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OREGON
ENVIRONMENTAL QUALITY
COMMISSION MEETING
MATERIALS 09/29/2000

DEQ

State of Oregon
Department of Environmental Quality

Environmental Quality Commission

☒ Rule Adoption Item
☐ Action Item
☐ Information Item

Agenda Item G
September 28-29, 2000 Meeting

Title:

Klamath Falls Carbon Monoxide Maintenance Plan

Summary:

Since 1991, carbon monoxide levels in Klamath Falls have remained well below air quality standards making the area eligible for maintenance planning and redesignation to attainment.The department has developed a maintenance plan and technical analysis that demonstrate that Klamath Falls will continue to be in compliance with CO standards through the year 2015. Adoption of this plan by the Commission and subsequent approval by the US Environmental Protection Agency will redesignate Klamath Falls as being in attainment with CO standards.This change in status will allow for the removal of the oxygenated fuel requirements, and it will also allow new or expanding industries to be subjected to less stringent emission control technologies.

Department Recommendation:

It is recommended that the Commission adopt the proposed Klamath Falls CO Maintenance Plan and supporting rule amendments (as presented in Attachment A of the Department Staff Report) as an amendment to the Oregon Clean Air Act State Implementation Plan (SIP).

Report Author | Division Administrator | Director

State of Oregon
Department of Environmental Quality Memorandum

Date: July 28, 2000

To: Environmental Quality Commission

From: Langdon Marsh

Subject: Agenda Item G, Klamath Falls Carbon Monoxide Maintenance Plan, EQC Meeting September 28-29, 2000

Background

On May 12, 2000, the Director authorized the Air Quality Division to proceed to a public hearing on proposed rules that would establish a Carbon Monoxide Maintenance Plan for the City of Klamath Falls.

Pursuant to the authorization, hearing notice was published in the Secretary of State's Bulletin on June 1, 2000. On May 25th, the Hearing Notice and informational materials were mailed to the mailing list of those persons who have asked to be notified of rulemaking actions, and to a mailing list of persons known by the Department to be potentially affected by or interested in the proposed rulemaking action.

A Public Hearing was held Thursday, June 29th with David Collier serving as Presiding Officer. Written comment was received through July 3rd. The Presiding Officer's Report (Attachment C) summarizes the testimony received.

No public testimony or written comment was received regarding the proposed CO maintenance plan. The plan is being submitted to the Environmental Quality Commission as initially proposed to the public.

The following sections summarize the issue that this proposed rulemaking action is intended to address, the authority to address the issue, the process for development of the rulemaking proposal including alternatives considered, a summary of the rulemaking proposal presented for public hearing, a summary of the significant public comments, a summary of how the rule will work and how it is proposed to be implemented, and a recommendation for Commission action.

Accommodations for disabilities are available upon request by contacting the Public Affairs Office at (503) 229-5317 (voice)/(503) 229-6993 (TDD).

<u>Issue this Proposed Rulemaking Action is Intended to Address</u>

A carbon monoxide maintenance plan has been developed for Klamath Falls as required by the Clean Air Act. The plan evaluates expected growth in population, motor vehicle travel, and other factors, and ensures that public health will be protected by keeping CO levels in compliance with federal standards. The CO maintenance plan will allow the Environmental Protection Agency (EPA) to redesignate the Klamath Falls Urban Growth Boundary (UGB) as in attainment with standards and remove the federal requirement for oxygenated fuels. Once redesignated by EPA, the Klamath Falls UGB will become a state maintenance area for carbon monoxide. As a CO maintenance area, new or expanding major industry in Klamath Falls will become subject to less stringent emission control technology requirements. These requirements are outlined in the department's New Source Review program for maintenance areas (OAR 340-224-0060).

In addition to the CO Maintenance Plan, the initial rulemaking proposal (dated April 7, 2000) discussed the department's intent to adopt revisions to the Klamath County Clean Air ordinance as an amendment to the Klamath Falls PM10 Attainment Plan. Subsequent to mailing the draft rulemaking package, the department was informed by the Klamath County Board of Commissioners that they would need additional time to review and evaluate the proposed ordinance changes. The department published notice prior to the hearing that the proposed revisions to the Klamath County Ordinance would not be part of the department's rulemaking proposal and testimony would not be taken on the proposed ordinance revisions. Once the Klamath County Commissioners have completed their review and adoption process, the department will act to incorporate the revised ordinance into the state and EPA approved PM10 plan.

<u>Relationship to Federal and Adjacent State Rules</u>

An EPA approved maintenance plan is required under the federal Clean Air Act in order to ensure continued protection of public health, and to change the legal status of Klamath Falls from nonattainment to attainment (i.e. in compliance with standards) for CO. Redesignation to attainment will also allow the department to discontinue the oxygenated fuels program in Klamath Falls. The Klamath Falls CO Maintenance Plan is being adopted as an amendment to the Oregon Clean Air Act State Implementation Plan (SIP). This action does not affect adjacent states.

Authority to Address the Issue

The following authority was relied on in developing the CO Maintenance Plan.

Clean Air Act as amended in 1990, Section 186.
Clean Air Act as amended in 1990, Section 211.
Clean Air Act as amended in 1990, Part D, subparts 1 and 3.
General state authority to develop air quality plans: ORS 468.015, 468.035, 468A.035, 468A.085
OAR's 340-200-0040; 200-0030; 200-0040; 200-0090

Process for Development of the Rulemaking Proposal (including Advisory Committee and alternatives considered)

A committee of local stakeholders has advised the department throughout the development of the CO maintenance plan. The committee actively participated in the plan development process and considered several options and alternatives for ensuring continued compliance with CO standards. The proposed plan reflects the final recommendations of the advisory committee.

Summary of Rulemaking Proposal Presented for Public Hearing and Discussion of Significant Issues Involved.

Monitoring for carbon monoxide (CO) began in Klamath Falls in 1988. Violations of the 8-hour average CO standard were measured in both 1988 and 1989, and the Klamath Falls area was redesignated to nonattainment under the 1990 Clean Air Act amendments. The Act required that an oxygenated fuels program be adopted for the wintertime CO season and the program was implemented in Klamath Falls in October of 1992. Oxygenated fuels was initially needed to bring the area into compliance with CO standards, and the on-going transition to cleaner vehicles has helped maintained compliance over the past eight years. The last exceedance of CO standards occurred in 1991. Since then, CO levels in Klamath Falls have remained well below standards, making the area eligible for maintenance planning and redesignation to attainment.

The department has developed a technical analysis and maintenance plan that demonstrates continued compliance with (CO) standards in Klamath Falls through the year 2015, without the need for oxygenated fuels. EPA approval of this plan will allow the Klamath Falls Urban Growth Boundary (UGB) to be redesignated as in attainment with standards, and will allow removal of the oxygenated fuels requirement.

Eliminating the oxygenated fuel requirement will affect the general public as well as gasoline retailers and suppliers. Eliminating oxygenated fuel in Klamath Falls will result in a slight cost savings (about one to two cents per gallon) to gasoline distributors that supply oxygenate to retailers. Klamath Falls area gasoline retailers should also see a small cost savings, and will no longer have to maintain records of oxygenated fuel shipments received. Retailers and distributors will no longer have to switch between selling oxygenated fuel during the winter months and traditional fuels during the remainder of the year.

The general public may see the cost savings reflected at the pump. The public may also experience improved vehicle operation without oxygenated fuel. (Some owners of older vehicles have reported problems of reduced gas mileage or vehicle performance with the use of oxygenated fuels). Ethanol suppliers (ethanol being the preferred oxygenate used in Oregon) may experience a small economic loss when oxygenated fuels are discontinued in Klamath Falls.

The plan also establishes a "budget" for motor vehicle emissions to be used in the transportation conformity process. This will affect the Oregon Department of Transportation (ODOT) and other local transportation planning agencies. Under the state conformity program ODOT has primary responsibility to ensure consistency between transportation and air quality plans for Klamath Falls. ODOT will use the emissions budget established in this plan in making conformity determinations for all future regionally significant transportation plans, programs, and projects.

Redesignation of Klamath Falls to a carbon monoxide maintenance area will result in relaxed emission control requirements for new or expanding major industry. As a CO nonattainment area, new or expanding major industry is subject to the most stringent requirements including Lowest Achievable Emission Rate (LAER) control technology and emission offsets. LAER technology draws from the most effective emission control methods achieved at similar facilities nationwide, and does not consider cost as a factor in determining whether an emission control approach is feasible. Once redesignated, the LAER requirement will be replaced by Best Available Control Technology (BACT). Unlike LAER, BACT does allow cost to be considered in evaluating the feasibility of emission controls. Sources must still provide an analysis demonstrating that the proposed emissions increase will have no significant impact on the maintenance area. Maintenance Area New Source Review (NSR) requirements will make it easier for new industry to locate in the Klamath Falls area or for existing industry to expand.

The maintenance plan also contains a tiered contingency plan to prevent or quickly correct any significant deterioration in air quality. The contingency plan establishes an early warning action level based on monitored CO values. If CO levels are measured above 90% of standards, Phase 1 of the contingency plan requires that growth and other planning assumptions be reviewed with local stakeholders to determine if additional action is needed to prevent a violation. Should a violation occur, Phase 2 of the contingency plan requires that nonattainment New Source Review

requirements and the oxygenated fuels program be automatically reinstated until the department and local advisory committee revise the plan to bring the area into compliance.
Summary: Key features of the plan include:

- Technical analysis and demonstration that compliance with CO standards will be maintained through at least the year 2015 without the need for oxygenated fuels.
- Establishes a motor vehicle emissions budget for transportation conformity purposes within the Klamath Falls Urban Growth Boundary.
- Eliminates the oxygenated fuel requirement for Klamath Falls.
- Establishes a tiered contingency plan that will respond to unanticipated conditions and prevent or quickly correct any significant deterioration in air quality.

Summary of Significant Public Comment and Changes Proposed in Response

No public testimony or written comment was received. The CO maintenance plan is being submitted to the Commission as initially proposed to the public.

Summary of How the Proposed Rule Will Work and How it Will be Implemented

The oxygenated fuel requirement can not be eliminated until the Environmental Protection Agency formally approves the CO maintenance plan. Once approved, the change in oxygenated fuel requirements will be implemented through the DEQ office in Medford. Affected gasoline suppliers will also be notified. We anticipate that the earliest the oxygenated fuels program could be removed from Klamath Falls is the winter of 2001/2002.

Recommendation for Commission Action

It is recommended that the Commission adopt the proposed Klamath Falls CO Maintenance Plan and supporting rule amendments (as presented in Attachment A of the Department Staff Report) as an amendment to the Oregon Clean Air Act State Implementation Plan (SIP).

Attachments

A. Rule (Amendments) Proposed for Adoption
   1. Klamath Falls CO Maintenance Plan
   2. Supporting Rule Amendments
   3. Klamath Falls CO Emissions Inventory and Emissions Forecast

B. Supporting Procedural Documentation:
   1. Legal Notice of Hearing
   2. Fiscal and Economic Impact Statement
   3. Land Use Evaluation Statement
   4. Questions to be Answered to Reveal Potential Justification for Differing from Federal Requirements
   5. Cover Memorandum from Public Notice

C. Presiding Officer's Report on Public Hearing

D. Advisory Committee Membership

Reference Documents (available upon request)

Advisory Committee briefing materials.
EPA guidance for the development of carbon monoxide maintenance plans.

Approved:

Section: [signature]

Division: [signature]

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Date Prepared: July 28, 2000

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Attachment A-1

State Implementation Plan Revision
For Carbon Monoxide in the
Klamath Falls Urban Growth Boundary

A Plan For Maintaining
National Ambient Air Quality Standards
For Carbon Monoxide

DEQ
State of Oregon
Department of Environmental Quality

State of Oregon
Department of Environmental Quality
Air Quality Division
811 SW 6th Ave.
Portland, Oregon 97204

STATE IMPLEMENTATION PLAN REVISION
FOR CARBON MONOXIDE IN THE KLAMATH FALLS URBAN GROWTH BOUNDARY

A Plan For Maintaining National Ambient Air Quality Standards For Carbon Monoxide

Klamath Falls Urban Growth Boundary

August 21, 2000

State of Oregon
Department of Environmental Quality
Air Quality Division
811 SW Sixth Ave.
Portland, Oregon 97204-1390

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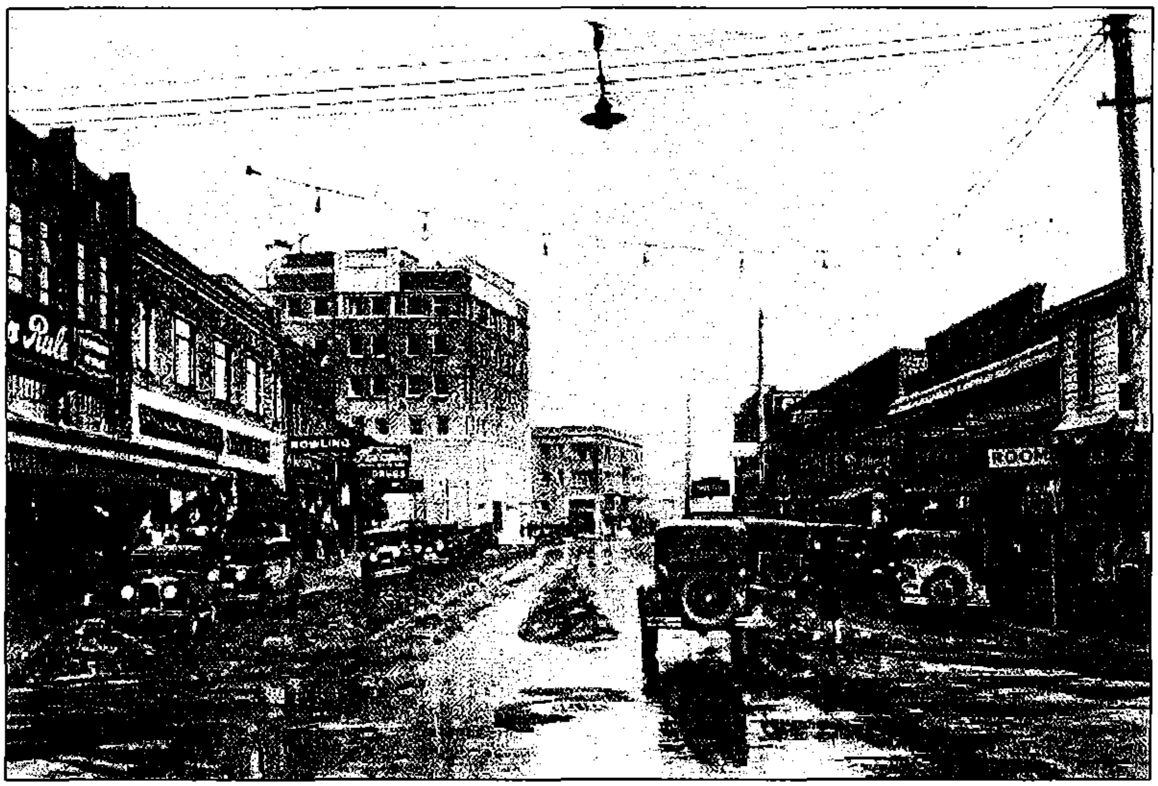
4.54.0 ACKNOWLEDGMENT AND SUMMARY



Klamath Falls 8th and Main Street, 1928

4.54.0.1 Acknowledgments

Without the efforts of numerous individuals in state and local governments and private entities who are dedicated to healthy air, this supplement to the Oregon State Implementation Plan would not have been possible. Special appreciation goes to:

- Klamath Falls Air Quality Plan Advisory Committee: Leisa Cook, Chair;
- Cameron Gloss, City of Klamath Falls.
- Klamath County.

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Special thanks to Patsy McMillan, Director of the Klamath County Museum for the photo of uncongested traffic in Klamath Falls c. 1928.

4.54.0.2 Executive Summary: The Klamath Falls Carbon Monoxide Maintenance Plan

The Klamath Falls Carbon Monoxide Nonattainment Area is defined by the Klamath Falls Urban Growth Boundary (UGB). The area has complied with National Ambient Air Quality Standards (NAAQS) for carbon monoxide since 1991. By submitting this maintenance plan and redesignation request, the department is asking the Environmental Protection Agency (EPA) to redesignate the Klamath Falls UGB as in attainment with standards. Once redesignated by EPA, the Klamath Falls UGB will become a state maintenance area for carbon monoxide. EPA requires maintenance plans to demonstrate continued compliance for at least ten years following EPA approval. This maintenance plan demonstrates continued compliance with standards through the year 2015. This Redesignation Request/Maintenance Plan has been adopted by the Oregon Environmental Quality Commission (EQC) and submitted to EPA as an amendment to the State Implementation Plan (SIP).

The maintenance plan accounts for future growth and provides for the protection of public health. The plan will remove the oxygenated fuel requirement in Klamath Falls and will establish a CO emissions allocation (budget) for the future transportation system. Finally, the plan will remove the most stringent industrial emission control requirements for new or expanding major industry in nonattainment areas, replacing them with somewhat less stringent maintenance area requirements.

4.54.0.2.1 Background

What is Carbon Monoxide?

Carbon monoxide (CO) is a colorless, odorless, poisonous gas. It decreases the oxygen carrying capacity of the blood. High concentrations can severely impair the function of oxygen-dependent tissues, including the brain, heart and muscle. Prolonged exposure to even low levels of CO can aggravate existing conditions in people with heart disease or circulatory disorders. Motor vehicles are the predominate source of CO in Oregon, but other contributing sources include wood stoves, and major industry.

EPA has established health based National Ambient Air Quality Standards (NAAQS) for carbon monoxide at 35 parts per million (ppm) 1-hour average and 9 ppm maximum 8-hour average. Any CO value monitored above these levels is considered an exceedance[1]. Two exceedances within one calendar year are considered a violation. If an area is in violation of the standard, EPA designates it as a nonattainment area. Experience has demonstrated that the 8-hour average is the more likely of the two standards to be exceeded.

[1] Fractional values below 9.5 ppm round down to 9 ppm or less and are considered in compliance.

Past CO Problem and Current Attainment of Standards

The Klamath Falls area exceeded the federal 8-hour CO standard of 9 parts per million beginning in the late 1980s. The highest maximum 8-hour average CO value of 10.7 ppm was recorded on January 18, 1989. In that year, the 8-hour CO standard was exceeded on six days. The 1-hour average carbon monoxide standard has never been exceeded in Klamath Falls. The last violation of the standard (two consecutive years in which the second high CO concentration is above the standard) occurred in 1989. The period 1989-90 was a transitional period with the second high CO value in 1989 above the standard and the second high in 1990 below the standard. Compliance with standards was achieved in 1991 when second high CO concentrations in two consecutive years (1990 and 1991) fell below the standard. Since 1991, peak CO values have been significantly below the CO standards. The ten-year trend in ambient CO concentrations as measured at the reference monitor (6th & Hope Streets) is shown below in Figures 4.54.0-1, and 4.54.0-2.

Figure 4.54.0-1: Klamath Falls CO Trend
Max 8-Hr and 2nd High 8-Hr Avg., 1988-98

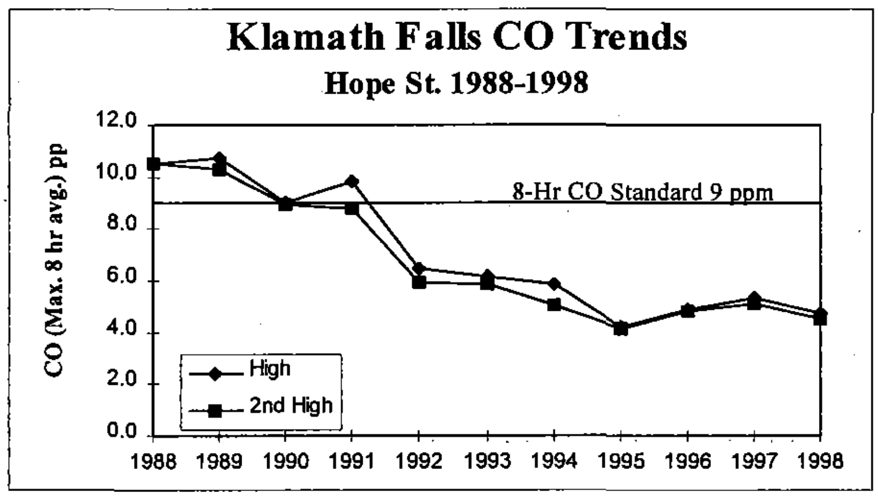
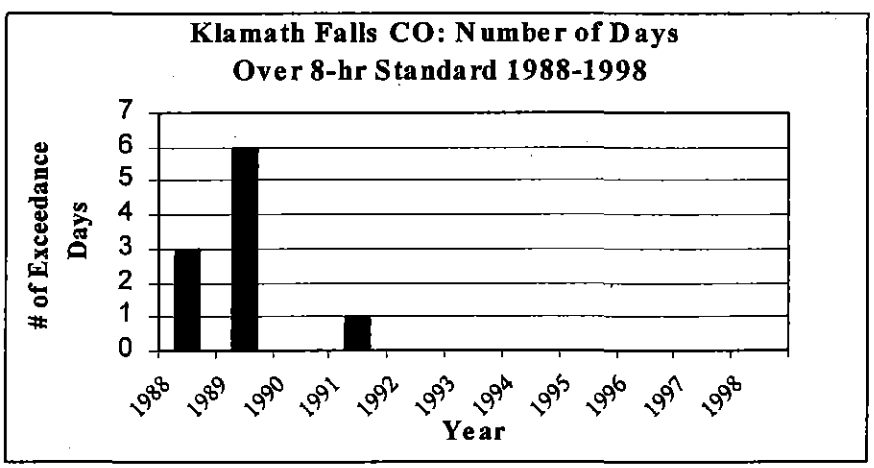


Figure 4.54.0-2: Number of Days Over Standards 1988-98



Success in Reducing CO

Carbon monoxide control strategies have been successful in bringing Klamath Falls into attainment with the 8-hour CO standard. Compliance with CO standards was achieved at the Hope Street site by 1991 when second high CO values were measured at levels below the standard for two consecutive years. CO values have remained well below standards ever since. Emission reduction strategies primarily responsible for compliance include:

- Federal new car emission standards, in place at the time of compliance; and
- The wintertime use of oxygenated fuel for motor vehicles. Implementation of the federally required oxygenated fuel program began in the fall of 1992, and assured continued compliance with standards through the 1990's.

4.54.0.2.2 Need for Maintenance Plan

The Klamath Falls carbon monoxide maintenance plan is designed to insure continued compliance with carbon monoxide standards through at least 2015. Projection of future carbon monoxide emissions considered growth in all source categories as well as technological changes affecting carbon monoxide emissions. An EPA-approved CO maintenance plan and redesignation to attainment provide:

- Assurance that public health will be protected from adverse impacts of CO;

- Assurance that regulatory limits, expectations, and conditions will be known for at least the next ten years;

- The ability to discontinue the oxygenated fuels program.

Projections of Future CO Levels

Future growth in Klamath Falls is expected to be moderate over the next twenty years. Forecasts for future population, housing, and employment were developed by the City of Klamath Falls, in consultation with Klamath County, the Oregon Department of Transportation, and the Klamath Falls Air Quality Advisory Committee. Growth estimates are also consistent with forecasts developed by the Oregon Office of Economic Analysis. The Klamath Falls UGB was estimated to have a population of 40,365 in 1996. Based on the long-range forecast, the Klamath Falls UGB population is expected to grow to approximately 50,219 by 2015 (1.2 percent per year compounded average growth). Population, housing and employment forecasts were used in the Oregon Department of Transportation's latest travel demand model to predict growth in motor vehicle travel in the Klamath Falls area. More detail on emission estimates by source category is provided in the maintenance plan (Section 4.54.3) and in Appendix D5-4. Growth rates used to forecast future CO emissions are shown in Table 4.54.0-1

Table 4.54.0-1: Annual Average Growth Rates (1996-2015)
Klamath Falls Urban Growth Boundary

Population Growth	1.2%/yr
Household Growth	1.1%/yr
Avg. Non-Industrial Employment	0.7%/yr
Industrial Employment	1.3%/yr
Vehicle Miles Traveled	1.8%/yr

Estimated as a compound rate

The maintenance plan takes growth and other factors into account in evaluating the effect of future carbon monoxide emissions on air quality in the Klamath Falls UGB. One goal of the maintenance plan is to maintain future year emissions at or below the 1996 attainment emission level. In establishing the 1996 attainment benchmark, it was agreed with EPA that the 1996 emission level could be portrayed without the effect of oxygenated fuels. This is based on the fact that design value (1996) ambient CO concentrations are significantly below standards, and that 2nd high CO values came into compliance with standards prior to implementation of the oxygenated fuels program. This adjusted attainment level provides a more equitable maintenance benchmark for the Klamath Falls airshed. Results of the maintenance analysis for Klamath Falls shows that future year emissions through 2015 will remain below attainment levels, even without the oxygenated fuels program. The maintenance analysis demonstrates that the oxygenated fuels program can be discontinued while ensuring continued compliance with standards. Figure 4.52.0-3 shows the 1996 attainment benchmark level and projected emissions through 2015 (without oxygenated fuels). Figure 4.52.0-4 shows the results of an additional analysis of 1996 and expected 2015 ambient CO concentrations at the 6th & Hope St. monitor. This analysis also demonstrates continued compliance with standards.

Figure 4.52.0-3: Klamath Falls CO Maintenance Analysis

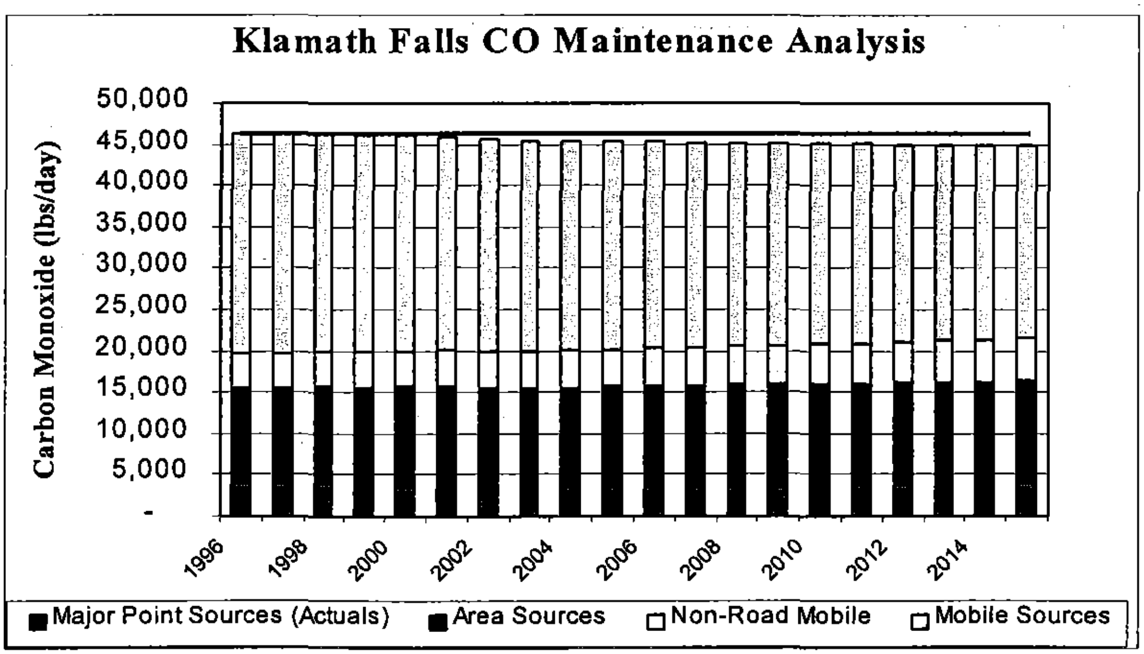
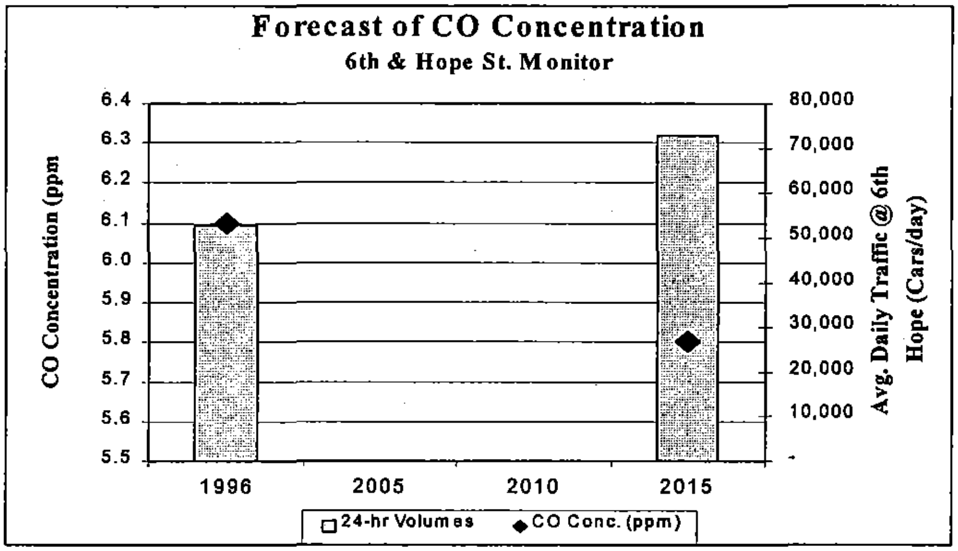


Figure 4.52.0-4: Estimation of Future CO Concentrations at 6th & Hope St. Monitor



4.54.0.2.3 Maintenance Plan Development Process

In developing the maintenance plan DEQ relied on the involvement of the Klamath Falls Air Quality Plan Advisory Committee and the Oregon Department of Transportation (ODOT). Motor vehicle travel data from the latest ODOT travel demand model reflects roadway projects and programs outlined in the 1995 Klamath Falls Urban Area Transportation Systems Plan (TSP).

The Klamath Falls Air Quality Plan Advisory Committee recommended the following key provisions as part of the CO Maintenance Plan:

- Discontinue the wintertime oxygenated fuel program.
- Adopt a contingency plan that will both prevent and correct any future violation of standards.

4.54.0.2.4: Maintenance Plan Summary: Strategies, Conformity, and Contingency Plan

Federal New Car Program

Federal standards for exhaust (tailpipe) emissions have been and will continue to be the most effective CO emission reduction strategy. A 12 percent reduction in average motor vehicle fleet emissions is expected between 1996 and 2015 due to the federal exhaust emission standards and the changeover to newer cars. It is also expected that future national strategies such as low sulfur fuels will reduce CO emissions even further.

Oxygenated Fuels

The Clean Air Act Amendments of 1990 required the Department to implement an oxygenated fuel program for the Klamath Falls area. The program was implemented in the fall of 1992. Gasoline suppliers distributing fuel in Klamath Falls are required to provide gasoline with a minimum oxygen content by weight of 2.7 percent from November 1st through the end of February.

The oxygenated fuels program will be discontinued in Klamath Falls upon EPA approval of this maintenance plan. The maintenance demonstration shows that the Klamath Falls Urban Growth Boundary will continue to comply with the carbon monoxide health standard through 2015 without oxygenated fuel, while maintaining a comfortable safety margin. The oxygenated fuel program is being retained as a contingency strategy, and will be reinstated in the event CO standards are violated in the future.

Woodstove Curtailment

Woodstove emission control efforts in the Klamath Basin have made significant strides in reducing particulate emissions through emission certification standards for new stoves, changeout programs to encourage removal of noncertified stoves and local ordinances to curtail burning during stagnant weather periods. Residential woodheating also contributes to background levels of CO in the UGB. The continued attrition of older woodstoves coupled with a general trend away from significant woodheating will limit overall woodstove emission growth.

Transportation Conformity: CO Emissions Budget

The transportation conformity process, required by the 1990 Federal Clean Air Act Amendments, is designed to ensure consistency between transportation and air quality plans in nonattainment and maintenance areas. Conformity requires that emissions allocated to the transportation sector be formally identified in the State Implementation Plan (SIP). This allocation establishes an "emission budget" within the air quality plan for use in the transportation conformity process. The Department of Transportation (ODOT) must periodically forecast motor vehicle emissions as part of updating the long-range transportation plan for the Klamath Falls area. Under the conformity requirements, future motor vehicle emissions resulting from significant transportation projects and programs must remain within the emissions allocation (budget) established in this maintenance plan. Exceeding the emission budget jeopardizes funding for the proposed projects. The carbon monoxide motor vehicle emissions budget for Klamath Falls is described in Section 4.54.3.2.2 of the Maintenance Plan.

Contingency Plan Elements

The maintenance plan must contain contingency measures that would be implemented either to prevent or correct a violation of the CO standard after the area has been redesignated to attainment. The Clean Air Act requires that measures in the original attainment plan be reinstated if a violation occurs. The strategy adopted by the Klamath Falls air quality committee involves a tiered contingency plan to both prevent and quickly correct any significant deterioration in air quality. The contingency plan establishes an early warning action level based on monitored CO values. If CO levels are measured above 90% of standards, Phase 1 of the contingency plan requires that growth and other planning assumptions be reviewed with local stakeholders to determine if additional action is needed to prevent a violation. Should a violation occur, Phase 2 of the contingency plan requires that the most stringent requirements for new or expanding major industry, and the oxygenated fuels program, be automatically reinstated until the department and local advisory committee revise the plan to bring the area into compliance. The Klamath Falls CO Contingency Plan is described in Section 4.54.3.3 of the Maintenance Plan.

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4.54.1 INTRODUCTION

4.54.1.1 Purpose of Redesignation Request and Maintenance Plan Document

This document incorporates a redesignation request and maintenance plan to ensure continued compliance with National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO) in the Klamath Falls Carbon Monoxide Nonattainment Area (i.e. Urban Growth Boundary). The Klamath Falls CO Maintenance Plan complies with applicable 1990 Federal Clean Air Act (CAA) requirements and Environmental Protection Agency (EPA) guidance and policies.

The maintenance plan demonstrates continued compliance with CO standards through at least the year 2015 without the need for an oxygenated fuels program. For Klamath Falls, this demonstration also allows the department to remove the most stringent emission control technology and air quality analysis requirements applicable to new or expanding major industry in nonattainment areas. These requirements will be replaced by maintenance area requirements for emission control technology and air quality analysis.

4.54.1.2 Klamath Falls Area Description

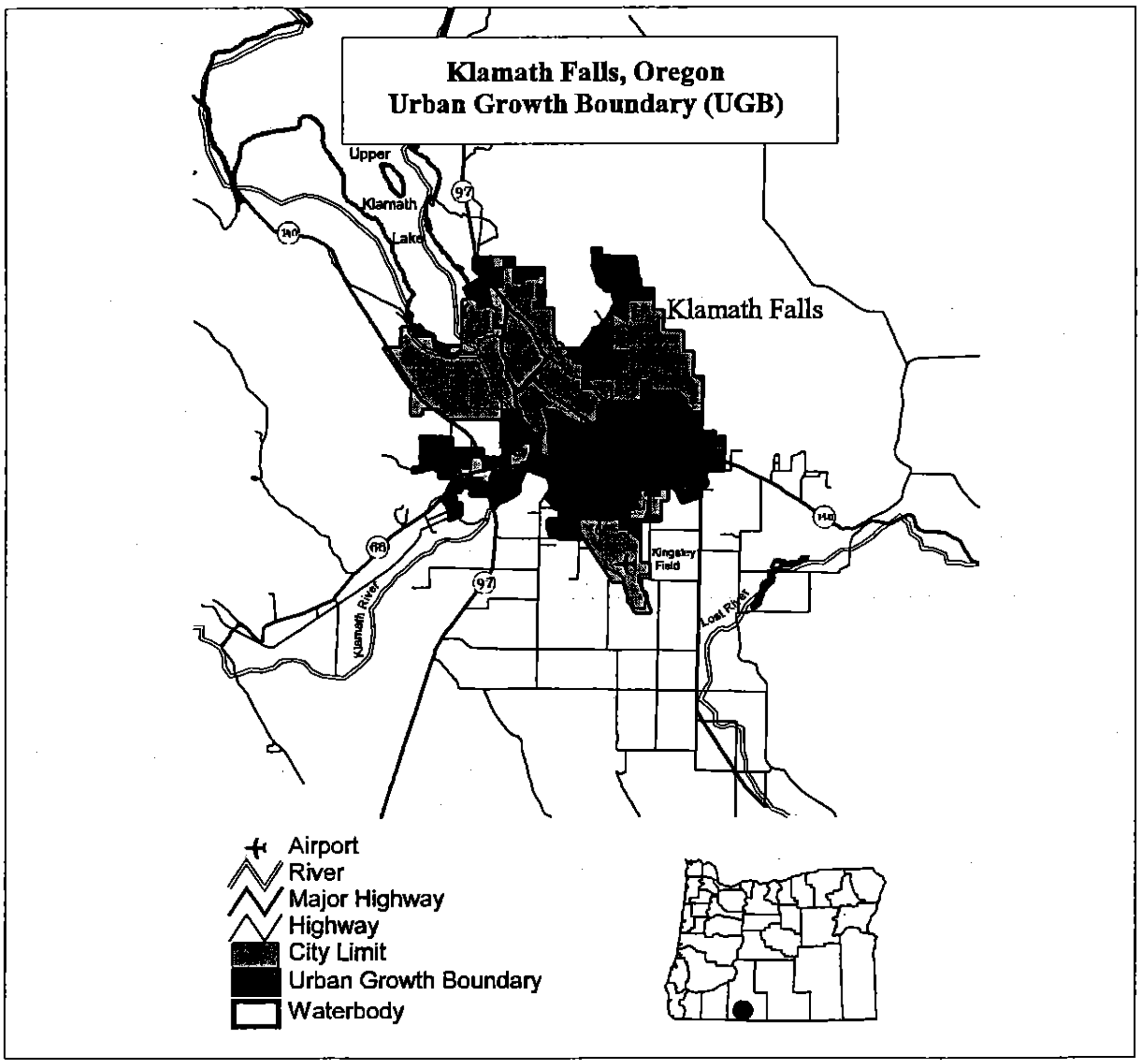
Klamath Falls is located in south central Oregon at an elevation of 4,105 feet. The area is typified by semi-arid, high desert climate where annual rainfall is only 14.3 inches. The Klamath Falls UGB was estimated to have a population of 40,365 in 1996. Based on the long-range forecast, the Klamath Falls UGB population is expected to grow to approximately 50,219 by 2015 (1.2 percent per year compounded average growth). The city of Klamath Falls serves as an important commercial center for south central Oregon.

The Klamath Basin is a relatively flat area of some several thousand square miles of old lake bed that is drained by the Klamath River. Upper Klamath Lake covers 132 square miles and has a surface elevation of 4,140 feet above sea level. The Lower Klamath Lake area is a very large, flat, somewhat marshy region with an elevation of about 4,100 feet above sea level. The region is punctuated by occasional hills and a system of elongated ridges rising up to 2,000 feet above the valley floor.

The central business district of Klamath Falls is situated at the southern end of Upper Klamath Lake where the elevation changes between the Upper and Lower Klamath Lake areas. Most of the Klamath Falls residential area, especially the south suburban area, is located on the lower elevation area. Thus the Klamath Falls area is confined by high terrain to the east and west. To the north is the large expanse of Upper Klamath Lake and flat terrain also stretches for a number of miles to the south.

Because of its elevation, dry climate and low frequency of cloud cover, Klamath Falls can experience very strong and shallow nighttime inversions that break up with daytime solar heating. In the wintertime, frigid arctic air masses frequently invade the Klamath Basin. Temperatures can remain well below freezing for several weeks at a time. Upper Klamath Lake often freezes over and 6 to 10 inches or more of snow may cover the ground. Winter nights are commonly clear and cool in the Klamath basin. Under these conditions, strong nighttime inversions occur over the south suburban area of Klamath Falls. These inversions are confined and maintained by the surrounding terrain. Inversions of as much as 10° F have been observed within 60 feet of the surface.

Figure 4.54.1-1 Klamath Falls Carbon Monoxide Nonattainment Area



4.54.1.3 History of CO Problem in Klamath Falls Area

Klamath Falls was designated under the 1990 Clean Air Act amendments as a nonattainment area for carbon monoxide. The Klamath Falls Carbon Monoxide Nonattainment Area is defined as the Urban Growth Boundary (UGB), an area encompassing both the City of Klamath Falls and parts of Klamath County (see Figure 4.54-1).

Carbon monoxide concentrations have been measured at the same location in the Klamath Falls UGB (S. Sixth & Hope St. site) since 1988. The last violation of the maximum 8-hour average CO standard occurred in 1989 with measured high and second high values above the 9-ppm standard (10.9 ppm on 01/19/89 and 10.3 ppm on 12/23/89). Only one exceedance has occurred since 1989 (January 5, 1991 with a high maximum 8-hr avg. value of 9.8 ppm). Klamath Falls has not had an exceedance of the 35-ppm 1-hour avg. carbon monoxide standard. Compliance with the maximum 8-hour average CO standard was attained in 1991 when the second highest CO value of 8.8 ppm resulted in two consecutive years (1990 and 1991) of second high CO values below the standard. Since 1991, maximum CO values have been significantly below the standard.

A formal carbon monoxide attainment plan was not developed for the Klamath Falls UGB prior to reauthorization of the Clean Air Act in 1990. On November 15, 1990 EPA designated the Klamath Falls UGB as a moderate nonattainment area for carbon monoxide based on 1988-89 CO levels. Since the initial nonattainment design concentration of 10.5 ppm was less than 12.7 ppm, no formal attainment plan or attainment demonstration was required[1]. However, the Act does require the implementation of an oxygenated fuel program in areas such as Klamath Falls with CO design values equal to or greater than 9.5 ppm. The department adopted a wintertime oxygenated fuels program for Klamath Falls on October 16, 1992. The oxygenated fuels program was submitted to EPA as an amendment to the State of Oregon Clean Air Act Implementation Plan (SIP) in order to meet the 1990 CAAA requirements. Attainment of the CO standard also relied on the Federal Motor Vehicle Control Program.

The oxygenated fuels program and continual change over to cleaner cars have proven effective in reducing carbon monoxide emissions, and Klamath Falls has remained in compliance with CO standards since 1991. Based on this compliance, Klamath Falls may apply for redesignation to attainment in accordance with the 1990 Clean Air Act amendments. This document is part of the formal procedure to redesignate the area as in attainment with standards. Upon redesignation by EPA, Klamath Falls will become a carbon monoxide maintenance area.

[1] The Clean Air Act set 12.7 ppm as a threshold for attainment plan submittals. Areas with design values less than 12.7 were not required to submit a formal attainment plan, but were required to adopt certain mandatory programs such as oxygenated fuels.

4.54.1.4 National Ambient Air Quality Standards for Carbon Monoxide

This Maintenance Plan addresses the ambient air quality standards for carbon monoxide as defined in the federal Clean Air Act.

Carbon monoxide is a colorless, odorless gas that replaces the oxygen in the body's red blood cells through normal respiration. Exposure to high levels of CO can slow reflexes, cause confusion and drowsiness, and in high enough doses and/or long exposure can result in death. People with heart disease are more susceptible to develop chest pains when exposed to high levels of CO. The major human-caused source of CO is incomplete combustion of carbon-based fuels. The primary source of CO is gasoline-powered motor vehicles. How a motor vehicle is operated and maintained has an effect on the amount of CO emitted. For example, in stop-and-go driving conditions, CO emissions are increased. Other important sources are woodstoves, open burning and fuel combustion in industrial and utility boilers. Most serious CO problems occur during the winter in urban areas when cooler temperatures encourage incomplete combustion and the resulting CO emissions are trapped near the ground by atmospheric inversions.

EPA has established National Ambient Air Quality Standards (NAAQS) for carbon monoxide at 35 parts per million (ppm) (1-hour average) and 9 ppm (maximum 8-hour average). Any CO value monitored above these levels, as defined by federal rules and guidance, is considered an exceedance. Two exceedances within one calendar year are considered a violation. If an area is in violation of the standard, EPA designates it as a nonattainment area, and requires that emission reduction strategies be developed to correct the violation. Experience has demonstrated that the 8-hour average is the more likely of the two standards to be exceeded.

The formal statement of the national 8-hour standard is contained in the Code of Federal Regulations (40 CFR part 50.8), which states:

> *The national primary ambient air quality standards for carbon monoxide are: (1) 9 parts per million (10 milligrams per cubic meter) for an 8-hour average concentration not to be exceeded more than once per year...*

40 CFR part 50.8 also contains reference methods for measuring CO concentrations in ambient air, procedures for averaging data to determine 8-hour concentrations, and requirements regarding presentation of data. In addition, EPA has also issued guidance specifying that two complete consecutive years of quality-assured ambient monitoring data with no violations of the NAAQS must be collected before an area can be considered to have attained the standard.

40 CFR part 50.8 defines how ambient air quality monitoring data are to be compared to the applicable NAAQS. It states that all monitoring data should be expressed to one decimal place, and indicates that standards defined in parts per million should be compared "in terms of integers with fractional parts of 0.5 or greater rounding." This led to an interpretation by EPA that any 8-hour CO concentration of less than 9.5 ppm would be equivalent to attainment. This rounding

convention is therefore used for CO monitoring data in this Maintenance Plan to demonstrate compliance with the CO NAAQS.

4.54.1.5 Redesignation Criteria/Organization of Document

Section 107(d)(3)(E) and related subsections of the Clean Air Act establish five key criteria that must be satisfied in order for a nonattainment area to be redesignated to attainment status:

- Attainment of NAAQS for CO: minimum 2 calendar years.
- Full approval of the State Implementation Plan (SIP) revision (i.e. Air Quality Plan) under section 110(k)[2].
- Demonstration that air quality improvement is due to permanent and enforceable reductions (see section 4.54.2.4).
- Full approval of a Maintenance Plan under section 175A.
- Fulfillment of all applicable Section 110 and Part D requirements[3]

Presented below is a summary of these redesignation criteria and a reference to the discussion of each criterion in this document.

Attainment Verification

The nonattainment area seeking redesignation must have attained the applicable NAAQS. Attainment of the NAAQS for CO in the Klamath Falls area is discussed in Section 4.54.2, "Attainment Demonstration."

SIP Approval

EPA designated the Klamath Falls UGB as a moderate nonattainment area for carbon monoxide by operation of law based on 1988-89 CO levels on November 15, 1990. Since the initial design concentration in Klamath Falls was less than 12.7 ppm (10.5 ppm in 1988), no formal attainment plan or attainment demonstration was required. The department did adopt a wintertime oxygenated fuels program for Klamath Falls as required by the Act, and has also relied on the federal Motor Vehicle Control Program to reduce CO emissions. The oxygenated fuels program was submitted to EPA in 1992 as an amendment to the State of Oregon Clean Air Act Implementation Plan (SIP) in order to meet the 1990 CAAA requirements.

The 1990 amendments to the Clean Air Act also required carbon monoxide nonattainment areas to submit plan revisions in the following areas: 1) 1990 Emission Inventory; 2) Vehicle

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[2] Section 110(k) requires that the State satisfy all FCAA requirements applying to a specific nonattainment area in order to be redesignated.

[3] Section 110 contains general provisions needed in a SIP.

Inspection Program changes, if applicable; 3) Transportation Conformity Requirements; 4) New Source Review Rules for major sources; and 5) Contingency Plan.

The administrative rules for the oxygenated fuel program were submitted in October 1992. The draft 1990 emission inventory was submitted to EPA in 1992. The 1990 inventory was not finalized, but instead EPA agreed that their comments on the 1990 draft would be incorporated into development of the 1996 inventory. The 1996 inventory is included as Appendix D5-4 of this plan. The Klamath Falls area does not have a vehicle inspection requirement.

DEQ submitted New Source Review Rule revisions to EPA in 1992, and transportation conformity rules in 1995. These SIP revisions and compliance with Section 110(k) of the FCAA, are discussed in Section 4.54.4.1, "SIP Requirements/Nonattainment Area Requirements."

Permanent and Enforceable Improvements in Air Quality

Improvement in air quality must be due to permanent and enforceable reductions in emissions resulting from the implementation of the applicable SIP, federal air pollution control regulations, and other permanent and enforceable reductions. Fulfilling the requirement for permanent and enforceable emission reductions is discussed in Section 4.54.2.4, "Permanent and Enforceable Improvements in Air Quality."

Nonattainment Area Requirements

The State must have met all requirements applicable to the nonattainment area under Section 110 and Part D of the Clean Air Act. Compliance with Section 110 and Part D of the Act is discussed in Section 4.54.4.1, "SIP Requirements/Nonattainment Area Requirements."

Maintenance Plan Elements

EPA must have fully approved a maintenance plan for the area meeting the requirements of Section 175A of the Clean Air Act. Concurrent approval of the maintenance plan and redesignation request is expected. There are essentially five parts to a Maintenance Plan which are as follows: an attainment inventory, a maintenance demonstration, a commitment to the continuation of operating the monitoring network, a commitment to continue to verify attainment, and a contingency plan. These sections are outlined below in Table 4.54.1.1 along with the rest of the redesignation requirements.

Table 4.54.1-1: Summary of Redesignation Requirements

Required Element	Section of Plan	
Attainment Verification	Section 4.54.2:	ATTAINMENT DEMONSTRATION
SIP Approval	Section 4.54.4:	ADMINISTRATIVE REQUIREMENTS
Permanent and Enforceable Improvements in Air Quality	Section 4.54.2:	ATTAINMENT DEMONSTRATION
Nonattainment Area Requirements	Section 4.54.4:	ADMINISTRATIVE REQUIREMENTS

Maintenance Plan Elements		
Attainment Inventory	Section 4.54.3:	MAINTENANCE PLAN
Maintenance Demonstration	Section 4.54.3:	MAINTENANCE PLAN
Monitoring Network	Section 4.54.4:	ADMINISTRATIVE REQUIREMENTS
Verification of Continued Attainment	Section 4.54.4:	ADMINISTRATIVE REQUIREMENTS
Contingency Plan	Section 4.54.3:	MAINTENANCE PLAN

4.54.2 ATTAINMENT DEMONSTRATION

4.54.2.1 Ambient Air Quality Monitoring Data

The Klamath Falls area has one carbon monoxide monitoring site (see Appendix[1] D5-2) located at 2300 Hope Street, near the intersection with State Route 39 (Hwy. 140). This monitoring site, which has been in use since 1988, is operated 6 months a year (October – March) during the period of highest CO concentrations. During the CO season, the monitor runs continuously with hourly and maximum 8-hour averages derived electronically via data loggers. After rigorous quality assurance, the data is transferred into the Aerometric Information Retrieval System (AIRS) which provides EPA with DEQ's air quality monitoring data. These data are used as the basis for this maintenance plan.

4.54.2.2 Attainment Years and Concentrations, Air Quality Summary

Klamath Falls has been in compliance with CO standards for nine consecutive calendar years. The last wintertime exceedance of the CO NAAQS in Klamath Falls occurred on January 4, 1991 (9.8 ppm). The highest and 2nd highest maximum 8-hour average CO concentrations for the eight-year period (1990 to 1998) are shown in Table 4.54.2-1. CO values in 1988 and 1989 represent the last violations recorded at Hope Street:

Year	2nd High Max. 8-hour Value
1988	10.5 ppm (Violation)
1989	10.3 ppm (Violation)
1990	8.9 ppm
1991	8.8 ppm (Attainment, second consecutive year < 9ppm)

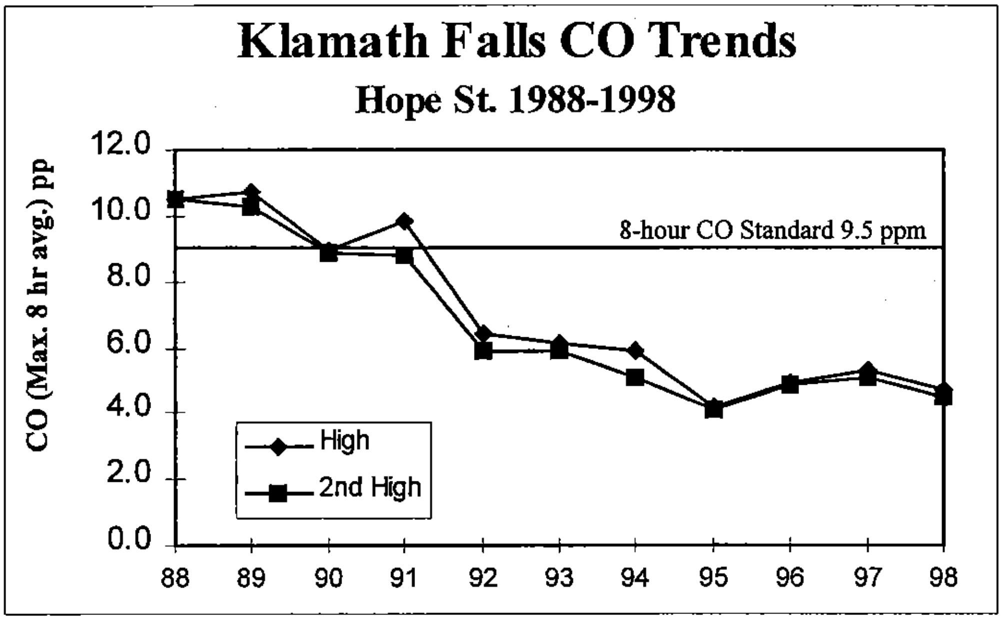
Table 4.54.2-1
Klamath Falls Carbon Monoxide Concentrations
Yearly Values (High and 2nd High) Since 1990

Concentration Highest Yearly	Date		Concentration 2nd Highest	Date
9.0 ppm	November 17, 1990		8.9 ppm	November 29, 1990
9.8 ppm	January 4, 1991		8.8 ppm	December 23, 1991
6.4 ppm	December 18, 1992		5.9 ppm	November 14, 1992
6.1 ppm	December 20, 1993		5.9 ppm	November 19, 1993
5.9 ppm	January 14, 1994		5.1 ppm	February 5, 1994
4.2 ppm	February 10, 1995		4.1 ppm	November 14, 1995
4.9 ppm	November 11, 1996		4.8 ppm	January 2, 1996
5.3 ppm	December 29, 1997		5.1 ppm	January 11, 1997
4.7 ppm	December 30, 1998		4.5 ppm	November 12, 1998

[1]Note: All appendix references in this Maintenance Plan refer to Volume 3 of the Oregon State Implementation Plan, unless otherwise noted.

Figure 4.54.2-1 shows that the trend in CO concentration since 1988 is clearly downward. Even with a slight upturn in recent years, CO concentrations remain significantly below the NAAQS. The effect of emission reduction strategies and meteorology on CO concentrations is discussed in the following sections.

Figure 4.54.2-1
Klamath Falls 8-Hour CO Trend



4.54.2.3 Permanent and Enforceable Improvement in Air Quality

The EPA has issued guidance specifying that, in order for an area to be redesignated to attainment, a state must be able to reasonably attribute improvements in air quality to emission reductions which are permanent and enforceable. Economic downturns and/or unusual meteorology are factors cited that might result in temporarily lower CO concentrations and an attainment record that is "artificial." Thus EPA desires some analysis demonstrating that achieved attainment has not been attributable to either a temporary economic downturn or to especially favorable meteorology. The control measures that brought about attainment must be permanent as well as enforceable. This section addresses these issues.

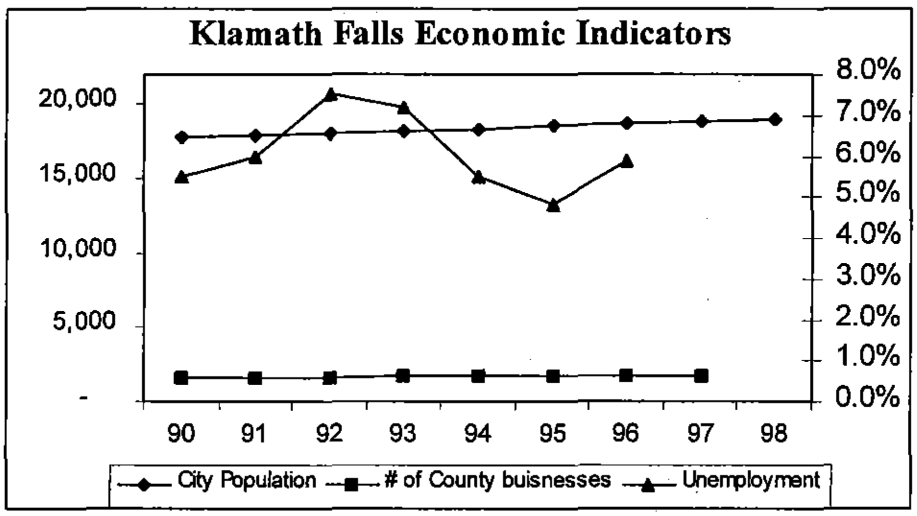
<u>**Economic Effects**</u>

Population and employment are key indices of the overall level of economic activity and growth, reflecting changes in industrial activity and travel demand. Klamath Falls is the largest city within the Klamath Basin. Key economic indicators are displayed in Figure 4.54.2-2. Information on the population and household projection figures used in developing this maintenance plan is presented in Appendix D5-6.

Klamath County is a major timber production center and suffered under the recessions of the 1980s. The timber industry appears to have stabilized in the county and prospects for sustained future growth rest primarily on additional diversification of the region's economy. During the decade of the 1980s Klamath County experienced some loss in population. However since 1990, population levels have rebounded with an average growth rate of approximately 0.9 percent per year. From 1990-97, total employment countywide has increase by 12 percent. Not all economic sectors have shared evenly in this rate of job growth. Employment in construction has increased 70 percent and 42 percent in the service sector, while conversely the number of manufacturing jobs declined by 11 percent[2].

Klamath Falls reached attainment in 1991 and has continued to meet standards throughout the 1990's. CO levels declined significantly throughout the mid 1990s despite growth in population, employment, and a significant decrease in unemployment between 1992 and 1995.

Figure 4.54.2-2: Economic Indicators



Meteorological Effects

Seasonal Ventilation

Peak CO concentrations are most generally associated with sustained low wind speeds. This section evaluates Klamath Falls seasonal wind speed conditions from calendar years 1988 to 1998 during the six-month winter period from October through March. This is a broader time frame than the typical CO season of November through February, and would capture any unusually poor ventilation conditions during the winter. The distribution of seasonal wind speeds (1988-1998) was evaluated based on data from the DEQ meteorological station at Peterson School, and is provided in Table 4.54.2-2 and Figures 4.54.2-3, 4.54.2-4, and 4.54.3-5. Data is presented for each season as the percentage of seasonal winds within several speed categories. In the following analysis, average wind speeds of 3 miles per hour or less are taken as an indicator of generally poor ventilation, and the potential for exceedance conditions. The purpose of this

2 From the report: Klamath Falls Economic Impact Assessment, E.D. Hovee & Co, April 1999

analysis is to evaluate whether improved CO concentrations can be attributed to a significant decrease in the occurrence of calm wind conditions when compared to the 1988/89 exceedance period. Again, this evaluation reflects continuous winter season ventilation (i.e. October 1988 through March 1989), not ventilation within a calendar year.

Table 4.54.2-2: Distribution of Seasonal Low Wind Speed Conditions October through March

Recorded at Peterson School

Winter Season	Wind Speed Percent Hourly wind speeds 0 – 3.0 mph	Rank – Most (1) to Least (10) Stagnant	3.1 – 4.0 MPH	4.1 – 5.0 MPH	5.0+ MPH	Highest High Max. 8-hr avg. CO Oct –March	2nd High Max. 8-hr avg. CO
1988-89	73%	10	10%	6%	10%	10.7	10.5
1989-90	80%	3	8%	5%	7%	10.7	10.3
1990-91	78%	6	8%	6%	7%	9.8	9.0
1991-92	79%	4	9%	5%	7%	9.8	8.8
1992-93	84%	1	7%	4%	5%	6.4	6.1
1993-94	82%	2	8%	5%	6%	6.1	5.9
1994-95	74%	8	10%	6%	10%	5.9	5.1
1995-96	75%	7	12%	6%	7%	4.9	4.8
1996-97	79%	5	9%	5%	7%	5.3	5.1
1997-98	74%	9	11%	6%	9%	5.3	5.1
Avg.	78%						
Std Dev	3.6%						
+1 Std Dev	82%						
- 1 Std Dev	74%						

Variation in low wind speed from season to season is modest and the trend is relatively stable.

The 1988/89 and 1989/90 winter seasons were used to designate the Klamath Falls area as nonattainment for CO based on the frequency and magnitude of exceedances. Many of the CO seasons since 1988-89 have demonstrated low wind speed conditions similar to those occurring during the 1988-89 exceedance events. Figure 4.54.2-3 shows the distribution of seasonal winds in various speed categories from the 1988/89 to 1997/98 winter seasons (October-March). The frequency of winds below 3.0 mph is substantially similar for both the 1988/89 exceedance and 1991-95 attainment periods. Figure 4.54.2-4 also shows how 2nd high CO concentrations continued to improve during the 1990-1995 attainment period in spite of generally poor ventilation conditions similar to those experienced during the 1988/89 exceedance period. Based on this evaluation, the department concludes that Klamath Falls did not have exceptional changes in calm winds from year to year. As a result, recent compliance with CO standards can not be solely attributed to favorable meteorology.

Figure 4.54.2-3: Distribution of Winter Season Winds

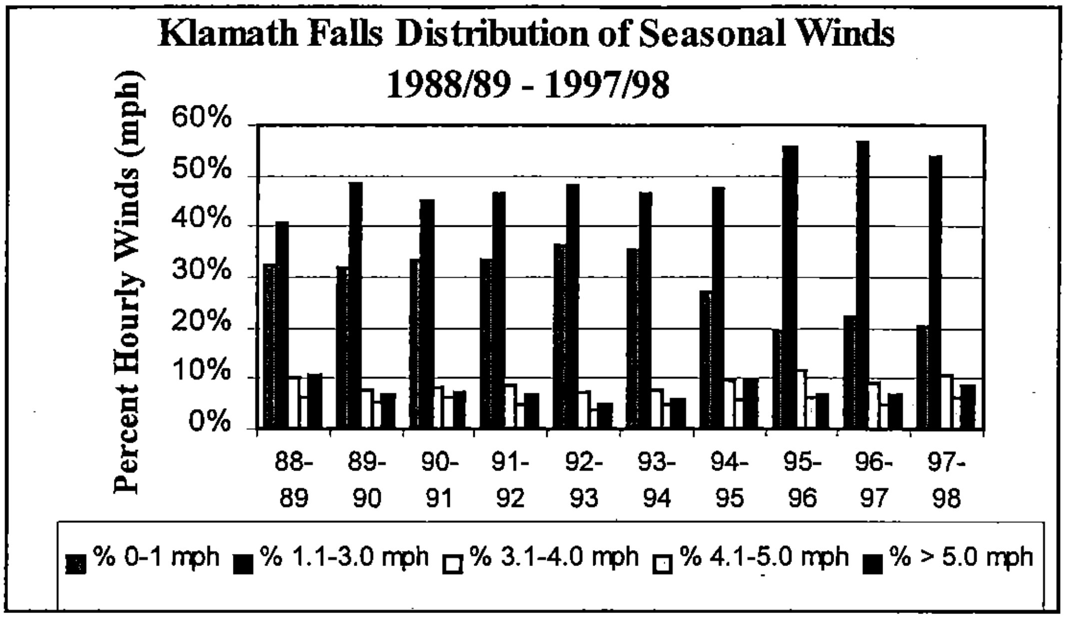
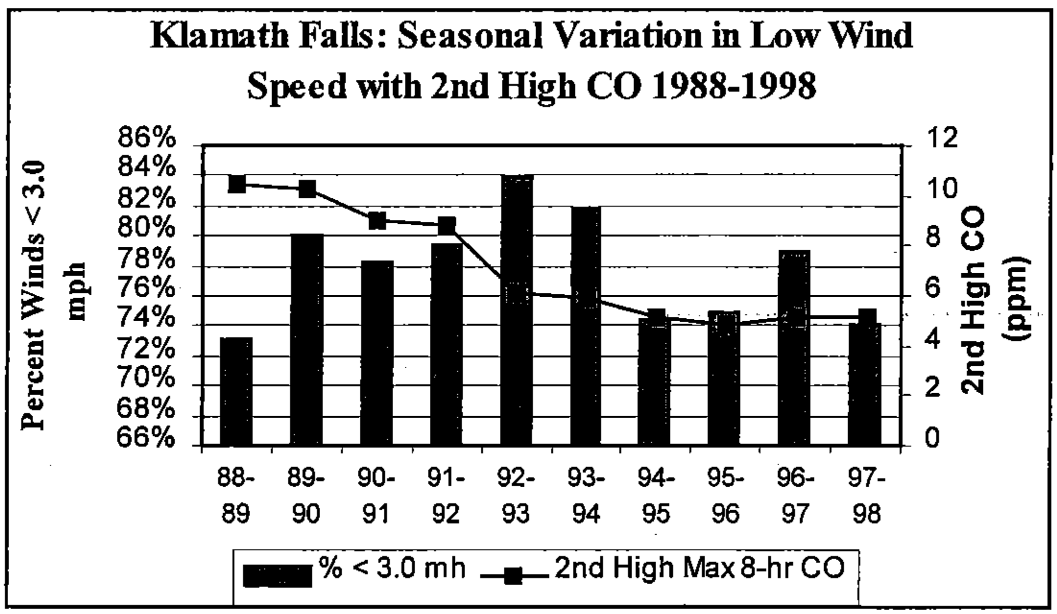


Figure 4.54.2-4: Low Wind Speed Distribution with CO Concentrations

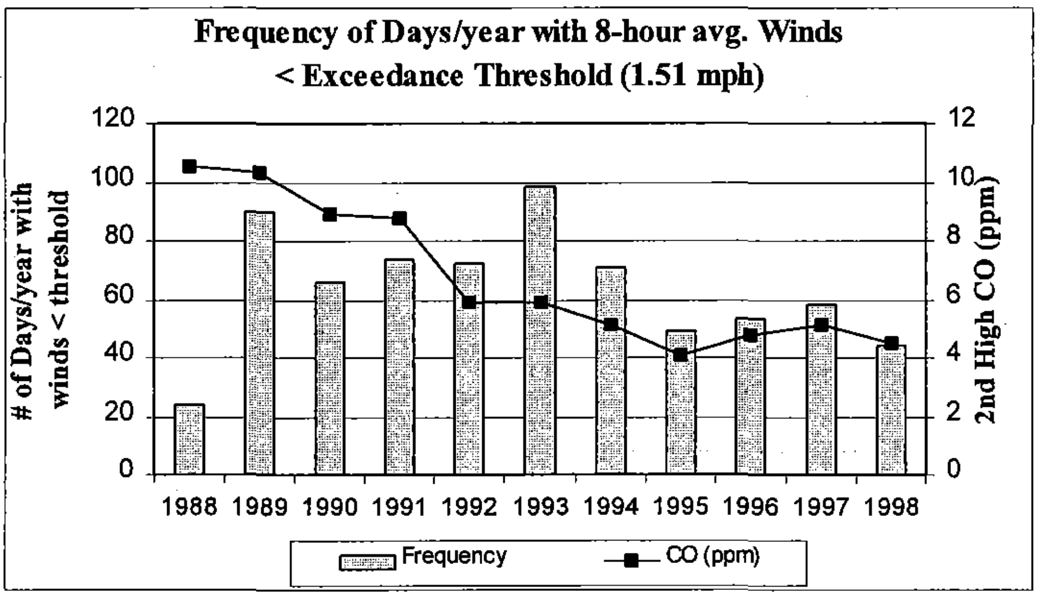


Exceedance Events

In addition to evaluating overall seasonal ventilation, an additional analysis was performed looking more specifically at wind speed characteristics associated with exceedance events. An evaluation of historic exceedances shows that the maximum 8-hour average CO concentration typically occurs during the period 5:00 p.m. to Midnight (typically +/- one hour). Individual CO exceedances have occurred under 8-hr avg. wind speed conditions as low as 0.3 mph, and as high as 2.5 mph; however the average of eight-hour wind speeds coincident with exceedance events (1988-1991) as one (1) mile per hour. For this analysis, one standard deviation (0.5 mph) was added to the 1-mph average to develop a threshold wind speed as an indicator of exceedance events. This threshold speed (1.5 mph) is taken as an indicator of exceedance potential. Selecting one standard deviation rather than a higher value (say 95% confidence limit above the average) serves to limit the number of days that can be claimed to have exceedance potential. This provides a more conservative test of exceedance conditions.

A review of hourly wind speed data within the 5:00 p.m.-midnight timeframe from 1988 through 1998 shows each season to have had the potential for exceedances. The fact that there have been no 2nd high CO values above standards since 1989 in spite of this potential, indicates that attainment of CO standards in Klamath Falls is due to permanent and enforceable emission reductions and not a function of atypical meteorology. Figure 4.54.2-5 shows the trends in exceedance potential and 2nd high CO values monitored at 6th & Hope Street.

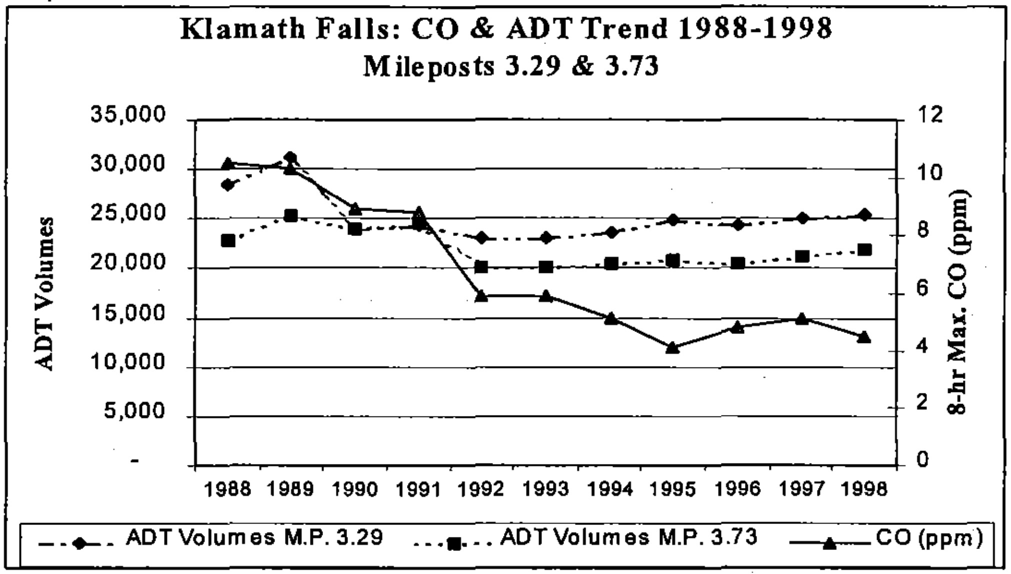
Figure 4.54.2-5: Frequency of 8-hour avg. winds < typical exceedance threshold



Changes in Traffic Patterns

Several factors may have contributed to decreasing CO concentrations over time. A significant drop in peak CO concentrations occurred in the same year as implementation of the oxygenated fuel program in 1992. While oxygenated fuel contributed to decreased CO concentrations, other factors influenced the downward trend including motor vehicle fleet turn over to cleaner cars, and to some extent a down turn in local traffic volumes in 1990. In recent years however, CO concentrations have remained low in spite of increasing traffic volumes in the area of 6th & Hope Street. Figure 4.54.2-6 shows the trend in 2nd high CO concentrations and the trend in Average Daily Traffic (vehicles/day) at mile posts 3.29 and 3.73 of Highway 140 (S. Sixth St.). These counters bracket to the west and east the section of S. 6th Street on which the CO monitor is located.

Figure 4.54.2-6: Average Daily Traffic (Vehicles per day)
Just to the west and east of the 6th & Hope Street monitor



Permanent and Enforceable Emission Reductions

Control strategies that were in place during the attainment period, all of which are permanent and enforceable measures, are listed below.

1. Federal Measures: Federal Motor Vehicle Control Program establishing emission standards for new motor vehicles.

2. SIP measures: Strategy relied on for attainment of standards.

   - Oxygenated fuel program was implemented in Klamath Falls during 1992, as required by the 1990 Clean Air Act amendments.

   Additional Supporting Measures (not specifically relied upon for attainment)

   - Major New Source Review Program (Lowest Achievable Emission Rate and offsets). [Rule citation: OAR 340-028-1900 through 340-28-2000.]

Given the economic, meteorological, and travel characteristics noted in the sections above, it seems clear that attainment with CO standards in 1991 and subsequent compliance can be attributed to permanent and enforceable measures.

4.54.2.4 Verification of Monitor Siting (area of highest CO concentration)

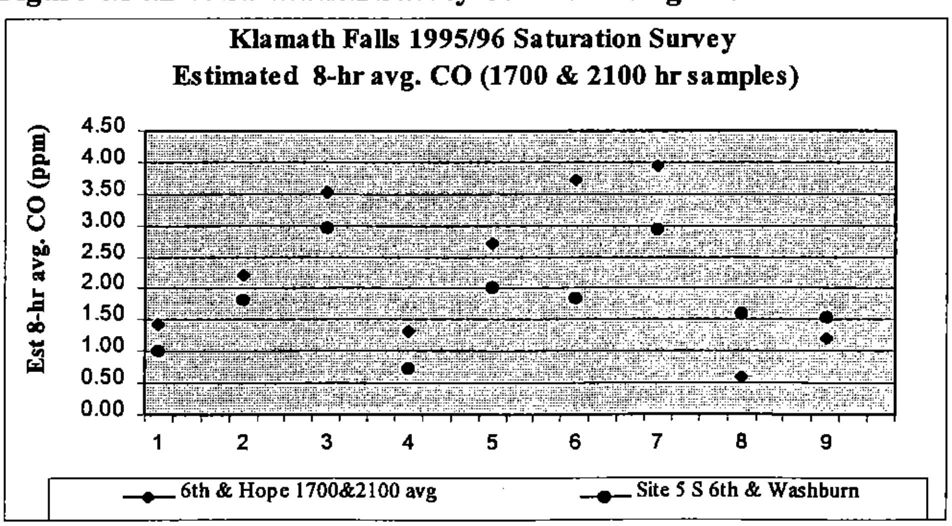
Field studies are routinely conducted to verify that the location of the carbon monoxide monitor generally represents "worst case" or peak level CO concentrations within the nonattainment area. The monitoring site at South 6th & Hope Streets was selected though field studies in the mid

1980's. The most recent field study was conducted by DEQ in the winter of 1995-96 to evaluate and verify the location of the Hope Street CO monitoring site as the high site for the Klamath Falls UGB. All CO concentrations measured during the study were well below standards. Nine sampling locations were selected based on traffic volumes. The survey also included duplicate sampling at the current reference monitor site as well as one neighborhood scale site at Peterson School. Sampling took place on nine days from December 19, 1995 to January 25, 1996. Sampling days were selected based on forecasts for calm meteorological conditions. On each sampling day, three sequential 4-hr bag samples were taken beginning at 1300 hours, 1700 hours, and 2100 hours.

Although stagnation conditions during the study period were not severe, samples were collected concurrently with measured 2nd high CO values at the Rogue Valley Mall site in Medford, Oregon (December 19, 1995) and the measured 2nd high at the Medford Brophy site (January 12, 1996). This indicates that the survey did capture periods of poor ventilation across southern Oregon. The survey also captured the 2nd high CO value at the Klamath Falls reference monitor for 1996 (January 2, 1996).

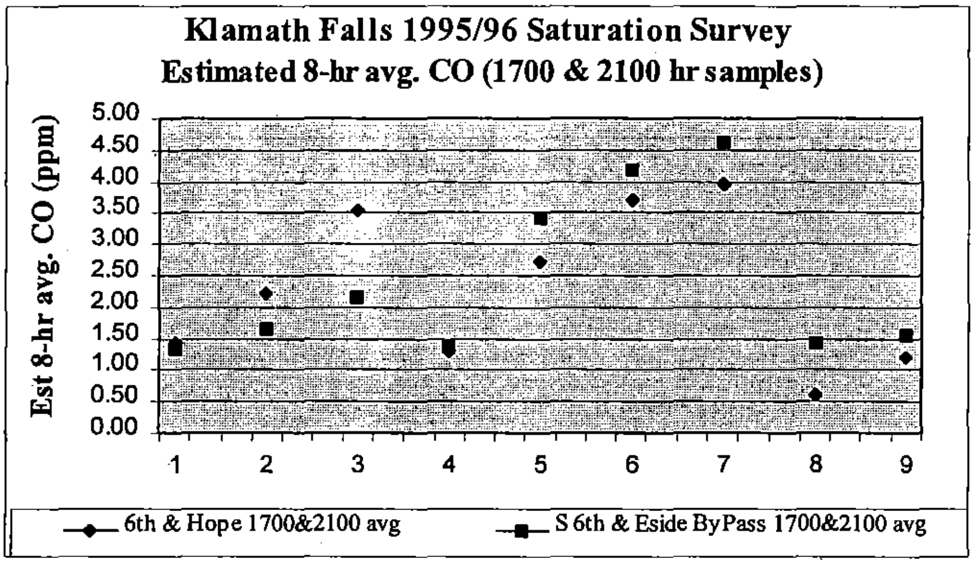
Of the nine locations surveyed, only two produced 4-hr CO concentrations equal to or greater than those measured at the Hope St. reference site. These were survey sites #5/#6 @ S. 6th & Washburn, and site #4 @ S. 6th & Eastside Bypass. To better compare the survey sites in terms relevant to the CO NAAQS, estimated 8-hour average CO concentrations were derived from the 4-hr average bag samples. Historic monitoring data from 1990 through 1997 were evaluated to determine the time frame typically associated with CO exceedances. This review showed that with one exception, all high and 2nd high maximum 8-hr average CO values between 1990 and 1997 occurred between about 5:00 p.m. and midnight. The 4-hour bag samples beginning at 1700-hrs and 2100-hrs were used to construct an estimated 8-hour average CO value that would best replicate and be comparable to the expected max. 8-hr average CO concentrations at the reference monitor. A comparison of this data shows that the current reference monitor site at 6th & Hope St. regularly produced higher 8-hr average CO values than survey site 5/6 @ S.6th & Washburn Way.

Figure 4.54.2-7: Saturation Survey Estimated Avg. CO



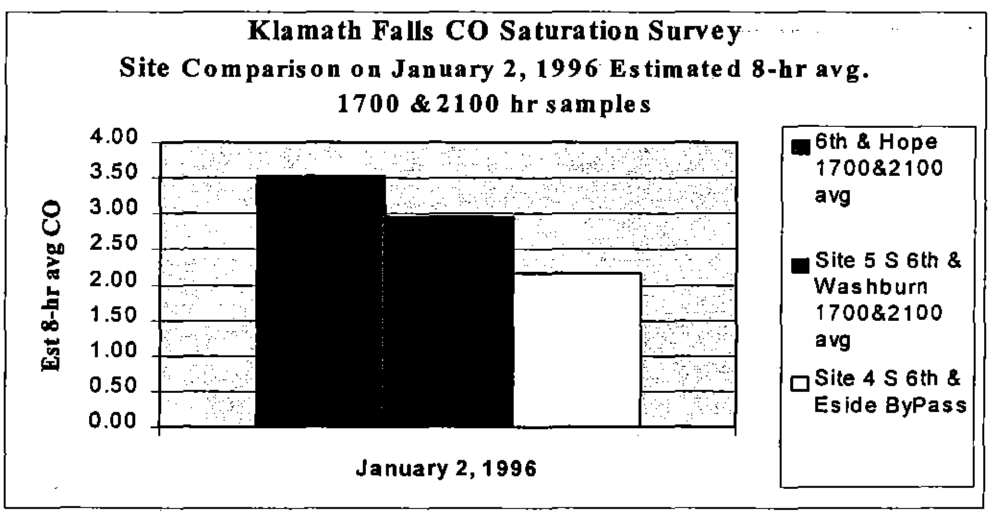
The data also shows that estimated 8-hr average CO values at survey site #4 (S. 6th St. & Eastside Bypass) are comparable to the reference site at 6th & Hope. Survey site #4 is approximately ¼ mile west of the reference site and generally represents the same geographic area within the UGB.

Figure 4.54.2-8: Saturation Survey Estimated Avg. CO



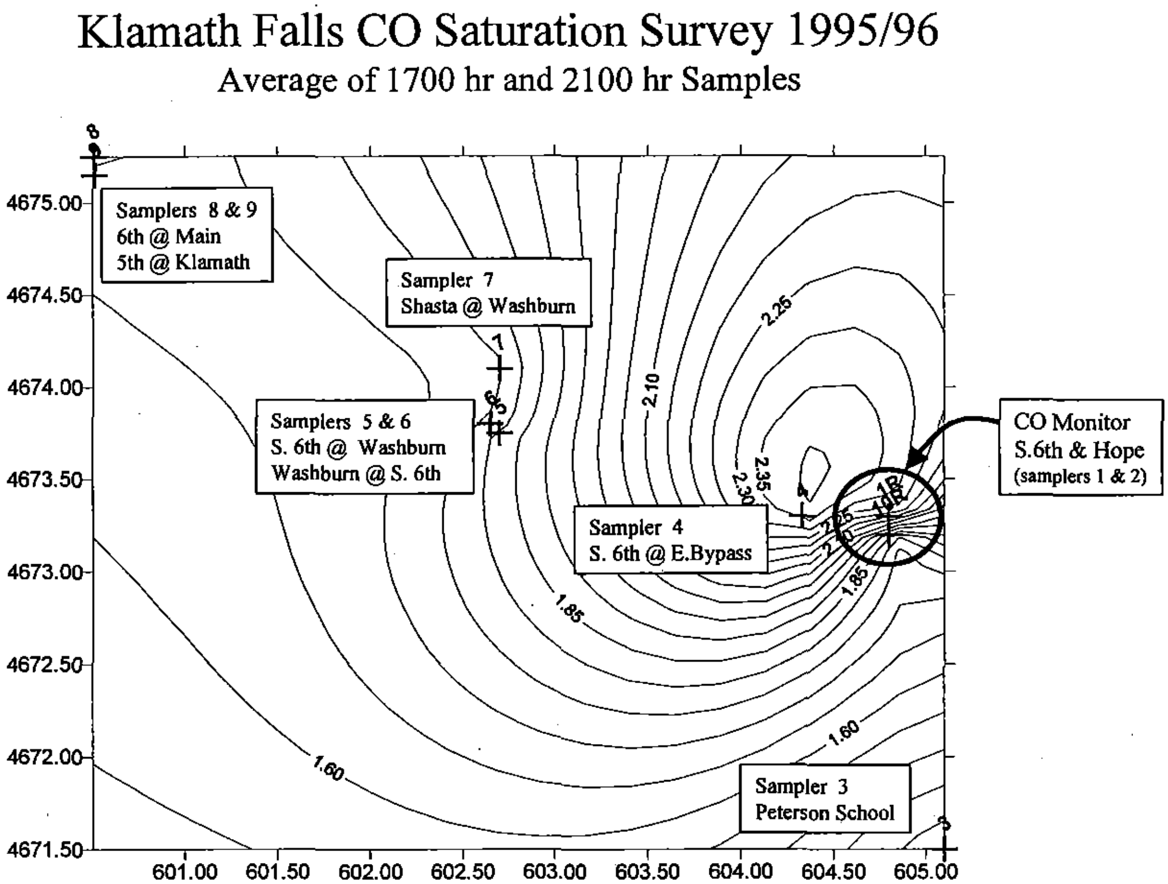
Analysis of survey data on January 2, 1996 shows that the Hope St. site produced an estimated max. 8-hr avg. CO value higher than either survey sites at South 6th & Washburn (#5/6) or South 6th & Eastside Bypass (#4). January 2nd is the date of the 2nd highest maximum 8-hr avg. CO concentration in 1996 and would be compared to the standard to gauge compliance.

Figure 4.54.2-9: Survey results on date of 2nd highest CO value in 1996



An isopleth construction of average 8-hr CO samples for all (1700 hr and 2100 hr) data collected in the survey also shows that the South 6th & Hope Street site does generally reflect the highest CO impact area within the nonattainment boundary (UGB).

Figure 4.54.2-10: Saturation Survey: Isopleth of Est. 8-hr Avg. CO.



Given that the S. 6th & Hope and S. 6th & Eastside Bypass sites generally reflect the same geographic area with the UGB, and that the highest estimated 8-hr CO concentrations vary between these two sites by only about 0.5 ppm, there is good confidence that the S. 6th & Hope site continues to represent peak CO concentrations in the UGB. The 1995/96 CO saturation survey is included as Appendix D5-3.

4.54.2.5 Conclusions Regarding Demonstration of Attainment

Monitoring data shows that Klamath Falls is in attainment with the national ambient air quality standards for carbon monoxide. Economic data shows that attainment is not attributable to a "down turn" in the economy. An evaluation of past ventilation conditions shows that attainment can not be attributed to especially favorable meteorology, and an evaluation of traffic volumes near the Hope Street site shows that CO concentrations have continued to decline in spite of increasing traffic. The 1995/96 saturation study demonstrates that the 6th & Hope Street monitoring location does represent the general area of maximum carbon monoxide exposure within the Klamath Falls UGB.

It is the department's expectation based on the evidence above, that attainment of carbon monoxide standards in Klamath Falls has been due to permanent and enforceable measures.

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4.54.3 MAINTENANCE PLAN

As part of this Redesignation Request/Maintenance it must be shown that compliance with standards will be maintained for at least 10 years after the date of EPA redesignation[1]. This section demonstrates that the Klamath Falls UGB will remain in attainment with air quality standards for carbon monoxide through the year 2015.

4.54.3.1 Attainment Inventory

An emission inventory representing a base-year emissions level was developed for the 1996 attainment year. A future year emissions forecast was also developed for the year 2015. In order to demonstrate continued attainment, future year emissions must be equal to or lower than base year emissions.

An emission inventory consists of emission estimates from all sources that emit carbon monoxide. These sources include major industry, on-road mobile sources (e.g. cars and trucks), non-road mobile sources (e.g., construction equipment, recreational vehicles, lawn and garden equipment), and area sources (e.g., outdoor burning, woodstoves, wildfires). The inventory for these sources includes both annual (tons of CO emitted per year), and daily (pounds of CO emitted during a typical winter day) emission estimates. Because compliance with the max. 8-hr average CO standard is linked to average daily emissions, emission estimates reflecting a typical winter season day (pounds of CO per day) will be used for the maintenance analysis and demonstration.

The base year (1996) CO design concentration (4.8 ppm) is significantly below the ambient CO standard (approximately 53 percent of the 9.0 ppm standard). Corresponding base-year emissions therefore represent an emissions level substantially below airshed capacity. Significant emissions growth could occur from 1996 levels without jeopardizing CO standards. In addition, Klamath Falls first achieved compliance with standards in 1991; one year prior to the implementation of the oxygenated fuels program. This shows that the airshed achieved an acceptable emission level before the benefit to motor vehicles of oxygenated fuels. Locking in airshed emissions at actual 1996 levels (with oxygenated fuels) could unfairly restrict emissions growth in the area. To avoid an unnecessarily stringent restriction on emissions growth, the base year attainment emission level was calculated without the benefit to mobile sources of oxygenated fuels[2].

The 1996 CO attainment emission inventory is summarized in Tables 4.54.3-1 and 4.54.3-2. On-road mobile sources were calculated by applying exhaust (tailpipe) emission rates developed by EPA's Mobile5b emission factor model to estimates of motor vehicle travel developed by the Oregon Department of Transportation's travel demand model. The procedures for calculating the

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1 Federal Clean Air Act Section 175A(a)

2 This approach was agreed to by EPA in the initial Technical Analysis Protocol for this plan.

attainment emission inventories and detailed results of mobile emission estimates are presented in Appendix D5-4. Per EPA guidance, emissions from Major Point Sources are estimated as actual emission levels not maximum permitted emissions.

Table 4.54.3-1: 1996 Attainment Emission Inventory (Typical CO Season Day)

Source Category	CO Emissions (lbs/day)	Percent Contribution
On-Road Mobile	26,734	58%
Non-Road Mobile	4,074	9%
Major Industry	3,923	8%
Area Sources	11,586	25%
Total Emissions	**46,316**	**100%**

Table 4.54.3-2: 1996 Attainment Emission Inventory (Annual Average CO)

Source Category	CO Emissions (Tons/year)	Percent Contribution
On-Road Mobile	4,795	54%
Non-Road Mobile	1,664	18%
Major Industry	705	8%
Area Sources	1,766	20%
Total Emissions	**8,930**	**100%**

4.54.3.2 Maintenance Demonstration

The maintenance demonstration must show that total emissions in the future will not exceed attainment (or base year) emissions. If emissions are projected to exceed base year levels, strategies must be adopted to reduce emissions below the attainment level.

4.54.3.2.1 Future Forecast

Figure 4.52.3-3 shows daily CO emissions projected to the year 2015. Because compliance with the maximum 8-hr average CO standard is linked to average daily emissions, emission estimates reflecting a typical winter season day (pounds of CO per day) will be used for the maintenance analysis and demonstration. The forecast of average annual emissions is not used for the maintenance evaluation, but is included in Appendix D5-4 for reference. Emission forecasting methodologies for each of the four major source categories are described briefly below. More specific information on emissions from individual sources and the procedures used for projecting emissions are presented in Appendix D5-4.

Major Industry

Emissions from major industry are estimated from operating permits and annual reporting of actual emissions. The emission inventory includes four major point sources. Two facilities, Jeld-Wen Inc. and Columbia Forest Products are located within the nonattainment area boundary (UGB). Two other facilities, Collins Products and a PGE gas transfer station are located outside the nonattainment boundary, but must be included in the inventory[3]. One additional facility (Klamath Co-Generation) is currently under construction and is expected to begin operations in 2001. Dispersion modeling of emission impacts was conducted for Klamath Co-Gen as part of the permitting process. This modeling shows that emissions from the facility will not influence CO concentrations in the nonattainment area. After consultation with EPA it was agreed that the Klamath Co-Generation facility should not be included in the emissions inventory and forecast, or maintenance analysis.

For maintenance planning purposes emissions from major industry are projected to increase at the rate equal to that of anticipated industrial employment growth. This is a moderately conservative approach for forecasting emissions (most protective of air quality), but reasonably accounts for the possibility of future new or expanding major industry affecting the Klamath Falls airshed.

Non-Road Mobile

Non-road mobile emissions reflect emissions from activities such as the use of landscape maintenance equipment, agricultural operations, construction, light commercial and industrial equipment use. Emissions are primarily from 2-cycle, 4-cycle, and diesel engines. The seasonal CO emission inventory is adjusted to reflect those activities occurring during the November through February time frame. Annual non-road emissions reflect year-round activity and are therefore a greater percentage of total airshed emissions on an annual basis. In general, non-road mobile emissions are expected to increase with area-wide population and employment.

Area Sources

Area source emissions include sources like woodstoves, other forms of home heating, open burning, industrial and commercial heating. Area source emissions generally increase with population and employment, although some sources like woodstoves have unique growth rates. In the case of home wood heating, the net emissions "change" reflects the small annual increase anticipated for cleaner certified stoves, balanced against the general decline over time in older noncertified stoves.

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[3] EPA guidance requires the emissions inventory to include all major point sources within a 25 mile buffer zone of the nonattainment area.

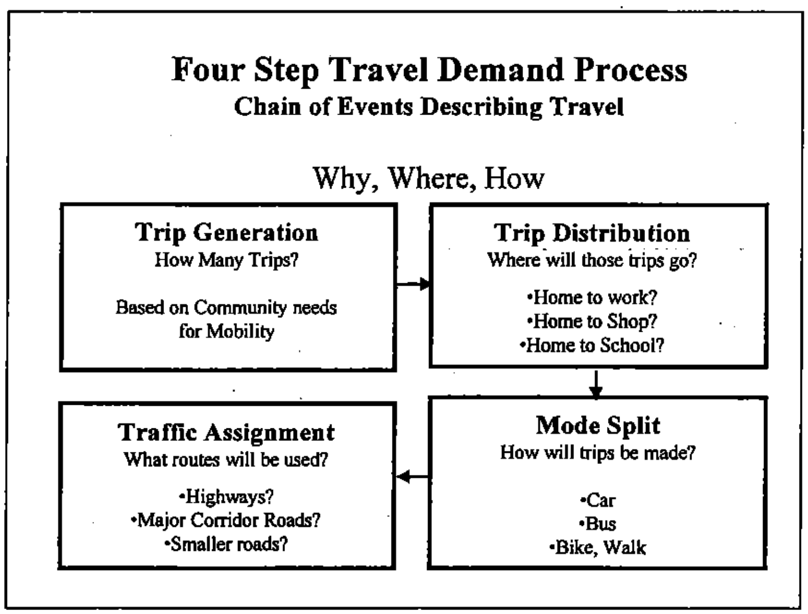
Mobile Source Emissions

Travel Modeling

Motor vehicle emissions are directly related to the amount of travel within a community. A "Best Practices" Travel Demand model was developed by the Oregon Department of Transportation to evaluate motor vehicle travel within the Klamath Falls UGB. The Best Practices model uses local travel survey information to simulate the choices made by Klamath Falls residents as to when, where, and how they will reach their destinations.

The model was first used to reproduce known motor vehicle travel behavior on the existing transportation network in a base year period (1995). Factors representing household and travel characteristics such as family size, income, vehicle access, employment and recreation opportunities were all evaluated to estimate the number and type of trips produced. The result of the modeling process is an estimation of traffic volumes, vehicle speeds, and vehicle miles traveled on the community road system.

The basic four-step process for travel modeling is presented below. The Oregon Department of Transportation has developed a new travel model for use in the Klamath Falls Maintenance plan. Additional detail about the travel model can be found in Appendix D5-3.



Future Forecasts

Future travel behavior is derived from official forecasts of future population, housing, economic activity and land use. Executive Order 97-22 directs key state agencies such as DEQ and ODOT to use population and employment forecasts developed or approved by the Oregon Office of

Economic Analysis (OEA). OEA forecasts are made at the county level, not the city level. Representatives from the City of Klamath Falls, Klamath County, DEQ and ODOT developed a future population and employment forecast for the Klamath Falls nonattainment area (UGB), that is both consistent with OEA projections and recommendations from the Klamath Falls Air Quality Advisory Committee. Future travel in the Klamath Falls UGB is based on the following growth rates (1996-2015).

Category	Growth Rate (compound): Percent per Year
Population	1.2%
Housing	1.1%
Industrial Employment	1.3%
Average Non-Industrial Employment	0.7%

Emission Rates

EPA's emission factor model was used to estimate emission rates from motor vehicles (passenger cars, pick-up trucks, heavy-duty diesel trucks, etc.). The emission factor model accounts for variations in emissions due to vehicle speeds, and any special measures like oxygenated fuels or vehicle inspection & maintenance. The emission factor model results are combined with data from the travel model to estimate emissions for the Klamath Falls motor vehicle fleet in 1996 and 2015.

Oxygenated Fuels Program

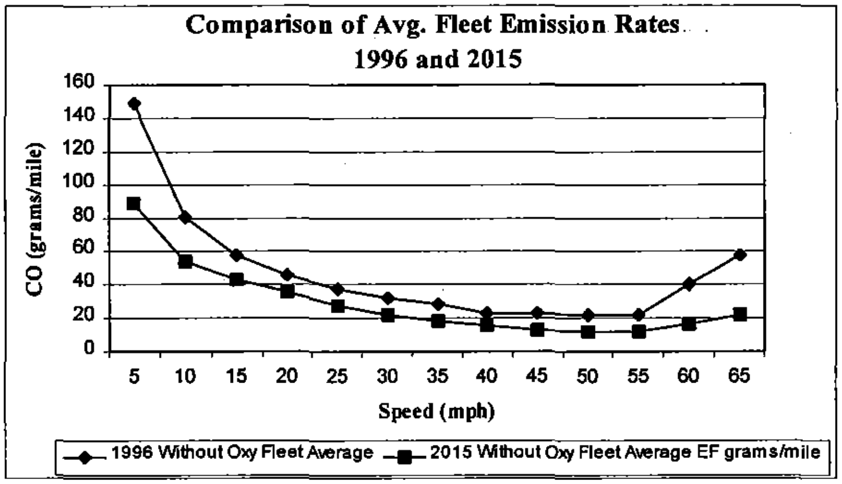
Gasoline engines are a major source of carbon monoxide (CO) and other pollutants. Under ideal conditions, the complete combustion of a hydrocarbon fuel (gasoline) results in a byproduct of mainly carbon dioxide (CO2) and water. In reality, engines do not achieve complete combustion, producing air pollutants such as particulate mater (PM), carbon monoxide (CO), oxides of nitrogen (NOx), and unburned hydrocarbons called volatile organic compounds (VOC). The addition of certain compounds (oxygenates) like ethanol to gasoline increases the amount of oxygen available for combustion. This in turn increases combustion efficiency and reduces emissions. The emission reduction effect depends on several factors, including vehicle speed and operating condition, vehicle age and type of emission control, and vehicle maintenance. Recent studies suggest that on average, wintertime oxygenated fuel reduces CO emissions by approximately ten to twenty five percent.

In general, oxygenated fuel is most effective in reducing emissions from older model-year vehicles, or poorly maintained vehicles. Federal vehicle emission standards continue to reduce emissions in newer cars. As a motor vehicle fleet becomes newer over time, oxygenated fuel becomes less effective in reducing CO emissions.

It should also be recognized that oxygenated fuel can reduce some hazardous air pollutants such as benzene (a known human carcinogen), acetaldehyde and 1,3-butadiene (both probable human carcinogens). It is not possible at this time to quantify the risk reduction benefit associated with

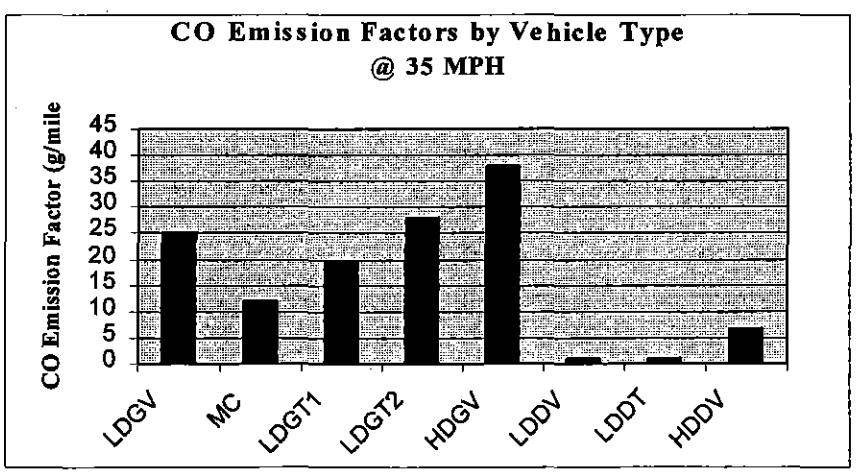
reduced hazardous air pollutants in Klamath Falls. It should merely be noted that oxygenated fuels can provide air quality benefits for pollutants other than carbon monoxide.
The carbon monoxide emission rate of motor vehicles (typically expressed as grams of CO per mile driven) changes with vehicle speed. The most efficient operating speeds for motor vehicles (and therefore the cleanest emissions) occur above approximately 35 miles per hour and less than 65 miles per hour. Figure 4.54.3-1 shows both the change in vehicle emission rates with speed, and the improvement in emission rates in 2015 due to the federal motor vehicle emission standards and fleet turnover.

Figure 4.54.3-1: Change in emission rate with speed



The Mobile5b emission factor model produces emission rate estimates for different vehicle types (such as light duty gas vehicles and heavy duty diesel truck), and then provides a composite "fleet average" emission rate for each speed. Figure 4.54.3-2 is an example of emission rates for different vehicle types @ 35 miles per hour. These fleet average emission rates (in grams CO/mile driven) are combined with travel model data (vehicle miles traveled-VMT and average speeds) to produce emission estimates for motor vehicle travel in the UGB.

Figure 4.54.3-2: Average emission rate by vehicle type (@ 35 mph)



LDGV = Light duty gas vehicle; MC= Motorcycle; LDGT1 and LDGT2 = Light duty gas trucks in different weight classes; LDDV = Light duty diesel vehicle; LDDT = Light duty diesel truck; and HDDV = Heavy-duty diesel vehicle.

Emissions Forecast for Klamath Falls (2015 Without Oxygenated Fuels)

Area-wide motor vehicle emissions are projected to be a total of 23,400 pounds per winter day in 2015 without the effect of oxygenated fuels. This is a 12 percent *decrease* from the 1996 attainment level. Emissions were projected assuming no future use of oxygenated fuel. Major point source emissions are expected to decrease slightly by 2015 (approximately 2%) due to anticipated emission reductions at Collins Products (equipment shutdown) in connection with a Klamath Co-Gen partnership. Non-road mobile sources are expected to increase with population and employment (approximately 24%) by 2015, and Area sources are expected to increase approximately 8 percent by 2015. As shown in the maintenance demonstration below, total emissions in 2015 are below the 1996 attainment level.

Figure 4.54.3-3: CO Maintenance Analysis (Emissions Forecast) Typical Winter CO Season Day (Lbs CO/Day)

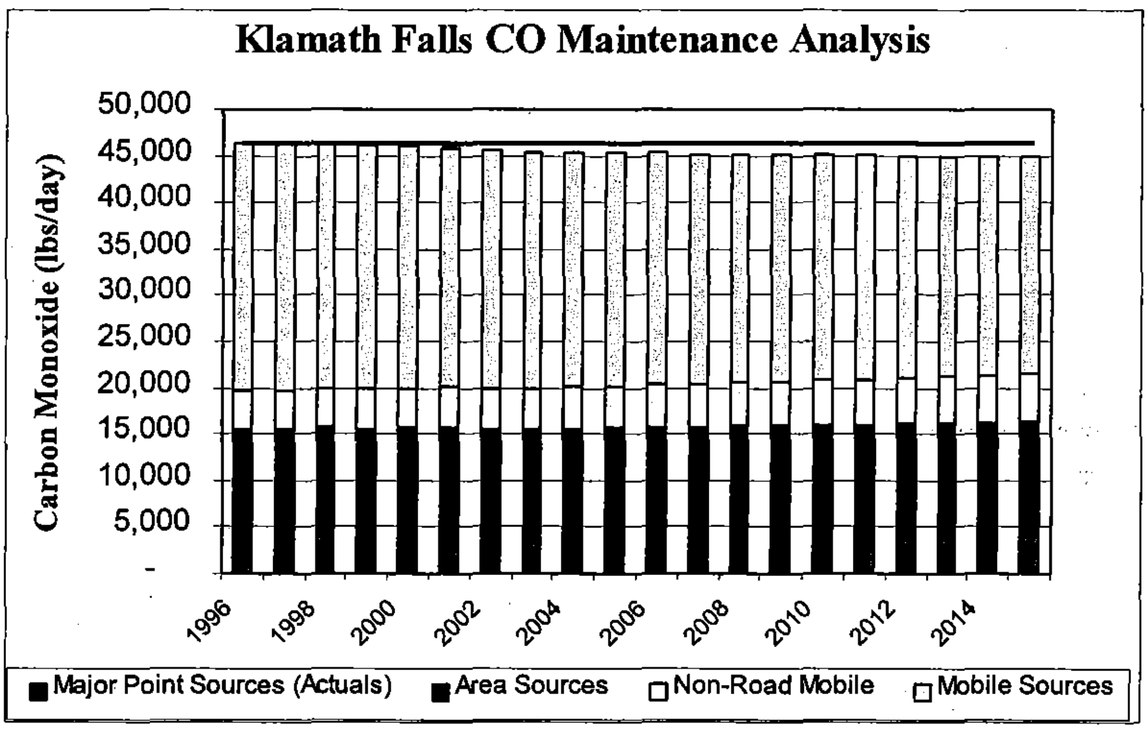


Table 4.54.3-3: CO Emissions Forecast
CO Nonattainment Area = Klamath Falls Urban Growth Boundary
(Pounds CO/Winter Day)

Year	1996	2000	2005	2010	2015
Area Sources	11,586	12,095	12,238	12,381	12,524
Non-Road Mobile Sources	4,074	4,284	4,546	4,809	5,072
Point Sources	3,923	3,575	3,416	3,628	3,841
On-Road Mobile Sources	26,734	26,032	25,154	24,277	23,400
Total	46,316	45,986	45,355	45,096	44,836

Net decrease in 2015 from 1996 attainment levels = - 1,480 lbs/day CO.

4.54.3.2.2 Transportation Emissions Budgets for Conformity

Federal and state transportation conformity regulations for nonattainment and maintenance areas require that mobile source emissions resulting from the implementation of transportation plans, programs, or projects meet certain criteria to ensure that compliance with air quality standards will not be jeopardized. Transportation programs and projects affecting travel in the Klamath Falls UGB are contained in the Klamath Falls Urban Area Transportation Systems Plan (TSP). All significant transportation projects likely to be built to 2015 have been accounted for in the RTP, travel model analysis, and emissions budget. The motor vehicle emissions budget outlined in Table 4.54.3-5 has been established for transportation conformity purposes within the Klamath Falls Urban Growth Boundary.

Allocation of Airshed Emissions

Airshed emissions are projected to remain below the 1996 attainment level through 2015. The difference between the this 1996 attainment/maintenance threshold ("cap") and yearly emission levels for 1997-2015, represent "unused capacity" in the airshed (See Figure 4.54.3-3). To help ensure the success of future conformity determinations and lower the risk to transportation funding, this unused capacity has been allocated to the motor vehicle emissions budget. Table 4.54.3-4 shows the unused airshed capacity for 2000, 2005, 2010, and 2015. Table 4.54.3-5 shows how this capacity has been allocated to the motor vehicle emissions budget.

Table 4.54.3-4: Unused Airshed Capacity (CO lbs/day)

Year	1996	2000	2005	2010	2015
Maintenance Level	46,316	46,316	46,316	46,316	46,316
Airshed Emissions	46,316	45,986	45,355	45,096	44,836
Unused Airshed Capacity	NA	331	961	1,221	1,480

Table 4.54.3-5: Motor Vehicle Emissions Budget Through 2015
Klamath Falls Motor Vehicle CO Emissions Budget
Typical Winter CO Season (lbs/day)

Year	1996	2000	2005	2010	2015
Motor Vehicle Emissions	26,734	26,032	25,154	24,277	23,400
Emissions Allocation	NA	331	961	1,121	1,480
Emissions Budget	**26,734**	**26,362**	**26,116**	**25,498**	**24,880**

The motor vehicle emissions budget was developed using the Oregon Department of Transportation (ODOT) travel demand model. The modeled road network represents programs and projects contained in the TSP. Travel model results were compared to actual traffic count data in Klamath Falls to validate model performance. Future travel demand models will also be validated to local travel data. Therefore, DEQ anticipates that future conformity determinations will be compatible with the emissions budget established in this plan.

Motor vehicle emission rates and travel model data used in this plan can be found Appendix D5-3. A summary of VMT estimates (based on seasonally adjusted average daily traffic) is provided in the following table.

Table 4.54.3-6: Base year (1996) VMT and future 2015 forecast (seasonally adjusted)

Functional Roadway Class	Seasonally Adjusted 1996 VMT (vehicle miles/day)	Seasonally Adjusted 2015 VMT (vehicle miles/day)
Principal Arterial	252,708	345,999
Minor Arterial	90,606	113,691
Major Collector	42,407	72,583
Minor Collector	Na	895
Local	6,984	13,566
Ramps	4,499	8,032
Off Network	39,720	55,476
Total UGB VMT	436,924	610,243

Note: Season neutral (May or October) VMT data from the travel model was adjusted using ground counts to reflect a typical winter CO season day (December-February). Wintertime daily travel is typically less than VMT reflecting an annual average or summertime season. **VMT used to estimate daily CO season emissions reflects Average Weekday Travel (AWDT), not Average Daily Travel (ADT) which includes the effect of weekend trips.4.54.3.2.3**

Evaluation of Future Ambient CO (Rollforward Analysis)

In addition to the emissions based maintenance analysis described above, an evaluation was conducted of motor vehicle traffic growth in the vicinity of the S. 6th & Hope St. monitor and its likely effect on future ambient CO concentrations. This is a very simple analysis technique called "roll forward", and is based on the premise that ambient CO concentrations at an intersection will change in proportion to changes in motor vehicle emissions impacting that intersection[4]. The rollforward approach involves adjusting the ambient CO design concentration (up or down) in proportion to increases (or decreases) in future year motor vehicle emissions in the vicinity of the monitor.

Motor vehicle emissions for the 6th & Hope Street intersection were calculated for the 1996 attainment year and then for 2015, based on expected traffic growth and expected improvements in motor vehicle exhaust emissions. Base year (1996) and future year (2015) traffic volumes at the intersection of S. 6th & Hope Streets were estimated by the Oregon Department of Transportation's travel demand model. CO emission rates in grams per mile (gm/mile) were calculated for each leg of the intersection based on estimated and calculated speeds using EPA's mobile emission factor model - Mobile5b. Emissions for both 3-hour peak and 5-hour off-peak travel conditions were calculated separately, then summed for total intersection emissions.

