Columbia River Gorge Air Study and Strategy

Oregon Department of Environmental Quality
Southwest Clean Air Agency

February 29, 2008 – DRAFT

Executive Summary

Introduction

This document describes the Oregon Department of Environmental Quality (DEQ) and Southwest Clean Air Agency's (SWCAA) (together, "air agencies") past work, scientific studies, strategy and rationale for managing visibility in the Gorge. It summarizes the current and future potential actions that, taken together, will help guard against long-term visibility degradation from current levels and drive continued visibility improvements in the future.

Gorge Commission Charge to the Air Agencies

The Columbia River Gorge Commission has responsibility under the Scenic Area Management Plan to protect natural, scenic, cultural, and recreational resources. In May 2000, the Gorge Commission recognized that while a Class I designation is not appropriate for the Gorge; there is some potential risk to those resources from air pollution that must be protected under the National Scenic Area Act.

Therefore, the Gorge Commission approved an air quality amendment to the National Scenic Area (NSA) Management Plan that asked the air agencies to (A) continue to monitor air pollution and visibility levels in the Gorge, (B) analyze monitoring and emissions data to identify all sources, both inside and outside the Scenic Area, that significantly contribute to air pollution, and (C) develop and implement a regional air quality strategy to carry out the purposes of the NSA. The Commission has noted it does not have expertise in air quality planning and they will rely on the air agencies to develop an air quality strategy for the NSA.

Gorge Air Project – Background

In 2001, the air agencies and the Washington Department of Ecology drafted a Gorge Air Quality Work Plan based on the Gorge Commission's charge to develop an approach to study and protect air quality in the Gorge with a focus chiefly on visibility and the emission sources that contribute to haze in the Scenic Area. In 2003, budget cutbacks forced the study and process to be redesigned. Resource reductions at the state level resulted in the Washington Department of Ecology dropping out of the Gorge project. DEQ and SWCAA had to abandon efforts for a large bi-state advisory committee process, and they were forced to scale back the technical study. The scope and funding for the Gorge project did not allow for a comprehensive and exhaustive evaluation of all possible air pollution effects on scenic, cultural, natural, and recreational resources. It was recognized that the redesigned technical study would not be able to provide answers to all possible questions about air quality in the Gorge. Because similar pollutants affect both visibility and acid deposition, visibility was selected as a surrogate of air quality in general. The air agencies developed an addendum to the Work Plan, which the Gorge Commission approved in August 2003.

During the course of its technical study, the air agencies learned of concerns relating to air quality impacts on ecological effects and cultural resources in the Gorge. For example, the U.S. Forest Service (USFS) conducted studies that looked at fog water chemistry, ozone injury to forests, and potential impact to lichen ecosystems. The Gorge Area Tribes began looking into the effects of air pollution on Native rock images. These studies have been very useful as a starting point for studying these issues and are discussed in this report.

Because many of the pollutants that impair visibility are the same ones that can affect broader ecosystem issues in the Gorge, the air agencies believe that the majority of strategies set forward in this document would both directly and indirectly benefit all the valued resources to be protected under the Scenic Area Act.

Gorge Commission Concurrence

The air agencies believe they have met the charge given them by the Gorge Commission and respectfully request the Commission concur with the following package of four key conclusions and recommendations that cannot be separated from each other:

1) The air agencies have:
    a. Monitored air pollution and visibility levels in the Gorge, and
    b. Analyzed monitoring and emissions data to identify the sources, both inside and outside the Gorge, that contributes to air pollution.

2) The air agencies have described in this document a reasonable approach to a regional air quality strategy for the Gorge that will produce continued improvement in visibility. This strategy is grounded in the chief conclusions of the air agencies' science study that no single action can feasibly be taken to dramatically improve Gorge visibility, but that visibility improvement can only be accomplished through the cumulative effect of many different emission reduction efforts. Any viable approach to achieve further visibility improvement in the Gorge must involve all the governmental entities, stakeholders, and agencies working together to implement a combination of the following:

    a) Current and existing federal and statewide strategies for regional air pollution reduction;

    b) New emission reduction strategies and projects that focus specifically on Gorge visibility improvement;

    c) Pursuit of future strategies and concepts to benefit the Gorge as they are developed and become available.

3) In five years (2013) the air agencies will conduct a progress assessment to verify whether visibility improvements in the Gorge attributed to man-made sources have occurred as expected. The agencies will also update the Gorge Commission on the implementation of current and new strategies and the development of potential future strategies.

4) The air agencies will continue to work as needed with all affected agencies, stakeholders, elected officials, the public, and Native American Tribes, and will be open to reviewing new research conducted by the USFS, Native American Tribes, and others as it is developed.

Overview of Agency Conclusions from Gorge Air Studies

After reviewing the available scientific studies looking at visibility trends, ecological effects, and sources of haze, the air agencies' findings and conclusions from the scientific studies are:

1. What are the visibility trends (Current and Future)?

- High haze events do occur in the Gorge. These events vary year-to-year, are influenced by local and regional emissions sources as well as local and regional meteorology. (i.e., local stagnation and regional and global transport winds).

- Visibility in the Gorge is not degrading and is in some instances improving slightly despite regional growth pressures. While there is not consensus among all stakeholders about the exact trajectory of this trend line, additional studies to reconcile the various views would not likely lead to a different conclusion by the agencies.

- Visibility is expected to improve somewhat in the coming years. The Agency's modeling analysis of expected future visibility trends suggests that visibility will improve slightly over the next decade (through 2018) - again despite strong anticipated regional growth pressures.

2. When is haze most significant and where does it come from?

- Visibility impairment in the Gorge is typically worse in the winter than it is in the summer, particularly at the eastern end of the Gorge when air stagnation conditions trap and concentrate pollution.

- Winter haze episodes are dominated by easterly winds with the majority of emissions coming from sources east of the Gorge. Winter haze concentrations are most significant at the east end of the Gorge, less significant at the west end of the Gorge.

- Summer haze episodes are dominated by westerly winds with emissions typically coming from the Portland/Vancouver area and other regional sources west of the Gorge. Summer haze concentrations are most significant at the west end of the Gorge, less significant at the east end of the Gorge.

- Haze pollution comes from everywhere. Some haze pollutants are generated locally, but a large fraction of haze pollution comes from regional sources as far away as Canada and beyond. Also, a large fraction of haze pollution is from natural sources, such as forest fires.

3. What are the most significant emission sources contributing to Gorge haze?

- Haze comes from all over the region, both locally and from far way. Generally, "man-made" emission sources (such as motor vehicles, power plant emissions, and woodstoves) each contribute a small amount to total haze. Haze events are the result of the collective contribution of these many sources.

- Natural sources such as wildfires and vegetation, and sources from outside the region (i.e. Canada and overseas) play a large role in Gorge haze, and contribute approximately 20% to over 50% of total haze depending on the season and location in the Gorge.

- Local sources from the Portland/Vancouver area play a minor to modest role in haze, contributing in the range of 3% to 20% of total haze depending on the day, season, and meteorology.

- Sources east of the Gorge contribute in the range of 13% - 57% of haze, and are most significant in the winter.

- The most significant man-made sources contributing to Gorge haze include:
    - power plant emissions,
    - woodstoves,
    - motor vehicles,
    - non-road emissions (e.g., ships, trains, trucks), and
    - agricultural sources of ammonia.

4. What can be done to reduce emissions and improve visibility?

- For each of the key contributing emission sources listed above, there exists today, or will soon exist, an emission reduction strategy that will reduce emissions over time, help improve regional and Gorge visibility, and reduce acid disposition, lowering the risk to cultural resources and ecosystems.

- The air agencies' science study confirms that there is no single source or group of sources that are primarily responsible for haze events in the Gorge. Therefore, continued improvement in visibility will require the collective benefit of emission reductions from many different sources, both locally and across the region. Many emission reduction strategies are currently underway, and new strategies are being developed. In the coming years these strategies will all act together to reduce haze in the Gorge.

- All these strategies (current, new, and those developed in the future), will evolve and play out over the next several years primarily as part of the federal Regional Haze reduction effort, or as targeted special emission reduction projects undertaken to benefit the Gorge. Other air quality planning efforts around the region, such as plans to meet or maintain public health standards or reduce air toxics may also contribute new emission reduction strategies that will provide co-benefits to the Gorge.

- DEQ and SWCAA will conduct a progress assessment in 2013 to determine whether these strategies are indeed producing the continued visibility improvements expected by the agencies.

5. What are the ecological effects of air pollution in the Gorge?

- Important work done by the USFS to date suggests that acidic deposition in the Gorge may pose some risk to sensitive ecosystems and Native American rock images.

- At this point, these studies are not conclusive. The air agencies would encourage the USFS and Gorge area tribes to continue this very valuable research to better understand the actual risk to Gorge ecosystems and cultural resources.

More discussion of the Agency's conclusions and strategies is provided in the section below and throughout this report.

Gorge Strategy Overview

The Gorge visibility strategy will rely on four basic approaches that together, over time, will drive continued visibility improvement in the Gorge. The four components include:

a) Current and existing federal and statewide strategies for regional air pollution reduction. (Report Section VII. A.) Key examples of theses strategies include:

- Prevention of Significant Deterioration (PSD): air quality permitting program for new and expanding major industrial sources.
- Motor Vehicle Inspection and Maintenance Program.
- Ultra-Low Sulfur Diesel Fuel Requirements.
- Diesel Retrofit on School Buses in SW Washington.
- Woodstove Smoke Reduction Project in Oregon and Washington.
- Federal Air Toxics Source Standards in Oregon and Washington.

b) New emission reduction strategies and projects that focus specifically on regional visibility improvement with benefits to the Gorge; or adopted for other purposes with co-benefits to the Gorge. (Report Section VII. B.) Key examples of theses strategies include:

- Federal Regional Haze Program.
- Best Available Retrofit Technology (BART) Facilities.
- Smoke Management in Oregon and Washington.
- California Low Emission Vehicles in Oregon and Washington.
- Diesel Retrofits for Local Government Fleets.
- Portland Air Toxics Solutions plan.
- Oregon's Utility Mercury Rule.

c) Pursuit of future strategies and concepts to benefit the Gorge as they are developed and become available. (Report Section VII. C.)

- Bi-State Solutions Initiatives:
  1) Columbia River Regional Diesel Reduction Project (project in development)
  2) Eastern Dairies and Agriculture Best Management Practices (concept)
- Oregon's "Heat Smart" Woodstove Upgrade Initiative (2009)
- Agricultural Burning
- Dust Management Plan for the Gorge
- Public Health – New Potential Strategies to Meet and Maintain Air Quality Health Standards
- State Greenhouse Gas Initiative

d) Progress Evaluation (Report Section VII. F.)

- In five years (2013) the air agencies will conduct a progress assessment to verify whether visibility improvements in the Gorge attributed to man-made sources have occurred as expected. The agencies will also update the Gorge Commission on the implementation of current and new strategies and the development of potential future strategies.

Note that in any given year visibility conditions may be better or worse depending on the influence of natural emission sources such as forest fires. The air agencies' will be focusing primarily on trends in man-made emissions to conduct a progress assessment to verify whether visibility improvements in the Gorge have occurred as expected.

Special Issues of Interest

1. PGE Boardman Facility

Oregon DEQ expects that both NOx and SO_2 emissions at the Boardman facility will be significantly reduced through the application of emission controls under the federal Regional Haze rule requiring Best Available Retrofit Technology (BART). DEQ is currently evaluating control technology options for the facility. The selection of BART

controls (and thus the level of emission reduction required) will be decided in late 2008 by the Oregon Environmental Quality Commission (EQC), after the lengthy public process. Oregon DEQ intends to begin this public rulemaking process in the summer of 2008.

Emission reductions at the Boardman facility will provide a relatively modest but significant improvement in Gorge visibility as well as reduce emissions contributing to acidic deposition. This will help reduce the risk to cultural resources and ecosystems in the Gorge.

2. Other BART Source Reductions

While likely not as significant as Boardman, other BART eligible major industrial facilities in Oregon and Washington will be reducing emissions to meet BART visibility improvement objectives. Benefits to the Gorge cannot be quantified at this time, but all reductions achieved from BART will help collectively improve regional visibility and reduce acid deposition.

3. Ammonia Emissions

The air agencies' Science Study suggests that regional ammonia emissions are a significant factor in haze formation affecting both Class I wilderness areas and the Gorge. There are many sources of regional ammonia, including the use of agriculture fertilizers, and regional animal feeding operations, such as dairies. In January 2008, the Oregon Task Force on Dairies and Air Quality convened to study air emissions from dairy operations and explore options for reducing those emissions. The Task Force will release its report in July 2008.

The air agencies hope the Task Force report will identify ways to reduce dairy emissions statewide. The air agencies also hope the Task Force report will be a springboard for bi-state cooperation in reducing air emissions from Oregon and Washington dairy operations, especially in regions east of the Gorge. DEQ and SWCAA will have a better sense of future possibilities when the Task Force has completed its work this summer. Section VII of this report discusses an initial concept for a bi-state dairy ammonia reduction project that could potentially be informed and encouraged by the result of the Dairy Task Force work.

4. Cultural Resources and Ecosystems

The USFS and Gorge-area Native American Tribes have begun important research into the question of acid deposition in the Gorge and the potential risk to important cultural and ecosystem resources there. The air agencies encourage this work to continue, and would welcome reviewing the results of any new studies during its 2013 visibility progress assessment.

The agencies cannot, at this time, fund or lead any new studies in the area of acid

deposition. We would however, be happy to participate in the design phase of new research and in the peer review of any study results.

In the air agencies' view, several additional studies will be required before conclusions can be drawn about the risk to cultural and natural resources from acidic deposition. While current studies suggest some acidic deposition is occurring, at this time the air agencies do not know with any certainty to what extent cultural or natural resources are at risk or are being harmed. Additional research by the USFS and Native American Tribes would help answer those questions.

As future studies are developed, the air agencies note that many of the same pollutants that impair visibility also play a key role in acidic deposition. Therefore, many of the upcoming strategies that improve visibility will also help reduce acidic deposition and reduce risks to cultural and natural resources.

Tribal Consultation

The air agencies have been in contact with each of the four Gorge-area Native American Tribes to discuss the Gorge Air Quality Study, the Gorge Air Strategy, and emerging air issues of concern. DEQ and SWCAA are currently pursuing a government-to-government consultation convened by the U.S. Environmental Protection Agency or U.S. Forest Service to discuss the Gorge project.

Conclusion

The air agencies have presented the Gorge Commission with a comprehensive understanding of the emission sources that influence scenic resources in the Gorge, a look into the likely future of haze trends in the Scenic Area, and a path forward for continued visibility improvement over time. With this framework now in place, the air agencies believe the Columbia River Gorge Commission should concur that the air agencies have met the charge given them.

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Section I. Introduction

This document describes the Oregon Department of Environmental Quality (DEQ) and Southwest Clean Air Agency's (SWCAA) (together, "air agencies") rationale and strategy for managing visibility in the Gorge. It summarizes the current and future potential actions that, taken together, will guard against long-term visibility degradation from current levels and drive continued visibility improvements in the future. It includes on-going oversight and evaluation of our progress. The Air agencies are requesting Gorge Commission concurrence with this strategy.

Section II. Gorge Commission Charge to the Air Agencies

In May 2000, the Gorge Commission approved an air quality amendment to the National Scenic Area Management Plan. The amendment language states that:

> *"Air quality shall be protected and enhanced, consistent with the purposes of the Scenic Area Act. The States of Oregon and Washington shall: (1) continue to monitor air pollution and visibility levels in the Gorge; (2) conduct an analysis of monitoring and emissions data to identify all sources, both inside and outside the Scenic Area that significantly contribute to air pollution. Based on this analysis, the States shall develop and implement a regional air quality strategy to carry out the purposes of the Scenic Area Act, with the U.S. Forest Service, the Southwest Air Pollution Control Authority [now the Southwest Clean Air Agency] and in consultation with affected stakeholders.*
>
> *The States and the Forest Service together shall provide annual reports to the Commission on progress made regarding implementation of this policy. The first report shall include a work plan and timeline for gathering/analyzing data and developing and implementing the strategy. The work plan shall be submitted to the Commission for approval at the next annual update (August 2001)."* [1]

There was recognition by the Gorge Commission in their discussions amending the Management Plan in 2000 that while a Class I (wilderness area) designation is not appropriate for the Gorge, there is some potential risk to the resources that must be protected under the National Scenic Area Act. The new air quality amendment language reflects both purposes of the National Scenic Area Act.

