STATE OF COLORADO

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Colorado Department of Public Health and Environment

CORRECTION

NOTICE OF PUBLIC HEARING
BEFORE THE
COLORADO AIR QUALITY CONTROL COMMISSION

Regarding:
LONG-TERM STRATEGY REVIEW AND REVISION OF COLORADO'S STATE IMPLEMENTATION PLAN FOR CLASS I AREA VISIBILITY PROTECTION

SUBJECT:

The Commission will consider a proposal to review and revise Colorado's Class I Area Visibility SIP Element, the Long-Term Strategy, pertaining to Phase I (reasonable attribution) of EPA's visibility protection program.

PUBLIC PARTICIPATION ENCOURAGED:

The Commission encourages all interested persons to provide their opinions or recommendations orally or in writing regarding the amended plan and whether it should be approved by the Commission.

HEARING SCHEDULE:

DATE: November 18, 2004
TIME: 9:00 a.m.
PLACE: Sabin Room
Colorado Department of Public Health & Environment
4300 Cherry Creek Drive, South
Denver, CO 80246-1530

The hearing may be continued at such places and time as the Commission may announce.

PARTY STATUS:

This is not a rulemaking hearing; therefore, party status requests shall not be considered by the Commission.

PROCEDURAL MATTERS:

Oral or written comments will be accepted at the hearing. The Commission encourages the submission of written recommendations and should be received at the Commission Office by November 4, 2004 if feasible, so that they can be distributed to the Commission for review prior to the hearing. The Commission requests that twenty (20) copies of all written statements be submitted.

Dated this 20th day of August 2004, at Denver, Colorado

COLORADO AIR QUALITY CONTROL COMMISSION

Douglas A. Lempke, Administrator

LONG-TERM STRATEGY REVIEW AND REVISION OF COLORADO'S STATE IMPLEMENTATION PLAN FOR CLASS I AREA VISIBILITY PROTECTION

PART I: REVIEW OF THE LONG-TERM STRATEGY

COLORADO DEPARTMENT OF
PUBLIC HEALTH AND ENVIRONMENT

JULY 30, 2004

PREPARED BY:

COLORADO AIR POLLUTION CONTROL DIVISION
TECHNICAL SERVICES PROGRAM
VISIBILITY, FIRE, AND QUALITY ASSURANCE UNIT

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ABBREVIATIONS, ACRONYMS, & TERMS

1977 CAAA	1977 Clean Air Act Amendments
ACD	Air Curtain Destructor
ALAPCO	Association of Local Air Pollution Control Officers
AQCC	Air Quality Control Commission of Colorado
AQRVs	Air Quality Related Values. A feature or property of a Class I Federal area other than visibility that may be affected by air pollution. General categories of AQRVs include odor, flora, fauna, soil, water, geologic features, and cultural resources.
ARS	Air Resource Specialists, Inc.
BACM	Best Available Control Measure
BART	Best Available Retrofit Technology
Atmospheric Extinction	Atmospheric extinction is a measure of the level of light scattering and absorption by particulates and gases in the atmosphere. Expressed as inverse mega meters or $Mm^{-1.}$
BLCA	Black Canyon of the Gunnison National Monument
BLM	U.S.D.I. Bureau of Land Management
Class I	Class I Federal areas are congressionally designated large national parks and wilderness created as of August 7, 1977
COHP	Hahn's Peak automated camera system site near the MZWA
Commission	Colorado Air Quality Control Commission
C.R.S.	Colorado Revised Statutes
Craig Settlement or Craig Consent Decree	A comprehensive "global settlement" between the owners of the Craig Station and the Sierra Club resolving Sierra Club's opacity lawsuit against Craig Station Units 1 and 2. The emission limitations (particulate, sulfur dioxide, and nitrogen oxides) are also intended to address visibility and acid deposition concerns. The Consent Decree was signed by the parties and filed with the federal district court on January 10, 2001. The court entered the Consent Decree on March 19, 2001.
Division	Colorado Air Pollution Control Division
DEHE	Devil's Head Fire Tower near the Lost Creek Wilderness Area. An automated camera system is located at this site.
Deciview (Dv)	Deciview (Dv) is a haziness index designed to be linear with respect to human perception of visibility.
EANE	Eagle's Nest Wilderness Area
EDF	Environmental Defense Fund
EPA	U.S. Environmental Protection Agency
FIP	Federal Implementation Plan
FLM	Federal Land Manager (USFS, NPS, BLM, USF&WS)
FPM	Fine Particle Mass or portion of the mass that is under 2.5 microns in diameter
GRSA	Great Sand Dunes National Monument

ABBREVIATIONS, ACRONYMS, & TERMS

Hayden Settlement	A comprehensive "global settlement" between the owners of the Hayden Generating Station, the Sierra Club, the State of Colorado, and the EPA/Dept. Of Justice concerning Sierra Club's lawsuit against Hayden, the State's ongoing visibility regulatory process, and EPA's Notice of Violation against Hayden. The set of emission reductions (particulate, sulfur dioxide, and nitrogen oxides) are also intended to address acid deposition concerns. The Consent Decree was signed by all parties and filed with the federal district court on May 22, 1996. It was entered by the court on August 19, 1996.
IMPROVE	Interagency Monitoring of PROtected Visual Environments. A visibility monitoring program for national parks, wilderness, and wildlife refuges, managed by a steering committee of federal land managers, EPA, and state organizations.
IMPROVE Protocol	Visibility monitoring sites operated according to IMPROVE protocols for data comparability
IWAQM	Interagency Workgroup on Air Quality Modeling
LAGA	La Garita Wilderness
LTS	Long-Term Strategy
MABE	Maroon Bells/Snowmass Wilderness Area
MEVE	Mesa Verde National Park
MOMA	Mount Massive Wilderness Area
Smoke MOU	Colorado Smoke Management Memorandum of Understanding
MOZI	Mount Zirkel Wilderness particle monitoring site just outside the wilderness area boundary at Buffalo Pass
MZVS	Mount Zirkel Visibility Study
MZWA	Mt. Zirkel Wilderness Area
NADP	National Acid Deposition Program. A collaborative effort to routinely monitor acid deposition in a standardized manner using a central lab.
NESCAUM	North Eastern States for Coordinated Air Use Management
NFRAQS	Northern Front Range Air Quality Study
NO_x	Nitrogen Oxides
NPCA	National Parks and Conservation Association
NPS	National Park Service
PM_{10}	Particulate matter under 10 microns in diameter
$PM_{2.5}$	Particulate matter under 2.5 microns in diameter
PSD	Prevention of Significant Deterioration
RA	Reasonable attribution
RACM	Reasonably Available Control Measure
ROMO	Rocky Mountain National Park
SNOW	Snowmass/Maroon Bells Wilderness
SO_2	Sulfur Dioxide
SIP and Visibility SIP	

ABBREVIATIONS, ACRONYMS, & TERMS

	State Implementation Plan for Class I Visibility Protection
STAPPA/ALAPCO	State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officers
SVR	Standard Visual Range
Tri-State	Tri-State Generation and Transmission Association
TPY	Tons per year, (tpy)
USFS	U.S.D.A. Forest Service
USF&WS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
WESTAR	Western States Air Resources Council
WEMI	Weminuche Wilderness
WHRI	Snowmass/Maroon Bells Wilderness monitoring site in the White River National Forest

I. INTRODUCTION

Federal law and Environmental Protection Agency (EPA) regulations require states with Class I areas (large national parks and wilderness areas) to amend their State Implementation Plan (SIP) to include visibility protection. Source-specific "reasonably attributable" impairment must be addressed under Phase I of the visibility program. Regional haze is to be addressed under Phase II. EPA's Phase I regulations appeared in 1980. Subsequently, the Colorado Air Quality Control Commission (AQCC) adopted a Visibility SIP addressing Phase I requirements in late 1987. EPA approved the SIP in October 1988. Phase II regulations were promulgated in the Federal Register in July 1999. Colorado is required to submit to EPA a Phase II regional haze SIP by the end of 2007.

The Phase I Visibility SIP consists of five major sections: existing impairment, new source review, consultation with federal land managers, monitoring strategy, and the long-term strategy. In addition, EPA and State regulations mandate a periodic review and, if necessary, revision of the Long-Term Strategy (LTS) section of the Visibility SIP at least every three years. This review is based upon the State's assessment of its success in achieving reasonable progress toward the national visibility goal of preventing any future and remedying any existing visibility impairment in Class I areas under Phase I of the visibility protection program.

EPA and State regulations also require that Colorado, in assessing whether reasonable progress has been achieved, review its LTS and report on its findings in seven categories: (1) progress in remedying existing impairment of visibility in any Class I area; (2) the ability of the long-term strategy to prevent future impairment of visibility in any Class I area; (3) any change in visibility since SIP approval and assessment of existing conditions; (4) additional measures, including the need for SIP revisions, that may be necessary to assure reasonable progress toward the national visibility goal; (5) the progress achieved in implementing BART and meeting other schedules set forth in the long-term strategy; (6) the impact of any BART exemption; and (7) the need for BART to remedy existing impairment in an integral vista declared since plan approval.

Part I of the review and revision document is a report on the activities, actions, processes, and progress made with respect to these seven categories within the context of the existing LTS, adopted by the Commission in February 2002. There is also an extensive data analysis and review of visibility conditions in Colorado's Class I areas. The good news is that visibility on the best and cleanest days at 5 out of the 6 monitoring sites is getting better – the remaining site shows no trend. However, on the worst days visibility conditions have declined in recent years at half of the monitoring sites. This decline coincides with the extensive and severe drought conditions in the West. The analysis shows the decline is associated with increases in drought related haze components such as dust. It is likely that the worsening visibility is linked to wildfires and wind events caused by the drought. In addition to direct impacts from the drought, fewer precipitation events equate to less of a potential for natural removal mechanisms (i.e., rain and snow storms) scrubbing particles out of the air. The Division concludes that the worsening visibility is very likely due to the sustained and extensive drought in the western United States.

Colorado believes, based on an assessment of the State's achievements with respect to these seven categories including a review of visibility conditions, that the current Class I visibility program of the State of Colorado achieves reasonable progress toward the national visibility goal.

This current document is Part I and it is organized as follows: Section I is the Introduction; Section II is background information about the visibility program and Colorado's Visibility SIP; Section III is the LTS review; Section IV describes the consultation process with Federal Land Managers; and Section V contains endnotes.

Part II is a separate document containing a SIP revision to the LTS. The amendments are intended to reflect current conditions and plans.

II. BACKGROUND INFORMATION

A. INTRODUCTION TO THE CLASS I VISIBILITY PROGRAM

The Federal 1977 Clean Air Act Amendments in section 169(A)[1] set as a national goal:

"...the prevention of any future and remedying any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from man-made air pollution."

Section 169(A) requires the EPA to promulgate regulations to ensure reasonable progress toward meeting the national goal for those Class I areas where EPA has determined that visibility is an important value. In 1979, EPA identified 156 such areas, including all twelve Class I areas in Colorado (see Figure 1 in Appendix A.1). The twelve Colorado Class I areas are:

Black Canyon of the Gunnison Wilderness
Eagles Nest Wilderness
Flat Tops Wilderness
Great Sand Dunes Wilderness
La Garita Wilderness
Maroon Bells-Snowmass Wilderness
Mesa Verde National Park
Mount Zirkel Wilderness
Rawah Wilderness
Rocky Mountain National Park
Weminuche Wilderness
West Elk Wilderness

Section 169(A) also specifically requires EPA to promulgate regulations providing guidance for states to amend their SIPs to ensure reasonable progress toward meeting the national goal for these 156 areas. On December 2, 1980, EPA released those regulations.[2]

In 1987 the Colorado Air Pollution Control Division developed the Colorado State Implementation Plan for Class I Visibility Protection (Visibility SIP), which was adopted by the Colorado Air Quality Control Commission (AQCC) on November 19, 1987, and approved by the EPA in October 1988.[3] The Visibility SIP provides for review of visibility impacts for existing and proposed sources, formally incorporates consultation with the federal land managers, and includes a monitoring strategy and a plan for long-term progress toward the national goal, known as the Long-Term Strategy.

The Visibility SIP is Colorado's plan to remedy any existing and prevent any future visibility degradation in Class I areas under Phase I of the national visibility program. Periodic review and revision, if necessary, of the SIP through the LTS review process is required by EPA to ensure that reasonable progress is being made toward the national visibility goal.

B. NATIONAL REGULATORY HISTORY

This section is a brief summary of the national regulatory history of EPA's visibility requirements.

1. PHASE I REGULATIONS

On December 2, 1980 the EPA outlined a phased visibility program to ensure progress in achieving the national goal set forth by Congress. Regulations promulgated for Phase I of the program required Colorado and 36 other states with Class I areas to revise their SIPs to include visibility protection.[2]

Research conducted by EPA identified two general types of visibility impairment in Class I areas:

1. Impairment due to smoke, dust, colored gas plumes, or layered haze emitted from stacks which obscure the sky or horizon and are relatable to a single stationary source or a small group of stationary sources.

2. Impairment due to widespread, regionally homogeneous haze from a multitude for sources which impairs visibility in every direction over a large area, commonly referred to as regional haze.

EPA adopted a phased approach because it concluded that monitoring and regional scale modeling techniques, as well as knowledge concerning effectiveness of controls, were not fully developed for use in a regional haze regulatory program. EPA indicated regulations concerning more complex problems such as regional haze and urban plumes would be addressed in later phases.

Therefore, Phase I of the visibility regulations focused on "reasonably attributable" (RA) impairment and required states to:

1. Coordinate SIP development with the appropriate federal land managers (FLMs).

2. Develop programs to assess and remedy Phase I visibility impairment from existing major sources and to prevent visibility impairment from new sources.

3. Develop a long-term strategy to address reasonable progress toward the national visibility goal.

4. Develop a visibility monitoring strategy to collect information on visibility conditions.

5. Consider in all aspects of visibility protection any "integral vistas" (important views of landmarks or panoramas that extend outside of the boundaries of the Class I area) identified by the FLMs or states as critical to the visitors' enjoyment of the Class I areas.

The affected states were to submit to EPA revised SIPs satisfying these provisions by September 2, 1981.

a. Integral Vista Controversy.

An integral vista adopted into regulation can be afforded the same level of protection from visibility impairment as the Class I area itself or any lesser level of protection, as determined by a state on a case-by-case basis. Because views in the Western U.S. commonly extend for great distances, integral vistas are a controversial aspect of the Visibility SIP package.

Numerous parties sought judicial review of the EPA's 1980 visibility regulations in the U.S. Court of Appeals. Most of the controversy centered on the protection of integral vistas. The cases were consolidated as *Mountain States Legal Foundation vs. EPA.* In March 1981, the Court stayed the consolidated litigation pending EPA action on related administrative petitions and appeals. Because of the litigation and the uncertainty of the legality of the regulation, Colorado and 33 other states did not submit SIP revisions within EPA's original time lines.

The Department of Interior, as the federal land manager of the National Park Service and U.S. Fish and Wildlife Service, preliminarily identified integral vistas associated with Class I areas on January 15, 1981. However, both the Department of Interior and the Department of Agriculture (speaking for the U.S.D.A. Forest Service) later declined to officially list any vistas, in part because states already had sufficient opportunity through existing authority to protect integral vistas. Thus, the naming of integral vistas and incorporation of them into SIPs was left up to individual states.

Colorado was not required to incorporate integral vistas in its Visibility SIP because the FLMs declined to provide a finalized list. The SIP's original LTS indicated that an AQCC subcommittee "shall determine if integral vistas and/or other scenic vistas should be identified, and, if so, the criteria to be used for such identification." Extensive subcommittee discussion of the issues occurred during 1987-1989. Colorado's approach is reflected in the 1992 LTS[4] and the 1997 LTS.[5]

b. EDF/NPCA Lawsuit and Settlement.

In December 1982, the Environmental Defense Fund (EDF) and the National Parks and Conservation Association (NPCA) filed a citizen's suit alleging that EPA had failed in its mandatory responsibility under the 1977 Clean Air Act Amendments to promulgate SIPs for states that failed to do so. The 1984 court-approved settlement required EPA to develop Federal Visibility SIPs or Federal Implementation Plans (FIPs) for those states without an adopted revised SIP.

On November 24, 1987, EPA published final rulemaking incorporating FIPs into the SIPs of 29 states, including Colorado.[6] At the time a Colorado FIP was proposed, the EPA was in the process of reviewing a revised Colorado SIP developed by the Division and adopted by the AQCC in late 1987. The Colorado Visibility SIP was approved by EPA in October 1988.[3]

2. PHASE II REGULATIONS.

The Clean Air Act Amendments of 1990 added section 169(B) to the Act to address regional haze. Because regional haze and visibility problems do not respect state and tribal boundaries, the amendments authorized EPA to establish visibility transport regions as a way to combat regional haze. Congress also specifically ordered EPA to establish a transport region for Grand Canyon National Park, and to create a Grand Canyon Visibility Transport Commission (GCVTC). EPA established the GCVTC in November 1991. The GCVTC region included nine western states and 211 tribal lands. The Governors or their designees of each of the states, including Colorado, the leaders of four Indian tribes, and EPA and federal land managers (in an ex-officio capacity) served as the members of the GCVTC. The Commission adopted a work plan and committee structure in order to carry out its tasks. Technical committees drew upon expert resources in government, private industry, academia and environmental groups. The GCVTC's broad task was to recommend to EPA what measures, if any, are appropriate to address regional haze in Class I areas of the Colorado Plateau. The GCVTC delivered its final report to EPA on June 10, 1996.[7] Consistent with its responsibilities in sections 169(A) and 169(B) of the Clean Air Act, EPA proposed a regional haze regulation on July 31, 1997[8], responding in part to the GCVTC's recommendations. Phase II regulations regarding regional haze were finalized by EPA and promulgated in July 1999.[9] Colorado has chosen to develop its regional haze SIP following §308 of EPA's regulatory options and, as such, the SIP is due to EPA at the end of 2007.