For purposes of the rollforward analysis, motor vehicle emissions were calculated without the effects of oxygenated fuels. Also, for the purposes of the rollforward analysis a more conservative attainment period design value was selected, reflecting the highest second high CO value in the three year period straddling the attainment year (i.e. highest of the 2nd high CO values from 1995, 1996, and 1997). The rollforward design value selected was 5.1 ppm (2nd high in 1997). This design value was then adjusted to reflect a scenario without the effect of oxygenated fuels. Analysis from the "Interagency Assessment of Oxygenated Fuels, White House Office of Science and Technology Policy", June, 1997, indicates that the improvement in ambient CO concentrations resulting from oxygenated fuels range from about 0.5 ppm to 1.0 ppm. Therefore, for purposes of the rollforward analysis the attainment (base) year design concentration was increased from 5.1 ppm to 6.1 ppm.

Background CO concentrations were estimated to be approximately 69 percent of the annual second high for 1996 recorded at the DEQ Hope Street CO monitor. To determine a CO background level without oxyfuel, the adjusted design concentration of 6.1 ppm was multiplied by 0.69 to yield an estimated concentration of 4.2 ppm. This adjusted background concentration was also assumed to apply to the 2015 calendar year.

The result of the rollforward analysis as shown in Table 4.52.3-7 demonstrates continued compliance with standards at South 6th & Hope through the year 2015. Figure 4.54.3-4 shows how the continued change-over to cleaner vehicles results in lower future ambient CO concentrations, even though local motor vehicle travel is expected to increase.

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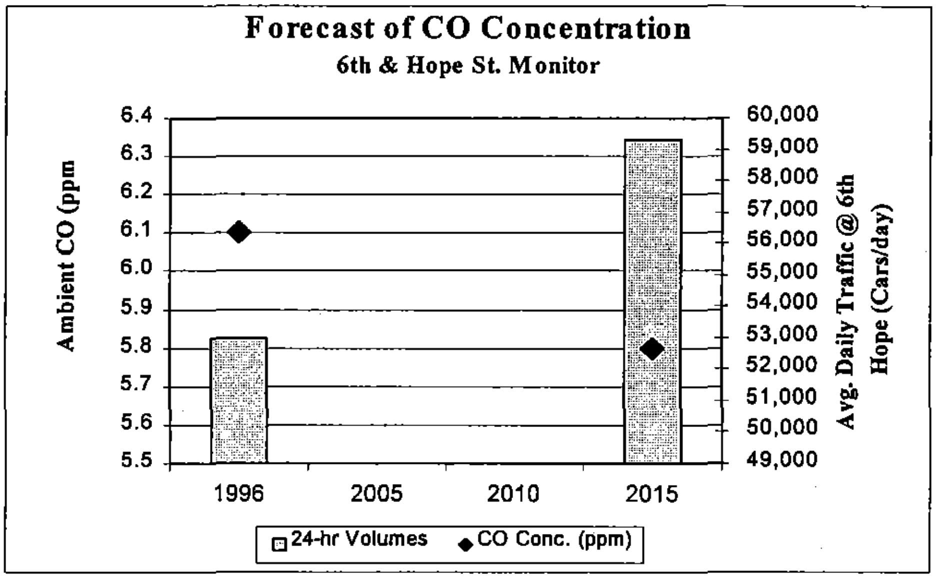
4 This approach is also based on the fact that CO is a relatively stable gas, and that motor vehicles contribute most of the CO measured at traffic-oriented monitoring sites.

Table 4.54.3-7: 2015 Second Highest Maximum 8-hour CO Concentrations at DEQ 6th & Hope Street Monitoring Site

Location	1996 Design Concentration	2015 CO Concentration
SE 6th & Hope St. Monitor	6.1 ppm	5.8 ppm

Figure 4.54.3-4: Evaluation of Future Ambient CO Concentrations at S. 6th & Hope



The details of the rollforward methodology, including Mobile5b emission factor inputs, outputs, design concentration adjustment, and example calculations are contained in Appendix D5-7.

Non-Monitored Intersections

Using results from the 2015 travel data, the Department of Transportation conducted an analysis of key intersections in the Klamath Fall UGB, ranking them by a weighting factor that reflects the effect of both future traffic volume and congestion (volume in relation to design capacity). Table 4.52.3-8 shows the top ranked 15 intersections. Congestion was estimated using hourly peak volumes and road capacities to develop volume to capacity ratios, weighted by traffic volume to identify the most heavily traveled and congested intersections.

The intersection screening analysis was conducted to evaluate potential future problem areas based on traffic volumes and congestion. The following intersections were identified as areas warranting future observation and evaluation. Five of the top fifteen ranked intersections identified in the screening analysis were included in a 1995/96 winter saturation study. The 1995/96 study confirmed that the current monitoring location of S. 6th & Hope St. reflects the area of highest ambient carbon monoxide concentrations in Klamath Falls. Ambient CO concentrations are influenced by many factors including vehicle traffic, topography and ventilation. Congestion alone is not necessarily an indicator of the highest CO concentrations. Intersections identified through this screening analysis will be evaluated further in the next Klamath Falls carbon monoxide saturation survey. (See Appendix D5-7 for further detail on the intersection screening analysis).

Table 4.54.3-8: Top Ranked Intersections For 2015

1.	Eastside By-Pass @ Sixth St.	(included in 1995/96 study)
2.	East Side By-Pass @ Washburn Way	
3.	Washburn Way @ Sixth St.	(included in 1995/96 study)
4.	East Side Bypass @ Shasta Way	
5.	East Side By-Pass @ Main St.	
6.	Campus Drive @ K.Falls Malin Hwy.	
7.	K.Falls Malin Hwy @ Esplanade St.	
8.	Hope St. @ Sixth St.	(included in 1995/96 study)
9.	Summers Lane @ Sixth St.	
10.	Washburn Way @ Crosby Ave.	
11.	Washburn Way @ Hilyard Ave.	
12.	Homedale Rd. @ Sixth St.	
13.	Washburn Way @ Shasta Way	(included in 1995/96 study)
14.	E. Main St. @ Sixth St.	(included in 1995/96 study)
15.	Shasta Way @ South Sixth St.	

* Intersections were ranked using the method where average weekday traffic is multiplied by average weekday traffic (AWDT) all divided by the hourly capacity ($AWDT^2/C$). This weights volume to capacity ratios for each intersection by their relative traffic volumes. A value of V*V/C (or $AWDT^2/C$) was determined for each intersection leg, and then those values were totaled for the intersection node.

4.54.3.3 Control Measures

The maintenance analysis shows that compliance with carbon monoxide standards can be maintained through 2015 without the need of oxygenated fuels. The Klamath Falls area will continue to rely on the following control strategies for long-term maintenance:

Federal Motor Vehicle Emission Standards

Federal motor vehicle emission standards will continue to be the most effective CO emission reduction strategy. A 12 percent reduction in average fleet emissions is expected between 1996 and 2015 due to this program. Expected improvements in CO emission control technology include heated catalysts, which will help reduce the higher emissions from cold starts. The potential for cleaner fuels in the future will also help maintain the effectiveness of motor vehicle emission control technologies.

New Source Review

New or expanding major industry is required to comply with New Source Review (NSR) requirements for nonattainment areas until EPA redesignates the area as a CO maintenance area. Nonattainment area requirements include Lowest Achievable Emission Rate (LAER) control technology and emission offsets. LAER technology draws from the most effective emission control methods achieved at similar facilities nationwide, and does not consider cost as a factor is determining whether an emission control approach is feasible. Offsets must be provided within the area of significant air quality impact to provide a net air quality benefit.

Once redesignated by EPA, new or expanding major sources of CO in Klamath Falls will be subject to New Source Review requirements for maintenance areas. The LAER requirement will be replaced by Best Available Control Technology (BACT). Unlike LAER, BACT does allow cost to be considered in evaluating the feasibility of emission controls. Sources must still provide an analysis demonstrating that the proposed emissions increase will have no significant impact on the maintenance area. This can be done in several ways, including providing emission offsets (emission reduction credits), establishing a growth allowance for major industry, or through dispersion modeling.

Oxygenated Fuels

The Clean Air Act Amendments of 1990 required the Department to implement an oxygenated fuel program for four classified CO nonattainment areas, including the Klamath Falls area. The program was implemented in the fall of 1992. Gasoline suppliers distributing fuel in Klamath Falls are required to provide a minimum oxygen content by weight of 2.7% in gasoline from November 1st through the end of February. The oxygenated fuels program will be discontinued in Klamath Falls upon EPA approval of this maintenance plan. The maintenance demonstration shows that the Klamath Falls Urban Growth Boundary will continue to comply with the carbon monoxide health standard through 2015 without oxygenated fuel, while maintaining a comfortable safety margin. The oxygenated fuel program is being retained as a contingency strategy, and will be reinstated in the event CO standards are violated in the future.

Woodstove Curtailment

Woodstove emission control efforts have produced significant reductions in particulate emissions through emission certification standards for new stoves, changeout programs to encourage removal of noncertified stoves and local ordinances to curtail burning during stagnant weather periods. While initially adopted as a PM10 control strategy, woodstove curtailment and related strategies have provided a significant reduction in CO emissions as well. The woodstove strategies will continue to reduce carbon monoxide and particulate emissions in the Klamath Falls area.

4.54.3.4 Contingency Plan

The Maintenance Plan must contain contingency measures that would be implemented in the event of: 1) a violation of the CO standard after the area has been redesignated to maintenance, or 2) other appropriate triggering protocol contained in the plan. Klamath Falls' contingency plan is outlined below.

The Clean Air Act Section 175A(d) requires that all control measures contained in the State Implementation Plan (SIP) prior to redesignation be retained as a contingency measure in the Maintenance Plan. Therefore, Lowest Achievable Emission Rate (LAER) technology and emission offsets for major industrial sources must be contingency measures in the CO Maintenance Plan. Reinstatement of the wintertime oxygenated fuel program must also be in the contingency plan.

The Klamath Falls CO Contingency Plan is designed in phases in order to both prevent a violation of CO standards, and to promptly correct any violation that may occur.

<u>Phase 1: Risk of Violation</u>

If monitored second high CO concentrations at 6th & Hope St[5] in any year equal or exceed 8.1 ppm[6], the DEQ will identify a planning group of local stakeholders to review growth and other factors to determine if significant planning assumptions have changed. Within six months of triggering Phase 1 of this contingency plan, the planning group will recommend additional strategies as necessary to prevent an exceedance or violation of CO standards. If the high CO concentration were determined to be an exceptional event, no further action would be needed.

The contingency strategies to be considered include, but are not limited to:

- Improvements to parking and traffic circulation;
- Aggressive signal retiming program;
- Increased funding for transit;
- Public information program;
- Reinstate the requirement for oxygenated fuels during the winter CO season;
- Development of a commuter rideshare program;
- Incentives to increase transit ridership;
- Accelerate use of van networks for shared commute or other trips;
- Evaluate the potential for Environmental Justice Grants to fund prevention measures.

In the event of a second occurrence in a calendar year of an 8-hour CO concentration equaling or exceeding 8.1 ppm, the planning group will conduct a more comprehensive evaluation of planning assumptions and emission sources significantly contributing to CO levels, and will develop additional emission reduction strategies as appropriate.

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5 (As measured by either the National Air Monitoring System or the State and Local Air Monitoring System)

6 Trigger threshold of 8.1 ppm equals 90% of CO National Ambient Air Quality Standard (9.0 ppm)

Phase 2: Actual Violation

If a violation of the CO standard occurs, the following contingency measures will automatically be implemented:

(1) New Source Review requirements for proposed new or expanding major sources will be modified. The requirement to install Best Available Control Technology (BACT) will be replaced with a requirement to install Lowest Achievable Emission Rate (LAER) technology. These requirements will take effect upon validation of the violation by DEQ. All other New Source Review requirements for nonattainment areas will be reinstated as well.

(2) The wintertime oxygenated fuel program will be reinstated.

If a violation occurs, the nonattainment New Source Review and oxygenated fuels program must be automatically reinstated until such time as the department, in consultation with a local advisory committee, revises the maintenance plan to ensure that the violation will be corrected. The nonattainment area NSR requirements and oxygenated fuels program may once again be removed when EPA approves a revised maintenance plan that ensures future compliance.

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4.54.4 ADMINISTRATIVE REQUIREMENTS

The criteria that must be satisfied for a nonattainment area to be redesignated to attainment include several administrative requirements related to compliance with various Clean Air Act provisions. Each of these elements is described below.

4.54.4.1 SIP Requirements/Nonattainment Area Requirements

Klamath Falls has met all SIP requirements specified in Section 110 and Part D of the Clean Air Act.

In summary, Section 110 says that a state shall submit a plan, that becomes part of the State Implementation Plan (SIP), providing for the implementation, maintenance, and enforcement of an air quality standard. Part D outlines specific plan requirements for nonattainment areas.

4.54.4.2 Summary of Previous Planning Requirements

A carbon monoxide attainment plan was not required for the Klamath Falls UGB prior to reauthorization of the Clean Air Act in 1990. On November 15, 1990 EPA designated the Klamath Falls UGB as a moderate nonattainment area for carbon monoxide by operation of law based on 1988-89 CO levels. The Clean Air Act Amendments required the implementation of an oxygenated fuel program in areas such as Klamath Falls with CO design values equal to or greater than 9.5 ppm. The department adopted a wintertime oxygenated fuel program for Klamath Falls on October 16, 1992. This strategy was submitted to EPA as an amendment to the State of Oregon Clean Air Act Implementation Plan (SIP) in order to meet the 1990 CAAA requirements.

4.54.4.3 1990 Clean Air Act Requirements and Status

The 1990 Clean Air Act Amendments place additional requirements on moderate CO nonattainment areas. Following are the DEQ submittal dates and EPA approval dates of submissions required by section 110 and Part D of the 1990 Clean Air Act Amendments:

a. *1990 Emissions inventory, to be revised every three years thereafter until attainment.* On November 15, 1992, DEQ submitted to EPA a comprehensive 1990 carbon monoxide emission inventory for the Klamath Falls nonattainment area. EPA provided comments on the submittal in July, 1993. Since the 1996 emission inventory will serve as both periodic EI update and attainment (base-year) inventory, EPA agreed that completing the 1990 and 1993 inventories would not be necessary, and that EPA's comments on the draft 1990 EI would be incorporated into the 1996 inventory. The 1996 attainment inventory included as

Appendix D5-4 in this Redesignation Request / Maintenance Plan submittal will also be used to meet the periodic emission inventory requirement. The emissions forecast is also included in Appendix D5-4.

b. *Oxygenated gasoline*. On November 16, 1992, the DEQ submitted to EPA an oxygenated gasoline program for the Klamath Falls area. The regulations were effective October 16, 1992. The program mandated the use of gasoline with no less than 2.7 percent oxygen content in the winter months.

c. *Transportation and General Conformity Requirements.* Section 176(c) of the Clean Air Act requires states to revise the SIPs to establish criteria and procedures for demonstrating that federal actions conform to the goals established in the SIP. On April 14, 1995, DEQ submitted to EPA a revision to the Oregon SIP establishing transportation conformity requirements for Oregon (OAR 340-020-0710 through 340-020-1080). General Conformity requirements (OAR 340-020-1500 through 340-020-1600) were submitted on September 27, 1995. EPA approved the transportation conformity rules as a SIP revision on May 16, 1996. EPA modified the transportation conformity rules in 1997 to allow more flexibility; DEQ adopted these changes in 1998. The revised state rules were submitted to EPA as a revision to the State Implementation Plan on October 13, 1998.

d. *New Source Review Rules (NSR) for "major sources"* On November 16, 1992, DEQ submitted revisions to the New Source Review permit program. These revisions included a requirement that offsets come from contemporaneous, actual emission reductions under OAR 340-028-1970(5), and other changes.

e. Contingency Measures. Initial contingency measures were not required for Moderate Nonattainment Areas such as Klamath Falls, with design values less than 12.7 ppm.

4.52.4.4 Monitoring Network and Commitments

The DEQ is responsible for the operation of the permanent ambient CO monitor in the Klamath Falls UGB. The DEQ oversees the quality control and quality assurance program for the CO data.

The DEQ will continue to comply with the air monitoring requirements of Title III, Section 319, of the FCAA. The monitoring site will also continue to be operated in compliance with EPA monitoring guidelines set forth in 40 CFR Part 58, "Ambient Air Quality Surveillance," and Appendices A through G of Part 58. In addition, DEQ will continue to comply with the "Ambient Air Quality Monitoring Program" specified in Volume 2, Section 6 of the SIP. Further, DEQ will continue to operate and maintain the network of State and Local Air

Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS) in accordance with the terms of the State/EPA Agreement (SEA)

The DEQ also periodically conducts saturation studies to verify that existing monitors are recording the highest CO concentrations in the area. The DEQ will commit to conducting a reevaluation survey in the event of major changes in traffic patterns, as soon as practicable after identifying any such changes. DEQ will also commit to a five-year periodic survey, pending EPA review. Based on CO monitoring data, relevant traffic data and other considerations such as special project funding availability, DEQ air monitoring, modeling and planning staff in consultation with EPA air monitoring, modeling and planning staff may reach agreement that the periodic survey is unnecessary, or should be delayed.

4.52.4.5 Verification of Continued Attainment

The DEQ will analyze on an annual basis the CO air quality monitoring data to verify continued attainment of the CO standard, in accordance with 40 CFR Part 50 and EPA's Redesignation guidance. This data, along with the previous year data, will provide the necessary information for determining whether the Klamath Falls UGB continues to comply with standards.

The Clean Air Act requires the state to submit a revision to the maintenance plan eight years after the initial redesignation request is approved by EPA. The revision will provide for continued maintenance of standards. The next maintenance plan update will likely be in 2009, assuming EPA approval of this plan in 2001 (EPA has a maximum of 18 months from the date of submittal to act on the plan). The maintenance plan revision in 2009 will include a full emissions inventory update and emissions forecast. The plan will show continued attainment for at least the next ten years beyond EPA approval of the revised plan.

For the interim period between EPA approval of this plan and the 2009 plan revision, the department will rely on ambient monitoring data to track progress of the maintenance plan. Growth projections for Klamath Falls are modest. As long as ambient CO concentrations show no significant upward trend, a mid-term emission inventory update or emissions tracking program will not be necessary. If carbon monoxide concentrations significantly increase over current levels, then an evaluation of growth and other planning assumptions will be necessary.

If a second-high carbon monoxide concentration in any year is measured above eighty percent (80%) of the standard, the department will prepare an analysis of growth factors to determine if other planning assumptions have changed. The analysis will include a review of emission factors, growth rate assumptions, traffic data, and other significant assumptions used to develop the maintenance plan. If there are significant changes, the department will consult with EPA to determine if a more extensive periodic emission inventory update, or other action, is warranted.

4.52.4.6 Maintenance Plan Commitments

As part of the CO Maintenance Plan, DEQ commits to do the following:

The DEQ will commit to conducting a saturation re-evaluation survey in the event of major changes in traffic patterns, as soon as practicable after identifying any such changes. DEQ will also commit to a five-year periodic survey, pending EPA review.

DEQ will commit to an evaluation of growth and other planning assumptions if carbon monoxide concentrations significantly increase over current levels.

-###-

Appendix D5

MAINTENECE PLAN APPENDICIES

STATE IMPLEMENTATION PLAN REVISION
FOR CARBON MONOXIDE IN THE KLAMATH FALLS URBAN GROWTH
BOUNDARY

Appendix D5-1

Technical Analysis Protocol

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

MAR 26 1999

Reply To
Attn Of: OAQ-107

Annette Liebe, Manager
Airshed Planning Section
Oregon Department of Environmental Quality
811 SW Sixth Avenue
Portland, Oregon 97204-1390

Re: Klamath Falls TAP Addendum

Dear Ms. Liebe,

EPA has reviewed and signed the Klamath Falls CO maintenance plan Technical Analysis Protocol (TAP), enclosed for your records. This letter will also be an addendum to the TAP because it formalizes a change in the highway vehicle emission model ODEQ will use.

The TAP states that ODEQ will use MOBILE5ah. However, as a result of recent discussions between ODEQ and EPA technical staff, ODEQ has communicated a preference for the most recent model available, MOBILE5b.

MOBILE5b is an option for new analyses and submissions that do not rely upon previous analyses and submissions for program stringency or approvability. Although Mobile 5a continues to be acceptable for all highway vehicle emission factor modeling, MOBILE5b contains additional features.

EPA acknowledges this preference and understands that the Klamath Falls CO maintenance plan will use MOBILE5b to demonstrate maintenance of the NAAQS.

Please feel free to contact me at (206) 553-1189 or Tracy Oliver at (206) 553-1388 if you have any questions.

Sincerely,

Bonnie Thie, Manager
State and Tribal Programs Unit

TO:BT:yd

RECEIVED
MAR 31 1999
AIR QUALITY DIVISION

Technical Analysis Protocol
Klamath Falls Carbon Monoxide Maintenance Plan
December 1998

This Technical Analysis Protocol (TAP) provides the framework for EPA and DEQ agreement on the technical approach and assumptions to be used in the development of a carbon monoxide maintenance plan for the Klamath Falls CO Nonattainment Area. The maintenance plan will support a request for redesignation to attainment, and designation of the Klamath Falls Urban Growth Boundary as a maintenance area. Development of the maintenance plan will involve a local advisory committee appointed by the department. The TAP document may be amended as necessary, based on comment from the advisory committee, EPA, or other stakeholders.

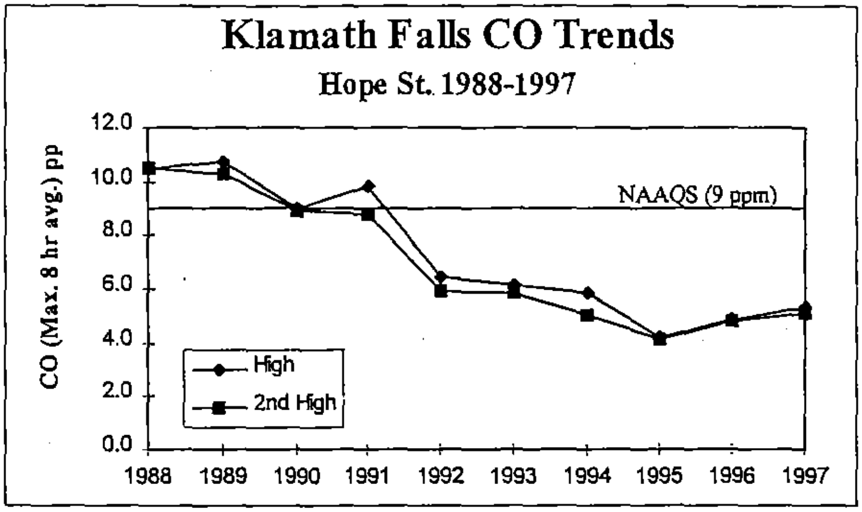
I. Background Information

The Klamath Falls Carbon Monoxide Nonattainment Area is defined as the Urban Growth Boundary (UGB), an area encompassing both the City of Klamath Falls and parts of Klamath County. In order to adequately account for air pollution impacts on the UGB from the surrounding area, the Klamath Falls Carbon Monoxide Maintenance Plan will consider emissions from all sources within the Klamath Falls UGB as well as major point sources within a 25 mile radius.

A. Attainment Year and Concentrations

One carbon monoxide monitor has been in place at the same location in the Klamath Falls UGB (Hope St. site) since 1988. The last violation of the maximum 8-hour average CO standard occurred in 1989 with measured high and second high values above the 9 ppm NAAQS (10.9 ppm on 01/19/89 and 10.3 ppm on 12/23/89). Only one exceedance has occurred since 1989 (January 5, 1991 with a high maximum 8-hr avg. value of 9.8 ppm). Klamath Falls has not had an exceedance of the 35 ppm 1-hour avg. NAAQS. Klamath Falls first achieved compliance with CO standards in 1990 with a recorded second high below the NAAQS (8.9 ppm). The CO standard was attained in 1991 when the second high value of 8.8 ppm resulted in two consecutive years (1990 and 1991) of second highs below the NAAQS. Since 1991, maximum CO values have been significantly below the NAAQS.

Figure 1



Calendar year 1996 has been selected as the attainment year for maintenance plan purposes. This is discussed in more detail in Section V of this document. Using 1996 provides the opportunity to use up-to-date activity and emissions data. The CO season will be defined as the three month period of December 1995, January and February 1996. Emissions will be expressed as average pounds per day for a typical three month CO season. A maintenance year seasonal emission inventory will be projected out at least ten years beyond anticipated EPA approval.

Inventoried source categories will include stationary point sources, stationary area sources, non-road mobile and on-road mobile sources. On-road mobile emissions will be based on modeled VMT for 1996 and the future forecast year, adjusted for wintertime travel. Residential wood combustion emissions will be based on 1998 activity data, adjusted to reflect home heat demand for the 1995/96 winter and projected to the future forecast year. Similar adjustments for other source categories will be made to estimate emissions. For major stationary point sources the inventory will include permitted sources with annual CO emissions greater than 100 tons per year located inside or within a 25-mile radius of the nonattainment area. For existing major point sources, attainment and future year emissions will be based on projected actual emission levels (not Plant Site Emission Limits).

B. Control Strategies

Based on monitoring data from 1988-1989, the Klamath Falls UGB was designated as a moderate nonattainment area for CO by operation of law under the 1990 Clean Air Act amendments. The attainment date was December 31, 1995. The 1990 amendments required implementation of an oxygenated fuel program in areas like Klamath Falls with CO design values equal to or greater than 9.5 ppm. Because the Klamath Falls design value was less than 12.7 ppm, no formal attainment plan or attainment demonstration was required. Only implementation of the required control measures was necessary. An oxygenated fuel program was developed for the Klamath Falls area and introduced in 1992. The Klamath Falls UGB also relies on the Federal Motor Vehicle Emissions Control Program as a CO control strategy.

II. Potential Risk for Renewed Nonattainment

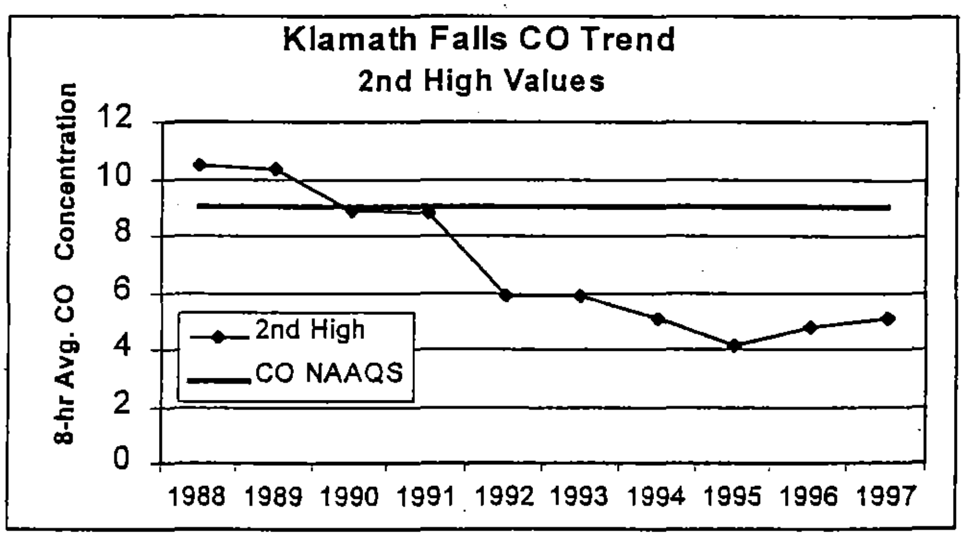
Table 1 shows the seven highest and second high measured values for CO since 1990.

Table 1
Klamath Falls Carbon Monoxide Concentrations
Yearly Values (High and 2nd High) Since 1990

Concentration Highest Yearly	Date		Concentration 2nd Highest	Date
9.0 ppm	November 17, 1990		8.9 ppm	November 29, 1990
9.8 ppm	January 5, 1991		8.8 ppm	December 23, 1991
6.4 ppm	December 18, 1992		5.9 ppm	November 14, 1992
6.1 ppm	December 20, 1993		5.9 ppm	November 19, 1993
5.9 ppm	January 14, 1994		5.1 ppm	February 5, 1994
4.2 ppm	February 10, 1995		4.1 ppm	November 14, 1995
4.9 ppm	November 11, 1996		4.8 ppm	January 2, 1996
5.3 ppm	December 29, 1997		5.1 ppm	January 11, 1997

Figure 2 shows that the trend in CO concentration since 1988 is clearly downward. Even with a slight upturn in recent years, CO concentrations remain significantly below the NAAQS. Meteorological trends and associated impacts will be addressed in the maintenance plan.

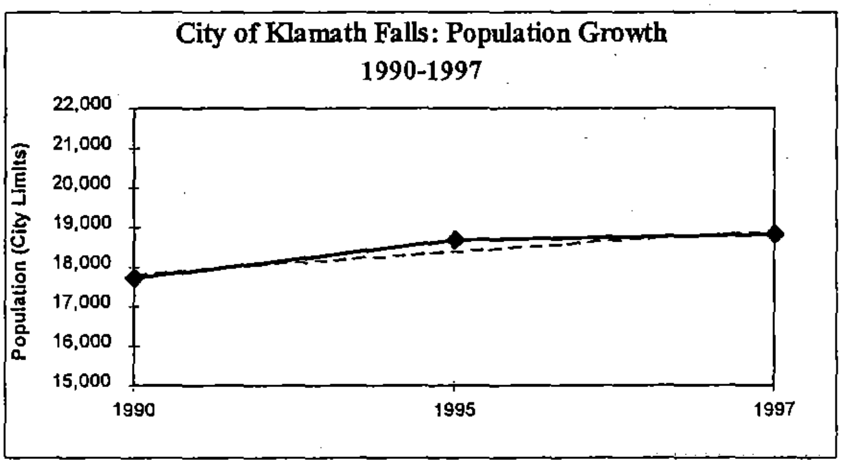
Figure 2
Klamath Falls Carbon Monoxide Trend
Yearly Second Highest Concentrations (Max. 8-hr avg.)



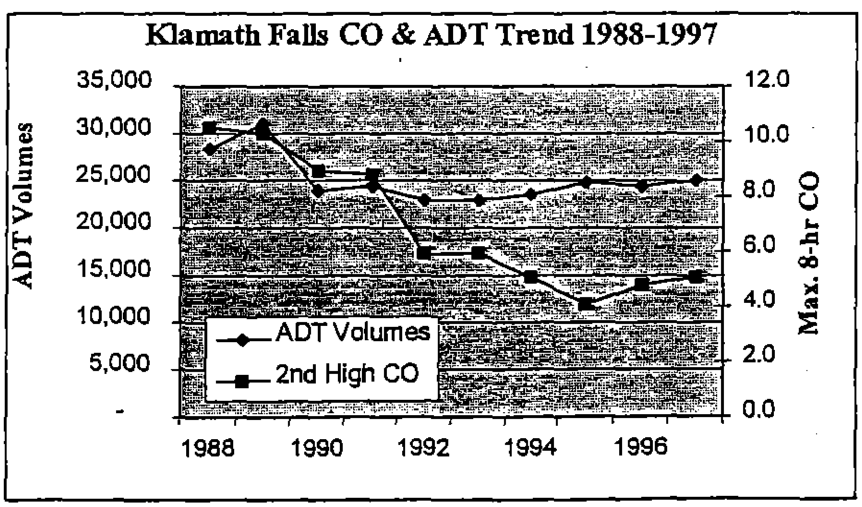
Strategy Impacts

A significant drop in peak CO concentrations occurred in the same year as implementation of the oxygenated fuel program in 1992. While oxygenated fuel contributed to decreased CO concentrations, other factors influenced the downward trend including, motor vehicle fleet turn over, a down turn in local traffic volumes, and a lessening of severe air stagnation conditions prevalent in the mid 1980's through early 1990's. Although traffic volumes have recovered in recent years, CO concentrations have remained low.

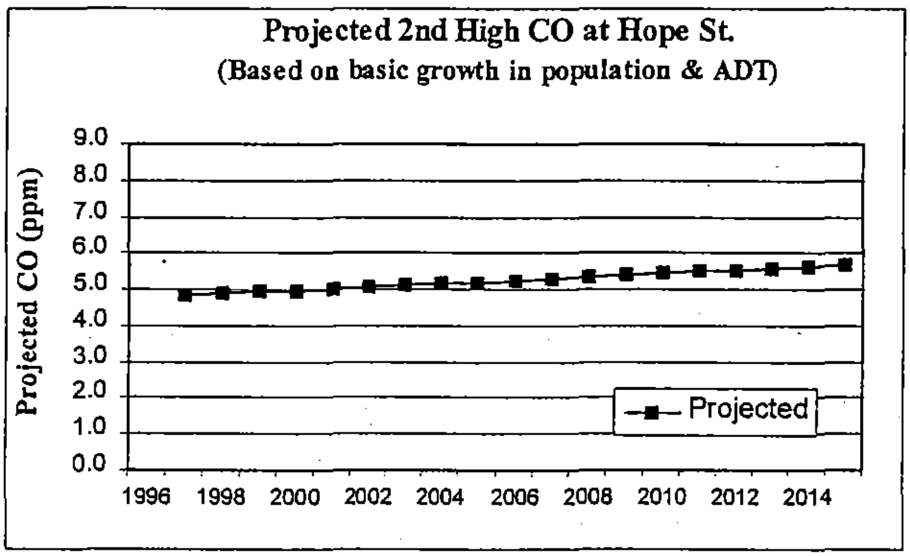
Growth projections from local comprehensive plans will be reconciled with population and travel forecasts from the Oregon Department of Transportation. Historic population growth has been approximately 1 percent per year. Future population growth is expected to be modest as well. Growth in average daily traffic volumes near the Hope St. site have been growing at approximately 1 percent per year since 1991.



In spite of growing traffic volumes near the Hope St. monitor, CO values continued to decline from 1990-1995. Concentrations have shown a small upturn in 1996 and 1997.



Growth factors for population and motor vehicle travel will be developed in cooperation with the Oregon Department of Transportation and a local advisory committee. Given future emission reductions from vehicle fleet turnover, it is expected that the Klamath Falls area will remain in attainment for CO. Future year mobile emissions with and without oxygenated fuel will be evaluated as part of the maintenance plan analysis. CO emission projections for motor vehicles will be based on EPA's current emission factor model (Mobile 5a_H). The maintenance plan will evaluate the possibility of discontinuing the oxygenated fuel program. A simple projection of current CO concentrations based on recent population and traffic growth, and changes in on-road mobile emissions indicates that future CO levels will still be substantially below the NAAQS in 2015, even without oxygenated fuel. This suggests that a maintenance plan could eliminate oxygenated fuels as a strategy while still providing a sizable safety margin.

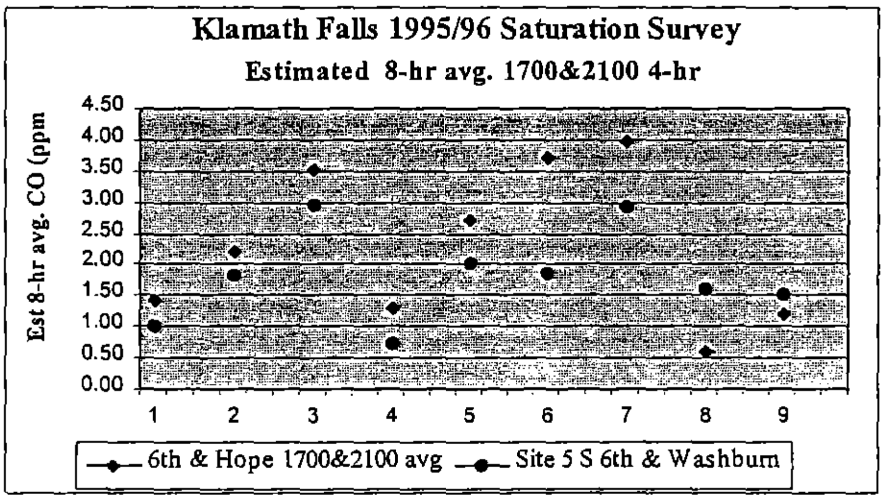


Saturation Survey

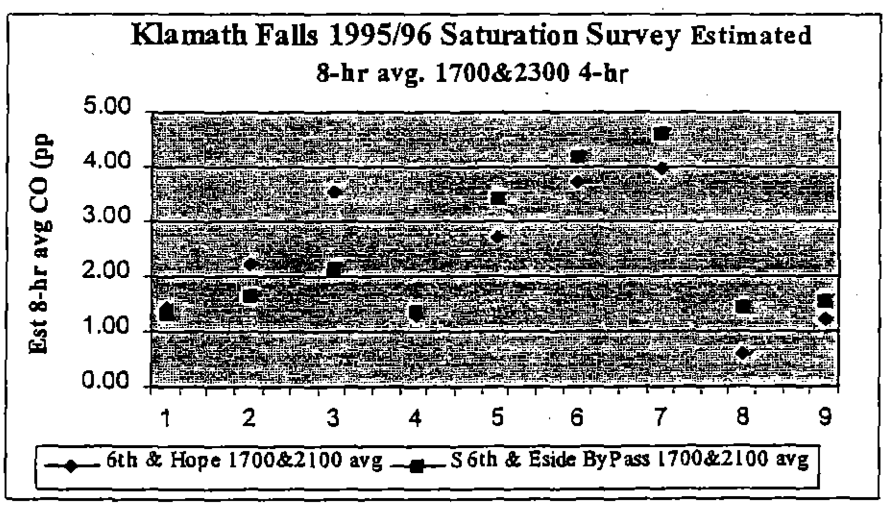
A CO saturation study was conducted in 1995-96 by DEQ to evaluate the appropriateness of the Hope Street CO monitoring site. All CO levels measured during the study were well below the NAAQS. Nine sampling locations were selected based on traffic volumes. The survey also included duplicate sampling at the current reference monitor site as well as one neighborhood scale site at Peterson School. Sampling took place on nine days from December 19, 1995 to January 25, 1996. Sampling days were selected based on forecasts for calm meteorological conditions. On each sampling day, three sequential 4-hr bag samples were taken beginning at 1300 hours, 1700 hours, and 2100 hours.

Although stagnation conditions during the study period were not severe, samples were collected concurrently with the measured 2nd high CO value at the Rogue Valley Mall site in Medford, Oregon (December 19, 1995) and the measured 2nd high at the Medford Brophy site (January 12, 1996). This indicates that the survey did capture periods of poor ventilation across southern Oregon. The survey also captured the 2nd high CO value at the Klamath Falls reference monitor for 1996 (January 1, 1996).

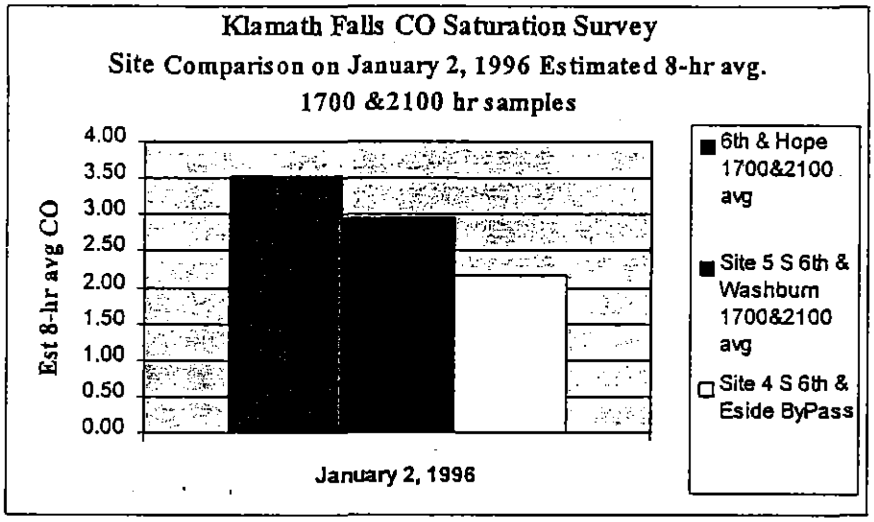
Of the nine survey locations only two produced 4-hr CO concentrations equal to or greater than those measured at the Hope St. reference site. These were survey sites #5/#6 @ S. 6th & Washburn, and site #4 @ S.6th & E. Bypass. To better compare the survey sites in terms relevant to the CO NAAQS, estimated 8-hour average CO concentrations were derived from the 4-hr average bag samples. Historic monitoring data from 1990 through 1997 were evaluated to determine the time frame typically associated with CO exceedences. This review showed that with one exception, all high and 2nd high maximum 8-hr average CO values between 1990 and 1997 occurred between about 5:00 p.m. and midnight. Therefore, an estimated 8-hour average constructed from the 1700 and 2100 hour bag samples would best replicate expected max. 8-hr average CO values at the reference monitor. A comparison of this data shows that the current reference monitor site at 6th & Hope St. regularly produced higher 8-hr average CO values than survey site 5/6 @ S.6th & Washburn.



The data also shows that estimated 8-hr average CO values at survey site #4 (S.6th St. & Eastside Bypass) are comparable to the reference site at 6th & Hope. Survey site #4 is approximately ¼ mile west of the reference site and generally represents the same geographic area within the UGB.



Analysis of survey data on January 2, 1996 (the measured 2nd high 8-hr max CO concentration at the Hope St. reference monitor) shows that the Hope St. site produced estimated 8-hr CO values higher than either survey sites #5/6 or site #4.



Taken together, the saturation survey data confirm that the current reference monitor location at 6th & Hope St. continues to represent the area of highest CO concentration in the UGB.

III. Demonstration of Attainment

A. Monitored Data

Monitored CO data from 1990 and 1991 will be used to show that the area reached attainment well before the 1995 Clean Air Act deadline. Data through 1997 demonstrates that the area continues to be in attainment.

B. Other Attainment Documentation

The saturation study referenced above provides further evidence that the area is in attainment. An analysis of the saturation study will be submitted as an appendix to the maintenance plan.

The attainment demonstration will also include a meteorological analysis comparing the non-attainment and attainment periods.

IV. Summary of Approved SIP Revision

A. Summary of Air Quality Attainment Measures/Dates of Approval

A formal carbon monoxide attainment plan was not developed for the Klamath Falls UGB prior to reauthorization of the Clean Air Act in 1990. On November 15, 1990 EPA designated the Klamath Falls UGB as a moderate nonattainment area for carbon monoxide by operation of law based on 1988-89 CO levels. The Clean Air Act Amendments required the implementation of an oxygenated fuel program in areas such as Klamath Falls with CO design values equal to or greater than 9.5 ppm. The department adopted an oxy-fuel program for Klamath Falls on October 16, 1992. This strategy was submitted to EPA as an amendment to the State of Oregon Clean Air Act Implementation Plan (SIP) in order to meet the 1990 CAAA requirements.

B. Description of Permanent and Enforceable Emission Reductions

The Klamath Falls UGB attained the CO NAAQS in 1991 due to a number of factors; most importantly fleet turn over, and perhaps to some extent decreased traffic volume in the area. CO levels have continued to decline due to the introduction of oxygenated fuel in 1992 and the increasing number of cleaner motor vehicles. In recent years CO concentrations have remained low in spite of increased traffic volumes, showing that attainment is due to permanent and enforceable measures. These measures will carry over to the maintenance plan, although the possibility of eliminating oxygenated fuel will be evaluated.

C. Clean Air Act Sections 110 and Part D Requirements

- The key portions of Section 110 and Part D that apply to the Klamath Falls nonattainment area are sections 107(d)- Nonattainment Area Designations, 175(A)-Maintenance Plan Requirements, 176(c)(4)-Transportation Conformity, 187(a)-Plan Submissions and Requirements for Moderate Areas, and 2211(m)-Oxygenated Fuels Program. Other important requirements include:

- 1977 CAA Amendments -- New Source Review and Plant Site Emission Limit rules were submitted to EPA on 9/9/81 and approved on 8/13/82.

- 1990 CAA Amendments -- Oxygenated fuel program rules were adopted on October 16, 1992, submitted to EPA on 11-16-92 and approved on 3-17-94; conformity rules were adopted in 1995 and approved by EPA on 5/16/96.

V. Air Quality Maintenance Plan

A. Attainment Year Emissions Inventory

An attainment emission inventory will be developed for calendar year 1996. For maintenance plan purposes, this inventory will not include oxygenated fuel and is discussed further in Section B. The CO season EI will be developed to reflect the winter of 1995/96. An emission Inventory Preparation Plan (IPP) will be prepared and submitted for EPA review in the winter of 1998/99.

B. Maintenance Demonstration

EPA's September 4, 1992 guidance on CO maintenance demonstrations (Calcagni memo) states that the State should be able to rely on the attainment inventory comparison approach in areas where no modeled attainment demonstration was required. Klamath Falls is an area where no attainment demonstration was required, therefore an emission comparison approach is appropriate. For the Klamath Falls CO maintenance plan we propose that future year airshed emissions be compared to 1996 levels (without oxy-fuels). Maintenance will be demonstrated by showing that projected emissions will not increase over the attainment inventory level. It is also anticipated that additional control measures will not be required to keep the area in attainment throughout the maintenance period.

One concern with using 1996 emission levels is that they do not represent airshed capacity for Klamath Falls. Klamath Falls CO levels in 1996 were approximately half the NAAQS (4.8 ppm 2nd high). Significant emissions growth could occur from 1996 levels without ever jeopardizing air quality standards. Locking in airshed emissions at 1996 levels could unfairly restrict emissions growth in the area. Based on recent communication with EPA Region X, we intend to establish a 1996 attainment emissions level that does not include the effect of oxygenated-fuels. Establishing this higher emission limit as that attainment level would at least in part, provide a reasonable margin for growth in the area at levels significantly below the NAAQS. Even so, given the low levels of CO in Klamath Falls we believe that this emission level would still represent ambient CO concentrations significantly below the NAAQS.

It is our intent to project emissions out at least ten years beyond EPA approval. Motor vehicle emission budgets would be established for the horizon year and any necessary intermediate years.

Although not required, the department is also willing to augment the inventory comparison approach by conducting a simple proportional roll-forward analysis of ambient CO concentrations at the Hope Street monitoring site. No other analysis will be required. Factors supporting the use of roll-forward include:

- The second high CO value in 1996 ("design value") is significantly below the NAAQS, making a simplified modeling approach reasonable. There is little concern that future CO values will be close enough to the NAAQS to warrant the sensitivity of a more sophisticated model.

- The emission source mix and characteristics in Klamath Falls are relatively simple and straight forward, with no single major point source significantly contributing to NAAQS exceedances. Major point sources and other area sources will be assumed as background contributors to CO in the roll forward analysis.

- The total airshed inventory is not totally dominated by motor vehicle emissions. Ambient CO levels at the Hope Street site are significantly influenced by local motor vehicle emissions, as are most CO monitoring sites. A preliminary analysis suggests that ambient CO levels have followed decreases in motor vehicle emissions over time. It is this relationship we believe that supports the use of a proportional approach. More sophisticated intersection analysis techniques are not necessary and would have no precedent in other Oregon CO areas.

The Department of Transportation is currently developing an improved travel demand forecasting model for the Klamath Falls area. Current household survey information and other data are being gathered to improve trip generation estimates and refine future forecasts of motor vehicle travel in the UGB. It is expected that this model will provide VMT data for emission inventory estimates by January, 1999. The new model will provide VMT data more representative of local conditions and will be used in the assessment of the oxy-fuel program. The model will also be used to establish a motor vehicle emissions budget that will govern future transportation conformity determinations.

A local advisory committee will provide recommendations on retaining or eliminating oxygenated fuel. The committee will be comprised of local representatives from private and public sectors, including major industry, business, city, county, environmental, transportation, forestry, and health interests. Members are selected by invitation from the department, in consultation with local stakeholders. The committee functions in an advisory capacity to the department and the Environmental Quality Commission.

Progress Tracking

The Clean Air Act requires the state to submit a revision to the maintenance plan 8 years after the redesignation request is approved by EPA to provide for maintenance of the NAAQS for an additional 10 years following the first 10 year maintenance period. The next maintenance plan update will likely be in 2009, assuming EPA approval of this plan in 2001 (EPA has a maximum 18 months to act on the plan after its submittal in 1999). The maintenance plan revision in 2009 will include a full emissions inventory update and project emissions and continued attainment out an additional ten years (minimum) beyond EPA approval of the revised plan.

For the interim period between EPA approval of this plan and the 2009 plan revision, the DEQ will rely on ambient monitoring data to track progress of the maintenance plan. It is likely that Klamath Falls will experience minimal growth over the next ten years, in the range of one percent per year. If low growth rates are confirmed during the plan development process, the department believes that a mid-term emission inventory update is unnecessary, as long as monitoring data shows no significant upward trend in concentrations. If CO concentrations significantly increase over current levels then an evaluation of growth and other planning assumptions would be necessary.

The trigger for such an evaluation will be based on measured CO concentrations. If a second high CO concentration in any year is measured above 7.2 ppm (80% of NAAQS), the department will prepare an analysis of growth factors to evaluate if any significant planning assumptions have changed. The analysis would include a review of emission factors, growth factors, rule effectiveness and penetration factors and other significant assumptions used to prepare the maintenance plan. DEQ would compare the updated emission factor summary to the attainment inventory and maintenance emission forecast, and evaluate any changes that have occurred. If there have been significant changes, DEQ would, in consultation with EPA Region 10, determine if a more extensive periodic emission inventory is necessary, or if other action is warranted.

C. Monitoring Network and Commitments

The 1995-96 saturation study confirmed that the existing monitor is correctly located in the vicinity of highest CO values for the Klamath Falls UGB. Saturation surveys are typically conducted about every five to ten years. Based on CO monitoring data, relevant traffic data and other considerations such as resource priorities for PM2.5 implementation, DEQ air quality staff in consultation with EPA may reach agreement that the next periodic survey is unnecessary, or should be delayed.

D. Verification of Continued Attainment

DEQ will continue to operate the CO monitor at the Hope Street site, and will analyze on an annual basis the CO air quality monitoring data to verify continued attainment of CO standards. This data, along with data from previous years will provide the necessary information for determining whether the area continues to attain the NAAQS. An emissions tracking approach will also be identified and discussed in the final redesignation document.

E. Contingency Measures

Contingency measures and triggering events will be discussed with the local advisory committee and addressed in the maintenance plan document.

VI. Other Resource Considerations

Completing the emission inventory work for the maintenance plan will require significant resources from our Technical Services Section. It is our understanding that combining the attainment year selection with the 1996 Periodic Emission Inventory (PEI) will satisfy EPA's emission inventory needs, and that completion of the 1990 CO base year and 1993 CO PEI will not be required.

VII. Schedule for Completion

• Technical Analysis Protocol to EPA	December 1998
• Technical Work Completed *(draft EI)*	May 1999
• Plan development and EQC adoption	December 1999
• EPA Submittal	December 1999
• EPA Approval (EPA allowed up to 18 months)	June 2001

VIII. EPA Review

The department anticipates that the oxygenated fuel program will not be needed to maintain compliance with CO standards. Local fuel distributors must be informed of any change in requirements by mid summer in order to make appropriate adjustments for the winter season (starting November). If the oxy-fuel program is found to be no longer necessary, the department would like to work with EPA on an approval schedule that would allow fuel suppliers adequate time to adjust before the winter season begins. Assuming EQC adoption no later than December 1999, we would like to establish a goal for EPA approval of no later than the summer of 2000. It is understood that this goal must be flexible given unanticipated changes in DEQ or EPA workload and priorities.

Department of Environmental Quality

Annette Liebe 2/8/99

Annette Liebe, Manager, Airshed Planning — Date

Region 10 Environmental Protection Agency

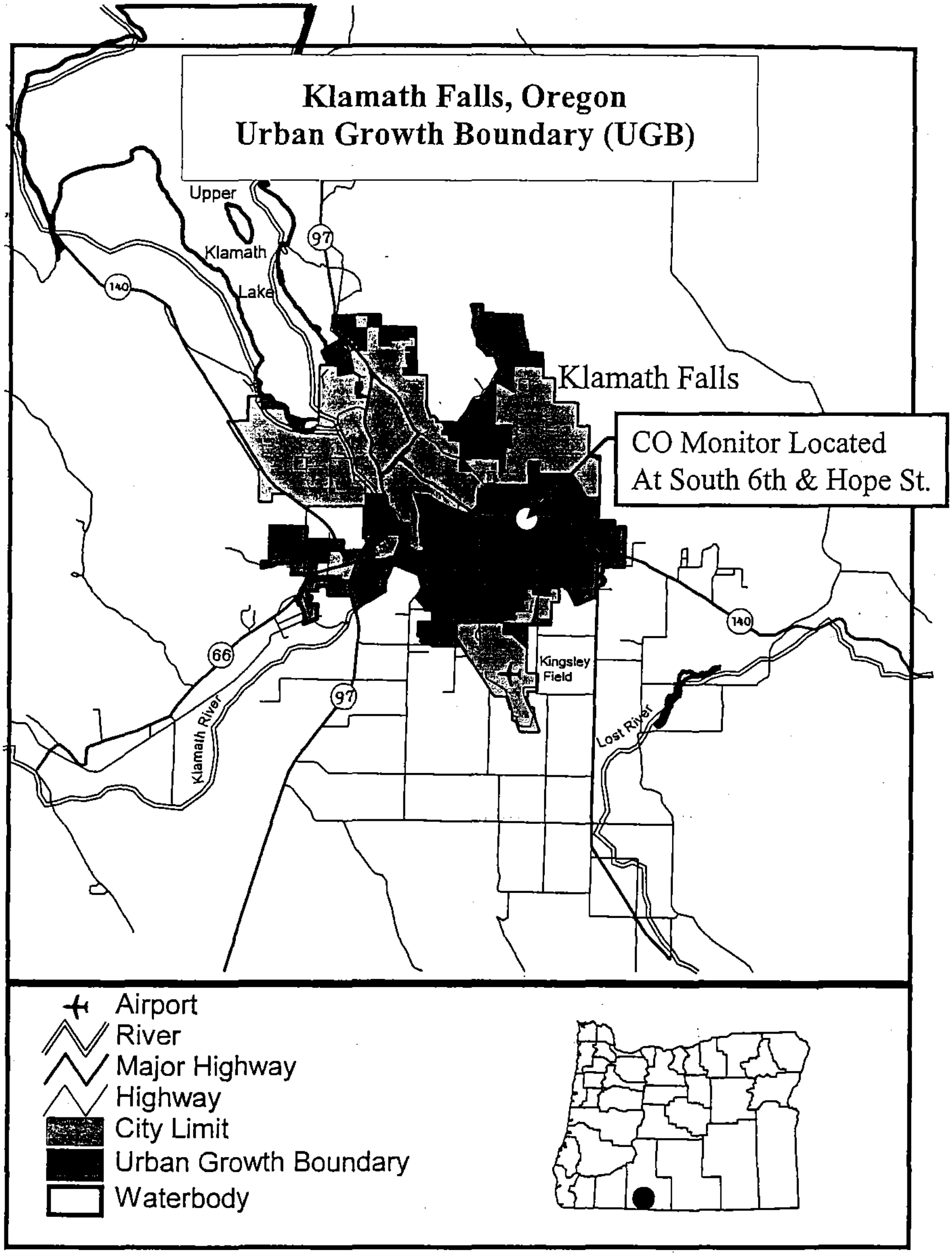
Bonnie Thie 3-26-99

Bonnie Thie, Manager, State and Tribal Air Programs Unit — Date

STATE IMPLEMENTATION PLAN REVISION
FOR CARBON MONOXIDE IN THE KLAMATH FALLS URBAN GROWTH BOUNDARY

Appendix D5-2

CARBION MONOXIDE MONITORING NETWORK


Klamath Falls, Oregon
Urban Growth Boundary (UGB)
Upper
Klamath
Lake
97
140
Klamath Falls
CO Monitor Located
At South 6th & Hope St.
66
Kingsley
Field
Klamath River
Lost River
Airport
River
Major Highway
Highway
City Limit
Urban Growth Boundary
Waterbody

STATE IMPLEMENTATION PLAN REVISION
FOR CARBON MONOXIDE IN THE KLAMATH FALLS URBAN GROWTH BOUNDARY

Appendix D5-3

CARBON MONOXIDE SATURATION STUDY

Oregon

DEPARTMENT OF
ENVIRONMENTAL
QUALITY

May 9, 2000

Keith Rose MS OAQ-107
US EPA Region 10
1200 SW 6th
Seattle, WA 98101

Dear Mr. Rose;

Attached are two copies of the "Klamath Falls CO Survey Report, Winter 1995-96" summarizing the results of that EPA funded special study. The purpose of the study was to reassess CO levels in Klamath Falls. The current site ranks among the maximum impact sites indicated by the study, however weather conditions during the winter of 1995-96 were not conducive to pollutant buildup. CO levels have been substantially reduced in the last 10 years due in part to the aggressive wood stove program and to improved pollution control for motor vehicles.

If you have any problems or questions regarding this study, you can reach me at (503) 229-6458 or Monica Russell at (503)-229-5713.

Sincerely,

Gerry Preston

Gerry Preston
Manager Air Quality Technical Services

Cc: AQM Laboratory
Western Region

LTR/AQ77173.doc

811 SW Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696

Klamath Falls CO Survey Report
Winter 1995-96

Oregon Department of Environmental Quality

Prepared by: Bill Becker, Monica Russell

Reviewed by: Jeffrey M Smith date: 5/8/00

Richard Peters date: 5/9/00

Introduction

Prior to this CO survey of 1995-96, no surveys have been conducted in the Klamath Falls area since the initial survey there of 1986-87. The purpose of this study included verification that the current site is appropriately located, as well as examination of the spatial distribution of CO in the Klamath Falls area.

Topography and meteorology, in combination with the use of wood stoves, have had a major impact on the air quality in the Klamath Falls area. Klamath Falls has been classified as a non-attainment area for both PM_{10} and carbon monoxide (CO). Unlike some other cities so classified (CO non-attainment), one of the contributors to pollutant levels in Klamath Falls has been home space heating (i.e. wood stoves), in addition to mobile sources.

Klamath Falls has had an aggressive wood stove program that included burning advisory calls, wood stove change-outs, and a public education component. Thanks to the cooperation and participation by Klamath Falls residents, the program has had a significant effect on CO levels, as well as the PM_{10} levels upon which it was focused. PM_{10}. levels have dropped substantially, and there have been no exceedances of the PM_{10} standard since 1992.

Carbon monoxide (CO) monitoring in Klamath Falls began in 1988. From 1988 to 1991 there were a total of 10 exceedances of the NAAQS putting the area into non-attainment status. Since 1992 there have been no exceedances of the CO standard and maximum CO levels have dropped to almost half of what they were 10 years ago.

In addition to the positive effects of the wood stove program on CO levels, traffic and business operations have changed the CO impacts which are related to mobile sources. More businesses along S. 6th Street, Washburn, and Shasta have increased traffic there. The improvements to the Eastside Bypass have virtually eliminated traffic along the older Alameda Street, which roughly parallels the Eastside Bypass route. The completion of Washburn Street as a North-South thoroughfare crossing the entire city from the Southside Bypass to the Eastside Bypass has made the intersection of Shasta and Washburn a major queuing point as well. The earthquake which occurred in the Klamath Falls area several years ago has also changed traffic patterns by forcing the closure of several government and private office buildings in the downtown area resulting in much less traffic in that part of town. Finally, residential expansion in all directions, particularly to the east of the city along S. 6th Street, has increased vehicle traffic along all major routes in Klamath Falls.

Procedure

In addition to the current CO monitoring site on Hope Street, eight sites were selected for study based on input from the DEQ Air Quality Planning section recommendations, traffic counts, and local interviews. Appendix A contains a map and list of the sites. AirMetrics Minivol survey samplers were set up using standard DEQ CO siting criteria. The Minivols are programmable battery powered sequential bag samplers. The sampler unit consists of two bag holders and a central pump housing. Two Minivols were sited at Hope Street for quality assurance purposes. In addition a reference method CO monitor was operated and used for bag analysis.

A review of historical hourly data showed that the highest CO values in Klamath Falls occurred most often between 1300 and 0100 hours. Based on this information three sets of four-hour bags were sampled. The first four-hour bag was collected between 1300 and 1700, the second between 1700 and 2100 and the third between 2100 and 0100.

A sampling forecast was developed to sample on days predicted to have poor ventilation in order to maximize the opportunity to collect highest pollutant samples. The decision to sample was made after reviewing weather data, and samplers were started by noon. Sampling began December 15, 1995 and continued through February 15, 1996. Samples were analyzed immediately after collection, and the highest bags reanalyzed for quality control purposes, as long as there was enough sample remaining in the bag for analysis.

Results and Discussion

Eighty seven percent of the total possible samples were collected. Equipment failure was the primary cause of missed samples and fortunately, much of the early malfunctions were corrected early in the process. The entire data set is displayed in Appendix B.

There was excellent agreement between the two survey samplers collocated for quality assurance purposes at the Hope Street site. A linear regression performed between the two data sets yielded an r^2=0.95. The relationship indicated by a linear regressions performed on the bag samplers and the reference method was also good yielding an r^2=0.88 between the reference method and each of the survey samplers. In general (approximately 75% of the time) the survey sampler values were somewhat higher than those of the reference method sampler.

The precision results, re-analyzing the highest bag from each group, were also good as shown in the table below:

Date	Bag Value	QC check
19-Dec	2.1	2.2
	3.85	3.75
	3.3	3.3
20-Dec	3.25	3.2
	3.25	3.2
	2.5	2.5
	2.25	2.15
2-Jan	0.7	0.65
	5.05	5
	5	5
	4	4
10-Jan	1.65	1.6
	0.1	0.15
	1.85	1.85
11-Jan	2.95	2.9
	0.5	0.5
	3.5	3.5
12-Jan	0.25	0.3
	5	5
	5.55	5.55
13-Jan	0.5	0.5
	6.55	6.55
	6.3	6.3
22-Jan	0.4	0.45
	3.55	3.55
	4.8	4.8
25-Jan	2.55	2.5
	3.2	3.15
	0.45	0.45

At the Hope Street site, the survey samplers and the permanent reference method monitor were all collocated. The additional reference method monitor that was used for analyzing the bags. That monitor was run continuously otherwise, and was located approximately 100 meters from the other samplers. The CO levels indicated by the data from that sampler were lower than the other reference method and the survey samplers approximately 70% of the time; indicating a drop in CO levels as the distance from the roadside increased.

The levels of CO observed in this study were moderate. Four of the nine days sampled showed values greater than 4.0 ppm. The maximum 4 hour bag was 6.6 ppm and was measured at site # 8 (6th & Main). At this site, there were no other values greater than 4.0 ppm. This maximum occurred on January 13, and was the day of highest 8-hour average maximums for eight out of the eleven sites. Sites were evaluated with regard to the numbers of times the maximum CO value occurred there. Site #8 did not rank among the highest performing sites for either maximum four or eight hour averages. Site #5 (6th & Washburn) showed the highest number of daily 4 hour maximums (8 out of 27). Site #4 (6th and Eastside Bypass) showed 6 out of 27, and site # 6 (Washburn & 6th) showed 5out of 27.

The maximum 8 hour average was 5.2 ppm and occurred at site #9 (5th & Klamath) during the 1700-0100 time interval. Site #9 did not rank among the highest performing sites of the study either. There was no single site that consistently showed maximum 8-hour averages for either averaging period. Site # 6 had the most daily high 8-hour averages (three of them) for the 8-hour average ending at 2100. Sites #5 and #2 had two each and sites #1, #4, and # 9 had one each. Site #4 had the most daily high 8-hour averages (three) for the 8-hour average ending at 0100. Sites #1 and #6 had two each and sites #2, #5, and #9 had one each.

The Peterson School site (#3) was a background site located 200 feet from the nearest road in the middle of the school playground. The final sample value from Peterson School was higher than either value from the Hope Street samplers. Traffic in the school neighborhood is insignificant after the school closes, so this sample most likely represents impacts from home space heating rather than traffic.

The weather during the study period was relatively mild compared to conditions seen in the past. Stagnant periods were short term, the 10th through the 13th being the period of longest duration. Only the 13th had very cold temperatures and low wind speeds conducive to pollution buildup; and in fact was the day of highest recorded CO levels for the study. However, the weather warmed and the wind speeds picked up on the 14th and sampling was discontinued until the 22nd.

Conclusions

The downtown sites and Peterson School showed the lowest values of the study. Highest levels were seen where traffic has become heavier away from the downtown and out of the neighborhoods. Traffic patterns have changed considerably in the past 10 years as discussed above. The Bypasses have eliminated a great deal of neighborhood traffic and the longest and slowest moving traffic and queuing for access occurs on South 6th Street and Washburn.

Although the Hope Street site showed CO levels as high as other sites of the study, like all the other sites where daily high CO values were recorded, it did not show highest values the majority of the time. Ideally it would be prudent to run an additional reference method monitor at or near site #6 or #5 at Washburn and South 6th, or site #4 at South 6th and the Eastside Bypass for a winter season to further investigate the results of this study. Laboratory staff indicate, however, that permanent siting at several of these locations would be difficult, if not impossible to accomplish: therefore a follow up bag study might be more feasible.

This study indicates that CO levels have fallen considerably since sampling initially began in Klamath Falls. It is reasonable to assume that levels have dropped based on the successful wood stove program and on emission control improvements in motor vehicles: however, the relatively mild weather conditions, certainly do not give worst case scenario results.

Appendix A

Appendix A

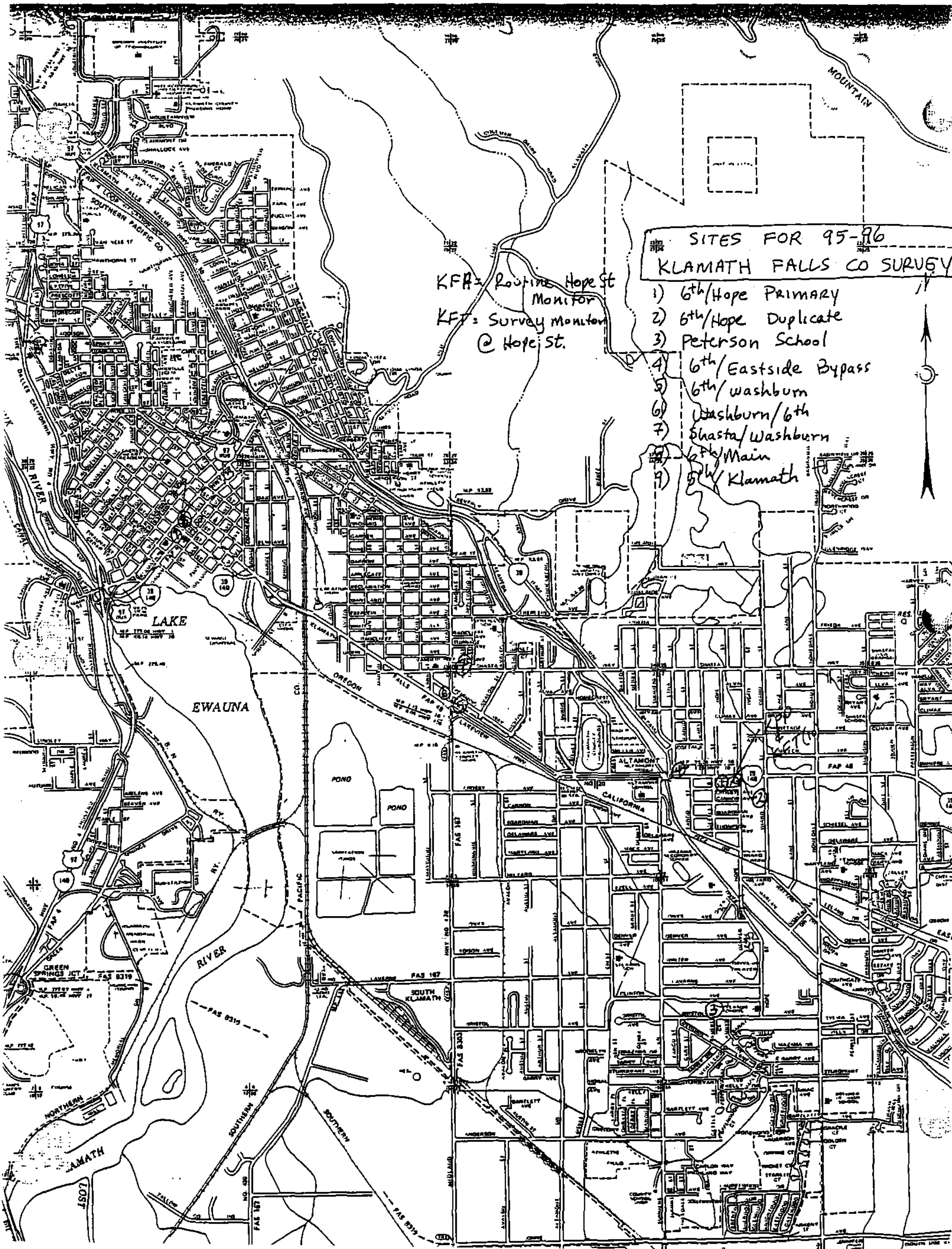
KLAMATH FALLS CO SURVEY
WINTER 1995-96
SITE LIST

REFERENCE METHOD CO SAMPLERS

KFH Routine Monitor Site S. 6th/Hope St.	18-00-010
KFT Survey Monitor Site in Backyard near Hope St. Trailer	95-18-010

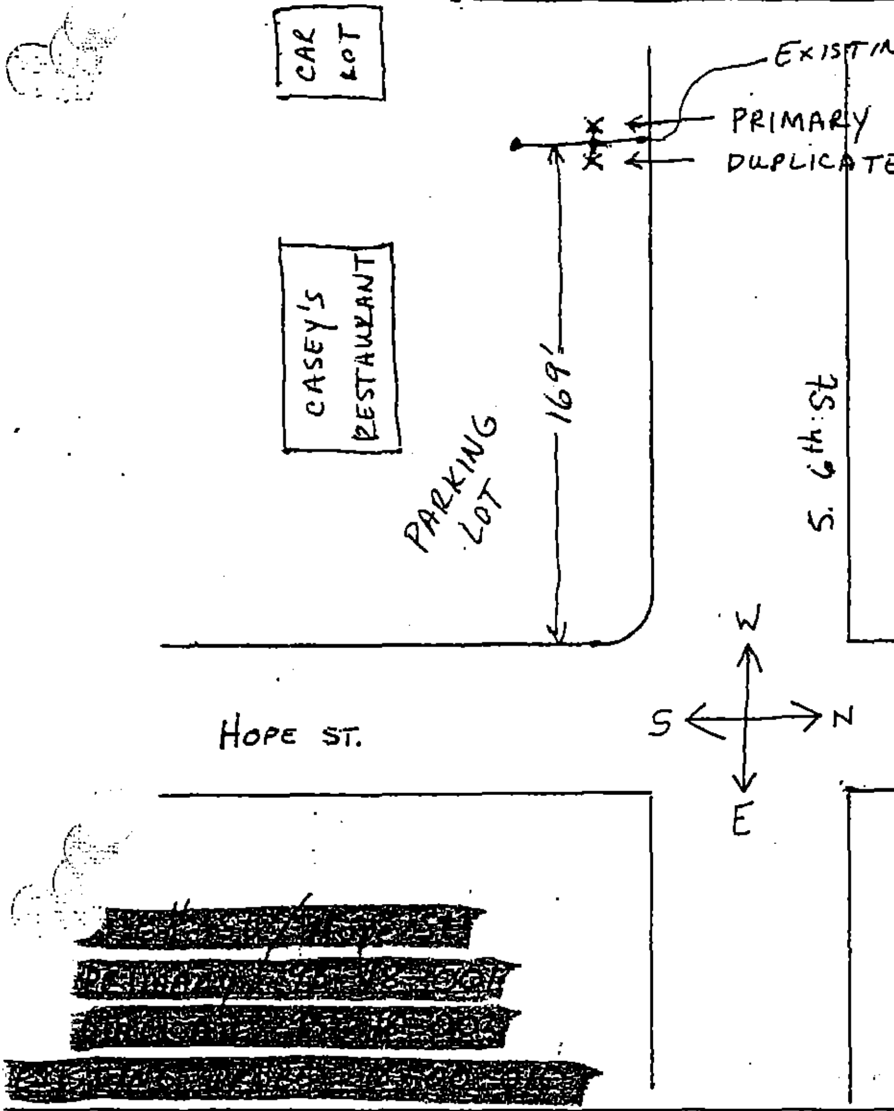
SURVEY CO SAMPLERS

1. S. 6th St./Hope St. - Primary (West towards car lot)	95-18-001
2. S. 6th St./Hope St. - Duplicate (East towards Casey's Restaurant)	95-18-002
3. Peterson School - attached to fence in middle of schoolyard	95-18-003
4. S. 6th St./Eastside Bypass - in Town Pump parking lot	95-18-004
5. S. 6th St./Washburn - on "No Parking" sign in front of Olympic Inn	95-18-005
6. Washburn/S. 6th St. - on "No Parking" sign by Norco Welding	95-18-006
7. Shasta/Washburn - on power pole by Hot & Now drive-thru lanes	95-18-007
8. 6th/Main - on "Left lane must turn left" sign by Klamath First Federal Bank	95-18-008
9. 5th/Klamath - on street light pole by VFW Hall	95-18-009



SITES FOR 95-96
KLAMATH FALLS CO SURVEY
1) 6th/Hope PRIMARY
2) 6th/Hope Duplicate
3) Peterson School
4) 6th/Eastside Bypass
5) 6th/washburn
6) Washburn/6th
7) Shasta/Washburn
8) 6th/Main
9) 5th/Klamath
KFA = Routine Hope St Monitor
KFT = Survey Monitor @ Hope St.
MOUNTAIN
SOUTHERN PACIFIC CO
LAKE
EWAUNA
RIVER
OREGON
CALIFORNIA
ALTAMONT
SOUTH KLAMATH
GREEN SPRINGS JCT
FAS 8319
FAS 167
POND
NORTHERN
SOUTHERN
PACIFIC
LOST

KLAMATH FALLS CO SURVEY
WINTER 1995-96

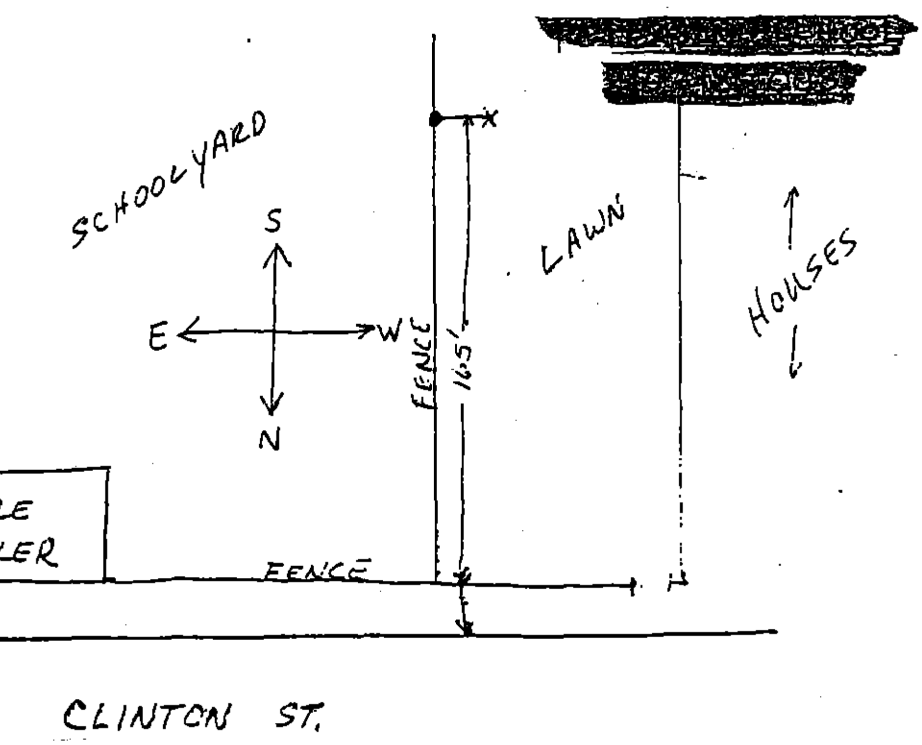


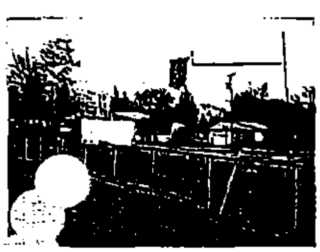
- ON "WALKER'S CAR CORNER" METAL SIGN POST ADJACENT TO EXISTING PROBE
- PRIMARY ON ~~EAST~~ WEST SIDE TOWARDS CAR LOT
- DUPLICATE ON ~~WEST~~ EAST SIDE TOWARDS RESTAURANT
- 13' FROM CURB
- 169' FROM INTERSECTION W/ HOPE

PRIMARY
95-18-001

DUPLICATE
95-18-002

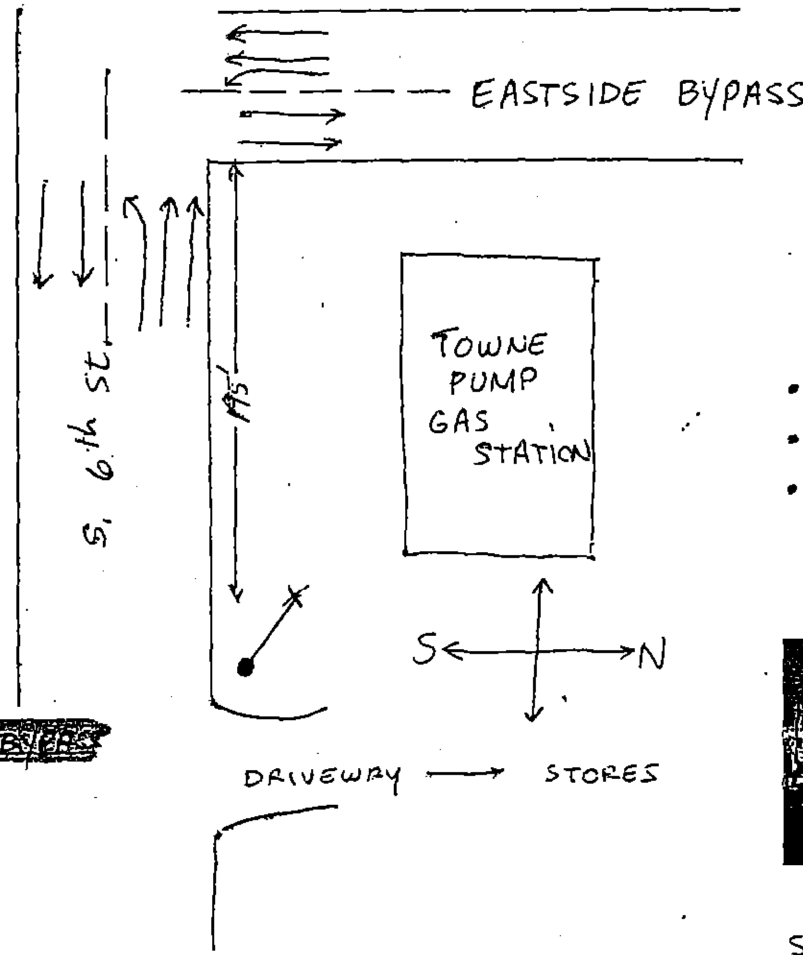
- ON FENCEPOST IN SCHOOLYARD BEHIND EXISTING TRAILER
- 165' BACK FROM CLINTON ST.





95-18-003
Peterson School

WINTER 1995-96

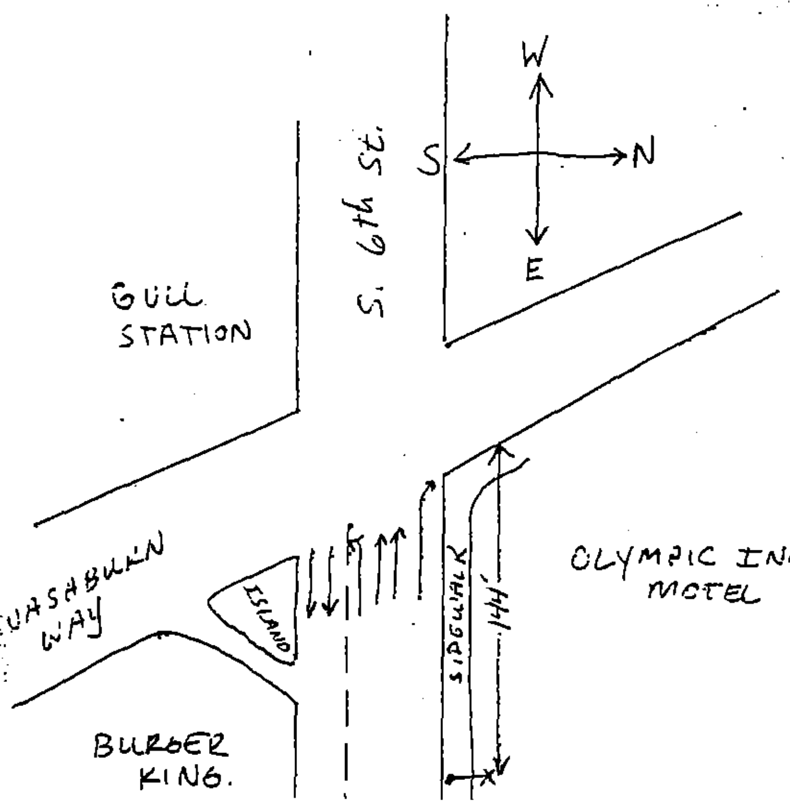


[redacted]

- ON PP&L Light Pole #43.
- 11' FROM CURB
- 195' BACK FROM INTERSECTION W/ EASTSIDE BYPASS

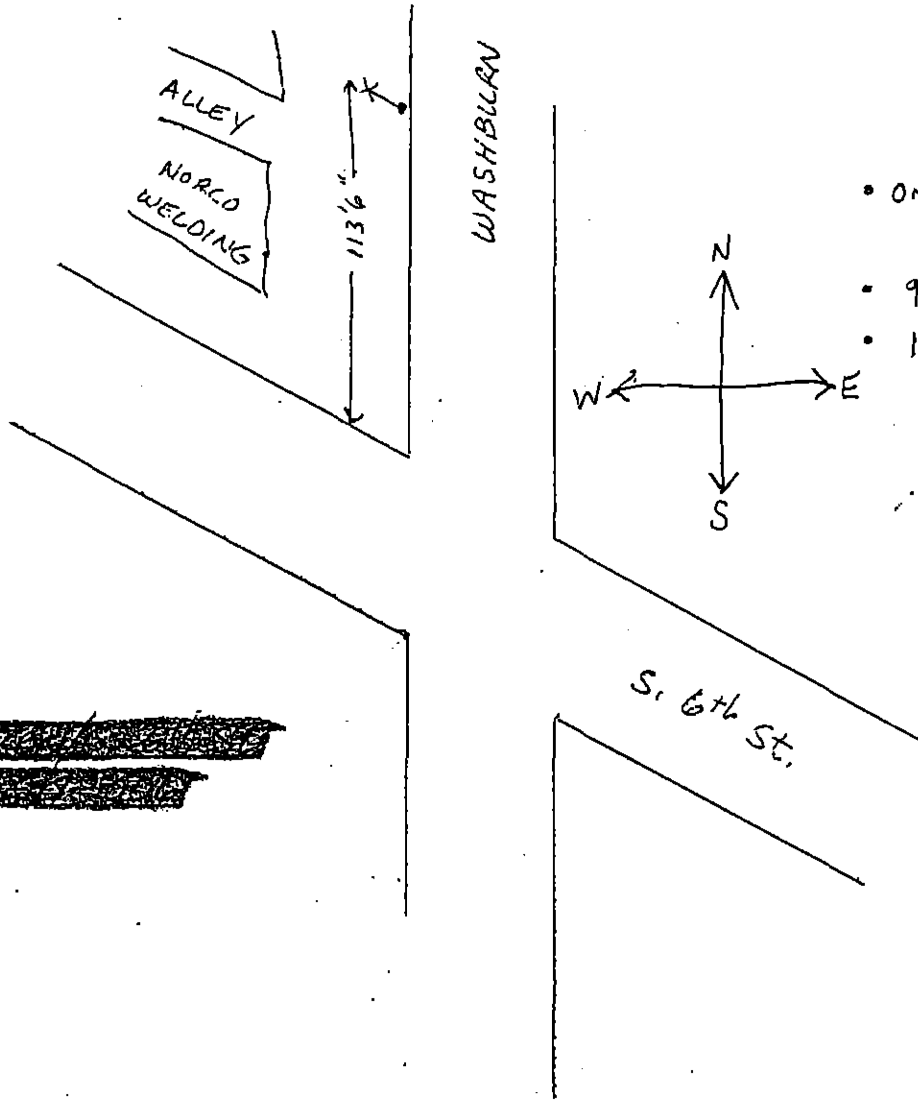
95-18-004
S. 6th / Eastside Bypass

[redacted]



- ON WOODEN 'NO PARKING SIGN
- 9' BACK FROM CURB
- 144' BACK FROM INTERSECTION W/ ...HG.

KLAMATH FALLS CO SURVEY
WINTER 1995-96

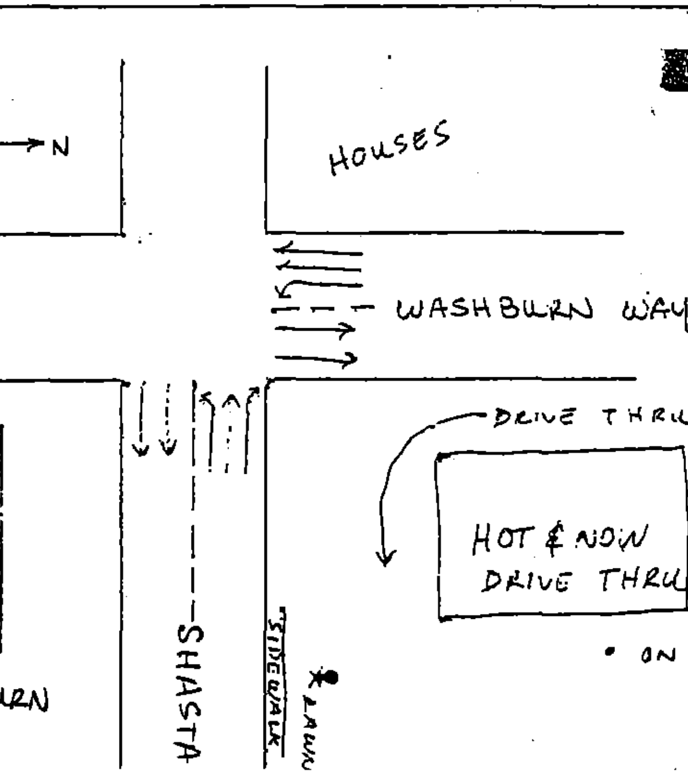


• ON "NO PARKING" SIGN IN FRONT OF NORCO WELDING
• 9' BACK FROM CURB
• 113'6" BACK FROM INTERSECTION w/ 6th St.

[redacted]

WASHBURN/S. 6th St
95-18-006

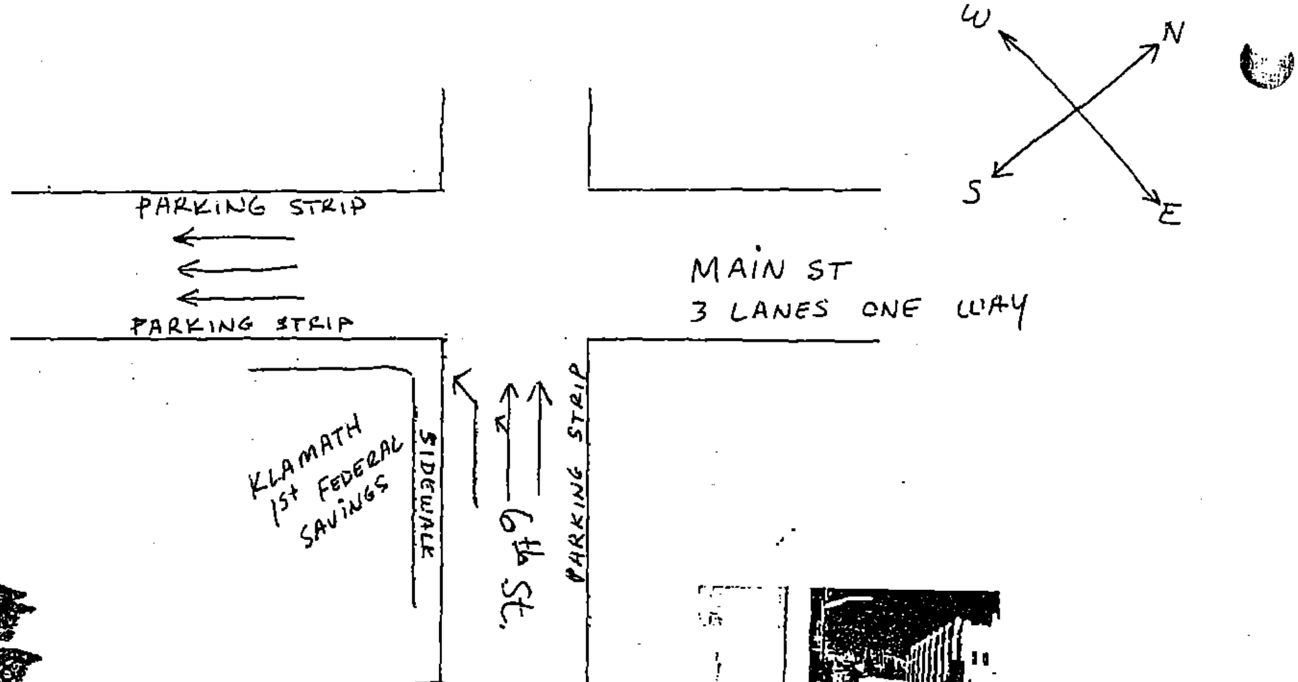
[redacted]



SHASTA/WASHBURN
95-18-007

• ON ANTENNA MAST BOLTED TO PP&L POWER POLE #K4650 SW1529.

KLAMATH FALLS CO SURVEY
WINTER 1995-96



[redacted]

6th/Main
95-18-008

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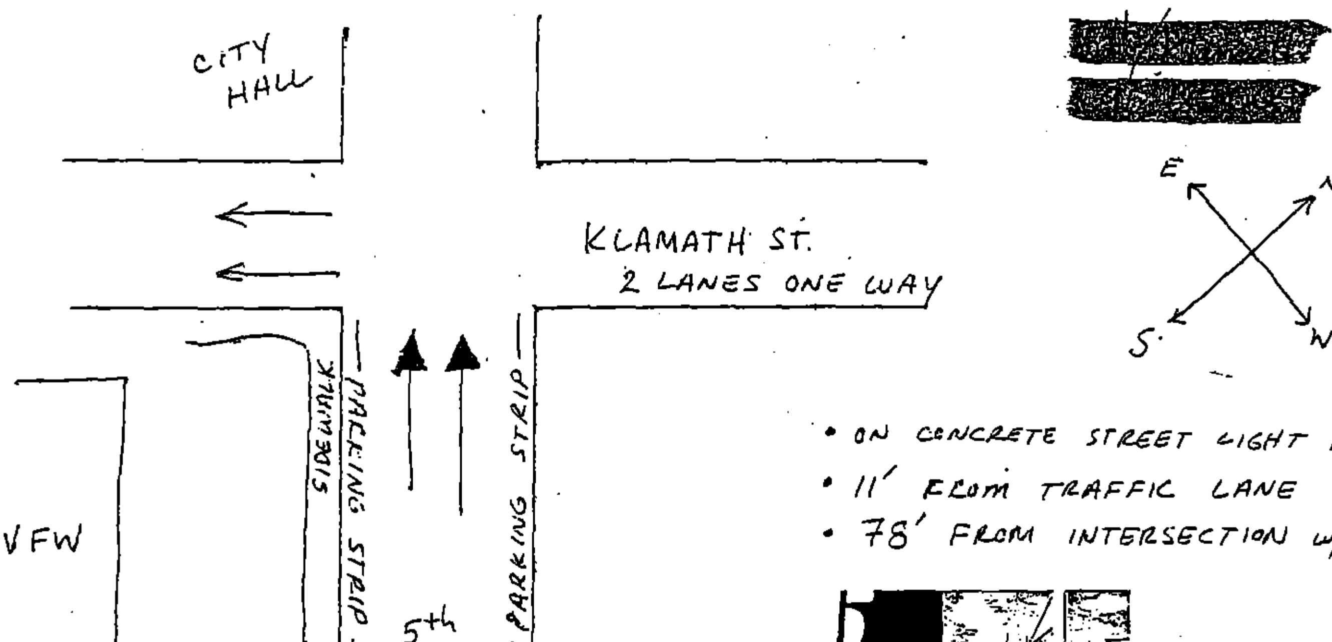
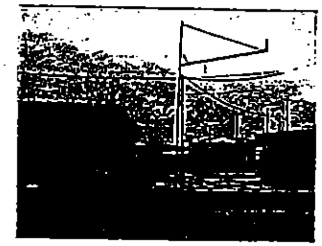


- ON CONCRETE STREET LIGHT POLE
- 11' FROM TRAFFIC LANE
- 78' FROM INTERSECTION W/KLAMAT

5th/Klamath
95-18-009

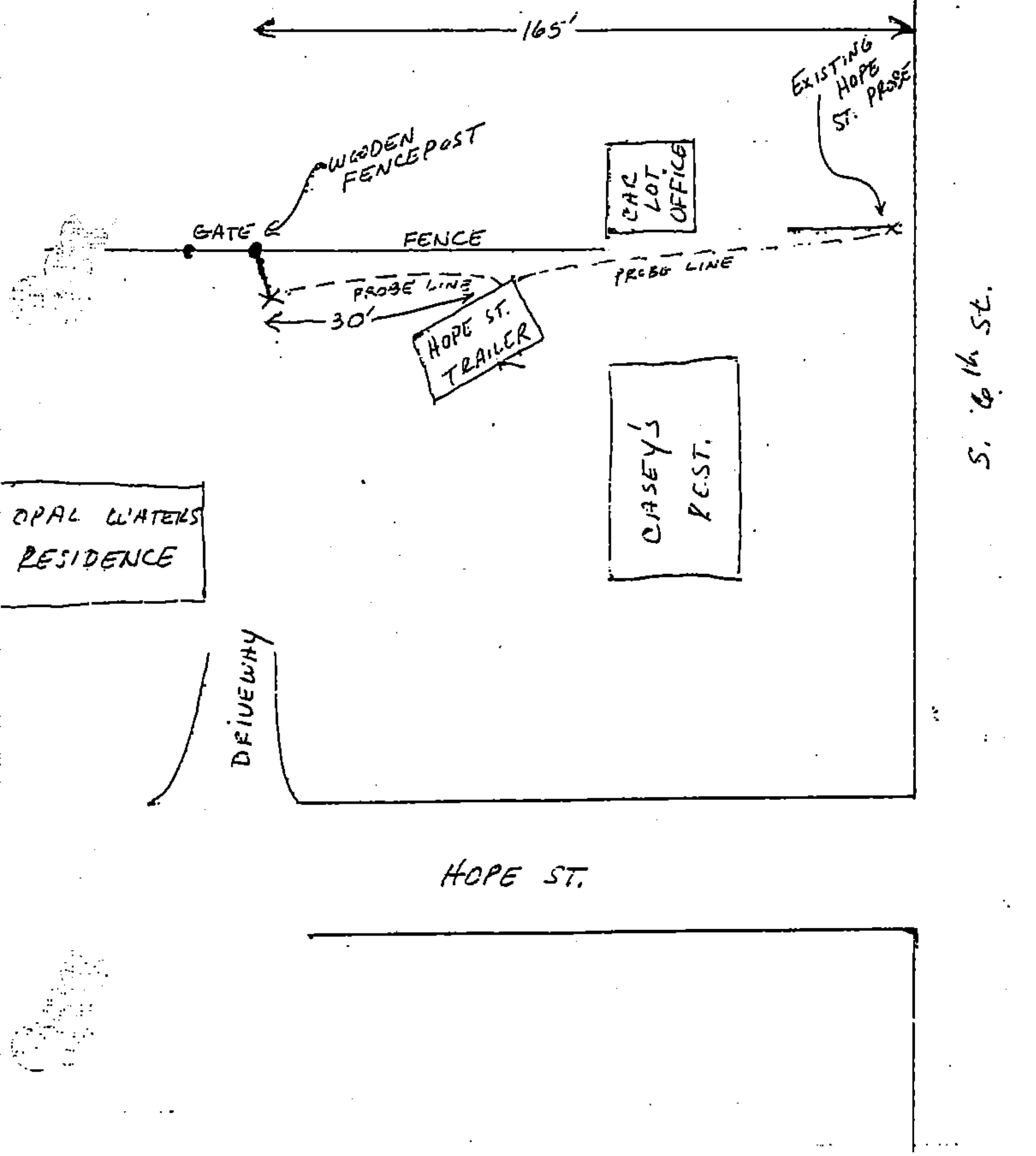
KLAMATH FALL CO SURVEY
WINTER 1995-96



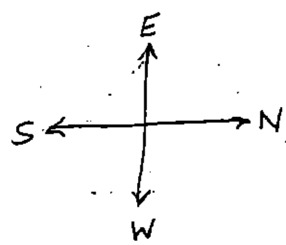
[redacted]

THIS SITE IS THE PROBE ATTACHED TO THE SURVEY MONITOR IN THE HOPE ST. TRAILER. THE PROBE IS MOUNTED ON A FENCE POST IN MRS. OPAL WATER'S BACKYARD.

KFT
95-18-010



- WOODEN ON FENCEPOST IN BACKYARD WITH HOPE ST. TRAILER
- 165' BACK FROM S. 6th St.



Appendix B

Klamath Falls CO Survey

Date/hours		Site No.---> 1	2	3	4	5	6	7	8	9	Hope Street I	Hope Street II	Maximum	Minimum	Average
Dec 19	1400	0.8	0.7		1.5	1.5	3.9	3.3	1.6	1.6	1.1	0.6	3.9	0.6	1.6
	1700	2.1				1.2	2.2	2.4	1.8	1.5	2.0	1.0	2.4	1.0	1.8
	2100	0.8				0.9		0.9	0.8	0.7	0.4	0.5	0.9	0.4	0.7
Dec 20	1400	2.2	2.1	1.1	2.5	0.9	1.1	1.2		1.4	2.0	0.8	2.5	0.8	1.5
	1700	3.3	3.3	1.7	1.6	1.9	1.5	2.3	1.4	1.7	2.9	1.8	3.3	1.4	2.1
	2100	1.3	1.1	0.8	1.8	1.8		0.6			0.5	0.5	1.8	0.5	1.0
Jan 2	1400			0.7			3.9	1.7	1.8	2.7	2.8	0.7	3.9	0.7	2.0
	1700			3.4	2.9		5.1	5.0	4.0	4.0	5.9	5.3	5.9	2.9	4.4
	2100	1.7	2.1	0.9	1.5	2.7	2.1	1.3	1.7	1.5	0.6	0.9	2.7	0.6	1.5
Jan 10	1400	1.6	1.8	0.2		1.9	1.3	1.0	1.4	1.2	1.8	0.9	1.9	0.2	1.3
	1700		1.7	0.1	1.5	1.2	0.6	1.1	0.8	0.6	1.6	0.9	1.7	0.1	1.0
	2100	1.0		0.3	1.3	0.3	0.3		0.1	0.3	0.8	0.6	1.3	0.1	0.5
Jan 11	1400	2.0	1.8	0.5	1.7	1.5	0.7	0.9		0.8	1.7	1.0	2.0	0.5	1.2
	1700	3.0	3.0	1.1	3.5	1.2	0.7	1.2	0.6	0.8	2.7	2.1	3.5	0.6	1.8
	2100	2.6	2.4	1.5		2.8	1.3		0.9	1.0	2.4	2.7	2.8	0.9	1.9
Jan 12	1400	1.8	1.8	0.3	2.8	5.6	2.2	2.2	1.4	2.1	2.0	0.7	5.6	0.3	2.0
	1700	4.0	3.9	1.7	3.4	1.6	1.5	1.6	1.4	1.3	4.6	2.9	4.6	1.3	2.5
	2100	3.5			5.0	2.2	1.6	1.3	1.3	1.9	3.3	3.5	5.0	1.3	2.6
Jan 13	1400	1.1	0.9		2.4	3.4	1.9	2.5	0.5	1.1	1.2	0.3	3.4	0.3	1.5
	1700		4.6	3.2	4.8	2.8	2.9	2.8	6.6	6.3	5.1	4.3	6.6	2.8	4.3
	2100	3.4	3.4	3.5	4.5	3.1	3.8	2.4	3.5	4.1	3.2	3.2	4.5	2.4	3.4
Jan 22	1400	0.8	0.8	0.5	2.3	3.6	4.8	2.5	1.3	1.7	0.7	0.3	4.8	0.3	1.7
	1700	0.9	0.8	0.5	2.1	2.5	2.4	2.2	1.5	1.2	0.7	0.6	2.5	0.5	1.4
	2100	0.4	0.4	0.5	0.8		0.9	0.5	0.5	0.5	0.4	0.4	0.9	0.4	0.5
Jan 25	1400	1.6	1.2	0.7	1.9	3.2	1.1	2.1	1.5	1.2	1.5	0.1	3.2	0.1	1.4
	1700	2.6	1.8	0.8	2.4	2.1	1.5	2.0	1.8	1.0	1.5	0.2	2.6	0.2	1.6
	2100	0.6	0.6	0.5	0.8	1.0	1.2	0.9	0.5	1.2	0.5	0.0	1.2	0.0	0.7
Maximum		4.0	4.6	3.5	5.0	5.6	5.1	5.0	6.6	6.3	5.9	5.3	6.6	2.9	4.4
Minimum		0.4	0.4	0.1	0.8	0.3	0.3	0.5	0.1	0.3	0.4	0.0	0.9	0.0	0.5
Average		1.9	1.9	1.1	2.4	2.1	2.0	1.8	1.6	1.6	2.0	1.3	3.1	0.8	1.8

8 Hour Averages

Site No.--->

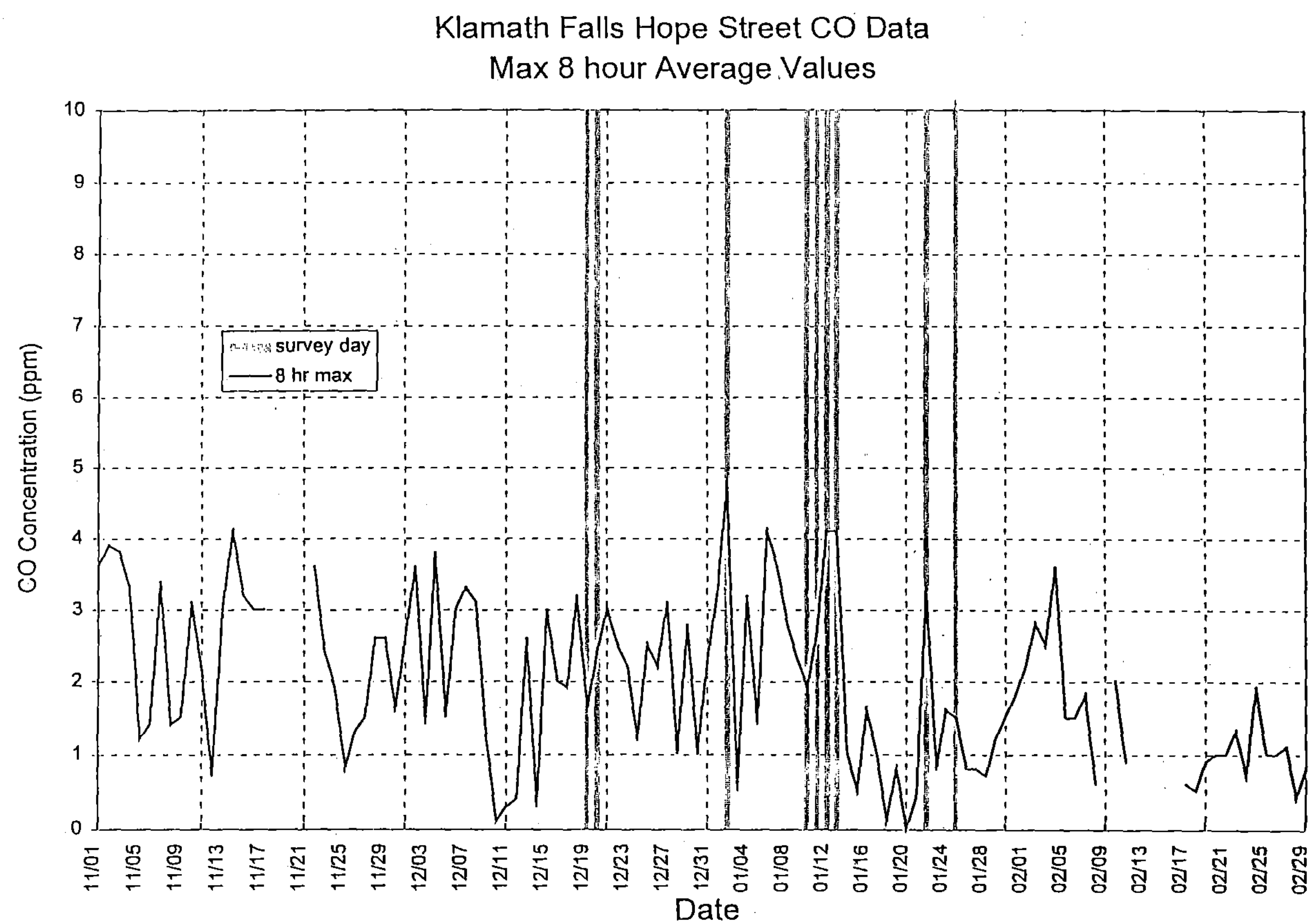
Date/hours	1	2	3	4	5	6	7	8	9	Hope Street	Hope Street II	Maximum	Minimum	Average
Dec 19 1700	1.5	0.7		1.5	1.3	3.0	2.8	1.7	1.5	1.5	0.8	3.0	0.7	1.6
2100	1.4				1.0	2.2	1.6	1.3	1.1	1.2	0.8	2.2	0.8	1.3
Dec 20 1700	2.7	2.7	1.4	2.0	1.4	1.3	1.7	1.4	1.5	2.4	1.3	2.7	1.3	1.8
2100	2.3	2.2	1.3	1.7	1.8	1.5	1.4	1.4	1.7	1.7	1.1	2.3	1.1	1.6
Jan 2 1700			2.1	2.9		4.5	3.3	2.9	3.3	4.3	3.0	4.5	2.1	3.3
2100	1.7	2.1	2.2	2.2	2.7	3.6	3.1	2.8	2.7	3.2	3.1	3.6	1.7	2.7
Jan 10 1700	1.6	1.7	0.1	1.5	1.5	0.9	1.0	1.1	0.9	1.7	0.9	1.7	0.1	1.2
2100	1.0	1.7	0.2	1.4	0.7	0.5	1.1	0.4	0.4	1.2	0.8	1.7	0.2	0.8
Jan 11 1700	2.5	2.4	0.8	2.6	1.3	0.7	1.0	0.6	0.8	2.2	1.5	2.6	0.6	1.5
2100	2.8	2.7	1.3	3.5	2.0	1.0	1.2	0.8	0.9	2.6	2.4	3.5	0.8	1.9
Jan 12 1700	2.9	2.8	1.0	3.1	3.6	1.9	1.9	1.4	1.7	3.3	1.8	3.6	1.0	2.3
2100	3.8	3.9	1.7	4.2	1.9	1.5	1.4	1.3	1.6	4.0	3.2	4.2	1.3	2.6
Jan 13 1700	1.1	2.7	3.2	3.6	3.1	2.4	2.6	3.5	3.7	3.1	2.3	3.7	1.1	2.8
2100	3.4	4.0	3.3	4.6	2.9	3.3	2.6	5.0	5.2	4.1	3.7	5.2	2.6	3.8
Jan 22 1700	0.8	0.8	0.5	2.2	3.0	3.6	2.3	1.4	1.4	0.7	0.4	3.6	0.4	1.6
2100	0.6	0.6	0.5	1.4	2.5	1.6	1.3	1.0	0.8	0.5	0.5	2.5	0.5	1.0
Jan 25 1700	2.1	1.5	0.7	2.1	2.7	1.3	2.1	1.6	1.1	1.5	0.1	2.7	0.1	1.5
2100	1.6	1.2	0.6	1.6	1.5	1.3	1.5	1.1	1.1	1.0	0.1	1.6	0.1	1.1
Maximum	3.8	4.0	3.3	4.6	3.6	4.5	3.3	5.0	5.2	4.3	3.7	5.2	3.3	4.1
Minimum	0.6	0.6	0.1	1.4	0.7	0.5	1.0	0.4	0.4	0.5	0.1	0.0	0.0	0.8
Average	2.0	2.1	1.3	2.5	2.0	2.0	1.9	1.7	1.7	2.2	1.5	2.0	0.6	1.9

8 Hour Averages ending at 2100

Date/hours (Site No.--->)	1	2	3	4	5	6	7	8	9	Hope Street	Hope Street II	Maximum	Minimum	Average
19-Dec	1.5	0.7		1.5	1.3	3.0	2.8	1.7	1.5	1.5	0.8	3.0	0.7	1.6
20-Dec	2.7	2.7	1.4	2.0	1.4	1.3	1.7	1.4	1.5	2.4	1.3	2.7	1.3	1.8
02-Jan			2.1	2.9		4.5	3.3	2.9	3.3	4.3	3.0	4.5	2.1	3.3
10-Jan	1.6	1.7	0.1	1.5	1.5	0.9	1.0	1.1	0.9	1.7	0.9	1.7	0.1	1.2
11-Jan	2.5	2.4	0.8	2.6	1.3	0.7	1.0	0.6	0.8	2.2	1.5	2.6	0.6	1.5
12-Jan	2.9	2.8	1.0	3.1	3.6	1.9	1.9	1.4	1.7	3.3	1.8	3.6	1.0	2.3
13-Jan	1.1	2.7	3.2	3.6	3.1	2.4	2.6	3.5	3.7	3.1	2.3	3.7	1.1	2.8
22-Jan	0.8	0.8	0.5	2.2	3.0	3.6	2.3	1.4	1.4	0.7	0.4	3.6	0.4	1.6
25-Jan	2.1	1.5	0.7	2.1	2.7	1.3	2.1	1.6	1.1	1.5	0.1	2.7	0.1	1.5
Maximum	2.9	2.8	3.2	3.6	3.6	4.5	3.3	3.5	3.7	4.3	3.0	4.5	2.1	3.3
Minimum	0.8	0.7	0.1	1.5	1.3	0.7	1.0	0.6	0.8	0.7	0.1	1.7	0.1	1.2
Average	1.9	1.9	1.2	2.4	2.2	2.2	2.1	1.7	1.8	2.3	1.3	3.1	0.8	1.9

8 Hour Averages ending at 2500

Date/hours (Site No.--->)	1	2	3	4	5	6	7	8	9	Hope Street	Hope Street II	Maximum	Minimum	Average
19-Dec	1.4				1.0	2.2	1.6	1.3	1.1	1.2	0.8	2.2	0.8	1.3
20-Dec	2.3	2.2	1.3	1.7	1.8	1.5	1.4	1.4	1.7	1.7	1.1	2.3	1.1	1.6
02-Jan	1.7	2.1	2.2	2.2	2.7	3.6	3.1	2.8	2.7	3.2	3.1	3.6	1.7	2.7
10-Jan	1.0	1.7	0.2	1.4	0.7	0.5	1.1	0.4	0.4	1.2	0.8	1.7	0.2	0.8
11-Jan	2.8	2.7	1.3	3.5	2.0	1.0	1.2	0.8	0.9	2.6	2.4	3.5	0.8	1.9
12-Jan	3.8	3.9	1.7	4.2	1.9	1.5	1.4	1.3	1.6	4.0	3.2	4.2	1.3	2.6
13-Jan	3.4	4.0	3.3	4.6	2.9	3.3	2.6	5.0	5.2	4.1	3.7	5.2	2.6	3.8
22-Jan	0.6	0.6	0.5	1.4	2.5	1.6	1.3	1.0	0.8	0.5	0.5	2.5	0.5	1.0
25-Jan	1.6	1.2	0.6	1.6	1.5	1.3	1.5	1.1	1.1	1.0	0.1	1.6	0.1	1.1
Maximum	3.8	4.0	3.3	4.6	2.9	3.6	3.1	5.0	5.2	4.1	3.7	5.2	2.6	3.8
Minimum	0.6	0.6	0.2	1.4	0.7	0.5	1.1	0.4	0.4	0.5	0.1	1.6	0.1	0.8
Average	2.0	2.3	1.4	2.6	1.9	1.8	1.7	1.7	1.7	2.2	1.7	3.0	1.0	1.9



Klamath Falls Hope Street CO Data
Max 8 hour Average Values
survey day
8 hr max
CO Concentration (ppm)
0
1
2
3
4
5
6
7
8
9
10
Date
11/01
11/05
11/09
11/13
11/17
11/21
11/25
11/29
12/03
12/07
12/11
12/15
12/19
12/23
12/27
12/31
01/04
01/08
01/12
01/16
01/20
01/24
01/28
02/01
02/05
02/09
02/13
02/17
02/21
02/25
02/29

STATE IMPLEMENTATION PLAN REVISION
FOR CARBON MONOXIDE IN THE KLAMATH FALLS URBAN GROWTH BOUNDARY

Appendix D5-4

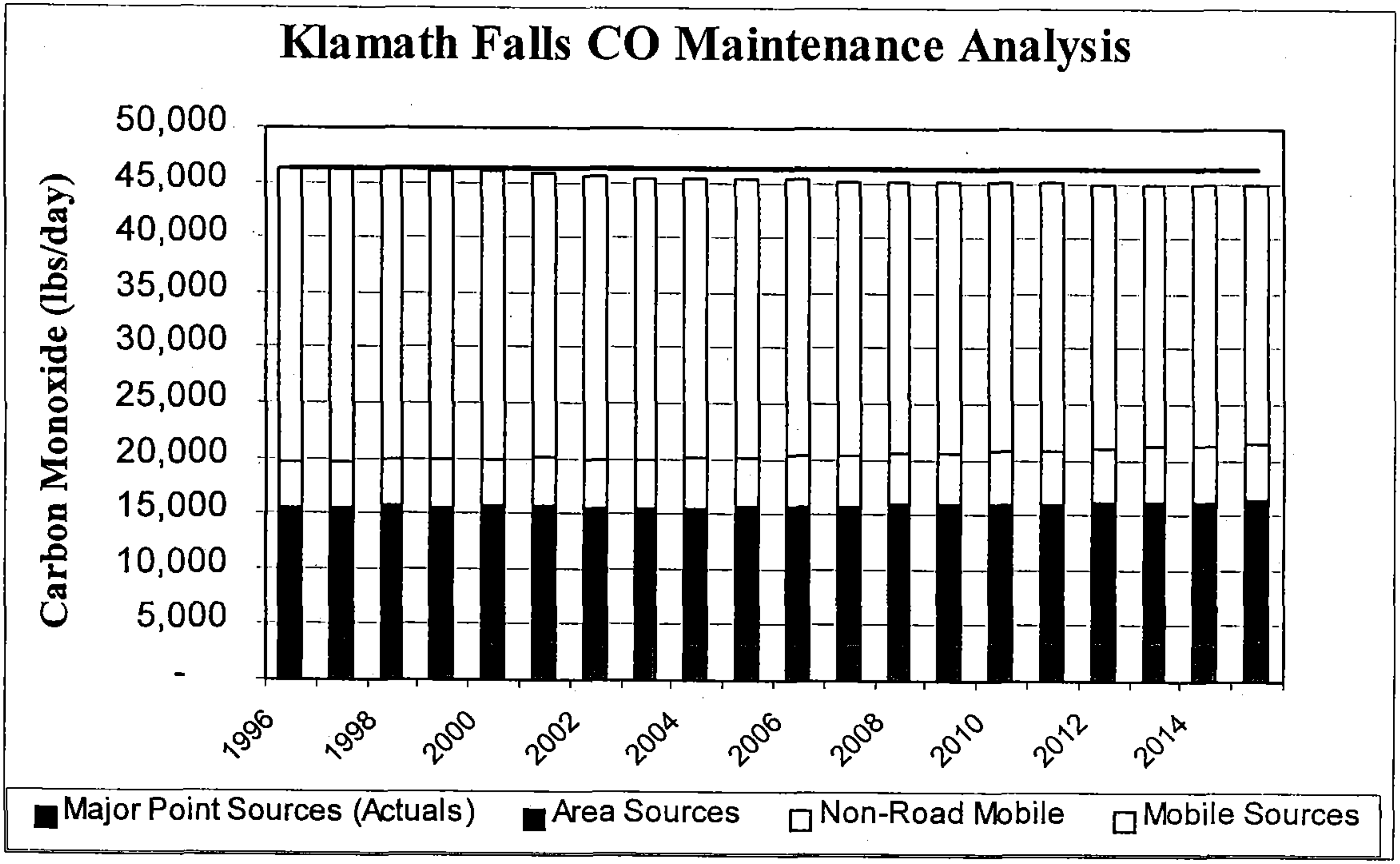
EMISSION INVENTORY AND EMISSIONS FORECAST

ummary of Klamath Falls Carbon Monoxide Emission Inventory and Forecast (1996-2015). Final Update April 26, 2000

'inter CO Season December 1 through February 28

Carbon Monoxide Lbs/day																					
ıtegory	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ajor Point Sources (Actuals)	8%	3,923	3,978	4,033	3,528	3,575	3,623	3,288	3,331	3,373	3,416	3,458	3,501	3,543	3,586	3,628	3,671	3,713	3,756	3,798
'ea Sources	25%	11,586	11,617	11,649	12,067	12,095	12,124	12,153	12,181	12,210	12,238	12,267	12,295	12,324	12,352	12,381	12,409	12,438	12,467	12,495
ɔn-Road Mobile	9%	4,074	4,127	4,179	4,231	4,284	4,336	4,389	4,441	4,494	4,546	4,599	4,651	4,704	4,756	4,809	4,861	4,914	4,967	5,019
obile Sources	58%	26,734	26,558	26,383	26,207	26,032	25,856	25,681	25,505	25,330	25,154	24,979	24,804	24,628	24,453	24,277	24,102	23,926	23,751	23,575
ıtal All Sources	100%	46,316	46,280	46,244	46,033	45,986	45,940	45,511	45,459	45,407	45,355	45,303	45,251	45,199	45,148	45,096	45,044	44,992	44,940	44,887

Net from 1996 Base -1480 lbs/day



Net Emissions Decrease from 1996 Attainment Level = 1,478 lbs/day

STATE IMPLEMENTATION PLAN REVISION
FOR CARBON MONOXIDE IN THE KLAMATH FALLS URBAN GROWTH BOUNDARY

Appendix D5-5

CONFORMITY PROCESS

Appendix D5-5
(Volume 3)
CONFORMITY PROCESS

The transportation conformity process for Oregon is contained in OAR 340-020-0710 et. seq. . The transportation conformity rule was adopted by the Environmental Quality Commission on March 3, 1995 and became effective on March 23, 1995. EPA approved the transportation conformity rules as a SIP revision on May 16, 1996. The state rule is more effective, more efficient and more equitable than the federal regulation because:

1. it requires all transportation control measures to be implemented in a timely manner regardless of their eligibility for federal funding;
2. it requires consistency with emissions budgets while EPA reviews maintenance plans for approval;
3. it requires analysis of localized air quality impacts for some state and locally funded projects.

