
FINAL REPORT

of the

**Puget Sound Clean Air Agency
CO/Ozone Stakeholders Group**

Prepared with the Assistance of

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SECTION I – OZONE

Puget Sound Clean Air Agency CO/Ozone Stakeholders Group

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Section 1 – Executive Summary – Ozone¹

In its 1995 Ozone Maintenance Plan effort, the Puget Sound Clean Air Agency (the Clean Air Agency) committed to revisiting the region's ozone maintenance plan after five years to review the plan's assumptions and control strategies. The Clean Air Agency also committed to revising and updating the maintenance plan as necessary, in light of new scientific monitoring, modeling, and technical information, to help ensure that the region remained in attainment with the national ozone standard, particularly in light of continued growth in the Puget Sound region. High ozone levels recorded in the summer of 1998 also highlighted the appropriateness and timeliness of this review.²

In August 2000, the Clean Air Agency convened a broad-based stakeholder group, consisting of representatives from the health, fuels industry, environmental, business, and regulatory communities, to assist the Agency in its ozone maintenance plan update process. Specifically, the Stakeholders Group (the Group) was charged with identifying and recommending the range of actions that might be prudent to include in the updated maintenance plan to achieve the emission reductions necessary to stay in attainment with the Federal ozone standard in light of current and projected air quality.

To support its evaluation of potential emission reduction strategies to include in the updated maintenance plan, the Stakeholders Group reviewed key technical information. A model was used to help determine that VOC reductions are the most effective path to reducing ozone levels in Puget Sound and an emissions inventory was developed to identify the sources of VOC emissions and where potential emission reduction opportunities might lie. Air quality data was reviewed to understand the region's ozone trends over the past decade, and the model was also used to reflect what ozone concentrations would likely be in the years 2007 and 2015 without additional local emission controls. The technical analyses as a whole was seen by the Stakeholders Group as collectively demonstrating that the region remains susceptible to potential ozone standard violations, and that pursuit of continuing prudent reductions of ozone forming emissions was warranted.

The Stakeholders Group recognized the importance of maintaining the Federal ozone standard both from a health perspective (repeated exposure to ozone pollution can trigger a variety of health problems and worsen existing health conditions, such as bronchitis, heart disease, and asthma), as well as a regulatory perspective (consequences of nonattainment include possible loss of Federal highway funds and increased control on the region's point sources). In its effort to assist the Clean Air Agency in helping to ensure that the ozone standard is not violated, the stakeholders considered both regulatory and voluntary VOC emission reduction strategies, related to a variety of sources, including but not limited to, fuels, paints, personal care products, motor vehicles, lawn mowers, and outboard motors.

After analysis and discussion of the technical data and potential emission reduction strategies, the Stakeholders Group developed its final strategy recommendations for ozone emission reduction measures,

¹ Please see Section II – CO Executive Summary for a summary of the CO effort.

² Please see Appendix F of the Final Report for a graph displaying ozone concentrations during the 1998 ozone episode.

contingency measures, and policy positions. In developing its recommendations, the Group considered several factors, including potential emissions reductions, cost-effectiveness, implementation feasibility, and additional benefits provided by the strategy, such as increased public awareness.

The recommended emission reduction measures were considered to be reasonable actions for the region to implement in order to help ensure that the region remain in attainment with the Federal ozone standard over the lifetime of the maintenance plan. In addition, the recommended ozone reduction measures also produce additional air quality benefits, such as toxics emissions reductions. The table below provides a brief description of the recommended emission reduction measures and the estimated VOC emission reduction and cost-effectiveness numbers associated with each.

Table 1 - Recommended Emission Reduction Measures

Strategy <i>(Please note that the following are abbreviated descriptions of the recommended strategies. Please see the Stakeholders CO/ozone report for the actual recommendation language.)</i>	% VOC Emission Reduction³		Cost per ton⁴	
	2007	2015	2007	2015
Continue the current voluntary low RVP gasoline program	4.5%	3.3%	\$3,900	\$4,800
Develop a voluntary coatings program designed to increase the purchase and use of low VOC paints	1.9%	3.9%	\$5,400	\$5,400
Continue and enhance the current state Inspection & Maintenance Program	1.4%	1.0%	\$6,500	\$7,000
Enhance the current vapor recovery program by increasing educational and enforcement efforts	0.5%	0.6%	\$4,650	\$4,650
Develop a voluntary gas can program designed to increase turnover of older gas cans for newer, lower emitting gas cans	0.2%	0.2%	\$8,400	\$8,400
Work with Puget Sound Clean Air Agency partners to enhance the current "Grasscycling" program to provide incentives for the public to turn in older, two-stroke lawn mowers for cleaner alternatives such as electric mowers	0.2%	0.2%	\$2,250	\$2,250
<i>Total Reductions Produced by Recommended Measures</i>	8.7%	9.2%		

In discussing potential emission reduction strategies, the Group also identified an ozone contingency measure to be implemented if there were a violation of the Federal ozone standard. The stakeholders recommended that if a violation of the ozone standard occurs, a model paint rule should be implemented that requires architectural paints sold in the Puget Sound region to comply with the emission limits recommended by STAPPA/ALAPCO in their Model Rule: Regulating Air Emissions from Paint, October 2000.

In addition to the recommended emission reduction and contingency measures described above, the CO/Ozone Stakeholders recommended a series of policy positions that represent good direction for the Clean Air Agency to pursue. These strategies represent policies, programs, and efforts that the Group supports because they are valuable from an educational, informational, or advocacy perspective, and would result in VOC emission reductions. They include recommendations to address emissions from marine engines and personal care products, to enhance the current Smog Watch Program, and to support

³ The emission reduction estimates reflect potential emission reductions from human-caused, or nonbiogenic, VOCs, versus overall (biogenic and nonbiogenic) VOCs.

⁴ Cost-effectiveness calculations were based, in part, on staff assumptions developed in light of available information. While considering the cost-effectiveness numbers an important factor in developing its recommendations, the Group also recognized that the reliability of the cost estimates was established by the quality of available information and the assumptions used to calculate the estimates. Because of this variability in assumptions and available information, the reliability of the cost-effectiveness estimates varies from strategy to strategy.

efforts designed to promote use of alternative vehicles. (Please see the CO and ozone sections of the Final Report for a complete description of the recommended policy statements.)

The Stakeholders Group recognizes that the region must continue to be vigilant and to take prudent steps to remain in attainment, particularly as the population in the Puget Sound region continues to grow and place pressure on all of our natural resources, including air quality. To ensure that the updated maintenance plan's emission reduction measures continue to be effective and/or appropriate in light of anticipated, and unanticipated, future occurrences, the Group recommends that the Clean Air Agency engage in a comprehensive review of the maintenance plan at an appropriate interval during the lifetime of the plan, (2007 or as deemed appropriate by the Clean Air Agency). The stakeholders also recognize the resource implications associated with implementation of different strategies, and that many strategies and recommended programs would take additional Clean Air Agency efforts and resources to develop and implement. The Group recognizes the necessity of additional funding for the Clean Air Agency to support efforts to implement some of the recommended strategies and recommends and supports increases to the Agency's non-fee based budget, believing that the implications of going into nonattainment are too severe, and that modest increases in the Clean Air Agency's resources are a good investment to help implement these prudent strategies to reduce VOC emissions.

The Stakeholders Group believes its recommendations represent reasonable and cost-effective actions that cut across all sources, requiring the oil industry, mobile sources, and the general public to contribute to reducing overall regional ozone levels. The Group also believes that its recommendations will help to keep the region in attainment and avoid the significant consequences of nonattainment status, and will contribute to achieving important improvements to the region's overall air quality and, thus, human and ecological health.

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Section 1 – Summary of Process and Recommendations – Ozone

▪ Charge

In its 1995 Ozone Maintenance Plan effort, the Puget Sound Clean Air Agency (the Clean Air Agency) committed to revisiting the region's ozone maintenance plan after five years to review the plan's assumptions and control strategies.⁵ The Clean Air Agency also committed to revising the maintenance plan as necessary, in light of new scientific monitoring, modeling, and technical information, to help ensure that the region remained in attainment with the national ozone standard, particularly in light of continued growth in the Puget Sound region.⁶

As part of its commitment to revisit the ozone maintenance plan early, the Puget Sound Clean Air Agency convened a broad-based stakeholder group in August 2000 to provide the Clean Air Agency with recommendations to help ensure that the Federal ozone standard is maintained through the year 2015. Specifically, the Stakeholders Group (the Group) was charged with identifying the range of actions (if any) that might be prudent to consider including in the Ozone Maintenance Plan Update to achieve the emission reductions necessary to stay in attainment in light of current and projected air quality.

▪ Ozone

Ozone (O₃) is a gas that forms in the atmosphere through a series of complex chemical reactions involving volatile organic compounds (VOCs)⁷, oxides of nitrogen (NO_x), and sunlight. Repeated exposure to ozone pollution can trigger a variety of health problems and worsen existing health conditions, such as bronchitis, heart disease, and asthma. Because ozone generally forms in hot, dry weather, anyone who spends time outdoors in the summer is exposed to the possible health impacts resulting from ozone pollution. In addition, ozone affects plant life by interfering with the ability of plants to produce and store food, making them more susceptible to disease, insects, other pollutants, and harsh weather.

Ozone precursors, VOCs and NO_x, are emitted by both human sources and natural (biogenic) sources, such as from resin in trees. The CO/ozone Stakeholders Group focused its efforts on the most effective

⁵ In 1995, the Puget Sound Clean Air Agency developed an Ozone Maintenance Plan and a request to the U.S. EPA for redesignation to attainment for the Puget Sound ozone nonattainment area. The maintenance plan, which included emission reduction and contingency measures, was developed as part of the region's redesignation request to help ensure that the region remained in attainment with the ozone standard.

⁶ High ozone levels recorded in the summer of 1998 also highlighted the appropriateness and timeliness of this review. Please see Appendix F of the Final Report for a graph displaying ozone concentrations during the 1998 ozone episode.

⁷ Volatile organic compounds are hydrocarbon substances that participate in atmospheric photochemical reactions.

ways to control ozone-forming pollutants from human sources,⁸ which include cars, trucks, buses, recreational boats, lawn and garden equipment, and architectural coatings.⁹

- **Process**

The Stakeholders Group, which consisted of 13 members representing government, the health community, the fuels industry, environmental interests, small businesses, and automobile dealers, met nine times over the course of ten months to develop its recommendations for CO and ozone emissions control in the Puget Sound region.

The process consisted of group review of technical information presented by Clean Air Agency staff regarding ozone formation in the Puget Sound, air quality data, projected future ozone concentrations, and the effectiveness of potential emission-reduction strategies. In light of the technical data, the group discussed and debated a number of emission reduction strategies and developed its final recommendations. The source categories analyzed by the Group included motor vehicles, recreational boats, lawn and garden equipment, architectural coatings, personal products, gasoline stations, and other sources that emit ozone precursors, (VOCs and NO_x).

- **Observations**

Some key observations give meaningful context to the Group's recommendations. Significant technical efforts and analyses have occurred since the Clean Air Agency's 1995 Ozone Maintenance Plan effort and additional air quality data have been collected. A model was developed that helped the Agency and stakeholders to better understand ozone formation in the Puget Sound and how it is impacted by reductions of VOC and NO_x emissions. This information allowed the stakeholders to determine that VOC reductions are the most effective path to reducing ozone levels in Puget Sound. An emissions inventory was developed as input to the model and to identify the sources of VOC emissions and where potential emission reduction opportunities might lie. The Group also reviewed air quality data collected during the 1990's to understand ozone trends over the past decade, and the model was used to reflect what ozone concentrations would likely be in the years 2007 and 2015 without additional local controls. The technical analyses as a whole—including monitoring data, projected ozone concentrations, and projected VOC reductions from the strategies—was seen by the stakeholders as collectively demonstrating that the region remains susceptible to potential ozone standard violations, and that pursuit of continuing prudent reductions of ozone forming emissions was warranted.

The Stakeholders Group also acknowledged the importance of remaining in attainment with the ozone standard given the significant consequences of nonattainment, which includes possible loss of Federal highway funds and increased control on the region's point sources. While realizing that ozone concentrations will decline over the next 15 years because of new Federal programs that will be implemented, specifically Low Sulfur Fuels and Tier II Motor Vehicle Standards, the stakeholders also recognized that the emissions benefits from those programs will likely not be realized until 2007, and the full benefits of those programs until 2015 (or later).

The Group recognized that the air quality benefits produced by potential local emission reduction strategies could be an important contribution to remaining in attainment, particularly through 2007, and

⁸ Modeling work conducted for the CO/Ozone Stakeholders Process indicated that biogenic (natural) emissions are not a major factor in the ozone formation that contributes to ozone concentrations over or near the standards in Puget Sound.

⁹ As noted above in footnote 3, VOCs are organic compounds. Organic chemicals are widely used as ingredients in items such as household products, paints, fuels, solvents, cosmetics, and other products. All of these products can release organic compounds while they are being used, and to some degree, when they are stored.

agreed that it was important for the region to take prudent additional steps beyond the anticipated Federal programs to reduce ozone concentrations.

Throughout the course of its discussions, the Group recognized the resource implications associated with implementation of different strategies, and that many strategies and recommended programs would take additional Clean Air Agency efforts and resources to develop and implement. The Group recognizes the necessity of additional funding for the Clean Air Agency to support efforts to implement some of the recommended strategies, particularly those that are voluntary efforts. Voluntary programs undertaken by the Clean Air Agency are supported by non-fee based funds, since they are not regulatory in nature and cannot be supported by permit or other mandated fees. To ensure that these efforts are reasonably funded, the Group recommends and supports increases to the Agency's non-fee based budget. The stakeholders believe the implications of going into nonattainment would be too severe, and that modest increases in the Clean Air Agency's resources are a good investment to help implement these prudent strategies to reduce VOC emissions.

▪ **Final Recommendations to Reduce VOCs**

After analysis and discussion of the technical data and potential emission reduction strategies, the Stakeholders Group developed its final strategy recommendations for ozone emission reduction measures, contingency measures, and policy positions. In developing its final recommendations, the Group considered several factors, including potential emissions reductions, cost-effectiveness¹⁰, implementation feasibility, and additional benefits provided by the strategy, such as increased public awareness.

Recommended Emission Reduction Measures

The Stakeholders Group recommended the following strategies as emission reduction measures. These strategies were considered to be reasonable actions for the region to implement in order to help ensure that the region remain in attainment with the Federal ozone standard over the lifetime of the maintenance plan.

In addition, if implemented, the recommended VOC emission strategies would provide additional air quality benefits. In particular, all of the recommended strategies would also provide toxics emissions reductions. Exposure to toxic air pollutants of significant concentration and duration can result in considerable health effects. Because of the potential health impact of toxics emissions, the toxics reductions produced by the recommended VOC emission reduction strategies were viewed as an important collateral benefit by stakeholders.

Table 1 below displays the percentage of VOC emission reductions produced by the strategies, both individually and collectively, as well as the cost per ton for each strategy. The stakeholders' final recommendations follow.

¹⁰ Cost-effectiveness calculations were based, in part, on staff assumptions developed in light of available information. While considering the cost-effectiveness numbers an important factor in developing its recommendations, the Group also recognized that the reliability of the cost estimates was established by the quality of available information and the assumptions used to calculate the estimates. Because of this variability in assumptions and available information, the reliability of the cost-effectiveness estimates varies from strategy to strategy.

Table 1 - Recommended Emission Reduction Measures

Strategy	% VOC Emission Reduction ¹¹		Cost per ton ¹²	
	2007	2015	2007	2015
Low RVP gasoline	4.5%	3.3%	\$3,900	\$4,800
Voluntary coatings program	1.9%	3.9%	\$5,400	\$5,400
Inspection & maintenance	1.4%	1.0%	\$6,500	\$7,000
Enhanced vapor recovery program	0.5%	0.6%	\$4,650	\$4,650
Voluntary gas can program	0.2%	0.2%	\$8,400	\$8,400
Enhanced "Grasscycling" program	0.2%	0.2%	\$2,250	\$2,250
<i>Total Reductions Produced by Recommended Measures</i>	8.7%	9.2%		

Low Reid Vapor Pressure Gasoline

This recommendation was developed by the stakeholders to help reduce the VOC emissions that are produced when gasoline is burned by on-road motor vehicles.¹³ On-road motor vehicles account for approximately 156 tons of the 369 human-caused (nonbiogenic) VOC tons estimated per summer episode day for the year 2007.¹⁴ It is estimated that lower RVP gasoline will yield a 4.5% (approximately 16.6 tons) reduction in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholder Group recognizes and supports the voluntary participation of the region's oil companies in the Puget Sound Clean Air Agency's program to reduce regional VOC emissions by producing and distributing low Reid Vapor Pressure (RVP) gasoline during the summer months. The Stakeholders Group recommends that the Clean Air Agency and participating oil companies continue the successful existing program and continue to work together to get the greatest RVP reductions possible. At a minimum, RVP levels should be reduced to the existing voluntary program levels of 7.8 psi during the summer months.

Voluntary Coatings Program

VOCs emitted from architectural coatings account for approximately 21 tons of the 369 nonbiogenic VOC tons estimated per summer episode day for the year 2007. To reduce the emissions from this category, the stakeholders are recommending a voluntary coatings program designed to encourage consumers to purchase and use low VOC paints. It is estimated that if such a program were implemented, the region would realize a 1.9% reduction (approximately 6.9 tons) in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency implement a Voluntary Coatings Program designed to reduce VOC emissions from coatings such as household paint, industrial building and road striping. The program should contain a strong educational component designed to inform the public about the air quality effects associated with high VOC paints and the availability of lower VOC paints. In addition, the Agency should actively encourage retail outlets to

¹¹ The emission reduction estimates reflect potential emission reductions from human-caused, or nonbiogenic, VOCs, versus overall (biogenic and nonbiogenic) VOCs.

¹² As noted in footnote 11, the cost-effectiveness calculations were based, in part, on staff assumptions developed in light of available information. While considering the cost-effectiveness numbers an important factor in developing its recommendations, the Group also recognized that the reliability of the cost estimates was established by the quality of available information and the assumptions used to calculate the estimates. Because of this variability in assumptions and available information, the reliability of the cost-effectiveness estimates varies from strategy to strategy.

¹³ Lower RVP gasoline would also produce VOC emission reductions from other gasoline-operated equipment such as lawn mowers and off-road vehicles.