3. STATE OF COLORADO'S PHASE I STATE IMPLEMENTATION PLAN FOR CLASS I VISIBILITY PROTECTION ADDRESSING REASONABLY ATTRIBUTABLE IMPAIRMENT

The various elements of Phase I of Colorado's Class I Visibility State Implementation Plan are spread throughout Colorado Air Quality Control Commission Regulation No. 3. The pieces are pulled together into one document for reference, *Colorado's Plan for Visibility Protection in Class I Areas.*[10] All of the components of the Visibility SIP are important to long-term visibility protection of Class I areas in the State and are integrated in varying degrees into the LTS review and revision protocol. Therefore, each of the components is briefly discussed in this section. For more information the reader is referred to the document mentioned above.

a. Existing Impairment.

The AQCC's Regulation No. 3, *Stationary Source Permitting and Air Pollution Emission Notice Requirements*, includes provisions to address impairment within Class I areas reasonably attributable to existing major sources.

Regulation No. 3 Part D §XIV.D provides for an affected FLM or the Division to certify visibility impairment in a Class I area due to an existing stationary source. Existing sources regulated under this program are those that were not in operation prior to August 7, 1962 nor for which construction was commenced on or after August 7, 1977, which have the potential to emit 250 tons or more of an air pollutant regulated by the Division.

The FLM or the Division may certify at any time that impairment exists in any Class I area.

If the Division reasonably attributes the impairment to an existing source, the Division must conduct a BART analysis and determine if additional emission limitations are required. If so, the source must apply for a BART permit from the Division. Once the permit is granted, the source must limit its emissions on a schedule not to exceed five years. At the time of Colorado's Visibility SIP development, the FLMs did not indicate that potentially reasonably attributable types of visibility impairment were present in any of Colorado's Class I areas. The Division concurred with the finding. However, in 1993 the USFS certified visibility impairment in the Mount Zirkel Wilderness in northwest Colorado.[11] The certification has subsequently been resolved and is discussed below in section III.B.1.a.

b. New Source Review.

Applicants for permits to operate as a major source must demonstrate that the proposed source will not have an adverse impact on visibility in any Class I area. Regulation 3 Part D §XIII.A sets forth a schedule for the participation of affected FLMs and consultation with the Division in the review process of such an analysis as part of the Prevention of Significant Deterioration (PSD) permitting application process.

The Division is required to consider any FLM determinations that the proposed source would have an adverse impact on visibility in the Class I area (Regulation 3 Part D §V.A.6, VI.A.6, and XIII.C). The Division may independently make its own determination. If the Division does determine that its own or the FLM's analysis demonstrates that an adverse impact would occur, the Division shall not issue the permit.

In addition to the analysis, a source may be required to conduct monitoring to establish the condition of, and impact on, air quality related values (AQRVs) in the Class I area that may be affected. Monitoring can be required both before completing a permit application to construct and during the construction and operation of the source (Regulation 3 Part D §VI.A.3, §VI.A.4, §XIII.B).

c. Consultation With Federal Land Managers.

Regulation No. 3 provides for participation by the FLMs in the new source review process. The FLMs may also make recommendations to the Division concerning integral vistas, identify impairment in any Class I area, and provide consultation concerning elements considered for inclusion in the monitoring strategy. The Division also is required to consult with the FLMs during development and review of the Long-Term Strategy (Regulation 3 Part D §XIV.F.1.a).

d. Monitoring Strategy.

The monitoring strategy in the SIP is based on the following four goals:

1. To provide information for new source visibility impact analysis.

2. To determine existing conditions in Class I areas and the source(s) of any certified impairment.

3. To determine actual effects from the operation of new major sources or modifications to major sources on nearby Class I areas.

4. To establish visibility trends in Class I areas to evaluate progress towards meeting the national visibility goal.

Potential new major sources must conduct visibility analyses utilizing existing visibility data. If data are adequate and/or representative of the potentially impacted Class I area(s), the permitees will be notified of the visibility levels against which impacts are to be assessed. If visibility data are not adequate, pre-construction monitoring of visibility may be required.

If the FLMs or the Division certify existing impairment in a Class I area, the Division will determine if the documented visibility impairment can be reasonably attributed to emissions from an existing local stationary source. In making this determination, the Division will consider all available data, including the following:

1. Data supplied by the FLM;

2. The number and type of sources likely to impact visibility in the Class I area;

3. The existing emissions and control measures on the source(s);

4. The prevailing meteorology near the Class I area; and

5. Any modeling that may have been done for other air quality programs.

If available information is not sufficient to make a decision regarding "reasonable attribution" of visibility impairment from an existing source(s), the Division will initiate cooperative studies. Such studies could involve the FLMs, the potentially affected source(s), the EPA, and others.

e. Long-Term Strategy.

The LTS is that portion of the Visibility SIP that is the State's long-term strategy for making reasonable progress toward remedying existing and preventing future visibility impairment.

EPA regulations require the State to: (1) develop a long-term strategy; (2) coordinate its LTS with existing plans and goals, including those of federal land managers, that may affect impairment in any Class I area; (3) demonstrate why the LTS is adequate for making reasonable progress toward the national goal and state why the minimum factors (listed in the next paragraph) were or were not addressed in developing the LTS; (4) consider the time necessary for compliance as well as the economic, energy, and non-air quality environmental impacts of compliance, the remaining useful life of any affected existing source, as well as the effect of new sources; (5) review its strategy no less frequently than every 3 years and consult with federal land managers during this process; and (6) report to EPA and the public on progress achieved toward the national visibility goal.

During development of the LTS the State must consider, at a minimum, the following six factors:

- *Emission reductions due to ongoing air pollution control programs*. For example, the attainment and maintenance of National Ambient Air Quality Standards in the Denver metropolitan area and other non-attainment areas throughout Colorado may reduce visibility impairment in a number of Class I areas in the State. If this is the case, the State should explain how this would contribute to reasonable progress.

- *Additional emission limitations and schedules for compliance*. For example, states may have to control other sources causing impairment not covered by BART to make reasonable progress toward the national goal.

- *Measures to mitigate the impacts of construction activities*. This recognizes that nearby construction activities can contribute to impairment in Class I areas. If this appears to be a problem in Colorado, then the State should explain in its LTS what measures it will take to mitigate these impacts.

- *Source retirement and replacement schedules*. The construction of new sources, which will ensure the early or scheduled retirement of older, less well-controlled sources, can greatly aid progress toward the national visibility goal over the long term.

- *Smoke management techniques for agricultural and forestry management purposes including such plans as currently exist within the State for this purpose.* The LTS should discuss measures that would constitute reasonable progress in relation to this issue.

- *Enforceability of emission limitations and control measures*. In some situations the enforceability of proposed or actual emission limitations and control measures on sources causing existing impairment may be an issue.

f. Colorado's LTS History and the Current Review and Revision.

Since the time the Colorado Visibility SIP was adopted by the AQCC in 1987, the LTS has been amended and/or reviewed on seven occasions:

- The original 1987 LTS was reviewed and revised in August 1992.

- After the 1993 certification of impairment, the EPA requested an informal LTS status report, which was supplied in December 1993.

- The 1996-97 LTS was formally reviewed and revised in two stages:

    - August 1996 -- focusing entirely on the Mt. Zirkel Wilderness Area certification of impairment and the incorporation of emission limitations for

the Hayden Generating Station; and

- April 1997 -- addressing all other issues.

- The LTS was comprehensively reviewed again in January 1999, but a SIP revision was not found to be necessary.

- Following the Craig Consent Decree in early 2001, the LTS was again amended in April 2001 incorporating emission limitations, schedules, and reporting requirements for Craig Units 1 and 2. The State, the USFS, and EPA concluded that the 1993 certification of visibility impairment involving Mt. Zirkel Wilderness Area was resolved.[12,13]

- The February 2002 LTS was comprehensively reviewed and the LTS portion of the SIP was updated and reorganized into a more readable format.[14]

Past LTS reviews and SIP revisions are available from the Division.

Part I of the current review and revision document is a report on the activities, actions, processes, and progress made with respect to the seven review categories within the context of the existing LTS, adopted by the Commission in February 2002. Colorado believes, based on an assessment of the State's achievements with respect to these seven categories, that the current Class I visibility program of the State of Colorado achieves reasonable progress toward the national visibility goal under Phase I of the visibility protection program.

Part II is a separate document containing a SIP revision to the LTS. The revision is a relatively small series of amendments intended to reflect current conditions and plans.

III. REVIEW OF COLORADO'S LONG-TERM STRATEGY

A. STATE AND EPA REQUIREMENTS

State regulations require the Division to periodically report to the AQCC on the progress made toward the national visibility goal. This report to the AQCC is being submitted to fulfill these requirements. A SIP revision is contained in a separate document.

EPA regulations require that the State provide this report to the public and the Administrator of EPA. Both EPA and State regulations require the report to include an assessment of:

1. The progress achieved in remedying existing impairment of visibility in any Class I area.

2. The ability of the long-term strategy to prevent future impairment of visibility in any Class I area.

3. Any change in visibility since the last such report, or in the case of the first report, since plan approval, including an assessment of existing conditions.

4. Additional measures, including the need for SIP revisions that may be necessary to ensure reasonable progress toward the national visibility goal.

5. The progress achieved in implementing BART and meeting other schedules set forth in the long-term strategy.

6. The impact of any exemption from BART granted to any facility.

7. The need for BART to remedy existing impairment in an integral vista declared since plan approval.

B. STEP-BY-STEP REVIEW

Each element of the review is presented in detail below.

1. PROGRESS IN REMEDYING EXISTING IMPAIRMENT OF VISIBILITY IN ANY CLASS I AREA.

The Class I Visibility SIP is focused on source-specific or plume-type impairment from single or small groups of stationary sources, consistent with Phase I of the implementation of EPA's visibility program.

a. Visibility Impacts in the Mt. Zirkel Wilderness.

In July 1993, the USFS certified visibility impairment in the Mt. Zirkel Wilderness Area and named the Hayden and Craig power stations as suspected sources.[11] As noted, upon certification by a federal land manager of visibility impairment in a Class I area, the Division must determine if it can "reasonably attribute" the visibility impairment to one or more existing

stationary sources. If so, the Division must conduct a BART analysis and as a result may order emission limitations for each pollutant at the facilities.

The Division considered existing information available at the time of the USFS certification of impairment to determine if it could make a decision to reasonably attribute visibility impairment within the MZWA to the Hayden and/or Craig generating stations. The Division concluded that existing information was insufficient to reasonably attribute. The Division's response was to collaboratively develop with other stakeholders the $3.5 million Mt. Zirkel Visibility Study (MZVS) in order to collect additional information. The MZVS was concluded in July 1996.[15]

For a complete review of the activities, studies, and events that have occurred in relation to this environmental matter, see the April 1997 and January 1999 LTS reviews (available from the Division). Below is a summary of the how the certification of impairment has been resolved.

(i). Hayden Station.

The certification of impairment made by the USFS regarding the Hayden Station was resolved through a settlement process that began in late 1995. On May 21, 1996, the Sierra Club, State of Colorado, owners of Hayden Station, and Environmental Protection Agency/Department of Justice executed an agreement -- the Hayden Consent Decree.[16] On May 22, 1996, the Decree was filed in federal district court. The court approved it on August 19, 1996. The Decree was intended to resolve a number of issues, including a successful Sierra Club lawsuit against the Hayden Station, the needs of the State's visibility regulatory program in relation to Hayden, and an EPA complaint against the facility. In addition, the Decree was intended to make progress toward reducing acid deposition in the Mt. Zirkel Wilderness.

Emission limitations, construction schedules, and reporting requirements taken from the Hayden Consent Decree were incorporated into the Visibility SIP by the AQCC on August 15, 1996. The State believes that these significant emission reductions will effectively eliminate the visibility impairment in the MZWA that could be associated with the Hayden Station. The State further believes that the Hayden Consent Decree effectively resolves the certification of impairment brought by the USFS against the Hayden Station. The Forest Service has concluded that its complaint against Hayden has been satisfied. EPA approved this SIP amendment on January 16, 1997.[17]

The construction of Hayden's control equipment progressed ahead of schedule. All compliance dates in the SIP and Consent Decree were met and the emission limitations for NOx, SO_2, opacity, and particulate matter have been consistently achieved in actual operation. The relevant emission limitations and monitoring requirements have been moved into the facility's Title V operating permit and the permit has been issued and the Consent Decree has been terminated.

(ii). Craig Generating Station (Yampa Project).

The certification of impairment made by the USFS regarding the Craig Station Units 1 and 2 was also resolved through a settlement process that began in Fall 1999. After Hayden was resolved in August 1996, attention turned to Craig Station Units 1 and 2. The Mt. Zirkel Visibility Study (MZVS) indicated to the Division that sulfate haze from Yampa Valley power plants occasionally entered the MZWA and along with regional haze contributed to visibility impairment. Thus, the focus to resolving the Craig Station portion of the certification was on reducing SO_2, the precursor pollutant of sulfate, from Craig Station Units 1 and 2. The State preferred to resolve the visibility certification through negotiated settlement. If settlement seemed unlikely, the State was prepared to resolve the certification using the available regulatory tools. At a meeting in late 1996 between the State, Craig Owners, and EPA, the State agreed to temporarily delay pursuing regulatory action in order to foster the collaboration needed to jointly develop additional information on various SO_2 emission reduction options and associated cost. Craig Station Units 1 and 2 at the time achieved 65% SO_2 control; both EPA and the State believed that an improvement in the degree of control would resolve the certification. A joint study, known as the Craig Station Flue Gas Desulfurization Study (Craig FGD Study), became the focus for a negotiated settlement. The information could also be used as part of a BART determination if needed. The study was completed in August 1999.[18]

There are other issues involved and parties concerned with emissions from Craig Station Units 1 and 2. The USFS has strong concerns about local emissions of SO_2 and NOx that may be associated with acid deposition and aquatic and terrestrial ecosystem effects in the MZWA. A 1996 Colorado statute provides FLMs with an opportunity to assert impairment to Class I areas by air pollution adversely affecting non-visibility related qualities of the area, such as the aquatic ecosystem.[19] The USFS did not trigger the law with an assertion related to MZWA and was awaiting the outcome of the resolution of the visibility certification and/or global settlement of all issues. In addition, the Sierra Club initiated a citizen lawsuit under the Clean Air Act in late 1996 directed against Craig Station Units 1 and 2 regarding opacity issues.

In Fall 1999, the Sierra Club, Craig Owners, EPA, the State, and the USFS began global settlement talks with an independent mediator. On September 22, 1999, EPA issued a SIP call to Colorado indicating the State had twelve months to resolve the certification regarding Craig Station Units 1 and 2.[20] The Craig Owners and Sierra Club concluded a Consent Decree and filed it with the federal district court on January 10, 2001. The court approved the agreement on March 19, 2001. The State resolved the certification of impairment for Units 1 and 2 of Craig Station by adopting emission limitations, schedules, and reporting requirements from the Craig Consent Decree into the Visibility SIP. The USFS concluded that, "the proposed reductions of both sulfur dioxide and nitrogen oxides will resolve all Forest Service issues relative to the Craig Stations and our 1993 Certification of Impairment."[21] The SIP was amended by the AQCC on April 19, 2001[12] and EPA published final approval of the SIP amendment after a public comment period.[13]

The upgrade at Craig Units 1 and 2 has been proceeding.

- Unit 1
  - Tie-in of the new control equipment began September 13, 2003.
  - The unit was initially started-up on October 27, 2003 with completion of NOx overfire-air boiler upgrades.
  - Completion of SO2 removal upgrades was completed November 18, 2003. SO2 removal has been consistently above 90% since mid-December 2003.
  - Completion of Unit 1 baghouses occurred on December 19, 2003.
  - Testing of NOx upgrades continued through the end of 4th quarter 2003.
- Unit 2
  - Tie-in of the new control equipment began March 13, 2004.

(iii). Other Stationary Sources and the MZWA.

The Division has found no evidence that other stationary sources potentially subject to BART may reasonably be attributed to cause or contribute to visibility impairment at MZWA under Phase I of the EPA visibility program. The USFS certification of visibility impairment, related to the Phase I program, has been completely resolved. Regional haze that impacts any Colorado Class I areas, including MZWA, will be addressed as plans for Phase II of the visibility program are prepared over the next few years.

(iv). Monitoring and the MZWA.

It is important to track the effect of the emission reductions at Hayden and Craig generating stations on visibility impairment near the Wilderness as well as on acid levels in sensitive lakes and the snowpack. Funding for and the collection of these data are provided variously by the USFS, U.S. Geological Survey, EPA, and the Division. Table 1 below provides a brief overview of monitoring activities in and around MZWA.

Table 1
Long-Term Visibility and Non-Visibility Air Quality Related Value Measurements In and Near the Mt. Zirkel Wilderness Area

Instrument, Measurement, or Sampler	1. Sponsor 2. Funding 3. History	Purpose
Continuous SO_2 monitor at Buffalo Pass Tower*	1. Colorado Air Pollution Control Division 2. $9,800/year by CAPCD 3. 9/97 through present.	Measures frequency and magnitude of SO_2 "hits" at Buffalo Pass as an indicator of the presence of Craig and Hayden emissions and potential impacts at the Mt. Zirkel Wilderness Area. The monitor provides hourly average SO_2. The purpose of the monitor is to determine whether trends are occurring as emissions change at Hayden and Craig 20 and 40 miles away, respectively, in the Yampa Valley.