The conformity rule also establishes interagency consultation procedures for making RTP and TIP conformity determinations and for developing transportation related provisions of the maintenance plan.

STATE IMPLEMENTATION PLAN REVISION
FOR CARBON MONOXIDE IN THE KLAMATH FALLS URBAN GROWTH BOUNDARY

Appendix D5-6

HISTORIC AND PROJECTED POPULATION, HOUSEHOLDS AND EMPLOYMENT

mate of 1996 & 2015 Population/Dwellings in Urban Growth Boundary
d on 7-99 estimate from City of Klamath Falls (percent of Travel Study Area HH in UGB)
eron Gloss estimates that the % ... UGB would not change significantly between 1996 and 2015

	Travel Study Area					1996 Urban Growth Boundary		
NO	Reported 1990 Dwellings	Census AVGPRS_HH	Reported 1990 POP Est.	Reported 1996 Dwellings	Reported 1996 POP Est.	Estimated 1996 % of HH in UGB	Estimated 1996 HH in UGB	Estimated 1996 POP in UGB
20	17	2.66	45	17	45	0.3	5.1	13.566
21	35	2.74	96	51	140	0.9	45.9	125.766
22	81	2.53	205	81	205	1	81	204.93
23	432	2.74	1184	432	1184	1	432	1183.68
24	79	2.70	213	79	213	1	79	213.3
25	244	2.70	659	357	964	1	357	963.9
26	663	2.40	1591	672	1613	1	672	1612.8
27	621	2.60	1615	637	1656	1	637	1656.2
28	498	2.60	1295	542	1409	1	542	1409.2
29	151	2.80	423	155	434	1	155	434
30	3	2.70	8	3	8	0.7	2.1	5.67
31	73	2.70	197	79	213	1	79	213.3
32	1054	2.50	2635	1059	2648	1	1059	2647.5
33	50	1.48	74	50	74	1	50	74
34	65	1.80	117	65	117	1	65	117
35	122	2.30	281	122	281	1	122	280.6
36	313	2.50	783	313	783	1	313	782.5
37	569	2.30	1309	569	1309	1	569	1308.7
38	975	2.20	2145	975	2145	1	975	2145
39	359	2.30	826	360	828	1	360	828
40	83	1.80	149	83	149	1	83	149.4
41	175	1.60	280	175	280	1	175	280
42	0	1.60	0	0	0	1	0	0
43	2	2.20	4	2	4	1	2	4.4
44	224	1.90	426	224	426	1	224	425.6
45	609	2.00	1218	609	1218	1	609	1218
46	93	2.30	214	93	214	1	93	213.9
47	4	2.50	10	11	28	1	11	27.5
48	0	2.80	0	0	0	1	0	0
49	165	2.60	429	165	429	1	165	429
50	447	2.50	1118	471	1178	1	471	1177.5
51	704	2.50	1760	704	1760	1	704	1760
52	168	2.10	353	236	496	1	236	495.6
53	371	2.60	965	371	965	1	371	964.6
54	249	2.40	598	249	598	1	249	597.6
55	0	2.62	0	0	0	1	0	0
56	352	2.40	845	355	852	1	355	852
57	3	2.50	8	7	18	1	7	17.5
58	327	2.50	818	340	850	1	340	850
59	85	2.80	238	104	291	0.8	83.2	232.96
60	42	2.50	105	42	105	0.6	25.2	63
61	44	2.51	110	44	110	0	0	0
62	63	2.40	151	63	151	0.7	44.1	105.84
63	18	2.60	47	18	47	0.3	5.4	14.04
64	74	2.70	200	85	230	1	85	229.5
65	341	2.50	853	341	853	1	341	852.5
66	615	3.00	1845	615	1845	1	615	1845
67	466	3.00	1398	469	1407	1	469	1407
68	251	2.60	653	306	796	0.75	229.5	596.7
69	283	2.80	792	283	792	0.95	268.85	752.78
70	425	2.40	1020	425	1020	1	425	1020
71	275	2.50	688	275	688	1	275	687.5
72	602	2.72	1637	602	1637	1	602	1637.44
73	157	2.70	424	157	424	1	157	423.9
74	70	2.60	182	115	299	0	0	0
75	43	2.80	120	80	224	0	0	0
76	140	2.80	392	65	182	0	0	0
77	56	2.70	151	56	151	0.2	11.2	30.24
78	53	2.70	143	56	151	0.1	5.6	15.12
79	11	2.70	30	11	30	0	0	0
80	12	2.70	32	12	32	0	0	0
81	88	2.80	246	88	246	0.1	8.8	24.64
82	31	2.90	90	31	90	0.6	18.6	53.94
83	33	2.89	95	33	95	0	0	0
84	24	2.50	60	24	60	0	0	0
85	86	2.40	206	86	206	0	0	0
86	66	2.60	172	66	172	0	0	0
87	21	2.61	55	21	55	0	0	0
88	120	2.30	276	120	276	1	120	276
89	0	2.20	0	0	0	1	0	0
90	32	1.80	58	32	58	1	32	57.6
91	0	2.40	0	0	0	1	0	0
92	135	2.80	378	135	378	1	135	378
93	261	2.20	574	261	574	1	261	574.2
94	31	2.30	71	31	71	1	31	71.3
95	67	2.30	154	67	154	1	67	154.1
96	319	2.40	766	319	766	1	319	765.6
97	17	2.40	41	17	41	1	17	40.8
98	24	2.30	55	24	55	1	24	55.2
99	113	2.90	328	113	328	1	113	327.7
100	526	2.80	1473	607	1700	1	607	1699.6
101	132	2.20	290	132	290	1	132	290.4
	16632	2.48	41491	17144	42,810		16223	40,365

103.18% <== Change in study area population 1990 to 1996

		Growth Boundary			
TAZNO	16TOTFAM	Estimated 2015 % of HH in UGB	Estimated 2015 HH in UGB	Estimated 2015 POP in UGB	Estimated 2015 POP in UGB
20	17	0.3	5.1	2.66	14
21	86	0.9	77.4	2.74	212
22	81	1	81	2.53	205
23	577	1	577	2.74	1581
24	79	1	79	2.70	213
25	407	1	407	2.70	1099
26	716	1	716	2.40	1718
27	697	1	697	2.60	1812
28	567	1	567	2.60	1474
29	230	1	230	2.80	644
30	1300	0.7	910	2.70	2457
31	89	1	89	2.70	240
32	1059	1	1059	2.50	2648
33	70	1	70	1.48	104
34	85	1	85	1.80	153
35	122	1	122	2.30	281
36	313	1	313	2.50	783
37	569	1	569	2.30	1309
38	975	1	975	2.20	2145
39	360	1	360	2.30	828
40	83	1	83	1.80	149
41	175	1	175	1.60	280
42	140	1	140	1.60	224
43	2	1	2	2.20	4
44	224	1	224	1.90	426
45	609	1	609	2.00	1218
46	93	1	93	2.30	214
47	275	1	275	2.50	688
48	790	1	790	2.80	2212
49	240	1	240	2.60	624
50	471	1	471	2.50	1178
51	704	1	704	2.50	1760
52	236	1	236	2.10	496
53	471	1	471	2.60	1225
54	249	1	249	2.40	598
55	0	1	0	2.62	0
56	405	1	405	2.40	972
57	12	1	12	2.50	30
58	465	1	465	2.50	1163
59	210	0.8	168	2.80	470
60	52	0.6	31.2	2.50	78
61	84	0	0	2.51	0
62	123	0.7	86.1	2.40	207
63	18	0.3	5.4	2.60	14
64	107	1	107	2.70	289
65	341	1	341	2.50	853
66	615	1	615	3.00	1845
67	504	1	504	3.00	1512
68	476	0.75	357	2.60	928
69	358	0.95	340.1	2.80	952
70	425	1	425	2.40	1020
71	275	1	275	2.50	688
72	602	1	602	2.72	1637
73	192	1	192	2.70	518
74	165	0	0	2.60	0
75	200	0	0	2.80	0
76	85	0	0	2.80	0
77	91	0.2	18.2	2.70	49
78	56	0.1	5.6	2.70	15
79	11	0	0	2.70	0
80	72	0	0	2.70	0
81	113	0.1	11.3	2.80	32
82	31	0.6	18.6	2.90	54
83	33	0	0	2.89	0
84	50	0	0	2.50	0
85	86	0	0	2.40	0
86	66	0	0	2.60	0
87	60	0	0	2.61	0
88	120	1	120	2.30	276
89	0	1	0	2.20	0
90	32	1	32	1.80	58
91	0	1	0	2.40	0
92	200	1	200	2.80	560
93	261	1	261	2.20	574
94	31	1	31	2.30	71
95	267	1	267	2.30	614
96	369	1	369	2.40	886
97	17	1	17	2.40	41
98	24	1	24	2.30	55
99	153	1	153	2.90	444
100	647	1	647	2.80	1812
101	132	1	132	2.20	290
	21787		19,988		50,219

math Falls 20[illegible] n & Employment Forecast for Travel Study Area

E	15SFAM	MULTI 15MFAM	OTHER 15OFAM	TOTAL 15TOTFAM	Persons Per/HH	TOTAL 2015 POP	15IDEM	15RTEM	15SEM	15EDEM	15GOVT	15SPEC	15OTEM	TOTAL 15TOTEMP	Persons Per/HH
							EMPLOYMENT								
1	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
2	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
3	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
4	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
5	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
6	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
7	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
8	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
9	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
10	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
11	0	0	0	0	N/A		0	0	0	0	0		0	0	N/A
20	17	0	0	17	2.66	45	875	1	15	0	10		0	901	2.66
21	86	0	0	86	2.74	236	650	3	28	0	0		22	703	2.74
22	76	5	0	81	2.53	205	5	25	6	0	0		0	36	2.53
23	10	135	432	577	2.74	1581	110	0	600	425	77	150	0	1362	2.74
24	10	26	43	79	2.70	213	0	138	575	0	100	875	16	1704	2.70
25	332	75	0	407	2.70	1099	15	0	10	0	0	30	0	55	2.70
26	675	41	0	716	2.40	1718	5	31	48	138	39		0	261	2.40
27	655	42	0	697	2.60	1812	27	11	36	0	0		24	98	2.60
28	530	37	0	567	2.60	1474	1	7	1	30	62		1	102	2.60
29	210	20	0	230	2.80	644	0	4	9	0	0		0	13	2.80
30	825	475	0	1300	2.70	3510	0	10	10	0	21		0	41	2.70
31	64	25	0	89	2.70	240	48	0	30	47	0		34	159	2.70
32	847	212	0	1059	2.50	2648	10	17	101	23	0		38	189	2.50
33	17	53	0	70	1.48	104	4	150	525	0	65		44	788	1.48
34	23	62	0	85	1.80	153	118	250	375	5	187		20	955	1.80
35	107	15	0	122	2.30	281	0	1	29	0	88		0	118	2.30
36	301	12	0	313	2.50	783	3	4	12	27	0		2	48	2.50
37	458	53	58	569	2.30	1309	7	0	169	65	0		7	248	2.30
38	940	35	0	975	2.20	2145	2	46	32	0	0		1	81	2.20
39	316	44	0	360	2.30	828	27	36	61	65	0		66	255	2.30
40	43	40	0	83	1.80	149	244	58	16	0	19		189	526	1.80
41	45	130	0	175	1.60	280	282	71	105	0	145		38	641	1.60
42	0	140	0	140	1.60	224	30	20	150	0	0		21	221	1.60
43	2	0	0	2	2.20	4	13	277	14	0	0		10	314	2.20
44	98	126	0	224	1.90	426	1	204	139	2	8		18	372	1.90
45	307	138	164	609	2.00	1218	8	207	25	52	74		8	374	2.00
46	29	64	0	93	2.30	214	0	11	2	0	101		0	114	2.30
47	275	0	0	275	2.50	688	0	0	15	0	20		3	38	2.50
48	375	415	0	790	2.80	2212	0	0	0	0	0		0	0	2.80
49	167	18	55	240	2.60	624	1	10	1	0	0		0	12	2.60
50	442	16	13	471	2.50	1178	3	34	77	0	0		2	116	2.50

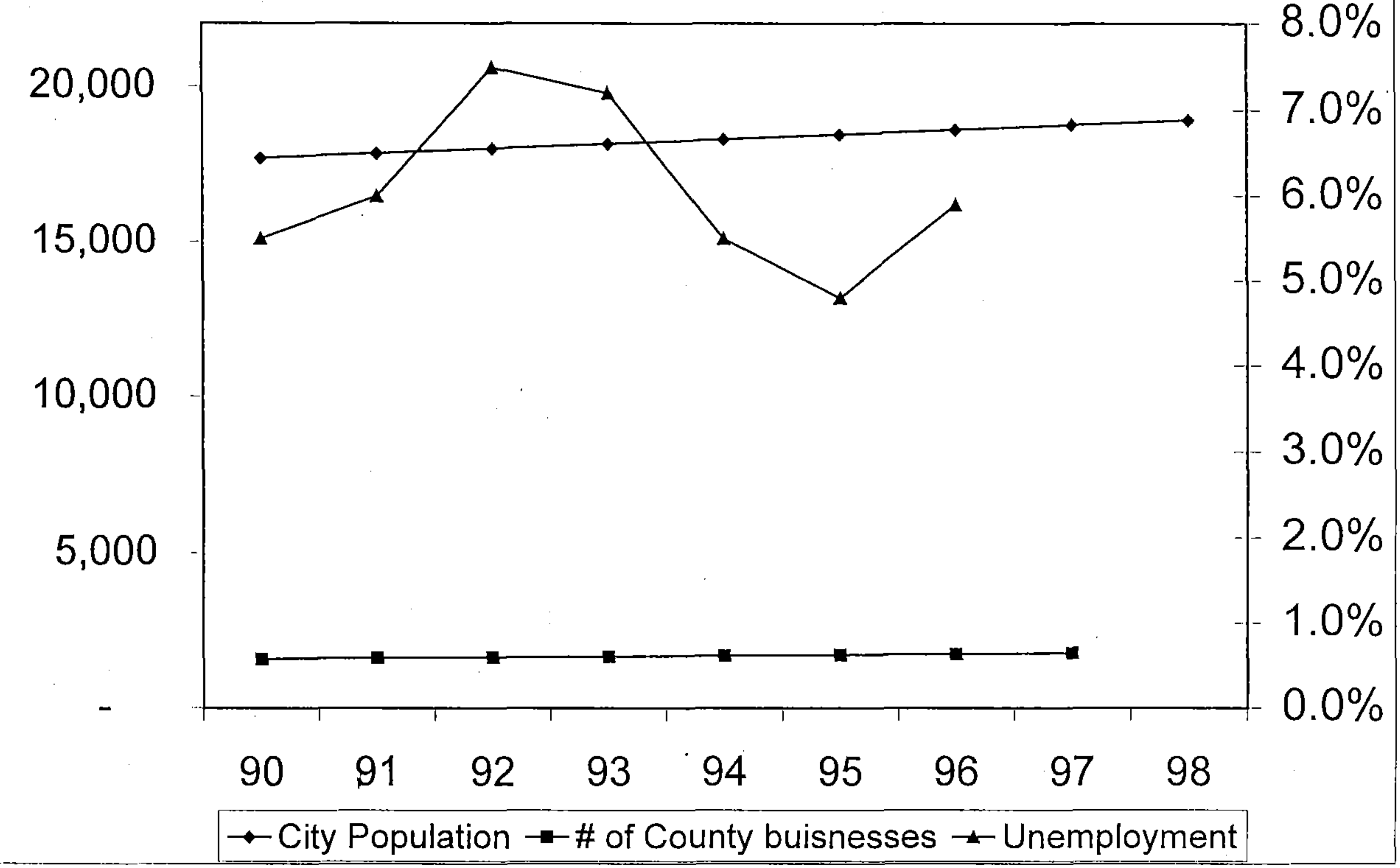
ımath Falls 2[illegible]on & Employment Forecast for Travel Study Area

ΙE	15SFAM	MULTI 15MFAM	OTHER 15OFAM	TOTAL 15TOTFAM	Persons Per/HH	TOTAL 2015 POP	15IDEM	15RTEM	15SEM	15EDEM	15GOVT	15SPEC	15OTEM	TOTAL 15TOTEMP	Persons Per/HH
							EMPLOYMENT								
51	656	43	5	704	2.50	1760	34	218	86	0	4		80	422	2.50
52	187	45	4	236	2.10	496	18	37	27	0	39		2	123	2.10
53	422	49	0	471	2.60	1225	1	8	4	148	0		4	165	2.60
54	220	21	8	249	2.40	598	54	13	2	63	55		13	200	2.40
55	0	0	0	0	2.62	0	285	425	95	0	46		47	898	2.62
56	286	0	119	405	2.40	972	103	9	28	0	3		5	148	2.40
57	12	0	0	12	2.50	30	416	55	22	0	0		0	493	2.50
58	457	8	0	465	2.50	1163	0	25	20	0	0		1	46	2.50
59	210	0	0	210	2.80	588	0	2	0	0	0		18	20	2.80
60	41	11	0	52	2.50	130	22	6	0	0	0		0	28	2.50
61	64	0	0	64	2.51	161	6	0	0	0	0		0	6	2.51
62	123	0	0	123	2.40	295	1146	1	0	44	0		0	1191	2.40
63	18	0	0	18	2.60	47	98	0	2	0	0		2	102	2.60
64	85	22	0	107	2.70	289	155	23	3	0	0		6	187	2.70
65	310	13	18	341	2.50	853	10	0	9	0	0		10	29	2.50
66	570	25	20	615	3.00	1845	3	9	0	2	0		1	15	3.00
67	504	0	0	504	3.00	1512	0	0	0	0	2		1	3	3.00
68	451	25	0	476	2.60	1238	1	4	0	44	0		0	49	2.60
69	320	38	0	358	2.80	1002	0	0	5	9	0		6	20	2.80
70	406	19	0	425	2.40	1020	5	42	28	48	0		38	161	2.40
71	259	16	0	275	2.50	688	1	0	8	50	0		74	133	2.50
72	599	3	0	602	2.72	1637	32	2	12	0	7		8	61	2.72
73	192	0	0	192	2.70	518	5	10	3	0	0		32	50	2.70
74	165	0	0	165	2.60	429	0	0	0	0	0		0	0	2.60
75	200	0	0	200	2.80	560	5	0	7	0	0		3	15	2.80
76	95	0	0	95	2.80	266	0	0	0	0	0		0	0	2.80
77	75	16	0	91	2.70	246	0	8	16	0	0		0	24	2.70
78	56	0	0	56	2.70	151	2	0	1	0	0		0	3	2.70
79	11	0	0	11	2.70	30	0	1	0	0	0		0	1	2.70
80	72	0	0	72	2.70	194	0	0	0	0	0		0	0	2.70
81	110	3	0	113	2.80	316	125	0	1	149	0		0	275	2.80
82	31	0	0	31	2.90	90	55	18	25	0	465		30	593	2.90
83	33	0	0	33	2.89	95	2	0	0	0	0		52	54	2.89
84	50	0	0	50	2.50	125	0	0	0	0	0		0	0	2.50
85	24	0	62	86	2.40	206	60	60	4	0	18		24	166	2.40
86	66	0	0	66	2.60	172	0	2	6	0	0		9	17	2.60
87	60	0	0	60	2.61	157	1	3	0	0	0		0	4	2.61
88	105	15	0	120	2.30	276	0	12	12	0	0		0	24	2.30
89	0	0	0	0	2.20	0	0	36	21	0	0		5	62	2.20
90	0	32	0	32	1.80	58	0	514	57	0	0		0	571	1.80
91	0	0	0	0	2.40	0	0	352	69	0	0		7	428	2.40
92	116	39	45	200	2.80	560	0	2	0	0	0		0	2	2.80
93	221	34	6	261	2.20	574	32	13	23	0	0		10	78	2.20
94	29	2	0	31	2.30	71	0	60	6	0	0		0	66	2.30
95	227	0	40	267	2.30	614	1	23	0	50	0		1	75	2.30
96	333	26	10	369	2.40	886	18	1	0	0	0		1	20	2.40
97	17	0	0	17	2.40	41	31	92	68	0	0		50	241	2.40
98	24	0	0	24	2.30	55	0	65	36	0	0		47	148	2.30
99	92	61	0	153	2.90	444	0	0	23	0	0		0	23	2.90
100	577	70	0	647	2.80	1812	1	1	4	0	0		14	20	2.80
101	114	18	0	132	2.20	290	0	6	3	0	0		0	9	2.20
				21,787	2.47	54,540								18314	
	17577	3108	1102				5217	3784	3952	1486	1655	1055	1165		

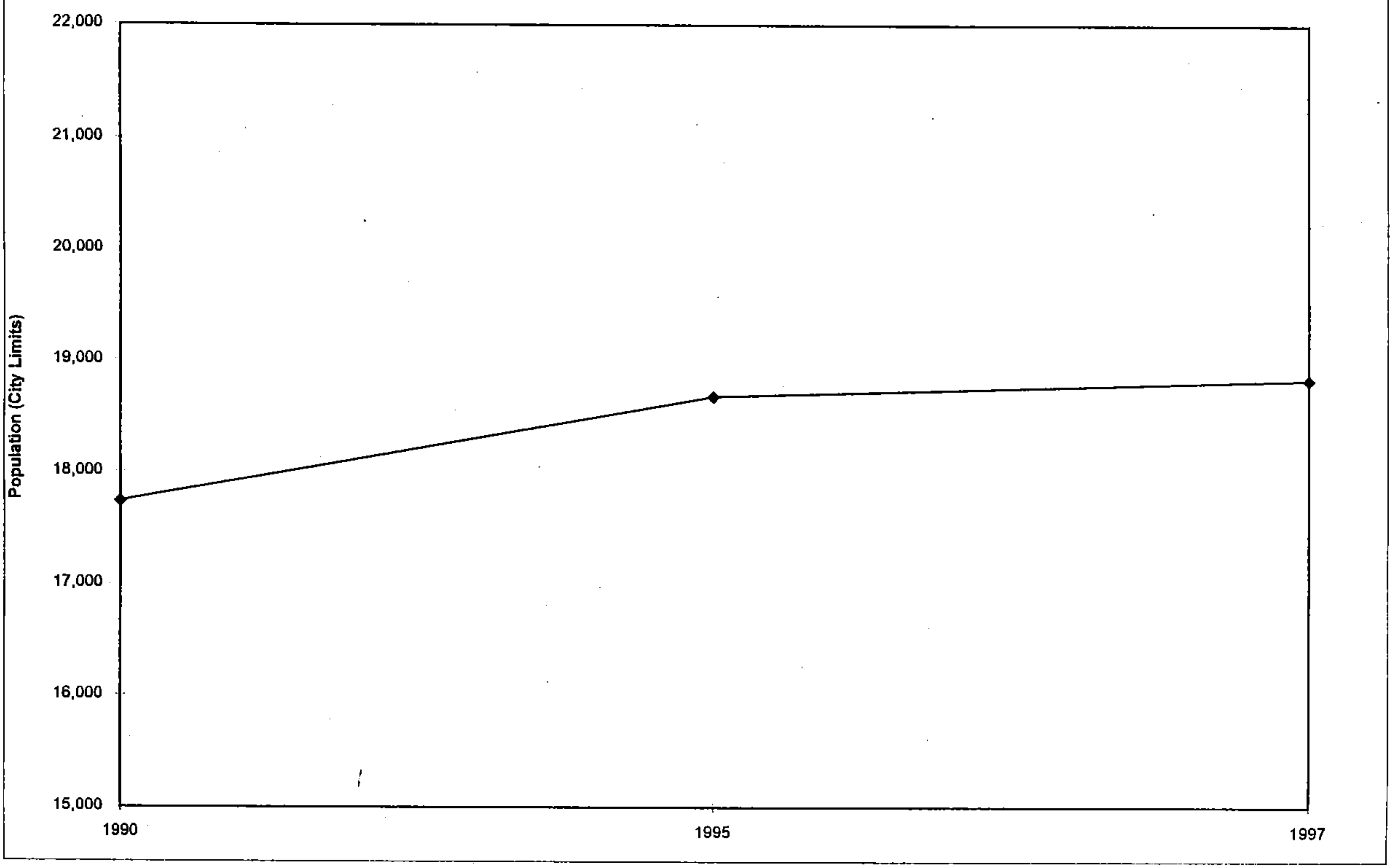
TOTAL DWELLINGS 21787

TOTAL EMPLOYEES => 18314

Klamath Falls Economic Indicators



City of Klamath Falls: Population Growth
1990-1997



STATE IMPLEMENTATION PLAN REVISION
FOR CARBON MONOXIDE IN THE KLAMATH FALLS URBAN GROWTH BOUNDARY

Appendix D5-7

ROLLFORWARD ANNALYSIS

APPENDIX D_

Klamath Falls
Rollforward Analysis
(Revised 3-16-00)

The Oregon Department of Environmental Quality (DEQ) conducted a rollforward analysis (proportional modeling) for the intersection of the Klamath Falls—Malin Highway (OR 39/140)[1] and Hope Street in Klamath Falls. This intersection directly impacts the DEQ carbon monoxide (CO) monitoring site located on the south side of the highway and west of Hope Street. This intersection was selected in consultation with Air Program staff in the U.S. Environmental Protection Agency's Region 10 office.

This report provides information on the general methodology employed, background concentration, calculations, and a summary of the results. The following technical data is included: traffic counts (Oregon Department of Transportation--ODOT); 1996 and 2015 transportation model link volumes (ODOT); and spreadsheet calculations of 8-hour CO emissions. Mobile5b input and output data sets are included in Appendix D_, Emission Inventory and Forecast.

General Methodology

The rollforward formula for determining 2015, 8-hour CO concentrations is given below:

2015, 8-Hr CO Conc. = [1996 Design Conc. – Background Conc.]*
[2015 Intersection 8-Hr CO Ems.]/[1996, Hwy 39&Hope, 8-Hr CO Ems.]

+ Background Conc.

Where 1996 Design Conc. = 6.1 ppm, parts per million (5.1 ppm +1.0 ppm); adjusted by 1.0 ppm, the assumed impact of no oxygenated fuel;

Background Conc = 4.2 ppm, the estimated concentration from sources other than the traffic-related emissions from vehicles passing next to the prediction site;

2015 Intersection 8-Hr CO Ems. is the estimate of 8-hour CO emissions on the traffic links (legs) directly impacting the prediction site;

1996 Hwy 39&Hope , 8-Hr CO Ems. is the estimate of 8-hour CO emissions at the Hwy 39 and Hope Street intersection directly related to the 8-hour CO concentrations recorded at the DEQ Hope Street CO monitor.

[1] Also known as South 6th Avenue

The CO emissions for the intersection of OR 39/140 and Hope Street were assumed to be directly proportional to the adjusted design value concentration (6.1 ppm) at the Hope Street monitoring site. The actual design value of 5.1 ppm was adjusted upwards by 1.0 ppm to reflect an emissions regime without oxygenated fuel. (The 1996 emissions inventory was calculated without oxygenated fuel in consultation with EPA Region 10.) Carbon Monoxide emissions for an 8-hour period of 1 P.M. to 9 P.M. were calculated for each leg of the OR 39/140 and Hope Street intersection. This time period was selected because it matched up with the 14-hour manual traffic count (December 2-3, 1997, starting at 7 A.M. and ending at 9 P.M.) taken by the Oregon Department of Transportation at the OR 39/140 and Hope Street intersection. Even though the actual maximum 8-hour CO concentrations generally occurred for slightly later time periods (ending at 11 P.M. or midnight), the selection of 1 P.M. to 9 P.M. had no effect on the rollforward calculation, since the peak traffic period was incorporated. The hourly traffic volumes from 3 P.M. to 6 P.M. were fairly close to each other, so the analysis segmented the 8-hour traffic volumes into a three-hour peak period and a five-hour off-peak period, with corresponding speeds. Mobile5b was used to generate CO emission factors for the three-hour peak period and the five-hour off-peak period for each leg of the intersection. The individual leg emissions were then summed to yield total 8-hour CO emissions for the intersection. The CO emissions were calculated without taking credit for oxygenated fuel.

Background CO Concentration

To the extent possible, estimates of background CO are based on the results of periodic saturation bag sampling surveys (typically, four to six weeks in the wintertime). The department conducted such surveys in Klamath Falls in 1986/1987 and1995/1996. In the 1995/1996 study, the department operated one of the sites in a residential neighborhood (Peterson School) approximately one mile south of the DEQ Hope Street CO monitor.

Because the rollforward analysis was conducted on the basis of no oxygenated fuel (for the base year and forecast year CO emissions), it was necessary to estimate a background CO concentration commensurate with no oxygenated fuel. During the 1995/1996 study the highest 8-hour average concentration at the Peterson School site was 3.33 ppm, recorded on January 13, 1996. This concentration was equal to 69 percent of the annual second high for 1996 recorded at the DEQ Hope Street CO monitor. To determine CO background level without oxyfuel, the adjusted design concentration of 6.1 ppm was therefore multiplied by 0.69 to yield an estimated concentration of 4.2 ppm. This concentration level was also assumed to apply to the 2015 calendar year.

Rollforward Calculation for the Hope Street Monitor

The calculation of the 2015, 8-hour CO concentration for the Hope Street monitoring site at the intersection of the Klamath Falls—Malin Highway (OR 39/140) and Hope Street follows. The first step was to estimate 1996, 24-hour traffic volumes for the intersection of OR 39/140 and Hope Street using the previously mentioned 1997, 14-hour traffic count. Based on traffic trend data from 1990 to 1997 for OR 39/140 just to the west of

Hope Street, the 1997, 24-hour volumes were adjusted to 1996 by dividing the 24-hour volumes for each leg of the intersection by 1.01. The next step involved factoring the 1996, 24-hour leg volumes into 8-hour volumes using the 1997, 14-hour count. Finally, the 8-hour leg volumes were segmented into the aforementioned 3-hour peak period and 5-hour off-peak period.

Based on the ODOT traffic model forecast to 2015, a linear growth rate of 0.6 percent per year was applied to the 1996 traffic volumes to yield estimated 2015 volumes. Baseline speeds for the highway were determined using speed run data collected in 1999 for a 0.6 mile section of OR 39/140 between the Eastside Bypass on the west and Homedale Road on the east. Because of the light traffic volumes on Hope Street, it was assumed to operate at 20 miles per hour for 1996 and 2015, all hours. For 2015 peak period speeds reflected volume to capacity constraints. The 1996 and 2015 traffic volumes and speeds (2-way average) for the OR 39/140 and Hope Street intersection are tabulated below.

OR 39/140 and Hope Street Traffic Volumes and Speeds

Street Segment	1996 24-Hr Volume	2015 24-Hr Volume	1996 Peak 3-Hr Speed, mph	1996 Off-Peak Speed, mph	2015 Peak 3-Hr Speed, mph	2015 Off-Peak Speed, mph
Hope North of OR 39/140	612	685	20	20	20	20
OR 39/140 West of Hope	25,611	28,661	18.3	24.5	18.0	24.5
Hope South of OR 39/140	3,112	3,482	20	20	20	20
OR 39/140 East of Hope	23,677	26,497	18.3	24.5	18.0	24.5

The calculation of 1996 and 2015, 8-hour CO emissions for the OR 39/140 and Hope Street intersection is shown below.

Klamath Falls OR 39/140 at Hope St. CO Emissions for West and East Legs

Klamath Falls Hwy 39/140 at Hope St. 8-Hour CO Emissions								
West Leg								
From West								
Time	97 Vol	96 Vol	96 Speed, mph	96 CO EF, gm/VMT	96 CO Ems, gm/Mile	2015 Vol	15 Speed, mph	15 CO EF, gm/VMT	2015 CO Em's, gm/Mile
5-Hr Off-Pk	3575	3539.604	22.9	44.27	156698.3	3961.1	22.9	33.36	132142.3
3-4 PM	1184	1172.277	18	54.25	63596.04	1311.872	17.7	42.29	55479.07
4-5 PM	1245	1232.673	18	54.25	66872.52	1379.46	17.7	42.29	58337.36
5-6 PM	1277	1264.356	18	54.25	68591.34	1414.916	17.7	42.29	59836.8
Total					355758.2				305795.5
To West									
Time	97 Vol	96 Vol	96 Speed, mph	CO EF, gm/VMT	96 CO Ems, gm/Mile	2015 Vol	15 Speed, mph	15 CO EF, gm/VMT	15 CO Em's, gm/Mile
5-Hr Off-Pk	2945	2915.842	26.1	39.42	114942.5	3263.06	26.1	28.52	93062.47
3-4 PM	1043	1032.673	18.5	53.1	54834.95	1155.644	18.3	41.57	48040.12
4-5 PM	922	912.8713	18.5	53.1	48473.47	1021.576	18.3	41.57	42466.91
5-6 PM	767	759.4059	18.5	53.1	40324.46	849.836	18.3	41.57	35327.68
Total					258575.3				218897.2
East Leg									
From East									
Time	97 Vol	96 Vol	96 Speed, mph	CO EF, gm/VMT	96 CO Ems, gm/Mile	2015 Vol	15 Speed, mph	15 CO EF, gm/VMT	15 CO Em's, gm/Mile
5-Hr Off-Pk	2615	2589.109	26.1	39.42	102062.7	2897.42	26.1	28.52	82634.42
3-4 PM	938	928.7129	18.5	53.1	49314.65	1039.304	18.3	41.57	43203.87
4-5 PM	853	844.5545	18.5	53.1	44845.84	945.124	18.3	41.57	39288.8
5-6 PM	697	690.099	18.5	53.1	36644.26	772.276	18.3	41.57	32103.51
Total					232867.4				197230.6
To East									
Time	97 Vol	96 Vol	96 Speed, mph	CO EF, gm/VMT	96 CO Ems, gm/Mile	2015 Vol	15 Speed, mph	15 CO EF, gm/VMT	15 CO Em's, gm/Mile
5-Hr Off-Pk	3375	3341.584	22.9	44.27	147931.9	3739.5	22.9	33.36	124749.7
3-4 PM	1147	1135.644	18	54.25	61608.66	1270.876	17.7	42.29	53745.35
4-5 PM	1184	1172.277	18	54.25	63596.04	1311.872	17.7	42.29	55479.07
5-6 PM	1223	1210.891	18	54.25	65690.84	1355.084	17.7	42.29	57306.5
Total					338827.5				291280.6

Klamath Falls OR 39/140 at Hope St. CO Emissions for North and South Legs and Total CO Emissions for the Intersection

Klamath Falls Hwy 39/140 at Hope St. 8-Hour CO Emissions									
North Leg									
Time	97 Vol	96 Vol	96 Speed, mph	CO EF, gm/VMT	96 CO Ems, gm/Mile	2015 Vol	15 Speed, mph	15 CO EF, gm/VMT	15 CO Em's, gm/Mile
1-9 PM	278	275.2475	20	49.92	13740.356	308.024	20	39.09	12040.6
South Leg									
Time	97 Vol	96 Vol	96 Speed, mph	CO EF, gm/VMT	96 CO Ems, gm/Mile	2015 Vol	15 Speed, mph	15 CO EF, gm/VMT	15 CO Em's, gm/Mile
1-9 PM	1540	1524.752	20	49.92	76115.644	1706.32	20	39.09	66700.0
Total CO Em's (All Legs)					1275884				109194

Using the rollforward formula, the estimated 2015, 8-hour CO concentration for the OR 39/140 and Hope Street intersection (without oxygenated fuel) is calculated as follows.

2015 8-Hr CO Conc. = (6.1 ppm – 4.2 ppm)(2015 8-Hr CO Ems)/(1996 8-Hr CO Ems) + 4.2 ppm
= (1.9 ppm)(1,091,945 gm/mi)/(1,275,884 gm/mi) + 4.2 ppm
= 5.8 ppm

Non-monitored Hot Spots

[Add documentation on results of screening analysis with a listing of the three higest intersections by volume and the three highest by congestion.]

Attachment A-2

340-200-0040

State of Oregon Clean Air Act Implementation Plan

(1) This implementation plan, consisting of Volumes 2 and 3 of the State of Oregon Air Quality Control Program, contains control strategies, rules and standards prepared by the Department of Environmental Quality and is adopted as the state implementation plan (SIP) of the State of Oregon pursuant to the federal Clean Air Act, Public Law 88-206 as last amended by Public Law 101-549.

(2) Except as provided in section (3) of this rule, revisions to the SIP shall be made pursuant to the Commission's rulemaking procedures in Division 11 of this Chapter and any other requirements contained in the SIP and shall be submitted to the United States Environmental Protection Agency for approval.

(3) Notwithstanding any other requirement contained in the SIP, the Department is authorized:

(a) To submit to the Environmental Protection Agency any permit condition implementing a rule that is part of the federally-approved SIP as a source-specific SIP revision after the Department has complied with the public hearings provisions of 40 CFR 51.102 (July 1, 1992); and

(b) To approve the standards submitted by a regional authority if the regional authority adopts verbatim any standard that the Commission has adopted, and submit the standards to EPA for approval as a SIP revision.

[**NOTE:** Revisions to the State of Oregon Clean Air Act Implementation Plan become federally enforceable upon approval by the United States Environmental Protection Agency. If any provision of the federally approved Implementation Plan conflicts with any provision adopted by the Commission, the Department shall enforce the more stringent provision.]

[Publications: The publication(s) referred to or incorporated by reference in this rule are available from the agency.]

Stat. Auth.: ORS 468.020

Stats. Implemented: ORS 468A.035

Hist.: DEQ 35, f. 2-3-72, ef. 2-15-72; DEQ 54, f. 6-21-73, ef. 7-1-73; DEQ 19-1979, f. & ef. 6-25-79; DEQ 21-1979, f. & ef. 7-2-79; DEQ 22-1980, f. & ef. 9-26-80; DEQ 11-1981, f. & ef. 3-26-81; DEQ 14-1982, f. & ef. 7-21-82; DEQ 21-1982, f. & ef. 10-27-82; DEQ 1-1983, f. & ef. 1-21-83; DEQ 6-1983, f. & ef. 4-18-83; DEQ 18-1984, f. & ef. 10-16-84; DEQ 25-1984, f. & ef. 11-27-84; DEQ 3-1985, f. & ef. 2-1-85; DEQ 12-1985, f. & ef. 9-30-85; DEQ 5-1986, f. & ef. 2-21-86; DEQ 10-1986, f. & ef. 5-9-86; DEQ 20-1986, f. & ef. 11-7-86; DEQ 21-1986, f. & ef. 11-7-86; DEQ 4-1987, f. & ef. 3-2-87; DEQ 5-1987, f. & ef. 3-2-87; DEQ 8-1987, f. & ef. 4-23-87; DEQ 21-1987, f. & ef. 12-16-87; DEQ 31-1988, f. 12-20-88, cert. ef. 12-23-88; DEQ 2-1991, f. & cert. ef. 2-14-91; DEQ 19-1991, f. & cert. ef. 11-13-91; DEQ 20-1991, f. & cert. ef. 11-13-91; DEQ 21-1991, f. & cert. ef. 11-13-91; DEQ 22-1991, f. & cert. ef. 11-13-91; DEQ 23-1991, f. & cert. ef. 11-13-91; DEQ 24-1991, f. & cert. ef. 11-13-91; DEQ 25-1991, f. & cert. ef. 11-13-91; DEQ 1-1992, f. & cert. ef. 2-4-92; DEQ 3-1992, f. & cert. ef. 2-4-92; DEQ 7-1992, f. & cert. ef. 3-30-92; DEQ 19-1992, f. & cert. ef. 8-11-92; DEQ 20-1992, f. & cert. ef. 8-11-92; DEQ 25-1992, f. 10-30-92, cert. ef. 11-1-92; DEQ 26-1992, f. & cert. ef. 11-2-92; DEQ 27-1992, f. & cert. ef. 11-12-92; DEQ 4-1993, f. & cert. ef. 3-10-93; DEQ 8-1993, f. & cert. ef. 5-11-93; DEQ 12-1993, f. & cert. ef. 9-24-93; DEQ 15-1993, f. & cert. ef. 11-4-93; DEQ 16-1993, f. & cert. ef. 11-4-93; DEQ 17-1993, f. & cert. ef. 11-4-93; DEQ 19-1993, f. & cert. ef. 11-4-93; DEQ 1-1994, f. & cert. ef. 1-3-94; DEQ 5-1994, f. & cert. ef. 3-21-94; DEQ 14-1994, f. & cert. ef. 5-31-94; DEQ 15-1994, f. 6-8-94, cert. ef. 7-1-94; DEQ 25-1994, f. & cert. ef. 11-2-94; DEQ 9-1995, f. & cert. ef. 5-1-95; DEQ 10-1995, f. & cert. ef. 5-1-95; DEQ 14-1995, f. & cert. ef. 5-25-95; DEQ 17-1995, f. & cert. ef. 7-12-95; DEQ 19-1995, f. & cert. ef. 9-1-95; DEQ 20-1995 (Temp), f. & cert. ef. 9-14-95; DEQ 8-1996(Temp), f. & cert. ef. 6-3-96; DEQ 15-1996, f. & cert. ef. 8-14-96; DEQ 19-1996, f. & cert. ef. 9-24-96; DEQ 22-1996, f. & cert. ef. 10-22-96; DEQ 23-1996, f. & cert. ef. 11-4-96; DEQ 24-1996, f. & cert. ef. 11-26-96; DEQ 10-1998, f. & cert. ef. 6-22-98; DEQ 15-1998, f. & cert. ef. 9-23-98; DEQ 16-1998, f. & cert. ef. 9-23-98; DEQ 17-1998, f. & cert. ef. 9-23-98; DEQ 20-1998, f. & cert. ef. 10-12-98; DEQ 21-1998, f. & cert. ef. 10-12-98; DEQ 1-1999, f. & cert. ef. 1-25-99; DEQ 5-1999, f. & cert. ef. 3-25-99; DEQ 6-1999, f. & cert. ef. 5-21-99; DEQ 10-1999, f. & cert. ef. 7-1-99; DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-020-0047; DEQ 15-1999, f. & cert. ef. 10-22-99; DEQ 2-2000, f. 2-17-00, cert. ef. 6-1-01

340-200-0050

340-204-0030

Designation of Nonattainment Areas

The following areas are designated as Nonattainment Areas:

(1) Carbon Monoxide Nonattainment Areas:

(a) The Salem Nonattainment Area for Carbon Monoxide is the Salem-Kaiser Area Transportation Study as defined in OAR 340-204-0010.

[Note: Air quality plans have been submitted to the Environmental Protection Agency for the Grants Pass CBD, Klamath Falls UGB, and Medford UGB with a request that the federal nonattainment status be revised. All applicable nonattainment area requirements continue to apply in each area until EPA redesignates the area to attainment. Contact the Air Quality Division's State Implementation Plan Coordinator for current information.]

~~The Grants Pass Nonattainment Area for Carbon Monoxide is the Grants Pass CBD as defined in OAR 340-204-0010. After the effective date of the Environmental Protection Agency's approval of this section as a revision to the Oregon Clean Air Act Implementation Plan as published in the Federal Register, the Grants Pass CBD is not subject to OAR 340-204-0030 and is no longer considered a nonattainment area.~~

~~(b) The Klamath Falls Nonattainment Area for Carbon Monoxide is the Klamath Falls UGB as defined in OAR 340-204-0010.~~

(2) PM_{10} Nonattainment Areas: Revocation of the nonattainment area designation for the following areas will be effective upon final notice in the Federal Register:

(a) The Eugene Nonattainment Area for PM_{10} is the Eugene-Springfield UGA as defined in OAR 340-204-0010.

(b) The Grants Pass Nonattainment Area for PM_{10} is the Grants Pass UGB as defined in OAR 340-204-0010.

(c) The Klamath Falls Nonattainment Area for PM_{10} is the Klamath Falls UGB as defined in OAR 340-204-0010.

(d) The LaGrande Nonattainment Area for PM_{10} is the LaGrande UGB as defined in OAR 340-204-0010.

(e) The Lakeview Nonattainment Area for PM_{10} is the Lakeview UGB as defined in OAR 340-204-0010.

(f) The Medford Nonattainment Area for PM_{10} is the Medford-Ashland AQMA as defined in OAR 340-204-0010.

(g) The Oakridge Nonattainment Area for PM_{10} is the Oakridge UGB as defined in OAR 340-204-0010.

[**NOTE:** This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the Environmental Quality Commission under OAR 340-200-0040.]

Stat. Auth.: ORS 468.020

Stats. Implemented: ORS 468A.025

Hist.: DEQ 14-1995, f. & cert. ef. 5-25-95; DEQ 18-1996, f. & cert. ef. 8-19-96; DEQ 15-1998, f. & cert. ef. 9-23-98; DEQ 1-1999, f. & cert. ef. 1-25-99; DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-031-0520; DEQ 15-1999, f. & cert. ef. 10-22-99

340-204-0040

Designation of Maintenance Areas

The following areas are designated as Maintenance Areas:

(1) Carbon Monoxide Maintenance Areas:

(a) The Eugene Maintenance Area for Carbon Monoxide is the Eugene-Springfield AQMA as defined in OAR 340-204-0010.

(b) The Portland Maintenance Area for Carbon Monoxide is the Portland Metropolitan Service District as referenced in OAR 340-204-0010.

(c) The Medford Carbon Monoxide Maintenance Area is the Medford UGB as defined in OAR 340-204-0010. [Note: EPA maintenance plan approval and redesignation pending].

(d) The Grants Pass Carbon Monoxide Maintenance Area is the Grants Pass CBD as defined in OAR 340-204-0010. [Note: EPA maintenance plan approval and redesignation pending].

(e) The Klamath Falls Carbon Monoxide Maintenance Area is the Klamath Falls UGB as defined in OAR 340-204-0010. [Note: EPA maintenance plan approval and redesignation pending].

~~The Grants Pass Maintenance Area for Carbon Monoxide is the Grants Pass CBD as defined in OAR 340-204-0010. After the Effective date of the Environmental Protection Agency's approval of this section as a revision to the Oregon Clean Air Act Implementation Plan as published in the Federal Register, the Grants Pass CBD is subject to OAR 340-204-0040 and is considered a maintenance area.~~

(2) Ozone Maintenance Areas:

(a) The Medford Maintenance Area for Ozone is the Medford-Ashland AQMA as defined in OAR 340-204-0010.

(b) The Oregon portion of the Portland - Vancouver Interstate Maintenance Area for Ozone is the Portland AQMA, as defined in OAR 340-204-0010.

(3) PM_{10} Maintenance Areas: There are no areas in the state that have been designated by the EQC as PM_{10} Maintenance Areas.

[**NOTE:** This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the Environmental Quality Commission under OAR 340-200-0040.]

Stat. Auth.: ORS 468.020

Stat. Implemented: ORS 468A.025

Hist.: DEQ 14-1995, f. & cert. ef. 5-25-95; DEQ 18-1996, f. & cert. ef. 8-19-96; DEQ 15-1998, f. & cert. ef. 9-23-98; DEQ 1-1999, f. & cert. ef. 1-25-99; DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-031-0530; DEQ 15-1999, f. & cert. ef. 10-22-99

340-204-0090

Oxygenated Gasoline Control Areas

(1) The following are oxygenated gasoline control areas:

(a1) Clackamas, Multnomah, Washington and Yamhill Counties;

(b2) Jackson County;

(2) The oxygenated fuel requirement also applies to any area formerly listed as nonattainment for carbon monoxide in 340-204-0030 and classified by EPA as moderate or worse, until EPA redesignates the area to attainment and repeals the oxygenated fuel requirement.

[Note: The department has submitted a request to the Environmental Protection Agency asking that the oxygenated fuel requirement be repealed in the Grants Pass Control Area and Klamath Falls Control Area. These areas remain Oxygenated Gasoline Control Areas and oxygenated fuel requirements continue to apply until such time as EPA approves the request for repeal. Contact the Air Quality Division's State Implementation Plan Coordinator for current information].

~~Grants Pass Control Area; after the effective date of the Environmental Protection Agency's approval of this section as a revision to the Oregon Clean Air Act Implementation Plan as published in the Federal Register, the Grants Pass control area is not subject to OAR 340-204-0090 and is no longer considered a control area.~~

(1) ~~(4) Klamath Falls Control Area.~~

[**NOTE:** This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the Environmental Quality Commission under OAR 340-200-0040.]

Stat. Auth.: ORS 468 & ORS 468A

Stats. Implemented: ORS 468A.420

Hist.: DEQ 25-1992, f. 10-30-92, cert. ef. 11-1-92; DEQ 4-1993, f. & cert. ef. 3-10-93; DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-022-0470; DEQ 15-1999, f. & cert. ef. 10-22-99

Attachment A-3

STATE OF OREGON AIR QUALITY CONTROL PROGRAM

VOLUME 3: STATE IMPLEMENTATION PLAN APPENDICES

SECTION 4.53: Klamath Falls

Appendix D4: Klamath Falls Carbon Monoxide
D4-4: Emission Inventory and Forecast

STATE OF OREGON
1996 Attainment Year
SIP Emission Inventory
for
Carbon Monoxide

Klamath Falls UGB

May 15, 2000

Oregon Department of Environmental Quality
Air Quality Division
Technical Services
811 SW 6th Avenue
Portland, Oregon 97204

EXECUTIVE SUMMARY

The Klamath Falls Carbon Monoxide (CO) Nonattainment Area has met the National Ambient Air Quality Standards (NAAQS) for carbon monoxide. In accordance with the 1990 Federal Clean Air Act Amendments (CAAA), the area can now redesignate to attainment status through a process which involves developing a Redesignation Request / Maintenance Plan. This attainment year emission inventory is for 1996, and is provided as part of the maintenance plan package to show compliance with published EPA requirements. The principal components for development and documentation have been addressed in this inventory, which includes stationary point sources, stationary area sources, non-road mobile sources, on-road mobile sources, quality assurance implementation, and emissions summaries. The geographic focus for this 1996 emission inventory is the Klamath Falls CO Nonattainment Area, which has the same boundary as the Klamath Falls Urban Growth Boundary.

During the average winter 1996 day, on-road mobile sources contribute 58% of the total carbon monoxide (CO) air emissions in the Klamath Falls UGB. Gasoline vehicles contribute 91% of the CO emissions within the on-road mobile category, whereas diesel vehicles contribute 9% of the on-road mobile category.

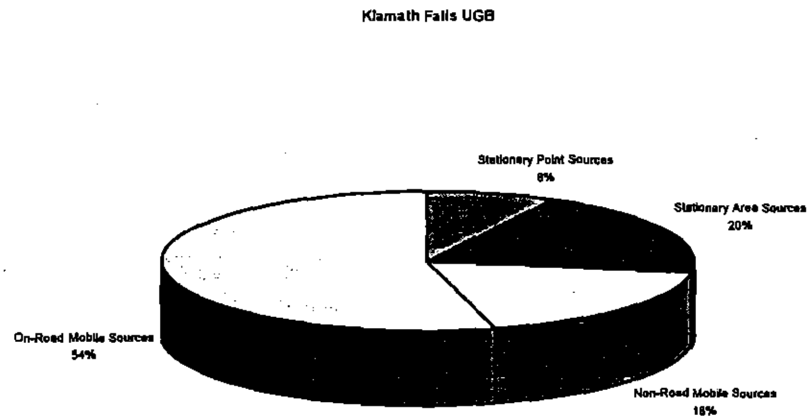
Stationary area sources comprise 25% of the total CO air emissions in the Klamath Falls UGB on a winter carbon monoxide season day. Within the area source category, residential wood combustion accounts for 85% of the emissions. Wood combustion in fireplaces account for about 28% of the total are source emissions, and wood combustion in wood and pellet stoves account for about 72% of the CO area source emissions.

Non-road mobile sources contribute 9% of the total CO on an average winter day. Within this category, 4-cycle engines comprise 58% of the total emissions, 2-cycle-engines contribute a little over 5%, and diesel engines account for about 4%; aircraft and railroads contribute about 28% and 4% respectively.

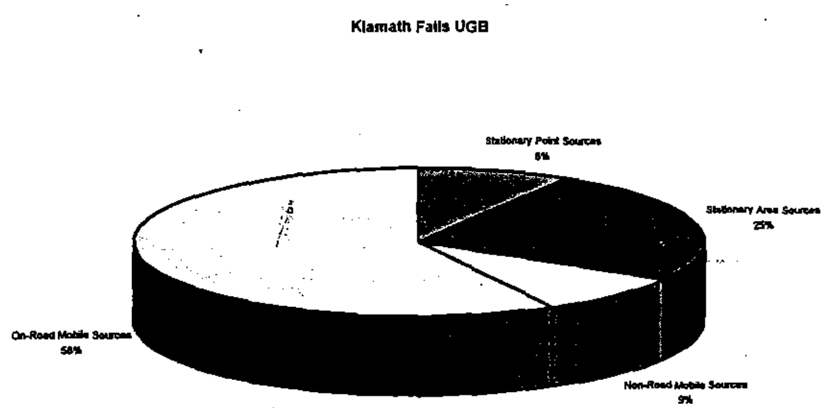
Stationary point sources comprise 8% of the CO air emissions in the Klamath Falls UGB on an average winter season day. This category includes only those stationary sources with annual CO emissions greater than 100 tons per year. There are five such large point sources within the Klamath Falls UGB and 25-mile buffer zone.

Details of the Oregon 1996 Klamath Falls UGB CO NAA Attainment Year SIP Emission Inventory from point, area, non-road, and on-road mobile sources are presented in the following document.
The relative percentage of annual and CO season CO emissions from stationary point, stationary area, non-road mobile, and on-road mobile sources are shown in the Executive Summary Figures a and b.

Executive Summary Figure a: Annual CO emissions in 1996 by category



Executive Summary Figure b: Seasonal CO emissions in 1996 by category



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Part 1: INTRODUCTION TO THE REPORT

1.1 INTRODUCTION

1.1.1 PURPOSE OF THE REPORT

The Clean Air Act Amendments (CAAA) of 1990 authorized the U.S. Environmental Protection Agency (EPA) to designate nonattainment areas with respect to the National Ambient Air Quality Standards (NAAQS). Under the 1990 CAAA, pre-enactment carbon monoxide nonattainment areas were classified according to the severity of nonattainment. Each state was required to submit a list designating nonattainment areas within the state.

Oregon submitted a list of areas that were in nonattainment to EPA on 15 March 1991. The area within the Klamath Falls Urban Growth Boundary was listed as nonattainment for carbon monoxide (Klamath Falls UGB / NAA). The nonattainment area had a design value of 10.5 parts per million (ppm) for Carbon Monoxide, and exceeded the NAAQS in 1988. The NAAQS limit is 9 ppm, but it must reach 9.5 ppm to be considered an exceedance. One carbon monoxide monitor has been in place at the same location in the Klamath Falls UGB (Hope St. sit) since 1988. The last violation of the maximum 8-hour average CO standard occurred in 1989 with measured high and second high CO value above the 9 ppm NAAQS (10.9 ppm on 01/19/89 and 10.3 ppm on 12/23/89). However, only one exceedance has occurred since 1989 (January 5, 1991 with a high maximum 8-hr average value of 9.8 ppm). Klamath Falls has not had an exceedance of the 35 ppm 1-hour average NAAQS. Klamath Falls first achieved compliance with CO standards in 1990 with a recorded second high below the NAAQS (8.9 ppm). The CO standard was attained in 1991 when the second high value of 8.8 ppm resulted in two consecutive NAAQS years (1990 and 1991) of second highs below the NAAQS. Since 1991, maximum CO values have been significantly below the NAAQS.

The area to be included in the emission inventory area for the Klamath Falls CO nonattainment area was delineated as the Klamath Falls UGB in the *Inventory Preparation Plan* (IPP) submitted June 2, 1999. The Oregon CO IPP was approved by EPA Region X on November 19, 1999 by letter from Ms. Joan Cabreza.
This document fulfills the EPA requirements for preparing the 1996 attainment Year and 2015 maintenance Year emission inventories, specified in the provisions of the 1990 CAAA, and EPA guidance documents.

1.1.2 DESCRIPTION OF INVENTORY AND AREA COVERED

The 1996 Attainment Year inventory covers carbon monoxide emissions for the Klamath Falls Urban Growth Boundary (UGB) nonattainment area. Emissions are reported on an annual basis and on a daily rate for the period of the Carbon Monoxide Season.

Emissions are reported in this inventory for two representative time periods: Annual Emissions (in units of "tons per year") that represent CO emissions generated over the 1996

Attainment Year of January 1 through December 31; and Seasonal Emissions (in units of "pounds per day") that represent CO emissions generated in a three-month period - called the CO season - when ambient CO accumulations are typically the highest. For the Klamath Falls UGB, the CO Season is defined as the period of three months: December 1995, January and February 1996.

The geographic area of the Klamath Falls UGB is shown in Figure 1. Figure 2 shows the 25-mile extension or buffer to the Klamath Falls UGB area. The shaded area shows an area within a 25-mile radius of Klamath Falls. The Klamath Falls 25-mile buffer includes incorporated and unincorporated Klamath County. The purpose of the 25-mile buffer is to inventory major point sources of CO that are located outside of the urban growth boundary/ non-attainment area but may influence the ambient air quality of the area.

Figure 1: Klamath Falls Urban Growth Boundary

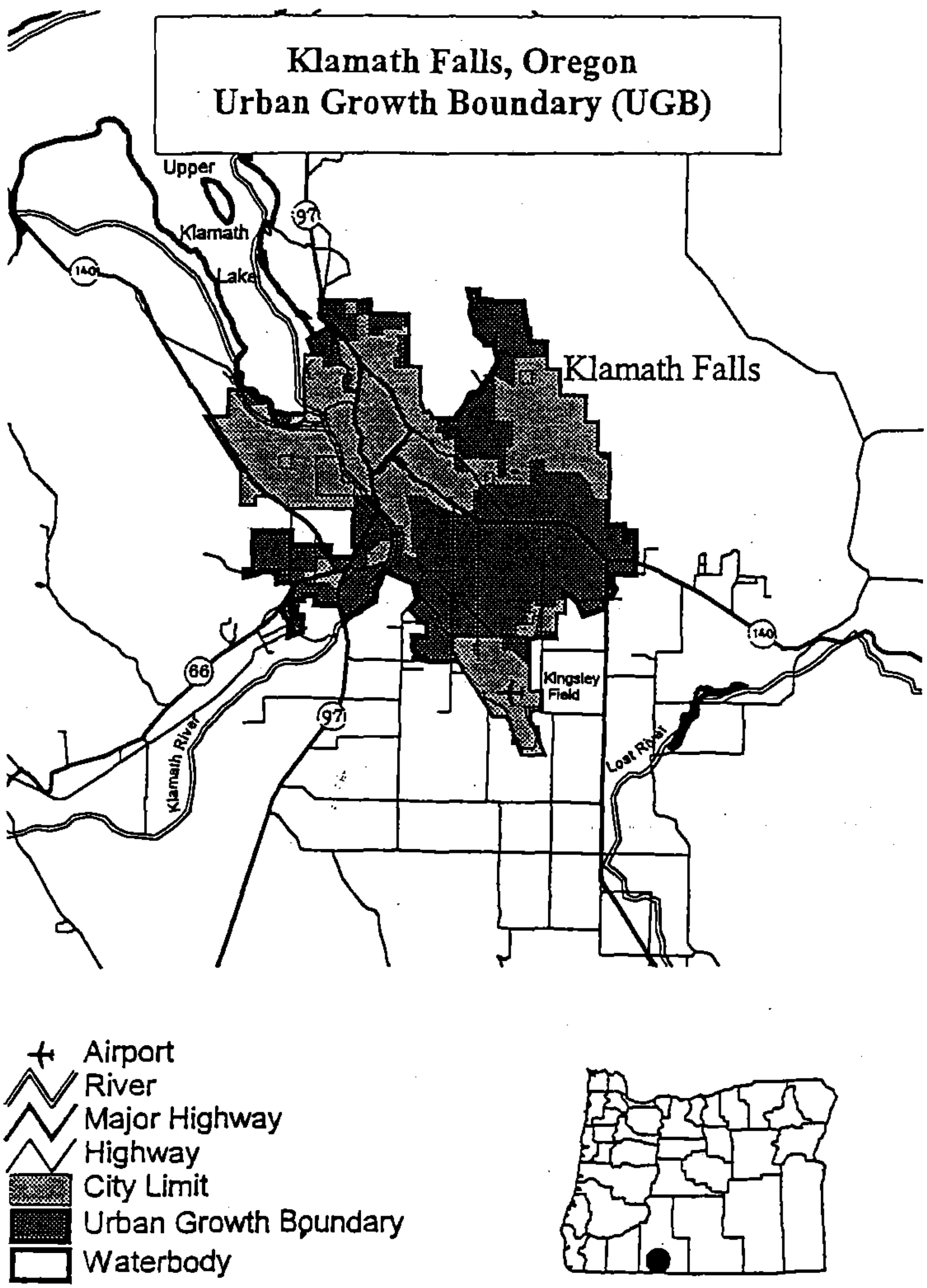
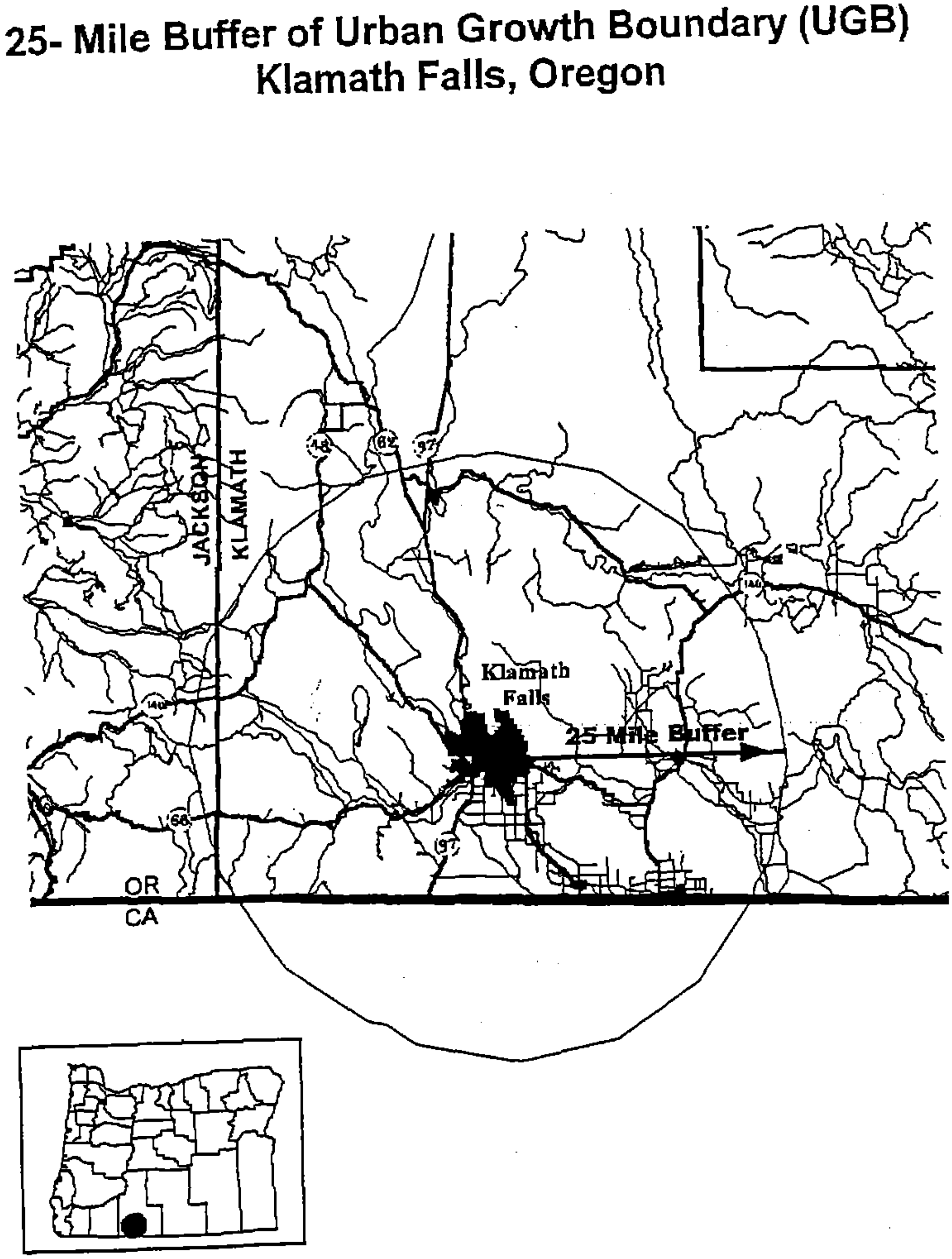


Figure 2: Klamath Falls 25-Mile Buffer for CO Sources >100 tons/year



1.1.3 CONTENTS

The Report is divided into the following parts:

Part 1:	Introduction to the Report
Part 2:	Klamath Falls CO 1996 Attainment Year Emission Inventory
Part 3:	Quality Assurance and Quality Control
Part 4:	References
Part 5:	Appendices

- Part 1 provides an introduction to this Report and its purpose. Contents of the Report are briefly described. Information concerning automated systems and a description of the Oregon DEQ Air Contaminant Source Information System (ACSIS) are included. Sources, which were excluded from the inventory, are described with rationale for the exclusions. EPA procedure and guidance documents used in preparing the inventory are described. Finally, information on the personnel responsible for the preparation of the inventory is outlined.

- Part 2 describes in detail the methodologies and approaches taken to estimate emissions in the Klamath Falls UGB CO Nonattainment Area for the 1996 Attainment Year inventory. Part 2 is divided into sections describing the inventory process and the types of emission sources that are addressed in the inventory, as follows:

  - Section 1.0 provides a map of the Klamath Falls UGB inventory area and 25-Mile Buffer and a written description of the area.

  - Section 2.0 contains summary tables for stationary point, stationary area, non-road mobile, and on-road mobile sources in the Klamath Falls UGB.

  - Section 3.0 contains a discussion of the stationary point source emission category methodology and emissions estimate approach. Tables summarizing point source emissions estimates follow the discussion.

  - Section 4.0 addresses stationary area sources and contains a discussion of the approaches used in estimating emissions. Each area source category inventoried is described in detail, including the methodology used in making the calculations. Tables summarizing stationary area source emissions estimates follow the discussion.

➢

➢ Section 5.0 provides a discussion of the approach and methodology used in evaluating emissions from non-road mobile sources. Tables summarizing non-road mobile source emissions estimates follow the discussion.

➢ Section 6.0 provides a description of the approach and methodology used in evaluating emissions from on-road mobile sources. Tables summarizing on-road mobile source emissions estimates follow the discussion.

➢ Section 7.0 describes future year growth rates and their associated assumptions through the year 2015.

❖ Part 3 describes the quality assurance procedures utilized in preparing the 1996 inventory.

❖ Part 4 contains an extensive list of references utilized for the Klamath Falls CO emission inventory.

❖ Part 5 includes appendices with supplemental data used to estimate emissions.

Tables and figures for each emission category are located at the end of the discussion section for that category. For example, summary emission tables for all stationary point source types in the Klamath Falls UGB are located at the end of Part 2, Section 3. Please note that the references listed in the tables are numbered as 'DEQ master references' (See Part 4 for this classification at the end of each entry).

1.1.4 Discussion of Automated Systems

1.1.4.1 DEQ Emission Inventory System

The inventory has been assembled by the staff of the Technical Services Section, Air Quality Division of the Oregon Department of Environmental Quality (DEQ). The point source emissions are specifically drawn from the DEQ Air Contaminant Source Information System (ACSIS). The ACSIS data is used for tracking compliance with plant site emission limits and for reporting compliance status to the EPA AIRS system. ACSIS is also used to store actual emission data also reported to AIRS. ACSIS contains annual emission levels for each permitted point source as well as, emission factors, and annual activity levels (fuel use and production levels).

1.1.5 SOURCES NOT INVENTORIED

All sources in the Klamath Falls UGB nonattainment area were considered for inclusion into the emission inventory. Sources were rejected for one of the following reasons: 1) point source emitted less than 5 tons of CO per year, 2) point, area, non-road, or mobile sources did not emit significant CO during the winter CO season, 4) categories were not applicable to the Klamath Falls area (e.g., emissions from orchard burning were not included due to lack of commercial orchards that prune and burn the pruned material[222]). Major stationary point sources were included if they were within a 25-mile buffer of Klamath Falls UGB. Point sources inside the Klamath Falls UGB that contributed less than 100 tons and over 5 tons of CO per year were included in the Area Source – Small Point Source category of this inventory. Agricultural Burning Category was combined with the Open Burning Category in this inventory.

1.1.6 GUIDANCE DOCUMENTS

The inventory was conducted using all current and applicable EPA procedure and guidance documents. Two primary documents utilized were *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume I*[3], hereinafter referred to as the EPA Procedures Document and *Emission Inventory Requirements for Carbon Monoxide State Implementation Plans*[1]. Emission factors were taken from the EPA Procedures Document[3], the *Compilation of Air Pollutant Emission Factors*[8,216], hereinafter referred to as AP-42, and in some instances from the *FIRE Version 6.22 SCC Code and Emission Factor Listings For Criteria Air Pollutants* [318]. Localized emission factors were used when documentation existed to support their accuracy (e.g., source test reports). These and other information sources are cited in the text, as appropriate.

1.1.7 CONTACT PERSONNEL FOR THE INVENTORY

ODEQ personnel Steven Aalbers, Wendy Anderson, Svetlana Lazarev, Kevin Mcgillivray, Jeff Ross and Wes Risher performed most of the required source calculations. For transportation (on-road mobile) sources, outside assistance was obtained from the Oregon Department of Transportation (ODOT).

The abbreviated list of those conducting this Klamath Falls 1996 Attainment Year SIP emission inventory is shown below:

ODEQ :
Andrew Ginsburg
Air Quality Division Administrator

Gerry Preston,
Technical Services Manager
Emission Inventory
Steven Aalbers, Emission Inventory Specialist
Wendy Anderson, Emission Inventory Specialist
Svetlana Lazarev, Emission Inventory Specialist
Kevin McGillivray, Emission Inventory Specialist
Wesley Risher, Emission Inventory Specialist
Quality Assurance
Monica Russell, Air Quality Monitoring Coordinator
Brian Fields, Emission Inventory Specialist

Annette Liebe,
Airshed Planning Manager
David Collier, Air Quality Planner

ODEQ Eastern Region
Jeff Ross, Source Test Coordinator

Oregon State Department of Transportation
Systems Study Unit
William Upton, Manager
Mike Gillett, Transportation Engineer

Part 2: KLAMATH FALLS CARBON MONOXIDE ATTAINMENT AREA INVENTORY

Part 2.1 ATTAINMENT AREA DESCRIPTION

2.1.1 ATTAINMENT AREA MAPS

A map outlining the Klamath Falls UGB Carbon Monoxide inventory area can be found in Part 1, Figure 1. A map outlining the 25-mile buffer zone in addition to the UGB can be found in Part 1 Figure 2. The Klamath Falls Area Domestic Open Burning Boundary is defined by the Klamath Falls city boundary and can be seen in Figure 1. Figure 3 represents an Oregon Department of Transportation TAZ map developed as part of 1999 Travel model study of Klamath Falls transportation systems plan. Finally, the vehicle inspection boundary, which is the same as the Klamath Falls UGB is shown in Figure 1.

2.1.2 LEGAL DESCRIPTIONS

2.1.2.1 Legal Description of Klamath Falls Urban Growth Boundary / CO Inventory Area

Legal description of the Klamath Falls Urban Growth Boundary Attainment Area as adopted by Oregon DEQ define the boundaries as shown in Figure 1 and can be found in Oregon Administrative Rules (OAR) 340, Division 202.

Legal Description of Klamath Falls Urban Growth Boundary (340-202-0120)

Klamath Falls UGB" means the area within the bounds beginning at the southeast corner of Section 36, Township 38 South, Range 9 East; thence northerly approximately 4500 feet; thence westerly approximately 1/4 mile; thence northerly approximately 3/4 mile into Section 25, T38S, R9E; thence westerly approximately 1/4 mile; thence northerly approximately 1/2 mile to the southern boundary of Section 24, T38S, R9E; thence westerly approximately 1/2 mile to the southeast corner of Section 23, T38S, R9E; thence northerly approximately 1/2 mile; thence westerly approximately 1/4 mile; thence northerly approximately 1/2 mile to the southern boundary of Section 14, T38S, R9E; thence generally northwesterly along the 5000 foot elevation contour line approximately 3/4 mile; thence westerly 1 mile; thence north to the intersection with the northern boundary of Section 15,.T38S, R9E; thence west 1/4 mile along the northern boundary of Section 15, T38S, R9E; thence generally southeasterly following the 4800 foot elevation contour line around the old Oregon Institute of Technology Campus to meet with the westerly line of Old Fort Road in Section 22, T38S, R9E; thence southwesterly along the westerly line of Old Fort Road approximately 1 and 1/4 miles to Section 27, T38S, R9E; thence west approximately 1/4 mile; thence southwesterly approximately 1/2 mile to the intersection with Section 27, T38S, R9E; thence westerly approximately 1/2 mile to intersect with the Klamath Falls City Limits at the northerly line of Loma Linda Drive in Section 28, T38S, R9E; thence northwesterly along Loma Linda Drive approximately 1/4 mile; thence southwesterly approximately 1/8 mile to the Klamath Falls City Limits; thence northerly along the Klamath Falls City Limits approximately 1 mile into Section 21, T38S, R9E; thence westerly approximately 1/4 mile; thence northerly approximately 1 mile into Section 17, T38S, R9E; thence westerly approximately 3/4 mile into Section 17, T38S, R9E; thence northerly approximately 1/4 mile; thence westerly approximately 1 mile to the west boundary of Highway 97 in Section 18, T38S, R9E; thence southeasterly along the western boundary of Highway 97 approximately 1/2 mile; thence southwesterly away from Highway 97; thence southeasterly to the intersection with Klamath Falls City Limits at Front Street; thence westerly approximately 1/4 mile to the western boundary of Section 19, T38S, R9E; thence southerly approximately 1 and 1/4 miles along the western boundary of Section 19, T38S, R9E and the Klamath Falls City Limits to the south shore line of Klamath Lake; thence northwesterly along the south shore line of Klamath Lake approximately 1 and 1/4 miles across Section 25, T38S, R9E and Section 26, T38S, R9E; thence westerly approximately 1/2 mile along Section 26, T38S, R9E; thence southerly approximately 1/2 mile to Section 27, T38S, R9E to the intersection with eastern boundary of Orindale Draw, thence southerly along the eastern boundary of Orindale Draw approximately 1 and 1/4 miles into Section 35, T38S, R9E; thence southerly approximately 1/2 mile into Section 2, T39S, R8E; thence easterly approximately 1/4 mile; thence northerly approximately 1/4 mile to the southeast corner of Section 35, T38S, R8E and the Klamath Falls City Limits; thence easterly approximately 1/2 mile to the northern boundary of Section 1, T38S, R8E; thence southeasterly approximately 1/2 mile to Orindale Road; thence north 500 feet along the west side of an easement; thence easterly approximately 1 and 1/4 miles through Section 1, T38S, R8E to the western boundary of Section 6, T39S, R9E; thence southerly approximately 3/4 mile to the southwest corner of Section 6, T39S, R9E; thence easterly approximately 1/8 mile to the western boundary of Highway 97; thence southwesterly along the Highway 97 right-of-way approximately 1/4 mile; thence westerly approximately 1/2 mile to Agate Street in Section 7, T39S, R8E; thence northerly approximately 1/4 mile; thence westerly approximately 3/4 mile to Orindale Road in Section 12, T39S, R8E; thence northerly approximately 1/4 mile into Section 1, T39S, R8E; thence westerly approximately 3/4 mile to the Section 2, T39S, R8E boundary line; thence southerly approximately 3/4 mile along the Section 2, T39S, R8E boundary line to the northwest corner of Section 12, T39S, R8E; thence westerly approximately 1/8 mile into Section 11, T39S, R8E; thence southerly approximately 1/8 mile; thence northeasterly approximately 3/4 mile to the southern boundary of Section 12, T39S, R8E at Balsam Drive; thence southerly approximately 1/4 mile into Section 12, T39S, R8E; thence easterly approximately 1/4 mile to Orindale Road; thence southeasterly approximately 500 feet to Highway 66; thence southwesterly approximately 1/2 mile along the boundary of Highway 66 to Holiday Road; thence southerly approximately 1/2 mile into Section 13, T39S, R8E; thence northeasterly approximately 1/4 mile to the eastern boundary of Section 13, T39S, R8E; thence northerly approximately 1/4 mile along the eastern boundary of Section 13, T39S, R8E; thence westerly approximately 1/4 mile to Weyerhaeuser Road; thence northerly approximately 1/8 mile; thence easterly approximately 1/8 mile; thence northerly approximately 1/8 mile; thence westerly approximately 1/8 mile to Farrier Avenue; thence northerly approximately 1/4 mile; thence easterly approximately 1/4 mile to the eastern boundary of Section 13, T39S, R8E; thence northerly approximately 1/8 mile along the eastern boundary of Section 13, T39S, R8E; thence easterly approximately 1/4 mile along the northern section line of Section 18, T39S, R8E; thence southerly approximately 1/4 mile; thence easterly approximately 1/2 mile to the boundary of Highway 97; thence southerly approximately 1/3 mile to the Burlington Northern Right-of-Way; thence northeasterly approximately 1 and 1/3 miles along the high water line of the Klamath River to the Southside Bypass in Section 8, T39S, R9E; thence southeasterly along the Southside Bypass to the Southern Pacific Right-of-Way in Section 9, T39S, R9E; thence southerly approximately 1/2 mile along the Southern Pacific Right-of-Way; thence southwesterly approximately 1/4 mile along the Midland Highway; thence southeasterly approximately 1/4 mile to the old railroad spur; thence easterly 1/4 mile along the old railroad spur; thence southerly approximately 1/4 mile in Section 16, T39S, R9E; thence westerly approximately 1/3 mile; thence southerly approximately 1/4 mile; thence easterly approximately 1/16 mile in Section 21, T39S, R9E; thence southerly approximately 1/8 mile to the Lost River Diversion Channel; thence southeasterly approximately 1/4 mile along the northern boundary of the Lost River Diversion Channel; thence easterly approximately 3/4 mile along Joe Wright Road into Section 22, T39S, R9E; thence southeasterly approximately 1/8 mile on the eastern boundary of the Southern Pacific Right-of-Way; thence southeasterly approximately 1 mile along the western boundary of the Southern Pacific Right-of-Way across Section 22, T39S, R9E and Section 27, T39S, R9E to a point 440 yards south of the northern boundary of Section 27, T39S, R9E; thence easterly to Kingsley Field; thence southeasterly approximately 3/4 mile to the southern boundary of Section 26, T39S, R9E; thence east approximately 1/2 mile along the southern boundary of Section 26, T39S, R9E to a pond; thence north-northwesterly for 1/2 mile following the Klamath Falls City Limits; thence north 840 feet; thence east 1155 feet to Homedale Road; thence north along Homedale Road to a point 1/4 mile north of the southern boundary of Section 23, T39S, R9E; thence west 1/4 mile; thence north 1 mile to the Southside Bypass in Section 14, T39S, R9E; thence east 1/2 mile along the Southside Bypass to the eastern boundary of Section 14, T39S, R9E; thence north 1/2 mile; thence east 900 feet into Section 13, T39S, R9E; thence north 1320 feet along the USBR 1-C 1-A to the southern boundary of Section 12, T39S, R9E; thence north 500 feet to the USBR A Canal; thence southeasterly 700 feet along the southern border of the USBR A Canal back into Section 13, T39S, R9E; thence southeast 1600 feet to the northwest parcel corner of an easement for the Enterprise Irrigation District; thence east-northeast 2200 feet to the eastern boundary of Section 13, T39S, R9E; thence north to the southeast corner of Section 12, T39S, R9E; thence along the Enterprise Irrigation Canal approximately 1/2 mile to Booth Road; thence east 1/2 mile to Vale Road; thence north 1 mile to a point in Section 6, T39S, R10E that is approximately 1700 feet north of the southern boundary of Section 6, T39S, R10E; thence west approximately 500 feet; thence south approximately 850 feet; thence west approximately 200 feet; thence north approximately 900 feet; thence west approximately 1600 feet to the western boundary of Section 6, T39S, R10E; thence north approximately 1/2 mile to the southeast corner of Section 36, T38S, R9E, the point of beginning.

Note: Sections of OAR 340-264 which do not apply to the Klamath Falls UGB have been deleted. A complete copy of rule OAR 264-0200 may be obtained from Oregon Department of Environmental Quality. See Part 1 Figure 1 for Klamath Falls City boundary.

Open Burning Control Areas

340-264-0200 Generally areas around the more densely populated locations in the state and valleys or basins which restrict atmospheric ventilation are designated open burning control areas. The practice of open burning may be more restrictive in open burning control areas than in other areas of the state. The specific open burning restrictions associated with these Open Burning Control Areas are listed in OAR 340-264-0100 through 340-264-0170 by county. The location of the Klamath Falls Open Burning Control Areas are the same as the Klamath Falls UGB shown in Figure 1. The Open Burning Control Areas of the State are defined as follows:

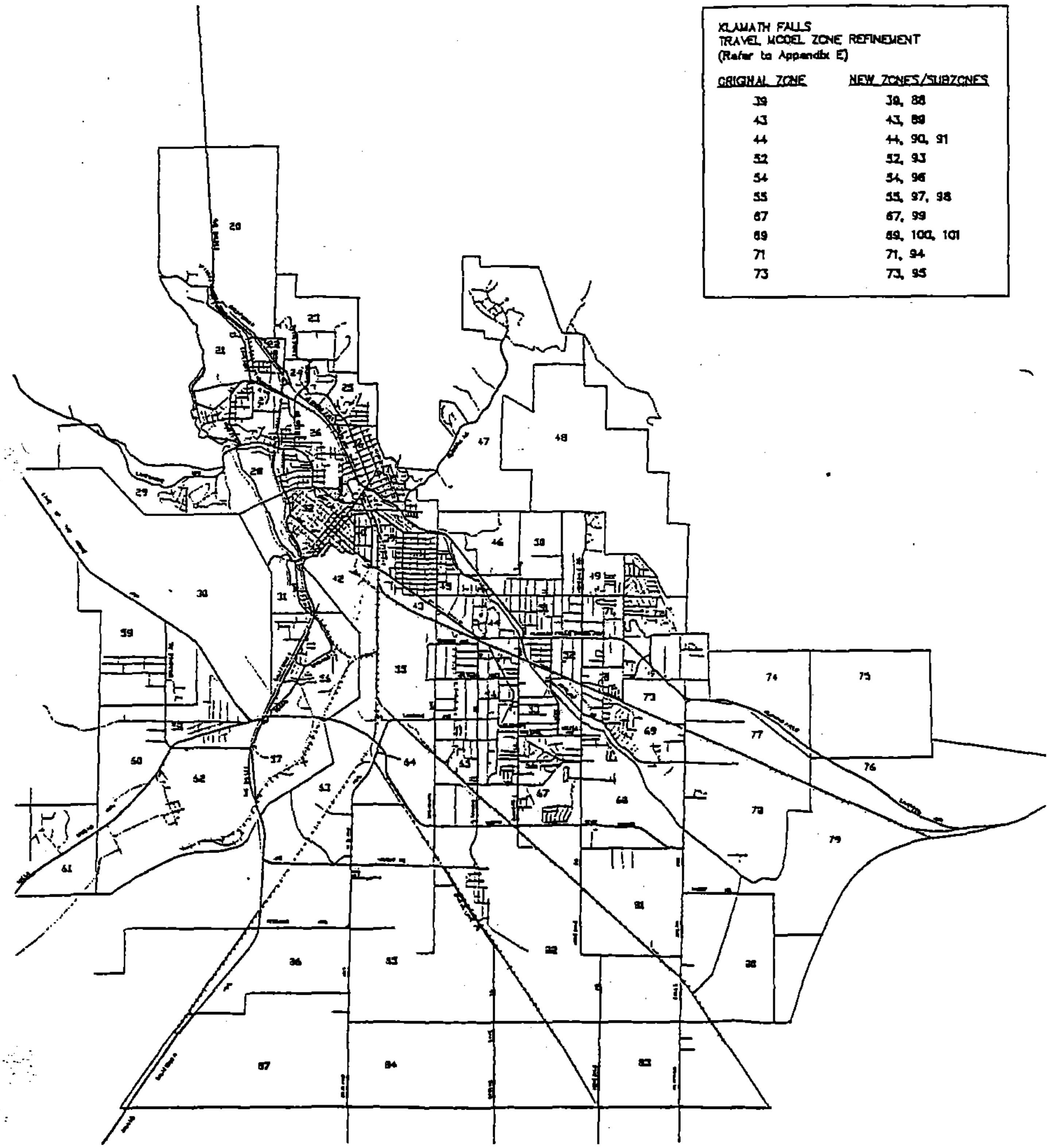
(1) All areas in or within three miles of the incorporated city limit of all cities with a population of 4,000 or more.

2.1.2.3 Legal Description of Klamath Falls Area Wood Stove Curtailment Ordinance / Critical PM_{10} Control Area

Legal Description of the Klamath Falls Woodstove Curtailment Ordinance Area (Critical PM_{10} Control Area) is the same as Klamath Falls UGB area shown in Part 1 Figure 1.

2.1.2.4 Description of Klamath Falls Area Transportation Analysis Zone Boundary

Figure 3: Klamath Falls Area Transportation Analysis Zone Boundary



Part 2.2 SUMMARY OF EMISSIONS DATA

Summary tables of emission data that are presented here include stationary point sources, stationary area sources, non-road mobile sources, and on-road mobile sources. Summary emissions are expressed as graphs in Figures 4,5,6 and 7.

Table 2.2.1: Summary of 1996 CO Emissions Data

Klamath Falls UGB Carbon Monoxide Emissions				
Source Description	Table #	SCC Code	CO Annual Emissions (tons/yr)	CO Season Emissions (lbs/day)
AREA SOURCES				
WASTE DISPOSAL, TREATMENT, & RECOVERY				
Residential Open Burning	2.4.10	26-10-030-000	625.9	1,276.2
Industrial Open Burning	2.4.11	26-10-010-000	27.9	153.3
Commercial / Institutional Open Burning	2.4.12	26-10-020-000	6.1	33.3
Commercial / Institutional On-Site Incineration	2.4.13	26-01-020-000	0.2	0.7
Category Subtotal			660	1,463
SMALL STATIONARY FUEL & WOOD USE				
Industrial				
Fuel Oil Combustion		21-02		
Distillate	2.4.3	21-02-004-000	3.3	21.0
Residual	2.4.3	21-02-005-000	0.3	1.6
Kerosene	2.4.3	21-02-000-000	Combined with Distillate	
Natural Gas Combustion	2.4.4	21-02-006-000	27.4	176
Liquid Petroleum Gas Combustion	2.4.5	21-02-007-000	1.2	8
Industrial Subtotal			32	206
Commercial / Institutional				
Fuel Oil Combustion		21-03		
Distillate	2.4.3	21-03-004-000	0.9	8.1
Residual	2.4.3	21-03-005-000	0.1	1.0
Kerosene	2.4.3	21-03-011-000	Combined with Distillate	
Natural Gas Combustion	2.4.4	21-03-006-000	3.6	32.1
Liquid Petroleum Gas Combustion	2.4.5	21-03-007-000	0.0	0.4
Commercial Subtotal			5	42
Residential				
Fuel Oil Combustion		21-04		
Distillate	2.4.3	21-04-004-000	1.1	10.7
Residual	2.4.3	21-04-005-000	NA	NA
Kerosene	2.4.3	21-04-011-000	Combined with Distillate	
Natural Gas Combustion	2.4.4	21-04-006-000	8.4	78.2
Liquid Petroleum Gas Combustion	2.4.5	21-04-007-000	0.4	3.6
Wood Combustion				
Fireplaces	2.4.6	21-04-008-001	284.7	2,660
Woodstoves - Certified Catalytic	2.4.6	21-04-008-030	42.5	397
Woodstoves - Certified Non-Catalytic	2.4.6	21-04-008-050	171.9	1,606

Table2.2.1: Summary of 1996 CO Emissions Data (continued)

Woodstoves - Conventional & FP Insert	2.4.6	21-04-008-051	511.9	4,781
Exempt Pellet Stoves	2.4.6	21-04-008-053	8.4	78
RWC Subtotal			1,019	9,522
Residential Subtotal			1,029	9,614
Category Subtotal			1,066	9,862
SMALL POINT SOURCES				
Permitted Sources (act.>5t/yr, PSEL < 100 t/yr)	2.4.14	23-07-060-000	36.2	243
Category Subtotal			36	243
MISCELLANEOUS AREA SOURCES				
Other Combustion		28-10		
Forest Wild Fires	2.4.7	28-10-001-000	0.0	0
Slash Burning	2.4.8	28-10-005-000	0.0	0
Structural Fires	2.4.9	28-10-030-000	3.2	17
Category Subtotal			3	17
Total Area Sources			**1,766**	**11,586**
POINT SOURCES				
Source Number		Company name		
	2.3.1	Jeld-Wen	121	692
180009	2.3.1	Modoc Lumber	0	0
180013	2.3.1	Collins/Weyerh.	166	909
180014	2.3.1	Columbia Forest Prod.	256	1434
180072	2.3.1	PGE Station 14	162	889
Total Point Sources			**705**	**3923**
NON-ROAD SOURCES				
NONROAD VEHICLES — GASOLINE TWO-CYCLE				
Recreational Equipment	2.5.2	22-60-001-000	0	0
Construction Equipment	2.5.2	22-60-002-000	2	7
Industrial Equipment	2.5.2	22-60-003-000	21	112
Lawn / Garden Equipment	2.5.2	22-60-004-000	133	9
Agricultural Equipment	2.5.2	22-60-005-000	0	0
Light Commercial Equipment	2.5.2	22-60-006-000	17	93
Logging Equipment	2.5.2	22-60-007-000	0	0
Airport Service Equipment	2.5.2	22-60-008-000	0	0
GASOLINE 2-CYCLE SUBTOTAL			173	220
NONROAD VEHICLES — GASOLINE FOUR-CYCLE				
Recreational Equipment	2.5.3	22-60-001-000	0	0
Construction Equipment	2.5.3	22-60-002-000	28	62
Industrial Equipment	2.5.3	22-60-003-000	68	368
Lawn / Garden Equipment	2.5.3	22-60-004-000	743	24
Agricultural Equipment	2.5.3	22-60-005-000	0	0
Light Commercial Equipment	2.5.3	22-60-006-000	335	1,811
Logging Equipment	2.5.3	22-60-007-000	0	0
Airport Services Equipment	2.5.3	22-60-008-000	21	112

Table2.2.1: Summary of 1996 CO Emissions Data (continued)

GASOLINE 4-CYCLE SUBTOTAL			1,195	2,378
NONROAD VEHICLES — DIESEL CYCLE				
Recreational Equipment	2.5.4	22-60-001-000	0	0
Construction Equipment	2.5.4	22-60-002-000	44	97
Industrial Equipment	2.5.4	22-60-003-000	4	18
Lawn / Garden Equipment	2.5.4	22-60-004-000	0	0
Agricultural Equipment	2.5.4	22-60-005-000	0	0
Light Commercial Equipment	2.5.4	22-60-006-000	1	9
Logging Equipment	2.5.4	22-60-007-000	0	0
Airport Services Equipment	2.5.4	22-60-008-000	8	46
DISEL CYCLE SUBTOTAL			58	170
NON-ROAD ENGINES/ VEHICLE SUBTOTAL			1,426	2,768
AIRCRAFT				
Military Aircraft	2.5.5	22-75-001-000	79	432
Commercial Aircraft	2.5.5	22-75-020-000	12	64
General Aviation	2.5.5	22-75-050-000	97	532
Air Taxi	2.5.5	22-75-060-000	21	115
AIRCRAFT SUBTOTAL	2.5.5	22-75-000-000	209	1,143
RAILROADS				
Line Haul Locomotives	2.5.6	22-85-002-000	24	131
Switch Yard Locomotives	2.5.6	22-85-002-000	6	32
RAILROAD SUBTOTAL	2.5.6	22-85-000-000	30	163
Total Non-Road Mobile Sources:			**1,664**	**4,074**
ON-ROAD MOBILE SOURCES				
Vehicle type				
LDGV	2.6.2	21-01-001-000	2,792	15,563
LDGT1	2.6.2	22-01-020-000	971	5,411
LDGT2	2.6.2	22-01-040-000	437	2,438
HDGV	2.6.2	22-01-070-000	183	1,018
LDDV	2.6.2	22-30-001-000	14	80
LDDT	2.6.2	22-30-060-000	5	27
HDDV	2.6.2	22-30-070-000	360	2,009
MC	2.6.2	22-010-080-000	34	188
Total On-Road Mobile Sources:	2.6.2		**4,795**	**26,734**
Total UGB CO Emissions:			**8,930**	**46,316**

Figure 4: Distribution of the 1996 Annual CO Emissions (tons/yr.)

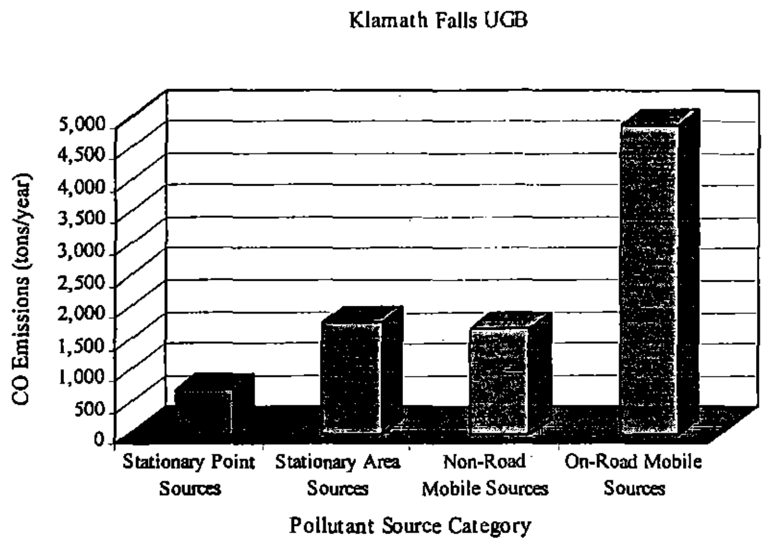


Figure 5: Percentage of CO Annual Emissions for 1996 (tons/yr.)