¹⁴ Please see Appendix E of the Stakeholders' Report for the detailed emissions inventory.

promote the sale of low VOC paints, and should seek to establish partnerships with appropriate public and private entities to encourage the use of low VOC paints.

To determine if the voluntary efforts are influencing the type of coatings sold and used in the Puget Sound region, the Group recommends that the following targets be established:

- By 2007, 60% of paints applied should comply with the California Air Resources Board's stricter Suggested Control Measures (SCMs). (Achieving a 60% target in 2007 would result in a 1.9% reduction in overall nonbiogenic VOCs.)
- By 2015, 100% of paints applied should comply with the SCMs. (Achieving a 100% target in 2015 would result in a 3.9% reduction in overall nonbiogenic VOCs.)

If these targets are not met, the Clean Air Agency should consider implementing a model paint rule to reduce VOC emissions from the coatings category.

Inspection and Maintenance

On-road motor vehicles are a significant source of VOC emissions in the Puget Sound, approximately 156 tons of the 369 nonbiogenic VOC tons estimated per summer episode day for the year 2007. Emissions from this source category are currently controlled, in part, by the State's Motor Vehicle Inspection and Maintenance Program (I/M Program). To continue to gain emission benefits from the Program, the stakeholders developed a recommendation that supports continuation, and enhancement of, the current I/M Program. It is estimated that if an enhanced program were implemented, the region would realize a 1.4% (approximately 5.1 tons) reduction in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group strongly supports the continuation of the Washington State Department of Ecology's Inspection and Maintenance Program (I/M Program), knowing that a fee increase is required to do so. The Group recognizes that the I/M Program is necessary to keep the region in attainment with the Federal air quality standards, especially ozone.

In addition, the Group strongly recommends improving the I/M Program to increase the effectiveness of the program. In an effort to enhance the I/M Program, the Washington State Department of Ecology should continue to explore cost-effective ways to increase the efficiency of the program through changes in program design and use of improved technology. In particular, the Stakeholder Group recommends that the Department of Ecology do the following:

- Analyze the effects of more effective testing methods such as ASM 2525 and/or the effects of an increased repair waiver.
- Explore ways to mitigate the effects of a higher repair waiver limit, including funding to assist low-income vehicle owners with repair costs.
- Analyze how the advent of on-board diagnostics affects program design options.
- Explore the use of high-emitter profiles in the program design.
- Continue to track successes and failures in the use of remote sensing at other jurisdictions:
 - track advances in remote sensing technology and program design.
 - identify possible funding mechanisms for remote sensing.

Stage II Vapor Recovery

Gasoline station/refueling emissions account for approximately 8 tons of the 369 nonbiogenic VOC tons estimated per summer episode day for the year 2007. VOCs are emitted when motor vehicles refuel and stage II vapor recovery systems are designed to capture these evaporative emissions. Many stage II systems are not maintained properly however, resulting in less effective capture of emissions. If efforts are undertaken to improve the results provided by stage II systems, it is estimated that the region would

realize a 0.5% (approximately 1.79 tons) reduction in overall nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency develop an enhanced Vapor Recovery enforcement program, designed to better educate gas station owners/operators of the need to maintain existing Stage I and Stage II Vapor Recovery Systems and of the regulations that define the appropriate level of control and maintenance. Educational efforts should be multilingual to ensure effective communications. The program should also contain appropriate enforcement provisions to enhance compliance with existing requirements. In addition, the Agency may consider a broader public education component regarding the role of Stage II Vapor Recovery Systems in relation to overall air quality.

Voluntary Gas Can Program

Evaporation of gasoline can occur through gas can walls and the cap of gas cans. In addition, evaporation occurs when there is spillage from and overfilling of gas cans. To reduce the evaporative emissions from this source, the stakeholders are recommending a program that focuses on encouraging the sale and purchase of gas cans designed to decrease evaporative emissions. If such a program were implemented, potential emission reductions have been estimated at 0.2% (approximately 0.6 tons) reduction in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency develop a voluntary program designed to encourage the purchase of lower emitting gas cans. Such a program should include a strong public education component to inform the public of the air quality impacts associated with evaporation, spillage, and overfilling of fuel cans, and of the availability of lower-emitting cans. The Clean Air Agency should also explore developing partnerships with public and private entities to promote the purchase of lower emitting cans.

Enhancement of Current "Grasscycling" Program

Gas lawn and garden equipment exhaust account for approximately 32 tons of the 369 nonbiogenic VOC tons estimated per summer episode day for the year 2007. Emissions from this source category are produced largely by older, less efficient equipment, in particular two-stroke, oil and gas mixture engines. The current "Grasscycling" program is designed to provide incentives to encourage homeowners and others to buy more efficient equipment, such as electric mowers. The stakeholders are recommending that the program be enhanced to specifically target trade-ins of two-stroke engines. If the "Grasscycling" program was enhanced, an additional 0.2% (approximately 0.6 tons) emission reductions is estimated in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency work with participating partners to enhance the current "Grasscycling" program to further promote the use of cleaner alternatives for lawn and garden equipment by both public and private entities. The enhancements should target trade-ins of two-stroke lawn mowers by providing rebates for every two-stroke mower turned in. In addition, a robust educational program should be developed to inform the public of the air quality impact of lawn and garden equipment, the benefits of using cleaner alternatives, such as electric lawn and garden equipment, and the opportunity to trade-in equipment with higher-emitting two-stroke engines.

Recommended Contingency Measure

In discussing potential emission reduction strategies, the Group identified an ozone contingency measure to be implemented if there were a violation of the Federal ozone standard.¹⁵ The Group recommends that a mandatory requirement for low VOC paints could be a reasonable contingency measure. The Group believes that a voluntary coatings program should be implemented first (see the Voluntary Coatings recommendation in the discussion above), but recognized that if a violation were to occur, approximately 1.3% more VOC reductions by the year 2007 could be achieved by a mandatory low VOC paint rule. The recommendation follows:

Model Paint Rule

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency implement a model paint rule in the event of a violation of the Federal ozone standard. If a violation of the ozone standard occurs, a model paint rule should be implemented that requires architectural paints sold in the Puget Sound region to comply with the emission limits recommended by STAPPA/ALAPCO in their Model Rule: Regulating Air Emissions from Paint, October 2000.

Recommended Policy Positions

In addition to the recommended emission reduction measures described above, the stakeholders recommend a series of policy positions that represent good direction for the Clean Air Agency to pursue. These strategies represent policies, programs, and efforts that the Group supports because they are valuable from an educational, informational, or advocacy perspective, and would result in VOC emission reductions. The recommended policy statements follow below.

Marine Engines

The CO/Ozone Stakeholders Group recognizes the significant share of two-cycle marine engines to overall VOC emissions in the Puget Sound area, (approximately 39 tons of the estimated 355 nonbiogenic tons projected for a 2007 summer episode day) and recommends that the Clean Air Agency continue to explore cost-effective measures to reduce emissions from this source category as much as possible. In particular, a strong education and information program aimed at the marine industry, recreational outboard motor and jet ski users, and rental establishments should be implemented to inform them and the public of the air quality impacts of two-cycle engines and of the benefits of using cleaner alternatives, such as four-cycle engines and non-motorized boating. In addition, the Clean Air Agency should consider market testing different program approaches that would phase out the use of two-cycle engines, for example, providing incentives for older two-cycle engines to be turned in. By market testing different approaches, including incentive levels, the Agency could better determine cost effectiveness, consumer response, and other implementation issues. At a minimum, the Clean Air Agency should explore partnerships with other entities, public and private, to develop a public education and outreach program that promotes alternatives to old, two-cycle motors including cleaner motors and non-motorized boating.

Personal Care Products¹⁶

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency explore the possibility of developing an educational program designed to encourage the public to purchase products with low VOC content, such as non-aerosol products. This type of program should focus on educating the public regarding the air quality impact of personal care products and the benefits of using products with low VOC content.

¹⁵ Contingency measures are to be implemented if the region violated the ozone standard. The current Ozone Maintenance Plan includes two contingency measures: a requirement for lower Reid Vapor Pressure gasoline in the summertime and enhancements to the state's Inspection and Maintenance program.

¹⁶ This source category includes products such as deodorants, perfumes, nail polish removers and hair sprays.

Stage II Vapor Recovery Systems¹⁷

The CO/Ozone Stakeholders Group recognizes that there are two critical factors, enhanced Stage II systems and on-board vapor recovery systems, currently developing that could or will impact the region's near-term and long-term future directions with respect to Stage II Vapor Recovery Systems, and therefore developed its policy recommendation to account for the potential impact of both factors.

First, the California Air Resources Board is currently designing and implementing portions of an enhanced Stage II Vapor Recovery System. These enhancements require stricter emission controls and hence greater VOC emission reductions are anticipated as a result. Much of the technology associated with the enhanced system, however, is not yet fully developed or the full impacts of these technologies are still unknown. In light of the uncertainties associated with the developing enhanced system, the CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency monitor changes in the definitions and requirements of CARB certified vapor recovery equipment, and convene a stakeholder process, when timely, to discuss revising local Stage II Vapor Recovery regulations as necessary to the appropriate level of control in light of CARB developments.

Second, on-board vapor recovery systems are becoming more prevalent as newer motor vehicles penetrate the Puget Sound fleet. On-board vapor recovery systems are designed to capture most of the emissions released during vehicle refueling and will likely, at a future point in time, make Stage II Vapor Recovery Systems unnecessary. The overall impact of these systems on air quality is not yet known, however, and the difficulty of forecasting fleet penetration creates an additional uncertainty. To address these uncertainties, the CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency work with the Washington State Department of Ecology to annually monitor the impact of on-board vapor recovery systems on overall air quality, in order to determine if/when it is appropriate to remove existing Stage II Vapor Recovery Systems from gas stations in the Puget Sound region.¹⁸

Vehicle Miles Traveled Reductions

The CO/Ozone Stakeholders Group, recognizing the valuable benefits of reducing vehicle miles traveled (VMT), including reductions in traffic congestion and vehicle emissions such as CO, CO₂, VOC, and NO_x, supports the Puget Sound Clean Air Agency's efforts to develop partnerships and/or support initiatives designed to achieve VMT reductions. In particular, the Stakeholder Group supports the Puget Sound regional Council in its efforts to research long-term user fee policies; linking land use and transportation; provision of mobility options, including trip reduction programs; better traffic management strategies; and other strategies as part of its Destination 2030 work, to achieve national and state air quality and environmental objectives, and local and regional growth management objectives.

Promoting Cleaner Vehicles

The CO/Ozone Stakeholders Group supports the Puget Sound Clean Air Agency's efforts to develop partnerships and/or support initiatives designed to provide incentives, such as tax reductions, grants or rebates, that promote fleet change over to cleaner vehicles. In particular, the Stakeholders Group supports the efforts of the Clean Cities Coalition, which has developed proposed legislation to encourage the purchase and use of cleaner vehicles, including alternative fuel vehicles and hybrid vehicles. The Stakeholders Group also encourages and supports Clean Air Agency efforts to develop partnerships with

¹⁷ As noted above in the *Recommended Emission Reduction Measures*, stage II vapor recovery systems are designed to capture evaporative emissions produced when motor vehicles refuel.

¹⁸ Chapter 173-491-040, section 5(d)(i and ii) of the Washington Administrative Code state respectively that "Beginning on July 1, 2001, and each year thereafter, the Department of Ecology shall publish the canister capture rate. When the canister capture rate reaches fifteen percent and there are no major exceptions, waivers, or other adjustments to the EPA onboard canister regulations or program implementation, the Department of Ecology shall revise (c) of this subsection to incorporate the effect of canisters."

individual entities that are designed to encourage change over to cleaner vehicle fleets. In addition, the Stakeholders Group recognizes that at some future point in time, it might be advantageous for the Clean Air Agency to explore the use of state-based mandates to purchase or convert to alternative fuel or advanced technology vehicles.

Enhanced "Smog Watch" Program

The CO/Ozone Stakeholders Group recognizes the importance of the Puget Sound Clean Air Agency's Smog Watch program, which is designed to reduce smog-producing activities during summer hot spells. When weather conditions and air monitoring data indicate the probability of elevated smog levels, through Smog Watch messages, the public and businesses are alerted that voluntary actions such as postponing mowing, driving less and refueling in the evening hours will help avoid elevated smog levels and possible violations of the Clean Air Act. To activate a Smog Watch, the Clean Air Agency relies on the media to notify the public as well as many participating businesses and public agencies that, in turn, notify their employees to take Smog Watch actions.

The CO/Ozone Stakeholders Group recognizes that although it is difficult, if not impossible to quantify the air quality benefits of the Smog Watch program, it is a critical tool to help manage potential short-term smog events. Smog Watch is also an effective public education program that reinforces long-term behavioral and market changes that ultimately contribute to improved air quality. For these reasons, the CO/Ozone Stakeholders Group supports the continuation and enhancement of the Smog Watch program. For example, the Agency's recently established relationship with a local TV stations has resulted in air quality becoming a regular feature of the weather report; during a Smog Watch, this relationship will provide an even wider audience for the Agency's smog reduction messages. Other enhancements to the Smog Watch program that the Agency might consider include¹⁹:

- Working with individual entities to develop individual smog-reducing programs that are tailored to the needs and specifications of the individual entities.
- Highlighting and reinforcing existing programs, such as the "Grasscycling" program.
- Including voluntary gas can program and/or programs designed to reduce emissions from sources such as marine engines and personal care products.
- Buying inexpensive advertisements in early summer in neighborhood weeklies to let the public know what Smog Watch means before an actual Smog Watch event.
- Expand the current "Enviro-Star" program and extend it to businesses that implement smog reducing policies from a menu developed by the agency. Each menu item would have a points value and once the business reached a certain points value, they would qualify as an Enviro-Star business. Menu items would include but not be limited to, telecommute days when there is a Smog Watch Alert, reduced use of company vehicles during Smog Watch Alerts, etc.
- Establish a voluntary e-mail Smog Watch Alert program for businesses and individuals where PSCAA would notify them via e-mail of a Smog Watch Alert.
- Develop a one-class Smog Watch education program for science teachers to use in their classrooms.
- Establish a Smog Watch website that can be easily located by citizens as the current Smog Watch information is challenging to locate.

The CO/Ozone Stakeholders Group recognizes that the Smog Watch Program will continue to improve over time and suggests that the Clean Air Agency update the Program annually to identify and implement appropriate enhancements.

¹⁹ Please see Appendix I of the Stakeholders Group CO/ozone Final Report for a detailed list of additional suggested enhancements.

Revisiting the Ozone Maintenance Plan

To ensure that the maintenance plan's emission reduction measures continue to be effective and/or appropriate in light of anticipated, and unanticipated, future occurrences, the Stakeholders Group recommends that the Clean Air Agency engage in a comprehensive review of the maintenance plan at an appropriate interval during the lifetime of the plan, (2007 or as deemed appropriate by the Clean Air Agency). The Group believes that it is prudent for the Clean Air Agency to review the maintenance plan around 2007 to respond proactively to address changes such as implementation of Federal Tier II emission standards and low sulfur fuel requirements, fleet penetration, and the possible adoption of a new ozone standard, to ensure that the maintenance plan emission reduction measures remain an effective and reasonable approach to achieving the region's air quality goals.

▪ **Conclusion**

The Puget Sound region has an opportunity to achieve critical air quality improvements over the next decade. Technical data indicates that these improvements will help ensure that the region remains in attainment with the Federal ozone standard. The Group recognizes the important efforts already implemented that have brought the region into attainment with the standard, however, the Group also recognizes that the region must continue to be vigilant and to take prudent steps to remain in attainment, particularly as the population in the Puget Sound region continues to grow and place pressure on all of our natural resources, including air quality.

The emission reduction strategies recommended by the Group represent reasonable and cost-effective actions that can be implemented to reduce ozone levels in the Puget Sound region. The Group's recommendations cut across all sources, requiring the oil industry, mobile sources, and the general public to contribute to reducing overall regional ozone levels. In addition, the recommended strategies will require a significant commitment from the Clean Air Agency, as the recommended strategies will require substantial effort on the Agency's part to develop. Successful implementation will result in the need for additional resources for the Agency.

The Group believes its recommendations are an important contribution to keeping the region in attainment and avoiding the significant consequences of nonattainment status, and will contribute to achieving important improvements to the region's overall air quality and, thus, human and ecological health.

Final Report
CO/Ozone Stakeholders Group ★ Puget Sound Clean Air Agency
June 27, 2001

Section 1 – Final Report – Ozone

INTRODUCTION

In its 1995 Ozone Maintenance Plan effort, the Puget Sound Clean Air Agency (the Clean Air Agency) committed to revisiting the region's Ozone Maintenance Plan after five years to review the plan's assumptions and control strategies. The Clean Air Agency also committed to revising the maintenance plan as necessary, in light of new scientific monitoring, modeling, and technical information, to help ensure that the region remained in attainment with the national ozone standard, particularly in light of continued growth in the Puget Sound region.

To that end, the CO/Ozone Stakeholders Group (the Group) was convened by the Clean Air Agency in August 2000 to provide the Agency with recommendations to ensure that the Federal ozone standard is maintained through the year 2015. Participants represented a variety of interests, including government, the health community, the fuels industry, environmental interests, small businesses, and automobile dealers. Clean Air Agency staff provided technical support and background information, with assistance from the Washington State Department of Ecology, and Sierra Research (a consultant hired to provide technical analysis). Additional technical support was provided by Washington State University (WSU), which provided air quality modeling information used in the process. The Stakeholders Group met over the course of ten months and analyzed and evaluated both regulatory and voluntary strategies designed to generate ozone producing emission reductions within the Puget Sound region.

BACKGROUND

Ozone

What is typically referred to as smog is primarily made up of ground-level ozone, which is produced by a combination of pollutants from many sources. Specifically, ozone (O₃) is a gas that forms in the atmosphere through a series of complex chemical reactions involving volatile organic compounds²⁰ (VOCs), oxides of nitrogen (NO_x), and sunlight. Ozone is produced most frequently when there are hot, sunny summer days, and periods of temperature inversions (cold air underlying warmer air).

