART

Based upon ADEQ's review of all of the above, ADEQ concurs with FMMI's conclusion that the NESHAP for Primary Copper Smelting constitutes BART for PM emissions.

D. Streamlined SO_2 BART Analysis

Step 1: Identify the Existing Control Technologies in Use at the Source

In a letter dated July 17, 2007, FMMI stated that "we do not disagree with the results that the Miami facility is subject-to-BART, because the visibility impact was greater than 0.5 dv at the Superstition Wilderness area…"

On August 3, 2008, FMMI provided another letter to ADEQ, presenting several bases for streamlining the BART review for the FMMI Smelter. According to the letter, FMMI stated that it believed that only the following emissions units at the facility constituted the "source subject-to-BART":

- The Electric Furnace (installed in 1974)
- The four Hoboken Converters (Converters Nos. 2-5) (installed in 1974) ;

Table 13.4 – Current Air Pollution Control Equipment and Emission Limits for Equipment Subject-to-BART at the FMMI Smelter.

Emissions Units Subject-to-BART	Current Control	SO_2 Emission Limit
Electric Furnace (Process Gases)	Acid plant tail gas system	1. 820 pounds per hour [Installation Permit #1232] 2. 3,515 tons per year [Installation Permit #1232] 3. 0.065% concentration by volume [40 CFR 60.163(a)]
Electric Furnace (Captured Fugitive Emissions)	Vent fume stack scrubber	1. 312 pounds per hour [Installation Permit #1232] 2. 1,336 tons per year [Installation Permit #1232]
Hoboken Converters (Process Gases)	Acid plant tail gas system	1. 820 pounds per hour [Installation Permit #1232] 2. 3,515 tons per year [Installation Permit #1232] 3. 0.065% concentration by volume [40 CFR 60.163(a)]
Hoboken Converters (Fugitive Emissions)	Smelter fugitives	1. 1,288 pounds per hour [Installation Permit #1232] 2. 5,517 tons per year [Installation Permit #1232]

In addition to identifying the above controls for the BART-eligible equipment at the Miami primary copper smelter, ADEQ also determined that it is important to note the process changes and control equipment that have been installed over time at the facility.

According to ADEQ's *Final Miami Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan*, dated June 2002, smelting operations began in Miami in 1915. Prior to 1974, the facility operated reverberatory furnaces and Peirce Smith converters in order to process copper sulfide ore from the nearby mines. In 1974, however, an electric furnace and Hoboken or siphon converters were

installed for processing dried copper ore concentrates. A double contact acid plant was also installed in order to reduce the amount of SO_2 gases that are produced and emitted during the smelting and converting operations.

Prior to the installation of the double contact acid plant in late 1974, all process gasses from the smelting operations were emitted into the atmosphere after particulate matter was first removed by an electrostatic precipitator. Sulfur balance data available from that time period indicated that emissions of SO_2 from the Miami smelter were at least 34,000 lbs/hr (17 tons/hr). Actual emissions of SO_2 in the time period were estimated to be greater than 175,000 tons per year.

In 1992, the Miami smelter undertook a series of pollution control improvements, including the installation of an IsaSmelt® furnace and a 528 ton per day oxygen plant to enrich the smelting blast air.

In particular, the IsaSmelt® furnace eliminated the Miami copper smelter's use of the electric furnace as the primary device for smelting. In addition to increasing the facility's efficiency in producing copper, the IsaSmelt® conversion also improved the control of SO_2 emissions, as the new furnace comprises a closed vessel that is designed to contain the emissions from the process and route the process gasses generated to the acid plant. The result of these upgrades reduced the amount of fugitive SO_2 emissions being directly vented to the atmosphere from the electric furnaces that it replaced.

The double contact sulfuric acid plant is the predominant control device for process gases containing SO_2 at the Miami smelter. Process gases that are produced by the IsaSmelt® furnace, electric furnace, and converters are first cooled and cleaned of particulates in a gas scrubbing and electrostatic precipitator system in order to prepare the gas stream for treatment in the acid plant. After cooling and cleaning, the gas stream is dried and the SO_2 is converted by catalyst to sulfur trioxide (SO_3). The SO_3 is then adsorbed in circulating sulfuric acid to become sellable grade acid. Overall efficiency of SO_2 recovery from the acid plant has been found to be 99.9%

According to ADEQ's Final Miami Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan, dated June 2002, the complete list of SO_2 Process and Control Technologies employed by the Miami primary copper smelter throughout the years is as follows (Table 13.5):

Table 13.5 – Implementation of SO_2 Process and Control Technology

Year	Equipment
1974	Replacement of reverberatory furnace and old converters with an Electric Furnace and Hoboken converters. Installation of a double contact acid plant for treatment of primary process gases.
1979 – 1981	Installation of Electric Furnace matte fume hoods at matte tapping area for capture of fugitive emissions.

Table 13.5 – Implementation of SO_2 Process and Control Technology	
Year	**Equipment**
1992	Installation of an IsaSmelt® Furnace and new oxygen plant. Installation of IsaSmelt® Furnace tapping launder covers, Electric Furnace slag tapping hoods, and vent fume scrubber for capture and control of fugitive emissions. Upgrade to increase the fan capacity of vent fume system for the two new fugitive emissions collection points. Upgrades to the acid plant and installation of a 3rd stage electrostatic mist precipitator at the acid plant and acid plant tail gas peaking scrubber for control of primary process emissions.
1997	Replacement of the old intermediate absorption tower at the acid plant with a new tower to increase the efficiency of the acid plant. The replacement is equipped with high efficiency (candle type) mist eliminators. Installation of a new catalytic converter, preheater, SO_3 cooler, product acid cooler and a final absorber, and replacement of two cold reheat exchangers at the acid plant.
1998	Intermediate absorber and cold reheat exchangers put into service.

Steps 2 - 6: Streamlined Analysis

On November 27, 2007, FMMI submitted a letter to ADEQ indicating that in December 2003, the Western Regional Air Partnership (WRAP) had made a finding that "[a] double-contact acid plant will be considered the appropriate retrofit control equipment…" for SO_2 emissions. In support, FMMI referred ADEQ to see a November 2002 report from E.H. Pechan & Associates, Inc. entitled *WRAP Market Trading Forum Non-Utility Sector Allocations Final Report from the Allocations Working Group*.

ADEQ reviewed the November 2002 report, and found that, at the time the report was published, the WRAP did state that "[a] double contact acid plant is considered the appropriate retrofit control equipment (all smelters in the Western States are currently equipped with double contact acid plants.)" In addition, the report noted that there are six primary copper smelters in the WRAP region. Of the six, five are near copper mines in the southwest United States and use a batch process to produce copper. Of these five, only two of the smelters were producing copper, "…(the ASARCO smelter in Hayden, Arizona and the Phelps Dodge (now FMMI) smelter in Miami, Arizona.)"

The WRAP's report also stated that the sixth smelter, Kennecott Utah Copper Corporation's operation near Garfield, Utah, was constructed in the mid 1990's and that it uses a flash copper converting technology. This flash copper converting technology allows copper to be produced in a continuous process.

ADEQ's analysis of the copper smelting industry in the United States has revealed that there are currently three operating copper smelters. Those smelters are the ASARCO smelter in Hayden, Arizona, the FMMI smelter in Miami, Arizona, and the Kennecott Utah Copper Corporation's facility near Garfield, Utah. No other copper smelters have operated since the time that the WRAP's report has been published, and ADEQ is unaware of any plans to restart any of those smelters in the near future.

As previously noted, ADEQ's review of the Kennecott Utah Copper Corporation's operation has led to the determination that the continuous production of blister copper is a fundamentally different process than the process employed by the FMMI Smelter. ADEQ has also determined that BART does not contain a requirement that the source be redesigned when the Department considers the available control alternatives. As a result, ADEQ has concluded that it is not necessary to consider the use of Kennecott Utah Copper Corporation's process as a potential BART alternative.

Emissions from the Miami smelter have varied over the years due to a number of factors, including the price of, and demand for, copper. According to the *2018 SO_2 Emissions Evaluation For Non-Utility Sources Final Report, October 2006,* provided by Pechan to the WRAP's Stationary Sources Joint Forum, historical SO_2 emissions from the Miami smelter are as follows (Table 13.6):

Table 13.6 – Annual SO_2 Emissions from the Miami Smelter

Year	SO_2 Emissions (Tons Per Year)
1990	5,676
1996	5,737
1998	6,097
2000	6,810
2003	8,005
2004	8,754

As noted in Table 13.6, SO_2 emissions from this facility have been steadily increasing since 1990. It is understood that the emissions increase trend can be attributed to increased utilization of capacity that was already available at the facility. Air Quality Control Permit Number 29622 issued by ADEQ on July 5, 2006, however, limits overall SO_2 emissions from the facility to no more than 10,368 tons per year. In addition, short term emissions are addressed in the permit, as seen in Table 13.4 above.

According to ADEQ's *Final Miami Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan*, dated June 2002, the process changes and installation of air pollution controls through the years has resulted in an increased overall SO_2 control efficiency at the Miami primary copper smelter. Since the 1970's, the SO_2 control rate has risen from approximately 5% to approximately 75% with the installation of the double contact acid plant in the 1974, to approximately 99% as a result of the activities identified in Table 13.5. Conversely, estimated SO_2 emissions from the facility fell from approximately 175,000 tons per year in the early 1970s, to less than 10,000 tons per year at the current time.

A review of EPA's RACT/BACT/LAER Clearinghouse (RBLC) revealed that no emission limitations or air pollution control devices have been approved for copper smelters for sulfur oxides since the installation of the double contact acid plant in 1974. In addition, the only two remaining primary copper smelting operations that use batch converters are in Arizona and are subject to ADEQ's jurisdiction. Since the installation of the double contact acid plant there have been no changes at either the ASARCO Hayden smelter or the FMMI smelter that have triggered Prevention of Significant Deterioration review for sulfur oxides (SO_2). As a result, ADEQ has determined that the most stringent control available to control SO_2 emissions from primary copper smelting operations is the double contact acid plant.

It should also be noted that EPA non-attainment designations for the new 1-hour SO2 standard are required to be completed in June 2013. EPA has proposed to accept the Governor's recommendation to

designate the Miami area as non-attainment for the new standard. This designation will result in an obligation for the State of Arizona to work on a State Implementation Plan to prescribe control strategies to bring the area to compliance with the 1-hour SO2 standard within 5 years of designation. That timeline will ensure that additional SO2 emission reductions that are necessary to protect human health will be in place prior to the end of the BART period, which will be no sooner than July 15, 2018. It clearly creates certainty with both regulatory processes where the establishment of any new controls to achieve compliance with the NAAQS will essentially translate into significant improvement from a visibility perspective. It should be noted that the control technology evaluation from a NAAQS compliance standpoint does not have built-in cost considerations. From that standpoint, that process will result in emission reductions that may otherwise be considered cost-prohibitive in a conventional BART analysis.

Step 7: Select BART

Based upon ADEQ's review of all of the above, ADEQ concurs with FMMI's conclusion that the installation and operation of the double contact acid plant with the New Source Performance Standard of 650 ppm constitutes BART for SO_2.

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XIV. SRP CORONADO GENERATING STATION BART ANALYSIS AND DETERMINATION

A. Process Description

SRP Coronado Generating Station (CGS) is comprised of two coal-fired electric utility steam generating units, specifically Unit 1 and Unit 2. These are dry-turbo-fired boilers with a net rated output of 395 MW and 390 MW respectively. CGS generates electricity by combustion of pulverized coal that heats water in boiler tubes to produce steam. This steam is then used to turn a turbine which is connected on a common shaft to a generator rotor. As the rotor in the generator is turned, it induces an electrical current in the stator windings of the generator, making electricity.

B. Consent Decree

On December 22, 2008, SRP and EPA entered into entered into a Consent Decree which requires the implementation of the following pollution control projects for SO_2 and NO_X at SRP's CGS facility.

- Addition of LNB to Units 1 and 2 to reduce NO_X emissions. Coupled with the burner additions will be modifications to the furnace combustion air system on each Unit (ACC).
- Addition of a Selective Catalytic Reduction (SCR) to Unit 2. The SCR will further reduce NO_X emissions from Unit 2.
- Replacement of the existing Pullman Kellog wet limestone Flue Gas Desulfurization systems on Unit 1 and Unit 2 with new wet limestone FGD (WFGD) systems to further reduce SO_2 emissions.

The implementation schedule as laid out in the Consent Decree is as follows:.

Table 14.1 – Implementation Summary of Pollution Control Projects

Unit	Projected Operational Date	Expected Emission Rates
1 or 2	ACC – June 1, 2009	NO_X - 0.320 lb / MMBtu
2 or 1	ACC – June 1, 2011	NO_X - 0.320 lb / MMBtu
2	SCR – June 1, 2014	NO_X - 0.080 lb / MMBtu
2	FGD – January 1, 2012	SO_2 – 95% control or 0.080 lb / MMBtu
1	FGD – January 1, 2013	SO_2 – 95% control or 0.080 lb / MMBtu

C. Description of Emissions Units Subject to Best Available Retrofit Technology (BART)

The BART– affected emission units at the CGS are Units 1 and 2. These units are BART- eligible since they meet the following requirements:

1. They were "in existence" between 1962 and 1977. Units 1 and 2 were in the construction phase in this period.
2. The emissions from the combined BART-eligible units are greater than 250 tons/year. Emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_X), and particulate matter below 10 micron size (PM_{10}) are 29,384, 20,361, and 1,008 tons per year respectively.

3. These units belong to one of the 26 categories of sources identified in the Regional Haze Rule.

Further in order to confirm that the CGS has visibility impacts on the Class I areas, CALPUFF modeling was conducted by SRP to assess impacts at 17 Class I areas. Modeling was conducted with three years of CALMET meteorological data (2001-2003). The results of the baseline CALPUFF modeling are listed in Table 2. This table provides the 8th highest delta-deciview and the total 8th highest deciview (Source contribution plus the natural background).

As demonstrated in Table 2, the impact of CGS on the visibility in Class I areas is more than 0.5 dv threshold that is used as a trigger for BART applicability. Therefore, Units 1 and 2 at CGS are presumed to cause or contribute to visibility impairment and are, therefore, subject-to-BART for SO_2, $NO_{X,}$ and PM_{10}.

Table 14.2 – Regional Haze Impacts Due to Baseline Emissions								
Class I Area	**Ave. Annual Natural Background**	**Met Year 2001**		**Met Year 2002**		**Met Year 2003**		**Average Highest Total Δdv**
		8th Highest Δdv	**8th Highest Total Δdv**	**8th Highest Δdv**	**8th Highest Total Δdv**	**8th Highest Δdv**	**8th Highest Total Δdv**	
Bandalier, NM	4.46	1.0	5.4	1.1	5.5	1.0	5.5	5.46
Bosque del Apache	4.41	1.5	5.9	1.7	6.1	1.5	5.9	5.96
Chiricahua, NM	4.36	0.8	5.2	0.6	5.0	1.1	5.5	5.23
Chiricahua, W	4.35	0.7	5.1	0.6	5.0	1.2	5.6	5.23
Galiuro W	4.32	1.0	5.3	0.8	5.1	0.9	5.2	5.2
Gila W	4.39	2.0	6.4	2.0	6.4	2.3	6.7	6.5
Grand Canyon NP	4.39	1.1	5.5	0.8	5.2	0.5	4.9	5.2
Mazatzal W	4.35	0.9	5.2	1.0	5.4	1.4	5.8	5.45
Mesa Verde NP	4.53	1.1	5.6	1.1	5.6	1.2	5.7	5.63
Mount Baldy W	4.39	1.6	6.0	1.4	5.8	2.0	6.4	6.1
Petrified Forest NP	4.41	2.5	6.9	2.8	7.2	2.7	7.1	7.1
San Pedro Parks W	4.47	0.9	5.4	1.3	5.8	1.3	5.7	5.6
Sierra Ancha W	4.36	1.0	5.3	1.3	5.6	1.7	6.0	5.6
Superstition W	4.32	1.1	5.4	1.0	5.3	1.4	5.7	5.5
Pine Mountain W	4.36	0.5	4.8	0.7	5.1	1.0	5.3	5.1
Saguaro W & NP	4.28	0.8	5.1	0.6	4.9	0.7	4.9	5.0
Sycamore Canyon W	4.40	0.8	5.2	0.7	5.1	0.8	5.2	5.2

Notes: W: Wilderness Area; NP: National Park; NM: National Monument

D. BART for NO_X

Step 1: Identify the Existing Control Technologies in Use at the Source

NO_X emissions from both Units 1 and 2 are currently controlled by good combustion practices and overfire air. The resulting emission rate ranges from 0.45 to 0.50 lbs/MMBtu.

Step 2: Identify All Available Retrofit Control Options

The alternative NO_X control technologies for limiting NO_X emissions from Unit 1 and Unit 2 are listed as follows:

- Advanced Combustion Control-Low NO_X burners (LNB) and over fire air (OFA)
- Selective non-catalytic reduction (SNCR)
- Selective catalytic reduction (SCR)

The brief evaluation of the above control technologies is provided below:

Advanced Combustion Control (ACC). ACC, including LNB and OFA, on a dry-turbo-fired boilers are designed to control fuel and air mixing to reduce peak flame temperatures resulting in less NO_X formation. Combustion reduction and burnout are achieved in three stages within a conventional low NO_X burner. In the initial stage, combustion occurs in a fuel rich, oxygen deficient zone where the NO_X is formed. In the second stage, the exhaust gases from Stage 1 are exposed to a reducing atmosphere where hydrocarbons that react with the already formed NO_X are formed. In the third stage, internal air staging completes the combustion, but may result in additional NO_X formation. This, however, can be minimized by completing the combustion in an air lean environment. Combustion air is separated into primary and secondary flow sections to achieve complete burnout and to encourage the formation of nitrogen, rather than NO_X. Primary air (70-90%) is mixed with the fuel producing a relatively low temperature, oxygen deficient, fuel-rich zone thereby reducing the formation of fuel-bound NO_X. Secondary air representing 10-30% of the combustion air is injected above the combustion zone through a special wind-box with air introducing ports and/or nozzles mounted above the burners. Combustion is completed at this increased flame volume. This process limits the production of thermal NO_X.

Selective Non-Catalytic Reduction (SNCR). SNCR is based on a gas-phase homogeneous reaction that involves the injection of an-amine based compound into the fuel at an appropriate temperature range for reduction of NO_X. An amine-based compound such as ammonia (NH_3) or urea ($(NH_2)_2$ CO) is used as the NO_X reducing agent. When ammonia or urea is injected into the flue gas stream, it selectively reduces the NO_X into molecular nitrogen and water. At stoichiometric conditions, when the adequate residence time is reached, the overall reactions that occur may be characterized by:

Ammonia

$$4\ NO + 4\ NH_3 \rightarrow 4\ N_2 + 6\ H_2O$$

$$2\ NO_2 + 4\ NH_3 + O_2 \rightarrow 3\ N_2 + 6\ H_2O$$

Urea

$$2\ (NH_2)_2\ CO + 4\ NO + O_2 \rightarrow 4\ N_2 + 2\ CO_2 + 4\ H_2O$$

In an SNCR system, NO_X reduction does not take place in the presence of a catalyst, but rather is driven by the thermal decomposition of ammonia and urea and the subsequent reduction of NO_X. Consequently,

the SNCR process operates at higher temperatures than the SCR process. The temperature of the flue gas is critical to the successful reduction of NO_X with SNCR at the point where the reagent is injected. For the ammonia injection process, the necessary temperature range is 1700 to 1900°F. The other factors affecting the performance of SNCR performance are gas mixing, residence time at operating temperatures, and ammonia slip. Since ammonia is present in the flue gas, a portion of the ammonia may oxidize at temperatures greater than 2000°F. Above 2000°F, the reaction of ammonia oxidation becomes predominant. Nitrogen monoxide is formed as a product of the reaction. Thus, when the flue gas temperature at reagent injection locations is higher than the appropriate temperature window, the SNCR process results in increased NO_X formation rather than NO_X reduction. At temperatures lower than the required temperature window, the NO_X reduction rates becomes lower, and unreacted ammonia may slip through and be emitted to the atmosphere.

Selective Catalytic Reduction (SCR). SCR is a process that involves post-combustion removal of NO_X from the flue gas utilizing a catalytic reactor. In the SCR process, ammonia injected into the flue gas reacts with the NO_X and oxygen to form Nitrogen and water by the following general reactions:

$$4\ NO + 4\ NH_3 \rightarrow 4\ N_2 + 6\ H_2O$$

$$2\ NO_2 + 4\ NH_3 + O_2 \rightarrow 3\ N_2 + 6\ H_2O$$

These reactions take place on the surface of the catalyst. The function of the catalyst is to effectively lower the activation energy of the NO_X decomposition reaction to about 375 to 750°F, depending on the specific catalyst and other contaminants in the flue gas. The factors affecting SCR performance are catalyst reactor design, optimum operating temperature, sulfur content of the fuel, catalyst deactivation due to aging or poisoning, ammonia slip emissions, and design of the ammonia injection system.

The SCR system is comprised of a number of subsystems, including the SCR reactor, ammonia injection system, and ammonia storage and delivery system. The SCR reactor would be located downstream of the economizer and ESP, and upstream of the air pre-heater. From the ESP outlet, the flue gas would first pass through a low-pressure ammonia/air injection grid designed to provide optimal mixing of ammonia with flue gas. The ammonia treated flue gas would then flow through the catalyst bed and exit to the air pre-heater. The SCR system for a pulverized coal boiler typically uses a fixed bed catalyst in a vertical down-flow, multi-stage reactor.

Reduction catalysts are divided into two groups: base metal, primary vanadium, platinum, or titanium (lower temperature) and zeolite (higher temperature). Both groups exhibit advantages and disadvantages in terms of operating temperature, ammonia- NO_X ratio, and optimum oxygen concentration. The optimum operating temperature for a vanadium-titanium catalyst system is in the range of 550° to 800°F, which is significantly higher than the optimum operating temperature for the platinum catalyst systems. The vanadium-titanium catalyst begins to break down, however, when continuously operating at temperatures above this range. Operation above the maximum temperature results in oxidation of ammonia to either ammonium sulfate or NO_X, thereby actually increasing the NO_X emissions.

To achieve high NO_X control efficiencies, the SCR vendor suggests a higher ammonia injection rate than is stoichiometrically required to react all of NO_X in the combustion gases. This results in emissions of un-reacted ammonia or "ammonia slip". The various SCR vendors typically guarantee ammonia slip of about 2 ppm for systems designed for very high NO_X performance levels. This excess ammonia may react with SO_3 and water to form ammonium bisulfate $(NH_4)\ HSO_4$ and ammonium sulfate, $(NH_4)_2\ SO_4$. Higher levels of ammonia and SO_2 results in formation of higher levels of these salts. These ammonium salts may condense as the flue gases cool and can lead to increased emissions of both PM_{10} and $PM_{2.5}$.

Furthermore the catalyst promotes the partial oxidation of SO_2 to SO_3, which in turn combines with water thereby increasing the formation of these ammonia salts and potential emissions of PM_{10} and $PM_{2.5}$.

Some SCR installations have experienced significant air pre-heater plugging and corrosion resulting from the deposition of ammonium bisulfate. The plugging and corrosion can cause reduced boiler efficiency, higher flue gas pressure drop, more frequent air pre-heater cleaning and washing, increased boiler downtime, and increased maintenance cost. The primary factors for controlling the formation and deposition of ammonium bisulfate are the levels of ammonia, the level of SO_3, the air pre-heater surface temperature profile, the air pre-heater surface material, and the air pre heater physical configuration. The temperature window for ammonium bisulfate formation is as wide as 300^o to 425^oF.

The SCR system is subject to catalyst deactivation over time. Catalyst deactivation occurs through two primary mechanisms: physical deactivation and chemical poisoning. Physical deactivation usually results from either prolonged exposure to excessive temperatures or masking of the catalyst due to entrainment of particulate from ambient air or air contaminants. Chemical poisoning is caused by the irreversible reaction of the catalyst with a contaminant in the gas stream and thus a permanent condition. Catalyst suppliers typically guarantee a limited lifetime for high performance catalyst systems. Fly ash plugging generally results from excessive carryover to the catalyst or poor catalyst gas flow design.

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the above control technologies are feasible options for BART at CGS.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

The alternative NO_X control technologies, ACC, SNCR, and SCR, have been successfully applied to new utility coal fired boilers, as well as retrofitted to existing coal fired boilers. The effectiveness of these technologies in reducing NO_X emissions is dependent primarily on the inlet NO_X concentrations, residence time, and operating temperatures. ACC has been demonstrated to achieve 25% to 35% reduction in uncontrolled NO_X emissions. SNCR has been demonstrated to achieve NO_X control efficiencies ranging from 30% to 50% with inlet NO_X concentration of 300 to 400 ppmvd. If staged combustion is used to reduce inlet NO_X concentrations to less than 250 ppmvd, SNCR is capable of achieving NO_X control efficiencies of only 20% to 40%. Likewise, SCR can achieve NO_X control efficiencies as high as 90% with inlet concentrations in the range of 300 to 400 ppmvd. If inlet NO_X concentrations are less than 250 ppmvd, SCR can achieve NO_X control efficiencies ranging from 70% to 80%.

In its BART analysis, CGS considered the above technologies for control of NO_X in the following sequence: ACC in both Unit 1 and Unit 2, ACC with SNCR in both Unit 1 and Unit 2, ACC in both Unit 1 and Unit 2 with SCR in Unit 2, and ACC and SCR in both Unit 1 and Unit 2. Based on the information provided by the equipment vendors, the controls listed above were estimated to reduce NO_X emissions as demonstrated in Table 14.3.

Table 14.3 – NO_X Emission Factors resulting from NO_X Controls

Control Option	Control Technology	Unit 1	Unit 2
		Pounds/MMBtu	
	Baseline	0.433	0.433
3	ACC- Both Units	0.32	0.32
4a	ACC and SNCR- Both Units	0.224	0.224
4 b	ACC (Both Units) and SCR on Unit 2	0.32	0.08
5	ACC and SCR on both Units	0.08	0.08

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

Costs of Compliance

Based on the vendor data on the capital cost and operation & maintenance cost for different control options, Table 14.4 provides the information on the annual costs associated with each of the control options.

Table 14.4 – Total Capital and Annual Costs associated with NO_X Controls

Control Option	Control Technology	Total Capital (Million $)	Fixed Capital (Million $)	Annual O&M (Million $)	Total Annual Cost (Million $)
3	ACC- Both Units	$13.00	$1.227	0	$1.227
4a	ACC and SNCR- Both Units	$26.00	$2.454	$2.200	$4.654
4 b	ACC (Both Units) and SCR on Unit 2	$79.00	$7.4570	$1.100	$8.557
5	ACC and SCR on both Units	$145.0	$13.69	$3.400	$17.09

* Fixed capital cost calculation is based on a CRF of 0.09439, assuming an interest rate of 7%, and amortization period of 20 years.

Table 14.5 provides annual estimated emission numbers for NO_X and cost figures relating to the implementation of various control options for NO_X.

Table 14.5: Total Annual Emissions of NO_X with different options of NO_X Controls

Factor	Baseline	Option 3	Option 4a	Option 4b	Option 5
Unit 1	10,332 tpy	7,636 tpy	5,345 tpy	7,636 tpy	1,909 tpy
Unit 2	10,029 tpy	6,887 tpy	4,821 tpy	1,722 tpy	1,722 tpy
Total (Both Units)	20,361 tpy	14,523 tpy	10,166 tpy	9,358 tpy	3,631 tpy
Reduction from Baseline	-	5,838 tpy	10,195 tpy	11,003 tpy	16,730 tpy
Incremental Reduction from earlier option	-	5,838 tpy	4,357 tpy	808 tpy	5,727 tpy

Table 14.5: Total Annual Emissions of NO_X with different options of NO_X Controls					
Factor	**Baseline**	**Option 3**	**Option 4a**	**Option 4b**	**Option 5**
Annualized Cost (Million $)	-	$1.227	$4.654	$8.556	$17.09
Cost of reduction (Dollar per ton)	-	$210	$457	$778	$1,021
Incremental cost of reduction (Dollar per ton)	-	$210	$787	$4,830	$1,489

Energy Impacts

SCR will consume significantly more energy as compared to the energy consumption in SNCR. This is due to the power required for the increased fan static pressure required to overcome the pressure drop across the catalyst bed, as well as for pumps and evaporator blower. Assuming a pressure drop of 14 inches of water across the catalyst bed, SCR applied to both units will consume 7,300 kWh more electrical power per year than SNCR (approaching 1% of the total power generation of the CGS).

Non-Air Quality Environmental Impacts

One of the most significant impacts of retrofitting SCR and SNCR is the addition of ammonia and urea storage and handling systems. Anhydrous ammonia and aqueous ammonia above 20% are considered dangerous to human health. An accidental release of anhydrous ammonia or 20% or greater aqueous ammonia is reportable to local, state, and federal agencies. In anticipation of such an incident, the site will need to develop, implement, and maintain a Risk Management Plan (RMP) and Process Safety Measures (PSM) Program.

Ammonia associated with fly ash has the potential to present several problems with the disposal and/or the use of fly ash. Once the fly ash is exposed to the SNCR process, there will be a significant quantity of soluble salts associated with fly ash. These salts are expected to be $(NH_4)HSO_4$ and $(NH_4)_2SO_4$.

Dry disposal of ash can cause the leachate and/or runoff water to contain increased concentrations of ammonia. If and when these salts are contacted with water, they will most likely be dissolved and the resulting aqueous concentration of nitrogen-containing compounds can increase in the waters associated with the ash. Table 10 below summarizes the non-air quality environmental impacts associated with the proposed BART control options.

Table 14.6 – Summary of Non-Air Quality Environmental Impacts	
Control Option	**Summary of Non-Air Quality Environmental Impacts**
ACC	- Potential to increase in loss of ignition (LOI) of flyash, which could reduce recycling sales. - Slight increase in CO_2 emissions/kWH associated with reduced boiler efficiency. - Potential for incomplete combustion (lost energy). - Potential for increased corrosion and more frequent replacement of furnace water tubes.

Table 14.6 – Summary of Non-Air Quality Environmental Impacts	
Control Option	**Summary of Non-Air Quality Environmental Impacts**
SNCR	- Addition of ammonia or urea storage and handling systems. - Anhydrous ammonia and aqueous ammonia above 20% are considered dangerous to human health and accidental releases are reportable to local, state, and federal agencies. - The facility must develop, implement, and maintain a Risk Management Plan (RMP) and Process Safety Measures Program (PSM). - Sulfuric acid in the flue gas can cause various power plant operation and maintenance problems. Condensation of sulfuric acid has a significant detrimental effect on downstream equipment, including fouling and corrosion of heat transfer surfaces in the air pre heater. - Ammonia associated with flyash has the potential to present several problems with the disposal and/or use of flyash. - Dry disposal of flyash can cause leachate and/or runoff water to contain increased concentrations of ammonia and/or nitrogen-containing compounds.
SCR	- Addition of Ammonia handling system. - Anhydrous ammonia and aqueous ammonia above 20% are considered dangerous to human health and accidental releases are reportable to local, state, and federal agencies. - The facility must develop, implement, and maintain a Risk Management Plan (RMP) and Process Safely Measures Program (PSM). - Disposal of spent catalyst containing heavy metals such as vanadium, tungsten, or molybdenum. - Increase in CO_2 emissions from power required for the increased fan static pressure required to overcome the pressure drop across the catalyst bed, as well as for pumps and evaporator blower.

Step 6: Evaluate Visibility Impacts

Four different scenarios for control of NO_x emissions were modeled for each meteorological year (2001-2003) and for all 17 Class I areas within 300 km. Brief details of the modeling results are as under:

Option 3: WFGD with ACC. The modeling result indicates that this control option provides an improvement in visibility index by approximately 0.11dv.

Option 4a: WFGD with ACC and SNCR on both units. The modeling result indicates that this control option provides an improvement in visibility index by approximately 0.19 dv.

Option 4b: WFGD with ACC on both units and SCR on Unit 2. The modeling result indicates that this control option provides an improvement in visibility index by approximately 0.22 dv.

Option 5: WFGD with ACC and SCR on both units. The modeling result indicates that this control option provides an improvement in visibility index by approximately 0.34 dv.

Table 12.7 below provides information on the cost in dollars per deciview improvement in visibility achieved by implementing the respective control options. The table also presents details on the incremental cost in dollars per deciview improvement over different control options.

Table 12.7 – Summary for NO_X BART

Factor	Option 2 Baseline, WFGD	Option 3 ACC	Option 4a ACC w/ SNCR	Option 4b ACC w/ SCR for Unit 2	Option 5 ACC w/ SCR
Reduction in Emission (tpy)	-	5,838	10,195	11,003	16,730
Annualized Cost (Million $)	-	$1.227	$4.654	$8.557	$17.09
Visibility Index Improvement Over Baseline (Δ dv)	-	0.11	0.19	0.22	0.34
Incremental Cost Effectiveness (Million $/dv)	-	$11.15	$24.50	$38.89	$50.25

Step 7: Select BART

After reviewing the BART analysis provided by the company, and based upon the information above, ADEQ has determined that BART control at CGS for NO_x is ACC (Low NO_x burners with OFA) with an associated NO_x emission rate of 0.32 lbs/MMBtu on 30-day rolling average basis.