The Columbia River Gorge Commission has responsibility under the Scenic Area Management Plan to protect natural, scenic, cultural, and recreational resources. It is recognized that the Commission does not have expertise in air quality planning and that they will rely on the Oregon and Washington air quality agencies to develop an air

[1] Management plan amendment language adopted by the Columbia River Gorge Commission on May 9, 2000. SMA Natural Resources Policy 12[pages I-123]

quality strategy for the Scenic Area. However, as the regional policy-making body for the Scenic Area, the Gorge Commission must ensure that any proposed air quality strategy carries out the purposes of the Scenic Area Act. Therefore, in its review of the strategy, the Gorge Commission must find that it is consistent with those purposes.

Section III. Gorge Air Project – Background

In 2001, the air agencies and the Washington Department of Ecology developed an approach to study and protect air quality in the Gorge with a focus chiefly on visibility and the emission sources that contribute to haze in the Scenic Area. After a lengthy public process and Gorge Commission approval of the plan, the 2001 Work Plan encompassed two elements: (1) the development of a bi-state air quality advisory committee to lead a strategy development process and (2) a technical study to assess the causes of visibility impairment and to identify the emission sources that contribute to haze in the Scenic Area.

In 2003, budget cutbacks forced the study and process to be redesigned. Resource reductions at the state level resulted in the Washington Department of Ecology dropping out of the Gorge project and its statewide visibility protection program. DEQ and SWCAA had to abandon efforts for a bi-state air quality advisory committee and the technical study was scaled back. The scope and funding for the Gorge project did not allow for a comprehensive and exhaustive evaluation of all possible air pollution effects on scenic, cultural, natural, and recreational resources. It was recognized that the redesigned technical study would not be able to provide answers to all possible questions about air quality in the Gorge. Because similar pollutants affect both visibility and acid deposition, visibility was selected as a surrogate of air quality in general. The air agencies developed an addendum to the Work Plan and the Gorge Commission approved the changes in August 2003.

During the course of its technical study, the air agencies also learned of concerns with other air quality issues affecting the Gorge, specifically relating to ecological effects and cultural resources. For example, the U.S. Forest Service conducted studies that looked at fog water chemistry, ozone injury to forests, and potential impact to lichen ecosystems. The Gorge Area Tribes began looking into the effects of air pollution on Native rock images.

Because the pollutants that impair visibility in the Gorge are the same ones that can affect broader ecosystem issues in the Gorge, the air agencies believe that the strategies set forward in this document would both, directly and indirectly, benefit all the valued resources to be protected under the Scenic Area Act.

Section IV. Gorge Commission Concurrence with Gorge Air Strategy

This strategy document, together with the air agencies' Science Summary Report, represents fulfillment of the work set out to be performed in 2000. The emission reduction strategies described in this document, both existing and new, together with the

progress tracking and evaluation milestones in 2013, are designed to drive continued improvement in Gorge visibility in the future. Any additional research conducted by the Tribes and USFS on the topic of rock image or ecosystem risks will be welcomed as part of the agency's 2013 progress assessment.

The air agencies believe they have met the charge given them by the Gorge Commission and respectfully request the Commission concur with the following package of four key conclusions and recommendations that cannot be separated from each other:

1) The air agencies have:
    a. Monitored air pollution and visibility levels in the Gorge, and
    b. Analyzed monitoring and emissions data to identify the sources, both inside and outside the Gorge, that contributes to air pollution. (Report Section V.)

2) The air agencies have described in this document an approach to a regional air quality strategy for the Gorge that will produce continued improvement in visibility. This strategy is grounded in the chief conclusions of the air agencies' Science Study that no single action can feasibly be taken to dramatically improve Gorge visibility, but that visibility improvement can only be accomplished through the cumulative effect of many different local and regional emission reduction efforts. Any viable approach to achieve further visibility improvement attributed to man-made sources in the Gorge must involve all the governmental entities, stakeholders, and agencies working together to implement a combination of the following: (Report Section VII.)

    a. Current and existing federal and statewide strategies for regional air pollution reduction; (Report Section VII. A.)

    b. New emission reduction projects that focus specifically on Gorge visibility improvement; (Report Section VII. B.)

    c. Pursuit of future strategies and concepts to benefit the Gorge as they are developed and become available. (Report Section VII. C.)

3) In five years (2013) the air agencies will conduct a progress assessment to verify whether the visibility improvements in the Gorge have occurred as expected. The air agencies will also update the Gorge Commission on the implementation of current and new strategies and the development of potential strategies. (Report Section VII. F.)

4) The air agencies will continue to work as needed with all affected agencies, stakeholders, elected officials, the public, and Native American Tribes and will be open to reviewing new research conducted by the USFS, Native American Tribes, and others as it is developed. (Report Section VIII.)

The air agencies have presented the Gorge Commission with a comprehensive understanding of the emission sources that influence scenic resources in the Gorge, a look

into the likely future of haze trends in the Scenic Area, and a path forward for continued visibility improvement over time. With this framework now in place, the air agencies believe the Columbia River Gorge Commission should concur that the agencies have met the charge given them and that the above approach is consistent with the National Scenic Area Act and Gorge Management Plan.

Section V. Air Studies

A. Background on Haze

Haze is air pollution that results in reduced visibility of an area. In general, the higher the concentration of the pollutants, the more visibility is impaired. Visibility impairment typically occurs at pollution levels much lower than federal air quality health standards, and so does not generally pose a risk to public health. Haze does degrade valued scenic vistas, and visibility impairing pollutants can also, in high enough concentration, potentially harm sensitive ecosystems and other resources.

The air pollutants responsible for haze are particulate matter (PM). Particulate matter (PM) can be released as primary particles (PM emissions released directly into the atmosphere from fire, dust, etc.) or as secondary particles, (PM chemically formed in the atmosphere from precursor gases). The major precursor gases are sulfur dioxide (SO_2), nitrous oxides (NO_x), ammonia (NH_3) and volatile organic compounds (VOCs).

Particulate matter can be further broken down to distinct particle species in the atmosphere: ammonium sulfate, ammonium nitrate, organic compounds, elemental carbon, and coarse PM. Air monitoring on bad visibility days shows the main pollutants impacting the Gorge are organic carbon, nitrates, and sulfates. Sulfates and nitrates are secondary particles chemically formed in the atmosphere from precursor gases such as sulfur oxides (SO_x) and oxides of nitrogen (NO_x), which are products of fossil fuel combustion (coal burning power plants, automobiles, and industrial boilers). The presence of ammonia (NH_3) also plays a key role in the formation of sulfates and nitrates. Sources typically associated with ammonia emissions include livestock farming, application of fertilizer, and the decomposition of manure. For the most part, organic carbon comes from sources that emit wood smoke directly into the atmosphere such as wildfires and residential woodstoves. Another pollutant of concern is elemental carbon, a byproduct of fossil-fuel combustion. Elemental carbon affects visibility by absorbing light. These pollutants all have the ability to affect visibility by scattering or absorbing light.

B. Gorge Visibility Studies

Since 2004, the air agencies and other scientists have conducted several visibility studies to learn as much as possible about regional and local emission sources influencing haze levels in the Gorge. The studies used a combination of air monitoring, chemical analysis, and computer model simulations to investigate the causes of haze. They evaluated hundred of emission source types from in-Gorge sources to sources as far as Seattle and

beyond. The scientists explored fundamental questions like: where is haze pollution coming from, what emission sources are significant contributors to haze levels and what is the expected future trend in visibility looking out about ten years. These studies were all conducted to obtain a better understanding of what is happening with visibility in the Gorge.

This document highlights the key findings and conclusions and does not attempt to reconcile all of the studies. Each study was designed to look at a different part of the visibility story. No single study provided all the needed information. However, taken together the results of all the studies provide a good picture of the geographic areas and significant emission sources that influence haze in the Gorge. The results will help guide the air agencies and others on how to best focus resources for future emission reduction efforts.

The key visibility study highlights are summarized below. The complete body of research is available from the air agencies, and is also available at the following web site http://www.gorgeair.org.

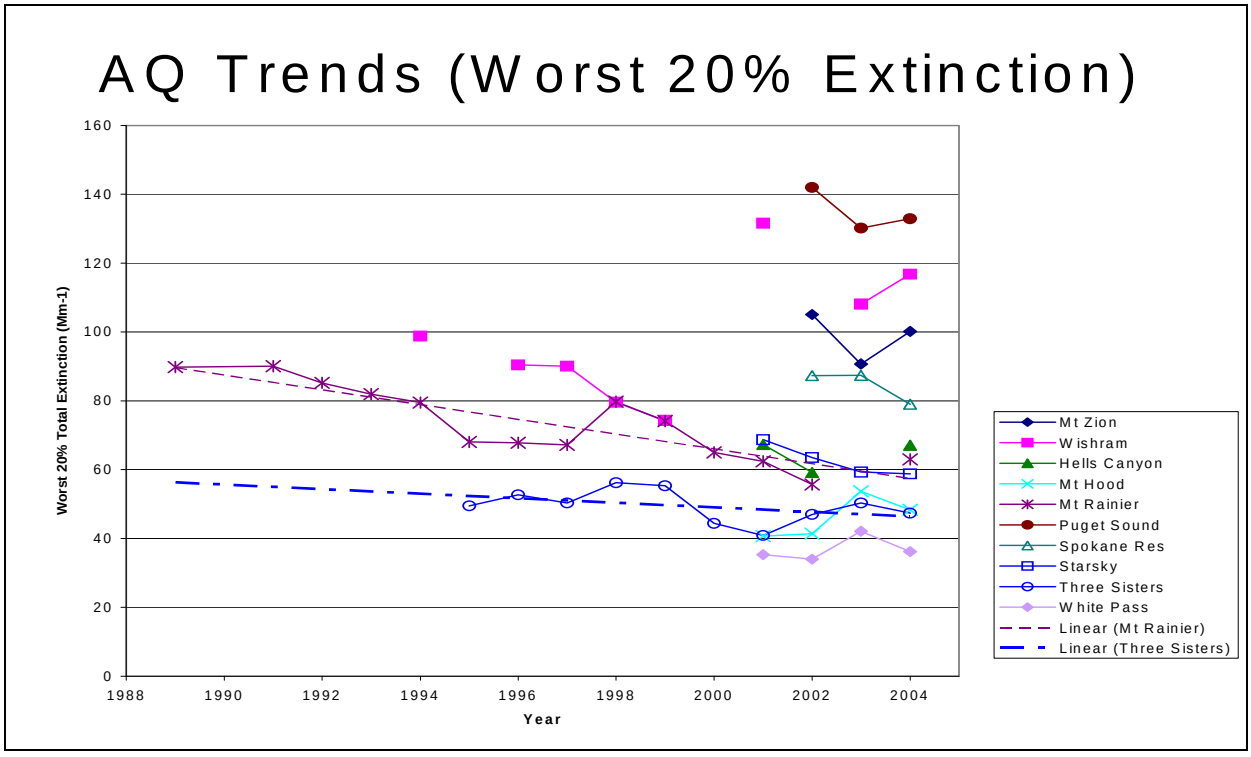
1) Current Visibility Trends

Several independent researchers offered the agencies their analysis of current visibility trends in the Gorge. The highlights of the findings are presented below. The observation of historical monitoring data in the Gorge suggests improving trends for some pollutants, (like sulfate and lead), but no improvement in other pollutants (like nitrate and ammonium).

The highlights of current monitoring trend analyses are presented below in Figures 1-2. The historical trend data tells a relatively consistent story, although the interpretation of the data can be expressed somewhat differently by various researchers. One trends analysis suggests that current haze levels show a slightly improving or flat trend. Another analysis suggests that there is no significant improving trend, but that the trend is not worsening.

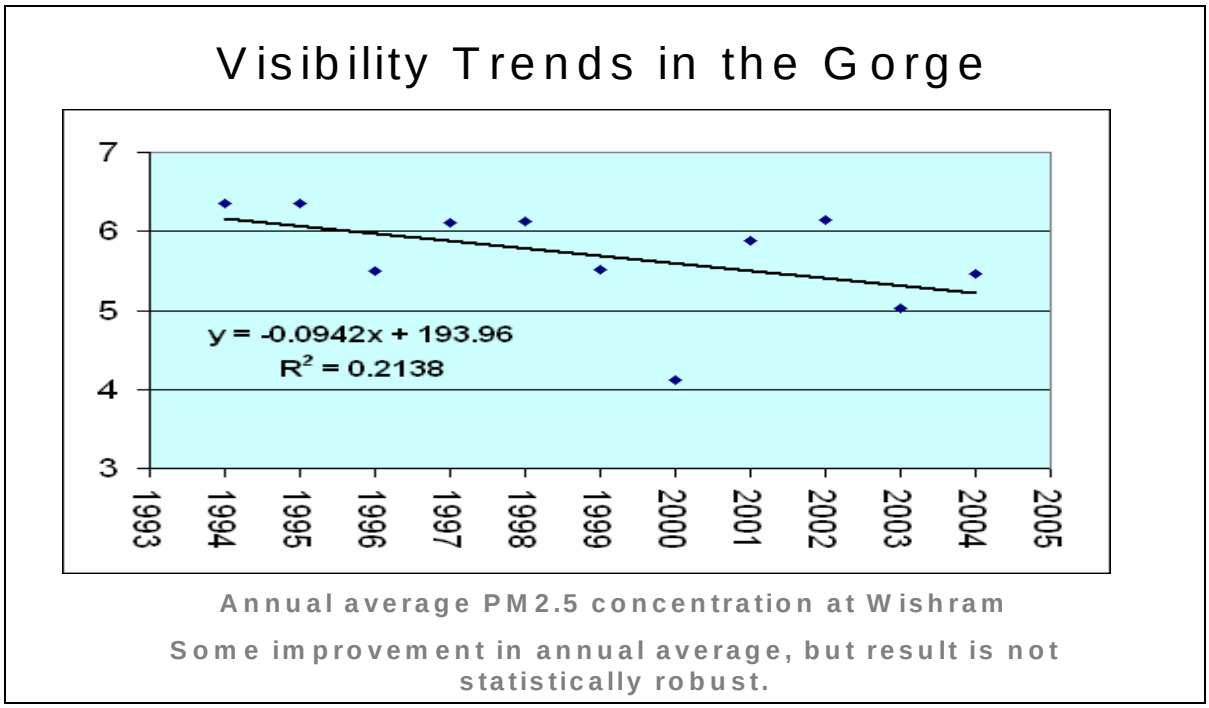
Study	Findings
Updated Air Quality Trends For the Columbia River Gorge (Kent Norville, Air Sciences, 2006 - prepared for Klickitat County) **(See Figure 1)**	Historical look at air quality trends: • All long-term (> 7 years) monitoring stations show a downward (improving) trend in air quality. • Shorter-term monitoring stations (3 to 7 years) are either flat or show a downward trend. • No monitoring station shows a long-term upward (worse) trend even though population has increased.

Figure 1: AQ Trends Showing the Worst 20% Visibility Days (Norville, 2006)



Study	Findings
Who is polluting the Columbia River Gorge? (Dan Jaffe, University of Washington, 2006 – prepared for the Yakama Nation) **(See Figure 2)**	Historical look at air quality trends: • No evidence for improving air quality on the worst days or in the fall, when most air quality problems occur in the Gorge.