Wind patterns can also affect ozone concentration by blowing ozone-forming pollutants (VOCs and NO_x) away from their sources. Ozone-forming reactions take place while the VOCs and NO_x are moving with the wind away from their sources. This air is then "trapped" and concentrated by inversion layers or geographical barriers such as mountains, explaining why ozone concentrations are frequently higher miles away from the source of the ozone-forming pollutants.

²⁰ Volatile organic compounds are hydrocarbon substances that participate in atmospheric photochemical reactions. Organic chemicals/compounds are widely used as ingredients in items such as household products, paints, fuels, solvents, cosmetics, and other products. All of these products can release organic compounds while they are being used, and to some degree, when they are stored.

Ozone precursors, VOCs and NO_x, are emitted by both human sources and natural (biogenic) sources, such as from resin in trees. See Figures 1 and 2 below.

Figure 1 – 1996 VOC Emissions

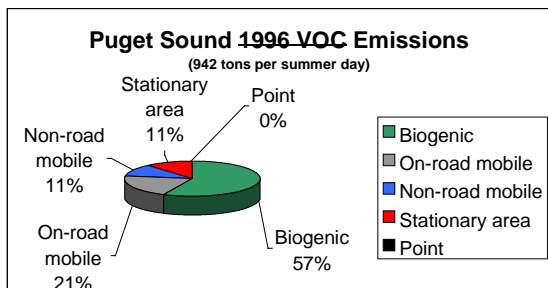
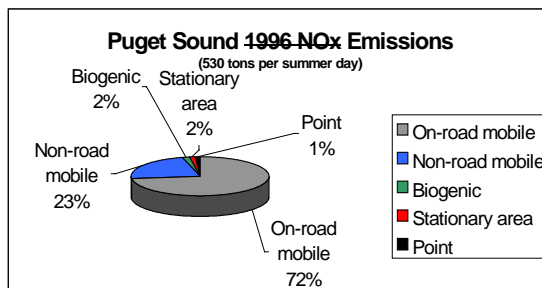


Figure 2 – 1996 NO_x Emissions



The Stakeholders Group focused its efforts on the most effective ways to control ozone-forming pollutants from human sources.²¹ Throughout the Puget Sound, these sources include, cars, trucks, buses, recreational boats, lawn and garden equipment, architectural coatings, personal products, gasoline stations, and other sources that emit VOC's and/or NO_x.

Repeated exposure to ozone pollution can have both significant human health and environmental impacts. Ozone can cause permanent damage to lungs and can trigger a variety of health problems including chest pains, coughing, nausea, throat irritation, and congestion. Ozone also worsens health conditions such as bronchitis, heart disease, emphysema, and asthma. Because ozone generally forms in hot, dry weather, anyone who spends time outdoors in the summer is exposed to the possible health impacts resulting from ozone pollution.

In addition to human health, ozone affects plant life. It interferes with the ability of plants to produce and store food, making them more susceptible to disease, insects, other pollutants, and harsh weather. Ozone damages the foliage of trees and other plants, and can contribute to loss in crop production.

Federal ozone standard

To improve and maintain air quality and to protect human health, the EPA establishes National Ambient Air Quality Standards for all criteria air pollutants, including ozone.²² The original ozone standard, based on one-hour ozone averages, was 0.12 parts per million (ppm). The standard is violated when ozone concentrations exceed the standard more than three times in three years at any one monitoring site. In July 1997, EPA issued a revised ozone standard that was designed to be more protective of human health and the environment. The new standard, based on eight-hour average ozone averages, was set at 0.08 ppm. To determine if a violation has occurred, the fourth highest values from each year over a three-year consecutive period from any one monitoring site are identified and then averaged. If the average is over 0.085 ppm, then the standard has been violated.²³

EPA intended the eight-hour standard to replace the one-hour standard, however, the eight-hour standard was challenged in Federal court. The U.S. Court of Appeals for the District of Columbia issued an

²¹ Modeling work conducted for the CO/Ozone Stakeholders Process indicated that biogenic (natural) emissions are not a major factor in the ozone formation that contributes to ozone concentrations over or near the standards in Puget Sound.

²² The criteria pollutants for which National Ambient Air Quality Standards have been developed are: ozone, nitrogen dioxide, carbon monoxide, particulate matter, sulfur dioxide, and lead.

²³ Although the ozone standards are 0.12 ppm and 0.08 ppm for the one-hour and eight-hour standards respectively, a rounding convention is applied when determining if an exceedance has occurred. The third decimal place of the computed value is rounded, with values equal to or greater than 5 rounding up. Thus, an exceedance occurs if the computed value is equal to or greater than 0.125 ppm for the one-hour standard and 0.085 ppm for the eight-hour standard.

opinion in 1999 remanding the new eight-hour standard and limiting the manner in which EPA could implement it. EPA appealed the decision to the U.S. Supreme Court and reinstated the one-hour standard while the legal process continued. In February 2001, the Supreme Court upheld EPA's interpretation of the Clean Air Act and the new ozone standard, however, the Court directed EPA to develop an implementation plan for moving from the one-hour standard to the new standard in a manner consistent with the Court's opinion. EPA is currently reviewing the results of the litigation to determine the approach and schedule for moving forward with implementing the eight-hour ozone standard. As EPA moves forward with the eight-hour standard, the one-hour standard remains in place to ensure continued health protection.

Table 1 - One-hour and Eight-hour Ozone Standards

Pollutant	One-hour Standard		Eight-hour Standard	
Ozone	1-Hour 0.12 ppm	To attain this standard, the daily maximum one-hour average concentration measured by continuous air monitor must not exceed 0.12 ppm (technically 0.124 to account for rounding) more than once per year, averaged over three consecutive years.	8-Hour 0.08 ppm	To attain this standard, the three-year average of the fourth-highest daily maximum eight-hour average of continuous ambient air monitoring data over each year must not exceed 0.08 ppm (technically 0.084 to account for rounding).

Clean Air Act Requirements

The Clean Air Act requires that any state which submits a request for redesignation from a nonattainment area (i.e., an area where a national air quality standard has been violated) to an attainment area, must also submit a revision to the State Implementation Plan to provide for the maintenance of the air quality standard for at least ten years after the redesignation. These maintenance plans are to contain any additional control measures necessary to ensure maintenance of the standard, as well as contingency measures to ensure that the State will promptly correct any violation of the standard that occurs after redesignation.

Efforts to Reduce Ozone

In 1995, the Puget Sound Clean Air Agency developed an Ozone Maintenance Plan and a request to the U.S. EPA for redesignation to attainment for the Puget Sound ozone nonattainment area. The region was entitled to apply for redesignation to attainment because air quality data collected over three years (1992-1994) demonstrated that there were no violations of the ozone standard.²⁴ The reduced ozone levels were largely attributable to stringent controls on industrial emissions, and significant improvements in motor vehicle technology and the rate of fleet turnover. The maintenance plan was developed as part of the region's redesignation request to help ensure that the region remained in attainment with the ozone standard. The plan analysis period covered 1993-2010, and the Puget Sound ozone nonattainment area was redesignated to attainment in 1996.

In the course of developing its Ozone Maintenance Plan, the Puget Sound Clean Air Agency convened a Maintenance Plan Advisory Steering Committee to provide policy recommendations on how best to understand the region's air quality trends, and on what ozone emission reduction measures and other actions were reasonable and necessary to keep the region in attainment for ozone over the lifetime of the maintenance plan. The Steering Committee recommended an Ozone Maintenance Plan strategy centered on six key elements:²⁵

²⁴ There were two exceedances (but no violation) of the standard at one monitor in July 1994 during an extremely hot weather episode that elevated ozone levels.

²⁵ Please see Appendix A for the 1995 Clean Air Agency Advisory Steering Committee report for more detail.

-
- Keep existing control measures, such as the VOC and NOx control measures, on industrial and mobile sources.
 - Prepare contingency measures in case they are needed.
 - Commit to a serious evaluation of how best to identify and target high polluting vehicles.
 - Find out more about ozone and its precursors in Puget Sound.
 - Establish a public smog advisory program.
 - Review the maintenance plan earlier than required by law to make sure that it's effective in ensuring the region stays in attainment.

The Steering Committee's suggestions were built largely around three key components: learning more about ozone in the Puget Sound region, maintaining current efforts so that no ground was lost in maintaining air quality, and revisiting the plan to ensure that the region was moving in the right direction with respect to ozone.

Based on the Steering Committee's suggestions, the Clean Air Agency developed its 1995 Ozone Maintenance Plan to include commitments to:

- Maintain all current control measures.
- Study in-use vehicle control/refinements to the state's Inspection and Maintenance program.
- Implement a smog watch program.
- Develop an ozone research program to better understand ozone formation and concentrations in the Puget Sound region.

The Plan also included two contingency measures: a requirement for lower Reid Vapor Pressure gasoline in the summertime and enhancements to the state's Inspection and Maintenance program. These measures would be implemented if the region were to violate the ozone standard anytime during the life of the maintenance plan.

Since EPA's approval of the 1995 Ozone Maintenance Plan, the Clean Air Agency has worked with the Washington State Department of Ecology to study potential vehicle inspection and maintenance enhancements, has developed and implemented an effective smog watch program, and has worked with Washington State University, the Department of Ecology and EPA to develop an air quality simulation model to better understand ozone formation in the Puget Sound Region.

Current Stakeholders Group's Charge

As part of its commitment to revisit the Ozone Maintenance Plan early, the Puget Sound Clean Air Agency convened the current CO/Ozone Stakeholders Group in August 2000, and charged the Group with providing the Clean Air Agency with recommendations to ensure that the Federal ozone standard is maintained through the year 2015.²⁶ Specifically, the Group was charged with identifying the range of actions (if any) that might be prudent to consider including in the Ozone Maintenance Plan Update to achieve the emission reductions necessary to stay in attainment in light of current and projected air quality.²⁷

In order to develop its recommendations, the stakeholders reviewed key technical data regarding sources of ozone precursors, ozone concentration trends, and the affect of potential emission-reduction strategy

²⁶ When the Stakeholder Group was convened in 2000, the Group examined ozone concentrations and reductions in light of both the one-hour and the proposed eight-hour standard as the outcome of the Supreme Court decision was not yet known. As noted in the text above, the Supreme Court issued its opinion in February 2001, supporting EPA's development of the proposed eight-hour standard. While EPA continues to resolve implementation issues, the one-hour standard will remain in effect. The Puget Sound Clean Air Agency will continue to strive to meet both standards until the eight-hour standard is fully implemented.

²⁷ See Appendix B for the CO/Ozone Stakeholders Group Charter.

packages on the region's ozone concentrations in relation to both the one-hour and eight-hour standards. (Throughout this report, "standard" is used generally for both the one-hour and eight-hour standard unless otherwise noted.²⁸)

The Group evaluated a range of regulatory and voluntary emission reduction strategies, considering potential emission reductions, cost-effectiveness, feasibility, and additional costs and benefits associated with the implementation of the strategies. Throughout the course of the process, stakeholders acknowledged the importance of remaining in attainment with the ozone standard, as the consequences of nonattainment, including possible loss of Federal highway funds and increased control on the region's point sources, are significant.

Technical Work/Data Supporting the Effort

The Stakeholders effort was supported by several key technical efforts, which together provided a comprehensive technical context for the stakeholders' strategy discussions. A brief description of the technical efforts follows below.

Technical Advisory Committee and Technical Analysis Protocol

As an initial step, a technical advisory committee (TAC) was convened by the Clean Air Agency to develop a Technical Analysis Protocol (TAP) to support the CO/Ozone Stakeholders Process.²⁹ The TAP provided the scientific basis for the CO/ozone strategy evaluation discussions and included direction on population, employment and travel growth estimates, air quality monitoring history and episode selection, and methods for developing emissions inventories for 1996, 2007 and 2015.³⁰ The Clean Air Agency also convened the TAC periodically throughout the course of the process to discuss modeling results.

Emissions Inventory

The emissions inventory was developed by the Puget Sound Clean Air Agency consistent with the advice of the TAP, with significant assistance from the Washington State Department of Ecology. The emissions inventory is a list, by source, of the air contaminants directly emitted into the region's air. The data in the emissions inventory are based on calculations using emission factors, which are methods for converting source activity levels into an estimate of the emissions released by those sources. A base case emissions inventory was developed for the year 1996 and projected emissions inventories were developed for the years 2007 and 2015. (Please see the section titled *Where VOCs Come From* below for greater detail.)

Modeling

Modeling efforts also provided critical technical input for the Stakeholders process. Washington State University used a state-of-the-art model to determine the region's ozone formation's sensitivity to VOC and/or NO_x reduction, to predict future ozone concentrations using the emission inventories and to evaluate the effect of potential emission-reduction strategies.³¹ Descriptions of the key modeling efforts follow below.

²⁸ Puget Sound Clean Air Agency staff related that data demonstrates that the region is similarly positioned with respect to both the one-hour and the eight-hour standard, and thus, both standards were considered generally.

²⁹ The Technical Committee Members were: Tim Larson, University of Washington; Mike Kulakowski, Equiva Services; Rory MacArthur, Chevron; Kay Jones, Zephyr Consulting; Mahbulul Islam, EPA; Clint Bowman and Sally Otterson, Washington State Department of Ecology; Larry Blain, Puget Sound Regional Council; and Dave Kircher, John Anderson, Mike Gilroy, and Naydene Maykut of the Puget Sound Clean Air Agency.

³⁰ Please see Appendix C for a copy of the Technical Analysis Protocol.

³¹ WSU's modeling system includes the latest mesoscale (middle-scale) meteorological model that provides wind and temperature fields for the photochemical model. The *mesoscale* model enhances the models predictive ability by allowing the weather systems to interact with the local topography. The *photochemical* model and reactions are so named because the chemical reactions are driven by sunlight. The photochemical model uses area and point source emissions, critical meteorological

ANALYTIC PATH FOLLOWED TO UNDERSTAND OZONE IN THE PUGET SOUND

In its effort to develop recommendations for potential ozone emission reduction measures, the Stakeholders Group reviewed the technical analyses to develop a comprehensive understanding of ozone in the Puget Sound. As a first step, the Group reviewed modeling results that demonstrated how VOCs and NOx interact to contribute to ozone formation in Puget Sound. Based on the modeling results, the stakeholders identified VOC reductions as the most effective path to reducing ozone levels in Puget Sound. To determine the major sources of VOCs in Puget Sound, an emissions inventory was developed for 1996 and projected emissions inventories developed for 2007 and 2015. Both 2007 and 2015 were selected because they represent important benchmarks for the ozone maintenance planning process. The planning period concludes with the year 2015 and 2007 is the plan's midpoint. In addition, key Federal programs (Tier II Motor Vehicle Standards and Low Sulfur Fuels) will be implemented by 2007, and the impact of these programs on ozone concentrations will begin to be realized in the 2007 time frame.

Air quality data were also critical to the Group's understanding of ozone in the Puget Sound region. Air quality data from 1996 were selected for the ozone "base case" because the region experienced elevated levels of ozone during a hot, sunny period in the summer of 1996. Significant amounts of high quality data were collected during that ozone event, which provided an excellent basis for technical analyses.³² The air quality data also demonstrated where maximum ozone concentrations occur in the region. Anthropogenic VOC emissions are highest along the Interstate 5 corridor, and as a result of geography, urban emissions and wind direction, the highest ozone levels are measured at monitors southeast of Seattle, in particular at Enumclaw.³³ Modeling results provided a final key technical piece. The model was used to estimate what ozone concentrations might likely be in the years 2007 and 2015 without additional local controls.

All of the technical elements were considered and provided the Stakeholders Group with a comprehensive foundation for considering and evaluating potential emission reduction strategies to reduce ozone levels in the Puget Sound region.

Emissions Contributing to Ozone Formation

The first important conclusion of the Stakeholders process was the determination that reducing VOC emissions is the most effective method for reducing ozone concentrations. Because of the complexity of the chemical reactions that produce ozone, the reduction of VOCs and/or NOx does not produce proportional reductions in ozone. Using modeling inputs based on data from the 1996 ozone episode, the modeling results demonstrated that if NOx emissions decrease at a certain level, ozone levels would increase. See Figure 3 below.³⁴ In addition, the modeling indicated that for the Puget Sound region, reducing VOC emissions would have the greatest effect on reducing ozone in the areas where the maximum ozone is measured.³⁵ The modeling also indicated that biogenic (natural) emissions are not a major factor in the ozone formation that contributes to ozone concentrations over or near the standards.

Figure 3 - Ozone Sensitivity Analysis - 1996

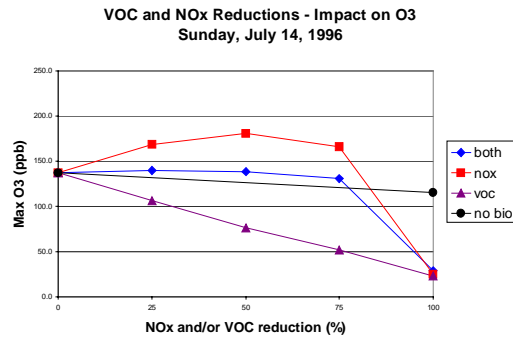
parameters from the meteorological model, chemical mechanisms and dispersion equations to produce three-dimensional fields of ozone, VOCs and NO_x.

³² In addition to the 1996 data, the Group reviewed data from a 1998 summer ozone event. The 1998 ozone event was more severe than the 1996 event and the Region experienced two exceedances of the ozone standard during that summer.

³³ There are 13 ozone monitoring stations between Vancouver, B.C. and Portland, Oregon.