E. PM_{10} BART

Step 1: Identify the Existing Control Technologies in Use at the Source

PM_{10} emissions from the facility are currently controlled through the use of a hot-side ESP.

Steps 2-6: Streamlined Review

SRP's BART analysis for PM_{10} was limited to a statement that the current emission levels associated with the existing controls at the Coronado Generating Station range from 0.01 to 0.03 lb/MMBtu. As noted in Section X, PM_{10} BART for similar emissions units with similar emissions controls was determined to be 0.03 lb/MMBtu. Since SRP's CGS is already meeting or exceeding the stringency of the emissions limitation, further analysis was determined to be unnecessary.

Step 7: Select BART

After reviewing the analysis provided by SRP, and the information presented above, ADEQ has determined that BART for PM_{10} from Units 1 and 2 is no further control, and an emissions limitation of 0.03 lb/MMBtu.

F. SO_2 BART

Step 1: Identify the Existing Control Technologies in Use at the Source

SO_2 emissions are currently controlled with the use of low-sulfur coal and partial wet flue gas desulfurization. The resulting emission rate ranges from 0.6 to 0.7 lbs/MMBtu.

Step 2: Identify All Available Retrofit Control Options

Following control options are available for control of SO_2.

- Wet Flue Gas Desulfurization
- Spray Dryer Absorber
- Dry Sorbent Injection

A brief evaluation of the above control technologies is provided below:

Wet Flue Gas Desulfurization (WFGD). This control option uses limestone or lime to react with SO_2 in the flue gas. The temperature of the flue gas is reduced to its adiabatic saturation temperature and the SO_2 is removed from the flue gas by reaction with the alkaline medium. SO_2 and other acid gases are absorbed into the scrubbing slurry, which falls into the lower section of the reaction tank. Finely ground limestone and make-up water are added to the reaction tank to neutralize and regenerate the scrubbing slurry.

Limestone scrubbing introduces limestone slurry into the scrubber. The SO_2 is absorbed, neutralized, and partly oxidized to calcium sulfite and calcium sulfate in line with the following reaction:

$$CaCO_3 + SO_2 + \tfrac{1}{2}\, H_2O \rightarrow CaSO_3 \bullet H_2O + CO_2$$

$$CaSO_3 \cdot H_2O + 1\tfrac{1}{2}\, H_2O + \tfrac{1}{2}\, O_2 \rightarrow CaSO_4 \bullet 2H_2O$$

Lime scrubbing is similar to limestone scrubbing in equipment and process flow, except that lime is a more reactive reagent than limestone. The reactions for lime scrubbing are as follows:

$$Ca(OH)_2 + SO_2 \rightarrow CaSO_3 \bullet \tfrac{1}{2}H_2O + \tfrac{1}{2}H_2O$$

$$Ca(OH)_2 + SO_2 + \tfrac{1}{2}O_2 + H_2O \rightarrow CaSO_4 \bullet 2H_2O$$

If lime or limestone is used as the reagent for SO_2 removal, additional equipment is needed to prepare the lime/limestone slurry and collecting and dewatering the resultant sludge. Calcium sulfite sludge is difficult to mechanically dewater and is typically stabilized with fly ash for landfilling. Calcium sulfate is stable and is easily dewatered through mechanical processes. To produce calcium sulfate, an air injection blower is needed to supply oxygen for the second reaction to occur (forced oxidation).

Dry Sorbent Injection (DSI). In DSI systems, a dry powdered alkaline material is injected into the hot gas stream to neutralize the acidic species like SO_2, and the resulting solid salts and remaining excess alkaline material is collected by a downstream particulate capture device. Various alkaline materials, both chemically processed and naturally occurring, have seen application in dry scrubbing. Dry hydrated lime, a calcium based alkaline sorbent, is in wide use in dry scrubbing.

Spray Dryer Absorber (SDA). The process consists of the SDA module, a down-stream fabric filter, a reagent preparation system and a product handling system. Hot, untreated flue gas is introduced into a spray dryer absorption chamber contacts a fine spray of reagent slurry. A significant part of the SO_2 in the flue gas is rapidly absorbed into the alkaline droplets. The control of gas distribution, slurry flow rate, and droplet size ensure that the droplets are dried to a fine powder before they touch the chamber walls of the spray dryer absorber.

A portion of the dry product, consisting of fly ash and reaction product, drops to the bottom of the absorption chamber and is discharged. The treated flue gas flows to a particle separator, where the remaining suspended solids are removed. Outlet gasses from the particulate separator pass on to the stack by means of an induced draft fan.

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the referenced control technologies are technically feasible.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

SRP and EPA's consent decree stipulates the installation of WFGDs for both the units. WFGD is the most effective control technology available for controlling SO_2 emissions. Since SRP is committing to the WFGD technology, other control technologies are not evaluated from this point forward in the BART analysis.

Table 12.8 – Annual SO_2 Emissions resulting from SO_2 Controls

Control Option	Control Technology	Unit 1	Unit 2
		Pounds/MMBtu	
1	Baseline-Partial FGD	0.610	0.689
2	Wet FGD	0.08	0.08

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

Costs of Compliance

Based on the vendor data on the capital cost and operation & maintenance cost for different control options, Table 9 provides the information on the annual costs associated with each of the control options.

Table 12.9 – Total Capital and Annual Costs associated with SO_2 Controls

Control Option	Control Technology	Total Capital Cost	Fixed Capital Cost	Annual O&M	Total Annualized Cost
1	Baseline- Partial FGD	--	--	--	--
2	WFGD	$347,000,000	$32,753,330	$11,600,000	$44,353,330

* Fixed capital cost calculation is based on a Capital Recovery Factor (CRF) of 0.09439, assuming an interest rate of 7%, and amortization period of 20 years.

Table 12.10 provides annual estimated emission numbers for SO_2 and cost figures relating to the implementation of WFGDs.

Table 12.10 – Total Annual Emissions of SO_2 and cost of reduction with WFGD		
	Baseline, Option 1	**Option 2, WFGD**
Unit 1	14,556 tpy	1,909 tpy
Unit 2	14,828 tpy	1,722 tpy
Total (Both Units)	29,384 tpy	3,631 tpy
Reduction from Baseline	-	25,753 tpy
Annualized Cost	-	$ 44,353,330
Cost of reduction ($ per ton)	-	$1,722

Step 6: Evaluate Visibility Impacts

The new WFGD control scenario was modeled for each meteorological year (2001-2003) and for all 17 Class I areas within 300 km. The modeling result indicates that the installation of a WFGD will provide for significant visibility benefit. The highest visibility improvement will occur at the Petrified National Forest where an improvement of 1.38 Δdv is expected.

Table 12.11 provides information on annualized cost and the cost in dollars per deciview average improvement in visibility achieved by implementing the control option.

Table 12.11 – Summary for SO_2 BART		
	Option 1, Baseline	**Option 2, WFGD**
Reduction in Emission (tpy)	-	25,753
Annualized Cost	-	$44,353,330
Visibility index (dv)	2.66	1.28
Improvement in Visibility Index (dv)	-	1.38
Incremental Cost Effectiveness ($ per dv)	-	$32,140,094

Step 7: Select BART

Based on its review of the company's analysis and the information above, the Department accepts SRP's recommended BART control of WFGDs for both units with an associated SO_2 emission rate of 0.08 lbs/MMBtu on 30-day rolling average basis.

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Appendix E

Public Process Documentation
Arizona State Implementation Plan Revision
Under Section 308 of the Federal Regional Haze Rule
May 2013

(Supplement to Arizona's Regional Haze SIP submitted in 2011)

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ADEQ Arizona Department of Environmental Quality
Janice K. Brewer, Governor
Henry R. Darwin, Director

PUBLIC NOTICE

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
30 DAY PUBLIC COMMENT PERIOD AND HEARING ON PROPOSED REVISION TO THE ARIZONA STATE IMPLEMENTATION PLAN FOR REGIONAL HAZE UNDER CLEAN AIR ACT SECTION 308 OF THE FEDERAL REGIONAL HAZE RULE

The Arizona Department of Environmental Quality (ADEQ) opens a thirty day public comment period with the publication of this notice on March 29, 2013, for the proposed revision to the Arizona State Implementation Plan (SIP) for Regional Haze under Section 308 of the Federal Regional Haze Rule.

A public hearing on the proposed SIP revision will be held on Monday, April 29, 2013, at 2:00 p.m., at ADEQ, Conference Room 145, 1110 W. Washington St., Phoenix AZ. All interested parties will be given an opportunity at the public hearing to submit comments, data, and views, orally and in writing. Written comments may be submitted prior to or during the public hearing and must be postmarked or received by at ADEQ by 5:00 p.m. on April 29, 2013.

Written comments should be addressed, faxed, or e-mailed to: Lisa Tomczak, Air Quality Division, State Implementation Plan Section, Arizona Department of Environmental Quality, 1110 W. Washington St. Phoenix, AZ 85007, FAX: (602) 771-2366, E-Mail: tomczak.lisa@azdeq.gov

Copies of the proposed SIP are available for review, Monday through Friday, between 8:30 a.m. and 4:30 p.m., at the ADEQ Records Center, 1110 W. Washington St., Phoenix, AZ 85007, (602) 771-4712. The proposed SIP can also be viewed online at http://www.azdeq.gov/environ/air/plan/index.html by selecting Air Quality – Public Notices, Meetings, and Hearings.

Persons with a disability may request a reasonable accommodation such as a sign language interpreter, by contacting Linda Morrison, (602) 771-4793, via email morrison.linda@azdeq.gov. TDD line for hearing impaired individuals, (602) 771-4829. Requests should be made as early as possible to allow time to arrange the accommodation.

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AFFIDAVIT OF PUBLICATION

ADEQ
AIR QUALITY DIVISION
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THE ARIZONA REPUBLIC

6840 **State Agency Public Notices**

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY 30 DAY PUBLIC COMMENT PERIOD AND HEARING ON PROPOSED REVISION TO THE ARIZONA STATE IMPLEMENTATION PLAN FOR REGIONAL HAZE UNDER CLEAN AIR ACT SECTION 308 OF THE FEDERAL REGIONAL HAZE RULE

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Pub: March 29; April 1, 2013

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Tabitha Weaver, being first duly sworn, upon oath deposes and says: That she is a legal advertising representative of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

The Arizona Republic

March 29; April 1, 2013

Sworn to before me this
2st day of
April A.D. 2013

MANUEL VARGAS
Notary Public - State of Arizona
MARICOPA COUNTY
My Commission Expires
November 30, 2015

Notary Public

6840 State Agency Public Notices

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY 30 DAY PUBLIC COMMENT PERIOD AND HEARING ON PROPOSED REVISION TO THE ARIZONA STATE IMPLEMENTATION PLAN FOR REGIONAL HAZE UNDER CLEAN AIR ACT SECTION 308 OF THE FEDERAL REGIONAL HAZE RULE

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March 29; April 1, 2013

Sworn to before me this
2st day of
April A.D. 2013

MANUEL VARGAS
Notary Public - State of Arizona
MARICOPA COUNTY
My Commission Expires
November 30, 2015

Notary Public

ADEQ Arizona Department of Environmental Quality
Janice K. Brewer, Governor
Henry R. Darwin, Director

Public Hearing Agenda

AIR QUALITY DIVISION
HEARING ON PROPOSED REVISION TO ARIZONA'S STATE IMPLEMENTATION PLAN FOR REGIONAL HAZE UNDER SECTION 308 OF THE FEDERAL REGIONAL HAZE RULE

Monday, April 29, 2013, at 2:00 p.m.
Arizona Department of Environmental Quality, Conference Room 145
1110 W. Washington St., Phoenix, AZ 85007

Pursuant to 40 CFR § 51.102 notice is hereby given that the above referenced meeting is open to the public.

1. Welcome and Introductions
2. Purposes of the Oral Proceeding
3. Procedure for Making Public Comment
4. Brief Overview of the Proposed SIP Revision
5. Question and Answer Period
6. Oral Comment Period
7. Adjournment of Oral Proceeding

Copies of the proposed SIP are available for review, Monday through Friday, between 8:30 a.m. and 4:30 p.m., at the ADEQ Records Center, 1110 W. Washington St., Phoenix, AZ 85007, (602) 771-4712. The proposed SIP can also be viewed online at http://www.azdeq.gov/environ/air/plan/index.html by selecting Air Quality – Public Notices, Meetings, and Hearings. For additional information regarding the hearing please call Lisa Tomczak, ADEQ Air Quality Division, at (602) 771 - 4450 or 1-800-234-5677, Ext. 771-4450.

Persons with a disability may request a reasonable accommodation such as a sign language interpreter, by contacting Linda Morrison, (602) 771-4793, via email lm1@azdeq.gov. TDD line for hearing impaired individuals, (602) 771-4829. Requests should be made as early as possible to allow time to arrange the accommodation.

ADEQ Arizona Department of Environmental Quality

Air Quality Division Sign-In Sheet

Please Sign In

SUBJECT: Proposed State Implementation Plan Revision Under Section 308 of the Regional Haze Rule DATE: April 29, 2013

	NAME	ORGANIZATION	PHONE	E-MAIL (primary method of contact)
1.	STEVE CALDERON	ADEQ	602-771-2352	SMC@azdeq.gov
2.	Lisa Tomczak	ADEQ	602-771-4450	lt5@azdeq.gov
3.	Ryan Templeton	ADEQ	602-771-4230	rct@azdeq.gov
4.	Todd Weaver	Freeport-McMoRan	602-366-7818	Todd_weaver@fmi.com
5.	BRETT LINDSAY	PHOENIX CEMENT	928-634-2261	blindsay@smaterials.com
6.	Eddie Al-Rayes	Trinity Consultants	602-274-2900	ealrayes@trinityconsultants.com
7.	Barbara Cenalmor	SRP	602-236-2322	barbara.cenalmor@srpnet.com

Air Quality Division Sign-In Sheet - p _2_ of _4_

	NAME	ORGANIZATION	PHONE	E-MAIL
8.	Heather Wilkey	Dorn Policy Group	602-606-4667	heather@dornpolicygroup.com
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Proposed Revision to the Arizona Regional Haze State Implementation Plan
Under Section 308 of the Federal Regional Haze Rule

Oral Proceeding
Hearing Officer Script

April 29, 2013

Danielle Hazeltine: Good afternoon, thank you for coming. I now open this public hearing to receive comments on the Proposed Revision to the Arizona Regional Haze State Implementation Plan under Section 308 of the Federal Regional Haze Rule. From this point on, I will refer to that as the Regional Haze SIP.

It is now Monday, April 29, 2013, at 2:12 p.m.. The location is Room 145, Arizona Department of Environmental Quality, Phoenix, Arizona. My name is Danielle Hazeltine and I have been appointed by the Director of the Arizona Department of Environmental Quality to preside at this proceeding.

The purposes of this proceeding are to provide the public an opportunity to:

1) hear about the substance of the proposed SIP revision,
2) ask questions regarding the proposed SIP revision, and
3) present oral argument, data, and views regarding the proposed SIP revision in the form of comments on the record.

Lisa Tomczak is representing the ADEQ Air Quality State Implementation Plan Section.

The public notice appeared in the *Arizona Republic* on March 29, and April 1, 2013, and on ADEQ's website. The public comment period began on March 29, 2013. The Proposed Revision to the Regional Haze SIP was released for public comment on March 29, and 30, 2013, and on ADEQ's

website. Copies of the proposed revision were made available at the ADEQ Phoenix Records Center and on ADEQ's website.

The procedure for making a public comment on the record is straightforward. If you wish to comment, you need to fill out a speaker slip, which is available at the sign-in table, and give it to me. Using speaker slips allows everyone an opportunity to be heard and allows us to match the name on the official record with the comments.

You may also submit written comments to me today. Please note the comment period on the Proposed Regional Haze SIP closes at the completion of this public hearing or 5:00 p.m. today, whichever is later.

The agenda for this hearing is simple. First, we will present a brief overview of the Proposed Regional Haze SIP.

Following the overview, I will conduct a question and answer period. The purpose of the question and answer period is to provide information that may help you in making comments on the Proposed Regional Haze SIP.

Thirdly, I will conduct the oral comment period. At that time, I will begin to call speakers in the order that I have received speaker slips.

Please be aware that any comments you make at today's hearing that you want the Department to formally consider must be given either in writing or on the record during the oral comment period of this proceeding.

* * * * *

At this time, Lisa Tomczak will give a brief overview of the Proposed Revision to the Regional Haze SIP.

Lisa Tomczak: Under Section 308 of the Federal Regional Haze Rule in 40 CFR Part 51, states are

required to submit state implementation plans that address visibility impairment at Federal Class I areas. The plan must provide current visibility conditions, analysis of haze impairing pollutants, a demonstration of reasonable progress towards the goal at the end of the first planning period (covering 2008 through 2018), and a long-term strategy describing how Arizona will improve visibility at Class I areas.

Arizona submitted a State Implementation Plan (SIP) for the first planning period on February 28, 2011. On August 27, 2011, Arizona's Regional Haze SIP became complete as a matter of law. The plan provides for reductions in anthropogenic pollutants, such as sulfur dioxide and nitrogen oxides, through implementation of best available retrofit technology (BART) on those sources that Arizona determined required a BART analysis. Reduction will also occur through implementation of many on-going pollution control programs such as Prevention of Significant Deterioration, New Source Review, statewide rules regarding Reasonably Attributable Visibility Impairment, state and federal regulations regarding mobile sources, and control programs to meet the National Standards for particulate matter. Visibility impairment resulting from activities such as prescribed burning and open burning are addressed through Arizona's Enhanced Smoke Management Program as well as a statewide permit program regarding open burning.

On December 21, 2012, EPA proposed to approve in part and disapprove in part Arizona's Regional Haze SIP, which included all portions of the SIP except for the portions that were addressed in a final rule published in the Federal Register on December 5, 2012. In the rule published on December 5, 2012, EPA took final action to approve in part and disapprove portions of Arizona's Regional Haze SIP and to promulgate a Federal Implementation Plan (FIP) for the disapproved elements. This final rule addressed only the portion of the SIP related to Arizona's determination of BART to control emissions from eight units at three electric generating stations: Apache Generating Station, Cholla Power Plant and Coronado Generating Station.

In the Notice of Proposed Rulemaking on December 21, 2012, EPA proposed to partially disapprove the SIP because it did not include the most recently available emission inventory. EPA had concerns about several elements related to BART, as well as Arizona's reasonable progress goals and factors regarding reasonable progress towards those goals.

To address these deficiencies, Arizona is proposing to revise its Regional Haze SIP. This revision incorporates the following; a 2008 inventory based on the National Emissions Inventory, supporting information and discussion regarding the BART elements proposed for disapproval on December 21, 2012, and additional analysis and discussion on Arizona's reasonable progress goals.

Ms. Hazeltine: This concludes the explanation period of this proceeding on the Proposed Regional Haze SIP.

* * * * *

Are there any questions before we move to the oral comment period?

* * * * *

Hearing none, I now open this proceeding for oral comments.

So I will call you by name, and if you could just, do you want them to come up?

Ms. Tomczak: I think we can hear you.

Ms. Hazeltine: Speak loudly.

Paul Sebee?

Mr. Sebee: Thank you. Good afternoon. I am Paul Sebee, and I am here today on behalf of the American Coalition for Clean Coal Electricity (ACCCE), which is a nonprofit organization formed by the nation's coal producing companies, mining companies, electric utilities and the nation's railroads. ACCCE is an organization whose purpose is aimed at educating the public, including public sector decision makers, about the benefits of affordable, reliable and environmentally

compatible coal fuel and electricity in advocating rights on behalf of public policies that are consistent with ACCCE's mission.

On behalf of its members, ACCCE has long been an advocate of policies that advance environmental improvement and economic prosperity, prosperity and energy security. I am here today to speak in support of the Arizona Department of Environmental Quality's revised Regional Haze State Implementation Plan proposal.

As you know, as Lisa mentioned, on December 7, 2012, the US Environmental Protection Agency ("EPA") promulgated a partial Regional Haze Federal Implementation Plan ("FIP") for the State of Arizona. In the Arizona FIP, EPA disapproved a number of BART determinations made by Arizona Department of Environmental Quality, specifically disapproving ADEQ's BART determinations for three power stations, several units of each.

The ADEQ's original Regional Haze SIP contained BART determinations for the Apache, Cholla and Coronado units, and set those emission control technology determinations as for NO_x burners. EPA rejected that reasonable BART determination and instead imposed selective catalytic reductions as BART. Unfortunately, that FIP will not result in any humanly perceptible visibility improvement in Class I areas in Arizona or on the Colorado Plateau, yet it would impose a billion dollar expenditure, which would be passed on to electric utilities and their consumers.

In the Arizona FIP, EPA though expressly encouraged Arizona to submit a revised SIP to replace all portions of the EPA FIP. We applaud Arizona for doing that and developing that. In our estimation, being long involved in these issues, the ADEQ's revised SIP affirms its original reasonable determinations, yet elaborates and provides additional material information which demonstrates that the ADEQ undertook the necessary BART analysis when making its determination for the units.

ACCCE therefore believes that the ADEQ revised SIP thoroughly accomplishes the goals of both the Regional Haze rule established by EPA as well as the provisions of federal law in the Clean Air Act Section 169A. ACCCE therefore urges Arizona to promptly finalize and submit the revised SIP proposal to EPA for promulgation and hopefully EPA incorporation into the Arizona SIP.

The basis for these, the framework for these comments of course, is that the Regional Haze program is an example of the partnership established by Congress in 1977 in the Clean Air Act between the states and the federal government. As long recognized by the Supreme Court of the United States, the Clean Air Act establishes a comprehensive national program that makes state and federal government partners in this struggle against air pollution. The Act specifically gives states air pollution prevention and control at its source and is the primary responsibility of the states and local government. With respect to the Regional Haze rule and visibility provisions of the Act, ACCCE has twice affirmed that the Act calls for states to play the lead role in designing and implementing Regional Haze programs.

Despite the Clean Air Act's clear directive that states that states are to take the lead in designing Regional Haze programs, the EPA FIP imposed a determination that is not consistent with that state and federal partnership. We applaud the Arizona DEQ for preserving and defending its role in that important partnership and the basis by which Congress created it.

In our estimation and view, the revised SIP addresses all of EPA's concerns that were raised in the FIP, and specifically the Arizona DEQ's revised SIP clearly affirms the agency's decision as to how it reached its conclusion for all the BART analyses for all of the BART sources involved in that SIP, namely the Apache, Cholla and Coronado units.

Appendix D of the revised Arizona SIP sets forth that the agency's rational BART analysis reasonably sets forth how the ADEQ arrived at its BART determinations for each of those power stations.

As I said, Arizona's revised SIP preserves affordable and reliable electricity generation in Arizona, which its citizens and businesses rely on for the economic activity in this state as well as balancing values of environmental protection in the context of visibility on these issues. This is not a health-based application of the Act.

EPA's FIP, on the other hand, arbitrarily penalizes Arizona's energy consumers and economy by requiring a costly control technology that has little to no environmental improvement for the purposes of this program.

In conclusion, we support the proposed rules and encourage the State to move ahead with them promptly for submittal to EPA and to advance those and advocate and maybe finalize by EPA as quickly as possible.

Thank you very much.

Ms. Hazeltine: Thank you. We will continue with Brett Lindsay.

Brett Lindsay: I am Brett Lindsay, environmental manager for Phoenix Cement Company. In addition to Phoenix Cement Company providing formal comments in support of ADEQ's revised SIP, I have one minor question that I wanted to pose. If the SIP requires control reductions by 2016, does the Department assess what type of permit revision would be required for installation of that type of control equipment?

That's it. Thank you.

Ms. Hazeltine: Thank you. Are there any speakers that didn't get a chance to turn in a slip? Okay.

This concludes the oral comment period of this proceeding.

* * * * *

If you have not already submitted written comments, you may submit them to me at this time. Again, the comment period for this draft report closes at 5:00 p.m. on Monday, April 29, 2013, or at the end of this hearing, if it's after 5:00 p.m.

Thank you for attending.

The time is now 2:26 p.m.. I now close this oral proceeding.

ADEQ
Arizona Department
of Environmental Quality

Air Quality Division

Public Hearing Presiding Officer Certification

I, Danielle Hazeltine, the designated Presiding Officer, do hereby certify that the public hearing held by the Arizona Department of Environmental Quality was conducted on April 29, 2013, at the Arizona Department of Environmental Quality, Conference Room 145, 1110 West Washington Street, Phoenix, Arizona, in accordance with public notice requirements by publication in *The Arizona Republic* beginning March 29, 2013. Furthermore, I do hereby certify that the public hearing was recorded from the opening of the public record through concluding remarks and adjournment, and the transcript provided contains a full, true, and correct record of the above-referenced public hearing.

Dated this 29 day of April 2013.

Danielle Hazeltine

State of Arizona)
) ss.
County of Maricopa)

Subscribed and sworn to before me on this 29 day of April.

Notary Public

My commission expires: 4/2/2016

EPA Region 9 Comments on
Proposed Revision to Arizona RH SIP
04/25/13

The following are EPA Region 9's comments on Arizona's proposed revision to its State Implementation Plan for Regional Haze under section 308 of the Regional Haze Rule. Our comments are based on our review of Arizona's SIP revision transmitted to EPA Region 9 in a letter dated March 29, 2013, to Jared Blumenfeld, Regional Administrator. Our comments are listed in the same order as the contents of the revised SIP.

General Comment

1) Please clarify in writing whether ADEQ is formally withdrawing those portions of its 2011 submittal that are replaced by the 2013 submittal. If ADEQ is replacing portions of its previous SIP submittal, please list those portions of the 2011 submittal that are officially withdrawn as part of this SIP revision.

Arizona Revised Statutes (Enclosure 1)

2) Please clarify which statutory provisions, if any, Arizona wishes to have approved into the revised SIP, and which ones are intended only as supporting information.

State Implementation Plan Completeness Checklist (Enclosure 2)

3) Please note that enforceable emission limitations are a required element of a Regional Haze Plan. We encourage ADEQ to identify elements of existing rules or permit provisions that could address some of the elements that are currently missing from Arizona's plan, such as monitoring, recordkeeping and reporting requirements and to submit these provisions for SIP approval or specify their location in the approved SIP.

Proposed Arizona RH SIP (Enclosure 3)

4) A footnote in this enclosure says "Technical Support Document for Arizona BART Analyses and Determinations," although the document contains other elements of the plan revision as well.

Reasonable Progress Goal Demonstration (Chapter 11)

5) Please clarify whether this chapter is intended as a replacement for sections 11.4 and 11.5 in Arizona's 2011 Regional Haze SIP or for Chapter 11 in its entirety.

6) ADEQ has done a very good job assessing the monitoring data for coarse mass and fine soil. Since these pollutants have a large anthropogenic component, the plan should provide further justification for excluding them from the reasonable progress analysis, or make a determination using the four factors listed in the Regional Haze Rule regarding whether further controls on these sources are reasonable.

7) The reasonable progress analysis for NO_x and SO_2 needs additional work to meet the requirements of the Regional Haze Rule. The rule requires the State to consider the four factors when setting reasonable progress goals (RPGs). In addition, where a state's RPGs, provide for less progress than the uniform rate of progress (URP), the state must explain, based on the four factors, why its RPGs are reasonable and the URP is not. We recognize ADEQ's resource constraints. However, there is no allowance in the regulation for the State to defer the analysis to future planning periods or to use a lack of resources as a justification for failing to apply the four factors. A complete justification for the RPGs must be provided for this planning period.

8) ADEQ has done a good job analyzing and assessing the more recent visibility monitoring data and comparing it to the base period. EPA concurs with the State's assessment that coarse mass and fine soil visibility impairment does not appear to be increasing. We also concur with the State's assessment that there appears to be a statistically significant decrease in nitrate visibility impairment at some Class I areas in Arizona. This kind of analysis can augment and inform a four factor analysis, but cannot replace it.

9) In a few instances, the text attributes more significance to monitoring trends at particular Class I areas than is justified by the data analysis. This is a notable problem with Sycamore Canyon, where the data shows no significant trend on the worst 20 percent of days (Table 11.9). Please review all statements attributing trends to particular Class I areas and ensure that these statements are supported by the data analysis.

Visibility Trend Analysis: 2000-2009 (Chapter 11.4.3)

10) Please include an explanation of regional ammonium sulfate trends (pages 38-39) that clarifies whether the sources causing the increases of sulfate in 2005 and 2007 are within or outside Arizona.

Coarse Mass Analysis and Large Point Source Locations (Chapter 11.4.4-5)

11) At the PEFO1 monitor, coarse mass significantly contributes 21 percent to total extinction during 2005-2009 (page 31). Further, both trend methods of the 20 percent worse coarse mass days (pages 42-43) showed an increase in coarse mass. In light of those results, please include a discussion of the emission trends of PM_{10} at the large point sources near the PEFO1 monitor.

Arizona BART Analysis and Determination (Appendix D)

12) The heading to Appendix D states that: "The following replaces Appendix D contained in the 2011 Regional Haze Submission." EPA has already taken final action to approve and disapprove certain portions of Appendix D contained in the 2011 Regional Haze submission. EPA has also proposed action on the remainder of the 2011 version of Appendix D. Therefore, we request that you clarify precisely which portions of Appendix D are withdrawn and which remain. For those withdrawn portions, please indicate clearly which portion of the new submittal is its replacement.

Arizona Sources that Chose to Demonstrate Not "Potentially-Subject-to-BART"
(Appendix D, Section VI.C)

13) *Hayden Smelter:* In its comment letter dated March 6, 2013, submitted on EPA's proposed partial approval/disapproval, ASARCO indicated that Converters 1, 3, 4, and 5 as well as Anode Furnace 1 and 2 are BART-eligible. This differs slightly from ASARCO's previous position, which is still reflected in Appendix D of the supplemental SIP (page 77). Please incorporate ASARCO's more recent position on this issue into Appendix D.

14) *Hayden Smelter:* We have a comment regarding BART eligibility for the ASARCO Hayden Smelter (page 78). The proposed supplement states:

> . . . each emission unit has to be evaluated individually against the 15 tpy threshold to assess BART applicability. Since the average PTE for each of the BART-eligible units is below 15 tpy, the units should not be subject to a BART analysis. However, Asarco has gone ahead and completed a BART analysis. ADEQ has analyzed the proposal and is incorporating it as part of this SIP.

The Regional Haze Rule 40 CFR 51.308(e)(1)(ii)(C) provides that: "[a] State is not required to make a determination of BART . . . for PM_{10} if a BART-eligible source has the potential to emit less than 15 tons per year of such pollutant." In promulgating this de minimis exception to the general requirements for BART-eligible sources, EPA explained that "(t)he de minimis levels discussed today apply on a plant-wide basis. Applying de minimis levels on a unit by unit basis as suggested by certain commenters could exempt hundreds of tons of emissions of a visibility-impairing pollutant from BART analysis." 70 FR 39104 39117 (July 6, 2005). Therefore, in order to qualify for this de minimis exception, the total emissions from all BART-eligible units at the entire plant must be less than 15 tpy. Since the proposed SIP revision already includes a BART analysis for PM_{10} for the ASARCO Hayden smelter, we recommend that you clarify that the ASARCO Hayden smelter is subject to BART for PM_{10}.

15) *Miami Smelter:* In its comment letter dated March 6, 2013, submitted on EPA's proposed partial approval/disapproval, Freeport-McMoRan (FMMI) indicated that the Remelt Vessel should not be included as part of the BART-eligible source at the Miami smelter. This differs slightly from FMMI's previous position, which is still reflected in Appendix D of the

supplemental SIP. Please incorporate FMMI's more recent position on this issue into Appendix D.

16) *Miami Smelter:* In an attachment to the revised SIP, FMMI included potential-to-emit (PTE) calculations for NO_x emissions for the BART-eligible source at the Miami Smelter in order to demonstrate that NO_x emissions were below the NO_x de minimis threshold of 40 tpy. Although the calculations indicate that NO_x emissions from the BART-eligible source are less than 40 tpy, we do not consider them to be an accurate representation of PTE, as it is not clear to what extent they are based on a physical limitation or enforceable limit.

Catalyst Paper (Appendix D, Section IX)

17) The revised SIP still contains a BART analysis and determination for NO_x and SO_2 at the Catalyst Paper Mill (page 96) that is also included in Tables 1.1 and 1.3. However, ADEQ's comment letter on EPA's December 21, 2012, proposed rulemaking states that:

> Catalyst Paper has now cancelled the operating permit for its permanently closed facility. There is therefore no reason for EPA "to require that Catalyst Paper notify us prior to resuming operation of mill," as proposed at 77 Fed. Reg. at 75724. Since the plant has permanently closed, resuming operation will be treated as the construction of a new plant and will be subject to new source review, rather than BART.

We recommend that you replace the BART analysis and determination for this facility with a statement that the plant has permanently closed and that reactivation of the plant is subject to new source review, rather than BART.

AEPCO—Apache Generating Station BART Analysis and Determination
(Appendix D, Section X.D.1)

18) There is a clarification to Arizona's 2011 SIP submittal regarding ADEQ's NO_x BART determination for Apache Unit ST1 (page 110) that states:

> It should be noted that the proposed BART limit for STI will apply when STI operates alone or if STI and GTI are operated as a combined cycle operation. The proposed BART limit does not apply to (a) GTI in stand-alone simple cycle operation or (b) STl /GTI when STI burners are shut off and STI is not producing electricity.

