Chapter 10 Long Term Strategy for Visibility Improvement

This chapter presents Washington State's Long Term Strategy for Visibility Improvement. The strategy is a comprehensive strategy addressing both Regional Haze (RH) and Reasonably Attributable Visibility Impairment (RAVI).

10.1 Introduction

The Clean Air Act requires a visibility State Implementation Plan (SIP) to contain a long-term (10-to-15 year) strategy for making reasonable progress toward the national goal of remedying any existing visibility impairment in mandatory Class I Areas resulting from human-caused air pollution and preventing future visibility impairment.[1]

The state of Washington has chosen to develop a comprehensive strategy addressing both RH and RAVI as its Long-Term Strategy for Visibility Improvement in this foundational RH SIP. The Environmental Protection Agency's (EPA) rules for protection of visibility allow each state to submit a Long-Term Strategy in its foundational RH SIP that addresses both visibility impairment from RH and RAVI.[2] The result is a single comprehensive state strategy that integrates Regional Haze and RAVI requirements. The comprehensive strategy is updated on the schedule set by the Regional Haze Rule (RHR) for RH SIP updates.

Washington's RAVI SIP focused on point sources and silvicultural smoke management. Most notably, the 1999 update to the RAVI SIP included the Reasonable Available Control Technology (RACT) emission limits for the Centralia Power Plant, and then operated by PacifiCorp, now owned by the TransAlta, Centralia Generation, LLC, as reasonable progress. EPA approved the RACT emission limits for sulfur and particulate matter as meeting Best Available Retrofit Technology (BART) requirements.

Though silvicultural smoke is not a point source (and not required to be addressed under RAVI), Washington recognized silvicultural smoke was having major impacts on visibility as well as health impacts. Washington chose to address silvicultural smoke proactively. Ecology coordinated with the Washington State Department of Natural Resources (DNR) to update the state smoke management plan and included DNR's updated silvicultural smoke management plan for the state of Washington into the 1999 update to Washington's RAVI SIP.

The 1999 updates to Washington's RAVI SIP were approved by EPA in 2003.[3]

10.2 Overview of Washington's Long-Term Strategy

Washington's Long-Term Strategy for this foundational RH SIP applies to mandatory Class I Areas both within the state and outside the state where emissions from the state are reasonably anticipated to contribute to visibility impairment. The strategy is designed to achieve the

[1] Clean Air Act, §169A(b)(2)(B)
[2] 40 CFR 51.306(c)
[3] 68 FR 34821, June 11, 2003

Reasonable Progress Goals established by this foundational RH SIP for mandatory Class I Areas inside Washington and the Reasonable Progress Goals established by other states for mandatory Class I Areas outside of Washington where emissions from Washington are reasonably anticipated to contribute to visibility impairment. The Reasonable Progress Goals serve as benchmarks for progress in meeting the national visibility goal by 2064.

Washington's comprehensive Long-Term Strategy focuses on the implementation of BART, already adopted federal and state controls on sources of visibility-impairing pollutants, and the evaluation and development of additional controls on non-BART point sources. The Long-Term Strategy covers the period from 2005 to 2018. The technical basis for western states' RH SIPs developed by the Western Regional Air Partnership (WRAP), BART, and the unique circumstances of Washington's involvement in the Regional Haze Program all played a role in the development of the Long-Term Strategy.

EPA promulgated the RHR on July 1, 1999. In the preamble EPA stated the following:

> *The EPA believes that the technical tools and our scientific understanding of visibility impairment are now sufficiently refined to move forward with a national program addressing regional haze in Class I areas.*[4]

Still, it took a lot of work that extended over years even for the WRAP, which had been a pre-existing regional planning organization (the Grand Canyon Visibility Transport Commission), to resolve technical and policy issues, develop technical background and analyses, and provide individual member states with the technical information needed for development of state RH SIPs.

The WRAP developed the Technical Support System (TSS) to serve as the gateway to the technical information that forms the basis of western state RH SIPs. The TSS provides information on visibility monitoring, emission inventories, source apportionment, and 2018 visibility projections. Further information on TSS is contained in Appendix G. The TSS may be accessed through http://vista.cira.colostate.edu/tss/ .

Ecology participated actively in the WRAP until July 2002 when the State Legislature cut funding for Ecology's full range of visibility activities (including planning, monitoring, and special projects). The State Legislature's cut of all visibility funding was part of a major reduction in state spending in response to an economic downturn which seriously reduced state revenues. Eventually the State Legislature restored funding effective July 2007 solely for activities needed to develop the RH SIP. The restoration did not include all visibility-related activities.