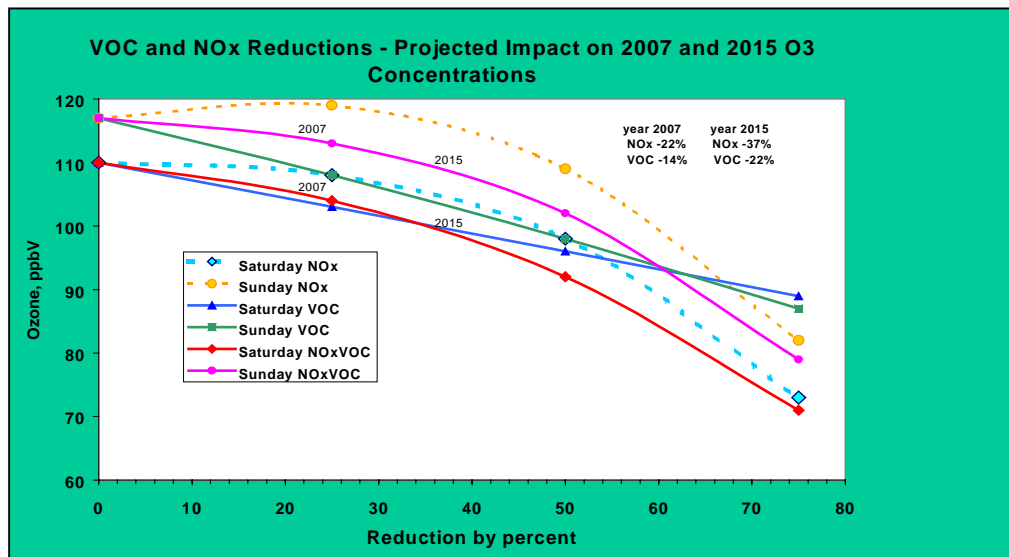
³⁴ The modeling inputs were based on data from a July, 1996 ozone episode. The 1996 episode data was selected for modeling purposes because a significant amount of high quality air quality data were collected during the episode. The sensitivity analysis displayed in Figure three is based on one day of the 1996 ozone episode, when the highest ozone concentration was measured in the Region.

³⁵ Please see Appendix D, *VOC/NOx Sensitivity – O3 Difference Contours*



The model was also used to determine the impact of NOx and VOC reductions on ozone concentrations in the years 2007 and 2015. The analysis, displayed in Figure 4 below,³⁶ indicated that in 2007 a NOx reduction between 0-30%, without VOC reductions could actually result in increased ozone levels.

Figure 4 - Ozone Sensitivity Analysis for Future Years 2007 and 2015 (VOC and NOx reduction impact on O3)



The modeling results led the stakeholders to focus on developing and analyzing strategies to reduce VOC emissions – rather than NOx - throughout Puget Sound in order to have the greatest impact on reducing ozone concentrations.

The modeling results also helped determine how much VOC emissions reductions might be needed in order to result in decreases in ozone formation. A VOC reductions target for the process was established based on the modeling results described above and anticipated emission reductions for NOx and VOCs in the years 2007 and 2015. The anticipated NOx and VOC reductions come from Federal programs (Low Sulfur Gasoline and Tier II Motor Vehicle Standards) that are already slated to occur due to recent EPA rulemakings. A greater NOx reduction is anticipated from the Federal programs than VOC reductions, so a minimum percentage of VOC reductions will likely be needed to address the anticipated NOx disbenefit (described above). Five percent VOC reductions was selected as a lower limit for the target range to

³⁶ As described in footnote 14, the modeling inputs were based on data from a July, 1996 ozone episode. The 1996 episode data were selected for modeling purposes because a significant amount of high quality air quality data was collected during the episode. The sensitivity analysis displayed in Figure four was based on data from the weekend of the 1996 ozone episode, to account for the two days when measured ozone concentrations were highest.

ensure that, based on the sensitivity of the model, the VOC reductions would be sufficient to be registered by the model. Fifteen percent was selected as an upper limit for the target range because VOC reductions above 15% appear extremely difficult to achieve in the Puget Sound region. Based on these analyses, a VOC reduction target of 5-15% was established by the Stakeholders Group. This target served as a guide for the stakeholders when analyzing the potential emission reduction strategies and when developing strategy packages for modeling purposes.³⁷

Where VOCs Come From

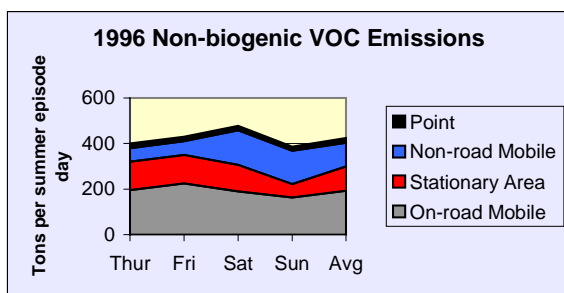
The modeling demonstrated that VOC reductions are the most effective method for reducing ozone concentrations. A VOC emissions inventory was developed to determine which Puget Sound sources were contributing to VOC emissions and how much. Because ozone levels are greatest in the summer period, a summer ozone emissions inventory was developed.

The emissions inventory developed to support the Stakeholders process describes the portion of emissions from each source category to overall non-biogenic VOC emissions. The ozone emissions inventory was developed based on data collected in conjunction with a 1996 ozone episode (July 11-14), as a significant amount of high quality concentration data were collected. Once the 1996 emissions inventory was completed, emissions inventories were also estimated for the years 2007 and 2015 based on projected emissions.³⁸ The projected emissions inventories account for growth in the Puget Sound Region over the planning period,³⁹ and account for the Federal emission reduction measures that will be implemented in future years (as explained above). However, additional local VOC emission reduction measures were not assumed.

See Figures 5 - 7 for VOC emissions displayed by tons per summer day over a four-day episode period. (As noted above, the emissions inventory was based on the July 1996 summer ozone episode, which occurred over the course of four days.) The VOC emissions released from different sources shifts over the four-day period as total VOC emissions increase slightly on weekend days. Over the course of weekend days, emissions increase from sources such as marine/boat engines and lawn and garden equipment, and decrease from sources such as on-road mobile, construction equipment, and industrial sources.

The non-biogenic or human-caused emissions for 1996, over the period of the four-day episode, exceeded 400 tons per day, with on-road mobile and non-road mobile emitting the greatest amounts.

Figure 5 - 1996 Non-Biogenic VOC Emissions



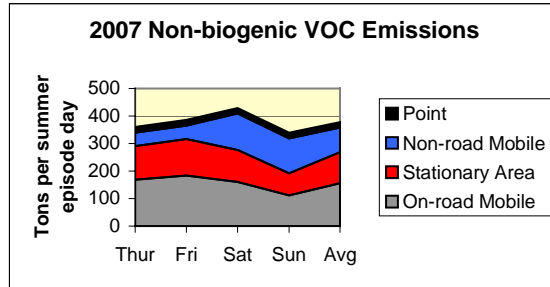
³⁷ Stakeholder selected emission reduction strategies were “packaged” together to ensure that there were enough VOC reductions to result in a demonstrable difference in the modeling results given the model’s sensitivity. Modeling inputs with VOC reductions below 5% would not be sufficient to estimate differences using the model.

³⁸ Please see Appendix E for a detailed list of Puget Sound VOC Summer Episode Day Emissions (tons/day) by source.

³⁹ The Puget Sound Regional Council provided growth estimates.

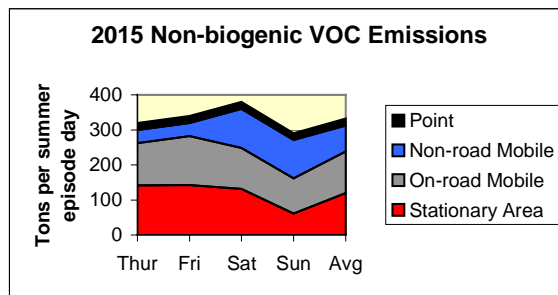
In 2007, overall VOC emissions are projected to decline slightly as new Federal programs begin to be implemented.

Figure 6 - 2007 Non-Biogenic VOC Emissions



In 2015, for each of the four episode days, emissions are projected below 400 tons per day because of the effect of these Federal programs, which will be fully implemented by that time.

Figure 7 - 2015 Non-Biogenic VOC Emissions



Tables 2 - 4 below display the tons per summer episode day by individual sources within each of the major source categories by year.

Table 2 - On-Road Mobile VOC Emissions in Tons per Summer Episode Day

Source	1996	2007	2015
Vehicle Type ⁴⁰			
▪ Gas passenger cars (< 6,000 lbs.)	92	64	35
▪ Light truck 1 & SUV (< 6,000 lbs.)	30	37	44
▪ Light truck 2 & SUV (6,000–8,500 lbs.)	33	28	24
▪ Heavy gas truck/MC	25	18	11
▪ Diesel truck & bus	14	10	5
Total Tons Per Summer Episode Day	194	157	119

Table 3 - Non-Road Mobile VOC Emissions in Tons per Summer Episode Day

⁴⁰ Increased emissions from the light truck 1 category are due to projected sales trends that indicate that sales of light truck 1 and SUV vehicles will continue to increase. In addition, the projected emission reductions in the gas passenger cars category are a result of both increased sales in the light truck 1 category and the implementation of the Federal Tier II and low sulfur fuel standards.

<i>Source</i>	1996	2007	2015
Equipment ⁴¹			
▪ Gasoline boats	43	40	36
▪ Lawn and garden	32	22	13
▪ Aircraft	10	10	10
▪ Gasoline off-road	8	8	9
▪ Other	12	9	6
Total Tons Per Summer Episode Day	105	89	74

Table 4 - Stationary Area VOC Emissions in Tons per Summer Episode Day

<i>Source</i>	1996	2007	2015
▪ Consumer solvents	27	27	27
▪ Industrial surface coatings	30	34	39
▪ Architectural coatings ⁴²	21	21	21
▪ Gasoline stations/refueling	8	8	8
▪ Other	19	22	24
Total Tons Per Average Summer Day	105	112	119

Air Quality Data and Projected Ozone Trends

Air quality data were examined to display ozone concentrations for the years 1990-1999, and a trend analysis conducted to project ozone concentrations in future years. The observed maximum eight-hour and one-hour concentrations demonstrate that the region has indeed exceeded the ozone standard occasionally over the past ten years and there continues to be a risk of an ozone violation, though no violation of the standard has occurred in the 1990's. See Figures 8 and 9 below. In addition, the data identify those areas where the ozone concentrations are the highest. Because of the region's geography and wind patterns, the areas of maximum ozone concentrations occur southeast of Seattle. Wind blows pollutants into valleys southeast of Seattle where it is contained by the Cascade Mountains.

⁴¹ Although the Puget Sound population is expected to keep growing, emissions for gasoline boats and lawn and garden equipment are expected to decrease due to cleaner burning gasoline engines and fuels.

⁴² VOC emissions from architectural sources remain constant because while there is a trend toward using water-based paints, population and development continue to increase, increasing the overall amount of paints applied.

Figure 8 - Ozone Eight-Hour Maximum Concentration 1990-1999

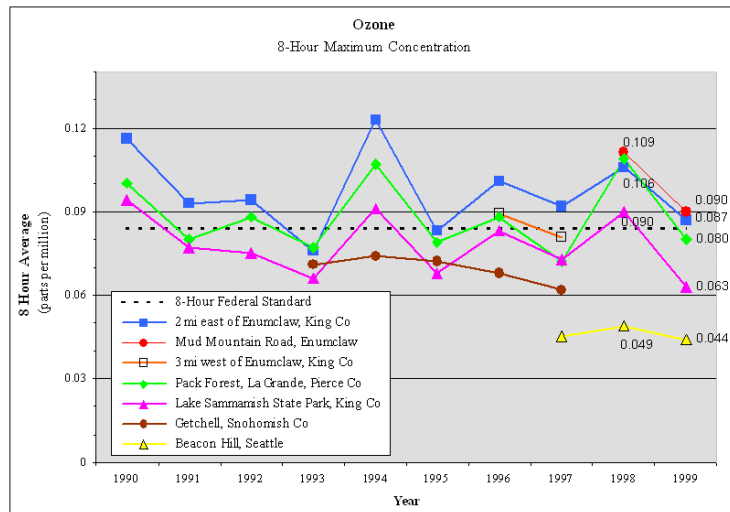
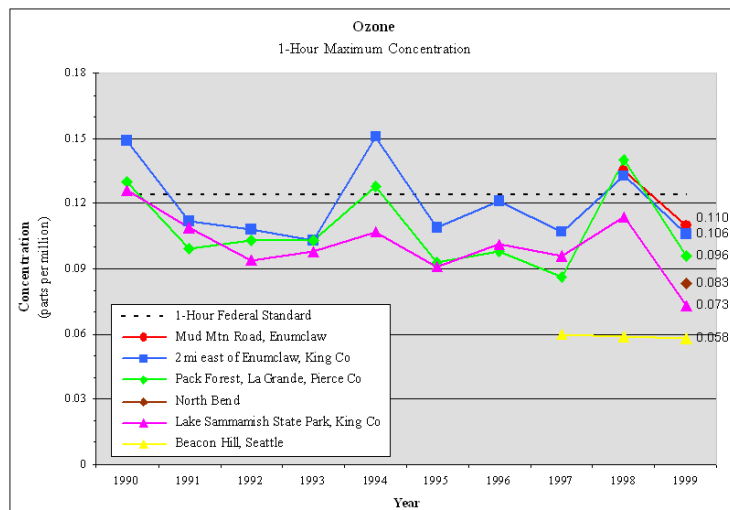


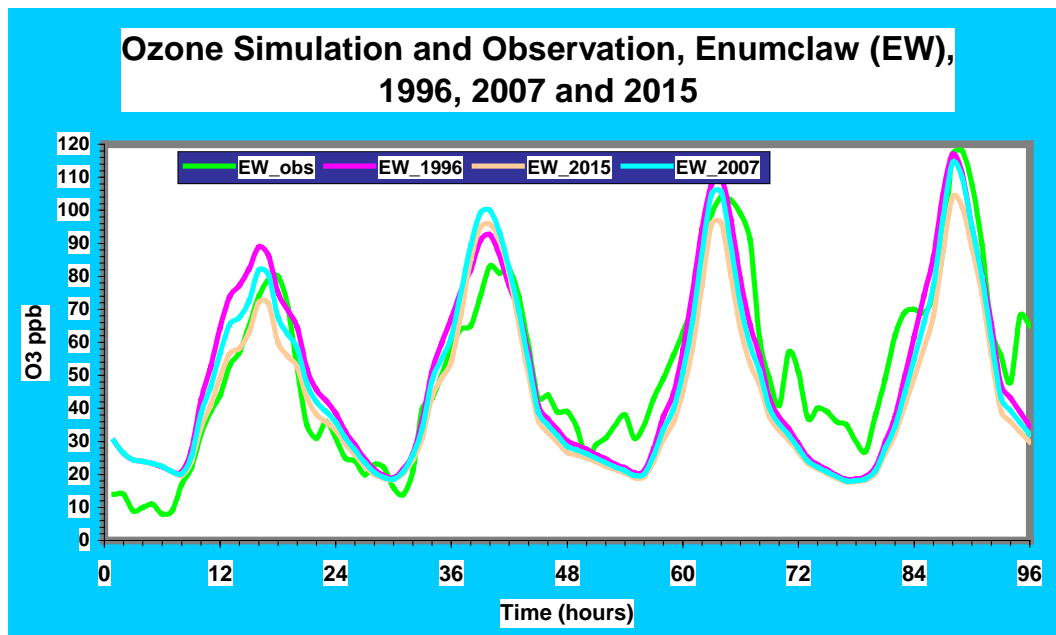
Figure 9 - Ozone One-Hour Maximum Concentration 1990-1999



The model was also used to estimate ozone concentrations in 2007 and 2015, and the emissions inventory projections for those years were used as the modeling inputs. Emissions inventory data from 1996 were also modeled and then compared to the actual observed concentrations in order to calibrate the accuracy of the model. (As noted above, 1996 data were used for the base year because of the significant amount of high quality data collected during the 1996 ozone event.) Figure 10 below, displays the results of these analyses. Each of the four lines displayed represents the following: the 1996 ozone concentrations based on actual ozone concentrations observed over the four-day ozone episode period in July 1996; the ozone concentrations over the same period of time based on the emissions inventory that was developed for 1996; the 2007 projected ozone concentrations for a four-day episode based on the 2007 emissions inventory; and, 2015 projected ozone concentrations for a four-day episode based on the 2015 emissions inventory. The analyses indicate that the model produces accurate results, as the actual observed concentrations tracks closely to those based on the 1996 emissions inventory. The results also indicate a reduction in ozone concentrations in the year 2015, an anticipated result of the implementation of the Federal Low Sulfur Fuel and Tier II Motor Vehicle Programs. As noted above, the emissions inventories

for 2007 and 2015, and hence the ozone concentration trend analyses, account for the anticipated Federal programs, but do not account for additional local controls.

Figure 10 - Ozone Concentrations – Base Year 1996 and Projected Years 2007 and 2015⁴³



The modeling indicates particularly that between 2001 and 2007 there is a continuing threat of an ozone violation under the right meteorological conditions. (A period of warm, sunny summer days with light winds could increase ozone concentrations.)

The 2007 and 2015 concentration estimates were based on the emissions inventories developed with the 1996 ozone event data. In 1998 the region experienced a more severe event than that of 1996, with higher ozone concentrations, which indicated that the Stakeholders Group should keep in mind that the 1996 base case is not a worse case scenario for ozone concentrations.⁴⁴

Impact of Strategies to Reduce VOCs

The model was also used to determine the affect of strategy “packages” on ozone concentrations in the Puget Sound region. Strategies were packaged together to meet the target range, described above, of 5-15% VOC reductions. The results of the modeling, in conjunction with the trend data, the emissions inventory, and the projected VOC reductions from the strategies, were considered together to develop the Group’s final recommendations. Please see the Process Description below for an explanation of how the modeling packages were developed and the Modeling Results section below for an explanation of the modeling results.

⁴³ Enumclaw was selected as the monitoring site to base the modeling analyses on as this is the site that registers the highest ozone concentrations throughout Puget Sound.

⁴⁴ See Appendix F for a graphic displaying the ozone levels during the 1998 episode.

DEVELOPMENT OF VOC REDUCTION STRATEGY RECOMMENDATIONS

Process Description

The CO/Ozone Stakeholders Group convened by the Clean Air Agency met a total of nine times over the course of ten months. The first meeting provided the stakeholders with a framework for the process, background information regarding the ozone standard and the current status of air quality in the Puget Sound area. The following five meetings focused on the various sources of VOC – and strategies to reduce emissions from these sources – within the Puget Sound region, which included fuels, paints, personal care products, motor vehicles, lawn mowers, and outboard motors. Clean Air Agency staff identified a series of initial strategies, and stakeholders then proposed additional sources and strategies for consideration. Please see Appendix G for the full range of strategies considered by the stakeholders.