We appreciate this clarification that appears to be consistent with the CAA, the RHR and the BART Guidelines, under which combined cycle turbines are considered "steam electric plants" and are therefore BART-eligible. In order to ensure that this clarification is properly incorporated into the applicable SIP, we request that you also include this clarification in Table 1.1 of Appendix D.

Cholla (Section XI)

19) Please confirm that ADEQ is not making a new submittal with respect to Cholla and that ADEQ's prior BART determinations for Cholla are not being withdrawn or replaced.

ASARCO Hayden (Section XII)

20) Please clarify whether ADEQ is withdrawing and replacing its prior BART analysis and determination for ASARCO Hayden or only portions thereof.

21) The PM10 BART analysis in Appendix D (page 146 of 174) is based, in part, on PM10 emission calculations contained in the ASARCO comment letter included as an attachment. Those PM10 emission calculations are in turn based on certain source documents that do not appear to be attached to either the revised SIP or ASARCO's comment letter. Please include the following two documents:

- The 2002 Acid Plant tail gas particulate matter performance test report (referenced on page 6 of ASARCO's comment letter)
- "Final Report, Fugitive SO2 Emission Study, Asarco Ray Complex, Hayden, Arizona" prepared by TRC North American Weather Consultants, conducted from October 1994 through May 1995 (referenced on page 7 of ASARCO's comment letter)

Freeport-McMoran Miami (Section XIII)

22) Please clarify whether ADEQ is withdrawing and replacing its prior BART analysis and determination for Freeport-McMoran Miami or only portions thereof.

Coronado (Section XIV)

23) Please confirm that ADEQ is not making a new submittal with respect to Cholla and that ADEQ's prior BART determinations for Cholla are not being withdrawn or replaced.

Attachments

24) We suggest that you not include any comment letters as part of the final SIP submittal. To the extent that there is pertinent information or analysis in the letters or attachments that does not exist elsewhere, the SIP should cite to those portions of the letters and attachments. Those materials will be included in the docket and administrative record, but not approved into the SIP.

Visibility Tables

25) If you include a table of visibility impacts, please ensure that the values for Saguaro National Park East and West Units are not reversed. In the original haze SIP submittal, in Table 6.1 – Baseline Conditions for 20% Worst Days (page 40), the values of "Baseline Conditions for 20% Worst Visibility Days (dv)" were reversed. The values should read:

- Saguaro NP – East Unit (SAGU1 monitor) 14.83
- Saguaro NP – West Unit (SAWE1 monitor) 16.22

These values are correct in other SIP tables, e.g. Table 6-3, and used correctly in calculations of the URP and number of years to natural conditions.

United States Department of the Interior

NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225-0287

IN REPLY REFER TO:

April 29, 2013

N3615 (2350)

Lisa Tomczak
Air Quality Division, State Implementation Plan Section
Arizona Department of Environmental Quality
1110 West Washington Street
Phoenix, Arizona 85007

Dear Ms. Tomczak:

The National Park Service (NPS) has reviewed the March 2013 revision to the Arizona State Implementation Plan (SIP) for Regional Haze, particularly the added sections on emissions inventory and reasonable progress analyses. We did not see substantive changes to the Best Available Retrofit Technology (BART) sections and refer Arizona Department of Environmental Quality (ADEQ) to our December, 2010 BART comments to ADEQ and our September, 2012 and March, 2013 BART comments to EPA Region 9.

Comparison of 2002 and 2008 Emissions Inventories

EPA proposed partial disapproval of the Arizona Regional Haze SIP because ADEQ did not include the most recent emissions inventory as required under Section 40.51.308(d)(4)(v). ADEQ has provided the 2008 inventory developed in cooperation with the Western Regional Air Partnership (WRAP) and compared emissions trends to the 2002 baseyear inventory.

Table 8.7.1 indicates that point sources are the largest source category for sulfur dioxide (SO_2) emissions. In Section 8.7.9 please briefly describe the basis for the reductions in SO_2 and nitrogen oxide emissions from point sources between 2002 and 2008. Is this due to required emissions controls that will continue into the future, permanent facility closures, changes in electricity generation and industrial activity that are influenced by economic conditions and not permanent reductions, or other factors?

We agree that differences in methodologies make direct comparison between the two inventories difficult. Where inventory methods changed for a sector (e.g. areas sources, on-road and non-road mobile sources), differences between methods likely apply to all pollutants from the sector and not just those pollutants that are highlighted in the tables due to large percentage increases.

Reasonable Progress Demonstration

EPA proposed to disapprove Arizona's reasonable progress goals because the State did not conduct an adequate four factor analysis of potential emission controls for point and area sources. In this SIP revision, however, ADEQ did not conduct a more detailed four factor analysis, but instead provided an evaluation of the IMPROVE monitoring data to assert that visibility improvement since 2000 is sufficient to demonstrate reasonable progress. Arizona should have considered what emissions controls are reasonable in the first review period, independent of the rate of progress projected by 2018.

We agree with ADEQ that the regional haze metrics for the 20% worst and 20% best visibility days are easily influenced by non-anthropogenic events such as wildfire. Analysis of annual trends provides an additional weight of evidence, but does not replace the regional haze metrics. EPA's April 2013 guidance for periodic progress reports recommends that states consider five-year rolling averages for the 20% worst and 20% best days to reduce the influence of any single year on the overall visibility trends.

Data in Table 11.14 suggest that for the period 2006-2010, visibility on the 20% worst days is near or below the 2018 Reasonable Progress Goals at all Class I areas. However, the extrapolation of the rate of reduction between 2000 and 2010 to 2018 has not been supported. ADEQ has not demonstrated that significant additional anthropogenic controls will occur between 2010 and 2018. In Chapter 8 ADEQ did not demonstrate that observed emissions reductions from point sources were permanent reductions. For example, industrial emissions that declined during the economic recession could increase when the economy recovers. Nor has ADEQ explained how variability in emissions (e.g. fire, dust) that influenced visibility trends to 2010 were represented in the revised projections to 2018. Organic carbon and elemental carbon emissions from fire likely increased in 2011 and 2012 at several Class I areas due to large wildfires in those years. The revised 2018 projections are informative but are not conclusive.

Phoenix Cement

ADEQ has not demonstrated that Selective Non Catalytic Reduction (SNCR) controls are not reasonable for Phoenix Cement. ADEQ did not provide a $/ton cost or $/dv visibility benefit for SNCR. SNCR has been required for BART and RP for cement plants in other western states.

We appreciate the opportunity to work closely with Arizona DEQ to improve visibility in our Class I areas. For further information regarding our comments, please contact Pat Brewer at (303) 969-2153.

Sincerely,

Susan Johnson
Chief, Policy, Planning and Permit Review Branch

cc:

Colleen McKaughan
Associate Director, Air Division
U. S. EPA, Region 9
75 Hawthorne Street
San Francisco, California 94105

ACCCE
AMERICAN COALITION FOR CLEAN COAL ELECTRICITY

April 29, 2013

SUBMITTED AT PUBLIC HEARING

Lisa Tomczak
Air Quality Division, State Implementation Plan Section
Arizona Department of Environmental Quality,
1110 W. Washington St.
Phoenix, AZ 85007

Re: **Air Quality Division: Proposed Revision to Arizona's State Implementation Plan for Regional Haze Under Section 308 of the Federal Regional Haze Rule**

Dear Ms. Tomczak:

The following comments, submitted on behalf of the American Coalition for Clean Coal Electricity ("ACCCE"), are in response to the above-noted Arizona Department of Environmental Quality Proposed Revision to Arizona's State Implementation Plan ("Revised SIP") for Regional Haze.

As you know, on December 7, 2012, the US Environmental Protection Agency ("EPA") promulgated a partial Regional Haze Federal Implementation Plan ("FIP") for the State of Arizona. In the Arizona FIP, EPA disapproves all but one of Arizona's best available retrofit technology ("BART") for NO_x determinations. Specifically, EPA disapproved the Arizona Department of Environmental Quality's ("ADEQ") BART determinations for Apache Units 2 and 3, Cholla Units 2, 3 and 4 and Coronado Units 1 and 2.

In its Arizona FIP, EPA expressly encouraged Arizona "to submit a revised SIP to replace all portions of [the Arizona] FIP, and [that EPA is] ready to work with the State to develop a revised plan." 77 Fed. Reg. 72,514/1. In furtherance of EPA's invitation that the State submit a partial revised Regional Haze SIP, the ADEQ undertook a significant effort to prepare the Revised Regional Haze SIP to address all of EPA's stated reasons for rejecting Arizona's BART determinations for the Apache, Cholla and Coronado Units. The Revised SIP demonstrates that the State of Arizona has diligently complied with the federal Clean Air Act's ("CAA") Visibility Program requirements to meet the program's Regional Haze goals. Arizona has made reasonable BART determinations utilizing and applying the EPA's rules and guidelines.

ACCCE believes that the Revised SIP clearly accomplishes the goals of the Regional Haze program and should therefore be approved and finalized by the ADEQ. Further, Arizona's BART determinations should be respected and approved by EPA, and EPA's FIP for Arizona withdrawn until EPA takes final agency action on Arizona's Revised SIP.

I. ACCCE

ACCCE is a non-profit organization formed by the nation's coal-producing companies, railroads, a number of electricity generators, and related companies for the purpose of educating the public (including public-sector decision-makers) about the benefits of affordable, reliable and environmentally compatible coal-fueled electricity and advocating on behalf of public policies that are consistent with ACCCE's mission. ACCCE, originally named the Center for Energy and Economic Development ("CEED"), was created in 1992. CEED combined with Americans for Balanced Energy Choices to become the American Coalition for Clean Coal Electricity "ACCCE" in 2008. On behalf of its members, ACCCE has long been an advocate of policies that advance environmental improvement, economic prosperity, and energy security. ACCCE is committed to continued and enhanced U.S. leadership in developing and deploying new, advanced clean coal technologies. ACCCE has rail, coal producers and electric utility members doing business in the State of Arizona.

II. The Regional Haze Program

The Regional Haze program seeks to address visibility impairment in national parks and wilderness areas, known as Class I areas. Sections 169A and 169B of the CAA establish goals for the Regional Haze program and direct states to develop State Implementation Plans ("SIPs") to ensure reasonable progress is made toward these goals, including requirements for BART. *See* 42 U.S.C. § 7491-7492. The Regional Haze Rules, adopted by EPA in 1999, were based upon a "group" approach with regard to the determination of BART for stationary sources, rather than attribution from the emissions source(s) to the affected Class I area. Those provisions were successfully challenged in the U.S. Court of Appeals for the D.C. Circuit by States and industry. In response to these Court of Appeals decisions, EPA revised its regional haze rules in 2005 and 2006. The D.C. Circuit cases, *American Corn Growers Ass'n v. EPA*, 291 F.3d 1 (D.C. Cir. 2002), *Center for Energy and Economic Development v. EPA*, 398 F.3d 653 (D.C. Cir. 2005), and *Utility Air Regulatory Group v. EPA*, 471 F.3d 1333, 1338 (D.C. Cir. 2006), make clear that States have "broad authority" and discretion for establishing their reasonable progress goals and determining BART. *American Corn Growers*, 291 F.3d 19.

As long recognized by the Supreme Court of the United States, the Clean Air Act establishes "a comprehensive national program that makes the States and the Federal Government partners in the struggle against air pollution." 42 U.S.C. 7401(a)(3)-(4). Further, the Clean Air Act states "air pollution prevention and air pollution control at its source is the primary responsibility of States and local governments." 42 U.S.C. 7401(a). The US Court of Appeals for the District of Columbia Circuit has held that the Clean Air Act "calls for states to play the lead role in designing and implementing regional haze programs." *American Corn Growers*, 291 F.3d at 2.

Because visibility improvement is an aesthetic goal, the CAA does not make improving visibility conditions in Class I areas paramount above all other competing considerations. Instead, the States are given broad discretion to weigh public interest factors in determining (a) how much progress towards improving visibility they deem to be reasonable and (b) whether

Like "reasonable progress," BART is primarily a State determination that involves the weighing of public interest factors, specifically "the costs of compliance, the energy and nonair quality environmental impacts of compliance, any existing pollution control technology in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology." ("BART Analysis"). 40 C.F.R 51.308(e)(1)(ii)(A). Unlike other technology standards in the statute (*cf* CAA § 112), BART is not the maximum feasible technology, but rather the technology that makes sense based on a weighing of the costs and benefits of installing (or not installing) that technology. EPA may only reject a State's BART determination when it finds that the State's determination is not supported by the data or analysis or fails to comply with the Regional Haze program.

Despite the CAA's clear directive that the States are to take the lead in designing and implementing the Regional Haze program, EPA imposed a Regional Haze FIP for Arizona that is not consistent with the state-federal partnership enshrined in the Clean Air Act. In its Revised Regional Haze SIP, the State of Arizona has further met the Regional Haze Program requirements and the Revised SIP should therefore be approved.

III. Arizona's Revised SIP Affirms Its Earlier Rational BART Determinations

The ADEQ's Revised SIP addresses all of EPA's concerns that the agency raised when it promulgated its FIP for Arizona. Specifically, the ADEQ's Revised SIP:

A. Clearly reaffirms that the ADEQ conducted a full BART analysis for all BART sources in Arizona including the Apache, Cholla, and Coronado units.

B. Appendix D to the Revised SIP sets forth the ADEQ's rational BART analysis and reasonably sets forth how the ADEQ arrived at its BART determinations for the Apache, Cholla, and Coronado units using the BART five-factor analysis.

C. The Revised SIP sets forth the complete BART analysis that the ADEQ originally conducted when it completed its BART determinations.

D. The analysis and data set forth in the Revised SIP demonstrate that the ADEQ's BART determinations are reasonable and rationally-based.

E. As the ADEQ's Revised SIP states, the ADEQ's BART determinations for Apache, Cholla, and Coronado have not changed since Arizona's original Regional Haze SIP submission.

F. The ADEQ's Revised SIP also reaffirms the ADEQ's Reasonable Progress determinations and demonstrates that the ADEQ properly conducted the four factor reasonable progress analysis when making its determinations.

IV. Arizona's Revised SIP Preserves Affordable and Reliable Electricity Generation In Arizona

Arizona's citizens and businesses rely on the affordable electricity produced in Arizona. The ADEQ's Revised SIP preserves affordable electricity by determining that BART at the Apache, Cholla, and Coronado units is the installation of cost effective emission control technologies – low nitrogen oxide burners. Low nitrogen oxide burners are much less expensive than SCR and are a highly effective emission control technology that meets the goals of the federal Clean Air Act's Regional Haze program.

EPA's FIP on the other hand, arbitrarily penalizes Arizona energy consumers by requiring installation of costly SCR technology. As a consequence, EPA's FIP unnecessarily harms electricity consumers in Arizona, the utilities that provide power to these consumers, and Arizona's entire economy - all for very little appreciable environmental benefit. The cost of the controls required by EPA in its FIP for these stations is hundreds of millions of dollars – and the cost will ultimately be paid for by energy consumers in the form of higher electricity rates.

For instance, the operator of the Apache Station estimates that installing SCR technology at the station will cost at least $80 million, which is **up to 40 times** that of Arizona Electric Power Cooperatives original BART application to the ADEQ. The operator of the Coronado Station, Salt River Project, estimates that installing SCR at its station will cost $110 million. And while the cost of SCR is much, much greater than low nitrogen oxide burners, the improvement in visibility at our nation's national parks and wilderness areas attributable to SCR is not humanly perceptible.

V. ADEQ's Revised SIP Makes Economic And Environmental Sense

The ADEQ's Revised SIP allows the operators of the Apache, Cholla, and Coronado units to keep producing affordable electricity while decreasing the amount of nitrogen oxide emitted in the air which improves visibility and furthers the goal of the Regional Haze program. The ADEQ's Revised SIP makes sense for Arizona's economy, makes sense for consumers, and it meets the requirements and goals of the Regional Haze program.

VI. Conclusion

The CAA embodies a cooperative federalism approach to addressing air quality issues. It allows States, like Arizona, to balance sensible environmental protection yet still encourage responsible economic development. Arizona's ability to protect its citizens and the environment must include the ability to meaningfully take into account real and distinct Arizona circumstances. The ADEQ's Revised SIP protects its citizens and the environment, maintains and encourages economic development in the State and meets the goals of the Regional Haze program. The ADEQ's proposed Revised Regional Haze SIP is well supported by a robust record and should be promptly approved.

Respectfully Submitted,

Mark Ourada
Vice President - Central Region
American Coalition for Clean Coal Electricity

CALPORTLAND

April 29, 2013

Via email

Lisa Tomczak
Air Quality Division
State Implementation Plan Section
Arizona Department of Environmental Quality
1110 W. Washington St. Phoenix, AZ 85007
tomczak.lisa@azdeq.gov

Re: Comments on the State of Arizona Proposed Regional Haze State Implementation Plan

Dear Ms. Tomczak:

CalPortland is the owner and operator of the Rillito Cement Plant ("Rillito Plant")[1], located approximately 20 miles north of Tucson, Arizona, which is addressed in the Arizona Department of Environmental Quality's ("ADEQ") "Proposed Arizona State Implementation Plan – Regional Haze under Section 308 of the Federal Regional Haze Rule," dated March 2013 (the "Proposed Revised SIP"). CalPortland appreciates the opportunity to provide these comments concerning the Proposed Revised SIP as it affects the Rillito Plant.

The Rillito Cement Plant includes four kilns, Kilns 1 though 4. Kilns 1 through 3 are not currently in operation and are in care and maintenance given current economic conditions. Kiln 4 is currently in operation.

CalPortland welcomes and appreciates ADEQ's efforts to address the Environmental Protection Agency's ("EPA") proposed partial approval and disapproval of Arizona's Section 308 Regional Haze State Implementation Plan. EPA Proposed Rule, Partial Approval and Disapproval of Air Quality Implementation Plans; Arizona; Regional Haze and Visibility Impacts of Transport, Ozone and Fine Particulates, 77 Fed. Reg. 75704 (Dec. 12, 2012). ADEQ's efforts are extraordinary given the limited amount of time provided by EPA's consent decree with the National Parks Conservation Association and others (D.D.C. Case 1:11-cv-01548).

As set forth in the detailed comments below, CalPortland agrees with the Proposed Revised SIP's conclusions with respect to CalPortland's Rillito Cement Plant. We respectfully request revisions to the discussion of CalPortland's facility to clarify what we understand to be ADEQ's intent. In addition, we request that ADEQ revise its reasonable progress goals so that they are consistent with IMPROVE monitoring data which shows that significant progress has already occurred.

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[1] We note that the Proposed Revised SIP (as defined herein) refers to the Rillito Plant in several ways, including, for example, "Arizona Portland Cement Company" or "APCC." For ease of reference, the comments herein refer to the plant by its current name, "Rillito Plant."

Discussion

1. **ADEQ correctly concluded that Kiln 4 does not cause or contribute to visibility impairment and therefore it follows that a four-factor reasonable progress analysis is not necessary for Kiln 4.**

In Arizona's Regional Haze State Implementation Plan submitted to EPA on February 28, 2011, ADEQ determined that, because Kiln 4's average emissions of all pollutants is less than the 0.5 dv threshold, it does not cause or contribute to visibility impairment, and therefore it is not subject to BART. EPA agrees with ADEQ's determination in its proposed rule partially approving and partially disapproving the Arizona Regional Haze State Implementation Plan with respect to Kiln 4:

> Rillito Cement Plant: As seen in Table 10, the visibility modeling performed by CalPortland[2] indicates that the 98th percentile impact from the Kiln 4 at the Rillito Cement Plant is below 0.5 dv at the most affected Class I area. Based on our review of the visibility modeling, we propose to approve ADEQ's determination that the Rillito Cement Plant is exempt from BART.

77 Fed. Reg. 75704, 75722. Consistent with the prior Arizona Regional Haze State Implementation Plan submitted to EPA in 2011, and EPA's proposed approval, ADEQ's Proposed Revised SIP incorporates its prior determination that Kiln 4 does not cause or contribute to visibility and is not subject to BART. *See* Appendix D. In its Proposed Revised SIP, ADEQ concludes that, because visibility modeling conducted by the Western Regional Air Partnership ("WRAP")[3] demonstrates that Kiln 4 does not cause or contribute to visibility impairment at any Class I area, Kiln 4 is not subject to BART.

CalPortland agrees. ADEQ's conclusion is reasonable and consistent with Section 308 and EPA guidance.[4]

Moreover, because Kiln 4 does not cause or contribute to visibility impairment, the facility is not required to undergo the five-factor BART analysis. Likewise, given the lack of visibility

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[2] To be clear, CalPortland did not perform this modeling. Modeling was performed by Western Regional Air Partnership ("WRAP"). *See* Appendix D, Section VI.

[3] We note there is a typographical error in the draft SIP. WRAP conducted the visibility modeling, not CalPortland. *See* Section VI of Appendix D.

[4] Section 308 requires states to determine which of the BART-eligible sources "may reasonably be anticipated to cause or contribute to any impairment of visibility in a mandatory Class I Federal area," so as to be "subject to BART." 40 C.F.R. § 51.30(e)(1)(ii). Additionally, EPA BART Guidelines state that once a source is determined to be eligible for BART, the state may examine whether the particular source is subject to BART. EPA, Appendix Y to Part 51 – Guidelines for BART determinations Under the Regional Haze Rule, 70 Fed. Reg. 39156, 39161 (July 6. 2005). If analyses or information submitted demonstrates that a particular sources is "not reasonably anticipated to cause or contribute to any visibility impairment in a Class I area," then a BART determination is not necessary, i.e., the source is not subject to BART. *Id.*

impairment, it follows that the facility is not be required to undergo a similarly burdensome four-factor reasonable progress analysis either.

EPA's Guidance for Setting Reasonable Progress Goals under the Regional Haze Program ("Reasonable Progress Guidelines"), consistent with the environmental purpose of the Regional Haze Rule, does not require that a full four-factor analysis be conducted for every potential source. *See* Guidance for Setting Reasonable Progress Goals Under the Regional Haze Program (July 1, 2007). Before conducting four-factor analyses, a state must identify the sources to analyze - there is no requirement to conduct a four-factor analysis for every source of emissions in a state. Instead, as EPA makes clear in its Reasonable Progress Guidelines, the analysis for a given Class I area "process begins with the identification of key pollutants and source categories that contribute to visibility impairment at the Class I area." Reasonable Progress Guidelines at 3-1. Sources that contribute to visibility impairment at a Class I area must undergo a four-factor analysis. Source that do not contribute, such as Kiln 4, are not required to perform such analysis.

In this case, given the lack of visibility impacts from Kiln 4, it is reasonable and consistent with Section 308 and EPA's Reasonable Progress Guidelines to conclude that a four-factor analysis is not required for Kiln 4.[5]

2. ADEQ's decision to defer consideration of Kilns 1-3 at this time is reasonable and consistent with Section 308.

Because Kilns 1-3 have not operated since 2008, ADEQ determined that a four-factor analysis is not necessary at this time. Again, ADEQ's conclusion is lawful and reasonable.

Due to the deep recession, CalPortland placed Kilns 1 through 3 in care and maintenance in 2008 and there have been no emissions from these three kilns since that time. The Douglas Lime Plant, owned by Lhoist, is in a similar situation. It stopped operations in 2009 and has not operated since. With respect to the Douglas Lime Plant, in its proposed partial disapproval, EPA stated "Given the lack of emissions from the plant, EPA proposes to find that requiring controls would not be reasonable at this time." 77 Fed. Reg. 75729. The same conclusion must be reached for Kilns 1 through 3. It would be unreasonable to require a more burdensome analysis or reach a different conclusion for CalPortland's kilns than Lhoist's lime plant.

3. The Proposed Revised SIP's discussion of CalPortland's facility should be clarified.

To further clarify why a four-factor reasonable progress analysis for CalPortland's facility is not required or appropriate at this time, we respectfully request that paragraph two of Section 11.3.3.5 of the Proposed Revised SIP be revised as follows:

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[5] CalPortland maintains that it would be unreasonable to conclude otherwise. After all, if an emission unit that ADEQ determined, and EPA agreed, is not subject-to-BART still has to undergo a reasonable progress analysis that is essentially the same as a BART analysis, then the entire subject-to-BART exercise (as described in Section III of the BART Guidelines) is rendered meaningless.

CalPortland's Rillito Cement Plant is located 20 miles north of Tucson. The facility operates four cement kilns. Although Kiln 4 was identified as BART-eligible, based on a modeling analysis performed by the Western Regional Air Partnership ("WRAP"), ADEQ determined that Kiln 4 is exempt from BART because it does not cause or contribute to visibility impairment at any nearby Class I areas. Additional details on the modeling results can be found in Section VI.A of the BART TSD in Appendix D. Pursuant to EPA's guidance (Guidance for Setting Reasonable Progress Goals under the Regional Haze Program, Section 3.0, Identifying Key Pollutants and Source Categories for the First Planning Period) determining the sources that contribute to visibility impairment at a Class I area is a prerequisite to conducting a four-factor analysis. In addition, EPA's guidance recommends "focusing on those source categories that may have the greatest impact on visibility at Class I Areas...." Section 4.0. Since WRAP's modeling demonstrated that Kiln 4 does not contribute to visibility impacts at any Class I area, ADEQ has determined that a four-factor analysis for Kiln 4 is not necessary or appropriate.

Due to economic conditions, Kilns 1-3 have been in care and maintenance mode since 2008 (as documented in a CalPortland letter to ADEQ dated March 19, 2013) and ADEQ has received no indication of when the facility will resume normal operations. Due to the lack of operation and economic conditions, ADEQ has determined that a four-factor analysis for Kilns 1-3 is not necessary or appropriate at this time. The Department will revisit this decision in the next planning period.

In addition, we recommend that the first sentence of 11.5.2 and IV.C of the TSD be deleted and replaced with the following:

EPA has performed an initial Q/D (emissions/distance) analysis to identify point sources that it suggests ADEQ should evaluate for further controls based on NO_x emissions. However, the Q/D analysis does not correlate with the IMPROVE monitoring data and ADEQ has not relied on it to identify sources for further evaluation.

4. Even if a four-factor analysis were presented, it would not support additional controls at this time.

Although a four-factor analysis is unnecessary, should ADEQ elect to present one, CalPortland provides the following analysis for the Department's consideration to include in section 11.3.3.5:

Reasonable Progress Analysis – Kilns 1-3	
Cost of Compliance	Kilns 1-3 stopped production in 2008 during the recession. Given the lack of emissions from the kilns since 2008, it would be unreasonable to require controls at this time.

Reasonable Progress Analysis – Kilns 1-3	
Time Necessary for Compliance	Several years would be required to design, permit and then construct any control equipment.
Energy and Non-Air Quality Environmental Impacts of Compliance	All technically feasible controls (low NO_x burners, mid-kiln firing, mixing air technologies, and SNCR) would increase energy usage. With respect to SNCR, the storage, transport, and use of urea or ammonia create the potential for hazardous spills and ammonia slip.
Remaining Useful Life	The remaining useful life is unknown and unknowable at this time. CalPortland has an application pending to modernize its facility and permanently shutdown these kilns. Whether CalPortland moves forward with this modernization once the application is processed will depend on the state of the economy at that time.
Conclusion	Given the current lack of NO_x emissions, it is not reasonable to require additional controls on the kilns at this time. The kilns will be considered in future planning periods.

Reasonable Progress Analysis – Kiln 4	
Cost of Compliance	Kiln 4 already uses NO_x burners and preheater riser duct firing to control NO_x emissions. The only remaining technically feasible control alternative would be SNCR. Given the similar capacities for Kiln 4 and Phoenix Cement's kiln, annual costs would be very similar to the cost estimates for Phoenix Cement's kiln, described below.
Time Necessary for Compliance	Several years would be required to design, permit, and then construct SNCR.
Energy and Non-Air Quality Environmental Impacts of Compliance	SNCR would increase energy usage. Storage, transport, and use of urea or ammonia create the potential for hazardous spills and ammonia slip.
Remaining Useful Life	The remaining useful life is unknown and unknowable at this time. CalPortland has an application pending to modernize its facility and permanently shutdown Kiln 4. Whether CalPortland moves forward with this modernization once the application is processed will depend on the state of the economy at that time.
Conclusion	Given the existing controls in use, WRAP's modeling which demonstrates Kiln 4 does not cause or contribute to visibility impairment, the uncertain remaining useful life, and IMPROVE monitoring data which shows that visibility improvements will exceed the URPs for Saguaro National Park, ADEQ finds that it is not reasonable to require the installation and operation of SNCR.

5. Arizona's Reasonable Progress Goals should be revised to reflect the significant improvements that have already occurred.

The Proposed Revised SIP provides an assessment of the visibility progress made in Arizona's Class I Areas. Section 11.4. This analysis, based on actual IMPROVE monitoring data, demonstrates that Arizona's Reasonable Progress Goals ("RPGs") are too conservative for both units of Saguaro National Park. TSD, Table 18. Specifically, IMPROVE monitoring data from the 2005-2009 time period shows that visibility impairment at that time was already less than the RPGs established for 2018.[6] *Id.*

The existing RPGs for Saguaro National Park, which EPA has already proposed to disapprove, are based on modeling results that relied on outdated emission inventory information. There is no requirement that the RPGs be based on models and decade-old emission inventories. In this case, the best source of information is the monitoring data. Accordingly, ADEQ should revise the RPGs for Saguaro National Park to reflect actual monitoring data, which shows significant improvements are being made.

This is critically important given that a primary reason EPA has proposed to disapprove of Arizona's reasonable progress demonstration is EPA's mistaken impression, based on the inaccurate RPGs, that there is a "slow rate of visibility improvement on the worst days at all Class I areas." 77 Fed. Reg. 75730.

6. The decision to focus on SO_2 and NO_x pollutants is reasonable.

In the Proposed Revised SIP, as in the 2011 SIP, the reasonable progress analysis focuses on sources of SO_2 and NO_x. This is reasonable and within ADEQ's discretion. Nonetheless, EPA proposed to disapprove ADEQ's decision to defer consideration of coarse mass and fine soil sources during the first planning period. To further strengthen ADEQ's reasonable position, CalPortland recommends deleting the final sentence in Section 11.3.1.3 and replacing it with the following text[7]:

> Significant sources of particulate matter (both fine and coarse) are difficult to identify and quantify given emission inventory limitations for nonanthropogenic sources, uncertainties associated with windblown emission estimates, and poor model performance. Given these factors, along with the IMPROVE monitoring

[6] In addition, both units of SNP are well on their way to meeting their Uniform Rates of Progress goals for 2018. TSD, Table18. Updated projections based on monitoring data from 2005 to 2009 shows that visibility impairment in 2018 will be 1.9 dv less than the URPs for both units.

[7] EPA reached the same conclusion for its Federal Implementation Plan for Hawaii. *See* 77 Fed. Reg. 31692, 31707-31708 ("However, the sources of coarse mass (CM) are uncertain because of emission inventory limitations associated with natural sources (predominantly wildfires) and uncertainty of fugitive (windblown) emissions. Because of the difficulty in attributing the sources of visibility impairment for this pollutant, EPA has determined that it is not reasonable in this planning period to recommend emission control measures for coarse mass. Coarse mass contribution to visibility impairment, emissions sources, and potential control measures should be addressed in future Regional Haze plan updates.")

data which shows significant progress towards natural conditions, particulate matter sources were not included in this first analysis. Arizona intends to address particulate matter in future planning periods once there is a sound basis for making emission control determinations for all significant sources of particulate matter.

Conclusion

As described above, there is no legal requirement for a four-factor analysis where the facility does not contribute to visibility impairment. EPA's guidelines, consistent with the environmental purpose of the Regional Haze Rule, do not require that a four-factor analysis be conducted for every potential source within a state. If a source does not contribute to visibility impairment, it need not perform additional analysis. *See* Reasonable Progress Guidelines at 3-1

With respect to CalPortland's potential impact on Saguaro National Park, the following facts overwhelmingly support the conclusion that no further analysis is necessary:

- ADEQ determined, and EPA has proposed to concur, that Kiln 4 does not contribute to visibility impacts.
- Kilns 1 through 3 are not operating.
- NO_x emissions are a minor contributor (9-11%) to visibility impacts at Saguaro National Park.
- Saguaro National Park is on track to meet the uniform rate of progress without any additional controls on CalPortland's facility.

In sum, a reasonable progress analysis is not appropriate or necessary given this set of facts.

Thank you for the opportunity to submit these comments. If there are any questions, please contact me at (626) 852-6262 or jgrady@calportland.com.

Sincerely,

Jay M. Grady
Director, Environmental Affairs

SRMG
Salt River Materials Group
100% AMERICAN™

Sent e-mail (.pdf) and first class mail

April 29, 2013

Lisa Tomczak
Air Quality Division
State Implementation Plan Section
Arizona Department of Environmental Quality
1110 West Washington Street
Phoenix, AZ 85007
E-mail: tomczak.lisa@azdeq.gov

Re: March 29, 2013 Proposed Revision of the Arizona State Implementation Plan ("SIP") for Regional Haze under Section 308 of the Federal Regional Haze Rule

Dear Ms. Tomczak:

Phoenix Cement Company ("**PCC**"), a division of the Salt River Pima-Maricopa Indian Community, submits the following comments on the above-referenced proposed revised Rule 308 SIP:

1. PCC agrees with the methodology and results of the proposed revised Rule 308 SIP's rate of progress demonstrations relating to non-BART sources of NO_X, including those indicated by Table 11.14, Table 21 and corresponding text. PCC believes these are consistent with the requirements of 40 C.F.R. § 51.308(d)(2) or properly inform any application of 40 C.F.R. § 51.308(d)(2) and consideration of corresponding findings.