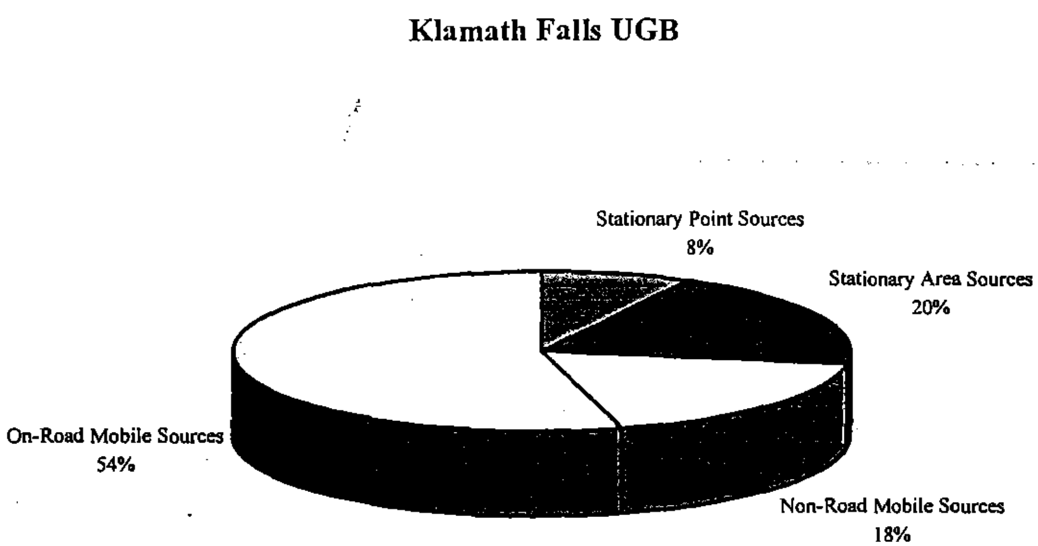


Figure 6: Distribution of the 1996 Seasonal CO Emissions (lb./day)

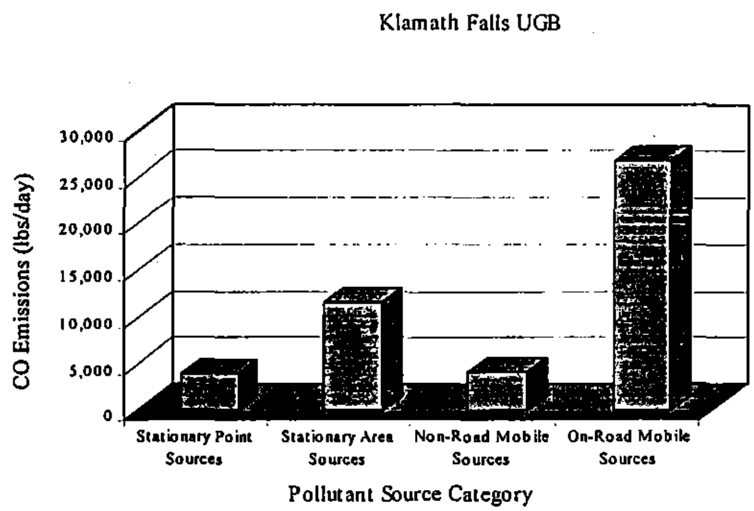
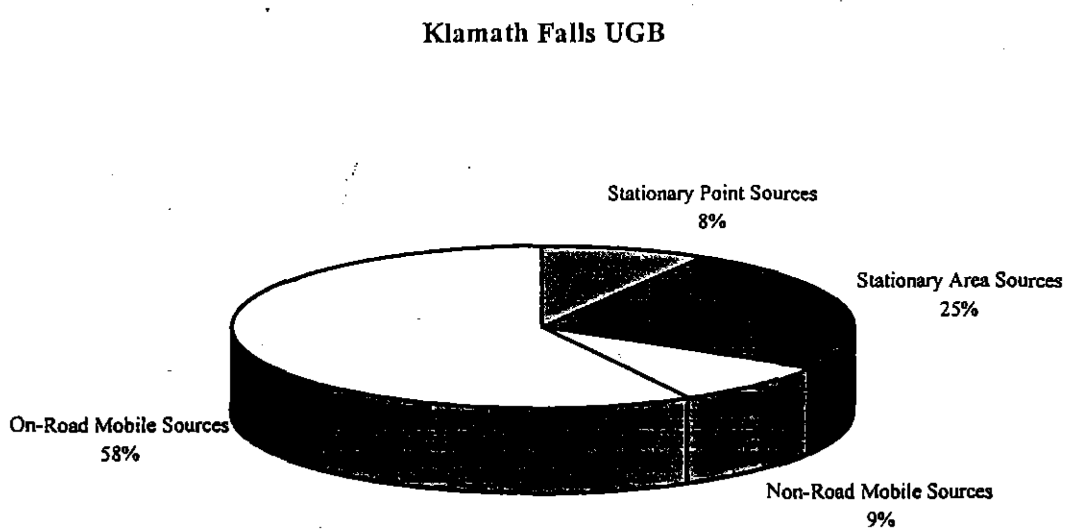


Figure 7: Percentage of CO Seasonal Emissions for 1996 (lb./day)



Appendix E, Table E-1. Klamath Falls UGB 1996 TO 2015 CO SOURCE GROWTH FACTORS

POINT SOURCE Growth	Growth Rate	Growth Area	Growth Rate Description	Growth Type
Point Source growth from 1996	1.40%	UGB	Industrial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
AREA Source Growth	**Growth Rate**	**Growth Area**	**Growth Rate Description**	**Growth Type**
WASTE DISPOSAL, TREATMENT, & RECOVERY				
Commercial / Institutional On-Site Incineration	1.1%	UGB	Commercial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Commercial / Institutional Open Burning	1.1%	UGB	Commercial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Industrial Open Burning	1.40%	UGB	Industrial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Residential Open Burning	1.1%	UGB	Household Land Use / Zoning Based (Ref.333)	Compound rate
SMALL STATIONARY FUEL & WOOD USE				
Industrial				
Fuel Oil Combustion	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Distillate	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Residual	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Kerosene	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Natural Gas Combustion	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Liquid Petroleum Gas Combustion	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Commercial / Institutional				
Fuel Oil Combustion				
Distillate	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Residual	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Kerosene	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Natural Gas Combustion	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Liquid Petroleum Gas Combustion	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Residential				
Fuel Oil Combustion				
Distillate	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
Residual	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
Kerosene	1.1%	UGB	Household Land Use / Zoning Based (Ref.333)	Compound rate
Natural Gas Combustion	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
Liquid Petroleum Gas Combustion	1.1%	UGB	Household Land Use / Zoning Based (Ref.333)	Compound rate
Wood Combustion				
Fireplaces	1.20%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Woodstoves - Certified Catalytic	1.06%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Woodstoves - Certified Non-Catalytic	1.06%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Woodstoves - Conventional	-0.96%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Fire Place Inserts	-0.22%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Exempt Pellet Stoves	0.20%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
SMALL POINT SOURCES				
Permitted Sources (>5 tons/year, <100 tons/yr.)	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
MISCELLANEOUS AREA SOURCES				
Other Combustion				
Forest Wild Fires	0.00%	UGB	No Growth - no increase in forest resources	No Growth
Slash Burning	0.00%	UGB	No Growth - no increase in forest resources	No Growth
Structural Fires	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
NON-ROAD Growth	**Growth Rate**	**Growth Area**	**Growth Rate Description**	**Growth Type**
2-, 4-Stroke & Diesel				
Recreational Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Construction Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Industrial Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Lawn / Garden Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Agricultural Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Light Commercial Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Logging Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Air Service Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Railroads	1.40%	UGB	BEA, Industrial Employment (SIC Employees)	Linear, Non-Compounding
MOBILE SOURCE Growth	**Growth Rate**	**Growth Area**	**Growth Rate Description**	**Growth Type**
Mobile Sources - average all vehicle types		UGB	ODOT Travel Demand Model	Linear

sal 7/23/99,10/1/99, 12/27/99 adjusted RWC growth rates

Appendix E, Table 2. Klamath Falls UGB 1996 CO Season: Summary of Annual and Seasonal Emissions Growth from 1996 to 2015

Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Tons per Year																			
	Actuals																			
POINT SOURCES (1)	705	715	725	632	641	649	588	596	603	611	619	626	634	641	649	657	664	672	679	687
Percent of Category	*8%*	*8%*	*8%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*8%*	*8%*	*8%*
	PSELs																			
POINT SOURCES psels	1,106	1,106	1,121	994	1,008	1,580	1,601	1,622	1,644	1,665	1,687	1,708	1,729	1,751	1,772	1,794	1,815	1,837	1,858	1,879
AREA SOURCES	1,766	1,775	1,784	1,846	1,860	1,870	1,880	1,890	1,900	1,910	1,920	1,930	1,940	1,950	1,960	1,970	1,980	1,990	2,000	2,010
Percent of Category	*20%*	*20%*	*20%*	*21%*	*21%*	*21%*	*21%*	*21%*	*21%*	*21%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*
NON-ROAD SOURCES	1,664	1,686	1,707	1,729	1,750	1,771	1,793	1,814	1,836	1,857	1,878	1,900	1,921	1,943	1,964	1,986	2,007	2,028	2,050	2,071
Percent of Category	*19%*	*19%*	*19%*	*19%*	*20%*	*20%*	*20%*	*20%*	*21%*	*21%*	*21%*	*21%*	*22%*	*22%*	*22%*	*22%*	*22%*	*23%*	*23%*	*23%*
MOBILE SOURCES	4,795	4,764	4,732	4,701	4,669	4,637	4,606	4,574	4,543	4,511	4,479	4,448	4,416	4,385	4,353	4,321	4,290	4,258	4,227	4,195
Percent of Category	*54%*	*53%*	*53%*	*53%*	*52%*	*52%*	*52%*	*52%*	*51%*	*51%*	*50%*	*50%*	*50%*	*49%*	*49%*	*48%*	*48%*	*48%*	*47%*	*47%*
TOTAL ALL SOURCE	8,930	8,939	8,948	8,907	8,919	8,928	8,866	8,874	8,881	8,889	8,896	8,904	8,911	8,919	8,926	8,934	8,941	8,949	8,956	8,964
Total Percent	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Lbs per Day																			
	Actuals																			
POINT SOURCES (1)	3923	3978	4033	3528	3,575	3,623	3,288	3,331	3,373	3,416	3,458	3,501	3,543	3,586	3,628	3,671	3,713	3,756	3,798	3,841
Percent of Category	*8%*	*9%*	*9%*	*8%*	*8%*	*8%*	*7%*	*7%*	*7%*	*8%*	*8%*	*8%*	*8%*	*8%*	*8%*	*8%*	*8%*	*8%*	*8%*	*9%*
	PSELs																			
POINT SOURCES psels	10,382	10,382	10,496	8,510	8,627	12,567	12,738	12,908	13,079	13,249	13,420	13,591	13,761	13,932	14,102	14,273	14,444	14,614	14,785	14,955
AREA SOURCES	11,586	11,617	11,649	12,067	12,095	12,124	12,153	12,181	12,210	12,238	12,267	12,295	12,324	12,352	12,381	12,409	12,438	12,467	12,495	12,524
Percent of Category	*25%*	*25%*	*25%*	*26%*	*26%*	*26%*	*27%*	*27%*	*27%*	*27%*	*27%*	*27%*	*27%*	*27%*	*27%*	*28%*	*28%*	*28%*	*28%*	*28%*
NON-ROAD SOURCES	4,074	4,126	4,179	4,231	4,284	4,336	4,389	4,441	4,494	4,546	4,599	4,651	4,704	4,756	4,809	4,861	4,914	4,967	5,019	5,072
Percent of Category	*9%*	*9%*	*9%*	*9%*	*9%*	*9%*	*10%*	*10%*	*10%*	*10%*	*10%*	*10%*	*10%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*
MOBILE SOURCES	26,734	26,558	26,383	26,207	26,032	25,856	25,681	25,506	25,330	25,155	24,979	24,804	24,628	24,453	24,278	24,102	23,927	23,751	23,576	23,400
Percent of Category	*58%*	*57%*	*57%*	*57%*	*57%*	*56%*	*56%*	*56%*	*56%*	*55%*	*55%*	*55%*	*54%*	*54%*	*54%*	*54%*	*53%*	*53%*	*53%*	*52%*
TOTAL ALL SOURCE	46,316	46,280	46,244	46,033	45,986	45,940	45,511	45,459	45,407	45,355	45,303	45,251	45,199	45,148	45,096	45,044	44,992	44,940	44,888	44,836
Total Percent	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

Annual Mobile Source Growth as Generated from Season Day Emissions Above

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mobile Source Growth		0.993438	0.9869	0.9803	0.9738	0.967188	0.9606	0.95406	0.9475	0.9409	0.9344	0.9278	0.9213	0.9147	0.9081	0.9016	0.895002	0.8884	0.8819	0.8753

Note:
1) Point sources PSEL are included here for comparison purposes only. Actual point sources projected emissions are included in the total calculations.

Part 2.3 STATIONARY POINT SOURCES

2.3.1 Introduction and Scope

This is an overview and summary of the stationary point source inventory. Point sources are defined as stationary industrial sources emitting more than 100 tons per year of CO within a 25-mile buffer zone of the Klamath Falls UGB. Emission information has been compiled and reported for each applicable individual point source within the Klamath Falls UGB and 25-mile buffer zone emitting CO at the levels listed above. Sources inside the Klamath Falls UGB which emit less than 100 tons per year of CO are assigned to the appropriate area source category.

Significant CO Point sources operating in Klamath Falls UGB in 1996 include Jeld Wen, Inc., Collins Products LLC, and Columbia Forest Products. PG&E Gas Transmission is located outside the UGB but within the 25-mile buffer zone. Calculations and background data for each point source included in this inventory, as shown in Table 2.3.1 through Table 2.3.3 are included in Appendix A.

2.3.2 Methodology and Approach

Stationary point source emissions and compliance data for the State of Oregon is maintained in a database of permitted sources that includes two major classifications:
1) A2 and/or synthetic minor sources emitting 10 to 99 tons per year, and 2) Title V sources emitting 100 tons or more per year. Point sources in this database were carefully screened in order to select sources located within the Klamath Falls UGB, and for sources emitting more than 100 tons per year, located outside the UGB but within the 25-mile buffer surrounding the attainment area. California's Siskyou County APCD was contacted for the information on possible major CO sources located in southern portion of the 25-mile buffer zone around Klamath Falls UGB.

Initial estimates of actual emissions were made when an Oregon Air Contaminant Discharge Permit (ACDP), a Synthetic Minor permit, or a Title V permit was issued. Emission factors used to calculate permitted pollutant levels in the various permit types are based on:
1) methods and procedures given in AP-42[11], 2) the result of detailed local studies or experience, 3) source tests, or 4) chemical mass balance calculations.

2.3.2.1 Annual Emission Calculations

The Emission Inventory Group, Technical Services Section, Air Quality Division of the Oregon DEQ reviews these emission factors during the annual update of the emission inventory. These emission factors, together with the annual production levels, are used to estimate actual annual emissions. Data used in the estimates includes emission factors, annual throughput or process rate, and operation schedule. These emissions estimates are given in Appendix A of this inventory.

Annual point source emission estimates are calculated and saved in MS ACCESS format. Data from the MS ACCESS files is used to update the DEQ database ACSIS. Attainment year(1996) actual annual emissions calculations for the point sources included in this inventory are provided in spreadsheet format in Appendix A.

As required by the EPA guidance document[3], Rule Effectiveness (RE) was applied to the inventory of stationary point sources. The intent of Rule Effectiveness is to accurately estimate emissions by avoiding miscalculations generated by assuming that regulatory programs for stationary sources are being and will continue to be implemented with full effectiveness, achieving all of the reported, required, or intended emission reductions, and maintaining that level over time. RE is applied to the calculation of controlled emissions as follows:

RE Emissions = Uncontrolled Emissions x (1 - (Control Efficiency x RE Factor))

RE is generally applied to emission sources where there is a regulatory program in place requiring an emission reduction to the emission source. Sources exempt from RE include: unregulated uncontrolled sources, sources for which emissions are calculated by means of direct determination, and sources with control achieved by means of an irreversible process change that eliminates the potential for CO emissions. Examples of direct determination include: chemical mass balance, continuous emission monitoring (CEM), and in certain cases stack testing.

Generally, the EPA default of 80 percent rule or control effectiveness is used. To use a factor other than 80 percent, EPA requires a local category-specific evaluation that covers categories representing at least 80 percent of the emissions inventory. EPA has acknowledged that in cases where control efficiencies exceed 95 percent, using an 80 percent RE factor may artificially inflate emission estimates. In these cases, EPA allows a source specific evaluation to derive an alternative factor. The new RE factor can be found by following EPA's Questionnaire Approach, SSCD study, or some other approach approved by the EPA. The Questionnaire Approach was not used in this inventory for CO. Sources that are exempt from RE evaluation were also identified. Documentation of RE can be found in Appendix A.

Control Efficiencies (CE) are usually found in several ways. The most common way is from the permit, which often references a source test measuring input and output emission quantities. Where a source test was performed only on an output stream, the control efficiency is be determined by a ratio of the output emission rate to the uncontrolled emission rate predicted by an emission factor. Control Efficiencies are stated by equipment manufacturers based on previous source tests on similar units, typically subject to verification by future source tests. Control Efficiencies may also be determined when factors were used in mass balance calculations. For the case of Klamath Falls, no control efficiencies were effective for 1996 and were listed as zero.

Because the CE was zero, the RE emissions equaled the estimated uncontrolled emissions.

2.3.2.2 Seasonal Emission Calculations

To determine typical daily emissions from point sources during the CO season, a seasonally adjusted activity level had to be found for each source. The equation for calculating typical daily emissions follows:

$$\text{Typical CO Season Emissions} = \text{Annual Emissions (tons/yr)} \times \frac{SAF}{(\text{\# of Activity Days} \times \text{\# Weeks})}$$

For sources with permits, the typical annual activity levels in days per week and weeks per year were found in the sources' permits. For those sources without permits, an activity level of zero was assumed. Seasonal adjustments of the typical annual activity levels to the CO season for permitted sources inside the Klamath Falls UGB was performed using permitted operating times.

2.3.3 Summary of Stationary Point Source Emissions

Per EPAs Guidance for CO Maintenance Plans, stationary point sources emissions reflect actual 1996 emissions, not maximum allowable permitted levels.

Stationary point source emissions have been summarized by annual and seasonal emissions by source in Figures 10 through 13. Stationary point source emissions are further summarized by firm and by source category in Tables 2.3.1 through 2.3.3. Since RE is zero for all the point sources in 1996, the rule effected emissions are the same as the uncontrolled emissions. Therefore all three of the tables represented RE emissions.

Figure 8: Distribution of Annual Point Source CO Emissions for 1996

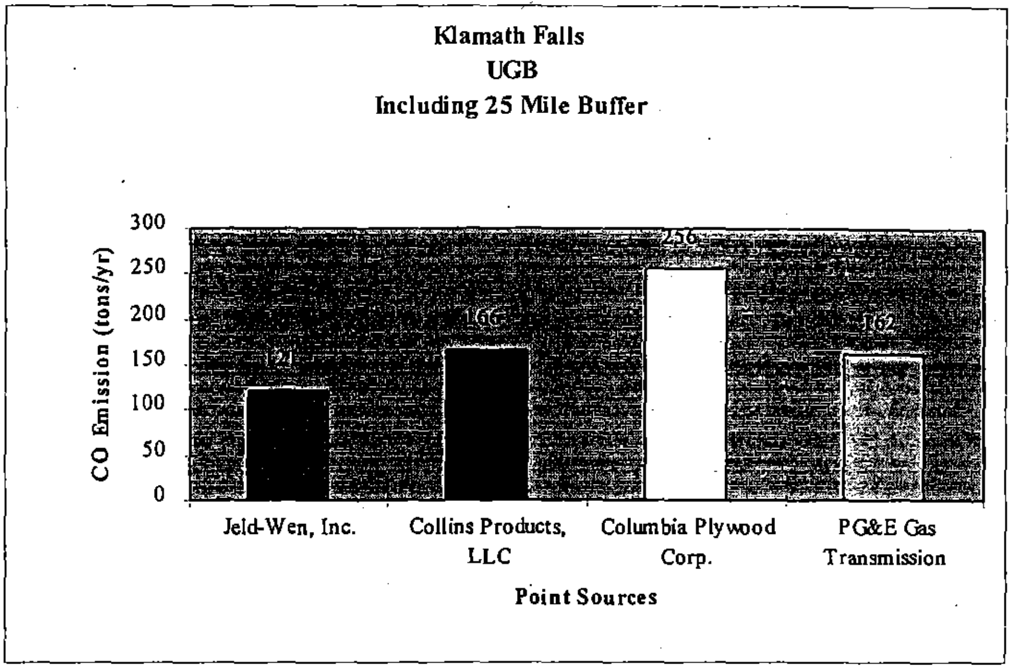


Figure 9: Percentage of Annual Point Source CO Emissions for 1996

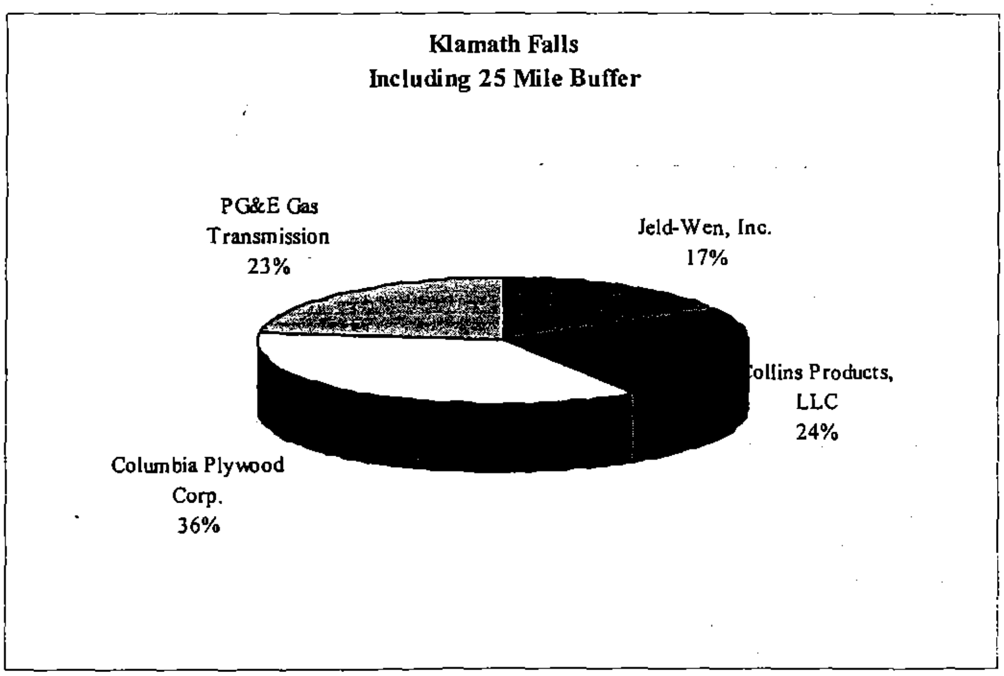


Figure 10: Distribution of Seasonal Point Source CO Emissions for 1996

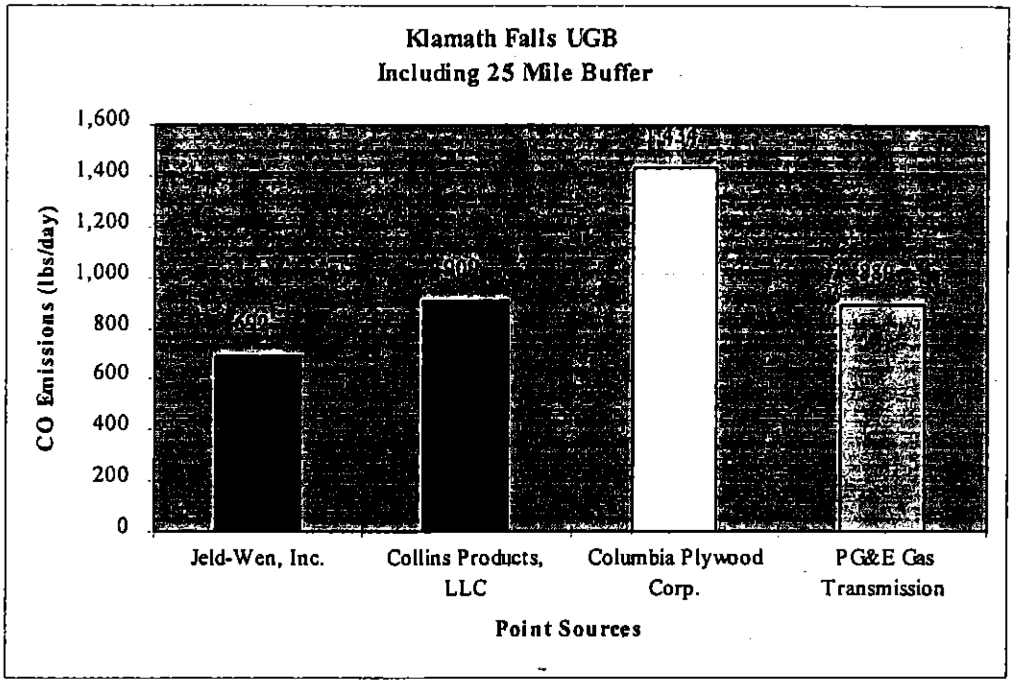
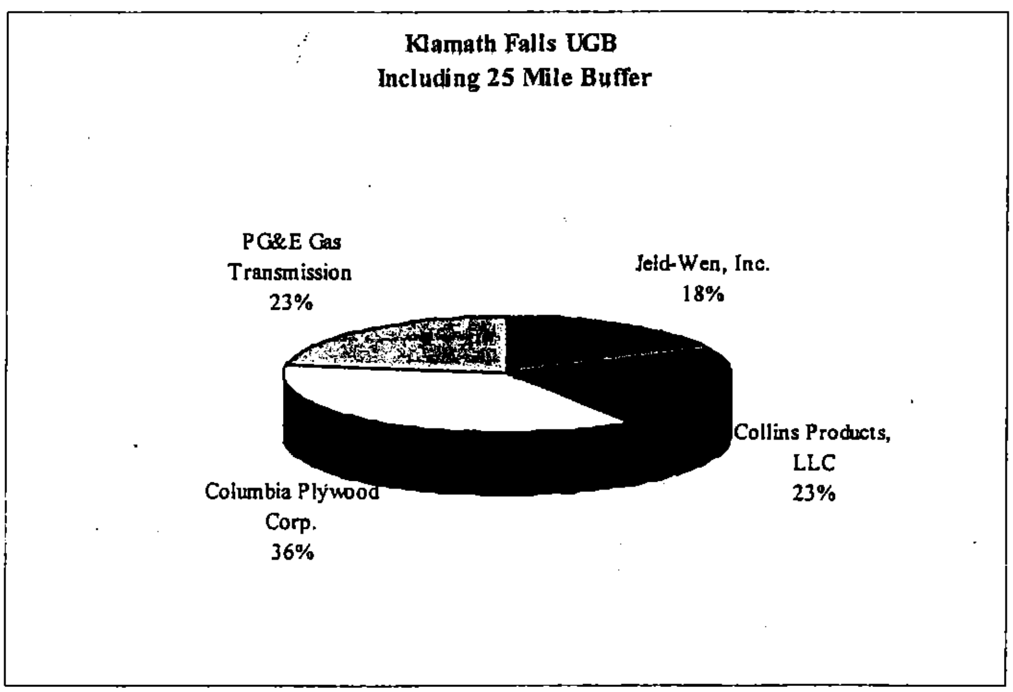


Figure 11: Percentage of Seasonal Point Source CO Emissions for 1996



POINT SOURCE SUMMARIES

Rule Effected point source emissions for both annual and seasonal CO emissions are summarized in Table 2.3.1 by actual uncontrolled emissions, in Table 2.3.2 by RE emissions and in Table 2.3.3 by RE emissions by source category. Since none of the sources had CO controls in 1996, their control efficiencies and rule effectiveness are equal to zero.

Table 2.3.1: Klamath Falls 1996 CO Season: Summary of Point Source Emissions by Firm

Source Number	Company name	(1) ——CO Emissions—— Annual (t/yr)	(2) Daily (lbs/dy)
180006	Jeld-Wen	121	692
180009	Modoc Lumber	0	0
180013	Collins/Weyerh.	166	909
180014	Columbia Forest Products	256	1434
180072	PGE Station 14	162	889
	Total CO (within 25 mile radius of the Klamath Falls UGB):	705	3923

Notes:

1) The rule-effected annual emissions are from the Table 2.3.2 Summary of Rule-Effected Point Source Emissions.

2) The rule-effected typical daily emissions for 1996 are from the Table 2.3.2 Summary of Rule-Effected Point Source Emissions.

3) For SCC codes see individual source spreadsheet in th e Appendix A.

4) Modoc Lumber (source # 180009) was closed in April 1995

Table 2.3.2: Klamath Falls UGB 1996 CO Season: Summary of Rule Effected Point Source Emissions (Tons/Year, Lbs/Day)

Source Number	SCC*	Company name	(1) CE	(2) RE	(3) SAF	(4) CO Activity (d/wk)	(5) CO Activity (d/yr)	(6) No RE Applied CO Emissions (t/yr)	(7) No RE Applied CO Emissions (lbs/dy)	(8) RE Applied CO Emissions (t/yr)	(9) RE Applied CO Emissions (lbs/dy)	(10) PSEL (t/yr)
180006		Jeld-Wen	0%	0%	1.0	7	350	121	692	121	692	142
180009		Modoc Lumber	0%	0%	1.0	0	0	0	0	0	0	0
180013		Collins/Weyerh.	0%	0%	1.0	7	365	166	909	166	909	262
180014		Columbia Forest Products	0%	0%	1.0	7	357	256	1,434	256	1,434	499
180072		PGE Station 14	0%	0%	1.0	7	356	162	889	162	889	203
Total CO (within a 25 mile radius of the Klamath Falls UGB)								705	3,923	705	3,923	1,106

Notes:

* For SCC codes see individual source spreadsheet in the Appendix A-2.

1) None of the sources had CO controls in 1996, subsequently, their 1996 baseline Control Efficiencies(CE) are all zero.

2) Rule Effectiveness(RE) is zero if no controls exist. RE emissions for daily and annual emissions are calculated using EPA-452/R-92-101 *The Guidelines For Estimating and Applying Rule Effectiveness for Ozone/CO SIP Base Year Inventories. (DEQ Ref.165)*

3) Seasonal Adjustment Factors (SAF)_were assumed to be 1 unless a reasonable SAF could be determined using the Emission Statements or some other method. Lbs per Day is Average Winter Day Emissions and is calculated:
   (Tons per Yr) * (2000 Lbs/Ton) * (SAF) / (Days per Year)

4) Activity was pulled directly from the source's permit in effect in 1996.

5) Annual days of operation are taken from the 1996 annual report for each source.
   Days per Year =(Hours per Year)/ (Hours per Day)

6) The annual emissions are calculated in Appendix A, Table-A2 using the following general equation:
   Tons per Year Actual Emissions = (1996 production levels)*(current emission factor)/2000lb./ton.

7) The daily emissions (lb./day actual emissions) are calculated by multiplying the annual emissions by 2000 lb./ton and then dividing by the annual days of operation.

8) The Rule Effected annual emissions are calculated using the equation:
   RE emissions = Uncontrolled Emissions* (1-(CE*RE)).
   Uncontrolled Emissions are calculated by the following equation:
   Uncontrolled Emissions = Actual Emissions/(1-CE)
   For all sources the Actual Emissions = the Uncontrolled Emissions = the Rule Effected Emissions.

9) The Rule Effected seasonal daily Emissions are calculated using the equation:
   RE emissions = Uncontrolled Emissions* (1-(CE*RE)).
   Uncontrolled Emissions are calculated by the following equation:
   Uncontrolled Emissions = Actual Emissions/(1-CE)
   For all sources the Actual Emissions = the Uncontrolled Emissions = the Rule Effected Emissions.

10) The Plant Site Emission Limits are the limits on the current permit (as of 1998).

Table 2.3.3 Klamath Falls UGB 1996 CO Season: Summary of Point Source Rule Effected Emissions by Source Category

SIC1	SIC2	SIC3	Source #	Company Name	CO Emissions Annual (tons/yr)	 CO season (lbs/day)
Sawmills and Planing mills (242)						
Millwork, Veneer, Plywood, and Structural Wood Members (243)						
Gas Production and Distribution (492)						
2421	2493	4961	18-0006	Jeld-Wen, Inc.	121	692
2421			18-0009	Modoc Lumber	0	0
2436			18-0013	Collins Products	166	909
2436	4961		18-0014	Columbia Forest Products.	256	1,434
4922			18-0072	PG&E Gas Transmission	162	889
	Total				705	3,923

Notes:

1) Only point sources with CO greater than 100 ton/yr. and located within the Klamath Falls UGB or within 25 miles of the UGB (radius/buffer zone) are included.

2) Modoc Lumber Co. was closed in April 1995 and its permit was canceled.

3) If a Source Industry Category is not in this Table there were no major sources with the SIC in the Klamath Falls UGB inventory (including the 25 mile boundary)

4) For SCC codes see individual source spreadsheet in the Appendix A-2.

Part 2.4 STATIONARY AREA SOURCES

2.4.1 INTRODUCTION AND SCOPE

This section describes the development of the emissions inventory for carbon monoxide for stationary area sources located in the Klamath Falls UGB in the 1996 CO Attainment Year. Area sources included in this inventory are stationary and collectively represent relatively small and numerous individual sources within the inventory area. Included in the area source category are four groups of distinct area source emission contributors: Waste disposal, treatment and recovery (including residential, industrial, and commercial open burning); Small stationary fuel and wood use (including residential, industrial, and commercial combustion); Small point sources (industrial point sources with CO Plant Site Emission Limits (PSEL) less than 100 tons/year and actual CO emissions greater than 5 tons/year); and Miscellaneous (forest fires, structural fires, and slash burning).

Table 2.4.1 lists the procedures used to develop the emission estimates for the various categories of area source CO emissions included in the Klamath Falls UGB inventory. Estimated emissions represented in this inventory occur on an average weekday during the three-month CO season of December 1through December 31, 1995 and January 1 through February 28, 1996.

2.4.2 METHODOLOGY AND APPROACH

2.4.2.1 Source Category Identification

Discussion of guidance documents and broad methodology used to calculate stationary area source emissions can be found in Part I. The list of stationary area sources included in the inventory was based on the EPA Procedures Document[3] and the *Emissions Inventory Requirements for CO*[1]. These area sources were compared to sources evaluated in the *Portland Metro CO NAA, 1991 SIP CO Inventory*[56], and the annual inventory of point source categories.

Emission factors were taken from the EPA Procedures Document[3], the FIRE Version 6.22 SCC's and Emission Factors[318], the Compilation of Air Pollution Emission Factors (AP-42)[8], various EPA Surveys, and local studies conducted by the Oregon Department of Environmental Quality or environmental consulting firms. Errors in estimated emissions could occur in the multiplier values used, in the accuracy of calculations, or in mistakes in the construction of equations. Therefore, estimated emissions were checked for reasonableness by a number of approaches: 1) using alternative multiplier values when possible; 2) comparing estimates with the results of earlier area source inventories; and 3) performing independent checks on the accuracy of the multiplier values, the methodologies, and the emission calculations.

Seasonal activity factors were taken from the EPA Procedures Document[3] or were derived by DEQ and based upon season specific activity levels. State regulations applicable to each area source category are outlined in Table 2.4.1; these regulations were used when determining control efficiency and rule penetration. Rule effectiveness for all categories was based upon the default level of 80 percent from EPA's *Guidelines for Estimating and Applying Rule Effectiveness For Ozone / CO State Implementation Plan Base Year Inventories*[165]. Applicable state regulations cited are from Oregon Administrative Rules, Chapter 340, Department of Environmental Quality[32]. These citations are abbreviated using the following format: OAR 340-(Division #)-(Applicable Rule #'s). All rule citations are followed with the effective date of the rule as it was applied in this inventory for historical reasons. This date is important because the rules in effect for this specific inventory year may be subject to changes. When a rule is applied to emission calculations it is assumed to have been in effect throughout the year of the inventory.

2.4.2.2 Prevention of Double Counting

Special care was taken to prevent double counting of emissions sources associated with both area and point sources. First the area sources were reviewed to identify which categories may have been accounted for in the point source inventory. Only two area sources were suspected: industrial open burning and industrial fuel consumption. Industrial open burning was not included with the point sources because it is illegal under Oregon rules and would only occur outside of a company's permitted and reported activities. Industrial fuel consumption was only calculated for the Klamath Falls UGB industries and is negligible compared to the CO emissions from the TV sources. Where appropriate industrial fuel consumption from the stationary point sources was subtracted from the area source categories. We believe the rest of the area source emissions form fuel consumption represent smaller industrial sources, which do not account for CO emissions in their permits. Agricultural burning category was not inventoried as a separate category to prevent double counting. Carbon monoxide emissions from agricultural burning were included in the open burning category emissions as the number of permits and violations provided by the Klamath County Fire district #1 for this inventory represented permits and violations issued in 1996 for all kinds of burns and did not indicate the category.

2.4.3 Summary of Stationary Area Source Emissions

A summary of the stationary area source inventory is shown in Tables 2.4.1 and 2.4.2 for the major area source categories. Annual emissions and daily emissions, adjusted for activity during the CO season, are shown. Summary area source emissions are expressed as graphs in Figures 12 through 17.

2.4.4 Discussion of Area Source Categories

Each of the major area source categories, as shown in Tables 2.4.1 and 2.4.2 is comprised of area source types. Detailed descriptions of the emission estimation methodology for each source type is included in Tables 2.4.3 through 2.4.14 and in Appendix B. The applicable appendix table number is included in the annotations, which accompany the summary table. Discussion of data sources, emission factors, seasonal adjustment factors, and activity levels which affect the area source are included for each area source type. Applicable state regulations affecting a specific area source emission category are included in the notes on each category summary table. If specific area source type emissions were affected by state regulations during the inventory year, control efficiency, rule effectiveness, and rule penetration have been applied[1,3]. Example calculations for emissions estimates are included on individual spreadsheets. The following sections describe these major categories; subsections corresponding to individual area source types are included.

2.4.4.1 Waste Disposal, Treatment, and Recovery

This category includes disposal, treatment, recovery and clean up of solid and liquid wastes by incineration and open burning.

2.4.4.1.1 Incineration

This category consists of the disposal of solid waste, infectious waste, or crematory incinerator waste from industrial and commercial/institutional sources by combustion. Combustion occurs in a structure or furnace for the purpose of reduction in volume or weight of the waste material.

2.4.4.1.1.1 Industrial Incineration

The Klamath Falls UGB does not contain any industrial incineration sources that fall into the description listed above and as such has not been inventoried here.

2.4.4.1.1.2 Commercial Incineration

In Oregon, commercial incineration sources are treated as permitted point sources. Because emissions from these smaller "point sources" are below the point source cut-off level used in this inventory they are included here as part of the area source category. Commercial on-site solid waste incineration tonnage is based upon actual annual emission calculations from Oregon DEQ Air Contaminant Discharge Permits. For the purpose of the area source inventory "commercial" on-site solid waste incineration is restricted to DEQ class A2 and class B permits winnowed for the appropriate commercially related SIC classifications. Commercial incineration activity is assumed to occur 5 days/week and the seasonal adjustment factor is uniform (1.0) as found in EPA Procedures Document[3], Table 5.8-1. Specific incineration rules apply to Infectious Wastes and Crematory Incinerators. Control efficiency, rule effectiveness and rule penetration have been applied to the emissions estimates. Applicable state regulations are from OAR 340-230-0010, 0030, 0100, 0110, 0120, 0130, 0140, 0150, 0200, 0210, 0220 and 0230 (rule effective date 3-13-90, renumbered from 340-25-850, 855, 860,865, 870, 875,880, 885,890, 895, 900, and 905 effective date 10-14-99)[22].-

Methodology, information sources, and a summary of estimated emissions from commercial incineration are shown in Table 2.4.13.

2.4.4.1.1.3 Residential Incineration

Residential on-site solid waste incineration activity is assumed to be zero. DEQ rules outlining structural requirements, source tests, and continuous emission monitoring as well as associated permit costs preclude individual residential construction of incineration devices. Destruction of solid waste and yard debris at residential sites is included in residential open burning calculations.

2.4.4.1.2 Open Burning

This category includes waste material disposal from industrial, commercial / institutional, and residential sources in open outdoor fires, burn barrels or incinerators which do not meet DEQ emission limits, or burn in a manner in which combustion air is not effectively controlled and combustion products do not vent through a stack or chimney.

2.4.4.1.2.1 Industrial Open Burning -

Industrial open burning is prohibited in the Klamath Falls UGB except by special letter (hardship) permit issued by DEQ Western Region Office. DEQ permit tracking does not indicate if the hardship burn permit is issued for residential, commercial, or industrial purpose. Emissions were calculated by first allocating the employee population from *County Business Patterns, Oregon 1990*[240] in SIC groups 20 - 39 to the Klamath Falls UGB based upon the percentage of population within the UGB. The loading factor of 160 tons/1,000 employees for industrial open burning is based on the value provided in the EPA Procedures Document[3], Table 4.6-2. The emission factors are from AP-42, Table 2.5-1[8] and are an average of the factors for open burning of wood and refuse. Industrial open burning is assumed to occur five days per week, 52 weeks per year. A DEQ calculated seasonal adjustment factor (1.0) is used which reflects a uniform application of illegal open burning on an annual basis. Since legal open burning is assumed to be zero based on the applicable Oregon Administrative Rules listed below, all open burning is illegal. Under this method, control efficiency, rule effectiveness and rule penetration are inherent in the illegal emissions estimates. Applicable state regulations are from OAR 340-264-0010, 0020, 0030, 0040, 0050, 0060, 0070, 0080, 0120, 0130, 0140, and 0180 (rules effective date 3/11/92 renumbered from 340-23-022, 025, 030, 035, 040, 042, 043, 045, 065, 070, 075, and 100 effective date 10-14-99)[22].

Methodology, information sources, and a summary of estimated emissions from industrial open burning are shown in Table 2.4.4.

2. 4.4.1.2.2 Commercial Open Burning -

Commercial open burning is prohibited in the Klamath Falls UGB except by special letter (hardship) permit issued by DEQ. DEQ permit tracking does not indicate if the hardship burn permit is issued for residential or commercial purposes. Emissions were calculated by first allocating the employee population from *County Business Patterns, Oregon 1990*[240] in SIC groups 50 - 99 to the Klamath Falls UGB based upon the percentage of population within the UGB. The loading factor of 24 tons/1,000 employees /year for commercial open burning is based on the value provided in the EPA Procedures Document[3], Table 4.6-2. The emission factors are from AP-42, Table 2.5-1[8] and are an average of the factors for open burning of wood and refuse. Commercial open burning is assumed to occur five days per week, 52 weeks per year. A DEQ calculated seasonal adjustment factor (1.0) is used which reflects a uniform application of illegal open burning on an annual basis. Since legal open burning is assumed to be zero based on the applicable Oregon Administrative Rules listed below, all open burning is illegal. Under this method, control efficiency, rule effectiveness and rule penetration are inherent in the illegal emissions estimates. Applicable state regulations are from OAR 340-264-0010, 0020, 0030, 0040, 0050, 0060, 0070, 0080, 0120, 0130, 0140, and 0180 (rules effective date 3/11/92 renumbered from 340-23-022, 025, 030, 035, 040, 042, 043, 045, 065, 070, 075, and 100 effective date 10-14-99)[22].

Methodology, information sources, and a summary of estimated emissions from commercial open burning are shown in Table 2.4.5.

Control efficiency, rule effectiveness and rule penetration are inherent in the estimation of open commercial and industrial open burning since all burning is illegal.

2.4.4.1.2.3 Residential Open Burning

Residential open burning is prohibited inside the Klamath Falls Burn Ban Boundary (BBB) during CO season and is restricted in the rural Klamath Falls UGB. The BBB is defined by the Klamath Falls city boundary, see Figure 1. For rural Klamath Falls, the Klamath County Fire District #1 and Environmental Health Department prohibits residential open burning during fire season, typically July 1 through mid-October. Permits are issued for residential open burning in rural parts of the Klamath Falls UGB on days outside the fire season when the ventilation index is above 400. Open burning is also banned on yellow and red days regulated by the Klamath County Health Department during the wood stove curtailment season, usually during October - February.

Legal Burning

CO emissions were estimated by distinguishing between legal and illegal burning. CO emissions from legal burning were estimated by multiplying the tons of each type of material legally burned by the emission factor for the specific material. The tons of each type of material legally burned were estimated by acquiring the number of open burning permits issued by the Klamath County Fire District #1 and Klamath County Environmental Health Department[335]. Estimated amount burned/permit is based on discussions with the Grants Pass FD's Ron Shwartz[323]. Amount burned per permit is an estimate based on observational experience. Grants Pass estimate is used in this inventory for the lack of local information and based on the assumption that the amount per permit burned in Grants Pass is similar to that burned in Klamath Falls. We assume that each annual permit was used twice during the 1996 (once in spring and once in fall) to estimate actual amount of burns. The size of the burn piles is assumed to be the legal limit described on the permit application[323]. The pile size is multiplied by a material specific density to obtain weight per burn[8]. The type of material burned was estimated by reviewing the illegal burn violation report for incidences whose only violation was that the ventilation index was below 400[323]. Using these otherwise legal burns should give an indication of what types of materials and how much of each type make up piles. Once the pile size, material type and relative amounts, and number of legal open burns are estimated, the number of tons of each type of material burned is calculated. The number of tons of material burned was multiplied by emission factors from AP-42[8] to the legal burn determine the total legal emissions. To calculate the annual emissions from brush, the equation was:

issued permits * factor * % brush * pile size * density brush pile = amount brush burned.

amount of brush burned * brush CO emission factor = CO emissions.

The '% brush' refers to the relative percentage of legal material burned that may be composed of brush. The other legal materials considered are wood and leaves/grass. Because residential open burning is prohibited during CO season , there were no typical day emissions from legal burning.

Illegal Burning

CO emissions from illegal burning were estimated by multiplying the tons of each type of material illegally burned by the emission factor for the specific material. The tons of each type of material were estimated by acquiring the violation information for the Klamath Falls UGB from Klamath County Fire District #1[335]. The number of violations was then multiplied by a factor (illegal open burns/documented violation) to estimate the number of actual illegal burns. For the lack of the local information, this factor came from interviews with Josephine County open burning inspectors and the fire district. The size of the piles and the relative percentage of the material types was taken from the violation records. The pile size was converted from volume to mass by using material densities obtained from the ODEQ Waste, Management, & Cleanup (WMC) division[96]. To calculate the annual emissions for garbage, the equation was:

Reported Violations * % Garbage burned * Factor * avg. Pile Size * density Garbage pile = amount garbage burned.

Amount of garbage burned * Garbage CO Emission Factor = CO emissions.

The '% garbage' refers to the relative percentage of illegal material burned that may be composed of garbage. The other illegal materials considered are wood, brush and leaves/grass. Some of this otherwise legal material may have been burned out of season, in a prohibited area, in too large a pile, or when the ventilation index was below 400.

The emission factors are from AP-42[8]. The material densities are estimates from the ODEQ, WMC Division, solid waste section[269]. CO season typical day emissions were calculated by multiplying the annual emissions by a ODEQ derived seasonal adjustment factor, then divided by the number of days per week that burning likely occurred.

Rule Effectiveness (RE)
RE applies to residential open burning and is inherent in the estimation method. The category is in fact split into 100% RE (legal burning) and 0% RE (illegal burning).

Applicable state regulations are from OAR 340-264-0010, 0020, 0030, 0040, 0050, 0060, 0070, 0080, 0120, 0130, 0140, and 0180 (rules effective date 3/11/92 renumbered from 340-23-022, 025, 030, 035, 040, 042, 043, 045, 065, 070, 075, and 100 effective date 10-14-99)[22].

Methodology, information sources, and a summary of estimated emissions from residential open burning are shown in Table 2.4.10.

2.4.4.2 Small Stationary Fossil Fuel and Wood Use

This category includes small furnaces, heaters, heating units, and cooking devices, which produce emissions less than 100 tons/year. Four main types of fuel are used within the Klamath Falls UGB by industrial, commercial/institutional, and residential sources: fuel oils, natural gas, liquefied petroleum gas (LPG), and wood. Wood fuel use is only evaluated for residential sources in which it is primarily used in fireplaces, wood stoves, furnaces, and for cooking. For the purpose of the area source inventory fossil fuel and wood fuel use is evaluated for space heating or cooking purposes only; use of these fuels by industrial and commercial sources for other purposes is included in the point source inventory.

2.4.4.2.1 Fuel Oil Combustion

Fuel oil emissions from industrial and commercial sources are from fuel oil consumption in large or small boilers, furnaces, heaters, space heaters, and other heating devices. Residential fuel oil emission sources are primarily from fuel consumption in furnaces, space heaters, and other heating devices. For this inventory, industrial and commercial fuel oil consumption includes residual oil, distillate oil, and kerosene use; residential fuel oil consumption includes distillate and kerosene use only.

Fuel oil use emissions estimates are based on the U.S. Department of Energy/Energy Information Administration document *State Energy Data Report: Consumption Estimates, 1996*[343], Klamath Falls UGB population data, SIC population data and *County Business Patterns, 1996, Oregon*[334]. Fuel oil use estimates for industrial sources have been calculated by using Klamath Falls UGB SIC group 20 - 39 employee population (Appendix B, Table B-4). The Klamath Falls industrial population number for 1996 were estimated by City of Klamath Falls City Planner Cameron Gloss. Industrial fuel oil consumption estimates are summarized in Appendix B, Table B-5. Fuel oil use estimates for commercial sources have been calculated by using Klamath Falls UGB SIC group 50 - 99 employee population. Commercial fuel oil consumption estimates are summarized in Appendix B, Table B-5.

These estimates assume that a portion of the commercial and industrial activity within Klamath County occurs within the UGB. Industrial and commercial fuel oil use in this category is assumed to be used for space heating for employees working in a facility. Oregon DEQ Air Contaminant Discharge Permits (ACDPs) are issued based on process related emissions only. Facilities, which are, included in the point source inventory report total fuel oil use on an annual basis as part of the ACDP requirements. For this inventory the fuel oil use reported in the ACDP is assumed to be used for processes related purposes: not for space heating or other uses. Emission factors for industrial, and residential sources are from the EPA document C*ompilation of Air Pollutant Emission Factors,* (AP-42, 5th Edition)[216], Table 1.3-1. The emission factors for industrial, and commercial/institutional distillate fuel oil are the same. Seasonal adjustment factors and activity levels are taken from the EPA Procedures Document[2], Table 5.8-1.

Fuel oil use emissions estimates for residential sources are calculated using the U.S. Department of Energy/Energy Information Administration document *State Energy Data Report: Consumption Estimates, 1996*[343], Klamath Falls UGB population data[333] and *County Business Patterns, 1996, Oregon*[334]. Population estimates can be found in Appendix B, Table B-1. Fuel oil use for residential sources has been estimated by using Klamath Falls UGB population number; residential fuel oil consumption estimates are summarized in Appendix B, Table B-5. Emission factors are from the EPA document C*ompilation of Air Pollutant Emission Factors,* (AP-42, 5th Edition)[216], Table 1.3-1. Total distillate and kerosene use is combined for emission estimate purposes. While the American Standards for Testing and Materials (ASTM) classify kerosene as Grade 1 and furnace oil as Grade 2 they are both distillate oils and have similar gross heating value. AP-42 does not provide separate emission factors for the two fuels when used in a residential furnace. In addition, use of kerosene as a space heating fuel, particularly in furnaces, is limited in Oregon. Seasonal adjustment factors and activity levels are taken from the EPA Procedures Document[2], Table 5.8-1. A summary of the emission estimates and assumptions for fuel oil use for space heating are shown in Table 2.4.3.

2.4.4.2.2 Natural Gas and Liquefied Gas Combustion

Natural gas and liquefied gas combustion oil emissions from industrial and commercial sources are from natural gas and liquefied petroleum gas (LPG) fuel consumption in large or small boilers, furnaces, heaters, space heaters, and other heating devices. Residential natural gas and liquefied petroleum gas (LPG) fuel emission sources are primarily from fuel consumption in furnaces, space heaters, and other heating devices. For this inventory, industrial and commercial natural gas and liquefied petroleum gas (LPG) fuel oil consumption includes residual oil, distillate oil, and kerosene use; residential fuel oil consumption includes distillate and kerosene use only. Natural gas and liquefied petroleum gas (LPG) fuel use emissions estimates are based on the U.S. Department of Energy/Energy Information Administration document *State Energy Data Report: Consumption Estimates, 1996* [343], Klamath Falls UGB population data[333], SIC population data[333] and *County Business Patterns, 1996, Oregon*[334].

Natural gas and liquefied petroleum gas (LPG) fuel use for industrial sources have been estimated by using Klamath Falls UGB SIC group 20 - 39 employee population data (Appendix B, Table B-4) provided by the City of Klamath Falls City Planner Cameron Gloss. Industrial natural gas and liquefied petroleum gas (LPG) fuel consumption estimates are summarized in Appendix B, Table B-5. Natural gas and liquefied petroleum gas (LPG) fuel use for commercial sources have been estimated by using Klamath Falls UGB SIC group 50 - 99 employee population developed by the City of Klamath Falls City Planner Cameron Gloss. Three source permits included in the stationary point source category mention the use of natural gas. The use included in the stationary point source category has not been subtracted to prevent double counting in the industrial natural gas category to avoid negative CO emissions that would result. We believe the reason for that is major industrial point sources location. Most of the major industrial CO sources are located in 25 miles radius buffer zone outside UGB and thus do not contribute to double counting of the UGB emissions. Commercial natural gas and liquefied petroleum gas (LPG) fuel consumption estimates are summarized in Appendix B, Table B-5.

These estimates assume that a portion of the commercial/institutional and industrial activity within Klamath County occurs within the UGB. Industrial and commercial natural gas and liquefied petroleum gas (LPG) fuel use in this category is assumed to be used for space heating for employees working in a facility. Oregon DEQ Air Contaminant Discharge Permits (ACDPs) are issued based on process related emissions only. Facilities, which are included in the point source inventory, report total natural gas and liquefied petroleum gas (LPG) fuel use on an annual basis as part of the ACDP requirements. For this inventory the natural gas and liquefied petroleum gas (LPG) fuel use reported in the ACDP is assumed to be used for processes related purposes: not for space heating or other uses. Natural gas emission factors for commercial/institutional and industrial sources are from the EPA document *Compilation of Air Pollutant Emission Factors,* (AP-42, 5th Edition)[216], Table 1.4-1. LPG emission factors for commercial/institutional and industrial sources are from the EPA document *Compilation of Air Pollutant Emission Factors,* (AP-42, 5th Edition)[216], Table 1.5-1. The emission factors for industrial, and commercial/institutional natural gas and LPG use are the same. Seasonal adjustment factors and activity levels are taken from the EPA Procedures Document[2], Table 5.8-1.

Natural gas and liquefied petroleum gas (LPG) fuel use emissions estimates for residential sources are calculated using the U.S. Department of Energy/Energy Information Administration document *State Energy Data Report: Consumption Estimates*[286] Klamath Falls UGB population data[325]. Population estimates can be found in Appendix B, Table B-1. Natural gas and liquefied petroleum gas (LPG) fuel use estimates for residential sources have been adjusted by proportioning Klamath Falls UGB population to state-wide population and applying that ratio to state-wide residential natural gas and liquefied petroleum gas (LPG) fuel use. Residential natural gas and liquefied petroleum gas (LPG) fuel consumption estimates are summarized in Appendix B, Table B-5. This method was chosen due to the lack of Klamath Falls specific information for natural gas and liquefied petroleum gas (LPG) fuel heating devices in the UGB. Natural gas emission factors for residential sources are from the EPA document *Compilation of Air Pollutant Emission Factors,* (AP-42, 5th Edition)[216], Table 1.4-1. LPG emission factors for residential sources are from the EPA document *Compilation of Air Pollutant Emission Factors,* (AP-42, 5th Edition)[216], Table 1.5-1.. Seasonal adjustment factors and activity levels are taken from the EPA Procedures Document[2], Table 5.8-1. No source permits included in the stationary point source category mention the use of LPG; no subtraction to prevent double counting in the industrial natural gas category was conducted.

Because no State regulations apply to residential, commercial/institutional, and industrial natural gas or LPG fuel use for space heating, no control efficiency, rule effectiveness, or rule penetration have been applied to the emission estimate.

A summary of the emissions estimates and assumptions for natural gas and LPG fuel use are shown on Table 2.4.4 and on Table 2.4.5 respectively.

2.4.4.2.3 Residential Wood Combustion

Wood is an important residential space-heating source in Oregon. As a heating source wood contributes a significant percentage of pollutants to the airshed when compared to fuel oil and natural gas. Because the CO season in Klamath Falls occurs during the winter months when residential wood combustion is at its height, emissions from residential wood burning are considered to be significant.

Information on wood use for the Klamath Falls UGB was taken from the results of a wood heating survey conducted within the Klamath Falls area in winter of 1998-1999 and covers estimated usage during the 1999 heating season. This survey provided DEQ with information on the percentage of homes in the Klamath Falls UGB that used wood stoves and fireplaces, and an estimate of the average number of cords burned during the 1999 heating season in wood stoves and fireplaces. Survey data was restricted to reflect data for Klamath Falls zip codes only in order to more closely characterize the wood burning activity within the UGB. Survey data included fuel use information from both certified and non-certified wood stoves. Because the public is generally unable to ascertain what type of emission control their wood stove utilizes, the survey results for certified wood stoves was adjusted to represent a 25% catalytic to 75% non-catalytic stove mix. This conclusion allows the use of different emission factors for catalytic and non-catalytic stoves. The CO emissions from certified stoves, non-certified stoves, and fireplaces was then summed to give the total CO emissions for the residential wood heating category.

The average number of cords burned during the 1996 calendar year was taken from the 1999 Oregon DEQ Wood Heating Survey. Survey results also provided information on wood types burned and allowed a wood density adjustment to be made to determine the tons of wood burned. The number of wood stoves and fireplaces used in 1996 was estimated by multiplying the percentages of wood stoves and fireplaces obtained from the 1998-1999 wood heating survey by the estimated occupied housing units in the Klamath Falls UGB in 1996. The number of occupied housing units was then multiplied by the average number of cords burned per device to give the total number of cords burned. The weight of a typical cord of wood, the survey result information on the species of wood burned, and EPA wood density information was used to determine the tons/typical cord burned. The total cords burned by device were multiplied by the tons/cord to give the total wood burned by each device. Finally a CO emission factor based upon the type of wood burning device was applied to determine CO emissions from the burning of wood in wood stoves, pellet stoves, and fireplaces. Seasonal adjustment of annual emissions to a typical day was based upon EPA seasonal adjustment factor methodology. Because there are existing state regulations influencing the types of wood stoves sold and local regulations restricting daily use of wood burning devices, the EPA techniques of applying rule effectiveness (RE), control efficiency (CE), and rule penetration (RP) were applied to the emissions estimates. Adopted State regulations which effect residential wood combustion can be found in OAR 340-34-001, 005, 010, 015, 020, 045, 050, 060, and 070 (effective date 11-13-91)[22].

Example calculations are included on individual spreadsheets. Detailed information about data sources, assumptions, and calculations are shown in Appendix B, Tables B-1, B-6, B-7, B-8, B-9, B-10, B-11, and B-12. A summary of the emission estimates and assumptions for residential wood use are shown in Table 2.4.6.

2.4.4.3 Small Point Sources

Emissions from small point sources included permitted stationary point sources within the Klamath Falls UGB which emitted CO below the 100 tons/year cutoff level for the stationary point source category. Emissions were calculated by multiplying the emission factors used to generate the PSEL in effect during 1996 and actual 1996 production levels. Seasonal adjustments were assumed to be uniform (1), and activity was assumed to be 7 days/week. There are no rules or control efficiencies that affect this area source category. As such, RE and CE will not be applied.
A summary of the emission estimates and assumptions for area source emissions from small point sources are shown in Table 2.4.14.

2.4.4.4 Miscellaneous Area Sources

The area sources described in this section are combustion sources and may result from anthropogenic activity or natural causes. Source types include agricultural activity, forest wildfires, slash burning, and structural fires.

2.4.4.4.1 Other Combustion

Other combustion sources, which contribute to air pollutant levels may be intermittent in nature or may be the result of forestry activity. Intermittent emission sources include forest wild fires and structural fires. Emission sources from forest activity include slash burning from logging or land clearing activities. Prescribed burning designed for forest health or wildlife habitat enhancement is included with slash burning.

2.4.4.4.4.1 Forest Wild Fires

Forest wild fires are uncommon in the Klamath Falls UGB portion of Klamath County. According to the Department of Forestry, 946 acres were burned in 1996 in Klamath - Lake district's private land [329]. Using USGS maps and comments from state fire officials, the district-wide values were adjusted to estimate the incidence of wildfires occurring within, or in areas adjacent to the Klamath Falls UGB.

There are no recent studies examining fuel load and emission factors for wildfires. The best estimate for fuel loading, however, comes from in AP-42[8], Section 13.1, which is primarily based on studies reported from 1970 to 1975. AP-42[8] estimated total CO fuel loading from Pacific Northwest wildfires to be 60 tons per acre. The most recent emission factor available is from Ward[43,44], which lists the CO emissions from material burned at 500 lb./ton.

Forest wild fires are assumed to have an activity of seven days per week. Area specific fire information was obtained from the *Oregon Department of Forestry*[329]; this information was used by DEQ to calculate an appropriate seasonal adjustment factor. Because no state regulations affect this emission category, control efficiency, rule effectiveness, and rule penetration were not applied.

Due to the urban nature of the Klamath Falls UGB area, no forest fires were reported for the 1996 emission inventory year. A summary of emissions estimates from forest wild fires and supporting data are given in Table 2.4.7.

2.4.4.4.4.2 Slash Burning

Slash burning of forest materials occurs under controlled conditions to promote good natural resource management, to remove logging residues, and periodically to aid in land clearing activities for local area construction/development projects. Slash burning is not significant within the Klamath Falls UGB. Emissions from slash burning fuel loading were estimated using county and region-wide data provided by the Oregon Department of Forestry in the 1996 *Oregon Smoke Management Annual Data Report*[211]. These values were adjusted to reflect estimated slash burning inside or immediately adjacent to the UGB (based on visual examination of USGS maps of Klamath County).

The emission factors for carbon monoxide used in this inventory are based on DEQ estimates and recent regional studies of wildfires and prescribed burning, and are summarized in memoranda from Darold Ward[43,44]. A value of 250 lb./ton, from Ward[43,44], is used for this inventory. An activity level of 5 days per week is used which assumes that most slash burning activity does not occur on weekend days. The 5 days per week is based on the commercial workweek assumed for commercial SIC employee populations. A DEQ specific seasonal adjustment factor is calculated based upon the occurrence of slash burning in 1996. Because slash burning emissions are estimated using actual reported tons of material burned, control efficiency, rule effectiveness, and rule penetration were not applied.

Details of the assumptions used and a summary of the estimated emissions from slash burning are shown in Table 2.4.8.

2.4.4.4.4.3 Structural Fires

Emissions from structural fires were estimated using data obtained directly from the State Fire Marshall's Office[212]. The fuel loading factor of 6.8 tons per fire, and an emission factor of 60 lbs per ton for CO were taken from information provided in the EPA Procedures Document[3], Section 4.8.4. The activity level and seasonal adjustment factor used are from the EPA Procedures Document[3], Table 5.8-1. Because no state regulations affect this emission category, no control efficiency, rule effectiveness, or rule penetration were applied.

Details of the data used and a summary of emission estimates from structural fires are shown in Table 2.4.9.

2.4.5 Stationary Area Source Comparison

Figure 12: Distribution of Annual Area Source Emissions for 1996

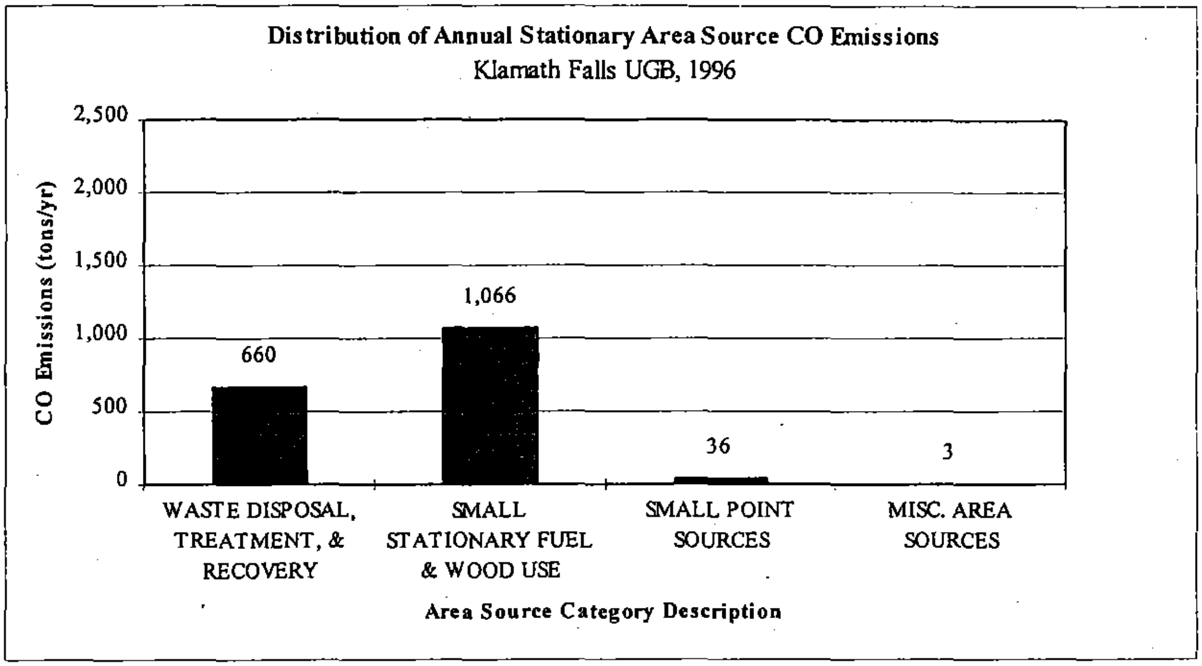


Figure 13: Percentage of Annual Area Source Emissions for 1996

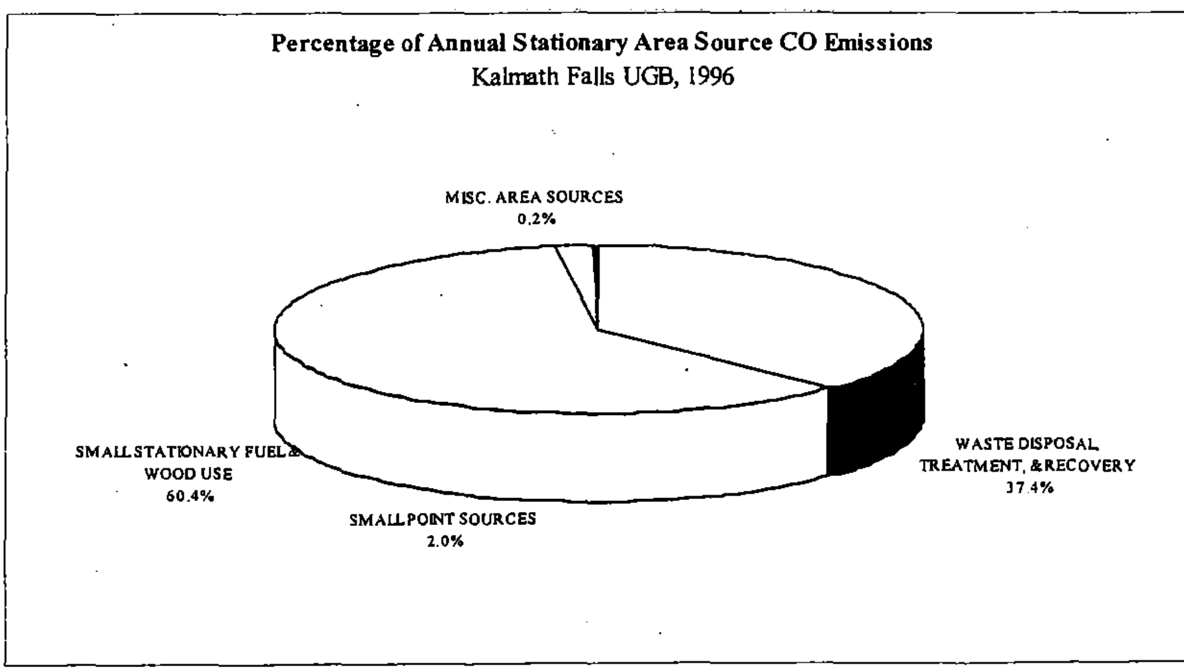


Figure 14: Distributions of Seasonal Area Source Emissions for 1996

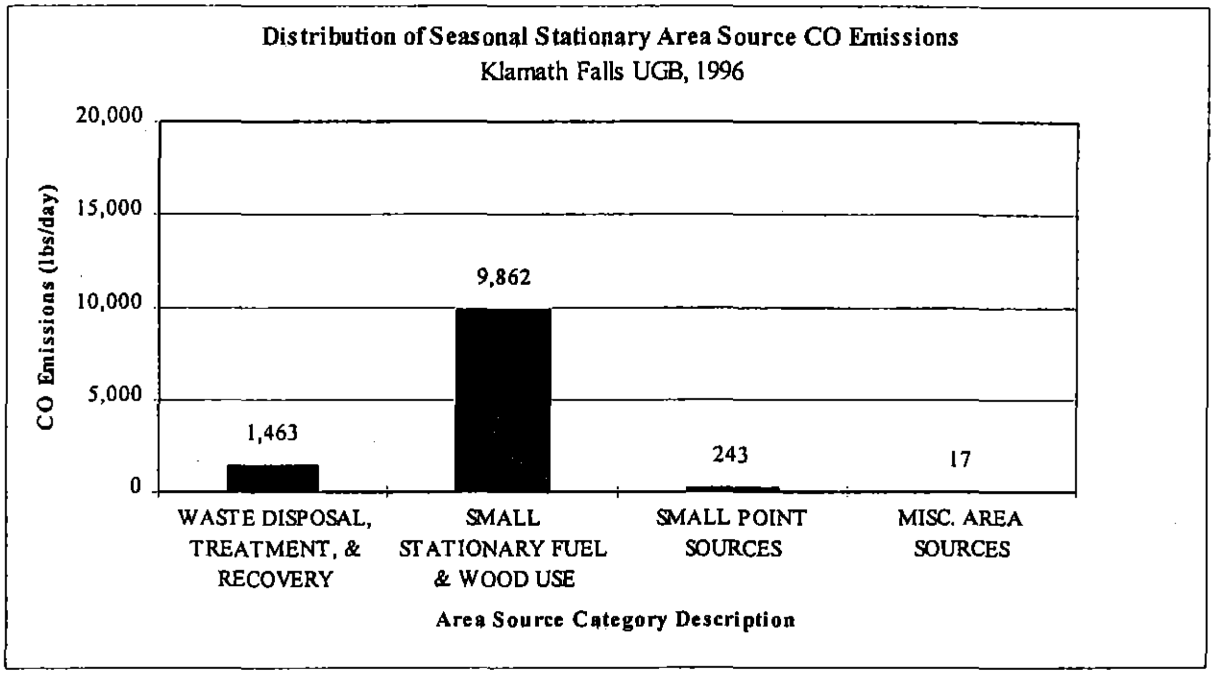


Figure 15: Percentage of Seasonal Area Source Emissions for 1996

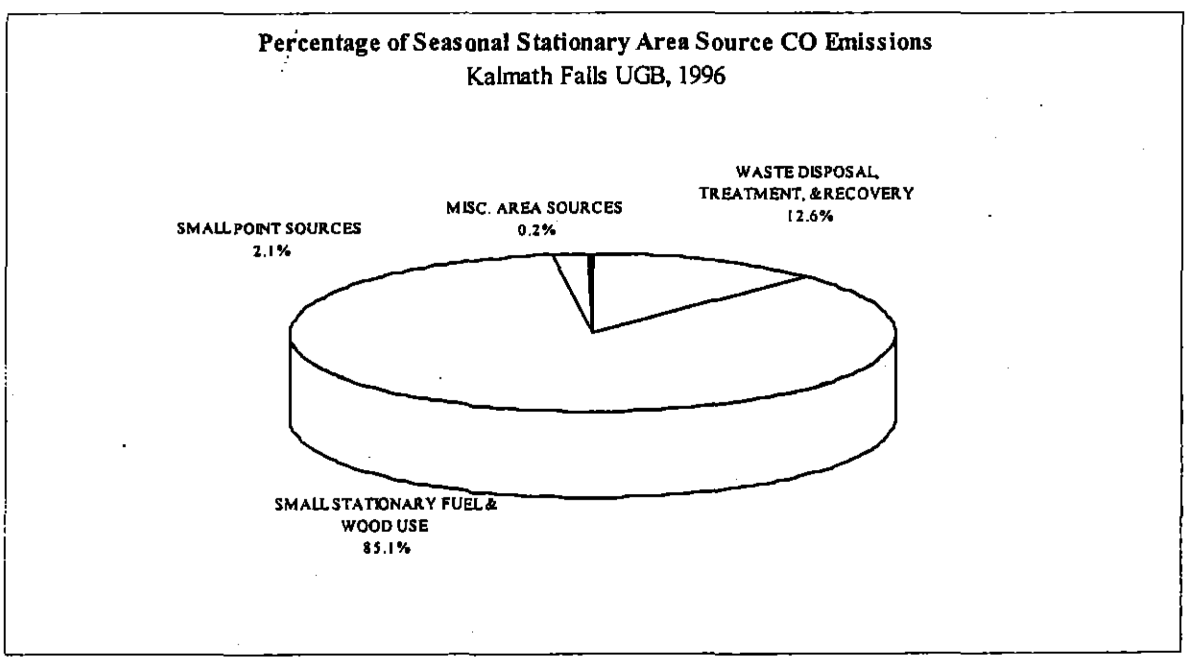


Figure 16: Annual Area Source Emissions Divided by Individual Categories for 1996

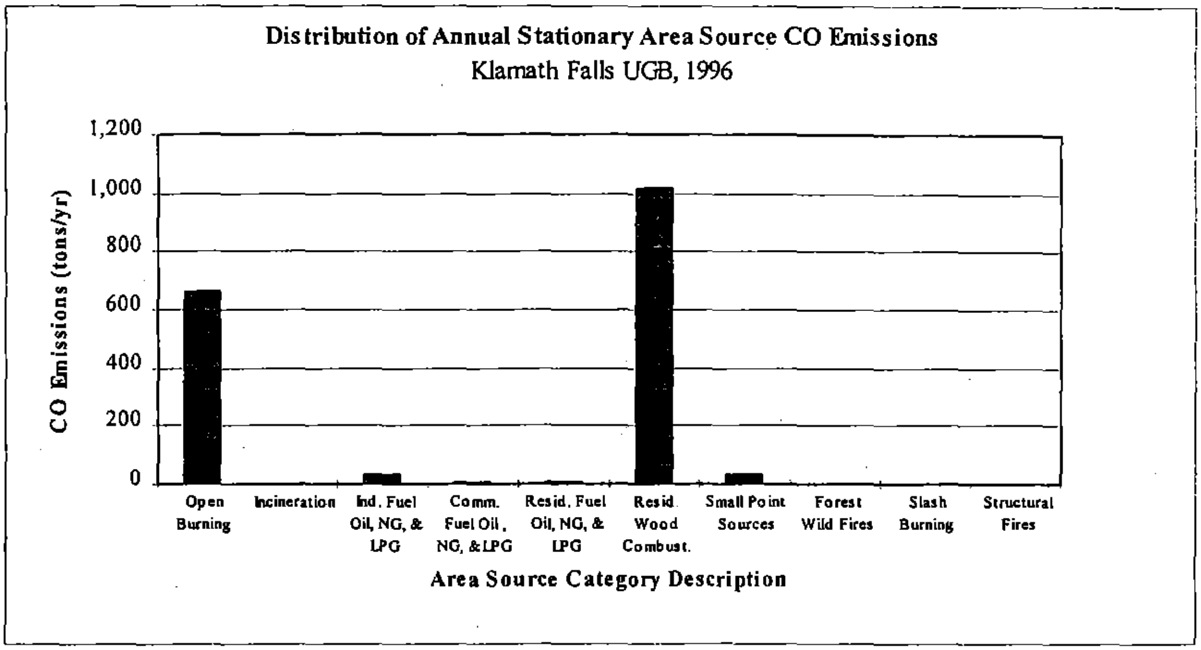
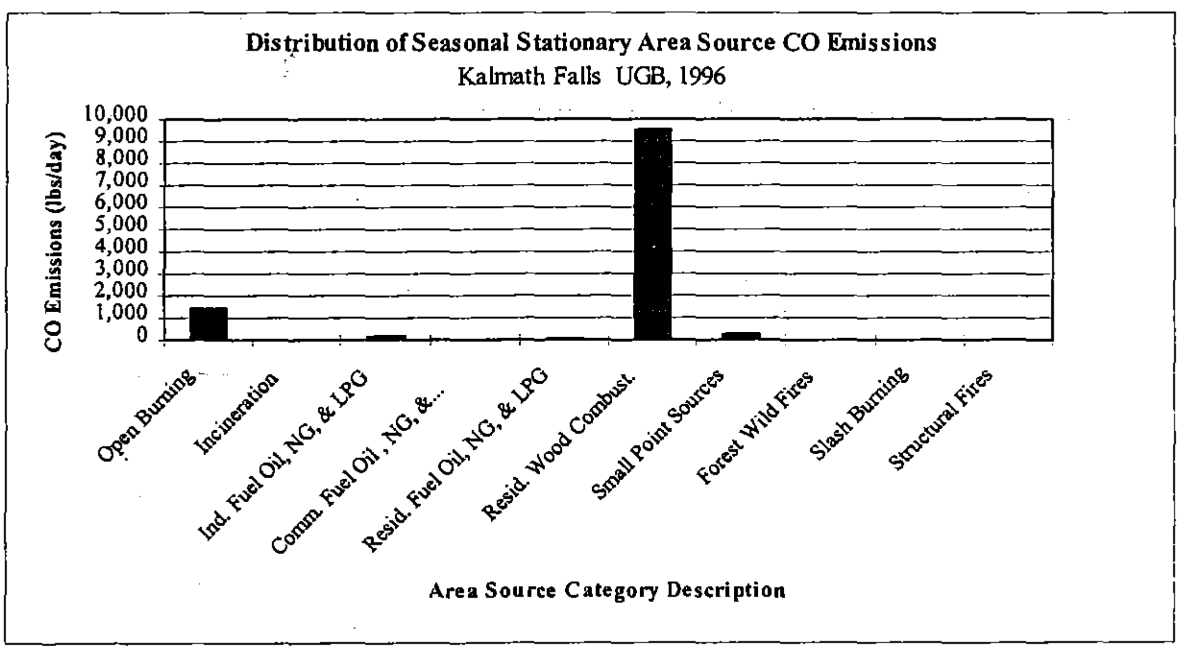


Figure 17: Seasonal Area Source Emissions Divided by Individual Categories for 1996



AREA SOURCES SUMMARIES

Table 2.4.1: Klamath Falls UGB 1996 CO Season: Summary of Estimation Procedures for Area Sources

Source Description	Table Number	SCC Label	Estimation Approach
WASTE DISPOSAL, TREATMENT, & RECOVERY			
Residential Open Burning	2.4.10	26-10-030-000	Activity Level
Industrial Open Burning	2.4.11	26-10-010-000	Per Capita
Commercial / Institutional Open Burning	2.4.12	26-10-020-000	Per Capita
Commercial / Institutional On-Site Incineration	2.4.13	26-01-020-000	Activity Level
SMALL STATIONARY FUEL & WOOD USE			
Industrial Fuel Type & Usage			
Fuel Oil Combustion	2.4.3	**21-02**	
Distillate/Kerosene Fuel Oil	2.4.3	21-02-004-000	Commodity-Consumption
Residual Fuel Oil	2.4.3	21-02-005-000	Commodity-Consumption
Natural Gas Combustion	2.4.4	21-02-006-000	Commodity-Consumption
Liquid Petroleum Gas Combustion	2.4.5	21-02-007-000	Commodity-Consumption
Commercial / Institutional Fuel Type & Usage			
Fuel Oil Combustion	2.4.3	**21-03**	
Distillate/Kerosene Fuel Oil	2.4.3	21-03-004-000	Commodity-Consumption
Residual Fuel Oil	2.4.3	21-03-005-000	Commodity-Consumption
Natural Gas Combustion	2.4.4	21-03-006-000	Commodity-Consumption
Liquid Petroleum Gas Combustion	2.4.5	21-03-007-000	Commodity-Consumption
Residential Fuel Type & Usage			
Fuel Oil Combustion	2.4.3	**21-04**	
Distillate/Kerosene Fuel Oil	2.4.3	21-04-004-000	Commodity-Consumption
Natural Gas Combustion	2.4.4	21-04-006-000	Commodity-Consumption
Liquid Petroleum Gas Combustion	2.4.5	21-04-007-000	Commodity-Consumption
Wood Fuel Combustion - Residential Only			
Fireplaces	2.4.6	21-04-008-001	Activity Level
Woodstoves - Certified Catalytic	2.4.6	21-04-008-030	Activity Level
Woodstoves - Certified Non-Catalytic	2.4.6	21-04-008-050	Activity Level
Woodstoves - Conventional & FP Insert	2.4.6	21-04-008-051	Activity Level
Exempt Pellet Stoves	2.4.6	21-04-008-053	Activity Level
SMALL POINT SOURCES			
Permitted Sources (>5 tons/year, < 100 tons/year)	2.4.14	23-07-060-000	Commodity-Consumption
MISCELLANEOUS AREA SOURCES			
Other Combustion		**28-10**	
Forest Wild Fires	2.4.7	28-10-001-000	Activity Level
Slash Burning	2.4.8	28-10-005-000	Activity Level
Structural Fires	2.4.9	28-10-030-000	Activity Level

Notes:

SCC (Source Classification Code) Label: The 8-digit, 4-part codes system used by US EPA Factor Information & Retrieval (FIRE) database and AIRS Facility Subsystem (AFS) to list and identify individual processes or unit operations that generate air emissions.

"Activity Level" - emission rate estimated on basis of quantity of reported levels of specific (or related) activity (i.e., fire department permits, complaints, survey results)

"Per Capita" - emission rate estimated on basis of area population and using a per person multiplier (or "per thousand people").

"Commodity-Consumption" - emission rate estimated on basis of commercial product as indicated by the quantity of sales, production or consumption of a class of commercial articles.

Table 2.4.2: Klamath Falls UGB 1996 CO Season: Summary of Emissions from Area Sources

Source Description	Table #	SCC Code	CO Annual Emissions (tons/yr)	CO Season Emissions (lbs/day)
WASTE DISPOSAL, TREATMENT, & RECOVERY				
Residential Open Burning	2.4.10	26-10-030-000	625.9	1,276.2
Industrial Open Burning	2.4.11	26-10-010-000	27.9	153.3
Commercial / Institutional Open Burning	2.4.12	26-10-020-000	6.1	33.3
Commercial / Institutional On-Site Incineration	2.4.13	26-01-020-000	0.2	0.7
Category Subtotal			660	**1,463**
SMALL STATIONARY FUEL & WOOD USE				
Industrial				
Fuel Oil Combustion		21-02		
Distillate	2.4.3	21-02-004-000	3.3	21
Residual	2.4.3	21-02-005-000	0.3	2
Kerosene	2.4.3	21-02-000-000	Combined with Distillate	
Natural Gas Combustion	2.4.4	21-02-006-000	27.4	176
Liquid Petroleum Gas Combustion	2.4.5	21-02-007-000	1.2	8
Industrial Subtotal			32	206
Commercial / Institutional				
Fuel Oil Combustion		21-03		
Distillate	2.4.3	21-03-004-000	0.9	8
Residual	2.4.3	21-03-005-000	0.1	1
Kerosene	2.4.3	21-03-011-000	Combined with Distillate	
Natural Gas Combustion	2.4.4	21-03-006-000	3.6	32
Liquid Petroleum Gas Combustion	2.4.5	21-03-007-000	0.0	0.4
Commercial Subtotal			5	42
Residential				
Fuel Oil Combustion		21-04		
Distillate	2.4.3	21-04-004-000	1.1	11
Residual	2.4.3	21-04-005-000	NA	NA
Kerosene	2.4.3	21-04-011-000	Combined with Distillate	
Natural Gas Combustion	2.4.4	21-04-006-000	8.4	78
Liquid Petroleum Gas Combustion	2.4.5	21-04-007-000	0.4	4
Wood Combustion				
Fireplaces	2.4.6	21-04-008-001	284.7	2,660
Woodstoves - Certified Catalytic	2.4.6	21-04-008-030	42.5	397
Woodstoves - Certified Non-Catalytic	2.4.6	21-04-008-050	171.9	1,606
Woodstoves - Conventional & FP Insert	2.4.6	21-04-008-051	511.9	4,781
Exempt Pellet Stoves	2.4.6	21-04-008-053	8.4	78
RWC Subtotal			1,019	9,522
Residential Subtotal			1,029	9,614
Category Subtotal			1,066	9,862
SMALL POINT SOURCES				
Permitted Sources (act.>5t/yr, PSEL < 100 t/yr)	2.4.14	23-07-060-000	36.2	243
Category Subtotal			36	243
MISCELLANEOUS AREA SOURCES				
Other Combustion		28-10		
Forest Wild Fires	2.4.7	28-10-001-000	0.0	0
Slash Burning	2.4.8	28-10-005-000	0.0	0
Structural Fires	2.4.9	28-10-030-000	3.2	17
Category Subtotal			3	17
Area Source Total			**1,766**	**11,586**

Note: NA indicates category or pollutant not applicable

Table 2.4.3: Klamath Falls UGB 1996 CO Season: Area Source Emissions From Fuel Oil Use

Area	(1) 1996 Fuel Oil Use (10^3 gal)	(2) CO EF (lbs/ 10^3/gal)	(3) Acty (d/wk)	(4) CO Season Adjst (SAF)	(5) — CO Emissions — Annual (t/yr)	(6) CO Season (lbs/day)
SCC 21-04-004-000						
Residential Distillate/Kerosene Use						
Klamath Falls CO UGB	459	5.0	7	1.7	1.1	11
Total Residential Distillate/Kerosene Use:					1.1	11
SCC 21-03-004-000						
Commercial Distillate/Kerosene Use						
Klamath Falls CO UGB	362	5.0	6	1.4	0.9	8
Total Commercial Distillate/Kerosene Use:					0.91	8
SCC 21-03-005-000						
Commercial Residual Oil Use						
Klamath Falls CO UGB	46	5.0	6	1.4	0.1	1
Total Commercial Residual Oil Use:					0.1	1
SCC 21-02-004-000						
Industrial Distillate/Kerosene Use						
Klamath Falls CO UGB	1,308	5.0	6	1.0	3.3	21
Stationary Point Sources (7)	0	5.0	6	1.0	0.0	0
Total Industrial Distillate/Kerosene Use:					3.3	21
SCC 21-02-005-000						
Industrial Residual Oil Use						
Klamath Falls CO UGB	102	5.0	6	1.0	0.3	2
Total Industrial Residual Oil Use:					0.3	2
Total CO UGB Emissions from Fuel Oil Use:					5.7	42

Notes:

1) Klamath Falls UGB Fuel Oil Use estimates from Appendix B, Table B-5 Klamath Falls UGB, 1996. Residential Fuel Oil use based on UGB residential population, See Appendix B, Table B-1. Commercial and Industrial LPG use based on SIC employees within Klamath Falls UGB portion of Klamath County. See Appendix B, Table B-4, Klamath Falls UGB SIC population estimates.
2) Emission factors (EF) are from the EPA document "Compilation of Air Pollutant Emission Factors" (AP-42) 5th Ed., Table 1.3-1 (Ref. 216). EFs for the industrial and commercial/Institutional sources listed above are identical and are for uncontrolled fuel oil combustion characteristic of space heating devices.
3) Activity is from EPA Procedures Document, Table 5.8-1 (Ref. 2).
4) Season Adjustment Factor (SAF) is taken from the EPA Procedures Document, Table 5.8-1 (Ref 2).
5) Annual CO Emissions [tons/yr.] = (Fuel Oil Use [10^3 gallon] * Emission Factor [lb./gallon]) / 2000 [lb./ton]
6) CO Season CO Emissions [lbs/day] = ((Annual Emissions [tons/yr.] * 2000 [lbs/ton]) * SAF) / (activity [days/week] * 52 [weeks/yr.])
7) No Stationary Point sources utilize Fuel Oil according to their permits.
8) There are no applicable State regulations which effect this category. No state control efficiency (CE), rule penetration (RP), or rule effectiveness (RE) were applied to this category.

Table 2.4.4: Klamath Falls UGB 1996 CO Season: Area Source Emissions From Natural Gas Use

Area	(1) 1993 Nat Gas Use (10^6 ft^3)	(2) CO EF (lbs/ 10^6 ft^3)	(3) Acty (d/wk)	(4) CO Seasn Adjst (SAF)	(5) — CO Emissions — Annual (t/yr)	(6) CO Season (lbs/day)
SCC 21-04-006-000 Residential NG Use Klamath Falls CO UGB						
	419	40	7	1.7	8.4	78
				Total	8.4	78
SCC 21-03-006-000 Commercial/Institutional NG Use Klamath Falls CO UGB						
	341	21	6	1.4	3.6	32
Small Point Sources adjustment (7)					0	0
				Total	3.6	32
SCC 21-02-006-000 Industrial NG Use Klamath Falls CO UGB						
	1,567	35	6	1.0	27.4	176
Stationary Point Source adjustment(8)					NA	NA
				Total	27.4	176
Total CO UGB / NAA Emissions from Natural Gas Use:					39.4	286

NA - Not applicable as indicated in note 9

Notes:

1) Natural Gas Use estimates are from Appendix B, Table B-5 for Klamath Falls UGB, 1996. Residential use based on 1996 Klamath Falls UGB residential population. Commercial and Industrial Natural Gas is use based on 1996 SIC employees within Klamath Falls UGB portion of Klamath County. See Appendix B, Table B-4, Klamath Falls UGB SIC Population Estimates.
2) Emission Factors (EF) are from the EPA document "Compilation of Air Pollutant Emission Factors" (AP-42), 5th Ed. (Ref. 216), Table 1.4-1 for Uncontrolled Small Industrial Boilers, (10 - 100 10^6 Btu/hr heat input), Commercial Boilers (0.3 - <10 106 Btu/hr heat input), and Residential Furnaces (<0.3 106 Btu/hr heat input).
3) Activity is from EPA Procedures Document, Table 5.8-1 (Ref. 2).
4) Season Adjustment Factor (SAF) is taken from the EPA Procedures Document, Table 5.8-1 (Ref 2).
5) Annual Emissions [tons/yr] = (annual Natural Gas Use [10^6 ft3] * EF [lbs/10^6 ft3]) / 2000 [lbs/ton]
6) CO Season Emissions [lbs/day] = ((Annual Emissions [t/yr] * 2000 [lbs/ton]) * SAF) / (activity [days/week] * 52 [weeks/yr])
7) None of the small point sources utilize natural gas according to their permits.
8) Stationary Point source Natural Gas usage adjustment: Stationary Point source natural gas use is not subtracted to avoid negative CO emissions that would result. Note that Industrial Point Sources are located in 25 miles radius buffer zone outside UGB while CO emissions form NG use calculated here represent emissions in K. Falls UGB area only.

SAF= 1.0 Activity (days/wk) = 6

Source Number	Source Name	1996 Usage (MM ft3)	CO EF (lb/MM ft3)	CO Emissions Annual (t/yr)	CO Emissions Season (lbs/day)
18-0006	Jeld-Wen, Inc.	4.9	21	0.05	0
18-0013	Colins Products	1431.00	0.01	64.3	352
18-0013	Colins Products	206.00	17.00	1.8	10
18-0014	Columbia Plywood Corp.	29.00	0.02	0.3	2
			Total	66.5	364

1) No applicable State regulations apply to this category for carbon monoxide emissions. Therefore, Control Efficiency (CE), Rule Penetration (RP), and Rule Effectiveness (RE) .have not been applied to this category.

Table 2.4.5: Klamath Falls UGB 1996 CO Season: Area Source Emissions From Liquefied Petroleum Gas Use

	(1)	(2)	(3)	(4)	(5)	(6)
	1996 LPG Use	CO EF	Acty	CO Seasn Adjst	— CO Emissions — Annual	Season
Area	(10^3 gal)	(lbs/10^3 gal)	(d/wk)	(SAF)	(t/yr)	(lbs/day)
SCC 21-04-007-000 Residential LPG Use						
Klamath Falls UGB	247	3.1	7	1.7	0.4	3.6
				Total	0.4	3.6
SCC 21-03-007-000 Commercial LPG Use						
Klamath Falls UGB	45	1.9	6	1.4	0.0	0.4
				Total	0.0	0.4
SCC 21-02-007-000 Industrial LPG Use(7)						
Klamath Falls UGB	763	3.2	6	1.0	1.2	7.8
				Total	1.2	7.8
Total CO NAA Emissions from Liquid Petroleum Use:					1.6	11.8

Notes:

2) LPG Use estimates from Appendix B, Table B-5 for Klamath Falls UGB portion of Klamath Co., 1996 Residential use based on UGB residential population (see Appendix B, Table B-1). Commercial and Industrial LPG use based on SIC employees within Klamath Falls UGB portion of Klamath County (see Appendix B, Table B-5 and Appendix B, Table B-4, Klamath Falls UGB Industrial and Commercial SIC Population Estimates. Emission Factors
3) (EF) for Industrial & Commercial categories are from AP-42 (5th Edition), Table 1.5-1 for Industrial and Commercial Boilers for Propane (Ref. 216). EFs for Residential LPG use is from "Short List" of AMS SCCs and Emission Factors and is for Residential, All Combustor Types (Ref. 25). No EF exists for this category in FIRE, Version 6.22.
4) Activity is from EPA Procedures Document, Table 5.8-1 (Ref. 2).
5) Season Adjustment Factor (SAF) is taken from the EPA Procedures Document, Table 5.8-1 (Ref 2).
6) Annual Emissions [tons/yr] = (LPG Use [10^3 gallons] * EF [lbs/10^3 gallons]) / 2000 [lbs/ton])
7) CO Season Emissions [lbs/day] = ((Annual Emissions [tons/yr] * 2000 [lbs/ton]) * SAF) / (activity [days/week] * 52 [weeks/yr]).
8) No Stationary Point sources utilized LPG in 1996 according to their permits.
9) There are no applicable State regulations which effect this category. No state control efficiency (CE), rule penetration (RP), or rule effectiveness (RE) were applied to this category.

Table 2.4.6: Klamath Falls UGB 1996 CO Season: Emissions From Residential Wood Use

(1) Woodburning Device	(2) CO NAA Wd Fuel Use (tons)	(3) CO EF (lbs/ton)	(4) Control Efficiency (CE) %	(5) Rule Effectivness (RE) %	(5) Rule Penetration (RP) %	(6) Activity (d/wk)	(7) CO Season Adjustment (SAF)	(8) — CO Emissions — Annual (t/yr)	(9) CO Season (lbs/day)
Within UGB									
SCC 21-04-008-001									
Conventional Fireplaces without Inserts									
Klamath Falls UGB	2,254	252.6		100	100	7	1.7	284.7	2,660
SCC 21-04-008-030									
DEQ Certified Catalytic Wood Stoves									
Klamath Falls UGB	814	104.40	55	100	100	7	1.7	42.5	397
SCC 21-04-008-050									
DEQ Certified Non-Catalytic Wood Stoves									
Klamath Falls UGB	2,442	140.8	39	100	100	7	1.7	171.9	1,606
SCC 21-04-008-051									
Conventional Wood Stoves and Fireplaces with Inserts									
Klamath Falls UGB	4,436	230.8		100	100	7	1.7	511.9	4,781
SCC 21-04-008-053									
Exempt Pellet Stoves									
Klamath Falls UGB	321	52.2		100	100	7	1.7	8.4	78
TOTAL	10,268							1,019	9,522

Notes:

1) Woodburning Device categories from EPA procedures manual (Ref 5).
2) Wood Fuel Use based on an Oregon DEQ Woodheating Survey (see Appendix B, Table B-6)
3) Emission Factors (EF) are from AP-42 (Ref. 216), Table 1.9-2 and Table 1.10-2.
4) Control Efficiency (CE) estimated based on EPA guidance (Ref 165) and according to EIIP (Ref. 321) reflected in lower emission factors of certified catalytic and non-catalytic woodstoves.
   Control Efficiency = (1 - (Controlled Emissions / Uncontrolled Emissions))
   catalytic woodstoves CE = (1-(104.4/230.8) = 54.8%
   non-catalytic wood stoves CE = (1-(140.8/230.8) = 39%
5) Rule Effectiveness (RE) and Rule Penetration (RP) are indicated through survey questionnaire results; see EPA guidance, EPA-452/R-92-010, Nov. 1992 (Ref. 165). The 1999 Oregon DEQ Woodheating Survey (Ref 348) was funded by Oregon DEQ.
   The effect of Oregon Administrative Rules (Chapter 340-34-010 and Chapter 340-3-400) is included in the calculations.
   RE and RP are directly determined as a result of this survey and are both equal to 100%.
6) Activity is at the indicated number of days/week.
7) The Season Adjustment Factor (SAF) is taken from the EPA Procedures Document, Table 5.8-1 (Ref. 2).
8) Annual Emissions (t/yr) = (Wood Fuel Use [tons] * EF [lbs/ton])/2000 [lbs/ton]. Control Efficiency is reflected in the EF.
9) CO Season Emissions [lbs/day] =
   (((Annual Emissions [tons/yr] * 2000 [lbs/ton])*SAF) / (Activity [days/wk] * 52 [wks/yr])) * (1 - CE/100 * RE/100 * RP/100))
   if uncontrolled EF is used to estimate annual emissions or
   ((Annual Emissions [tons/yr] * 2000 [lbs/ton])*SAF) / (Activity [days/wk] * 52 [wks/yr])
   if controlled EF is used to estimate annual emissions.

Table 2.4.7: Klamath Falls UGB 1996 CO Season: Emissions From Forest Wild Fires

	(1)	(1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
										CO Emissions		
Area	Annual No. of Fires K.Falls	No. of Fires in CO Season K.Falls	K.Falls Annual Acres Burned	K.Falls Burned in Season	Fuel Amount Per Acres Burned (tons/acre)	Annual Tons Burned	CO EF (lbs/ton)	Acty (d/wk)	CO Seasonal Adjustment Factor (SAF)	Annual (tons/yr)	CO Season Typical Day (lbs/day)	CO Season Worst Case Dy (lbs/day)
SCC 28-10-001-000 Forest Wildfires												
K. Falls	0.00	0.00	0.00	0.00	60	0	500	7	0.0	0.0	0.00	0
TOTAL										0.0	0.00	0

Notes:

18)

1) Acres Burned (946 acres were burned in 1996 in Klamath - Lake district's private land are from the Department of Forestry (Ref. 329). Although a certain number of fires occurred in Klamath county (128 fires in Klamath-Lake district in 1996, Ref.329), no fires are traceable to the Klamath Falls proper. The number of forest fires and acres burned is assumed to be zero based on the following estimations:
2) a)Forests in Klamath Falls UGB are estimated at equivalent to zero. DEQ estimation based on survey of fire protection boundary maps and Klamath County Maps from Klamath County GIS.
3) b) Carbon Monoxide is not considered pollutant that travels great distances from its origination.
4) Acres burned in season = ((No. of Fires in CO Season UGB) / (No. of fires UGB)) * (Annual Acres burned)
5) Fuel amount per acres burned (tons/acre) is estimated based on an AP-42 emission factor (Ref. 216), given in Table 13.1
6) Annual tons burned = (annual acres burned) * (fuel amount per acres burned [tons/acre])
7) The CO Emission Factor is based on studies of Pacific SE forests by Ward (Ref 43).
8) Activity is at the indicated number of days/week. Since wildfire cannot be predicted, the likelihood of occurrence is set at 7 days/wk.
9) Of total forest wildfires that occurred in Klamath county , ~ 0% occurred during the three month CO season, December - February (Oregon Forest Fire Summary, Ref 42).
10) CO Season Adjustment Factor (SAF) = (0 acres * 12) / (0 acres * 3 mo).CO Season Adjustment Factor (SAF) = 0.00

1996 Fire Report Data and Reduction to Klamath Falls UGB

1996	-----Man-caused----- Peak (14) Season Activity # Fires	(15) Annual Activity # Fires	-----Lightning----- Peak (15) Season Activity # Fires	(15) Annual Activity # Fires	-----TOTAL----- Peak (15) Season Activity # Fires	(15) Annual Activity # Fires	(15) Klamath County Annual # of District # Fires	Klamath Falls Annual # of County # Fires	(16) Klamath County Seasonal % of Annual
Klamath - Lake Dist.	0	128	0	N/A	0	128	N/A	0.00	#DIV/0!
Total	0	128	0	N/A	0	128	N/A	0.00	#DIV/0!
1996	(12) CO K. Falls UGB % of Forested County	(15) Annual Activity District Acres	(13) Annual Activity County Acres	Annual CO UGB Acres	Peak CO UGB Acres	Seasonal % of Annual	(13) Klamath County Annual # District Acres	Klamath County Annual # of County Acres	Seasonal % of Annual
Acres Burned Klamath - Lake Dist.	1.E-11	946	N/A	0.00E+00	0.E+00	#DIV/0!	N/A	0.00	#DIV/0!
Total		946	N/A	0.00	0.00	#DIV/0!	N/A	0.00	#DIV/0!

Notes:

1) Annual Emissions (t/yr) = ((tons burned) * (CO EF [lbs/ton])) / (2000 [lbs/ton])
2) CO Season Typical Day Emissions [lbs/day] = ((Annual Emiss. [t/yr]) * (2000 [lbs/t]) * (SAF)) / ((7 [dys/wk]) * (52 wks/yr)).
3) CO Season Worst Case Day Emissions [lbs/day] = ((Annual Emissions [t/yr]) * (SAF) * (2000 [lbs/ton])
4) Worst Case Day assumes that all 15+ acres will be burned on the same day, adjusted for a very small likelihood of occurrence during the winter months with a SAF of .02.
5) No applicable State regulations; No Control Efficiency, Rule Effectiveness, or Rule Penetration applied to this category
6) For Klamath Falls % of County indications, K. Falls èstimated at 0.6% of Klamath County, Ref. 328 but forests estim. at equiv. to zero. DEQ estim. based on survey of fire protection boundary maps and Klamath County Maps from Klamath County GIS.
7) CO season is defined as the months of December through February. 8)
9) Number of fires and acres burned are taken from the *Oregon Department of Forestry, Ref. 329.*

Table 2.4.8: Klamath Falls UGB 1996 CO Season: Emissions From Slash Burning

Area	(1) Tons Burned	(2) CO UGB Factor	(3) UGB Tons Burned	(4) CO EF (lbs/ton)	(5) Acty (d/wk)	(6) CO Seasonal Adjustment Factor SAF	(7) CO Emissions - CO Annual (t/yr)	(7) Season (lbs/day)
SCC 28-10-010-000								
Managed Slash Burning								
Klamath Falls CO	210,973	0.0%	0	250	5	0.00	0	0
TOTAL K. Falls/NAA							0	0

Notes:

1) Data for tons burned, by county, is taken from the "Oregon Smoke Management Annual Data Report", 1996 (Ref. 211) pg. 23, Table 7A (Restricted Area) and 7B (Non-Restricted Area).
2) CO UGB Factor represents the percentage of Klamath county slash fire tons burned that occurred over a 5 year period which caused a winter-time intrusion into Klamath Falls. Since there were no intrusions into Klamath Falls since 1980, CO UGB Factor equals zero. Burning from land clearing activities related to construction, demolition, and commercial / industrial activity is included with commercial open burning category.

3) CO K. Falls Tons Burned = (County Tons Burned) * (CO K. Falls Factor)
4) The CO Emission Factor is for prescribed fires and is based on studies of Pacific SW forests by Ward (Ref. 43).
5) Slash burning does not take place on weekend days, and Activity is at the indicated 5 days/week.
6) CO Season Adjustment Factors are calculated based on occurrence of slash burning in 1996
CO Season Adjustment Factor (SAF) = (peak season activity * 12 mo) / (annual activity * 3 mo).

Year	Dec	Jan	Feb	Tons Burned CO Season	% in Season	SAF
Klamath County 1996	1996	1996	1996			
210,973	0	0	0	0	0.0%	0.00

The values for Tons Burned are calculated by the Oregon Department of Forestry, and include the contribution of the duff layer to the total tonnage burned.
7) Annual Emissions [t/yr.] = (tons burned) * (EF) / 2000 [lb./ton].
CO Season Emissions [lb./day] = ((Annual Emiss. [t/yr.] * 2000 [lb./ton]) * SAF)/(activity [days/wk] * 52[wk/yr]).

8) RE, RP, and CE not applicable to this category.

Table 2.4.9: Klamath Falls UGB 1996 CO Season: Emissions From Structural Fires

Area	(1) Number of Fires	(2) Fuel Loading Factor	(2) Tons Burned	(3) CO EF (lbs/ton)	(4) Acty (d/wk)	(5) CO Seasonal Adjustment Factor (SAF)	(6) – CO Emissions -- Annual (t/yr)	(7) Season (lbs/day)
SCC 28-10-030-000 Structural Fires Klamath Falls								
Klamath Falls Fire District #1	92	1.15	106	60	7	1	3.2	17.4
TOTAL Klamath Falls CO	92		106				3.2	17.4

Notes:
1) Data is from Oregon State Fire Marshall's Office (Ref. 273), Oregon Fire Incident Reporting System-1996
2) Tons Burned = (Number of Fires) * (Fuel Loading Factor) The fuel loading factor is taken from the EPA Procedures Document, Section 4.8.4 (Ref 2). The value used in this inventory is 1.15 tons of material per fire. This fuel loading factor was developed by California Air Resources Board (CARB) and is acceptable default value for all types of structures. Ref. 321 Chapter 18, p.18.4-2.
3) Emission Factors (EF) are taken from the EPA Procedures Document, Section 4.8.4 (Ref 2).
4) Activity level is number of days/week from EPA Procedures Document (Ref. 2) Table 5.8-1.
5) Seasonal Adjustment Factor (SAF) from EPA Procedures Document (Ref.2) Table 5.8-1.
6) Annual Emissions [tons/yr] = ((Tons Burned) * Emission Factor [lbs/10^3 tons]) / 2000 [lbs/ton]
7) CO Season Emissions [lbs/day] = ((Annual Emissions [tons/yr] * 2000 [lbs/ton]) * SAF)/(Activity [days/wk]*52 [wks/yr]
8) RE, RP, and CE not applicable to this category.

Table 2.4.10: Klamath Falls UGB 1996 CO Season: Area Source Emissions From Residential Open Burning

SCC 26-10-030-000						
(1a) Material Burned (Per Capita Open Burning Rate) [tons/1000 people-yr]	(2a) Residential Population [1000 people]	(3a) Emission Factor [lb CO/ ton burned]	(4a) CO Seasonal Activity [days/week]	(5a) Seasonal Adjustment Factor, CO	(6a) CO Annual Emissions [tons/year]	(7) CO Seasonal Emission Rate [lb/ day]
Res. Burning - UGB outside the City Limits						
450	21.6	122	7	0.38	594.5	1241.3
(1b) Material Burned [tons/violation]	(2b) Number of Violations	(3b) Emission Factor [lb./ton]	(4b) CO Seasonal Activity [days/wk]	(5b) Seasonal Adjustment Factor, CO 0	(6b) CO Annual [tons/yr.]	(7) CO Season Typical Day [lb./day]
Illegal Burning - City Limits						
0.8	13	116	7	0.3	0.6	1.0
(1c) Material Burned [tons/permit]	(2c) Permits Issued	(3c) Emission Factor [lb./ton]	(4c) Activity [days/wk]	(5c) Seasonal Adjustment Factor, CO	(6c) CO Annual [tons/yr.]	(7) CO Season Typical Day [lb./day]
Legal Burning - Permitted in City Limits						
0.4	1262	122	7	0.2	30.8	33.8
			Total CO Emissions:		626	1276

Notes:
1)a) Legal and illegal burning inside the UGB but outside the City Limits are accounted for by using population of the area inside UGB outside the City Limits. Per capita open burning rate for the area within UGB outside the City Limits is based on the value of 450 tons/1,000 people/year. Method per EPA guidance document "*Procedures for the Preparation of Emission Inventories For Carbon Monoxide and Precursors of Ozone*[2] ", Table 4.6.2.
b) For illegal burning inside the UGB the per violation open burning rate is estimated by the Grants Pass Fire District and used here based on the assumption that amount of the material burned per violation in K.Falls is approximately the same as in Grants Pass, (Append B-3).
c) For legal burning inside the City Limits, the per permit open burning rate was estimated by the Grants Pass Fire District and used here based on the assumption that amount of the material burned per permit in Klamath Falls is approximately the same as in Grants Pass, (Append B-3).
2)a) Estimate of the residential population inside the Klamath Falls UGB but outside the Klamath Falls City limits. b) Number of 1996 violations reported by Klamath County Fire District #1, Ref.#335.
c) Number of 1996 permits issued by Klamath Falls Fire District and Klamath County Environmental Health Department. Ref.#335. Permits and violations are for Air Quality Control Area. Larry Calkins of ODEQ ER estimated that 90 % of those permits and violations Permits and violations numbers include agricultural burning. 47 % of the UGB population resides in the city limits which allows us to assume that 47 % of the UGB permits and violations were issued inside the city limits.
3) a) Average EF for brush, grass, and wood taken from the EPA AP-42, Table 2.5-5 (5th Ed.), see Appendix B-3.
b) Average EF for brush, grass, wood, and municipal trash from EPA AP-42, Table 2.5-5(5th Ed.), see App B-3.
c) Average EF for brush, grass, and wood taken from the EPA AP-42, Table 2.5-5 (5th Ed.), see Appendix B-3.
4)a), b), and c) Activity is taken from the EPA guidance document *Procedures for the Preparation of Emission Inventories For Carbon Monoxide and Precursors of Ozone*[2], Page 5-18.
5)Seasonal Adjustment Factor (SAF = (peak season CO activity/ annual CO activity) / (3 mo. Season/ 12 mo. Year)
a) The peak season for the CO season is from December 1 through the end of February.
SAF = (71/ 746)/(3/ 12) = 0.38
Peak season activity and annual activity numbers are from Klamath County Fire district #1 and Klamath County Environmental Health Department. (Ref. 335).
b) SAF = (1 Violations, Peak Season/ 13 Violations, Annually) / (3 months/ 12 months) = 0.3
c) Legal Burning, inside City Limits: SAF = (63/ 1262) / (3/ 12) = 0.20
6)a) Annual CO emissions [tons/year] =
((Per Capita Open Burning Rate [tons/1,000 people-yr.]) * (Resid. Population [1,000 people] * (EF [lb./ton]))/ (2000 [lb./ton])
b) Annual CO emissions [tons/year] = (Material burned [tons/violation] * (# of violations) * EF [lb./ton]/(2000 lb./ton)
c) Annual CO emissions [tons/year] = (Material burned [tons/permit] * (Number of permits) * EF [lb./ton]/(2000 lb./ton)
7)CO Typical Day Emissions [lb./day] =
((Annual Emissions [tons/year]) * (2000 [lb./ton]) * (SAF))/ ((Activity [days/wk]) * (52 [wk./year]))
8) The Rule Effectiveness (RE) and Rule Penetration (RP) are taken into account by the division of legal and illegal open burning. This methodology does not allow for the separation of RE & RP into distinct adjustment factors.

Table 2.4.11: Klamath Falls UGB 1996 CO Season: Area Source Emissions From Industrial Open Burning

SCC 26-10-010-000	(1) Material Burned (tons/1000 mfg. employees/ yr.)	(2) Industrial Population (1000 mfg. employees)	(3) Emission Factor (lb./ton)	(4) Activity (days/wk)	(5) CO SAF	(6) CO Annual (tons/yr.)	(6) CO Season Typical Day (lb./day)
Legal Burning	0	4.10	85	7	0	0.0	0.0
Illegal Burning	160	4.10	85	7	1	27.9	153.3
Total Emissions						27.9	153.3

Notes:

1) a) For legal burning, the material loading is zero. The DEQ prohibits industrial open burning inside Klamath Falls UGB as defined in OAR 340 Division 23.
b) For illegal burning, the material loading is from Ref. 2, Table 4.6-2, p. 4-38.
2) The industrial employee population for the Klamath Falls UGB is estimated in Appendix B, Table B4.
3) Emission Factor (EF) was taken from the EPA AP-42, Table 2.5-1 (5th Ed.).
4) Activity is taken from the EPA guidance document *Procedures for the Preparation of Emission Inventories For Carbon Monoxide and Precursors of Ozone* (Ref.2), Page 5-18.
5) Seasonal Adjustment Factor (SAF)= (peak season activity * 12 months)/(annual activity * 3 months)
<u>Legal Burning</u>
SAF = ((0 burning peak season activity) * (12 months))/((0 annual open burns) * (3 months)) = undefined = 0

The peak season for the CO season is from December 1 through the end of February. Although mathematically this equation is undefined, the SAF does not affect emissions and is assumed to be 0.
<u>Illegal burning</u>
SAF = ((3 months burning peak Season Activity) * (12 months))/((12 months annual open burns) * (3 months)) = 1
6) <u>Annual CO emissions [tons/year]</u> =
((Material Burned [tons/1000mfg. employees/yr.]) * (Ind. Population [1000mfg employees]) * (EF [lb./ton]))/ (2000 [lb./ton])
<u>CO Typical Day Emissions [lb./day]</u> =((Annual Emissions [tons/year]) * (2000 [lb./ton]) * (SAF))/ ((Activity [days/wk]) * (52 [wk./year]))
7) The Rule Effectiveness (RE) and Rule Penetration (RP) are taken into account by the division of legal and illegal open burning. This methodology does not allow for the separation of RE & RP into distinct adjustment factors.