To prepare for each meeting, Puget Sound Clean Air Agency staff and Sierra Research staff developed summary sheets for each of the strategies to be considered by the stakeholders during the course of the meeting. The summary sheets included emission reduction and cost-effectiveness calculations for the strategy, described how the estimates were calculated and what key assumptions were used, identified other potential air quality benefits, and identified any potential issues associated with implementing the strategy.⁴⁵

The last three meetings of the Group were dedicated to developing and approving the stakeholders' recommendations. Subgroups of stakeholders were formed to assist the full Group with this task. The stakeholder subgroups were formed based on the major VOC source categories considered by the Group.⁴⁶ The charge of the subgroups was twofold – first to review and discuss the strategies within the source categories to determine which strategies should be included in strategy packages developed for modeling purposes⁴⁷; and second, to develop draft final recommendations for each of the selected strategies to present to the full Stakeholders Group. The subgroups met several times over the course of four months to consider and evaluate the emission reduction strategies, to recommend strategies for modeling, and to propose draft final recommendations. During the course of subgroup discussions, additional and/or alternative strategies were also developed for consideration by the full Group. Although the full Group did not formally adopt criteria, the subgroups generally considered the following factors in developing their strategy recommendations:

- Potential emission reductions.
- Cost-effectiveness.
- Likelihood of implementation.
- Time frame required to realize emission reductions.
- Alternative approaches/strategies.

Each of the subgroups reported their modeling package strategy recommendations to the full Stakeholders Group, and the Group as a whole considered the subgroups' recommendations for modeling to either

⁴⁵ Please see Appendix H for strategy summary sheets.

⁴⁶ Subgroups were formed around each of the five key source categories. A subgroup addressed each of the following sources/source groupings:

- Fuels, gas cans, outboard motors, and lawn and garden equipment
- Clean vehicles, trip reduction, and CO
- Vapor recovery
- Inspection and maintenance
- Architectural coating, personal care products, and enhanced Smog Watch

⁴⁷ As noted in Footnote 14, selected emission reduction strategies were “packaged” together to ensure that there were enough VOC reductions to result in a demonstrable difference in the model given the model's sensitivity. Modeling inputs with VOC reductions below 5% would not impact the model.

endorse or reject the recommendations. The strategies that the full Stakeholders Group recommended for modeling purposes were then organized into strategy packages.

Based on the recommended strategies, the stakeholders developed three strategy packages for modeling. Each of the strategy packages developed produced between 5-15% VOC reductions (the VOC reduction target established earlier in the process).

In developing the packages, the stakeholders considered criteria similar to those used to evaluate the individual strategies:

- Total VOC reductions produced by the package.
- Overall cost of the package.
- The Clean Air Agency's ability to implement the strategies - both from a funding and an authority perspective.
- The likelihood that a package can be implemented in light of possible public perceptions and political will.
- Time required to realize the projected emission reductions.

After the Group developed the strategy packages, the packages were analyzed by technical staff to determine if, when combined, the packages' overall emission reductions either increased or decreased. The emission reduction inputs were then forwarded to Washington State University for modeling. As described above, the model was used to determine the effect of each of the strategy packages on ozone concentrations for the years 2007 and 2015. While the modeling work was being completed, the subgroups developed final draft recommendations. In doing so, the subgroups anticipated supporting evidence from the model, and considered other technical information presented, as well as their overall charge. When completed, the modeling results were presented to the full Stakeholders Group and the Group considered the subgroups' final draft recommendations in light of the modeling results.

Subgroup Recommendations⁴⁸

As described above, after the full menu of strategies was presented to the stakeholders over the course of several meetings, subgroups were convened to effectively discuss and sort through the various source categories and the strategies presented. The first task of the subgroups was to discuss the array of strategies presented to the full group and recommend strategies that should be included in the modeling packages. As the subgroups discussed the strategies, considering factors such as potential emission reductions and cost-effectiveness, recommendations were organized into two categories:

Strategies Recommended for Modeling

These strategies were recommended for modeling in order to determine their impact on the region's ozone concentrations. Strategies were selected for modeling because they produced significant estimated emission reductions, appeared cost-effective, represented important educational opportunities, and/or would help to make existing emission reduction efforts more effective.

Strategies Recommended for Policy Statements

The subgroups recommended that these strategies be supported by the Stakeholders Group as a general policy, but should not be modeled at the current time. Strategies were identified for policy statements because they represented important educational opportunities or they appeared to be "good ideas," but required further development or the impact they would have on overall VOC emissions could not be

⁴⁸ This section describes the stakeholder subgroups' initial strategy suggestions regarding which strategies should be considered for modeling purposes and which should be considered for policy statements. For the full group's final recommendations, please see the section entitled *Final Recommendations to Reduce VOCs*

estimated. In addition, some subgroups identified strategies that are being implemented in different forums, which might be worthy of Clean Air Agency support.

The subgroups' recommendations were presented to the full Stakeholders Group based on the two categories described above, and are described below by source category. (As noted in the section entitled *Process Description*, the full menu of strategies evaluated by the Stakeholders Group can be found in Appendix F. The strategies listed below are those that were moved forward for further consideration/action.) The strategies recommended for modeling and for policy statements are displayed in both narrative and table format. The narratives briefly describe the strategies considered and recommended by the subgroups, and tables six, eight, and ten include estimated emission reductions and cost-effectiveness numbers for each strategy recommended. The potential emissions reductions display the estimated VOC emissions reductions that would likely occur if the strategy were implemented. The cost-effectiveness numbers are estimates of the cost per ton of VOC reduction and vary from strategy to strategy based on the projected emission reductions and the actual cost to implement and maintain each strategy. Both the emissions reductions and cost-effectiveness numbers were calculated by Clean Air Agency and Sierra Research staff based on the methodology explained in Appendix J.

Area Sources

Area sources account for approximately 11% of the total VOC emissions (including biogenic emissions) in the 1996 emissions inventory. Because of population growth, emissions from this source category are projected to increase between now and 2015. Included in this source category are consumer household and personal products, architectural coatings, and gasoline stations. Please see Table 5 below for the stationary area source emission estimates and projections in tons per summer episode day.

To achieve emission reductions from this source category, the stakeholders considered strategies related to gasoline stations, architectural coatings, and personal care products. The subgroups' recommendations, and cost-effectiveness and potential emission reduction estimates for each strategy in this source category are contained in Table 6.

Table 5 – Stationary Area VOC Emissions in Tons per Summer Episode Day

Source ⁴⁹	1996	2007	2015
Gasoline stations/refueling	8	8	8
Architectural coatings	21	21	21
Consumer solvents	27	27	27
Industrial surface ⁵⁰	30	34	39
Other ⁵¹	19	22	24
TOTAL	105	112	119

Gasoline Stations/Refueling

Strategies in this category are related to the “Stage II” Vapor Recovery Systems that capture the vapors emitted when motor vehicles refuel.⁵² Gasoline stations account for approximately eight tons of the 105 VOC tons produced per summer episode day by stationary area sources.

⁴⁹ Many of the emissions from specific sources within the stationary area source category are expected to remain the same. For example, VOC emissions from sources such as architectural coatings and consumer solvents are expected to remain constant even though there are trends toward using low emitting paints and consumer solvents, population and development continue to increase, increasing the overall amounts of these products used.

⁵⁰ The Stakeholders Group did not consider strategies from the industrial surface category because many of these sources are controlled by existing regulations.

⁵¹ The Stakeholders Group concluded that emission reductions from the “Other” category would be difficult to achieve because the category encompasses a significant amount of diverse sources, each of which contributes differently to VOC emissions.

Strategy Recommended for Modeling

- *Enhanced education and enforcement:* Enhance the current Stage II Vapor Recovery Systems program to better educate gas station owners/operators, increase the inspection frequency and achieve better operation and maintenance results for Stage II systems.

Strategies Recommended for Policy Statements

- *Installation of California Air Resources Board Certified (CARB) Enhanced Vapor Recovery Systems:* Adopt in the Puget Sound region the new standards and systems components developed by CARB for its enhanced Stage II vapor recovery effort. Enhanced equipment would be adopted for new gas stations only or for all stations, new and existing.
- *Phase-out of Stage II Systems:* Phase out Stage II vapor system requirements as vehicles with on-board vapor recovery systems begin to penetrate the Puget Sound fleet.

Note: The subgroup recognized that both CARB's enhanced vapor recovery system effort and on-board vapor recovery systems could have an impact on Stage II Vapor Recovery Systems in Puget Sound. Specifically, at some point in time enhanced vapor recovery equipment could be required, and/or at a later point in time existing equipment phased out. A significant amount of uncertainty exists with respect to each of these factors, and the subgroup recommended that the Clean Air Agency monitor developments related to both CARB enhancements and on-board vapor recovery systems.

Architectural Coatings

Strategies in this category address VOC emissions from architectural paints, which include paints applied to buildings and used for traffic improvements. Architectural coatings account for approximately 21 tons of the 105 VOC tons produced per summer episode day by stationary area sources.

Strategies Recommended for Modeling

- *Voluntary Coatings Program:* Develop a voluntary program designed to promote sale and use of low VOC emitting paints. The voluntary program would include education, partnership components and set measurable reduction goals to track the impact of the program's efforts.
- *Model Paint Rule:* Develop and implement a paint rule that requires architectural paints sold in the Puget Sound region to comply with the emission limits recommended by STAPPA/ALAPCO in their Model Rule: Regulating Air Emissions from Paint.

Strategies Recommended for Policy Statements

- None of the architectural coatings strategies were classified by the subgroup for policy statements.

*Personal Care Products*⁵³

Strategies in this category are designed to achieve emission reductions from personal care products such as nail polish, hair spray, and spray-on deodorants. Personal care products account for approximately 27 tons of the 105 VOC tons produced per summer episode day by stationary area sources.

⁵² The installation of Stage II Gasoline Vapor Recovery Systems is required at all new or rebuilt gas stations in the Puget Sound region, on existing stations located in King, Snohomish, and Pierce Counties that dispense more than 600,000 gallons of gasoline per year, and at existing stations in Kitsap County that dispense more than 840,000 gallons/year.

⁵³ Personal care products are a subset of consumer solvents, which also includes household goods such as cleaning products. Personal care products were extracted from the consumer solvents category because stakeholders identified them as a potential source of emissions reductions.

Strategies Recommended for Modeling

- None of the personal care product strategies were recommended for modeling.

Strategies Recommended for Policy Statements

- Voluntary personal care products measure:* Develop a voluntary program designed to educate the general public regarding the air quality impacts of personal care products and to promote sale and use of products with low VOC content.

Table 6 - Recommendation Summary, Emission Reduction and Cost-Effectiveness Estimates for Area Source Strategies

Strategy	% VOC Emission Reduction		Cost per ton	
	2007	2015	2007	2015
<i>Strategies Recommended for Modeling</i>				
Enhanced education/enforcement	0.5%	0.6%	\$4,650	\$4,650
Model Paint Rule	3.1%	3.8%	\$6,400	\$6,400
Voluntary Coatings Program	1.9%	3.9%	\$5,400	\$5,400
<i>Strategies Recommended for Policy Statements</i>				
Requiring CARB enhanced Stage II systems	0.1%	0.3%	\$9,800	\$8,300
▪ new stations only				
▪ all stations	0.7%	1.2%	\$11,100	\$8,700
Phase-out of Stage II systems	N/A	-0.4%	N/A	N/A
Voluntary personal care products measure	0.8%	0.9%	\$4,000	\$4,000

On-Road Mobile Sources

On-road mobile sources account for approximately 21% of the total VOC emissions (including biogenic emissions) in the 1996 emissions inventory. Despite population increases, emissions from this source category are projected to decrease because of Federal programs that will be phased in over the next several years, specifically Low Sulfur Fuels and Tier II Motor Vehicle Standards. Included in this source category are cars, light and heavy trucks, and buses. Please see Table 7 below for the mobile sources emission estimates and projections in tons per summer episode day.

Table 7 - On-Road Mobile VOC Emissions in Tons per Summer Episode Day

Source	1996	2007	2015
Vehicle Type			
▪ Gas passenger cars	92	64	35
▪ Light truck 1 & SUV	30	37	44
▪ Light truck 2 & SUV	33	28	24
▪ Heavy gas truck/MC	25	18	11
▪ Diesel truck & bus	14	10	5
Total Tons	194	157	119

To achieve emission reductions from this source category, the stakeholders considered strategies related to fuels, motor vehicle standards, commute trip reduction, and the state motor vehicle inspection and maintenance program. The subgroups' recommendations, cost-effectiveness and potential emission reduction estimates for each strategy in this source category are contained in Table 8.

Fuels

Strategies in this category are related to the fuels sold and used in the Puget Sound region. Any fuels strategies adopted will also likely have a beneficial impact on some non-road mobile sources such as lawn and garden equipment.

Strategies Recommended for Modeling

- *Low Reid Vapor Pressure:* Continue, on an annual basis, the partnership program between Puget Sound refiners and the Clean Air Agency designed to reduce RVP levels in gasoline produced and sold in the Puget Sound region during the summer months.

Strategies Recommended for Policy Statements

- None of the fuels strategies were recommended for policy statements.

Clean Vehicles

Strategies in this category are related to reducing emissions from vehicles sold and used in the Puget Sound region. The strategies focus on promoting or requiring the use of cleaner vehicles and reducing the number of gross polluting vehicles.

Strategy Recommended for Modeling

- *California LEV II Program without ZEV Requirement:* Implement the California Low Emission Vehicle Program without a phase-in requirement for Zero Emission Vehicles.

Note: The subgroup recommended that a CAL LEV II program be modeled; however, this group recognized that a comprehensive CAL LEV II program would not be cost-effective because of the costs associated with zero emission vehicles (ZEVs). To improve the cost-effectiveness, the strategy was revised to exclude the ZEV component.

Strategies Recommended for Policy Statements

- *Support efforts to promote cleaner vehicles:* Support efforts to develop partnerships and/or support initiatives designed to provide incentives that promote fleet change over to cleaner vehicles, in particular the efforts of the Clean Cities Coalition.
- *Support efforts to reduce vehicle miles traveled:* Support efforts to develop partnerships and/or support initiatives designed to achieve vehicle-miles-traveled reductions, in particular the efforts of the Puget Sound Regional Council.

Note: The subgroup recommended that the Stakeholders Group support efforts to promote clean vehicles and reduce vehicle miles traveled, however, agreed that the initial strategies presented regarding cleaner vehicles (CNG Fleet Rule, SULEV Fleet Rule, and commute trip reduction), were either too difficult to implement, were not cost-effective, or that better strategy alternatives existed. The subgroup identified existing efforts to promote cleaner, alternative vehicles and reduce vehicle miles traveled, and recommended that the stakeholders support these efforts and other efforts like them.

Inspection and Maintenance of Motor Vehicles

The overall strategy in this category was to enhance the state's current Inspection and Maintenance Program (I/M), by requiring additional and/or different tests and changing key aspects of the program. The stakeholders examined a variety of possible enhancements, many of which were pieces of or combinations of one another.

Note: In developing the Inspection and Maintenance recommendations, the subgroup debated between recommending one of two I/M programs for modeling – a program built around the ASM 2525 test, and one built around the current I/M test with tighter cutpoints and an increased repair waiver. The subgroup recognized that there were many issues to consider in selecting a specific program, including cost, emission reductions, and political feasibility, and agreed that the complexities associated with identifying a specific program would best be discussed with the full Group.

In discussing the I/M options, the stakeholders agreed that it would be prudent to model the I/M strategy (the difference in emission reductions estimated for the ASM 2525 test and the current program with an increased waiver and tighter cutpoints is slight, 1.3% vs. 1.5%) that produced the least emission reductions in order to understand what the minimal impact from an enhanced I/M program would be on ozone concentrations. (See Category A – the I/M modeling recommendation below.) The Group recognized that there were many factors to consider in selecting an actual test program, and noted that the Department of Ecology had the expertise and knowledge to select an appropriate program, obviating the need for a Group recommendation on a specific test program.

Although not prepared to make a recommendation on a specific I/M program, the Group agreed to a general policy statement that expressed the Group’s collective support for continuation of the current I/M program, as well as advocating an enhanced I/M program. In particular, the statement was intended to support the Department of Ecology’s legislative efforts to lift the current I/M fee cap, which would allow for the current I/M program to continue, as well as provide the Department with the flexibility to develop an enhanced I/M program.

Strategy Recommended for Modeling

- *ASM 2525 test, adding a gas cap and OBD check:* Enhance the current I/M program by implementing use of the ASM 2525 test, a gas cap check, and an on-board diagnostics check.

Table 8 - Recommendation Summary, Emission Reduction and Cost-Effectiveness Estimates for On-Road Mobile Strategies

Strategy	% VOC Emission Reduction		Cost per ton	
	2007	2015	2007	2015
<i>Strategies Recommended for Modeling</i>				
Low Reid Vapor Pressure	4.5%	3.3%	\$3,900	\$4,800
CAL LEV II without ZEV requirement	1.0%	2.5%	\$7,800	\$7,800
Inspection & maintenance – ASM 2525	1.4%	1.0%	\$6,500	\$7,000
<i>Strategies Recommended for Policy Statements⁵⁴</i>				
Support efforts to promote cleaner vehicles				
Support efforts to reduce vehicle miles traveled				

Non-Road Mobile Sources

Non-road mobile sources account for approximately 11% of the total VOC emissions (including biogenic emissions) in the 1996 emissions inventory. Emissions from this source category are projected to decrease because of Federal programs that will be phased in over the next several years, in particular Low Sulfur Fuels. Included in this source category are gasoline boats, lawn and garden equipment and off-road vehicles. Please see Table 9 below for the non-road mobile sources emission estimates and projections in tons per summer episode day.

To achieve emission reductions from this source category, the stakeholders considered strategies related to gas cans, lawn and garden equipment, and outboard motors. The subgroups’ recommendations, cost-effectiveness and potential emission reduction estimates for each strategy in this source category are contained in Table 10.

⁵⁴ Potential emission reduction and cost-effectiveness estimates were not calculated for these strategies, as they were developed by the individual subgroups and support efforts implemented by other entities.

Table 9 - Non-Road Mobile VOC Emissions in Tons per Summer Episode Day

<i>Source</i>	1996	2007	2015
Equipment			
▪ Gasoline boats	43	40	36
▪ Lawn and garden	32	22	13
▪ Aircraft	10	10	10
▪ Gasoline off-road	8	8	9
▪ Other	12	9	6
Total Tons	105	89	74

Lawn and Garden Equipment

Strategies Recommended for Modeling

- *Enhancement of current “Grasscycling” Program:* Enhance the current “Grasscycling” Program by providing incentives in the form of rebates. The incentives should target the gross-polluting two-stroke, oil and gas mixture engine lawnmowers in order to increase turnover to cleaner mowers.