2. PCC agrees with the proposed revised Rule 308 SIP's reasonable progress analysis relating to PCC and the Sycamore Canyon Wilderness Area and the ADEQ's assessment of PCC's submittal informing the analysis. Concerning specifically the analysis' references to reasonable progress in relation to the uniform rate of progress, PCC agrees with the references based partly, but not exclusively, on the projections of Table 11.14, Table 21 and corresponding text. PCC believes these are consistent with the requirements of 40 C.F.R. § 51.308(d)(2) or properly inform any application of 40 C.F.R. § 51.308(d)(2) and consideration of corresponding findings. Based on the analysis including these references and projections, it would not be reasonable, necessary or lawful to require the installation and operation of selective non-catalytic reduction at PCC's Clarkdale facility as part of the implementation plan.

3. PCC reserves the right to supplement its comments at any time, even after the conclusion of the comment period for the proposed revised Rule 308 SIP, to the extent that the ADEQ's final revised SIP is based materially on information or correspondence not available in the administrative record of the proposal as of April 29, 2013.

4. The foregoing notwithstanding, the proposed revised Rule 308 SIP as it relates to non-BART sources of NO_X is a procedural alternative to the conclusions of law that PCC explained in its March 6, 2013 comments on the EPA's December 21, 2012 proposed partial disapproval of the original Rule 308 SIP, in summary:

   a. The EPA's proposed partial disapproval as to non-BART sources of NO_X is untimely (comment 7 of PCC's March 6, 2013 comments), which would render any revision of the SIP as to non-BART sources of NO_X unnecessary under the Clean Air Act;

   b. The EPA's proposed partial disapproval as to non-BART sources of NO_X is not justified (comment 3 of PCC's March 6, 2013 comments);

   c. The EPA's proposal partial disapproval as to non-BART sources inappropriately applies to non-BART sources standards applicable to BART sources (comment 5 of PCC's March 6, 2013 comments); and

   d. The EPA's proposed partial disapproval as to non-BART sources generally and as it may relate to PCC specifically is and would be otherwise contrary to applicable law (comments 1, 2, 4 and 6 of PCC's March 6, 2013 comments).

   PCC's March 6, 2013 comments on the EPA's proposed partial disapproval are attached hereto and incorporated herein by this reference.

If you have any questions regarding these comments, please do not hesitate to let me know. Thank you.

Sincerely,

Verle C. Martz
Vice President Engineering & Environment
Phoenix Cement Company, a Division of the Salt River Pima-Maricopa Indian Community

Attachment (1) – PCC's March 6, 2013 Comments on EPA's December 21, 2012 Proposed Partial Disapproval of Rule 308 SIP with Four Attachments

cc: Gary Bohnee, Office of Congressional & Legislative Affairs, Salt River Pima-Maricopa Indian Community
Jennifer Giff, Senior Counsel Corporate/Enterprise, Office of the General Counsel, Salt River Pima-Maricopa Indian Community
Roger Smith, President and Chief Executive Officer, Phoenix Cement Company, a Division of the Salt River Pima-Maricopa Indian Community
Pete Kuehner, Senior Vice-President and Chief Operating Officer, Phoenix Cement Company, a Division of the Salt River Pima-Maricopa Indian Community
Brett Lindsay, Environmental Manager, Phoenix Cement Company, a Division of the Salt River Pima-Maricopa Indian Community
George A. Tsiolis, Attorney at Law
File

SRMG
Salt River Materials Group
100% AMERICAN™

March 6, 2013

Sent Email (.pdf) and Certified Mail (Return Receipt Requested)

Gregory Nudd
EPA Region 9 Air Division (AIR-2)
75 Hawthorne Street
San Francisco, California 94105
Email: r9azreghaze@epa.gov

Re: DOCKET ID NO. EPA-R09-OAR-2012-0904
Comments on "Proposed Partial Approval and Disapproval of Air Quality Implementation Plans; Arizona; Regional Haze and Visibility Impacts of Transport, Ozone and Fine Particulates," 77 Fed. Reg. 75704 (December 21, 2012) and 78 Fed. Reg. 7702 (February 4, 2013)

Dear Mr. Nudd:

Phoenix Cement Company ("**PCC**"), a division of the Salt River Pima-Maricopa Indian Community ("**SRPMIC**"), submits the following comments on the above-referenced proposed rule ("**SIP Disapproval Proposal**" or "**Proposal**").

1. The SIP Disapproval Proposal Directly Affects SRPMIC.

The EPA is proposing to disapprove Arizona's regional haze state implementation plan ("**ARHP**" or "**SIP**") based partly on the SIP's treatment of the PCC kiln in Clarkdale, Arizona and reasonable progress ("**RP**") goals ("**RPGs**") for the Sycamore Canyon Wilderness Area ("**SCWA**"):

> Point Sources of [Nitrogen Oxides ("**NO_X**")]: The State's analysis of point sources to justify its RPGs did not provide sufficient supporting information to demonstrate the requirements of the [regional haze rule ("**RHR**")] have been met . . . with respect to cement kilns, the ARHP contends that the Rillito Cement Plant does not "appreciably diminish or impair visibility," but the plan does not provide technical documentation of that assertion. Given the slow rate of visibility improvement on the worst days at all Class I areas, a thorough analysis

> is required before concluding that nothing more can be done to improve visibility. Therefore, EPA proposes to disapprove the State's finding that it is not reasonable to require additional NO_X controls on non-BART point sources in Arizona.[1]

Although the above provision refers to "Rillito Cement Plant," the SIP's own assertion that the plant "does not appreciably diminish or impair visibility" is expressly in relation to PCC, not Rillito Cement Plant.[2] Therefore, the SIP Disapproval Proposal is based materially on the SIP's treatment of PCC.

On November 6, 2012, the EPA shared with PCC a "Five Factor RP Analysis" concerning PCC and the SCWA.[3] The EPA has made clear its intention to include in a proposed Federal Implementation Plan ("**FIP**") requirements to install and operate additional NO_X emissions controls at PCC, ostensibly to achieve RPGs for the SCWA.[4] The EPA would not be planning to propose such FIP requirements for PCC if the SIP Disapproval Proposal did not correspondingly concern, in material part, PCC.[5] As the EPA acknowledges, it is the SIP Disapproval Proposal that "creates the basis"[6] for the FIP.

2. The EPA Did Not Satisfy Tribal Consultation Requirements Applicable to the SIP Disapproval Proposal.

The EPA's statement that the SIP Disapproval Proposal "does not have tribal implications, as specified in Executive Order 13175 . . . [because] it will not impose substantial direct costs on tribal governments,"[7] is incorrect. PCC is a branch of the government of

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[1] 77 Fed. Reg. at 75730/1 (emphasis added) (referring to sources that are not required to maintain or install "Best Available Retrofit Technology" or "**BART**").

[2] SIP at 165, second paragraph.

[3] Technical Analysis for Arizona and Hawaii Regional Haze FIPs: Task 9: Five-Factor RP Analysis, Contract No. EP-D-07-102, Work Assignment 5-12, Prepared for Thomas Webb, Air Planning Office, EPA Region 9, Prepared by Uma Shankar *et al.*, Institute for the Environment, University of North Carolina at Chapel Hill, *et al.*, October 3, 2012 ("**October 3 Analysis**"). **Attachment 1**. (All attachments to this letter are incorporated in and constitute a part of SRPMIC's comments.)

[4] November 6, December 6, December 9 and December 14, 2012 Emails from EPA to PCC. **Attachment 2**.

[5] 42 U.S.C. § 7410(c)(1) (stating a prerequisite to a FIP is EPA's disapproval of the SIP, a finding that the State failed to make the required SIP submittal, or a finding that the SIP submittal did not include applicable administrative completeness components).

[6] 77 Fed. Reg. at 75736/3 ("this action creates the basis for future action").

[7] 77 Fed. Reg. at 75736/3.

SRPMIC.[8] The Proposal "creates the basis"[9] for any FIP that would impose on SRPMIC costly requirements to install and operate additional NO_X emissions controls at PCC. But for the proposed SIP disapproval in relation to PCC, there could lawfully be no FIP proposal in relation to PCC.[10] Therefore, the Proposal does have significant tribal implications and the EPA should have consulted with SRPMIC "early in the process of developing the proposed regulation."[11]

Had SRPMIC been consulted "early in the process of developing" the SIP Disapproval Proposal, SRPMIC would have developed and explained to the EPA the real costs to SRPMIC and its members that would arise from requirements to install and operate additional NO_X emissions controls at PCC and the true measure of benefits to visibility in the SCWA that would, and would not, result. This would have informed the EPA's decision whether to "propose to disapprove the State's finding that it is not reasonable to require additional NO_X controls on non-BART point sources in Arizona."[12]

3. The SIP Disapproval Proposal is Not Justified as to Non-BART Point Sources of NO_X, such as PCC.

The SIP Disapproval Proposal offers no justification for the EPA's proposal "to disapprove the State's finding that it is not reasonable to require additional NO_X controls" on PCC.[13, 14] The EPA may question the State's conclusion that PCC does not "appreciably

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[8] PCC is an enterprise division of the SRPMIC government, established following SRPMIC's acquisition of the assets of another cement company in 1987 and doing business under SRPMIC law. SRPMIC established PCC for the purpose of promoting the economic self-sufficiency of SRPMIC so as to enable SRPMIC to survive and prosper as an independent Indian community by earning profits to sustain SRPMIC's necessary governmental programs. SRPMIC relies substantially on the revenues of PCC in order to meet the safety, health and educational needs of SRPMIC's members.

[9] 77 Fed. Reg. at 75736/3.

[10] The SIP Disapproval Proposal does not assert that the SIP submittal was untimely and the EPA did not make a timely determination that the SIP is administratively incomplete. See Section 7, below.

[11] 65 Fed. Reg. 67249, 67250 (November 9, 2000), Executive Order 13175, Sec. 5(b)(2)(A).

[12] 77 Fed. Reg. at 75730/1.

[13] *Id.*

[14] The Proposal does not specify that the SIP is defective because a reasonable progress, or four-factor, analysis was not conducted for sulfur dioxide ("SO_2"), coarse mass or fine soil emissions relating to PCC. Nor does anything in the rulemaking docket indicate the SIP is defective for such reasons. For these reasons, SRPMIC assumes that the EPA does not propose the SIP is defective for not including a reasonable progress analysis for SO_2, coarse mass or fine soil emissions relating to PCC; and SRPMIC reserves the right to challenge any FIP proposal provision that concerns SO_2, coarse mass or fine soil emissions relating to PCC.

diminish or impair visibility" in the SCWA.[15] However, the EPA must find that the application of a four-factor analysis under § 51.308(d)(1)(i)(A) could or would have pointed to the necessity to install and operate additional emissions controls at PCC in order to improve visibility in the SCWA, before the EPA can find that the State's conclusion as to PCC is a material basis for disapproving the SIP.[16]

There is, in fact, nothing in the SIP Disapproval Proposal or rulemaking docket of the Proposal that indicates the EPA has found PCC contributes to visibility impairment in a Class I area, or that additional emissions controls at PCC would improve visibility in a Class I area.[17] That the Proposal includes a thorough four-factor analyses under § 51.308(d)(1)(i)(A) for non-BART point sources of SO_2[18] underscores that the EPA should similarly have included in the Proposal a four-factor analyses for the non-BART point sources of NO_X, including PCC,[19] in order to inform the Proposal and enable affected non-BART point sources of NO_X, such as PCC, to make informed comments on the Proposal.[20]

It is irrelevant that the Proposal's four-factor analyses for the non-BART point sources of SO_2 did not produce additional grounds for proposing to disapprove the SIP. What is relevant is that the EPA considered it necessary to include four-factor analyses for the non-

[15] 77 Fed. Reg. at 75730/1.

[16] *See* 77 Fed. Reg. at 75729, fn. 148 ("While visibility is not an explicitly listed factor to consider when determining whether additional controls are reasonable, the point of additional controls is to make reasonable progress toward natural visibility conditions. Therefore, the projected visibility benefit of the controls should be taken into account when determining if the controls are needed to make reasonable progress.").

[17] The Proposal also includes no analysis that indicates the SIP's reasonable progress goal for the worst 20% days in the SCWA is incorrect.

[18] 77 Fed. Reg. at 75728-30.

[19] The Proposal does not identify PCC as a BART-eligible source and includes Arizona's cement kilns only in the Proposal's analysis of non-BART sources. 77 Fed. Reg. at 75730/1. The Proposal also does not challenge the SIP's determination that PCC is not BART-eligible and is not subject to BART. *See* SIP Appendix D at p. 11 (incorporating Appendix H of April 4, 2005 Stationary Sources Joint Forum report ("**SSJF**"); SSJF Appendix H (Table of BART Eligibility Determinations); *see also* December 6, 2012 Email from EPA to PCC ("We are not looking at Phoenix Cement as a BART source, but rather a source that should be looked at under the reasonable progress requirement."). Therefore, the EPA has accepted PCC's status as a non-BART source. SRPMIC reserves the right to demonstrate that PCC is not a BART-eligible source and is not subject to BART in the event of a contrary statement by the EPA.

[20] The notice-and-comment rulemaking procedures under 42 U.S.C. § 7607(d) require that the EPA: (i) publish in the Federal Register its proposed decision to disapprove a SIP, including the basis, purpose and "factual data on which the proposed rule is based"; (ii) allow comment on the proposal; (iii) establish a rulemaking docket; and (iv) publish the final rule based on information in the docket. The notice-and-comment rulemaking procedures under the Administrative Procedure Act, 5 U.S.C. § 553, are substantially equivalent. SRPMIC believes that either or both sets of procedures apply to this proceeding.

BART point sources of SO_2 in order to inform the Proposal and affected sources' review of the Proposal. The EPA's failure to similarly include, within the Proposal, four-factor analyses for the non-BART point sources of NO_X is a material omission of what clearly would be a key justification for proposing to disapprove the SIP as to such sources.

The SIP Disapproval Proposal is, therefore, unjustified as to non-BART point sources of NO_X, such as PCC; SRPMIC and other non-BART point sources of NO_X are deprived of their due process right to comment in an informed manner on the Proposal; and the Proposal's application to PCC and other sources of NO_X would be unfounded. Absent such foundation, there would in turn be no basis for promulgating a FIP that imposes emissions control requirements on PCC and other non-BART sources of NO_X. Again, it is the Proposal that "creates the basis"[21] for the FIP.

4. The EPA's October 3 Analysis Does Not Separately Justify the SIP Disapproval Proposal as to PCC.

The October 3 Analysis[22] is not included in the rulemaking docket of the SIP Disapproval Proposal and, therefore, is not lawfully a justification of the Proposal. Moreover, it is unclear that the October 3 Analysis informs the Proposal, and the Proposal itself and rulemaking docket do not indicate that the October 3 Analysis informs the Proposal. Therefore, the October 3 Analysis has no legal bearing on the sufficiency of the Proposal.[23]

SRPMIC is, nonetheless, in the process of reviewing the installation and operating costs and associated visibility benefits of NO_X emissions controls at PCC that are described in the October 3 Analysis.

SRPMIC's preliminary review indicates the October 3 Analysis substantially under-estimates the costs of installing and operating selective non-catalytic reduction NO_X emissions controls ("**SNCR**") at PCC and substantially over-estimates the improvements to visibility in the SCWA that would result from the installation and operation of SNCR.

Without limitation, the CALPUFF and CALPOST modeling described in the October 3 Analysis: (i) failed to use the annual average and 20% worst days averaging periods when using IMPROVE Method 8 for assessing impacts and improvements to visibility as required

[21] *Id.* at 75736/3. See footnote 10, above.

[22] See footnote 3, above.

[23] To hold that the final decision to disapprove the SIP is based on the October 3 Analysis, without a supplemental proposal to that effect and without soliciting public comments on the October 3 Analysis, would frustrate the public's right to notice-and-comment rulemaking and fully-informed judicial review of the final rule.

under 42 U.S.C. § 7491 and 40 C.F.R. §§ 51.301 and 51.308; (ii) failed to consider the significant role that nitrogen oxide-nitrogen dioxide ("**NO-NO_2**") chemistry plays within relatively short dispersion distances, such as the 9 kilometers separating the SCWA from PCC; and (iii) failed to consider diurnal variability in NO-NO_2 conversion rates, which can be substantial in the case of PCC and the SCWA.[24] In addition, the CALPUFF model failed to use a representative NO_X emissions rate.[25, 26] Also, the October 3 Analysis substantially under-estimates the costs associated with installing and operating SNCR at PCC.[27] Correcting for these failures would yield a conclusion that the imposition of SNCR requirements on PCC would be unjustifiable under 42 U.S.C. § 7491 and 40 C.F.R. § 51.308. (SRPMIC reserves the

[24] See Trinity Consultants' Report, **Attachment 3**.

[25] The Guidelines for BART Determinations ("**Guidelines**") state the Guidelines are not binding for sources other than 750 megawatt power plants; however, the EPA "encourages" use of the Guidelines for other source categories. 70 Fed. Reg. 39104, 39108/3 (July 6, 2005). The October 3 Analysis did not follow the Guidelines' suggestion to use for the CALPUFF model emissions estimates that "reflect steady-state operating conditions during periods of high capacity utilization" based on actual emission rates during the "meteorological period modeled." *Id.* at 39162/3. Instead, the EPA multiplied the maximum rated capacity of a backup kiln feeder, which is included in the equipment list in PCC's air quality permit, by a 1.6 feed-to-clinker conversion factor to derive a maximum tons-per-day clinker production rate, which it then multiplied by the highest annual average lbs NO_X/ton clinker value derived from emissions inventories reported for the period 2005-2010, in order to derive a lbs NO_X/hour emissions rate for use in the CALPUFF model. The October 3 Analysis provides no justification for its use of a kiln feed rate and lbs NO_X/ton clinker values for a period outside the "meteorological period modeled." The October 3 Analysis also does not explain why the maximum rated capacity of the backup feeder and highest annual average lbs NO_X/ton clinker value for the period 2005-2010 reflect "steady-state operating conditions during periods of high capacity utilization." Notably: (a) the feeder in question is a backup feeder that is never used unless the primary feeder is being maintained or repaired; (b) since the kiln first began operation, there has never been a day when the kiln feed rate approached the maximum rated capacity of the backup feeder; and (c) the lbs NO_X/ton clinker values for the kiln are lower in years with high capacity factors than in years with low capacity factors and lower still when the kiln is operating on a maximum capacity day, which is when the kiln is operating most efficiently. These factors alone indicate the lbs NO_X/hour emissions rate used in the CALPUFF model for the October 3 Analysis was not representative of real world conditions, let alone reflective of "steady-state operating conditions during periods of high capacity utilization." SRPMIC believes one way to derive a lbs NO_X/hour emissions rate that is representative of "steady-state operating conditions during periods of high capacity utilization" would be to use the average of the top 5-10% tons-per-day clinker production rates and the average of the lbs NO_X/ton clinker values reported for those clinker production rates. This would yield a lbs NO_X/hour emissions rate that is perhaps 25-30% lower than the emissions rate used for the October 3 Analysis.

[26] In advance of having an opportunity to review comprehensively the October 3 Analysis and underlying documents, SRPMIC's preliminary review indicates that: (a) the EPA has substantially over-estimated PCC's contribution to visibility impairment in the SCWA; and (b) PCC may contribute substantially less than 0.5 deciview of visibility impairment in the SCWA. See Section 6, below.

[27] The EPA's estimate is that it would cost $1,268,764 to install SNCR and $544,866 annually to operate SNCR at PCC. A more realistic estimate is $1,744,560 to install SNCR and $1,287,798 annually to operate SNCR. See SRPMIC Estimate of Capital and Operating Costs, **Attachment 4**.

right to supplement these comments with, or submit as comments on the proposed FIP, the results of SRPMIC's own analysis.)

In the alternative, and without limiting the foregoing comments, correcting for the failures in the October 3 Analysis would yield a conclusion that any imposition of SNCR requirements on PCC earlier than 10 to 15 years after the date of the FIP's promulgation would be inappropriate under 42 U.S.C. § 7491 and 40 C.F.R. § 51.308, particularly in light of SRPMIC's substantial reliance on PCC's revenues to meet the safety, health and educational needs of SRPMIC's members and the need to plan substantially long term against any regulatorily-imposed diminishment of those revenues. This is a matter of the basic welfare of SRPMIC's members.

5. The EPA is Inappropriately Applying to Non-BART Sources Standards Applicable to BART Sources.

The SIP Disapproval Proposal states Arizona had an obligation to consider improvements to visibility in Class I areas that would result from imposing emissions control technology requirements on sources that do not meet the definition of "BART-eligible source" at 40 C.F.R. § 51.301 and/or sources that are not "subject to BART" under 40 C.F.R. § 51.308(e).[28] The Proposal asserts that "a thorough analysis is required before concluding that nothing more can be done to improve visibility" in the Class I areas.[29] SRPMIC understands from other rulemakings that the EPA believes 40 C.F.R. § 51.308(d)(1)(i)(A) authorizes the imposition, on non-BART sources, of the same kinds of emissions control technology requirements that can be imposed pursuant to BART determinations under 40 C.F.R. § 51.308(e)(1)(ii).[30]

SRPMIC questions the EPA's interpretation of § 51.308(d)(1)(i)(A), both generally and to the extent that the EPA applies the interpretation to PCC. First, such an interpretation would make the definition of "BART-eligible source" surplusage, in violation of applicable canons of

[28] *Id.* at 75728-30.

[29] *Id.* at 75730/1.

[30] *See, e.g.*, 77 Fed. Reg. 14604, 14621-22 (Partial Disapproval of Arkansas Regional Haze SIP) (March 12, 2012).

regulatory construction,[31] and obliterate any meaningful distinction between the BART five-factor determination requirements of § 51.308(e)(1)(ii) and the four-factor reasonable progress evaluation mandate of § 51.308(d)(1)(i)(A). Second, the October 3 Analysis is clearly a BART five-factor determination. This indicates a plan by the EPA to apply BART determination requirements to PCC even though PCC is not a BART-eligible source and is not subject to BART. Such a plan would be contrary to law.

The EPA would do better to give Arizona "wide latitude to determine the additional control requirements" that may, or may not, be necessary under § 51.308(d)(1)(i)(A) for the current planning period;[32] and, in all circumstances, maintain a meaningful distinction in practice between control technology determinations required under 40 C.F.R. § 51.308(e)(1)(ii) and reasonable progress evaluations required under 40 C.F.R. § 51.308(d)(1)(i)(A).

6. To the Extent Applicable to Non-BART Sources, Such as PCC, the 0.5 Deciview Threshold Proposed in the SIP is Appropriate for the SCWA.

The Disapproval Proposal states that the EPA is proposing to approve Arizona's decision to set 0.5 deciview ("**dv**") (based on a 3-year average of the 98th percentile impacts) as the Class I area visibility impairment contribution threshold for determining whether a source is subject to BART, but the EPA is seeking comments on whether this threshold is reasonable.[33] The applicability of such a contribution threshold to non-BART sources is unclear, although there is at least one instance in which the EPA has considered the threshold when evaluating sources not subject to BART.[34] Also, as explained in Section 5 above, the EPA appears poised to eliminate the distinction between the BART five-factor determination requirements of § 51.308(e)(1)(ii) and the four-factor reasonable progress evaluation mandate

[31] *See United States v. Geyler*, 932 F.2d 1330, 1333 (9th Cir. 1991) ("A long line of precedents requires us to give meaning wherever possible to every word and clause when interpreting a statute.") (citing *Moskal v. United States*, 498 U.S. 103 (1990)); *Donnelly v. FAA*, 411 F.3d 267, 271 (D.C. Cir. 2005) ("We must strive to interpret a statute to give meaning to every clause and word, and certainly not to treat an entire subsection as mere surplusage."); *see also Rosenberg v. XM Ventures*, 274 F.3d 137, 142 (3rd Cir. 2001) ("This precept of statutory construction applies to the interpretation of regulations as well."); *Petit v. U.S. Dep't of Educ.*, 675 F.3d 769, 793 (D.C. Cir. 2011) ("As we have often explained, judges should hesitate to treat words in a regulation or statute as mere surplusage—words of no consequence.").

[32] EPA "Guidance for Setting Reasonable Progress Goals Under the Regional Haze Program," section 4.2 (June 1, 2007).

[33] 77 Fed. Reg. at 75706/2; *see also id.* at 75710/3 *and* 75720/2-3.

[34] 77 Fed. Reg. 14604, 14621 (Partial Disapproval of Arkansas Regional Haze SIP) (March 12, 2012) ("Arkansas's lack of RPG analysis is especially troublesome in light of several sources not subject to BART which contribute to the impairment of visibility above 0.5 dv, as explained in more detail in our proposed rulemaking.").

of § 51.308(d)(1)(i)(A). Therefore, to the extent Arizona's decision is applicable to non-BART sources, SRPMIC offers the following comment.

40 C.F.R. Part 51 Appendix Y, Subsection III.A.1 generally provides that the larger the number of emissions sources potentially contributing to visibility impairment in a Class I area, the more states should consider setting the threshold for that area at a level lower than 0.5 dv.[35] This provision, however, does not mandate that states set the threshold lower than 0.5 dv in such instances.[36] Nonetheless, SRPMIC believes the distances from the SCWA of the other point sources considered in the SIP Disapproval Proposal and the low levels of their potential contributions to visibility impairment in the SCWA indicates that the 0.5 dv threshold would be appropriate for the SCWA.

7. The SIP Disapproval Proposal is Untimely.

The EPA does not dispute that SIP disapprovals and corresponding FIPs under 42 U.S.C. § 7491 are subject to the requirements of 42 U.S.C. § 7410.[37]

42 U.S.C. § 7410(k)(1)(B) provides as follows:

> Completeness finding. Within 60 days of the Administrator's receipt of a plan or plan revision, but no later than 6 months after the date, if any, by which a State is required to submit the plan or revision, the Administrator shall determine whether the minimum criteria established pursuant to subparagraph (A) have been met. Any plan or plan revision that a State submits to the Administrator, and that has not been determined by the Administrator (by the date 6 months after receipt of the submission) to have failed to meet the minimum criteria established pursuant to sub-

[35] 70 Fed. Reg. 39104, 39161/3-39162/1 (July 6, 2005) (Final Part 51 Appendix Y Rules).

[36] *See* 70 Fed. Reg. at 39120/3-39121/1 ("In a regulatory context, we believe that a State's decision as to an appropriate threshold for contribution could depend upon the number of sources affecting a class I area.") (emphasis added); *cf.* 77 Fed. Reg. 76174, 76183/2 (Partial Disapproval of Washington Regional Haze SIP) (December 26, 2012) (noting all states in the Western Regional Air Partnership, which includes Arizona, adopted the 0.5 dv contribution threshold in their SIPs).

[37] 77 Fed. Reg. at 75711/1 ("In addition to what is required by the RHR, general SIP requirements mandate that the SIP must also include all regulatory requirements . . .") (referencing fn. 31, "*See* CAA section 110(a)(2) (requirements for SIPs)"); *id.* at 75713/2 ("ADEQ adopted and transmitted its Regional Haze SIP . . . to EPA Region 9 in a letter dated February 28, 2011. The plan was determined complete by operation of law on August 28, 2011.") (referencing fn. 50, "CAA section 110(k)(1)(B)"); *id.* at 75735/3 ("EPA is legally obligated to issue a FIP for the disapproved parts of Arizona's RH SIP pursuant to CAA section 110(c)(1) . . ."); *accord id.* at 75735/3-75736/1; *see also* 42 U.S.C. §§ 7491(b)(2)(A), 7491(d) *and* 7491(g)(4) (referring to EPA regional haze FIP promulgations pursuant to 42 U.S.C. § 7410).

> paragraph (A), shall on that date be deemed by operation of law to meet such minimum criteria.

(Emphasis added.)

42 U.S.C. § 7410(k)(1)(A) provides:

> [T]he Administrator shall promulgate minimum criteria that any plan submission must meet before the Administrator is required to act on such submission under this subsection. The criteria shall be limited to the information necessary to enable the Administrator to determine whether the plan submission complies with the provisions of this Act.

Arizona submitted the SIP to the EPA in February 2011. More than six months have passed since the EPA's receipt of the submission. Within the required six months, the EPA did not make a determination that the SIP fails to meet the minimum criteria established under § 7410(k)(1)(A). Therefore, the SIP is "deemed by operation of law" to meet the "minimum criteria."

Among the "minimum criteria" that the EPA has established under § 7410(k)(1)(A) is the requirement that a regional haze SIP include necessary reasonable progress evaluations under 40 C.F.R. § 51.308(d)(1)(i)(A). The SIP Disapproval Proposal states that a material reason for the EPA's proposal to disapprove the SIP is the EPA's determination that the SIP fails to contain necessary reasonable progress evaluations for non-BART sources of NO_X. Also, the Proposal states "the plan does not provide technical documentation" for the assertion that PCC "does not 'appreciably diminish or impair visibility.'"[38] These statements are administrative incompleteness determinations.[39] The time for such determinations was within six months after Arizona's submittal, i.e., no later than August 2011, which has long since passed. Therefore, any EPA disapproval of the SIP on the grounds that it does not contain required reasonable progress evaluations for non-BART sources of NO_X would be void *ab initio*.

[38] 77 Fed. Reg. at 75730/1.

[39] 42 U.S.C. § 7410 does not allow the EPA to treat a claimed omission of a required element of a SIP as a substantive deficiency warranting disapproval of the SIP. SRPMIC believes 42 U.S.C. § 7410(c)(1)(A) and (B) indicate that a claimed failure to include a required element in a SIP is not grounds for disapproving the SIP, but rather is grounds for remanding the SIP back to the State to correct the omission. The EPA had ample opportunity over the last two years to remand the SIP to the State to correct omissions, which makes questionable its intention to instead propose a FIP.

SRPMIC believes that, if the EPA had notified Arizona within the required six-month timeframe that the SIP was administratively incomplete for failing to include four-factor analyses for non-BART sources of NO_X, then Arizona would have responded with a supplemental submittal, as envisioned by the Clean Air Act. That the EPA failed to engage in this process, or give practical meaning to 42 U.S.C. § 7410(k)(1)(A) during the proceedings on the SIP, highlights what appears to be an attempt by the EPA to increase its authority over regional haze regulation at the expense of the authority that the Clean Air Act grants to the states.

SRPMIC would note, further, that the consent decree which the EPA voluntarily entered into with the National Parks Conservation Association litigants[40] is not a shield from the requirements of the Clean Air Act and cannot legally remove limitations that the Clean Air Act places on the EPA's discretion.[41] SRPMIC reserves the right at the appropriate time to challenge the scope, force and effect of the consent decree relative to the legal requirements mandated by Congress and codified at 42 U.S.C. § 7410.

* * * *

In addition to the above comments, SRPMIC incorporates by reference the comments on the SIP Disapproval Proposal that are submitted by the Arizona Department of Environmental Quality, so that they are a part of SRPMIC's comments.

If you have any questions regarding these comments, please do not hesitate to let me know. Thank you.

Sincerely,

Verle C. Martz
Vice President Engineering & Environment
Phoenix Cement Company, a Division of the
Salt River Pima-Maricopa Indian Community

[40] Partial Consent Decree, United States District Court for the District of Columbia, 1:11-cv-01548-ABJ, Filed March 30, 2012.

[41] *Michigan v. EPA*, 268 F.3d 1075, 1081 (D.C. Cir. 2001) ("EPA is a federal agency — a creature of statute," and may exercise "only those authorities conferred upon it by Congress.").

Attachments

1 – EPA's October 3 Analysis
2 – Emails from EPA to PCC
3 – Trinity Consultants' Report With Electronic Files
4 – Summary of SNCR Costs for PCC

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ATTACHMENT 1

EPA'S OCTOBER 3 ANALYSIS

Technical Analysis for Arizona and Hawaii Regional Haze FIPs: Task 9: Five-Factor RP Analyses

Contract No: EP-D-07-102
Work Assignment: 5-12
Version: **1**

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1 Introduction

This report describes the 5-factor analyses of all technically feasible NO_x control options on the applicable units at the five facilities as listed below:

- CalPortland Cement Rillito Plant Kilns 1-4
- Phoenix Cement Plant Kiln 4

The five factors considered in these analyses are as follows:

1. Cost of compliance;
2. Energy and non-air quality impacts of compliance;
3. Any existing pollution control technology in use at each source;
4. Remaining useful life of the source, and
5. Degree of visibility improvement that may be reasonably expected from the use of emissions controls.

Andover Technology Partners (ATP) estimated the cost of compliance for these units using EPA Control Cost Manual (EPA, 2002), cost estimation methods based on the latest Integrated Planning Model [IPM]) documented online by EPA (2010), and other reasonable engineering approaches. The control options were analyzed not only for the feasibility of implementation but also the first four factors listed above to estimate the total cost per year of each control technology, and the cost of emission reductions in $/TPY for each.