Instrument, Measurement, or Sampler	1. Sponsor 2. Funding 3. History	Purpose
Continuous ambient nephelometer at Buffalo Pass Tower*	1. US Forest Service 2. $9,600/year by USFS 3. 1994 through present.	Measures frequency and magnitude of visibility episodes (the nephelometer measures light scattering, a component of visibility) at Buffalo Pass. This measurement provides hourly average light scattering but is subject to significant weather interferences. Periods "before" compared to "after" emission controls may be difficult to distinguish.
Automatic camera system	1. US Forest Service 2. $5,280/year by USFS 3. 10/90 through present	Three 35mm slides are taken each day and archived. The visual information can be used to document various types of visibility conditions and matched/collated with instrumental measurements.
IMPROVE aerosol monitor at Buffalo Pass Tower*	1. Initially USFS, now EPA as part of the national IMPROVE visibility monitoring network. 2. $14,000/year by EPA (for supplies and analysis) $33,000/year by USFS (for support of all Buffalo Pass Tower monitoring operations) 3. 1994 through present	Measurements include 1-in-3 day sampling, 24-hour filter based PM2.5 (chemically speciated) and PM10 (mass only). Light extinction reconstruction is calculated from the various aerosol constituents. Measurement of overall reconstructed light extinction is used for episode identification as well as trends. These reconstructed extinction data will be compared between the before and after periods. While this measure is not as prone to weather interferences as the nephelometer, other challenges in analyzing these data include changes in regional emissions, climatic variation, wildfire, and the nature of trying to distinguish episodic change in a 24-hour average.
National Acid Deposition Program (NADP) sampler at Buffalo Pass Tower*.	1. USFS 2. $12,288/year by USFS 3. 1984 through present	Measurement of acid precipitation-related chemical constituents. The network collects data on the chemistry of precipitation for monitoring of geographical and temporal long-term trends. The precipitation at each station is collected weekly. It is then sent to the Central Analytical Laboratory where it is analyzed for hydrogen (acidity as pH), sulfate, nitrate, ammonium, chloride, and base cations (such as calcium, magnesium, potassium and sodium).
Mercury deposition sampler at Buffalo Pass Tower*	1. USFS 2. $12,000/year by USFS 3. 1997 through present	Mercury deposition sampling is done through the NADP program. This site is sponsored and funded by USFS. The purpose is to measure mercury deposition. The sample is collected weekly and sent to the NADP's Central Analytical Laboratory.

Instrument, Measurement, or Sampler	1. Sponsor 2. Funding 3. History	Purpose
Snowpack chemistry sampling in March or April of each year prior to spring snowmelt.	1. USGS, NPS, USFS 2. $115,000/year 3. 1990 through present	Annual measurement of snowpack chemistry prior to spring snowmelt and the release of acids during the "spring acid pulse." The U.S. Geological Survey has been monitoring snowpack chemistry at more than 50 locations throughout the Rocky Mountain region, extending from northern New Mexico to northern Montana, annually since 1993. There are 20 sites in Colorado, including several in and near the Mt. Zirkel Wilderness. Some sites in Colorado have been monitored since 1990. The purpose of the monitoring is to: 1) have an integrated measurement of acid deposition and snow chemistry over the snow accumulation months in high altitude areas associated with sensitive high altitude aquatic ecosystems; 2) determine whether trends are occurring in the snowpack chemistry; and 3) provide indicators of regional and/or local source emission changes.
Lake sampling in Mt. Zirkel Wilderness (and 2 other wilderness areas) during summer and fall.	1. USFS/EPA/CDPHE/ USGS 2. $62,000 3. 1983 through present	Measurements of acid precipitation-related chemical constituents as well as overall measures such as hydrogen ion, pH, and buffering capacity of 3 lakes in the Mt. Zirkel Wilderness. The purpose of the long-term monitoring of these lakes is to: 1) determine the natural variance in chemistry of the lakes; 2) determine whether trends are occurring in the chemistry of lakes in the Mt. Zirkel Wilderness, and 3) provide information on the ambient chemistry of lakes in the Wilderness.

*Buffalo Pass monitoring tower is at the southern end of the Mt. Zirkel Wilderness.

The measurements provide a reasonably comprehensive network to track the emission changes through different parts of the key systems, including atmospheric emissions, visibility, precipitation, acid deposition, mercury deposition, snowpack and aquatic ecosystems. The Division:

- is compiling each data set;
- has contracted with the USGS to assist in the analysis - specifically focusing on snow chemistry, lake, wet deposition (NADP), and mercury data;
- has presented a draft analysis plan to interested stakeholders including USFS and EPA; and
- will write an interim report by the end of 2004 on the effects of the reductions at Hayden.

A final report will be completed by the end of 2008 on the effects of the reductions at Craig as well as an assessment of the combined effect of the decreases in emissions from both facilities.

b. Regional haze.

EPA published its final regional haze rule in July 1999.[8] The rule offers several different

approaches and timelines for preparing Phase II SIPs. Colorado's SIP will be due to EPA at the end of 2007. Although regional haze is not the focus of this report under the Phase I LTS review, monitoring data indicates that regional haze occurs on an episodic basis in all of Colorado Class I areas.[22] A brief overview of Division and Commission activities follows.

Since the last LTS review, the Division has continued to participate in technical forums of the Western Regional Air Partnership (WRAP). The WRAP is a collaborative effort of tribal governments, state governments, private industry, environmental groups, and various federal agencies to implement the recommendations of the Grand Canyon Visibility Transport Commission and to develop the technical and policy tools needed by western states and tribes to comply with the regional haze regulations. Division staff monitor, participate in, and/or attend meetings or activities of the Stationary Sources Forum, Mobile Source Forum, Emissions Forum, Fire Emissions Joint Forum, Modeling Forum and Ambient Monitoring and Reporting Forum. More information about the WRAP is located at its web page (www.wrapair.org).

In 2002-2003 the WRAP contracted with the Western States Air Resources Council (WESTAR) to produce a template for Section 309 SIPs. These are the implementation plans for states submitting plans under Section 309 of the Rule. The templates were developed by representatives of WESTAR and WRAP member states, tribes, and federal agencies to assist the states and tribes in meeting the requirements of the federal regional haze rule. The WESTAR working group, including a Division participant, completed a model SIP template and Technical Support Document for use by states that were submitting a Plan under Section 309. These plans from the states of Wyoming, Utah, Arizona, New Mexico and Oregon were submitted to the various EPA Regions by December 31, 2003.

The Commission held numerous informational briefings about the regional haze rule, its requirements, and issues. These briefings have also provided an opportunity for interested stakeholders to make their views known to the Commission regarding the various options open to Colorado under the regional haze rule. The Commission, during 2003, recommended that Colorado develop its SIP under §308 of the rule.

Currently, the WRAP has again contracted with WESTAR to develop a similar product for the states submitting Plans under Section 308 and 309(g). The 308 SIP template will be used by the states in the WRAP region to meet the requirements of the Rule. These plans are due to EPA by December 31, 2007.

The data from visibility monitoring sites in Colorado from 1997 through May 2003 is of additional interest due to the regional haze rule. These data are discussed in section III.B.3 and presented in graphical forms in Appendices A.2 through A.7 of this LTS review.

d. Ongoing Air Pollution Control Programs.

Since the February 2002 LTS review/report several activities in ongoing air pollution control programs have occurred that are relevant to this review.

(i). "Brown Cloud" & Power Plant Emission Reductions.

The AQCC and the Public Utilities Commission approved a voluntary SO_2 and NOx emission reduction agreement for several Xcel Energy power plants in the Denver metropolitan area in the summer of 1999. The cost of the $211 million project is being recovered over 15 years through a monthly charge to customers. Average residential customers will pay less than $1 per month. Commercial and industrial customers also will pay an additional charge to pay for these improvements.

The end of 2003 marked the first full year of operation of the completed emission reductions. Xcel estimates that it has reduced SO_2 from these facilities by 70% - going from 22,500 to 9,700 in 2003. A SO_2 emissions cap for the facilities of 10,500 tons/year is also part of the agreement. NOx has also decreased by approximately 20% or 2,500 tons in 2003. These efforts are local initiatives that are not federally required.

(ii). "Brown Cloud" & Trends Over Time.

The Commission adopted a visibility standard for the Denver metropolitan area in 1990 as required by State statute. The level of visibility in Denver is measured with a transmissometer – a device that continuously sends a known amount of light across a distance, in this case approximately 1.5 miles, and measures how much light arrives. It provides a measure of total atmospheric extinction, that is, the amount of light absorbed or scattered away from the light path by natural and anthropogenic causes. The standard is set at 7.6% of the light or an average extinction .076/MM (megameters) during any 4-hour block during daylight hours when relative humidity is lower than 70%. The transmissometer has been in place since 1990.

Recently the Division reprocessed and quality assured the entire hourly data set with the purpose of looking at trends across the more than 10 years it has been operating. Figure 2 in Appendix A.1 shows the trend in daily maximum extinction. The trend shows a 28% improvement since 1991. Figure 3 shows the trends in visibility standard exceedances and associated Visibility Standard Index (VSI) categories. The frequency of exceedances was approximately 70% of monitored days during the early 1990's. It has dropped to approximately 50% of monitored days in the early 2000's. The data also show no significant seasonality indicating that the distribution of good, moderate, poor, and extremely poor days is about the same regardless of the time of year. Overall data uncertainty is roughly 10% of the standard level. Therefore, while instrument uncertainties cloud exact trends, the Division believes the downward trend is real.

While it is premature to speculate on visibility improvements in Class I areas from the emission reductions at Front Range power plants or the reduction in the Brown Cloud, any gains made may also reduce the contributions from the urbanized Northern Front Range to haze intrusions into the pristine and scenic mountainous areas of the State.

(ii). Review of Ongoing Programs and Status of Redesignations.

The most comprehensive review of existing and ongoing programs as well as monitoring data and trends is contained in the Colorado Air Quality Control Commission's 2002-2003 Report to

the Public. This report in its entirety is included as Appendix C.

As recently as 1995 Colorado had 12 "non-attainment" areas within the State for carbon monoxide, ozone, and/or PM10 health standards. Generally, all of these areas now maintain good air quality. This progress reflects the effects of local, statewide, regional, and national emission control strategies (see Appendix F for more information). This clean up of Colorado's non-attainment areas has also benefited Class I visibility conditions to some unknown degree.

In the summer of 2003, the Denver metropolitan area violated the 8-hour ozone standard. EPA has designated all or parts of 9 counties in northeastern Colorado as nonattainment for the 8-hour ozone, though the nonattainment designation has been deferred through September 30, 2005 with the adoption of the Ozone Action Plan by the Colorado Air Quality Control Commission in March 2004 under EPA's Early Action Compact provisions.

The table below shows the designation status for Colorado non-attainment areas.

Table 2
Colorado Non-Attainment Areas Status as of 4/9/04

PM10	**Redesignations**	**Plan Amendments**
Aspen	AQCC approved 1/11/01; EPA approved 5/15/03, effective 7/14/03	None
Canon City	AQCC approved 10/17/96; EPA approved 5/30/00, effective 7/31/00	None
Denver	AQCC approved 4/19/01; EPA approved 9/16/02, effective 10/16/02	Plan amendment to be developed with MOBILE6 in 2004 or 2005
Lamar	AQCC approved 11/15/01; Governor submitted to EPA 7/05/02 - awaiting EPA action	None
Pagosa Springs	AQCC approved 3/16/00; EPA approved 6/15/01, effective 8/14/01	None
Steamboat Springs	AQCC approved 11/15/01; Governor submitted to EPA 7/05/02 - awaiting EPA action	None
Telluride	AQCC approved 3/16/00; EPA approved 6/15/01, effective 8/14/01	None

Table 2 Continued
Colorado Non-Attainment Areas Status as of 4/9/04

Carbon Monoxide		
Colorado Springs	AQCC approved 1/15/98; EPA approved 8/25/99, effective 9/24/99	Amendment to drop oxyfuels approved by AQCC 2/17/00; EPA approved 12/22/00, effective 2/20/01 Amendment using MOBILE6 to eliminate I/M from SIP and revise emission budget approved by AQCC 12/18/03; legislature approved 2/2004
Denver	AQCC approved 1/10/00; EPA approved 12/14/01, effective 1/14/02	Amendment using MOBILE6 to revise emission budgets approved by AQCC 6/19/03; Governor submitted to EPA 10/15/03; awaiting EPA action
Ft. Collins	AQCC approved 7/18/02; EPA approved 7/22/03, effective 9/22/03	
Greeley	AQCC approved 9/19/96; EPA approved 3/10/99, effective 5/10/99	Amendment using MOBILE6 to revise emission budget & to eliminate oxyfuels from the regulation/SIP & I/M from the SIP approved by AQCC 12/19/02; Governor submitted to EPA 6/20/03; emission budgets adequate 1/20/2004; awaiting final action
Longmont	AQCC approved 12/19/97; EPA approved 9/24/99, effective 11/23/99	Amendment using MOBILE6 to revise emission budget approved by AQCC 12/18/03; legislature 2/2004
Ozone		
Denver	AQCC approved 1/11/01; EPA approved 9/11/01, effective 10/11/01	Early Action Compact Ozone Action Plan approved by AQCC 3/12/04; legislature approved 4/30/2004

(iii). PSD Increment, Southwest Colorado, and Emission Tracking.

In letters commenting on the April 1997 and the January 1999 LTS reports, both the NPS and USFS raised issues about minor source permitting and tracking of emissions. In Colorado, a compliance demonstration with PSD increments is not required to obtain a minor source construction permit. Underlying these issues is a concern about the cumulative effects of the many recent and potential new minor sources as a result of the

development of oil and gas fields or due to growth along the Front Range. In response to the concerns, the Division proposed the following:

- a meeting with the NPS and USFS to listen to minor source permitting and impact concerns (this meeting occurred on March 2, 1998); and

- that the Division, NPS, and USFS contact the AQCC and request time to present an informational briefing to bring these issues to the attention of the public and other stakeholders (this occurred at the April 16, 1998 AQCC meeting).

From these meetings several issues emerged:

1) Federal land managers are concerned about minor source growth and emissions of NOx in several parts of the State, but especially in southwestern Colorado due to gas well development.

2) Land managers are also concerned about the likelihood of sources importing higher NOx emitting gas compressor engines into Colorado because Colorado does not require BACT for minor sources while Wyoming, Utah and New Mexico either do require BACT or its functional equivalent. A PSD increment study in southwestern Colorado could demonstrate the need for BACT.

2) A decision by Colorado to require minor sources to demonstrate compliance with PSD increments at the time of permitting would necessitate an AQCC rulemaking because the Division does not have authority to impose such a requirement under existing regulations.

4) There is need for a PSD increment modeling study in southwestern Colorado to determine how much of the NOx increment is consumed at Mesa Verde National Park and the Weminuche Wilderness as well as on Class II lands.

Prior to these meetings, the Division had prepared a PSD Increment Tracking System plan and submitted it to EPA. In July 1997, the Division received a favorable response from EPA to the plan. At the time of January 1999 LTS review, the Division had begun a S.W. Colorado NOx increment study.

The study was finalized in October 1999 and is available at the following web address: http://apcd.state.co.us/permits/psdinc/. Findings regarding the two Class I areas in the study domain and general results regarding Class II areas are included below:

> The Class I nitrogen dioxide (NO_2) increment is 2.5 micrograms per cubic meter (mg/m^3) on an annual basis. The maximum receptor at Mesa Verde National Park (MVNP) has an annual NOx concentration of 1.09 mg/m^3, according to the CALMET/CALPUFF modeling system.[3] The maximum receptor from CALMET/CALPUFF at the Weminuche Wilderness Area

(Weminuche) has an annual NOx concentration of 0.51 mg/m^3. Therefore, modeled concentration estimates at both Mesa Verde National Monument and at the Weminuche Wilderness Area are well below the Class I NO_2 increment. In addition, due to the magnitude of the impacts at the Class I areas, it's clear that no major source in Colorado consumes more than 75 percent of the increment at MVNP or Weminuche.[4]

Footnote 3: In the CALMET/CALPUFF modeling, no atmospheric conversion of NO to NO_2 has been assumed; that is, it has been assumed that all NOx emitted exists as NO_2. In addition, it has been assumed there is no deposition.

Footnote 4: Regulation No. 3, Part B, § VII.A.5.a states that new sources and modifications shall consume no more than 75% of an applicable increment. (p.14)

In general, the modeling suggests that the Class II PSD increments in the Colorado portion of the study area are not being violated over broad geographic areas. In most areas, about 4 to 8 mg/m^3 of the Class II increment of 25 mg/m^3 has been consumed; assuming 75 percent of all emitted NOx exists as NO_2. Areas with modeled estimates over 15 mg/m^3 are isolated and restricted to small geographic areas immediately adjacent to large NOx sources. Given the inherent and reducible [sic] uncertainties in the emissions and dispersion modeling system, the ISCST3 estimates are probably on the high side.
(p. 15)

Based on the results of this study, a snapshot of the level of nitrogen dioxide PSD increment consumption in S.W. Colorado found that about 45% of the Class I increment has been consumed at Mesa Verde National Park and about 20% at Weminuche Wilderness.