Strategies Recommended for Policy Statements

- No lawn and garden equipment strategies were recommended for policy statements.

Gas Cans

Strategies Recommended for Modeling

- *Voluntary Gas Can Program:* Implement a voluntary gas can program to promote the use of less evaporative gas cans for fuel storage. Promote lower emitting cans through homeowner education, media promotions, retailer partnerships and financial incentives.

Strategies Recommended for Policy Statements

- No gas can strategies were recommended for policy statements.

Outboard Motors/Marine Engines

Strategies Recommended for Modeling

- No outboard motor/marine engine strategies were recommended for modeling.

Strategies Recommended for Policy Statements

- *Marine Engines Program:*⁵⁵ Implement a program to promote cleaner alternatives to two-cycle marine engines through education, partnerships, and pilot programs that support incentives to trade in two-cycle motors.

⁵⁵ The subgroup recognized that marine engines, including outboard motors, contribute significantly to VOC emissions and recommended that a policy statement for this source category support development of an education and outreach program.

Table 10 - Recommended Strategies, Emission Reduction and Cost-Effectiveness Estimates for Non-Road Mobile Strategies

Strategy	% VOC Emission Reduction		Cost per ton	
	2007	2015	2007	2015
Strategies Recommended for Modeling				
Enhanced “Grasscycling” Program	0.2%	0.2%	\$2,250	\$2,250
Voluntary gas can program	0.2%	0.2%	\$8,400	\$8,400
Strategies Recommended for Policy Statements				
Marine engines ⁵⁶				

Cross-cutting

Episodic

This strategy is designed to reduce emissions from a variety of sources when weather conditions and air monitoring data indicate the probability of elevated ozone or smog levels. The Agency currently has a Smog Watch program in place that notifies the public of elevated smog levels and alerts the public and businesses that voluntary actions such as driving less and refueling in evening hours will help to avoid further elevations of smog levels.

Note: The subgroup agreed that as presented to the full Stakeholders Group, the enhanced smog watch program strategy provided minimal reductions at a high cost, and that the proposed strategy should not be recommended for modeling or for a policy statement. The recommendation was subsequently reworked, however, and an enhanced Smog Watch program is part of the Group’s final recommendations. Please see the section of this report entitled *Final Recommendations – Recommended Policy Positions*.

Recommended Strategy Packages

The full Stakeholders Group reviewed and discussed the recommendations of the subgroups as described above in *Subgroup Recommendations*. The Group agreed with the recommendations as presented by the subgroups, and used the recommended strategies to develop strategy packages, which were then modeled by Washington State University to determine their impact on regional ozone concentrations. The stakeholders developed the packages to meet the established target of 5-15% VOC reductions. Tables 11- 13 below describe the contents of each of the strategy packages.

Strategy package #1 below was designed to determine the effect of all of the recommended strategies on ozone concentrations. The model paint rule was excluded from the package because the voluntary coatings strategy was included. (In order to accurately demonstrate the impact of the strategies, similar strategies targeting the same emission source category should not be modeled together.) To determine the impact of a model paint rule, the second strategy package below was developed consisting of all of the recommended strategies, except for the voluntary coatings program – the model paint rule was substituted for this strategy.

The third strategy package below was developed in order to see the effect of strategies associated with the mobile source category, as this is a highly significant source of VOC emissions and of possible emission reduction strategies.

⁵⁶ Potential emission reduction and cost-effectiveness estimates were not calculated for these strategies as they were developed by the individual subgroups and support efforts implemented by other entities.

Table 11 - Strategy Package One

Strategy	% VOC Emission Reduction		Cost per ton	
	2007	2015	2007	2015
Voluntary coatings program	1.9%	3.9%	\$5,400	\$5,400
Low RVP gasoline (8.2 psi)	2.5%	1.9%	\$3,900	\$4,800
Enhanced “Grasscycling” program	0.2%	0.2%	\$2,250	\$2,250
Voluntary gas can program	0.2%	0.2%	\$8,400	\$8,400
Enhanced vapor recovery program	0.5%	0.6%	\$4,650	\$4,650
Inspection & maintenance	1.4%	1.0%	\$6,500	\$7,000
California LEV II minus ZEV requirement	1.0%	2.5%	\$7,800	\$7,800
<i>Total Reductions Produced by Package</i>	7.7%	10.3		

Table 12 - Strategy Package Two

Strategy	% VOC Emission Reduction		Cost per ton	
	2007	2015	2007	2015
Model paint rule	3.1%	3.8%	\$6,400	\$6,400
Low RVP gasoline (7.8 psi)	4.5%	3.3%	\$3,900	\$4,800
Enhanced “Grasscycling” program	0.2%	0.2%	\$2,250	\$2,250
Voluntary gas can program	0.2%	0.2%	\$8,400	\$8,400
Enhanced vapor recovery program	0.5%	0.6%	\$4,650	\$4,650
Inspection & Maintenance	1.4%	1.0%	\$6,500	\$7,000
California LEV II minus ZEV requirement	1.0%	2.5%	\$7,800	\$7,800
<i>Total Reductions Produced by Package</i>	10.9%	11.6%		

Table 13 - Strategy Package Three

Strategy	% VOC Emission Reduction		Cost per ton	
	2007	2015	2007	2015
Low RVP gasoline (8.2 psi)	2.5%	1.9%	\$3,900	\$4,800
Enhanced vapor recovery program	0.5%	0.6%	\$4,650	\$4,650
Inspection & maintenance	1.4%	1.0%	\$6,500	\$7,000
California LEV II minus ZEV requirement	1.0%	2.5%	\$7,800	\$7,800
<i>Total Reductions Produced by Package</i>	5.4%	6.0%		

Modeling Results

WSU modeled the selected strategy packages in order to determine the impact of the emission reductions produced by each package on ozone concentrations in 2007 and 2015. The modeling results estimated that the VOC reductions would produce decreases in ozone concentrations. In addition, the model projected air quality improvements, largely due to Federal programs, but also displayed information that showed that projected peak concentrations in 2007 are potentially high enough to cause exceedances of the ozone standards. The emission reductions estimated for the strategy packages were not large enough for the model to be able to demonstrate significant differences between the three strategy packages developed by the stakeholders, although all of the packages resulted in some reduction in ozone concentrations. See Figures 11 and 12 below.

Although the modeling results demonstrated minimal reductions in ozone concentrations as a result of implementing the strategies, the technical analyses as a whole, including monitoring data, projected ozone concentrations, emissions inventories and projected VOC reductions from the strategy packages, were seen by the Stakeholders Group as collectively demonstrating that the region remains susceptible to

potential ozone standard violations and that the air quality benefits produced by the strategies could be an important contribution to remaining in attainment.

The Group agreed that it was important for the region to take prudent additional steps, beyond the anticipated Federal programs, to reduce ozone concentrations. In addition, external factors, such as meteorology, are difficult to predict and impossible to control, making it even more important to gain VOC emission reductions where prudent opportunities exist, particularly because of the significant consequences of becoming a non-attainment area for ozone.

Figure 11

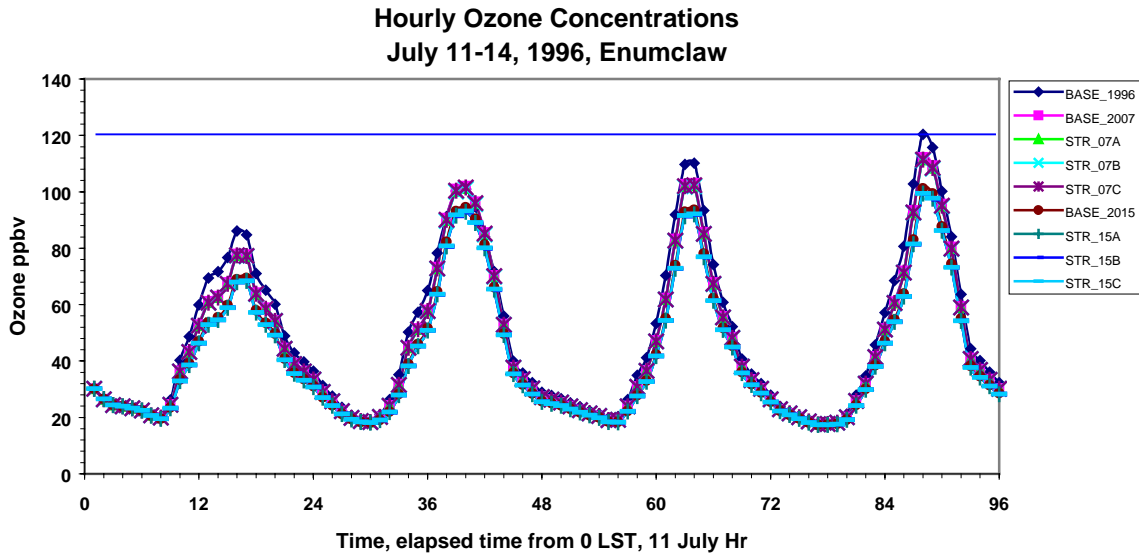
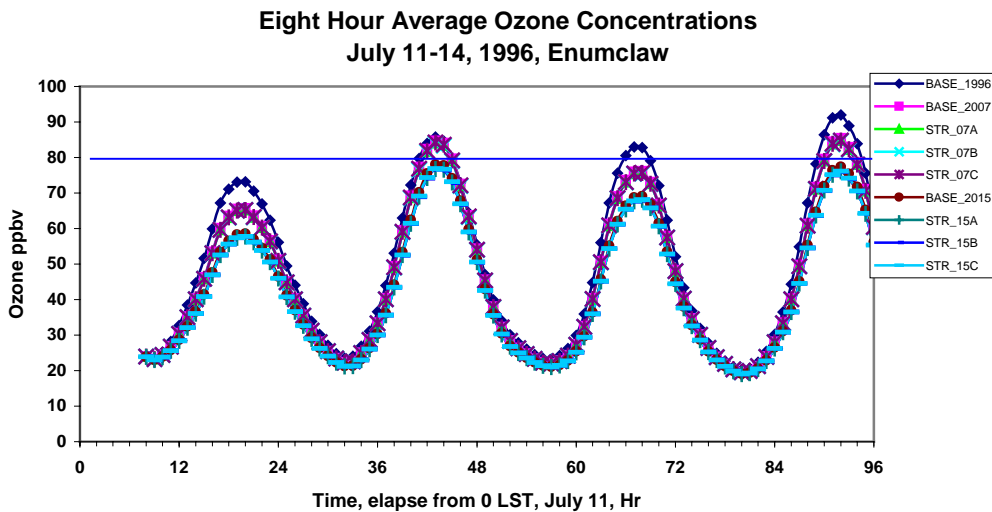


Figure 12



FINAL RECOMMENDATIONS TO REDUCE VOCS

Based upon the technical data assembled by the Clean Air Agency, the modeling results, and the recommendations of the individual source subgroups, the Stakeholders Group developed its final strategy recommendations for ozone emission reduction measures and contingency measures. In developing its final recommendations, the Group considered several factors, including potential emissions reductions, cost-effectiveness⁵⁷, implementation feasibility, and additional benefits provided by the strategy, such as increased public awareness.

Throughout the course of its discussions, the stakeholders recognized the resource implications associated with implementation of different strategies. Many strategies and recommended programs will take additional Clean Air Agency efforts and resources to develop and implement. The Group recognizes the necessity of additional funding for the Clean Air Agency to support efforts to implement some of the recommended strategies, particularly those that are voluntary efforts. Voluntary programs undertaken by the Clean Air Agency are supported by non-fee based funds, since they are not regulatory in nature and cannot be supported by permit or other mandated fees. To ensure that these efforts are reasonably funded, the Group recommends and supports increases to the Agency's non-fee based budget. The stakeholders believe the implications of going into nonattainment would be too severe, and that modest increases in the Clean Air Agency's resources are a good investment to help implement these prudent strategies to reduce VOC emissions.

The full Group's final recommended emission reduction and contingency measures, and policy position statements follow below by source.⁵⁸

Recommended Emission Reduction Measures

The Stakeholders Group recommended the following strategies as emission reduction measures. These strategies were considered to be reasonable actions for the region to implement in order to help ensure that the region remain in attainment with the Federal ozone standard over the lifetime of the maintenance plan. The strategies cut across different sources and were identified as representing important emission reduction and/or educational opportunities at reasonable costs.

In addition, the recommended VOC emission strategies also provide additional air quality benefits. In particular, all of the recommended strategies would also provide toxics emissions reductions. Exposure to toxic air pollutants of significant concentration and exposure can result in significant health effects, so the toxics reductions produced by the recommended VOC emission reduction strategies were viewed as an important collateral benefit by stakeholders.

Table 14 below displays the percentage of nonbiogenic VOC emission reductions produced by the strategies, both individually and collectively, as well as the cost per ton for each strategy. The stakeholders' final recommendations follow.

⁵⁷ Cost-effectiveness calculations were based, in part, on staff assumptions developed in light of available information. While considering the cost-effectiveness numbers an important factor in developing its recommendations, the Group also recognized that the reliability of the cost estimates was established by the quality of available information and the assumptions used to calculate the estimates. Because of this variability in assumptions and available information, the reliability of the cost-effectiveness estimates varies from strategy to strategy.

⁵⁸ Although the California LEV II program (minus the ZEV requirement) strategy was selected for modeling purposes, it was not recommended as a potential emission reduction measure. Additional analysis determined that while a CAL LEV II-type program produces VOC emission reductions, it produces even greater NOx reductions. As described in the section of this document entitled *Emissions Contributing to Ozone Formation*, decreases in NOx emissions can actually increase ozone levels in the Puget Sound region. Because of the NOx disbenefit associated with the CAL LEV II (minus ZEVs) strategy, the Group did not recommend the strategy as a potential emission reduction measure.

Table 14 - Recommended Emission Reduction Measures

Strategy	% VOC Emission Reduction		Cost per ton ⁵⁹	
	2007	2015	2007	2015
Low RVP gasoline	4.5%	3.3%	\$3,900	\$4,800
Voluntary coatings program	1.9%	3.9%	\$5,400	\$5,400
Inspection & maintenance	1.4%	1.0%	\$6,500	\$7,000
Enhanced vapor recovery program	0.5%	0.6%	\$4,650	\$4,650
Voluntary gas can program	0.2%	0.2%	\$8,400	\$8,400
Enhanced "Grasscycling" program	0.2%	0.2%	\$2,250	\$2,250
<i>Total Reductions Produced by Recommended Measures</i>	8.7%	9.2%		

Low Reid Vapor Pressure Gasoline

This recommendation was developed by the stakeholders to help reduce the VOC emissions that are produced when gasoline is burned by on-road motor vehicles.⁶⁰ On-road motor vehicles account for approximately 156 tons of the 369 nonbiogenic VOC tons estimated per summer episode day for the year 2007. It is estimated that lower RVP gasoline will yield a 4.5% (approximately 16.6 tons) reduction in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group recognizes and supports the voluntary participation of the region's oil companies in the Puget Sound Clean Air Agency's program to reduce regional VOC emissions by producing and distributing low Reid Vapor Pressure (RVP) gasoline during the summer months. The Stakeholder Group recommends that the Clean Air Agency and participating oil companies continue the successful existing program and continue to work together to get the greatest RVP reductions possible. At a minimum, RVP levels should be reduced to the existing voluntary program levels of 7.8 psi during the summer months.

Voluntary Coatings Program

VOCs emitted from architectural coatings account for approximately 21 tons of the 369 nonbiogenic VOC tons estimated per summer episode day for the year 2007. VOCs are emitted when coatings such as household paints are applied. To reduce the emissions from this category, the stakeholders are recommending a voluntary coatings program designed to encourage consumers to purchase and use low VOC paints. It is estimated that if such a program were implemented, the region would realize a 1.9% reduction (approximately 6.9 tons) in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency implement a Voluntary Coatings Program designed to reduce VOC emissions from coatings such as household paint, industrial building, and road striping. The program should contain a strong educational component designed to inform the public about the air quality effects associated with high VOC paints and the availability of lower VOC paints. In addition, the Agency should actively encourage retail outlets to promote the sale of low VOC paints, and should seek to establish partnerships with appropriate public and private entities to encourage the use of low VOC paints.

To determine if the voluntary efforts are influencing the type of coatings sold and used in the

⁵⁹ Please see footnote 58 above re: cost-effectiveness calculations.

⁶⁰ Lower RVP gasoline would also produce VOC emission reductions from other gasoline-operated equipment such as lawn mowers and off-road vehicles.

Puget Sound Region, the Group recommends that the following targets be established:

- By 2007, 60% of paints applied should comply with the California Air Resources Board's stricter Suggested Control Measures (SCMs). (Achieving a 60% target in 2007 would result in a 1.9% reduction in overall nonbiogenic VOCs.)
- By 2015, 100% of paints applied should comply with the SCMs. (Achieving a 100% target in 2015 would result in a 3.9% reduction in overall nonbiogenic VOCs.)

If these targets are not met, the Clean Air Agency should consider implementing a model paint rule to reduce VOC emissions from the coatings category.

Inspection and Maintenance

On-road motor vehicles are a significant source of VOC emissions in the Puget Sound, approximately 156 tons of the 369 nonbiogenic VOC tons estimated per summer episode day for the year 2007. Emissions from this source category are currently controlled, in part, by the State's Motor Vehicle Inspection and Maintenance Program. To continue to gain emission benefits from the Program, the stakeholders developed a recommendation that supports continuation, and enhancement of, the current I/M Program. It is estimated that if an enhanced program were implemented, the region would realize a 1.4% (approximately 5.1 tons) reduction in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group strongly supports the continuation of the Washington State Department of Ecology's Inspection and Maintenance Program (I/M Program), knowing that a fee increase is required to do so. The Group recognizes that the I/M Program is necessary to keep the region in attainment with the Federal air quality standards, especially ozone.