After Ecology resumed active participation in RH planning, Ecology focused its efforts on BART and on gaining an understanding of the technical basis developed by the WRAP for RH at Washington State's 8 mandatory Class I Areas. This dual focus resulted from Ecology's recognition that as the foundational RH SIP, this SIP has 3 major components: Reasonable Progress Goals, the Long-Term Strategy, and BART. Reasonable Progress Goals and the Long-

[4] 64 FR at 35717, July 1, 1999

Term Strategy depend upon the technical information and analyses in TSS and consultation between the states and other stakeholders provided by the WRAP.

As a result of Ecology's own evaluation and analysis of the WRAP's technical basis for the RH SIP, Ecology decided how to proceed with future control of visibility-impairing pollutants affecting mandatory Class I Areas.

Before we begin the discussion, it is useful to remind the reader that about the differences between emitted visibility-impairing pollutants and monitored visibility-impairing pollutants. Once emitted, particles and gases may go through chemical changes before they are captured by an air sampler. For this reason, the chemical species causing visibility-impairment may not be the same chemical species that were emitted. Table 10-1 below compares emitted visibility-impairing pollutants with the particles measured by Interagency Monitoring of Protected Visual Environments (IMPROVE) monitor.

Table 10-1 Emitted and Monitored Visibility-Impairing Pollutants

Emitted Aerosol	Monitored Particle
Sulfur Dioxide (SO_2)	Sulfate (SO_4)
Nitrogen Oxides (NO_X)	Nitrate (NO_3)
Organic Carbon (OC)	Organic Mass Carbon (OMC)
Volatile Organic Compounds (VOCs)	Organic Mass Carbon (OMC)
Elemental Carbon (EC)	Elemental Carbon (EC)
Fine Soil	Fine Soil
Coarse Matter (CM)	Coarse Matter (CM)
Sea Salt	Sea Salt

First of all, Ecology recognizes that BART and already adopted federal and state controls are important for making reasonable progress by 2018. Of special importance are federal fuel and engine rules for on-road and non-road vehicles. These result in the following large projected percent decreases in visibility-impairing emissions from mobile sources:

- Sulfur dioxide (SO_2) , 95%
- Nitrogen Oxides (NO_X), 64%
- Volatile Organic Compounds (VOCs), 56%
- Organic Carbon (OC) (also called Primary Organic Aerosols), 25%
- Elemental Carbon (EC), 65%

Secondly, Washington recognizes the need to focus on the Most Impaired Days. Not only is visibility impairment and the impact of visibility pollutants much worse on the Most Impaired Days but reduction of pollutants on these days is the only way to ensure reasonable progress in remedying existing impairment. Ecology is dealing with the Least Impaired Days under the assumption that emissions reductions impacting the Most Impaired Days will maintain or improve visibility on the Least Impaired Days. WRAP modeling projecting 2018 visibility impairment confirms this assumption.

Third, Ecology concludes that Washington should focus controls primarily on sulfate and secondarily on nitrate during the 2005-2018 control period. On the Most Impaired Days, at 4 of the state's 6 IMPROVE sites, sulfate is the major pollutant contributing to total light extinction (including Rayleigh scattering) in the baseline period. Sulfate at these sites ranges from 27 to 38% of the total light extinction. In the 2018 projections, sulfate remains the major pollutant contributing to total light extinction at 3 of the 6 IMPROVE sites. Sulfate ranges from 28 to 35% of total light extinction at these 3 sites and contributes 25% to total light extinction at a fourth site.

Nitrate contributes more than 10% of total light extinction only at 2 IMPROVE sites (OLYM1 and SNPA1) within Washington in both the baseline period and in 2018 visibility projections. On the other hand, nitrate makes a larger and more widespread impact on mandatory Class I Areas outside the state than sulfate on both the Most Impaired Days and the Least Impaired Days. Nitrate and sulfate emissions from Washington make reasonably anticipated contributions of 10% or more to the total modeled concentrations impacting certain mandatory Class I Areas in Oregon, Idaho, and Montana.

Fourth, Ecology recognized that the Organic Mass Carbons (OMC) fraction on IMPROVE filters is an important contributor to total light extinction but in two different ways with very different implications. OMC measured by IMPROVE monitoring is composed of primary organic aerosols and secondary organic compounds. Primary organic aerosols are directly emitted as particulates. Secondary organic compounds are formed from condensation or photo-oxidization of VOCs.