Figure 2: Who Is Polluting the Columbia Gorge Trends Slide, presented at Gorge Policy Day, September 25, 2007 (Jaffe 2006)



2) Future Visibility Trends (to 2018)

One of the key outcomes of the visibility study was to estimate the future trend in Gorge visibility that can be projected over the next decade, given expected growth and already adopted emission reduction strategies. The air agencies estimated visibility in 2018 for summer and winter haze episodes in the Gorge. The forecast was based on expected emissions changes in the region. Figures 3-5 show the projected future trends in Gorge visibility over the next decade.

Study	Findings
CAMx Modeling Study (Chris Emery, ENVIRON, 2007 – sponsored by DEQ & SWCAA) **(See Figures 3-4)**	Future look at visibility trends: • Little visibility change (1% - 3%) in the summertime (August episode). • Wintertime (November episode) visibility haze levels will improve a small (10%) yet noticeable amount. • Haze levels have held steady and will likely show a small improvement over the next decade, despite population growth.

Figure 3: CAMx Modeling (Emery 2007) Future Visibility Trends: August

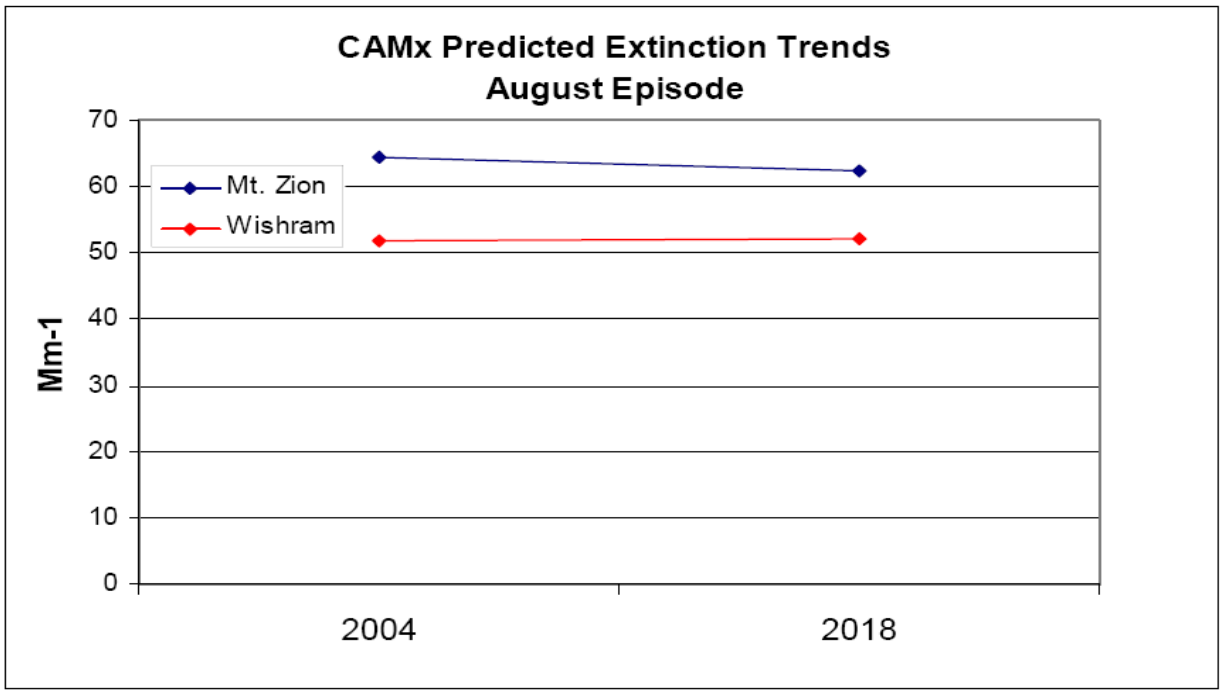
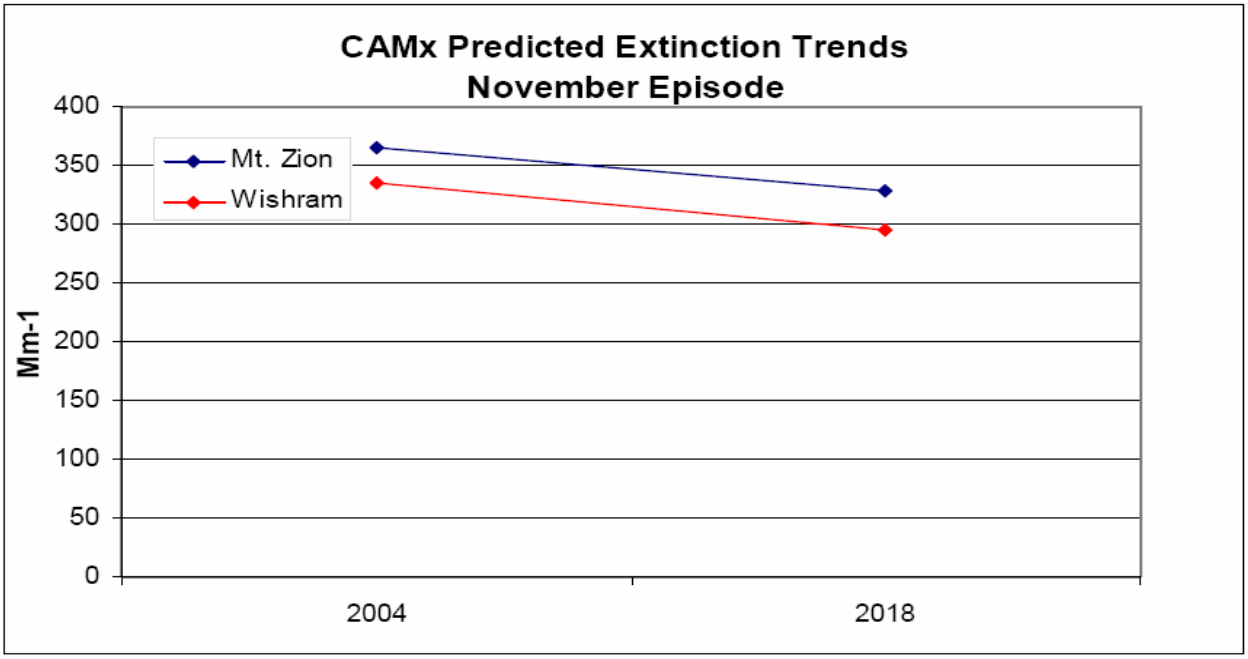
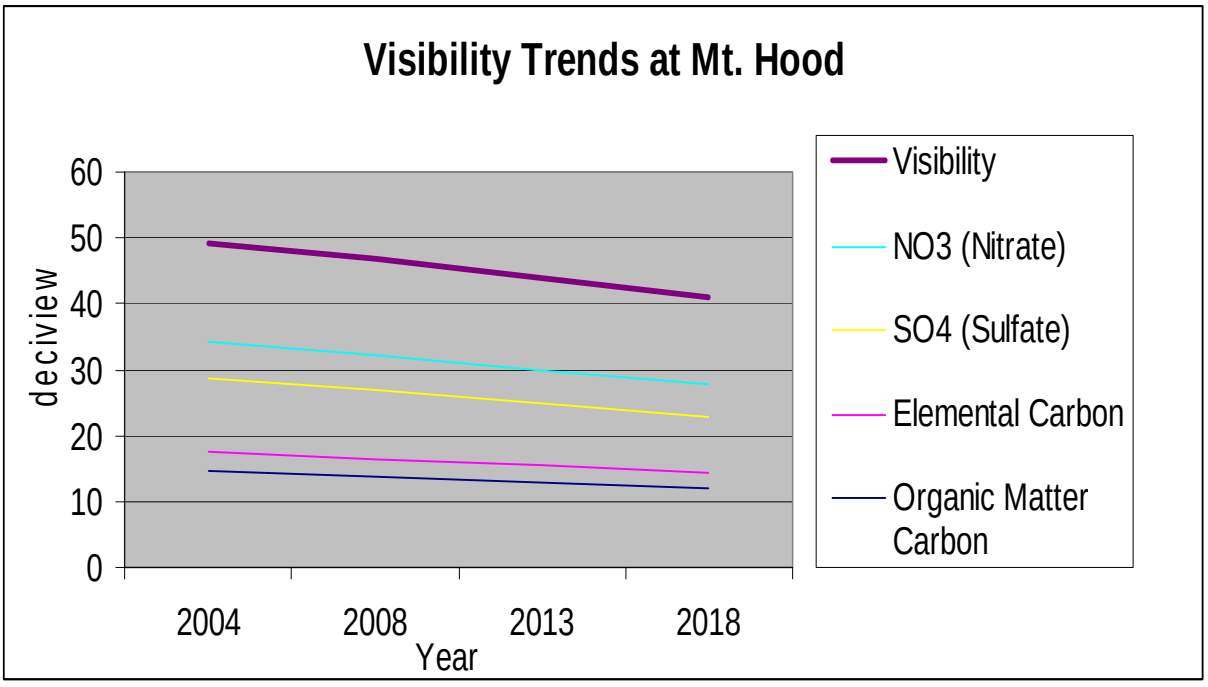


Figure 4: CAMx Modeling (Emery 2007) Future Visibility Trends: November



Study	Findings
Western Regional Air Partnership (WRAP) (Technical Support System-TSS) Haze Reduction Glide Slope Analysis 2008) [2](http://vista.cira.colostate.edu/tss/) **(See Figure 5)** The WRAP is a regional organization in the west that assists states in the analysis and preparation of Regional Haze plan for improving visibility in wilderness areas and national parks.	Future look at visibility trends: • Some visibility improvement. • Sulfate visibility greatly improved. • Nitrate visibility somewhat improved.

Figure 5: WRAP TSS Visibility Modeling Results for 2018 (2008)



Taken together, the agencies conclude that current monitoring trends show that visibility in the Gorge is not getting worse, but rather holding steady or improving slightly in the face of significant regional growth pressure. Even so, trends are not improving as much as the agencies would hope.

[2] The Technical Support System (TSS) has been developed by the Western Regional Air Partnership (WRAP) to provide technical data and analytical results prepared by WRAP Forums and Workgroups. The TSS is a tool to support implementation of Regional Haze plans and to provide a tool to show past and future visibility conditions.

3) Source Contribution to Haze

The air agencies analyzed monitoring and emissions data to identify the sources, both inside and outside the Gorge that contributed to air pollution. The air agencies sponsored a number of separate studies with each study providing a clearer link to determining the causes of visibility impairment in the Gorge. The three main studies conducted were:

- *Haze Gradient Study*: The Haze Gradient study provided a snapshot of how haze moves into and throughout the Gorge, from both the west and east, and how haze movement relates to wind directions and seasons. The haze gradient study did not attempt to identify specific emission source types contributing to haze.
- *CoHaGo Study*: The CoHaGo Study built on the findings from the Haze Gradient Study and tried to estimate individual sources likely to be contributing significantly to haze.
- *CAMx Modeling Study*: The CAMx Modeling Study further identified what sources were contributing to haze and identified specific source regions. The CAMx Modeling Study was conducted for one haze event in the summer and one haze event in the winter. While the source categories and regions are likely representative of most haze events, the actual percent contribution to haze by a single source category may vary. The CAMx study was not able to include the effects of fugitive dust.

Table 1 provides a summary of findings from the three studies describing the different source contributions to haze.

Table 1: Summary of Source Contribution to Haze

Study	Summer	Winter
Haze Gradient (Mark Green, DRI, 2006 – DEQ & SWCAA sponsored study)	• Summertime episode is cleaner. • Increased haze at the western end of the Gorge from west winds transporting emissions through the Gorge.	• Wintertime haze is worst. • Winds from the east blowing haze into the Gorge.
Causes of Haze in the Gorge (CoHaGo) (Mark Green, DRI, 2006 – DEQ & SWCAA sponsored study)	• Main contributors of haze are estimated to include organic carbon and sulfate: o Burning – such as forest fires (organic carbon) o Oil combustion and paper mill emissions (sulfate) o Portland/Vancouver metro area emissions o Dust	• Wintertime haze is worse than the summer. • Caused by haze-forming pollutants such as nitrates, sulfates, and organics. • Contributing sources include: • Sources to the east of the Gorge: o Wood burning emissions (organics) o Coal fired power plant (sulfates and nitrates) o Regional ammonia sources, including nearby confined animal feeding operations (CAFO) (ammonia –contributes to the formation of sulfates and nitrates). • Sources to the west of the Gorge: o Pulp & paper o Shipping o Mobile sources o Wildfires o Agricultural burning
CAMx Modeling (Chris Emery, ENVIRON, 2007 – DEQ & SWCAA sponsored study)	Emission sources responsible for haze: • Natural sources such as wildfires and vegetation (~33%) • Outside the region - overseas emissions (~22%) • Portland-area emissions (~3% - ~20%)	Emission sources responsible for haze: • Sources east of the Gorge (~13% - 57%) o power plants, o vehicle emissions o residential wood heating o ammonia • Emissions from outside the region, including Canada and overseas (~19% - ~23%)

4) Ecological Effects

During visibility study, the air agencies became aware of a number of other studies conducted to look at the ecological effects of air pollution in the Gorge. Given the special historic and cultural value of Native American rock images and natural resources in the Gorge, the Forest Service funded studies to sample and analyze fog and cloud water chemistry, lichen chemistry, and ozone injury to forests for assessing potential risks to culturally significant artifacts and ecosystems in the Scenic Area. Briefly, excess nitrogen is of concern. Nitrogen enrichment of the ecosystem is occurring, based on lichen data. Additionally, acid fog has been observed in the Eastern Gorge at levels as low as pH 3.7. The stability of Native American rock images may be at risk due to nitrogen enrichment or acid fog. Ammonia is believed to be the primary cause of excess nitrogen in the eastern Gorge, while fossil fuel combustion is believed to be the primary cause of excess nitrogen in the western Gorge.

The highlights of the findings are presented below. The acid deposition monitoring data shows that ammonium is increasing, while nitrates are steady and sulfates are decreasing. The ecological studies on lichen show that nitrogen loading is increasing, while sulfur remains steady and lead is decreasing.

Table 2 presents a summary of these studies and their conclusions.

Table 2: **Summary of Ecological Effects of Air Pollution in the Columbia River Gorge National Scenic Area**

Study	**Findings**
Air Pollution in the CRGNSA – Detection, Trends, and Ecological Effects (Linda Geiser, USDA Forest Service, Gorge Science Day presentation – Sept 2006.)	• Nitrogen deposition is high in the Gorge. • Sulfur deposition has held steady and remains moderately high in the Gorge. • Lead deposition has decreased dramatically.
Atmospheric deposition inputs and effects on lichen chemistry and indicator species in the Columbia River Gorge, USA (USDA Forest Service, Published in Environmental Pollution 146 – June 2006.)	• Nitrogen deposition rates very high, more than double expected • Acidity of the fog & cloud water samples were characterized as extreme (seven day average fog samples as low as pH 3.7) • Impacts of nitrogen deposition well documented for lichen communities
Deposition of Nitrogen and Sulfur in the Columbia River Gorge National Scenic Area (Mark Fenn, USDA Forest Service, Gorge Science Day presentation – Sept 2006.)	• Nitrogen enrichment of ecosystem underway based on lichen data • Acidic fog and precipitation events occur, but no clear evidence of soil acidification in forested areas

Ozone Injury in West Coast Forests: 6 Years of Monitoring (Sally Campbell USDA Forest Service – June 2007)	• Ozone injury was found at one biomonitoring site in OR & WA • Site is unique (Jeffrey Pine at an irrigated site) • Overall, federally managed forests in OR & WA are not being injured by ozone

In addition, the Tribal Nations of the Gorge area have initiated a study of air pollution effects on rock image stability, based on concerns that air pollutions levels could have the potential to impact cultural and natural resources. Rock images may be damaged either directly or indirectly. Direct damage may result from acid rain, acid fog, and soot. Indirect damage may result from accelerated weather caused by lichen growth. Excess nitrogen, which can lead to acid precipitation and increased lichen growth, has been documented to be occurring in the Gorge.