In addition, the Group strongly recommends improving the I/M Program to increase the effectiveness of the program. In an effort to enhance the I/M Program, the Washington State Department of Ecology should continue to explore cost-effective ways to increase the efficiency of the program through changes in program design and use of improved technology. In particular, the Stakeholder Group recommends that the Department of Ecology do the following:

- Analyze the effects of more effective testing methods such as ASM 2525 and/or the effects of an increased repair waiver.
- Explore ways to mitigate the effects of a higher repair waiver limit, including funding to assist low-income vehicle owners with repair costs.
- Analyze how the advent of on-board diagnostics affects program design options.
- Explore the use of high-emitter profiles in the program design.
- Continue to track successes and failures in the use of remote sensing at other jurisdictions.
- Track advances in remote sensing technology and program design.
- Identify possible funding mechanisms for remote sensing.

Stage II Vapor Recovery

Gasoline station/refueling emissions account for approximately 8 tons of the 369 nonbiogenic VOC tons estimated per summer episode day for the year 2007. VOCs are emitted when motor vehicles refuel and stage II vapor recovery systems are designed to capture these evaporative emissions. Many stage II systems are not maintained properly however, resulting in less effective capture of emissions. If efforts are undertaken to improve the results provided by stage II systems, it is estimated that the region would realize a 0.5% (approximately 1.79 tons) reduction in overall nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency develop an enhanced Vapor Recovery Enforcement Program, designed to better educate gas station owners/operators of the need to maintain existing Stage I and Stage II Vapor Recovery Systems, and of the regulations that define the appropriate level of control and maintenance. Educational efforts should be multilingual to ensure effective communications. The program should also contain appropriate enforcement provisions to enhance compliance with existing requirements. In addition, the Agency may consider a broader public education component regarding the role of Stage II Vapor Recovery Systems in relation to overall air quality.

Voluntary Gas Can Program

Evaporation of gasoline can occur through gas can walls and the caps of gas cans. In addition, evaporation occurs when there is spillage from and overfilling of gas cans. To reduce the evaporative emissions from this source, the stakeholders are recommending a program that focuses on encouraging the sale and purchase of gas cans designed to decrease evaporative emissions. If such a program were implemented, potential emission reductions have been estimated at 0.2% (approximately 0.6 tons) reduction in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency develop a voluntary program designed to encourage the purchase of lower emitting gas cans. Such a program should include a strong public education component to inform the public of the air quality impacts associated with evaporation, spillage and overfilling of fuel cans, and of the availability of lower emitting cans. The Clean Air Agency should also explore developing partnerships with public and private entities to promote the purchase of lower emitting cans.

Enhancement of Current "Grasscycling" Program

Gas lawn and garden equipment exhaust account for approximately 32 tons of the 369 nonbiogenic VOC tons estimated per summer episode day for the year 2007. Emissions from this source category are produced largely by older, less efficient equipment, in particular two-stroke, oil and gas mixture engines. The current "Grasscycling" program is designed to provide incentives to encourage homeowners and others to buy more efficient equipment, such as electric mowers. The stakeholders are recommending that the program be enhanced to specifically target trade-ins of two-stroke engines. If the "Grasscycling" program was enhanced, an additional 0.2% (approximately 0.6 tons) emission reductions is estimated in overall summer day nonbiogenic VOC emissions in the year 2007. The stakeholders' recommendation follows below.

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency work with participating partners to enhance the current "Grasscycling" program, to further promote the use of cleaner alternatives for lawn and garden equipment by both public and private entities. The enhancements should target trade-ins of two-stroke lawn mowers by providing rebates for every two-stroke mower turned in. In addition, a robust educational program should be developed to inform the public of the air quality impact of lawn and garden equipment, the benefits of using cleaner alternatives such as electric lawn and garden equipment, and the opportunity to trade-in equipment with higher-emitting two-stroke engines.

Recommended Contingency Measure

In discussing potential emission reduction strategies, the Group identified an ozone contingency measure to be implemented if there were a violation of the Federal ozone standard.⁶¹ The stakeholders recommend that a mandatory requirement for low VOC paints could be a reasonable contingency measure. The Group believes that a voluntary coatings program should be implemented first (see the Voluntary Coatings recommendation in the discussion above), but recognized that if a violation were to occur, approximately 1.3% more VOC reductions by the year 2007 could be achieved by a mandatory low VOC paint rule. The recommendation follows:

Model Paint Rule

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency implement a Model Paint Rule in the event of a violation of the Federal ozone standard. If a violation of the ozone standard occurs, a Model Paint Rule should be implemented that requires architectural paints sold in the Puget Sound region to comply with the emission limits recommended by STAPPA/ALAPCO in their Model Rule: Regulating Air Emissions from Paint, October 2000.

Recommended Policy Positions

In addition to recommended emission reduction measures, the CO/Ozone Stakeholders recommend the following policy positions that represent good direction for the Clean Air Agency to pursue. These strategies represent policies, programs and efforts that the Group supports because they are valuable from an educational, informational or advocacy perspective and would result in VOC emission reductions. The recommended policy statements follow below.

Marine Engines

The CO/Ozone Stakeholders Group recognizes the significant share of two-cycle marine engines to overall VOC emissions in the Puget Sound area, (approximately 39 tons of the estimated 355 tons projected for a 2007 summer episode day) and recommends that the Clean Air Agency continue to explore cost-effective measures to reduce emissions from this source category as much as possible. In particular, a strong education and information program aimed at the marine industry, recreational outboard motor and jet ski users, and rental establishments should be implemented to inform them and the public of the air quality impacts of two-cycle engines and of the benefits of using cleaner alternatives, such as four-cycle engines and non-motorized boating. In addition, the Clean Air Agency should consider market testing different program approaches that would phase out the use of two-cycle engines, for example, providing incentives for older two-cycle engines to be turned in. By market testing different approaches, including incentive levels, the Agency could better determine cost effectiveness, consumer response, and other implementation issues. At a minimum, the Clean Air Agency should explore partnerships with other entities, public and private, to develop a public education and outreach program that promotes alternatives to old, two cycle motors including cleaner motors and non-motorized boating.

Personal Care Products

The CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency explore the possibility of developing an educational program designed to encourage the public to purchase products with low VOC content, such as non-aerosol products. This type of program should focus on educating the public regarding the air quality impact of personal care products and the benefits of using products with low VOC content.

⁶¹ As noted on page seven of this document, contingency measures are to be implemented if the region violated the ozone standard. The current Ozone Maintenance Plan includes two contingency measures: a requirement for lower Reid Vapor Pressure gasoline in the summertime and enhancements to the state's Inspection and Maintenance program.

Stage II Vapor Recovery Systems

The CO/Ozone Stakeholders Group recognizes that there are two critical factors currently developing, enhanced Stage II Systems and on-board vapor recovery systems, that could or will impact the region's near-term and long-term future directions with respect to Stage II Vapor Recovery Systems, and therefore developed its policy recommendation to account for the potential impact of both factors.

First, the California Air Resources Board is currently designing and implementing portions of an enhanced Stage II Vapor Recovery System. These enhancements require stricter emission controls, and hence greater VOC emission reductions are anticipated as a result. Much of the technology associated with the enhanced system, however, is not yet fully developed or the full impact of these technologies is still unknown. In light of the uncertainties associated with the developing enhanced system, the CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency monitor changes in the definitions and requirements of CARB certified vapor recovery equipment, and convene a Stakeholders process, when timely, to discuss revising local Stage II Vapor Recovery regulations as necessary to the appropriate level of control in light of CARB developments.

Second, on-board vapor recovery systems are becoming more prevalent as newer motor vehicles penetrate the Puget Sound fleet. On-board vapor recovery systems are designed to capture most of the emissions released during vehicle refueling, and will likely, at a future point in time, make Stage II Vapor Recovery Systems unnecessary. The overall impact of these systems on air quality is not yet known, however, and the difficulty of forecasting fleet penetration creates an additional uncertainty. To address these uncertainties, the CO/Ozone Stakeholders Group recommends that the Puget Sound Clean Air Agency work with the Washington State Department of Ecology to annually monitor the impact of on-board vapor recovery systems on overall air quality, in order to determine if/when it is appropriate to remove existing Stage II Vapor Recovery Systems from gas stations in the Puget Sound region.⁶²

Vehicle Miles Traveled Reductions

The CO/Ozone Stakeholders Group, recognizing the valuable benefits of reducing vehicle miles traveled (VMT), including reductions in traffic congestion and vehicle emissions such as CO, CO₂, VOC, and NO_x, supports the Puget Sound Clean Air Agency's efforts to develop partnerships and/or support initiatives designed to achieve VMT reductions. In particular, the Stakeholder Group supports the Puget Sound Regional Council in its efforts to research long term user fee policies, linking land use and transportation, the provision of mobility options including trip reduction programs, better traffic management strategies, and other strategies as part of its Destination 2030 work, to achieve national and state air quality and environmental objectives, and local and regional growth management objectives.

Promoting Cleaner Vehicles

The CO/Ozone Stakeholders Group supports the Puget Sound Clean Air Agency's efforts to develop partnerships and/or support initiatives designed to provide incentives, such as tax reductions, grants or rebates, that promote fleet change over to cleaner vehicles. In particular, the Stakeholder Group supports the efforts of the Clean Cities Coalition, which has developed proposed legislation to encourage the purchase and use of cleaner vehicles, including alternative fuel vehicles and hybrid vehicles. The Stakeholder Group also encourages and supports Clean Air Agency efforts to develop partnerships with individual entities that are designed to encourage change over to cleaner vehicle fleets. In addition, the Stakeholder Group recognizes that in the future, it might be advantageous for the Clean Air Agency to

⁶² Chapter 173-491-040, section 5(d)(i and ii) of the Washington Administrative Code state respectively that "Beginning on July 1, 2001, and each year thereafter, the Department of Ecology shall publish the canister capture rate. When the canister capture rate reaches fifteen percent and there are no major exceptions, waivers, or other adjustments to the EPA onboard canister regulations or program implementation, the Department of Ecology shall revise (c) of this subsection to incorporate the effect of canisters."

explore the use of state-based mandates to purchase or convert to alternative fuel or advanced technology vehicles.

Enhanced "Smog Watch" Program

The CO/Ozone Stakeholders Group recognizes the importance of the Puget Sound Clean Air Agency's Smog Watch program, which is designed to reduce smog-producing activities during summer hot spells. When weather conditions and air monitoring data indicate the probability of elevated smog levels, through Smog Watch messages, the public and businesses are alerted that voluntary actions such as postponing mowing, driving less and refueling in the evening hours will help avoid elevated smog levels and possible violations of the Clean Air Act. To activate a Smog Watch, the Clean Air Agency relies on the media to notify the public, as well as many participating businesses and public agencies that, in turn, notify their employees to take Smog Watch actions.

The CO/Ozone Stakeholders Group recognizes that although it is difficult, if not impossible, to quantify the air quality benefits of the Smog Watch program, it is a critical tool to help manage potential short-term smog events. Smog Watch is also an effective public education program that reinforces long-term behavioral and market changes that ultimately contribute to improved air quality. For these reasons, the CO/Ozone Stakeholders Group supports the continuation and enhancement of the Smog Watch program. For example, the Agency's recently established relationship with a local TV stations has resulted in air quality becoming a regular feature of the weather report; during a Smog Watch, this relationship will provide an even wider audience for the Agency's smog reduction messages. Other enhancements to the Smog Watch program that the Agency might consider include⁶³:

- Working with individual entities to develop individual smog-reducing programs that are tailored to the needs and specifications of the individual entities.
- Highlighting and reinforcing existing programs, such as the "Grasscycling" program, including voluntary gas can program and/or programs designed to reduce emissions from sources such as marine engines and personal care products.
- Buying inexpensive advertisements in early summer in neighborhood weeklies to let the public know what Smog Watch means before an actual Smog Watch event.
- Expand the current "Enviro-Star" program and extend it to businesses that implement smog reducing policies from a menu developed by the agency. Each menu item would have a points value and once the business reached a certain points value, they would qualify as an Enviro-Star business. Menu items would include but not be limited to, telecommute days when there is a Smog Watch Alert, reduced use of company vehicles during Smog Watch Alerts, etc.
- Establish a voluntary e-mail Smog Watch Alert program for businesses and individuals where PSCAA would notify them via e-mail of a Smog Watch Alert.
- Develop a one-class Smog Watch education program for science teachers to use in their classrooms.
- Establish a Smog Watch website that can be easily located by citizens as the current Smog Watch information is challenging to locate.

The CO/Ozone Stakeholders Group recognizes that the Smog Watch Program will continue to improve over time and suggests that the Clean Air Agency update the Program annually to identify and implement appropriate enhancements.

Revisiting the Ozone Maintenance Plan

⁶³ Please see Appendix I for a detailed list of additional suggested enhancements.

To ensure that the maintenance plan's emission reduction measures continue to be effective and/or appropriate in light of anticipated, and unanticipated, future occurrences, the Stakeholders Group recommends that the Clean Air Agency engage in a comprehensive review of the maintenance plan at an appropriate interval during the lifetime of the plan, (2007 or as deemed appropriate by the Clean Air Agency). The Group recognizes that its recommended emission reduction strategies will play an important role in helping to keep the region in attainment, but also recognizes that over the next several years, in particular between 2001 and 2007, other factors will influence ozone concentrations and air quality in Puget Sound. For example, implementation of Federal Tier II emission standards and low sulfur fuel requirements, fleet penetration, and the possible adoption of a new ozone standard, could potentially impact the region's approach to ozone. The Group believes that it is prudent for the Clean Air Agency to review the maintenance plan around 2007 to respond proactively to these, and other changes, to ensure that the maintenance plan emission reduction measures remain an effective and reasonable approach to achieving the region's air quality goals.

CONCLUSION

The Puget Sound region has an opportunity to achieve critical air quality improvements over the next decade. Technical data indicate that these improvements will help ensure that the region remains in attainment with the Federal ozone standard. The Group recognizes the important efforts already implemented that have brought the region into attainment with the standard, however, the Group also recognizes that the region must continue to be vigilant and to take prudent steps to remain in attainment, particularly as the population in the Puget Sound region continues to grow and place pressure on all of our natural resources, including air quality.

The emission reduction strategies recommended by the stakeholders represent reasonable and cost-effective actions that can be implemented to reduce ozone levels in the Puget Sound region. The Group's recommendations cut across all sources, requiring the oil industry, mobile sources, and the general public to contribute to reducing overall regional ozone levels. In addition, the recommended strategies will require a significant commitment from the Clean Air Agency, as the recommended strategies will require substantial effort on the Agency's part to develop. Successful implementation will result in the need for additional resources for the Agency.

The Group believes its recommendations are an important contribution to keeping the region in attainment and avoiding the significant consequences of nonattainment status, and will contribute to achieving important improvements to the region's overall air quality and, thus, human and ecological health.

We appreciate the opportunity to serve the Agency, its Board, and the citizens of the Puget Sound region.

SECTION II – CARBON MONOXIDE

Puget Sound Clean Air Agency CO/Ozone Stakeholders Group

Final Report
CO/Ozone Stakeholders Group ~~of~~ Puget Sound Clean Air Agency
June 27, 2001

Section 2 – Executive Summary – Carbon Monoxide⁶⁴

▪ **Charge**

In 1994, the Puget Sound Clean Air Agency (Clean Air Agency) began the process of developing a carbon monoxide (CO) maintenance plan and requesting redesignation to attainment. Air monitoring data over four years had demonstrated that there had been no violations of the CO standard and that, in fact, CO levels were declining significantly. The maintenance plan was completed in 1995 and the Region was designated to attainment for the federal CO standards in 1996. To ensure that the maintenance plan provisions remain appropriate in light of new data and technical analyses, the Clean Air Agency is reviewing its 1995 CO Maintenance Plan and updating the plan as necessary to ensure that the Region remains in attainment with the CO standard over the life of the plan.

To assist the Clean Air Agency in this effort, a CO/Ozone Stakeholders Group (the Group) was convened in August 2000 to provide the Agency with recommendations to ensure that the federal carbon monoxide standards are maintained through the year 2015. Specifically, the Group was charged with identifying the range of actions prudent to include in the CO Maintenance Plan to achieve the emission reductions necessary to stay in attainment in light of current and projected air quality.

▪ **Process**

The CO/Ozone Stakeholders Group, which consisted of 13 members representing government, the health community, the fuels industry, environmental interests, small businesses, and automobile dealers, met nine times over the course of ten months to analyze and discuss an approach for the CO Maintenance Plan and to discuss strategies designed to generate ozone producing emission reductions within the Puget Sound Region. (Please see Section One of this report for information on the ozone effort.)

In order to develop its recommendations, the Group reviewed key CO technical data, including existing air quality data and emission inventory trends for the years 2007 and 2015. A roll-forward analysis was also completed to compute projected highs for CO concentrations in future years. In light of the technical data, the group discussed the most appropriate way to update the CO Maintenance Plan and developed its final recommendations.

▪ **Observations**

The technical information supporting the Stakeholders effort, specifically existing air quality data, projected emissions inventories and the roll-forward analysis, all indicated that CO concentrations in the Region will continue to decrease well below the health-based national standards. Given the data, the

⁶⁴ Please see Section I – Ozone Executive Summary for a summary of the ozone effort.

Group focused on reviewing the current CO contingency measure and developing a contingency measure recommendation.⁶⁵

The current CO contingency measure is a region-wide wintertime oxygenated gasoline program, which produces emission reductions largely from older vehicles. As newer vehicles penetrate the Puget Sound fleet, the overall cost-effectiveness of the oxygas program will decrease significantly. In light of the cost of the oxygas program and the higher likelihood that future CO violations could occur at highly localized hot spots versus throughout the region, the stakeholders agreed that a “tiered” contingency measure would be most appropriate. A first tier contingency measure would be designed to address local CO hot spots,⁶⁶ and a second tier measure would be implemented if there were a regional CO problem.

▪ **Recommendation**

After analysis and discussion of the technical data and proposed contingency measure approach, the Group developed its final recommendation. In developing its recommendation, the Group considered several factors, including the likelihood of a CO violation, resources available to implement proposed contingency measures, and the role of local governments. The Group’s recommendation follows below.

Level I – “Hot Spot” Problem

This contingency measure would be triggered upon a quality assured exceedance of the federal (eight-hour) CO standard at any one monitoring site throughout the Puget Sound Region.⁶⁷

The Puget Sound Clean Air Agency (the Agency) would approach the appropriate local and state government entities to investigate traffic conditions where the exceedance occurred and to identify and evaluate the effectiveness of local mitigation measures. If local transportation system improvements at the “hot spot” could be implemented promptly, and would help prevent future exceedances, the most effective action would be implemented. Depending upon the specific “hot spot” and nature of the problem, possible actions could include:

- Traffic surveillance and controls.
- Traffic signal improvement.
- Motorist information systems.
- Integrated traffic control systems.
- Roadway channelization and intersection improvement.
- Traffic flow improvements.