The first way OMC is an important contributor to light extinction is related to fire. OMC is the dominant contributor to total light extinction on the Most Impaired Days at Washington's 2 IMPROVE monitoring sites that are most impacted by natural fire (NOCA1 and PASA1). Contributions of 44 and 49% of total light extinction in the baseline period increase slightly to projected contributions of 45 and 51% in 2018 under an emissions scenario that holds fire constant during the first planning period. Based in this information, it does not appear possible for North Cascades National Park, Glacier Peak Wilderness, and Pasayten Wilderness to reach natural conditions unless contributions of OMC from natural fires to total light extinction can be greatly reduced.

The analysis of NOCA1 monitoring data in section 5.2 shows that when data from the high wildfire year of 2003 is excluded, OMC is no longer the predominant visibility-impairing species during "most impaired days". Instead, sulfates from anthropogenic sources become the predominant visibility-impairing species.

The importance of fire for maintaining healthy forest ecosystems has been recognized in governmental and non-governmental programs and in evolving policies supporting prescribed fire and providing options for more widespread use of fire for prescription purposes. Overall, the result is that more smoke (and OMC) from prescribed fires can be expected. Whether prescribed fire programs will mitigate visibility impairment due to wildfire and reduce the total amount of smoke affecting visibility over the long-term is uncertain.

Another important consideration is that climate change models predict a drier Pacific Northwest in the future. This would lead to drier forest conditions which are more conducive to wildfire. A median scenario developed by the University of Washington predicts that due to changes in summer precipitation and temperature, the area burned within the Columbia Basin in the northwestern United States will increase from about 425,000 acres annually during the period of 1916-2006, to 0.8 million acres in the 2020*s*, to 1.1 million acres in the 2040*s*.[5]

There has been discussion in the WRAP and elsewhere about the reinterpretation of natural conditions to reflect more smoky conditions where the ecological role of fire is more dominant. While EPA has defined natural conditions as having no visibility impairment due to human-caused emissions, the Federal Land Managers (FLMs) and others believe that conditions will be smokier in the future as the ecological role of fire is re-established.

Ecology questions whether the scientific understanding of the role of fire and its impact on natural conditions is advanced enough to redefine natural conditions at this time. Since there is still over 50 years remaining to reach the RHR's goal of natural conditions, there is plenty of time to improve scientific understanding and consider appropriate revisions. Ecology's focus for North Cascades National Park, Glacier Peak Wilderness, and Pasayten Wilderness in this foundational SIP period will therefore be two-fold: 1) sulfate and nitrate reductions and 2) tracking fire impacts.

The second way OMC is an important contributor to light extinction is emissions from area sources. OMC causes 22 to 26% of total light extinction in the baseline period and 25 to 28% in 2018 visibility projections at the other 4 IMPROVE monitors. Washington's VOC emission inventory is much larger than the OC (primary organic aerosol) inventory both in the 2000-2004 baseline period and in 2018. Area sources, the largest human-generated source category of VOCs in 2018, are dominated by emissions from solvent utilization and residential wood combustion. Both of these reflect the impact of population growth has on the total amount of emissions. The total emissions would be even larger if there were no controls on the individual units comprising the areas sources. Residential wood combustion is discussed later in this chapter.

Finally, Ecology's analysis shows that emissions from outside of Washington play a significant role in visibility impairment in Washington's mandatory Class I Areas. These include emissions from outside the WRAP region. WRAP has characterized these outside emissions as regional contributions from outside domain, Canada, and Pacific offshore. All are beyond direct control by the state of Washington.

Outside domain consists of the background air concentrations of visibility-impairing pollutants contributed by the rest of the world. As such it represents visibility impairment from the rest of the world and cannot be reduced as a result of actions by the state of Washington or any single jurisdiction. It is expected to increase over the next 50 years.

[5] The Climate Impacts Group, University of Washington, *Evaluating Washington's Future in a Changing Climate*, June 2009.

On the other hand, Canadian emissions can be controlled — by Canada. Both Canada and the United States have committed to reducing cross-border air pollution and recognizing significant human health and ecosystems effects, including regional haze, associated with fine particulate matter and its precursors. Both countries made a commitment to negotiating a Particulate Matter Annex to the United States-Canada Air Quality Agreement while actively developing and implementing emission reduction programs. Negotiations on the Annex were held in 2007 and 2008. Significant reductions in human-caused and wildfire emissions from Canada are needed for mandatory Class I Areas in Washington to reach natural conditions.

Pacific offshore emissions reflect emissions from offshore commercial marine shipping. The WRAP acknowledges that marine vessel emissions affect Washington's Class I areas.[6]

EPA adopted regulations for US–flagged large ocean going vessels in December 2009. The International Maritime Organization (IMO) has both approved the Western North America emissions control area and is in the process of implementing fuel sulfur content and engine regulations for large marine vessels.