Table 2.4.12: Klamath Falls UGB 1996 CO Season: Area Source Emissions From Commercial / Institutional Open Burning

SCC 26-10-020-000	Material Burned (tons/1000 employees/ yr.)	Commercial Population (1000 employees)	Emission Factor (lb./ton)	Activity (days/wk)	CO SAF	CO Emissions Annual (tons/yr.)	CO Season Typical Day (lb./day)
Legal Burning	(1a)	(2a)	(3)	(4)	(5)	(6)	(6)
	0	11.1	85	7	0	0.0	0.0
Illegal Burning	(1b)	(2b)					
	24	5.9	85	7	1	6.1	33.3
Total Emissions						6	33

Notes:

1)a) For legal burning, the material loading is zero. The DEQ prohibits commercial open burning inside the Klamath Falls UGB as defined in OAR 340 Division 23. OAR 340-23-100 makes an exception for commercial open burning if the DEQ issues a letter
permit. The DEQ issued no letter permits in 1996.

b) For illegal burning, the material loading factor of 24 tons/1000 rural employees was taken from Ref. 2, p. 4-38.
2)a) The commercial employee population number used for legal burning estimation is from Appendix B, Table B4.
b) Since the material loading factor used for illegal burning estimation is for rural population only, the number of rural commercial
employees was calculated as follows: The ratio of the commercial employee population to the total K. Falls UGB population 11,420/25,396 estimated in Appendix B, Table B4 and B1 respectively) was applied to the population within UGB but outside City Limits (rural population) 7,767 (see Appendix B, Table B4).
3) Emission factor (EF) was taken from the EPA AP-42, Table 2.5-1 (5th Ed.).
4) Activity is taken from the EPA guidance document *Procedures for the Preparation of Emission Inventories For Carbon Monoxide and Precursors of Ozone*[2], Page 5-18.
5) Seasonal Adjustment Factor (SAF)=(peak season activity * 12 months)/(annual activity * 3 months)
Legal Burning
SAF = ((0 burning peak season activity) * (12 months)) / ((0 annual open burns) * (3 months)) = undefined =0
The peak season for CO is from December 1 through the end of February.
SAF does not affect emissions and is assumed to be 0.
Illegal burning
SAF = ((3 months burning peak Season Activity) * (12 months))/((12 months annual open burns) * (3 months)) = 1
6)Annual CO emissions [tons/year] =
((Material Burned [tons/1000 mfg. Employees/yr.]) * (Commercial Population [1000 mfg. Employees]) * (EF [lb./ton]))/ (2000 [lb./ton])
CO Season Typical Day [lb./day] = ((Annual Emissions [tons/year]) * (2000 [lb./ton]) * (SAF))/((Activity [days/wk]) * (52 [wk./year]))
7)The Rule Effectiveness (RE) and Rule Penetration (RP) are taken into account by the division of legal and illegal open burning. This methodology does not allow for the separation of RE & RP into distinct adjustment factors.

Table 2.4.13: Klamath Falls UGB 1996 CO Season: Area Source Emissions From Commercial / Institutional On-Site Incineration

ACDP Number	(1) Commercial Incineration Source ACDP Name	(2) Annual Tons Burned	(3) CO EF (lb./ton)	(4) Control Effn (CE)	(5) Rule Effct (RE)	(6) Rule Pentrtn. (RP)	(7) Activity (d/wk)	(8) CO Season Adjust (SAF)	(9) - CO Emissions - Annual (t/yr.)	(10) Season (lb/day)
	SCC 26-01-020-000									
	Klamath Falls UGB									
18-0085	Klamath Humane Society	12	10.0	0.95	0.80	0.95	3.0	Uniform	0.06	0.21
18-0087	Eternal Hills Memorial	10	10.0	0.95	0.80	0.95	2.0	Uniform	0.05	0.28
18-0088	Klamath Cremation Service	10	10.0	0.95	0.80	0.95	3.5	Uniform	0.05	0.16
	TOTALS:	**33**							**0.16**	**0.65**

Notes:

1) These estimates are based upon DEQ Emissions calculations for commercial on-site solid waste incineration. Source ACDP Number/Name is Oregon DEQ Air Contaminant Discharge Permit number. All incinerators in the State of Oregon must have design review, permits, source tests and continuous emission monitoring. All incinerators must be permitted in Oregon. Those sources which are above the cutoff limit for CO are included in the Point Source Inventory. Sources included here are below the cutoff levels. Applicable sources here are from DEQ Permit database and are minimal sources. The following sources were not included in the incineration category.

2) "Annual Tons Burned" are based on maximum throughput per DEQ ACDP permit limits, as noted here.

Source ACDP No. & Name - Incinerators		PSEL	Comments
18-0018	Robert Edwards, Jr., M.D.	0.3 tpy	PSEL for CO is from permit Review Report; New source as of 1998
18-0056	Merle West Medical Center	negl.	Incinerator removed in 1989; Permitted for 2 boilers only
18-0083	Bio-Waste Management Corp.	Negl.	Bio. & medical waste incinerator outside UGB. Orig. permitted for 2-50 tpd input Nov. 88; ceased operation Feb. 92 (source test not conducted).
18-0085	Klamath Humane Society	Permit PSEL is based on maximum charging rate of 12 tons per year	
18-0087	Eternal Hills Memorial	Inspection memo indicates up to 200 lb/day(*2day/wk*52 wk/yr=) or 10.4 ton per year	
18-0088	Klamath Cremation Service	Permit inspection form: about 200 lb/day or 10.4 tpy	

3) Emissions Factors from FIRE version 6.0, SCC 5-03-001-01(Ref.318).

4) Control Efficiency (CE) assumed to be 95% based upon BACT requirements in rules.

5) Rule Effectiveness (RE) = 80%. EPA default (Ref. 165).

6) Rule Penetration (RP) = ((uncontrolled emissions covered by regulation/ total uncontrolled emissions) * (100)) Applicable rules for Crematory Incineration are Oregon Administrative Rules (OAR), Chapter 340, Div. 230-0010, 0030, 0200, 0210, 0220, 0230. Applicable rules for Solid & Infectious Waste Incineration are OAR, Chapter 340, Div. 230-0010, 0030, 0100, 0110, 0120, 0130, 0140, 0150.

Rule Penetration - Crematory Incinerators:

Rules effective 3/13/90; Compliance required by 3/13/93. Assumed 25% compliance in 1990, 60% in 1991 and 95% in 1992.

Rule Penetration - Solid and Infectious Waste Incinerators:

Rules effective 3/13/90; Compliance required by 3/13/95. Assumed 15% compliance in 1990, 30% in 1991, 45% in 1992, 60% in 1993, 75% in 1994, 90% in 1995. Assumed 95% compliance in 1996. None of this type found in Klamath Falls UGB.

7) Activity is from permit.

8) Seasonal Adjustment Factor (SAF) is assumed to be uniform from EPA Guidance (Ref. 2, pg. 5-18).

9) Annual emissions [tons/yr.] = (Annual tons burned * Emission Factor [lb./ton]) / 2000 [lb./ton]

10) Season Emissions [lb./day] = ((Annual Emissions [t/yr.] * 2000 [lb./ton]) / (Activity [days/wk]* 52 [weeks/yr.])) * (1-(CE*RE*RP))

Table 2.4.14 Klamath Falls UGB 1996 CO Season: Area Source Emissions From Small Point Sources

		(1)	(2)	(3)	(3)	(4)	(5)
		CO	CO		CO		
		Control	Season	CO	Yearly	---CO Emissions---	
Source		Efficncy	Adjust	Activity	Activity	Annual	Season
Number	Company Name	CE	SAF	(d/wk)	(days/yr)	(tons/yr)	(lbs/day)
SCC 1-02-009-05							
18-0023	Klamath Veneer	0.0	1	7	325	23.2	142.6
18-0097	Kingsley Field AFB	0.0	1	5	260	13	100.0
TOTAL						36.2	242.6

Notes:
1) Where controls exist, they are accounted for in the PSEL emission factor.
2) Seasonal adjustment factors were assumed to be 1 unless a reasonable seasonal adjustment factor could be determined using the Emission Statements or some other method. Pounds per Day is Average Winter Day Emissions and is calculated:
((Tons per Yr) * (2000 Lbs/Ton) * (SAF)) / (Days per Year)
3) The small point sources are selected in Appendix B, Table B-2. The selected source emits less than 100 tons CO/yr and is in the Klamath Falls UGB.
4) The daily emissions are calculated by dividing the annual emissions by the annual days of operation.
5) As recommended by Jeff Ross, Kingsley Field AFB's PSEL is used as estimated 1996 emissions because its permit does not account for engine tests where the engine is installed in the plane, it does not account for the length of a "test event", and it does not account for CO emissions from small on-site boilers, generators and other miscellaneous units. Ref. 330. Kingsley Field AFB's 1999 ACDP permit lists CO PSEL as 54.6 tons/yr. Klamath Veneer's 1996 and 1999 ACDPs PSEL is 35.5 tons/yr.

Part 2.5 NON-ROAD MOBILE SOURCES

2.5.1 INTRODUCTION AND SCOPE

Within the Klamath Falls UGB, non-road mobile emission source categories inventoried include gasoline and diesel-powered vehicles and equipment, railroads, and aircraft.

2.5.2 NON-ROAD VEHICLES AND EQUIPMENT

Emissions from off-road vehicles and equipment were evaluated using the *Nonroad Engine and Vehicle Emission Study — Report*[49a], and revision, *Methodology to Calculate Nonroad Emission Inventories at the County and Sub-county Level, Final Report*[49b]. The companion documents, *Nonroad Emission Inventories for CO and Ozone Nonattainment Boundaries*[51b, 51c], provided emission inventory data for Spokane. The Nonroad study (completed in 1991) was prepared by the EPA Office of Mobile Sources (OMS). These studies categorized and reported emissions for off-road vehicles and equipment for selected nonattainment areas. The Spokane Consolidated Metropolitan Statistical Area (CMSA) was one area studied.

Because of its proximity and socio-economic similarity to Klamath Falls, the Spokane CMSA is considered to have per capita area source emission rates similar to Klamath Falls and was chosen as a surrogate. OMS indicated that a purpose of a Nonroad Study was to provide emission data for scaling of nonattainment areas similar to the nonattainment area being inventoried[50]. At the request of DEQ, the data provided in the Nonroad Study for the Spokane CMSA was supplemented with more detailed information regarding the contribution of gasoline and diesel vehicles and equipment[51a,b,c]. The supplementary data provided by OMS was used to prepare the non-road emission estimates submitted in this SIP attainment-year inventory.

Following receipt of the revised non-road data [49b, 51b,c] from OMS in August of 1992, the non-road emission estimates for the Oregon nonattainment areas were revised and expanded. Waterborne vessels were not inventoried for Klamath Falls due to the lack of available water.

2.5.2.1 Vehicle Categories

Vehicle categories used in the Nonroad Study[49a,51b] include Lawn and Garden Equipment, Off-Highway Recreation Equipment, Construction Equipment, Industrial Equipment, Agricultural Equipment, Light Commercial Equipment, Logging Equipment, and Air Service Equipment. These vehicle categories are grouped into three equipment types: two-cycle gasoline engines, four-cycle gasoline engines, and diesel engines. A summary of emissions from non-road mobile sources can be found in Table 2.5.1.

The OMS Nonroad Study data was generated using two approaches that are identified in the Nonroad Study as Inventory A and Inventory B. The emission estimates for the 1996 Inventory Year for Klamath Falls used an average of Inventory A and B, as recommended by EPA[49b].

The approach taken with the inventory in this Report was to factor the emission estimates for the Spokane CMSA, as given in the revised Nonroad studies[51b,c], using population estimates of Klamath Falls UGB. Spokane CMSA 1990 population was utilized with information on Spokane Ozone Nonattainment Area CO emissions to develop a per capita emission factor for the pollutant from each equipment type. The per capita emission factor for each equipment type was then applied to the Klamath Falls UGB 1996 population to estimate emissions.

The non-road vehicle CO emission factors include tailpipe emissions from the Nonroad studies[51b,c]. The seasonal adjustment factors used are taken from the revised Nonroad studies[51b,c]. No State regulations pertaining specifically to non-road vehicles or equipment emissions were in effect for the 1996 inventory year, therefore control efficiency, rule effectiveness and rule penetration have not been applied to the non-road inventory calculations.

The details of these calculations and summary emissions are shown in Tables 2.5.2, 2.5.3, and Table 2.5.4.

2.5.3 AIRCRAFT

Methods of aircraft emission estimates varied by aircraft category. The categories include commercial, civil, and military. The civil aircraft category is further broken down to include the sub-categories of air taxi and general aviation. For all categories, activity is considered uniform over the year.

Klamath Falls has a commercial airport with an adjoining Air National Guard Base. Activity levels for all categories were provided by Bill Hancock, Klamath Falls International Airport operations manager[336]. Mr. Hancock provided total operations for all categories and for individual aircraft types among the commercial and military categories. Landing and Takeoff values were estimated as 1 LTO per 2 operations as indicated in *Procedures for Emission Inventory preparation, Volume IV: Mobile Sources, 1992*[6a].

For commercial aircraft activity, the fleet specific method outlined in *Volume IV: Mobile Sources, 1992*[6a] was used. Emissions were calculated using the *FAA Aircraft Engine Emission Database (FAEED)*[76]. For some aircraft, engine data was not available in the database. For these aircraft types, emissions were calculated by the database for similar aircraft types. The results generated using the FAEED program are shown in Appendix Table C-4.

The fleet specific method was also used for the estimation of military aircraft emissions. The FAEED program was utilized again and the results can be found in Appendix Table C-4.

Emissions for civil aircraft were estimated using the fleet average method described in and emission factors from *Volume IV: Mobile Sources, 1992*[6a]. The details of these calculations and summary emissions are given in Table III.5.5.

2.5.4 WATERBORNE VESSELS

Waterborne vessels fall under two categories: commercial and recreational. In the case of the Klamath Falls UGB, neither category of vessel has an applicable place within the CO emission inventory for lack of sufficient activity within the UGB. As such, the waterborne vessels were not inventoried for the Klamath Falls UGB.

2.5.5 RAILROADS

Emissions from railroad operations were estimated following the recommended methodology in *Volume IV: Mobile Sources*[91]. This method required determining fuel consumption of line haul operations and yard operations, and applying the emission factors given to each type of operation. These emission factors reflect the relative contribution to emissions from different railroad engine types: line and yard.

Fuel consumption for line haul operations was estimated using data obtained by contacting the rail organizations operating in the Klamath Falls UGB corridor in 1996: Union Pacific Railroad, Burlington Northern RR, and Amtrak Passenger Rail Transport[372]. The estimate was developed by scaling down system-wide fuel consumption by applying a ratio of fuel consumption index of Gross Ton Miles (GTM) for the system by dividing by total system fuel use. Southern Pacific also provided information on state GTM which was then reduced to Klamath Falls UGB specific GTM with a ratio of Klamath Falls UGB track miles to state track miles (see Appendix C, Table C-2). Total line haul fuel use for the Klamath Falls UGB was then calculated by multiplying the Klamath Falls UGB GTM with the previously generated fuel consumption index. Fuel use was subsequently applied to the appropriate emission factors cited above to obtain estimated line haul CO emissions within the Klamath Falls UGB.

Fuel consumption for yard operations was estimated using data obtained by contacting Union Pacific Railroad, Burlington Northern RR, and Amtrak Passenger Rail Transport[372]. Information provided by the railroad company includes the number of yard locomotives, hours per day of operation, and days per year of operation. Daily and annual fuel use was not provided , but was instead taken from *Volume IV: Mobile Source*[91]. Daily fuel use was based on 24 hours per day of operation. These data and calculations are shown in Appendix C, Table C-3.

Activity and seasonal adjustment factors of line haul and of yard operations are considered to be uniform throughout the year. Full calculations can be found on Table 2.5.6. and Appendix C, Tables C-2 and C-3.

2.5.6 NON-ROAD MOBILE SOURCE COMPARISON

The non-road mobile source categories listed above are compared and summarized in Figures 18 through 21 and in Table 2.5.1. Each category is summarized independently in Tables 2.5.2 through 2.5.6.

Figure 18: Distribution of Annual Non-Road Mobile Source Emission Summary for 1996

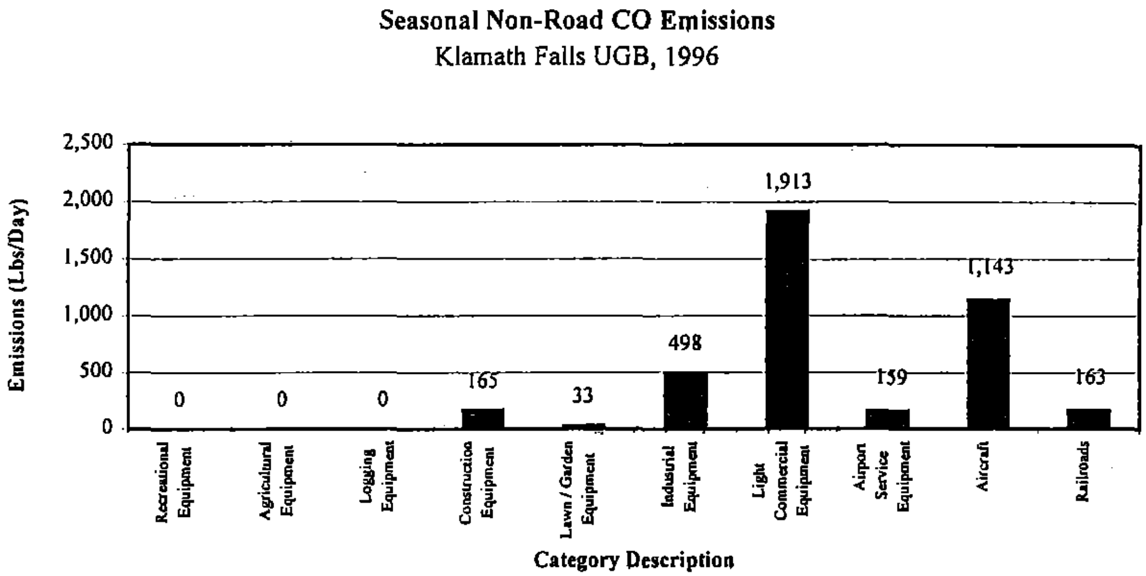


Figure 19: Percentage of Annual Non-Road Mobile Source Emission Summary for 1996

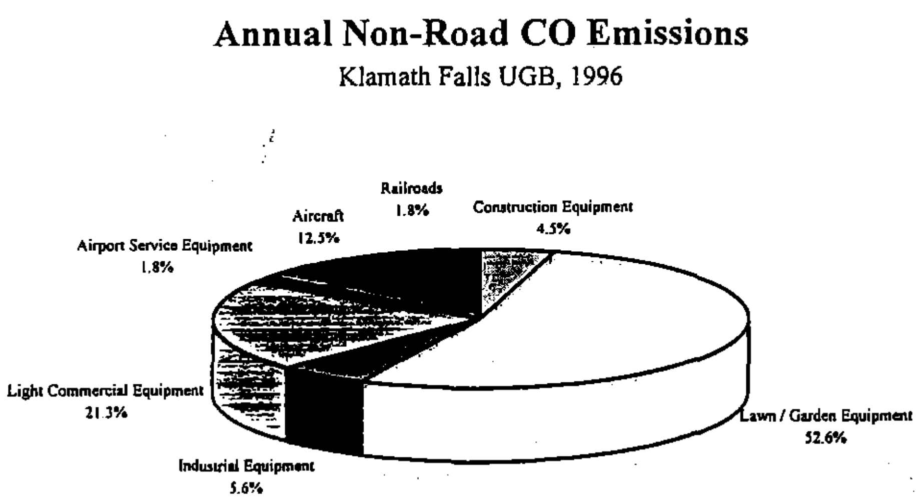


Figure 20: Distribution of Seasonal Non-Road Mobile Source Emission Summary for 1996

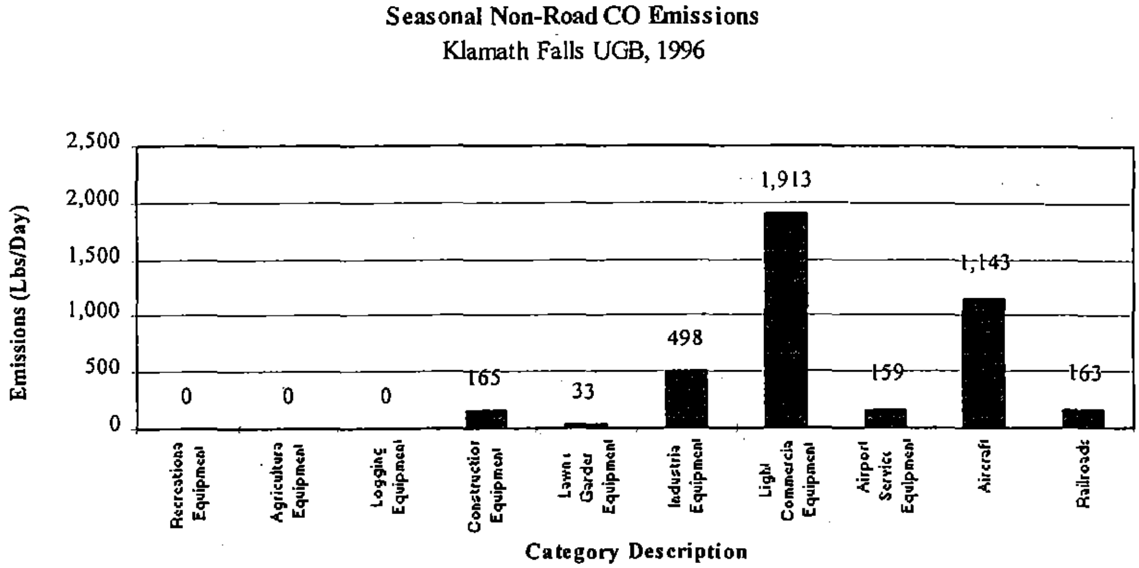
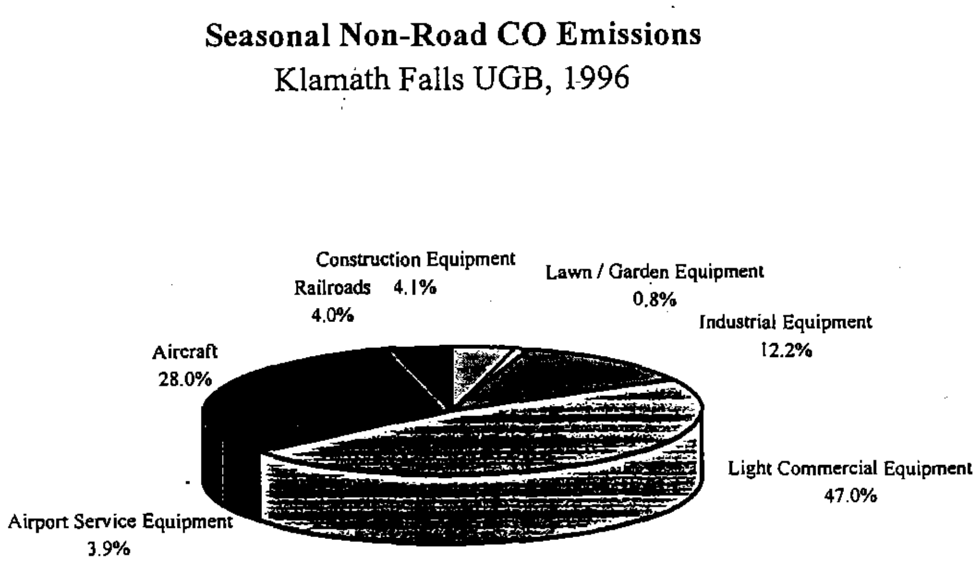


Figure 21: Distribution of Seasonal Non-Road Mobile Source Emission Summary for 1996



NON-ROAD MOBILE SOURCE SUMMARIES

Table 2.5.1: Klamath Falls UGB 1996 CO Season: Summary Emissions From Non-Road Mobile Sources

Non-Road Categories Source Description	Summary Table Number	SCC Label	CO Annual Emissions [tons/yr]	CO Season Emissions [lbs/day]
NONROAD VEHICLES --- GASOLINE TWO-CYCLE				
Recreational Equipment	2.5.2	22-60-001-000	0.0	0.0
Construction Equipment	2.5.2	22-60-002-000	2.2	6.6
Industrial Equipment	2.5.2	22-60-003-000	20.7	112.4
Lawn / Garden Equipment	2.5.2	22-60-004-000	132.9	8.8
Agricultural Equipment	2.5.2	22-60-005-000	0.0	0.0
Light Commercial Equipment	2.5.2	22-60-006-000	17.1	92.5
Logging Equipment	2.5.2	22-60-007-000	0.0	0.0
Airport Service Equipment	2.5.2	22-60-008-000	0.1	0.0
Gasoline 2-Cycle Subtotal			173	220
NONROAD VEHICLES --- GASOLINE FOUR-CYCLE				
Recreational Equipment	2.5.3	22-60-001-000	0.0	0.0
Construction Equipment	2.5.3	22-60-002-000	28.5	61.7
Industrial Equipment	2.5.3	22-60-003-000	68.1	368.0
Lawn / Garden Equipment	2.5.3	22-60-004-000	742.8	24.2
Agricultural Equipment	2.5.3	22-60-005-000	0.0	0.0
Light Commercial Equipment	2.5.3	22-60-006-000	335.2	1,811.2
Logging Equipment	2.5.3	22-60-007-000	0.0	0.0
Airport Services Equipment	2.5.3	22-60-008-000	20.7	112.4
Gasoline 4-Cycle Subtotal			1,195	2,378
NONROAD VEHICLES --- DIESEL CYCLE				
Recreational Equipment	2.5.4	22-60-001-000	0.0	0.0
Construction Equipment	2.5.4	22-60-002-000	43.7	97.0
Industrial Equipment	2.5.4	22-60-003-000	3.6	17.6
Lawn / Garden Equipment	2.5.4	22-60-004-000	0.4	0.0
Agricultural Equipment	2.5.4	22-60-005-000	0.0	0.0
Light Commercial Equipment	2.5.4	22-60-006-000	1.5	8.8
Logging Equipment	2.5.4	22-60-007-000	0.0	0.0
Airport Services Equipment	2.5.4	22-60-008-000	8.5	46.3
Diesel Cycle. Subtotal			58	170
NON-ROAD ENGINES/ VEHICLE SUBTOTAL		:	1,425.9	2,768
AIRCRAFT				
Military Aircraft	2.5.5	22-75-001-000	78.9	432.5
Commercial Aircraft	2.5.5	22-75-020-000	11.7	63.8
General Aviation	2.5.5	22-75-050-000	97.0	531.6
Air Taxi	2.5.5	22-75-060-000	20.9	114.7
AIRCRAFT SUBTOTAL	2.5.5	22-75-000-000	209	1,143
RAILROADS				
Line Haul Locomotives	2.5.6	22-85-002-000	23.8	131.0
Switch Yard Locomotives	2.5.6	22-85-002-000	5.9	32.4
RAILROAD SUBTOTAL	2.5.6	22-85-000-000	29.7	163
			(tons/yr)	(lbs/day)
TOTAL NON-ROAD MOBILE SOURCES		:	1,664	4,074

Table 2.5.2: Klamath Falls UGB 1996 CO Season: Summary Emissions From Non-Road Vehicles & Equipment, Two-Cycle

(1) Equipment Category (2-Cycle Gasoline Engines) Klamath Falls UGB	(2) Klamath Falls UGB Population [persons]	(3) CO EF [lbs/person]	(4) CO SAF	(5) CO Emissions Annual [tons/yr]	(5) CO Emissions CO Season [lbs/day]
SCC 22-60-001-000 Recreational Equipment	40,365	0.00	0.00	0.0	0.0
SCC 22-60-002-000 Construction Equipment	40,365	0.11	0.54	2.2	6.6
SCC 22-60-003-000 Industrial Equipment	40,365	1.02	0.99	20.7	112.4
SCC 22-60-004-000 Lawn/Garden Equipment	40,365	6.59	0.01	132.9	8.8
SCC 22-60-005-000 Agricultural Equipment	40,365	0.00	0.00	0.0	0.0
SCC 22-60-006-000 Light Commercial Equipment	40,365	0.85	0.99	17.1	92.5
SCC 22-60-007-000 Logging Equipment	40,365	0.00	0.00	0.0	0.0
SCC 22-60-008-000 Airport Services Equipment	40,365	0.01	0.00	0.1	0.0
UGB TOTAL:				173	220

Notes: 1)Recreational Equipment does not include Water Recreation vehicles as are defined in the Non-road Emissions inventories (Ref 51c & Append C-1).
2)1996 Klamath Falls UGB population figure developed by the City Planner for Klamath Falls Cameron Gloss. Ref. 333. 1996 Klamath Falls UGB population: 40,365. Also see Appendix B, Table B-1
3)The per capita emission factors are derived from the Nonroad Emission inventories (Appendix C, Table C-1 which is compiled using Ref 51c, Spokane CMSA 1990 Pop).

Equipment Category	CO NAA Population [10^3 persons]	CO NAA Emissions [tons/year]	Emission Factor [lbs/person]
Recreational Equipment	361.36	0	0.00
Construction Equipment	361.36	20	0.11
Industrial Equipment	361.36	185	1.02
Lawn & Garden Equipment	361.36	1,190	6.59
Agricultural Equipment	361.36	0	0.00
Light Commercial Eq.	361.36	153	0.85
Logging Equipment	361.36	0	0.00
Air Services Equipment	361.36	1	0.01
Total		1,549	

(Emission Factor, lbs/person) = (CO NAA Emissions, t/yr * 2000 lbs/t) / (Spokane Study Population)

4)The CO Season Adjustment factors (SAF) are derived from factors given in the Nonroad Emission inventories (Refs 51c), also found in Appendix C, Table C-1. Recreation and Lawn/Garden equipment SAFs reflect seasonal use of chainsaws, snowblowers, and snowmobiles. Recreational, agricultural, & logging equipment contained undefinable SAF because both the numerator and the denominator was equal to zero. As such, those three categories were assigned SAFs of zero.
5)(Annual Emissions, tons/yr) = (NAA Population) * (Emission Factor) / (2000 lbs/ton)
(Season Emissions, lbs/day) = (Annual Emissions, t/yr) * (2000 lbs/ton) * SAF / (365 days/yr).
Assumes seasonal activity for each equipment type listed is 7 days per week and 52 weeks per year.
6) No applicable rules for non-road vehicles, no RE, RP, or CE applied.

Table 2.5.3: Klamath Falls UGB 1996 CO Season: Summary Emissions From Non-Road Vehicles & Equipment, Four-Cycle

(1) Equipment Category (4-Cycle Gasoline Engines)	(2) Klamath Falls UGB Population	(3) CO EF (lbs/person)	(4) CO Seasonal Adjustment Factor (SAF)	(5) CO Emissions Annual (t/yr)	CO Season (lbs/day)
Klamath Falls UGB					
SCC 22-60-001-000 Recreational Equipment	40,365	0.00	0.00	0.0	0.0
SCC 22-60-002-000 Construction Equipment	40,365	1.41	0.40	28.5	61.7
SCC 22-60-003-000 Industrial Equipment	40,365	3.38	0.99	68.1	368.0
SCC 22-60-004-000 Lawn/Garden Equipment	40,365	36.80	0.01	742.8	24.2
SCC 22-60-005-000 Agricultural Equipment	40,365	0.00	0.00	0.0	0.0
SCC 22-60-006-000 Lt Commrcl Equipment	40,365	16.61	0.99	335.2	1,811.2
SCC 22-60-007-000 Logging Equipment	40,365	0.00	0.00	0.0	0.0
SCC 22-60-008-000 Airport Services Equipment	40,365	1.02	0.99	20.7	112.4
UGB Total				1,195	2,378

Notes:
1)Recreational Equipment does not include Water Recreation vehicles; as are defined in the Nonroad Emissions inventories (Ref 51c & Append C-1).
2)1996 Klamath Falls UGB population figure developed by Cameron Gloss, City Planner for Klamath Falls, Ref.333. 1996 Klamath Falls UGB population: 40,365. Also see Appendix B, Table B-1.
3) The per capita emission factors are derived from the Non-road Emission inventories (Append. C, Table C-1 which is compiled using Ref 51c, Spokane CMSA 1990 Pop US Census Estimates).

Equipment Category (4-Cycle)	CO NAA Population (10^3 people)	CO NAA Emissions (tons/year)	CO NAA EFs (lbs/person)
Recreational Equipment	361.36	0	0.00
Construction Equipment	361.36	255	1.41
Industrial Equipment	361.36	610	3.38
Lawn & Garden Equipment	361.36	6,650	36.80
Agricultural Equipment	361.36	0	0.00
Light Commercial Eq.	361.36	3,001	16.61
Logging Equipment	361.36	0	0.00
Air Services Equipment	361.36	185	1.02
Total		10,701	

(Emission Factor lbs/person) = (CO NAA Emissions t/yr * 2000 lbs/t) / (Spokane Population)

4) The CO Season Adjustment factors (SAF) are derived from factors given in the Nonroad Emission inventories (Refs 51c),also found in Appendix C, Table C-1. Recreation and Lawn/Garden equipment SAFs reflect seasonal use of chainsaws, snowblowers, and snowmobiles. Recreational, agricultural, & logging Equipment contained undefinable SAF because both the numerator and the denominator was equal to zero. Those three categories were assigned SAFs of zero.
5) (Annual Emissions t/yr = (NAA Population) * (Emission Factor) / 2000 lbs/ton)
(Season Emissions lbs/day) = (Annual Emissions t/yr) * (2000 lbs/t) * SAF / (days/yr).
6) No applicable rules for non-road vehicles, no RE, RP, or CE applied.

Table 2.5.4: Klamath Falls UGB 1996 CO Season: Summary Emissions From Non-Road Vehicles & Equipment, Diesel

(1)	(2)	(3)	(4)	(5)	
Equipment Category (Diesel-type Engines)	K.FallsUGB Population	CO EF	CO SAF	---------- CO Emissions -------- Annual	CO Season
Klamath Falls UGB	(persons)	(lbs/person)		(t/yr)	(lbs/day)
SCC 22-60-001-000 Recreational Equipment	40,365	0.00	0.00	0.0	0.0
SCC 22-60-002-000 Construction Equipment	40,365	2.16	0.41	43.7	97.0
SCC 22-60-003-000 Industrial Equipment	40,365	0.18	0.90	3.6	17.6
SCC 22-60-004-000 Lawn/Garden Equipment	40,365	0.02	0.00	0.4	0.0
SCC 22-60-005-000 Agricultural Equipment	40,365	0.00	0.00	0.0	0.0
SCC 22-60-006-000 Light Commercial Equipment	40,365	0.07	1.11	1.5	8.8
SCC 22-60-007-000 Logging Equipment	40,365	0.00	1.11	0.0	0.0
SCC 22-60-008-000 Airport Services Equipment	40,365	0.42	0.99	8.5	46.3
UGB Total			:	58	170

Notes:

1) Recreational Equipment does not include Water Recreation vehicles; as are defined in the Non-road Emissions inventories (Ref 51c & Append C-1).

2) 1996 Klamath Falls UGB population figure developed by Cameron Gloss, Ref. 333

1996 Klamath Falls UGB population: 40,365. Also see Appendix B, Table B-1.

3) The per capita Emission Factors (EF, in "lb/person") are from the Nonroad Emission inventories (Appendix C, Table C-1 which is compiled using Ref 51c, Spokane CMSA 1990 Pop).

Equipment Category (Diesel)	CO NAA Population [10^3 people]	CO NAA Emissions [tons/year]	CO NAA EF [lbs/person]
Recreational Equipment	361.36	0.0000	0.00
Construction Equipment	361.36	391	2.16
Industrial Equipment	361.36	32	0.18
Lawn & Garden Equipment	361.36	4	0.02
Agricultural Equipment	361.36	0.0000	0.00
Light Commercial Eq.	361.36	13	0.07
Logging Equipment	361.36	0.0000	0.00
Air Services Equipment	361.36	76	0.42
Total		516	
Emission Factor [lbs/person] = CO NAA Emissions [t/yr] * [2000 lbs/t] / [Spokane Study Population]			

4) The CO Season Adjustment factors (SAF) are derived from factors given in the Nonroad Emission inventories (Ref 51c), also found in Appendix C, Table C-1. Recreation and Lawn/Garden equipment SAFs reflect seasonal use of chainsaws, snowblowers, and snowmobiles. Recreational, agricultural, & logging equip contained undefinable SAF because both the numerator and the denominator was equal to zero. As such, those three categories were assigned SAFs of zero.

5)Annual Emissions [t/yr] = [NAA Population] * [Emission Factor] / [2000 lbs/ton]

Season Emissions [lbs/day] = Annual Emissions [t/yr] * [2000 lbs/t] * SAF[ ] / [days/yr]

6) No applicable rules for non-road vehicles, no RE, RP, or CE applied.

Table 2.5.5: Klamath Falls UGB 1996 CO Season: Non-Road Source Emissions From Aircraft

Area/Airport	(1) 1996 LTOs	CO EF	Annual (t/yr)	(4) CO Emissions CO Season (lbs/day)
SCC 22-75-000-000				
Klamath Falls U.G.B.				
		(2)		
Klamath County		(lbs/LTO)		
Kingsley Field				
Air Taxi	1,488	28.13	20.9	114.7
GA-Local	5,138	12.01	30.9	169.1
GA-Itinerant	11,014	12.01	66.2	362.5
		(3) (lbs/year)		
Commercial	2,140	23,303	11.7	63.8
Military-FAA	7,493	157,847	78.9	432.5
		Total County:	209	1143

Notes:

1) LTOs are individual aircraft Landings (i.e., arrivals) and Take-Offs (i.e., departures). Civil Aircraft (Air Taxi and General Aviation), Commercial Aircraft and Military Aircraft Operations from Bill Hancock, Airport Operations Manager at Klamath Falls International Airport (**Ref 336**). LTOs = Operations / 2. Note: FAA Air Traffic Activity (previous **Ref 77**) for 1996 is not available.

Note: FAA Airport Activity Stats of Cert. Route Carriers (previous **Ref 75**) for 1996 is not available.

2) Emission Factors from EPA Mobile Sources, Volume IV (**Ref 91**), SECTION 5.2.4.2, PAGE 176.

3) Results from Appendix Tables C-4 (lbs per year)

4) Civil Aircraft Emissions were Calculated Using the Fleet Average Method Outlined in (**Ref 91**).
Tons per Year Emissions = (LTO's per Year)*(Lbs/LTO)/(2000Lbs/Ton)
Lbs per Day Emissions = (LTO's/Yr)*(Lbs/LTO)/(365 Days/Yr)
Commercial Emissions were computed by the FAA Aircraft Engine Emission Database (FAEED) using the Aircraft-Specific Inventory Method outlined in (**Ref 91**) (see Appendix C, Table C-4);
Military Emissions were computed by the FAA Aircraft Engine Emission Database (FAEED) using the Aircraft-Specific Inventory Method outlined in (**Ref 91**) (see Appendix C, Table C-4);
Tons per Year Emissions = (Lbs/Yr)/(2000 Lbs/Ton)
Lbs per Day Emissions = (Lbs/Yr)/(365 Days/Yr)

5) Rule Effectiveness, Rule Penetration, and Control Efficiency are not applied to this category because there are no applicable rules for aircraft operations.

Table 2.5.6: Klamath Falls UGB 1996 CO Season: Non-Road Source Emissions From Railroads

LOCOMOTIVE EMISSIONS	(1) Fuel Consumption	(2) CO Emission Factor	(3) Weekly Activity	(4) Seasonal Adjustment Factor (SAF)	(5) ---- CO Emissions ---- Annual Emissions	Seasonal Emissions
	[gallons]	[lbs CO/gal]	[d/wk]	[—]	[t/yr]	[lbs/day]
SCC 22-85-000-000						
Railroads within KlamathFalls UGB						
SCC 22-85-005-000						
Line Haul Locomotives	761,725	0.0626	7	1.0	23.8	131.0
SCC 22-85-010-000						
Switching Yard Locomotives	131,965	0.0894	7	1.0	5.9	32.4
					[t/yr]	[lbs/day]
TOTAL Klamath Falls CO EMISSIONS from RAILROADS					**29.7**	**163.4**

Notes:
1) Fuel consumption calculation method from EPA Mobile Source, Volume IV - Section 6 **(Ref 91)**.
See Appendix C, Table C-2 for Line Haul calculation worksheet.
See Appendix C, Table C-3 for Yard Operation calculation worksheet.
2) Locomotive Emission Factors from Procedures Document, Volume IV Table 6-1 (Line Haul Locomotives) and Table 6-3 (Switch Yard Locomotives) **(Ref 91)**.
3) Weekly Activity is the typical number of days of operation per week.
4) The "CO Season" for this EI is the three full months of December, January and February.
Seasonal fuel consumption is assumed to be uniform with a Seasonal Adjustment Factor (SAF) = 1.0.
5) Annual Emissions [t/yr] = ((gallons fuel burned) * (EF)) / (2000 [lbs/ton])
Seasonal Emissions [lbs/day] = (Annual Emissions [t/yr]) * (2000 [lbs/t]) * SAF / ([days/yr])

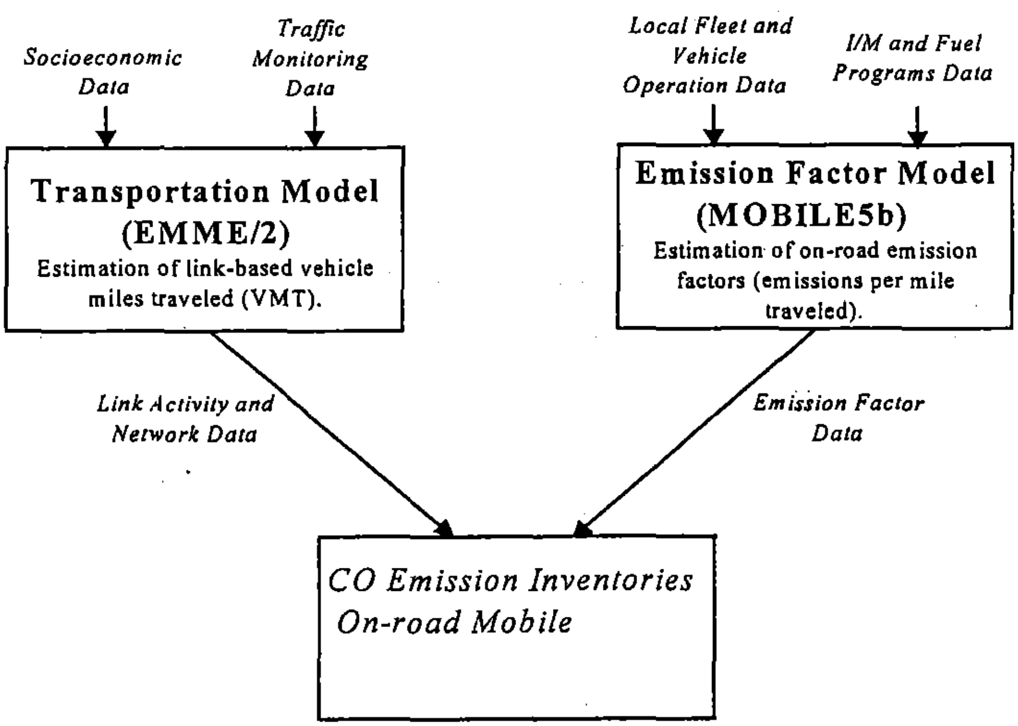
Part 2.6 ON-ROAD MOBILE SOURCES

2.6.1 INTRODUCTION AND SCOPE

The 1996 and 2015 carbon monoxide emission inventories from on-road mobile sources were completed in accordance with the current EPA emission inventory preparatory guidelines[91,133] and approved emission factor model (MOBILE5b).[332] This component of the emission inventory was completed by ODEQ, but incorporated several key elements and contributions from the ODOT and other local jurisdiction participants. At various points in this section, reference is made to the material assembled into Appendix D of this report. Appendix D provides supplemental, technical detail related to the development of the on-road motor vehicle emission inventory.

Figure 22 provides an overview of the inventory process for on-road mobile sources. As shown in the boxed text of this figure, the two main steps in developing inventories were (1) link-based activity estimation using the EMME/2 transportation network travel demand model, (2) fleet CO emission factor modeling using the EPA's MOBILE5b model. The completion of each of these individual steps is discussed in section 2.6.2. These are followed by a presentation of the inventory results in Section 2.6.3.

Figure 22. Overview of main processing steps and software used for the on-road mobile source emission inventory.



2.6.2 METHODOLOGY AND APPROACH

2.6.2.1 Estimating Vehicle Activity

Vehicle activity data used to estimate on-road mobile source emissions were obtained from ODOT's EMME/2 transportation network travel demand model. The Oregon Department of Transportation, designed and completed the EMME/2 transportation network travel demand modeling for the Klamath Falls 1998 Transportation System Planning (TSP) required by the Oregon Department of Transportation and Department of Land Conservation and Development's Transportation Planning Rule. ODEQ reaped the benefit of this Transportation System Planning effort and was supplied the relevant data. ODEQ, in turn, reviewed the socioeconomic data and other assumptions contained within the EMME/2 model set up for 1996 as they pertain to the emission inventory development process.

TRAVEL DEMAND MODEL

A 1996 travel demand model using EMME/2 software was developed by ODOT's Transportation Planning Analysis Unit. The model includes trip generation, trip distribution, and traffic assignment steps. It was validated to 1996 ground counts. Travel times were calculated per link with delays as assigned to simulate stop and intersection controls. The model generates 24-hour traffic volumes, which were used to calculate vehicle miles traveled (VMT) for the region.

Land use forecasts were prepared for the model based on current land use regulations and comprehensive plan updates for the City of Klamath Falls and parts of Klamath County. The data was allocated to individual transportation analysis zones (TAZs) established within the EMME/2 model. More extensive model documentation is provided in the Appendix D, Table D-6.

Average daily and peak hour traffic volumes and speeds were used for the ODEQ air quality analysis. This data includes traffic links within the study area for the years 1990 and 1996. Predicted future year traffic is based on predicted population and employment growth, land use planning and projected household survey results. The projected VMT growth in Klamath Falls is estimated to be two percent (2%) per year.

VEHICLE MILES TRAVELED (VMT) ESTIMATION

Estimates of Vehicle Miles Traveled (VMT) were produced for the base year and future years using the EMME/2 model. The 1996 base year transportation model was validated to an inventory of existing traffic counts using Federal Highway Administration guidelines.

Vehicle activity in the form of vehicle miles traveled (VMT) were derived from the EMME/2 travel demand model developed by ODOT as part of the 1998 Transportation System Plan (TSP) and Transportation Improvement Program (TIP) for Klamath Falls. As part of the Transportation System Plan an air quality conformity determination was also conducted. The 1998 TSP/TIP represented the anticipated transportation needs of the Klamath Falls area to the year 2015 and included roadway types useful for reporting purposes. The validation of the EMME/2 network was considerably more extensive than the local Highway Performance Monitoring System (HPMS) network. The data values reported in this document do not reflect HPMS-based adjustments.

The EMME/2 data acquired from ODOT, modeled typical weekday activity in 1996 and 2015. These data included link distance, travel time, speed estimates and VMT for each link in the transportation network as well as the additional, off-network activity assigned to local travel. The location of link nodes (start and end points of the link segment) were also provided in order to properly place the location of activity within the Klamath Falls UGB. Overall, the domain covered by the EMME/2 modeling is larger than that of the Klamath Falls UGB. For the estimation of CO emission inventories, thus, only the links located within the Klamath Falls UGB were used to estimate vehicle activity (and thus emissions). The ODOT provided the Klamath Falls UGB boundary along with the link node location data. The 1996 activity estimates were calculated by back casting the link-level activity from current count data and by projecting 1990 network output. In summary, the 1996 vehicle activity data used in this CO inventory are presented in Appendix D.

2.6.2.2.1 Temporal Adjustments

Temporal adjustments to the VMT data were evaluated by the DEQ. The VMT adjustment factors for the CO season were estimated by DEQ in consultation with ODOT to account for monthly variation in on-road activity and are presented in Table 2.6.1.[313] The results of this calculation are shown in Appendix D Table D-6

2.6.2.2 Emission Estimation

The EPA's MOBILE5b model was used to calculate CO exhaust emission factors from on-road mobile sources in accordance with EPA reference documents and guidelines.[133, 217, 315, 332] MOBILE5b develops emission factors in the units of grams per mile and includes the effects of fleet characteristics, vehicle operating conditions, vehicle emission standards, fuel parameters, and ambient conditions. Carbon monoxide emission factors were developed for 1996 and 2015 under local modeling conditions.

2.6.2.3 Inputs to MOBILE5b

Location-specific data were used in place of the model's default values when available. Input data addressing the following modeling parameters were used in the inventory process and were provided by the DEQ.[246,247,316]

2.6.2.3.1 One-time Data

The critical Flag data and associated one-time data are summarized below.

Tampering Rates - The vehicle tampering rates supplied by MOBILE5b were used in this analysis. TAMFLG was set to 1(min/max temperature).

Speeds - One speed was assumed to apply to all eight vehicle types, so SPDFLG was set to 1.

VMT Mix by Vehicle Type - Spot checks indicated that there would be almost no difference between using the local data and the national default VMT mix. Consequently, the VMFLG was set to 1 and the MOBILE5b default settings were used.

Annual Mileage Accumulation Rates and Registration Distributions - Based on guidance in Volume IV, national annual mileage accumulations in MOBILE5b were used. Registration data covering passenger vehicles was obtained from the Oregon Motor Vehicles Division for light-duty gasoline vehicle (LDGV) and light-duty diesel vehicle (LDDV) for Klamath County. MYMRFG was therefore set to 3.

Basic Emission Rates - MOBILE5b rates were used, so NEWFLG was set to 1.

Inspection and Maintenance (I/M) Program - No I/M program exists so IMFLAG set to 1.

Additional Correction Factors - No additional correction factors were applied to the Klamath Falls area analysis. Therefore ALHFLG was set to 1.

Anti-Tampering Program – No anti-tampering program exists so ATPFLG set to 1.

Refueling Emissions - Refueling emissions for the Klamath Falls UGB were not calculated with MOBILE5b emission factors, nor are they necessary for a CO inventory, so RLFLAG was set to 5.

Local Area Parameter Flag - This flag was set to 2 (one record input for all scenarios).

Minimum and Maximum Daily Temperature – Local data on the minimum and maximum daily temperatures for Klamath Falls were collected from the EPA AIRS records for the prior three CO seasons (1994, 1995 and 1996). Average values were calculated for the minimum and maximum temperatures in accordance with the guidance. The ten highest CO days from the design period and corresponding temperatures are contained in Appendix D, Table D1. The TEMFLG was set to 1 indicating the min/max temperatures were used to model the typical winter day in accordance with the MOBILE5b guidance. The minimum and maximum Klamath Falls CO season averages are:

Minimum Daily Temperature – 17.3 Degrees F.
Maximum Daily Temperature - 42.0 Degrees F.

Idle Emission Factor Calculation – The IDLFLG was set to 1 because these emissions are not necessary for a CO inventory.

Composition of "HC" Emission Factors - In accordance with Volume IV guidance, NMHFLG was set to 3 to compute VOC emissions.

HC Emission Factor Output – The HCFLAG was set to 1 to print only the sum of the HC components as they are not necessary for a CO study.

2.6.2.3.2 Local Area Perimeter Record

Scenario Name – States that this is the Klamath Falls CO EF model.

Fuel Volatility Class – Left blank to indicate that no reformulated gasoline is assumed in the modeling.

Minimum and Maximum Temperatures – The 24--hour minimum and maximum temperatures on the ten days with the highest 8-hour CO measurements during the 1994 –1996 CO seasons were taken from EPA AIRS and averaged respectively.

Base Reid Vapor Pressure (RVP) - The 1996 winter RVP value of 13.6 was obtained initially from EPA in a telephone conversation. The RVP was also verified by referral to ASTM data[168] where Oregon distributors are allowed to distribute class D or E fuel (13.5 or 15 psi) during the winter months (Dec., Jan., Feb.) and it has since been determined that the average winter Oregon RVP is 13.6. The Period 2 parameter was also set at 13.6 and the start year of period 2 was defaulted to 2020.

Oxygenated Fuel - For the 1996 CO season, oxygenated fuel was dispensed in the Klamath Falls area, however, it was modeled without oxy fuel to provide a fair comparison with the 2015 model year in which there will be no oxy requirement. In addition, Klamath Falls CO levels in 1996 were approximately half the NAAQS (4.8 ppm second high) and 1996 attainment emissions level could easily be established without including the effect of oxygenated fuels. Therefore, the MOBILE5b flag was set to 1 indicating no oxy fuel use.

Diesel Sales Fraction - No local data has been available on diesel sales, so this flag was set to 1.

Reformulated Gasoline – No reformulated gasoline is used so this flag was left blank.

2.6.2.3.2 Scenario-specific Data

The scenario-specific data values are shown below.

Region - The Klamath Falls area is considered as low altitude, so this parameter was set to 1.

Calendar Year - The base year for this emission inventory update is 1996, so this parameter was initially set to 96.

Speed - Speed was calculated in the EMME/2 model. It is a function of the length of the node and travel time. In an effort to estimate more precisely the emission rate for any given speed the ODOT EMME/2 model allowed for speeds to be any positive number and used an estimated function to reflect a more accurate rate for any given speed. These speeds were then used in MOBILE5b calculations. Therefore, link speeds began at 6 mph and progressed accordingly to 65 mph.

Ambient Temperature - With TEMFLG set at 1 to use the minimum and maximum temperature inputs, the ambient temperature was set at 27.3 degrees Fahrenheit as the average ambient temperature.

Operating Modes – The standard operating mode fractions of 20.6, 27.3, and 20.6 (national defaults) were used to represent the cold start, stabilized, and hot start operation modes.

Month of operation – This field was left blank and is defaulted to run a January 1 scenario.

The detailed documentation of the MOBILE5b input data and specifications are included in Appendix D in addition to the model outputs.

2.6.2.3 Emission Scenario

Emission factors for an inventory scenario were completed representing both annual and CO seasonal differences in the reporting period and the discontinuation of the oxygenated fuel program. One inventory was completed for the 1996 attainment year: annual and CO season inventories. One inventory was completed for the 2015 maintenance plan representing the removal of oxygenated fuels during the winter CO season.

Following the approval by EPA the mobile source emission estimates for 1996 did not include the Oxygenated fuel distribution in the MOBILE5B input file parameter configuration.

2.6.3 SUMMARY OF MOBILE SOURCE EMISSIONS

On-road mobile source emissions have been summarized in the following Figures and Tables by vehicle class and by roadway type for annual and seasonal daily CO emissions.

Using the procedures, data and models described above, the on-road mobile source emission inventory was completed. The results of the on-road mobile emission estimates within the Klamath Falls UGB are shown in Figures 23 through 30. Table 2.6.1 and 2.6.2 presents additional inventory results reported by vehicle class and roadway type, respectively. The data in Table 2.6.1 show that the majority of the annual on-road mobile source emissions originate from light-duty gasoline vehicles (automobiles) and light-duty gasoline trucks. These vehicle classes emit 87 percent of the fleet total on-road inventory. Table 2.6.3. represents seasonal adjustment factors determination.

Figure 23: Distribution of Annual On-road Mobile CO Emissions by Vehicle Class, 1996

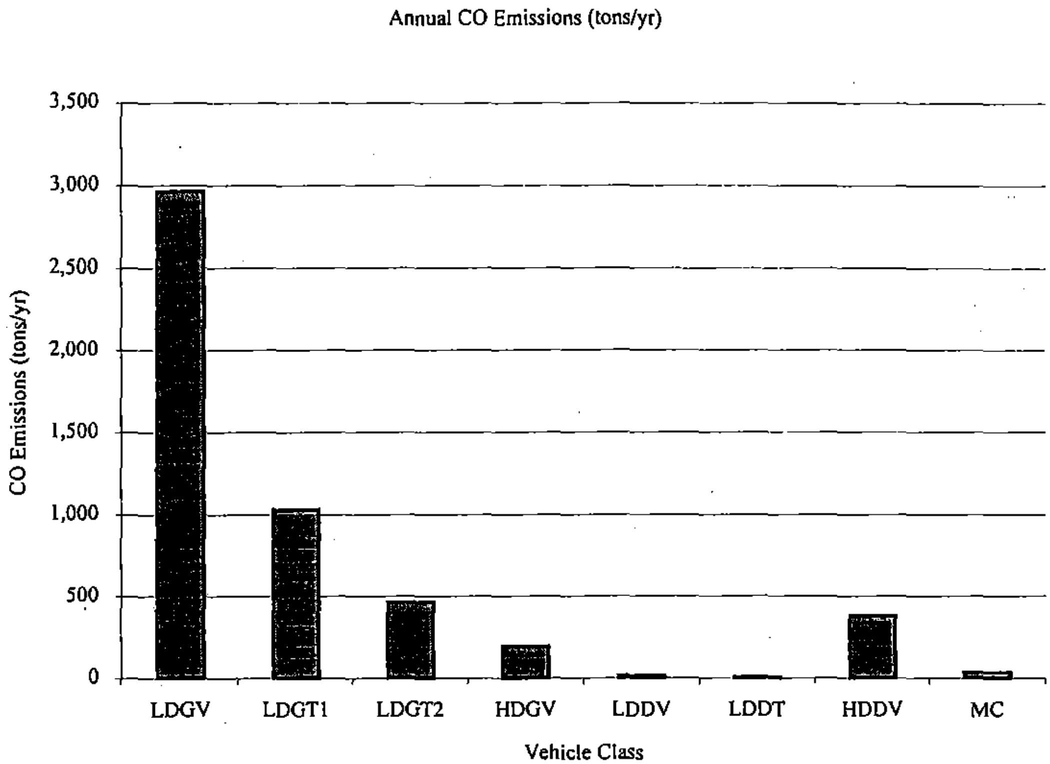


Figure 24: Percentage of Annual On-road Mobile CO Emissions by Vehicle Class, 1996

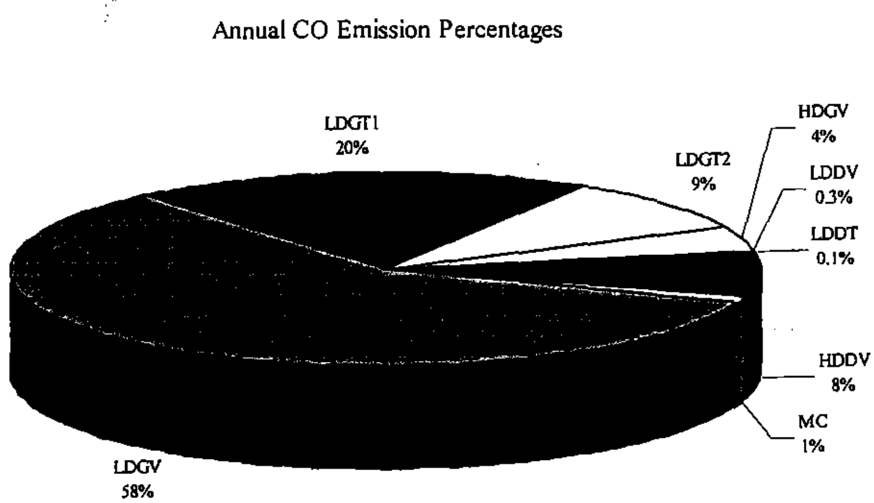


Figure 25: Distribution of Annual On-road Mobile CO Emissions by Roadway Type, 1996

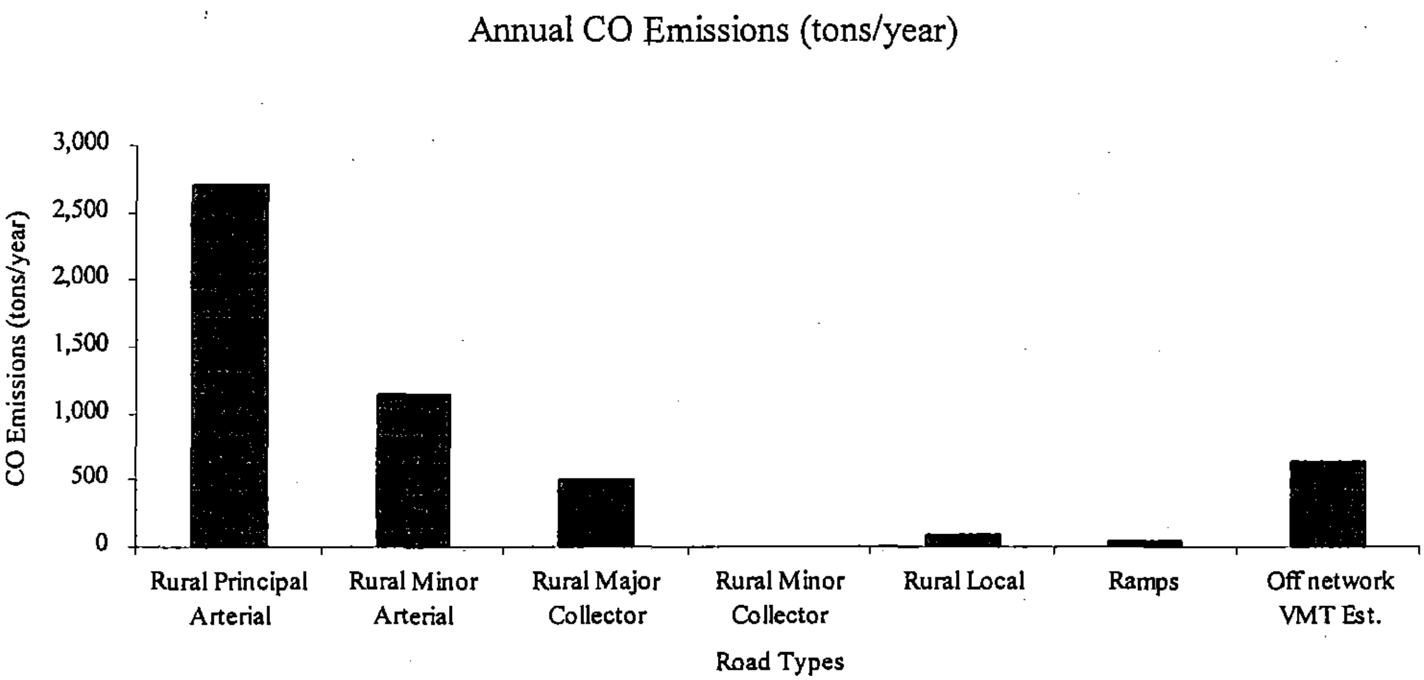


Figure 26: Percentage of Annual On-road Mobile CO Emissions by Roadway Type, 1996

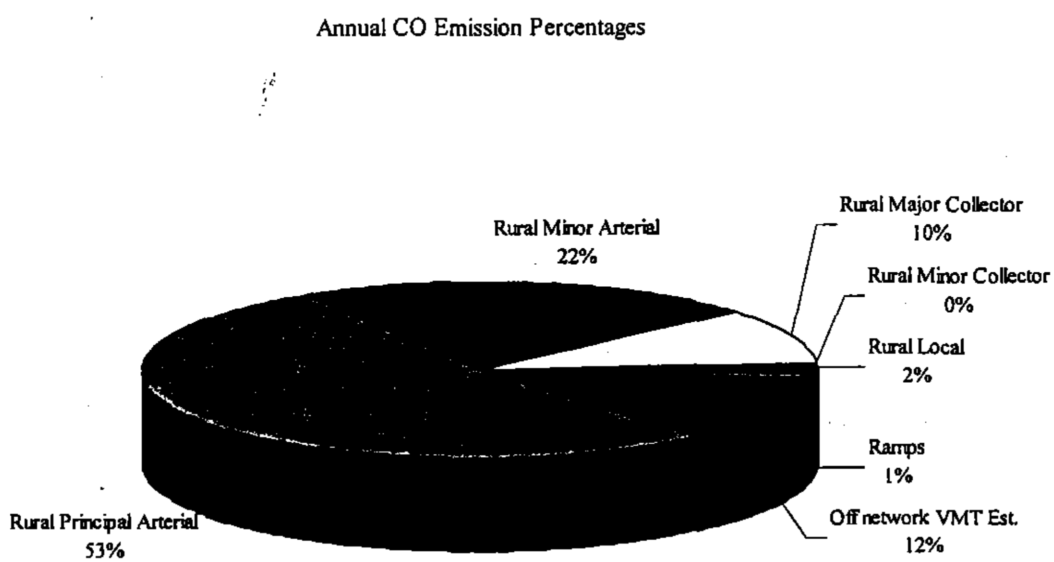


Figure 27 Distribution of Seasonal On-road Mobile CO Emissions by Vehicle Class, 1996

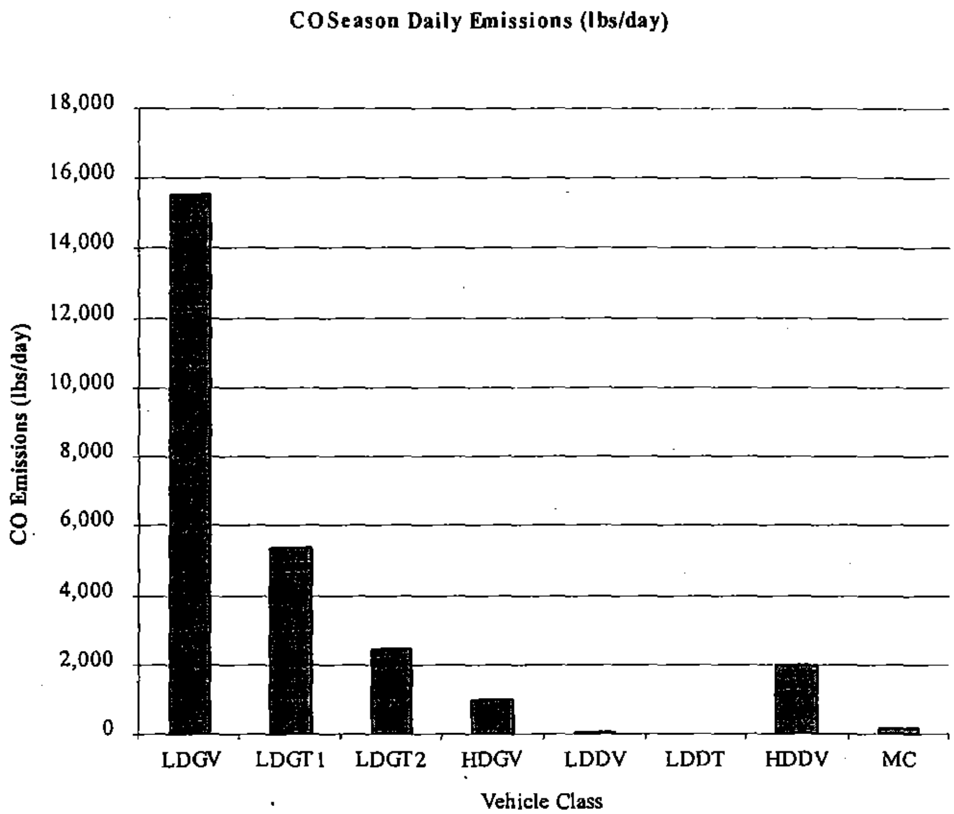


Figure 28: Percentage of Seasonal On-road Mobile CO Emissions by Vehicle Class, 1996

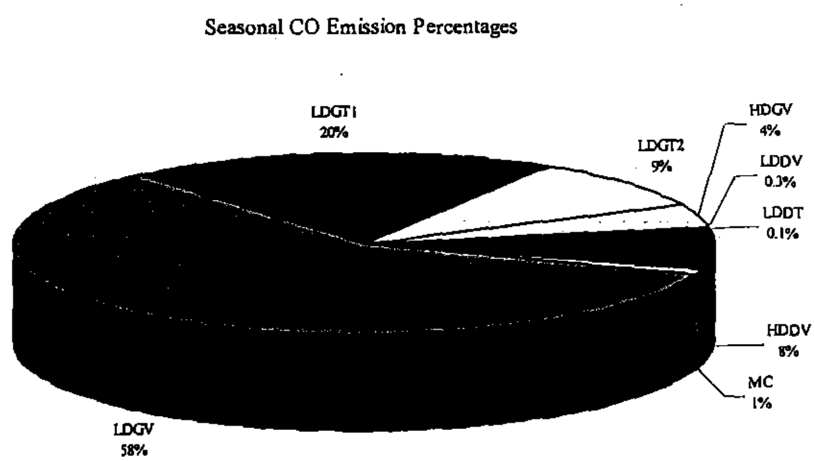


Figure 29: Distribution of Seasonal On-road Mobile CO Emissions by Roadway Type, 1996

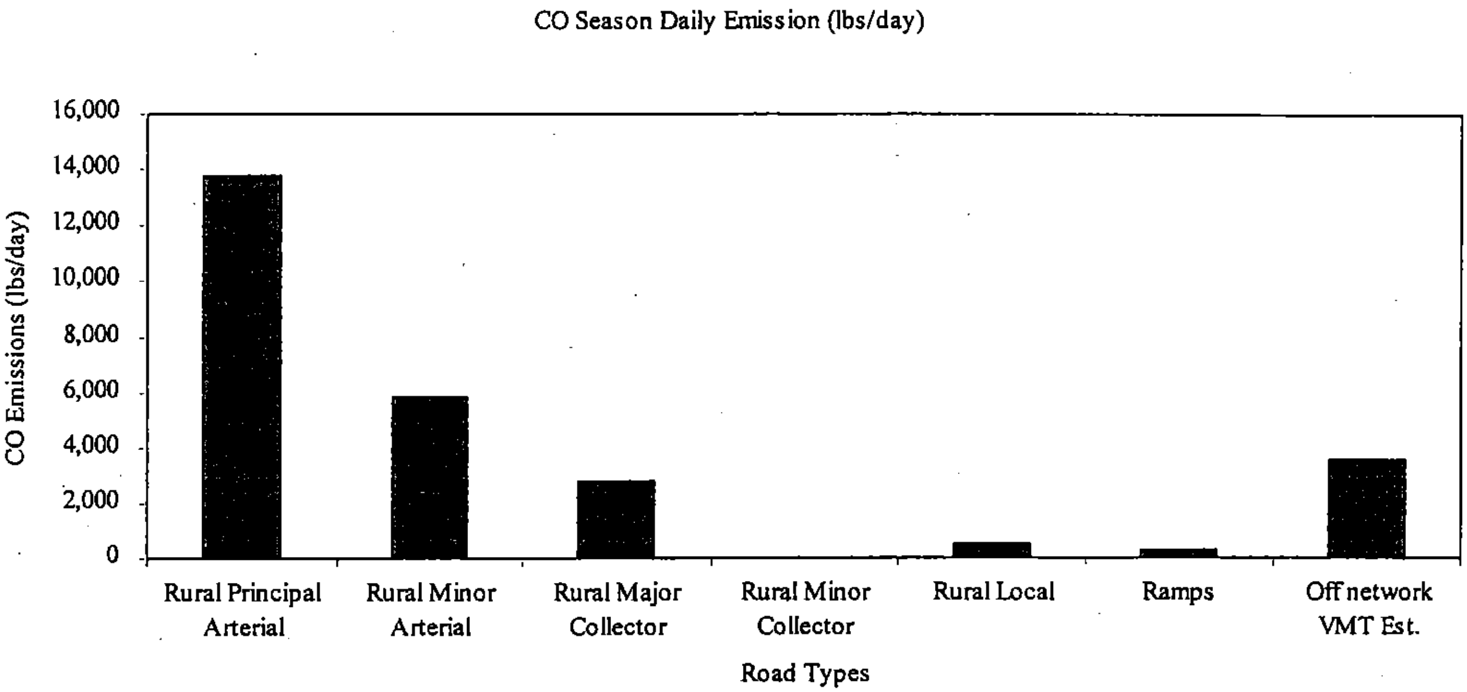


Figure 30: Percentage of Seasonal On-road Mobile CO Emissions by Roadway Type, 1996

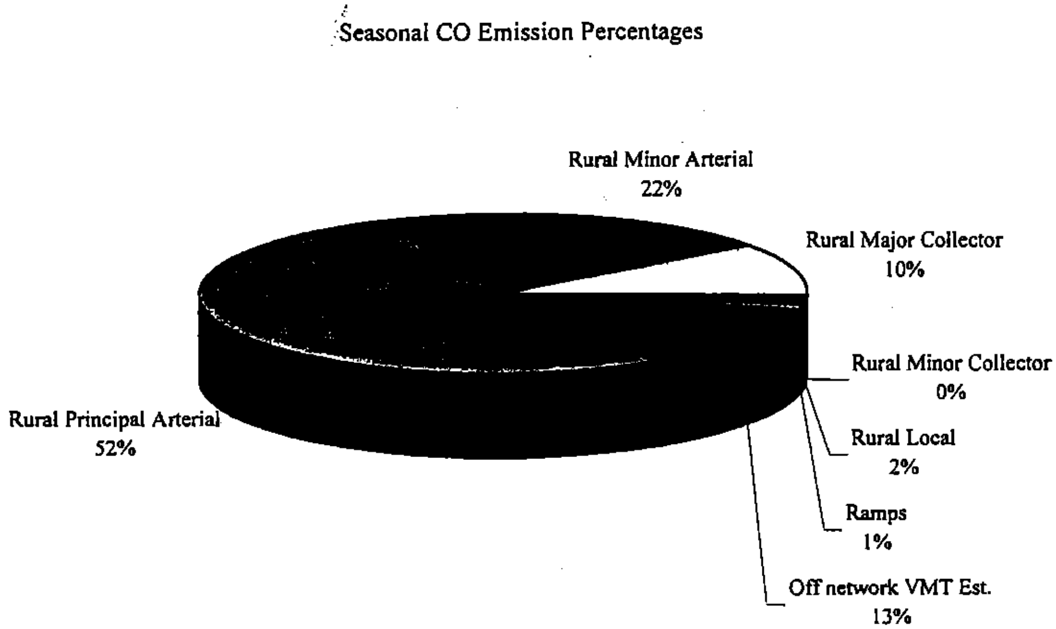


Table 2.6.1: On-Road mobile emissions by vehicle class

Inventory	Description	LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC	Total	Units
1996 CO	Annual	2,792	971	437	183	14	5	360	34	4,795	Tons/year
1996 CO	Seasonal	15,563	5,411	2,438	1,018	80	27	2,009	188	26,734	Lbs./day

Table 2.6.2: On-Road mobile emissions by roadway type

Inventory	Description	Rural Principal Arterial	Rural Minor Arterial	Rural Major Collector	Rural Minor Collector	Rural Local	Ramps	Off Network VMT Est.	Total	Units
1996 CO	Annual	2,573	1,094	445	0	81	44	558	4,795	Tons/year
1996 CO	Seasonal	13,771	5,857	2,803	0	509	279	3,514	26,734	Lbs./day

Table 2.6.3: CO Season VMT Adjustment Determination

			ODOT 1996 State Average Seasonal Factors (1)						
HT	Area HZ	Functional Classification	01-Dec	15-Dec	01-Jan	15-Jan	01-Feb	15-Feb	Winter Average
1	14-Central/Eastern OR	01 = Rural Interstate	1.2396	1.3877	1.4154	1.4429	1.3812	1.3195	1.3644
2	14-Central/Eastern OR	02 = Rural Principal Arterial	1.2746	1.3722	1.3973	1.4641	1.448	1.4318	1.3980
6	14-Central/Eastern OR	06 = Rural Minor Arterial	1.2573	1.3833	1.46	1.5545	1.5168	1.479	1.4418
7	14-Central/Eastern OR	07 = Rural Major Collector	1.4264	1.4724	1.3178	1.483	1.4414	1.3997	1.4235
8	14-Central/Eastern OR	08 = Rural Minor Collector	1.4264	1.4724	1.3178	1.483	1.4414	1.3997	1.4235
9	14-Central/Eastern OR	09 = Rural Local	1.4264	1.4724	1.3178	1.483	1.4414	1.3997	1.4235
11	14-Central/Eastern OR	11 = Urban Interstate	1.1675	1.1773	1.1399	1.1025	1.0939	1.0853	1.1277
12	14-Central/Eastern OR	12 = Urban Principal Arterial (Other Freeways/Expressways)	0.9981	1.0016	0.9957	1.0465	1.044	1.0414	1.0212
14	14-Central/Eastern OR	14 = Urban Principal Arterial.	1.0392	1.0483	1.0911	1.1339	1.0957	1.0575	1.0776
16	14-Central/Eastern OR	16 = Urban Minor Arterial (2)	1.0392	1.0483	1.0911	1.1339	1.0957	1.0575	1.0776
17	14-Central/Eastern OR	17 = Urban Collector	1.0392	1.0483	1.0911	1.1339	1.0957	1.0575	1.0776
19	14-Central/Eastern OR	19 = Urban Local	Not available here						

Seasonal factors are divided into VMT for seasonally adjusted VMT
Example

Seasonally neutral daily VMT for Urban Collectors	20,000 ADT
Average Winter Seasonal Adjustment factor	1.0776
Seasonally adjusted VMT = 20,000 / 1.0776	18,559 ADT

Notes
1. Seasonal Adjustment factors were provided by Don Crownover (ODOT) on April 17, 1997, Ref. 313.
2. Discussions with Mike Gillett, Senior Transportation Analyst, ODOT Transportation Planning Analysis Unit advised using the Urban Collector average Winter seasonal adjustment factor to adjust the Rural Principal Arterial VMT. ODOT believes this is the best method to adjust Klamath Falls VMT to reflect seasonal variations within the Transportation Study Boundary.

Part 2.7 FUTURE YEAR EMISSION FORECAST (2015)

2.7.1 Growth Factor Development

Since levels of growth are varied depending upon the type of CO source category, a variety of applicable growth factors were developed for application to the 2015 emission inventory. The ODOT and the Klamath Falls Air Quality Plan Advisory Committee assessed pertinent growth patterns within the Klamath Falls UGB. Based on recommendations by the Advisory Committee, ODOT and Klamath Falls city planner Cameron Gloss calculated the appropriate population, household, employment, VMT, and selected employment growth rates. DEQ provided growth assumption for wood use based on analysis of woodheating survey trends from 1993 to 1999 and analysis of the information provided by the Klamath County Building department and local woodstoves sellers.

2.7.2 Growth Factor Implementation

The growth rates shown in the Table 2.7.1 were applied by DEQ staff for point, area, non-road mobile and on-road mobile source categories. Point, area, and non-road mobile sources were grown at a simple, linear, non-compounding rate from 1996 to 2015 using the following formula (except the area source/residential wood combustion category):

1996 Attainment Year Value + ((Growth Rate) * (Number of Years from 1996) * (1996 Attainment Year Value))

For example, for a selected sub-category for the year 2015, with a 1996 value of 10 tons per year, and a growth rate of 1%:

10 ton/yr. in 1996 + ((.01 growth) * (19 years) * (10 ton/yr. in 1996)) = 12.2 ton/yr. in 2015

The residential wood combustion category subsections were assumed a growth rate according to the estimate of new devices added to both the existing stock of housing units in 1996 and to new housing built or projected to be constructed after 1996, using the formula:

(1996 emissions) + ((emissions per device) * (Estimated No. of devices installed each year in new and existing RWC HUs)* (No. of years from 1996)

Figures 31 and 32 represent percentage of the 2015 projected annual and seasonal CO emissions by source category respectively. Figures 33 and 34 represent comparison of 1996 and projected 2015 Seasonal and Annual CO Emissions Distributions respectively.

Table 2.7.1: Klamath Falls 1996 to 2015 CO Source Growth Factors

POINT SOURCE Growth	Growth Rate	Growth Area	Growth Rate Description	Growth Type
Point Source growth from 1996	1.40%	UGB	Industrial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
AREA Source Growth	**Growth Rate**	**Growth Area**	**Growth Rate Description**	**Growth Type**
WASTE DISPOSAL, TREATMENT, & RECOVERY				
Commercial / Institutional On-Site Incineration	1.1%	UGB	Commercial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Commercial / Institutional Open Burning	1.1%	UGB	Commercial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Industrial Open Burning	1.40%	UGB	Industrial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Residential Open Burning	1.1%	UGB	Household Land Use / Zoning Based (Ref.333)	Compound rate
SMALL STATIONARY FUEL & WOOD USE				
Industrial				
Fuel Oil Combustion	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Distillate	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Residual	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Kerosene	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Natural Gas Combustion	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Liquid Petroleum Gas Combustion	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Commercial / Institutional				
Fuel Oil Combustion				
Distillate	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Residual	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Kerosene	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Natural Gas Combustion	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Liquid Petroleum Gas Combustion	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Residential				
Fuel Oil Combustion				
Distillate	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
Residual	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
Kerosene	1.1%	UGB	Household Land Use / Zoning Based (Ref.333)	Compound rate
Natural Gas Combustion	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
Liquid Petroleum Gas Combustion	1.1%	UGB	Household Land Use / Zoning Based (Ref.333)	Compound rate
Wood Combustion				
Fireplaces	1.20%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table I
Woodstoves - Certified Catalytic	1.06%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table I
Woodstoves - Certified Non-Catalytic	1.06%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table I
Woodstoves - Conventional	-0.96%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table I
Fire Place Inserts	-0.22%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table I
Exempt Pellet Stoves	0.20%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table I
SMALL POINT SOURCES				
Permitted Sources (>5 tons/year, <100 tons/yr.)	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
MISCELLANEOUS AREA SOURCES				
Other Combustion				
Forest Wild Fires	0.00%	UGB	No Growth - no increase in forest resources	No Growth
Slash Burning	0.00%	UGB	No Growth - no increase in forest resources	No Growth
Structural Fires	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
NON-ROAD Growth	**Growth Rate**	**Growth Area**	**Growth Rate Description**	**Growth Type**
2-, 4-Stroke & Diesel				
Recreational Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Construction Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Industrial Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Lawn / Garden Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Agricultural Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Light Commercial Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Logging Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Air Service Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Railroads	1.40%	UGB	BEA, Industrial Employment (SIC Employees)	Linear, Non-Compounding
MOBILE SOURCE Growth	**Growth Rate**	**Growth Area**	**Growth Rate Description**	**Growth Type**
Mobile Sources - average all vehicle types		UGB	ODOT Travel Demand Model	Linear

Figure 31: Percentage of 2015 Projected Annual CO emissions

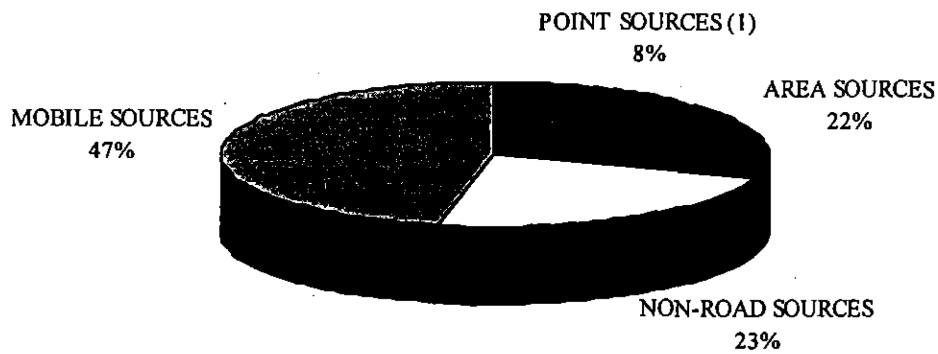


Figure 32: Percentage of 2015 Projected Seasonal CO emissions

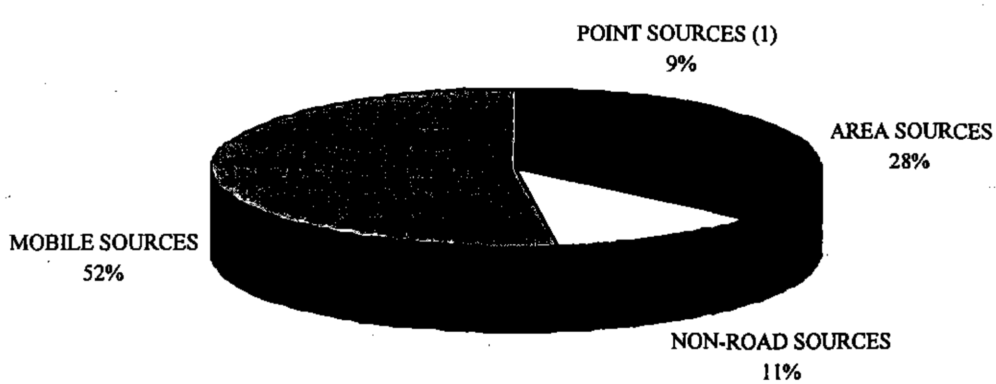


Figure 33: Comparison of 1996 and 2015 Seasonal CO Emissions Distribution

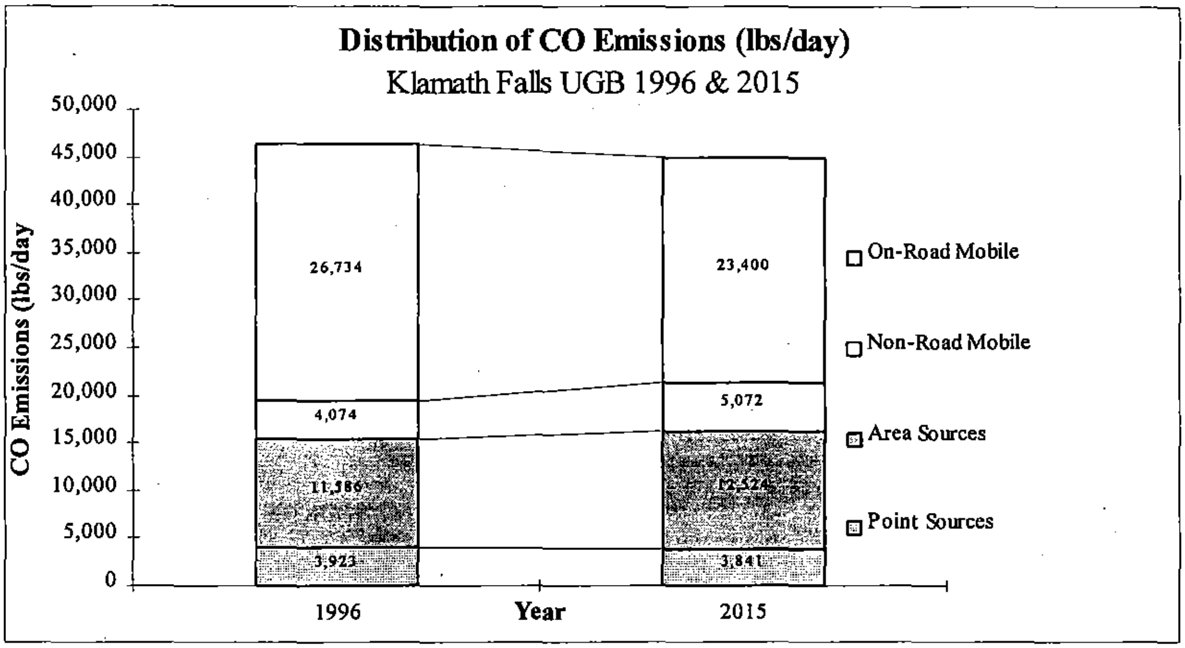
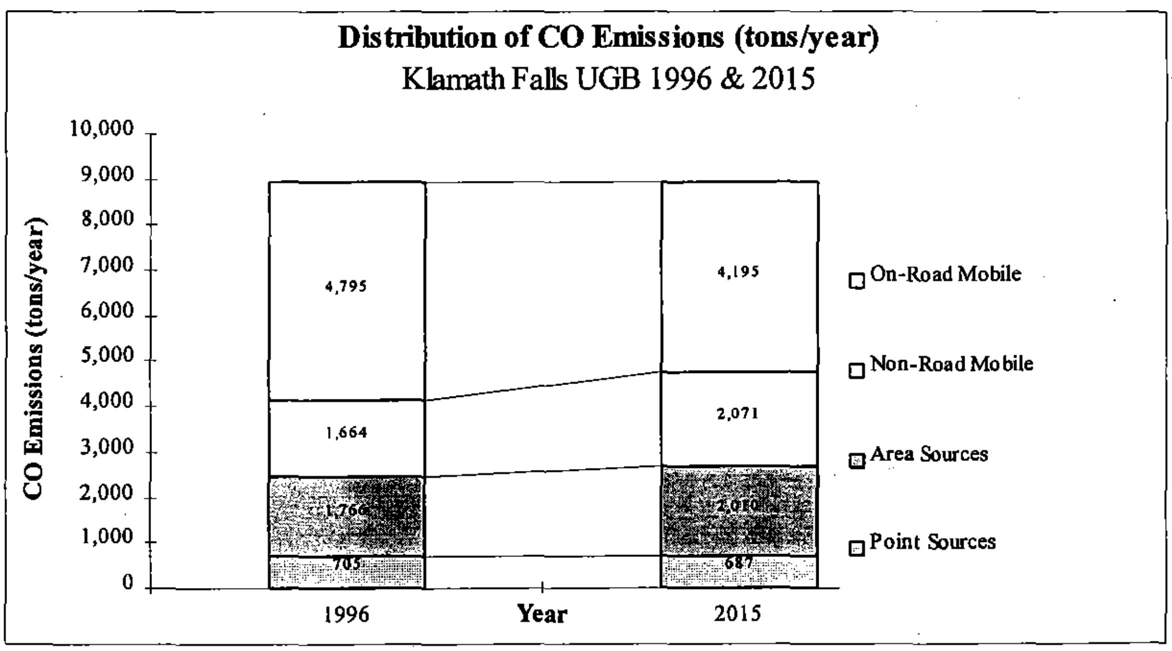


Figure 34: Comparison of 1996 and 2015 Seasonal CO Emissions Distribution



PART 3: QUALITY ASSURANCE AND QUALITY CONTROL

3.1 INTRODUCTION

The Oregon DEQ is responsible for overall quality and accuracy of this inventory Attainment Year. Results of this of Carbon Monoxide (CO) sources and emissions for the Klamath Falls Urban Growth Boundary (UGB) in the 1996 inventory will be used for years to come in making decisions and planning strategies that affect the people and resources of the State of Oregon. It is critical to produce accurate and useful emission inventories that ensure consistency and confidence by each future user.

Quality assurance methods and quality control measures remain a regular and important element of the efforts of every inventory and technical service that the Oregon DEQ produces. The management of the Air Quality Division of the Oregon DEQ commit the personnel and resources necessary for conducting Quality Assurance and Control (QA/QC) activities in the planning and preparing stages as well as the inventory development and report completion stages.

A Quality Assurance (QA) plan is developed as a significant part of the Inventory Preparation Plan (IPP) and is submitted for approval by the Region 10 office of the US EPA. Essential elements of the QA plan include identifying the DEQ personnel and external resources (i.e., ODOT for transportation issues) used in EI development and QA activities, describes the data collection and analysis measures to be used, and outlines the data handling methods and QA/ QC procedures to be followed. Upon incorporating IPP revision requests and directions provided by the Region 10 office and receiving approval to proceed, the Oregon DEQ implements the QA plan and prepares the emission inventory.

Quality Control (QC) describes the regular activities implemented by DEQ inventory development personnel to improve and control the quality of the inventory as it is being developed. Staff that contribute to each emission inventory make a continual effort to inspect, correct and verify the estimation methods, calculations and quantities in the emission inventories produced by DEQ.

QA and QC were considered separate activities in preparing this emission inventory. Quality Assurance, (QA) is a planned system of review and audit procedures conducted by personnel not actively involved in the inventory development process. Tools were utilized by QA personnel to examine the data in the electronic spreadsheets and printed tables. Appearances of errors, inaccuracies and validity were identified and noted on an Error Report & Correction Sheet for each table, then returned to the EI preparation personnel for revision. Corrections were verified by the QA auditor before final acceptance. The QA auditing process was tracked and recorded to ensure that a complete and comprehensive QA audit was performed.

The framework of this emission inventory is established in part on earlier emission inventories produced in the Klamath Falls area and on inventories for other Air Quality maintenance areas. Therefore, the QA/ QC measures taken in earlier inventories are re-checked, improved and used in subsequent inventories.

Emission inventories produced by the Oregon DEQ observe the methodologies and tools provided by the formative seven-volume QA guidance and methodology document, the Emission Inventory Improvement Program (EIIP), US EPA Document 454/R-97-004f. Originally issued in July 1997 by the Office of Air Quality Planning and Standards of the US EPA, the guidance and methodology of the EIIP has significantly influenced the data collection and reporting of each emission source category as well as the QA/ QC process of this inventory.

3.2 ORGANIZATION AND PERSONNEL

Monica Russell, who has experience with the emission inventory process, was appointed a Quality Assurance Coordinator. Brian Fields and Steve Aalbers, emission inventory specialists, provided QA auditing.

Wendy Anderson, Svetlana Lazarev, Kevin McGillivray, and Wes Risher performed the bulk of the required source calculations, the Quality Control checking and made corrections to the inventory tables that were identified in the QA audit at the DEQ Headquarters Office.
For transportation (highway motor vehicle) sources, DEQ's Wes Risher was the primary coordinator. Mr. Risher was the agency's liaison with outside assistance that was obtained from the Oregon Department of Transportation, Highway Division. Howard Harris, DEQ Transportation Control Program Coordinator, provided technical direction on On-Road Mobile Source modeling and source calculation.

The abbreviated organizational hierarchy for carrying out the Quality Assurance Program is shown below.

Oregon Department of Environmental Quality
Air Quality Division

Andy Ginsburg, Administrator - Air Quality Division
- Gerry Preston, Manager - Technical Services Section
  - Emission Inventory
    - Wendy Anderson, Emission Inventory Specialist
    - Svetlana Lazarev, Emission Inventory Specialist
    - Kevin McGillivray, Emission Inventory Specialist
    - Wes Risher, Emission Inventory Specialist
    - Jeff Ross, Source Test Coordinator
  - Quality Assurance
    - Monica Russell, Air Quality Monitoring Coordinator
    - Steven Aalbers, Emission Inventory Specialist
    - Brian Fields, Emission Inventory Specialist

Annette Liebe, Manager - Airshed Planning Section

Howard Harris, CO SIP Coordinator & Transportation Control Program Coordinator
David Collier, CO SIP Planning & Development Specialist

The bulk of the source data is limited to single sources of information. Therefore, data evaluation relied heavily upon checking against previously compiled information, where available.

3.3.1 DATA COLLECTION AND ANALYSIS

To ensure the comprehensive nature of the emission inventory, the listing of sources from EPA's Quality Assurance Plan[3,10,11,298] guidance document and EPA's *Procedures for the Preparation of Emissions for Carbon Monoxide And Precursors Of Ozone*[2] were used. The inventoried sources are marked under the appropriate pollutant category. Only those sources that have been determined to operate in the inventory areas were included.

As discussed in Section 1.3, the source categories were divided into Stationary Point Sources, Stationary Area Sources, Non-Road Mobile and On-Road Mobile Sources. Stationary point source information is maintained by DEQ for sources with annual emissions of at least 5 tons per year, so a questionnaire/survey was not necessary to identify stationary area and point sources. Emissions from stationary point sources were calculated on the basis of 1996 production levels and the best available emission factors (from TV source tests or from the permits). Point Sources considered in this inventory are listed in Appendix A, Table A-1.

Many of the stationary area sources and non-road mobile sources were estimated based upon commodity consumption or by applying per capita emission rates. Population data was obtained from the City Planner for Klamath Falls Cameron Gloss [333]. Stationary area source emission estimates were based upon emission factors published in *AP-42*[216], *FIRE Version 6.22 SCC and Emission Factor Listings*[318], DEQ estimates based on similar processes, and other documented sources. On-road mobile sources were based on EPA's Mobile 5b model[332] and ODOT's transportation demand model (EMME/2) to estimate vehicle miles traveled. Customized data included the County registrations for light duty vehicles (gas and diesel) and temperatures.

Input data collection procedures relied heavily upon the EPA guidance document *Procedures for the Preparation of Emissions For Carbon Monoxide And Precursors Of Ozone*[2]. Where possible, localized data were used in place of the EPA's factors. For example, residential open burning estimates based on local information are more accurate than nationally derived values because of the specific local regulation in the Klamath Falls UGB. In this case, use of local data is more appropriate than national data.

In all cases, the source of the information and validation for its use was documented in the calculation spreadsheets and checked at the time of QC for reliability and appropriateness.

3.4 DATA HANDLING

Data handling included: 1) coding formats and data recording, 2) data tracking, and 3) QA/QC (which included data checking, data correcting, and handling corrected data). Specific additional procedures included checking data after conversion to the inventory format, checking for missing data, and reviewing the estimates.

3.4.1 DATA CODING AND RECORDING

No air dispersion modeling was performed for this SIP so coding the source emissions for entry into the model was not necessary.

3.4.2 DATA TRACKING

Information obtained from source files, other divisions of the DEQ, other State, Federal, and local agencies, and private companies used in compiling the emission inventories were recorded in reference files, in appendices, and documented on the calculation spreadsheets. The appendices and calculation spreadsheets were also stored electronically. All emission factors, throughputs, seasonal adjustment factors, and activities were documented on the calculation spreadsheets in both hard copy and electronic copy. All of the above mentioned information is kept at DEQ Headquarters.

3.4.3 QA/QC PROCEDURES - CHECKING AND CORRECTING

The QA personnel generated QC forms and conduct any necessary training to ensure consistency and thoroughness by the QC personnel. The QC forms followed the forms outlined in the *Quality Assurance Implementation Instructions And Examples For SIP Inventory Development*[298]. The forms are:

1. Point source spreadsheet data form
2. Point source correction form
3. Area source calculation sheet check off list
4. Area source appendices check off list
5. Area source correction form
6. Non-road mobile calculation sheet check off list
7. Non-road mobile appendices check off list
8. Non-road mobile correction form
9. Summary sheet form
10. Summary sheet correction form

The QC of all source category emissions include:

1. Checking input data for inventory completeness, missing data, incorrect calculations, incorrect information, and reasonableness, and
2. Correcting the calculation sheets, summary sheets, and Appendices.

The QA of the emission estimates include:

1. A sample calculation of selected emissions,
1. Ensuring that all QC corrections were addressed,
3. Reviewing the emission summary for reasonableness, and
1. Ensuring that the data transferred between agencies and consultants are intact.

3.4.3.1 Checking Data

3.4.3.1.1 Inventory Completeness

Completeness of the inventory was determined by checking against the EPA QA Plan guidance source listings. Double counting of sources was checked to ensure that source categories included in stationary point source category were not also included in area or non-road mobile categories.

3.4.3.1.2 Missing Data

In order to ensure that all the necessary data was submitted for each stationary point source, forms were created to identify all the data elements required by EPA to be reported for each stationary point source. Any parameter left blank during the initial completion of the form was considered a missing data element. Further review of the source files and, as necessary, contact with facility personnel were procedures used to obtain the missing information. If these steps did not result in supplying a missing data element, estimates were made based on similar point sources or from information contained in EPA publications. Written documentation of the source of the data were recorded in the Emission Inventory notebook on the Data Error Report and Correction form as well as in the Audit Trail notebook.

Missing data for stationary area sources and non-road mobile sources can usually be identified by the inability to calculate emissions. If the appropriate data was missing, a reasonable effort was made to acquire it. If this was unsuccessful, estimates were made based on data of recent years or on information contained in EPA documents. Missing data were recorded on the QC area and non-road mobile correction forms.

3.4.3.1.3 Incorrect Calculations

In order to ensure that all the calculations were done correctly, the calculations were first reviewed to ensure that they were used correctly, then the electronic equations were reviewed to make sure that they were entered correctly. Any improperly used or incorrect calculations were noted on the calculation sheet, in the Appendix, or on the correction form. All calculation corrections were documented on the QC Correction Forms.

3.4.3.1.4 Incorrect Information

In order to ensure that the information on the Summary Sheet, The Calculation Sheet and in Appendices are correct, all the explanations, titles, and reference were checked for accuracy and clarity. Any changes were documented either directly on the sheet or on the QC correction forms.

3.4.3.1.5 Reasonableness

A reasonableness check was performed on the estimated emissions, activity levels, and emission factors using the Portland CO SIP [319,320], the 1993 Medford UGB CO SIP, and 1993 Grants Pass CO SIP EI as background comparisons.

Stationary point source estimated emissions associated with the Air Contaminant Discharge Permit, Title V Permit, or Title V draft for each identified point source were reviewed in relation to similar sources. In addition, the stationary point source production levels source tests, and permitted emission factors were rechecked. The source's current operational status was also reviewed using notices of construction, permit addendum's, and DEQ source inspector information. Stationary area source and non-road mobile estimated emissions were compared, when possible, to the 1993 Medford UGB CO SIP and 1993 Grants Pass UGB SIP emission inventories submittal. The references from which the emission factors and activity levels were taken were confirmed for the appropriateness of their use. Any reasonableness errors were documented in the correction forms.

3.4.3.2 Correcting Data

Receipt of information that necessitated a correction to the data used in the preparation of the emission inventories was documented on the Correction form. For minor changes the corrections were noted on the actual spreadsheet with an explanation, a signature, and a date. The correction was made to the electronic copy and the corrected version was printed and placed in the final draft notebook. The correction information was placed in an audit trail notebook for QA examination.

3.4.3.3 Sample calculations

DEQ staff verified each inventory process step by duplicating a sample calculation for at least one source category. Some of these were included in the emission inventory documentation.

3.4.3.4 Corrections Review

The QA coordinator reviewed all the correction forms for accurate, appropriate and complete corrections. This involved understanding why a correction was needed, why the original mistake was made, and whether the new information was accurate. The QA coordinator(s) signed and dated the correction form after they were satisfied with the corrections.

3.4.3.5 Reasonableness Review (QA)

The emissions estimate summaries were reviewed by DEQ and its peers to determine whether they were reasonable. Peer review (QA) utilizes the resources and expertise of local/state agencies and industries to review emission estimates. DEQ worked with the Klamath Falls Air Quality Plan Advisory Committee and ODOT in this role.

Examples of the reasonableness checks performed at this stage are: estimated per capita or per activity level emission estimates were compared with similar regions. The proportion of emissions by category with those of a similar region (e.g., on-road mobile sources contribute 20% of total inventory) were also compared.

3.4.3.6 Reference Data Used to Facilitate QA

Reference data commonly used to facilitate QA are presented in the table below:

Reference	Data	Level of Resolution
Census of Population and Housing, Summary Population and Housing Characteristics (U.S. Dept. of Commerce, Bureau of the Census)	Population, housing	Townships, Sub-county
County Business Patterns - Oregon, 1996 (U.S. Dept. of Commerce, Bureau of the Census)	Employment, establishments by Standard Industrial Classification (SIC) code	County
State Energy Data Report Consumption Estimates (U.S. Dept. of Energy, Energy Information Administration)	Energy consumption by fuel type	State
Highway Statistics (U.S. Dept. of Transportation, Federal Highway Administration)	VMT, on-road and off-road fuel consumption	State
Regional Interim Emission Inventories (U.S. EPA)	Emissions of criteria pollutants (including PM and CO)	County
Census of Manufacturers (U.S. Dept. of Commerce, Bureau of the Census)	Employment, hours worked, value of shipments by SIC code.	County, State

3.4.3.7 Computerized Checks

Computerized checks have included several parts: (1) verifying that each occurrence of data formatting resulted in equivalent emissions (or other data) before and after formatting, and (2) verifying the data totals and record lengths of any data transfers between agencies and consultants in the inventory process.

3.4.4 DATA REPORTING

Hard copy of the completed emission inventory will be provided to EPA Region X.

Part 4: REFERENCES (DEQ Master Reference)

1a. *Emission Inventory Requirements for Carbon Monoxide State Implementation Plans*, EPA-450/4-91-011, U.S. EPA, Research Triangle Park, NC, March 1991.

1b. *Emission Inventory Requirements for Ozone State Implementation Plans*, EPA-450/4-91-010, U.S. EPA, Research Triangle Park, NC, March 1991.

2. *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume I: General Guidance for Stationary Sources*, EPA-450/4-91-016, U.S. EPA, Research Triangle Park, NC, May 1991.

2a. *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume II: Emission Inventory Requirements For Photochemical Air Quality Simulation Models*, EPA-450/4-91-014, U.S. EPA, Research Triangle Park, NC, May 1991.

3. *Procedures for Emission Inventory Preparation, Volume I: Emission Inventory Fundamentals*, EPA-450/4-81-026a, U.S. EPA, Research Triangle Park, NC, September 1981.

4. *Procedures for Emission Inventory Preparation, Volume II: Point Sources*, EPA-450/4-81-026b, U.S. EPA, Research Triangle Park, NC. September 1981.

5. *Procedures for Emission Inventory Preparation, Volume III: Area Sources*, EPA-450/4-81-026c, U.S. EPA, Research Triangle Park, NC, September 1981.

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10. *Guidance for the Preparation of Quality Assurance Plans for O_3/CO SIP Emission Inventories*, EPA-450/4-88-023, U.S. EPA, Research Triangle Park, NC, December 1988.

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41. *Determination of Emissions and Impacts from Propane Flaming and Stack Burning of Grass Seed Crop Residues, 1986*, OMNI Environmental Services, Inc., for Oregon Department of Environmental Quality, Portland, OR, 3 March 1987.

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44. Memorandum. U.S. Department of Agriculture, Forest Service, Darold Ward to Batson, DEQ. Emission Factors for Slash Burning and Forest Wildfires, 5 July 1983.

49a. *Nonroad Engine and Vehicle Emission Study - Report, Appendixes*, 21A-2001, U.S. EPA, Office of Air and Radiation, Washington, DC, November 1991.

49b. *Methodology to Calculate Nonroad Emission Inventories at the County and Sub-County Level, Final Report*, Energy and Environmental Analysis, Inc., for U.S. EPA, Office of Mobile Sources, Ann Arbor, MI, July 1992.

50. Telecon. Oregon DEQ with Natalie Dobie, Office of Mobile Sources, U.S. EPA. Scaling of nonroad mobile source estimates from regional studies, 20 February 1992.

51a. Supplementary Data Sheets of the Seattle-Tacoma CMSA Inventory to the *Nonroad Engine and Vehicle Emission Study - Report.* Supplied by Natalie Dobie, Office of Mobile Sources, U.S. EPA, 10 March 1992.

51b. *Nonroad Emission Inventories for CO and Ozone Nonattainment Boundaries, Seattle-Tacoma*, Energy and Environmental Analysis, Inc., for U.S. EPA, Office of Mobile Sources, Ann Arbor, MI, July 1992.

51c. *Nonroad Emission Inventories for CO and Ozone Nonattainment Boundaries, Spokane*, Energy and Environmental Analysis, Inc., for U.S. EPA, Office of Mobile Sources, Ann Arbor, MI, July 1992.

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133. *User's Guide to Mobile5 (Mobile Source Emission Factor Model)*, EPA-AA-AQAB-94-01, U.S. EPA, Office of Mobile Sources, Ann Arbor, MI. May 1994.

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213a. *Forest Fire Summary, 1991*, Oregon Department of Forestry, Plans, Studies, and Development Section, Forest Protection Division, Salem, OR 1992, General File 1-0-4-200.

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291. "Operational Guidance for the Oregon Smoke Management Program," Draft Directive 1-4-1-601, Version 2.1, Appendix 4: Special Protection Zone Requirements, pp. 1, 67-68.

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345 Klamath Falls 1999 Oregon Woodheating Survey Overview Report. Prepared by Oregon Institute of Technology for the Department of Environmental Quality Air Quality Division, July 29, 1999.

346 Oregon Smoke Management Annual Data Report, 1996, Oregon Department of Forestry, Forest Protection Division, Salem, OR.

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371 1996 Klamath Falls Fleet Mix used to distribute VMT into vehicle class, *Mobile5b* CO input and output file printouts, without Oxy, custom LDGV/LDDV KFalls 1996 DMV registration.

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404 Emails from David Brzezinski to Jeff Stocum regarding the TEMFLAG setting on MOBILE5b. 3/17/00 and 3/28/00. Located in Mobile 5b Guidance Document folder.