Once all the feasible control options were identified, EPA reviewed and recommended control configurations on all applicable units to examine the visibility impacts of their emissions. UNC performed these impact assessments using the base configuration of existing controls as well as all EPA-approved control configurations for each BART facility at all Class I Areas (CIAs) within a 300-km radius through the use of dispersion modeling. Per EPA requirements these analyses used the following models and processors, and EPA-provided meteorological inputs available from a previous BART analysis done by ENSR (2009) using CALMET version 5.8:

- CALPUFF version 5.8 (v5.8) level 070623 puff dispersion model was used to estimate concentrations of visibility-impairing pollutants emitted by each facility at the relevant CIAs.
- The POSTUTIL utility version 1.56 was used to adjust these concentrations for the phase-partitioning of HNO_3 between gas and particle based on additional input information.
- The adjusted concentrations were used in the CALPOST visibility post-processor version 6.221 (v6.221) to calculate the visibility impairment in deciview (dv) relative to the background visibility at each CIA.

The change in deciview, or delta-dv, corresponding to the NO_x emission reduction for each control option relative to the base configuration was used along with the yearly cost of control to estimate the control option cost effectiveness in $/dv at each CIA, as a maximum of all the CIAs, and as a total over all the CIAs.

2 Work Performed and Deliverable Summary

In the five-factor analysis performed in this task ATP examined NO_x control options and their costs for each of the five facilities considering the first four factors listed in Section 1. These

cost estimates have been used along with the visibility impact assessments performed by UNC for each facility to estimate the control option effectiveness in a combined metric specified by EPA, namely, $/dv. The overarching considerations for the visibility impact assessments, including the CIAs that are potentially affected by these facilities are provided in Section 2.1. The five-factor analyses for each plant are described in Section 2.2.

2.1 General Considerations for Visibility Modeling

In Task 4 of this WA we used GIS software to determine the nearest distances to the boundaries of CIAs within a 300-km radius of the major emitting facilities in Arizona. The 19 CIAs and their nearest mean distances (as determined in the Task 4 screening) from the applicable facilities identified for Reasonable Progress analysis are listed in Table 1. The domain description, Lambert Conformal grid specifications and meteorological inputs to CALPUFF required for this analysis are from CALMET v5.8 inputs and outputs provided by EPA from a BART analysis for 2001-2003 performed by ENSR Corporation for the Navajo Generating Station (ENSR, 2009).

Table 1. CIAs Within 300 km of the Five RP Facilities.

CIA	Short Name	State		
Bandelier NM	band	NM		
Bryce Canyon	brca	UT		
Capitol Reef	care	UT		
Chiricahua NM	chir	AZ		
Chiricahua	chrw	AZ		
Galiuro	gali	AZ		
Gila	gila	NM		
Grand Canyon	grca	AZ		
Mazatzal	maza	AZ		
Mesa Verde	meve	CO		
Mount Baldy	moba	AZ		
Petrified Forest	pefo	AZ		
Pine Mountain	pimo	AZ		
Saguaro	sagu	AZ		
San Pedro Parks	sape	NM		
Sierra Ancha	sian	AZ		
Superstition	supe	AZ		
Sycamore Canyon	syca	AZ		
Zion	zion	UT		

The CALPUFF model set-up for the five facilities followed the guidance of the modeling protocol that was initially delivered to EPA on March 19, 2012 as a Task 5 deliverable. This modeling protocol invokes almost all the model input settings provided in the WRAP BART

Subject Protocol provided in its Appendix A. Differences in model set-up from the recommendations of the WRAP protocol due to the CALPUFF version used, or other direction from the EPA are noted in this protocol. UNC verified and reconciled any discrepancies in the CALPUFF inputs through a series of test runs. Of note, CALPUFF modeling used a constant value of 1 ppb throughout for ammonia per EPA guidance. Further facility-specific details on the visibility analysis performed under Task 9 are provided in Section 2.2.

2.2 Five-Factor Analyses

This section describes the control options analysis, followed by the details of the visibility modeling and the results of the five-factor analysis for each facility. The visibility modeling used combinations of control technologies (control "scenarios") specified by the EPA with respect to the emissions inputs, which were also provided by the EPA with extensive source documentation. The costs of compliance and visibility impacts for each scenario were estimated based on the following assumptions:

- The costs and emission reductions (in tons reduced) for the individual technologies that make up each control configuration are additive, i.e., the control scenario costs and emission reductions can be expressed, respectively, as the sum of the component technology costs, and the sum of the associated emission reductions (in tons reduced).
- The control efficiencies determined in the cost of control analyses are applicable to the baseline emission values used in the visibility modeling.
- The baseline periods used vary by source and unit, in order to account for differences in dates of installation of controls. This approach reflects a more realistic assessment of "existing pollution control technology in use at each source" than using a uniform baseline for all units.
- The baseline emissions used in the CALPUFF modeling are not identical to those used in the control options analyses because the BART Guidelines on which these analyses are based provide different methods for calculating baseline emissions for these two purposes.
- The baseline emission inputs for NO_x for the electricity generating facilities use the 24-hour average emission rate from the highest emitting day of a representative most recently available baseline period (excluding start-up, shutdown or malfunction). These data were extracted from the Clean Air Market Division (CAMD) Continuous Emission Monitoring System (CEMS) database. CEMS data are also used for the cement kilns, as indicated by the Emission Inventory submittals.
- The baseline emission inputs for PM and SO_2 for purposes of visibility modeling are derived from the hourly plant heat input (from the CAMD CEMS database) multiplied by emission limits specified in ADEQ's BART determinations for these units.
- The control costs analyses use the annual average emission values in tons per year (TPY) based upon actual emissions from baseline periods that reflect future anticipated annual emissions.

Specifics of the emissions used and the visibility impacts of base case and control scenarios are discussed in the sections on visibility and control effectiveness analysis for each facility.

2.2.1 CalPortland Cement Rillito Plant Units 1 - 4

Formerly known as Arizona Portland Cement, the CalPortland Cement Rillito Plant (Figure 4) has three long kilns and one precalciner kiln. The type and rated capacities are shown in Table 26. It is currently understood that these kilns have fabric filters, but have no SO_2 or NO_x controls. It is understood that the three smaller kilns are not currently being operated and it is unclear if these three kilns will be operated in the future. However, all 4 kilns are being included in this RP analysis.

Figure 4. Kilns at the CalPortland Cement Rillito Plant

Table 26. CalPortland Kiln Data[1]

Year on Line	Fuel	Type	Capacity, TPD	Capacity, 1000 TPY
1949	CGk	Long DRY	408	121
1951	CGk	Long DRY	408	121
1955	CGK	Long DRY	408	121
2002	CGKA	PreCaliner	3084	969
Fuels: C=Coal; G=Gas; K=Coke; A=Alternative				

Facility emissions data developed by EPA for this facility are presented in Table 27. Annual emissions estimates and emission rates were determined by estimating a representative output (tons of clinker per year) from reported data and multiplying by representative emission rate in lb/ton. With regard to existing controls, kiln number 4 is new enough that it likely has some form of low NO_x combustion controls, but it is unlikely that kilns 1-3 have any NO_x controls

Table 27. Estimated Emissions and Production Rates for CalPortland Cement Kilns 1-4

	Kilns1-3 (each)*	Kiln 4	Units	Source

[1] Portland Cement Association, "US and Canadian Portland Cement Industry: Plant Information Summary", December 31, 2006.

NO_x Rate	8.70	3.59	lb/ton clinker	EPA[6]
TPY clinker	121,000	969,000	Ton/yr	PCA[5]
TPY clinker	143,157	1,053,932	Ton/yr	EPA[6]
TPY NO_x	623	1,894	Ton/yr	Calculated
* Data for kilns 1-3 is per kiln, not total.				

2.2.1.1 NO_x Control Options Analysis

2.2.1.1.1 Available NO_x Control Technologies

Available Technologies include MAT, LNB, mid-kiln firing, SNCR, and SCR, and combinations of these technologies. In addition, kiln 4, as a precalciner kiln, could implement low NO_x combustion controls in the calciner. Thus low NOx calciner is another option for kiln 4. The cost of a Low NOx Calciner (LNC) is expected to be in the same range as MAT [7].

2.2.1.1.2 Feasible NO_x Control Technologies

All of the technologies cited above are feasible. mid-kiln firing provides similar levels of reduction as other combustion technologies such as MAT, but is more costly than MAT unless alternative fuels are available. Since information regarding the availability of alternative fuels (such as tires) was not available, mid-kiln firing was not evaluated. LNC is feasible for kiln 4. SCR, while available, has had very limited use on cement kilns and will not be evaluated further. For kiln 4, it is unclear if it currently has LNB with indirect firing. If it already has such controls, it could likely still achieve further NO_x reductions through MAT or LNC.

2.2.1.1.3 Evaluation of Control Technologies

Tables 28(a) and 28(b) show estimated cost of controlling NO_x from the CalPortland Cement Kilns. LNB is more expensive than MAT or LNC for kiln 4 and it would therefore be conservative to use that as the basis for 30% reduction, although MAT may be applicable at a lower cost. SNCR can be used to provide 50% NO_x reduction whether used alone or in combination with combustion controls (assumed here to be LNB, although MAT may be applied at a lower cost). The cost and emissions information on Table 28(a) is *per kiln*.

[6] RP_Cement_modeling_runs - EPA 20120912.xlsx

[7] Memo from J. Staudt to R. Srivastava, S. Vijay, E. Torres, Re: Costs and Performance of Controls – revised from comments, March 10, 2009 at page 14

Table 28(a). NO_x Control Technologies for CalPortland Kilns 1-3

(a)

	MAT	LNB	SNCR	LNB and SNCR
capital	$676,001	$2,708,493	$383,535	$3,092,028
Annualized Capital	$63,810	$255,663	$36,203	$291,866
FOM (incl. admin, ins	$102,045	$183,345	$90,347	$198,686
Reagent			$115,120	$80,584
Total Cost, $/year	$165,855	$439,008	$241,669	$571,136
Percent Reduced	30%	30%	50%	51%
tons reduced	187	187	312	318
$/ton reduced	$887	$2,349	$776	$1,798
Incremental $/ton (compared to MAT)			$608	$3,098
Incremental $/ton (compared to LNB)			($1,584)	$1,010
lb/hr emission rate	111	111	79	77

Table 28(b). NO_x Control Technologies for CalPortland Kiln 4

(b)

	MAT or LNC	LNB	SNCR	LNB and SNCR
capital	$1,188,275	$3,427,320	$1,336,373	$4,763,693
Annualized Capital	$112,165	$323,515	$126,144	$449,659
FOM (incl. admin, insur, tax	$122,536	$212,098	$128,460	$265,553
Reagent			$349,978	$244,985
Total Cost, $/year	$234,701	$535,613	$604,583	$960,197
Percent Reduced	30%	30%	50%	51%
tons reduced	568	568	947	966
$/ton reduced	$413	$943	$638	$994
Incremental $/ton (compared to MAT)			$976	$1,824
Incremental $/ton (compared to LNB)			$182	$1,067
lb/hr emission rate	336	336	240	235

2.2.1.1.4 Energy and Environmental Impacts

All these technologies can have a modest impact. MAT can have a beneficial impact on CO and SO_2 emissions. SNCR and SCR can result in ammonia slip, which is generally well controlled, and therefore not a major concern.

2.2.1.2 Visibility Modeling

The modeling included emission inputs from all four kilns. However, due to special requirements for capturing the output concentration files from CALPUFF for later sensitivity studies that may be done by EPA, the CALPUFF setup involved two streams of dispersion calculations. The calculation steps are described in Section 2.2.4.2.2.

For Kilns 1-3, maximum 24-hr average baseline emissions needed for the visibility modeling are based on NO_x and SO_2 emission factors representing the highest values reported over 2005-

2007, which was the most recent 3-year period of continuous operation. Annual emissions needed for the control cost estimates on these units were based on the NO_x and SO_2 emission factors representing the average over the reported emission inventory (EI) values for 2005-2007.

For Kiln 4, the maximum 24-hr average emission inputs needed for the visibility modeling were taken from the WRAP BART modeling for this facility, and converted from g/s to TPY. The annual emission values used in the cost estimates for this unit are based on emission factors for NO_x and SO_2 that represent the average of values reported over the entire 2005-2010 period.

Due to the installation of a baghouse (FF) on each kiln per a Consent Decree of January 11, 2011, the filterable PM emission rate is limited to 0.008 gr/dscf. The EPA[6] provided a conversion of this value into lb/hr and g/s using stack exit temperatures and flow rates. PM emission factors for Kiln 1-3 used the NPS spreadsheets for a dry cement kiln with FF, and for Unit 4, the spreadsheet for a precalciner with FF.

The emissions for the NO_x control cases are specified below, and tabulated in Table 29; in the base and control scenarios, EPA specified that the emissions of Units 1-3 should be lumped together as one source due to identical stack parameters and control technology on each.

- Ctrl2-1uses LNB or MAT controls (as both have the same control efficiency) on each of Units 1-3, and baseline emissions on Unit 4.
- Ctrl2-2 uses SNCR controls on each of Units 1-3, and baseline emissions on Unit 4.
- Ctrl2-3 uses baseline emissions on Units 1-3, and LNB or MAT controls on Unit 4.
- Ctrl2-4 uses baseline emissions on Units 1-3, and SNCR control on Unit 4.
- Costs are shown separately in the last two columns of Table 29 for MAT and for LNB for Ctrl2-1 and Ctrl2-3; the control cost is repeated in these columns for Ctrl2-2 and Ctrl2-4 strictly for consistency, as the only control for these scenarios is SNCR.

Table 29. Base and Control Scenarios for NO_x Used in CalPortland Units 1-4 RP Analyses

Control Option	Units 1-3		Unit 4		All Units		
	Control	D-Emis (TPY)	Control	D-Emis (TPY)	D-Emis (TPY)	$/year if using MAT	$/year if using LNB
Base		0		0	0	$0	$0
Ctrl2-1	LNB or MAT	561		0	561	$497,565	$1,317,024
Ctrl2-2	SNCR	936		0	936	$725,007	$725,007
Ctrl2-3		0	LNB or MAT	568	568	$234,701	$535,613
Ctrl2-4		0	SNCR	947	947	$604,583	$604,583

2.2.1.2.1 Stack Parameters

Stack parameters for CalPortland were taken from the facility's Kiln 5 Class permit application, Appendix G, Table G3-1, and provided to us by EPA. They are listed in Table 30.

[6] RP_Cement_modeling_runs - EPA 20120912.xlsx

Table 30. Stack Parameters for CalPortland Units 1-4

Unit #	LON	LAT	Stack Height		Stack Elevation		Stack Diameter		Stack Temperature		Exit Velocity	
	deg	deg	ft	m	ft	m	ft	m	F	K	ft/s	m/s
Unit 1-3	-111.14965	32.40767	75.0	22.86	2060.0	627.89	10.0	3.05	425.00	491.48	52.70	16.06
Unit 4	-111.14977	32.40760	75.0	39.62	2060.0	627.89	16.0	4.88	399.99	477.59	47.83	14.58

2.2.1.2.2 CALPUFF and POSTUTIL Inputs

The EPA specified emission requirements for the CALPUFF modeling. The emissions data are also documented in Appendix A, and in the supporting spreadsheet documentation for this report. We performed extensive QA of these inputs using customized Unix scripts to ensure compliance with the data on the spreadsheets provided by EPA[6].

Per EPA's specification the emissions of Units 1-3 were combined in CALPUFF inputs as a single source. Also, as separate CALPUFF output concentration files were requested by EPA for the resulting two sources (Units 1-3 and Unit 4) we set up CALPUFF run directories for CalPortland in two streams, one for each source. The rest of the CALPUFF input preparation for the 2001-2003 modeling period followed the procedure used in the Task 7 and Task 8 visibility analysis of six BART facilities under this WA. Discrete receptor data for the CIAs within the 300-km radius of the CalPortland plant were obtained from NPS. The two sets of CALPUFF outputs were combined first in POSTUTIL for each scenario, and the nitrate was repartitioned between gas and particle phases in a subsequent POSTUTIL run for each scenario.

2.2.1.2.3 CALPOST Setup

We followed the modeling protocol delivered with the Task 5 report in setting up the CALPOST inputs for each of the 12 CIAs within 300 km of the CalPortland Cement Rillito plant. Results are available for each of the years 2001-2003 and the composite period 2001-2003 using four visibility methods. They are reported here for Method 6(a) and Method 8(b) for the composite period. Due to the large number of post-processing runs required, we used customized scripts to extensively QA the CALPOST inputs.

2.2.1.2.4 Extraction of Visibility Results with POSTCALPOST

Table 31 summarizes the results for the 98th percentile visibility impairment due to CalPortland within the composite three-year period from 2000-2003 at all the affected CIAs for the base case and control options. Table 32 summarizes the visibility benefits for the control scenarios.

[6] RP_Cement_modeling_runs - EPA 20120912.xlsx

Table 31. 98th Percentile Visibility Impairment (Δ-dv) for CalPortland Units 1-4 Base Case and Control Scenarios: (a) IMPROVE Method 6(a); (b) IMPROVE Method 8(b).

(a)

Class I Area	Base	Ctrl2-1	Ctrl2-2	Ctrl2-3	Ctrl2-4
	Base Case	LNB or MAT u.1-3	SNCR u. 1-3	LNB or MAT u.4	SNCR u.4
Chiricahua NM	0.20	0.18	0.16	0.18	0.17
Chiricahua	0.22	0.19	0.17	0.20	0.18
Galiuro	0.87	0.78	0.72	0.79	0.74
Gila	0.94	0.83	0.76	0.85	0.79
Mazatzal	0.11	0.10	0.09	0.10	0.09
Mount Baldy	0.08	0.07	0.06	0.07	0.06
Petrified Forest	0.08	0.07	0.07	0.07	0.07
Pine Mountain	0.09	0.08	0.08	0.09	0.08
Saguaro	1.15	1.02	0.93	1.03	0.96
Sierra Ancha	0.11	0.10	0.09	0.10	0.10
Superstition	0.28	0.24	0.23	0.24	0.23
Sycamore Canyon	0.08	0.06	0.06	0.07	0.06
Total	4.22	3.72	3.41	3.79	3.51
Max	1.15	1.02	0.93	1.03	0.96
# CIAs w/ Δ-dv ≥ 0.5	3	3	3	3	3

(b)

Class I Area	Base	Ctrl2-1	Ctrl2-2	Ctrl2-3	Ctrl2-4
	Base Case	LNB or MAT u.1-3	SNCR u. 1-3	LNB or MAT u.4	SNCR u.4
Chiricahua NM	0.23	0.20	0.18	0.21	0.19
Chiricahua	0.25	0.21	0.19	0.22	0.20
Galiuro	1.02	0.90	0.83	0.91	0.84
Gila	1.23	1.07	0.97	1.11	1.02
Mazatzal	0.13	0.11	0.10	0.11	0.11
Mount Baldy	0.11	0.09	0.08	0.09	0.08
Petrified Forest	0.11	0.09	0.08	0.09	0.08
Pine Mountain	0.11	0.10	0.09	0.10	0.09
Saguaro	1.26	1.12	1.02	1.12	1.04
Sierra Ancha	0.13	0.11	0.10	0.12	0.11
Superstition	0.30	0.27	0.24	0.27	0.24
Sycamore Canyon	0.09	0.08	0.07	0.08	0.08
Total	4.97	4.35	3.96	4.43	4.08
Max	1.26	1.12	1.02	1.12	1.04
# CIAs w/ Δ-dv ≥ 0.5	3	3	3	3	3

Table 32. Visibility Benefits (dv) for CalPortland Units 1-4 for the Control Scenarios Corresponding to Table 31.

(a)

Class I Area	Ctrl2-1	Ctrl2-2	Ctrl2-3	Ctrl2-4
	LNB or MAT u.1-3	SNCR u. 1-3	LNB or MAT u.4	SNCR u.4
Chiricahua NM	0.03	0.04	0.02	0.04
Chiricahua	0.03	0.05	0.03	0.04
Galiuro	0.09	0.15	0.08	0.13
Gila	0.11	0.18	0.09	0.15
Mazatzal	0.01	0.03	0.01	0.02
Mount Baldy	0.01	0.02	0.01	0.02
Petrified Forest	0.01	0.02	0.01	0.02
Pine Mountain	0.01	0.02	0.01	0.02
Saguaro	0.13	0.22	0.12	0.19
Sierra Ancha	0.02	0.02	0.01	0.02
Superstition	0.03	0.05	0.04	0.05
Sycamore Canyon	0.01	0.02	0.01	0.02
Total	0.49	0.81	0.43	0.70
Max	0.13	0.22	0.12	0.19
# CIAs with dv ≥ 0.5	0	0	0	0

(b)

Class I Area	Ctrl2-1	Ctrl2-2	Ctrl2-3	Ctrl2-4
	LNB or MAT u.1-3	SNCR u. 1-3	LNB or MAT u.4	SNCR u.4
Chiricahua NM	0.03	0.05	0.03	0.05
Chiricahua	0.03	0.05	0.03	0.04
Galiuro	0.13	0.19	0.11	0.18
Gila	0.17	0.26	0.12	0.21
Mazatzal	0.01	0.03	0.01	0.02
Mount Baldy	0.02	0.03	0.02	0.03
Petrified Forest	0.02	0.03	0.01	0.02
Pine Mountain	0.01	0.02	0.01	0.02
Saguaro	0.14	0.24	0.15	0.22
Sierra Ancha	0.02	0.03	0.01	0.02
Superstition	0.03	0.06	0.04	0.06
Sycamore Canyon	0.01	0.02	0.01	0.02
Total	0.62	1.01	0.54	0.89
Max	0.17	0.26	0.15	0.22
# CIAs with dv ≥ 0.5	0	0	0	0

Table 31 shows the greatest impairment due to CalPortland at Saguaro for both visibility methods. The differences in impairment when applying the same control technology on Units 1-3 vs. Unit 4 are slight, and the impairment is greater in the case of controls on Unit 4 than on Units 1-3.

Table 32 shows the greatest visibility benefits, as expected, at the most significantly impaired CIAs, namely, sagu, gila and gali, with the controls on Units 1-3 providing greater visibility benefits than on Unit 4 using the same technology.

2.2.1.3 Control Effectiveness Results

The results of the control effectiveness in $/dv (millions) for CalPortland are presented in Tables 33 and 34. Table 34 presents the control effectiveness at each CIA, and Table 34 summarizes the results for the CIA with the maximum deciview impact, and for deciview impact summed over all CIAs.

Table 33. Control Effectiveness (million $/dv) for the Calculation Methods of Table 31

(a)

Class I Area	Ctrl2-1		Ctrl2-2	Ctrl2-3		Ctrl2-4
	MAT u.1-3	LNB u.1-3	SNCR u. 1-3	MAT u.4	LNB u.4	SNCR u.4
Chiricahua NM	19	51	17	11	24	16
Chiricahua	16.1	42.5	14.2	8.4	19.1	14.1
Galiuro	5.6	14.8	4.9	3.0	6.9	4.6
Gila	4.4	11.8	4.0	2.6	6.0	4.0
Mazatzal	38.3	101.3	29.0	23.5	53.6	35.6
Mount Baldy	45.2	119.7	38.2	23.5	53.6	35.6
Petrified Forest	45.2	119.7	40.3	21.3	48.7	35.6
Pine Mountain	45.2	119.7	38.2	26.1	59.5	37.8
Saguaro	3.8	10.1	3.3	2.0	4.5	3.2
Sierra Ancha	33.2	87.8	30.2	23.5	53.6	33.6
Superstition	15.5	41.2	15.1	6.5	14.9	11.9
Sycamore Canyon	38.3	101.3	36.3	23.5	53.6	40.3
$/dv_sum	1.0	2.7	0.9	0.5	1.2	0.9
$/dv_max	3.8	10.1	3.3	2.0	4.5	3.2

(b)

Class I Area	Ctrl2-1		Ctrl2-2	Ctrl2-3		Ctrl2-4
	MAT u.1-3	LNB u.1-3	SNCR u. 1-3	MAT u.4	LNB u.4	SNCR u.4
Chiricahua NM	16.6	43.9	14.5	9.0	20.6	13.4
Chiricahua	15.5	41.2	13.4	9.0	20.6	13.7
Galiuro	4.0	10.5	3.7	2.2	5.0	3.3
Gila	3.0	7.8	2.8	1.9	4.4	2.8
Mazatzal	35.5	94.1	25.9	21.3	48.7	31.8
Mount Baldy	31.1	82.3	26.9	14.7	33.5	24.2
Petrified Forest	33.2	87.8	29.0	16.8	38.3	26.3
Pine Mountain	38.3	101.3	31.5	21.3	48.7	33.6
Saguaro	3.5	9.2	3.0	1.6	3.7	2.8
Sierra Ancha	27.6	73.2	25.9	18.1	41.2	28.8
Superstition	16.6	43.9	12.5	6.3	14.5	10.2
Sycamore Canyon	35.5	94.1	31.5	23.5	53.6	35.6
$/dv_sum	0.8	2.1	0.7	0.4	1.0	0.7
$/dv_max	3.0	7.8	2.8	1.6	3.7	2.8

Table 33 and 34 separately report the control effectiveness between MAT and LNB controls due to their difference in cost. They show that the greatest effectiveness is for MAT on Unit 4, followed by SNCR on Unit 4. Table 33 shows that the control effectiveness for MAT is the greatest at the most significantly impaired CIAs nearby (sagu, gila and gali) and much less at the CIAs farther away such as pefo and Sierra Ancha (sian); LNB on Units 1-3 is the least effective. Method 8(b) is more effective than Method 6(a) due to its greater visibility benefits.

Table 34. Summary of Control Effectiveness for the Calculation Methods of Table 31

(a)

							Using dv from area with highest impact (12 areas)			
Controls	Control Option	ton/yr reduction	cost, $/yr (millions)		$/ton reduction		visibility impact, dv	visibility benefit, dv	$/dv (millions)	
			if using MAT	if using LNB	if using MAT	if using LNB			if using MAT	if using LNB
Base Case	Base	0	$0.0	$0.0			1.2			
LNB or MAT u.1-3	Ctrl2-1	561	$0.5	$1.3	$887	$2,348	1.0	0.13	$3.8	$10.1
SNCR u. 1-3	Ctrl2-2	936	$0.7	$0.7	$775	$775	0.9	0.22	$3.3	$3.3
LNB or MAT u.4	Ctrl2-3	568	$0.2	$0.5	$413	$943	1.0	0.12	$2.0	$4.5
SNCR u.4	Ctrl2-4	947	$0.6	$0.6	$638	$638	1.0	0.19	$3.2	$3.2
(same tons & costs as above)							Using dv sum over all areas (12 areas)			
Controls	Control Option	ton/yr reduction	cost, $/yr (millions)		$/ton reduction		visibility impact, dv	visibility benefit, dv	$/dv (millions)	
			if using MAT	if using LNB	if using MAT	if using LNB			if using MAT	if using LNB
Base Case	Base	0	$0.0	$0.0			4.2			
LNB or MAT u.1-3	Ctrl2-1	561	$0.5	$1.3	$887	$2,348	3.7	0.49	$1.0	$2.7
SNCR u. 1-3	Ctrl2-2	936	$0.7	$0.7	$775	$775	3.4	0.81	$0.9	$0.9
LNB or MAT u.4	Ctrl2-3	568	$0.2	$0.5	$413	$943	3.8	0.43	$0.5	$1.2
SNCR u.4	Ctrl2-4	947	$0.6	$0.6	$638	$638	3.5	0.70	$0.9	$0.9

(b)

							Using dv from area with highest impact (12 CIAs)			
Controls	Control Option	ton/yr reduction	cost, $/yr (millions)		$/ton reduction		visibility impact, dv	visibility benefit, dv	$/dv (millions)	
			if using MAT	if using LNB	if using MAT	if using LNB			if using MAT	if using LNB
Base Case	Base	0	$0.0	$0.0			1.3			
LNB or MAT u.1-3	Ctrl2-1	561	$0.5	$1.3	$887	$2,348	1.1	0.17	$3.0	$7.8
SNCR u. 1-3	Ctrl2-2	936	$0.7	$0.7	$775	$775	1.0	0.26	$2.8	$2.8
LNB or MAT u.4	Ctrl2-3	568	$0.2	$0.5	$413	$943	1.1	0.15	$1.6	$3.7
SNCR u.4	Ctrl2-4	947	$0.6	$0.6	$638	$638	4.1	0.22	$2.8	$2.8
(same tons & costs as above)							Using dv sum over all areas (12 areas)			
Controls	Control Option	ton/yr reduction	cost, $/yr (millions)		$/ton reduction		visibility impact, dv	visibility benefit, dv	$/dv (millions)	
			if using MAT	if using LNB	if using MAT	if using LNB			if using MAT	if using LNB
Base Case	Base	0	$0.0	$0.0			5.0			
LNB or MAT u.1-3	Ctrl2-1	561	$0.5	$1.3	$887	$2,348	4.3	0.62	$0.8	$2.1
SNCR u. 1-3	Ctrl2-2	936	$0.7	$0.7	$775	$775	4.0	1.01	$0.7	$0.7
LNB or MAT u.4	Ctrl2-3	568	$0.2	$0.5	$413	$943	4.4	0.54	$0.4	$1.0
SNCR u.4	Ctrl2-4	947	$0.6	$0.6	$638	$638	0.1	0.89	$0.7	$0.7

2.2.2 Phoenix Cement Plant Unit 4

At Phoenix Cement, one new precalciner kiln replaced older kilns and is the only kiln in operation at this site. The facility as seen in Google Maps is shown in Figure 5. Data from the Portland Cement Association [8] on kiln capacity and characteristics are shown in Table 35.

Figure 5. Phoenix Cement Plant, Clarkdale, AZ

Table 35. Phoenix Cement Kiln Data[5]

Year on Line	Fuel	Type	Capacity, TPD	Capacity, 1000 TPY
2002	CK	PreCaliner	2721	912
Fuels: C=Coal; G=Gas; K=Coke; A=Alternative				

The reported emissions and kiln data are shown in Table 36. Annual emissions and emission rates were estimated using a representative output (tons of clinker per year) from reported data and multiplying by representative emission rate in lb/ton.

Existing controls likely include some form of combustion controls since the kiln is only ten years old, but it is unclear at this time if LNB with indirect firing is currently utilized at the kiln.

Table 36. Estimated Emissions and Production Rates for Phoenix Cement Kilns 1-4

	Kiln 4	Units	Source
NOx Rate	3.25	lb/ton clinker	EPA [2]
TPY clinker	888,680	Ton/yr	PCA [5]
TPY clinker	996,265	Ton/yr	EPA [6]
TPY NOx	1,620	Ton/yr	Calculated

[8] Portland Cement Association, "US and Canadian Portland Cement Industry: Plant Information Summary", December 31, 2006.
[2] US EPA, RP_Cement_modeling_runs - EPA 20120912.xls
[5] Portland Cement Association, "US and Canadian Portland Cement Industry: Plant Information Summary", December 31, 2006.

2.2.2.1 NO_x Control Options Analysis

2.2.2.1.1 Available NO_x Control Technologies

Available technologies include MAT, LNB, Mid-Kiln firing, LNC, SNCR, and SCR, and combinations of these technologies.

2.2.2.1.2 Feasible NO_x Control Technologies

All of these technologies are feasible except possibly LNB, if it is already deployed. Mid-kiln firing provides similar levels of reduction as other technologies such as MAT but is more costly than MAT unless alternative fuels are available, which can make mid-kiln firing very attractive. Since information regarding the availability of alternative fuels (such as tires) was not available, mid kiln firing was not evaluated. SCR, while available, has had very limited experience on cement kilns and a more comprehensive technical review should be performed prior to using this approach. It is unclear if the kiln currently has LNB with indirect firing. If it already has such controls, it could likely still achieve further NO_x reductions through MAT or LNC.

2.2.2.1.3 Evaluation of Control Technologies

Table 37 provides NOx control technologies and cost estimates for Phoenix Cement Kiln 4. Information on the type of NO_x control technologies currently deployed on this kiln was not available. It is likely that the kiln uses some form of low-NOx technology, although it is unclear what form is used.. Shown in this table are MAT or LNC, LNB, SNCR alone (50% reduction) and LNB plus SNCR. MAT or LNC and LNB are both shown to provide 30% NO_x reduction, although for cost estimations LNB is more conservative. For 50% NO_x reduction, both SNCR and SNCR in combination with combustion controls (in this case LNB, with MAT or LNC as a less expensive alternative) are shown. SNCR is by itself expected to be capable of 50% NO_x reduction; therefore in combination with combustion controls it should certainly be capable of that level of reduction (given a 30% reduction from combustion controls and an additional 30% from SNCR). Thus a more conservative control cost estimate for 50% reduction would result from LNB in combination with SNCR.

Table 37. NO_x Control Options for Phoenix Cement Kiln 4

Item	MAT or LNC	LNB	SNCR	LNB and SNCR
capital	$1,155,839	$3,300,783	$1,268,764	$4,569,547
Annualized Capital	$109,103	$311,571	$119,762	$431,333
FOM	$121,239	$207,037	$125,756	$257,787
Reagent			$299,348	$209,543
Total Cost, $/year	$230,342	$518,607	$544,866	$898,663
Percent Reduced	30%	30%	50%	51%
tons reduced	486	486	810	826
$/ton reduced	$474	$1,067	$673	$1,088
Incremental $/ton (compared to MAT)			$971	$1,964
Incremental $/ton (compared to LNB)			$81	$1,117
lb/hr emission rate	288	288	205	201

2.2.2.1.4 Energy and Environmental Impacts

Each of the evaluated control measures has a modest energy impact. MAT can have a beneficial impact on CO and SO_2 emissions. SNCR and SCR can result in ammonia slip, which is generally well controlled.