Commercial marine shipping has been added to the discussion of factors involved in the Long-Term Strategy later in this chapter. Significant reductions in these emissions are needed for mandatory Class I Areas in Washington to reach natural conditions.

Due to the geographic location of Washington and the dominant weather patterns, emissions from other states are generally not significant contributors to visibility impairment in Washington's mandatory Class I Areas. The exception is Oregon.

Particulate Matter Source Apportionment Technology (PSAT) modeling shows Oregon contributes 10% or more of sulfate on the Least Impaired Days to 3 IMPROVE monitors (MORA1, WHPA1, and PASA1) in both 2002 and 2018. PSAT modeling also projects Oregon contributes 10% or more of sulfate to the other 3 IMPROVE monitors (OLYM1, NOCA1, and SNPA1) in 2018. Similarly PSAT modeling shows Oregon contributes more than 10% of nitrate on the Least Impaired Days to all of Washington's IMPROVE monitors in both 2002 and 2018.

The Weighted Emissions Potential (WEP) analysis indicates that Primary Organic Aerosols from Oregon impact Washington's southernmost IMPROVE monitor, WHPA1, on the Most Impaired Days and the Least Impaired Days and the MORA1 IMPROVE monitor on the Least Impaired Days. Visibility impairment on the Least Impaired Days at both IMPROVE monitors is attributable mainly to area sources, especially in the Portland area, and to natural fire. Area sources in the Portland area contribute to impairment at WHPA1 on the Most Impaired Days.

The Long-Term Strategies of both Washington and Oregon focus on the Most Impaired Days under the assumption that emissions reductions impacting the Most Impaired Days will maintain or improve visibility on the Least Impaired Days.

Bottomline. The RHR established the goal of achieving natural conditions by 2064. There are obstacles to achieving this goal. Most importantly, significant sources of visibility-impairing

[6] http://vista.cira.colostate.edu/docs/wrap/emissions/OffshoreEmissions.doc

emissions are outside of the jurisdiction of the state. Further there is some uncertainty about the level of visibility representing natural conditions because of increased fire resulting from climate change and the re-institution of prescription burning that mimics natural fire cycles in the Northwestern US forests. Re-evaluation of natural conditions may be appropriate at some time in the future.

Still, as of 2010, 54 years remain to reach the RHR's goal of natural conditions. If the goal is to be met, Washington has to do its share by accepting the responsibility for developing additional controls on emissions of visibility-impairing emissions from sources within the state. The next section discusses Washington's plans to control emissions within the state.

10.3 Plans for Further Controls on Visibility-Impairing Pollutants

The purpose of developing Four-Factor Analysis is to evaluate a source or source category for potential controls. The Four Factors, which are a statutory requirement of Section 169A (g)(1) of the Clean air Act, are sometimes referred to as "the four statutory factors". The factors area as follows:

- Costs of compliance
- Time needed for compliance
- Energy and non-air quality environmental impacts of compliance
- Remaining useful life of a facility

Ecology developed a set of Four-Factor Analyses for significant sources of SO_2 and NO_X. Ecology deemed a specific industry or emission source category that emits 1,000 tons or more of SO_2 or NO_X a year as significant. The set of Four-Factor Analyses is found in Appendix F and summarized in the Four-Factor Analysis subsection of section 9.2.1 of Chapter 9. Table 10-1 below presents an overview of the specific industries and emission source categories and the associated emissions of SO_2 and NO_x.

The set of four-factor analyses indicates there is the potential for SO_2 and NO_X emission reductions from a number of individual sources, principally boilers (oil-, natural gas-, and wood-fired), process heaters, and Fluidized Catalytic Cracking Unit (FCCU)/Carbon Monoxide (CO) boiler systems. This identification sets the stage for future development of SO_2 and NO_X limitations for individual sources.

A provision (RCW 70.94.154) of Washington State's Clean Air Act requires existing sources to use RACT. The RACT provision requires Ecology to develop new requirements for an existing emission source category through a formal rulemaking action. Ecology can issue a new rule (or revise an existing one) to require the installation of new emission controls. The rule will allow the sources a limited time to upgrade the controls to meet the new or revised emission standards. The result of the process is a rule requiring all units of the defined source category to achieve a set of defined emission limitations.

Washington State law has an economic hardship provision. A company that demonstrates it meets criteria for economic hardship is allowed either an extended time to achieve compliance or an alternate, source-specific emission limitation.