The National Park Service commented on a draft of the 2002 LTS review and revision and encouraged the Division "to track minor source activity for purposes of accounting for emissions growth and potential for visibility impacts on Class I areas." As a result, in the 2002 LTS review the Division stated it would produce for the next LTS review, a year-by-year tracking of minor source emissions for the report. Since the last LTS review, the Division has completed the Colorado Emission Inventory System. The system is able to track both minor and major stationary source emissions over time. Figure 4 in Appendix A.1 is a summary of the emissions totals by year for seven southern Colorado counties: Archuleta, Conejos, Costilla, Dolores, La Plata, Las Animas and Monteczuma. Please note that tribal emissions from the Southern Ute lands are not included. A significant amount of gas development has occurred on those lands that the State does not inventory nor does it show the activity in New Mexico. Figure 4 shows that SOx emissions are a minor concern from that area. NOx emissions have grown by about 2,000 tpy. The Division has also developed a County Emissions Inventory for Colorado that is on the web (www.cdphe.state.co.us/ap/aphom.asp, find

link for *Technical Services Program* and then to *Inventory*). The information has been developed from a variety of sources and reflects data for 2001.

Air quality issues in the SW portion of Colorado and NW portion of New Mexico have grown significantly since the Division's increment study and development of an emission tracking system. Below is a partial list of current activities:

- The BLM has completed a draft Environmental Impact Statement (EIS) for 10,000 additional wells. Cumulative source impacts are predicted to exceed visibility thresholds at both Mesa Verde National Park and Weminuche Wilderness. BLM must recommend an air quality mitigation in the final EIS and record of decision.
- A trend of increasing high measured ozone in the Farmington area have led to the State of New Mexico to put into place an Early Action Ozone Compact in San Juan County to address the issue and begin to lay the ground work for reducing emissions of NOx and/or organic carbon.
- Two coal-burning power plants (1,500 MW and 5-600 MW) have been proposed in the same general area in New Mexico.
- The State of New Mexico has proposed a collaborative stakeholder based approach to address the multiple air quality issues (i.e., visibility, nitrate deposition, PSD increment, toxics, ozone, road dust) facing the area.
- New Mexico is working with EPA, federal land managers, and the other 4-Corners states (including Colorado) in scoping-out a comprehensive increment study not only for NOx but NO2, SO2 and PM10 as well.
- The National Park Service has supported the comprehensive increment study but has requested that current/potential visibility impacts be added and that all the Class I areas in the vicinity be included.

The Division has provided inventories as requested, attended briefings and reviewed EIS' as appropriate. There is considerable reason to believe that one or more large-scale studies will result – driven by the proposed power plants, the ozone issue, the EIS, and/or visibility concerns. The Division will participate as appropriate and will provide a status report in the next LTS review.

2. THE ABILITY OF THE LONG-TERM STRATEGY TO PREVENT FUTURE IMPAIRMENT OF VISIBILITY IN ANY CLASS I AREA.

Generally, the State of Colorado considers its New Source Review and Prevention of Significant Deterioration (PSD) programs as meeting the long-term strategy requirements for preventing future impairment from proposed major stationary sources or major modifications to existing facilities. In addition, there are specific activities the Division has undertaken.

a. Modeling Guidance.

The Division has published modeling guidance that presents methods for estimating impacts from stationary sources of air pollution. The guideline is intended to help permit applicants, air quality specialists, and others understand the Division's expectations for the ambient air impact analysis and to prevent unnecessary delays in the permit process. It provides a starting point for modeling, but allows the use of professional judgment. The guidance contains sections on visibility modeling. In 2001, a technical peer review of the guidance was completed. A more general public review process was finished toward the end of that year. The finalized guidance document is available via the Air Pollution Control Division's web site at: http://apcd.state.co.us/permits/cmg.html.

b. Smoke Management.

Colorado believes its smoke management program is protective of public health and welfare as well as Class I visibility. The Division will be sending its program to EPA for certification later in 2004 under EPA's *Interim Air Quality Policy on Wildland Prescribed Fire*, May 1998. The program is described below.

(i). Regulation No. 9.

Regulation No. 9 (Open Burning, Prescribed Fire, and Permitting) is the main vehicle in Colorado for addressing smoke management. In addition to its permitting sections, it implements Colorado Senate Bill 01-214 ("Concerning the Application of State Air Quality Standards to the Use of Prescribed Fire for Management Activities Within the State and Making an Appropriation Therefor") that became law in 2001. The regulation also incorporates permitting and reporting requirements for all users of prescribed fire similar to those in State's past Smoke Management Memorandum of Understanding (MOU). The AQCC adopted the regulation on January 17, 2002.

Regulation No. 9 is in eight sections:

I. Scope
II. Definitions
III. Open Burning Permit Requirement
IV. General Open Burning Permits
V. Planned Ignition Fire Permits
VI. Unplanned Ignition Fire Permits
VII. Additional Requirements for Significant Users of Prescribed Fire
VIII. Fees

The rule applies to all open burning activity within Colorado, with certain exceptions. Section III specifically exempts agricultural open burning from the permit requirement.

After the scope and definitions sections, the rule has several sections regarding permitting and other requirements applicable to open burning of various types. The open burning

permitting section of Regulation No. 1, Section II.C has been moved and reorganized into Regulation No. 9, but not substantively revised. These provisions are now found in section III and parts of section IV. Section IV contains requirements for a general open burning permit and associated permit conditions. Sections V and VI contain the permitting, information, modeling and reporting requirements, as well as a smoke risk rating process and permit conditions for planned ignition prescribed fires to insure that prescribed fires neither violate National Ambient Air Quality Standards nor have unacceptable visibility impacts. These provisions are similar to the past voluntary agreements among signatories of the Colorado Smoke Management MOU for prescribed fire. The regulation, however, applies to all users of prescribed fire above a de minimus level. The rule also specifies requirements regarding suppression of prescribed fire if monitoring and/or air pollution levels indicate that permit conditions, the burn prescription, and/or air quality standards have been or will be exceeded. The Division's draft permits for large burns with a high smoke-risk are subject to a 30-day public comment period and the opportunity for a public comment hearing before the Commission. The Division will disclose potential visibility impacts of these proposed fires and must consider comments when determining whether to grant, conditionally grant, or deny the final permit.

Sections VII and VIII are the elements of the regulation that implement SB01-214. Section VII addresses how significant users of prescribed fire (i.e., those that own or manage 10,000 acres and generate at least 10 tons of PM_{10} annually from use of prescribed fire) must submit planning documents to the Commission. The regulation identifies the contents of the planning documents. The rule further requires that all such prescribed fire activities of significant users shall conform to the State standard to "minimize emissions using all available, practicable methods that are technologically feasible and economically reasonable." SB 01-214 directs the Commission to hold a public hearing regarding each planning document and to develop any necessary comments and recommendations to bring the plans into consistency with the State goal. After July 1, 2002 the Division cannot issue open burning permits to significant users for lands whose planning documents and fuel management decision-making are inconsistent with Commission recommendations and comments. The Commission has had hearings on the planning documents of the U.S.D.A. Forest Service, U.S.D.I. Bureau of Land Management, Colorado Division of Wildlife, U.S.D.I. National Park Service, D.O.D. Fort Carson, and U.S.D.I. Fish and Wildlife Service. All were approved unanimously.

Fees are discussed in section VIII. No fees are charged for general permits (local authorities may charge fees under their own authority). Significant users of prescribed fire pay fees of $59.98/hour to the Division for review of planning documents. Prescribed fire permitees pay for the cost of the prescribed fire program based on a cost distribution methodology. The Division's Fiscal Officer calculated the cost of the program to be $129,646.45 at the outset of the program beginning in calendar year 2002. The Statement of Basis, Specific Statutory Authority and Purpose of the regulation also specifies the Commission's intent that the Division annually calculate the cost to administer the program and report to the Commission each August on program costs, projections, and revenues. If the cumulative cost varies more than 5% from the total fee amount in regulation, the Division will seek a fee change before the Commission in a properly noticed public hearing. In addition, the Statement indicates that any deficits not be

funded by stationary source fees. The cost of the program rose to $144,309.85 beginning in calendar year 2003 as a result of the program hiring an additional staff person primarily as a field liaison and to conduct compliance assistance with permitees.

While not included in the rule, it is important to note that the statute also finds the prescribed fires of significant users conducted on lands the primary purpose of which is nonagricultural to be for "commercial purposes". The effect is to subject any such activity conducted without a permit to significantly higher fines than previously (i.e., up to $100/day for "noncommercial purposes" and up to $10,000/day for "commercial purposes").

In March 2004, the Commission approved changes to Regulation No. 9 allowing the permitting of Air Curtain Destructors (ACD) to be used for the narrow purpose of burning wildland fuels generated as a result of projects to reduce the risk of wildfire. The use of ACDs in lieu of pile burning will significantly reduce emissions from defensible space and other types of wildfire risk reduction projects.

(ii). The Regulation, the Smoke MOU, and Visibility Protection.

Section III.A of the regulation requires anyone seeking to conduct open burning to obtain a permit from the Division. Regulation No. 9 also contains a number of factors the Division must consider in determining whether and, if so, under what conditions, a permit may be granted. Many of these factors relate to potential visibility impacts in Class I areas. For example,

- the potential contribution of such burning to air pollution in the area;
- the meteorological conditions on the day or days of the proposed burning;
- the location of the proposed burn and smoke-sensitive areas and Class I areas that might be impacted by the smoke and emissions from the burn;
- whether the applicant will conduct the burn in accordance with a smoke management plan or narrative that requires:
    - that best smoke management methods will be used to minimize or eliminate smoke impacts at smoke-sensitive receptors (including Class I areas);
    - that the burn will be scheduled outside times of significant visitor use in smoke-sensitive receptor areas that may be impacted by smoke and emissions from the fire; and
    - a monitoring plan to allow appropriate evaluation of smoke impacts at smoke-sensitive receptors.

The regulation requires all prescribed fire permitees to submit an application to the Division. Planned ignition burns must include a computer model output that indicates the meteorological conditions under which the planned ignition is proposed and the air pollution (including visibility) impacts. A permit is granted only if the modeling run demonstrates that under the prescribed meteorological conditions for the burn there will be no unacceptable air pollution (including visibility) impacts. The Simple Approach Smoke Estimation Model (SASEM) is used to evaluate most projects in Colorado. The Division reviews the modeling outputs that accompany each permit application and determines if the burn can be conducted without causing

unacceptable visibility impacts within Class I areas, as well as other smoke sensitive sites. In addition, the regulation provides that the Division may impose "permit conditions necessary to ensure that the burn will be conducted so as to minimize the impacts of the fire on visibility and on public health and welfare."

Permitees are also required to report actual activity to the Division. Depending on the size and type of fire, reporting may be a daily requirement. At a minimum, each year all permitees must return their permit forms with information indicating whether or not there was any activity in the area covered by the permit and, if so, how many acres were burned. The Division annually prepares a report on prescribed burning activity and estimated emissions. Reports from 1990 through 2000 are available by contacting the Division.

As mentioned above, the regulation requires that the draft permit for any proposed prescribed fire rated as having a "high" smoke risk rating be subject to a 30-day public comment period. The notice for the public comment period must contain information relating to the potential air quality and visibility impacts at smoke sensitive receptors, including Class I areas.

The Division's web site contains information about the various aspects of Colorado's Smoke Management Program, downloadable forms and instructions, on-line forms, and links. It is also used to contain the notices for public comment periods for the draft permits subject to public comment.

Operational understandings relating to prescribed fire activity have historically been done within the MOU. The Colorado Department of Public Health and Environment, the Forest Service, National Park Service, Bureau of Land Management, Fish and Wildlife Service, Air Force Academy, U.S. Army (Fort Carson), U.S. D.O.E. Rocky Flats Field Office, City of Boulder Wildland Fire Department, Colorado Division of Wildlife, and the Colorado State Forest Service are signatories to the MOU. The current MOU was revised during 2000 and became effective during calendar year 2001. As stated above, the MOU will be revisited during calendar year 2004 with the Division's major prescribed fire permit customers. The MOU can then be re-negotiated with a focus on clarifying any operational issues that have emerged since the adoption of the regulation. Similar to Regulation No. 9, the MOU requires each signatory focus on Class I visibility protection when planning burns:

> "Each land management signatory, shall, on a case-by-case basis, explicitly consider potential visibility impacts of smoke in Class I areas and other important scenic views." [Emphasis added.]

3. CHANGES IN VISIBILITY SINCE SIP APPROVAL AND ASSESSMENT OF EXISTING CONDITIONS

Visibility monitoring is being performed in or near a number of Colorado's Class I areas. The specific purposes of monitoring may vary, but generally include assessing existing conditions and trends as well as learning more about the sources of visibility impairment in Colorado's Class I areas.

The routine visibility monitoring performed in Colorado's Class I areas are at IMPROVE or IMPROVE Protocol sites. IMPROVE is an acronym that stands for Interagency Monitoring of PROtected Visual Environments. IMPROVE is a cooperative visibility monitoring effort of the EPA, NPS, USF&WS, BLM, USFS, Western States Air Resources Council (WESTAR), Mid-Atlantic Regional Air Management Association (MARAMA), North Eastern States for Coordinated Air Use Management (NESCAUM), and the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officers (STAPPA/ALAPCO). IMPROVE Protocol sites are operated using the same equipment and procedures as other sites in the IMPROVE network across the country, allowing comparisons of data from all these sites. IMPROVE sites are funded by EPA. IMPROVE Protocol sites are funded by the sponsoring federal land management agency or state. Sites are operated by the NPS, BLM, or the USFS. The State of Colorado does not directly fund any of these sites. IMPROVE has an extensive web site at: http://vista.cira.colostate.edu/improve. Graphically processed IMPROVE data as well as links to photographic images of various haze levels at Class I areas and meteorological data are found on the Visibility Information Exchange Web System (VIEWS) at: http://vista.cira.colostate.edu/views/.

The types of visibility monitoring being performed in Colorado's Class I areas and some of the results of this monitoring are summarized in this section of the LTS review. The section is divided into three major parts:

a. Monitoring Methods and Network -- a very brief discussion of each of the types of routine visibility monitoring performed in Colorado and a description of the monitoring network in place as of December 2003.

b. Site-By-Site Data Summaries -- summaries of the routine data available as of early December 2003 collected by these methods, a short discussion of the data, and of possible data trends of each site (park or wilderness area).

c. Overall Conclusions from the Routine Monitoring -- statements about visibility levels, sources, and trends in Colorado's Class I areas.

a. Monitoring Methods and the Network.

Routine visibility monitoring consists of three general components. The first, view monitoring, is used to document the visual quality of a scene. The second component, atmospheric optical monitoring, measures basic optical properties of the atmosphere (e.g., atmospheric extinction, light scattering) that relate to the atmosphere's ability to cause visibility impairment. In some of Colorado's Class I areas atmospheric extinction is directly measured with a transmissometer. At one of the monitoring sites, a nephelometer monitors the scattering coefficient of ambient air. The third component of most routine visibility monitoring systems, particle monitoring, measures fine atmospheric particles that are responsible for visibility impairment. This third component is considered the core method for IMPROVE and at each site, at a minimum, is a chemically speciated fine particle monitor. Each general component of

monitoring is described in more detail below. For a discussion of various visibility metrics (e.g., extinction) see Appendix B.

(i). View Monitoring.

Camera systems are used to document visibility in a view from a fixed location. A specially constructed camera system automatically takes slides of a view at regularly scheduled times each day (usually three times per day). The slides provide a qualitative record of visibility conditions that exist at a site.

Automated camera systems are in place at the following sites to monitor visibility conditions in or near the following Class I areas:

- Eagles Nest Wilderness (EANE);
- La Garita Wilderness (LAGA);
- Maroon Bells-Snowmass Wilderness site in the White River National Forest (MABE); and
- Mt. Zirkel Wilderness (ZIRK).

In addition, camera systems are in place at the following Class II wilderness areas:

- Lost Creek Wilderness (at the Devil's Head Fire Tower) (DEHE); and
- Mount Massive Wilderness (MOMA).

In the past automated camera systems operated at the following sites (the letters in parentheses below are how each site is referenced within the IMPROVE data management system):

- Colorado National Monument (COLM);
- Dinosaur National Monument (DINO);
- Great Sand Dunes National Monument (GRSA);
- Mesa Verde National Park (MEVE);
- Rocky Mountain National Park (ROMO);
- West Elk Wilderness (WEEL); and
- Weminuche Wilderness (WEMI).

Once a multi-year visual record of site conditions is collected, the camera systems are removed and installed to document conditions at another site. A spectrum of various visibility conditions seen on the slides taken at a given site and relationship to other monitoring if available are archived onto a photo CD and uploaded to the VIEWS web site.

(ii). Atmospheric Optical Monitoring.

Atmospheric extinction describes the ability of particles and gases in the atmosphere to attenuate light over a given distance (e.g., per kilometer). Extinction occurs due to the scattering and absorption of light from gaseous and aerosol constituents of the atmosphere. A

transmissometer is an optical visibility monitoring device, which can continuously measure atmospheric extinction. The instrument accomplishes the measurement by sending a light beam of known intensity to a distant receiver and measuring the resulting loss of light. A nephelometer directly measures the scattering component of atmospheric extinction.

High relative humidity, rain and fog events reduce visibility. Data collected during periods experiencing such events are often excluded from transmissometer and nephelometer data in order that it reflect anthropogenic influences. Transmissometer data are collected at the following IMPROVE sites (the letters in parentheses below are how each site is referenced within the IMPROVE data management system):

- Mesa Verde National Park (MEVE), through May 1993; and
- Rocky Mountain National Park (ROMO).