2.2.2.2 Visibility Modeling

The visibility modeling considered the single kiln that is being evaluated for NO_x controls at Phoenix Cement Plant. The NO_x and SO_2 emission rates for this plant for the maximum 24-hour average were based on the highest value from the entire 2005-2010 period of available data from the facility's EI submittals. Annual emissions needed for the cost estimates were also based on emission factors representing the average over this entire period. However the average clinker production rate used in converting these emission factors to annual emission rates for $SO_2$and NO_x excluded the lower production rates from 2008-2010 as not being representative of future operations.

PM emission rates were calculated by the EPA using the PM emission factors averaged over the EI values for the years 2005-2010, and the flow rate and stack parameters from the facility EI submittals. PM speciation used the NPS spreadsheet for a precalciner with FF.

The emissions for the NO_x control cases are specified as follows, and tabulated in Table 38; in the base and control scenarios:

- Ctrl-1 uses LNB or MAT on Kiln 4 (they both have 30% control efficiency).
- Ctrl-2 uses SNCR on Kiln 4.
- Costs are shown separately in the last two columns of Table 38 for MAT and for LNB for Ctrl-1; the control cost is repeated in these columns for Ctrl2 strictly for consistency, as the only control for this case is SNCR.

Table 38. Base and Control Scenarios for NO_x Used in Phoenix Cement Unit 4 RP Analyses

Control Option	Unit 4		$/year	
	Control	D-Emis (TPY)	if using MAT	if using LNB
Base		0	$0	$0
Ctrl-1	LNB or MAT	486	$230,342	$518,607
Ctrl-2	SNCR	810	$544,866	$544,866

2.2.2.2.1 Stack Parameters

Stack parameters for Phoenix Cement were provided by EPA from the Title V permit application Permit No. 35426, submitted June 29, 2006. They are shown in Table 39.

Table 39. Stack Parameters for Phoenix Cement Kiln

Unit #	LON	LAT	Stack Height		Stack Elevation		Stack Diameter		Stack Temperature		Exit Velocity	
	deg	deg	ft	m	ft	m	ft	m	F	K	ft/s	m/s
Kiln 4	-112.08302	34.77763	213.25	65.0	3816.57	1163.29	9.09	2.77	211.73	373.0	66.6	20.3

2.2.2.2.2 CALPUFF Emissions Inputs

The EPA specified emission requirements for the CALPUFF modeling. The emissions data are also documented in Appendix A, and in the supporting spreadsheet documentation for this report. We performed extensive QA of these inputs using customized Unix scripts to ensure compliance with the data on the spreadsheets provided by EPA[6].

2.2.2.2.3 CALPOST Setup

We followed the modeling protocol delivered with the Task 5 report in setting up the CALPOST inputs for each of the 12 CIAs within 300 km of the Phoenix Cement Plant. Results are available for each of the years 2001-2003 and the composite period 2001-2003 using four visibility methods. They are reported here for Method 6(a) and Method 8(b) for the composite period. We used customized scripts to extensively QA the CALPOST inputs.

2.2.2.2.4 Extraction of Visibility Results with POSTCALPOST

Table 40 summarizes the results for the 98th percentile visibility impairment due to Phoenix Cement within the composite three-year period from 2000-2003 at all the affected CIAs for the base case and control options. Table 41 summarizes the visibility benefits for the control scenarios.

[6] US EPA, RP_Cement_modeling_runs - EPA 20120912.xls

Table 40. 98th Percentile Visibility Impairment (Δ-dv) for Phoenix Cement Base Case and Control Scenarios: (a) IMPROVE Method 6(a); (b) IMPROVE Method 8(b).

(a)

Class I Area	Base	Ctrl-1	Ctrl-2
	Base Case	LNB or MAT	SNCR
Bryce Canyon	0.06	0.04	0.03
Galiuro	0.02	0.02	0.01
Grand Canyon	0.38	0.27	0.20
Mazatzal	0.45	0.32	0.24
Mount Baldy	0.03	0.02	0.02
Petrified Forest	0.16	0.11	0.08
Pine Mountain	0.56	0.40	0.30
Saguaro	0.02	0.02	0.01
Sierra Ancha	0.07	0.05	0.04
Superstition	0.08	0.06	0.04
Sycamore Canyon	3.99	3.29	2.67
Zion	0.07	0.05	0.04
Total	5.91	4.66	3.67
Max	3.99	3.29	2.67
# CIAs w/ Δ-dv ≥ 0.5	2	1	1

(b)

Class I Area	Base	Ctrl-1	Ctrl-2
	Base Case	LNB or MAT	SNCR
Bryce Canyon	0.09	0.06	0.04
Galiuro	0.03	0.02	0.01
Grand Canyon	0.51	0.37	0.27
Mazatzal	0.51	0.37	0.27
Mount Baldy	0.05	0.03	0.02
Petrified Forest	0.21	0.15	0.10
Pine Mountain	0.66	0.47	0.35
Saguaro	0.03	0.02	0.01
Sierra Ancha	0.09	0.06	0.04
Superstition	0.10	0.07	0.05
Sycamore Canyon	5.15	4.13	3.30
Zion	0.09	0.06	0.04
Total	7.49	5.80	4.51
Max	5.15	4.13	3.30
# CIAs w/ Δ-dv ≥ 0.5	4	1	1

Table 40 shows the greatest visibility impairment due to Phoenix Cement at Sycamore Canyon for all scenarios and both methods. The impairment is greater for Method 8(b) than for Method 6(a). SNCR controls provide the greatest benefit of all technologies, as confirmed by the results in Table 41.

Table 41. Visibility Benefits (dv) for Phoenix Cement Kiln 4 for the Control Scenarios Corresponding to Table 40

(a)

Class I Area	Ctrl-1	Ctrl-2
	LNB or MAT	SNCR
Bryce Canyon	0.02	0.03
Galiuro	0.01	0.01
Grand Canyon	0.11	0.18
Mazatzal	0.12	0.21
Mount Baldy	0.01	0.02
Petrified Forest	0.05	0.08
Pine Mountain	0.16	0.26
Saguaro	0.01	0.01
Sierra Ancha	0.02	0.04
Superstition	0.03	0.04
Sycamore Canyon	0.70	1.33
Zion	0.02	0.04
Total	1.25	2.24
Max	0.70	1.33
# CIAs with dv ≥ 0.5	1	1

(b)

Class I Area	Ctrl-1	Ctrl-2
	LNB or MAT	SNCR
Bryce Canyon	0.03	0.04
Galiuro	0.01	0.01
Grand Canyon	0.15	0.25
Mazatzal	0.14	0.24
Mount Baldy	0.01	0.02
Petrified Forest	0.06	0.10
Pine Mountain	0.19	0.32
Saguaro	0.01	0.01
Sierra Ancha	0.03	0.04
Superstition	0.03	0.05
Sycamore Canyon	1.02	1.85
Zion	0.03	0.05
Total	1.69	2.98
Max	1.02	1.85
# CIAs with dv ≥ 0.5	1	1

2.2.2.3 Control Effectiveness Results

The results of the control effectiveness in $/dv (millions) for Phoenix Cement are presented in Tables 42 and 43. Table 42 presents the control effectiveness at each CIA, and Table 43 summarizes the results for the CIA with the maximum deciview impact, and for the deciview impact summed over all CIAs.

Table 42. Control Effectiveness (million $/dv) for the Calculation Methods of Table 40

(a)

Class I Area	Ctrl-1		Ctrl-2
	MAT	LNB	SNCR
Bryce Canyon	12.1	27.3	17.0
Galiuro	32.9	74.1	45.4
Grand Canyon	2.1	4.8	3.0
Mazatzal	1.9	4.2	2.6
Mount Baldy	25.6	57.6	34.1
Petrified Forest	4.7	10.6	6.7
Pine Mountain	1.5	3.3	2.1
Saguaro	32.9	74.1	45.4
Sierra Ancha	11.0	24.7	15.6
Superstition	9.2	20.7	13.3
Sycamore Canyon	0.3	0.7	0.4
Zion	10.5	23.6	15.1
$/dv_sum	0.3	0.4	0.2
$/dv_max	0.2	0.7	0.4

(b)

Class I Area	Ctrl-1		Ctrl-2
	MAT	LNB	SNCR
Bryce Canyon	8.5	19.2	12.4
Galiuro	25.6	57.6	38.9
Grand Canyon	1.6	3.5	2.2
Mazatzal	1.7	3.7	2.3
Mount Baldy	16.5	37.0	23.7
Petrified Forest	3.7	8.4	5.3
Pine Mountain	1.2	2.7	1.7
Saguaro	28.8	64.8	41.9
Sierra Ancha	9.2	20.7	13.0
Superstition	7.9	17.9	11.6
Sycamore Canyon	0.2	0.5	0.3
Zion	8.5	19.2	12.1
$/dv_sum	0.2	0.3	0.2
$/dv_max	0.1	0.5	0.3

Table 43. Summary of Control Effectiveness for the Calculation Methods of Table 40

(a)

						Using dv from area with highest impact (12 areas)			
Control Option	ton/yr reduction	cost, $/yr (millions)		$/ton reduction		visibility impact, dv	visibility benefit, dv	$/dv (millions)	
		if using MAT	if using LNB	if using MAT	if using LNB			if using MAT	if using LNB
Base	0	$0.0	$0.0			3.99			
Ctrl-1	486	$0.2	$0.5	$474	$1,067	3.29	0.70	$0.3	$0.7
Ctrl-2	810	$0.5	$0.5	$673	$673	2.67	1.33	$0.4	$0.4
	(same tons & costs as above)					Using dv sum over all areas (12 areas)			
Control Option	ton/yr reduction	cost, $/yr (millions)		$/ton reduction		visibility impact, dv	visibility benefit, dv	$/dv (millions)	
		if using MAT	if using LNB	if using MAT	if using LNB			if using MAT	if using LNB
Base	0	$0.0	$0.0			5.91			
Ctrl-1	486	$0.2	$0.5	$474	$1,067	4.66	1.25	$0.2	$0.4
Ctrl-2	810	$0.5	$0.5	$673	$673	3.67	2.24	$0.2	$0.2

(b)

						Using dv from area with highest impact (12 areas)			
Control Option	ton/yr reduction	cost, $/yr (millions)		$/ton reduction		visibility impact, dv	visibility benefit, dv	$/dv (millions)	
		if using MAT	if using LNB	if using MAT	if using LNB			if using MAT	if using LNB
Base	0	$0.0	$0.0			5.15			
Ctrl-1	486	$0.2	$0.5	$474	$1,067	4.13	1.02	$0.2	$0.5
Ctrl-2	810	$0.5	$0.5	$673	$673	3.30	1.85	$0.3	$0.3
	(same tons & costs as above)					Using dv sum over all areas (12 areas)			
Control Option	ton/yr reduction	cost, $/yr (millions)		$/ton reduction		visibility impact, dv	visibility benefit, dv	$/dv (millions)	
		if using MAT	if using LNB	if using MAT	if using LNB			if using MAT	if using LNB
Base	0	$0.0	$0.0			7.49			
Ctrl-1	486	$0.2	$0.5	$474	$1,067	5.80	1.69	$0.1	$0.3
Ctrl-2	810	$0.5	$0.5	$673	$673	4.51	2.98	$0.2	$0.2

Tables 42 and 43 separately present the control effectiveness for MAT and LNB due to their difference in cost. They show that the greatest effectiveness is for MAT, followed by SNCR. Table 42 shows that the control effectiveness for MAT is the greatest, i.e., has lowest $/dv values at the most significantly impaired CIAs (Sycamore Canyon) and much less at the farther CIAs such as sagu and sian. LNB is found to be the least effective control technology due to its

relatively high cost. Method 8(b) is found to be more effective than Method 6(a) due to its greater visibility benefits.

2.3 Conclusions

The five-factor BART analysis of the five facilities that we analyzed led to the following conclusions:

- The visibility impacts are greatest for each facility at the nearest CIAs, and the control options are least effective (greatest in million $/dv) at the farthest ones. The CIAs which experience the greatest visibility impacts and show the greatest benefits are listed below for the respective facilities; the number of CIAs with impairment > 0.5 dv due to that facility, averaged over all scenarios, is listed in parentheses
    - for CalPortland, Saguaro; Gila in the case of controls on Kilns 1-3 using Method 8(b) (3 of 12), and
    - for Phoenix Cement, Sycamore Canyon (2 of 12)
- Tables 9, 17, 25, 34, and 43 summarize the aggregated results for each facility as a sum over all the relevant CIAs of the $/dv (in millions) for each control option for Method 6(a) and Method 8(b). In general, the control effectiveness increases for
    - the nearest CIAs
    - SNCR control compared to LNB and SCR
    - MAT control compared to LNB and SNCR

References

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EPA, 2002: EPA Air Pollution Control Cost Manual (Sixth Edition), Report No. EPA/452/B-02-001, U.S. Environmental Protection Agency.

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Staudt, J., and C. Erickson, 2008: Selective Catalytic Reduction System Performance and Reliability Review. Presented at the 2008 International Power Generation Conference, December 2-4, 2008, Orlando, FL.

Western Regional Air Partnership (WRAP), 2006: *CALMET/CALPUFF Protocol for BART Exemption Screening Analysis for Class I Areas in the Western United States*. Western Regional Air Partnership Air Quality Modeling Forum, Regional Modeling Center, August 15, 2006; http://pah.cert.ucr.edu/aqm/308/bart/WRAP_RMC_BART_Protocol_Aug15_2006.pdf

Appendix A
Emissions Data Tables

This appendix provides the emissions data for CALPUFF modeling of the base case(s) and control scenarios analyzed for the three EGU facilities. These data were extracted from a master spreadsheet that is being delivered as part of the documentation for this task.

Table A-4(a). NO_x, SO_2 and PM emission inputs for base and control scenarios for CalPortland Cement Units 1-3 and Unit 4 visibility modeling

	LCC - X (km)	LCC - Y (km	JDAY	NOx	NOx emission rate notes	JDAY	SO2	JDAY	HI	HI	ADEQ Emission Factors (lb/MMBtu)			NOx	SO2	PM
				lb/day			lb/day		MMBtu/day	MMBtu/hr	NOx	SO2	PM	g/s	g/s	g/s
CalPortland Cement - H5-5-GB Units 1-3 (Task 9)																
Units 1-3 (total) - Base	-1324.225	-737.812		10,800	E.C. : RP_Cement_modeling_runs.xls cpc Base (		255.360							56.700	1.341	3.783
Units 1-3 (total) - Ctrl1 (LNB or MAT)	-1324.225	-737.812		7,560	E.C. : RP_Cement_modeling_runs.xls cpc - Mod		255.360							39.690	1.341	3.783
Units 1-3 (total) - Ctrl2 (SNCR)	-1324.225	-737.812		5,400	E.C. : RP_Cement_modeling_runs.xls cpc - Mod		255.360							28.350	1.341	3.783
CalPortland Cement - H5-5-GB -Unit 4 (Task 9)																
Unit 4 - Base	-1324.237	-737.818		12,962	E.C. : RP_Cement_modeling_runs.xls cpc Base (		63.429							68.052	0.333	1.204
Unit 4 - Ctrl1 (LNB or MAT)	-1324.237	-737.818		9,074	E.C. : RP_Cement_modeling_runs.xls cpc - Mod		63.429							47.636	0.333	1.204
Unit 4 - Ctrl2 (SNCR)	-1324.237	-737.818		6,481	E.C. : RP_Cement_modeling_runs.xls cpc - Mod		63.429							34.026	0.333	1.204

Table A-4(b). Speciated PM emission inputs for base and control scenarios for CalPortland Cement Units 1-3 and Unit 4 visibility modeling

	PM	PM	Heating Value	% Sulfur	% Ash	PM speciation spreadsheet	Mass Fraction for Spreadsheet Species						Modeled Species Emission Rates (g/s)				
	g/s	lb/hr					Coarse	Fine Soil	Fine EC	CPM IOR	CPM OR	Chk sum	PMC	PMF	EC	SO4	SOA
CalPortland Cement - H5-5-GB Units 1-3 (Task 9)																	
Units 1-3 (total) - Base	3.783	30.023					0.067	0.077	0.000	0.753	0.103	1.000	0.253	0.292	0.000	2.850	0.389
Units 1-3 (total) - Ctrl1 (LNB or MAT)	3.783	30.023				2006FinalDryCementKilnFFSpeciation.xls	0.067	0.077	0.000	0.753	0.103	1.000	0.253	0.292	0.000	2.850	0.389
Units 1-3 (total) - Ctrl2 (SNCR)	3.783	30.023					0.067	0.077	0.000	0.753	0.103	1.000	0.253	0.292	0.000	2.850	0.389
CalPortland Cement - H5-5-GB -Unit 4 (Task 9)																	
Unit 4 - Base	1.204	9.557					0.230	0.256	0.010	0.444	0.061	1.000	0.277	0.308	0.012	0.535	0.073
Unit 4 - Ctrl1 (LNB or MAT)	1.204	9.557				2006FinalPreheaterPrecalcinerKilnFFSpeciation.xls	0.230	0.256	0.010	0.444	0.061	1.000	0.277	0.308	0.012	0.535	0.073
Unit 4 - Ctrl2 (SNCR)	1.204	9.557					0.230	0.256	0.010	0.444	0.061	1.000	0.277	0.308	0.012	0.535	0.073

Table A-5(a). NO_x, SO_2 and PM emission inputs for base and control scenarios for Phoenix Cement Kiln 4 visibility modeling

	LCC - X (km)	LCC - Y (km	JDAY	NOx	NOx emission rate notes	JDAY	SO2	JDAY	HI	HI	ADEQ Emission Factors (lb/MMBtu)			NOx	SO2	PM
				lb/day			lb/day		MMBtu/day	MMBtu/hr	NOx	SO2	PM	g/s	g/s	g/s
Phoenix Cement - DC-431 (Task 9)																
Unit 4 - Base	-1367.308	-464.145		15,498	E.C. : RP_Cement_modeling_runs.xls phc Base		104.580							81.363	0.549	0.65
Unit 4 - Ctrl1 (LNB or MAT)	-1367.308	-464.145		10,849	E.C. : RP_Cement_modeling_runs.xls phc- Mod		104.580							56.954	0.549	0.65
Unit 4 - Ctrl2 (SNCR)	-1367.308	-464.145		7,749	E.C. : RP_Cement_modeling_runs.xls phc- Mod		104.580							40.682	0.549	0.65

Table A-5(b). Speciated PM emission inputs for base and control scenarios for Phoenix Cement Kiln 4 visibility modeling

	PM	PM	Heating Value	% Sulfur	% Ash	PM speciation spreadsheet	Mass Fraction for Spreadsheet Species						Modeled Species Emission Rates (g/s)				
	g/s	lb/hr					Coarse	Fine Soil	Fine EC	CPM IOR	CPM OR	Chk sum	PMC	PMF	EC	SO4	SOA
Phoenix Cement - DC-431 (Task 9)																	
Unit 4 - Base	0.65	5.122				2006FinalPreheaterPrecalcinerKilnFFSpeciation.xls	0.230	0.256	0.010	0.444	0.061	1.000	0.148	0.165	0.006	0.287	0.039
Unit 4 - Ctrl1 (LNB or MAT)	0.65	5.122					0.230	0.256	0.010	0.444	0.061	1.000	0.148	0.165	0.006	0.287	0.039
Unit 4 - Ctrl2 (SNCR)	0.65	5.122					0.230	0.256	0.010	0.444	0.061	1.000	0.148	0.165	0.006	0.287	0.039

Appendix B

Andover Technology Partners Report Chapter 5: Reasonable Progress Analysis

5. Reasonable Progress Analysis

Task 9: Conduct Reasonable Progress Analysis for Four Class I Areas

Under this task, Andover Technology Partners conducted a four-factor analysis of sources to identify whether there are additional reasonable NOx controls available.

Cost estimates performed in this section utilize methods consistent with the US EPA Control Cost Manual,[3] cost estimating methods used in EPA's latest Integrated Planning Model (IPM) methods[4], and other reasonable engineering methods and are described in greater detail in associated spreadsheets provided with this document.

[3] EPA. 2002. EPA Air Pollution Control Cost Manual (Sixth Edition). EPA/452/B-02-001

[4] Documentation of EPA IPM Base Case v4.10. http://www.epa.gov/airmarkets/progsregs/epa-ipm/BaseCasev410.html#documentation

5.1 Arizona Portland Cement Company, Rillito, AZ

This facility, shown in Figure 5-1 has three long dry kilns and one precalciner kiln. The type and rated capacities are shown in Table 5-1. It is currently understood that these kilns have fabric filters, but have no SO2 or NOx controls. It is understood that the three smaller kilns are not currently being operated and it is unclear if these three kilns will be operated in the future.

Figure 5-1. Arizona Portland Cement Company, Rillito Plant.

Table 5-1. Kilns at the Arizona Portland Cement Plant [5]

Year on Line	Fuel	Type	Capacity, TPD	Capacity, 1000 TPY
1949	CGk	Long DRY	408	121
1951	CGk	Long DRY	408	121
1955	CGK	Long DRY	408	121
2002	CGKA	PreCaliner	3084	969
Fuels: C=Coal; G=Gas; K=Coke; A=Alternative				

Facility emissions data was developed by EPA, and this is shown in Table 5-2. Annual emissions estimates and emission rates were determined by estimating a representative output (tons of clinker per year) from reported data and multiplying by representative emission rate in lb/ton.

With regard to existing controls, kiln number 4 is new enough that it likely has some form of low NOx combustion controls, but it is unlikely that kilns 1-3 have any NOx controls.

[5] Portland Cement Association, "US and Canadian Portland Cement Industry: Plant Information Summary", December 31, 2006.

Table 5-2. Estimated emissions and production rates for Arizona Portland Cement Kilns 1-4

	Kilns 1-3 (each)*	Kiln 4		Source
NOx Rate	8.70	3.59	lb/ton clinker	EPA [6]
TPY clinker	121,000	969,000	Ton/yr	PCA [5]
TPY clinker	143,157	1,053,932	Ton/yr	EPA [6]
TPY NOx	623	1,894	Ton/yr	Calculated
* Data for kilns 1-3 is per kiln, not total.				

5.1.1 NOx Controls

Available Technologies

Available Technologies include MAT, LNB, Mid Kiln firing, SNCR, and SCR, and combinations of these technologies. In addition, kiln 4, as a calciner kiln, could implement low NOx combustion controls in the calciner. So, low NOx calciner is another option for kiln 4. The cost of a low NOx calciner (LNC) is expected to be in the same range as MAT.[7]

Feasible Technologies

All of these technologies are feasible. Mid Kiln firing provides similar levels of reduction as other combustion technologies such as MAT but is more costly than MAT unless alternative fuels are available. Since information regarding the availability of alternative fuels (such as tires) was not available, Mid Kiln Firing was not evaluated. LNC is feasible for kiln 4. SCR, while available, has very limited experience on cement kilns and will not be evaluated further. For kiln 4, it is unclear if it currently has LNB with indirect firing If it already has such controls, it could likely still achieve further NOx reductions through implementation of MAT or LNC.

Evaluation of Technologies

Tables 5-3a and 5-3b show estimated cost of controlling NOx from the Arizona Portland Cement Kilns. LNB is more expensive than MAT or LNC (for kiln 4) and it would be conservative to use that as the basis for 30% reduction, although MAT may actually be applicable at a lower cost. SNCR can be used to provide 50% NOx reduction whether used alone or in combination with combustion controls (assumed here to be LNB, although MAT may be applied at a lower cost). The cost and emissions informaton on Table 5-3a is per kiln, not total for the three kilns.

[6] US EPA, RP_Cement_modeling_runs - EPA 20120912.xls

[7] Memo from J. Staudt to R. Srivastava, S. Vijay, E. Torres, Re: Costs and Performance of Controls – revised from comments, March 10, 2009 at page 14

Energy and Environmental Impacts of NOx Control Measures

Each of these measures has a modest energy impact. MAT can have a beneficial impact on CO and SO_2 emissions. SNCR and SCR can result in ammonia slip, which is generally well controlled.

Table 5-3a. NOx Controls for Kilns 1-3 (values shown are *per* kiln)

	MAT	LNB	SNCR	LNB and SNCR
capital	$676,001	$2,708,493	$383,535	$3,092,028
Annualized Capital	$63,809.67	$255,663	$36,203	$291,866
FOM (incl. admin, insur, taxes)	$102,045	$183,345	$90,347	$198,686
Reagent			$115,120	$80,584
Total Cost, $/year	$165,855	$439,008	$241,669	$571,136
Percent Reduced	30%	30%	50%	51%
tons reduced	187	187	312	318
$/ton reduced	$887	$2,349	$776	$1,798
Incremental $/ton (compared to MAT)			$608	$3,098
Incremental $/ton (compared to LNB)			-$1,584	$1,010
lb/hr emission rate	111	111	79	77

Table 5-3b. NOx Controls for Kiln 4

	MAT or LNC	LNB	SNCR	LNB and SNCR
capital	$1,188,275	$3,427,320	$1,336,373	$4,763,693
Annualized Capital	$112,165	$323,515	$126,144	$449,659
FOM (incl. admin, insur, taxes)	$122,536	$212,098	$128,460	$265,553
Reagent			$349,978	$244,985
Total Cost, $/year	$234,701	$535,613	$604,583	$960,197
Percent Reduced	30%	30%	50%	51%
tons reduced	568	568	947	966
$/ton reduced	$413	$943	$638	$994
Incremental $/ton (compared to MAT)			$976	$1,824
Incremental $/ton (compared to LNB)			$182	$1,067
lb/hr emission rate	336	336	240	235

5.2. Phoenix Cement, Clarkdale, AZ

At Phoenix Cement, one new kiln replaced older kilns, so that only one precalciner kiln remains in operation at this site. The Phoenix Cement facility is shown in Figure 5-2 and data from the Portland Cement Association on kiln capacity and characteristics are shown in Table 5-4

Figure 5-2. Phoenix Cement, Clarkdale, AZ

Table 5-4 Phoenix Cement Plant Kiln [8]

Year on Line	Fuel	Type	Capacity, TPD	Capacity, 1000 TPY
2002	CK	PreCaliner	2721	912
Fuels: C=Coal; G=Gas; K=Coke; A=Alternative				

The reported emissions and kiln data are shown in Table 5-5. Annual emissions estimates and emission rates were determined by estimating a representative output (tons of clinker per year) from reported data and multiplying by representative emission rate in lb/ton.

Existing controls likely include some form of combustion controls since the kiln is only ten years old, but it is unclear at this time if LNB with indirect firing is currently utilized at the kiln.

[8] Portland Cement Association, "US and Canadian Portland Cement Industry: Plant Information Summary", December 31, 2006.

Table 5-5. Estimated Uncontrolled Emissions Rates

NOx Rate	3.25	lb/ton clinker	EPA [9]
TPY clinker	888,680	Ton/yr	PCA [8]
TPY clinker	996,265	Ton/yr	EPA [2]
TPY NOx	1,620	Ton/yr	Calculated

5.2.1 NOx Controls

Available Technologies

Available Technologies include MAT, LNB, Mid Kiln firing, low NOx Calciner (LNC), SNCR, and SCR, and combinations of these technologies.

Feasible Technologies

All of these technologies are feasible except possibly LNB if it is already deployed. Mid Kiln firing provides similar levels of reduction as other technologies such as MAT but is more costly than MAT unless alternative fuels are available, which can make mid kiln firing very attractive. Since information regarding the availability of alternative fuels (such as tires) was not available, Mid Kiln Firing was not evaluated. SCR, while available, has limited experience on cement kilns and a more comprehensive technical review should be performed prior to utilizing this approach.

It is unclear if the kiln currently has LNB with indirect firing If it already has such controls, it could likely still achieve further NOx reductions through implementation of MAT or LNC.

Evaluation of Technologies

Information on the type of NOx control technologies currently deployed on this kiln was not available. It is likely that the kiln utilizes some form of low NOx technology, although it is unclear what form is used.. Table 5-6 shows estimated cost of controlling NOx from the Phoenix Cement kiln. Shown here are MAT or LNC, LNB, SNCR alone (50% reduction) and LNB plus SNCR. MAT or LNC and LNB are both shown for 30% reduction, although for cost estimating LNB should be used since it is more conservative. For 50% NOx reduction, both SNCR and SNCR in combination with combustion controls (in this case LNB, but MAT or LNC are possible alternatives that would be less expensive) are shown. Although SNCR is generally expected to be capable of 50% NOx reduction alone, in combination with combustion controls it would certainly be capable of 50% NOx reduction (30% reduction from combustion controls plus an additional 30% from SNCR). Therefore, a more conservative estimate of control costs for 50% reduction would result from the combination of LNB with SNCR.

[9] US EPA, RP_Cement_modeling_runs - EPA 20120912.xls

Energy and Environmental Impacts of NOx Control Measures

Each of these measures has a modest energy impact. MAT can have a beneficial impact on CO and SO_2 emissions. SNCR and SCR can result in ammonia slip, which is generally well controlled. Table 5-6 shows the results of a cost analysis for Phoenix cement.

Table 5-6. NOx Control options for Phoenix Cement

	MAT or LNC	LNB	SNCR	LNB and SNCR
capital	$1,155,839	$3,300,783	$1,268,764	$4,569,547
Annualized Capital	$109,103	$311,571	$119,762	$431,333
FOM	$121,239	$207,037	$125,756	$257,787
Reagent			$299,348	$209,543
Total Cost, $/year	$230,342	$518,607	$544,866	$898,663
Percent Reduced	30%	30%	50%	51%
tons reduced	486	486	810	826
$/ton reduced	$474	$1,067	$673	$1,088
Incremental $/ton (compared to MAT)			$971	$1,964
Incremental $/ton (compared to LNB)			$81	$1,117
lb/hr emission rate	288	288	205	201

ATTACHMENT 2

Emails from EPA to PCC

From: <McKaughan.Colleen@epamail.epa.gov>
Date: December 14, 2012, 4:19:48 PM MST
To: "Martz, Verle" <vmartz@srmaterials.com>
Cc: <Nudd.Gregory@epamail.epa.gov>, <Webb.Thomas@epamail.epa.gov>, <Withey.Charlotte@epamail.epa.gov>, <Chen.Eugene@epamail.epa.gov>, <Kelly.Shaheerah@epamail.epa.gov>
Subject: Responses to Questions on EPA Process for Phoenix Cement

Hi, Verle,

You had asked us some questions in an email dated 11/28/12. I have highlighted those questions and provided the responses below.

(1) if the questions were asked pursuant to a particular statute or regulation; (2) what the EPA intends to do with our answers; and (3) if the EPA is getting ready to propose that the Clarkdale facility is a BART-eligible source.

1) We are asking these questions in the context of our action on the 2018 visibility goals for the Arizona Regional Haze program. As we state in Section VIII.B. of the proposed action, because Arizona's 2018 visibility goals provide for a rate of improvement in visibility slower than the rate needed to show attainment of natural conditions by 2064, the Regional Haze Rule requires the state (or EPA in the case of a Federal plan) to demonstrate why its Reasonable Progress Goals are reasonable and why a rate of progress leading to attainment of natural visibility conditions by 2064 is not reasonable. [See 40 CFR 51.308(d)(1)(ii).]

2) Given the rate at which visibility-impairing pollutants are emitted from the Phoenix Cement plant, and it's proximity to Class I areas, EPA is trying to determine if there are reasonably cost-effective controls that can be installed at the facility. Your information will help us to make an accurate estimate of the costs and benefits of additional controls at Phoenix Cement.

3) We are not planning to propose that the Clarkdale faciilty is a BART-eligible source.

I hope this information is helpful. I am going to be out of the office over the holidays. If you need information during that time, please contact Greg Nudd at 415-947-4107; nudd.gregory@epa.gov.

Colleen W. McKaughan
Associate Director, Air Division
USEPA, Region 9
(520) 498-0118

* * * * *

From: McKaughan.Colleen@epamail.epa.gov
[mailto:McKaughan.Colleen@epamail.epa.gov]
Sent: Sunday, December 09, 2012 07:27 PM
To: "Enos, Diane (President)" Diane.Enos@SRPMIC-nsn.gov; Martz, Verle
Cc: Webb.Thomas@epamail.epa.gov; Nudd.Gregory@epamail.epa.gov; Ebbert.Laura@epamail.epa.gov
Subject: Proposed partial approval and partial disapproval of Arizona's regional haze plan

Good evening, President Enos and Mr. Martz,

Thank you for the opportunity to talk on Friday. The notice of proposed rulemaking for the remainder of the Arizona Regional Haze Plan (Phase 2) was signed late Friday evening, Dec. 7th. In this notice EPA is stating what we propose to approve and disapprove in the State's Regional Haze Plan. EPA is not proposing any federal measures at this time. However, we do have a consent decree deadline of March 8, 2023 to propose federal measures for those parts of the plan for which we proposed disapproval.

I am sharing a pre-publication copy of our Phase 2 action with you, so that you may take full advantage of the public comment period on the proposal. We have also sent a copy of the notice to ADEQ. I will be in touch with Mr. Martz regarding some questions he asked about the information that we have shared with him. If you have additional questions, or want to have another call about our action, please call me at the number below. I am available all week.