Development of a RACT rule takes a significant expenditure of time and resources. Ecology estimates that it will take a year to develop background information for a RACT rule and another 9 to 18 months to develop the rule itself. As a best case, Ecology estimates 2 RACT rules could be developed in a 5-year period at current staffing levels

In recognition of the constraints on implementing RACT, Ecology proposes to proceed by first doing technical analysis on the set of 5 identified specific industries and emission source categories to gain a better understanding of the existing levels of controls on individual point sources and the potential opportunities for additional controls. This may be accompanied by modeling of the visibility impacts and evaluating the potential for visibility improvement. Ecology will use these analyses to prioritize the specific industries and emission source categories for RACT evaluation.

Table 10-2 Specific Industries or Emission Source Categories Selected for Further Evaluation

Specific Industry or Emission Source Category	Significant Specific SO_2 Industry or Emissions Source Category?	Significant Specific NO_X Industry or Emissions Source Category?	Total SO_s Emissions (tons per year)	Total NO_X Emissions (tons per year)
Industrial Processes				
Primary Metal Production				
Aluminum Ore Electro-Reduction	Yes	No	8,193	149
Petroleum Industry				
Process Heaters	Yes	Yes	2,764	3,668
Catalytic Cracking Units	Yes	Yes	1,571	"Large"[a]
Pulp and Paper and Wood Products				
Sulfate (Kraft) Pulping	Yes	Yes	5,081	3,769
Sulfite Pulping	No	Yes	378	1,296
Mineral Products				
Cement (Wet Process)	Yes	Yes	1,209	3,528
Cement (Dry Process)	No	Yes	312	1,597
Glass Manufacture	No	Yes	317	1,620
External Combustion Boilers				
Industrial				
Wood/Bark Waste	Yes	Yes	1,820	5,176
Residual Oil	Yes	No	1.569	419
Natural Gas	No	Yes	8	2,123

* While catalytic cracking units do not directly emit any air pollutants, the associated catalyst regeneration systems and carbon monoxide boilers that control the emissions from the catalyst regenerators produce large quantities of NO_X. This NO_X is the product of the combustion of the carbon monoxide from the catalyst regeneration process and combustion of ammonia that may be included in the refinery gas used to supplement the carbon monoxide supplied as fuel by the regenerator to the carbon monoxide boiler.

Ecology's schedule for RACT development is as follows:

- Technical analysis and prioritization, July 2010-June 2011
- Development of the first RACT rule, July 2011-December 2013
- Development of the second RACT rule, January 2014-June 2016

10.4 Factors Involved in the Long-Term Strategy

The RHR requires states to consider 7 factors (labeled "RHR factor" below) in developing a long-term strategy.[7] As discussed above, Ecology is adding 2 additional factors (labeled "Ecology factor"), residential wood combustion and commercial marine shipping.

1. Emission reductions due to ongoing air pollution control programs, including measures to address RAVI (RHR factor)

   Current state and federal rules and state and local air agency permits limit visibility-impairing emissions from point, area, on-road, and non-road mobile sources. The emission reductions from most rules and permits in existence in 2006 are reflected in the projected 2018 emission inventory.

   Permitted limits include sulfur and particulate matter limits resulting from the RACT evaluation of the TransAlta Centralia Generation, LLC coal-fired power plant. These limits were approved by EPA as meeting BART requirements on June 11, 2003.[8]

   Future major and minor new sources or modifications to existing sources will need to meet state permitting requirements; including meeting Best Available Control Technology (BACT) emission limits, to obtain a permit. Major New Source Review permits include requirements to meet Air Quality Related Values protection criteria established by the FLMs for Class I Areas.

   Ecology and local air pollution control authorities in Washington take every opportunity to reduce emissions from existing emission units and to minimize the growth in new emissions through our state New Source Review program. This program requires the imposition of BACT emission reductions for all new sources and modifications that result in the increase of emissions.

   Under other requirements of state law[9], when a company decides to modify or replace an existing emission control system, Ecology or the local air pollution control authority must assure that the modified or replacement control system meets a RACT level of emissions control. This process results in a reduction in emissions from a stationary source, though not so dramatic a reduction as might be achieved through the New Source Review program. Processing modifications and replacements of control equipment is an ongoing workload and from year-to-year the emission reductions are unpredictable.

[7] 40 CFR 51.308(d)(3)(v)
[8] 68 FR at 34824, June 11, 2003
[9] RCW 70.94.153

EPA approved the state's silvicultural Smoke Management Plan (SMP) on June 11, 2003 as part of the state's RAVI SIP. Additional information is provided under RHR factor 5.

2. Emission reductions to mitigate the impacts of construction activities (RHR factor)

   Construction activities as a source of air pollution are regulated under the jurisdiction of Ecology or a local air quality agency. Construction activities are addressed by state air quality rules.[10] Local air quality agencies and local governments have additional rules and policies governing mitigation of air pollution from construction activities.