It is currently unclear the levels at which nitrogen or acid deposition are harmful to the ecosystem. These studies are a first step in understanding ecological effects in the Gorge, and the results can help inform decision-makers as to the next steps that could be taken to evaluate this issue. The air agencies look forward to the results of the Tribal study and any additional studies by the U.S. Forest Service to obtain a better understanding of air quality's impact on acid rain deposition, cultural resources, and ecological effects in the Gorge.

C. Air Agencies' Overall Conclusions Based on the Study Results

The air agencies have evaluated the various studies and modeling scenarios and believe our conclusions are consistent with findings from the various studies. For example, all the scientists and peer reviewers who reviewed the air agencies' Gorge scientific studies agreed that no single source, or group of sources was primarily responsible for Gorge haze events, and that haze reduction would need to result from the cumulative effect of numerous emission reduction activities. This is consistent with the air agencies' conclusion and forms the basis for our strategic approach. In summary, the Agencies have concluded the following:

What are the visibility trends (Current and Future)?

- High haze events do occur in the Gorge. These events vary year-to-year, are influenced by local and regional emissions sources as well as local and regional meteorology. (i.e., local stagnation and regional and global transport winds).
- Visibility in the Gorge is not degrading; and is in some instances improving slightly despite regional growth pressures. Based on the scientists' review of historical data, one trend analysis suggests that current haze levels show a slightly improving or flat trend while another analysis suggests that there is no evidence for improvement on the worst air quality days. While there is not consensus among all stakeholders about the exact trajectory of this trend line, additional studies to reconcile the various views would not likely lead to a different conclusion by the agencies.

- Visibility is expected to improve somewhat in the coming years. The Agency's modeling analysis of expected future visibility trends suggests that visibility will improve slightly over the next decade (through 2018); again despite strong anticipated regional growth pressures.

When is haze most significant and where does it come from?

- Visibility impairment is typically worse in the winter than it is in the summer, particularly at the eastern end of the Gorge when air stagnation conditions trap and concentrate pollution.
- Winter haze episodes are dominated by easterly winds with the majority of emissions coming from sources east of the Gorge. Winter haze concentrations are most significant at the east end of the Gorge, less significant at the west of the Gorge.
- Summer haze episodes are dominated by westerly winds with emissions typically coming from the Portland/Vancouver area and regional sources west of the Gorge. Summer haze concentrations are most significant at the west end of the Gorge, less significant at the east end of the Gorge.
- Haze pollution comes from everywhere. Some haze pollutants are generated locally, but a large fraction of haze pollution comes from regional sources as far away as Canada and beyond. Also, a large fraction of haze pollution is from natural sources, such as forest fires.

What are the most significant emission sources contributing to Gorge haze?

- Haze comes from all over the region, both locally and from far way. Generally, "man-made" emission sources (such as motor vehicles, power plant emissions, and woodstoves) each contribute a small amount to total haze. Haze events are the result of the collective contribution of these many sources.
- Natural sources such as wildfires and vegetation, and sources from outside the region (i.e. Canada and overseas) play a very large role in Gorge haze, and contribute approximately 20% to over 50% of total haze depending on the season and location in the Gorge.
- Local sources from the Portland/Vancouver area play a minor to modest role in haze, contributing in the range of 3% to 20% of total haze depending on the day, season, and meteorology. Sources east of the Gorge contribute in the range of 13% - 57% of haze, and are most significant in the winter.
- A break out of key contributing sources is presented in Section VI below.

What are the ecological effects of air pollution in the Gorge?

- Important work done by the USFS to date suggests that acidic deposition in the Gorge may pose some risk to sensitive ecosystems and Native American rock images.

- At this point, these studies are not conclusive. The USFS and Gorge area tribes should continue this very valuable research to better understand the actual risk to Gorge ecosystems and cultural resources.

Section VI: Key Focus Areas for Emission Reduction Actions to Provide Visibility Improvement

Some of the most valuable information learned from the studies involved a better understanding of the role of natural sources of haze, sources of haze coming from far away and beyond the air agencies' jurisdiction, and those sources that could be within the air agencies' ability to influence.

The Modeling Study demonstrated that a rather large fraction of haze in the Gorge comes from sources outside the region (i.e. outside of Oregon and Washington) and also from natural sources. The air agencies' modeling study looked at regional and source contributions for both the 2004 base-year assessment and the 2018 future visibility forecast. The air agencies recognized that the natural and distant source emissions are beyond its jurisdiction and tried to characterize those emission sources and regions where emissions reduction efforts could be achieved.

A. August 2004 Haze Event

Figures 6-9 provides an overview of the 2004 contributing sources based on the CAMx Modeling Study. The figures provide source allocation information for both the August and November 2004 haze episodes studied, and for both the Mt Zion (west Gorge) and Wishram (east Gorge) monitoring sites. For the August 2004 episode, natural (vegetation and wildfires) and distant (outside the region from overseas and Canada) emissions dominate. These natural and distant ("beyond our jurisdiction") emissions comprise up to 59% - 77%, respectively, of the visibility impairment in the summertime. Other emissions consist of man-made "within our jurisdiction" sources (23% - 41%). These include man-made source emissions, such as motor vehicles, nonroad sources (construction equipment, trains, and boats), area sources (such as residential woodstoves, open burning), and point sources (permitted industrial facilities).

Figure 6 : August 2004 Haze Event – Contributing Sources at Mt. Zion

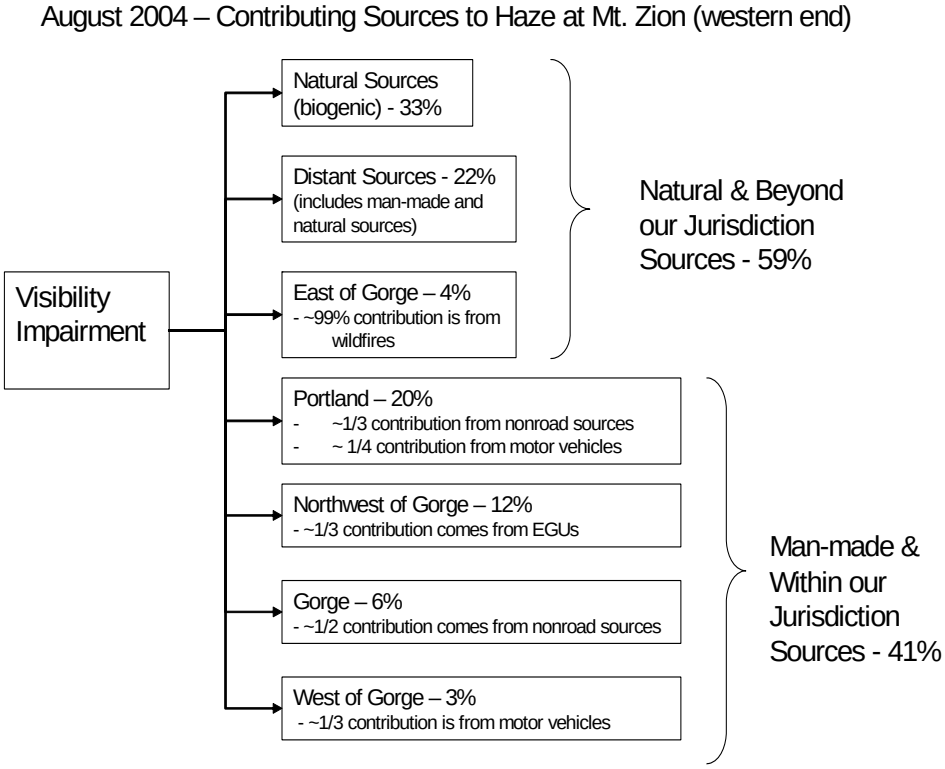
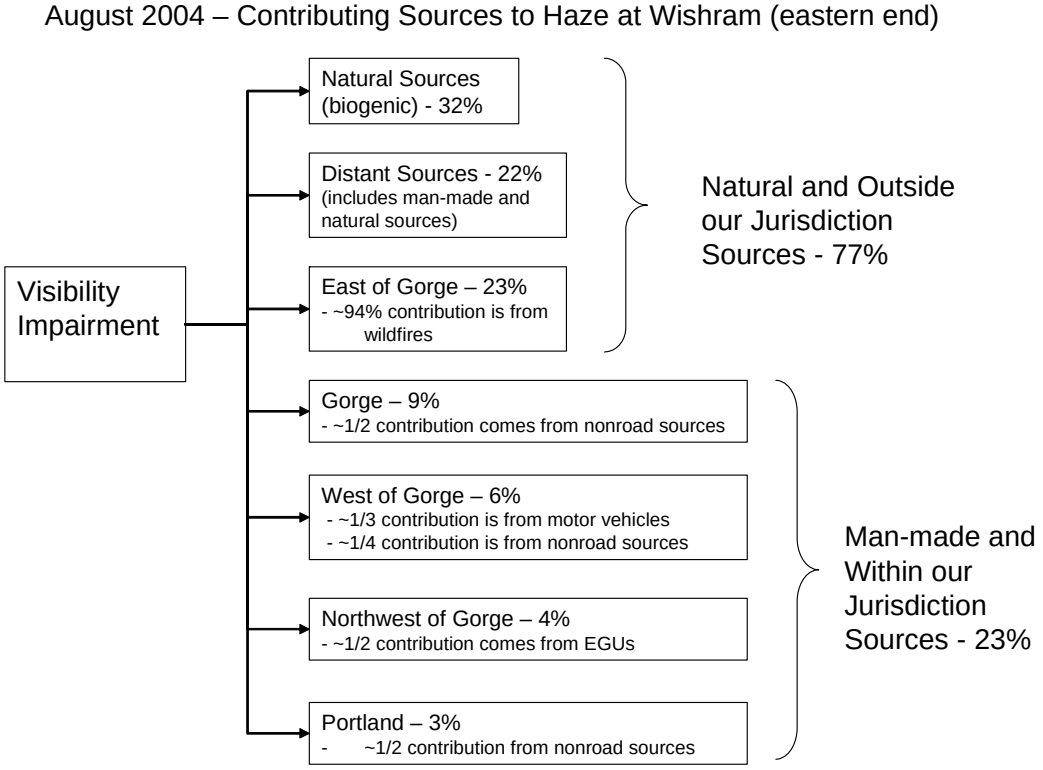


Figure 7: August 2004 Contributing Sources at Wishram



B. November 2004 Haze Event

In Figures 8 and 9, the November 2004 contributing sources to haze are displayed. Natural and distant emission contributions are less, comprising only 28% - 30% of the source contribution to visibility impairment. Man-made "controllable" emissions dominate, contributing 70% - 72%.

Figure 8: November 2004 Contributing Sources at Mt. Zion

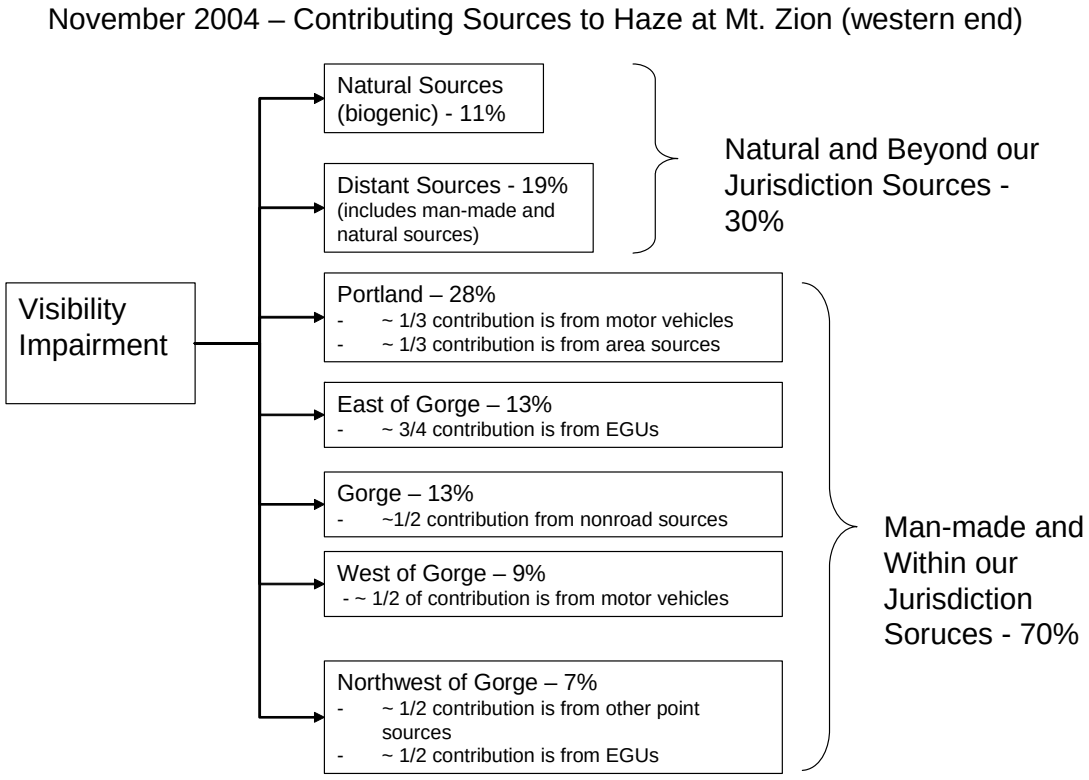
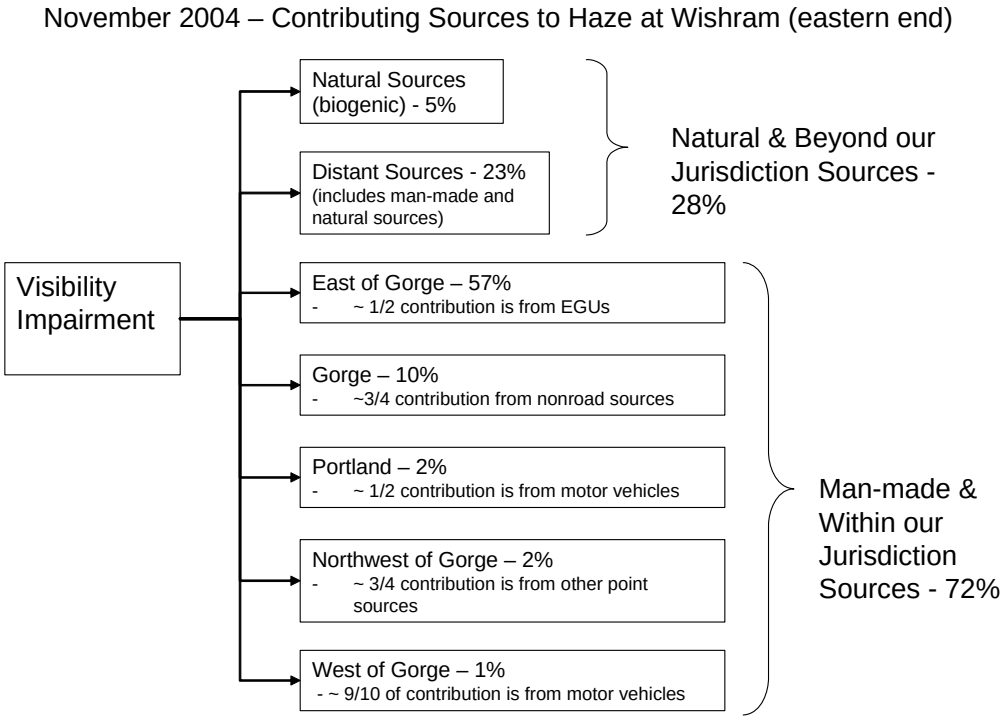


Figure 9: November 2004 Contributing Sources at Wishram



C. Regional Emissions Forecast to 2018

After looking at the 2004 (base-year assessment) sources, the air agencies wanted to predict future year source contributions. A 2018 emissions inventory was developed and based on the best available forecasting information from a number of different growth factors and forecasts. It included estimations on regional growth factors for population, housing units, and employment, Oregon Department of Transportation projections of future year transportation (motor vehicles) forecasts, EPA's economic growth projections, and U.S. Department of Energy projections. During the peer review of the modeling, a few areas were identified as needing some modifications to the initial 2018 emissions projections. Despite these small modifications, the air agencies do not believe the overall impact will significantly change the overall source contribution.