Colleen W. McKaughan
Associate Director, Air Division
USEPA, Region 9
(520) 498-0118

*** * * * ***

From: McKaughan.Colleen@epamail.epa.gov
[mailto:McKaughan.Colleen@epamail.epa.gov]
Sent: Thursday, December 06, 2012 10:35 AM
To: Martz, Verle
Cc: Lindsay, Brett; Nudd.Gregory@epamail.epa.gov; Kuehner, Pete; Smith, Roger; Webb.Thomas@epamail.epa.gov

Subject: Re: EPA Information for Salt River Materials Group_RE: FW: 2012 Phoenix Cement Plant ENERGY STAR Certification

Hi, Verle,

I'm sorry for my delayed response. As you can imagine, we are working hard to meet our December 7th consent decree deadline where we will proposing approval of some parts of the State's Regional Haze SIP and disapproving other parts. I will call you upon signature and send you a pre-publication copy of the Federal Register notice so you have that information right away. We will also be sharing this information with the Salt River Pima Maricopa Tribe, and arranging for formal consultation.

We are not looking at Phoenix Cement as a BART source, but rather a source that should be looked at under the reasonable progress requirement. EPA's responsibility at this time is to evaluate the Arizona Regional Haze SIP against the Regional Haze requirements in both the Clean Air Act and the Regional Haze Rule. These include three major elements: BART, Reasonable Progress Goals for the 12 Class I areas, and Arizona's Long Term Strategy.

We would be glad to talk to you whenever you are ready to do so. ADEQ has indicated a desire to talk to us early next week and we will be setting up that meeting. Please give me a call at the number below if you have additional questions.

Colleen W. McKaughan
Associate Director, Air Division
USEPA, Region 9
(520) 498-0118

*** * * * ***

From: McKaughan.Colleen@epamail.epa.gov
[mailto:McKaughan.Colleen@epamail.epa.gov]
Sent: Tuesday, November 06, 2012 4:34 PM
To: Martz, Verle
Cc: Nudd.Gregory@epamail.epa.gov; Kelly.Shaheerah@epamail.epa.gov
Subject: EPA Information for Salt River Materials Group

Hi, Verle,

Here is the information that I promised - a summary sheet of information for the two cement plants, plus our contractor report. Our staff engineers are in the

process of reviewing this material now, so if you notice any errors in the documents, we would be interested in that information. We wanted to give you an opportunity to look at the materials, and then we would like to schedule a conference call with you at your convenience to go over any questions that you might have.

We also have some questions (below) that would help our understanding of your facility.

Regarding next steps, we have to propose action on the Arizona Regional Haze Plan by December 8, 2012. If we disapprove any portions of the plan we will have to propose federal measures. Our deadline to propose federal measures is March 8, 2013. If the Salt River Materials Group would like to submit information to EPA for our consideration, we would like to receive that information no later than the first week of January, 2013.

I am going to Navajo tomorrow, but I'm back on Thursday. If you have questions in the meantime, Greg Nudd is the project lead. Greg can be reached at 415-947-4107. Thank you for your cooperation on these issues.

Colleen W. McKaughan
Associate Director, Air Division
USEPA, Region 9
(520) 498-0118

Phoenix Cement Company

1. Kiln 4 was installed in 2002. What is the expected lifetime of the kiln?

2. Does the facility use any of the following methods for controlling NOx emissions from Kiln 4 or the pyroprocessing system? If so, which are used?

- Combustion zone control of temperature and excess air
- Feed mix composition
- Reduction of alkali content of raw feed
- CemStar process
- Kiln fuel change
- Increasing thermal efficiency

3. Does Kiln 4 or the pyroprocessing system use any of the following NOx combustion controls? If so, which are used?

- Staged combustion
- Low-NOx burner system
- Staged combustion in calciner (SCC)
- Low NOx Calciner

4. Does Kiln 4 use any of the following NOx add-on controls? If so, which are used?

- SNCR
- SCR

ATTACHMENT 3

Trinity Consultants' Report

(Electronic Data Files Under Separate Attachment/Enclosure)

PROJECT REPORT

Review of EPA's October 3, 2012 "Five-Factor" Analysis Concerning Phoenix Cement Company

Prepared for:

Phoenix Cement Company, a Division of the Salt River Pima-Maricopa Indian Community

Prepared By:

TRINITY CONSULTANTS
One Copley Parkway
Suite 310
Morrisville, NC
(919) 462-9693

March 4, 2013

Project 120301.0082

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1. INTRODUCTION

Trinity Consultants, Inc. ("**Trinity**") has reviewed the model described in the EPA's October 3, 2012 report concerning the Salt River Pima-Maricopa Indian Community—Phoenix Cement Company cement kiln in Clarkdale, Arizona ("**PCC**"). Trinity has determined that certain assumptions in the EPA's model resulted in an over-estimation of impacts on visibility in the Sycamore Canyon Wilderness Area ("**SCWA**") that are attributable to PCC and an overestimation of improvements to visibility in the SCWA that may result from the addition of selective non-catalytic reduction emissions control technology ("**SNCR**") at PCC.

The EPA estimated impacts on visibility in the SCWA for three different PCC emissions scenarios:

- Base Case – emissions estimates reported for the period 2005-2010;
- Ctrl-1 – emissions estimates for the same period, assuming the addition of low-NOx burner emissions control technology ("**LNB**") or mixing air emissions control technology ("**MAT**"); and
- Ctrl-2 – emissions estimates for the same period, assuming the addition of SCNR.

The EPA modeled the three emissions scenarios in order to estimate improvements to visibility in the SCWA that may result from the addition of LNB/MAT or SNCR at PCC.[1]

PCC already employs LNB. Therefore, the Ctrl-1 scenario has no relevance. The only possibly relevant additional emissions control technology scenario is Ctrl-2, i.e., SNCR. Accordingly, the remainder of this report focuses on the Base Case and SNCR scenarios.

[1] Table 40 of EPA Report.

This section discusses the approach the EPA used to model visibility impairment in the SCWA that is attributable to PCC and certain deficiencies in the EPA's approach.

2.1. EPA'S MODELING APPROACH

The EPA ran each emissions scenario in CALPUFF using meteorological data from the period 2001-2003 to estimate resulting ambient air concentrations of pollutants in the SCWA. The EPA then used CALPOST processing to estimate light extinction in the SCWA that would result from those concentrations, using two different methods:

IMPROVE Method 6 ("**Equation 1**"):

$$b_{ext}\ (Mm^{-1}) = 3[(NH_4)_2SO_4]f(RH) + 3[NH_4NO_3]f(RH) + 4[OC] + 1[Soil] + 0.6[Coarse\ Mass] + 10[EC] + Raleigh\ Scattering\ (10\ Mm^{-1}\ by\ default) + 0.33[NO_2\ (ppb)]$$

IMPROVE Method 8 ("**Equation 2**"):

$$b_{ext}\ (Mm^{-1}) = 2.2[small\ sulfates]\ fs(RH) + 4.8[large\ sulfates]\ fL(RH) + 2.4[small\ nitrates]\ fs(RH) + 5.1[large\ nitrates]\ fL(RH) + 2.8[small\ organics] + 6.1[large\ organics] + 10[elemental\ carbon] + 1[fine\ soil] + 1.7][sea\ salt]\ fss(RH) + 0.6[coarse\ mass] + Raleigh\ Scattering\ (site\text{-}specific) + 0.33[NO_2\ (ppb)]$$

Where:

f(RH) = relative humidity scattering enhancement factor from monitoring data representative of SCWA during 1988-1997[2]

[ ] All concentrations in μg/m^3 except [NO_2] which is in ppb

Based on these estimated light extinction values and the background light extinction values derived from the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report[3], the EPA calculated the deciviews of visibility impairment theoretically attributable to PCC for the Base Case and SNCR scenarios.

In calculating the deciviews of visibility impairment using IMPROVE Method 8, the EPA paired the estimated light extinction values with the 20% best days background light extinction values.

[2] U.S. EPA, *Interpolating Relative Humidity Weighting Factors to Calculate Visibility Impairment and the Effects of IMPROVE Monitor Outliers*, prepared by Science Applications International Corporation, Raleigh, NC, EPA Contract No. 68-D-98-113, August 30, 2001.

[3] U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service, *Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I report – Revised (2010)*. National Resource Report NPS/NRPC/NRR-2010/232. National Park Service, Denver, Colorado. November 2010.

2.2. DEFICIENCIES IN EPA'S APPROACH

The EPA's approach described in the previous section is inappropriate for at least two reasons.

First, if the EPA used IMPROVE Method 8 because it is a method used in prevention of significant deterioration ("**PSD**") modeling, then, consistent with PSD modeling guidance, the EPA should have paired the estimated light extinction values with the default annual average background light extinction values.[4]

Second, the regional haze rules require the necessity of improvements to visibility in a Class I area to be determined also as a function of the most impaired days, which is defined as "the average visibility impairment (measured in deciviews) for the twenty percent of monitored days in a calendar year with the highest amount of visibility impairment,"[5] i.e., the 20% worst visibility days.

By failing to calculate deciviews based on the annual average background and 20% worst visibility days, the EPA overestimated the impacts on visibility in the SCWA that are attributable to PCC and overestimated the improvements to visibility in the SCWA that may result from the addition of SNCR at PCC.

The EPA failed, in addition, to consider that nitrogen oxides ("**NO_X**") in the ambient air that are attributable to PCC would not convert predominantly to NO_2 by the time they reach the SCWA. Stack emissions are largely NO and then gradually convert to NO_2 as the plume disperses downwind.[6] Whereas perhaps a complete conversion of NO to NO_2 can be assumed to occur in typical CALPUFF runs (in which the distance traveled by the NO_X is typically in excess of 50 kilometers), such a conversion cannot properly be assumed to occur over the mere 9 kilometers of distance between PCC and the SCWA. When such short distances are involved, photochemical modeling techniques should be used to account for representative NO-NO_2 conversion chemistry.[7] Given the presence of the NO_2 term in Equation 1 and Equation 2, above, an overestimation of NO_2 concentrations in the modeling yields unrealistically high light extinction values. This notwithstanding, the EPA assumed that all NO_X in the ambient air that are attributable to PCC are 100% NO_2 in the SCWA. This led to a further overestimation of impacts on visibility in the SCWA that are attributable to PCC and a further overestimation of improvements to visibility in the SCWA that may result from the addition of SNCR at PCC.

To correct for some of the deficiencies in the EPA's analysis, described above, Trinity re-ran CALPOST to produce Method 8 deciview values that are based on the annual average background. These are presented in the last row in Table 2-1, below.

In addition, the EPA and PCC may wish to consider: (a) re-running the CALPUFF model to include the results of photochemical modeling or other technique to account for representative NO-NO_2 conversion chemistry; and (b) re-running CALPOST to produce also Method 8 deciview values that are based on the 20% worst days. Pending such an exercise, the range of possible decreases in the deciview estimates for

[4] 40 C.F.R. § 52.21(p); U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service*, Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I report – Revised (2010)*. National Resource Report NPS/NRPC/NRR-2010/232. National Park Service, Denver, Colorado. November 2010.

[5] 40 C.F.R. § 51.308(d)(1), 51.301.

[6] 40 C.F.R. Part 51, Appendix W, § 6.2.4

[7] CALPUFF also has improved chemical transformation modules currently under review; e.g., RIVAD.

the Base Case and SNCR scenarios that could result from taking representative NO-NO_2 conversion chemistry into account is indicated by the last column in Table 2-1.[8, 9]

Table 2-1. Visibility Impairment at Sycamore Canyon with Varying NO_2

Visibility Approach	Scenario	Impairment With NO_2 (Δdv)	Impairment Without NO_2 (Δdv)
Method 6 - Annual Average Bkg	Base Case	3.99	2.32
	SNCR	2.67	1.85
	Net Improvement	1.33	0.46
Method 8 - 20% Best Days	Base Case	5.15	2.79
	SNCR	3.30	2.09
	Net Improvement	1.85	0.70
Method 8 -Annual Average Bkg	Base Case	4.10	2.17
	SNCR	2.59	1.62
	Net Improvement	1.52	0.55

* Impairment values are 22nd High Values over the 2001-2003 period

The modeling outputs underlying Table 2-1 are enclosed as electronic files with this report.

[8] There is significant diurnal variability in NO_X-NO_2 conversion rates. Trinity's preliminary modeling for one 24-hour day indicates that: (a) hourly NO-NO_2 distribution varies significantly based on temperature, ozone level, and sunlight intensity; (b) NO_2 concentrations generally are highest at night and lowest during the day; and (c) nighttime predictions can greatly influence daily average visibility impairment.

[9] Due to the short amount of time, Trinity has not fully evaluated other deficiencies in the EPA's modeling, including the EPA's use in its CALPUFF model of a NO_X emissions rate that appears not to reflect steady-state operating conditions during periods of high capacity utilization or is otherwise not representative. In addition, Trinity did not evaluate the EPA's estimates of the costs of installing and operating SNCR at PCC.

ATTACHMENT 4

Summary of SNCR Costs for PCC

Capital Costs & Annual Cost Calculations

Selective Non-Catalytic Reduction

Cost Item	Estimated Cost ($)
1. Purchased Equipment Costs	
a. Selective Non-Catalytic Reduction System[1 2]	838,489
b. Taxes, 3% of a[3]	25,115
Subtotal Purchased Equipment Costs (B)	863,644
2. Installation Direct Costs[3]	
a. Foundations and Support, 8% of B	69,091
b. Handling & Erection, 14% of B	120,910
c. Electrical Installation, 4% of B	34,546
d. Piping, 2% of B	17,273
e. Insulation, 1% of B	8,636
f. Painting, 1% of B	8,636
Subtotal Total Construction Costs (TCC)	259,093
Total Direct Costs (TDC)	1,122,737
3. Installation Indirect Costs[3]	
a. Engineering and Supervision, 10% of B	86,364
b. Construction and Field Expense, 5% of B	43,182
c. Construction Fees, 10% of B	86,364
d. Start-up, 2% of B	17,273
e. Performance Test, 5% of B	43,182
f. Contingencies, 40% of B	345,457
Total Indirect Costs (TIC)	621,823
Total Capital Cost, TCC = TDC + TIC	1,744,560

Cost Item	Estimated Cost ($)
Direct Annual Costs	
Operating and Supervision[4]	
Operator (2 hr/shift @ $39.00/hr)	85,410
Supervisor (15% of Operator)	12,812
Maintenance	
Labor (1 hr/shift @ $39.00/hr)	42,705
Parts and Material, 10% of B	86,364
Utilities and Other Costs[4]	
Energy	94,334
Reagent[5]	563,439
Total Direct Annual Costs	885,064
Indirect Annual Costs[3]	
Overhead, 60% sum operating, supervisory, maintenance labor	84,556
G & A Charges, 2% of total capital costs	34,891
Property Tax, 1% of total Capital costs	17,446
Insurance, 1% of total Capital costs	17,446
Annualized Capital costs[6]	248,386
Total Indirect Annual Costs	402,725
Total Annual Costs	1,287,789

[1]Based on capital cost data provided by Arizona DEQ (2005 Drake Cement BACT analysis), corrected from 165,325 acfm design to 207,360 acfm as follows:

$Cost_B = Cost_A\ (Capacity_B/Capacity_A)^{0.65}$ (Cooper 1986) 2005 Dollars

[2]Cost Escalation estimate: from the Bureau of Labor Statistics (BLS) Producer Price Index (PPI) for Support Activities for Non-Metallic Minerals, Industry Code 213115, from Table 5. PPI for Net Output of Selected Industries and their Products, not seasonally adjusted. October 2005 to October 2012 = 111.367%

[3]Cost factors obtained from USEPA Control Cost Manual or PCC management

[4]Based on data provided by Arizona DEQ (2005 Drake Cement BACT analysis) when applicable, corrected from 165,325 acfm design to 207,360 acfm design as follows:

$MMBtu/hr_B = MMBtu/hr_A\ (Capacity_B/Capacity_A)$

[5]Based on reagent data provided by Arizona DEQ (2005 Drake Cement BACT analysis): reagent cost = $0.60/lb and reagent requirement based on 1.1 to 1.0 ratio of NH_3 to NOx, Nox removed with SNCR @ 1.75lb/ton compared to 3.5 lb/ton without SNCR for total production of 4000 tpd & 330 days/year

[6]Based on 10 years equipment life and average annual interest rate of 7% as follows:

Annualized Capital Costs = $i\ (1+i)^n / [(1+i)^n-1] * \text{Total Capital Costs}$

Where i = interest rate (%)

n = equipment life (years)

Tucson Electric Power Company

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Telephone (520) 918-8351
Email: EBakken@tep.com

Submitted via email to tomczak.lisa@adeq.gov

April 29, 2013

Lisa Tomczak
Air Quality Division, State Implementation Plan Section
Arizona Department of Environmental Quality
1110 W. Washington St.
Phoenix, Arizona 85007

RE: Proposed revision to the Arizona State Implementation Plan (SIP) for Regional Haze under Section 308 of the Federal Regional Haze Rule

Dear Ms. Tomczak:

Tucson Electric Power Company (TEP), a wholly-owned subsidiary of UNS Energy Corporation (NYSE: UNS), respectfully submits these comments to the Arizona Department of Environmental Quality (ADEQ) regarding proposed revisions to the *Arizona State Implementation Plan (SIP) for Regional Haze under Section 308 of the Federal Regional Haze Rule (Proposed SIP Revisions).*

TEP owns and operates electric generation, transmission, and distribution assets that safely and reliably serve more than 400,000 customers with affordable electricity in Southern Arizona. TEP owns and operates fossil-fired electricity generating units in Arizona, including the H. Wilson Sundt Generating Station (Sundt) and Springerville Generating Station (SGS) Units 1 and 2. Actions considered under ADEQ's proposed SIP could potentially affect Sundt Unit 4 and/or SGS Units 1 and 2. Therefore, ADEQ's proposed SIP is of great importance to TEP.

In December 21, 2012 EPA published, in the Federal Register, a Proposed *Partial Approval and Disapproval of Air Quality Implementation Plans; Arizona; Regional Haze and Visibility Impacts of Transport, Ozone and Fine Particulates (EPA Proposed Disapproval)* [77 FR 75704]. As a result ADEQ has revised the Arizona Regional Haze SIP and is requesting comments leading up to a hearing scheduled for April 29, 2013.

TEP supports ADEQ's Proposed SIP Revisions as well as the Department's decision not to revise certain aspects of the SIP as described in the comments below.

Sundt Unit 4 is not BART eligible

In 2007, while ADEQ was developing its Regional Haze SIP, TEP provided information to ADEQ to assist in determining the BART eligibility of Irvington Generating Station Unit 4. The station has since been renamed as the H. Wilson Sundt Generating Station and is referred to herein as "Sundt". TEP provided documents showing that Sundt Unit 4 underwent "reconstruction" in the 1980s as part of a coal conversion project, and was therefore, not "in existence" on August 7, 1977 (one of the requirements for BART eligibility). Using that information, ADEQ concluded, as stated below[1], that Sundt Unit 4 is not a BART eligible unit and, therefore, BART requirements are not applicable.

> "ADEQ concludes, however, that the plain reading of EPA's guidance is most appropriate, and has determined that it is appropriate to treat reconstructed sources as new sources as of the time of the reconstruction. As a result, ADEQ concurs that the reconstructed Unit I4 at TEP's Irvington Generating Station was not "in existence" prior to August 7, 1977. Therefore, ADEQ has determined that there are no BART-eligible emissions units at TEP's Irvington Generating Station."

On March 2, 2011, ADEQ submitted Arizona's Regional Haze SIP to EPA, without BART requirements for Sundt Unit 4.

In the *EPA Proposed Disapproval*, EPA accepts TEP's and ADEQ's assertion that the coal conversion project qualified as a "reconstruction" under the Regional Haze Rule. However, EPA concludes that "the Unit remains BART-eligible because it did not go through NSR/PSD permitting" [77 FR 75722]. The proposal footnotes an internal EPA memorandum [77 FR 75722, footnote 97] that provides additional detail regarding EPA's view of BART eligibility for Sundt Unit 4. In this memorandum, EPA states that the exemption from BART for sources reconstructed after August 1977, "is introduced in the BART Guidelines" [40 C.F.R. Part 51 Appendix Y], however, EPA claims that Appendix Y is "not binding with respect to TEP Sundt Unit 4 (I4) because it is not part of a fossil fuel-fired electric generating plant with a total generating capacity in excess of 750 MW".

TEP submitted comments[2] to the *EPA Proposed Disapproval* stating:

> "While Appendix Y is not binding on Arizona with respect to Sundt Unit 4, in providing the guidance EPA did "encourage States to follow the guidelines for all source categories" in order to address "concerns about equitable application of the BART requirement to source owners with similar sources in different States" [70 FR 39108]. As a federal agency, EPA must apply the Regional Haze Rule consistently across states and the guidelines are the means by which EPA itself, intends to ensure that consistency is maintained. For EPA to claim it can ignore

[1] Arizona State Implementation Plan, Regional Haze Under Section 308 of the Federal Regional Haze Rule, January 2011; p. 146

[2] Tucson Electric Power Company letter to Gregory Nudd, United States Environmental Protection Agency, RE: EPA Docket ID No. EPA-R09-OAR-2012 (77 FR 75704; December 21, 2012), dated March 6, 2013; pp. 2-3

these guidelines, in its evaluation of a particular state's SIP, is arbitrary and capricious.

Furthermore, EPA's explicit preference for states to apply Appendix Y to all source categories is in direct conflict with EPA's conclusion that the State of Arizona was incorrect in applying those guidelines, as it did, with respect to BART eligibility of Sundt Unit 4.

Appendix Y expressly provides that *any* emissions unit for which a reconstruction "commenced" after August 7, 1977, *is not BART eligible*[3], and contains no exceptions or qualifications to this broad exemption.

Footnote 9 in the preamble to the BART Guidelines[4], referenced in the internal EPA memorandum, is not to the contrary, as it merely reflects the reality that post-1977 source reconstructions, in general, would have gone through NSR/PSD permitting. That footnote does not, nor could it contradict the plain, unqualified language of EPA's rule text that exempts "any" post-1977 reconstruction. In the context of the Clean Air Act the word "any" has an expansive meaning.

Likewise, while the preamble statement observing that BART was intended to "apply to sources which had been 'grandfathered'" from NSR permitting requirements[5] is generally true, it does not follow that BART applies either to all "grandfathered" sources (it does not apply, for example, to sources that were in operation before 1962) or to sources, like Sundt Unit 4, that were not grandfathered but instead were exempt from NSR permitting requirements as a result of a mandatory coal conversion pursuant to a Department of Energy Order under Section 301(c) of the Power Plant and Industrial Fuel Act of 1978 (which superseded Sections 2(a) and (b) of the Energy Supply and Environmental Coordination Act of 1974)[6]. EPA has failed to consider Congresses intent with respect to this law.

In the Proposed SIP Revision, ADEQ did not change its position that Sundt Unit 4 is not a BART eligible unit. Based on the reasoning above, TEP supports ADEQ's position.

Reasonable Progress Goals

The January 2011 Arizona Regional Haze SIP[1] included an analysis that considers the four statutory factors and provides a reasoned basis for excluding various emission sources from consideration for additional controls in establishing the state's initial reasonable progress goals (RPG). However, the Department determined that it was not possible to complete a four factor analysis for emissions from external combustion sources, without a major investment of resources and an exhaustive facility-by-facility review to evaluate each unit. ADEQ stated that such an analysis would be beyond the scope and effort required in the first Regional Haze SIP, therefore no further analysis was conducted.

[3] 40 C.F.R. Part 51 App. Y § II.A.2 (emphases added)
[4] 70 FR 39111
[5] 70 Fed. Reg. at 39111
[6] *see* 40 C.F.R § 52.21(b)(2)(iii)(*b*).

For point sources of SO_2 that were not BART-eligible such as Springerville Generating Station, EPA conducted its own four factor analysis [77 FR 75729] and as a result agreed with the ADEQ's findings that "it is not reasonable to require additional SO2 controls on non-BART sources" [77 FR 75730].

For point sources of NOx, EPA proposed to disapprove Arizona's finding that it is not reasonable to require additional controls on non-BART eligible point sources, because, in EPA's view, Arizona did not perform a thorough analysis. EPA asserts that ADEQ's analysis of point sources did not provide sufficient supporting information to demonstrate the requirements of the Regional Haze Rule have been met.

However, EPA does not appear to be fully considering the flexibility states have in conducting analysis for RPG. For example, in the *EPA Proposed Disapproval* of the RPG in the Arizona Regional Haze SIP, EPA notes that [77 FR 75710]:

> "The mechanism for ensuring continuing progress toward achieving the natural visibility goal is the submission of a series of regional haze SIPs that establish two RPGs (i.e., two distinct goals, one for the ''best'' and one for the ''worst'' days) for every Class I area for each ten-year implementation period. The RHR does not mandate specific milestones or rates of progress, but instead calls for states to establish goals that provide for ''reasonable progress'' toward achieving natural (i.e., ''background'') visibility conditions. In setting RPGs, states must provide for an improvement in visibility for the most impaired days over the ten-year period of the SIP, and ensure no degradation in visibility for the least impaired days over the same period.
>
> **States have significant discretion in establishing RPGs**, *(emphasis added)* but are required to consider the following factors established in section 169A of the CAA and in EPA's RHR at 40 CFR 51.308(d)(1)(i)(A): (1) The costs of compliance; (2) the time necessary for compliance; (3) the energy and non-air quality environmental impacts of compliance; and (4) the remaining useful life of any potentially affected sources. States must demonstrate in their SIPs how these factors are considered when selecting the RPGs for the best and worst days for each applicable Class I area. **States have considerable flexibility** *(emphasis added)* in how they take these factors into consideration, as noted in EPA's *Guidance for Setting Reasonable Progress Goals under the Regional Haze Program*, July 1, 2007, memorandum from William L. Wehrum, Acting Assistant Administrator for Air and Radiation, to EPA Regional Administrators, EPA Regions 1–10 (pp. 4–2, 5–1) (''EPA's Reasonable Progress Guidance'').

TEP disagrees with EPA's decision to disapprove the state's finding that additional NOx controls are not reasonable, "[g]iven the slow rate of visibility improvement on the worst days at all Class I areas" [77 FR 75730]. As the monitoring data analyzed in sections III and IV of the TSD for the Proposed SIP Revisions (Appendix A) demonstrate, actual progress has been considerably better than the progress forecast in ADEQ's original SIP submission. In particular, Table 12, in the revised SIP, shows that substantial reductions in visibility impairment attributable to ammonium nitrate (and thus NOx) concentrations have occurred since the baseline period.

ADEQ's revised SIP presents Arizona's progress towards reaching the previously presented RPGs and Uniform Rates of Progress (URPs) as interpreted through IMPROVE monitor data. ADEQ chose to present IMPROVE data trends, as opposed to surrogate measures such as Emission Inventory trends, as monitoring data most accurately measure visibility changes within a region. However, ADEQ also provides analysis within this section relating trends seen at the IMPROVE monitors to those noted within the emission inventories where appropriate. Finally, ADEQ compares State-wide extinction trends for individual visibility impairment components to regional trends. This section compares the rate of progress between the baseline and progress periods towards the goal of natural visibility at each of the Arizona IMPROVE monitors and how that rate compares to RPGs and URPs for the 20% most impaired and least impaired days. An alternate analysis of reasonable progress is also included which illustrates the effect that one single year has on the original results.

Based on the information in the revised SIP, in particular the monitoring data described above demonstrating substantial reductions in visibility impairment attributable to ammonium nitrate (and thus NOx) since the baseline period, ADEQ is correct to conclude that it is not reasonable to require additional controls for these source categories at this time. TEP fully supports this conclusion.

If you have any questions regarding these comments, please feel free to contact me.

Sincerely,

Erik Bakken
Director, Corporate Environmental Services
and Land Management

cc: Mark Mansfield, TEP
Phil Dion, TEP
Eric Massey, ADEQ

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RESPONSIVENESS SUMMARY

Comments Taken at the Public Hearing and Written Comments Received on the Proposed Arizona State Implementation Plan Revision Under Section 308 of the Federal Regional Haze Rule

(1) Comment: EPA requests clarification in writing whether ADEQ is formally withdrawing those portions of its 2011 submittal that are replaced by the 2013 submittal. If ADEQ is replacing portions of its previous SIP submittal, please list those portions of the 2011 submittal that are officially withdrawn as part of this SIP revision. (EPA Comment)

Response: ADEQ has revised and is formally superseding Chapter 10, Sections 10.4, 10.7, and 10.8; Chapter 11 in its entirety; and Appendix D, Sections VI (C), VII, IX, XII (B & C), XIII (B, C, & D) in the Regional Haze SIP as submitted on February 28, 2011. ADEQ is also adding Sections 8.6, 8.7, 8.8, and 8.9 to Chapter 8. ADEQ is not revising/superseding sections addressed in EPA's NFRM from December 5, 2012 (77 FR 72511).

(2) Comment: EPA requests clarification which statutory provisions from Enclosure 1 Arizona wishes to have approved into the revised SIP, and which ones are intended only as supporting information. (EPA Comment)

Response: Enclosure 1 provides the authorizing statutes as supporting information for the SIP submission and was not intended to be included in the approved SIP. ADEQ submitted this information in support of the SIP completeness checklist that is contained in Enclosure 2.

(3) Comment: In the State Implementation Plan Completeness checklist (Enclosure 2), EPA encourages ADEQ to identify elements of existing rules or permit provisions that could address some of the elements that are currently missing from Arizona's plan, such as monitoring, recordkeeping and reporting requirements and to submit these provisions for SIP approval or specify their location in the approved SIP. (EPA Comment)

Response: In the December 21, 2012, proposed disapproval, EPA identified several portions of ADEQ's SIP that EPA believes lack the appropriate monitoring, recordkeeping, and reporting requirements to ensure compliance with BART limits. However, specifically for the copper smelters, Arizona has determined that compliance with the federal NSPS and NESHAP limits were BART. These federal requirements already contain the necessary monitoring, recordkeeping and reporting requirements to ensure that the companies are in compliance with the limits. As only copper smelters are being considered in this SIP revision, ADEQ has determined that the revised SIP contains the appropriate monitoring, recordkeeping and reporting.

(4) Comment: In Enclosure 3, a footnote says "Technical Support Document for Arizona BART Analyses and Determinations," although the document contains other elements of the plan revision as well. (EPA Comment)

Response: ADEQ has removed the incorrect reference.

(5) Comment: EPA requests clarification whether Chapter 11 is intended as a replacement for Sections 11.4 and 11.5 in Arizona's 2011 Regional Haze SIP or for the entire chapter. (EPA Comment)

Response: ADEQ is formally superseding Chapter 11 as submitted on February 28, 2011, and is replacing the chapter in its entirety with the version of Chapter 11 as submitted in this SIP revision. See response to comment #1.

(6) Comment: EPA acknowledges that ADEQ has done a very good job assessing the monitoring data for coarse mass and fine soil. Since these pollutants have a large anthropogenic component, EPA requests that ADEQ provide further justification for excluding them from the reasonable progress analysis, or make a determination using the four factors listed in the Regional Haze Rule regarding whether further controls on these sources are reasonable. (EPA Comment)

Response: ADEQ acknowledges the importance of Fine and Coarse Soil mass for visibility standards; however, as ADEQ asserted in Section 11.3.1 of the 2011 Regional Haze SIP, large components of particulate emissions are associated with non-anthropogenic sources and thus ADEQ does not feel particulate pollutants should be included in four factor analyses.

ADEQ has shown that when comparing baseline (2000-2004) and progress period (2006-2010) visibility standards at Arizona Class I areas, all monitoring locations are on the glide path for 2018 URP goals with the exception of GRCA2 and SYCA1, which are on track for meeting Arizona's 2018 RPG standards.

With respect to the GRCA2 site, ADEQ has shown that for the 20% most impaired days of the Progress Period (2005-2009) Fine Soil and Coarse Mass have relative contributions of 6% and 12% respectively when assessing visibility condition impairment. Analysis of the 2008 Arizona Emission Inventory reveals that <20% of the total fine particulate emissions for the State of Arizona are attributable to Point Source emissions and ~6% of coarse particulate matter emissions for the State of Arizona are attributable to point source emissions. Therefore, it is not reasonable to expect further point source controls to result in significant visibility improvement at GRCA2 regardless of the cost to the point source. In comparison, Arizona has reported that approximately 50% of fine particulate and 58% of coarse particulate emissions originate from the Fugitive and Road Dust Source Category. Furthermore, Arizona has reported that approximately 20% of fine particulate and 36% of coarse particulate emissions originate from the Windblown Dust Source category. Combined, it is estimated that these two categories account for 70% of fine particulate and 94% of coarse particulate emissions in the State of Arizona.

With respect to the SYCA1 site, ADEQ recognizes the anomalous nature of visibility trends at this site in comparison to other IMPROVE sites throughout Arizona. More analysis would be necessary before attributing the observed particulate concentrations to anthropogenic or non-anthropogenic sources at this location. This would require the development of a microscale emissions inventory akin to those developed for a non-attainment area SIP. Because particulate matter concentrations are most impacted by local emissions or exceptional events ADEQ determined that completion of this level of effort was not appropriate for the first regional haze planning period. Even though the area is not meeting the URP, the statistical method used to identify the visibility trend shows no conclusive change in visibility due to coarse mass.