   Construction activities have not been identified as contributing to visibility impairment in mandatory Class I Areas in Washington. Impacts occur close to the construction site. Washington's mandatory Class I Areas are relatively far from urban areas.

3. Emission limitations and schedules of compliance to achieve the reasonable progress goal (RHR factor)

   In addition to existing federal and state rules, BART plays a role in achieving the emission reductions being used to achieve 2018 Reasonable Progress Goals. Ecology prepared and issued administrative orders to the sources subject to BART. The orders, which are enforceable under state law, require compliance with the BART determination by a specified date. The final orders will be submitted to EPA for federal approval as part of the state's regional haze SIP.

4. Source retirement and replacement schedules (RHR factor)

   Ecology is not aware of any scheduled and documented source retirement or replacement of point sources emitting visibility-impairing pollutants. Source retirement and replacement schedules are not part of this long-term strategy. If Ecology receives documentation of source retirement and replacement schedules in the future, the resulting reductions in visibility-impairing pollutants will be incorporated into the long-term strategy during periodic updates to the RH SIP.

5. Smoke management techniques for agriculture and forestry management purposes including plans as they currently exist within the state for these purposes (RHR factor)

   Under Washington State law, Ecology and the local air agencies have authority to regulate agricultural burning. State law recognizes the need to protect public health and welfare, including visibility, while also allowing for agricultural burning that is reasonably necessary. The state has established controls for agricultural burning to minimize adverse health and environmental impacts. The state works with a variety of stakeholders including agricultural burners, agricultural interests groups, and air quality interest groups to encourage development, research, and use of alternatives to burning.

[10] WAC 173-400-040(3) and (8).

Under state law, Ecology chairs and works with the Agricultural Burning Practices and Research Task Force (Ag Burn Task Force). The Ag Burn Task Force works toward reducing emissions from agricultural burning. This group develops Best Management Practices to reduce emissions from agricultural activities and identifies and, when funding is available, funds research into viable alternatives to field burning.

Under state law[11] the Washington State Department of Natural Resources (DNR) serves as the SMP administrator and is responsible for managing smoke emissions from silvicultural forest burning. The plan "applies to all persons, landowners, companies, state and federal land management agencies, and others who do outdoor burning in Washington State on lands where DNR provides fire protection or where such burning occurs on federally managed, unimproved forestlands and tribal lands of participating Indian nations in the state"[12].

Although prescribed burning from forestry activities is not considered a stationary source, Washington proactively addressed this source in its RAVI SIP because of significant impacts on visibility from prescribed burn plumes. Washington incorporated the state's SMP into the September 1999 revisions to the RAVI SIP.

6. Residential wood combustion program and controls including woodstove change-outs (Ecology factor)

   Residential wood smoke is a significant source of air pollution—including visibility-impairing pollutants—in Washington. Over time the state has developed and implemented a program to address this source and now has a mature residential wood combustion program. Some aspects of the program include:

   - Emission standards for woodstoves and fireplaces that are more restrictive than current EPA standards
   - A burn-ban program that limits use of wood-burning home heating devices and outdoor burning when fine particulate levels are elevated in the cooler months
   - To the extent that funding is available, woodstove change out programs are implemented to replace older, more polluting woodstoves with cleaner, more efficient heating devices

   Ecology is currently working with EPA and other states to update emission standards for home heating devices.

7. Controls on emissions from commercial marine shipping (Ecology factor)

   The WRAP acknowledges that marine vessel emissions affect Washington's Class I areas.[13] Ecology's analysis of WRAP technical information confirms that mandatory

[11] Revised Code of Washington 70.94.6536
[12] 1998 Smoke Management Plan, page 5
[13] http://vista.cira.colostate.edu/docs/wrap/emissions/OffshoreEmissions.doc

Class I Areas in Washington are impacted by visibility-impairing emissions from outside the state including Pacific offshore emissions from commercial marine shipping.

Washington is also impacted by shipping through the Strait of Juan de Fuca, which separates Vancouver Island, British Columbia from the north shore of Washington's Olympic Peninsula. These emissions however are not in WRAP emission inventories. Neither the Pacific offshore emissions nor in-shore emissions (which are assigned to Washington counties) include Canadian vessel traffic within and just outside the Strait of Juan de Fuca. The Canadian vessel traffic goes to and from Canadian ports, primarily the Port Metro Vancouver, the largest port on the West coast of the United States and Canada.