The Clean Air Agency would assist local government in securing resources to implement the selected measure/s.

Level II – Regional Problem

This contingency measure would be triggered if there were violations of the federal (eight-hour) CO standard at multiple monitoring sites throughout the Puget Sound Region. The measure would consist of implementation of a regional oxygas requirement as prescribed in the Clean Air Agency’s Regulation.

⁶⁵ Contingency measures are emission reduction measures that are implemented if there is a violation of the national standard.

⁶⁶ “Hot Spots” refer to highly localized spots where CO levels have a tendency to be elevated, due primarily to traffic congestion combined with unfavorable meteorological conditions.

⁶⁷ In presenting its draft recommendation, subgroup members explained that there were several discussions regarding the appropriate trigger for the first tier contingency measure. While the recommendation states that the first tier measure be triggered by an exceedance, the subgroup acknowledged that a violation of the standard would likely be an acceptable trigger if the Clean Air Agency were committed to working with local governments when exceedances occur to prevent second exceedances, which is what constitutes a violation of the standard.

The Clean Air Agency's CO/Ozone Group supports the use of ethanol in gasoline for the Puget Sound region because of the negative environmental consequences associated with the use of MTBE.

▪ **Conclusion**

The Puget Sound Region has made significant progress in improving CO levels over the past decade. Technical data projects that these improvements will continue and that there is a high probability that the Region will remain in attainment with the federal CO standards. The Stakeholders Group recognizes, however, that it is important to have appropriate contingency measures in place in the event of a violation. The Group also recognizes that, while prudent to have an effective contingency measure in place, a region-wide oxygas program is not a cost-effective first step as CO level spikes generally occur in highly localized areas, or "hot spots." The stakeholders believes that a more targeted approach to addressing CO "hot spots" should be an initial step in addressing increased CO levels, followed by a regional oxygas program if violations occur region wide.

The Group believes that if a violation were to occur, its recommendation provides an effective and appropriate path to reducing CO levels by first addressing "hot spot" problems at the local level and then, if necessary, addressing region wide CO level increases.

Final Report
CO/Ozone Stakeholders Group ★ Puget Sound Clean Air Agency
June 27, 2001

Section 2 – Final Report – Carbon Monoxide

INTRODUCTION

In 1994, the Puget Sound Clean Air Agency (Clean Air Agency) began the process of developing a carbon monoxide (CO) maintenance plan and requesting redesignation to attainment. Air monitoring data over four years had demonstrated that there had been no violations of the CO standard and that, in fact, CO levels were declining significantly. The maintenance plan was completed in 1995 and the Region was designated to attainment for the federal CO standards in 1996. To ensure that the maintenance plan provisions remain appropriate in light of new data and technical analyses, the Clean Air Agency is reviewing its 1995 CO Maintenance Plan and updating the plan as necessary to ensure that the Region remains in attainment with the CO standard over the life of the plan.

To assist the Clean Air Agency in this effort, a CO/Ozone Stakeholders Group (the Group) was convened in August 2000 to provide the Agency with recommendations to ensure that the federal carbon monoxide standards are maintained through the year 2015. Participants represented a variety of interests including government, the health community, the fuels industry, environmental interests, small businesses, and automobile dealers. Agency staff provided technical support and background information, with assistance from the Washington State Department of Ecology and Sierra Research (a consultant hired to provide technical analyses). The Stakeholders Group met over the course of ten months to analyze and discuss an approach for the CO Maintenance Plan and to discuss strategies designed to generate ozone producing emission reductions within the Puget Sound Region. (Please see Section One of this report for information on the ozone effort.)

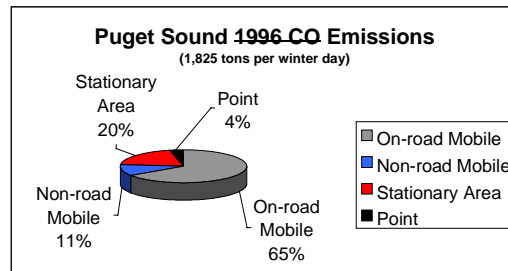
BACKGROUND

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless gas that is formed when carbon in fuel is not burned completely. The highest levels of CO typically occur during the winter months when there is colder air and inversion conditions are more frequent, trapping air pollution near the ground. Motor vehicle exhaust is the main source of CO. Because of the significant emission contributions from motor vehicles, higher concentrations of CO are characteristically observed during peak travel periods, when there is heavy traffic congestion. Other CO sources include non-road vehicles, such as construction equipment and boats, residential wood burning, and industrial processes.⁶⁸ See Figure 1 - Puget Sound 1996 CO Emissions.

⁶⁸ Specific CO sources are organized into larger source categories - on-road mobile, non-road mobile, point, and area sources. The on-road mobile category contains specific motor vehicle sources such as passenger cars, trucks, SUVs, and buses. The non-road mobile category contains sources such as construction equipment, gasoline boats, and lawn and garden equipment. CO

Figure 1- Puget Sound 1996 CO Emissions



Carbon monoxide is a pollutant of concern because it can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues. Exposure to low levels of CO can cause chest pains and other cardiovascular effects for those who suffer from heart disease. Higher levels of CO can also affect the central nervous system, causing vision problems and reduced manual dexterity.

Federal Carbon Monoxide Standard

EPA has set two health-based standards for carbon monoxide: a one-hour standard of 35 parts per million (ppm) and an eight-hour standard of 9 parts per million. The standards are violated if CO levels exceed either the one-hour or the eight-hour standard at any one monitoring site more than once a year.

Clean Air Act Requirements

The Clean Air Act requires that any state which submits a request for redesignation from a nonattainment area (the western portions of King, Pierce, and Snohomish Counties were classified as a CO nonattainment area based on 1987-88 air quality measurements), to an attainment area, must also submit a revision to the State Implementation Plan to provide for the maintenance of the air quality standard for at least ten years after the redesignation. These maintenance plans are to contain any additional control measures necessary to ensure maintenance of the standard, as well as contingency provisions to ensure that the State will promptly correct any violation of the standard that occurs after redesignation.

Previous Maintenance Plan Effort

In 1995, the Puget Sound Clean Air Agency developed a carbon monoxide maintenance plan and a request to the U.S. EPA for redesignation to attainment for King, Pierce, and Snohomish Counties. The plan analysis period covered 1993-2010, and the Puget Sound carbon monoxide nonattainment area was redesignated to attainment in 1996.

In order to assist the Clean Air Agency in developing the CO Maintenance Plan, a Maintenance Plan Advisory Steering Committee was convened in 1994 to provide policy recommendations on how best to understand the Region's air quality trends, and on what CO control measures and other actions appeared reasonable and necessary to keep the Region in attainment for CO. At the time the Advisory Committee was convened, the Region's CO levels had declined significantly and CO emission inventory trends prepared for the 1993-2010 plan analysis indicated that CO levels would continue to decrease. In light of the air quality data and the projected trends, the Advisory Committee focused its efforts on whether all of the existing CO emission controls needed to remain in effect for the Region to stay in attainment over the life of the maintenance plan.

stationary area sources include residential wood burning sources. Point sources are larger industrial processes such as metals processing and chemical manufacturing.

The Advisory Committee recommended that the removal of the oxygenated fuel program be diligently pursued for the Puget Sound region and occur as soon as possible, subject to several conditions and understandings, including reinstatement of the program if the CO standard were violated and continuation of the other existing CO control measures.⁶⁹

Based on the Steering Committee's suggestions, the Clean Air Agency developed its 1995 CO Maintenance Plan to include commitments to:

- Continuation of the motor vehicle Inspection and Maintenance Program.
- Continuation of best available control technology (BACT) for new stationary sources.
- Developing a cooperative program with local governments to address CO "hot spots."⁷⁰
- Incorporating oxygenated gasoline as a contingency measure, such that if the CO standard were violated, the oxygas program would be implemented the following winter.

Since EPA's approval of the 1996 CO Maintenance Plan, the Clean Air Agency has worked with the Washington State Department of Ecology to study potential vehicle inspection and maintenance enhancements, has continued requiring BACT for new sources, and has worked with local governments to identify and address CO "hot spots."

Stakeholders Group's Charge

The current CO/Ozone Stakeholders Group was convened in August 2000 and charged with providing the Clean Air Agency with recommendations to ensure that the federal carbon monoxide standard is maintained through the year 2015. Specifically, the Group was charged with identifying the range of actions prudent to include in the CO Maintenance Plan to achieve the emission reductions necessary to stay in attainment in light of current and projected air quality.⁷¹

Technical Work/Data Supporting the Effort

In order to develop its recommendations, the Stakeholders Group reviewed key CO technical data, including existing air quality data and emission inventory trends for the years 2007 and 2015. A roll-forward analysis was also completed to compute projected highs for CO concentrations in future years. The technical work was guided by a Technical Analysis Protocol (TAP), which was developed by a technical advisory committee convened by the Clean Air Agency. The TAP provided the scientific basis for the Stakeholders' discussions and included direction on the CO probability analysis, used to determine maintenance with the CO standard.⁷²

Emissions Inventory

The emissions inventory is a list, by source, of the air contaminants directly emitted into the Region's air. The data in the emissions inventory is based on calculations and is developed using emission factors, which are a method for converting source activity levels into an estimate of emissions contributions for those sources. A base case emissions inventory was developed for the year 1996 and projected emissions inventories were developed for the years 2007 and 2015. See Table 1 - Total Puget Sound Winter Day CO Emissions and Figure 2.

⁶⁹ Oxygenated gasoline contains an added chemical compound with a high percentage of oxygen, which reduces CO by improving combustion. The wintertime sale of this fuel was mandated by the 1990 Clean Air Act amendments for nonattainment areas, which the Puget Sound region was officially classified at that time. Please see Appendix K for the 1995 Clean Air Agency Advisory Steering Committee report for more detail.

⁷⁰ "Hot Spots" refer to highly localized spots where CO levels have a tendency to be elevated, due primarily to traffic congestion combined with unfavorable meteorological conditions.

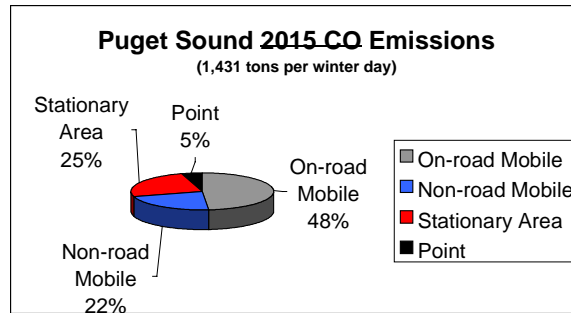
⁷¹ See Appendix B for the CO/Ozone Stakeholders Group charter.

⁷² Please see Appendix C for a copy of the Technical Analysis Protocol.

Table 1 - Total Puget Sound Winter Day CO Emissions

Source Category	1996	2007	2015
▪ On-road mobile	1,745	1,176	762
▪ Non-road mobile	202	229	229
▪ Stationary area combustion sources	360	417	417
▪ Point sources	66	66	66
Total Tons Per Winter Day	2,373	1,888	1,474

Figure 2 - Puget Sound 2015 CO Emissions

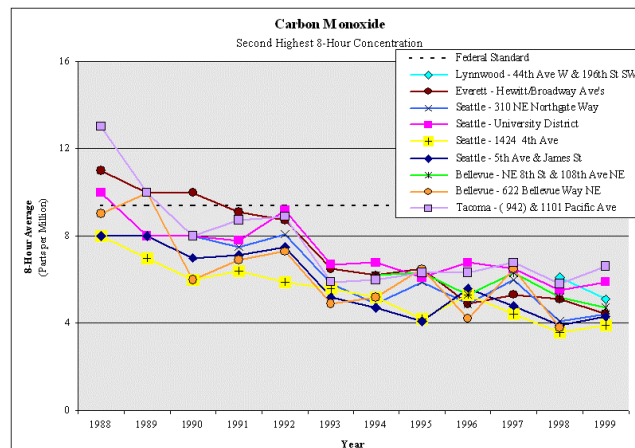


The emissions inventory predicts substantial future reductions in CO emissions, largely as a result of a decrease in on-road emissions, which are expected to continue to decline as older motor vehicles are replaced by newer vehicles that meet federal Tier II emission standards and operate on low sulfur fuels.

Air Quality Data and Future Projections

Air quality data also demonstrates a continuing reduction in CO levels. Data from 1988 through 1999 demonstrates that CO levels in the Puget Sound continued to decline significantly and remain well below the national CO standards. See Figure 3 below.

Figure 3 - CO Eight-Hour Concentrations



To project carbon monoxide concentrations in future years, a roll-forward emission model was used. Roll-forward analyses assume that air quality readings in the vicinity of a monitor are directly related to on-road mobile emissions, and that future percent reductions in on-road emissions will result in the same

percentage improvement in air quality, taking into account “background” levels of CO.⁷³ The analysis computes projected second highest CO concentrations for future years because the CO standards are not to be exceeded more than once per year, making the second high the critical value for planning purposes.

A roll-forward analysis was completed for the 1995 CO Maintenance Plan and was updated for the current process. The analysis indicates that CO levels will continue to decrease and remain significantly below the standards. Please see Table 2 – Roll-Forward Analysis Results

Table 2 – Roll-Forward Analysis Results

Year	On-road Emissions (tons per winter day)	Projected Second High Concentration (parts per million)	Projected Safety Margin (%)
1996	1,745	6.8	24.4
2007	1,176	4.8	46.7
2015	762	3.4	62.2

DEVELOPING THE RECOMMENDATION

Given that existing air quality data, projected emissions inventories, and the roll-forward analysis project that CO concentrations in the Region will continue to decrease well below the health-based national standards, the CO/Ozone Stakeholders Group focused on reviewing the current contingency measure and developing a contingency measure recommendation. Contingency measures are emission reduction measures that are implemented if there is a violation of the national standard.

The current CO contingency measure is a region-wide wintertime oxygenated gasoline program. Oxygenated gasoline is most effective in older vehicles with fewer emission control systems. As newer vehicles penetrate the Puget Sound fleet, the overall cost-effectiveness of the oxygas program will decrease significantly. In light of the cost of the oxygas program, and the higher likelihood that future CO violations could occur at highly localized hot spots versus throughout the region, the Stakeholders Group agreed that a “tiered” contingency measure would be most appropriate. A first tier contingency measure would be designed to address local CO hot spots and a second tier measure would be implemented if there were a regional CO problem. A tiered approach was selected to ensure that local CO problems would be addressed before implementing an expensive region-wide wintertime oxygas measure. To develop its recommendation further, the Stakeholders Group charged a subgroup with developing a draft CO contingency measure recommendation.

The subgroup met several times to consider a tiered contingency measure approach and to develop a draft recommendation. Clean Air Agency staff supported the subgroup’s efforts by developing a proposed contingency measure option, based on the Stakeholders Group’s discussions, and by providing technical assistance. In developing a recommendation, the subgroup considered several factors, including the likelihood of a CO violation, resources available to implement proposed contingency measures, and the

⁷³ The roll-forward analysis assumes a CO background level of 0.7 ppm. Background CO accounts for the monitored concentrations that are produced by non-road sources and by “regional contributions” from on-road sources. These contributions are conservatively assumed to remain constant over time, when, in fact, more stringent emission control efforts will also reduce their impact.

role of local governments. The subgroup recommendation was presented to the full Stakeholders Group to either revise or endorse.

Final Recommendation

Based upon the technical data assembled by the Clean Air Agency and the recommendation of the CO subgroup, the Stakeholders Group developed its final recommendation for the CO Maintenance Plan update. The Group's recommendation follows below:

Level I – “Hot Spot” Problem

This contingency measure would be triggered upon a quality assured exceedance of the federal (eight-hour) CO standard at any one monitoring site throughout the Puget Sound Region.⁷⁴

The Puget Sound Clean Air Agency (the Agency) would approach the appropriate local and state government entities to investigate traffic conditions where the exceedance occurred and to identify and evaluate the effectiveness of local mitigation measures. If local transportation system improvements at the “hot spot” could be implemented promptly, and would help prevent future exceedances, the most effective action would be implemented. Depending upon the specific “hot spot” and nature of the problem, possible actions could include:

- Traffic surveillance and controls.
- Traffic signal improvement.
- Motorist information systems.
- Integrated traffic control systems.
- Roadway channelization and intersection improvement.
- Traffic flow improvements.

The Clean Air Agency would assist local government in securing resources to implement the selected measure/s.

Level II – Regional Problem

This contingency measure would be triggered if there were violations of the federal (eight-hour) CO standard at multiple monitoring sites throughout the Puget Sound Region. The measure would consist of implementation of a regional oxygas requirement as prescribed in the Clean Air Agency's Regulation. The Clean Air Agency's CO/Ozone Group supports the use of ethanol in gasoline for the Puget Sound region because of the negative environmental consequences associated with the use of MTBE.

CONCLUSION

The Puget Sound Region has made significant progress in improving CO levels over the past decade. Technical data projects that these improvements will continue and that there is a high probability that the Region will remain in attainment with the federal CO standards. The Stakeholders Group recognizes, however, that it is important to have appropriate contingency measures in place in the event of a violation. The Group also recognizes that, while prudent to have an effective contingency measure in place, a region-wide oxygas program is not a cost-effective first step as CO level spikes generally occur in highly

⁷⁴ In presenting its draft recommendation, subgroup members explained that there were several discussions regarding the appropriate trigger for the first tier contingency measure. While the recommendation states that the first tier measure be triggered by an exceedance, the subgroup acknowledged that a violation of the standard would likely be an acceptable trigger if the Clean Air Agency were committed to working with local governments when exceedances occur to prevent second exceedances, which is what constitutes a violation of the standard.

localized areas, or “hot spots.” The Stakeholders Group believes that a more targeted approach to addressing CO “hot spots” should be an initial step in addressing increased CO levels, followed by a regional oxygen program if violations occur region wide.

The Group believes that if a violation were to occur, its recommendation provides an effective and appropriate path to reducing CO levels by first addressing “hot spot” problems at the local level and then, if necessary, addressing region wide CO level increases.