D. August 2018 – Haze Event

In Figures 10 and 11, the August 2018 contributing sources to haze are displayed. Natural and distant emission contributions are about the same as 2004, comprising about 57% to 66% of the source contribution to visibility impairment. Man-made (within our jurisdiction) emissions contribute roughly 35% to 41%, also about the same as 2004 emissions.

Figure 10 : August 2018 Contributing Sources to Haze at Mt. Zion

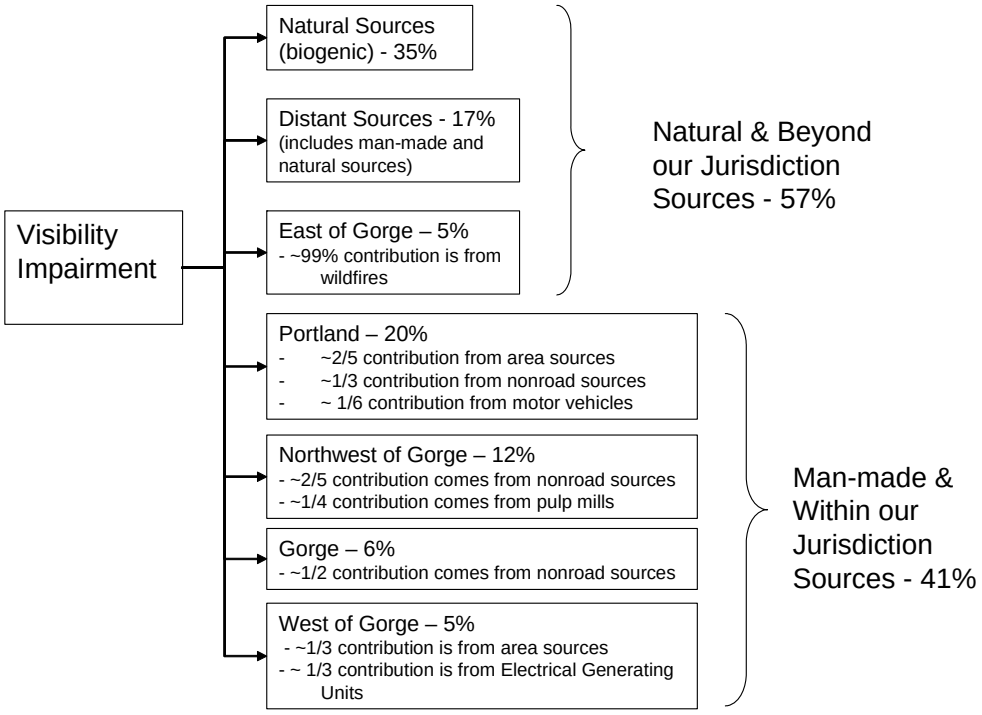
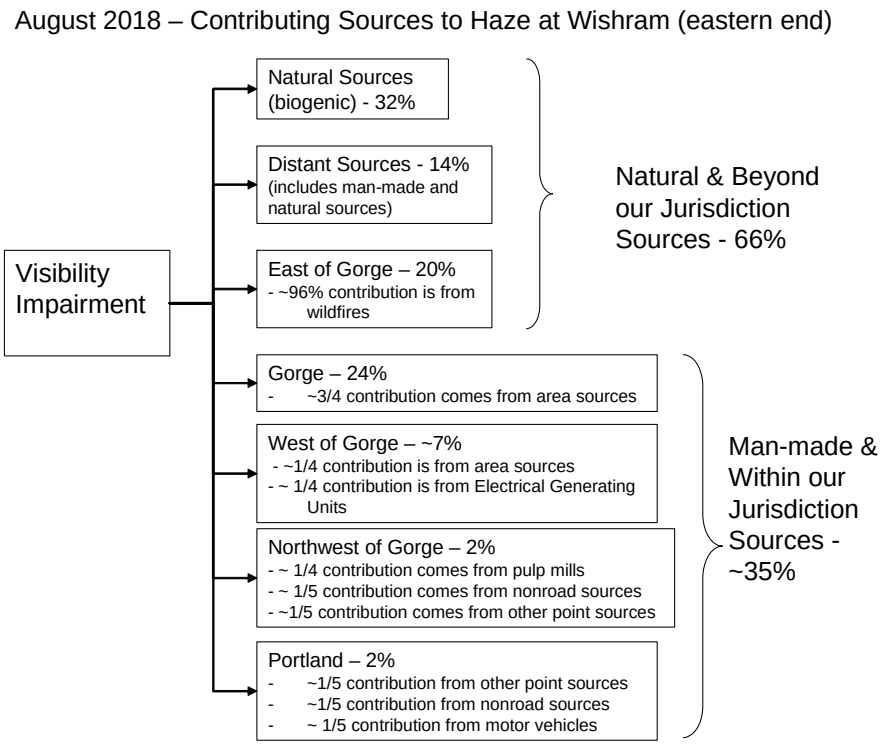


Figure 11: August 2018 Contributing Sources to Haze at Wishram



E. November 2018 Haze Event

In Figures 12 and 13, the November 2018 contributing sources to haze are displayed. Natural and distant emission contributions are less, comprising only 31% - 33% of the source contribution to visibility impairment. Man-made "controllable" emissions dominate, contributing 67% - 69%.

Figure 12 : November 2018 Contributing Sources to Haze at Mt. Zion

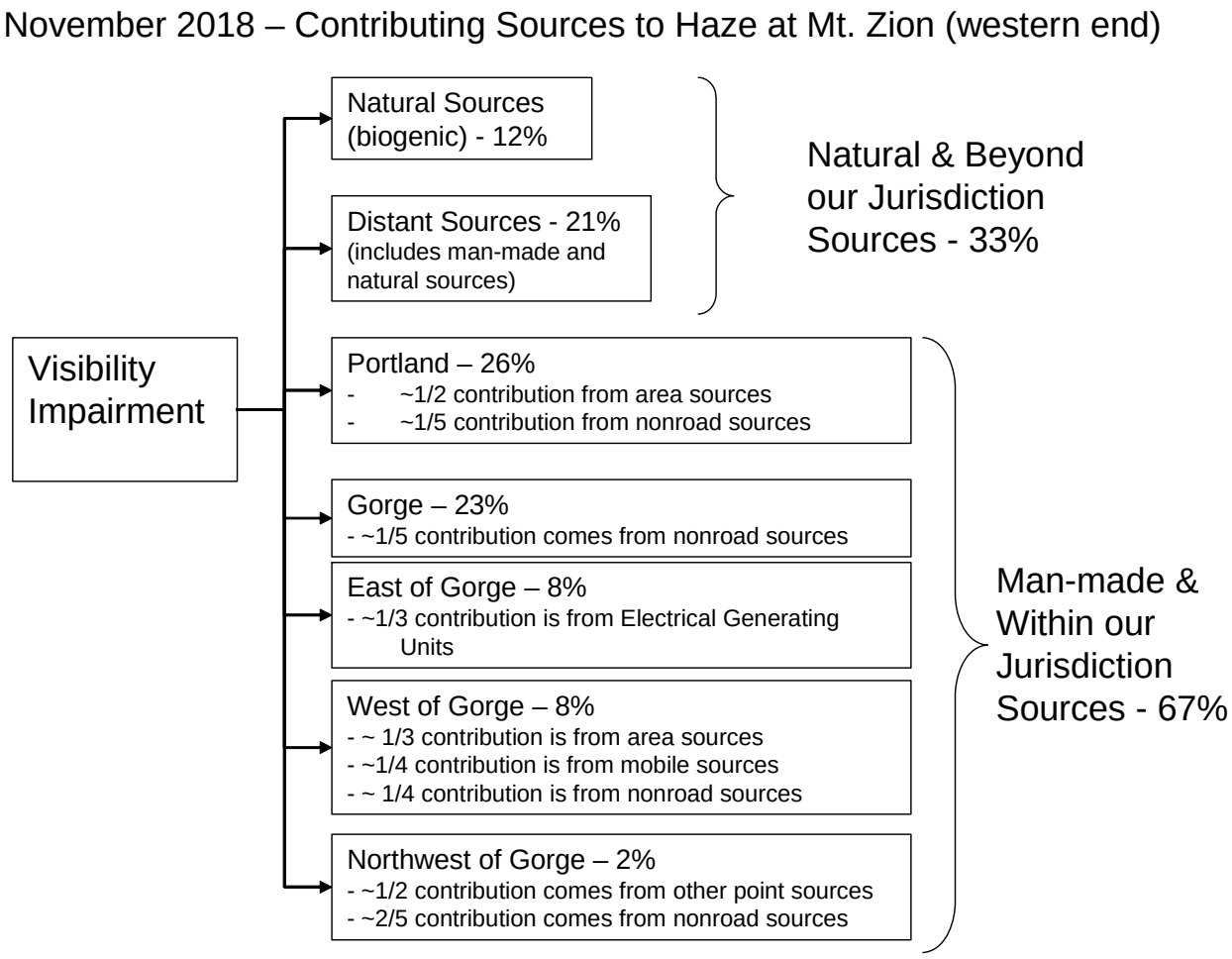
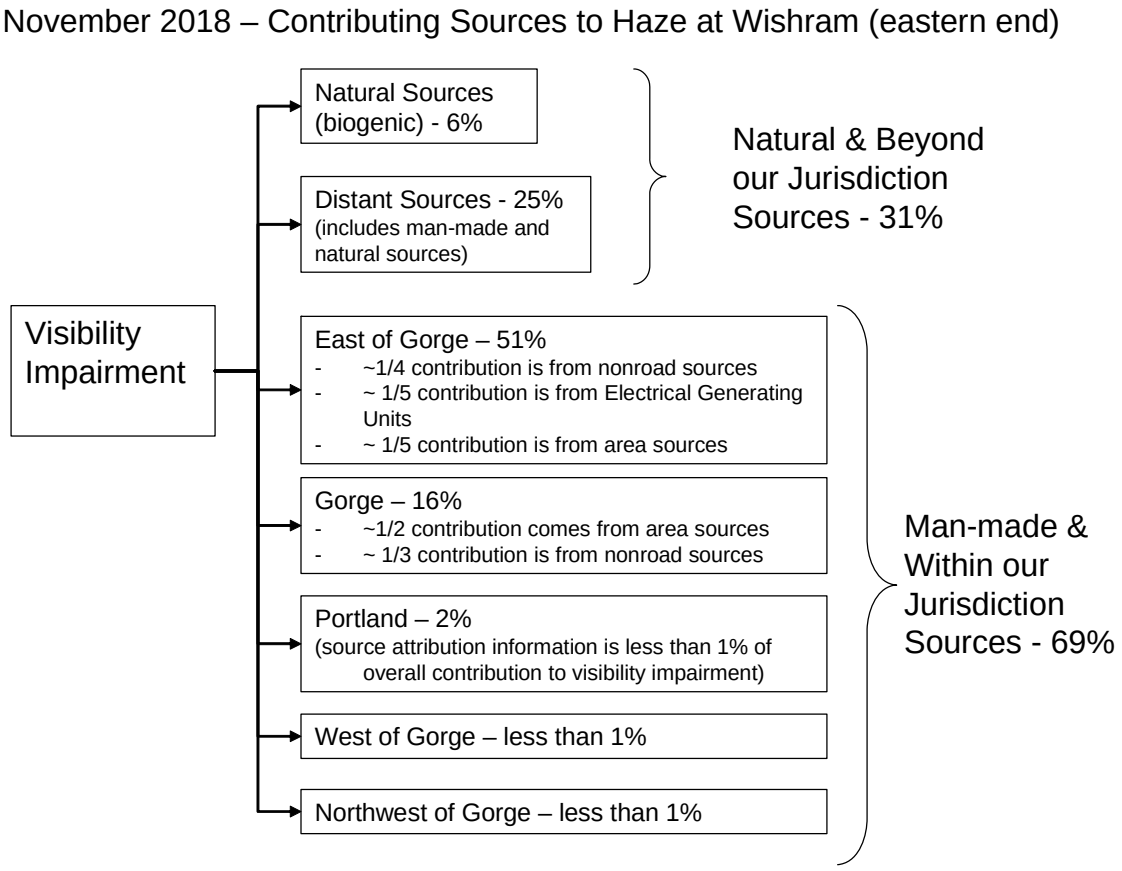


Figure 13: November 2018 Contributing Sources to Haze at Wishram



F. ”What-If” Scenarios: What Influences Haze Levels in the Gorge

The air agencies decided to test if any haze improvement could be seen from reducing emissions from the various key source sectors identified in Figures 6-13. The agencies used their computer model to evaluate some of the above conclusions by evaluating several hypothetical scenarios where the emissions from key regional source categories were completely removed from the model (“Zeroed-Out”) in order to evaluate the resulting effect on haze. Actually eliminating these emissions is of course, not possible; however, these hypothetical “What-If” exercises provide valuable insight and information about just what it would take to obtain an immediate and dramatic reduction in haze.

The “test-cases” included hypothetical scenarios such as removing all emissions from regional cars and trucks; all train emissions in the Gorge; removing emissions from all regional industry; eliminating ammonia from all Confined Animal Feeding Operation facilities (CAFO) in the region.

Table 3 shows the range of magnitude in visibility changes in "deciviews"[3] (dv) that result from the test case scenarios. The predicted visibility changes vary significantly depending on the location in the Gorge (west end vs. east end), time of year, and the meteorology driving haze formation on any given day. The hypothetical test scenarios were run during an August (10 days) and November (14 days) modeling episode. The highest values for improvement would typically occur on only a few days of the episode. For example, zeroing out all the CAFO emissions in the entire modeling area, resulted in a predicted range of visibility improvement from 0 dv to 9.3dv at Wishram (east end), with the highest value of 9.3 dv occurring only on one day of the November episode. The remaining values ranged from zero to 5.4 dv. The results of this run indicate that the ammonia emissions are important to the formation of haze. The agencies have a desire to improve regional emission estimates for ammonia to better understand its contribution to haze. A more detailed analysis of the agencies' scenario-testing can be found in Appendix A.

Table 3: Agency Test Scenarios for Changes in Haze (November)

Hypothetical Test Scenario (November only)	**Range of Visibility Improvement (min and max values)**	
	Mt. Zion – west end (dv)	**Wishram – east end (dv)**
PGE Boardman EGU	0 - 0.9	0 – 2.3
On-road (cars and trucks) mobile emissions from the Portland/Vancouver area.	0 - 2.7	0 - 0.4
On-road (cars and trucks) and non-road (construction equipment) mobile emissions in the entire modeling area.	0.7 - 3.9	0.7 - 2.9
Major point source emissions in the Portland/Vancouver area	0 - 0.2	0 - 0.02
Major point sources inside the Gorge region	0 - 3.4	0 - 2.6
Major point source emissions in the entire modeling area	0.1 - 3.9	0.1 - 4.7
Regional dairy emissions east of the Gorge	0 - 1.7	0 - 0.6
Confined Animal Feeding Operation (CAFOs) in the entire modeling area	0.01 - 2	0 – 9.3
Railroad emissions in the entire modeling area	0.06 – 0.5	0.3 - 1.2
Residential wood combustion emissions in the entire modeling area	0.2 - 3	0.03 – 0.4
Total Haze in November Episode	22 - 38	19 - 36

[3] A "deciview" is a measure of visibility. One deciview is equivalent to a perceptible change in visibility (as perceived by an average person). The higher the deciview index, the more visibility is impaired.