Nephelometer data are collected at:

- Mt. Zirkel Wilderness (MOZI).

Standard visual range (SVR) may be calculated from the extinction and scattering measurements with a number of assumptions. Visual range is defined as the farthest distance at which a large black object on the horizon can be seen. SVR is visual range, which has been normalized, taking into account the effect of altitude on the visual range.

(iii). Particle Monitoring.

Atmospheric particle monitoring is accomplished by a combination of particle sampling and sample analysis. Simultaneous particulate samples are collected in the four channels of the IMPROVE Particle Sampler: three $PM_{2.5}$ samples (particles less than 2.5 microns in diameter) on different filter types (Teflon, nylon, and quartz) and one PM_{10} sample (particles less than 10 microns in diameter) on a Teflon filter. The filters are subsequently analyzed for total mass, elements, organic and light absorbing carbon, ions, and optical absorption. Particulate monitoring is used to quantify and identify the air pollutants responsible for visibility degradation. Atmospheric extinction can be reconstructed from these chemically speciated aerosol samples – this is the core method EPA has selected for monitoring haze. Typically, an IMPROVE Sampler takes a 24-hour sample once every three days. The IMPROVE web site contains literature that indicates[23] the overall uncertainty (defined as the ratio of the mean precision from all sources divided by the mean concentration) is 4% to 7% for most variables and >15% for organic carbon. These numbers reflect precision – accuracy is unknown.

Particulate monitoring with an IMPROVE Sampler is performed in or near the following Colorado Class I areas (the letters in parentheses below are how each site is referenced within the IMPROVE data management system):

- Great Sand Dunes National Monument (GRSA).
- Mesa Verde National Park (MEVE).

- Weminuche Wilderness Area (WEMI).
    - This monitoring site also represents visibility conditions in La Garita Wilderness and Black Canyon of the Gunnison Wilderness.
- Snowmass/Maroon Bells Wilderness site in the White River National Forest (WHRI).
    - This monitoring site also represents visibility conditions in West Elk Wilderness, Eagles Nest Wilderness, and Flat Tops Wilderness.
- Mount Zirkel Wilderness Area (MOZI).
    - This site also represents visibility conditions in the Rawah Wilderness.
- Rocky Mountain National Park (ROMO).

b. Routine Monitoring Data Summary.

A number of the visibility monitoring sites in Colorado's Class I areas have been in operation for several years. Table 3 below is a summary of the types of monitoring and the dates when monitoring has occurred at each of the sites.

Table 3
Routine Visibility Monitoring

SITE	CAMERA	TRANSMIS-SOMETER	NEPHELO-METER	IMPROVE PARTICULATE MONITORING	SITE TYPE[1]
BLCA Black Canyon	2/85-11/93				BLM - IMPROVE PROTOCOL
COLM Colorado N.M.	7/81-9/91				NPS – IMPROVE PROTOCOL
COLP Louisiana Pacific	7/92-1/97				NPS - IMPROVE PROTOCOL
DEHE Devil's Head Fire Tower	5/94-				USFS- IMPROVE PROTOCOL
DINO Dinosaur	9/79-2/81 6/85-9/91				NPS- IMPROVE

1 IMPROVE Protocol sites are operated using the same equipment and procedures as other sites in the IMPROVE network across the country, allowing comparisons of data from all these sites. IMPROVE sites are funded by EPA. IMPROVE Protocol sites are funded by the sponsoring federal land management agency or state. Sites are operated by the NPS, BLM, or the USFS.

SITE	CAMERA	TRANSMIS-SOMETER	NEPHELO-METER	IMPROVE PARTICULATE MONITORING	SITE TYPE[1]
N.M.					PROTOCOL
EANE Eagle's Nest	6/93-				USFS-IMPROVE PROTOCOL
GRSA Great Sand Dunes	7/87-4/95			5/88-	NPS - IMPROVE
LAGA La Garita	9/97-				USFS-IMPROVE PROTOCOL
MEVE Mesa Verde	9/79-4/95	9/88-7/93		3/88-	NPS - IMPROVE
MOMA Mt. Massive	7/97-				USFS - IMPROVE PROTOCOL
MOZI/ ZIRK/ COYV/ COHP Mt. Zirkel	10/90- up to 3 sites at times		12/93-	12/93-	USFS - IMPROVE
ROMO Rocky Mtn. NP	10/85-1/95	12/87-		10/87-	NPS - IMPROVE
WEEL West Elk	7/92-11/96				USFS - IMPROVE PROTOCOL
WEMI Weminuche	7/86-8/93			3/88-	USFS - IMPROVE
WHRI/ MABE Maroon Bells/ Snowmass	12/91-			7/93-9/99 (channel A only) 9/99- (full IMPROVE)	USFS – IMPROVE PROTOCOL USFS – IMPROVE

In 2003, two temporary sites were installed in Western Colorado. The sites use IMPROVE protocols and equipment but are unable to utilize one of the analytical laboratories under contract to the long-term sites. As such, these temporary sites are known as IMPROVE Look-Alike sites. One is at the north end of the Flat Tops Wilderness at Ripple Creek Pass and is funded by Shell Exploration and Production Company. The other is to the west of the first site nearly on the border with Utah at Douglas Pass. This site is funded by the Colorado Governor's Office of Energy Management and Conservation. The sites were installed and are operated by a consulting firm, Air Sciences. The Division has provided technical support and advice as needed. These sites are funded for operation for 3 and 2 years respectively. As data are processed from these sites, they will be uploaded to the VIEWS site annually.

A new IMPROVE protocol site has recently (Summer 2004) been added to the network within Colorado by the USFS. The Shamrock Mines site near Vallecito and the Weminuche Wilderness is intended to supplement the existing Weminuche Wilderness site. Shamrock Mines is at a much lower altitude than the current site and NOx and ozone are also monitored at the new site. The USFS is concerned with the cumulative impacts of oil and gas development in the 4-corners region and believes the new location will better capture pollutants in the area.

For IMPROVE and IMPROVE Protocol sites in Colorado the camera, transmissometer, and nephelometer based data are collected, analyzed, and archived by Air Resource Specialists, Inc. (ARS), the contractors to IMPROVE, NPS, USFS and BLM for optical data. The particle data are collected, analyzed and archived by the University of California at Davis, the contractors to IMPROVE, NPS, USFS and BLM for particle measurements. These raw data may be downloaded from the IMPROVE or VIEWS web sites.

Selected particulate monitoring data from the Class I areas listed in the above table have been summarized, analyzed, and included in this section of the LTS review. For this LTS, the Division is utilizing a computer program it has created to follow the multiple data processing steps detailed in EPA's *Guidance for Tracking Progress Under the Regional Haze Rule*[24]. The program starts with quality assured data downloaded from the VIEWS web site and performs the compositing and lengthy missing data analysis steps. The output of the program consists of processed data used by the Division to analyze and produce an extensive series of graphs and plots for each monitored Class I area in Colorado. The Division recognizes that this LTS Review is not part of the regional haze program. Nevertheless, the Division wants to use common data sets consistent with the *Guidance* for both parts of the visibility protection program in order to avoid confusion. Data processed consistent with the *Guidance* provides data sets useful to the purposes of this section of the LTS review.

c. Site-By-Site Data Summaries Starting with 1997 Data.

Figure 1 in Appendix A.1 contains a map of the Class I areas in Colorado. Camera data are not presented in this report since the slides are used as a qualitative measurement of visibility conditions. A set of slides or electronic images for each of the sites, which includes examples of poor, average, and good visibility, are available on the VIEWS web site. Only sites with particle

monitoring are presented below. Past LTS reviews present data from discontinued slide/densitometry analyses and transmissometers.

(i). Data Prior to 1997 Not Utilized.

Data from some Class I areas extend back into the late-1980's or early-1990's. However, data prior to 1997 are not used in this LTS review. This is due to an operational change in the IMPROVE network affecting nitrate in 1996. At the time this change was not forecast to cause any systematic bias in the data. Since then, it has been noted that abrupt differences in nitrate occurred after the operational change at many sites. IMPROVE has been working to resolve the issue regarding how to handle pre-1997 data (see footnote below containing relevant portions of the minutes from the June 2003 IMPROVE Steering Committee meeting).[2] For the purposes of this LTS review, the Division has chosen to start with 1997 and assume that after the operational change, all the nitrate data are "good". This is consistent with IMPROVE's approach.

(ii). The Plots and Graphs Constructed for This Review.

As mentioned earlier, contractors perform a number of analyses on the various particulate filters collected within the IMPROVE Sampler. This information can be used to reconstruct chemically speciated fine mass, extinction, and deciview estimates. The particulate matter collected on the filters is analyzed to determine the mass of various chemical elements and ions. From these data the amount of various constituents is calculated. For example, from the measured silica, aluminum, calcium, iron, and titanium the fine soil contribution to the mass is calculated. The fine particle mass budgets can be misleading in estimating the contribution of each constituent to actual visibility impairment. The constituents of fine particle mass do not contribute to visibility impairment equally on a per unit of mass basis. Therefore, the Division reports reconstructed extinction budgets for sites with aerosol monitoring to estimate the contribution to actual visibility impairment by the different types of fine particles. Extinction is expressed as an amount of extinction per unit distance, in this case a megameter (e.g., 30/MM). Trends in the haze index, known as deciview (dv), are also provided for each site.

In figures with speciated reconstructed extinction, extinction is divided into 6 categories:

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2 **Handling the Nitrate Trends Issue**

"Abrupt changes occurred in nitrate data at many IMPROVE sites, which affected both magnitude and variability. The addition of glycerin to the Module B denuder in 1996 corresponds roughly to the time of the first nitrate change. The second change occurred in 2000 data, but no known change in the denuder protocol occurred at that time. The amount of change varies by site. Both NPS ARD and CIRA personnel worked on this issue and compared results. The current solution is to replace the nitrate values with arbitrary, constant values, and test other variables to see if missing values can be replaced. Then generate daily aerosol extinction and sort into quintiles (10-30-50-70-90) based upon reconstructed extinction. Then replace the arbitrary nitrate values with estimated constant nitrate values by group, and recalculate the budgets. The current procedure for nitrate substitution value generation is: 1) assume the nitrate data are "good" after 1996, 2) generate budgets for 1997-1999 and sort into annual 10-30-50-70-90 groups, and 3) compute average nitrate by site, group, and year. Unresolved issues are: 1) budget generation procedures have changed since nitrate substitution values were first generated – we need to recalculate, 2) which are "good" data, and when should we substitute, 3) should we generate new substitution values when we get new data, 4) should we apply substitutions at sites that began after 1996, 5) what should we use for nitrate during the initial sort, 6) how can we substitute without altering the seasonal distribution of clean/hazy days, 7) do we need four years of data prior to "good" data to generate substitution values for missing values of all variables, and 8) at what point can we stop substituting for nitrate? This is not an important issue for the regional haze regulations, which use baseline data from 2000-2005. It is an issue, however, for historical trends work. Discussion resulted in a sub-committee being formed to look into the nitrate issue."

- The *ammonium sulfate* portion of the budget is primarily produced by emissions of SO_2 from industrial facilities, including smelters and power plants.

- *Ammonium nitrates* are generated from nitrogen oxide gases that come from mobile and stationary sources of fuel combustion as well as agricultural operations.

- Industrial emissions, forest fires, and biogenic emissions (emissions of compounds from biological processes) contribute to the *organic carbon* portion.

- The *elemental carbon* portion of the budget is due to sooty, black carbon from industrial and transportation sources and forest fire combustion.

- Because of the lower humidity and sandy soils in the West, emissions of *fine soil* dust and *coarse mass* particles contribute to extinction.

The Division recognizes that merely presenting data about average visibility conditions is insufficient. It is important to track "best" days (i.e., the average of the cleanest 20% of the samples in a given time period) as they are important to protect and the most sensitive to increased pollution. Data are also presented for "worst" days (i.e., the average of the dirtiest 20% of the samples in a given time period) as they are important indicators of the progress toward remedying existing visibility impairment and, in addition, indicate which categories of pollutants are the largest contributors to visibility degradation.

For each of the six Class I areas with monitoring sites in Colorado, data from 1997 through May 2003 or August 2003 (the most recent available data as of June 2004), are sorted into worst and best days for each year. A stacked bar graph for each available year of data at each site shows the chemically speciated composition of each worst day. For sites with data from 1997 through 2003, there are 7 separate bar graphs – one for each year. Each one is followed by a pie chart showing the average contribution in percent of each chemical constituent to overall extinction for the worst days that year. Finally, for each site a set of time series plots have been produced and include:

- A multiple line graph showing reconstructed extinction and its components between 1997 and 2003 for the best days;
- A simple line graph with visibility expressed as deciview for the best days between 1997 and 2003; and
- Same as above for the worst days.

(iii). Years With "Incomplete" Data.

The figures and captions in Appendices A.2 through A.7 indicate that some years have incomplete data. This has a particular meaning as defined in EPA's *Guidance*. For the purposes of regional haze, a year may not be used if it is "incomplete":

- each calendar quarter in the year must be at least 50% complete;
- overall, the calendar year must be 75% complete; and
- there should be no more than 10 missing sampling days in a row at any time during the calendar year.

If any of the three criteria are violated, the year is labeled "incomplete." For the purposes of this LTS review, the Division has used "incomplete" years but noted when it has done so.

(iv). Mesa Verde National Park (Appendix A.2).

IMPROVE Sampler data are available beginning in Spring 1988 at Mesa Verde. Figures 5-18 in Appendix A.2 are stacked bar graphs and pie charts that display speciated reconstructed extinction for each year's worst days. Figures 19 and 21 show yearly average reconstructed extinction between 1997 and 2003 for the best days and worst days, respectively. Figures 20 and 22 present yearly average deciview for the best and worst days. 1997 and 2003 are years with incomplete data. 1997 has 11 consecutive missed samples and its yearly percent completeness is under 75%. 2003 data are only available through May 31, 2003 at the time this analysis was started.

The information in Figures 5-22 is summarized below with "event" days defined as any sample day with a reconstructed extinction 30/MM or over:

- 1997 (incomplete data), figures 5 and 6:
  - Big events: 1 day over 30/MM and it is dominated by coarse mass, indicating a dust event.
  - Top 3 contributors to average worst day extinction: ammonium sulfate (46%), organic carbon (19%), and coarse mass (18%).
- 1998, figures 7 and 8:
  - Big events: 2 days over 30/MM, both dominated by ammonium sulfate.
  - Top 3 contributors: ammonium sulfate (46%), organic carbon (26%), and coarse mass (10%).
- 1999, figures 9 and 10:
  - Big events: 2 days over 30/MM. One is over 200/MM and is associated with a large regional dust event known as the Painted Desert Dust Storm. The other is just over 30/MM and is not dominated by any one species.
  - Top 3 contributors: coarse mass (33%), ammonium sulfate (27%), and organic carbon (20%).
- 2000, figures 11 and 12:
  - Big events: 2 days over 30/MM and both are dominated by organic and elemental carbon indicating a large-scale fire, likely a wildfire. One of the 2 days is nearly 150/MM.
  - Top 3 contributors: organic carbon (40%), ammonium sulfate (26%), and coarse mass (11%).
- 2001, figures 13 and 14:

    - Big events: no days over 30/MM.
    - Top 3 contributors: ammonium sulfate (40%), organic carbon (20%), and coarse mass (17%).
- 2002, figures 15 and 16:
    - Big events: 12 days over 30/MM and all but two with large contributions from coarse and fine mass, and organic and elemental carbon. There are 3 samples in December with large amounts of nitrate.
    - Top 3 contributors: organic carbon (28%), coarse mass (26%), and ammonium sulfate (18%).
- 2003 (incomplete data, only the first 5 months of the year), figures 17 and 18:
    - Big events: 6 days over 30/MM – one obviously a dust event with large contributions from coarse mass and fine soil. Another event in January involves significant amounts of nitrate. The others are an interesting combination of large contributors: coarse mass, fine soil, ammonium sulfate, and organic carbon.
    - Top 3 contributors: coarse mass (33%), organic carbon (25%), and ammonium sulfate (18%).
- Best Day Trends, figures 19 and 20:
    - Apparent Trend: towards better visibility on the best days over time. 2002 was a reversal of that trend and with incomplete data for 2003, it is too soon to say whether it continued.
    - Why: All the constituents of extinction have been decreasing over time. In 2002, all of them were up.
- Worst Day Trends, figures 21 and 22:
    - Apparent Trend: towards worsening visibility on the worst days over time. Extinction and deciview steadily increasing (except for 2001). An increase of nearly 4 deciviews from 1997 to 2002.
    - Why: most of the year-to-year variability is explained by coarse mass, fine soil, and organic carbon. The only component steadily decreasing is ammonium sulfate.

It is fair to consider whether the trend toward poorer visibility on the worst days is a reflection of the sustained drought in the Western U.S. One can see in the yearly worst days bar graphs examples of "event" days dominated by dust and/or fire. While a rigorous analysis is beyond this review, figures 23 and 24 show precipitation data at Mesa Verde National Park in two different ways to illustrate that there is indeed a drought in the area.

(v). Rocky Mountain National Park (Appendix A.3).

After noting an upswing in poorer visibility apparently related to drought, dust and smoke in the Mesa Verde National Park data, the Division wanted to next look at a very different site that is not in the Colorado Plateau in order to contrast and compare the two different types of locations.