While a significant portion of the total particulate emissions could be attributed to non-anthropogenic sources, Arizona fully expects improvements in Fine and Coarse particulate matter emissions from anthropogenic sources in future years as implementation and continuation of controls in new and current PM_{10} Nonattainment Areas occur and through the continuation of the Prevention of Significant Deterioration (PSD) rules and New Source Review (NSR) rules outlined in Section 12.7 of the 2011 Arizona Regional Haze SIP. However, in the absence of EPA guidance on the separation of anthropogenic sources from the Windblown Dust category and implementation of a four factor analysis for these anthropogenic emissions as

well as for the Road Dust Source category, it is unclear how a four factor analysis can be completed for Fugitive and Road Dust source emissions or Windblown Dust source emissions in accordance with the Regional Haze Rule. Factors such as remaining useful life, time necessary for compliance and non-air quality environmental benefits are vague with respect to these sources, and ADEQ notes that there is no formal guidance from EPA regarding how to conduct this kind of an analysis.

(7) Comment: EPA asserts that the reasonable progress analysis for NO_X and SO_2 needs additional work to meet the requirements of the Regional Haze Rule. The rule requires states to consider the four factors when setting reasonable progress goals (RPGs). When those RPGs provide for less progress than the uniform rate of progress (URP) the state must explain, based on the four factors, why its RPGs are reasonable and the URP is not. EPA recognizes ADEQ's resource constraints; however, there is no allowance in the regulation to defer the analysis to future planning periods or to use a lack of resources as a justification for failing to apply the four factors. EPA requests that ADEQ provides a complete justification for the RPGs for this planning period. (EPA Comment)

Response: ADEQ's February 28, 2011, Section 308 SIP submission included an analysis that addressed the four factors for specific point source categories throughout the State. It is the State's position that this analysis supports the Reasonable Progress Goals (RPGs) that were established as part of that submission. It is within the State's discretion to determine the appropriate process for reviewing the four factors as EPA did not establish rules specifying how the review should be completed.

ADEQ has shown that IMPROVE data have supported improvements in visibility associated with ammonium nitrate concentrations for the State of Arizona between the baseline period (2000-2004) and the progress period (2006-2010). In addition, with the exception of uncontrollable regional transport of ammonium sulfate for the year of 2007, ADEQ has shown that all sites except GRCA2 and TONT1 have exhibited decreased ammonium sulfate extinction. It should be noted that EPA approved New Mexico's reasonable progress analysis, despite not meeting a uniform rate of progress, because it was determined that uncontrollable sources such as natural wildfires, wind-blown dust, and emissions from Mexico were significant contributors to regional haze (77 FR 36044 and 77 FR 70693). In Arizona's SIP revision, ADEQ has shown evidence that these factors also affect regional haze in the State of Arizona.

(8) Comment: EPA acknowledges that ADEQ has done a good job analyzing and assessing the more recent visibility monitoring data and comparing it to the base period. EPA concurs with the State's assessment that coarse mass and fine soil visibility impairment does not appear to be increasing. EPA also concurs with the State's assessment that there appears to be a statistically significant decrease in nitrate visibility impairment at some Class I areas in Arizona. This kind of analysis can augment and inform a four factor analysis, but cannot replace it. (EPA Comment)

Response: ADEQ would like to emphasize that the monitoring data analysis is intended to support the four factor analysis, not replace it.

(9) Comment: EPA notes that in a few instances, the proposed SIP revision attributes more significance to monitoring trends at particular Class I areas than is justified by the data analysis. This is a notable problem with Sycamore Canyon, where the data shows no significant trend on the worst 20 percent of days (Table 11.9). EPA requests that ADEQ review all statements attributing trends to particular Class I areas and ensure that these statements are supported by the data analysis. (EPA Comment)

Response: In the final SIP submission, ADEQ has retracted the previous statement regarding Sycamore Canyon visibility improvement. ADEQ previously presented data supporting the assertion that all Class I

area monitors had met the URP glide path when analyzing an alternative baseline period (2000-2005) against a progress period (2006-2010). ADEQ has revised the aforementioned analysis to exclude 2005 from the baseline period in accordance with the Regional Haze Rule definition of the baseline period as the years of 2000-2004. In this revised analysis, SYCA1 and GRCA2 do not meet the URP glide path, but surpasses RPG expectations for the progress period. This information has been updated in the Technical Support Document (Section IV.B, Table 23) and the revised SIP document.

(10) Comment: In Chapter 11, Section 11.4.3, EPA requests that ADEQ includes an explanation of regional ammonium sulfate trends clarifying whether the sources causing the increases of sulfate in 2005 and 2007 are within or outside Arizona. (EPA Comment)

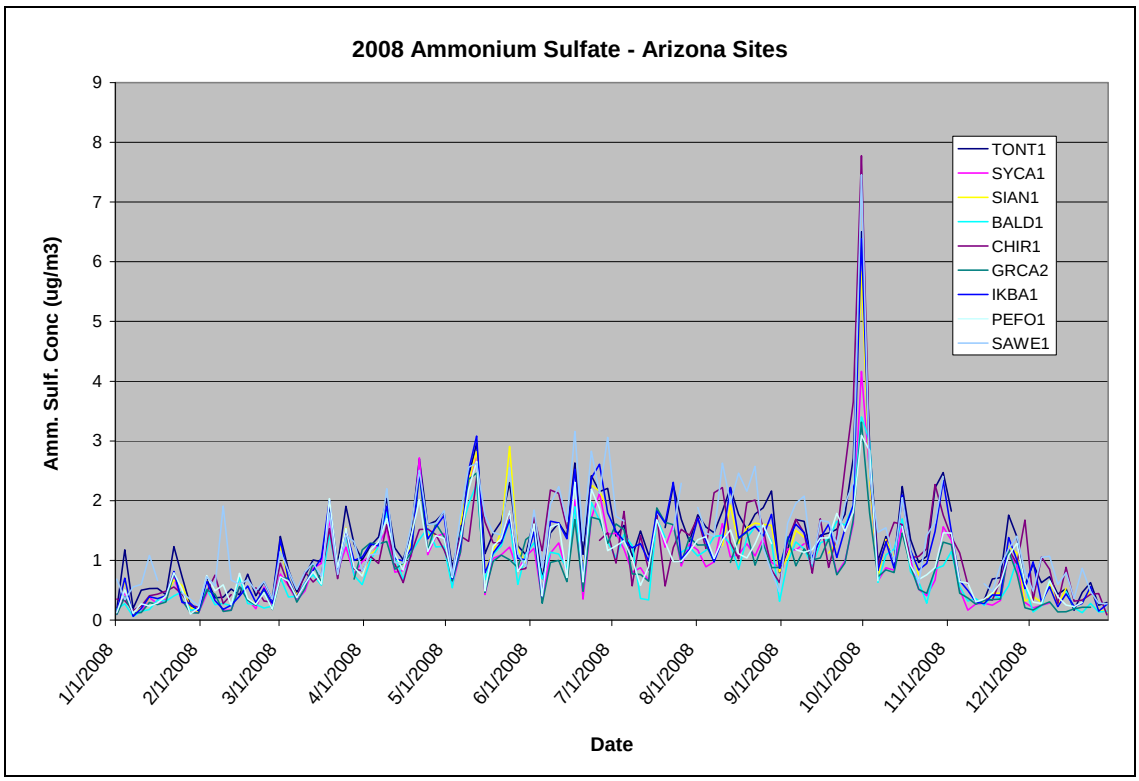
Response: ADEQ has provided additional analyses to assess the origination of 2005 and 2007 elevated ammonium sulfate extinctions in Section III of the TSD. These analyses support regional transport of ammonium sulfate in 2007 from sources outside of Arizona acting as the primary contributor to the elevated 2007 annual ammonium sulfate extinction noted. This information has been updated in the Technical Support Document and the revised SIP.

In addition, the Department reviewed all significant sources of SO2 in the State (including coal-fired power plants and copper smelters) and has concluded that there were no anomalous elevated emissions from the facilities for 2005. In fact in 2005, most facilities had significantly reduced emissions as compared to prior years.

Sulfur dioxide emissions in tons per year from significant sources:

Facility	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
APS - Cholla Generating Station	21049	20770	17147	18241	22027	21147	23522	16421	7956	6494
ASARCO - Hayden Smelter	20009	18438	18425	19395	12723	16088	20339	21742	23660	24187
TEP - Springerville Generating Station	20126	19565	19308	19308	9882	4903	5996	6562	7297	6746
AEPCO	5389	5168	5168	2920	2657	3021	2662	1904	4664	4588
SRP - Coronado Generating Station	19048	17742	18815	13950	10480	13520	16882	15900	11248	11722
FMM - Miami Smelter	9062	5667	8005	8754	7366	6383	9111	7091	4690	10314

Furthermore, in section 11.4.4 of the Arizona Regional Haze SIP Revision (May 2013), ADEQ asserted that regional transport of ammonium sulfate elevated the 2008 annual ammonium sulfate extinction average. Below, ADEQ supplements this assertion with two graphs depicting the magnitude of this singular event and the wind back-trajectories that were associated with the event. This event exhibits the same characteristics as the 2007 event outlined in more detail in the SIP revision and TSD. In addition, the Department reviewed all significant sources of SO2 in the State (including coal-fired power plants and copper smelters) and has concluded that there were no anomalous elevated emissions from the facilities for 2005. In fact in 2005, most facilities had significantly reduced emissions as compared to prior years.



(11) Comment: EPA notes that at the PEFO1 monitor, coarse mass significantly contributes 21 percent to total extinction during 2005-2009 (Chapter 11, Section 11.4.2, Table 11.5). Further, both trend methods of the 20 percent worst coarse mass days (Chapter 11, Section 11.4.4, Table 11.11) showed an increase in coarse mass. In light of those results, EPA requests that ADEQ include a discussion of the emission trends of PM_{10} at the large point sources near the PEFO1 monitor. (EPA Comment)

Response: ADEQ has provided additional analyses to assess the potential impacts of large point sources on coarse mass extinction at the PEFO1 monitor between 2007 and 2010 in Section III of the TSD. This analysis indicates increases in windblown dust emissions have caused the recent increase in coarse mass extinction at the PEFO1 monitor. This information has been updated in the Technical Support Document and the revised SIP.

(12) Comment: The heading to Appendix D states that: "The following replaces Appendix D contained in the 2011 Regional Haze Submission." EPA has taken final action to approve and disapprove certain portions of Appendix D contained in the 2011 Regional Haze submission. EPA has also proposed action on the remainder of the 2011 version of Appendix D. EPA requests that ADEQ clarifies the portions of Appendix D that are withdrawn and remain in the document. For those withdrawn portions, EPA requests that ADEQ indicate clearly which portion of the new submittal is its replacement. (EPA Comment)

Response: ADEQ has revised Sections VI (C), VII, IX, XII (B & C), XIII (B, C, & D) of Appendix D to address proposed deficiencies in EPA's Notice of Proposed Rulemaking from December 21, 2012 (77 FR 75704) and is submitting them as replacements for the equivalent sections in the 2011 Regional Haze SIP. The only sections included in EPA's NFRM from December 5, 2012 (77 FR 72511) that ADEQ is revising in this SIP revision are those that clarify that Gas Turbine 1 at the Arizona Electric Power Cooperative's Apache Generating Station is not subject to the BART emissions limitation when it operates in simple cycle mode.

(13) Comment: ASARCO submitted a comment letter dated March 6, 2013, on EPA's proposed partial approval/disapproval indicating that Converters 1, 3, 4, and 5 as well as Anode Furnace 1 and 2 are BART-eligible. This statement differs slightly from ASARCO's previous position, which is still reflected in Appendix D of the proposed SIP revision. EPA recommends that ADEQ incorporate ASARCO's more recent position on this issue into Appendix D. (EPA Comment)

Response: Appropriate edits have been made to reflect ASARCO's current position.

(14) Comment: In the proposed SIP revision, ADEQ stated that the ASARCO Hayden smelter is not subject to a BART analysis since the average potential to emit for each of the BART eligible unit is below 15 tons per year. ASARCO has completed a BART analysis, which ADEQ has reviewed and is incorporating it as part of this SIP. Since the proposed SIP revision already includes a BART analysis for PM_{10} for the ASARCO Hayden smelter, EPA recommends that ADEQ clarifies that the ASARCO Hayden smelter is subject to BART for PM_{10}. (EPA Comment)

Response: ADEQ does not agree that the ASARCO Hayden smelter is subject to BART for PM_{10} for the reasons given in its comments on EPA's proposed partial approval and partial disapproval of Arizona's Section 308 plan (77 FR 75704). The BART analysis supplies an alternative basis for not imposing the PM_{10} controls on the smelter facilities. It is therefore not appropriate to provide the requested clarification.

(15) Comment: In the comment letter submitted by Freeport-McMoRan (FMMI) dated March 6, 2013, regarding EPA's proposed partial approval/disapproval, FMMI indicated that the Remelt Vessel should not be included as part of the BART-eligible source at the Miami smelter. EPA believes this differs slightly from FMMI's previous position, which is still reflected in Appendix D of the supplemental SIP. EPA requests that the revised SIP incorporates FMMI's more recent position on this issue into Appendix D. (EPA Comment)

Response: Appropriate edits have been made to reflect FMMI's current position regarding the re-melt vessel.

(16) Comment: In an attachment to the revised SIP, FMMI included potential-to-emit (PTE) calculations for NO_x emissions for the BART-eligible source at the Miami Smelter in order to demonstrate that NO_x emissions were below the NO_x de minimis threshold of 40 tpy. Although the calculations indicate that NO_x emissions from the BART-eligible source are less than 40 tpy, EPA does not consider them to be an accurate representation of PTE, as it is not clear to what extent they are based on a physical limitation or enforceable limit. (EPA Comment)

Response: Historically the highest daily usage recorded at the facility was 519,401 cubic feet per converter. Using a 10-month operation cycle which is required for re-bricking the converters and other operational maintenance activities, the total possible NO_x emissions for the converters is 31.6 tons per year. In 2010 the converter process gas cooling system was changed from an air-to-gas tubing to water spray cooling. This conversion reduced the number of burn outs and holding fires due to plugging. The net effect is that natural gas usage is significantly lower after the change. ADEQ considers this change to be an inherent physical limitation and therefore a limitation on the potential emissions from these convertors. The total potential NO_x emissions from the BART eligible emissions units was determined to be less than the 40 tons per year threshold.

(17) Comment: The revised SIP contains a BART analysis and determination for NO_x and SO_2 at the Catalyst Paper Mill; however, ADEQ's comment letter on EPA's December 21, 2012, proposed rulemaking stating that ADEQ has cancelled the operating permit for its permanently closed facility. Since the plant has permanently closed, resuming operation will be treated as the construction of a new plant and will be subject to new source review, rather than BART. EPA recommends that ADEQ replaces the BART analysis and determination for Catalyst Paper Mill with a statement that the plant has permanently closed and that reactivation of the plant is subject to new source review, rather than BART. (EPA Comment)

Response: ADEQ has removed the analysis for Catalyst Paper Mill with a statement that the facility has permanently closed.

(18) Comment: ADEQ included a clarification to Arizona's 2011 SIP submittal regarding ADEQ's NO_x BART determination for Apache Unit ST1. This clarification appears to be consistent with the Clean Air Act, the Regional Haze Rule and the BART Guidelines. In order to ensure that this clarification is properly incorporated into the applicable SIP, EPA requests that ADEQ includes this clarification in Table 1.1 of Appendix D. (EPA Comment)

Response: ADEQ has incorporated the suggested changes.

(19) Comment: EPA would like confirmation that ADEQ is not making a new submittal with respect to Cholla and that ADEQ's prior BART determinations for Cholla are not being withdrawn or replaced. (EPA Comment)

Response: As part of this SIP revision, ADEQ is not revising or making a new submittal for the Cholla Generating Station.

(20) Comment: EPA would like clarification whether ADEQ is withdrawing and replacing its prior BART analysis and determination for ASARCO Hayden or only portions of the analysis and determination. (EPA Comment)

Response: As part of this SIP revision, ADEQ is superseding its previous submittal with a new submittal for ASARCO Hayden.

(21) Comment: The PM_{10} BART analysis in Appendix D (page 146 of 174) is partly based on PM_{10} emission calculations contained in the ASARCO comment letter included as an attachment. Those PM_{10} emission calculations are in turn based on certain source documents that do not appear to be attached to either the revised SIP or ASARCO's comment letter. EPA requests that ADEQ include those source documents. (EPA Comment)

Response: Appropriate summary sheets from the referenced documents have been incorporated in the revised SIP.

(22) Comment: EPA would like clarification if ADEQ is withdrawing and replacing its prior BART analysis and determination for Freeport-McMoran Miami or only portions of the analysis and determination. (EPA Comment)

Response: As part of this SIP revision, ADEQ is superseding its previous submittal with a new submittal for Freeport-McMoran Miami.

(23) Comment: EPA wants confirmation that ADEQ is not making a new submittal with respect to Coronado and that ADEQ's prior BART determinations for Coronado are not being withdrawn or replaced. (EPA Comment)

Response: As part of this SIP revision, ADEQ is not revising or making a new submittal for the Coronado Generating Station.

(24) Comment: EPA suggests that ADEQ does not include any comment letters as part of the final SIP submittal. To the extent that there is pertinent information or analysis in the letters or attachments that does not exist elsewhere, the SIP should cite to those portions of the letters and attachments. Those materials will be included in the docket and administrative record, but not approved into the SIP. (EPA Comment)

Response: Comment letters incorporated previously in the SIP will be removed. They will be identified by reference only in the revised SIP.

(25) Comment: If ADEQ includes a table of visibility impacts; please ensure that the values for Saguaro National Park East and West Units are not reversed. In the original haze SIP submittal, in Table 6.1 – Baseline Conditions for 20% Worst Days (page 40), the values of "Baseline Conditions for 20% Worst Visibility Days (dv)" were reversed. The values should read:

- Saguaro NP – East Unit (SAGU1 monitor) 14.83
- Saguaro NP – West Unit (SAWE1 monitor) 16.22

These values are correct in other SIP tables, e.g. Table 6-3, and used correctly in calculations of the URP and number of years to natural conditions. (EPA Comment)

Response: ADEQ has made the requested correction.

(26) Comment: Phoenix Cement Company (PCC) agrees with the methodology and results of the proposed revised Rule 308 SIP's rate of progress demonstrations relating to non-BART sources of NO_X, including those indicated by Table 11.14, Table 21 and corresponding text. PCC believes these are consistent with the requirements of 40 CFR § 51.308(d)(2) or properly inform any application of 40 CFR § 51.308(d)(2) and consideration of corresponding findings. (PCC comment)

Response: ADEQ acknowledges PCC's comments. However, ADEQ has decided that the previously mentioned analysis should be replaced with an analysis more in line with EPA's definition of the baseline period (i.e. 2000-2004). In the aforementioned analysis, ADEQ compared a baseline period of 2000-2005 to a progress period of 2006-2010. In the revised analysis, ADEQ has adopted the baseline period of 2000-2004, which matches the EPA definition of the baseline period. When analyzing the revised analysis which includes comparing the baseline period of 2000-2004 against the progress period of 2006-2010, ADEQ has found that while the SYCA1 monitor is currently exceeding expectations for the RPG glide-path towards 2018 visibility goals, it is no longer exceeding expectations for the URP glide-path for 2018 visibility standards.

(27) Comment: PCC agrees with the proposed revised Rule 308 SIP's reasonable progress analysis relating to PCC and the Sycamore Canyon Wilderness Area and ADEQ's assessment of PCC's submittal informing the analysis. Concerning specifically the analysis' references to reasonable progress in relation to the uniform rate of progress, PCC agree with the references based partly, but not exclusively, on the projection of Table 11.14, Table 21 and corresponding text. PCC believes these are consistent with the requirements of 40 CFR § 51.308(d)(2) or properly inform any application of 40 CFR § 51.308(d)(2) and consideration of corresponding findings. Based on the analysis including these references and projections, it would not be reasonable, necessary or lawful to require the installation and operation of selective non-catalytic reduction at PCC's Clarkdale facility as part of the implementation plan. (PCC comment)

Response: Please see response to comment 26.

(28) Comment: The proposed revised Rule 308 SIP, as it relates to non-BART sources of NO_X, is a procedural alternative to the conclusion of law that PCC explained in its March 6, 2013, comments on the EPA's December 21, 2012, proposed partial disapproval of the original Rule 308 SIP. (PCC Comment)

Response: For the full text of PCC's comments regarding EPA's December 21, 2012, proposal, please refer to EPA Docket: EPA-R09-OAR-2012-0904.

(29) Comment: Tucson Electric Power (TEP) supports ADEQ's position that Sundt Unit 4 is not BART-eligible. Arizona's Regional Haze SIP originally submitted in 2011, contained documentation that ADEQ used to make the determination that Sundt Unit 4 is not BART-eligible and, therefore, BART requirements are not applicable (Arizona State Implementation Plan, Regional Haze Under Section 308 of the Federal Regional Haze Rule, February 2011; p. 146). In the Proposed SIP Revision, ADEQ did not change its position that Sundt Unit 4 is not a BART-eligible unit. Based on comments submitted by TEP on EPA's proposed rulemaking on December 21, 2012 reasoning above, TEP continues to support ADEQ's position (Tucson Electric Power Company letter to Gregory Nudd, United States Environmental Protection Agency, RE: EPA Docket ID No. EPA-R09-OAR-2012 (77 FR 75704; December 21, 2012), dated March 6, 2013; pp. 2-3). (TEP Comment)

Response: ADEQ acknowledges the comment.

(30) Comment: Tucson Electric Power (TEP) supports ADEQ's conclusion that it is not reasonable to require additional controls for non-BART eligible point sources of NO_X at this time and TEP disagrees with EPA's decision to disapprove the state's finding that additional NO_X controls are not reasonable. EPA does not appear to be fully considering the flexibility states have in conducting analysis for reasonable progress goals. The monitoring data and analysis presented in ADEQ's proposed SIP revision demonstrates substantial reductions in visibility impairment attributable to ammonium nitrate since the baseline period. TEP fully supports ADEQ conclusion that it is not reasonable to require additional controls for non-BART sources of NO_X at this time. (TEP Comment)

Response: ADEQ acknowledges the comment.

(31) The American Coalition for Clean Coal Electricity (ACCCE) believes that Arizona's Revised Regional Haze SIP accomplishes the goals of the Regional Haze Program and should be approved and finalized by the ADEQ. Arizona's BART determination should be respected and approved by EPA, and EPA's Federal Implementation Plan for Arizona withdrawn until EPA takes final agency action on Arizona's Revised SIP.

Response: ADEQ acknowledges ACCCE's comment.

(32) Comment: The National Park Service (NPS) notes that Table 8.7.1 indicates that point sources are the largest source category for sulfur dioxide (SO_2) emissions. In Section 8.7.9, please describe the basis for the reductions in SO_2 and nitrogen oxide emissions from point sources between 2002 and 2008. Is this due to required emissions controls that will continue into the future, permanent facility closures, changes in electricity generation and industrial activity that are influenced by economic conditions and not permanent reductions, or other factors? (NPS Comment)

Response: ADEQ points out there have been several permanent air pollution control projects at the coal-fired power plants since 2002 that have resulted in significant emission reductions. The Tucson Electric Power Springerville facility installed new sulfur dioxide scrubber technology on its existing units (Units 1 and 2) in the 2004/2005 time frame as part of its plans to install new Units 3 and 4. Those projects resulted in SO_2 emission reductions of approximately 10,000 tons per year for the facility. APS Cholla installed new or upgraded PM, SO_2 and NO_X controls at its facility in the 2007-2009 time frame that has translated to reductions of approximately 67%, 25% and 14% for SO_2, NO_X and PM from pre-2007 levels. Since 2009, SRP Coronado has installed low-NO_X burners and new FGD systems on its existing units. Additionally, SCR will be installed on Unit 2 prior to June 2014.

In addition, ADEQ has determined that the Maricopa County Air Quality Department (MCAQD) altered their criteria for facilities reported to the 2008 National Emissions Inventory (NEI) as compared to the 2002 NEI. For the 2002 NEI submission MCAQD reported emissions for 145 point sources with NO_X and SO_X emissions totaling 3,522 tons per year (tpy) and 219 tpy, respectively. In contrast, MCAQD reported emissions for only 25 point sources in their 2008 NEI submission with NO_X and SO_X emissions totaling 2,205 tpy and 81 tpy, respectively. MCAQD attributed the change in point sources to their standardization of the definition of a point source to coincide with the federal Air Emission Reporting Requirements (AERR) rule, for which only major sources should be reported as point sources (http://www.maricopa.gov/aq/divisions/planning_analysis/docs/2008_PM10/08_PM_PEI_Chapt2.pdf). For comparative purposes, ADEQ examined the list of 25 point sources submitted by MCAQD for the 2008 NEI and determined that 22 of these sources were in operation in 2002. Total annual NO_X emissions for these 22 point sources decreased 1,165 tons between 2002 and 2008, while total annual SO_X emissions for these 22 point sources increased 21 tons over the same period. Three point sources were included in the 2008 NEI, which were not included in the 2002 NEI submission due to these three facilities beginning operation between 2003 and 2004. These three facilities emitted 41 tpy of SO_X and 672 tpy of NO_X in 2008.

Finally, the new 1-hour SO_2 standard will result in emissions controls that will permanently reduce SO_2 emissions from the two existing copper smelters in Arizona.

(33) Comment: NPS notes that EPA proposed to disapprove Arizona's reasonable progress goals because the State did not conduct an adequate four-factor analysis of potential emission control for point and area sources. In this SIP revision, ADEQ did not conduct a more detailed four-factor analysis, but instead provided an evaluation of the IMPROVE monitoring data to assert that the visibility improvement since 2000 is sufficient to demonstrate reasonable progress. Arizona should have considered what emissions controls are reasonable in the first review period, independent of the rate of progress projected by 2018. (NPS Comment)

Response: ADEQ disagrees that its four-factor analysis of potential emission controls for point and area sources is inadequate. Please see the responses to Comments 6, 7 and 8 for further explanation.

(34) Comment: NPS agrees with ADEQ that the regional haze metrics for the 20% worst and 20% best visibility days are easily influenced by non-anthropogenic event such as wildfire. Analysis of annual trends provides an additional weight of evidence, but does not replace the regional haze metrics. EPA's April 2013 guidance for periodic progress reports recommends that states consider five-year rolling averages for the 20% worst and 20% best days to reduce the influence of any single year on the overall visibility trends. (NPS Comment)

Response: EPA's proposed April 2013 guidance was not available to the States for review or consideration on February 28, 2011 when ADEQ submitted its Regional Haze SIP, or on March 29, 2013 when this SIP revision was proposed. ADEQ notes that guidance does not carry the weight of law. While ADEQ's analysis is not the rolling 5-year trend analysis that is recommended by EPA's recently proposed guidance, it is a robust method for analyzing the differences in visibility trends.

(35) Comment: NPS notes that data in Table 11.14 suggest that for the period 2006-2010, visibility on the 20% worst days is near or below the 2018 Reasonable Progress Goals at all Class I areas. However, the extrapolation of the rate of reduction between 2000 and 2010 to 2018 has not been supported. ADEQ has not demonstrated that significant additional anthropogenic controls will occur between 2010 and 2018. In Chapter 8, ADEQ did not demonstrate that observed emission reductions from point sources were permanent reductions. Nor has ADEQ explained how variability in emission (e.g. fire, dust) that influenced visibility trends to 2010 were represented in the revised projections to 2018. Organic carbon and elemental carbon emissions from fire likely increased in 2011 and2012 at several Class I area due to large wildfires in those years. The revised 2018 are informative but not conclusive. (NPS Comment)

Response: Regional Haze Rule 20% worst day analysis is heavily influenced by uncontrollable exceptional events such as large wildfires, exceptionally high winds speeds leading to windblown dust, and regional transport of pollutants from outside of the State. In the 2013 Regional Haze SIP revision, ADEQ has identified instances of all three of the aforementioned exceptional events. EPA further recognized the influence of these exceptional events when approving New Mexico's reasonable progress analysis, despite not showing a uniform rate of progress (77 FR 36044 and 77 FR 70693).

Approaches for analyzing the influence of these exceptional events on Arizona's Class I area visibilities have been presented in ADEQ's 2013 Regional Haze SIP revision. These approaches have shown that singular or multiple exceptional events in one year can significantly affect Regional Haze visibility trends for the 20% worst days. This is primarily due to the restriction of sample size, focusing on a sample subset which is highly dependent on exceptional events. While ADEQ cannot expect to control exceptional natural events such as wildfires, extreme instances of windblown dust, or regional transport of pollutants, where applicable, ADEQ expects future reductions in non-exceptional event emissions due to the implementation and/or continuation of several programs, control measures, and/or national standard changes.

The Department will continue the implementation of its Enhanced Smoke Management Program to reduce emissions from prescribed burns. ADEQ will also be implementing future particulate matter controls throughout the State with particular emphasis in current and future Nonattainment Areas. Several large point sources in the State of Arizona are also expected to implement new control technologies in response to the changes to the SO_2 National Ambient Air Quality Standard (NAAQS). NO_X emissions from point sources will continue to decrease with the implementation of Arizona's BART requirements or the contested FIP requirements at large point sources, the implementation of new federal standards at other point sources, and as a result of federal programs like the Corporate Average Fuel Economy and Tier 3 vehicle emissions

standards. Therefore, ADEQ expects to continue its current visibility improvement glide paths at Class I areas. ADEQ recognizes the limitations of extrapolating the 2000 to 2010 reduction rate out to 2018. This extrapolation was not intended to replace the original RPG analysis, but instead was intended to supplement and support the RPG analysis to show that for most cases; the monitoring data are indicating better progress today than would be expected with the URP glide-path.

(36) Comment: ADEQ has not demonstrated that selective non-catalytic reduction (SNCR) controls are not reasonable for Phoenix Cement. ADEQ did not provide a $/ton or $/dv visibility benefit for SNCR. SNCR has been required for BART and reasonable progress for cement plants in other western states. (NPS Comment)

Response: ADEQ would like to clarify that the Phoenix Cement Company is not BART-eligible, and therefore was never subject to a BART analysis.

ADEQ did not consider a dollar per ton or dollar per deciview cost metric in its analysis of whether to require additional controls under reasonable progress for PCC. ADEQ did, however, review the capital and operating costs associated with the installation and operation of a SNCR. ADEQ understands that there is one facility in Colorado that is required to install SNCR through the RP process. That, by itself, should not lead to the general conclusion that SNCR should be required for the Phoenix Cement facility. As discussed elsewhere in this responsiveness summary, analysis of ambient data for Sycamore Canyon shows trends better than the RPG expectations for the progress period. As a result, and after considering the four factors, ADEQ determined that additional controls were not necessary during this planning period.

(37) Comment: In Arizona's Regional Haze SIP submitted on February 28, 2011, ADEQ determined that Kiln 4 from the Rillito Cement Plant is not subject to BART because the average emissions of all pollutants is less than the 0.5 deciview threshold and does not contribute to visibility impairment. EPA agreed with ADEQ's determination with respect to Kiln 4. Given the lack of visibility impacts from Kiln 4, it is reasonable and consistent with Section 308 and EPA's Reasonable Progress Guidelines to conclude that a four-factor analysis is not required for Kiln 4. (CalPortland Comment)

Response: ADEQ acknowledges and concurs with the comment.

(38) Comment: ADEQ determined that a four-factor analysis is not necessary for Kilns 1 through 3 at the Rillito Cement Plant. CalPortland supports ADEQ's conclusion as lawful and reasonable because Kilns 1-3 have not operated since 2008. Due to the recession, CalPortland placed Kilns 1 – 3 in care and maintenance in 2008 and there have been no emissions from these three kilns since that time. The Douglas Lime Plant, owned by Lhoist, stopped operating in 2009 and has not resumed operations. With respect to the Douglas Lime Plant, in its proposed partial disapproval, EPA stated "*Given the lack of emissions from the plant, EPA proposes to find that requiring controls would not be reasonable at this time.*" (77 FR. 75729). CalPortland asserts that the same conclusion must be reached for Kilns 1 through 3 at the Rillito Cement Plant because it would be unreasonable to require a more burdensome analysis or reach a different conclusion for CalPortland's kilns than what was established for the Lhoist lime plant. (CalPortland Comment)

Response: ADEQ acknowledges and concurs with the comment.

(39) Comment: CalPortland requests that ADEQ clarify why a four-factor reasonable progress analysis is not required or appropriate for the Rillito Cement Plant at this time. (CalPortland Comment)

Response: ADEQ acknowledges the information received from CalPortland and has made changes that the Department determined to be appropriate.

(40) Comment: CalPortland asserts that ADEQ should revise its reasonable progress goals to reflect the significant visibility improvements that have already occurred. (CalPortland Comment)

Response: ADEQ acknowledges that improvements in visibility have occurred across the State and appropriate discussions are in the TSD substantiating those improvements.

(41) Comment: In the proposed SIP revision, as in the 2011 SIP submission, the reasonable progress analysis focuses on sources of SO2 and NOX. CalPortland agrees and supports ADEQ's analysis that this is reasonable and within the state's discretion. (CalPortland Comment)

Response: ADEQ acknowledges the comments