Table 4: Agency Test Scenarios for Changes in Haze (August)

Hypothetical Test Scenario (August only)	Range of Visibility Improvement (min and max values)	
	Mt. Zion – west end (dv)	Wishram – east end (dv)
On-road (cars and trucks) mobile emissions from the Portland/Vancouver area.	0.04 - 0.7	0 - 0.3
Major point source emissions in the Portland/Vancouver area	0 - 0.1	0 - 0.02
Major point sources inside the Gorge region	0 - 0.3	0 - 2.0
Regional dairy emissions east of the Gorge	0.03 - 0.7	0 - 0.3
Total Haze in August Episode	9 - 18	4 - 17

The air agencies' conclusions from the scenario-testing are:

- The What-if testing verifies the study scientists' conclusions that no single action could be taken to dramatically improve haze in the Gorge.
- Obtaining a dramatic reduction in haze - such reducing haze by half - would require actions that are clearly not possible (i.e., eliminating all transportation, industrial, or agricultural operations in the region).
- However, there are strategies that can help make small but meaningful improvements in visibility and that can collectively drive continued improvement in visibility.
- For each of the key contributing source categories, there is currently, or will soon be developed, an emission reduction strategy that will lower emissions and help improve visibility over the next several years.
- Specifically, in regard to the Boardman facility, the agency's "what-if" testing analysis shows that removing all Boardman emissions would not drastically improve visibility in the Gorge.
    - DEQ's current BART modeling analysis also shows that emission reductions at Boardman would provide a significant and meaningful improvement in visibility, both in the Gorge and at 14 Class-I wilderness areas across Oregon and Washington.
- Taken together the science summary report and the agency's "What-If" scenario testing confirm the conclusions of the project scientists, that obtaining continued improvement in Gorge visibility will require many small contributions in emission reduction from a wide variety of source categories over time.

Many of the key sources categories described above are already being addressed. New strategies are also being developed now to address key sources like the Boardman facility, and new strategy concepts are being considered for the future to address other source categories of interest. These existing, new, and potential future strategies are discussed below in Section VII.

Section VII. Gorge Strategy

Section VI of this report. *Key Focus Areas for Emission Reduction Actions to Provide Air Quality Visibility Improvement* identified the most significant source categories contributing to haze in the Gorge. The section discusses the significant contribution from natural and distant sources, as well as key local and regional sources including:

- Electrical Generating Units (EGU) east of the Gorge
- Area sources (i.e. a vast collection of sources such as residential woodstoves, dry cleaners, solvent cleaners)
- Non-Road Sources (a large collection of small sources such as construction equipment, trains, and boats)
- Mobile Sources (cars and trucks)
- Point Sources (the collective impacts from larger industrial sources)

For each of these contributing source categories there exists today, or will soon be developed a strategy to reduce emissions over time. Some of these strategies are national in scope, such as federal emission standards for engines or cleaner fuels that will drive emissions down over time. For other sources, such as motor vehicles and diesel engines, Oregon and Washington are taking independent action to reduce emissions further. The current strategies and new actions being taken to address the key haze contributors above are summarized in Table 4 below.

The Gorge visibility strategy is based on four basic approaches that will all work together over time to drive continued visibility improvement in the Gorge. These are discussed in more detail below. The four components include:

- **Current strategies** – Implementing existing regulatory actions, voluntary programs, and monitoring projects. (Table 4, Column A.) There are a number of regulatory programs and strategies already in place that will continue to drive visibility improvement attributed to man-made sources in the Gorge. The air agencies will ensure these strategies are successfully implemented and will track visibility monitoring over time to evaluate progress in meeting expected haze improvements trends.

- **New strategies** – Implementing new regulatory actions and voluntary programs. (Table 4, Column B.) **There are a number of regulatory programs and strategies about to begin that will continue to drive visibility improvement in the Gorge.**

- **Developments of Future Strategies and Concepts - There are** several specific emission reduction project concepts that could potentially be pursued by the air agencies or others. Some initial project concepts are discussed below (Table 4, Column C). In addition, future planning efforts for other air quality purposes, such as ensure compliance with federal air quality health standards for fine particulate and ozone, may produce benefits

for Gorge visibility as new strategies are developed over time to address public health in Oregon and Washington.

- **Progress Check-In** – In 5 years (2013), after sufficient monitoring data is collected to verify a visibility trend, the Agencies will assess whether or not visibility is improving as expected. This progress evaluation will include a report to the Gorge Commission on the progress of our existing and proposed strategies, and progress to date in reducing haze.

Note that in any given year visibility conditions may be better or worse depending on the influence of natural emission sources such as forest fires. The air agencies' will be focusing primarily on trends in man-made emissions to track continued improvement in Gorge visibility.

Table 4 summarizes current and new strategies, as well as several future strategy concepts and potential opportunities that will help reduce haze in the region and the Gorge. These strategies are discussed in more detail, below.

Table 5: Identified Controllable Sources and Proposed Strategies to Address Them

Emission Source Category or Region Contributing to Haze	**A. Current & Existing Federal and Statewide Strategies**	**B. New Emission Reduction Strategies**	**C. Potential Future Strategies and Concepts**
Electrical Generating Units (EGU)		Federal Regional Haze Program (Strategy #7, p. 32) BART controls (Strategy #8, p. 33)	
Motor Vehicles	Motor Vehicle Inspection Program – fleet turnover (Strategy #2, p. 30)	Low Emission Vehicle Standards (Strategy #10, p. 36)	
Nonroad Sources – typically diesel engines which include: • trucks • construction equipment • farming equipment • locomotive engines • marine engines	Ultra-low sulfur diesel fuel (Strategy #3, p. 30) Diesel Retrofit on School Buses (Strategy #4, p. 31)	Ultra-low sulfur diesel fuel (Strategy #3, p. 33) Diesel Retrofits for Local Government Fleets (Strategy #11, p. 36)	Bi-State Solutions - Columbia River Regional Diesel Emissions Reduction Project (Strategy #14, p. 39)

Area Sources • woodstoves • open burning • secondary aluminum plants • auto body refinishing shops	Woodstove smoke Reduction Project – Woodstove Changeouts (Strategy #5, p. 31) Federal Air Toxics Source Standards (Strategy #6, p. 31)	Federal Air Toxics Source Standards (Strategy #6, p. 31)	Oregon's Heat Smart Woodstove Upgrade Initiative (Strategy #15, p. 40)
Pulp Mills	Federal Air Toxics Source Standards (Strategy #6, p. 31)	Federal Regional Haze Program (Strategy #7, p. 32) BART controls (Strategy #8, p. 33)	
Other Point Sources		Federal Regional Haze Program (Strategy #7, p. 32) BART controls (Strategy #8, p. 33)	Federal Air Toxics Source Standards (Strategy #6, p. 31)
Burning • prescribed forestry • agricultural		Smoke Management Program (Strategy #9, p. 36)	Agricultural Burning (Strategy #16, p. 40)
Portland-area Emissions	Federal Air Toxics Source Standards (Strategy #6, p. 31) Portland ozone maintenance plan (Strategy #19, p.42)	Federal Air Toxics Source Standards (Strategy #6, p. 31) Portland Air Toxics Solutions plan (Strategy #12, p. 37)	Bi-State Solutions - Columbia River Regional Diesel Emissions Reduction Project (Strategy #14, p. 39)
Dust			Dust Management Plan for the Gorge (Strategy #17, p. 40)
Ammonia • agricultural operations (fertilizer) • dairy operations			Potential Gorge Solutions Agricultural Emissions Reduction Project (Strategy #17, p. 43) Oregon's Dairy Task Force Recommendations (Strategy #20, p. 42)

Acid Rain & Fog Water Chemistry			U.S. Forest Service Additional Studies (See Future Research p. 43)
Ozone	Portland ozone maintenance plan (Strategy #19, p.42)		State Greenhouse Gas Initiative (Strategy #18, p. 41)
Growth in new or expanding major industrial sources	Prevention of Significant Deterioration (PSD) permits (Strategy #1, p. 30)		
Tribal and Cultural Issues • fish (mercury) • rock images		Oregon's Utility Mercury Rule (Strategy #13, p. 37)	

A. Current Strategies

There are a number of strategies already underway that will address visibility issues and drive continued improvement. These strategies are highlighted to address particular emission sources that have been identified to cause haze.

1. Prevention of Significant Deterioration (PSD) permits

The PSD program is designed to help protect against visibility degradation that could be caused by proposed new or expanding federal major industrial facilities. The PSD program requires proposed new or expanding major sources to undergo an air quality analysis of visibility impacts in wilderness areas and national parks, as well as to evaluate potential adverse impacts on other ecosystem values (such as vegetation, lakes, and soils). Under Oregon's and Washington's PSD program, proposed major sources also have to evaluate their potential impacts on the Gorge. The PSD program does not reduce emissions from existing industrial facilities but rather helps manage and limit future emissions growth from proposed new or expanding major induistry. The Federal Land Manager has a key role in reviewing PSD analysis for any proposed facility.

2. Motor Vehicle Inspection and Maintenance Program

Vehicle inspection and maintenance programs (I/M) help improve air quality by identifying high-emitting vehicles in need of repair and causing them to be fixed as a prerequisite to vehicle registration within certain areas. Vehicle exhaust emissions can contribute to Gorge haze because it includes nitrogen oxide, one of the precursors to haze forming pollutants such as nitrates. All new passenger cars and trucks sold in the United

States today must meet stringent pollution standards, but they remain low-polluters only if the emission controls and the engine are both functioning properly. In the Portland/Vancouver area, the vehicle inspection program requires periodic emissions performance checks and repairs for those vehicles that fail emissions tests, and it ensures that vehicle exhaust emissions remain low.

3. Ultra-Low Sulfur Diesel Fuel Requirements

Beginning in 2006, EPA mandated new standards in on-road (highway) diesel fuel, known as ultra-low sulfur diesel (ULSD). This regulation dropped the sulfur content of diesel fuel from 500 ppm to 15 ppm. ULSD fuel enables the use of cleaner technology diesel engines and vehicles with advanced emissions control devices, resulting in significantly improved air quality. Subsequent reductions in sulfur will result in reductions of sulfur dioxide (SO2) and ultimately to reductions in sulfate. Diesel fuel intended for locomotive, marine and non-road (farming and construction) engines and equipment is required to meet the low sulfur diesel fuel maximum specification of 500 ppm sulfur in 2007 (down from 5000 ppm).

By 2010, the ULSD fuel standard of 15-ppm sulfur will apply to all non-road diesel fuel. Locomotive and marine diesel fuel will be required to meet the ULSD standard beginning in 2012, resulting in further reductions of diesel emissions. These rules not only reduces emissions of sulfur compounds (blamed for acid rain), but also reduces emissions of oxides of nitrogen and particulate matter, which are can be components of haze forming pollutants.

4. Diesel Retrofit on School Buses in SW Washington

Since the Washington State School Bus Retrofit Program was funded by the Washington State Legislature in 2004, more than 500 school buses in southwest Washington have received diesel oxidation catalysts. Retrofitted buses now emit 30 percent less air pollution in the form of fine-particles coming out of the exhaust pipe. The next step for this program will be to install Closed Crankcase Ventilation Systems (CCVS) on school buses. This equipment will reduce the amount of diesel fumes that build up inside the buses and will further protect the lungs of our schoolchildren and reduce visibility-impairing emissions in the region.

5. Woodstove Smoke Reduction Project in Oregon and Washington

In the fall 2007, SWCAA enhanced the annual rebate program it has been offering to Washington citizens to encourage the removal of old higher polluting woodstoves and replacing them with cleaner burning home heating devices. Upon written confirmation to SWCAA that destruction of the old uncertified woodstove has occurred, Washington residents become eligible for the following rebates: (1) $250 rebate if a new Washington-certified woodstove has been purchased; (2) $300 if a new Washington-certified pellet stove has been purchased; and (3) $400 if a conversion to natural gas or propane has been made. Residents of Skamania County may qualify for an additional $100 Gorge rebate

on a replacement unit to further reduce air emissions in the Columbia River Gorge National Scenic Area. Replacing uncertified woodstoves with a certified woodstove can reduce fine particulates by as much as 70%. During the wintertime, smoke from wood-burning stoves can be a significant source of air pollution emitting both fine particulates and air toxics. By changing out the older, polluting stoves with newer, more efficient devices, it can greatly improve health conditions and seasonal haze.

6. Federal Air Toxics Source Standards for Oregon and Washington

The air toxics source standards are air emission standards as required by the Clean Air Act Amendments. These standards, referred to as National Emission Standards for Hazardous Air Pollutants (NESHAP), regulate hazardous air pollutants (HAPs) or air toxics. NESHAPs contain control technology and/or work practice requirements known as maximum achievable control technology (MACT) or generally available control technology (GACT). All major sources of HAPs are subject to MACT while some area sources of HAPs are subject to MACT or GACT.

EPA has promulgated a number of air toxics standards for major sources that are currently in effect or about to go into effect over the next few years. For example, standards affecting pulp and paper mills and major surface coating operations are already in effect. Newer area source standards such as those affecting gas stations, dry cleaning auto body refinishing, and cement plants, etc. will affect sources in the Portland/Vancouver area and areas in and near the Gorge. EPA will continue to issue new standards and update existing standards that could include additional sources subject to air toxics regulations. A full listing of the air toxics source standards is available in Appendix B.

Though emissions from individual sources are often relatively small, collectively their emissions can be of concern - particularly where large numbers of sources are located in heavily populated areas. In addition to reducing air toxic emissions, these standards may reduce emissions of sulfur dioxide, oxides of nitrogen, volatile organic compounds, and other pollutants that contribute to haze. Overall, these standards will have a beneficial effect on visibility in the Gorge.

B. New Strategies

The following lists the new strategies, both regulatory and voluntary that are about to be underway. These strategies are identified as additional measures that will reduce visibility impairment in the Gorge.

7. Federal Regional Haze Program

The federal Clean Air Act contains requirements to protect and improve visibility in national parks and wilderness area in the country. In 1977, Congress designated certain national parks and wilderness areas as "Class I areas," where visibility was identified as an important value. Currently there are 156 Class I areas in the country. Oregon has 12

Class I areas and Washington has 8 Class I areas, which include Mt. Hood, Mt. Adams, and Crater Lake National Park. To address the problem of regional haze, EPA adopted the Regional Haze Rule in 1999. This rule is intended to improve visibility in all Class I areas, including Oregon and Washington. States are required to conduct certain analyses to ensure that they achieve a reasonable progress goal, one that is aimed at reaching natural background conditions in 60 years. It focuses on improving Class I area visibility on the haziest days (the worst 20%) and ensuring no degradation on the clearest days (the best 20%).

While the Gorge is not classified as a Class I area, the Regional Haze rule will have secondary benefits on the Columbia Gorge. Because the Gorge is located between two Class I areas (Mt. Hood and Mt. Adams), the area will benefit from Oregon and Washington's long term regional haze process.

Oregon and Washington, along with all other states in the country, are developing regional haze state implementation plans (SIPs) to meet this federal rule. These SIPs will contain specific strategies for regional haze that will be reviewed and updated every five years, with the objective of showing progress in improving visibility over the next 60 years, with 2018 as a key milestone date for measuring this progress. With each revision, Oregon and Washington will assess progress and determine if new strategies are needed to reduce haze in Class I areas. This process is expected to lead to visibility benefits in the Gorge over this time period as well.

8. Best Available Retrofit Technology (BART) Facilities

One of the primary elements of EPA's Regional Haze rule involves the BART (Best Available Retrofit Technology) requirements. Under BART, certain older industrial[4] sources must be evaluated to see if they significantly contribute to visibility impairment in Class I areas, and if so, whether retrofitting with emission controls is feasible and cost effective. Oregon has ten BART eligible sources, Washington has fifteen eligible sources.

A. BART Eligible Sources in Oregon

DEQ has been working with its BART eligible sources to conduct the required visibility analysis. The PGE Boardman facility has by far the largest visibility impact of any Oregon BART eligible source, and significantly impacts 14 Class I areas in Oregon, Washington and Idaho. The other BART eligible sources have modest visibility impacts. Each source is currently evaluating their options for reducing emissions. Some may install emission controls, others are considering enforceable changes to their air quality permit that would reduce emissions and visibility impacts to below significance levels.

[4] BART eligible sources include 26 source categories which began operation after August 7, 1962 and were "in existence" on August 7, 1977, with emissions of greater than 250 tons per year of any visibility impairing pollutant

Actions taken by each BART eligible facility will be described in DEQ's upcoming Regional Haze Plan and associated BART rulemaking, to be completed by the end of 2008. The BART actions and Regional Haze Plan is expected to be available for full public review through public hearings being planned for the summer of 2008.