Rocky Mountain National Park was established by the U.S. Congress in 1915 "...for the preservation of the natural conditions and scenic beauties..." The NPS conducted a Visitor Use

Survey during 1994 and 1995 that asked visitors to Rocky Mountain National Park to rank the various attributes of the park. Nearly 92 percent of park visitors rated natural scenery as an extremely important park feature and 87 percent of park visitors rated clean air an extremely important park feature. The two highest ranked park features obtained in the study were related to viewing scenery through clean air. (NPS Socio-Economic Studies Division, April 1996). Visibility protection and scenery are important attributes at this number one tourist attraction in the State of Colorado.

IMPROVE Sampler data are available beginning in Spring 1988 at Rocky Mountain. Figures 25-38 in Appendix A.3 are stacked bar graphs and pie charts that display speciated reconstructed extinction for each year's worst days. Figures 39 and 41 show yearly average reconstructed extinction between 1997 and 2003 for the best days and worst days, respectively. Figures 40 and 42 present yearly average deciview for the best and worst days. Only 2003 have incomplete data. 2003 data are only available through May 31, 2003 at the time this analysis was started.

The information in Figures 25-42 is summarized below with "event" days defined as any sample day with a reconstructed extinction 30/MM or over:

- 1997, figures 25 and 26:
  - Big events: No days over 30/MM.
  - Top 3 contributors to average worst day extinction: ammonium sulfate (39%), organic carbon (26%), and coarse mass (13%).
- 1998, figures 27 and 28:
  - Big events: 4 days over 30/MM both are dominated by organic carbon and sulfate with elemental carbon and nitrate also significant contributors.
  - Top 3 contributors: ammonium sulfate (36%), organic carbon (31%), and elemental carbon (10%).
- 1999, figures 29 and 30:
  - Big events: 3 days over 30/MM – all in March – and dominated by organic carbon, sulfate and nitrate.
  - Top 3 contributors: ammonium sulfate (30%), organic carbon (29%) and ammonium nitrate (15%).
- 2000, figures 31 and 32:
  - Big events: 9 days over 30/MM. All but one with significant organic carbon and coarse mass. The two highest days appear to be fire related.
  - Top 3 contributors: organic carbon (30%), coarse mass (27%), and ammonium sulfate (22%).
- 2001, figures 33 and 34:
  - Big events: 12 days over 30/MM. All but three of the days are dominated by ammonium nitrate and sulfate.
  - Top 3 contributors: ammonium sulfate (35%), ammonium nitrate (26%), and organic carbon (19%).
- 2002, figures 35 and 36:
  - Big events: 20 out of 24 days over 30/MM – 5 of the days are dominated by

ammonium sulfate and nitrate and all but one of the remaining 15 are significantly influenced by organic and, to a lesser extent, elemental carbon.
    - Top 3 contributors: organic carbon (33%), ammonium sulfate (24%), ammonium nitrate (20%).
- 2003 (incomplete data, only the first 5 months of the year), figures 37 and 38:
    - Big events: No days over 30/MM.
    - Top 3 contributors: ammonium sulfate (36%), ammonium nitrate (21%), and organic carbon (19%).
- Best Day Trends, figures 39 and 40:
    - Apparent Trend: towards better visibility on the best days over time. 2003, so far, is a reversal of that trend but with incomplete data for 2003 it is too soon to say whether that will continue once the whole year of data is considered.
    - Why: All the constituents of extinction have been decreasing over time. In 2003, all of them were up.
- Worst Day Trends, figures 41 and 42:
    - Apparent Trend: towards worsening visibility on the worst days over time. Extinction and deciview stair-step style increase (except for 2003 to date). An increase of nearly 4 deciviews from 1997 to 2002 with, so far, 2003 back to 1997 levels.
    - Why: most of the year-to-year variability is explained by organic carbon, ammonium nitrate, and coarse mass.

Compared to Mesa Verde National Park, on the Colorado Plateau, Rocky Mountain National Park seems less influenced by the drought, nevertheless, significant contributors to increases in extinction on the worst days include dust and fire related species. Figures 43 and 44 show precipitation data at Rocky Mountain National Park in two different ways to illustrate that there is indeed a drought in the area. Also contrasting with Mesa Verde National Park, is the increasingly significant role played by ammonium nitrate, especially in 2001 and 2002, at Rocky Mountain.

(vi). Mt Zirkel Wilderness Area (Appendix A.4).

Particle data is available from MOZI since Fall 1994. Figures 45-58 are stacked bar graphs and pie charts that display speciated reconstructed extinction for each year's worst days. Figures 59 and 61 in Appendix A.4 show yearly average reconstructed extinction between 1997 and 2003 for the best days and worst days, respectively. Figures 60 and 62 present yearly average deciview for the best and worst days. 2000 and 2003 have incomplete data. 2000 has 40 consecutive days missing with resulting low completeness percentages for some quarters as well as the overall year (59%). 2003 data are only available through August 31, 2003 at the time this analysis was started.

The information in Figures 45-58 is summarized below with "event" days defined as any sample day with a reconstructed extinction 30/MM or over:

- 1997, figures 45 and 46:

    - Big events: No days over 30/MM.
    - Top 3 contributors to average worst day extinction: ammonium sulfate (47%), organic carbon (23%), and coarse mass (14%).
- 1998, figures 47 and 48:
    - Big events: No days over 30/MM.
    - Top 3 contributors: ammonium sulfate (38%), organic carbon (31%), and coarse mass (15%).
- 1999, figures 49 and 50:
    - Big events: 1 day over 30/MM and dominated by coarse mass and fine soil. The event is approximately 70/MM and is associated with a large regional dust event known as the Painted Desert Dust Storm (also seen at Mesa Verde National Park).
    - Top 3 contributors: ammonium sulfate (27%), organic carbon (25%), and coarse mass (24%).
- 2000, (incomplete data) figures 51 and 52:
    - Big events: 4 days over 30/MM; all with significant organic and elemental carbon (fire related).
    - Top 3 contributors: organic carbon (40%), ammonium sulfate (21%), and coarse mass (19%).
- 2001, figures 53 and 54:
    - Big events: 2 days over 30/MM. One dominated by coarse mass and nitrate and the other by fine soil and coarse mass.
    - Top 3 contributors: ammonium sulfate (36%), organic carbon (23%), and coarse mass (14%).
- 2002, figures 55 and 56:
    - Big events: 6 days over 30/MM – all dominated by organic and elemental carbon (fire related).
    - Top 3 contributors: organic carbon (44%), ammonium sulfate (22%), and coarse mass (13%).
- 2003 (incomplete data, only the first 8 months of the year), figures 57 and 58:
    - Big events: 2 days over 30/MM both with significant organic carbon and ammonium sulfate.
    - Top 3 contributors: organic carbon (43%), ammonium sulfate (26%), and coarse mass (15%).
- Best Day Trends, figures 59 and 60:
    - Apparent Trend: towards better visibility on the best days over time, especially since 1998. 2003, so far, is a reversal of that trend but with incomplete data for 2003 it is too soon to say whether that will continue once the whole year of data is considered.
    - Why: All the constituents of extinction except nitrate have been decreasing over time. Nitrate especially spiked in 2003.
- Worst Day Trends, figures 61 and 62:
    - Apparent Trend: towards worsening visibility on the worst days over time. Extinction and deciview up-and-down but with an overall increase (except for 2003 to date).

- Why: most of the year-to-year variability is explained by organic carbon, coarse mass, elemental carbon and ammonium nitrate.

(vii). Weminuche Wilderness Area (Appendix A.5).

Fine particle monitoring has occurred for over ten years at Weminuche Wilderness, starting in 1988. Figures 63-76 in Appendix A.5 are stacked bar graphs and pie charts that display speciated reconstructed extinction for each year's worst days. Figures 77 and 79 show yearly average reconstructed extinction between 1997 and 2003 for the best days and worst days, respectively. Figures 78 and 80 present yearly average deciview for the best and worst days. 2000 and 2003 have incomplete data. 2000 has 12 consecutive days missing. 2003 data are only available through August 31, 2003 at the time this analysis was started.

The information in Figures 63-80 is summarized below with "event" days defined as any sample day with a reconstructed extinction 30/MM or over:

- 1997, figures 63 and 64:
  - Big events: 1 day over 30/MM with high coarse mass and fine soil (i.e., dust event).
  - Top 3 contributors to average worst day extinction: ammonium sulfate (43%), organic carbon (20%), and coarse mass (18%).
- 1998, figures 65 and 66:
  - Big events: 3 days over 30/MM.
  - Top 3 contributors: ammonium sulfate (42%), organic carbon (26%), and coarse mass (13%).
- 1999, figures 67 and 68:
  - Big events: 1 day over 30/MM and dominated by coarse mass and fine soil. The event is nearly 80/MM and is associated with a large regional dust event known as the Painted Desert Dust Storm (also seen at Mesa Verde National Park and Mt. Zirkel).
  - Top 3 contributors: ammonium sulfate (27%), coarse mass (27%), and organic carbon (26%).
- 2000, (incomplete data) figures 69 and 70:
  - Big events: 2 days over 30/MM both with significant organic carbon along with elemental carbon and ammonium sulfate.
  - Top 3 contributors: organic carbon (34%), ammonium sulfate (31%) and elemental carbon (14%).
- 2001, figures 71 and 72:
  - Big events: 1 day over 30/MM with large amounts of coarse mass and fine soil.
  - Top 3 contributors: ammonium sulfate (40%), organic carbon (25%) and coarse mass (12%).
- 2002, figures 73 and 74:
  - Big events: 5 days over 30/MM – all dominated by organic and elemental carbon (fire related).

    - Top 3 contributors: organic carbon (48%), ammonium sulfate (17%), and coarse mass (14%).
- 2003 (incomplete data, only the first 8 months of the year), figures 75 and 76:
    - Big events: 2 days over 30/MM both with large amounts of organic and elemental carbon.
    - Top 3 contributors: organic carbon (38%), ammonium sulfate (28%), and coarse mass (14%).
- Best Day Trends, figures 77 and 78:
    - Apparent Trend: towards better visibility on the best days over time.
    - Why: All the constituents of extinction except nitrate have been decreasing over time.
- Worst Day Trends, figures 79 and 80:
    - Apparent Trend: Lots of ups-and-downs in the annual averages. 2002 was the worst in this time period, however, just the year prior was the best year in this period.
    - Why: most of the year-to-year variability is explained by organic carbon, coarse mass, and elemental carbon.

(viii). White River National NF - Maroon Bells/Snowmass Wilderness (Appendix A.6).

Since summer 1993, a Module A IMPROVE sampler has been operated at the White River National Forest. This module contains a Teflon filter, which provides gravimetric mass, allows concentrations for some elements to be determined and Light Absorbing Carbon (LAC) to be measured. Since September 1999, a full 4-channel IMPROVE Sampler has been operating at this site. Figures 81-88 in Appendix A.6 are stacked bar graphs and pie charts that display speciated reconstructed extinction for each year's worst days. Figures 89 and 91 show yearly average reconstructed extinction between 1997 and 2003 for the best days and worst days, respectively. Figures 90 and 92 present yearly average deciview for the best and worst days. 2000, 2001 and 2003 have incomplete data. 2000 has 17 consecutive days missing. 2001 has 11 consecutive days missing. 2003 data are only available through August 31, 2003 at the time this analysis was started.

The information in Figures 81-92 is summarized below with "event" days defined as any sample day with a reconstructed extinction 30/MM or over:

- 2000, (incomplete data) figures 81 and 82:
    - Big events: 2 days over 30/MM both obviously fire related as they are dominated by organic and elemental carbon.
    - Top 3 contributors: organic carbon (39%), ammonium sulfate (28%) and coarse mass (13%).
- 2001, figures 83 and 84:
    - Big events: 1 day over 30/MM – a dust event dominated by coarse mass and fine soil.
    - Top 3 contributors: ammonium sulfate (38%), organic carbon (23%) and coarse

mass (14%).

- 2002, figures 85 and 86:
  - Big events: 5 days over 30/MM – all dominated by organic and elemental carbon (fire related).
  - Top 3 contributors: organic carbon (46%), ammonium sulfate (19%) and coarse mass (14%).
- 2003 (incomplete data, only the first 8 months of the year), figures 87 and 88:
  - Big events: 1 day over 30/MM, dominated by organic and elemental carbon.
  - Top 3 contributors: organic carbon (37%), ammonium sulfate (28%), and coarse mass (17%).
- Best Day Trends, figures 89 and 90:
  - Apparent Trend: towards better visibility on the best days over time, except for 2003 thus far.
  - Why: All the constituents of extinction except nitrate and organic carbon have been decreasing over time. In 2003, ammonium nitrate and sulfate increase.
- Worst Day Trends, figures 91 and 92:
  - Apparent Trend: Lots of ups-and-downs in the annual averages (only 2002 is considered "complete"). Need more years of data to discern any trend.
  - Why: most of the year-to-year variability is explained by organic carbon, coarse mass, and elemental carbon.

(ix). Great Sand Dunes National Monument (Appendix A.7).

Fine particle monitoring has occurred for over ten years at Great Sand Dunes National Monument, starting in 1988. Figures 93-106 in Appendix A.7 are stacked bar graphs and pie charts that display speciated reconstructed extinction for each year's worst days. Figures 107 and 109 show yearly average reconstructed extinction between 1997 and 2003 for the best days and worst days, respectively. Figures 108 and 110 present yearly average deciview for the best and worst days. Only 2003 have incomplete data. 2003 data are only available through August 31, 2003 at the time this analysis was started.

The information in Figures 93-106 is summarized below with "event" days defined as any sample day with a reconstructed extinction 30/MM or over:

- 1997, figures 93 and 94:
  - Big events: 2 days over 30/MM both with high coarse mass and fine soil (i.e., dust event), one of them has considerable ammonium sulfate as well.
  - Top 3 contributors to average worst day extinction: ammonium sulfate (41%), coarse mass (19%), and organic carbon (17%).
- 1998, figures 95 and 96:
  - Big events: 5 days over 30/MM. Four are ammonium sulfate events. The fifth has considerable organic carbon.
  - Top 3 contributors: ammonium sulfate (41%), organic carbon (28%), and coarse mass (13%).
- 1999, figures 97 and 98:

    - Big events: 4 days over 30/MM. Two dominated by coarse mass and fine soil. The third by organic carbon and the fourth a combination of coarse mass, organic carbon and ammonium sulfate. The largest event is associated with a large regional dust event known as the Painted Desert Dust Storm (also seen at Mesa Verde National Park, Mt. Zirkel and Weminuche).
    - Top 3 contributors: ammonium sulfate (29%), coarse mass (27%), and organic carbon (24%).
- 2000, (incomplete data) figures 99 and 100:
    - Big events: 9 days over 30/MM. Four are clearly dust related, however, one of them also has considerable organic carbon. The other event days have significant ammonium sulfate along with other contributors.
    - Top 3 contributors: organic carbon (29%), coarse mass (29%), and ammonium sulfate (22%).
- 2001, figures 101 and 102:
    - Big events: 3 days over 30/MM. One is clearly a dust event. The second is interesting in that there are almost equal contributions from fine soil, coarse mass, ammonium sulfate and ammonium nitrate. The third has significant organic carbon.
    - Top 3 contributors: ammonium sulfate (34%), coarse mass (24%), and organic carbon (20%).
- 2002, figures 103 and 104:
    - Big events: 14 days over 30/MM out of 23 days – 5 dominated by coarse mass and fine soil, and the remainder with significant organic and elemental carbon (fire related).
    - Top 3 contributors: coarse mass (30%), organic carbon (29%), and ammonium sulfate (17%).
- 2003 (incomplete data, only the first 8 months of the year), figures 105 and 106:
    - Big events: 7 days over 30/MM; 2 due to large amounts of coarse soil and fine soil, 1 dominated by sulfate, and the remainder with significant organic and elemental carbon.
    - Top 3 contributors: organic carbon (30%), ammonium sulfate (24%), and coarse mass (23%).
- Best Day Trends, figures 107 and 108:
    - Apparent Trend: a trend is not obviously apparent.
    - Why: Variability is driven by ups-and-downs in organic carbon, coarse mass, and ammonium nitrate.
- Worst Day Trends, figures 109 and 110:
    - Apparent Trend: Lots of ups-and-downs in the annual averages. 2002 was the worst in this time period, however, just the year prior was the best year in this period.
    - Why: most of the year-to-year variability is explained by organic carbon and coarse mass.

e. Overall Conclusions.

Colorado has among the best visibility in the country at its Class I areas and throughout other scenic and pristine parts of the State. However, on an episodic basis visibility can become impaired at all sites monitored.

Visibility on the best days is getting better except at Great Sand Dunes where there is no apparent trend at this time. This is good and important news as protecting the cleanest days is a critical aspect of the Class I visibility protection program.

Visibility on the worst days is clearly worse over time at three sites – Mesa Verde, Rocky Mountain and Mt. Zirkel. At the remaining three sites there is considerable year-to-year variability in the data (i.e., Great Sand Dunes, Weminuche) or a limited data record (i.e., Maroon Bells/Snowmass) such that qualitative trend assessments are difficult. Regardless of the site, organic carbon, elemental carbon, coarse mass and fine soil explain a large portion of the variability in extinction and there is a strong association between increases in overall extinction in any given year at these sites and increases in one or more of the 4 contributors indicated. These contributors are largely due to wildfires and dust storms. It is possible that the worsening visibility is to a large extent event driven and that these events are largely due to the sustained drought in the West. In addition to direct impacts from the drought, fewer precipitation events equate to less of a potential for natural removal mechanisms (i.e., rain and snow storms) scrubbing particles out of the air. A more thorough analysis will be performed by the WRAP (e.g., the Causes of Haze project) and the Division in preparation for Colorado's regional haze SIP.