APPENDIX TABLES

APPENDIX A: STATIONARY POINT SOURCES

APPENDIX B: STATIONARY AREA SOURCES

APPENDIX C: NON-ROAD MOBILE

MOBILE APPENDIX D: ON-ROAD

APPENDIX E: EMISSION FORECAST TABLES

APPENDIX A: STATIONARY POINT SOURCES

Appendix A, Table A-1: Individual Stationary Point Source Determinations

Appendix A, Table A-2: Individual Stationary Point Source Emission Calculations

Appendix A, Table A-1. Klamath Falls UGB 1996 Baseline Annual & Seasonal CO: Area Sources - Point Source Determination

PERMIT NO.	NAME	PLANT SITE ADDRESS	CITY	EMISSIONS (tons/yr)			S.I.C. Code	COMMENTS
				P.S.E.L.	Unas-signed	Actual		
18-0003	City of Klamath Falls	T39S R9E, Sec'n. 18	Klamath Falls	558	0	0	4911	Under construction, outside UGB
18-0005	Crown Pacific, L.P.	1 Sawmill Rd.	Gilchrist	818	0	495.4	2421	TV, Outside K. Falls UGB
[redacted]								
18-0008	Klamath Pacific Corporation	9492 Hill Road	Klamath Falls	0	0	0	3273	'B' Source CO emissions are negligible
[redacted]								
18-0018	Robert Edwards, Jr., M.D.	3539 Avalon Street	Klamath Falls	0.3	0	0.3	4953	'A2' Source; built 1998 (incinerator); CO emissions negligible
18-0020	Industrial Oils, Inc.	1291 Laverne Ave	Klamath Falls	1.2	0	0.3	2992	A2 Source
18-0021	Reach, Inc.	2350 Maywood Dr.	Klamath Falls	281	0	171	2429	'B' Source CO emissions are negligible
18-0023	Klamath Veneer, Inc.	4605 Lakeport Blvd	Klamath Falls	36	0	23.18	2435	'A2' Source
18-0043	Nu-Mix Concrete	E Main & Shasta Way	Klamath Falls	0	0	0	3273	'B' Source CO emissions are negligible
18-0056	Merle West Medical Center	2865 Daggett St.	Klamath Falls	0	0	0.22	4961	'B' Source CO emissions are negligible
18-0068	Klamath Pacific Corporation	9492 Hill Rd.	Klamath Falls	2.1	0	1.05	2951	Actual emissions are for 1995
18-0070	Jefferson State Redimix	4815 Tingley Ln.	Klamath Falls	0	0	0	3273	'B' Source for CO; outside Klamath Falls UGB
[redacted]								
18-0074	Klamath Pacific Corporation	Hwy 97	Klamath Falls	2.7	0	0.42	2951	Actual emissions are for 1995
18-0083	Bio-Waste Management Corp.	Worden-Keno Road	Klamath Falls	0	0	tbd	4953	A2' Source; outside Klamath Falls UGB
18-0085	Klamath Humane Society	2853 Memorial Dr.	Klamath Falls	0	0	0.06	4953	'B' Source CO emissions are negligible; included in Station-ary Area Source - Commercial Incineration category.
18-0086	Sturdi-Craft, Inc.	3501 Memorial Dr.	Klamath Falls	0	0	0	2431	'B' Source CO emissions are negligible
18-0087	Eternal Hills Memorial	4711 HWY 39	Klamath Falls	0	0	0.05	4953	'B' Source CO emissions are negligible; included in Station-ary Area Source - Commercial Incineration category.
18-0088	Klamath Cremation Service	2680 Memorial Dr.	Klamath Falls	0	0	0.05	4953	'A2' Source for CO; Included in Stationary Area Source-Commercial Incineration category.
18-0089	Jeld-Wen, Inc.	31725 HWY 97	Chiloquin	3.1	0	0.43	2431	Outside Klamath Falls UGB
18-0093	Aqua Glass West, Inc.	5855 Washburn Way	Klamath Falls	3.3	0	0.64	3088	TV for CO, Outside Klamath Falls UGB
18-0094	Fini Enterprises	1551 Mallard Lane	Klamath Falls	0.11	0	0	2819	'B' Source CO emissions are negligible
18-0095	Rogue Aggregates, Inc.	Buesing Rd.	Merrill	0	0	0	1442	Outside Klamath Falls UGB
18-0096	PG & E Gas Transmission	1/4-mi W of Diamond Lk. Jcn.	Chemult	701	0	427.5	4922	Outside Klamath Falls UGB
18-0097	Kingsley Field Air Base	Vanderburg Drive	Klamath Falls	13	4.8	13	9711	"A2"
18-0098	Jefferson State Redimix	Brown-Danforth Ranch site	W. Klamath Co.	0	0	0	1442	42 miles NW of K. Falls; outside of UGB

1) CE, RE, location, EFs, PTE, PSELs & production levels for TV, SM, & ACDP sources were assembled using permits, annual reports.
2) Some ACDP actual and PSEL emission data were retrieved from ODEQ's Air Contaminant Source Information System (ACSIS).
3) Major CO point sources that are included the Area Source inventory are indicated by gray shading and bold text.
4) RE was determined using EPA-452/R-92-010, "Guidelines For Estimating and Applying Rule Effectiveness (RE) for Base Year Inventories."
5) Major point sources that are included in the Area Source inventory must meet this criteria:
a) Must be inside the Klamath Falls UGB (Urban Growth Boundary) or within the 25 mile buffer; and
b) Must have a PSEL Calculated emissions (see note 1) of 100 tons/yr or greater.

Facility Name:	Jeld-Wen, Inc.		
Street Address:	3303 Lakeport Dr.		
	K Falls, OR 97601	Permit Issued:	12/19/1989
		Addendum:	
Mailing Address:	P.O. Box 1329	Permit Expires:	12/01/1991
	K Falls, OR 97601	SIC #1 :	2421
		SIC #2 :	2499
		SIC #3 :	4961

PLANT SITE EMISSION LIMITS		
	1996	1997
CO	ton/yr	ton/yr
Plant Site	156	142

ANNUAL PRODUCTION	1996	
Total Plant		
Oper. Parameters	7	days/wk
	50	weeks/yr
	350	days/yr
Boiler E	0	gal/yr
Boiler F	5,760,000	lb steam/yr
Boiler G	236,425,752	lb steam/yr
Paint dry ovens	4,870,000	scf/yr - NG

ANNUAL EMISSIONS

Source	Pollutant	SCC	Annual Thruput	Units	PSEL EF	EF Units	1996 Emissions ton/yr	1996 Emissions lbs/day
Boiler E	CO	1-02-004-01	0	Mlb steam/yr	5.00	lb/ M gal	0.0	0
Boiler F		1-02-009-05	5,760,000	lb steam/yr	1	lb/ M lb steam	2.9	16
Boiler G		1-02-009-05	236,425,752	lb steam/yr	1	lb/ M lb steam	118.2	676
Paint dry ovens		3-07-008-99	4,870,000	scf/yr - NG	21	lb/MM scf - NG	0.05	0
Boiler #9 - Oil		1-02-005-01						
					Total Plant CO Emissions:		121.1 tons/yr	692 lb/day

Note:
Emission Factors are from 1989 ACDP and 1998 TVd.

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Facility Name:	Collins Products, LLC			
Street Address:	6410 Hwy 66			
	K. Falls, OR 97601	Permit Issued	11/20/1995	
		Addendum:		
Mailing Address:	P.O. Box 16	Permit Expires:	07/01/2000	
	K Falls, OR 97601	SIC#1:	2436	

PLANT SITE EMISSION LIMITS		
	1996	1997
CO	ton/yr	ton/yr
Plant Site	262	262

ANNUAL PRODUCTION	1996	
Total Plant		
Oper. Parameters	7	days/wk
	52	weeks/yr
	365	days/yr
Boiler #7 - Sanderdust	194,938,000	lb steam/yr - SD
Boiler #8 - NG	6,211,231	(therms/yr - NG)
Boiler #8 - Oil	1,168	(gal/yr - oil)
Boiler #9 - NG	7,537,019	(therms/yr - NG)
Boiler #9 - Oil	584	(gal/yr - oil)
Defib. #1 - NG	103	MM cu.ft/yr
Defib. #2 - NG	103	MM cu.ft/yr
Core Dryer #1 - NG	659,200	(therms/yr - NG)
Core Dryer #2 - NG	659,200	(therms/yr - NG)

ANNUAL EMISSIONS

Source	Pollutant	SCC	Annual Thruput	Units	PSEL EF	EF Units	1996 ton/yr	Emissions lbs/day
Boiler #7 - Sanderdust	CO	1-02-009-03	194,938	Mlb steam/yr	1.00	lb/Mlb stea	97.5	534
Boiler #8 - NG		1-02-006-03	6,211,231	(therms/yr - NG)	0.0116	lb/therm NG	36.0	197
Boiler #8 - Oil		1-02-004-01	1,168	(gal/yr - oil)	0.044	lb/gal - oil	0.0	0
Boiler #9 - NG		1-02-006-03	7,537,019	(therms/yr - NG)	0.0075	lb/therm - N	28.3	155
Boiler #9 - Oil		1-02-005-01	1,168	(gal/yr - oil)	0.021	lb/gal - oil	0.0	0
Defib. #1 - NG		3-07-007-99	103	MM cu.ft/yr	17	lb/MM cu.tf	0.9	5
Defib. #2 - NG		3-07-007-99	103	MM cu.ft/yr	17	lb/MM cu.tf	0.9	5
Core Dryer #1 - NG		3-07-900-03	659,200	(therms/yr - NG)	0.0035	lb/therm - N	1.2	6
Core Dryer #2 - NG		3-07-900-03	659,200	(therms/yr - NG)	0.0035	lb/therm - N	1.2	6
					Total Plant CO Emissions:		165.9 tons/yr	909 lb/day

Note:
1) Emission Factors are from 1995 ACDP

ity Name:	Columbia Forest Products			
l Address:	South Hwy. 97			
	K Falls, OR 97601	Permit Issued	03/31/1993	
		Addendum:		
ng Address:	P.O. Box 1780	Permit Expires:	06/01/1997	
	K Falls, OR 97601	SIC #1	2436	
		SIC #2	4961	

PLANT SITE EMISSION LIMITS		
	1996	1997
CO	ton/yr	ton/yr
Plant Site	498	499

ANNUAL PRODUCTION	1996	
Total Plant		
Oper. Parameters	7	days/wk
	51	weeks/yr
	357	days/yr
Boiler #1	200,200,000	lb steam/yr
Boiler #2	70,800,000	lb steam/yr
V. Dryer - Moore (NG)	32,245,000	sq. ft/yr
V. Dryer - Moore (Stm)		sq. ft/yr
V. Dryer - COE (NG)		sq. ft/yr
V. Dryer Keller#1	77,386,000	sq. ft/yr
V. Dryer Keller#2	51,591,000	sq. ft/yr

ANNUAL EMISSIONS

Source	Pollutant	SCC	Annual Thruput	Units	PSEL EF	EF Units	1996 Emissions ton/yr	1996 Emissions lbs/day
Boiler #1	CO	1-02-009-05	200,200	000 lb steam/y	1.22	lb/1000 lb steam	122.1	684
Boiler #2		1-02-006-05	70,800	000 lb steam/y	1.22	lb/1000 lb steam	43.2	242
V. Dryer - Moore (NG)		3-07-007-99	32,245,000	sq. ft/yr	0.02	lb/M sq.ft	0.3	2
V. Dryer - Moore (Stm)		3-07-007-99	0	sq. ft/yr	0	lb/M sq.ft	0.0	0
V. Dryer - COE (NG)		3-07-007-99	0	sq. ft/yr	0.02	lb/M sq.ft	0.0	0
V. Dryer Keller#1		3-07-007-16	77,386,000	sq. ft/yr	1.4	lb/M sq.ft	54.2	303
V. Dryer Keller#2		3-07-007-16	51,591,000	sq. ft/yr	1.4	lb/M sq.ft	36.1	202
					Total Plant CO Emissions:		256 tons/yr	1434 lb/day

Notes:

(1) Emission Factors for dryers are taken from the 1993 ACDP.

<u>Exception:</u> Boilers' Emission Factor of "1.22 lbs CO/1000 lb Steam" was selected based on the EPA AP-42 External Draft, Section 1.6 - "Wood Waste Combustion in Boilers", and discussions with Thane Jennings (DEQ permit writer) and Jeff Ross (DEQ source test coordinator). (Ref. 355).

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Facility Name: PG&E Gas Transmission
Street Address: Harpold Valley Rd.
Bonanza, OR 97623
Mailing Address: 2100 SW River Pkwy.
Portland, OR 97201

Permit Issued: 07/01/1996
Addendum:
Permit Expires: 01/01/2003
SIC#1: 4922

PLANT SITE EMISSION LIMITS		
	1996	1997
CO	ton/yr	ton/yr
Plant Site	202	203

ANNUAL PRODUCTION	1996	
Total Plant		
Oper. Parameters	7	days/wk
	52	weeks/yr
	365	days/yr
Unit 14A	4,262	hours
Unit 14B	8,509	hours

ANNUAL EMISSIONS

Source	Pollutant	SCC	Annual Thruput	Units	PSEL EF	EF Units	1996 Emissions ton/yr	1996 Emissions lbs/day
Unit 14A	CO	3-10-002-99	4,262	hours	16.20	lb/hr	34.5	189
Unit 14B		2-02-002-01	8,509	hours	30	lb/hr	127.6	699
		2-02-002-09						
		3-99-999-99						
					Total Plant CO Emissions:		162.2 tons/yr	889 lb/day

Note:
Emission Factors are from 1998 TV addendum.

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APPENDIX B: STATIONARY AREA SOURCES

Appendix B, Table B-1. Klamath Falls Population & Housing Unit Data

Klamath Falls UGB (Urban Growth Boundary) Population Estimates for EI Year 1996						
Emission Inventory Year	UGB Outside City Limits Housing Units(4)	Population Inside UGB and Outside City Limits(3)	Klamath Falls City Limits Population (2)	Klamath Falls UGB Population (1)	Klamath Fall UGB Housing Units (4)	Klamath Falls City Limits Housing Units(4)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Notes:

1) 1996 UGB population number developed by Cameron Gloss (City Planner for Klamath Falls), Ref. 333.
2) 1996 Klamath Falls "City Limits Population" is from Portland State University Center for Population Research and Census, Ref. 272.
3) Population of the area between 1996 city limits and UGB is 40,365 - 18,765 = 21,600.
4) Number of Housing Units is total estimated population (UGB or City Limits) divided by an average of persons per household, as stated in the July 6, 1999 Intraoffice Memorandum, Ref. 333.

Appendix B, Table B-2. Klamath Falls UGB 1996 Annual & Seasonal CO: Area Sources - Small Point Source Determination

Permit #	NAME	Plant Site Address	City	Emissions, (tons/yr)			SIC Code	Comments
				PSEL	Unas	Actual		
180003	City of Klamath Falls	S18, T39S R9E	Klamath Falls	0	0	0	4911	Under construction, outside UGB
180005	Crown Pacific Limited Partne	1 Sawmill Rd.	Gilchrist	818	0	495.4	2421	TV, Outside K. Falls UGB
180006	Jeld-Wen, Inc.	3303 Lakeport BLVD	Klamath Falls	142	0	121	2421	TV, Major Source for CO
180008	Klamath Pacific Corporation	9492 Hill Road	Klamath Falls	0	0	0	3273	'B' Source CO emissions are negligible
180009	Modoc Lumber Co	404 N 4th & Oak	Klamath Falls	99	0	0	2421	Closed in April 1995
180013	Collins Products LLC	6410 HWY 66	Klamath Falls	262	0	97.6	2436	TV, Major Source for CO
180014	Columbia Forest Products	Balsam Dr. & Long Lk.	Klamath Falls	499	0	256	2436	TV, Major Source for CO
180018	Robert Edwards, JR. M.D.	3539 Avalon Str.	Klamath Falls	0.3	0	0.3	4953	'A2 Source CO emissions are negligible
180020	Industrial Oils, Inc.	1291 Laverne Ave	Klamath Falls	1.2	0	0.3	2992	A2 Source
180021	Reach, Inc.	2350 Maywood Dr.	Klamath Falls	281	0	171	2429	'B' Source CO emissions are negligible
[redacted]								
180043	Nu-Mix Concrete	E Main & Shasta Way	Klamath Falls	0	0	0	3273	'B' Source CO emissions are negligible
180056	Merle West Medical Center	2865 Daggett St.	Klamath Falls	0	0	0.22	4961	'B' Source CO emissions are negligible
180068	Klamath Pacific Corporation	9492 Hill Rd.	Klamath Falls	2.1	0	1.05	2951	Actual emissions are for 1995
180070	Jefferson State Redimix	4815 Tingley Ln.	Klamath Falls	0	0	0	3273	'B' Source for CO, otside K. Falls UGB
180072	PG & E Gas Transmission	Harpold Rd.	Bonanza	203	0	150.5	4922	Outside Klamath Falls UGB
180074	Klamath Pacific Corporation	Hwy 97	Klamath Falls	2.7	0	0.42	2951	Actual emissions are for 1995
180085	Klamath Humane Society	2853 Memorial Dr.	Klamath Falls	0	0	0.05	4953	'B' Source CO emissions are negligible
180086	Sturdi-Craft, Inc.	3501 Memorial Dr.	Klamath Falls	0	0	0	2431	'B' Source CO emissions are negligible
180087	Eternal Hills Memorial	4711 HWY 39	Klamath Falls	0	0	0	4953	'B' Source CO emissions are negligible
180088	Klamath Cremation Service	2680 Memorial Dr.	Klamath Falls	0	0	0	4953	'A2' Source for CO
180089	Jeld-Wen, Inc.	31725 HWY 97	Chiloquin	3.1	0	0.43	2431	Outside Klamath Falls UGB
180093	Aqua Glass West, Inc.	5855 Washburn Way	Klamath Falls	3.3	0	0.64	3088	TV for CO, Outside Klamath Falls UGB
180094	Fini Enterprises	1551 Mallard Lane	Klamath Falls	0.11	0	0	2819	'B' Source CO emissions are negligible
180095	Rogue Aggregates, Inc.	Buesing Rd.	Merrill	0	0	0	1442	Outside Klamath Falls UGB
180096	PG & E Gas Transmission	1/4 MI Wof Diamond Lak	Chemult	701	0	427.5	4922	Outside Klamath Falls UGB
[redacted]								
180098	Jefferson State Redimix	Brown-Danforth Ranch	Klamath Falls	0	0	0	1442	42 miles Nw of K. Falls, outside UGB

1) CE, RE, location, EFs, PTE, PSELs & production levels for TV, SM, & ACDP sources were assembled using permits, annual reports.
2) Some ACDP actual and PSEL emission data were retrieved from ODEQ's Air Contaminant Source Information System (ACSIS).
3) Small CO point sources that are included the Area Source inventory are indicated by gray shading and bold text.
4) RE was determined using EPA-452/R-92-010, "Guidelines For Estimating and Applying Rule Effectiveness (RE) for Base Year Inventories."
5) Small point sources that are included in the Area Source inventory must meet this criteria:
   a) Must be inside the Klamath Falls UGB (Urban Growth Boundary); and,
   b) Must have a PSEL Calculated emissions (see note 1) of less than 100 tons/yr and actual emission of greater than 5 tons/yr.

Appendix B Table B-3a. Legal Residential Op[illegible]urning

Open Burning Permits in the Air Quality Control Area (AQCA)

	Open Burning Allowed		
	Klamath County Fire District #1	Environmental Health (4'x6' permits)	Environmental Health (variant permits)
Dec. 1995	4	58	7
Jan. 1996	1	32	2
February	2	43	0
March	41	131	7
April	20	NA	NA
May	5	NA	NA
June	9	NA	NA
July	7	NA	NA
August	3	NA	NA
September	6	NA	NA
October	15	877	4
November	12	278	0
December	2	53	0
Permits Issued	127	1472	20

AQCA	1996
Klamath County FD#1	127*
Environmental Health Department	1472*

* including December 1995

City Limits Total Permits =	662
City Limits Peak Season Permits =	63

Material Loading

Amount of Material/burn[3]	Density[3]			Percentage[4]			Weight[5]			
All legal types	Wood	Brush	Leaves	Wood	Brush	Leaves	Wood	Brush	Leaves	Total
3 yd^3	lbs/ft^3	lbs/ft^3	lbs/ft^3	Tons	Tons	Tons	Tons	Tons	Tons	Tons/permit
81 ft^3	9.3	9.3	11.5	30%	40%	30%	0.11	0.15	0.14	0.40

Notes

1) Information on number of permits issued reported directly by Klamath County Fire District #1 and Klamath County Environmental Health Department, Ref. 335.
The following assumptions were made: 90% of the AQCA permits were issued in the UGB; 47% of the UGB permitted burns occurred in the city limits (47% of the UGB population reside in the city limits).
All the permits issued by the Environmental Health Department for 4'x6' burns are annual permits (Ref. 335).
We assume that each annual permit was used twice during the 1996 (once in spring and once in fall).
2) Estimated Amount Burned/permit is based on discussions with the Grants Pass FD's Ron Shwartz. Amount burned/permit is an estimate based on observational experience. Grants Pass estimate is used here for the lack of local information available and based on the assumption that the amount per permit burned in Grants Pass is similar to that burned in Klamath Falls.
3) The Density of the materials are estimates from a table of densities from DEQ, WMC, Solid Waste section and from discussions with Peter Spendelow of the DEQ Solid Waste Program (Ref 269).
4) The percentage of each type of material likely to be legally burned/permit is taken from the 93 Medford CO SIP, Appendix B-3 and was estimated by reviewing the violations (Medford) which were issued for burning when the ventilation index is below <400 between 1990-1997.

Estimation of Material Density & Emission Factors

	Density[3] (Lbs/ft^3)		EF[6] (Lbs./ton)	
Average Wood Burning	[redacted]	DEQ Solid Waste Recovery Survey Table	[redacted]	AP-42, Table 1.9-1 & Section 2.5
Brush/Weeds	[redacted]	DEQ Solid Waste Recovery Survey Table	[redacted]	AP-42 Sections 2.5
Leaves	[redacted]	DEQ Solid Waste Recovery Survey Table	[redacted]	AP-42 Sections 2.5

5) Weight/permit is estimated by multiplying the volume * density * the percent for each material type. The three material types were assumed.
6) Emission Factor (EF) calculations based upon AP-42 (Ref. 216), 5th Edition, Sections 1.9 and 2.5.
The Average Wood Burning EF was taken from the average of residential fireplace (252.6 lbs./ton, Table 1.9-1), unspecified forest residue (140 lbs./ton, Table 2.5-5), and unspecified orchard crops (52 lbs./ton, Table 2.5-5).
The average Brush/Weeds EF is taken from Backfire Burning Wild Hay (150 lbs./ton, Table 2.5-5) and Unspecified Weeds(85lb/ton, Table 2.5-5).
The EF for Unspecified Leaves is from Table 2.5-6.

Appendix B, Table B-3b. Illegal Residential Open Burning

Documented Open Burning Violations

	FD#1 violations
	1996
Dec. 1995	0
January	0
February	1
March	4
April	3
May	3
June	2
July	7
August	5
September	3
October	0
November	3
December	0
TOTAL	31

Total Documented Violations =	31
Total Peak Season (Dec-Feb) Violations =	1

City Limits, Documented Violations =	13
City Limits, Peak Season (Dec-Feb) Violations =	1

Notes:

1) The number of Res. open burning violations in the Klamath Falls City Limits were calculated based on the violations reported by the KCFD #1, Ref 335.
The following assumptions were made: 90% of the violations happened in the UGB; 47% of the UGB violations occurred in the city limits. (47% of the UGB population reside in the city limits).
2) The Peak Season violations were violations issued in Dec. 1995 - Feb. 1996.
3) According to KCFD# 1, they respond to illegal open burns immediately and has them extinguished. We assume that the number of violations reported is likely to reflect the total number of illegal open burns and no " lack of enforcement" multiplying factor is applied.

Estimated Material Being Illegally Burned (Medford used as a surrogate)

Approximate percentage of each type of material burned illegally, Reference 263; rounded to the nearest 5% [6].

Wood			Brush/Weeds/paper						Garbage		
			Approximate Volumes of Illegal Burn Piles[5]								
Height	Diameter	Volume[5]	Height	Diameter	Volume[5]	Height	Diameter	Volume[5]	Height	Diameter	Volume[5]
ft	ft	ft^3	ft	ft	ft^3	ft	ft	ft^3	ft	ft	ft^3
8	160	1280	1	3	5	12	12	904	5	10	262
15	15	1766	6	48	288			7	4	8	134
2	2	4	1.5	2	3			7	5	300	1500
2	5	26	1	2	2	2	2	4	3	400	1200
2.5	8	84			7			7	5	15	7
3	6	57	2	8	67	1	4	8	2	24	48
10	20	2093	2	2	4	1	1	1	1.5	3	7
4	100	400			7	2	2	4			7
5.5	120	660	4	1	2	12.5	150	1875			7
3	6	57	1	1	1	2	20	40	3	7	77
		7	6	8	48			7	2	4	17
2	3	9	3	3	14	2	12	151			7
		76	3	2	6			7	4	6	75
2	4	17	3	3	14			7			19
1	1	1	3	6	57	2	10	105	4	8	134
2	4	17			7	5	24	120			7
1	4	8	2	3	9	2	20	419			7
2	4	17	2	5	26	2	4	17	3	6	57
2	4	17	2	5	26	3	25	75	4	8	134
2	10	105	4	4	33	4	10	209	3	10	157
6	100	600	3	150	450	2	3	9	1	3	5
8	8	268	3	8	100	2	16	32	2	4	17
2	3	9	2	4	17	1	3	5	2	3	9
3	3	14	3	6	57	4	15	471	1	5	13
2	6	38	4	8	134	3	10	157			7
			6	14	615	3	25	75	2	4	17
			2	42	84	6	4	50			7
			2	3	9	3	40	120	1.5	6	28
			2	4	17	1	3	5			7
			2	4	17	2	2	4			7
			2	4	17	2	20	40			7
			1	15	15	2	4	17			7
			2	2	4	2	4	17	2	4	17
			4	10	209	2	4	17	1	4	8
			4	15	471	1	2	2			7
			4	8	134	1	2	2	3	20	628
			5	10	262				2	12	151
			2	4	17				3	6	57
					6				4	8	134
			2	3	9						7
[redacted]	Table continues	[redacted]		Table continues	[redacted]		Table continues	[redacted]		Table continues	[redacted]

[redacted]	Table continued	[redacted]	Table continued [redacted]				Table continued [redacted]			Table continued [redacted]	
			2	4	17						7
			1	1	1						7
					7						7
			1	2	2				5	24	*120*
			1	10	52				1	4	8
			4	180	*720*				3	6	57
			2	30	*60*				2.5	150	*375*
			1	3	5				1	12	*12*
			2	5	26						*7*
			2	4	17						*7*
			2	4	17				1	3	5
			2	4	17						*7*
	count	25					count	88		count	52
[redacted]											

Weight of Material Burned						
Density[8]	9	Lbs/ft^3		9	Lbs/ft^3	11 Lbs/ft^3
[redacted]						
						Tons/burn
						Average 0.8

4) Due to the lack of detailed violation information on material types burned in Klamath Falls, the illegal burning violations reported for the 1993 Medford CO SIP are used as a material loading surrogate.

5) The average volume of illegal burning violations was estimated from pile diameters and heights reported on the Jackson Co. Health and Human Services Documented Violation Summary for 1990-1997 (Ref. 263).
Pile dimensions for violations issued in Medford and Central Point were used. Central Point was included because Medford violations alone did not provide enough information to estimate average volumes for wood. The pile volumes were calculated using a 1/2 spheroid formula, the barrel is 7.43 ft^3.

6) The approximate percentage of each category of material illegally burned in Medford was estimated by counting the violations where the material burned was documented, determining the percentage, and rounding the percentage to the nearest 5%, Appendix B-3c (Material Types Burned).

7) The Italicized underlined pile heights were not reported and are estimated assuming that the height is roughly 1/2 the pile diameter.

8) Density of the different categories of solid waste was estimated after discussion with the DEQ solid waste department and using a DEQ solid waste density conversion table (Ref. 269).

Density and Emission Factor Estimates					
	Density[9] (Lbs/ft^3)		EF[10](Lbs/ton)		
Average Wood Burning	9.3	DEQ Solid Waste Recovery Survey Table	[redacted]	AP-42, Table 1.9-1 & Section 2.5	
Brush/Weeds	9.3	DEQ Solid Waste Recovery Survey Table	[redacted]	AP-42	Section 2.5, Table 2.5-5
Leaves	11.5	DEQ Solid Waste Recovery Survey Table	[redacted]	AP-42	Sections 2.5, Table 2.5-5
Municipal Waste (Garbage)	11	DEQ, WMC, Solid Waste Section, Peter Spendelow	[redacted]	AP-42	Sections 2.5, Table 2.5-5

9) Densities estimated by using a table of densities from Solid Waste, WMC, DEQ and from discussions with Peter Spendelow of the DEQ Solid Waste program (Ref. 269).

10) EFs estimated by using similar categories from the 5th edition of AP-42, Tables 1.9-1, 2.5-1, 2.5-5, 2.5-6, (Ref. 216).
The Average wood burning EF was taken from the average of residential fireplace (252.6 lb/ton, Table 1.9-1), unspecified forest residue (140 lb/ton, Table 2.5-5), and unspecified orchard crops (52 lb/ton, Table 2.5-5).
The average Brush/Weeds EF is taken from Backfire Burning Wild Hay (150 lb/ton, Table 2.5-5) and Unspecified Weeds(85lb/ton, Table 2.5-5).
The EF for uspecified leaves is from Table 2.5-6.
The EF for municipal waste is from Table 2.5-1.

Appendix B, Table B-3c. Percent of Each Category of Material Residential Open Burned

[redacted]

hay	leaves	paper	wood	brush
	5	1	4	6

Category	Material	Quantity of Burns	Proportion of Open Burns	Rounded to nearest 10%
Leaves:	(Leaves & Hay)	5	31%	30%
Wood:	(Wood)	4	25%	30%
Brush:	(Brush & Paper)	7	44%	40%
	Total:	16	Total: 100%	

[redacted]

hay	leaves	paper	wood	brush	garbage	oil/diesel	pine needles
3	19	6	13	21	20	0	1

Category	Material	Quantity of Burns	Proportion of Open Burns	Rounded to nearest 10%
Leaves:	(Leaves & Hay)	22	27%	30%
Wood:	(Wood)	13	16%	20%
Brush:	(Brush & Paper)	27	33%	30%
Garbage:	(Garbage)	20	24%	20%
	Total:	82	Total: 100%	

Notes:

1) Because Klamath Falls violation reports do not specify the type of material burned for each violation, the proportion of material types b determined for the Medford 1993 CO SIP inventory will be applied in this inventory as a surrogate.

2) This Spreadsheet summarizes the rough estimate of the percentage of open burning for the various types of material being burned.

3) The estimate was made by counting the illegal burns from the violation summary (Ref. 263).

4) The legal burns were estimated by only counting burns which would have been legal except the ventilation index was below 400. Material was grouped according to similar densities and emission factors. Violations issued for Medford addresses for all years were use

5) According to Klamath Falls Fire District #1, legally burnable material usually consists of yard debris, leaves, weeds, branches and grass Illegally Burned Material includes both legally burnable material and garbage.

Appendix B, Table B-4. 1996 Klamath Falls UGB SIC Population Estimates

Commercial (SIC 50-99)[1,3]

Category	SIC	K. Falls UGB
Retail Trade	52 - 59	3,254
Services	70 - 81 & 83 - 89	3,704
Educational	82	1,344
Government	91 - 98	1,630
Other[2]	50 - 51 & 07-14	1,165
	Total	11,097

Industrial (SIC 20-39)[1,3]

Category	SIC	K. Falls UGB
Manufacturing	20 - 39	4,102
	Total	4,102

Notes:

1) Data on UGB employment was developed by Klamath Falls City Planner Cameron Gloss (Ref. 333).
2) Data provided in Ref. 333 for the category "Other " includes Agricultural employees (SIC 07 - 14) and Wholesale employees (SIC 50 - 51).
3) SIC codes selected are the same as Commercial and Industrial SIC codes suggested in the EPA document "The Procedure For The Preparation of EI For CO and Precursors of Ozone" (Ref. 2a).

Appendix B, Table B-5. Fossil Fuel Consumption Estimates: Klamath Falls UGB, 1996

Source Type		(1) Distillate Fuel Oil (10^3 br)	(2) Distillate Fuel Oil (10^3 gal)	Residual Fuel Oil (10^3 br)	(2) Residual Fuel Oil (10^3 gal)	Kerosene (10^3 br)	(2) Kerosene (10^3 gal)	LPG (10^3 br)	(2) LPG (10^3 gal)	Natural Gas (10^9 ft^3)	(3) Natural Gas (10^6 ft^3)	Population
STATE-WIDE USE (ALL FUELS)												(1996)
Oregon (4)												3,181,000
1996	SCC											
Residential (1)	21-04-004-000	821	34,482	0	0	40	1,680	463	19,446	33	33,000	
Commercial (1)	21-03-004-000	620	26,040	84	3,528	38	1,596	82	3,444	26	26,000	
Industrial (1)	21-02-004-000	1,738	72,996	136	5,712	11	462	1,020	42,840	88	88,000	
RESIDENTIAL USE (5)												(1996)
Klamath Falls UGB (1996)			438		0		21		247		419	40,365
COMMERCIAL/INSTITUTIONAL USE (6)												(SIC 50-99,1996) 846,503
Klamath Falls UGB (1996)			341		46		21		45		341	11,097
INDUSTRIAL USE (7)												(SIC 20-39,1996) 230,419
Klamath Falls UGB (1996)			1,300		102		8		763		1,567	4,102

Notes:

1) 1996 fuel consumption data from Tables 240-242, "State Energy Data Report 1996: Consumption Estimates" (Ref. 343).
2) Oil Use [10^3 Gallons] = (Oil Use [10^3 Barrels]) * (42 [gallons/barrel])
   Kerosene Use [10^3 Gallons[= (Kerosene Use [10^3 Barrels]) * (42 [gallons/barrel)
   Residual fuel oil is generally used by industry and not used for residential heating, therefore gallons used is set to zero.
   LPG Use [10^3 Gallons] = (LPG Use [10^3 Barrels]) * (42 [gallons/barrel])
3) Natural Gas usage in billion cubic feet (10^9) * 1000 = million cubic feet (10^6).
4) 1996 State population based on census data from Portland State University, Center for Population Research and Census document entitled *Population Estimates For Oregon: July1, 1996* (Ref. 272).
5) UGB Residential Use = State Residential Use * (1996 Klamth Falls UGB Residential Population / 1996 State Residential Population).
   1996 Klamath Falls UGB population (Ref. 333) [see Appendix B, Table B-1].
6) UGB Commercial/Institutional Use = State Commercial Use * (Klamath Falls UGB SIC Commercial employment / State SIC Commercial employment)
   Top figure is State-wide SIC 50-99 Commercial employees from County Business Patterns, 1996 Oregon (Ref. 240).
   Bottom figure is the 1996 Klamath Falls UGB SIC Commercial population estimate from Ref. 333 (See Appendix B, Table B-4).
7) UGB Industrial Use = State Industrial Use * (Klamath Falls UBG SIC Industrial population / State SIC Industrial population)
   Top figure is State-wide SIC 20-39 Industrial employees from County Business Patterns, 1996 Oregon (Ref. 240).
   Bottom figure is the 1996 Klamath Falls UGB SIC Industrial population estimate from Ref. 333 (See Appendix B, Table B-4).

ssl 3/18/99 modified for K. Falls QA 09/15/1999 (sda)

Appendix B, Table B-6. Klamath Falls Residential Wood Fuel U[illegible] ...mates

	Klamath Falls UGB Survey Year 1999		Klamath Falls UGB Inventory Year 1996	
SURVEY DATA (1):			SURVEY DATA APPLIED TO Klamath Falls:	
Percentage of HU burning wood	26.5%		Klamath Falls Housing Units (HU) (5)	16,223
Woodburning HU with Fireplace (No Insert), Q8	29.6%		HDD - Inventory Year/Area = 1996/Klamath Falls (6)	5596
Woodburning HU with Wood Stove (Certified), Q8	28.9%		HDD - Survey Year/Area = 1998/Klamath Falls (6)	6053
Woodburning HU with Wood Stove (Non-certified), Q8 (2)	21.1%			
Woodburning HU with Fireplace Insert (Non-certified), Q8	14.9%		Typical cord weight: Tons/Cord of Wood (7)	1.48
Woodburning HU with Pellet Stove, Q8	5.6%		Tons/Ton Pellets (8)	1.0
Total	100%			
SURVEY DATA APPLIED TO Klamath Falls UGB:			Klamath Falls Cords Burned per HU (9)	
Woodburning HU (Fireplace w/o inserts)	29.6%		Cords Burned per HU (Fireplace)	1.20
Woodburning HU (Certified Catalytic Wood Stove) (3)	7.2%		Cords Burned per HU (Certified Catalytic W/S)	1.77
Woodburning HU (Certified Non-Cat Wood Stove) (3)	21.7%		Cords Burned per HU (Certified Non-Cat. W/S)	1.77
Woodburning HU (Non-Certified Wood Stove & FP Insert)	36.0%		Cords Burned per HU (Conv. Wood Stove or FP Insert)	1.94
Woodburning HU (Pellet Stove)	5.6%		Tons of Pellets Burned per HU (Pellet Stove)	1.33
Total % Woodburning Devices	100%			
Distribution to UGB Housing (4)			Klamath Falls, Tons of Wood Fuel Burned (10)	
UGB HU (Fireplace)	7.8%		Tons Burned from Fireplace	2,254
UGB HU (Certified Catalytic Wood Stove)	1.9%		Tons Burned from Cert. Catalytic. W/S	814
UGB HU (Certified Non-Cat Wood Stove)	5.7%		Tons Burned from Cert. Non-Cat W/S	2,442
UGB HU (Conventional Wood Stove or FP Insert)	9.5%		Tons Burned Conventional W/S or FP Insert	4,436
UGB HU (Pellet Stove)	1.5%		Tons Burned from Pellet Stove (11)	321
Total % HUs w/Woodburning Devices	26.5%		Total Klamath Falls Tons Wood Burned	10,268

Notes:
1) Data from the *"Oregon DEQ Wood Heating Survey, 1999"* (Ref. 348).
2) Wood Stoves include woodburning furnaces, cookstoves, and other woodburning devices not used for home heating.
3) There were no specific survey questions to estimate the number of catalytic stoves in the inventory area. It is estimated that 25% of all certified stoves are catalytic and 75% are non-catalytic.
HU with Certified Catalytic Stoves = (HU with Certified Stoves) * (0.25) *AND* HU with Certified Non Catalytic Stoves = (HU with Certified Stoves) * (0.75);
4) UGB HU [for each device type] (%) = (Woodburning HU [device type] (%)) * (UGB Housing Units Burning Wood (%))
5) Klamath Falls Housing Unit data from Ref.333 (See Appendix B, Table B-1).
6) Data for Heating Degree Days (HDD) are from "Climatological Data Annual Summary, Oregon, 1996" (Ref. 93). See Appendix B, Table B-8.
7) Fuel loading based upon DEQ estimate for typical cord wood mixture from *"Oregon DEQ Wood Heating Survey, 1999"* (Ref. 348). See Appendix B, Table B-7.
8) Wood pellets for pellet stoves used for home heating are sold by the ton (2000 pounds) in plastic bags.
9) Cords burned per a single wood burning housing unit for 1996 is a weighted average for each device (see calculations on page 2).
10) Klamath Falls Tons Burned in wood stove devices = (UGB Cords Burned per HU[for device]) * (Tons/Cord of wood) * (Number of KF Housing Units) * (UGB HU [for device] %)
11) Klamath falls Tons Burned in Pellet Stoves = (Tons Pellets Burned per HU[for pellet stoves]) * (Tons/Ton pellets) * (Number of KF Housing Units) * (UGB HU [for pellet stoves]) %

Appendix B, Table B-7 Klamath Falls 1998/99 Wood Heating Survey Notes

CORDS BURNED PER HOUSING UNIT IN KLAMATH FALLS UGB, 1996

FUEL LOADING ANALYSIS FOR KLAMATH FALLS UGB

Wood Type	(a) Percent of Cord Usage	(b) Typical Cord Usage Corrected	(c) Wood Density (lbs/ft3)	(d) Cord Density (lbs./cord)	(e) Typical Cord Weight (lbs./cord)	(f) Cord Weight (tons/cord)
Douglas Fir	14%	19.5%	32	2,560	499	0.25
Pine	49%	66.0%	40	3,200	2112	1.06
White Fir	10%	10.0%	24.3	1,944	194	0.10
Madrone/Tamarack	4%	4.0%	48	3,840	154	0.08
Total	78%	100%			2,959	1.48

(a) Percent of Cord Usage are the results of 1999 Wood Heating survey for Klamath Falls (question 13).
The total is 78% because percent of respondents burning other types of wood is not included here.
(b) Usage is adjusted to 100% to reflect a typical species mix cord of wood in the Klamath Falls Area.
Typical Cord Usage Distribution Corrected = The weighted percent of respondents indicating the wood species /The weighted total percent of respondents.
For the sake of the completeness of these calculations, category "other" was divided between two most used categories: douglas fir and pine.
Typical cord usage corrected was determined based on the survey question 13
("How much of the following varieties of wood do you burn most often?") as follows.
Survey question 13 results:

Q13A: % dougl.fir burned	# of respondents	Weighted # of resp.(*)	Doug Fir	
1-20%	10	3.45	34%	=# of resp. burning douglas fir 1-20% of a time/total number of respondents
21-50%	8	2.21	28%	=# of resp. burning douglas fir 21-50% of a time/total number of respondents
51-75%	8	2.21	28%	=# of resp. burning douglas fir 51-75% of a time/total number of respondents
76-100%	3	0.31	10%	=# of resp. burning douglas fir 76-100% of a time/total number of respondents
blank	470		100%	
Total	499	8	29	total number of respondents, excluding blank answers = 10+8+8+3

(*) Weighted number of respondents was calculated as 3.45 = 10*34%; 2.21 = 8*28%; 0.31 = 3*10%.

Q13B: % white fir burned	# of respondents	Weighted # of resp	White Fir
1-20%	7	2.45	35%
21-50%	7	2.45	35%
51-75%	2	0.20	10%
76-100%	4	0.80	20%
blank	479		100%
Total	499	6	20

Q13C: % pine burned	# of respondents	Weighted # of resp.	Pine
1-20%	9	0.95	11%
21-50%	17	3.40	20%
51-75%	18	3.81	21%
76-100%	41	19.78	48%
blank	414		100%
Total	499	28	85

Q13D: % tamarack	# of respondents	Weighted # of resp.	Tamarack
1-20%	3	1.50	50%
21-50%	0	0.00	0%
51-75%	2	0.67	33%
76-100%	1	0.17	17%
blank	493		100%
Total	499	2	6

APPENDIX C: NON-ROAD MOBILE

Appendix C, Table C-1: Non-Road Engine Emission Inventories for CO and Ozone Nonattainment Areas (Spokane, Washington), 2-cycle, 4-cycle, and diesel
Appendix C, Table C-2: Calculations of 1996 Fuel Use by Railroad Line Haul Operations
Appendix C, Table C-3: Calculations of 1996 Fuel Use by Railroad Yard Operations
Appendix C, Table C-4: Calculations of Commercial and Military Aircraft Emissions using FAEED

Appendix C, Table C-1. NONROAD ENGINE EMISSION INVENTORIES FOR CO AND OZONE NONATTAINMENT BOUNDARIES, Spokane, Washington (Average Inventory [A + B / 2])

Emissions and Seasonal Adjustment Factors

(1) This Table of Emission Rates & Seasonal Adjustment Factors (SAF) was Adapted from EPA Nonroad Engine & Vehicle Study, Spokane WA Report (See Notes below, Ref. 51a and Ref 51c)	CO Annual Emissions (CO Area) [tons/year]	(2) CO Season (CO Area) [tpwd]	(4). CO Seasonal Adjustment Factor (SAF)
List for Engine Type: 2-CYCLE Gasoline			
Lawn and garden category			
Trimmers/Edgers/Brush Cutters	194	0.00	
Lawn Mowers	501	0.00	
Leaf Blowers/Vacuums	70	0.00	
Rear Engine Riding Mowers	0	0.00	
Front Mowers	0	0.00	
Chainsaw < 4 HP	415	0.00	
Shredder <5 HP	0	0.00	
Tillers < 5 HP	1	0.00	
Lawn & Garden Tractors	0	0.00	
Wood Splitters	0	0.00	
Snowblowers	4	0.04	
Chippers/Stump Grinders	0	0.00	
Commercial Turf Equipment	0	0.00	
Other Lawn & Garden Equipment	5	0.00	
CATEGORY TTL	1,190	0.04	0.01
Airport Services Category			
Aircraft Support Equipment	0	0.00	
Terminal Tractors	1	0.00	
CATEGORY TTL	1	0.00	0.00
Recreational Equipment Category			
All Terrain Vehicles (ATV's)	0	0.00	
Minibikes	0	0.00	
Off-Road Motorcycles	0	0.00	
Golf Carts	0	0.00	
Snowmobiles	0	0.00	
Specialty Vehicle Carts	0	0.00	
CATEGORY TTL	0	0.00	0.00
Recreational Marine Category			
Vessels w/Inboard Engines	0	0.00	
Vessels w/Outboard Engines	78	0.00	
Vessels w/Sterndrive Engines	0	0.00	
Sailboat Auxillary Inboard Engines	0	0.00	
Sailboat Auxillary Outboard Engines	0	0.00	
CATEGORY TTL	78	0.00	0.00
Light Commercial Equipment Category			
Generator Sets	134	0.37	
Pumps	19	0.05	
Air Compressors	0	0.00	
Gas Compressors	0	0.00	
Welders	0	0.00	
Pressure Washers	0	0.00	
CATEGORY TTL	153	0.42	0.99

(1) This Table of Emission Rates & Seasonal Adjustment Factors (SAF) was Adapted from EPA Nonroad Engine & Vehicle Study, Spokane WA Report (See Notes below, Ref. 51a and Ref 51c)	CO Annual Emissions (CO Area) [tons/year]	(2) CO Season (CO Area) [tpwd]	(4) CO Seasonal Adjustment Factor (SAF)
Industrial Category			
Aerial Lifts	4	0.01	
Forklifts	169	0.46	
Sweepers/Scrubbers	7	0.02	
Other General Industrial Equipment	5	0.02	
Other Material Handling Equipment	0	0.00	
CATEGORY TTL	185	0.51	0.99
Construction Equipment Category			
Asphalt Pavers	0	0.00	
Tampers/Rammers	6	0.01	
Plate Compactors	8	0.01	
Concrete Pavers	0	0.00	
Rollers	0	0.00	
Scrappers	0	0.00	
Paving Equipment	6	0.01	
Surfacing Equipment	0	0.00	
Signal Boards	0	0.00	
Trenchers	0	0.00	
Bore/Drill Rigs	0	0.00	
Excavators	0	0.00	
Concrete/Industrial Saws	0	0.00	
Cementand Mortar Mixers	0	0.00	
Cranes	0	0.00	
Graders	0	0.00	
Off-Highway Trucks	0	0.00	
Crushing/Proc. Equip.	0	0.00	
Rough Terrain Forklifts	0	0.00	
Rubber Tired Loaders	0	0.00	
Rubber Tired Dozers	0	0.00	
Tractors/Loaders/Backhoes	0	0.00	
Crawlers	0	0.00	
Skid Steer Loaders	0	0.00	
Off-Highway Tractors	0	0.00	
Dumpers/Tenders	0	0.00	
Other Construction Equipment	0	0.00	
CATEGORY TTL	20	0.03	0.54
Agricultural Equipment Category			
2-Wheel Tractors	0	0.00	
Agricultural Tractors	0	0.00	
Agricultural Mowers	0	0.00	
Combines	0	0.00	
Sprayers	0	0.00	
Balers	0	0.00	
Tillers >5 HP	0	0.00	
Swathers	0	0.00	
Hydro Power Units	0	0.00	
Other Agricultural Equipment	0	0.00	
CATEGORY TTL	0	0.00	0.00
Logging Equipment Category			
Chainsaws >4 HP	0	0.00	
Shredders >5 HP	0	0.00	
Skidders	0	0.00	
Fellers/Bunchers	0	0.00	
CATEGORY TTL	0	0.00	0.00
Summary of Engine Type			
2-CYCLE ENGINES - TOTAL	1,627	1.00	0.22

(1) This Table of Emission Rates & Seasonal Adustment Factors (SAF) was Adapted from EPA Nonroad Engine & Vehicle Study, Spokane WA Report (See Notes below, Ref. 51a and Ref 51c)	CO Annual Emissions (CO Area) [tons/year]	(2) CO Season (CO Area) [tpwd]	(4) CO Seasonal Adjustment Factor (SAF)
List for Engine Type: 4-Cycle Gasoline			
Lawn and Garden Category			
Trimmers/Edgers/Brush Cutters	0	0.00	
Lawn Mowers	3,201	0.00	
Leaf Blowers/Vacuums	0	0.00	
Rear Engine Riding Mowers	234	0.00	
Front Mowers	66	0.00	
Chainsaw < 4 HP	0	0.00	
Shredder <5 HP	5	0.00	
Tillers < 5 HP	262	0.00	
Lawn & Garden Tractors	1,052	0.00	
Wood Splitters	28	0.00	
Snowblowers	10	0.11	
Chippers/Stump Grinders	123	0.00	
Commercial Turf Equipment	1,658	0.00	
Other Lawn & Garden Equipment	11	0.00	
CATEGORY TTL	6,650	0.11	0.01
Airport Services Category			
Aircraft Support Equipment	22	0.06	
Terminal Tractors	163	0.45	
CATEGORY TTL	185	0.51	0.99
Recreational Equipment Category			
All Terrain Vehicles (ATV's)	0	0.00	
Minibikes	0	0.00	
Off-Road Motorcycles	0	0.00	
Golf Carts	0	0.00	
Snowmobiles	0	0.00	
Specialty Vehicle Carts	0	0.00	
CATEGORY TTL	0	0.00	0.00
Recreational Marine Category			
Vessels w/Inboard Engines	57	0.00	
Vessels w/Outboard Engines	0	0.00	
Vessels w/Sterndrive Engines	0	0.00	
Sailboat Auxillary Inboard Engines	0	0.00	
Sailboat Auxillary Outboard Engines	0	0.00	
CATEGORY TTL	57	0.00	0.00
Light Commercial Equipment Category			
Generator Sets	1,898	5.20	
Pumps	371	1.02	
Air Compressors	250	0.68	
Gas Compressors	0	0.00	
Welders	370	1.01	
Pressure Washers	112	0.31	
CATEGORY TTL	3,001	8.22	0.99

(1) This Table of Emission Rates & Seasonal Adjustment Factors (SAF) was Adapted from EPA Nonroad Engine & Vehicle Study, Spokane WA Report (See Notes below, Ref. 51a and Ref 51c)	CO Annual Emissions (CO Area) [tons/year]	(2) CO Season (CO Area) [tpwd]	(4) CO Seasonal Adjustment Factor (SAF)
<u>Industrial Category</u>			
Aerial lifts	91	0.25	
Forklifts	448	1.23	
Sweepers/Scrubbers	42	0.11	
Other General Industrial Equipment	25	0.07	
Other Material Handling Equipment	4	0.01	
CATEGORY TTL	610	1.67	0.99
<u>Construction Equipment Category</u>			
Asphalt Pavers	2	0.00	
Tampers/Rammers	0	0.00	
Plate Compactors	14	0.02	
Concrete Pavers	0	0.00	
Rollers	21	0.02	
Scrapers	0	0.00	
Paving Equipment	44	0.05	
Surfacing Equipment	15	0.02	
Signal Boards	0	0.00	
Trenchers	20	0.02	
Bore/Drill Rigs	7	0.01	
Excavators	0	0.00	
Concrete/Industrial Saws	66	0.07	
Cementand Mortar Mixers	22	0.02	
Cranes	6	0.01	
Graders	0	0.00	
Off-Highway Trucks	0	0.00	
Crushing/Proc. Equip.	2	0.00	
Rough Terrain Forklifts	4	0.00	
Rubber Tired Loaders	6	0.01	
Rubber Tired Dozers	0	0.00	
Tractors/Loaders/Backhoes	3	0.00	
Crawlers	0	0.00	
Skid Steer Loaders	15	0.02	
Off-Highway Tractors	0	0.00	
Dumpers/Tenders	3	0.00	
Other Construction Equipment	5	0.01	
CATEGORY TTL	255	0.28	0.40
<u>Agricultural Equipment Category</u>			
2-Wheel Tractors	0	0.00	
Agricultural Tractors	0	0.00	
Agricultural Mowers	0	0.00	
Combines	0	0.00	
Sprayers	0	0.00	
Balers	0	0.00	
Tillers >5 HP	0	0.00	
Swathers	0	0.00	
Hydro Power Units	0	0.00	
Other Agricultural Equipment	0	0.00	
CATEGORY TTL	0	0.00	0.00
<u>Logging Equipment Category</u>			
Chainsaws >4 HP	0	0.00	
Shredders >5 HP	0	0.00	
Skidders	0	0.00	
Fellers/Bunchers	0	0.00	
CATEGORY TTL	0	0.00	0.00
Summary of Engine Type			
4-CYCLE ENGINES - TOTAL	10,758	10.79	0.36

(1) This Table of Emission Rates & Seasonal Adustment Factors (SAF) was Adapted from EPA Nonroad Engine & Vehicle Study, Spokane WA Report (See Notes below, Ref. 51a and Ref 51e)	CO Annual Emissions (CO Area) [tons/year]	(2) CO Season (CO Area) [tpwd]	(4) CO Seasonal Adjustment Factor (SAF)
List for Engine Type: Diesel			
Lawn and Garden Category			
Trimmers/Edgers/Brush Cutters	0	0.00	
Lawn Mowers	0	0.00	
Leaf Blowers/Vacuums	0	0.00	
Rear Engine Riding Mowers	0	0.00	
Front Mowers	0	0.00	
Chainsaw < 4 HP	0	0.00	
Shredder <5 HP	0	0.00	
Tillers < 5 HP	0	0.00	
Lawn & Garden Tractors	2	0.00	
Wood Splitters	0	0.00	
Snowblowers	0	0.00	
chippers and stump grinders	2	0.00	
Commercial Turf Equipment	0	0.00	
Other Lawn & Garden Equipment	0	0.00	
CATEGORY TTL	4	0.00	0.00
Airport Services Category			
Aircraft Support Equipment	6	0.02	
Terminal Tractors	70	0.19	
CATEGORY TTL	76	0.21	0.99
Recreational Equipment Category			
All Terrain Vehicles (ATV's)	0	0.00	
Minibikes	0	0.00	
Off-Road Motorcycles	0	0.00	
Golf Carts	0	0.00	
Snowmobiles	0	0.00	
Specialty Vehicle Carts	0	0.00	
CATEGORY TTL	0	0.00	0.00
Recreational Marine Category			
Vessels w/Inboard Engines	0	0.00	
Vessels w/Outboard Engines	0	0.00	
Vessels w/Sterndrive Engines	0	0.00	
Sailboat Auxiliary Inboard Engines	0	0.00	
Sailboat Auxiliary Outboard Engines	0	0.00	
CATEGORY TTL	0	0.00	0.00
Light Commercial Equipment Category			
Generator Sets	6	0.02	
Pumps	2	0.01	
Air Compressors	1	0.00	
Gas Compressors	0	0.00	
Welders	4	0.01	
Pressure Washers	0	0.00	
CATEGORY TTL	13	0.04	1.11

(1) This Table of Emission Rates & Seasonal Adustment Factors (SAF) was *Adapted* from EPA Nonroad Engine & Vehicle Study, Spokane WA Report (See Notes below, Ref. 51a and Ref 51c)	CO Annual Emissions (CO Area) [tons/year]	(2) CO Season (CO Area) [tpwd]	(4) CO Seasonal Adjustment Factor (SAF)
Industrial Category			
Aerial lifts	1	0.00	
Forklifts	15	0.04	
Sweepers/Scrubbers	12	0.03	
Other General Industrial Equipment	3	0.01	
Other Material Handling Equipment	1	0.00	
CATEGORY TTL	32	0.08	0.90
Construction Equipment Category			
Asphalt Pavers	1	0.00	
Tampers/Rammers	0	0.00	
Plate Compactors	0	0.00	
Concrete Pavers	1	0.00	
Rollers	4	0.01	
Scrappers	12	0.01	
Paving Equipment	5	0.01	
Surfacing Equipment	0	0.00	
Signal Boards	0	0.00	
Trenchers	6	0.01	
Bore/Drill Rigs	4	0.01	
Excavators	22	0.02	
Concrete/Industrial Saws	0	0.00	
Cementand Mortar Mixers	0	0.00	
Cranes	22	0.02	
Graders	20	0.02	
Off-Highway Trucks	12	0.01	
Crushing/Proc. Equip.	5	0.01	
Rough Terrain Forklifts	13	0.02	
Rubber Tired Loaders	63	0.07	
Rubber Tired Dozers	3	0.00	
Tractors/Loaders/Backhoes	56	0.06	
Crawlers	59	0.06	
Skid Steer Loaders	16	0.02	
Off-Highway Tractors	62	0.07	
Dumpers/Tenders	0	0.00	
Other Construction Equipment	5	0.01	
CATEGORY TTL	391	0.44	0.41
Agricultural Equipment Category			
2-Wheel Tractors	0	0.00	
Agricultural Tractors	0	0.00	
Agricultural Mowers	0	0.00	
Combines	0	0.00	
Sprayers	0	0.00	
Balers	0	0.00	
Tillers >5 HP	0	0.00	
Swathers	0	0.00	
Hydro Power Units	0	0.00	
Other Agricultural Equipment	0	0.00	
CATEGORY TTL	0	0.00	0.00
Logging Equipment Category			
Chainsaws >4 HP	0	0.00	
Shredders >5 HP	0	0.00	
Skidders	0	0.00	
Fellers/Bunchers	0	0.00	
CATEGORY TTL	0	0.00	0.00
Summary - Engine Type	—	—	—
DIESEL-CYCLE ENGINES - TOTAL	516	0.77	0.54

Notes:

1) Table C-1 Data is adapted from the EPA "Nonroad Engine and Vehicle Study - *Report*" Doc. EPA-21A-2001, November 1991 (Ref. 51a and 51c). As suggested in EPA Guidance (Ref. 49b), an average of results from Inventory A & Inventory B [A + B / 2] is used here (Ref. 91).
Column totals for each category do not correspond to EPA study hardcopy totals due to spreadsheet rounding .
2) Units: tpwd = tons/winter day (CO Season only); tpsd = tons/summer day (VOC, Ozone Season only).
3) Ozone Seasonal Adjust. Factor (SAF) = (Peak Season Activity * 12 Months) / (Annual Activity * Ozone *Season Months*)
4) Calculated above is Carbon *Monoxide Seasonal* Adjustment Factor (SAF) =
((CO [tons/winter day_CO Area] * 90 [winter days]) * 12 [months]) / (CO [tons/year_CO Area] * 3 [months]) [Unitless]
5) Particulate Matter Seasonal Adjustment Factor (SAF) =
((PM [tons/yr _CO Area] / 365 [days/yr]*120 [days/PM season])*12 [months])/ (PM [tons/yr _CO Area]*3 [months])
6) Activity is assumed to be uniform for each day of the week. See the "Nonroad Engine and Vehicle Emission Study - Appendices" (Ref. 49a), pp. *L-3&4*. This study did not consider day-to-day fluctuations in emissions.

Appendix C, Table C-2. Calculations of 1996 Fuel Use by Railroad Line Haul Operations

LINE HAUL OPERATIONS:	(1) System-wide Traffic Density [GTM*10^6]	(1) System-wide Fuel Consumption [Gallons*10^3]	(2) Fuel Consumption Index	(3) Klamath Falls UGB Traffic Density [GTM*10^3]	(4) UGB Fuel Consumption [Gallons]	(5) Statewide Trackage [miles]	(6) Klamath Falls UGB Trackage [miles]	(7) State Traffic Density [GTM*10^3]
SCC 22-85-005-000								
Line Haul Locomotives								
Union Pacific Railroad*	307,546	431,035	713	528,690	741,500	1,098	9	7,823
Burlington Northern RR	747,565	1,015,392	736	1,000	1,358	487,640	7	NA
Amtrak Passenger Rail Transport**	NA	NA	2.00	NA	18,980	NA	7	NA
TOTAL UGB FUEL USE (gallons):					761,838			

NA - not available

Notes:

1) System-wide Traffic Density, expressed in units of million "Gross Ton Mile", describes freight (car & load) total weight and distance hauled within the United States by each company, and is reported by Class 1 railroads annually to the Surface Transportation Board, US DOT (Form R-1, Schedule 755). Ref 372 which is an excerpt from the R-1 report System Fuel Use by Amtrak supplied by Amtrak (Ref 64).
System-wide Fuel Consumption, expressed here as thousands of gallons, is the total fuel consumed by each Class 1 company and is reported to the Surface Transportation Board, US DOT. Ref 372
2) The Fuel Consumption Index is the ratio of System-wide Traffic Density (GTM) to System-wide Fuel Consumed (gallons).
For Amtrak, GTM & Fuel Consumption not available; instead, fuel mileage in "gallons per mile" for a 1996-era locomotive was provided by Steve Covell, Amtrak Locom. Maintenance engineer (Ref. 372).
3) UGB GTM for SP calculated: (Fuel consumption) * (Fuel consumption index /1000)
GTM for BN supplied by BN (Refs 372).
UPRR provided 1996 fuel consumed for Line Haul in KF UGB.... GTM = Gross Ton-Mile,
Burlington Northern provided 1996 "maximum GTM for KF UGB" (via phone conversation, Ref. 372)
4) UGB Fuel Use calculated: (System Fuel Use, Gallons) * (UGB GTM/System GTM)
For Southern Pacific (UPRR), Fuel usage reported directly by the Manager of Compliance Measurement, Western Region of UPRR. (Ref.372)
For BN: (UGB GTM) / Fuel Consumption Index, GTM/gal)
For Amtrak: 6.25 UGB track miles*2 gallons per locomotive-mile*2 locomotives per train*1 train per day* 365days per year (Ref. 372).
5) State Track Miles for SP obtained from the Oregon Public Utility Commission (Ref 67).
System Loco Miles for Amtrak supplied by Amtrak (Ref 64).
6) UGB Track Miles for Southern Pacific measured from DEQ AQMA wall map.
UGB Loco Miles for Amtrak are DEQ estimates based on data & map from Amtrak (Ref 64):
System Loco Miles in State * percent which appear to be in County
7) State GTM supplied by Southern Pacific (Ref 68). They were not able to supply County GTM.
8) The railroad representation are only of type Class I (extensive rail systems, largest carriers of passengers and freight).

Appendix C-3, Table C-3. Calculations of 1996 Fuel Use by Railroad Yard Operations

SWITCHING YARD OPERATIONS: Railroad Companies	OPERATIONS DATA Quantity of Yard Locomotives	(1) Daily Operating Hours (hr/day)	(2) Annual Operating Days (days/yr)	(3) Daily Fuel Use (gal/day)	(4) Annual Fuel Use (gal/yr)
SCC 22-85-010-000					
Switching Yard Locomotives.					
Union Pacific Railroad*	1	7	364	66	23,994
Burlington Northern RR	4	31.5	364	297	107,972
Amtrak Passenger Rail Transport*	0	0	0	0	0
RAIL SWITCHING YARD FUEL USE, TOTAL (gallons per year):					131,965

* Union Pacific is listed instead of Southern Pacific, the actual rail company which operated in this UGB in 1996. Southern Pacific operations were absorbed by Union Pacific in September 1996 as a result of corporate merger.

** Amtrak has no rail yard operations (line haul only) in the Klamath Falls UGB.

Notes:

1) Number of locomotives and daily operating hours are provided by each railroad company and is documented in Ref. 372.

2) Operating days per week and were annualized by multiplying the average locomotive week length by 52 wks/yr.

3) Calculated by converting Daily Operating Hours to a 24-hour daily basis. The average dailyfuel consumption rate of 226 gallons/day is stated in the EPA Procedures Manual Vol. IV (Ref. 91, section 6.2.3).

4) Annual Fuel Use calculated per EPA Procedures Manual Vol. IV (Ref 91, section 6.2.3): Switching Yard Fuel Consumption [gals/yr]

Fuel usage [gal/yr] = (Locomotive-Hrs/day) / (24 hrs/day) * (226 Gallons/Locomotive-Day) * (364 Days/Yr)

Appendix C, Table C-4. Calculations of Commercial & Military Aircraft Emissions using FAEED

Area/Airport SCC 22-75-000-000		(1) 1996 LTOs	(2) CO (lbs/year)
KLAMATH FALLS UGB Kingsley Field			
Aircraft-Commercial			
Jetstream 31	(3)	711	3,417
DHC-8	(4)	306	2,198
D38	(5)	77	553
SWEAR METRO III	(6)	1,047	17,135
Commercial Totals:		2,140	23,303
Aircraft-Military			
F-16		7,493	157,847

SCC 22-75-000-000

SCC 22-75-020-000 SCC 22-75-050-000 [General Aviation]? SCC 22-75-060-000 [Air Taxi]?

SCC 22-75-020-000

SCC 22-75-001-000

Notes:

1) Aircraft operations from Bill Hancock, Airport Operations Manager at Klamath Falls International Airport (REF 336) as follows:

Information Received from Bill Hancock @ Klamath Falls Airport 4/5/99, Ref 336

Total Operations	Operations	LTOs*
Air Carrier	4,340	2,170
Air Taxi	2,916	1,458
Itinerant Civil	22,027	11,014
Itinerant Military	7,254	3,627
Local Civil	10,276	5,138
Local Military	7,731	3,866

Commercial (Air Carrier)	Operations	LTOs
Jetsteam 31	1422	711
DH-8	611	306
D38	154	77
SWM Metro III	2093	1,047
Total Com. Air Carrier:	4280	2,140

Military	Operations	LTOs
F-16 single engine fighter	14,985	7,493

Analysis for EI calculation:

	LTOs
Commercial Air Carrier:	2,140
Military:	7492.5
**Air Taxi:	1,488
GA Local:	5,138
GA Itinerant:	11,014

*Note: LTOs = Operations/2

**Note: Air Taxi = Air Taxi + (Total Air Carrier - Total Commercial Air Carrier)

Note:Commercial Aircraft LTO's are not listed in FAA Airport Actvty Stats of Cert Rt Carriers, 1996.

2) Emissions were computed by the FAA Aircraft Engine Emission Database (FAEED)(Ref 76) using the Aircraft-Specific Inventory Method outlined in (Ref 91);

The following aircraft types were substituted for the purpose of running FAEED:

(3) Lockheed Jetstar for BAE Jetstream 31

(4) DHC-6/300 for DHC-8

(5) DHC-6/300 for D38

(6) KINGAIR B200 for SWEAR-METRO III

Substitute aircraft are chosen based on similar engine types.

APPENDIX D: ON-ROAD MOBILE

Appendix D, Table D-1: Klamath Falls ambient temperature for the days with the 10 highest 8-hour Carbon Monoxide measured values from 1994-1996 CO Season.
Appendix D, Table D-2: Klamath Falls 1996 Mobile 5b multiple speed input file
Appendix D, Table D-3: Klamath Falls 1996 Mobile 5b multiple speed output file
Appendix D, Table D-4: Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs./day calculation table.
Appendix D, Table D-1a: Klamath Falls UGB CO 1996 Annual: On-Road Mobile Sources CO Emissions by Vehicle Class (without oxygenated fuel) tons/year
Appendix D, Table D-5b. Klamath Falls UGB CO 1996 Seasonal: On-Road Mobile Sources CO Emissions by Vehicle Class (without oxygenated fuel) lbs./day
Appendix D, Table D-6: Klamath Falls UGB CO 1996 Travel Demand Model Methodology Report

Appendix D, Table D-1, Klamath Falls ambient temperature for the days with the 10 highest 8-hour Carbon Monoxide measured values from 1994-1996 CO Seasons.

The Ambient Temperature for Mobile 5b
Klamath Falls, Hope Street
OR DEQ site #1800010; AIRS/AQS Site #410350006
1993 - 1996 Carbon Monoxide (max 8-hr averages)

						Temperature, F		
RANK	DATE	AVG., ppm	#HRS	START H	END HR	24H-Max	24H-Min	8H-Amb
1	12/20/93	7.05	8	16	24	37.134	11.934	21.609
2	12/22/93	6.76	8	16	24	37.134	11.934	24.084
3	12/23/93	6.36	8	17	25	42.534	13.734	21.834
4	01/14/94	5.86	8	15	23	42.534	24.534	32.859
5	12/21/93	5.78	8	16	24	37.134	13.734	22.059
6	02/04/94	5.06	8	17	25	44.334	11.934	22.734
7	12/22/94	5.04	8	16	24	40.734	20.934	26.334
8	12/21/94	5.01	8	16	24	42.534	24.534	30.384
9	01/20/94	5	8	15	23	47.934	20.934	36.684
10	01/18/94	4.99	7	15	23	47.934	19.134	33.984
					AVG. T, F	41.994	17.334	27.2565

The ambient temperature for Mobile 5b was calculated using the methodology described in the EPA guidance Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources (EPA 450/4-81-026d (Revised), 1992), section 3.3.5.2, pages 34-38).

For 1996 Klamath Falls EI, the calculations are based on the 1994-1996 CO Seasons: December 1, 1993 - February 28, 1994; December 1, 1994 - February 28, 1995 ; December 1, 1995 - February 29, 1996).

Eight hour average CO concentrations for Klamath Falls and dates on which they occurred were taken from AIRS and ranked based on the top single reading from Hope Street OR DEQ monitoring site #1800010.

The calculation methodology consists of averaging the inner eight hours of one hour temperature readings for each of the top ten CO days within the three CO seasons of the base season (1996) and then averaging the top ten 8-hour averages. Since the results of the running 8-hour averages for Carbon Monoxide are stored in the last, or end hour of the 8-hour period, the 1-hour temperatures counted 8 hours back from the hour the 8-hour measurement was taken (even if one day crossed over into a previous day). The one -hour temperatures were taken from the EPA AIRS AQS Site # 41-035-0004, Peterson Elementary.

Twenty four - hour maximum and minimum temperatures for the top 8-hour CO measurement days were taken from EPA AIRS AQS Site # 41-035-0004, Peterson Elementary and averaged respectively.

Min and Max temperatures are used in Mobile 5b when the whole day needs to be modeled.
Setting the TEMPFLAG to 1 and inputting the min and max temperatures gives the best daily average.
Ambient temperature (TMPFLAG set to 2) is used when peak or time specific estimates are to be produced (Ref. 404).

Appendix D, Table D-2: Klamath Falls 1996 Mobile 5b Multiple Speed Input File

```
1996 KLAMATH FALLS CO W/OUT OXY, CUSTOM LDGV/LDDV KFALL 96 REGISTRATION
1       TAMFLG  DEFAULT
1       SPDFLG  ONE AVG SPEED FOR ALL VEH TYPES
1       VMFLAG  MOBILE5 VMT MIX
3       MYMRFG  INPUT REGIST DIST BY AGE
1       NEWFLG  MOBILE5 BASIC EXHAUST EMISSION RATES
1       IMFLAG  NO IM PROGRAM
1       ALHFLG  NO EXHAUST EMISSION FACTOR CORRECTIONS
1       ATPFLG  NO ATP IS ASSUMED
5       RLFLAG  ZERO OUT NO REFUELING EF'S CALCULATED
2       LOCFLG  ONE LAP RECORD TO APPLY TO ALL SCENARIOS
1       TEMFLG  CALCULATED FROM MIN MAX TEMPERATURES
4       OUTFMT  80 COLUMN FORMAT
2       PRTFLG  CO OUTPUT ONLY
1       IDLFLG  NO IDLE EMISSION FACTORS CALCULATED
3       NMHFLG  VOC EMISSION FACTORS
1       HCFLAG  PRINT ONLY SUM OF ALL HC COMPONENTS
.046 .050 .054 .054 .049 .053 .049 .056 .057 .049    LDGV
.050 .047 .045 .030 .022 .024 .022 .034 .033 .029
.021 .013 .013 .015 .087
.055 .099 .098 .092 .097 .073 .062 .033 .027 .029    LDGT1
.031 .047 .044 .037 .028 .017 .023 .023 .019 .013
.010 .009 .008 .006 .020
.038 .072 .071 .059 .064 .070 .067 .056 .046 .039    LDGT2
.029 .069 .060 .051 .039 .025 .023 .025 .018 .014
.010 .011 .010 .007 .027
.036 .062 .063 .056 .058 .063 .062 .049 .042 .035    HDGV
.031 .065 .056 .050 .039 .032 .029 .033 .024 .018
.016 .016 .011 .011 .043
.046 .050 .054 .054 .049 .053 .049 .056 .057 .049    LDGV
.050 .047 .045 .030 .022 .024 .022 .034 .033 .029
.021 .013 .013 .015 .087
.055 .099 .098 .092 .097 .073 .062 .033 .027 .029    LDDT
.031 .047 .044 .037 .028 .017 .023 .023 .019 .013
.010 .009 .008 .006 .020
.057 .107 .103 .075 .080 .097 .089 .052 .046 .035    HDDV
.042 .047 .034 .028 .012 .014 .017 .019 .012 .009
.006 .005 .005 .002 .007
.144 .168 .135 .109 .088 .070 .056 .045 .036 .029    MC
.023 .097 .000 .000 .000 .000 .000 .000 .000 .000
.000 .000 .000 .000 .000
KF   1996 CO EF   17.3 41.9 13.6 13.6  20 1 1
1 96  5.0 27.3 20.6 27.3 20.6
1 96  6.0 27.3 20.6 27.3 20.6
1 96  7.0 27.3 20.6 27.3 20.6
1 96  8.0 27.3 20.6 27.3 20.6
1 96  9.0 27.3 20.6 27.3 20.6
1 96 10.0 27.3 20.6 27.3 20.6
1 96 11.0 27.3 20.6 27.3 20.6
1 96 12.0 27.3 20.6 27.3 20.6
1 96 13.0 27.3 20.6 27.3 20.6
1 96 14.0 27.3 20.6 27.3 20.6
1 96 15.0 27.3 20.6 27.3 20.6
1 96 16.0 27.3 20.6 27.3 20.6
1 96 17.0 27.3 20.6 27.3 20.6
1 96 18.0 27.3 20.6 27.3 20.6
1 96 19.0 27.3 20.6 27.3 20.6
1 96 20.0 27.3 20.6 27.3 20.6
```

1	96	21.0	27.3	20.6	27.3	20.6
1	96	22.0	27.3	20.6	27.3	20.6
1	96	23.0	27.3	20.6	27.3	20.6
1	96	24.0	27.3	20.6	27.3	20.6
1	96	25.0	27.3	20.6	27.3	20.6
1	96	26.0	27.3	20.6	27.3	20.6
1	96	27.0	27.3	20.6	27.3	20.6
1	96	28.0	27.3	20.6	27.3	20.6
1	96	29.0	27.3	20.6	27.3	20.6
1	96	30.0	27.3	20.6	27.3	20.6
1	96	31.0	27.3	20.6	27.3	20.6
1	96	32.0	27.3	20.6	27.3	20.6
1	96	33.0	27.3	20.6	27.3	20.6
1	96	34.0	27.3	20.6	27.3	20.6
1	96	35.0	27.3	20.6	27.3	20.6
1	96	36.0	27.3	20.6	27.3	20.6
1	96	37.0	27.3	20.6	27.3	20.6
1	96	38.0	27.3	20.6	27.3	20.6
1	96	39.0	27.3	20.6	27.3	20.6
1	96	40.0	27.3	20.6	27.3	20.6
1	96	41.0	27.3	20.6	27.3	20.6
1	96	42.0	27.3	20.6	27.3	20.6
1	96	43.0	27.3	20.6	27.3	20.6
1	96	44.0	27.3	20.6	27.3	20.6
1	96	45.0	27.3	20.6	27.3	20.6
1	96	46.0	27.3	20.6	27.3	20.6
1	96	47.0	27.3	20.6	27.3	20.6
1	96	48.0	27.3	20.6	27.3	20.6
1	96	49.0	27.3	20.6	27.3	20.6
1	96	50.0	27.3	20.6	27.3	20.6
1	96	51.0	27.3	20.6	27.3	20.6
1	96	52.0	27.3	20.6	27.3	20.6
1	96	53.0	27.3	20.6	27.3	20.6
1	96	54.0	27.3	20.6	27.3	20.6
1	96	55.0	27.3	20.6	27.3	20.6
1	96	56.0	27.3	20.6	27.3	20.6
1	96	57.0	27.3	20.6	27.3	20.6
1	96	58.0	27.3	20.6	27.3	20.6
1	96	59.0	27.3	20.6	27.3	20.6
1	96	60.0	27.3	20.6	27.3	20.6
1	96	61.0	27.3	20.6	27.3	20.6
1	96	62.0	27.3	20.6	27.3	20.6
1	96	63.0	27.3	20.6	27.3	20.6
1	96	64.0	27.3	20.6	27.3	20.6
1	96	65.0	27.3	20.6	27.3	20.6

Appendix D, Table D-3: Klamath Falls 1996 Mobile 5b Multiple Speed Output File

```
1996 Klamath Falls CO w/out Oxy, default LDDV registration
 MOBILE5b (14-Sep-96)
0
-M 49 Warning:
+                 1.00     MYR sum not = 1. (will normalize)
-M 49 Warning:
+                 1.00     MYR sum not = 1. (will normalize)
-M170 Warning:
+               Exhaust emissions for gasoline fueled vehicles
                beginning in 1995 have been reduced as a result of
                Gasoline Detergent Additive Regulations (1994).
0KF   1996 CO EF
                      Minimum Temp: 17. (F)   Maximum Temp: 42. (F)
                      Period 1 RVP: 13.6      Period 2 RVP: 13.6 Period 2 Yr:
2020
0VOC HC emission factors include evaporative HC emission factors.
0____________________________________________________________________________

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.:  5.0    5.0    5.0           5.0    5.0    5.0    5.0    5.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO:164.30 127.21 195.23 148.29 185.13   4.94   5.27  29.89 127.95
149.35

_____________________________________________________________________________

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.:  6.0    6.0    6.0           6.0    6.0    6.0    6.0    6.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO:138.76 108.06 164.28 125.48 169.89   4.57   4.87  27.65 106.76
126.89

_____________________________________________________________________________

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
```

```
0Cal. Year: 1996            Region: Low           Altitude:  500. Ft.
                      I/M Program: No         Ambient Temp:   34.2 (F)
                Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT    HDGV   LDDV    LDDT   HDDV    MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.:  7.0    7.0    7.0            7.0    7.0    7.0    7.0    7.0
   VMT Mix:  0.581  0.202  0.091          0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst   CO:120.37  94.33 141.92 109.08 156.25   4.23   4.52  25.62  90.81
110.59

________________________________________________________________________________
-
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low           Altitude:  500. Ft.
                      I/M Program: No         Ambient Temp:   34.2 (F)
                Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT    HDGV   LDDV    LDDT   HDDV    MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.:  8.0    8.0    8.0            8.0    8.0    8.0    8.0    8.0
   VMT Mix:  0.581  0.202  0.091          0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst   CO:106.55  84.03 125.10  96.76 144.02   3.93   4.19  23.79  78.58
98.25

________________________________________________________________________________
-
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low           Altitude:  500. Ft.
                      I/M Program: No         Ambient Temp:   34.2 (F)
                Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT    HDGV   LDDV    LDDT   HDDV    MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.:  9.0    9.0    9.0            9.0    9.0    9.0    9.0    9.0
   VMT Mix:  0.581  0.202  0.091          0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst   CO: 95.82  76.05 112.04  87.20 133.04   3.65   3.90  22.12  69.03
88.59

________________________________________________________________________________
-
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low           Altitude:  500. Ft.
                      I/M Program: No         Ambient Temp:   34.2 (F)
                Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
```

```
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 10.0   10.0   10.0          10.0   10.0   10.0   10.0   10.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 87.28  69.70 101.63  79.59 123.17   3.41   3.63  20.61  61.47
80.83
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 11.0   11.0   11.0          11.0   11.0   11.0   11.0   11.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 80.32  64.53  93.17  73.40 114.28   3.18   3.39  19.24  55.38
74.49
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 12.0   12.0   12.0          12.0   12.0   12.0   12.0   12.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 74.56  60.24  86.17  68.28 106.27   2.97   3.17  17.99  50.41
69.20
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
```

```
 Veh. Spd.: 13.0   13.0   13.0          13.0   13.0   13.0   13.0   13.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 69.72  56.63  80.30  63.97  99.04   2.78   2.97  16.86  46.30
64.72
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            _____ _____  _____  _____  _____  _____  _____  _____  _____
______
 Veh. Spd.: 14.0   14.0   14.0          14.0   14.0   14.0   14.0   14.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 65.59  53.55  75.29  60.29  92.50   2.61   2.79  15.82  42.85
60.89
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            _____ _____  _____  _____  _____  _____  _____  _____  _____
______
 Veh. Spd.: 15.0   15.0   15.0          15.0   15.0   15.0   15.0   15.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 62.03  50.89  70.98  57.11  86.58   2.46   2.62  14.87  39.92
57.57
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            _____ _____  _____  _____  _____  _____  _____  _____  _____
______
 Veh. Spd.: 16.0   16.0   16.0          16.0   16.0   16.0   16.0   16.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
```

```
 Exhst  CO: 58.93  48.56  67.22  54.35  81.22   2.31   2.47  14.01  37.41
54.66
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996           Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+          _____  _____  _____  _____  _____  _____  _____  _____  _____
_____
 Veh. Spd.: 17.0   17.0   17.0          17.0   17.0   17.0   17.0   17.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 56.19  46.51  63.92  51.90  76.36   2.18   2.33  13.22  35.21
52.09
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996           Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+          _____  _____  _____  _____  _____  _____  _____  _____  _____
_____
 Veh. Spd.: 18.0   18.0   18.0          18.0   18.0   18.0   18.0   18.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 53.76  44.68  61.00  49.73  71.95   2.06   2.20  12.50  33.28
49.80
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996           Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+          _____  _____  _____  _____  _____  _____  _____  _____  _____
_____
 Veh. Spd.: 19.0   19.0   19.0          19.0   19.0   19.0   19.0   19.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 51.59  43.03  58.38  47.79  67.94   1.96   2.09  11.84  31.56
47.75
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 20.0   20.0   20.0          20.0   20.0   20.0   20.0   20.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 49.46  41.54  56.28  46.11  64.30   1.86   1.98  11.23  30.01
45.82

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 21.0   21.0   21.0          21.0   21.0   21.0   21.0   21.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 47.37  39.84  54.06  44.25  60.99   1.76   1.88  10.68  28.59
43.88

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 22.0   22.0   22.0          22.0   22.0   22.0   22.0   22.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 45.46  38.28  52.03  42.54  57.97   1.68   1.79  10.17  27.29
42.11

0Emission factors are as of Jan. 1st of the indicated calendar year.
```

```
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT    HDGV    LDDV    LDDT    HDDV    MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 23.0   23.0   23.0           23.0    23.0    23.0    23.0    23.0
   VMT Mix:  0.581  0.202  0.091          0.038   0.003   0.001   0.075   0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 43.71  36.85  50.17  40.98   55.23    1.60    1.71    9.70   26.09
40.48
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT    HDGV    LDDV    LDDT    HDDV    MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 24.0   24.0   24.0           24.0    24.0    24.0    24.0    24.0
   VMT Mix:  0.581  0.202  0.091          0.038   0.003   0.001   0.075   0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 42.10  35.52  48.46  39.53   52.73    1.53    1.63    9.27   24.97
38.98
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT    HDGV    LDDV    LDDT    HDDV    MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 25.0   25.0   25.0           25.0    25.0    25.0    25.0    25.0
   VMT Mix:  0.581  0.202  0.091          0.038   0.003   0.001   0.075   0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 40.60  34.29  46.89  38.19   50.45    1.47    1.57    8.88   23.93
37.60
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
```

Reformulated Gas: No
0Veh. Type: LDGV LDGT1 LDGT2 LDGT HDGV LDDV LDDT HDDV MC All
Veh
+

Veh. Spd.: 26.0 26.0 26.0 26.0 26.0 26.0 26.0 26.0
VMT Mix: 0.581 0.202 0.091 0.038 0.003 0.001 0.075 0.007
0Composite Emission Factors (Gm/Mile)
Exhst CO: 39.22 33.14 45.42 36.95 48.38 1.41 1.50 8.52 22.94
36.31

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No
0Veh. Type: LDGV LDGT1 LDGT2 LDGT HDGV LDDV LDDT HDDV MC All
Veh
+

Veh. Spd.: 27.0 27.0 27.0 27.0 27.0 27.0 27.0 27.0
VMT Mix: 0.581 0.202 0.091 0.038 0.003 0.001 0.075 0.007
0Composite Emission Factors (Gm/Mile)
Exhst CO: 37.92 32.08 44.06 35.79 46.50 1.35 1.44 8.18 22.01
35.11

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No
0Veh. Type: LDGV LDGT1 LDGT2 LDGT HDGV LDDV LDDT HDDV MC All
Veh
+

Veh. Spd.: 28.0 28.0 28.0 28.0 28.0 28.0 28.0 28.0
VMT Mix: 0.581 0.202 0.091 0.038 0.003 0.001 0.075 0.007
0Composite Emission Factors (Gm/Mile)
Exhst CO: 36.71 31.08 42.79 34.71 44.79 1.30 1.39 7.88 21.14
34.00

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No
0Veh. Type: LDGV LDGT1 LDGT2 LDGT HDGV LDDV LDDT HDDV MC All
Veh

```
+
           ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 29.0   29.0   29.0          29.0   29.0   29.0   29.0   29.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 35.58  30.15  41.61  33.70  43.24   1.26   1.34   7.60  20.31
32.96
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+
           ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 30.0   30.0   30.0          30.0   30.0   30.0   30.0   30.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 34.53  29.27  40.50  32.75  41.83   1.21   1.29   7.34  19.53
31.99
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+
           ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 31.0   31.0   31.0          31.0   31.0   31.0   31.0   31.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 33.53  28.45  39.46  31.86  40.56   1.17   1.25   7.11  18.79
31.08
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+
           ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 32.0   32.0   32.0          32.0   32.0   32.0   32.0   32.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
```

```
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 32.60  27.68  38.48  31.03  39.41   1.14   1.22   6.89  18.10
30.23
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low           Altitude:  500. Ft.
                       I/M Program: No        Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______

 Veh. Spd.: 33.0   33.0   33.0          33.0   33.0   33.0   33.0   33.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 31.73  26.96  37.57  30.25  38.38   1.11   1.18   6.70  17.45
29.43
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low           Altitude:  500. Ft.
                       I/M Program: No        Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______

 Veh. Spd.: 34.0   34.0   34.0          34.0   34.0   34.0   34.0   34.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 30.91  26.29  36.71  29.52  37.46   1.08   1.15   6.52  16.84
28.69
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low           Altitude:  500. Ft.
                       I/M Program: No        Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______

 Veh. Spd.: 35.0   35.0   35.0          35.0   35.0   35.0   35.0   35.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 30.14  25.65  35.90  28.83  36.64   1.05   1.12   6.36  16.27
27.99
```

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	36.0	36.0	36.0		36.0	36.0	36.0	36.0	36.0	
VMT Mix:	0.581	0.202	0.091		0.038	0.003	0.001	0.075	0.007	
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	29.42	25.06	35.14	28.18	35.92	1.03	1.09	6.21	15.74	27.34

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	37.0	37.0	37.0		37.0	37.0	37.0	37.0	37.0	
VMT Mix:	0.581	0.202	0.091		0.038	0.003	0.001	0.075	0.007	
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	28.74	24.50	34.42	27.58	35.29	1.00	1.07	6.08	15.25	26.73

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	38.0	38.0	38.0		38.0	38.0	38.0	38.0	38.0	
VMT Mix:	0.581	0.202	0.091		0.038	0.003	0.001	0.075	0.007	
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	28.10	23.98	33.75	27.01	34.74	0.98	1.05	5.96	14.80	26.16

0Emission factors are as of Jan. 1st of the indicated calendar year.

```
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT    HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            _____  _____  _____  _____  _____  _____  _____  _____  _____
_____
 Veh. Spd.: 39.0   39.0   39.0           39.0   39.0   39.0   39.0   39.0
   VMT Mix:  0.581  0.202  0.091          0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 27.51  23.49  33.12  26.48  34.28   0.97   1.03   5.85  14.38
25.63

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0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT    HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            _____  _____  _____  _____  _____  _____  _____  _____  _____
_____
 Veh. Spd.: 40.0   40.0   40.0           40.0   40.0   40.0   40.0   40.0
   VMT Mix:  0.581  0.202  0.091          0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 26.95  23.04  32.53  25.98  33.91   0.95   1.02   5.76  14.00
25.13

_______________________________________________________________________________

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT    HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            _____  _____  _____  _____  _____  _____  _____  _____  _____
_____
 Veh. Spd.: 41.0   41.0   41.0           41.0   41.0   41.0   41.0   41.0
   VMT Mix:  0.581  0.202  0.091          0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 26.42  22.61  31.97  25.51  33.61   0.94   1.00   5.68  13.66
24.67

_______________________________________________________________________________

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
```

```
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 42.0   42.0   42.0          42.0   42.0   42.0   42.0   42.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 25.93  22.21  31.45  25.07  33.38   0.93   0.99   5.61  13.35
24.24
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
               Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 43.0   43.0   43.0          43.0   43.0   43.0   43.0   43.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 25.47  21.84  30.95  24.66  33.23   0.92   0.98   5.55  13.06
23.83
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
               Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 44.0   44.0   44.0          44.0   44.0   44.0   44.0   44.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 25.04  21.49  30.49  24.28  33.15   0.91   0.97   5.50  12.81
23.46
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
               Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
```

+

Veh. Spd.: 45.0 45.0 45.0 45.0 45.0 45.0 45.0 45.0
VMT Mix: 0.581 0.202 0.091 0.038 0.003 0.001 0.075 0.007
0Composite Emission Factors (Gm/Mile)
Exhst CO: 24.63 21.16 30.05 23.91 33.15 0.90 0.96 5.46 12.57
23.11

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No
0Veh. Type: LDGV LDGT1 LDGT2 LDGT HDGV LDDV LDDT HDDV MC All
Veh
+

Veh. Spd.: 46.0 46.0 46.0 46.0 46.0 46.0 46.0 46.0
VMT Mix: 0.581 0.202 0.091 0.038 0.003 0.001 0.075 0.007
0Composite Emission Factors (Gm/Mile)
Exhst CO: 24.25 20.85 29.64 23.57 33.22 0.90 0.96 5.43 12.36
22.79

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No
0Veh. Type: LDGV LDGT1 LDGT2 LDGT HDGV LDDV LDDT HDDV MC All
Veh
+

Veh. Spd.: 47.0 47.0 47.0 47.0 47.0 47.0 47.0 47.0
VMT Mix: 0.581 0.202 0.091 0.038 0.003 0.001 0.075 0.007
0Composite Emission Factors (Gm/Mile)
Exhst CO: 23.89 20.55 29.24 23.25 33.36 0.89 0.95 5.41 12.17
22.49

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No
0Veh. Type: LDGV LDGT1 LDGT2 LDGT HDGV LDDV LDDT HDDV MC All
Veh
+

Veh. Spd.: 48.0 48.0 48.0 48.0 48.0 48.0 48.0 48.0
VMT Mix: 0.581 0.202 0.091 0.038 0.003 0.001 0.075 0.007

```
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 23.54  20.27  28.87  22.94  33.58   0.89   0.95   5.41  11.99
22.20
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low          Altitude:  500. Ft.
                       I/M Program: No         Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 49.0   49.0   49.0          49.0   49.0   49.0   49.0   49.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 23.54  20.27  28.87  22.94  33.87   0.89   0.95   5.41  11.99
22.21
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low          Altitude:  500. Ft.
                       I/M Program: No         Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 50.0   50.0   50.0          50.0   50.0   50.0   50.0   50.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 23.54  20.27  28.87  22.94  34.25   0.90   0.96   5.42  11.99
22.23
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996            Region: Low          Altitude:  500. Ft.
                       I/M Program: No         Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 51.0   51.0   51.0          51.0   51.0   51.0   51.0   51.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 23.54  20.27  28.87  22.94  34.70   0.90   0.96   5.44  11.99
22.25
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low           Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 52.0   52.0   52.0          52.0   52.0   52.0   52.0   52.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 23.54  20.27  28.87  22.94  35.23   0.90   0.96   5.47  11.99
22.27
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low           Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 53.0   53.0   53.0          53.0   53.0   53.0   53.0   53.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 23.54  20.27  28.87  22.94  35.85   0.91   0.97   5.51  11.99
22.30
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996          Region: Low           Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 54.0   54.0   54.0          54.0   54.0   54.0   54.0   54.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 23.54  20.27  28.87  22.94  36.57   0.92   0.98   5.56  11.99
22.33
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
```

0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.581	0.202	0.091		0.038	0.003	0.001	0.075	0.007	
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	23.54	20.27	28.87	22.94	37.38	0.93	0.99	5.63	11.99	22.36

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	56.0	56.0	56.0		56.0	56.0	56.0	56.0	56.0	
VMT Mix:	0.581	0.202	0.091		0.038	0.003	0.001	0.075	0.007	
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	27.41	23.63	34.17	26.90	38.29	0.94	1.00	5.70	14.88	25.84

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	57.0	57.0	57.0		57.0	57.0	57.0	57.0	57.0	
VMT Mix:	0.581	0.202	0.091		0.038	0.003	0.001	0.075	0.007	
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	31.28	26.99	39.48	30.86	39.31	0.96	1.02	5.79	17.76	29.32

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6

Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	58.0	58.0	58.0		58.0	58.0	58.0	58.0	58.0	
VMT Mix:	0.581	0.202	0.091		0.038	0.003	0.001	0.075	0.007	
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	35.15	30.35	44.78	34.82	40.45	0.97	1.04	5.88	20.65	32.80

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	59.0	59.0	59.0		59.0	59.0	59.0	59.0	59.0	
VMT Mix:	0.581	0.202	0.091		0.038	0.003	0.001	0.075	0.007	
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	39.02	33.72	50.08	38.79	41.71	0.99	1.06	5.99	23.54	36.29

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	60.0	60.0	60.0		60.0	60.0	60.0	60.0	60.0	
VMT Mix:	0.581	0.202	0.091		0.038	0.003	0.001	0.075	0.007	
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	42.89	37.08	55.38	42.75	43.10	1.01	1.08	6.12	26.43	39.79

0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh

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+
          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 61.0   61.0   61.0          61.0   61.0   61.0   61.0   61.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 46.76  40.44  60.68  46.71  44.64   1.03   1.10   6.25  29.31
43.29
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996         Region: Low          Altitude:  500. Ft.
                   I/M Program: No        Ambient Temp:   34.2 (F)
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+
          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 62.0   62.0   62.0          62.0   62.0   62.0   62.0   62.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 50.63  43.80  65.98  50.67  46.34   1.06   1.13   6.40  32.20
46.80
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996         Region: Low          Altitude:  500. Ft.
                   I/M Program: No        Ambient Temp:   34.2 (F)
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+
          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 63.0   63.0   63.0          63.0   63.0   63.0   63.0   63.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 54.49  47.16  71.29  54.64  48.21   1.09   1.16   6.57  35.09
50.32
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996         Region: Low          Altitude:  500. Ft.
                   I/M Program: No        Ambient Temp:   34.2 (F)
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+
          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 64.0   64.0   64.0          64.0   64.0   64.0   64.0   64.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
```

```
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 58.36  50.52  76.59  58.60  50.26   1.12   1.19   6.75  37.98
53.85
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
0User supplied veh registration distributions.
0Cal. Year: 1996           Region: Low          Altitude:  500. Ft.
                       I/M Program: No       Ambient Temp:  34.2 (F)
                 Anti-tam. Program: No     Operating Mode:  20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+           _____  _____  _____  _____  _____  _____  _____  _____  _____