DEQ modeled 10 BART-eligible sources based on a visibility significance threshold of 0.5 deciview. Results of this modeling showed five sources with impacts above this level:

1. PGE Boardman - Boardman, OR
2. PGE Beaver – Port Westward, OR
3. Fort James, Wauna Mill – Clatskanie, OR
4. Weyerhaeuser – Springfield, OR
5. Amalgamated Sugar – Nyssa, OR
6. Boise Paper – St. Helens, OR
7. Pope & Talbot – Halsey, OR

Although the BART analysis is not yet complete, DEQ estimates real emission reductions will be achieved from these sources, either through the application of BART controls or through federally enforceable permit limitations applied to their air permit. These reductions will contribute to visibility improvement, and in some cases like the Boardman facility, will also reduce pollutants that play a role in acidic deposition.

B. BART Eligible Sources in Washington

Washington has identified 15 BART-eligible sources and is in the process of evaluating the modeling results to determine which sources are over the threshold and require scrutiny that is more rigorous. The schedule for BART eligible sources in Washington is for all sources to have their computer modeling work completed by early 2008. It will be known at that time how many sources are over the eligible 0.5 deciview threshold. Due to the location of these sources, individual impacts on the Gorge are likely small to negligible, but any reductions would still result in reduced regional pollution.

Washington has the following BART eligible facilities:

1. Graymont Western US Inc. – Tacoma, WA
2. TransAlta Centralia Generation – Centralia, WA
3. Longview Fibre Co. – Longview, WA
4. Weyerhaeuser Company – Longview, WA
5. Georgia Pacific - Camas, WA
6. Goldendale Aluminum – Goldendale, WA
7. Port Townsend Paper Co.- Port Townsend, WA
8. Simpson Kraft – Tacoma, WA
9. LaFarge Corporation – Tacoma, WA
10. Intalco Aluminum Corp. – Ferndale, WA

11. Aluminum Company of America – Wenatchee, WA
12. BP Cheery Point Refinery – Anacortes, WA
13. Tesoro Northwest Company – Anacortes, WA
14. Puget Sound Refining Company – Anacortes, WA
15. Conoco-Phillips Company – Anacortes, WA

C. BART Eligible Sources in Idaho

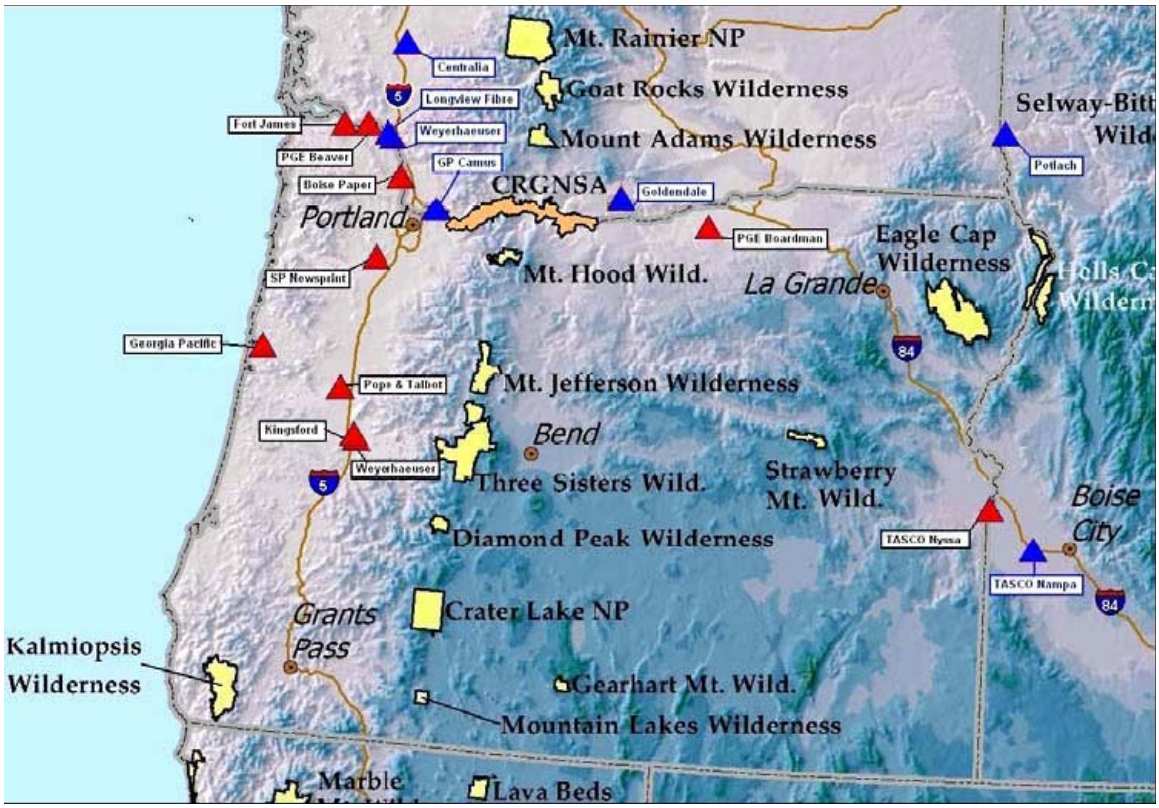
In Idaho, modeling of BART eligible sources is complete and two sources have been identified as being over the eligible threshold. These two sources, Amalgamated Sugar in Nampa, and a power plant located in Southern Idaho, are currently going through a BART determination. Due to the location of these sources, individual impacts on the Gorge are likely small to negligible, but any reductions would still result in reduced regional pollution.

Future Benefits to Gorge Visibility

As indicated in the Gorge Science Summary report, some of the contributing sources to haze in the Gorge was from electrical generating units both on the eastern side of the Gorge, Portland area sources (including paper mills) on the western side of the Gorge, and impacts from sources outside the region (such as Idaho). The emissions reductions obtained from the BART sources will result in cleaner air in Class I areas and potentially benefit the Gorge. In addition, when Oregon and Washington review the Regional Haze Plan for the next five year cycle in 2012, the focus will be on non-BART industrial sources (i.e., those industrial sources that were not subject to BART), as well as other sources, such as forestry and other outdoor burning. If over the long run, Oregon and Washington fail to make the Regional Haze goals for achieving reasonable progress toward natural visibility conditions the air agencies may have to revisit the cumulative impacts of its initial BART sources.

Figure 14 below shows some of the BART eligible sources in Oregon, Washington, and Idaho.

Figure 14: BART Eligible Sources in Oregon, Southern Washington and Western Idaho



9. Smoke Management in Oregon and Washington

The Gorge Science Summary report indicated that natural emissions, such as forest fires and other prescribed burning, were a major contributor to haze in the Gorge. In fall 2007, Oregon adopted changes to its Smoke Management Program to designate the entire Gorge Scenic Area as a special protection area. As a result, the area will be a high priority for the forest agencies to keep prescribed fire smoke out of the Gorge. Future strategy discussions will include conversations with the Washington Department of Ecology to establish a reciprocal agreement on the Washington side.

10. California Low Emission Vehicles in Oregon and Washington

On-road mobile sources were identified as another emission source contributing to haze formation in the Gorge. Vehicle emissions from Portland and beyond accounted for up to 16% of haze in the Gorge. In 2005 and 2006, Washington and Oregon adopted regulations requiring that vehicles sold in these states must meet the California low emission vehicle standards. The rules decrease emissions that cause ground-level ozone (an air pollutant formed by a chemical reaction of volatile organic compounds (VOC) and oxides of nitrogen (NOx), promote zero-emission vehicles and reduce greenhouse gases. The program applies only to new cars and trucks, (vehicles with fewer than 7500 miles,) and will be phased in beginning with the 2009 model year. When the rules take full

effect in model year 2016 they will reduce greenhouse gas emissions 30% and substantially improve fuel efficiency. Smog-forming emissions will be lowered 12% to 33% by 2020. California also intends to strengthen the greenhouse gas standards in the future, beginning in 2017, to obtain 45% greater reductions by 2020. The adoption of the California standards will reduce haze impairment in the Gorge.

11. Diesel Retrofits for Local Government Fleets

The Southwest Clean Air Agency is beginning to expand its diesel emission reduction program to local government fleets. Through funding from the Department of Ecology and the Southwest Clean Air Agency in 2008, diesel oxidation catalysts are planned to be installed on C-Tran, City of Vancouver, City of Longview, and the Vancouver Fire Department vehicles.

SWCAA is working to identify and assist local governments in SW Washington with retrofit projects. SWCAA committed to funding retrofits for the City of Vancouver Fire Department and Clark County Public Works from this account using Ecology's contract and vendor. Fleet evaluations have been conducted in preparation for technology installations. Because of the outreach effort in 2007, a few other government entities have been added to the list to be evaluated for retrofit technologies. The City of Cathlamet, City of Pe Ell, Cowlitz County Public Works, City of Stevenson, and City of Centralia all would like their fleets evaluated and appropriate emissions reduction equipment installed. As funding continues to be available, additional public fleets and private fleets in public service will continue to be retrofitted.

12. Portland Air Toxics Solutions Plan

To address the concern of air toxics in Oregon, the DEQ adopted an innovative state program to reduce risk from air toxics in Oregon. The goal of the program is to fill in the gaps in the federal air toxics program, which has primarily focused on reducing air toxics emissions from major industrial facilities. The program is designed to address risk from source categories or individual sources that are not otherwise regulated by federal standards including developing an area-wide plan to reduce risk from point, area and mobile sources in proportion to their contribution to the problem.

In 2006, the EQC adopted ambient benchmarks for 51 air toxics in Oregon. The benchmarks are set at levels protective of human health over a lifetime of exposure, and are based on recommendations of DEQ's Air Toxics Science Advisory Committee.

On February 1, 2008, DEQ announced the Portland region as Oregon's first air toxics geographic area. DEQ has determined that within the Portland region, which includes sections of Multnomah, Washington, Clackamas and Yamhill counties, at least ten air toxics are above the health benchmarks, and three of these are more than ten times above the benchmarks.

This DEQ project is named "Portland Air Toxics Solutions" or "PATS". Beginning in

2008, DEQ will work with a broad group of partners and an advisory committee to develop and implement a ten year air toxics emission reduction plan. This plan could include both mandatory and voluntary air toxics reduction measures needed to reduce risk. These efforts will help reduce air toxics, particulate, ozone precursors and greenhouse gases, many of which are haze-forming pollutants that could affect the Gorge.

13. Oregon's Utility Mercury Rule

To reduce mercury emissions from coal-fired power plants in Oregon, the Department of Environmental Quality (DEQ) adopted a Utility Mercury Rule. Mercury emissions, including those from burning coal, can eventually reach water bodies and accumulate in fish tissue, which is the main way humans are exposed to mercury. Several of Oregon's rivers, lakes and reservoirs currently have fish advisories because of high mercury content.

The rule limits mercury emissions for new plants and mandates installation of mercury control technology for Oregon's only existing coal-fired power plant. The plant, operated by Portland General Electric (PGE) is expected to reduce mercury emissions by 90 percent by July 1, 2012. Mercury emissions from the Boardman plant currently range from 137 to 281 pounds per year. DEQ estimates that mercury emissions from the Boardman plant will range from 18 to 35 pounds per year after installing controls.

These rules are one of the most stringent mercury rules in the nation. With the planned mercury emission reductions, it will provide greater protection from mercury deposition and bioaccumulation in fish, particularly for subsistence and recreational fishers in the Columbia River Basin.

C. Potential Future Strategies and Concepts

The air agencies have limited ability to control emissions from natural sources and from outside the region and lack the knowledge and resources to address ecological effects of air pollution in the Gorge. The air agencies welcome other agencies and organizations expertise and potential solutions to address these issues of concern. The air agencies will work with organizations to identify and potentially achieve additional emissions reduction that will specifically benefit visibility in the Gorge. The following are a sampling of potential strategies that could be employed over the next few years:

14. Gorge Solutions Initiatives

In 2006, the air agencies engaged the National Policy Consensus Center (NPCC) located at Portland State University to help explore implementation options. The NPCC designs and implements consensus-based decision-making systems throughout the United States, and the successful *Oregon Solutions* program was developed under NPCC's sponsorship. Oregon Solutions is a program that helps communities develop sustainable and collaborative projects to address community-based problems.

The NPCC was asked by the air agencies to identify various collaborative-process approaches to achieve air emission reductions in the Gorge. Based on the NPCC interviews, a range of possible options were considered, including a large stakeholder group and smaller emission reduction project teams. A large stakeholder group was not recommended because of lack of resources and the concern that it could delay implementation of the actual projects. NPCC's interview summary is available as Appendix B.

The air agencies believe that the use of small, focused Emission Reduction Project Teams offers the best chance at this time of fostering the positive outcomes stakeholders and the agencies are seeking, such as increased awareness of common interests and values from diverse Gorge interests, trust building, and taking meaningful actions to make progress in reducing air pollution in a way that is collaborative and equitable. The air agencies see the need to immediately begin efforts to identify and focus on new emission reduction projects that could provide benefits to the Gorge.

A "Bi-State Solutions" effort could be effective in achieving targeted emission reductions in sectors where a collaborative approach is needed among diverse stakeholders. It could be another important part of the overall strategy for improving visibility in the Gorge. A key principle of this particular strategy approach is that a couple of projects will be initiated by NPCC, and it is then hoped, that a model will have been developed that will lead to the implementation of a succession of self-sustaining emission reduction projects initiated by the community.

NPCC will be in charge of scoping, organizing, and leading the projects, with the support of other interested stakeholders and organizations.

DEQ and SWCAA would likely participate in all of the Gorge Solutions projects if desired by the entities, but would not necessarily serve as the convening organization.

Currently, the air agencies and NPCC are exploring two initial projects:

- **Columbia River Regional Diesel Reduction Project**: This Bi-State Solutions project would focus on diesel emissions from trucks, trains, and marine engines, particularly those diesel engines that transport goods along the Columbia River corridor. The project could include a bi-state partnership among freight carriers, ports, distribution centers, and others involved in the goods movement chain that may involve raising awareness, information sharing and implementing various emission reduction projects. One potential key stakeholder, the Port of Portland, has been taking actions to reduce emissions from port related operations since 2000. This includes reducing idling times, changing to ultra-low sulfur diesel fuel, and purchasing biodiesel vehicles.

  In addition to the regional effort, specific activities focused on reducing emissions in the Gorge are being explored. This could include the

electrification of truck stops near the transportation corridor of the Gorge Scenic Area and retrofitting construction and maintenance vehicles operating in the Gorge. Such actions will provide both public health and year round haze benefits by reducing NOx and VOC. This Solutions project is currently targeted for a spring 2008 kickoff.

- **Eastern Dairies and Agriculture Best Management Practices**. As identified in the Gorge visibility study, ammonia is a key pollutant contributing to haze formation and agricultural operations (fertilizer and dairies) are a significant source of ammonia. DEQ is currently working with the Oregon Department of Agriculture on a Dairy Air Task Force to address air emissions from dairies; the pursuit of this effort will likely wait until the conclusion of the task force, expected in July 2008. One of the potential Solutions Projects that could emerge from the recommendations of the task force could include the possibility of Washington regional air authorities and the Washington dairy industry joining the Oregon dairy industry in a common effort to reduce air emissions from regional dairy operations. The nature and extent of any such effort is premature.

These identified projects are some initial ideas for a Gorge Solutions process. The air agencies would like to hear from others who are interested in sponsoring additional emission reduction projects that might fit into a Bi-State Solutions framework for the Gorge. In the meantime, the air agencies have highlighted other potential new emission reduction projects that could be taken on by the air agencies or other entities and stakeholders.