4. ADDITIONAL MEASURES, INCLUDING SIP REVISIONS, THAT MAY BE NECESSARY TO ENSURE REASONABLE PROGRESS TOWARD THE NATIONAL GOAL.

Substantive LTS SIP revisions occurred in August 1996, April 1997, and April 2001. The 2002 SIP revision was to update outdated language and create a better overall organization of the LTS portion of the SIP. The Division does not believe extensive and substantive revisions are necessary at this time to ensure reasonable progress toward the national goal. However, once again, small updates and edits are proposed in order that this part of the SIP does not become outdated.

5. THE PROGRESS ACHIEVED IN IMPLEMENTING BART AND MEETING OTHER SCHEDULES SET FORTH IN THE LONG-TERM STRATEGY.

Hayden. Emission limitations and schedules for Hayden Generating Station were adopted into the SIP on August 15, 1996 based on the Hayden Consent Decree. By terms of the Decree, Hayden Station must provide progress reports to the State concerning construction of new equipment and compliance with new emission limitations (available by contacting the Division). The particulate and SO_2 control equipment for Units 1 & 2 have been installed and are operating. All schedules in both the Decree and in the SIP regarding Hayden were met, some up to six months ahead of deadlines in the SIP and Consent Decree. The emission limits and reporting requirements have been integrated into Hayden's Title V permit, as envisioned by the Consent Decree. As such, the court has terminated the Decree.

Craig. Emission limitations and schedules for Units 1 and 2 of the Craig Station were adopted into the SIP on April 19, 2001 based on the Craig Consent Decree. By the terms of the SIP, progress reports must be provided to the State. The Division has reviewed the reports received to date and construction, tie-in, and start-up activities appear to be progressing such that all schedules will be met.

6. THE IMPACT OF ANY EXEMPTION FROM BART.

The Division has not made a reasonable attribution decision. The need for a BART analysis has not been triggered, therefore, exemptions were neither requested nor granted.

7. THE NEED FOR BART TO REMEDY EXISTING IMPAIRMENT IN AN INTEGRAL VISTA DECLARED SINCE PLAN APPROVAL.

There have been no integral vistas listed by either the federal land managers or the State since the plan was approved. Therefore, a discussion on the need for BART in such integral vistas is not necessary.

IV. CONSULTATION WITH FEDERAL LAND MANAGERS

The Division is required by federal law to consult with the federal land managers during periodic reviews of the LTS. The Division is sending this draft of the report to the USFS and NPS. These agencies are the managers of all of Colorado's Class I areas. A cover letter to each agency (Appendix D) is also provided along with this report. The letters ask for written comments.

The U.S.D.A. Forest Service, Rocky Mountain Region letter of June 2, 2004 focuses on 2 issues. The Division's response follows each.

1. The Forest Service asserts that agricultural burning "contributes a significant amount of particulate matter that is responsible for visibility degradation and should be regulated to a similar degree as other users of prescribed fire."
    a. Division response: It is the Division's plan to address this source of prescribed fire during regional haze SIP development.
2. The Forest Service is also concerned about the "cumulative effects of minor source contributions to overall visibility degradation (particularly NOx). The increased development of oil and gas fields across the state, especially in southwestern Colorado, is significant and has the potential to contribute to worsening visibility if not adequately monitored. This is especially troubling because the State of Colorado does not have the authority to require BACT or its functional equivalent for minor sources, as do our neighbors in Wyoming, Utah and New Mexico. Our concern is not over single sources, but the potential impacts of dense gas fields comprising thousands of wells in a particular geographic area."
    a. Division response: The Division's response is contained in two locations.
        i. Section III.B.1.d.(iii) ("PSD Increment, Southwest Colorado, and Emission Tracking") in this LTS Review. It presents information about the Division's interactions with federal land managers regarding these issues and the Division's activities over a number of years.
        ii. The response to the issue of minor source BACT is contained in the LTS Revision section II.A.2 ("Minor Source Permitting") and is reproduced below. In addition, the issue of minor source BACT will be examined during the regional haze SIP development.

Minor Source Permitting.

Minor source permitting requirements include a demonstration that National Ambient Air Quality Standards will not be violated by operation of the proposed facility. Federal and State law do not require visibility analyses for such sources. Federal land managers and the Sierra Club, commenting on various past LTS reviews and revisions, have indicated that Colorado should require Best Available Control Technology (BACT) on minor sources. Colorado regulation neither requires BACT for individual minor sources nor for groupings of minor sources. Therefore, the Division does not have the authority to impose BACT on a new minor source and cannot require BACT for such sources. Apart from regional haze

impacts that are contributed to by nearly all sources of air pollution and will be addressed over time within the framework of the regional haze rule, the Division is unaware of any direct evidence that a minor source or grouping of minor sources are causing or contributing to visibility impairment in any Class I area in Colorado. Other perspectives may exist on this issue and any citizen, citizen group, or organization may directly propose a rule regarding BACT for rule-making before the Commission.

The U.S.D.I. National Park Service letter of June 18, 2004 raises six issues, outlined below, and the Division response to each one immediately follows:

1. "The review draft… reveals potential Phase I program limitations in dealing with visibility conditions that may be worsening in parts of the State like southwestern Colorado and the northern front range of the Rocky Mountains. Issues include rapid and widespread growth of minor sources and some major sources associated with energy development in the 4-corners region of southwestern Colorado and mostly urban and energy related growth occurring in northeastern Colorado."
   a. Division response: See section III.B.1.d.(iii) ("PSD Increment, Southwest Colorado, and Emission Tracking") in this LTS Review. It presents information about the Division's interactions with federal land managers regarding these issues and the Division's activities over a number of years.
2. "…as the report illustrates, several Class I areas in the past few years have seen their worst visibility days become even more degraded, including Rocky Mountain and Mesa Verde National Parks (NP).

   Consistent with the national visibility goal, we encourage the State to begin efforts to address the visibility conditions likely caused or contributed to by existing or projected future anthropogenic source emissions in the sub-regions of Colorado affecting these parks. For example, the substantial increases in ammonium nitrate extinction in Rocky Mountain NP suggests that emission sources of nitrogen oxides and ammonia, two fairly common manmade pollutants in the extended urbanized front range area, may be responsible for, and should be assessed for, impacts on the park. If reasonably available air management measures can forestall worsening trends in visual air quality and other air quality indicators like ozone or acidic deposition, it may be appropriate to begin implementing such programs as an interim step as the State transitions from its Phase I plan to development of its Phase II visibility program."
   a. Division response: The State's Early Ozone Action Plan was adopted by the Colorado Air Quality Control Commission in March 2004. Its control measures may improve visibility and deposition at Rocky Mountain National Park. The State's regional haze plan must be completed in approximately 2 years (July 2006) to allow for consultation with federal land managers, proper notice, public hearing, legislative review, and submittal to EPA by Colorado's Governor prior to the end of 2007. The issues raised above will be further examined within that SIP. The SIP is currently under development and it is the Division's sense that there will be no additional time to examine interim

measures.

3. As regional haze SIP development progresses it will be important for Colorado to "engage its neighboring states to implement strategies across state boundaries that will prove mutually beneficial to achieving the national visibility goal in all affected Class I areas. However, we believe that in certain cases current knowledge and understanding of existing and emerging air quality issues affecting some of the State's Class I areas might reasonably drive more timely efforts to effectively address these problems, outside of the Phase II rule development process if necessary."
    a. Division response: This comment suggests to the Division the complex of issues in the 4-corners area. The Division has indicated it will remain involved with other states, agencies and stakeholders as the issues progress. Time will tell whether PSD increment, visibility and/or other issues "drive" any measures by Colorado or neighboring states outside the regional haze SIP process.
4. "…legal authority issues related to air quality regulation of agricultural activities need to be resolved to ensure all sources contributing to air quality problems can be equitably addressed."
    a. Division response: It is the Division's plan to address this source of prescribed fire during regional haze SIP development. Legal authority will be resolved in the course of determining the most appropriate response to this source of smoke emissions.
5. "The current long-term strategy should, in part, incorporate appropriate reference to efforts the State will potentially take to deal with in-State sources of visibility impacts to in-State Class I areas, including urban haze or agricultural activities affecting nearby Class I areas."
    a. Division response: It is premature at this time to discuss potential strategies. Developmental work for the regional haze SIP has simply not progressed far enough to know whether what, if any, additional emission reductions will be needed to achieve reasonable progress at each of Colorado Class I areas.
6. "The long-term strategy could be used to promote actions to solve multiple issues associated with the air quality in some Class I areas that may be related to a common manmade pollutant or pollutants, such as that demonstrated by the role nitrogen oxides and/or ammonia play in visibility degradation, nitrogen deposition, and ozone formation."
    a. Division response: The comment suggests to the Division air pollution issues in the Denver metropolitan area and along the urbanized northern front range affecting Rocky Mountain National Park. The Division notes that the first of what the Department intends to be a series of meetings between the NPS and Department regarding Rocky Mountain National Park and its multi-pollutant issues has occurred. The meetings are intended to promote understanding and knowledge about what is going on at the park as well as, over time, the air pollution sources contributing to these issues in the park. The Division believes it is premature in this long-term strategy to pre-suppose what may be the outcome of this process.

V. ENDNOTES AND REFERENCES

1. Clean Air Act as amended in 1977, section 169(A) (42 U.S.C 7491).

2. "Visibility Protection for Federal Class I Areas," December 2, 1980, 45 Federal Register 80089, (codified at Part 40 Code of Federal Regulations section 51.300-307).

3. "Approval and Promulgation of State Implementation Plans: Revision to Regulation No. 3 Visibility Protection; Colorado," Environmental Protection Agency, August 12, 1988, 53 Federal Register, 30426.

4. "Long-Term Strategy Review of Colorado's State Implementation Plan for Class I Visibility Protection," adopted August 20, 1992 by the Colorado Air Quality Control Commission.

5. "Long-Term Strategy Review and Revision of Colorado's State Implementation Plan for Class I Visibility Protection, Part IIA: Long-Term Strategy Review," Colorado Department of Public Health and Environment, April 18, 1997.

6. "State Implementation Plans for Visibility Long-Term Strategies, Integral Vistas, and Control Strategies; Final Rule," November 24, 1987, 52 Federal Register, 45132.

7. Grand Canyon Visibility Transport Commission, Recommendations for Improving Western Vistas, June 10, 1996.

8. "Regional Haze Regulations; Proposed Rule," Environmental Protection Agency, July 31, 1997, 40 Federal Register 41138, (40 CFR Part 51).

9. "Regional Haze Regulations," July 1, 1999, 64 Federal Register 35714, (codified at Part 40 Code of Federal Regulations sections 51.308 and 309).

10. "Colorado's Plan for Visibility Protection in Class I Areas, The Colorado Visibility State Implementation Plan (Visibility SIP)," Colorado Department of Public Health and Environment/Air Pollution Control Division/Technical Services Program/Visibility, Research, and Quality Assurance Unit, July 1995. Note: This document describes what was in the SIP as of July 1995 but is not itself part of the Class I Visibility SIP.

11. Letter to Honorable Roy Romer, Governor of Colorado, from Elizabeth Estill, Regional Forester, U.S. Forest Service Rocky Mountain Region, July 14, 1993.

12. "Revision of Colorado's State Implementation Plan for Class I Visibility Protection, Craig Station Units 1 and 2 Requirements," adopted by the Colorado Air Quality Control Commission, April 19, 2001.

13. "Clean Air Act Approval and Promulgation of Air Quality Implementation Plan Revision for Colorado; Long-Term Strategy of State Implementation Plan for Class I Visibility Protection: Craig Station Requirements," 66 Federal Register, 35374.

14. "Long-Term Strategy Review and Revision of Colorado's State Implementation Plan for Class I Visibility Protection, Part I: Review of the Long-Term Strategy, and Part II: Revision of the Long-Term Strategy," adopted by the Colorado Air Quality Control Commission, February 21, 2002.

15 . Watson, J.G. and D. Blumenthal 1996, *Mt. Zirkel Wilderness Area, Reasonable Attribution Study of Visibility Impairment; Volume II: Results of Data Analysis and Modeling, Part 1 of 2 -- Final Report*; July 1, 1996. Desert Research Institute, University and Community College System of Nevada, 5625 Fox Avenue, Reno, Nevada 89506.

16. In the United States District Court for the District of Colorado, Civil Action No. 93-B-1749, Sierra Club, Plaintiff, vs. Public Service Company of Colorado, Inc., Salt River Project Agricultural Improvement and Power District, and PacifiCorp, Defendants, United States of America and State of Colorado, Plaintiff-Intervenors, Consent Decree, date lodged in Court, May 22, 1996, date entered in Court, August 19, 1996.

17. "Clean Air Act Approval and Promulgation of Air Quality Implementation Plan Revision for Colorado; Long-Term Strategy of State Implementation Plan for Class I Visibility Protection, Part I: Hayden Station Requirements," January 16, 1997, 62 Federal Register, 2305.

18. "Craig Station FGD System Modifications – Analyses of Potential Alternatives, Project Design Basis and Cost Estimates", EPA Contract #'s 68-D7-0001 – Phase # 1-005 & 9X-0264-NALX, dated August 31, 1999.

19. C.R.S. 25-7 Part 10, "Air Quality Related Values – Class I Federal Areas."

20. Letter to Honorable Bill Owens, Governor of Colorado from William P. Yellowtail, Regional Administrator, EPA Region 8; September, 22, 1999.

21. Letter from Tom L. Thompson, Acting Regional Forester, U.S.D.A. Forest Service, Rocky Mountain Region to Margie Perkins, Director, Colorado Air Pollution Control Division, December 14, 2000.

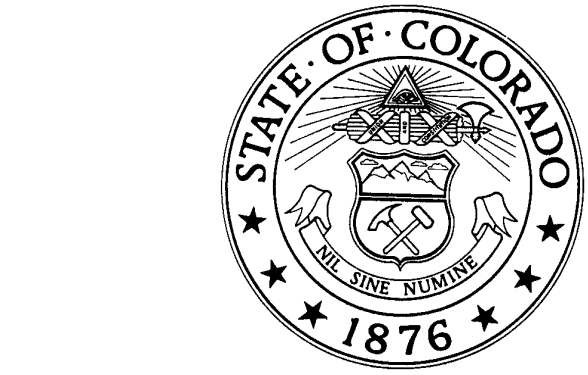
22. Malm, W., et. al., "Spatial and Seasonal Patterns and Temporal Variability of Haze and Its Constituents in the United States, Report III", Cooperative Institute for Research in the Atmosphere, Colorado State University, May 2000.

23 . “IMPROVE Data Guide: A Guide to Interpret Data”, University of California Davis, August 1995.

24 . “Guidance for Tracking Progress Under the Regional Haze Rule”, EPA-454/B-03-004, September 2003.

LONG-TERM STRATEGY REVIEW AND REVISION OF COLORADO'S STATE IMPLEMENTATION PLAN FOR CLASS I VISIBILITY PROTECTION

PART II: REVISION OF THE LONG-TERM STRATEGY



COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

JULY 30, 2004

PREPARED BY:

COLORADO AIR POLLUTION CONTROL DIVISION
TECHNICAL SERVICES PROGRAM
VISIBILITY, FIRE, AND QUALITY ASSURANCE UNIT

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PART II: COLORADO'S CLASS I VISIBILITY PROTECTION PROGRAM STATE IMPLEMENTATION PLAN REVISIONS TO THE LONG-TERM STRATEGY

Part II of the Long-Term Strategy (LTS) consists only of the State Implementation Plan revision of Colorado's Class I Visibility Protection Program. Part I of the LTS is a separate document and contains background information and the review/report sections.

The State is adopting this SIP revision in order to update the LTS. This SIP revision is intended to amend the 2002 LTS portion of the Class I Visibility SIP.

References in this SIP revision to Colorado Air Quality Control Commission Regulation No. 9 (Open Burning, Prescribed Fire, and Permits) are intended only to provide information about the location of various aspects of Colorado's smoke management program. Regulation No. 9 is neither being submitted for EPA approval, incorporation into the SIP by reference, nor to be federally enforceable. It implements Colorado's program and is not federally required. The State is precluded from submitting this Regulation No. 9 for incorporation into this SIP by C.R.S. 25-7-105.1. At a later date the State will submit the Colorado Smoke Management Memorandum of Understanding and Regulation No. 9 to EPA for certification under EPA's *Interim Air Quality Policy on Wildland Prescribed Fire*, May 1998.

The State of Colorado believes the strategies, activities, and plans outlined below in sections for Existing Impairment, Prevention of Future Impairment, Smoke Management, and Consultation and Communication with Federal Land Managers constitute reasonable progress toward the national visibility goal. The following Long-Term Strategy addresses the visibility issues that currently face the State of Colorado's Class I units within the framework of EPA's Phase I of the visibility protection program. The six factors required by the EPA to be considered in a LTS are embedded within the strategies below and marked with an asterisk for reference.

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I. EXISTING IMPAIRMENT.

The LTS must have the capability of addressing current and future existing impairment situations as they face the State. Generally, Colorado considers that its Air Quality Control Commission, Regulation No. 3, Part B, §XI.D ("Existing Impairment") meets this long-term strategy requirement regarding existing major stationary facilities. The State believes that its existing regulations along with the strategies and activities outlined below have together provided for reasonable progress toward the national visibility goal.