 Veh. Spd.: 65.0   65.0   65.0          65.0   65.0   65.0   65.0   65.0
   VMT Mix:  0.581  0.202  0.091         0.038  0.003  0.001  0.075  0.007
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 62.23  53.88  81.89  62.56  52.51   1.15   1.23   6.96  40.86
57.38
```

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

[illegible]	[illegible]	[illegible]	[illegible]	Speed	Volume	[illegible]	[illegible]	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
229	829	0.04	0.120	20	2295	91.78	2	45.82	4205.506224	85.17371938	3902.66
230	246	0.07	0.210	20	2246	157.23	2	45.82	7204.429806	145.9106347	6685.63
239	353	0.04	0.120	20	2945	117.79	2	45.82	5397.064488	109.3062361	5008.41
240	852	0.06	0.120	30	3370	202.22	2	31.99	6469.011402	187.6575724	6003.17
245	229	0.09	0.270	20	1555	139.97	2	45.82	6413.498712	129.8919822	5951.65
246	356	0.12	0.360	20	1694	203.23	2	45.82	9312.200208	188.5991091	8641.61
249	849	0.15	0.302	30	5776	866.40	2	31.99	27716.136	804.0089087	25720.24
251	839	0.05	0.150	20	3106	155.29	2	45.82	7115.41071	144.1077394	6603.02
251	252	0.09	0.180	30	3284	295.55	2	31.99	9454.532535	274.2636414	8773.69
252	360	0.07	0.210	20	1512	105.87	2	45.82	4850.903834	98.24489607	4501.58
252	403	0.13	0.262	30	5968	775.87	2	31.99	24819.95334	719.9944321	23032.62
253	363	0.13	0.262	30	6572	854.40	2	31.99	27332.34877	792.8757424	25364.09
255	359	0.09	0.270	20	1350	121.47	2	45.82	5565.645432	112.72049	5164.85
256	259	0.07	0.210	20	2169	151.82	2	45.82	6956.561934	140.8905902	6455.61
258	255	0.07	0.210	20	1509	105.66	2	45.82	4841.281634	98.05001856	4492.65
259	859	0.03	0.090	20	2169	65.07	2	45.82	2981.383686	60.38168151	2766.69
260	357	0.05	0.150	20	2300	114.98	2	45.82	5268.24614	106.6972903	4888.87
260	362	0.06	0.180	20	1683	101.01	2	45.82	4628.058264	93.73162584	4294.78
309	315	0.43	0.482	54	4395	1889.81	2	22.33	42199.39031	1753.718448	39160.53
309	319	0.5	0.565	53	4787	2393.75	2	22.3	53380.5135	2221.366927	49536.48
314	372	0.3	0.328	55	2510	753.04	2	22.36	16838.01912	698.8140312	15625.48
314	315	0.36	0.397	54	3518	1266.51	2	22.33	28281.22189	1175.308463	26244.64
315	314	0.36	0.397	54	3419	1230.93	2	22.33	27486.74729	1142.291759	25507.37
315	309	0.43	0.483	53	4495	1932.66	2	22.3	43098.23995	1793.482275	39994.65
319	309	0.5	0.564	53	4675	2337.38	2	22.3	52123.574	2169.060876	48370.06
319	323	0.57	0.641	53	4559	2598.69	2	22.3	57950.7201	2411.550668	53777.58
323	319	0.57	0.639	54	4445	2533.45	2	22.33	56571.94967	2351.011971	52498.10
323	327	1.19	1.304	55	2620	3117.80	2	22.36	69714.008	2893.281366	64693.77
327	347	0.93	1.098	51	6002	5581.46	2	22.25	124187.4872	5179.528675	115244.51
327	323	1.19	1.302	55	2371	2821.29	2	22.36	63083.99297	2618.121474	58541.20
343	539	0.45	0.901	30	4341	1953.54	2	31.99	62493.7446	1812.861915	57993.45
347	546	0.5	0.581	52	5636	2818.05	2	22.27	62757.9735	2615.116927	58238.65
347	327	0.93	1.071	52	5398	5020.19	2	22.27	111799.5534	4658.673441	103748.66
353	370	0.06	0.180	20	2945	176.68	2	45.82	8095.596732	163.9593541	7512.62
354	240	0.07	0.140	30	3370	235.92	2	31.99	7547.179969	218.9338344	7003.69
355	357	0.07	0.210	20	486	34.05	2	45.82	1560.25256	31.59964736	1447.90
355	245	0.11	0.330	20	1452	159.70	2	45.82	7317.563968	148.2019302	6790.61
356	355	0.08	0.192	25	486	38.92	2	37.6	1463.253632	36.1138827	1357.88
357	260	0.05	0.150	20	1708	85.42	2	45.82	3913.85276	79.26688938	3632.01
357	355	0.07	0.210	20	501	35.07	2	45.82	1607.038903	32.54720676	1491.31
359	251	0.08	0.240	20	3359	268.71	2	45.82	12312.49381	249.3637713	11425.85
360	860	0.06	0.180	20	1528	91.68	2	45.82	4200.805092	85.0785078	3898.30
360	359	0.08	0.161	30	5083	406.60	2	31.99	13007.15959	377.3207127	12070.49
362	260	0.06	0.180	20	2475	148.53	2	45.82	6805.562124	137.8324053	6315.48
362	601	0.1	0.300	20	1800	180.02	2	45.82	8248.37894	167.0536377	7654.40
363	700	0.05	0.100	30	6394	319.70	2	31.99	10227.28298	296.6801225	9490.80

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

inode	jnode	length	Traveltime	Speed	Volume	VMT(1)	HPCLASS	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
363	249	0.07	0.142	30	7200	503.98	2	31.99	16122.19864	467.6839272	14961.21
370	537	0.04	0.120	20	2945	117.79	2	45.82	5397.064488	109.3062361	5008.41
371	354	0.06	0.120	30	3370	202.22	2	31.99	6469.011402	187.6575724	6003.17
372	314	0.3	0.329	55	2609	782.57	2	22.36	17498.22048	726.2138085	16238.14
403	253	0.12	0.242	30	6572	788.68	2	31.99	25229.8604	731.8853007	23413.01
411	704	0.04	0.069	35	6766	270.64	2	27.99	7575.280776	251.1529324	7029.77
411	703	0.05	0.086	35	8321	416.06	2	27.99	11645.61737	386.1019859	10806.99
413	709	0.23	0.396	35	8507	1956.70	2	27.99	54767.89585	1815.789811	50823.96
413	708	0.27	0.464	35	7474	2017.93	2	27.99	56481.74874	1872.611359	52414.39
424	705	0.19	0.326	35	4494	853.94	2	27.99	23901.88136	792.4495174	22180.66
424	704	0.25	0.429	35	4465	1116.19	2	27.99	31242.08813	1035.808742	28992.29
426	518	0.09	0.098	55	2469	222.24	2	22.36	4969.279692	206.2358018	4611.43
502	552	0.22	0.240	55	3542	779.20	2	22.36	17422.82256	723.0846325	16168.17
503	527	0.37	0.404	55	1803	667.26	2	22.36	14919.88888	619.2074981	13845.48
505	506	0.49	0.535	55	2326	1139.90	2	22.36	25488.09245	1057.81069	23652.65
506	508	0.46	0.502	55	2128	978.85	2	22.36	21887.03681	908.3591314	20310.91
507	557	0.14	0.153	55	3091	432.76	2	22.36	9676.442048	401.59317	8979.62
508	509	0.72	0.786	55	4502	3241.71	2	22.36	72484.7161	3008.271715	67264.96
509	510	0.4	0.437	55	4502	1800.95	2	22.36	40269.28672	1671.262064	37369.42
510	511	0.27	0.296	55	4502	1215.64	2	22.36	27181.76854	1128.101893	25224.36
511	512	0.13	0.142	55	3517	457.27	2	22.36	10224.61086	424.3433556	9488.32
512	513	0.4	0.437	55	5168	2067.09	2	22.36	46220.08768	1918.233111	42891.69
513	514	1.04	1.135	55	5168	5374.43	2	22.36	120172.228	4987.406088	111518.40
514	515	0.3	0.327	55	5168	1550.32	2	22.36	34665.06576	1438.674833	32168.77
515	516	0.22	0.240	55	1920	422.49	2	22.36	9446.979256	392.0699703	8766.68
516	426	0.19	0.207	55	2469	469.17	2	22.36	10490.70157	435.3866927	9735.25
517	544	0.08	0.087	55	1953	156.27	2	22.36	3494.116704	145.013363	3242.50
518	564	0.08	0.087	55	2438	195.05	2	22.36	4361.380608	181.0066815	4047.31
518	819	0.1	0.109	55	2469	246.93	2	22.36	5521.42188	229.1508909	5123.81
524	525	0.06	0.065	55	1700	102.02	2	22.36	2281.068816	94.66926503	2116.80
524	600	1.17	1.289	54	7189	8411.17	2	22.33	187821.3167	7805.461303	174295.95
525	555	0.02	0.022	55	1700	34.01	2	22.36	760.356272	31.55642168	705.60
525	524	0.06	0.065	55	3034	182.04	2	22.36	4070.307072	168.9265033	3777.20
526	554	0.16	0.175	55	1713	274.06	2	22.36	6127.927936	254.3221975	5686.64
527	555	0.08	0.087	55	3176	254.07	2	22.36	5680.978368	235.7728285	5271.88
528	554	0.1	0.109	55	2369	236.85	2	22.36	5296.05544	219.7976986	4914.68
534	535	0.17	0.340	30	1890	321.36	2	31.99	10280.39917	298.220954	9540.09
535	536	0.06	0.120	30	1488	89.30	2	31.99	2856.54705	82.86469933	2650.84
535	534	0.17	0.340	30	2434	413.81	2	31.99	13237.74671	384.0097439	12284.47
536	535	0.06	0.120	30	3054	183.24	2	31.99	5861.732436	170.0412027	5439.62
536	537	0.06	0.120	30	3370	202.22	2	31.99	6469.011402	187.6575724	6003.17
537	371	0.06	0.120	30	3370	202.22	2	31.99	6469.011402	187.6575724	6003.17
537	536	0.06	0.120	30	2945	176.68	2	31.99	5652.076374	163.9593541	5245.06
538	567	0.16	0.175	55	1246	199.36	2	22.36	4457.6896	185.003712	4136.68
538	569	1.01	1.347	45	1364	1377.95	2	23.11	31844.49614	1278.724109	29551.31
539	343	0.45	0.901	30	4340	1952.99	2	31.99	62476.03814	1812.348274	57977.02

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

[illegible]	[illegible]	[illegible]	[illegible]	Speed	Volume	VMT (1)	VCLASS	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
539	540	0.45	0.901	30	4248	1911.56	2	31.99	61150.93236	1773.908686	56747.34
540	541	0.07	0.094	45	5383	376.78	2	23.11	8707.367312	349.6466221	8080.33
540	539	0.45	0.901	30	4247	1911.06	2	31.99	61134.8094	1773.44098	56732.38
541	542	0.05	0.067	44	6747	337.34	2	23.46	7914.07851	313.050761	7344.17
541	540	0.07	0.094	45	5381	376.68	2	23.11	8705.16724	349.5582777	8078.29
541	569	0.62	0.827	45	1365	846.09	2	23.11	19553.12141	785.1607275	18145.06
542	543	0.04	0.054	45	6785	271.39	2	23.11	6271.785924	251.8452116	5820.14
542	541	0.05	0.067	44	6746	337.29	2	23.46	7912.89378	313.0038976	7343.07
543	542	0.04	0.054	45	6784	271.35	2	23.11	6270.935476	251.8110616	5819.35
543	545	0.17	0.228	45	7105	1207.91	2	23.11	27914.86712	1120.928823	25904.67
544	805	0.37	0.404	55	5677	2100.45	2	22.36	46966.12908	1949.195434	43584.01
545	546	0.04	0.054	45	4507	180.28	2	23.11	4166.252312	167.2969562	3866.23
545	543	0.17	0.227	45	4406	749.03	2	23.11	17310.12721	695.092706	16063.59
546	545	0.04	0.054	45	5046	201.86	2	23.11	4664.910648	187.3207127	4328.98
546	347	0.5	0.568	53	4975	2487.60	2	22.3	55473.3685	2308.458612	51478.63
551	503	0.11	0.120	55	4130	454.27	2	22.36	10157.45931	421.5564217	9426.00
552	502	0.22	0.240	55	3490	767.89	2	22.36	17170.07406	712.595026	15933.62
552	551	0.89	0.974	55	4133	3678.17	2	22.36	82243.97511	3413.301967	76321.43
553	552	0.14	0.153	55	4081	571.40	2	22.36	12776.41456	530.2487008	11856.36
554	553	1.02	1.116	55	4081	4163.03	2	22.36	93085.30608	3863.240535	86382.06
555	525	0.02	0.022	55	3163	63.27	2	22.36	1414.609872	58.70935412	1312.74
555	526	0.21	0.229	55	1713	359.70	2	22.36	8042.905416	333.7978842	7463.72
556	528	0.14	0.153	55	2369	331.60	2	22.36	7414.477616	307.716778	6880.55
557	556	0.58	0.633	55	3741	2169.78	2	22.36	48516.2808	2013.530067	45022.53
558	507	0.29	0.317	55	4753	1378.43	2	22.36	30821.58524	1279.16212	28602.06
559	558	0.72	0.786	55	4753	3422.30	2	22.36	76522.55645	3175.85078	71012.02
560	807	0.03	0.033	55	4753	142.60	2	22.36	3188.439852	132.3271158	2958.83
561	560	0.27	0.295	55	3686	995.11	2	22.36	22250.70432	923.4521158	20648.39
562	561	0.52	0.568	55	5677	2951.99	2	22.36	66006.45168	2739.4098	61253.20
563	562	1.1	1.201	55	5677	6244.59	2	22.36	139629.0324	5794.905345	129574.08
564	517	0.19	0.207	55	2438	463.25	2	22.36	10358.27894	429.8908686	9612.36
565	566	0.73	0.796	55	1246	909.58	2	22.36	20338.2088	844.0794358	18873.62
566	567	0.41	0.447	55	1246	510.86	2	22.36	11422.8296	474.0720119	10600.25
566	565	0.73	0.796	55	1246	909.58	2	22.36	20338.2088	844.0794358	18873.62
567	538	0.16	0.175	55	1246	199.36	2	22.36	4457.6896	185.003712	4136.68
567	566	0.41	0.447	55	1246	510.86	2	22.36	11422.8296	474.0720119	10600.25
569	541	0.62	0.827	45	1364	845.87	2	23.11	19548.10654	784.9593541	18140.41
569	538	1.01	1.347	45	1365	1378.31	2	23.11	31852.66553	1279.052153	29558.90
576	1034	0.45	0.491	55	2233	1004.92	2	22.36	22469.9553	932.5515033	20851.85
600	960	0.28	0.482	35	8369	2343.29	2	27.99	65588.66471	2174.544543	60865.50
600	524	1.17	1.291	54	7492	8765.34	2	22.33	195729.9484	8134.127506	181635.07
601	960	0.03	0.052	35	7492	224.75	2	27.99	6290.746902	208.5651448	5837.74
601	362	0.1	0.300	20	2509	250.85	2	45.82	11494.08446	232.7886043	10666.37
601	602	0.28	0.481	35	7916	2216.49	2	27.99	62039.66706	2056.880104	57572.07
602	603	0.24	0.413	35	9347	2243.38	2	27.99	62792.16142	2081.828508	58270.38
602	601	0.28	0.481	35	7656	2143.69	2	27.99	60001.99506	1989.322569	55681.14

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

INODE	JNODE	Length	Travel Time	Speed	Volume	VMT(1)	FCLASS	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
603	602	0.24	0.413	35	9087	2180.98	2	27.99	61045.58542	2023.922049	56649.58
603	604	0.52	0.630	50	11173	5810.06	2	22.23	129157.7227	5391.670379	119856.83
604	811	0.04	0.048	50	8362	334.50	2	22.23	7435.872756	310.4094284	6900.40
604	603	0.52	0.629	50	10682	5554.54	2	22.23	123477.3353	5154.54343	114585.50
605	606	0.36	0.434	50	8593	3093.33	2	22.23	68764.69922	2870.572383	63812.82
605	811	0.67	0.806	50	8067	5404.74	2	22.23	120147.428	5015.536934	111495.39
606	605	0.36	0.433	50	8296	2986.73	2	22.23	66395.07014	2771.652561	61613.84
606	810	0.54	0.649	50	5942	3208.76	2	22.23	71330.75703	2977.692094	66194.10
700	363	0.05	0.100	30	7021	351.07	2	31.99	11230.69731	325.7878619	10421.95
700	701	0.07	0.140	30	7345	514.16	2	31.99	16447.94961	477.1335375	15263.50
701	700	0.07	0.140	30	7038	492.67	2	31.99	15760.55169	457.1930215	14625.60
701	702	0.46	0.790	35	7379	3394.39	2	27.99	95008.99289	3149.954157	88167.22
702	703	0.09	0.155	35	7379	664.12	2	27.99	18588.716	616.2953786	17250.11
702	701	0.46	0.790	35	7282	3349.67	2	27.99	93757.24651	3108.453415	87005.61
703	411	0.05	0.086	35	8453	422.64	2	27.99	11829.65162	392.2035078	10977.78
703	702	0.09	0.155	35	7282	655.37	2	27.99	18343.8091	608.1756682	17022.84
704	411	0.04	0.069	35	6804	272.17	2	27.99	7618.172652	252.5749814	7069.57
704	424	0.25	0.429	35	4494	1123.61	2	27.99	31449.8439	1042.696733	29185.08
705	706	0.17	0.292	35	6725	1143.32	2	27.99	32001.56599	1060.988679	29697.07
705	424	0.19	0.326	35	4465	848.30	2	27.99	23743.98698	787.2146437	22034.14
706	705	0.17	0.292	35	6796	1155.32	2	27.99	32337.31163	1072.120082	30008.64
706	707	0.4	0.687	35	6559	2623.49	2	27.99	73431.42912	2434.565702	68143.49
707	708	0.05	0.086	35	6960	348.00	2	27.99	9740.63196	322.9435783	9039.19
707	706	0.4	0.687	35	6630	2652.16	2	27.99	74233.9584	2461.172977	68888.23
708	707	0.05	0.086	35	7032	351.61	2	27.99	9841.493925	326.2875835	9132.79
708	413	0.27	0.464	35	7411	2001.07	2	27.99	56009.9465	1856.969098	51976.57
709	710	0.07	0.121	35	10122	708.55	2	27.99	19832.23053	657.5231997	18404.07
709	413	0.23	0.396	35	8571	1971.27	2	27.99	55175.98165	1829.319599	51202.66
710	709	0.07	0.121	35	10208	714.58	2	27.99	20001.12219	663.12268	18560.80
710	810	0.09	0.108	50	5766	518.98	2	22.23	11536.8965	481.606069	10706.10
710	1028	0.16	0.278	35	12231	1956.99	2	27.99	54776.20608	1816.06533	50831.67
711	712	0.13	0.224	35	10321	1341.74	2	27.99	37555.38657	1245.121566	34850.95
711	713	0.23	0.397	35	9827	2260.21	2	27.99	63263.21352	2097.445898	58707.51
712	251	0.07	0.121	35	10552	738.65	2	27.99	20674.72953	685.4556422	19185.90
712	711	0.13	0.225	35	10411	1353.46	2	27.99	37883.23344	1255.991091	35155.19
713	814	0.16	0.275	35	7307	1169.08	2	27.99	32722.63877	1084.895323	30366.22
713	711	0.23	0.397	35	9737	2239.51	2	27.99	62683.8849	2078.238679	58169.90
714	814	0.13	0.223	35	7217	938.15	2	27.99	26258.86049	870.5934484	24367.91
714	715	0.23	0.395	35	6794	1562.60	2	27.99	43737.28316	1450.077858	40587.68
715	1026	0.17	0.227	45	6495	1104.17	2	23.11	25517.37794	1024.657016	23679.82
715	714	0.23	0.395	35	6703	1541.75	2	27.99	43153.5769	1430.725501	40046.01
716	1027	0.12	0.160	45	5742	689.04	2	23.11	15923.82533	639.4253898	14777.12
716	1026	0.49	0.654	45	6046	2962.72	2	23.11	68468.48924	2749.370174	63537.94
717	718	0.07	0.094	45	5480	383.60	2	23.11	8865.076885	355.9794915	8226.69
717	1027	0.24	0.320	45	5384	1292.15	2	23.11	29861.65121	1199.10245	27711.26
718	717	0.07	0.093	45	2076	145.30	2	23.11	3357.876067	134.8363957	3116.07

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

[illegible]	[illegible]	Length	Travel time	Speed	Volume	VMT (1)	CLASS	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
718	719	0.07	0.093	45	3236	226.50	2	23.11	5234.343359	210.1864328	4857.41
718	725	0.07	0.120	35	3309	231.60	2	27.99	6482.383236	214.9187082	6015.57
719	718	0.07	0.093	45	2076	145.30	2	23.11	3357.876067	134.8363957	3116.07
719	720	0.14	0.187	45	3236	452.99	2	23.11	10468.68672	420.3728656	9714.82
720	1021	0.12	0.131	55	3072	368.59	2	22.36	8241.690288	342.0478842	7648.19
720	719	0.14	0.187	45	3138	439.38	2	23.11	10154.10878	407.7409057	9422.89
721	1021	0.46	0.502	55	2127	978.62	2	22.36	21881.99686	908.1499629	20306.23
725	718	0.07	0.120	35	1064	74.49	2	27.99	2084.969502	69.12564959	1934.83
725	726	0.5	0.560	54	4371	2185.63	2	22.33	48805.1179	2028.238679	45290.57
726	725	0.5	0.560	54	4372	2186.21	2	22.33	48817.95765	2028.772272	45302.48
751	712	0.07	0.121	35	10642	744.93	2	27.99	20850.47874	691.2824796	19349.00
751	1028	0.13	0.225	35	11632	1512.10	2	27.99	42323.53905	1403.206199	39275.74
805	563	0.03	0.033	55	5677	170.31	2	22.36	3808.06452	158.0428731	3533.84
807	559	0.38	0.415	55	4753	1806.21	2	22.36	40386.90479	1676.143467	37478.57
810	710	0.09	0.108	50	5942	534.79	2	22.23	11888.45951	496.2820156	11032.35
810	606	0.54	0.648	50	5766	3113.87	2	22.23	69221.37901	2889.636414	64236.62
811	604	0.04	0.049	49	8067	322.67	2	22.21	7166.527352	299.4350408	6650.45
811	605	0.67	0.807	50	8362	5602.83	2	22.23	124550.8687	5199.357925	115581.73
814	714	0.13	0.223	35	7307	949.88	2	27.99	26587.144	881.4774499	24672.55
814	713	0.16	0.275	35	7217	1154.65	2	27.99	32318.59752	1071.499629	29991.27
819	1034	0.09	0.098	55	2469	222.24	2	22.36	4969.279692	206.2358018	4611.43
819	518	0.1	0.109	55	2438	243.82	2	22.36	5451.72576	226.2583519	5059.14
829	258	0.04	0.120	20	2461	98.45	2	45.82	4511.16228	91.36414254	4186.31
839	239	0.06	0.180	20	2280	136.78	2	45.82	6267.296256	126.9309577	5815.98
849	360	0.14	0.281	30	5098	713.74	2	31.99	22832.39545	662.3379733	21188.19
852	252	0.05	0.100	30	4197	209.84	2	31.99	6712.71762	194.7271715	6229.32
859	230	0.03	0.090	20	2002	60.06	2	45.82	2751.907962	55.7341314	2553.74
860	256	0.05	0.150	20	2169	108.45	2	45.82	4968.97281	100.6361359	4611.15
960	601	0.03	0.052	35	8369	251.07	2	27.99	7027.356933	232.9869154	6521.30
960	600	0.28	0.481	35	7492	2097.66	2	27.99	58713.63775	1946.608018	54485.56
1021	720	0.12	0.131	55	2974	356.88	2	22.36	7979.783136	331.1781737	7405.14
1021	721	0.46	0.502	55	2226	1023.73	2	22.36	22890.70566	950.0135486	21242.30
1026	715	0.17	0.227	45	6405	1088.90	2	23.11	25164.46282	1010.485616	23352.32
1026	716	0.49	0.654	45	6143	3009.88	2	23.11	69558.30138	2793.131867	64549.28
1027	716	0.12	0.160	45	5646	677.47	2	23.11	15656.40565	628.6870824	14528.96
1027	717	0.24	0.320	45	5480	1315.21	2	23.11	30394.54932	1220.501114	28205.78
1028	751	0.13	0.226	35	11721	1523.70	2	27.99	42648.47496	1413.979213	39577.28
1028	710	0.16	0.278	35	12142	1942.67	2	27.99	54375.38928	1802.77654	50459.72
1034	819	0.09	0.098	55	2438	219.43	2	22.36	4906.553184	203.6325167	4553.22
1034	576	0.45	0.491	55	2207	993.32	2	22.36	22210.65756	921.7900891	20611.23
204	655	0.23	0.552	25	2575	592.16	6	37.6	22265.05432	549.5134558	20661.71
204	523	0.29	0.696	25	2529	733.28	6	37.6	27571.3092	680.4746659	25585.85
208	221	0.26	0.624	25	1071	278.58	6	37.6	10474.59296	258.5185598	9720.30
208	533	0.3	0.720	25	1793	538.02	6	37.6	20229.4392	499.2733853	18772.68
218	219	0.51	1.020	30	1072	546.83	6	31.99	17492.99893	507.4490535	16233.30
218	572	0.55	0.943	35	395	217.25	6	27.99	6080.8275	201.6054195	5642.94

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

[illegible]	[illegible]	[illegible]	[illegible]	Speed	[illegible]	[illegible]	[illegible]	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
219	220	0.16	0.320	30	1072	171.55	6	31.99	5487.999664	159.199703	5092.80
219	218	0.51	1.020	30	1071	546.44	6	31.99	17480.76275	507.094098	16221.94
220	219	0.16	0.320	30	1071	171.43	6	31.99	5484.160864	159.0883445	5089.24
220	221	0.22	0.440	30	1072	235.89	6	31.99	7545.999538	218.8995917	7002.60
221	220	0.22	0.440	30	1071	235.72	6	31.99	7540.721188	218.7464736	6997.70
221	208	0.26	0.624	25	1072	278.77	6	37.6	10481.92496	258.6995174	9727.10
222	530	0.07	0.168	25	1950	136.53	6	37.6	5133.34752	126.6937639	4763.69
222	223	0.14	0.336	25	1036	145.06	6	37.6	5454.08304	134.6096882	5061.32
223	405	0.05	0.120	25	1802	90.08	6	37.6	3386.9704	83.59224202	3143.07
223	655	0.13	0.312	25	649	84.33	6	37.6	3170.762504	78.25611544	2942.43
223	222	0.14	0.336	25	1728	241.93	6	37.6	9096.61312	224.5092799	8441.55
224	407	0.07	0.168	25	1621	113.47	6	37.6	4266.472	105.2988122	3959.24
224	405	0.25	0.600	25	447	111.76	6	37.6	4202.2136	103.7128805	3899.60
225	226	0.07	0.168	25	2730	191.07	6	37.6	7184.09664	177.3073497	6666.76
225	407	0.22	0.528	25	234	51.51	6	37.6	1936.781264	47.80079807	1797.31
226	227	0.21	0.504	25	2730	573.20	6	37.6	21552.28992	531.922049	20000.27
227	228	0.24	0.576	25	2800	672.10	6	37.6	25271.08032	623.7037862	23451.26
228	229	0.07	0.168	25	984	68.85	6	37.6	2588.758872	63.89195434	2402.34
229	230	0.09	0.216	25	244	21.98	6	37.6	826.467552	20.39766147	766.95
260	261	0.09	0.216	25	1336	120.28	6	37.6	4522.51296	111.6180401	4196.84
261	262	0.07	0.168	25	574	40.21	6	37.6	1511.815536	37.31241648	1402.95
261	260	0.09	0.216	25	1136	102.20	6	37.6	3842.80272	94.84242762	3566.08
261	861	0.11	0.220	30	2257	248.22	6	31.99	7940.538606	230.3446548	7368.73
261	355	0.13	0.390	20	951	123.60	6	45.82	5663.541237	114.7031644	5255.70
262	261	0.07	0.168	25	1673	117.08	6	37.6	4402.12528	108.6468077	4085.12
262	263	0.34	0.816	25	574	195.30	6	37.6	7343.104032	181.2317372	6814.31
263	734	0.25	0.600	25	978	244.39	6	37.6	9188.9794	226.7889291	8527.26
263	262	0.34	0.816	25	465	158.23	6	37.6	5949.328432	146.8326095	5520.91
268	1019	0.08	0.160	30	2024	161.91	6	31.99	5179.43692	150.2487008	4806.46
268	861	0.09	0.180	30	2179	196.12	6	31.99	6273.760437	181.9935969	5821.98
268	1018	0.26	0.780	20	557	144.85	6	45.82	6637.17729	134.4221232	6159.22
269	1018	0.06	0.180	20	689	41.34	6	45.82	1894.011854	38.35924276	1757.62
269	270	0.1	0.300	20	723	72.31	6	45.82	3313.367914	67.10532665	3074.77
270	269	0.1	0.300	20	689	68.89	6	45.82	3156.686424	63.93207127	2929.37
270	408	0.18	0.540	20	723	130.16	6	45.82	5964.062245	120.789588	5534.58
271	408	0.09	0.270	20	1755	157.96	6	45.82	7237.846332	146.5874165	6716.64
271	703	0.37	1.110	20	1559	576.74	6	45.82	26426.28178	535.2089829	24523.28
272	534	0.1	0.240	25	1346	134.65	6	37.6	5062.7272	124.9508166	4698.15
272	273	0.6	1.440	25	628	377.07	6	37.6	14177.98992	349.9203786	13157.01
273	272	0.6	1.440	25	750	449.94	6	37.6	16917.72144	417.5384187	15699.44
273	274	0.62	1.063	35	628	389.64	6	27.99	10906.11709	361.5843912	10120.75
274	275	0.36	0.617	35	799	287.73	6	27.99	8053.441783	267.0060134	7473.50
274	273	0.62	1.063	35	750	464.94	6	27.99	13013.59727	431.456366	12076.46
275	276	0.2	0.267	45	799	159.85	6	23.11	3694.078036	148.3366741	3428.06
275	274	0.36	0.617	35	921	331.45	6	27.99	9277.422091	307.5861915	8609.34
276	275	0.2	0.267	45	921	184.14	6	23.11	4255.512376	170.8812175	3949.06

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

Inode	Jnode	Length	[illegible]	Speed	Volume	VMT	[illegible]	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
276	546	0.52	0.693	45	799	415.60	6	23.11	9604.602894	385.6753526	8912.96
277	364	0.15	0.362	25	4477	671.55	6	37.6	25250.28	623.1904232	23431.96
277	604	0.47	1.129	25	2662	1250.96	6	37.6	47035.97192	1160.872958	43648.82
278	1033	0.07	0.168	25	4869	340.81	6	37.6	12814.31312	316.2641054	11891.53
278	409	0.14	0.240	35	2231	312.30	6	27.99	8741.181834	289.8075353	8111.71
278	364	0.17	0.408	25	4808	817.33	6	37.6	30731.52152	758.4703972	28518.49
278	279	0.22	0.377	35	3455	760.18	6	27.99	21277.41581	705.437268	19745.19
279	280	0.02	0.034	35	4274	85.47	6	27.99	2392.3053	79.31514477	2220.03
279	278	0.22	0.377	35	3574	786.24	6	27.99	22006.99195	729.6258352	20422.23
280	279	0.02	0.034	35	4388	87.76	6	27.99	2456.508762	81.44376392	2279.61
280	281	0.19	0.326	35	5400	1025.94	6	27.99	28716.09139	952.0611544	26648.19
281	280	0.19	0.326	35	5516	1048.05	6	27.99	29334.95869	972.5792502	27222.49
281	606	0.29	0.498	35	5197	1507.16	6	27.99	42185.54275	1398.631032	39147.68
282	414	0.18	0.312	35	5178	932.12	6	27.99	26090.06679	864.997216	24211.27
282	606	0.29	0.502	35	5173	1500.07	6	27.99	41986.91732	1392.04575	38963.36
283	284	0.29	0.498	35	3313	960.90	6	27.99	26895.605	891.7042502	24958.80
283	414	0.32	0.551	35	4316	1381.12	6	27.99	38657.63837	1281.665924	35873.83
284	840	0.16	0.274	35	2588	414.07	6	27.99	11589.92006	384.2553823	10755.31
284	418	0.25	0.429	35	788	197.01	6	27.99	5514.25392	182.8210839	5117.16
284	283	0.29	0.498	35	3308	959.31	6	27.99	26851.20446	890.2321826	24917.60
285	840	0.13	0.223	35	2582	335.72	6	27.99	9396.688041	311.5403675	8720.01
285	286	0.22	0.377	35	1904	418.98	6	27.99	11727.34537	388.8116184	10882.84
286	416	0.07	0.120	35	1904	133.31	6	27.99	3731.428071	123.7127877	3462.72
286	285	0.22	0.377	35	1898	417.61	6	27.99	11688.79754	387.5335932	10847.07
287	902	0.23	0.352	39	9326	2144.97	6	25.63	54975.48371	1990.503155	51016.60
287	1120	0.27	0.466	35	6986	1886.18	6	27.99	52794.16421	1750.352171	48992.36
290	902	0.2	0.302	40	6713	1342.56	6	25.13	33738.63332	1245.883445	31309.05
290	304	0.24	0.343	42	7343	1762.23	6	24.24	42716.42611	1635.327394	39640.34
292	1017	0.12	0.206	35	3230	387.54	6	27.99	10847.27819	359.6336303	10066.15
292	1012	0.42	0.721	35	2951	1239.22	6	27.99	34685.84057	1149.983853	32188.05
299	899	0.12	0.206	35	2954	354.44	6	27.99	9920.853972	328.9187082	9206.43
299	300	0.36	0.617	35	1808	650.95	6	27.99	18220.14648	604.0757238	16908.08
300	301	0.22	0.377	35	1854	407.88	6	27.99	11416.68436	378.5118782	10594.55
300	299	0.36	0.617	35	1808	650.78	6	27.99	18215.41057	603.9187082	16903.68
301	300	0.22	0.377	35	1854	407.87	6	27.99	11416.25331	378.4975872	10594.15
301	310	0.29	0.497	35	2319	672.55	6	27.99	18824.69129	624.1189681	17469.09
301	302	0.32	0.768	25	626	200.24	6	37.6	7528.987904	185.8194506	6986.81
302	1029	0.18	0.432	25	626	112.63	6	37.6	4235.055696	104.523441	3930.08
302	301	0.32	0.768	25	625	200.06	6	37.6	7522.334208	185.6552339	6980.64
303	1022	0.28	0.420	40	255	71.34	6	25.13	1792.790283	66.20326652	1663.69
303	1029	0.48	1.152	25	255	122.40	6	37.6	4602.05952	113.5812918	4270.66
304	290	0.24	0.337	43	6827	1638.38	6	23.83	39042.51914	1520.394209	36230.99
304	321	0.26	0.354	44	7010	1822.59	6	23.46	42757.95202	1691.3415	39678.87
305	1017	0.23	0.395	35	2864	658.66	6	27.99	18435.96338	611.2309762	17108.36
305	306	0.34	0.583	35	2186	743.29	6	27.99	20804.71509	689.765219	19306.53
306	307	0.04	0.069	35	2212	88.47	6	27.99	2476.241712	82.09799555	2297.92

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

									Average Weekday (Monday - Friday)		Weekday (Monday Friday)
[illegible]	[illegible]	[illegible]	[illegible]	Speed	Volume	VMT	[illegible]	EF by speed (without Oxy, [grams CO/VMT])	Total CO [Gm]	Seasonal VMT (2)	Seasonal Total CO [Gm]
306	305	0.34	0.583	35	2173	738.65	6	27.99	20674.90867	685.4615813	19186.07
307	306	0.04	0.069	35	2198	87.93	6	27.99	2461.04874	81.59428359	2283.82
307	308	0.39	0.669	35	597	232.93	6	27.99	6519.848131	216.1608296	6050.34
308	1020	0.36	0.617	35	954	343.43	6	27.99	9612.653843	318.7005568	8920.43
308	307	0.39	0.669	35	591	230.66	6	27.99	6456.043526	214.0454343	5991.13
309	1020	0.33	0.566	35	890	293.83	6	27.99	8224.27455	272.6698497	7632.03
310	311	0.07	0.120	35	1982	138.75	6	27.99	3883.704867	128.7614143	3604.03
310	301	0.29	0.497	35	2320	672.72	6	27.99	18829.48038	624.2777468	17473.53
311	310	0.07	0.120	35	1982	138.72	6	27.99	3882.862368	128.7334818	3603.25
311	312	0.22	0.377	35	1982	436.08	6	27.99	12205.92958	404.6787305	11326.96
312	311	0.22	0.377	35	1982	435.99	6	27.99	12203.28173	404.5909428	11324.50
312	313	0.22	0.377	35	2193	482.47	6	27.99	13504.36329	447.7273571	12531.89
313	813	0.14	0.240	35	1759	246.21	6	27.99	6891.44589	228.4808834	6395.18
313	312	0.22	0.377	35	2193	482.46	6	27.99	13503.93224	447.7130661	12531.49
314	813	0.43	0.737	35	1138	489.27	6	27.99	13694.70089	454.0378619	12708.52
321	304	0.26	0.337	46	6494	1688.32	6	22.79	38476.76266	1566.738864	35705.98
321	322	0.79	0.871	54	2939	2321.93	6	22.33	51848.6634	2154.722068	48114.94
322	323	0.5	0.550	55	2788	1394.21	6	22.36	31174.4238	1293.805679	28929.49
322	321	0.79	0.869	55	2782	2197.74	6	22.36	49141.47758	2039.477079	45602.71
323	322	0.5	0.549	55	2631	1315.61	6	22.36	29417.0396	1220.870453	27298.66
341	568	0.27	0.360	45	638	172.34	6	23.11	3982.850428	159.9324053	3696.04
341	402	0.55	0.733	45	343	188.59	6	23.11	4358.201661	175.0047327	4044.36
342	402	0.1	0.133	45	327	32.69	6	23.11	755.48901	30.33685969	701.08
342	343	0.3	0.400	45	542	162.55	6	23.11	3756.465792	150.8418708	3485.96
343	342	0.3	0.400	45	542	162.59	6	23.11	3757.484943	150.8827951	3486.90
355	261	0.13	0.390	20	0	0.00	6	45.82	0	0	0.00
364	277	0.15	0.361	25	4145	621.71	6	37.6	23376.2772	576.9390312	21692.91
364	278	0.17	0.409	25	5141	874.03	6	37.6	32863.38136	811.0858389	30496.83
402	342	0.1	0.133	45	327	32.69	6	23.11	755.421991	30.33416852	701.02
402	341	0.55	0.733	45	343	188.58	6	23.11	4358.16353	175.0032016	4044.32
405	223	0.05	0.120	25	1151	57.53	6	37.6	2163.2972	53.39133259	2007.51
405	224	0.25	0.600	25	1083	270.74	6	37.6	10179.918	251.2458241	9446.84
407	224	0.07	0.168	25	439	30.70	6	37.6	1154.142528	28.48485523	1071.03
407	225	0.22	0.528	25	1417	311.68	6	37.6	11719.10784	289.233853	10875.19
408	271	0.09	0.270	20	1790	161.08	6	45.82	7380.529812	149.4771715	6849.04
408	270	0.18	0.540	20	689	124.01	6	45.82	5682.035563	115.0777283	5272.86
409	278	0.14	0.240	35	2159	302.29	6	27.99	8461.158678	280.5235709	7851.85
409	704	0.23	0.394	35	2340	538.11	6	27.99	15061.77167	499.362101	13977.15
414	282	0.18	0.312	35	5173	931.08	6	27.99	26060.84523	864.0283964	24184.15
414	283	0.32	0.551	35	4321	1382.79	6	27.99	38704.3033	1283.213066	35917.13
416	286	0.07	0.120	35	1898	132.87	6	27.99	3719.162853	123.3061433	3451.34
416	1025	0.34	0.583	35	965	327.99	6	27.99	9180.426105	304.3703601	8519.33
418	284	0.25	0.429	35	787	196.86	6	27.99	5510.090408	182.6830457	5113.30
418	713	0.25	0.429	35	776	193.88	6	27.99	5426.799165	179.921585	5036.01
523	204	0.29	0.699	25	4200	1218.14	6	37.6	45802.03392	1130.418708	42503.74
525	523	0.07	0.120	35	129	9.05	6	27.99	253.4119434	8.401688938	235.16

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Volume	VMT(0)	[illegible]	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
530	222	0.07	0.168	25	983	68.83	6	37.6	2588.087712	63.87538976	2401.71
530	532	0.09	0.216	25	2732	245.88	6	37.6	9245.088	228.1737194	8579.33
532	533	0.06	0.144	25	2802	168.15	6	37.6	6322.28208	156.0373051	5867.00
532	530	0.09	0.216	25	753	67.75	6	37.6	2547.370296	62.87046214	2363.93
533	532	0.06	0.144	25	625	37.49	6	37.6	1409.56008	34.7886971	1308.06
533	208	0.3	0.720	25	1597	478.97	6	37.6	18009.3096	444.4793987	16712.43
534	272	0.1	0.240	25	1225	122.49	6	37.6	4605.7368	113.672049	4274.07
538	568	0.41	0.547	45	639	261.85	6	23.11	6051.348416	242.9934855	5615.58
546	276	0.52	0.693	45	921	478.77	6	23.11	11064.33218	444.2911656	10267.57
568	341	0.27	0.360	45	639	172.44	6	23.11	3985.034323	160.0201002	3698.06
568	538	0.41	0.547	45	638	261.71	6	23.11	6048.032131	242.8603192	5612.50
570	571	0.49	0.840	35	395	193.55	6	27.99	5417.4645	179.612101	5027.34
571	572	0.3	0.514	35	395	118.50	6	27.99	3316.815	109.9665924	3077.96
571	570	0.49	0.840	35	395	193.55	6	27.99	5417.4645	179.612101	5027.34
572	571	0.3	0.514	35	395	118.50	6	27.99	3316.815	109.9665924	3077.96
572	218	0.55	0.943	35	395	217.25	6	27.99	6080.8275	201.6054195	5642.94
603	1019	0.17	0.340	30	1928	327.83	6	31.99	10487.21772	304.22049	9732.01
604	277	0.47	1.129	25	2857	1342.92	6	37.6	50493.85216	1246.215293	46857.70
606	281	0.29	0.498	35	5312	1540.39	6	27.99	43115.43773	1429.461024	40010.61
606	282	0.29	0.502	35	5178	1501.75	6	27.99	42033.9965	1393.606626	39007.05
655	223	0.13	0.312	25	1992	258.90	6	37.6	9734.64752	240.2563103	9033.64
655	204	0.23	0.552	25	1156	265.87	6	37.6	9996.6556	246.7228099	9276.78
703	271	0.37	1.110	20	1524	564.06	6	45.82	25845.11923	523.4387528	23983.96
704	409	0.23	0.394	35	2272	522.47	6	27.99	14624.07245	484.8505011	13570.97
705	1122	0.04	0.096	25	4618	184.70	6	37.6	6944.90048	171.4038604	6444.79
705	903	0.08	0.138	35	7420	593.62	6	27.99	16615.53576	550.8760208	15419.02
709	1012	0.09	0.155	35	3655	328.91	6	27.99	9206.30286	305.2282851	8543.34
713	899	0.24	0.412	35	2954	708.93	6	27.99	19842.98429	657.8797327	18414.05
713	418	0.25	0.429	35	775	193.78	6	27.99	5423.923193	179.8262342	5033.34
715	1025	0.17	0.291	35	706	119.97	6	27.99	3357.913277	111.3291759	3116.10
721	1022	0.29	0.435	40	342	99.08	6	25.13	2489.988459	91.94905345	2310.68
734	263	0.25	0.600	25	254	63.44	6	37.6	2385.3534	58.87179844	2213.58
813	313	0.14	0.240	35	1759	246.27	6	27.99	6893.01333	228.5328508	6396.63
813	314	0.43	0.737	35	1137	488.98	6	27.99	13686.51661	453.7665182	12700.92
840	285	0.13	0.223	35	2588	336.43	6	27.99	9416.810052	312.2074981	8738.69
840	284	0.16	0.274	35	2582	413.19	6	27.99	11565.15451	383.4342984	10732.33
861	268	0.09	0.180	30	2444	219.96	6	31.99	7036.376445	204.1160913	6529.67
861	261	0.11	0.220	30	1908	209.92	6	31.99	6715.222437	194.799833	6231.65
899	299	0.12	0.206	35	2954	354.47	6	27.99	9921.492144	328.9398664	9207.03
899	713	0.24	0.412	35	2954	708.89	6	27.99	19841.70794	657.8374165	18412.87
902	290	0.2	0.302	40	7229	1445.89	6	25.13	36335.31622	1341.772457	33718.74
902	287	0.23	0.351	39	8810	2026.24	6	25.63	51932.41843	1880.322569	48192.67
903	705	0.08	0.138	35	6936	554.90	6	27.99	15531.76296	514.9443207	14413.29
903	1120	0.08	0.138	35	6753	540.22	6	27.99	15120.86976	501.3214551	14031.99
1012	709	0.09	0.155	35	3632	326.86	6	27.99	9148.842189	303.3232183	8490.02
1012	292	0.42	0.721	35	2968	1246.35	6	27.99	34885.3365	1156.597996	32373.18

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

									Average Weekday (Monday - Friday)		Weekday (Monday Friday)
[illegible]	[illegible]	[illegible]	[illegible]	Speed	Volume	[illegible]	[illegible]	EF by speed (without Oxy, [grams CO/VMT])	Total CO [Gm]	Seasonal VMT (2)	Seasonal Total CO [Gm]
1017	292	0.12	0.206	35	3213	385.56	6	27.99	10791.89158	357.7973274	10014.75
1017	305	0.23	0.395	35	2877	661.77	6	27.99	18522.87233	614.1123794	17189.01
1018	269	0.06	0.180	20	723	43.39	6	45.82	1988.020748	40.26319599	1844.86
1018	268	0.26	0.780	20	523	136.04	6	45.82	6233.462768	126.2457313	5784.58
1019	268	0.08	0.160	30	1793	143.43	6	31.99	4588.287312	133.1002227	4257.88
1019	603	0.17	0.340	30	2159	367.05	6	31.99	11741.99668	340.6199889	10896.43
1020	309	0.33	0.566	35	903	298.15	6	27.99	8345.090586	276.6754176	7744.14
1020	308	0.36	0.617	35	941	338.63	6	27.99	9478.335431	314.2473274	8795.78
1022	303	0.28	0.420	40	255	71.40	6	25.13	1794.211636	66.25575353	1665.01
1022	721	0.29	0.435	40	341	99.01	6	25.13	2488.144671	91.88096696	2308.97
1025	715	0.17	0.291	35	705	119.83	6	27.99	3353.921063	111.196817	3112.40
1025	416	0.34	0.583	35	959	325.98	6	27.99	9124.154449	302.5047142	8467.11
1029	302	0.18	0.432	25	625	112.53	6	37.6	4231.312992	104.431069	3926.61
1029	303	0.48	1.152	25	255	122.30	6	37.6	4598.413824	113.491314	4267.27
1033	1122	0.04	0.096	25	5041	201.63	6	37.6	7581.30304	187.1106162	7035.36
1033	278	0.07	0.168	25	4488	314.17	6	37.6	11812.73184	291.5445434	10962.07
1120	903	0.08	0.138	35	6235	498.79	6	27.99	13961.03134	462.8678545	12955.67
1120	287	0.27	0.467	35	7501	2025.32	6	27.99	56688.66761	1879.471604	52606.41
1122	705	0.04	0.096	25	5001	200.05	6	37.6	7522.06048	185.6484781	6980.38
1122	1033	0.04	0.096	25	4657	186.27	6	37.6	7003.85728	172.8589458	6499.50
201	573	0.17	0.255	40	137	23.33	7	25.13	586.1577526	23.33	586.16
201	202	0.51	0.765	40	50	25.32	7	25.13	636.3549276	25.32	636.35
202	400	0.06	0.090	40	1015	60.91	7	25.13	1530.748716	60.91	1530.75
202	201	0.51	0.765	40	87	44.45	7	25.13	1117.043075	44.45	1117.04
203	204	0.23	0.396	35	2585	594.63	7	27.99	16643.77207	594.63	16643.77
203	400	0.49	0.739	40	2839	1390.94	7	25.13	34954.40764	1390.94	34954.41
204	203	0.23	0.396	35	2839	652.89	7	27.99	18274.44148	652.89	18274.44
210	211	0.17	0.294	35	3078	523.28	7	27.99	14646.57081	523.28	14646.57
211	210	0.17	0.294	35	3080	523.68	7	27.99	14657.89557	523.68	14657.90
211	212	0.21	0.410	31	6460	1356.57	7	31.08	42162.21425	1356.57	42162.21
212	524	0.11	0.216	31	6545	719.98	7	31.08	22377.00326	719.98	22377.00
212	211	0.21	0.410	31	6463	1357.13	7	31.08	42179.6408	1357.13	42179.64
212	213	0.23	0.552	25	341	78.36	7	37.6	2946.209288	78.36	2946.21
213	212	0.23	0.552	25	250	57.40	7	37.6	2158.315952	57.40	2158.32
213	214	0.41	0.984	25	609	249.84	7	37.6	9394.171248	249.84	9394.17
214	213	0.41	0.984	25	518	212.36	7	37.6	7984.7172	212.36	7984.72
214	215	0.43	1.032	25	1223	525.88	7	37.6	19772.97896	525.88	19772.98
215	216	0.26	0.625	25	2328	605.20	7	37.6	22755.39968	605.20	22755.40
215	214	0.43	1.032	25	1132	486.73	7	37.6	18300.88256	486.73	18300.88
216	410	0.06	0.144	25	305	18.32	7	37.6	688.675584	18.32	688.68
216	217	0.16	0.385	25	2022	323.59	7	37.6	12166.81856	323.59	12166.82
216	215	0.26	0.625	25	2236	581.39	7	37.6	21860.30912	581.39	21860.31
217	601	0.07	0.169	25	3064	214.46	7	37.6	8063.86896	214.46	8063.87
217	216	0.16	0.384	25	1931	308.99	7	37.6	11617.97888	308.99	11617.98
222	231	0.36	0.864	25	0	0.00	7	37.6	0	0.00	0.00
225	406	0.18	0.432	25	1134	204.06	7	37.6	7672.5432	204.06	7672.54

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
228	257	0.06	0.144	25	1938	116.27	7	37.6	4371.6768	116.27	4371.68
228	244	0.1	0.240	25	2223	222.31	7	37.6	8358.7056	222.31	8358.71
231	232	0.07	0.168	25	0	0.00	7	37.6	0	0.00	0.00
231	222	0.36	0.864	25	275	99.02	7	37.6	3723.320448	99.02	3723.32
232	231	0.07	0.168	25	275	19.25	7	37.6	723.978976	19.25	723.98
232	233	0.23	0.552	25	0	0.00	7	37.6	0	0.00	0.00
233	406	0.18	0.432	25	403	72.60	7	37.6	2729.933712	72.60	2729.93
233	232	0.23	0.552	25	275	63.27	7	37.6	2378.788064	63.27	2378.79
233	234	0.23	0.552	25	46	10.51	7	37.6	395.179008	10.51	395.18
234	235	0.07	0.168	25	46	3.20	7	37.6	120.271872	3.20	120.27
234	233	0.23	0.552	25	678	156.04	7	37.6	5867.036696	156.04	5867.04
235	234	0.07	0.168	25	50	3.47	7	37.6	130.5472	3.47	130.55
235	237	0.26	0.624	25	0	0.00	7	37.6	0	0.00	0.00
235	236	0.35	0.840	25	46	15.99	7	37.6	601.35936	15.99	601.36
236	535	0.31	0.744	25	46	14.17	7	37.6	532.632576	14.17	532.63
236	235	0.35	0.840	25	0	0.00	7	37.6	0	0.00	0.00
237	238	0.2	0.480	25	0	0.00	7	37.6	0	0.00	0.00
237	235	0.26	0.624	25	50	12.90	7	37.6	484.8896	12.90	484.89
238	239	0.07	0.168	25	887	62.09	7	37.6	2334.752448	62.09	2334.75
238	250	0.1	0.240	25	172	17.24	7	37.6	648.34056	17.24	648.34
238	237	0.2	0.480	25	50	9.92	7	37.6	372.992	9.92	372.99
239	238	0.07	0.168	25	222	15.54	7	37.6	584.385592	15.54	584.39
239	240	0.09	0.216	25	0	0.00	7	37.6	0	0.00	0.00
241	600	0.16	0.385	25	2463	394.12	7	37.6	14818.79168	394.12	14818.79
241	243	0.26	0.624	25	83	21.57	7	37.6	811.056064	21.57	811.06
242	225	0.14	0.336	25	1174	164.36	7	37.6	6180.04128	164.36	6180.04
243	242	0.2	0.480	25	1929	385.84	7	37.6	14507.7344	385.84	14507.73
243	241	0.26	0.624	25	978	254.39	7	37.6	9565.102352	254.39	9565.10
244	228	0.1	0.240	25	1232	123.24	7	37.6	4633.824	123.24	4633.82
244	243	0.18	0.432	25	2825	508.44	7	37.6	19117.43424	508.44	19117.43
245	244	0.08	0.192	25	1257	100.59	7	37.6	3782.31936	100.59	3782.32
246	245	0.1	0.240	25	1361	136.08	7	37.6	5116.6832	136.08	5116.68
246	247	0.17	0.408	25	359	61.11	7	37.6	2297.82812	61.11	2297.83
247	246	0.17	0.408	25	1168	198.51	7	37.6	7464.13016	198.51	7464.13
250	238	0.1	0.240	25	887	88.71	7	37.6	3335.36064	88.71	3335.36
250	358	0.1	0.240	25	0	0.00	7	37.6	0	0.00	0.00
254	257	0.07	0.168	25	447	31.27	7	37.6	1175.67492	31.27	1175.67
254	358	0.09	0.216	25	1818	163.64	7	37.6	6152.99184	163.64	6152.99
257	228	0.06	0.144	25	1112	66.70	7	37.6	2507.7696	66.70	2507.77
257	254	0.07	0.168	25	2225	155.74	7	37.6	5855.75256	155.74	5855.75
287	288	0.14	0.337	25	2640	369.62	7	37.6	13897.85488	369.62	13897.85
288	287	0.14	0.337	25	2641	369.75	7	37.6	13902.53984	369.75	13902.54
288	289	0.36	0.867	25	2468	888.64	7	37.6	33412.9392	888.64	33412.94
289	708	0.07	0.122	34	3835	268.48	7	28.69	7702.573571	268.48	7702.57
289	891	0.12	0.206	35	1507	180.86	7	27.99	5062.282596	180.86	5062.28
289	288	0.36	0.867	25	2468	888.50	7	37.6	33407.5248	888.50	33407.52

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

Inode	Jnode	Length	Travel time	Speed	Volume	VMT (1)	Class	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
290	1011	0.14	0.336	25	519	72.67	7	37.6	2732.51608	72.67	2732.52
291	1013	0.24	0.411	35	1173	281.52	7	27.99	7879.811976	281.52	7879.81
291	891	0.31	0.532	35	1180	365.85	7	27.99	10240.04354	365.85	10240.04
291	892	0.32	0.768	25	131	41.86	7	37.6	1573.869824	41.86	1573.87
291	1011	0.36	0.864	25	351	126.26	7	37.6	4747.264704	126.26	4747.26
292	892	0.18	0.432	25	262	47.25	7	37.6	1776.56616	47.25	1776.57
293	1031	0.11	0.264	25	827	90.94	7	37.6	3419.471088	90.94	3419.47
293	712	0.36	0.864	25	629	226.36	7	37.6	8511.206688	226.36	8511.21
294	1031	0.11	0.264	25	513	56.48	7	37.6	2123.620928	56.48	2123.62
294	295	0.14	0.336	25	535	74.97	7	37.6	2818.750928	74.97	2818.75
294	1032	0.29	0.696	25	230	66.56	7	37.6	2502.664272	66.56	2502.66
295	296	0.1	0.240	25	106	10.57	7	37.6	397.338	10.57	397.34
295	294	0.14	0.336	25	535	74.92	7	37.6	2817.08224	74.92	2817.08
296	295	0.1	0.240	25	105	10.54	7	37.6	396.25136	10.54	396.25
296	297	0.29	0.696	25	106	30.65	7	37.6	1152.2802	30.65	1152.28
297	298	0.14	0.336	25	106	14.79	7	37.6	556.2732	14.79	556.27
297	296	0.29	0.696	25	105	30.56	7	37.6	1149.128944	30.56	1149.13
298	297	0.14	0.336	25	105	14.75	7	37.6	554.751904	14.75	554.75
298	420	0.24	0.576	25	469	112.63	7	37.6	4234.981248	112.63	4234.98
298	310	0.29	0.696	25	501	145.15	7	37.6	5457.517424	145.15	5457.52
301	1032	0.22	0.528	25	230	50.52	7	37.6	1899.474544	50.52	1899.47
306	1016	0.18	0.432	25	277	49.79	7	37.6	1872.157392	49.79	1872.16
307	420	0.27	0.648	25	1658	447.77	7	37.6	16836.27984	447.77	16836.28
310	298	0.29	0.696	25	499	144.85	7	37.6	5446.38444	144.85	5446.38
314	337	0.29	0.317	55	1213	351.63	7	22.36	7862.335	351.63	7862.34
317	318	0.22	0.377	35	882	194.10	7	27.99	5432.860679	194.10	5432.86
317	1014	0.24	0.576	25	277	66.37	7	37.6	2495.569152	66.37	2495.57
317	1013	0.26	0.446	35	874	227.32	7	27.99	6362.623543	227.32	6362.62
317	321	0.5	1.200	25	437	218.67	7	37.6	8222.1612	218.67	8222.16
318	317	0.22	0.377	35	882	193.99	7	27.99	5429.849515	193.99	5429.85
318	950	0.58	0.994	35	882	511.72	7	27.99	14322.99634	511.72	14323.00
319	950	0.5	0.857	35	498	248.80	7	27.99	6963.912	248.80	6963.91
319	320	0.51	0.874	35	241	122.66	7	27.99	3433.256199	122.66	3433.26
320	325	0.35	0.382	55	686	239.97	7	22.36	5365.787336	239.97	5365.79
320	319	0.51	0.874	35	242	123.48	7	27.99	3456.153139	123.48	3456.15
321	317	0.5	1.200	25	437	218.59	7	37.6	8219.0968	218.59	8219.10
321	326	0.57	0.681	50	4038	2301.57	7	22.23	51163.87442	2301.57	51163.87
323	834	0.44	0.482	55	1635	719.51	7	22.36	16088.2436	719.51	16088.24
324	834	0.06	0.066	55	1613	96.77	7	22.36	2163.705648	96.77	2163.71
324	325	0.22	0.240	55	913	200.81	7	22.36	4490.12278	200.81	4490.12
324	824	0.51	0.557	55	801	408.29	7	22.36	9129.334438	408.29	9129.33
325	324	0.22	0.240	55	910	200.11	7	22.36	4474.405936	200.11	4474.41
325	320	0.35	0.382	55	688	240.79	7	22.36	5384.05322	240.79	5384.05
325	335	0.8	1.067	45	350	280.13	7	23.11	6473.85052	280.13	6473.85
326	327	0.32	0.382	50	4038	1292.11	7	22.23	28723.57862	1292.11	28723.58
326	321	0.57	0.664	51	3678	2096.72	7	22.25	46651.94213	2096.72	46651.94

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	VMT (1)	[illegible]	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
327	373	0.22	0.240	55	756	166.28	7	22.36	3718.059259	166.28	3718.06
327	326	0.32	0.373	51	3678	1177.10	7	22.25	26190.564	1177.10	26190.56
328	373	0.46	0.502	55	751	345.36	7	22.36	7722.294767	345.36	7722.29
335	325	0.8	1.067	45	349	279.44	7	23.11	6457.932352	279.44	6457.93
337	314	0.29	0.317	55	1214	351.94	7	22.36	7869.402996	351.94	7869.40
358	254	0.09	0.216	25	447	40.20	7	37.6	1511.58204	40.20	1511.58
358	250	0.1	0.247	24	4445	444.48	7	38.98	17325.79142	444.48	17325.79
373	327	0.22	0.240	55	751	165.17	7	22.36	3693.27141	165.17	3693.27
373	328	0.46	0.502	55	756	347.68	7	22.36	7774.123906	347.68	7774.12
400	202	0.06	0.090	40	1217	73.01	7	25.13	1834.856898	73.01	1834.86
400	203	0.49	0.738	40	2585	1266.83	7	25.13	31835.34743	1266.83	31835.35
406	225	0.18	0.432	25	1507	271.18	7	37.6	10196.46576	271.18	10196.47
406	233	0.18	0.432	25	46	8.23	7	37.6	309.270528	8.23	309.27
410	216	0.06	0.144	25	305	18.30	7	37.6	687.951408	18.30	687.95
410	600	0.09	0.216	25	305	27.47	7	37.6	1033.013376	27.47	1033.01
420	298	0.24	0.576	25	470	112.81	7	37.6	4241.586816	112.81	4241.59
420	307	0.27	0.648	25	1651	445.69	7	37.6	16758.00792	445.69	16758.01
523	524	0.05	0.086	35	2529	126.43	7	27.99	3538.705725	126.43	3538.71
524	523	0.05	0.088	34	4071	203.56	7	28.69	5840.05033	203.56	5840.05
524	212	0.11	0.218	30	6639	730.30	7	31.99	23362.18823	730.30	23362.19
535	236	0.31	0.744	25	0	0.00	7	37.6	0	0.00	0.00
573	201	0.17	0.255	40	83	14.03	7	25.13	352.5379641	14.03	352.54
600	410	0.09	0.216	25	305	27.44	7	37.6	1031.927112	27.44	1031.93
600	241	0.16	0.384	25	1284	205.38	7	37.6	7722.25792	205.38	7722.26
601	217	0.07	0.169	25	2973	208.09	7	37.6	7824.0148	208.09	7824.01
708	289	0.07	0.122	34	3826	267.80	7	28.69	7683.233642	267.80	7683.23
712	293	0.36	0.864	25	628	226.19	7	37.6	8504.60112	226.19	8504.60
824	324	0.51	0.557	55	781	398.46	7	22.36	8909.552855	398.46	8909.55
834	324	0.06	0.066	55	1635	98.12	7	22.36	2193.8514	98.12	2193.85
834	323	0.44	0.482	55	1613	709.62	7	22.36	15867.17475	709.62	15867.17
891	289	0.12	0.206	35	1516	181.97	7	27.99	5093.28432	181.97	5093.28
891	291	0.31	0.532	35	1178	365.04	7	27.99	10217.57036	365.04	10217.57
892	292	0.18	0.432	25	262	47.16	7	37.6	1773.28368	47.16	1773.28
892	291	0.32	0.768	25	131	41.81	7	37.6	1572.233472	41.81	1572.23
950	319	0.5	0.857	35	498	248.86	7	27.99	6965.493435	248.86	6965.49
950	318	0.58	0.994	35	882	511.43	7	27.99	14315.05781	511.43	14315.06
1011	290	0.14	0.336	25	519	72.59	7	37.6	2729.389264	72.59	2729.39
1011	291	0.36	0.864	25	351	126.35	7	37.6	4750.7976	126.35	4750.80
1013	291	0.24	0.411	35	1175	282.11	7	27.99	7896.337272	282.11	7896.34
1013	317	0.26	0.446	35	875	227.47	7	27.99	6366.851712	227.47	6366.85
1014	1015	0.09	0.216	25	277	24.89	7	37.6	935.838432	24.89	935.84
1014	317	0.24	0.576	25	277	66.39	7	37.6	2496.209856	66.39	2496.21
1015	1014	0.09	0.216	25	277	24.90	7	37.6	936.078696	24.90	936.08
1015	1016	0.18	0.432	25	277	49.78	7	37.6	1871.676864	49.78	1871.68
1016	306	0.18	0.432	25	277	49.78	7	37.6	1871.676864	49.78	1871.68
1016	1015	0.18	0.432	25	277	49.79	7	37.6	1872.157392	49.79	1872.16

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

INODE	JNODE	LENGTH	TRAVTIME	Speed	Volume	VMT	FCLASS	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
1031	293	0.11	0.264	25	827	90.96	7	37.6	3420.012904	90.96	3420.01
1031	294	0.11	0.264	25	514	56.50	7	37.6	2124.481216	56.50	2124.48
1032	301	0.22	0.528	25	230	50.49	7	37.6	1898.572896	50.49	1898.57
1032	294	0.29	0.696	25	230	66.59	7	37.6	2503.852808	66.59	2503.85
202	205	0.07	0.168	25	1130	79.08	9	37.6	2973.52832	79.08	2973.53
205	202	0.07	0.168	25	966	67.59	9	37.6	2541.38024	67.59	2541.38
205	206	0.2	0.480	25	271	54.28	9	37.6	2040.74	54.28	2040.74
206	205	0.2	0.480	25	127	25.47	9	37.6	957.83744	25.47	957.84
206	207	0.36	0.864	25	165	59.25	9	37.6	2227.6872	59.25	2227.69
207	208	0.26	0.624	25	879	228.66	9	37.6	8597.737824	228.66	8597.74
207	206	0.36	0.864	25	20	7.27	9	37.6	273.535488	7.27	273.54
208	207	0.26	0.624	25	683	177.68	9	37.6	6680.908624	177.68	6680.91
244	357	0.2	0.480	25	1222	244.38	9	37.6	9188.688	244.38	9188.69
247	248	0.16	0.384	25	359	57.45	9	37.6	2160.231296	57.45	2160.23
248	249	0.08	0.192	25	286	22.85	9	37.6	859.181056	22.85	859.18
248	856	0.11	0.330	20	73	8.08	9	45.82	370.1976498	8.08	370.20
248	247	0.16	0.385	25	1782	285.06	9	37.6	10718.16576	285.06	10718.17
249	248	0.08	0.192	25	1709	136.74	9	37.6	5141.54432	136.74	5141.54
250	251	0.07	0.168	25	3031	212.15	9	37.6	7976.88136	212.15	7976.88
254	255	0.07	0.168	25	407	28.46	9	37.6	1070.07908	28.46	1070.08
255	256	0.09	0.216	25	566	50.97	9	37.6	1916.484408	50.97	1916.48
256	856	0.14	0.420	20	566	79.29	9	45.82	3632.938588	79.29	3632.94
258	257	0.07	0.210	20	952	66.64	9	45.82	3053.261978	66.64	3053.26
259	258	0.09	0.270	20	0	0.00	9	45.82	0	0.00	0.00
262	356	0.11	0.330	20	0	0.00	9	45.82	0	0.00	0.00
264	575	0.49	0.653	45	0	0.00	9	23.11	0	0.00	0.00
265	574	0.27	0.360	45	0	0.00	9	23.11	0	0.00	0.00
265	266	0.56	1.120	30	127	70.89	9	31.99	2267.909297	70.89	2267.91
266	267	0.16	0.320	30	122	19.54	9	31.99	625.0487712	19.54	625.05
266	265	0.56	1.120	30	126	70.56	9	31.99	2257.232314	70.56	2257.23
267	603	0.07	0.140	30	122	8.55	9	31.99	273.4588374	8.55	273.46
267	266	0.16	0.320	30	122	19.44	9	31.99	621.9828496	19.44	621.98
284	412	0.36	0.864	25	536	193.06	9	37.6	7259.234976	193.06	7259.23
285	1024	0.24	0.411	35	375	89.97	9	27.99	2518.354346	89.97	2518.35
302	1030	0.17	0.291	35	0	0.00	9	27.99	0	0.00	0.00
351	752	0.23	0.552	25	0	0.00	9	37.6	0	0.00	0.00
352	412	0.15	0.360	25	558	83.72	9	37.6	3147.95472	83.72	3147.95
352	752	0.35	0.840	25	0	0.00	9	37.6	0	0.00	0.00
356	262	0.11	0.330	20	1207	132.79	9	45.82	6084.378234	132.79	6084.38
357	244	0.2	0.480	25	1799	359.70	9	37.6	13524.72	359.70	13524.72
359	358	0.07	0.211	20	3073	215.12	9	45.82	9857.013754	215.12	9857.01
412	352	0.15	0.360	25	558	83.66	9	37.6	3145.63668	83.66	3145.64
412	284	0.36	0.864	25	537	193.30	9	37.6	7268.128128	193.30	7268.13
574	575	0.24	0.320	45	0	0.00	9	23.11	0	0.00	0.00
574	265	0.27	0.360	45	0	0.00	9	23.11	0	0.00	0.00
575	574	0.24	0.320	45	0	0.00	9	23.11	0	0.00	0.00

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

[illegible]	[illegible]	[illegible]	TravelTime	Speed	Volume	VMT(1)	FCLASS	EF by speed (without Oxy, [grams CO/VMT])	Average Weekday (Monday - Friday) Total CO [Gm]	Seasonal VMT (2)	Weekday (Monday Friday) Seasonal Total CO [Gm]
575	264	0.49	0.653	45	0	0.00	9	23.11	0	0.00	0.00
603	267	0.07	0.140	30	122	8.51	9	31.99	272.1174967	8.51	272.12
714	1024	0.26	0.446	35	516	134.08	9	27.99	3752.889683	134.08	3752.89
714	1023	0.37	0.635	35	1886	697.80	9	27.99	19531.36042	697.80	19531.36
752	351	0.23	0.552	25	0	0.00	9	37.6	0	0.00	0.00
752	352	0.35	0.840	25	0	0.00	9	37.6	0	0.00	0.00
856	248	0.11	0.330	20	72	7.95	9	45.82	364.4971836	7.95	364.50
856	256	0.14	0.420	20	0	0.00	9	45.82	0	0.00	0.00
1023	714	0.37	0.635	35	1886	697.82	9	27.99	19531.9818	697.82	19531.98
1023	1030	0.55	0.943	35	1619	890.71	9	27.99	24930.93092	890.71	24930.93
1024	285	0.24	0.411	35	375	90.08	9	27.99	2521.343678	90.08	2521.34
1024	714	0.26	0.446	35	516	134.18	9	27.99	3755.735147	134.18	3755.74
1030	302	0.17	0.291	35	0	0.00	9	27.99	0	0.00	0.00
1030	1023	0.55	0.943	35	1620	891.10	9	27.99	24942.01496	891.10	24942.01
370	371	0.05	0.100	30	0	0.00	30	31.99	0	0.00	0.00
503	504	0.17	0.186	55	2326	395.47	30	22.36	8842.807584	395.47	8842.81
504	505	0.19	0.207	55	2326	442.00	30	22.36	9883.137888	442.00	9883.14
506	532	0.25	0.429	35	198	49.60	30	27.99	1388.24802	49.60	1388.25
507	531	0.03	0.060	30	1662	49.86	30	31.99	1595.088579	49.86	1595.09
511	534	0.1	0.240	25	985	98.49	30	37.6	3703.21648	98.49	3703.22
515	543	0.19	0.326	35	3247	616.99	30	27.99	17269.41295	616.99	17269.41
517	545	0.18	0.309	35	485	87.27	30	27.99	2442.650353	87.27	2442.65
530	531	0.07	0.120	35	650	45.49	30	27.99	1273.302047	45.49	1273.30
531	530	0.07	0.120	35	1662	116.34	30	27.99	3256.493751	116.34	3256.49
531	557	0.14	0.240	35	650	90.98	30	27.99	2546.604094	90.98	2546.60
533	508	0.23	0.460	30	2374	546.12	30	31.99	17470.49077	546.12	17470.49
534	512	0.21	0.360	35	1650	346.55	30	27.99	9699.945696	346.55	9699.95
535	560	0.14	0.240	35	1068	149.46	30	27.99	4183.458174	149.46	4183.46
543	516	0.05	0.086	35	549	27.45	30	27.99	768.191148	27.45	768.19
545	820	0.07	0.140	30	3724	260.65	30	31.99	8338.190301	260.65	8338.19
556	527	0.07	0.140	30	1372	96.07	30	31.99	3073.327285	96.07	3073.33
561	536	0.16	0.320	30	1991	318.61	30	31.99	10192.26992	318.61	10192.27
700	732	0.04	0.080	30	0	0.00	30	31.99	0	0.00	0.00
700	730	0.12	0.240	30	51	6.10	30	31.99	195.0455892	6.10	195.05
701	732	0.06	0.120	30	0	0.00	30	31.99	0	0.00	0.00
701	733	0.08	0.160	30	244	19.50	30	31.99	623.7640528	19.50	623.76
719	725	0.1	0.171	35	1063	106.27	30	27.99	2974.60926	106.27	2974.61
725	717	0.1	0.134	45	3308	330.83	30	23.11	7645.38886	330.83	7645.39
730	701	0.07	0.140	30	34	2.38	30	31.99	76.1048498	2.38	76.10
730	731	0.08	0.160	30	51	4.06	30	31.99	130.0303928	4.06	130.03
731	730	0.08	0.160	30	34	2.72	30	31.99	86.9769712	2.72	86.98
731	734	0.17	0.340	30	27	4.53	30	31.99	145.0503376	4.53	145.05
732	700	0.04	0.080	30	985	39.40	30	31.99	1260.548036	39.40	1260.55
732	733	0.06	0.120	30	0	0.00	30	31.99	0	0.00	0.00
733	732	0.06	0.120	30	985	59.11	30	31.99	1890.822053	59.11	1890.82
733	734	0.06	0.120	30	244	14.62	30	31.99	467.8230396	14.62	467.82

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

									Average Weekday (Monday - Friday)		Weekday (Monday Friday)
[illegible]	[illegible]	[illegible]	[illegible]	Speed	Volume	VMT(1)	FCLASS	EF by speed (without Oxy, [grams CO/VMT])	Total CO [Gm]	Seasonal VMT (2)	Seasonal Total CO [Gm]
734	733	0.06	0.120	30	985	59.11	30	31.99	1890.822053	59.11	1890.82
734	731	0.17	0.340	30	9	1.54	30	31.99	49.4069555	1.54	49.41
820	544	0.03	0.052	35	3724	111.71	30	27.99	3126.681729	111.71	3126.68
				0							
		162.86	281.398	35	1,801,851	423,845.11	30	27.99	11,221,321.42	397204.00	10530527.70
Off System Estimated Speed & Volume =				25		42,385		37.6	1,593,657.63	42384.51	1593657.63
Links highlighted are those within 1/4 mile of the Hope and 6th Street Intersection: Node 712									12,814,979.05	439,588.51	12,124,185.33

Appendix D, Table D-4: 1996 Klamath Falls EMME/2 roadway type lbs/day calculation table.

Model Run Output for Klamath Falls Model Study Area (only includes area inside UGB and no centroid connections)

[illegible] | EF by speed (without Oxy, [grams CO/VMT]) | Average Weekday (Monday - Friday) Total CO [Gm] | Seasonal VMT (2) | Weekday (Monday Friday) Seasonal Total CO [Gm]

Functional Class Legend		VMT AAWD (1)	AAWD [Gm CO]	AAWD [Lbs CO/day]	Average Seasonal Day VMT	Seasonal AWD CO [Gm]	Average Seasonal Day [Lbs CO/day]
2	Rural Principal Arts	272,318.02	6,730,181.14	14,840.05	252,707.89	6,245,528.15	13,771.39
6	Rural Minor Arteria	97,636.45	2,862,593.44	6,312.02	90,605.47	2,656,452.71	5,857.48
7	Rural Major Collect	42,407.44	1,271,221.99	2,803.04	42,407.44	1,271,221.99	2,803.04
9	Rural Local	6,983.91	230,834.93	508.99	6,983.91	230,834.93	508.99
30	Ramps	4,499.29	126,489.91	278.91	4,499.29	126,489.91	278.91
	Off Network VMT	42,384.51	1,593,657.63	3,514.02	39,720.40	1,593,657.63	3,514.02
	Total	466,229.63	12,814,979.05	28,257.03	436,924.40	12,124,185.33	26,733.83

1. Vehicle Miles Traveled on an annual average week day (Monday - Friday). April/ October are chosen by ODOT to represent the annual day as the most neutral months.
2. Seasonal Adjustment factor is from Table 2.6.1 - CO Season VMT Adjustment Determination.
SAF is applied to Calss 2 and Class 6 roads only. The activity on the other roads (class 7, 8, 9, and 30) is assumed to be uniformed throughout a year.

Appendix D, Table D-5a. Klamath Falls UGB CO 1996 Annual: On-Road Mobile Sources CO Emissions by Vehicle Class (without oxygenated fuel) tons/year

Area Road Type	(1) Average week da VMT by road typ [Miles/day]	(2) Avg. Wkdy CO Emissions by Road Type [lbs/day]	(3) Avg. Wkdy to Avg. day adj factor	(4) Adjusted Emissions All Veh [lbs/day]	(5) Annual CO Emissions All Veh [tons/yr]	(6) CO Emissions LDGV SCC 21-01-001 000 [tons/yr]	LDGT1 SCC 22-01-020 000 [tons/yr]	LDGT2 SCC 22-01-040 000 [tons/yr]	HDGV SCC 22-01-070 000 [tons/yr]	LDDV SCC 22-30-001 000 [tons/yr]	LDDT SCC 22-30-060 000 [tons/yr]	HDDV SCC 22-30-070 000 [tons/yr]	MC SCC 22-01-080 000 [tons/yr]
K Falls UGB VMT Mix (7)						0.581	0.202	0.091	0.038	0.003	0.001	0.075	0.007
VMT Mix normalized (7)						0.58216	0.20240	0.09118	0.03808	0.00301	0.00100	0.07515	0.00701
Klamath Falls UGB													
Road Type													
Rural Principal Arterial	272,318	14,840	0.95	14,098	2,573	1,498	521	235	98	8	3	193	18
Rural Minor Arterial	97,636	6,312	0.95	5,996	1,094	637	222	100	42	3	1	82	8
Rural Major Collector	42,407	2,803	0.87	2,439	445	259	90	41	17	1	0	33	3
Rural Local	6,984	509	0.87	443	81	47	16	7	3	0	0	6	1
Ramps	4,499	279	0.87	243	44	26	9	4	2	0	0	3	0
Off network VMT Est.	42,384.51	3,514	0.87	3,057	558	325	113	51	21	2	1	42	4
Total Klamath Falls UG	466,230	28,257		26,276	4,795	2,792	971	437	183	14	5	360	34
Notes:						LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC

1) From ODOT EMME/2 output Miles/day: Appendix D, Table 4.
2) Average Week Day All Vehicle Emissions (lbs/day) = VMT ([miles/day], ODOT EMME/2 model output) * EPA Mobile 5b emissions factors [grams/mile] *0.002205[gm/lb].
3) Average Week Day to Average Day Adjustment factor, Ref. 313.
4) Average Day Emissions [lbs/day] = Average Week Day Emissions * Average Day Adjustment Factor.
5) Annual CO emissions, all vehicles [tons/yr] =
Average day adjusted emissions, all vehicles [lbs/day] * 365 days per year / 2000 [lbs/ton].
6) CO emissions by vehicle class = normalized weighted fleet VMT mix (%) * annual CO emissions.
7) VMT mix by vehicle class (a weighted percentage established using the EPA Mobile 5b) (Ref 371).

Vehicle Class	VMT Mix	VMT Mix normalized
LDGV	0.581	0.582164329
LDGT1	0.202	0.20240481
LDGT2	0.091	0.091182365
HDGV	0.038	0.038076152
LDDV	0.003	0.003006012
LDDT	0.001	0.001002004
HDDV	0.075	0.075150301
MC	0.007	0.007014028
Total	0.998	1

Appendix D, Table D-5b. Klamath Falls UGB CO 1996 Seasonal: On-Road Mobile Sources CO Emissions by Vehicle Class (without oxygenated fuel) lbs/day

Area Road Type	(1) Seasonal Wkdy Vehicle Miles Traveled by Road Type [Miles/day]	(2) easonal Wkdy CO Emissions by Road Type [Gm/day]	(3) CO Season Emissions All Veh [lbs/dy]	(4) CO Emissions LDGV SCC 21-01-001 000 [lbs/day]	LDGT1 SCC 22-01-020 000 [lbs/day]	LDGT2 SCC 22-01-040 000 [lbs/day]	HDGV SCC 22-01-070 000 [lbs/day]	LDDV SCC 22-30-001 000 [lbs/day]	LDDT SCC 22-30-060 000 [lbs/day]	HDDV SCC 22-30-070 000 [lbs/day]	MC SCC 22-01-080 000 [lbs/day]
Klamath Falls UGB											
VMT Mix (5)				0.581	0.202	0.091	0.038	0.003	0.001	0.075	0.007
				0.58216	0.20240	0.09118	0.03808	0.00301	0.00100	0.07515	0.00701
Klamath Falls UGB											
Road Type											
Rural Principal Arterial	252,708	6,245,528	13,771	8,017	2,787	1,256	524	41	14	1,035	97
Rural Minor Arterial	90,605	2,656,453	5,857	3,410	1,186	534	223	18	6	440	41
Rural Major Collector	42,407	1,271,222	2,803	1,632	567	256	107	8	3	211	20
Rural Local	6,984	230,835	509	296	103	46	19	2	1	38	4
Ramps	4,499	126,490	279	162	56	25	11	1	0	21	2
Off network VMT Est.	39,720	1,593,658	3,514	2,046	711	320	134	11	4	264	25
Total Klamath Falls UG	436,924	12,124,185	26,734	15,563	5,411	2,438	1,018	80	27	2,009	188
Notes:				LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC

1) From ODOT EMME/2 output Miles/day: Appendix D, Table D-4 .
2) All Vehicle Emissions (Gm/day) resulting from EPA Mobile 5b emission factors and ODOT EMME/2 model output.
3) Unadjusted Emissions, All vehicle classes [lbs/day] =
seasonal weekday emissions by road type [gm/day] * 0.002205 [gm/lb]
Annual VMT were adjusted with the SAF to represent seasonal VMT.
4) CO emissions by vehicle class = normalized weighted fleet VMT mix (%) * CO emissions
5) VMT mix by vehicle class (a weighted percentage established using the EPA Mobile 5b) (Ref 371).

Vehicle Class	VMT Mix	Normalized VMT Mix
LDGV	0.581	0.58216433
LDGT1	0.202	0.20240481
LDGT2	0.091	0.09118236
HDGV	0.038	0.03807615
LDDV	0.003	0.00300601
LDDT	0.001	0.001002
HDDV	0.075	0.0751503
MC	0.007	0.00701403
Total:	0.998	1

METHODOLOGY REPORT

Small Urbanized Area Model Components

Prepared for:
Oregon Department of Transportation

Prepared by:
Parsons Brinckerhoff Quade & Douglas, Inc.

May 1999

TABLE OF CONTENTS

1: INTRODUCTION AND BACKGROUND

There are numerous small, urbanized areas within the State of Oregon. Although they may be outside the jurisdiction of a metropolitan planning organizations (MPO) area, they nevertheless could benefit from a small scale regional transportation model. Resources prohibit developing a model tailored for each small urban area. However, since many of the rural communities are similar in travel behavior patterns, it was decided to develop a single generic rural area model.

A set of statewide travel demand model development guidelines[1] for Oregon were developed in 1994/1995. These guidelines were intended as a resource document for the state to assist counties and individual municipalities in developing their own travel demand models. Several of the techniques and methodologies described for smaller urban areas (i.e., non-MPO areas with population less than 50,000) were used in this study.

The project for which model development is being described in this report was a joint effort between the Oregon Department of Transportation, Planning Section, Transportation Development Branch (hereafter referred to as ODOT) and Parsons Brinckerhoff (PB). The major activities undertaken included: investigation and preparation of survey data, definition of trip purposes, development of household submodels, design of trip production and attraction models, estimation of trip distribution, validation of models in the Klamath Falls area, test application in the Roseburg area, and model documentation and assistance.

This *Methodology Report* describes the underlying theory and basis for the structure and formulation of each model component comprising the Small Urban Area generic rural model. A companion document, the *Application Guide*, contains detailed information on the computer programs, macros, and batch files required to run the model set. These documents should be used together to gain a full understanding of the Small Urban Area model set.

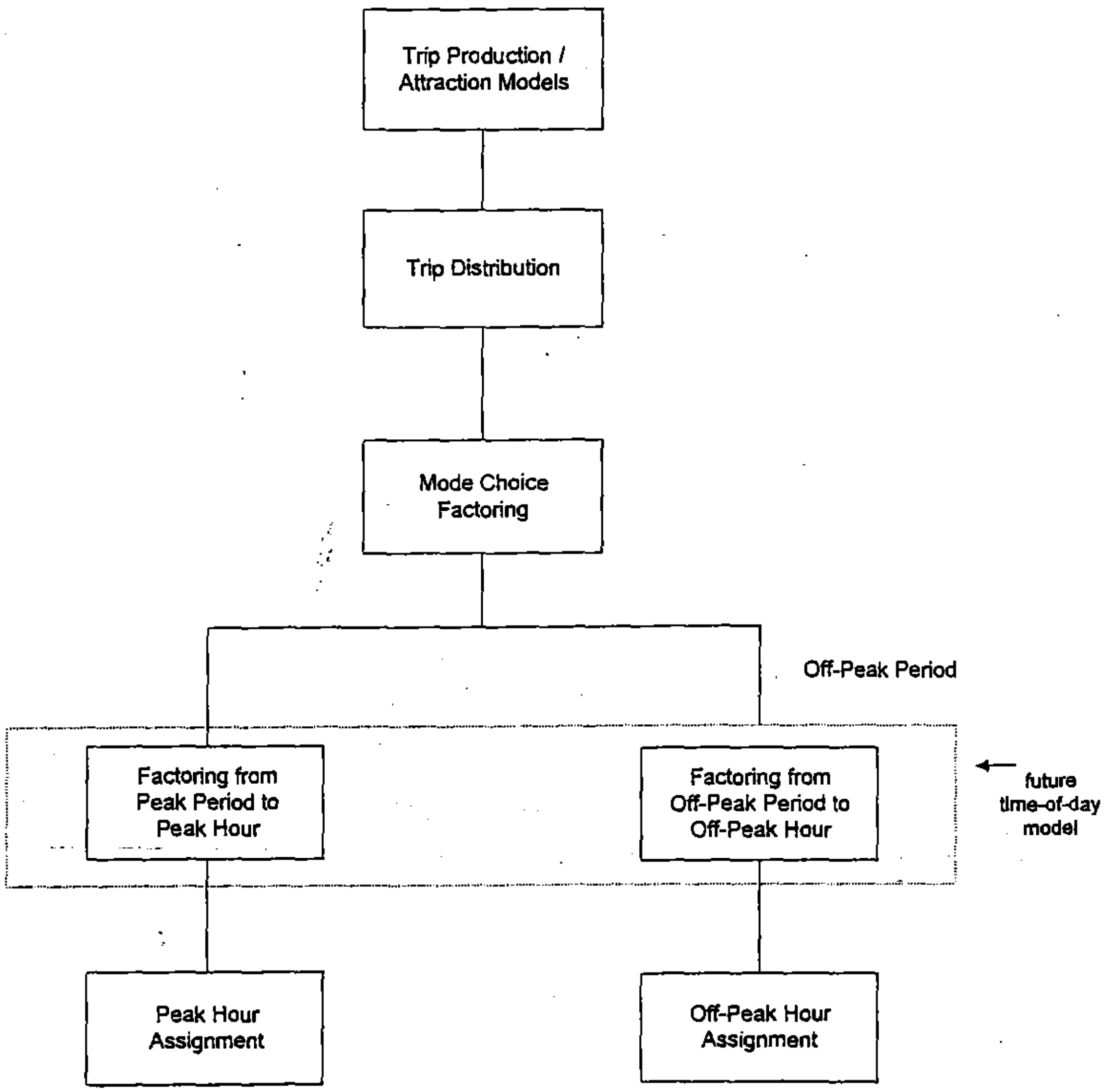
The overall structure of the Small Urban Area transportation model is shown in Figure 1. Basic socio-economic and demographic data feed into the trip production and attraction models. Initial plans called for diurnal factoring of the productions and attractions into peak and off-peak periods. However, some analysis and experimentation with the base data and trip distribution model revealed that the two time periods were unnecessary. Thus, only a single time period distribution model is used for each trip purpose; as is a single mode choice set of factors. Trips are however split into separate time periods using diurnal factors for the purpose of assigning them to the highway network by time-of-day.

A major highlight of the transportation model is the use of a destination choice model for trip distribution. In a more traditional gravity model, the trip distribution is related to auto or transit travel times (through an impedance function). However, in using a logit-based destination choice

[1] State of Oregon Department of Transportation, *Travel Demand Model Development and Application Guidelines*, September 1994, Revised June 1995.

model, other variables (such as density measures, activity center location dummy variables, socioeconomic variables, etc.) may also be considered in the utility expressions. For the model components that required specific network measures (i.e., travel times), Klamath Falls was chosen as the area most representative of other small urban areas. Thus, it was designated the generic rural area. A Klamath Falls network was developed that contained the street system and associated zonal data. The specific network sensitive information applied mostly to the destination choice and trip assignment models. Other model components utilized the full 8-county home interview survey data or other regional Census data.

Figure 1: Modeling Process



The Small Urban Area model was implemented in the EMME/2 transportation planning software package and in a series of stand-alone programs. The detailed macros and set-ups are described in the associated *User's Guide*.

2: INPUT DATA REQUIREMENTS

The assembly and preparation of data is foremost in any modeling effort. The basic data that are required included: land use and demographic data, and some representation of the transportation system to be modeled. The following data items were used in this study:

- Home interview survey data for the entire 3200 households within the 8 counties. This data served as the basis for many of the models and submodels developed. The underlying concept was to use all 3200 households for the trip production model analysis; while relying on a subset of those households (i.e., those within the Klamath Falls area) for the trip attraction and distribution models.

- Production zonal data including the number of households, population estimates, and some socioeconomic measures such as income and household size.

- Attraction zonal data including employment figures by type, as well as school enrollment. Employment was obtained by category (i.e., office, retail, manufacturing, etc.) for the Klamath Falls zone system.

- Networks for Roseburg and the surrounding area for both peak and off-peak time periods. These networks contained the roadways in the study area, with functional classes noted, the number of lanes, and other roadway data.

- Traffic count data was used to validate the Roseburg test application.

The home interview survey served as the basis for most of the model development work. In it, eight counties, covering most of Oregon's non-MPO areas, were surveyed. This included the coastal counties of Clatsop, Coos, and Lincoln (about 400 households each), eastern counties of Malheur and Umatilla (about 300 households each), central county, Deschutes (about 800 households), and southwestern counties, Josephine and Klamath (about 400 households each). The survey used a random sample of telephone numbers in the study area. The sampling frame consisted of listed and unlisted telephone numbers for the areas drawn in proportion to their distribution within the county. Due to the nature of the sampling frame, households without telephones were excluded from the sample.

The survey relied on the willingness of the respondents to complete a set of travel diaries for two complete days. Recruitment of households was conducted through a "recruitment interview" in which respondents were informed of the survey, its purpose, and the respondent's obligation to complete diaries. Data on households and household members were also collected during the recruitment interview.

Participating households were assigned a 2-day travel period sometimes extending into a weekend. Household members were asked to record travel information in their diaries for the specified 2-day period. Immediately after the assigned date, households were contacted to retrieve the diary information. The following information was collected for each activity:

- description of activity
- location of activity
- start and end times
- whether or not the activity included or required a trip
- if so, mode of travel

The rural household data contained the above information in four major tables. The "activity" table contained 206,080 records of 7,384 respondents' activities over two days. The information gathered for this table included the description of the activity, the location of the activity, the start and end times of the activity, whether the activity required a trip, and the mode of travel. The "person" table contained 7,384 records, one for each respondent. This table included various personal information about each respondent such as age, gender, employment status, education level, ethnic group, and the total number of activities and trips made by that person for each day. The "household" table contained 3,193 records with information on household size, income level, number of vehicles, type of home, and the total number of activities and trips for the household for each day. Finally, the "vehicle" table contained information about each vehicle in the household such as year, make, model, and vehicle classification.

3: DEFINITION OF TRIP PURPOSES

Trip purpose stratification attempts to organize travelers into loosely defined classes where similar travel behavior is observed. Then, generalizations can be made and applied to all travelers in each of the various classes. Thus, it is imperative that the trip purpose classes be defined appropriately. These definitions were based on behavioral travel information from travel surveys and on previous experience in other similar studies.

This chapter describes the process of defining generalized trip purposes for small urbanized areas in Oregon. Separate sections incorporate an expanded definition of the work trip, trip linking, and a suggested set of trip purposes for small urbanized areas. Further detail is provided in the Appendix regarding the cleaning of the survey data, as well as the creation of trip chains used in the posting of trip purposes. Much of the material in this section was obtained from an earlier document written by ODOT staff.

Historically, there have been five primary trip purposes utilized within most regional model sets:

- home-based work
- home-based shopping
- home-based other
- non-home based other (other-other)
- non-home based work (work-other)

Subsequent analysis of the recent home-interview survey—a primary source of travel behavior data for estimation of the trip production and attraction models—yielded an *expanded set* of trip purpose definitions for trip generation model construction.

3.1: AN EXPANDED DEFINITION OF THE WORK TRIP

A more refined or expanded definition of the classical home-based work trip was developed to provide additional insight into the mode choice decision. A detailed analysis of survey trip patterns revealed three fundamentally different types of work trips - direct home-based work, strategic home-based work, and complex home-based work. The classification of work trips in this manner provided a direct mechanism to incorporate or specify a set of restricted modal choices that would apply to each type of work trip. These restrictions do not necessarily suggest that separate mode choice models need to be estimated for each type of work trip; rather they contribute directly to an expanded definition of market segmentation in the application (or aggregate) form of the model.

A *direct home-based work trip* implicitly assumes that all modes of transportation are available, limited only by socioeconomic characteristics of the households or their proximity to transit services. For example, travelers within the households that do not have a car available are assumed not to be candidates for the drive-alone mode, similarly, households that are situated at a walk distance in excess of the maximum walk distance to transit are excluded from the walk to transit choice. Presumably, direct home-based work trips are the most susceptible to transit use.

A *strategic home-based work trip* contains an intermediate stop to drop off or pick up (i.e., serve a passenger) a child at daycare, nursery school, a baby-sitter, preschool, elementary or secondary school. If a traveler drops-off their child at a daycare center in the morning and proceeds directly home in the evening, both trips are considered strategic home-based work trips. This is because the decision on mode is influenced by the need to drop-off a passenger. This is the *only* case of serve passenger in which the intermediate destination is "linked-out" to create a composite trip. This type of trip is described as "strategic" reflecting the relative importance placed on this activity by the adult members of the household. The consequence of this important household decision limits the modes of travel available to the automobile.

The third category of work trips are defined as *complex home-based work*. Complex work trips are part of a trip tour that consists of one trip between home and work and another trip between work and home which involves some intermediate stop at any destination. In this case, the home-to-work leg of the trip chain would be classified as a complex home-based work trip, the work-to-other leg of the chain would be coded as non-home based work related, and the other-to-home leg would be coded as a complex home-based other trip. Complex work trips are part of a trip tour where the worker's choice of mode is conditioned to some extent on the tasks that the worker must accomplish on either one or both legs of the journey between home and work.

In the cases where the intermediate stop in between home and work is personal business, specific criteria are applied to determine whether the intermediate trip is linked out. For example, a trip from home to a short stop to get gas and then on to work is typical of one in which the fueling stop might be linked out. The intermediate personal business stop here is normally in the pathway from the person's home to their work destination. This stop has in most cases a minimal diversion to the travel path from home to their final work destination.

The unlinked trip records are summarized by mode and type of home-based work trip in Table 1 below. The values shown in this table are actual unexpanded trip records.

Table 1: Types of Home-Based Work Trips by Mode

	Work Trip Subtype					
	Direct		Complex		Strategic	
Mode	Count	Col %	Count	Col %	Count	Col %
Other	4	.1%	2	.2%		
Walk	175	2.2%	6	.6%	4	.4%
Bicycle	55	.7%	5	.5%		
Public Bus	11	.1%				
Auto Passenger	437	5.6%	62	6.4%	31	3.3%
Auto Driver	7,148	91.3%	894	92.3%	892	96.2%
Total	7,830	100.0%	969	100.0%	927	100.0%

3.2: TRIPS AND CHAINS

Multiple trips one after the other can be thought of as trip chains or tours. For example, a multi-stop chain from home to gas station to daycare to work to lunch, back to work and finally back home again is comprised of six individual trips. The chains existing in the survey data were examined for patterns that might help define trip-making behavior. Seven main trip chain categories were identified hierarchically. Except for work and university chains, all chains have two subtypes; direct and complex. Work and university chains have three subtypes – direct, complex, and strategic.

- school chains
- university chains (mutually exclusive with school chains)
- work chains
- shopping chains
- recreation chains
- other chains
- pickup/dropoff only chains

Thus, if a chain contained trips from home to shopping, then to work, then to recreation, then back home, the entire chain would be classified as a work complex chain since work activities have a higher priority than shopping or recreation activities. Furthermore, chain types (work, school, shop, recreation, other) were used as an aid in posting trip purposes on the various trip records. In the above example, there is one home-based shopping complex trip, two non-home-based work trips, and one home based recreation complex trip.

3.3: SURVEY ACTIVITY INTERPRETATION

Each survey respondent provided a description of his/her activities over a two-day period in a diary log. An interviewer then attempted to put each activity into one of 35 listed activities. The potential activities are listed in Table 2 below:

Table 2: Potential Activities

Trip	Casual Entertaining
Sleep for night	Formal Entertaining
Work	School/School-Related
Work-related	Cultural
Shopping (General)	Religious/Civil Services
Shopping (Major)	Civic
Personal Services	Amusements (At-home)
Medical Care	Amusements (Out-of-home)
Professional Services	Hobbies
Household/Personal Business	Exercise/Athletics
Household/Property Maintenance	Rest and Relaxation/Breaks
Household/Family Obligations	Spectator Athletic Events
Pick-up/Drop-off Passengers	Personal Hygiene/Dressing
Visiting	Tag-Along
Incidental Stop	Pet Care
Wait on Plane	Out of Area
Wait-for/Get-off Bus	Drive-Thru (Fast Food)

A more detailed description of an activity and its location were included in a "place name/landmark" variable and a street address. The activity that took place and the location of the activity (actual activity place, i.e. McDonalds) were used to help identify shopping, recreation, university, and daycare locations. These four locations were not originally identified in the activity location, *actloc*, variable.

3.4: ORIGIN AND DESTINATION LINK

Each trip activity was given an origin-destination link. Table 3 below summarizes the origin and destination locations for each trip activity from the Rural Household data.

In a simple work chain example, if a person travels from home to work and back home, this chain is called a direct work chain. The person made one home to work trip, and one work to home trip. In essence, he/she made two home to work *links*. Since this chain belongs to a direct work chain, the two trips would be classified as home-based work *direct* trips.

In a more complicated example, say a person travels from home to work to shopping (>5 minutes) and then back home. This is a complex work chain. The person made one home to work trip, one work to shop trip, and one shop to home trip. Since this chain is a complex work chain, the three trips would be classified as home-based work *complex*, non-home-based work, and home-based shop *complex* trips, respectively.

Table 3: Trips by Origin and Destination Link

	Destination													
Origin	Home	Work	Univ	School	Day-care	Shop	Rec	Other	P/D-Schl	P/D-Day-care	P/D-Work	P/D-Other	Total	
Home	26	4684	143	1623	40	2047	3609	3751	765	41	67	924	17720	36.5%
Work	4277	456	11	9		354	299	960	88	23	2	168	6647	13.7%
University	131	11				8	9	17	1	1		2	180	0.4%
School	1450	44	1	5	26	50	175	280	25		1	43	2100	4.3%
Daycare	46			17		1	1	1					66	0.1%
Shop	2870	172	4	15		961	309	653	17		1	84	5086	10.5%
Recreation	3596	154	2	51		420	463	617	17	5	3	108	5436	11.2%
Other	3703	761	13	306		1079	739	1588	36	7	9	194	8435	17.4%
P/D-School	548	173	3	68		45	39	55	74			32	1037	2.1%
P/D-Daycare	39	28				3	2	2	3				77	0.2%
P/D-Work	52	7		2		7	2	4	6			1	81	0.2%
P/D-Other	907	168	5	23		119	118	192	18			126	1676	3.5%
Total	17645	6658	182	2119	66	5094	5765	8120	1050	77	83	1682	48541	100.0%
	36.4%	13.7%	0.4%	4.4%	0.1%	10.5%	11.9%	16.7%	2.2%	0.2%	0.2%	3.5%	100.0%	

3.5: TRIP LINKING

As per the definition of "strategic" home-based work (or university) trips, intermediate stops in a work or university journey involving a pickup/drop-off of passengers at school or daycare were linked out. There were a total of 778 pickup/dropoffs trips linked out in this manner. Tables 4 and 5 below summarize the origins and destination locations for work chains and university chains respectively. The only other case where trips were linked out is short intermediate stops to run errands or buy gas. If the activities were coded as doing errands or buying gas and the activity duration was five minutes or less, then the trips were linked out. There were 417 trips linked out in this manner. There were also 26 loop trips that were discarded. In most cases, the respondents had gone out for a walk around the block. These trips had both origin and destination at the home location.

After completing all trip linking the resulting data set contained 47,320 trips. Originally there were 48,541 trips that belonged to a chain. There were 49,216 trips in the entire data set but 675 trips did not belong to chains because they were loop trips. These are different from the 26 loop trips above which *belonged* to chains.

Table 4: Work Chains Trips by Origin/Destination Link

Origin	Destination									Total	
	Home	Work	Shop	Rec	Other	P/D-Schl	P/D-Daycare	P/D-Work	P/D-Other	Total	
Home	4	4667	64	74	207	174	29	4	137	5360	34.9%
Work	4230	453	348	293	945	86	23	2	166	6546	42.7%
Shop	308	169	64	22	68			1	12	644	4.2%
Rec	198	152	31	31	48	2	1	1	8	472	3.1%
Other	359	749	106	58	236	6	5	4	39	1562	10.2%
P/D-Schl	65	171	14	5	7	34			8	304	2.0%
P/D-Daycare	28	28	1		1					58	0.4%
P/D-Work	1	7	2							10	0.1%
P/D-Other	149	162	14	11	32	2			12	382	2.5%
Total	5342	6558	644	494	1544	304	58	12	382	15338	100.0%
	34.8%	42.8%	4.2%	3.2%	10.1%	2.0%	0.4%	0.1%	2.5%	100.0%	

Table 5: University Chains Trips by Origin/Destination Link

Origin	Destination									Total	
	Home	Work	Univ	Shop	Rec	Other	P/D-Schl	P/D-Daycare	P/D-Other	Total	
Home		10	143	3	2	3	3		8	172	37.4%
Work	9	2	11		1	4			2	29	6.3%
Univ	131	11		8	8	14	1	1	2	176	38.3%
Shop	5		4	1		3				13	2.8%
Rec	6	1	2		3	1			1	14	3.0%
Other	14	1	10	1	2	2		1		31	6.7%
P/D-Schl	1		3				2			6	1.3%
P/D-Daycare	1					1				2	0.4%
P/D-Other	4	4	5						4	17	3.7%
Total	171	29	178	13	16	28	6	2	17	460	100.0%
	37.2%	6.3%	38.7%	2.8%	3.5%	6.1%	1.3%	0.4%	3.7%	100.0%	

3.6: TRIP PURPOSE DEFINITION

The general set of expanded trip purposes for consideration in the development of the trip generation models were as follows:

- home-based work
- home-based university
- home-based shopping
- home-based recreation
- home-based school
- home-based other
- nonhome-based work-related
- nonhome-based nonwork

Home-based work and home-based university trip purposes were further expanded into three purposes –direct, complex, and strategic. The remaining home-based trip purposes were expanded into two groups – direct and complex. Table 6 lists the general trip purposes between origin and destination activities. These trip purposes were posted on the survey records for use in subsequent model development activities.

Table 6: Trip Purpose Definitions

	Destination											
Origin	Home	Work	Univ	School	Daycare	Shop	Rec	Other	P/D-Schl	P/D-Daycare	P/D-Work	P/D-Other
Home	Out	HBW	HBUni	HBSch	HBSch	HBShp	HBRec	HBOth	HBSch	HBSch	HBOth	HBOth
Work	HBW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
University	HBUn	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW
School	HBSch	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW
Daycare	HBSch	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW
Shop	HBShp	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW
Recreation	HBRec	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW
Other	HBOth	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW
P/D-School	HBSch	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW
P/D-Daycare	HBSch	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW
P/D-Work	HBOth	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW
P/D-Other	HBOth	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW

HBW=home based work
HBUn=home based university
HBSch=home based school
HBRec=home based recreation
HBShp=home based shopping
HBOth=home based other
NW=nonhome based, work related
NNW=non home based, nonwork
Out=Thrown out; Loop Trip

3.7: FINAL TRIP PURPOSES

The initial set of trip purposes was described above. These were investigated using the rural home interview survey data. The final set of trip purposes for each model are listed in Table 7 below.

Table 7: Final Trip Purposes

Trip Generation	Trip Distribution	Mode Choice Factoring
Home-based work	Home-based work	Home-based work
Home-based elem/sec school	Home-based elem/sec school	Home-based elem/sec school
Home-based university	Home-based university	Home-based other
Home-based shop	Home-based shop	
Home-based recreation	Home-based recreation	
Home-based other	Home-based other	
Non-home based work	Non-home based work	Non-home based
Non-home based non-work	Non-home based non-work	

4: HOUSEHOLD SUBMODELS

The trip production models developed for the rural areas of Oregon cross-classify households by household size, workers per household, and measure of wealth (combined household income and auto ownership). Thus a set of submodels must be developed which estimate the necessary household distributions for each category. Households may need to be cross-classified by more than one scheme to satisfy different trip purpose categories. Two-way and three-way cross-classifications are common with best practice models tending towards the latter structure for the more significant trip purposes.

A set of household socio-economic models has been developed to estimate households by household size, household income, workers per household, and auto ownership level. The household size and income models relate a continuous average value of zonal quantity, such as household size, to shares of households by discrete ranges of that quantity, such as 1, 2, 3, and 4+ persons per household. The model relies on the strength and stability of relationships between the distribution and the corresponding mean values. The worker and auto ownership models are multinomial logit-based. Each of these submodels are discussed in this section.

Four submodels are presented here, namely:

- Household size distribution (1, 2, 3, 4+ persons)
- Household income distribution (4 categories)
- Household worker distribution (0, 1, 2, 3+ workers)
- Household auto ownership level (0, 1, 2, or 3+ vehicles)

The first two models (household size and income) do not incorporate transportation system characteristics. They are based solely on socioeconomic characteristics and assume these are largely independent of the transport system. Although the multinomial logit framework allows the worker and auto ownership models to include transportation characteristics, they are not included for other reasons described below.

4.1: HOUSEHOLD SIZE SUBMODEL

The purpose of the household size submodel is to estimate the number of households by persons per household (1, 2, 3, and 4+ persons). This submodel relates the average household size of the zone to the proportion of dwelling units by each size category. The model was estimated using 1990 CTPP data and hand-fit to meet the following additional constraints:

- the proportion of households by household size must sum to 1.0, and
- the proportion of households by household size must result in the correct average household size for the zone

The household size submodel is illustrated in Figure 2. The actual proportions of households by size category and average household size is shown in Table 8.

Figure 2: Household Size Submodel

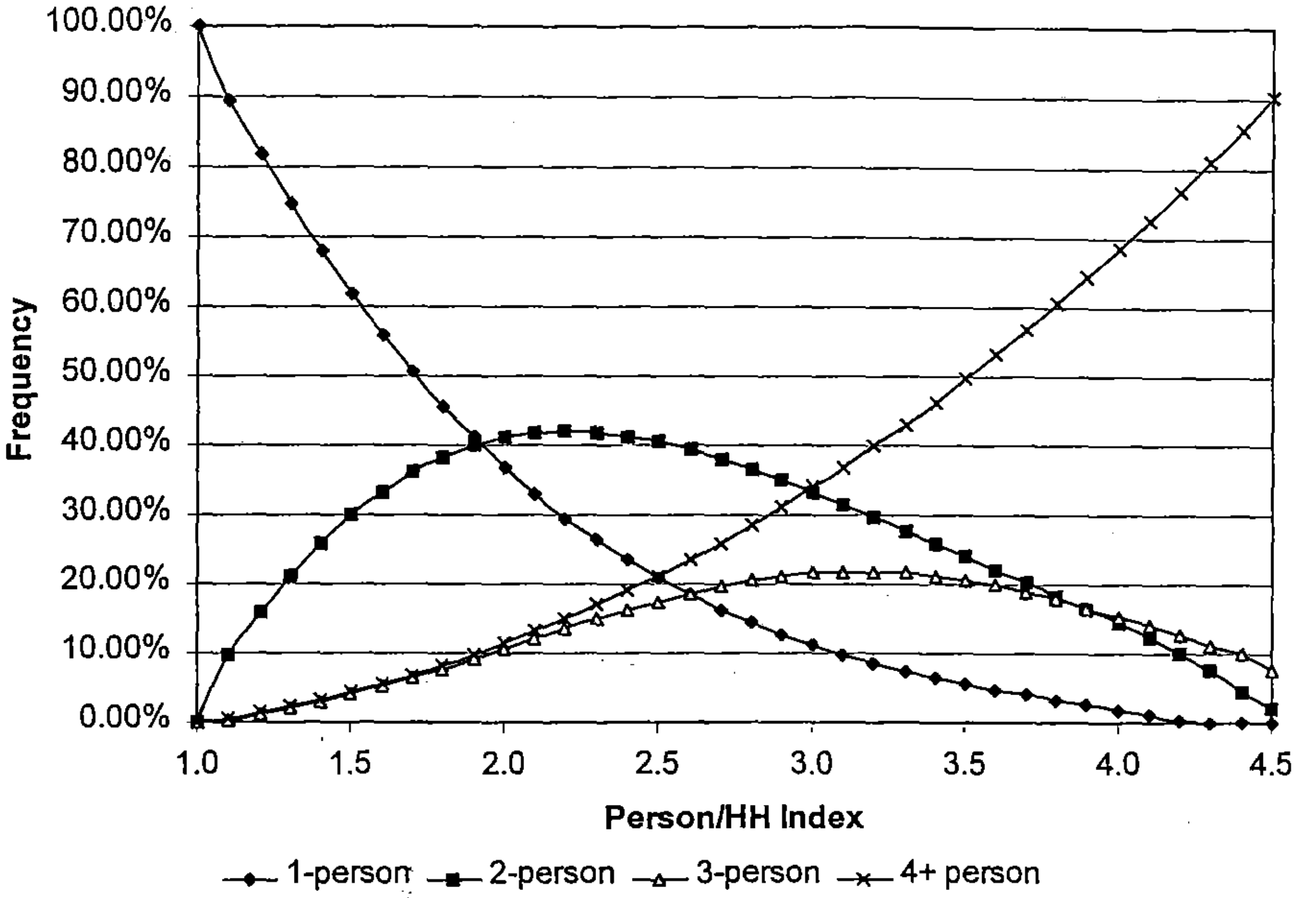