15. Oregon's Heat Smart Woodstove Upgrade Initiative (2009)

In 2009, DEQ plans to pursue Legislative approval of a program called Heat Smart, a program to accelerate the turnover of older, uncertified stoves. There are two components associated with Heat Smart, one of which would require the removal of old, uncertified woodstoves upon home sale. Another component of the Heat Smart program would also provide funding for local communities to establish change out programs. The DEQ hopes to pursue a number of wood smoke reduction efforts, such as working with local Gorge communities to develop woodstove change out and removal programs. By reducing the emissions from woodstoves, it would provide additional air quality benefits and improve visibility in the Gorge.

16. Agricultural Burning

DEQ plans to address burning from agricultural sources in the next few years. At issue is whether to ban field burning in the Willamette Valley to address issues of public health and impacts from smoke. The DEQ plans to work with the Oregon Department of Agriculture and the Oregon Department of Health and Human Services to compile data, assess impacts, and possibly develop a plan. If measures are put in place to either ban or restrict field burning, the reductions in smoke emissions will result in a beneficial effect

for the Gorge.

17. Dust Management Plan for the Gorge

The Gorge communities, in cooperation with the DEQ, SWCAA, and other agencies could work together through a public involvement process to develop a dust management plan for the Columbia River Gorge to address emissions from fugitive dust sources. Currently, the area surrounding Benton County has developed a dust management plan to control urban fugitive dust sources and other sources that contribute to wind-blown dust in the Columbia Plateau region. Regulations and control measures were outlined, including requirements to ensure the owner or operator of a source of fugitive dust will take precautions to minimize emissions. These control measures include watering, temporary chemical stabilizers, physical barriers (set up perpendicular to prevailing wind across a fugitive dust source), vegetative stabilization, limiting cleared area (minimizing exposed dust areas), traffic control, earth movement management, wheel washing, limiting site access, sweeping and cleaning, timely clean up, covering hauled material, crop rotation, and windbreaks. The county implements the policy by informing the public, notifying owners and operators of dust control measures, notifying folks of complaints or violations, issuing violations and penalties as appropriate. A similar program could be developed with the coordination of the air agencies and other agencies to address dust emissions in the Gorge.

18. State Greenhouse Gas Initiative

The States of Oregon and Washington are committed to combating global warming and several initiatives are underway to reduce greenhouse gas emissions. In February 2007, the western states (including Oregon and Washington) formed the Western Climate Initiative, which commits partners to developing a regional target for reducing greenhouse gases, participating in a multi-state registry, and developing a market-based program to achieve greenhouse gas emission reductions.

A. Washington Actions

Washington is the first state in the nation to adopt a carbon dioxide mitigation program for new electric power plants, requiring these facilities to include the full costs of carbon dioxide emissions. In addition, Washington adopted clean car standards and stronger energy efficiency standards for appliances and is increasing production and use of renewable liquid fuels. As part of this action, Washington has established goals to reduce greenhouse gas emissions to 1990 levels by 2020. By 2035, Washington will reduce greenhouse gas emissions 25% below 1990 levels; and by 2050, reduce emissions 50% below 1990 levels, or 70% below the state's expected emissions that year.

B. Oregon Actions

Oregon’s strategy to reduce greenhouse gas emissions includes reduction goals to reduce emissions to 10% below 1990 levels by 2020 and to 75% below 1990 levels by 2050.

DEQ will also develop greenhouse gas reporting rules to address the most significant emission sources of greenhouse gases in Oregon; these draft rules will be proposed for EQC consideration by mid-2008.

In Oregon, most of the strategies adopted to date are focused on two of the leading sources of greenhouse gas emissions - electricity and transportation. Current Oregon programs underway include OR-LEV, the Renewable Portfolio Standard (which requires that 25% of energy be from renewable resources by 2025), expansion of Business Energy Tax Credit (BETC) and Residential Energy Tax Credit (RETC) programs, and biofuels incentives. Future strategies are likely to target large fuel combustion sources, such as large industrial boilers and power plants and other sources that can contribute to haze in the Gorge.

19. Public Health - Strengthening of Air Quality Health Standards

Monitoring data collected by the state air agencies in the Gorge shows that air quality in the Gorge meets all federal air quality health standards. In fact, air quality levels that protect human health have been maintained in the Gorge for the past several decades. Nevertheless, this circumstance will not cause the air agencies to become complacent because protecting public health will always be a vital part of the Gorge's air quality strategy. As EPA in the future tightens national ambient air quality health standards to protect public health across the nation, the air agencies will continue to ensure that all new health standards impacting the Gorge are also met.

A. Particulate Matter ($PM_{2.5}$)

On September 21, 2006, the U.S. Environmental Protection Agency (EPA) adopted revisions to the national ambient air quality standards for particulate matter ($PM_{2.5}$). EPA lowered the $PM_{2.5}$ standard from 65 ug/m^3 to 35 ug/m^3 due to scientific studies showing an association between exposure to particulate matter and significant health problems, at much lower levels. Such health problems included aggravated asthma, chronic bronchitis, reduced lung function, irregular heartbeat, heart attack, and premature death in people with heart or lung disease. Communities that are in violation of the standard must take measures to reduce particulate matter pollution. In addition, those communities across the state may also undertake additional emission reduction strategies to ensure they stay below the standard and adequately protect public health.

B. Ozone (O_3)

On June 20, 2007, EPA proposed to strengthen the national ambient air quality standard for ground-level ozone (O_3), the primary component of smog. Scientific evidence indicates that adverse public health effects occurs following exposure to ozone at levels below the current standard, particularly in those with respiratory illnesses. In addition, new scientific evidence shows that repeated exposure to low levels of ozone damages vegetation, trees and crops, leading to increased susceptibility to disease, damaged foliage, and reduced crop yields. A lower ozone health standard will help reduce

ecosystem impacts in the Gorge because it has the possibility of causing a non-attainment designation for the Portland-Vancouver, which will require that new additional emission reduction programs be implemented.

20. Oregon's Dairy Task Force Recommendations

Oregon Senate Bill 235 (2007) created the Dairy Air Quality Task Force to study the air emissions from Oregon dairy operations and evaluate options for reducing those emissions. The Task Force is charged with making findings and recommendations concerning air emissions from dairy operations. The Task Force will be exploring voluntary measures, including education, demonstration projects, and incentive options, together with regulatory and/or legislative options for emission reduction. Any recommendations that come out of this workgroup could result in emissions reductions from dairies in and near the Gorge.

21. Additional Potential New Strategies

The air agencies have also identified a number of additional strategies that could be pursued to address potential sources of haze in the Gorge. Some of these efforts will require long-term plans, multiple organizations, and outside efforts. Many projects could also be undertaken by other organizations or individuals, interested in pursuing ways to reduce haze. At this time, the air agencies do not have the resources to pursue these additional new strategies. However, the air agencies would be willing to partner with other agencies and organizations to undertake such projects. The list is not comprehensive, but serves as a tool for further discussion and ideas.

1. Installation of Alternative Fuel Stations in and near Gorge.
2. Implementing EPA's Change a Light / Change the World Program to reduce electricity consumption.
3. Establishment of a commuter rail between Portland and Gorge-area communities.
4. Ensure surrounding States are achieving BART reductions and report to Gorge Commission on what they are/are not doing to achieve expected emission reductions.
5. The Regional Haze SIP is the mechanism in which emission reduction strategies for pulp & paper will be addressed, but with all such initiatives there are uncertainties surrounding whether or not emissions from this sector will be reduced under the rule.

Given the combination of the current, anticipated, and future strategies, the air agencies believe this combined strategy is feasible and complementary to improving Gorge visibility.

D. Future Research

The U.S. Forest Service (USFS) has provided information on fog water, acid deposition, and cultural resources as follows:

Fog Water Chemistry & Acid Deposition

The U.S. Forest Service (USFS) is looking at other components such as fog water and is trying to figure out how it fits into picture of acid rain. As mentioned earlier, the USFS has been conducting a study looking at the acid concentrations from fog water deposition in the Gorge. The results from the acid rain study suggests air pollution is at levels that could potentially impact cultural and natural resources, based on soil acidification and seeing elevated levels of nitrogen and sulfur in lichen plants. Studying lichen compositions help provide a first glimpse of potential ecological effects from air pollution. Potential sources of nitrogen are associated with agricultural sources from the eastern end of the Gorge, whereas emissions from fossil fuel combustion (such as motor vehicles and industrial processes) contribute nitrogen and sulfur at the west end of the Gorge. Excess nitrogen deposition is of concern because it can alter plant composition and productivity as well as soil chemistry. It is currently unclear the levels at which nitrogen or acid deposition are harmful to the ecosystem. What we do know at from the current studies is the trend of these pollutants and that sulfur and nitrogen deposition levels remain steady or are increasing in the Gorge.

As the USFS continues with its study, the air agencies look forward to being apprised of final study results and findings. In the meantime, the air agencies will be working to implement various emission reduction projects throughout the area, such as reducing emissions from those sources that emit nitrogen. Any reduction in sources that emit nitrogen (a component that can be transformed to nitrate, a haze forming pollutant) will help limit the availability of this pollutant to fall as acid rain. The air agencies will follow up on state and federal strategies, but look to the USFS, with its expertise, to take the lead on the fog water chemistry/acid rain issue.

Native American Cultural Resources, Rock Images, Culturally Important Plants

The air agencies recognize the importance of addressing the preservation of Native American rock images including petroglyphs and pictographs. Knowledge of potential damage to the rock images and indicators of atmospheric pollution will be helpful in establishing practices for rock image preservation and air quality improvements. Future projects could include a collaborative group process through the Oregon Consensus Program, a separate program within the National Policy Consensus Center, to further investigate the effects of visibility impairment on the Native American cultural resources and rock images.

E. Special Issues of Interest

1. PGE Boardman Facility

Oregon DEQ expects that both NOx and SO_2 emissions at the Boardman facility will be significantly reduced through the application of emission controls under the federal Regional Haze rule requiring Best Available Retrofit Technology (BART). DEQ is

currently evaluating control technology options for the facility. The selection of BART controls (and thus the level of emission reduction required) will be decided in late 2008 by the Oregon Environmental Quality Commission (EQC), after the lengthy public process. Oregon DEQ intends to begin this public rulemaking process in the summer of 2008.

Emission reductions at the Boardman facility will provide a relatively modest but significant improvement in Gorge visibility as well as reduce emissions contributing to acidic deposition. This will help reduce the risk to cultural resources and ecosystems in the Gorge.

2. Other BART Source Reductions

While likely not as significant as Boardman, other BART eligible major industrial facilities in Oregon and Washington will be reducing emissions to meet BART visibility reduction objectives. Benefits to the Gorge cannot be quantified at this time, but all reductions achieved from BART will help collectively improve regional visibility and reduce acid deposition.

3. Ammonia Emissions

The Gorge Science Study suggests that regional ammonia emissions are a significant factor in haze formation affecting both Class –I wilderness areas and the Gorge. There are many sources of regional ammonia, including the use of agriculture fertilizers, and regional animal feeding operations, such as dairies. In January 2008, the Oregon Task Force on Dairies and Air Quality convened to study air emissions from dairy operations and explore options for reducing those emissions. The Task Force will release its report in July 2008.

Oregon DEQ hopes the Task Force report will identify ways to reduce dairy emissions statewide. DEQ also hopes the Task Force report will be a springboard for bi-state cooperation in reducing air emissions from Oregon and Washington dairy operations, especially in regions east of the Gorge. DEQ and SWCAA will have a better sense of future possibilities when the Task Force has completed its work this summer. Section VII of this report discusses an initial concept for a bi-state dairy ammonia reduction project that could potentially be informed and encouraged by the result of the Dairy Task Force work.

4. Cultural Resources and Ecosystems

The USFS and Gorge area Tribes have begun important research into the question of acid deposition in the Gorge the potential risk to important cultural and ecosystem resources there. DEQ and SWCAA encourage this work to continue, and the agencies would welcome reviewing the results of any new studies and considering those conclusions during its 2013 visibility progress assessment.

The agencies can not, at this time, fund or lead any new studies in the area of acid deposition. We would however, be happy to participate in the design phase of new research and in the peer review of any study results.

In the air agencies' view, several additional studies will be required before conclusions can be drawn about the risk to cultural and natural resources from acidic deposition. While current studies suggest some acidic deposition can occur, at this time the air agencies do not know with any certainty to what extent cultural or natural resources are at risk or are being harmed. Additional research by the USFS would help answer those questions.

As future studies are developed, the air agencies note that many of the same pollutants that impair visibility also play a key role in acidic deposition. Therefore, many of the upcoming strategies that improve visibility will also help reduce acidic deposition and reduce risks to cultural and natural resources.

F. Progress Tracking, Contingency Planning, Periodic Reports to Gorge Commission

1. Monitoring

Continued operation of the Mt. Zion and Wishram sites by the U.S. Forest Service (USFS) is a major component of this Strategy Report. The air agencies will be relying mainly on visibility monitoring at the west and east ends of the Gorge to track haze conditions over time. Continued monitoring at these sites by the USFS is critical for the air agencies' to determine whether "continued improvement" is being achieved.

2. Contingency Planning

The air agencies envision a 5-year check-in (2013) report to the Gorge Commission to inform it as to whether there is a downward or upward trend in visibility improvement. If the air agencies find that Gorge haze levels are degrading, the air agencies will investigate the reasons and will consult with the Gorge Commission to discuss possible remedies. Much of it could depend on whether the downward trend is due to manmade source (which are controllable) versus natural sources, such as fires. While the air agencies' ability to address these natural sources is more limited, there may still be some actions available to employ with partner agencies to address smoke management control.

3. Technical Analysis

The Gorge Air provided a modeling analysis tool that is helpful in investigating unexpected increases in haze (should they occur), or testing the effectiveness of different emission reduction project concepts. The air agencies have some capacity to further investigate and model scenarios and conditions to assess the continued state of visibility in the Gorge.

Section VIII: Tribal Consultation

The air agencies stand ready to meet with each of the four Gorge area tribes to discuss the Gorge Air Study, the Gorge Air Strategy, and emerging air quality issues of concern. DEQ and SWCAA also stand ready to participate in any government-to-government consultation convened by the U.S. Environmental Protection Agency or U.S. Forest Service.

Section IX. Conclusion

The air agencies have presented the Gorge Commission with a comprehensive understanding of the emission sources that influence scenic resources in the Gorge, a look into the likely future of haze trends in the Scenic Area, and a path forward for continued visibility improvement over time. With this framework now in place, the air agencies believe the Columbia River Gorge Commission should concur that they have met the charge given them and that the air agencies' approach is consistent with the National Scenic Area Act and Gorge Management Plan.

The air agencies believe they have met the charge given them by the Gorge Commission in 2000, and respectfully request the Commission concur with the following package of four key conclusions and recommendations that cannot be separated from each other:

1) The air agencies have:
    a. Monitored air pollution and visibility levels in the Gorge, and
    b. Analyzed monitoring and emissions data to identify the sources, both inside and outside the Gorge, that contributes to air pollution.

2) The air agencies have described in this document a reasonable approach to a regional air quality strategy for the Gorge that will produce continued improvement in visibility. This strategy is grounded in the chief conclusions of the air agencies' Science Study that no single action can feasibly be taken to dramatically improve Gorge visibility but that visibility improvement can be accomplished through the cumulative effect of many different emission reduction efforts over time. Any viable approach to achieve further visibility improvement in the Gorge must involve all the governmental entities, stakeholders and agencies working together to implement a combination of the following:

    a. Current and existing federal and statewide strategies for regional air pollution reduction.
    b. New emission reduction projects that focus specifically on Gorge visibility improvement.
    c. Pursuing future strategies and concepts to benefit the Gorge as they are developed and become available.

3) Report back in five years (2013) to assess the progress and effectiveness of this approach, including an update on the implementation of current and new strategies

and the development of potential future strategies. The report will likely include changes in existing control strategies, the progress of the focus groups, and an update on state regional haze plans, emissions and visibility trends.

4) The air agencies will continue to work with all affected agencies, stakeholders, elected officials, the public, and Native American Tribes and will be open to reviewing new research conducted by the USFS, Native American Tribes, and others as it is developed.