A. Existing Impairment and the Mt. Zirkel Wilderness.

1. The Certification.

The U.S.D.A. Forest Service (USFS) concluded in its July 1993 certification letter to the State of Colorado that it was reasonable to believe that visibility impairment existed in the Mt. Zirkel Wilderness Area (MZWA) and that local existing stationary sources, the Craig and Hayden power stations, contributed to the problem.

2. Reasonable Progress for the Mt. Zirkel Wilderness.

a. Hayden.

The certification of impairment made by the USFS regarding the Hayden Station was resolved through a settlement process that began in late 1995. An agreement, the Hayden Consent Decree, was approved by the federal district court on August 19, 1996. The agreement was between the Sierra Club, State of Colorado, owners of Hayden Station, and Environmental Protection Agency/Department of Justice. The Decree was intended to resolve a number of issues, including a Sierra Club lawsuit against the Hayden Station, the needs of the State's visibility regulatory program in relation to Hayden, and an EPA complaint against the facility. In addition, the Decree was intended to make progress toward reducing acid deposition in the Mt. Zirkel Wilderness.

Emission limitations, construction schedules, and reporting requirements taken from the Hayden Consent Decree were incorporated into the Visibility SIP by the AQCC. The State believes that these significant emission reductions will effectively eliminate the visibility impairment in the MZWA that could be associated with the Hayden Station. The State further believes that the Hayden Consent Decree effectively resolves the certification of impairment brought by the USFS against the Hayden Station. The Forest Service has indicated that its complaint against Hayden has been satisfied.

The construction of Hayden's control equipment progressed ahead of schedule. All compliance dates in the SIP and Consent Decree were met and it appears that emission limitations for NOx, SO_2, opacity, and particulate matter are currently being achieved. The relevant emission limitations and monitoring requirements have been moved into the facility's Title V operating permit and the permit has been issued. As a result, the Consent Decree has been terminated by the court.

b. Craig Generating Station (Yampa Project).

The certification of impairment made by the USFS regarding the Craig Station Units 1 and 2 was also resolved through a settlement process that began in Fall 1999.

After Hayden was resolved in August 1996, the State's attention turned to Craig Station Units 1 and 2. In addition to the State and the USFS visibility certification, there are other issues concerning the emissions from Craig Station Units 1 and 2. The USFS has strong concerns about local emissions of SO_2 and NOx that may be associated with acid deposition and aquatic and terrestrial ecosystem effects in the MZWA. In addition, a citizen lawsuit under the Clean Air Act by the Sierra Club directed against Craig Station Units 1 and 2 regarding opacity issues was initiated in late 1996.

After several years of preliminary efforts, studies, and workshops, in Fall 1999 the Sierra Club, Craig Owners, EPA, the State, and the USFS began global settlement talks with an independent mediator. The Craig owners and Sierra Club concluded a Consent Decree and filed it with the federal district court on January 10, 2001. It was approved by the court on March 19, 2001. The State resolved the certification of impairment in relation to Units 1 and 2 of Craig Station by the AQCC adopting emission limitations, schedules, and reporting requirements from the Craig Consent Decree into the Visibility SIP. The Forest Service concluded that all of its concerns related to the Craig Station and the 1993 Certification of Impairment are now resolved.

The construction, tie-in, and start-up of Craig Station Units' 1 and 2 control equipment upgrade is on schedule and expected to be completed by mid-2004.

3. BART and Emission Limitations.

Although BART determinations were not made by the State regarding Hayden and Units 1 and 2 of Craig generating stations, emission limitations* for the two power plants were incorporated into the LTS SIP in August 1996 (Hayden) and April 2001 (Craig Units 1 and 2). These SIP amendments also address the enforceability of Hayden's and Craig's emission limitations* (the dates when the facilities must comply with emission limitations and the enforcement structure have been previously adopted into this LTS). Source retirement and replacement* and construction activities* are not required in the SIP or LTS at this time as the Division is unaware of any relevant issues triggering such a necessity.

a. Hayden's Emission Limitations.

The contents of the August 1996 LTS SIP revision incorporating emission limitations, construction and compliance schedules, and reporting requirements for Hayden generating station Units 1 and 2 are incorporated into this LTS SIP by reference.[1] EPA approved this SIP amendment on January 16, 1997.[2]

b. Craig's Emission Limitations.

The contents of the April 2001 LTS SIP revision incorporating emission limitations, construction and compliance schedules, and reporting requirements for the Craig generating station Units 1 and 2 are incorporated into this LTS SIP by reference. The SIP revision was adopted by the AQCC on April 19, 2001[3] and EPA published final approval of the SIP amendment after a public comment period on July 5, 2001.[4]

4. Monitoring.

It is important to track the effects of the emission changes on visibility and other Air Quality Related Values in and near Mt. Zirkel Wilderness Area. The Division commits to coordinating a monitoring strategy with other agencies and providing periodic assessments of various monitored parameters in "before" compared to "after" emission reductions periods.

B. Other Stationary Sources and Colorado Class I Areas and Additional Emission Limitations and Schedules for Compliance*.

There are no outstanding certifications of visibility impairment in Colorado. In addition, the Division has found no evidence that other stationary sources potentially subject to BART may reasonably be attributed to cause or contribute to visibility impairment at MZWA or any other Class I area in Colorado under Phase I of EPA's visibility program. The USFS certification of visibility impairment at Mt. Zirkel Wilderness Area has been completely resolved. Regional haze that impacts any Colorado Class I areas, including MZWA, will be addressed as a SIP revision for Phase II, regional haze, of the visibility program is prepared over the next few years. The State is prepared to respond to any future certifications as per AQCC Regulation No. 3 § XI.D.

* A factor that must be considered in a LTS SIP revision according to EPA regulation.

C. Ongoing Air Pollution Programs∗.

1. PM_{10}.

The State of Colorado has attained and maintained the PM_{10} standard in its non-attainment areas throughout the State. PM_{10} attainment and maintenance plans have been approved by EPA for Aspen, Canon City, Denver, Pagosa Springs, and Telluride. The plans for Steamboat Springs and Lamar have also been approved by the AQCC and await EPA action. These various plans contain numerous air pollution control programs that are effectively reducing emissions. The attainment and maintenance of the PM_{10} standard will likely have some small effect (since the standard is only rarely exceeded) on improving visibility in pristine and scenic areas.

2. Urban Haze -- Brown Cloud.

There is a concern about urban haze in the eastern Front Range urban corridor from the Denver metropolitan area to Fort Collins. This Front Range area is approximately 25-50 miles from Rocky Mountain National Park, a Class I area. The National Park Service, the federal land manager of the Park, has not certified visibility impairment in the Park. Analysis of Brown Cloud data indicates it has improved approximately 28% between 1991 and 2003. The Division will continue to provide technical support to efforts to understand and reduce the Brown Cloud.

3. Prevention of Significant Deterioration Increment Tracking.

The cumulative growth of many minor sources of air pollution, including mobile, area and stationary sources, can slowly lead to degradation of air quality and have visibility impacts. In Colorado, a compliance demonstration with PSD increments is not required to obtain a minor source construction permit.

In 1999, the Division completed an assessment of nitrogen dioxide PSD increment consumption in S.W. Colorado and found that about 45% of the Class I increment has been consumed at Mesa Verde National Park and 20% for Weminuche Wilderness. The document is available on the Division's web page at http://apcd.state.co.us/permits/psdinc/index.html. Due to the large amount of proposed minor and major source development in the 4-Corners area, especially in New Mexico, the Division will continue to stay involved in and inform the Commission about any future study findings that indicate visibility and/or PSD increment problems.

4. Emission Tracking.

Federal land managers have been concerned about the growth of minor source emissions near various Class I areas and have encouraged the Division to develop tools to track minor source activity. The Division has implemented a stationary source emission inventory system and has built the capability to be able to track minor source emissions over time on a routine basis. The Division has produced emission tracking tables and graphs for S.W. Colorado that indicated a growth in nitrogen oxides of 65% between 1991 and 2003. However, the Division has no emission data from tribal lands and a significant amount of activity is believed to occur on such lands.

∗ A factor that must be considered in a LTS SIP revision according to EPA regulation.

II. PREVENTION OF FUTURE IMPAIRMENT.

The LTS must establish mechanisms to address the prevention of future impairment and outline strategies to ensure progress toward the national goal.

A. Ongoing Air Pollution Programs∗.

1. PSD and NSR.

Generally, Colorado considers that its NSR and PSD programs meet the long-term strategy requirements for preventing future impairment from proposed major stationary sources or major modifications to existing facilities. The State believes that its existing regulations along with the activity outlined below have together provided for reasonable progress toward the national visibility goal.

a. Modeling.

The Division has published modeling guidance that presents methods for estimating impacts from stationary sources of air pollution. The guideline is intended to help permit applicants, air quality specialists, and others understand the Division's expectations for the ambient air impact analysis and to prevent unnecessary delays in the permit process. It provides a starting point for modeling, but allows the use of professional judgment. The guidance contains sections on visibility modeling. In 2001, a technical peer review of the guidance was completed. A more general public review process was finished at the end of that year. The finalized guidance document is available via the Air Pollution Control Division's web site at: http://apcd.state.co.us/permits/cmg.html. The Division will continue to maintain and update the guidance as needed.

2. Minor Source Permitting.

Minor source permitting requirements include a demonstration that National Ambient Air Quality Standards will not be violated by operation of the proposed facility. Federal and State law do not require visibility analyses for such sources. Federal land managers and the Sierra Club, commenting on various past LTS reviews and revisions, have indicated that Colorado should require Best Available Control Technology (BACT) on minor sources. Colorado regulation neither requires BACT for individual minor sources nor for groupings of minor sources. Therefore, the Division does not have the authority to impose BACT on a new minor source and cannot require BACT for such sources. Apart from regional haze impacts that are contributed to by nearly all sources of air pollution and will be addressed over time within the framework of the regional haze rule, the Division is unaware of any direct evidence that a minor source or grouping of minor sources are causing or contributing to visibility impairment in any Class I area in Colorado. Other perspectives may exist on this issue and any citizen, citizen group, or organization may directly propose a rule regarding BACT for rule-making before the Commission.

III. SMOKE MANAGEMENT PRACTICES∗.

The LTS requires that smoke management practices of prescribed burning be addressed.

∗ A factor that must be considered in a LTS SIP revision according to EPA regulation.

∗ A factor that must be considered in a LTS SIP revision according to EPA regulation.

A. The Colorado Smoke Management Memorandum of Understanding and AQCC Regulation No 9.

In the past, Colorado's existing open burning regulation did not specifically address prescribed fire. In this absence, operational understandings evolved over many years between the Division and the users of prescribed fire for grassland and forestland management. These understandings regarding the details of permitting and reporting of prescribed fire activity are contained in the Colorado Smoke Management Plan and Memorandum of Understanding (MOU). The Colorado Department of Public Health and Environment, the Forest Service, National Park Service, Bureau of Land Management, Fish and Wildlife Service, Air Force Academy, U.S. Army (Fort Carson), U.S. D.O.E. Rocky Flats Field Office, City of Boulder Wildland Fire Department, Colorado Division of Wildlife, and the Colorado State Forest Service are voluntary signatories to the MOU. The AQCC adopted Regulation No. 9 (Open Burning, Prescribed Fire and Permitting) on January 17, 2002. Part of the intention of adopting this regulation was to also include the voluntary requirements contained in the MOU in the regulation and apply them to all users of prescribed fire. In addition, the regulation implements Senate Bill 01-214. Overall, Regulation No. 9 is the main vehicle in Colorado for addressing smoke management.

B. SB01-214.

Colorado Senate Bill 01-214 ("Concerning the Application of State Air Quality Standards to the Use of Prescribed Fire for Management Activities Within the State and Making an Appropriation Therefor") became law in 2001. Regulations implementing it were adopted as part of Regulation No. 9. The statute and implementing regulations require significant users of prescribed fire for grassland and forestland management to conform to the State standard to "minimize emissions using all available, practicable methods that are technologically feasible and economically reasonable in order to minimize the impact or reduce the potential for such impact on both the attainment and maintenance of national ambient air quality standards and achievement of federal and state visibility goals." All significant users are to submit planning documents to the Commission. The regulation asks that planning documents explain the decision process and criteria the significant user applies to making choices about fuel treatment alternatives to achieve various land management goals and must demonstrate how the significant user will comply with the State standard. Each planning document will have a public hearing before the AQCC. The AQCC is to review and make recommendations and comments for each planning document. The Division cannot issue burning permits to any significant user of prescribed fire after July 1, 2002 if their plan for an area is not consistent with Commission comments and recommendations. To date, the Commission has had hearings on the planning documents of the U.S.D.A. Forest Service, U.S.D.I. Bureau of Land Management, Colorado Division of Wildlife, U.S.D.I. National Park Service, D.O.D. Fort Carson, U.S. Air Force Academy, and U.S.D.I. Fish and Wildlife Service. All were approved unanimously.

The statute also requires fees. Regulation No. 9 specifies that significant users shall pay fees of $59.98/hour to the Division for review of planning documents. Prescribed fire permitees also pay for the cost of the prescribed fire program based on a cost distribution methodology described in the regulation. The Division's Fiscal Officer has determined the cost of the program to currently be $144,309.85.

It is the State's intention that through this processes described above, the plans and practices

of significant users will, over time, increasingly consider air quality and visibility concerns into their fuel management decision making.

The regulation, encompassing both the new permitting regulation and the implementation of SB01-214, along with various aspects of the MOU contain a comprehensive smoke management program with elements relating to review and approval of planning documents, permitting of specific fires, reporting actual activity, and a fee program regarding open burning. The Division will be submitting its program to EPA for certification under EPA's *Interim Air Quality Policy on Wildland Prescribed Fire*, May 1998.

C. Program Development as Prescribed Burning Increases.

Recent catastrophic wildfires in Colorado and other western states have led to the development of the National Fire Plan and increased funding to federal land managers for increased prescribed fire. The Division is seeing approximately the same number of permit applications but much more burning than in the past. It also expects that the smoke management program will evolve over time as new situations and challenging burns are encountered. As the level and complexity of burning increases the Division will continually evaluate its regulatory program for this source of air pollution. Current activities include: increased field presence and compliance assistance to permittees, evaluation of different and more realistic models to forecast smoke output and impacts, and regulatory changes to allow the use of Air Curtain Destructors to burn piles with much fewer emissions.

D. Reporting.

The Division will continue to annually produce a report on prescribed burning activity and estimated emissions. The report will contain estimates of acres burned, piles burned, and estimated resulting emissions. The Division has annually prepared such reports since 1990.

IV. FEDERAL LAND MANAGER CONSULTATION AND COMMUNICATION.

The plans, goals, and comments of the federal land managers are to be addressed during SIP and LTS revisions. Good communication with the federal land managers is important to implementing the LTS and making reasonable progress toward the national goal.

A. Consultation.

The federal land managers (FLMs) with Class I areas in Colorado will be given opportunities to comment and provide input during the LTS review and revision process. The Division will provide, at a minimum, the opportunity for consultation with the FLMs at least 60 days prior to any public hearing on any element of the Class I Visibility SIP including LTS revisions and review.

B. Monitoring Plan.

C.R.S. 25-7-212(3)(a) requires the federal land management agencies of Class I areas in Colorado (i.e., U.S.D.I. National Park Service and U.S.D.A. Forest Service) to "develop a plan for evaluating visibility in that area by visual observation or other appropriate monitoring technique approved by the federal environmental protection agency and shall submit such plan for approval by the division for incorporation by the commission as part of the state implementation plan." The agencies have indicated that they have developed, adopted, and implemented a monitoring plan through the Class I visibility monitoring collaborative known as IMPROVE. The plan ensures that each Class I area in Colorado will have an on-site monitor or an off-site monitor that is representative of visibility in the Class I area. Letters from the National Park Service and Forest Service containing the monitoring plan are in Appendix A. Approval letters from the Division responding back to the federal land managers are also in the Appendix. This information is included here to conform to the requirements of state law to incorporate the monitoring plans into the SIP.

V. ENDNOTES AND REFERENCES

1. "Revision of Colorado's State Implementation Plan for Class I Visibility Protection, Craig Station Units 1 and 2 Requirements, Section III 'Enforceable Portion of the SIP Revision, Definitions, Emission Controls and Limitations, Continuous Emission Monitors, Construction Schedule, Emission Limitation Compliance Deadlines, and Reporting', March 13, 2001, Colorado Department of Public Health and Environment, Air Pollution Control Division, adopted April 19, 2001 by the Colorado Air Quality Control Commission.

2. "Clean Air Act Approval and Promulgation of Air Quality Implementation Plan Revision for Colorado; Long-Term Strategy of State Implementation Plan for Class I Visibility Protection, Part I: Hayden Station Requirements," January 16, 1997, 62 Federal Register, 2305.

3. "Long-Term Strategy Review and Revision of Colorado's State Implementation Plan For Class I Visibility Protection, Part I: Hayden Station Requirements, Section VI. C 'Enforceable Parts of the SIP Revision: Definitions, Emission Controls and Limitations, Continuous Emission Monitors, Construction Schedule, Emission Limitation Compliance Deadlines, and Reporting'", August 15, 1996, Colorado Department of Public Health and Environment, Air Pollution Control Division, adopted August 19, 1996 by the Colorado Air Quality Control Commission.

4. "Clean Air Act Approval and Promulgation of Air Quality Implementation Plan Revision for Colorado; Long-Term Strategy of State Implementation Plan for Class I Visibility Protection: Craig Station Requirements," 66 Federal Register, 35374.