After the WRAP had finalized the emission inventories and modeling of 2018 visibility impacts, EPA finalized a coordinated strategy for addressing pollution from oceangoing vessels. This strategy includes the following components:

(1) EPA regulations for controlling emissions from US.flagged vessels and vessels that purchase fuel in the United States
(2) The U.S. government's international efforts to reduce air pollution from oceangoing vessels through the designation of an Emission Control Area (ECA) off the West and the East Coasts of the United States
(3) New international standards for marine diesel engines.

EPA adopted the more rigorous engine and fuel standards for new marine diesel engines with per cylinder displacement at or above 30 liters (called Category 3 marine diesel engines) in December 2009. Category 3 marine diesel engines serve as the main propulsion engines on oceangoing vessels.

The EPA rule applies to new engines installed on U.S.-flagged vessels beginning in 2011. The rule requires more efficient use of such current technologies as engine cooling, engine timing, and advanced computer controls. It is expected to reduce Nitrogen Oxides (NO_X) levels by 15 to 25%. Beginning in 2016 the rule requires the use of high-efficiency emissions control technology, including Selective Catalytic Reduction (SCR), to reduce NO_X by 80% below current levels.

EPA revised the diesel fuel program to forbid the production and sale of marine fuel oil above 0.1% (1,000 ppm) sulfur for use in the waters within the proposed ECA. The program provides for the production and sale of less than or equal to 0.1% sulfur fuel for use in Category 3 marine vessels with some limited exceptions that do not affect West Coast marine shipping.

The IMO, a specialized agency of the United Nations, is taking a series of actions to reduce harmful emissions from ships. Amendments to the existing IMO regulations were adopted in October 2008 to allow for tighter controls in ECAs if needed to prevent, reduce, and control emissions. The revised regulations and will enter into force on July 1, 2010.

In July 2009, the IMO adopted in principle an ECA extending 200 nautical miles from the West and East Coasts of the United States and Canada. The ECA, which is expected to enter into force as early as August 2012, will reduce the allowed sulfur content of marine diesel fuel from 1.50% to 1.00% (15,000 ppm to 10,000 ppm) and further reduce the sulfur content to 0.10% (1,000 ppm) effective January 1, 2015. In practice, implementation of the ECA means that ships entering the ECA need to use IMO compliant fuel for the duration of their voyage that is within the ECA, including time in port as well as voyages whose routes pass through the area without calling on a port.

Ships constructed in 2016 or later will need to comply with stringent NO_X limits when operating within the ECA. Compliance is expected to necessitate the use of after-treatment technology, such as selective catalytic reduction (SCR).

The EPA and IMO regulations will start to benefit visibility in Washington's mandatory Class I Areas only in the final years of the 2005-2018 control period. As neither EPA nor IMO regulations were adopted at the time that PRP18a modeling was performed, the WRAP did not include any anticipated reductions in visibility-impairing pollutants from commercial marine shipping in modeling for this SIP. The reductions will be reflected in modeling for the next control SIP covering the 2018-2028 planning period, which is due in 2018 under the RHR.

8. Enforceability of emission limitations and control measures (RHR factor)

   Emission limits on stationary point sources are enforceable as a matter of state law. Chapter 173-400 Washington Administrative Code (WAC), General regulations for air pollution sources; Chapter 173-401 WAC, Operating permit regulation; Chapter 173-405 WAC, Kraft pulping mills; Chapter 173-410 WAC, Sulfite pulping mills; Chapter 173-415 WAC, Primary aluminum plants; Chapter 173-434 WAC, Solid waste incinerator facilities; and local air agency rules for point sources provide the authority to require proper operation and maintenance of control equipment. Ecology and local air agencies rely on field inspections to ensure compliance with the requirements.

   Ecology is issuing administrative orders to implement BART at the sources subject to BART. The orders will later be incorporated into the source's Title V permit by the agency with jurisdiction over the source (which may be Ecology or a local air agency).

   Existing federal and state rules are enforceable by the agency issuing the rules.

9. The anticipated net effect on visibility due to projected changes in point, area, and mobile source emissions over the first control period which ends in 2018 (RHR factor)

   The WRAP modeled the PRP18a inventory used for this SIP to determine the expected net effect of projected changes to visibility due to emission changes over the control period for the foundational RH SIP ending in 2018. Table 10-2 below presents the net effects of emission changes on visibility. The effects reflect the implementation of

controls on the books and presumptive SO_2 BART for Electrical Generating Units (EGUs) where BART had not been determined.

Table 10-3 Anticipated Net Effect on Visibility of Emission Reductions over the First Control Period

Class I Area	Most Impaired Days			Least Impaired Days		
	2000-2004 Baseline Conditions (dv)	2018 Projected Visibility (dv)	Net Effect (dv)	2000-2004 Baseline Conditions (dv)	2018 Projected Visibility (dv)	Net Effect (dv)
Olympic National Park	16.74	16.38	(0.36)	6.02	5.82	(0.20)
North Cascades National Park and Glacier Peak Wilderness	16.01	n/a	n/a	3.37	3.24	(0.13)
Alpine Lakes Wilderness	17.84	16.32	(1.52)	5.5	4.86	(0.64)
Mount Rainier National Park	18.24	16.66	(1.58)	5.47	4.83	(0.64)
Goat Rocks Wilderness and Mount Adams Wilderness	12.76	11.79	(0.97)	1.66	1.47	(0.19)
Pasayten Wilderness	15.23	15.09	(0.14)	2.73	1.89	(0.84)

NOTE: Parentheses indicate negative values.

The modeling results for the Most Impaired Days were considered in establishing Reasonable Progress Goals for Washington's mandatory Class I Areas except for North Cascades National Park and Glacier Peak Wilderness. The PRP18a inventory does not reflect major sulfur reduction projects totaling almost 9,000 tons/year of SO_2 at 3 major oil refineries located in the area with the greatest potential to impact visibility at the 2 mandatory Class I Areas. These emission reductions are not reflected in later PRP18b and PRP18cmv inventories either. As a result, there is no reliable modeling available that shows the net effect of emission changes.

The modeling results for the Least Impaired Days show that the no degradation goal can be met.

10.5 Development of Washington's Long-Term Strategy

The RHR requires consultation between states on the development of coordinated emission management strategies. This requirement applies both to mandatory Class I Areas within Washington and to mandatory Class I Areas outside Washington where emissions from Washington are reasonably anticipated to contribute to visibility impairment.

Participation in the WRAP has fostered a regionally consistent approach to haze planning in the western states and provided a sound mechanism for consultation. Consultation among the 15 western states within WRAP has occurred through meetings of WRAP committees, workgroups, and forums with participation by conference calls, face-to-face meetings, and workshops.

The result is that western states have agreed upon the Reasonable Progress Goals being set for 2018 and the appropriateness of the strategies to achieve these Goals for all mandatory Class 1 Areas in the WRAP region. As result of coordination through the WRAP, this foundational RH SIP reflects Washington's implementation of a regionally consistent approach to addressing visibility impairment in the West.

10.6 Summary

Washington State's Long-Term Strategy for Visibility Improvement is a comprehensive strategy that addresses both RH and RAVI. The Strategy applies to mandatory Class I Areas both within Washington and outside Washington where emissions from the state are reasonably anticipated to contribute to visibility impairment.

The strategy is designed to achieve the Reasonable Progress Goals established by this foundational RH SIP for mandatory Class I Areas inside Washington and the Reasonable Progress Goals established by other states for mandatory Class I Areas outside of Washington where emissions from Washington are reasonably anticipated to contribute to visibility impairment. The Reasonable Progress Goals serve as benchmarks for progress in meeting the national visibility goal by 2064. Washington will update its comprehensive Long- Term Strategy on the schedule set by the RHR for RH SIP updates.

The Long-Term Strategy for this foundational RH SIP is based on the following considerations:

A. Already adopted federal and state controls, especially federal fuel and engine rules for on-road and non-road vehicles, are important for making reasonable progress by 2018.
B. The focus should be on the Most Impaired Days.
C. Washington should focus controls primarily on sulfate and secondarily on nitrate.
D. In the 2000-2005 baseline period, OMC was an important contributor to total light extinction but in two different ways with two quite different implications.
    a. It does not appear possible for Pasayten Wilderness, North Cascades National Park, and Glacier Peak Wilderness to reach natural conditions unless contributions of OMC from natural fire to total light extinction can be greatly reduced.
    b. Projected 2018 OMC in Washington's other mandatory Class I federal areas reflects the impact of population increase on area source emissions despite existing controls on the individual area source units.
E. Regional contributions from outside domain, Canada, and Pacific offshore play a significant role in visibility impairment in Washington's mandatory Class I Areas but are beyond the direct control of the state of Washington.

The bottomline is that if the goal of natural conditions is to be met, Washington has to do its share by accepting the state's responsibility for developing additional controls on those sources of visibility-impairing emissions. During this first control period, Ecology commits to pursuing the RACT strategy discussed in section 10.3 above in order to reduce impacts from visibility-imparing emissions on Class I areas. .

Ecology also commits to identifying to EPA, to the extent practicable, the sources or source areas of visibility-impairing emissions in Canada that contribute to visibility impairment in Washington's Class I areas.