Table 8: Proportion of Households by Household Size and Average HH Size

Average	Proportion of Households Containing...				
HH Size	1 Person	2 Persons	3 Persons	4+ Persons	Total
1.0	1.000	0.000	0.000	0.000	1.000
1.1	0.894	0.097	0.003	0.007	1.000
1.2	0.817	0.158	0.011	0.014	1.000
1.3	0.746	0.212	0.020	0.023	1.000
1.4	0.679	0.259	0.029	0.033	1.000
1.5	0.617	0.300	0.040	0.044	1.000
1.6	0.559	0.334	0.052	0.055	1.000
1.7	0.506	0.362	0.064	0.068	1.000
1.8	0.456	0.384	0.077	0.083	1.000
1.9	0.411	0.400	0.091	0.098	1.000
2.0	0.369	0.411	0.106	0.114	1.000
2.1	0.331	0.418	0.120	0.132	1.000
2.2	0.295	0.420	0.134	0.150	1.000

2.3	0.263	0.418	0.149	0.170	1.000
2.4	0.234	0.413	0.162	0.191	1.000
2.5	0.208	0.405	0.175	0.213	1.000
2.6	0.185	0.394	0.186	0.236	1.000
2.7	0.163	0.380	0.196	0.260	1.000
2.8	0.144	0.366	0.205	0.285	1.000
2.9	0.127	0.349	0.212	0.312	1.000
3.0	0.112	0.332	0.216	0.340	1.000
3.1	0.098	0.314	0.219	0.369	1.000
3.2	0.086	0.296	0.219	0.399	1.000
3.3	0.075	0.278	0.217	0.430	1.000
3.4	0.065	0.259	0.213	0.463	1.000
3.5	0.056	0.240	0.207	0.497	1.000
3.6	0.048	0.221	0.199	0.532	1.000
3.7	0.040	0.202	0.189	0.568	1.000
3.8	0.033	0.183	0.178	0.606	1.000
3.9	0.026	0.164	0.166	0.644	1.000
4.0	0.019	0.144	0.153	0.684	1.000
4.1	0.011	0.123	0.140	0.726	1.000
4.2	0.004	0.101	0.127	0.768	1.000
4.3	0.000	0.075	0.113	0.812	1.000
4.4	0.000	0.044	0.099	0.857	1.000
4.5	0.000	0.020	0.076	0.904	1.000

4.2: HOUSEHOLD INCOME SUBMODEL

The purpose of the household income model is to estimate the share of households in a zone by ranges of household income. The submodel relies on the assumption that the relative share of households by income range or category is dependent on the mean income for that zone. For example, the model specifies that for zones with a mean income which is between 40% and 50% of the regional mean income, the income of approximately 48% of the households will be in quartile 1, 35% in quartile 2, 13% in quartile 3, and 4% in quartile 4. Rather than relate the percent distribution to the mean income, it is related to the ratio of the zone mean income divided by the regional mean income. This relative income measure eliminates the need to adjust for inflation in future forecasts.

Before proceeding with model estimation, income ranges must be defined. Four income categories, or quartiles are preferable, with an approximately equal number of households in each income range. Various summaries were made of the home interview survey data before deciding on the following income quartiles:

- $0 - $14,999

- $15,000 - $24,999
- $25,000 - $39,999
- $40,000 +

The model uses the mean (average) household income of the zone divided by the mean regional household income as the independent variable. This is referred to as the Income Index. Income Index ranges of 0.1 units were defined and the number of households in each income category by each was summed across the block groups for the same income index range. This aggregation process has the effect of smoothing the data without eliminating the inherent patterns of variation. The resulting percentages of households in each income category for each Income index range can be plotted and checked for reasonableness. The income submodel developed in this manner is shown in Figure 3 and Table 9.

Figure 3: Household Income Submodel

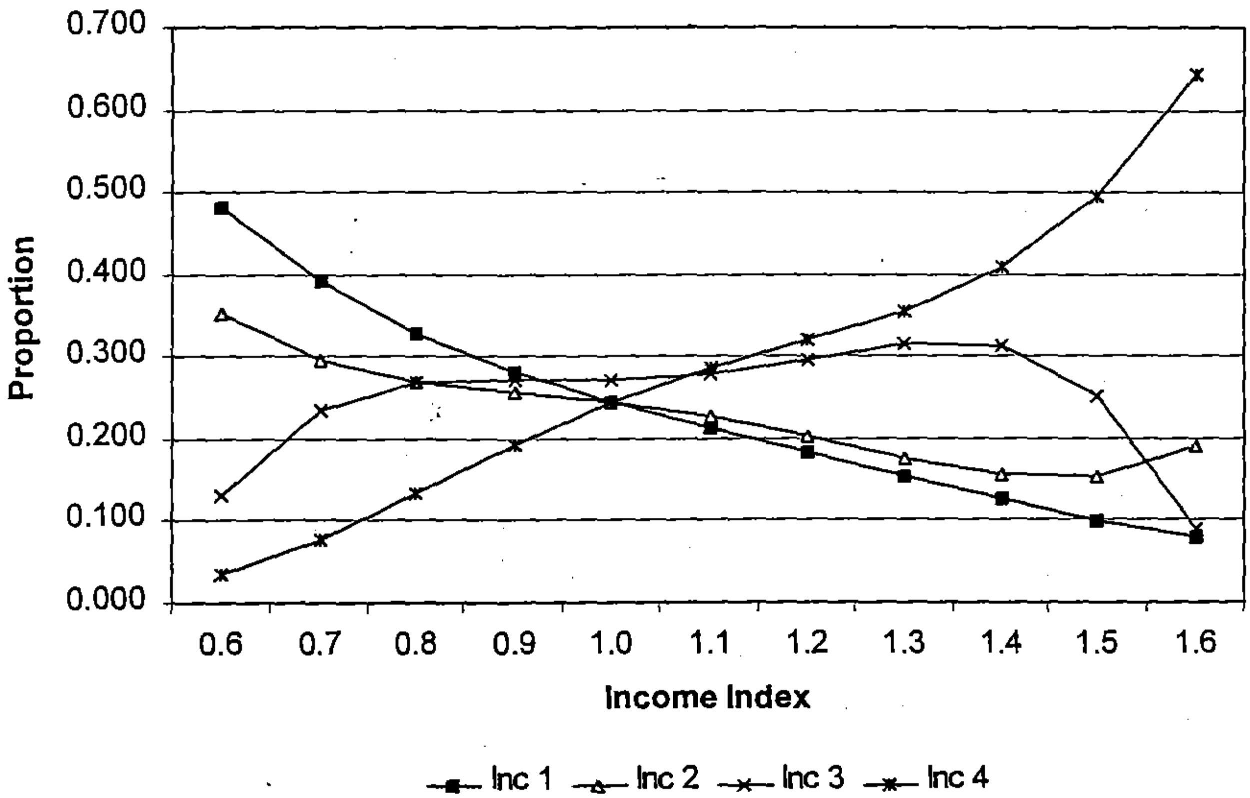


Table 9: Proportion of Households by Household Income Range and Income Index

Income Index	Inc1	Inc2	Inc3	Inc4	Total
0.6	0.480	0.353	0.132	0.035	1.000
0.7	0.391	0.296	0.235	0.077	1.000
0.8	0.327	0.269	0.269	0.134	1.000
0.9	0.280	0.255	0.272	0.192	1.000
1.0	0.243	0.243	0.271	0.243	1.000

1.1	0.211	0.226	0.278	0.285	1.000
1.2	0.182	0.202	0.296	0.320	1.000
1.3	0.153	0.175	0.315	0.356	1.000
1.4	0.125	0.154	0.312	0.408	1.000
1.5	0.099	0.153	0.252	0.496	1.000
1.6	0.079	0.189	0.089	0.643	1.000

4.3: HOUSEHOLD AUTO OWNERSHIP SUBMODEL

The purpose of the auto ownership submodel is to estimate the share of households with 0, 1, 2, or 3+ autos available. Auto ownership segmentation can be useful in the trip generation, trip distribution, and mode choice models. In this study, auto ownership is currently only used in the trip generation phase.

Traditionally, auto ownership models have followed an approach similar to that discussed above for income or household size submodels. Such models capture existing patterns and are capable of extrapolating these patterns to future years, but they omit important factors affecting auto ownership. More recently, auto ownership models have attempted to reflect the underlying causal relationships which influence car ownership. This has necessitated a change in structure – from the above curve-fitting exercise to estimation of logit models. In the logit model, various accessibility measures and land-use characteristics can be included in the estimation of auto ownership levels.

4.3.1: Model Formulation

The household auto ownership model is intended to predict the number households owning 0, 1, 2 and 3 or more autos within each traffic analysis zone. The general form of the model for each traffic analysis zone follows the standard multinomial logit formulation:

$$P_n = \frac{e^{U_n}}{\sum_{m=1}^{4} e^{U_m}}$$

$$U_n = a_n + \sum_i b_i * SE_i + \sum_j c_j * Acc_j$$

with:

where:

n,m = the number of autos owned, which can take the values of 0, 1, 2, or 3+

SE_i = i separate socio-economic household characteristics

Acc_j = j separate accessibility measures

a_n, b_i, c_j = model Coefficients

P_n = proportion of total households with auto ownership category n

4.3.2: Estimation File Construction

The estimation file was created from the home interview survey data. Initially, only the data from Klamath County was included, because that is the only county for which a network (and hence, accessibility measures) and demographic data were available. However, it was discovered that there were only five valid households in the 0-autos level. Thus, it was not possible to estimate a reasonable model based on this limited data.

The full eight-county data set was therefore used to estimate the auto ownership model. This precluded the use of any accessibility measures nor any demographic measures in the utility expressions. The data included in the estimation file (for both the auto ownership and worker submodels) are summarized in Table 10.

Table 10: Sample Auto Ownership and Worker Model Estimation File

Variable Name	Data Source	Variable Description
Sampno	Home interview	Household sample number
Hhtaz	Home interview	Residence zone number
Typehome	Home interview	Housing structure type
Lic_pers	Home interview	Licensed persons in household
Emp_pers	Home interview	Employed persons in household
Vehpld	Home interview	Vehicles per licensed driver
Vehpemp	Home interview	Vehicles per employed person
Income	Home interview	Income quartile
Hhsz	Home interview	Household size
Workers	Home interview	Number of workers
Autos	Home interview	Number of autos owned
Agehead	Home interview	Age of head of household
Agehhd	Home interview	Age category of head of household
Expfac	Home interview	Expansion factor
The following variables were included in the Klamath county data set. However, in the remaining (i.e., non-Klamath) counties, all values are zero.		
Zone	*Demographic dataset*	*Zone used in merging dataset*
Totemp	*Demographic dataset*	*Total employment*
Retemp	*Demographic dataset*	*Retail employment*
Nretemp	*Demographic dataset*	*Non-retail employment*
Cenroll	*Demographic dataset*	*College enrollment*
Totpop	*Demographic dataset*	*Total population*
Tothh	*Demographic dataset*	*Total number of households*
Zacres	*Demographic dataset*	*Zonal acreage*
Dcode	*Calculated value*	*Code used in merging dataset*

APPENDIX A: CLEANING RURAL HOUSEHOLD SURVEY DATA

APPENDIX B: TRIP CHAINING FOR RURAL HOUSEHOLD SURVEY DATA

APPENDIX E: EMISSION FORECAST TABLES

4.3.3: Model Estimation

The initial set of model estimations were performed using the Klamath County data only. It was hoped that some accessibility measures (i.e., employment within X-minutes of transit, or within Y-walk distance of transit, etc.) could be used to estimate the level of auto ownership. However, there were only five valid households owning 0-autos on Klamath County. Thus, it was not possible to estimate a model using this limited data.

The next step was to use the full, eight-county dataset. However, by using the eight-county data, the accessibility and demographic data items were no longer available for model estimation. Several alternative formulations were experimented with in the model estimation.

Run 801 used a single coefficient to represent each socio-economic variable. In other words, household size and number of workers were implicitly assumed to relate to auto ownership in a continuous linear manner. Run 802 represented each variable with a set of stratified model coefficients. Although some of these coefficients were insignificant , it was an improvement over the generic set of variable. Thus, all future runs considered stratified coefficients. Run 803 tested the exact Phoenix specification which deleted most of the insignificant coefficients. Runs 804 and 805 were tests with a retired household dummy variable. The dummy variable on both 0-autos and 1-auto seemed to work better. Thus, the final model was run number 804. All of the various runs (using the full eight-county dataset) are included in Table 11.

Table 11: Summary of Full Eight-County Auto Ownership Model Estimations

Alogit Code ->	Cleveland	Phoenix	801		802		803, same as		804		805	
Description ->	(C)	(p)	Generic var		Alt. Specific		Phoenix 100		add retired hh dumm		ret hh d on 1- only	
	selected	selected	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat
Total Observations			3193		3193		3193		3193		3193	
Observations Accepted		2839	3193		3193		3193		3193		3193	
Utility Expression Variables												
0 autos alternative			0-utility comparison basis									
Constant (p)	3.2950	2.1660					0.3930	2.2	-0.6833	-2.7	0.3954	2.2
HH size category 2 (p)	-2.4120	-0.9107					-1.8950	-5.4	-2.5420	-6.9	-1.8970	-5.4
HH size category 3 (p)	-3.1390	-0.8016										
HH size category 4 (p)		-2.0040										
Worker category 1 (p)	-1.5420	-0.7032					-0.7077	-2.3	-0.1115	-0.3	-0.7128	-2.3
Worker category 2 (p)	-3.8440	-2.1670					-2.7070	-3.7	-1.8830	-2.5	-2.7090	-3.7
Worker category 3 (p)	-4.1330	-5.4710										
Emp w/ 30-min of transit (p)		1.7530										
Emp w/ 40-min of transit (C)	0.0692											
1 mile retail employment (C)	0.5023											
Population density (C)	0.1501											
Walk trip indicator (C)	3.0940											
ker density (p)		0.0049										
density (p)		0.0248										
Retired HH dummy									2.0280	7.5		
1 auto alternative												
Constant	5.2700	2.7460	-1.1370	-2.7	0.8718	5.8	2.0060	13.3	2.0090	10.6	1.8750	10.3
Income			0.4440	4.0								

Income category 1												
Income category 2	1.5220	1.3720			1.0120	3.5	1.4610	4.9	1.2210	4.2	1.4620	4.9
Income category 3	3.5040	2.2510			1.8720	3.9	2.8350	5.9	2.2890	4.7	2.8460	5.9
Income category 4	3.1630	2.5140			1.5250	2.5	3.1890	5.2	2.4710	4.0	3.1990	5.2
Income category 5 (p)		2.9920										
Household size			1.6950	4.9								
HH size category 1												
HH size category 2	-2.3180	-0.3952			1.2950	3.4	-1.6790	-11.7	-1.8940	-12.5	-1.6850	-11.7
HH size category 3	-3.0770	-1.1680			13.7300	0.0	-1.9780	-7.6	-2.1100	-8.0	-1.9850	-7.6
HH size category 4		-1.2810			13.2000	0.0	-2.7220	-7.7	-2.8580	-8.1	-2.7290	-7.7
Workers			1.0140	3.9								
Worker category 0												
Worker category 1	-0.4464				1.0220	3.5	-0.2403	-1.7	-0.1928	-1.2	-0.1367	-0.8
Worker category 2	-1.7290	-1.2790			0.2986	0.4	-0.7897	-4.3	-0.6234	-3.0	-0.6659	-3.2
Worker category 3	-3.8830	-3.1910			-0.2113	0.0	-0.3882	-1.2	-0.3523	-1.0	-0.2570	-0.8
Emp w/ 30-min of transit (p)		-1.1530										
Emp w/ 40-min of transit (C)	0.0287											
Population density (C)	0.0623											
Walk trip indicator (C)	0.9919											
Worker density (p)		0.0053										
HH density (p)		0.0131										
Retired HH dummy		0.5229							0.3718	2.7	0.1748	1.3
2 autos alternative												
Constant	2.0270	0.4893	-3.8120	-8.6	-0.7366	-3.9	0.5480	3.3	0.7597	4.4	0.5480	3.3
Income			0.7684	6.8								
Income category 1												
Income category 2	2.1870	1.5080			1.0900	3.5	1.4780	4.9	1.2600	4.2	1.4780	4.9
Income category 3	5.1080	3.1960			2.3600	4.8	3.2160	6.7	2.6980	5.6	3.2180	6.7
Income category 4	5.4730	3.9920			2.8700	4.7	4.4210	7.3	3.7330	6.1	4.4220	7.3
Income category 5 (p)		4.9510										
Household size			2.9500	8.6								
HH size category 1												
HH size category 2	0.4958	1.0770			3.3920	8.7	0.3665	2.5	0.1870	1.2	0.3662	2.5
HH size category 3	-0.1006	0.3984			15.3800	0.1	-0.3999	-1.9	-0.5295	-2.5	-0.4004	-1.9
HH size category 4		0.5031			15.4700	0.0	-0.5252	-2.2	-0.6547	-2.7	-0.5258	-2.2
Workers			1.0100	3.9								
Worker category 0												
Worker category 1	-0.0201	0.6326			1.2270	4.0	-0.1490	-1.2	-0.2686	-2.0	-0.1485	-1.2
Worker category 2	-0.2932	0.0356			0.7094	0.9	-0.3929	-3.0	-0.4671	-3.6	-0.3923	-3.0
Worker category 3	2.5920	-0.9103			0.3996	0.0	0.1833	0.8	-0.0068	0.0	0.1842	0.8
3+ autos alternative												
Constant			-5.1860	-11.4	-1.9730	-8.5						
Income			0.9038	7.9								
Income category 1												
Income category 2	2.7110	1.7300			0.8634	2.6	1.2520	4.0	1.0260	3.3	1.2520	4.0
Income category 3	5.2780	3.2520			2.5260	5.1	3.3990	7.1	2.8590	5.9	3.4010	7.1
Income category 4	6.4430	4.3780			3.2700	5.3	4.8900	8.1	4.1580	6.8	4.8920	8.1
Income category 5 (p)		5.6530										
Household size			3.1160	9.0								
HH size category 1												
HH size category 2					3.6390	9.0						
HH size category 3					16.4300	0.1						
HH size category 4					16.6500	0.0						
Workers			1.2010	4.6								
Worker category 0												
Worker category 1					1.6480	5.2						
Worker category 2					1.2090	1.5						
Worker category 3					0.4168	0.0						
Summary Statistics												
Final likelihood value	-1,063.5			-3,182.4		-3,047.9		-3,141.1		-3,110.4		-3,140.3
Rho squared (zero)				0.2810		0.3114		0.2904		0.2973		0.2906
Rho squared (constants)				0.1561		0.1918		0.1671		0.1752		0.1673

Notes: Income categories: 1 <$15K; 2 $15-25K; 3 $25-40K; 4 $40K+
(p) indicates variables used in Phoenix model only, listed here for comparative purposes.

(C) Indicates variables used in Cleveland model only, listed here for comparative purposes.

In the future, some consideration should be given to including some transit accessibility or density measures. Both types of variable coefficients have been successfully estimated using other datasets. This could be accomplished by applying the current model in the chosen area, and then "calibrating" the new variable coefficient so that the auto ownership levels match the observed data.

4.4: HOUSEHOLD WORKER SUBMODEL

The purpose of the worker submodel is to estimate the share of households with 0, 1, 2, or 3+ workers. The number of workers is used in the trip generation model. Traditionally, household worker models have followed an approach similar to that discussed above for income or household size submodels. Such models capture existing patterns and are capable of extrapolating these patterns to future years, but they omit important factors affecting the number of workers in a household. This has necessitated a change in structure – from the above curve-fitting exercise to estimation of a multinomial logit model. In this manner, various demographic and land-use measures can be included in the prediction of workers per household.

The household worker model is intended to predict the number households with 0, 1, 2, and 3+ workers within each traffic analysis zone. The general form of the model follows the standard multinomial logit formulation described in Section 4.3.1 above. In addition, the estimation file was identical for both the auto ownership submodel and the worker submodel. The variables included in this common estimation file are included in Table 10. As with the auto ownership submodel, early results were obtained using Klamath County data only. Other runs were conducted using the full eight-county data. This resulted in a higher significance in the coefficient estimates. In addition, since the planned application was for a generic rural area, it was decided to continue to use the full eight-county dataset for model estimation.

Run 801 is a full multinomial implementation with stratified coefficients. In runs 802 and 803 some variations were tested using the discrete age-category variables. Neither of these proved fruitful. The next run, 804, tested a continuous variable coefficient for household size. This coefficient was insignificant. By deleting the age variables for the 3+ worker households (in run 805), the household size variable was only slightly more significant. Run 806 tested a continuous age variable. The last set of runs (809, 810, and 811) simply moved the coefficients from the various income, household size, or age categories. For instance, rather than having coefficients on income groups 1, 2, and 3; they were moved to income groups 2, 3, and 4. As expected, there was little change. As a final test, the exact Phoenix specification was run and compared to the first multinomial run.

The results of all of these runs are included in Table 12. The chosen model was run 801.

Table 12: Summary of Full Eight-County Worker Model Estimations

Alogit Code -->	Phoenix Model		812		801		802		803		804	
Description -->	Final run (# 014i)		Phoenix spec		Full multinomial		No age on 3+		No age at all		Hhsize continuous	
	estimate	t-stat	estimate	t-stat	estimate	t-stat	Estimate	t-stat	estimate	t-stat	estimate	t-stat
Total Observations	2993		3193		3193		3193		3193		3193	
Observations Used	2992		2924		2924		2924		2924		2924	
Utility Expression Variables												
0 worker alternative					0-utility (comparison basis)							
1 worker alternative												
Constant	3.2300	12.0	-2.2880	-7.2	-6.2150	-17.3	-5.5240	-15.9	-2.6800	-8.6	-1.1980	-4.5
Income category 1	-1.6520	-8.0	-1.8510	-10.8	-1.2890	-6.2	-1.5320	-8.0	-2.0630	-12.1	-0.8559	-4.4
Income category 2	-0.4832	-2.3	-1.4170	-9.1	-0.8954	-5.0	-1.2240	-7.0	-1.6570	-10.5	-0.6515	-3.8
Income category 3	-0.3903	-1.8	-0.6098	-4.2	-0.5454	-3.3	-0.7442	-4.5	-0.8345	-5.6	-0.4079	-2.5
Income category 4	-0.1436	-0.6										
Income category 5 (p)												
Household size											0.0717	0.6
HH size category 1	-2.0750	-9.0	3.6810	11.4	5.5650	16.3	5.5160	16.3	4.2620	13.2		
HH size category 2	-2.8030	-12.1	2.6630	8.4	5.1390	15.2	5.0860	15.2	3.5170	11.2		
HH size category 3	-0.9051	-3.0	4.3410	9.6	6.5170	12.8	5.0150	11.1	4.8180	10.8		
HH size category 4												
Age of head of household												
Age category 1												
Age category 2					5.3650	25.1	2.8600	18.8			3.6330	20.[illegible]
Age category 3					1.3500	9.3	1.4910	10.3			1.3070	9.[illegible]
Age category 4												
2 worker alternative												
Constant	2.0850	6.8	-5.7800	-18.4	-7.4060	-22.2	-6.6070	-20.2	-1.9540	-9.6	-6.7490	-15.6
Income category 1	-2.5210	-10.2	-1.9850	-8.0	-1.9050	-6.7	-1.9010	-7.4	-2.0930	-10.3	-1.9540	-7.3
Income category 2	-1.0460	-4.6	-1.6080	-7.9	-1.5130	-6.6	-1.7230	-8.2	-1.9900	-11.6	-1.5180	-6.6
Income category 3	-0.9063	-3.9	-0.9426	-5.5	-0.8841	-4.6	-1.0150	-5.7	-1.2050	-7.9	-1.0150	-5.1
Income category 4	-0.2577	-1.0										
Income category 5 (p)												
Household size											2.1700	13.4
HH size category 1	(n/a)											
HH size category 2	-2.2360	-9.4	4.1710	19.6	5.2580	22.1	5.2060	22.2	3.3560	16.7		
HH size category 3	-0.4694	-1.5	5.4580	14.1	6.9260	15.2	5.1750	14.2	5.2110	14.7		
HH size category 4												
Age of head of household												
Age category 1	1.3750	6.5	5.6460	13.7	6.3860	14.0	5.3600	13.5			4.9790	12.5
Age category 2	1.7410	11.4	4.3160	18.0	7.5790	25.4	4.8580	18.9			5.7560	19.7
Age category 3			1.9450	7.8	2.4000	9.3	2.4900	9.7			2.4560	9.0
Age category 4												
3+ worker alternative												
Constant	3.5890	7.2	-4.0190	-6.8	-5.1960	-8.3	0.4424	4.9	0.4488	5.0	-19.5300	[illegible]
Income category 1	-3.5160	-9.9	-2.7390	-10.4	-2.6700	-8.5	-3.1810	-12.7	-3.1060	-12.9	-3.5400	-7[illegible]
Income category 2	-2.0210	-6.8	-1.5880	-8.3	-1.6710	-6.5	-2.0110	-11.9	-2.0270	-12.1	-2.0420	-5.[illegible]
Income category 3	-1.5160	-5.6	-1.0570	-6.6	-1.0430	-4.9	-1.1190	-7.9	-1.1470	-8.1	-1.3920	-4.7
Income category 4	-0.6626	-2.4										

Income category 5 (p)												
Household size											5.3980	22.6
HH size category 1 (n/a)												
HH size category 2 (n/a)												
HH size category 3	-1.4400	-4.4	3.4780	10.2	4.8400	11.6	3.5040	11.4	3.4530	11.5		
HH size category 4												
Age of head of household												
Age category 1	0.3926	0.8	5.6440	8.6	6.3890	9.2					8.0330	8.4
Age category 2	0.2218	0.5	5.3220	9.1	8.2400	12.9					9.2790	11.1
Age category 3	0.4361	0.9	1.8480	2.9	2.3590	3.5					4.1820	4.6
Age category 4												
Summary Statistics												
Final likelihood value		-2899.6		-2575.2		-2,050.4		-2,686.9		-3,162.0		-1,913.3
Rho squared (zero)		0.1595		0.3647		0.4942		0.3371		0.2199		0.5280
Rho squared (constants)		0.1628		0.3600		0.4904		0.3323		0.2142		0.5245

Notes: All runs include non-availability codes for workers < hhsize.
Age categories: 1 18-25; 2 25-55; 3 56-65; 4 65+ years [age of head of household].
Income categories: 1 <$15K; 2 $15-25K; 3 $25-40K; 4 $40K+
(p) Indicates variables used in Phoenix model only, listed here for comparative purposes.

Table 12: Summary of Full Eight-County Worker Model Estimations (continued)

Alogit Code -->	805		806		809		810		811	
Description -->	004 w/o age on 3+		Age continuous		Inc grp 2, 3, 4		Hhsize grp 2, 3, 4		Age grp 2, 3, 4	
	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat
Total Observations	3193		3193		3193		3193		3193	
Observations Accepted	2924		2924		2924		2924		2924	
Utility Expression Variables										
0 worker alternative			0-utility (comparison basis)							
1 worker alternative										
Constant	-0.7226	-2.9	-1.9730	-5.8	-7.5050	-19.9	0.1685	1.0	-3.5090	-7.2
Income category 1	-0.7612	-4.2	-1.9780	-11.5			-1.7860	-8.8	-1.3290	-6.2
Income category 2	-0.5906	-3.6	-1.5830	-9.9	0.3941	1.9	-1.2110	-6.6	-0.9322	-5.1
Income category 3	-0.3059	-2.0	-0.8411	-5.6	0.7441	3.6	-0.7041	-4.1	-0.5195	-3.1
Income category 4					1.2890	6.2				
Income category 5 (p)										
Household size	-0.2287	-2.0								
HH size category 1			4.5760	13.9	5.5650	16.3			5.5770	16.4
HH size category 2			3.8510	12.0	5.1390	15.2	-1.5380	-12.6	5.2600	15.5
HH size category 3			4.8560	10.9	6.5170	12.8	-3.7720	-16.8	6.0050	12.3
HH size category 4							1.5610	1.4		
Age of head of household			-0.0178	-5.4						
Age category 1										
Age category 2	2.7660	19.6			5.3650	25.1	4.5730	22.5	2.6060	6.6
Age category 3	1.4520	10.1			1.3500	9.3	1.6000	10.5	-1.4260	-3.8
Age category 4									-2.9270	-7.9
2 worker alternative										
Constant	-5.4980	-15.0	-0.6443	-2.5	-9.3110	-22.9	-2.2720	-9.7	-1.6610	-3.9
Income category 1	-1.7140	-7.1	-2.0520	-9.9			-2.6420	-10.7	-1.8180	-6.4
Income category 2	-1.3990	-6.8	-1.9160	-10.9	0.3919	1.2	-1.9420	-9.0	-1.4650	-6.5

Income category 3	-0.8766	-4.9	-1.1940	-7.7	1.0210	3.4	-1.2560	-6.6	-0.8281	-4.3
Income category 4					1.9050	6.7				
Income category 5 (p)										
Household size	1.6740	11.5								
HH size category 1 (n/a)										
HH size category 2			3.7750	17.9	5.2580	22.1			5.3500	22.3
HH size category 3			5.1660	14.5	6.9260	15.2	-1.8150	-11.1	6.2760	15.0
HH size category 4							3.8080	3.3		
Age of head of household			-0.0302	-7.8						
Age category 1	4.3270	13.0			6.3860	14.0	5.1970	14.6		
Age category 2	4.3010	17.6			7.5790	25.4	6.2920	22.0	1.7830	4.4
Age category 3	2.4240	9.5			2.4000	9.3	2.5450	9.9	-3.4100	-8.5
Age category 4									-5.7780	-13.2
3+ worker alternative										
Constant	-13.8200	-23.7	0.4415	4.9	-7.8660	-11.6	-6.2430	-8.1	-2.4830	-10.7
Income category 1	-4.0780	-8.8	-3.0850	-12.8			-3.5840	-8.7	-2.4720	-8.0
Income category 2	-2.2730	-6.5	-2.0040	-12.0	1.0530	3.1	-2.0990	-7.0	-1.4510	-6.0
Income category 3	-1.2000	-4.5	-1.1270	-8.0	1.6270	5.0	-1.3580	-5.6	-0.9074	-4.4
Income category 4					2.6700	8.5				
Income category 5 (p)										
Household size	5.8190	25.2								
HH size category 1 (n/a)										
HH size category 2 (n/a)										
HH size category 3			3.4230	11.4	4.8400	11.6			4.2360	[illegible]
HH size category 4							8.4430	7.3	5.3430	21[illegible]
Age of head of household										
Age category 1					6.3890	9.2	7.1260	8.3		
Age category 2					8.2400	12.9	8.6800	11.1		
Age category 3					2.3590	3.5	3.5550	4.3	-0.3662	-1.0
Age category 4										
Summary Statistics										
Final likelihood value		-2,085.8		-3,117.4		-2,050.4		-2,156.4		-2,094.8
Rho squared (zero)		0.4854		0.2309		0.4942		0.4680		0.4832
Rho squared (constants)		0.4816		0.2253		0.4904		0.4641		0.4794

Notes: All runs include non-availability codes for workers < hhsize.
Age categories: 1 18-25; 2 25-55; 3 56-65; 4 65+ years [age of head of household].
Income categories: 1 <$15K; 2 $15-25K; 3 $25-40K; 4 $40K+
(p) Indicates variables used in Phoenix model only, listed here for comparative purposes.

5: TRIP PRODUCTION MODEL DEVELOPMENT

Trip production models predict the number of trips produced by a zone given socioeconomic characteristics of the zone. Trip production models are commonly based on cross-classification analysis with from 2 to 4 classification variables, each with from 2 to 5 categories. Separate cross-classification models are usually defined for each individual trip purpose, although it is typical to have a single set of classification variables and values for all trip purposes. Models were developed for Rural Oregon for the trip purposes defined in Table 7.

5.1: CROSS-CLASSIFICATION ANALYSIS

Trip production models using cross-classification analysis determine a set of trip rates per household for each category of the classification variables. The rates are actually the joint frequency distribution of trips by classification, divided by the joint frequency distribution of households by classification. Division is on a classification cell by classification cell basis. The result is a set of mean trip rates (trips per household) for each classification product of the joint distribution.

The idea of cross-classification trip production models is that households of similar socioeconomic characteristics have similar trip frequency characteristics. Using the joint frequency distributions of trips and households, trip rates are determined for a very disaggregate grouping of households. Also, the grouping by product of classification variables allows for trip rates to be determined that have nonlinear relationships with those classification variables. This is accomplished without having to specify functional form and structure as one would be required to do in traditional nonlinear regression analysis. Cross-classification analysis is therefore very powerful, is simple to apply, and is almost exclusively the method of choice in practice for traditional trip production model development.

5.2: DATA SOURCE AND CLASSIFICATION VARIABLES

The source of data for estimating trip production models is the household travel survey. Typically, one would use trip records from a survey of households in the specific region of interest. For a generic trip production model for Rural Oregon, trips from households in all 8 counties surveyed were used. The reasons are primarily the same as have already been mentioned: to have adequate representation of household types typically undersampled in home interview surveys (e.g. households with no automobiles owned), and to develop a single generic model which would be applicable to all rural areas in Oregon.

With nearly 3,200 households surveyed in the 8 counties, a rich set of data existed for classifying mean trip rates. If the sample of households were too small, one would be forced to develop a model with fewer classification variables and fewer categories of those variables. Had we developed a separate model for each county (or specifically Klamath County), we would have been limited in our specification of the cross-classification variables in order to get statistically meaningful mean trip rates.

Classification variables can be any attribute of the household for which a corresponding zonal value can be determined for applying the final model form. It is typical to base these on socioeconomic data. For the models developed here, the following classifications were preliminarily specified:

- household size (1, 2, 3, 4+ persons per household)
- household workers (0, 1, 2, 3+ workers per household)
- household annual income ($0 - $14,999, $15,000 - $24,999, $25,000 - $39,999, $40,000 +)
- household autos (0, 1, 2, 3+ autos per household)

After evaluating the joint frequency distribution, it was determined that we needed to eliminate some cells in order to increase the numbers of observations over all cells. A straightforward way to do this was to define a wealth classification based on a combination of auto ownership and household income. The final classification variable specification was therefore:

- household size (1, 2, 3, 4+ persons per household)
- household workers (0, 1, 2, 3+ workers per household)
- household wealth index :
  - $0 - $14,999 with 0 to 3+ autos
  - $15,000 - $24,999 with 0 or 1 autos
  - $15,000 - $24,999 with 2 or 3+ autos
  - $25,000 - $39,999 with 0 or 1 autos
  - $25,000 - $39,999 with 2 or 3+ autos
  - $40,000 + with 0 or 1 autos
  - $40,000 + with 2 or 3+ autos

5.3: MODEL RESULTS AND VALIDATION

As described earlier, the trip rates are calculated by summing the total trips (for a given trip purpose) and dividing by the sum of the households for each cross-classification category. In the model specified above, there would be (4 household size categories) * (4 income worker categories) * (7 wealth categories), giving 112 categories of trip rates.

These 112 trip rate values can be related to the households in the travel survey by their combination of household size, workers, and wealth (the product of cross-classification variables). Since each household is represented only once in the survey, the mean trip rate represents the estimated total trips (by purpose) for that household. If we compare the estimated trips with the observed trips reported in the survey for each household, we have a disaggregate validation measure to judge the effectiveness of the model. This is shown graphically in Figure 4. The regression line is another indicator of goodness of fit for the model. If the model predicted perfectly, the regression line for the scatter diagram would have a slope of 1.0 and an intercept of 0.0. The household based disaggregate comparison is a particularly good fit with an R-squared value of 0.35. At the household level, an R-squared value of 0.15 is usually quite acceptable.

Figures 5 and 6 show validation comparisons with increasing amounts of aggregation. Figure 5 is a TAZ level comparison. Again the R-square of 0.94 is extremely good at a TAZ level. The district level comparison shows an even better fit, as expected.

The evaluation criteria for validation of the cross-classification trip production models are typically that the disaggregate scatter diagrams exhibit acceptable goodness of fit characteristics, as they did here, and that the individual trip rates are statistically valid (i.e. they are based on a sufficient number of observations in each cross-classification cell – 10 being considered sufficient).

The final validation comparison is made after the software for applying the trip production model is complete. The actual total trips produced by the trip production application program are compared to the expanded total trips from the home interview survey. Figure 7 shows this comparison, for all trips, on a district basis. The statistics show a very good fit, with R-squared near 0.80. This statistic is clearly lower due to the one outlier. Otherwise, the slope and intercept value of the regression line are very good. It is also a particularly good fit given that the model trip rates were based on 8 county data, and these aggregate results are for the Klamath Falls are alone. We see how well the model fits when applied to an individual area.

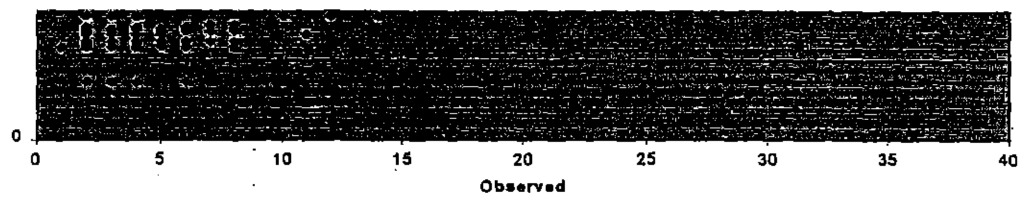

0
0 5 10 15 20 25 30 35 40
Observed

Figure 5.

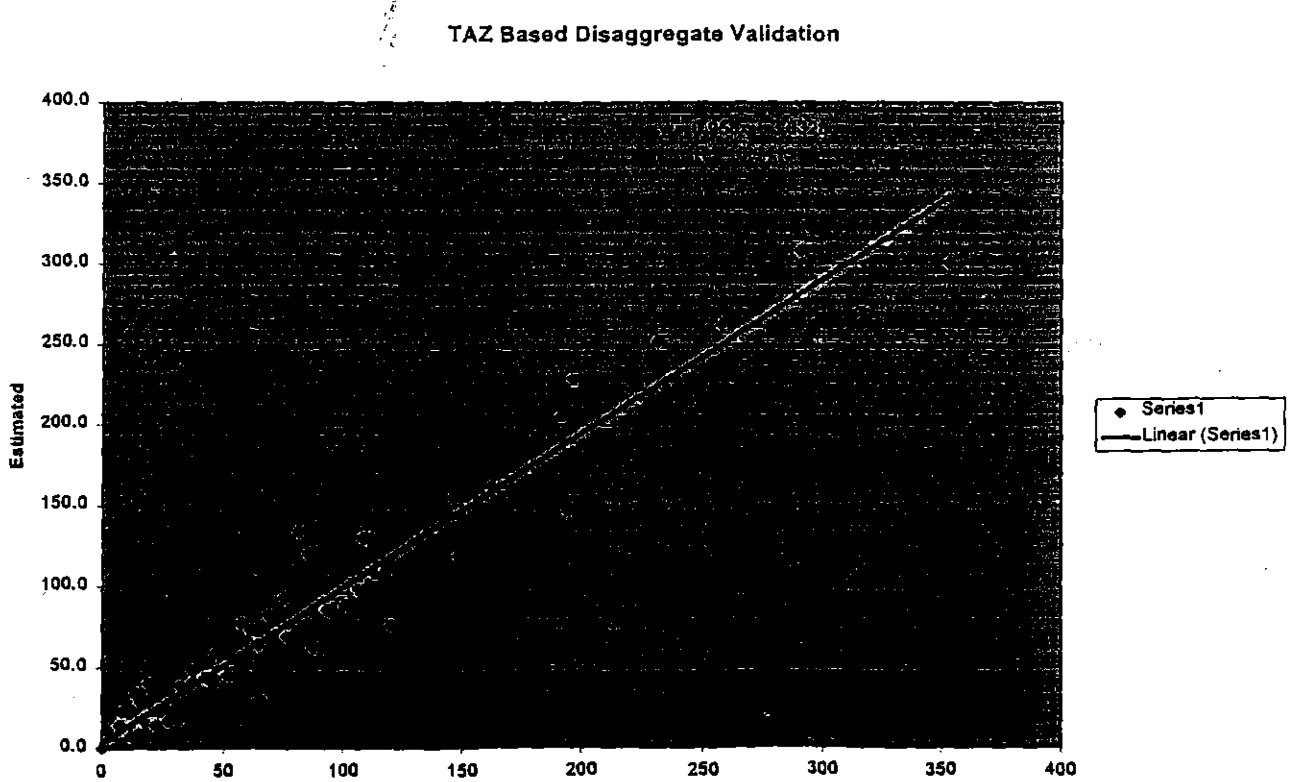

TAZ Based Disaggregate Validation
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Estimated
0 50 100 150 200 250 300 350 400
Series1
Linear (Series1)

Figure 6.

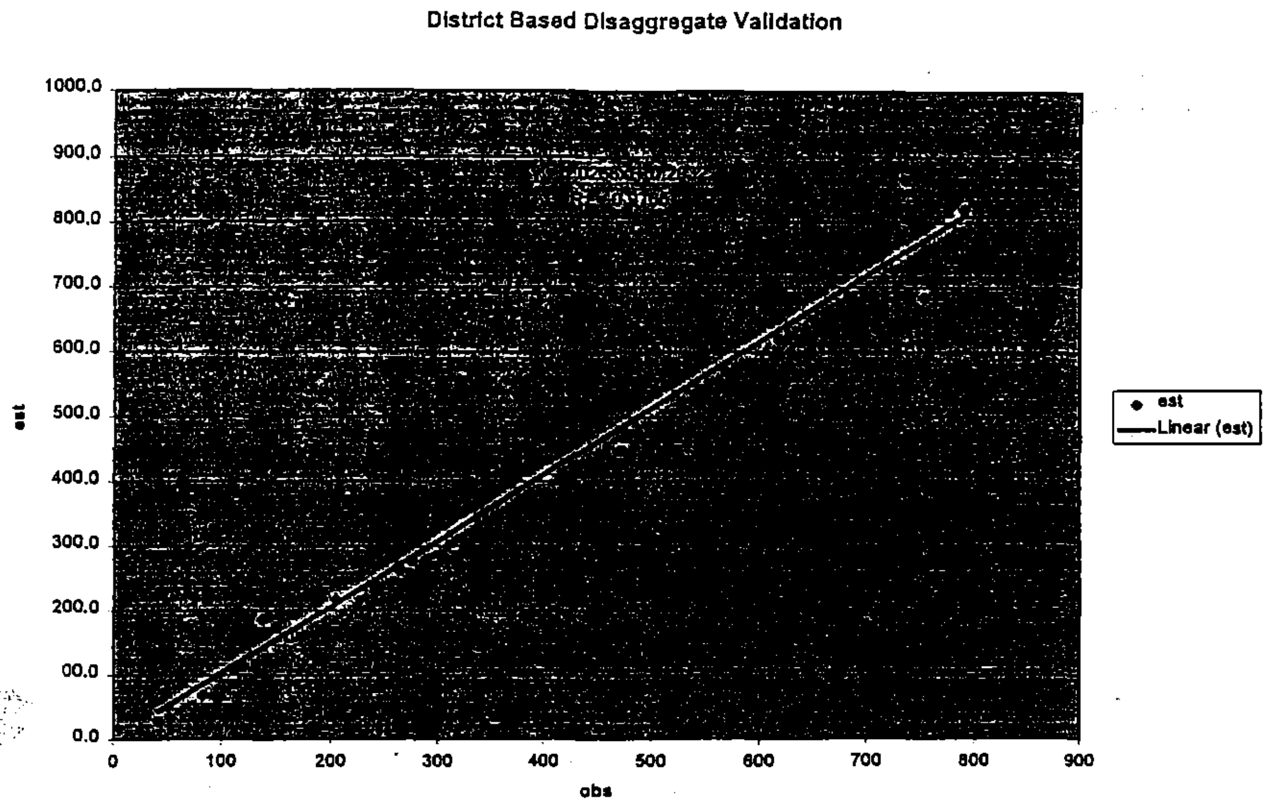
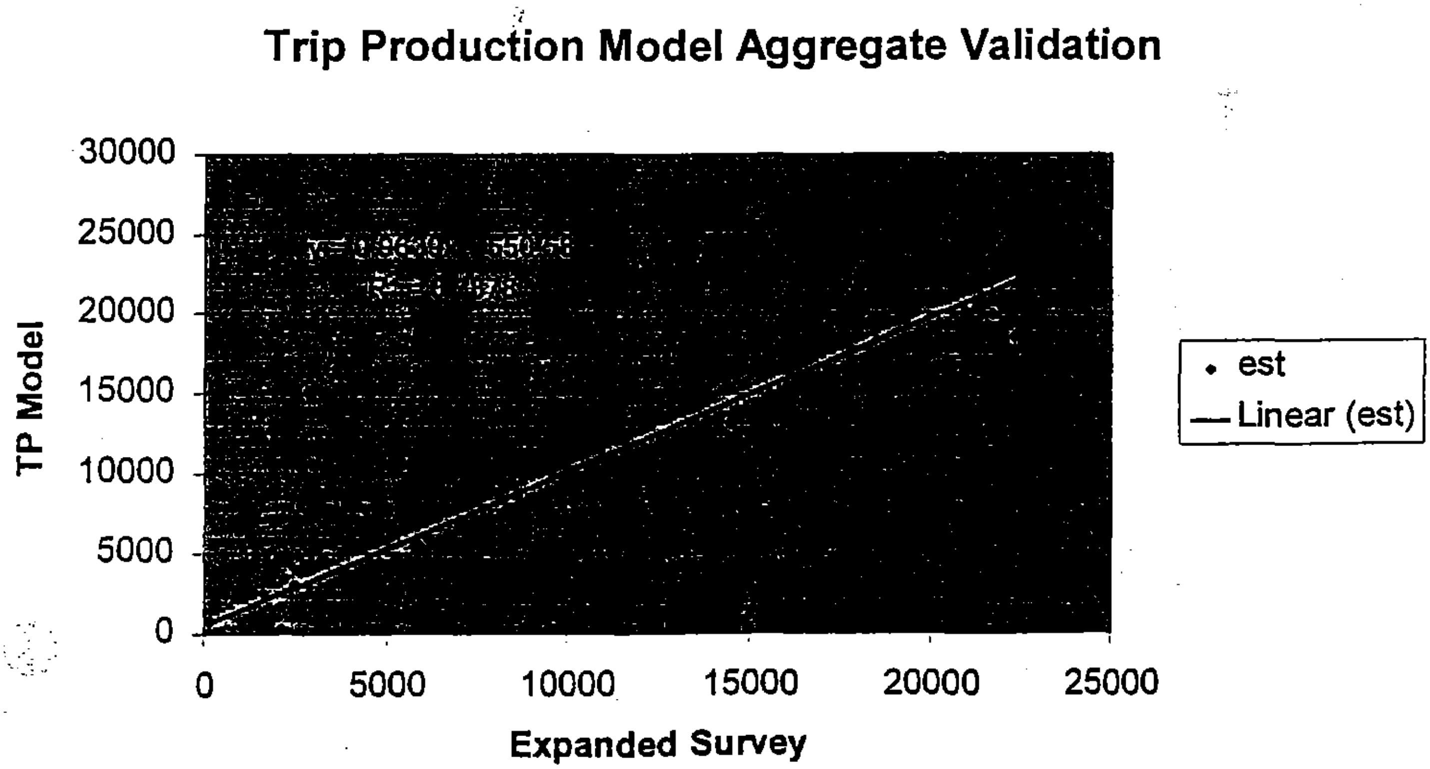


Figure 7.



6: TRIP ATTRACTION MODEL DEVELOPMENT

Trip attraction models predict the number of trips attracted to each zone or to a particular land use. Traditionally, trip attraction models are based on linear regression models because of the high correlation between the trips made and the explanatory land use variables including employment, population, and school/college enrollment. However, if a workplace survey were available, then a disaggregate trip attraction model should be considered. No such survey is available for the rural counties of Oregon. Thus, the trip attraction models are based on linear regression equations.

6.1: AGGREGATE ANALYSIS

Regression analysis at the district level forms the basis for development of a trip attraction model. Using trip ends (by purpose) in each district as the dependent variable and the aggregated zonal values (i.e., of employment, households, population, etc.) as the independent variables, multiple regression equations were be derived. These resulting models were then tested for sound statistical fit using base year data, and also checked for reasonableness.

The primary advantage of aggregate regression models is that they greatly simplify the process of data forecasting. One of the main disadvantages of regression models is that the aggregation process obscures variations in the data used for estimation. The district system is assumed to be homogeneous, but rarely this is the case. The reliability of the regression models is a function of the degree to which the district and zonal data represent the true variation. When constructing the district system for the attraction model, extra care must be taken to minimize the amount of variability within the districts.

6.2: TRIP ATTRACTION MODEL FORM

Attractions for the study area, at the district level, were regressed against the following set of typical land use variables:

- retail employment
- non-retail employment
- total employment
- total population
- total households
- college enrollment

The set of regression models that were tested are summarized in Table 13.

Table 13: Trip Attraction Models Tested

				Regression Statistics for Initial Run w/ Constant						
Trip Purpose	Model Alternative		Independent Variables	r Squared	F-Prob	Var Coeff	t values	Standard Error	Constant	% Expl by Const
					(1)				(2)	(3)

IN-PROGRESS DRAFT REPORT

HBWork	1	S	1. Total employment	0.711		1.263	5.948	0.212	245.663	17.2%
HBWork	2 **		1. Retail employment	0.822		2.466	5.720	0.431	199.862	14.0%
			2. Non-retail employment			1.018	5.499	0.185		
HBUniversity	1 **	S	1. College enrollment	1.000		0.536				
						(only 1 zone with any college enrollment)				
HBElem/Sec	1 **	S	1. Total population	0.744		0.399	6.454	0.062	-313.236	-39.6%
HBElem/Sec	2		1. Total population	0.728	0.000	0.938	0.888	1.056	-369.075	-46.7%
			2. Total households			-1.353	-0.511	2.645		
HBShop	1 **		1. Retail employment	0.841		4.155	8.661	0.480	119.020	13.1%
HBShop	2	S1	1. Retail employment	0.845		4.186	8.814	0.475	286.929	31.6%
			2. Non-retail employment			-0.233	-1.143	0.204		
HBShop	3	S2	1. Retail employment	0.865		4.232	9.551	0.443	-2.753	-0.3%
			2. Non-retail employment			-0.160	-0.822	0.195		
			3. Total population			0.082	1.686	0.049		
HBRec	1		1. Non-retail employment	-0.024	0.427	0.332	0.820	0.405	894.126	78.3%
	2 **	S	1. Non-retail employment	0.511	0.005	0.560	1.955	0.286	14.258	1.2%
			2. Total households			0.696	3.899	0.179		
	3		1. Non-retail employment	0.467	0.019	0.571	1.765	0.324	-38.562	-3.4%
			2. Total population			0.123	0.094	1.310		
			3. Total households			0.389	0.119	3.265		
HBOther	1		1. Retail employment	0.300	0.020	2.973	2.645	1.124	935.871	62.4%
	2		1. Retail employment	0.276	0.057	2.925	2.554	1.145	668.923	44.6%
			2. Non-retail employment			0.371	0.754	0.491		
	3	S	1. Retail employment	0.659	0.002	3.028	3.849	0.787	-414.455	-27.6%
			2. Non-retail employment			0.635	1.842	0.345		
			3. Total households			0.816	3.801	0.215		
	4		1. Retail employment	0.664	0.002	3.110	3.981	0.781	-499.733	-33.3%
			2. Non-retail employment			0.666	1.939	0.343		
			3. Total population			0.330	3.857	0.086		
	5		1. Total employment	0.474	0.008	1.048	2.724	0.385	-376.613	-25.1%
			2. Total households			0.845	3.171	0.266		
	6		1. Total employment	0.469	0.009	1.086	2.792	0.389	-450.697	-30.0%
			2. Total population			0.338	3.144	0.108		
	7 **		1. Retail employment	0.591	0.002	3.098	3.601	0.860	129.851	8.7%
			2. Total households			0.737	3.198	0.230		
NHB-Work	1		1. Retail employment	0.699	0.000	0.953	5.792	0.165	199.892	52.5%
	2 **	S	1. Retail employment	0.808		0.932	7.069	0.132	82.286	21.6%
			2. Non-retail employment			0.163	2.886	0.057		
NHB-NonWork	1		1. Retail employment	0.779		4.480	7.088	0.632	711.207	45.5%
	2		1. Retail employment	0.777		4.445	7.003	0.635	521.807	33.4%
			2. Non-retail employment			0.263	0.965	0.272		
	3 **	S	1. Retail employment	0.891		4.502	10.142	0.444	-70.524	-4.5%
			2. Non-retail employment			0.407	2.095	0.194		
			3. Total households			0.446	3.683	0.121		
	4		1. Retail employment	0.891		4.545	10.189	0.446	-111.289	-7.1%

			2. Non-retail employment			0.423	2.156	0.196		
			3. Total population			0.179	3.659	0.049		
Notes:	(1) Indicates the probability that all coefficients, excluding the constant are equal to 0.									
	(2) Can be removed, once a final model is selected.									
	(3) Percent of variation explained by the constant=(constant value*number of districts)/observed attractions.									
	** indicates preferred models for generic rural area model.									
	S indicates the models that are being used by SKATS.									

The regression model results were evaluated based upon the following criteria:

- The existence of a causal relationship between the independent and the dependent variables.
- Independent variables must be forecastable.
- The intercept must not be large in magnitude (i.e., explaining a large proportion of dependent variable value).
- Qualitative assessment of the reasonableness of the regression output against factual data.

6.3: HOME-BASED WORK TRIP ATTRACTIONS

The independent variables evaluated for the rate of attraction of home-based work trips are typically total employment as well as the stratification of total employment into retail and non-retail employment. The stratified model performs slightly better (i.e., r^2 values of 0.82 versus 0.71) and the constant is slightly smaller. The constant of this equation must be removed, as it is illogical to estimate trip attractions in a zone with no employment. This is done by rerunning the regression estimation and forcing the constant through zero. After removal of the constant term the final equation would be:

HBWork trip attractions = 2.624*retail employment + 1.140*nonretail employment

6.4: HOME-BASED UNIVERSITY TRIP ATTRACTIONS

In the home-based university trip purpose, the regression equation degenerated into a rate, because there was only one district that contained any colleges. Removal of the constant yields the following equation:

HBUniversity trip attractions = 0.536 * college enrollment

6.5: HOME-BASED SCHOOL TRIP ATTRACTIONS

For home-based elementary/secondary school attractions, two regression equations were tested. The independent variables used in the regression analyses were: total population and total households. These values are surrogates for school enrollment. If the school enrollment data were available, it should be used in place of these two variables. The two equations have similar indices of relative goodness of fit. However, the second equation had a negative coefficient on total households. The constant was also slightly larger in equation 2. Thus, equation 1 was chosen. After removal of the constant term the final equation would be:

HBElem/Sec trip attractions = 0.342 * total population

6.6: HOME-BASED SHOPPING TRIP ATTRACTIONS

Three regressions equations were tested for home-based shopping attractions. The coefficient of determination were about the same on all three equations. The negative value on the non-retail employment variable is logical for the following reasons: 1) non-retail employees should not, by themselves, attract shopping trips; 2) non-retail employees do make some non-motorized shopping trips to retail establishment in the vicinity of their workplace; 3) retail establishments do not judge their sales, and therefore their requirement for employment, on the basis of motorized trips attracted but on the basis of all trips attracted; and 4) the more non-retail employees there are in the area, the less the need to attract motorized shopping trips (per retail employee). However, the t-statistics on some coefficients in equations 2 and 3 were close to being insignificant. Thus, equation 1 was selected for implementation. After removal of the constant term the final equation would be:

HBShop trip attractions = 4.341 * retail Employment

6.7: HOME-BASED RECREATION TRIP ATTRACTIONS

The home-based recreation attraction model tested the following variables: non-retail employment, total households, and total population. A review of the statistical summaries of the three models clearly displays the strength of regression models 2 and 3 over that of 1. Further tests on the significance of the slope (size of t-statistic for individual variables) of the remaining regressions reveals a stronger correlation between the dependent and independent variables in equation 2. After removal of the constant term the final equation would be:

HBRec trip attractions = 0.552 * non-retail employment + 0.692 * total households

6.8: HOME-BASED OTHER TRIP ATTRACTIONS

All of the available land use variables are typically utilized in this regression model based on the assumption that they will have some positive effect on generating home-based other trips attractions. The coefficients of the various combinations of independent variables in each equation had a positive sign; thus, reinforcing the assumption of the positive effect they have on generation of home based other trip attractions. In all tests, there was at least one employment variable. In all cases, the employment variable was positive. In most cases, the statistical results on the employment variables were significant. Total population and total households combined with both employment variables to provide a better model than the remaining variables with total households providing a more sound relationship than total population. Removal of the constant term in equation 7 yielded the following final equation:

HBOther trip attractions = 3.225 * retail employment + 0.786 * total households.

6.9: NON-HOME BASED WORK TRIP ATTRACTIONS

Two equations were defined and tested for this trip purpose. Stratification by employment type (retail and non-retail employment) showed positive and strong correlation with the dependent variable. The combination of retail and non-retail employment proved to be the better model, accounting for about 81% of the variation in the dependent variable. Removal of the constant term resulted in the following final equation:

NHB-Work trip attractions = 0.997 * retail employment + .214 * non-retail employment

6.10: NON-HOME BASED NON-WORK TRIP ATTRACTIONS

Due to the fact that travel for this purpose neither begins nor ends at the traveler's home, it was hypothesized that all land use variables would contribute strongly to the explanation of the variability of this model. Stratified employment, total households, and population are tested in different combinations to assess the validity of this hypothesis. The combination of retail employment, non-retail employment and total household variables yielded the most significant and sound statistical results, with a coefficient of determination of 0.89, and the lowest bias coefficient and standard error of the estimate. Removal of the constant term gave the following final equation:

NHB-Non-Work trip attractions = 4.464 * retail employment + 0 .374 * non-retail employment + 0.426 * total households

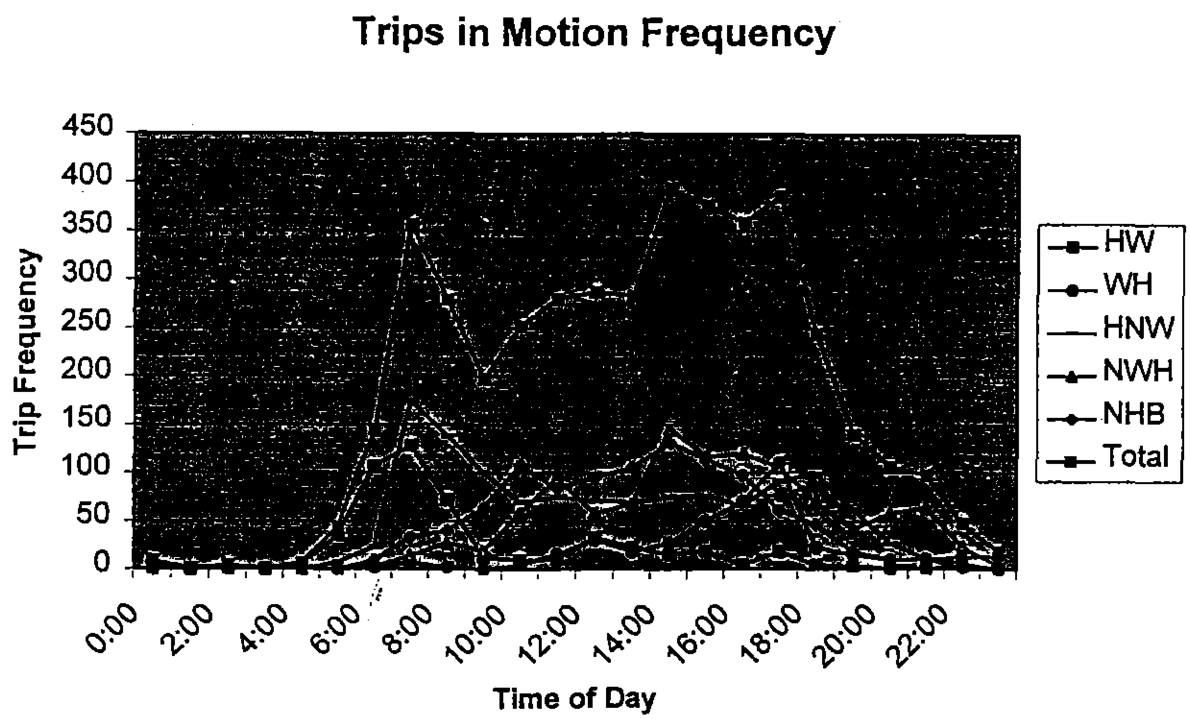
7: DIURNAL FACTORING

Travel occurs with different intensities at different times of the day. We are often interested in traffic measures during the peak travel periods; for example, level of service analysis is concerned only with the peak travel periods. We also require daily measures for evaluating daily vehicle-miles traveled (VMT) and estimating average daily traffic (ADT). It is therefore necessary that we take into account time of day variation in travel demand in the models under development.

Diurnal factoring is concerned with the frequency distribution of trips in progress within specified time periods. Figure 8. Shows a graph of the frequency distribution of Klamath Falls trips over a 24 hour period. The frequency plotted is the number of trips which where occurring during each hour. Trips are broken out into 5 categories:

- Home to Work
- Work to Home
- Home to Nonwork
- Nonwork to Home
- Nonhome-Based

We don't often look at home to work and work to home as separate trip purposes (they are usually considered together as home-based work trips). However, for the purpose of determining time of day factors, it is instructive to look at the directionality implicit in this distinction.
Figure 8.



In this model development project, travel demand is split by time of day prior to traffic assignment. The other models (trip generation, destination choice, mode choice factoring) are based on daily demand. For traffic assignment however, it is desirable to have a model which validates well with peak hour traffic counts. The diurnal factors developed from Figure 8. and described further below are used to divide daily demand into peak hour demand for each peak hour as well as other designated time periods of interest during the day.

7.1: TRIPS IN MOTION FREQUENCY

The trips in motion frequency is somewhat different than a typical trip frequency which would merely indicate at what time trips began their journeys. Trips in motion is a frequency of all trips in progress at the various time designations. For example, if a trip began at 8:00 am and ended at 9:05 am, the trip would contribute to the frequency in the 8-9 am slot and in the 9-10 am slot. This type of frequency is more indicative of the actual travel demand as it takes into account length of travel as opposed to just starts of trips.

7.2: SPECIFYING TIME PERIODS

Looking at the frequency distribution for total trips in motion, there appears to be three significant peaks: morning, evening, and late afternoon, with a fourth minor peak at midday. For each of the five trip purposes described above, the one hour periods during which maximum hourly trips in motion occurred were identified as:

- Home to Work (7:00 am to 8:00 am)
- Work to Home (4:45 pm to 5:45 pm)
- Home to Nonwork (7:15 am to 8:15 am)
- Nonwork to Home (4:30 pm to 5:30 pm)
- Nonhome-Based (1:45 pm to 2:45 pm)
- Total (7:30 am to 8:30 am and 4:30 pm to 5:30 pm)

One set of diurnal factors were to be specified for all trip purposes, so those for total trips were chosen. These were representative of the peaks identified by home to work and home to nonwork in the morning and work to home and nonwork to home in the evening. In addition to these two peak periods, two off-peak periods were identified. These are from 8:30 am to 4:30 pm, and the remainder of the day (12:00 am to 7:30 am and 5:30 pm to 12:00 am). Table 14. Shows the aggregate proportions of trips by the four specified time periods. The proportions under the total trips heading are the diurnal final factors.

Table 14.

Diurnal Factors							
		HW	WH	HNW	NWH	NHB	Total
am	7:30-8:30	24.80%	0.23%	17.62%	2.27%	3.97%	9.56%
mid	8:30-4:30	31.05%	40.97%	50.28%	57.09%	75.68%	54.87%
pm	4:30-5:30	2.73%	25.93%	6.19%	12.36%	7.66%	9.68%
rest	12:00-7:30 5:30-12:00	41.41%	32.87%	25.91%	28.27%	12.69%	25.89%
Daily		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

8: TRIP DISTRIBUTION MODEL DEVELOPMENT

The trip distribution model was developed as a set of destination choice models by trip purpose (see Table 7) based on the multinomial logit modeling framework. Parameters for the destination choice models were estimated with data specific to the Klamath Falls modeling area. This section describes the development of the destination choice models, variable definitions, parameter estimation, and validation.

8.1: DESTINATION CHOICE MODEL DEVELOPMENT

Multinomial logit based destination choice models are state-of-the-practice for trip distribution modeling. These models are much more behaviorally representative than their counterpart, the gravity models, commonly found in practice. Gravity models typically use a very general form of impedance function which reflects trip length characteristics on average of travelers. Travel characteristics which deviate from the average are typically represented through what are commonly referred to as K-factors. This modeling methodology is generally not regarded highly, particularly if too many K-factors are implemented rather than implementing more behaviorally responsive model forms (i.e. more model stratification by socioeconomic class or trip purposes more reflective of travel behavior).

Gravity models based on locally calibrated impedance functions and set of K-factors are also very much tied to the particular area. For this model development project, a generic trip distribution model which could be applied to other rural areas was desired. Therefore, the destination choice modeling framework is not only superior on a theoretical basis, but also on a practical basis.

8.1.1: MODEL FORMULATION

The functional form of the multinomial logit model was shown in Section 4.3.1. The same function is used for destination choice modeling as was used for auto ownership and workers per household modeling. The difference is in the alternative choices (traffic analysis zones as destination choices) and in the utility function specifications.

The first decision to be made in modeling destination choice is how to specify the alternatives. In a model with hundreds of traffic analysis zones, it may be impractical to allow each destination to be an alternative. Techniques have been developed for sampling from alternatives to give a limited choice set. For the Klamath Falls model, approximately 80 traffic analysis zones were represented and therefore 80 alternatives would define the choice set. Since 80 alternatives were well within the limits of the Alogit parameter estimation software used on this project, we decided to allow all 80 alternatives in the choice set and not complicate the procedure by sampling from alternatives.

A utility expression is required for each alternative. The destination choice model is ultimately applied for each production zone. The total trip productions are allocated to the choice set (attraction zones) for each production zone. Therefore, a utility is specified for each production zone to attraction zone interaction, given the production zone. The utility is defined by attributes of the zone pair interaction as well as by socioeconomic characteristics of the attraction zone. The model formulation is determined by finding the combination of utility function variables that result in the best model evaluation measures.

8.1.2: MODEL VARIABLES

As was mentioned in the previous section, destination choice utility function variables reflect the interaction of the production and attraction zone (i.e. distance, travel time, travel cost) and reflect characteristics of the attraction zones (i.e. geographic location, land use, socioeconomics). The list below contains all of the variables that were evaluated for possible inclusion in the utility expressions. Note that many of these variables proved to be not statistically significant and are therefore not part of the final utility expressions.

- Interzonal travel time (minutes)
- Interzonal travel time (first 5 minutes)
- Interzonal travel time (minutes exceeding first 5 minutes)
- Percent of interzonal time spent traversing 55 mph links
- Total households at attraction zone
- Households by housing category at attraction zone (single family, multi-family, other)
- Total employment at attraction zone
- Employment by category at attraction zone (industrial, retail, service, education, government, special, other)
- Employment by retail/nonretail
- Traffic analysis zone size (sq. miles)
- Klamath Falls CBD location (0/1)
- Altamont CBD location (0/1)
- Zone pair contained within a single district (0/1; districts are one of 15 predefined)
- Intrazonal zone pair (0/1)
- Side of river location of attraction zone (0/1; east/west)
- Zone pair on opposite sides of river (0/1)
- Orientation of zone pair locations (NE,NW,SE,SW)

8.1.3: PARAMETER ESTIMATION

As shown in section 4.1.3, the utility expressions for each alternative consist of the summation of attributes of the alternatives (variables) where each attribute is weighted by a model coefficient. These coefficients are the unknown parameters in the model estimation. The process of estimating the destination choice models involves solving for these unknown parameters given data on the alternatives available and on which alternative was observed to be chosen. For this modeling effort, that data comes by way of the household travel survey, specifically, the individual trips recorded on travel diaries.

Estimating the parameters of a multinomial logit model is a fairly straightforward task using maximum likelihood estimation techniques. Many software packages do this very well. In this project, ALOGIT[2] software was used to estimate the parameters. The software requires as input an estimation dataset and a specification of the utility functions (i.e. the combination of variables and their coefficients). The estimation dataset contains values for all of the variables mentioned in the previous Section in separate columns. These values are required for not only the alternative observed to be chosen, but for all non-chosen alternatives for each observation as well. The format of this dataset and the utility function definitions are input to Alogit through a control file, and the software computes the values of the parameters which best explain the choices observed by the individual trip makers, given attributes of all the alternatives and utility function definitions.

The output of ALOGIT for any given set of utility expressions is the values of the parameters estimated, some statistical measures of the significance of those parameter values, and some statistical measures of the overall quality of the maximum likelihood solution procedure. The quality of the estimated model can be judged based on the correctness of the signs of the parameters and their values relative to other comparable variable values. Other measures include the goodness of fit measures reported by the likelihood maximization method. A final evaluation measure used was to apply the resultant parameters to the utility functions in the multinomial logit formula and compute estimated proportions for each alternative. These proportions can then be summed by attraction district and compared to observed trips summed by attraction district. This summary can also be made over a range of travel time categories to provide even more information about how the estimated results compare to observed, stratified by travel time length.

Using all the aforementioned criteria, the utility specification that best suits the observed data is determined. This is done on a purpose by purpose basis, so a set of destination choice models are determined. Had there been even more observed trip records available, it may have been desirable to segment the trip purposes further by socioeconomic classification for example.

8.2: ESTIMATION EVALUATION

This section describes the findings from trial estimation runs with various utility function specifications. The final set of utility equations determined for Klamath Falls are presented, and some validation results are discussed.

[2] ALOGIT User's Guide, Version 3.8: August 1995, HCG Report 5001 – 1, Hague Consulting Group, The Hague, Netherlands.

8.2.1: ESTIMATION TRIALS

As discussed above, there are several evaluation criteria that one may use when evaluating various candidate model specifications. As it turned out, there was very little difference between likelihood function statistics between most model forms. They generally all had rho-squared values of approximately 0.35 which is quite acceptable, though not very useful as a measure of effectiveness when there is such little variation in values. Therefore, the primary criteria used to evaluate the estimation trials were that parameter values be reasonable in sign, value, and relation, and that district level disaggregate validation be acceptable. This was determined by looking at observed vs. estimated, both at actual values and at the equation of the regression lines through the scatter diagrams of observed vs. estimated.

8.2.2: USABLE UTILITY VARIABLES

A number of fairly complex utility functions where evaluated that intuitively seemed to represent the differences among alternative attraction zones fairly well. These included dummy variables for zone pairs that crossed the river in Klamath Falls (reflecting potential natural barrier bias), dummy variables that indicated the zone pair was intrazonal or intradistrict (reflecting short distance preference), variables that indicated directionality preference between zone pairs, and dummy variables for central business districts. Only the CBD indicator variables proved to be statistically significant and beneficial to the models.

Various level of service attributes were also evaluated to measure travel impedance between zones. These included travel time, the amount of travel time less than 5 minutes (i.e. min[travel time, 5 minutes]), the amount of travel time greater than 5 minutes (i.e. max[travel time, 5 minutes]), and the proportion of total travel time spent traversing 55 mph highway network links. Only travel time alone proved to be beneficial. As it turned out, a polynomial function of travel time (B_1*Time + B_2*Time**2 + B_3*Time**3, with B_1, B_2, and B_3 parameters to be estimated) was very significant in each of the trip purpose models.

Finally, many combinations of socioeconomic variables including housing, employment by category, zone size, and household and employment densities were evaluated. Employment by category was important with some categories contributing to some trip purpose models more than others.

8.2.3: SIZE VARIABLES

The utility expressions in a multinomial logit model are sometimes enhanced by including what is referred to as a size term. The size term is added to the summation of attributes as the natural logarithm of a combination of size variables, again weighted by unknown parameters. The utility equation defined in Section 4.3.1 can therefore be further generalized for the case where one or more size variables are included:

with:

where:

- n = the alternative number
- SE_i = i separate socio-economic household characteristics
- Acc_j = j separate interzonal accessibility or level of service measures (i.e. travel time)
- S_1 = size variable
- a_n, b_i, c_j = model Coefficients

Multinomial logit based destination choice models are a good example of models which benefit from the inclusion of a size term in utility functions. The size term (S_1, the argument to the natural logarithm) is a function of one or more variables which represent the size of the alternative in question; or in other words, is a measure of the underlying opportunities for selecting the given alternative relative to other alternatives. For example, total employment of the attraction zone is an excellent size variable for home-based work destination choice models as the employment variable represents a measure of the number of work related trips relative to that of the other attraction zones in the region.

8.3: MODEL RESULTS AND VALIDATION

The results of destination choice model estimation are shown in Figures 9-15. These figures show the final recommended models for the trip purposes defined earlier. Note that for home-based university trips, there is no model since all university trip productions go to a single, known attraction zone.

Figures 9-15 are all formatted the same way. The trip purpose is identified in the upper left hand corner. The utility function is defined below the trip purpose title. Variables in the utility functions are defined below the utility equations. Below these variable definitions are coefficient values and their corresponding t-statistic and standard error values. The table at the bottom compares observed vs. estimated trips by attraction district for each of five travel time ranges and all trips. Below this table at the bottom are root mean square error statistics and RMSE as a proportion of mean estimated trips per category. Finally, the graph in the upper right corner is a scatter diagram of total observed versus total estimated trips with the equation of the regression line through the scatter plot shown as well.

These figures provided the main criteria by which acceptable models were judged. While we were concerned with the quality of estimates in each travel time category and for each district, we concentrated primarily on getting good results for total trips by district and especially for districts with the most activity.

Looking at the percent RMSE for total trips for each purpose, we can conclude based on this disaggregate validation, that the models estimated are quite good. Percent RMSE relates average

$$U_n = a_n + \sum b_i * SE_i + \sum c_j * Acc_j + \ln[S_1]$$

absolute error between observed and estimated to the mean trips per district value. In no case was the mean error more than 4.5% of the mean trips per district. Looking at Figure 16., a composite of all trip purposes in one table and graph, we see that over all trip purposes the fit is extremely good and the measure of RMSE very small. Given the quality of the estimates for each trip purpose as well as for overall, we are quite happy with the destination choice model results.

8.4: TRANSFERABILITY

The final destination choice model forms contain variables that were carefully selected to both provide a robust model for Klamath Falls and be transferable to other Rural Oregon areas. The models depend only on network travel times, zonal socioeconomic and demographic data, and CBD location dummy variables. These should all be readily available for any region that requires a travel demand model.

Figure 9.

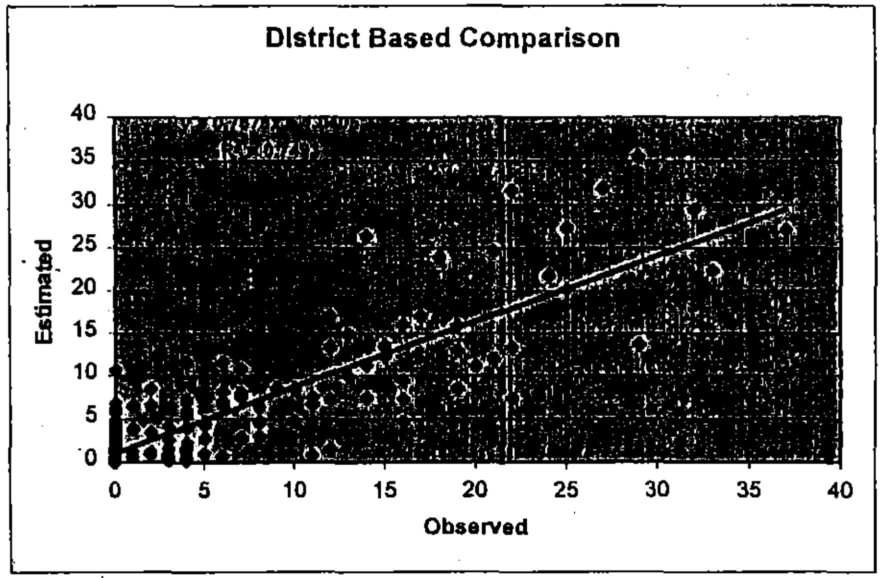
Home Based Work

$$V_{ij} = \beta_1 T_{ij} + \beta_2 T_{ij}^2 + \beta_3 T_{ij}^3 + \beta_4 KF\_CBD + \beta_5 Alt\_CBD + \ln[EMPtot]$$

Model Variables:

Vij	Systematic utility
Tij	Travel time skims from Klamath Falls EMME/2 model
KF_CBD	Dummy variable for Klamath Falls CBD zones
Alt_CBD	Dummy variable for Altamont CBD zones
EMPtot	Total employment of attraction zone

Estimated Cefficients:		T Ratio:	Std. Err.
$\beta 1$	-0.355300	-3.7	0.0950
$\beta 2$	0.031180	2.3	0.0137
$\beta 3$	-0.001202	-2	0.0006
$\beta 4$	-0.250400	-2.8	0.0886
$\beta 5$	0.006378	0.1	0.1000



District	Freq Zones	0 - 3 min. Obs	Est	3 - 6 min. Obs	Est	6 - 9 min. Obs	Est	9 - 12 min. Obs	Est	12 + min. Obs	Est	Total Obs	Est	Rel Err
1	4	21	26.6	29	52.4	59	43.7	47	28.5	3	9.7	159	160.9	1%
2	5	21	18.7	75	39	19	34	6	22.9	0	8	121	122.6	1%
3	3	4	4.3	1	9.6	5	7	4	4.6	1	1.7	15	27.2	81%
4	4	18	8.3	31	16	0	12.9	7	8.8	3	3	59	49	-17%
5	4	23	21.5	18	43.9	31	33.5	23	23.5	20	8.6	115	131	14%
6	5	25	11.5	16	23.8	34	19	16	12.6	0	4.4	91	71.3	-22%
7	6	4	2.6	14	6	0	5.3	4	3.4	0	1.3	22	18.6	-15%
8	8	0	3.3	0	7.1	6	6.5	6	4.9	0	1.5	12	23.3	94%
9	9	0	14.7	8	33.6	40	33.4	35	26.3	26	7.9	109	115.9	6%
10	6	0	0.8	0	2.1	0	2.3	2	1.6	8	0.7	10	7.5	-25%
11	4	0	7.9	24	17.3	24	15.7	8	11	0	3.7	56	55.6	-1%
12	8	21	16.7	67	40.9	26	38.4	20	25.3	0	9.4	134	130.7	-2%
13	10	9	5.4	20	13.3	12	12.5	6	8.6	0	2.9	47	42.7	-9%
14	5	0	1.2	0	3.2	15	3.6	4	2.4	0	0.9	19	11.3	-41%
15	1	4	6.7	19	13.6	8	10.6	4	7.6	6	2.8	41	41.3	1%
Total	82	150	150.2	322	321.8	279	278.4	192	192	67	66.5	1010	1008.9	
Root Mean Square Error			6.570134		17.24092		9.300753		7.21138		7.141662		8.873669	
Percent RMSE			4.38%		5.35%		3.33%		3.76%		10.66%		0.88%	

Figure 10.

Home Based Shopping Trips

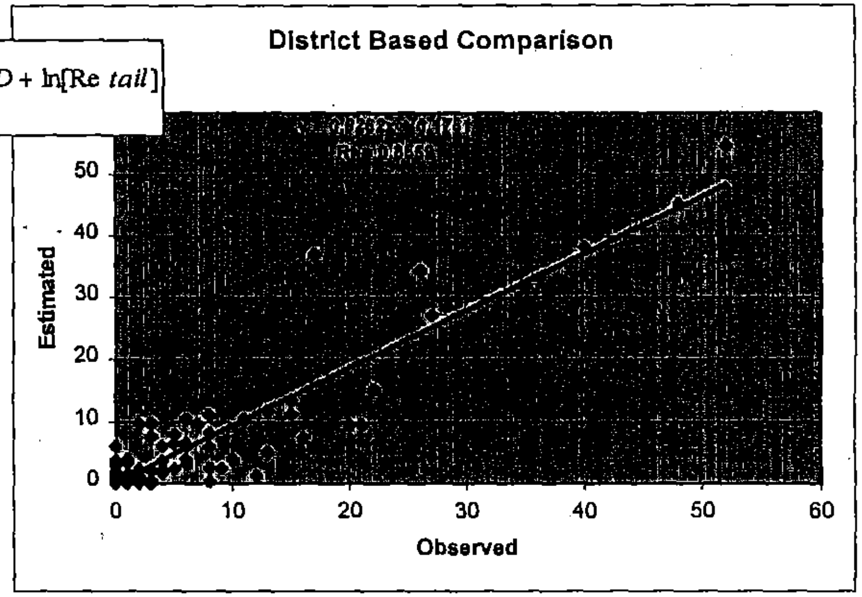
$$Vij = \beta_1 T_{ij} + \beta_2 T_{ij}^2 + \beta_3 T_{ij}^3 + \beta_4 \frac{Service_j}{\sum_j Service_j} + \beta_5 KF\_CBD + \beta_6 Alt\_CBD + \ln[Re\ tail]$$

Model Variables:

Vij	Systematic utility
Tij	Travel time skims from Klamath Falls EMME/2 model
Service	Total Service Employment of attraction zone
Retail	Total Retail Employment of attraction zone
KF_CBD	Klamath Falls CBD dummy
Alt_CBD	Altamont CBD dummy

Estimated Cefficients:

		T Ratio:	Std. Err:
β1	-0.89470	-5.7	0.158
β2	0.08540	2.9	0.030
β3	-0.00389	-2.3	0.002
β4	-15.91000	-7.6	2.100
β5	0.25380	1.4	0.181
β6	-0.13780	-1.3	0.103

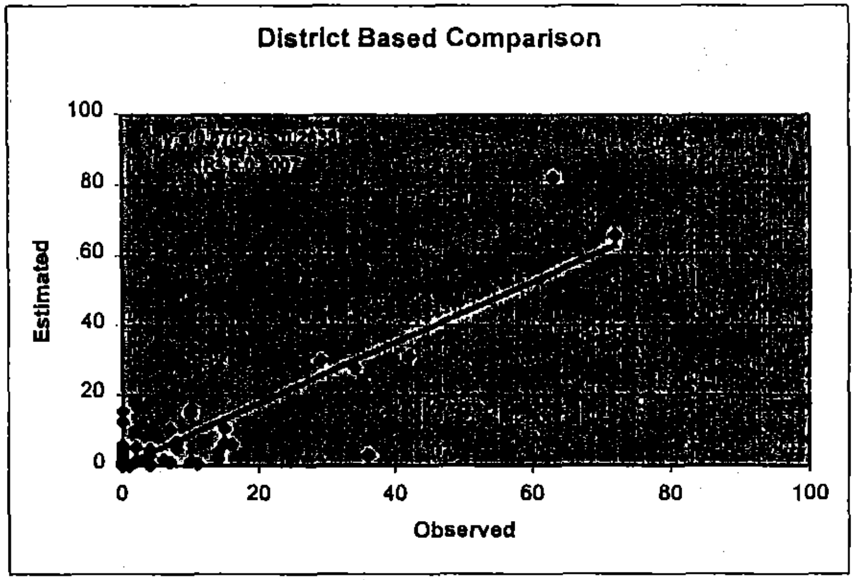


	Freq	0 - 3 min.		3 - 6 min.		6 - 9 min.		9 - 12 min.		12 + min.		Total		Rel
District	Zones	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Err
1	4	12	9	13	23.8	15	11.8	4	3.3	0	0.2	44	48.1	9%
2	5	18	51.7	91	89.5	45	42.1	15	13.1	0	0.3	169	196.7	16%
3	3	9	0.3	11	0.9	0	0.5	0	0.1	0	0	20	1.8	-91%
4	4	4	2.5	2	6.3	0	6.6	0	2.1	0	0.1	6	17.6	193%
5	4	3	2.2	2	6.1	0	6	0	1.5	0	0.1	5	15.9	218%
6	5	11	16.8	57	32.9	22	14.7	4	3.9	0	0.1	94	68.4	-27%
7	6	0	1.6	2	3.2	0	1.4	0	0.3	0	0	2	6.5	225%
8	8	0	0.1	0	0.8	0	0.9	0	0.7	0	0	0	2.5	-
9	9	3	0.3	0	0.8	0	0.6	0	0.1	1	0	4	1.8	-55%
10	6	0	1.6	0	4.1	0	2.6	0	0.7	0	0	0	9	-
11	4	0	6.5	25	13.9	20	7.3	3	2.7	0	0	48	30.4	-37%
12	8	64	38.8	43	58.7	18	25.9	10	6.6	0	0	135	130	-4%
13	10	11	3.7	1	7.6	0	2.9	0	0.6	0	0	12	14.8	23%
14	5	0	0.2	2	0.4	4	0.7	0	0.1	0	0	6	1.4	-77%
15	1	0	0	0	0	0	0	0	0	0	0	0	0	-
Total	82	135	135.3	249	249	124	124	36	35.8	1	0.8	545	544.9	
Root Mean Square Error			11.54686		9.209995		5.193843		1.261745		0.278089		12.91038	
Percent RMSE			8.55%		3.70%		4.19%		3.50%		27.81%		2.37%	

Figure 11.

Home Based Elementary/Secondary School Trips

$$Vij = \beta_1 T_{ij} + \beta_2 T_{ij}^2 + \beta_3 T_{ij}^3 + \beta_4 EducEmp + \ln[SF HHs]$$



Model Variables:

Vij	Systematic utility
Tij	Travel time skims from Klamath Falls EMME/2 model
EducEmp	Education Employment at attraction zone
SF HHs	Single Family Housing units at attraction zone

Estimated Coefficients:		T Ratio:	Std. Err.
β1	-0.31990	-1.9	0.168
β2	-0.00431	-0.1	0.038
β3	-0.00099	-0.4	0.002
β4	0.01103	12.7	0.001

	Freq	0 - 3 min.		3 - 6 min.		6 - 9 min.		9 - 12 min.		12 + min.		Total		Rel
District	Zones	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Err
1	4	0	1.8	0	1.3	0	0.5	0	0	0	0	0	3.6	-
2	5	0	0.1	0	0.2	0	0	0	0	0	0	0	0.3	-
3	3	11	16.1	14	17.1	2	2.7	0	0.4	0	0	27	36.3	34%
4	4	56	66.9	29	39.2	2	10.6	3	0.3	0	0	90	117	30%
5	4	0	0.4	4	0.8	0	0	1	0	0	0	5	1.2	-76%
6	5	0	17.7	0	26.5	0	4.4	0	0.7	0	0	0	49.3	-
7	6	4	3.6	0	7.7	4	1.6	0	0.8	0	0	8	13.7	71%
8	8	36	2.3	2	2.6	0	1.7	0	0	0	0	38	6.6	-83%
9	9	0	0.3	0	0.6	0	0.2	0	0	0	0	0	1.1	-
10	6	0	1.3	0	3.6	0	1.8	0	0.1	0	0	0	6.8	-
11	4	0	0.3	0	0.9	0	0.2	0	0	0	0	0	1.4	-
12	8	33	24.8	75	42.6	2	13.5	0	2.7	0	0	110	83.6	-24%
13	10	22	34.9	86	69.1	25	16.1	0	2.7	0	0	133	122.8	-8%
14	5	15	6.3	8	6.1	21	2.7	4	0.1	0	0	48	15.2	-68%
15	1	0	0	0	0	0	0	0	0	0	0	0	0	-
Total	82	177	176.8	218	218.3	56	56	8	7.8	0	0.0	459	458.9	

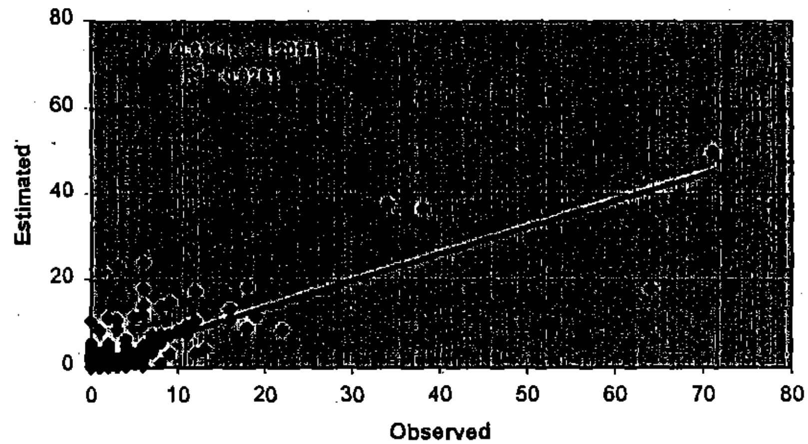
Root Mean Square Error	11.28001	12.22192	6.594846	1.620288	0	20.36037
Percent RMSE	6.37%	5.61%	11.78%	20.25%	#DIV/0!	4.44%

Figure 12.

Home Based Recreational Trips

$$V_{ij} = \beta_1 T_{ij} + \beta_2 T_{ij}^2 + \beta_3 T_{ij}^3 + \beta_4 (Govt + Spec + Oth) + \beta_5 KF\_CBD + \beta_6 Alt\_CBD + \ln[\,HHtot\,]$$

District Based Comparison



Model Variables:

Vij	Systematic utility
Tij	Travel time skims from Klamath Falls EMME/2 model
Govt	Total Government Employment of attraction zone
Spec	Total Special Employment of attraction zone
Oth	Total Other Employment of attraction zone
HHtot	Total housing units of attraction zone
KF_CBD	Klamath Falls CBD dummy variable
Alt_CBD	Altamont CBD dummy variable

Estimated Cefficients:

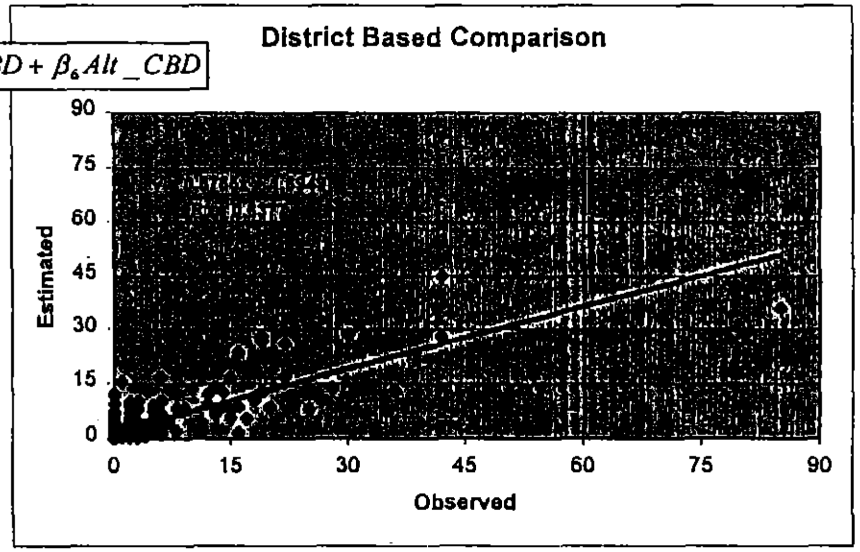
		T Ratio:	Std. Err.
$\beta 1$	-0.344300	-3.1000	0.111
$\beta 2$	0.027430	1.5000	0.018
$\beta 3$	-0.001534	-1.8000	0.001
$\beta 4$	0.003849	27.2000	0.000
$\beta 5$	1.222000	9.8000	0.124
$\beta 6$	2.121000	7.8000	0.272

District	Freq Zones	0 - 3 min. Obs	Est	3 - 6 min. Obs	Est	6 - 9 min. Obs	Est	9 - 12 min. Obs	Est	12 + min. Obs	Est	Total Obs	Est	Rel Err
1	4	10	13.8	28	27.3	25	26	10	7.8	2	1.9	75	76.8	2%
2	5	2	2.8	21	5.1	13	4.6	4	1.6	0	0.3	40	14.4	-64%
3	3	22	7	5	13.2	14	11.4	0	3.1	0	0.9	41	35.6	-13%
4	4	5	14.2	27	31.8	6	33.2	17	8.6	1	2.5	56	90.3	61%
5	4	3	13.4	5	27.8	78	27.4	14	6.9	1	2.2	101	77.7	-23%
6	5	1	15.1	12	28.5	15	25.2	0	7.8	0	1.9	28	78.5	180%
7	6	6	5.5	8	10.4	12	8.5	2	3.1	2	0.8	30	28.3	-6%
8	8	4	2.9	10	5.6	8	8.9	4	2.7	2	0.7	28	20.8	-26%
9	9	4	1.6	0	2.2	9	3.2	5	1.1	8	0.1	26	8.2	-68%
10	6	0	2.2	14	4	0	4.2	1	1.6	2	0.7	17	12.7	-25%
11	4	0	0.5	6	0.8	9	0.9	0	0.3	0	0	15	2.5	-83%
12	8	33	24.4	58	42.6	39	36.6	8	14.3	1	3.3	139	121.2	-13%
13	10	42	23.2	43	38.1	10	39.7	7	13.6	1	3	103	117.6	14%
14	5	0	1.7	0	2.9	2	4	0	1.1	0	0.4	2	10.1	405%
15	1	0	3.7	12	8.6	2	8.1	4	2.1	0	0.6	18	23.1	28%
Total	82	132	132	249	248.9	242	241.9	76	75.7	20	19.3	719	717.8	
Root Mean Square Error			8.516572		10.24308		17.40033		4.536151		2.383974		20.20779	
RMSE / Total			6.45%		4.11%		7.19%		5.97%		11.92%		2.81%	

Figure 13.

Home Based Other Trips

$$Vij = \beta_1 T_{ij} + \beta_2 T_{ij}^2 + \beta_3 T_{ij}^3 + \beta_4 (100 * SerEmp_j / TotEmp_j) + \beta_5 KF\_CBD + \beta_6 Alt\_CBD$$



Model Variables:

Vij	Systematic utility
Tij	Travel time skims from Klamath Falls EMME/2 model
SerEmp	Total Service Employment of attraction zone
TotEmp	Total Employment of attraction zone
KF_CBD	Klamath Falls CBD dummy
Alt_CBD	Altamont CBD dummy

Estimated Cefficients:		T Ratio:	Std. Err:
β_1	-0.46630	-5.0	0.093
β_2	0.03268	2.1	0.015
β_3	-0.00138	-1.9	0.001
β_4	0.00894	6.5	0.001
β_5	0.88320	8.5	0.104
β_6	0.95440	9.6	0.100

	Freq	0 - 3 min.		3 - 6 min.		6 - 9 min.		9 - 12 min.		12 + min.		Total		Rel
District	Zones	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Err
1	4	20	34.4	24	46.6	50	30.5	17	6.3	9	2.3	120	120.1	0%
2	5	1	38.6	60	47.8	66	37	4	7.7	0	3.3	131	134.4	3%
3	3	18	11.5	4	18.2	7	10.3	0	2.1	0	0.7	29	42.8	48%
4	4	28	10.8	27	14.6	8	10.5	6	2.4	0	0.5	69	38.8	-44%
5	4	5	5.8	25	8.7	8	6.5	11	1.4	2	0.4	51	22.8	-55%
6	5	32	16.9	14	25.2	23	15.5	5	3.1	1	1.1	75	61.8	-18%
7	6	4	16	13	25.2	25	17.9	0	4.2	0	1.5	42	64.8	54%
8	8	2	8.4	0	11.6	0	15.3	0	2.6	2	1.8	4	39.7	893%
9	9	6	7.6	0	10.7	1	13.7	7	2.6	5	1.6	19	36.2	91%
10	6	2	8.9	0	15.5	0	16.1	0	4.9	5	2.6	7	48	586%
11	4	2	8.3	14	10.8	14	10	3	1.9	0	0.9	33	31.9	-3%
12	8	83	28.6	89	40	24	31.8	3	8.1	2	3.4	201	111.9	-44%
13	10	25	26.2	48	38.1	16	39.7	1	9.2	0	4	90	117.2	30%
14	5	0	4.6	0	8.7	23	10.2	0	2.8	0	1.8	23	28.1	22%
15	1	0	1.4	6	2.2	2	1.6	3	0.3	0	0.1	11	5.6	-49%
Total	82	228	228	324	323.9	267	266.6	60	59.6	26	26.0	905	904.1	

	0 - 3 min.	3 - 6 min.	6 - 9 min.	9 - 12 min.	12 + min.	Total
Root Mean Square Error	19.05536	17.59479	13.67338	5.283181	2.591267	31.18732
Percent RMSE	8.36%	5.43%	5.12%	8.81%	9.97%	3.45%

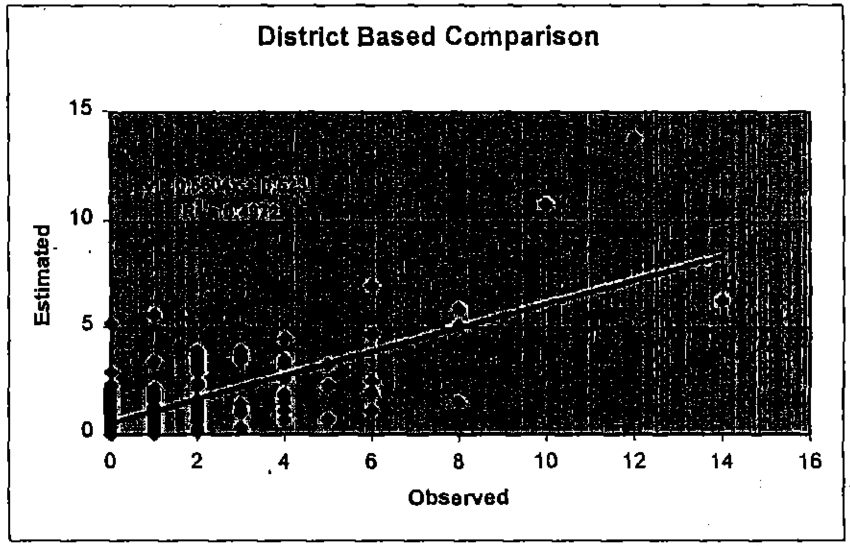
Figure 14.

Non Home Based Work Trips

$$V_{ij} = \beta_1 T_{ij} + \beta_2 T_{ij}^2 + \beta_3 T_{ij}^3 + \beta_4 KF\_CBD + \beta_5 Alt\_CBD$$

Model Variables:

Vij	Systematic utility
Tij	Travel time skims from Klamath Falls EMME/2 model
KF_CBD	Klamath Falls CBD dummy
Alt_CBD	Altamont CBD dummy



Estimated Cefficients:		T Ratio:	Std. Err:
β1	-0.279100	-2.5000	0.112
β2	-0.020450	-1.3000	0.016
β3	0.001483	2.4000	0.001
β4	0.626200	3.4000	0.186
β5	0.669400	3.7000	0.182

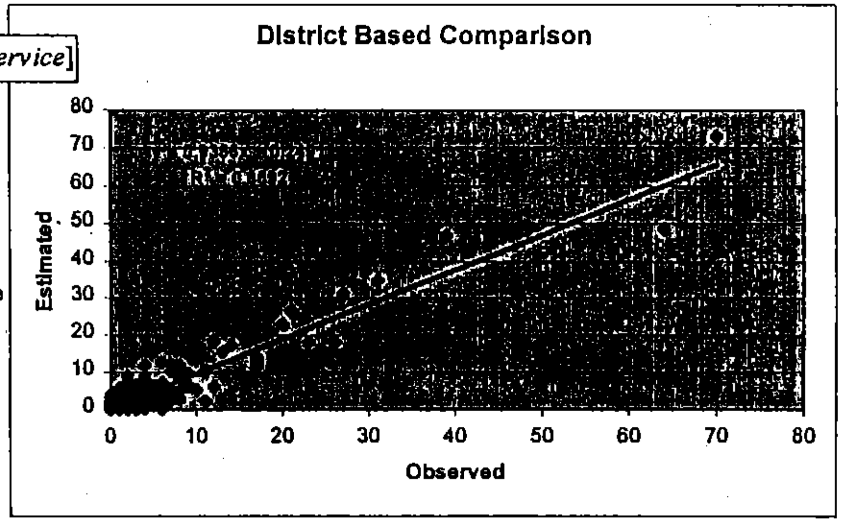
	Freq	0 - 3 min.		3 - 6 min.		6 - 9 min.		9 - 12 min.		12 + min.		Total		Rel
District	Zones	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Obs	Est	Err
1	4	13	11.7	17	19.3	8	5.9	1	0.8	0	1.2	39	38.9	0%
2	5	23	16.8	14	20	5	5.8	2	1.2	0	1.3	44	45.1	2%
3	3	0	3.1	4	6.3	0	1.7	0	0.3	1	0.6	5	12	140%
4	4	4	3.9	9	8.4	0	2.2	0	0.6	3	1	16	16.1	1%
5	4	9	3.2	16	6.5	2	1.5	1	0.9	0	1.1	28	13.2	-53%
6	5	7	7.5	10	11	0	3.1	1	0.6	0	0.6	18	22.8	27%
7	6	4	4.1	4	5.8	1	2	1	0.5	1	0.6	11	13	18%
8	8	0	3	8	5.3	1	2.2	0	0.9	0	1.2	9	12.6	40%
9	9	0	2.5	0	3.9	3	3.1	0	1	5	3.3	8	13.8	73%
10	6	1	2.3	0	3	1	1.9	1	0.5	1	1.2	4	8.9	123%
11	4	8	4.7	15	6.1	5	2.1	0	0.4	0	0.7	28	14	-50%
12	8	5	7.5	14	10.9	9	4.1	3	0.8	2	0.9	33	24.2	-27%
13	10	2	6.6	4	10.5	3	4.4	0	1.1	1	1.6	10	24.2	142%
14	5	1	1.4	0	2.1	1	1.2	0	0.5	1	1.1	3	6.3	110%
15	1	2	1	6	2.3	2	0.6	0	0.3	2	0.3	12	4.5	-63%
Total	82	79	79.3	121	121.4	41	41.8	10	10.4	17	16.7	268	269.6	

	0 - 3 min.	3 - 6 min.	6 - 9 min.	9 - 12 min.	12 + min.	Total
Root Mean Square Error	3.055596	4.633933	2.037646	0.823003	1.106044	7.7852
Percent RMSE	3.87%	3.83%	4.97%	8.23%	6.51%	2.90%

Figure 15.

Non Home Based NonWork Trips

$$Vij = \beta_1 T_{ij} + \beta_2 T_{ij}^2 + \beta_3 T_{ij}^3 + \beta_4 KF\_CBD + \beta_5 Alt\_CBD + \ln[Retail + Service]$$



Model Variables:

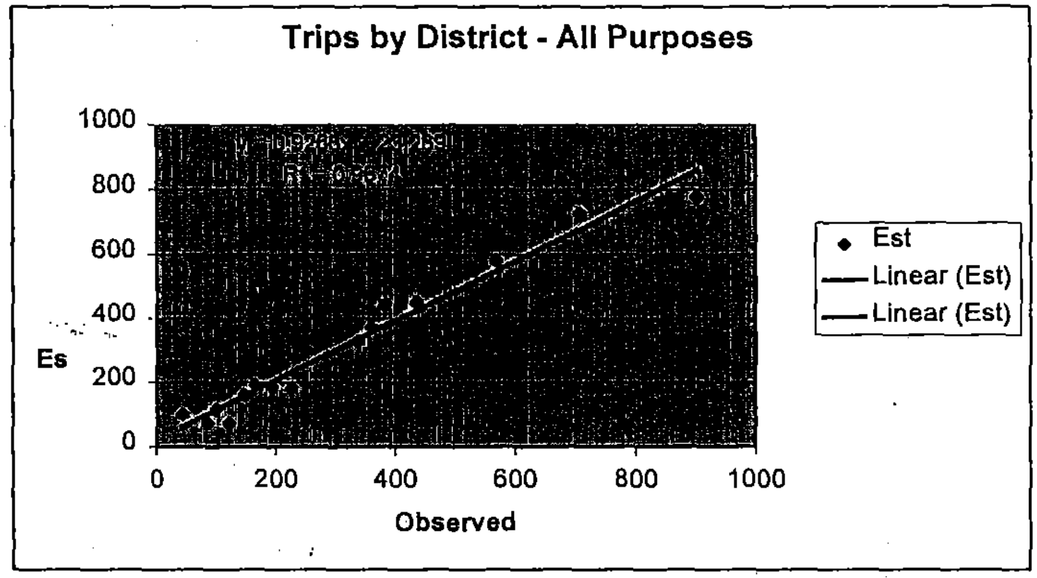
Vij	Systematic utility
Tij	Travel time skims from Klamath Falls EMME/2 model
Service	Total Service Employment of attraction zone
Retail	Total Retail Employment of attraction zone
KF_CBD	1 if attraction zone is in KF CBD (District 1); 0 otherwise
Alt_CBD	1 if attraction zone is in Altamont CBD (District 2); 0 otherwise

Estimated Cefficients:		T Ratio:	Std. Err.
$\beta 1$	-0.505900	-7.0000	0.073
$\beta 2$	0.035640	2.9000	0.012
$\beta 3$	-0.000429	-0.8000	0.001
$\beta 4$	-0.664200	-6.6000	0.101
$\beta 5$	-0.418000	-4.6000	0.090

District	Freq Zones	0 - 3 min. Obs	Est	3 - 6 min. Obs	Est	6 - 9 min. Obs	Est	9 - 12 min. Obs	Est	12 + min. Obs	Est	Total Obs	Est	Rel Err
1	4	73	54.6	39	47.2	13	20.2	7	7.7	0	3.7	132	133.4	1%
2	5	107	93.9	63	77.7	25	29.4	7	9.6	0	4.3	202	214.9	6%
3	3	8	12.9	17	13	3	5.9	0	2.1	0	1.3	28	35.2	26%
4	4	17	15.3	23	15.1	14	7.5	2	3	8	1.8	64	42.7	-33%
5	4	16	21.1	4	22.2	7	14.9	5	5.3	0	3.5	32	67	109%
6	5	26	37.7	40	35	10	13.7	0	4.5	0	2.3	76	93.2	23%
7	6	0	5.9	24	6.7	6	3	2	1.2	0	0.6	32	17.4	-46%
8	8	1	4.2	6	4.3	2	2.4	0	0.9	0	0.4	9	12.2	36%
9	9	0	2.7	0	3.1	8	1.5	10	0.6	10	0.2	28	8.1	-71%
10	6	1	2.7	2	3.1	1	1.7	0	0.6	2	0.3	6	8.4	40%
11	4	19	18	19	16.7	2	7.4	6	2.3	0	1	46	45.4	-1%
12	8	59	65.9	57	67.5	34	28.1	0	9.9	0	4.2	150	175.6	17%
13	10	9	4.8	20	5.3	9	2.4	1	0.8	0	0.3	39	13.6	-65%
14	5	2	0.4	3	0.5	3	0.2	8	0	4	0	20	1.1	-95%
15	1	2	0	0	0	1	0	1	0	0	0	4	0	-100%
Total	82	340	340.1	317	317.4	138	138.3	49	48.5	24	23.9	868	868.2	
Root Mean Square Error			7.429715		9.55287		4.941187		4.471465		3.864626		17.30896	
Percent RMSE			2.19%		3.01%		3.58%		9.13%		16.10%		1.99%	

Figure 16.

Summary of all trip purposes combined



District	Freq Zones	0 - 3 min. Obs	Est	3 - 6 min. Obs	Est	6 - 9 min. Obs	Est	9 - 12 min. Obs	Est	12 + min. Obs	Est	Total Obs	Est	Relative Error
1	4	149	151.9	150	217.9	170	138.6	86	54.4	14	19	569	581.8	2.2%
2	5	172	222.6	324	279.3	173	152.9	38	56.1	0	17.5	707	728.4	3.0%
3	3	72	55.2	56	78.3	31	39.5	4	12.7	2	5.2	165	190.9	15.7%
4	4	132	121.9	148	131.4	30	83.5	35	25.8	15	8.9	360	371.5	3.2%
5	4	59	67.6	74	116	126	89.8	55	39.5	23	15.9	337	328.8	-2.4%
6	5	102	123.2	149	182.9	104	95.6	26	33.2	1	10.4	382	445.3	16.6%
7	6	22	39.3	65	65	48	39.7	9	13.5	3	4.8	147	162.3	10.4%
8	8	43	24.2	26	37.3	17	37.9	10	12.7	4	5.6	100	117.7	17.7%
9	9	13	29.7	8	54.9	61	55.7	57	31.7	55	13.1	194	185.1	-4.6%
10	6	4	19.8	16	35.4	2	30.6	4	10	18	5.5	44	101.3	130.2%
11	4	29	46.2	103	66.5	74	43.6	20	18.6	0	6.3	226	181.2	-19.8%
12	8	298	206.7	403	303.2	152	178.4	44	67.7	5	21.2	902	777.2	-13.8%
13	10	120	104.8	222	182	75	117.7	15	36.6	2	11.8	434	452.9	4.4%
14	5	18	15.8	13	23.9	69	22.6	16	7	5	4.2	121	73.5	-39.3%
15	1	8	12.8	43	26.7	15	20.9	12	10.3	8	3.8	86	74.5	-13.4%
Total	82	1241	1241.7	1800	1800.7	1147	1147	431	429.8	155	153.2	4774	4772.4	
Mean		15.1		22.0		14.0		5.3		1.9		58.2		
Root Mean Square Error		11.98316		18.94763		11.50727		5.004949		3.769615		28.07927		
RMSE/Total		0.97%		1.05%		1.00%		1.16%		2.43%		0.59%		

9: MODE CHOICE FACTORING

All of the eight-county data was used to develop the mode choice factors. Two sets of factors were developed – one based on the private vehicle percentage (i.e., auto mode), and a second based on the vehicle occupancy. Together, these factors were used to convert person trips into person trips made by auto, and then into vehicles for assignment to the roadway system. The factors that should be applied are summarized in Table 15.

Table 15: Mode Factors and Vehicle Occupancies *

Trip Purpose	Private Vehicle %	Vehicle Occupancy
Home-based work	96.4%	1.087
Home-based elementary/secondary school	59.8%	1.861
Home-based other	91.7%	1.501
Non-home based	87.6%	1.582
All trips	88.2%	1.420
Note: * Based on weighted home interview survey data.		

10: TRAFFIC ASSIGNMENT

The only trip assignment procedure considered in this model development project was highway traffic assignment; there was no transit assignment element. This section describes the preparation for highway assignment, the definition of volume delay functions, and the validation of assigned volumes with observed traffic counts.

10.1: HIGHWAY ASSIGNMENT MODEL

The framework used in this project for modeling highway network flows is the user-optimal network equilibrium assignment methodology. This methodology is implemented using the EMME/2[3] software.

The EMME/2 highway assignment procedure requires that acceptable convergence criteria be specified. This can be done in three ways: by maximum iteration number; by gap size, and by relative gap percentage. In this model, 500 iterations were set as the maximum, gap size as 0.01, and relative gap as 0.001. These values were set based on experience in other similar sized regions. The critical point is that the solutions are determined with enough iterations that convergence is achieved to the degree that changes in individual link flows are very small.

[3] EMME/2 User's Manual Software Release 9, August 31, 1998, INRO Consultants, Inc., Montreal, Canada

Highway assignment was performed over four time periods as described in Chapter 7: Diurnal Factors. In theory, a different network reflecting differences in capacities and available service could be used in each time period. In this project, a single network was used for all four time periods.

The trip table loaded onto the network in each time period comes as a result of the destination choice model followed by mode choice factoring. This result is an origin/destination table of daily trips.

10.2: VOLUME DELAY FUNCTIONS

The volume delay functions are used to relate network travel time to network flows. The relationship that makes travel time increase as a function of flow is the part of the travel demand model that introduces traffic congestion as a negative factor. The theory of network equilibrium traffic assignment requires that volume delay functions (VDFs) be defined carefully in order to guarantee that the iterative equilibrium solution procedure converges toward an equilibrium solution. It is necessary that travel time for a link in the VDF be strictly, monotonically increasing with respect to flow on that link. The travel time must depend on flow on that link alone, and no others. Finally, the travel time functions must be continuously differentiable. These three requirements satisfy the mathematics that ensures the equilibrium solution method will be well-behaved. An additional practical requirement is that the VDF reflect macroscopic traffic behavior. A typical generic VDF, commonly referred to as the BPR function is:

$$T_a = T_a^{\,0}\{1+\alpha[\frac{V_a}{C_a}]^{\beta}\}$$

Where:

T_a	=	Congested travel time on link a
T_a^0	=	Free flow travel time on link a
V_a	=	Assigned flow on link a
C_a	=	Fixed capacity on link a
α, β	=	Coefficient and Exponent of BPR function

One method to determine the values for the BPR coefficient and exponent would be to calibrate these functions with observed travel time data on various link types, thus determining a set of locally determined values. Because this project was interested in creating a generic model, a set of generic values were desired. For many years, values of 0.15 and 4 for the coefficient and exponent, respectively, were deemed acceptable. Recent research points to a range of possible values by facility type as well as slightly higher values.[4] In this research, the slightly higher values of 0.83 and 5.5 for the coefficient and exponent, respectively, seemed to work well, and

[4] NCHRP Report 365, Travel Estimation Techniques for Urban Planning, Transportation Reseacrh Board, National Academy Press, Washington D.C., 1998.

were used for all links, for all time periods. These values were selected despite being indicated for freeway links in the referenced report. Some sensitivity analysis showed that there was not much of an effect on link volumes by changing these values. Also, the NCHRP report gives no guidance for setting parameters on lower functional classification links, which are the majority of links in rural and small urban areas.

10.3: VALIDATION OF ASSIGNMENT RESULTS

Highway assignment validation is typically based on the comparison of observed link counts with estimated link flows, and often observed vs. estimated travel times. In this project, link count data for Klamath Falls was collected in 1998. The base year socioeconomic data was however from 1990, and the household travel survey was yet a different year, 1996. This made it difficult to establish a set of link counts with which to validate the models. The traffic counts in 1998 reflected a different amount of travel activity than what really occurred in the calibration year. The validation standards were therefore somewhat speculative and not as rigorous as one might typically find.

The observed count data was based on daily counts, therefore estimated link flows from each of the four time period assignments were combined together to compare daily counts with daily flows. Table 16 shows a table with which validation criteria were judged. This table shows that counts and flows were compared by link type. Relative error and root mean square error were computed for comparison As indicated above, it was felt that observed counts could have overstated the calibration year counts by 15-20%, therefore a 19% relative error on the validation run was determined to be acceptable. Figure 17. shows a scatter diagram and resulting regression line for daily observed versus estimated link flows.

Table 16.

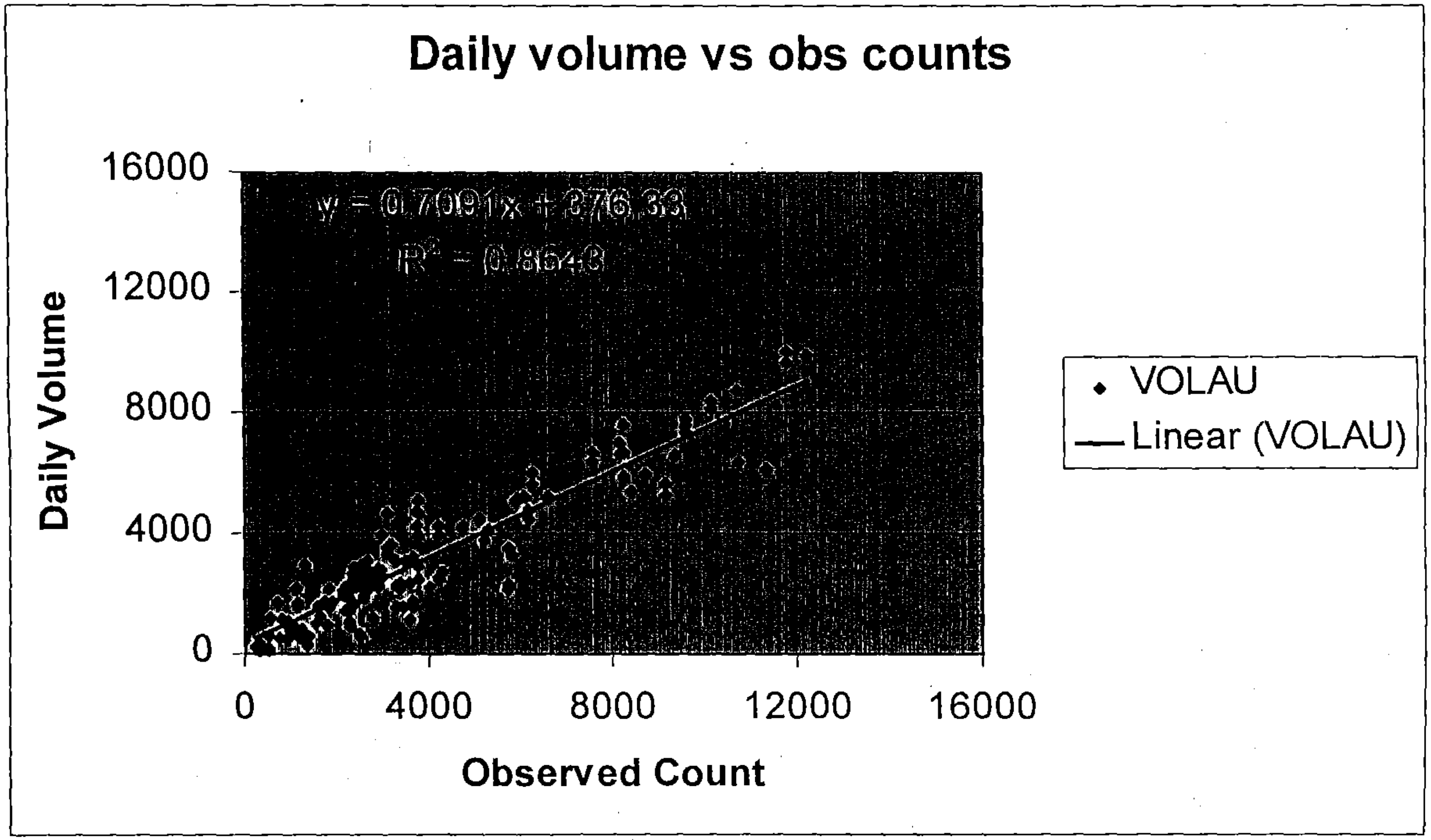
Klamath Falls, OR
Daily Assignment Validation Table

Link Type	Number Links	Obs vs Est Counts Obs	Est	(E-O)/O	%RMSE	Obs vs Est VMT Obs VMT	Est VMT	(E-O)/O	%RMSE	SSE Vol	SSE VMT
2	88	244600	239517.3	-2.1%	20%	163282	158956	-2.6%	21%	26274481	13464282
3	10	77300	63515.8	-17.8%	22%	40310	33076	-17.9%	23%	26110266	7720992
4	12	29900	29351.7	-1.8%	19%	11115	10889	-2.0%	17%	2426860	265494
5	4	17300	13860.5	-19.9%	27%	3979	3188	-19.9%	27%	4021702	212748
6	71	348800	243284.3	-30.3%	39%	79726	53874	-32.4%	50%	260045854	22000912
7	13	42500	34288.1	-19.3%	60%	7823	7138	-8.8%	38%	46648805	620600
8	23	62000	43379.1	-30.0%	42%	14293	9549	-33.2%	47%	28561870	1864521
9	4	11100	6864.1	-38.2%	47%	2061	1339	-35.0%	46%	5159760	170653
Total	225	833500	674060.9	-19.1%	36%	322589	278008	-13.8%	32%	399249597	46320202

Count Group	Number Links	Obs vs Est Counts Obs	Est	(E-O)/O	%RMSE	Obs vs Est VMT Obs VMT	Est VMT	(E-O)/O	%RMSE	SSE Vol	SSE VMT
0	906	-	-	-	-	-	-	-	-	-	-
<2000	57	56500	53273.2	-5.7%	50%	24324	22344	-8.1%	36%	13482964	1342284
<4000	101	286300	252007.1	-12.0%	30%	148013	138464	-6.5%	26%	73486298	14429477
<6000	27	136500	100274.2	-26.5%	33%	36376	29305	-19.4%	24%	73434999	2608861
<8000	12	78500	65124.7	-17.0%	19%	32738	27652	-15.5%	22%	16893304	3816328
<10000	16	141800	105066.3	-25.9%	28%	43155	32902	-23.8%	30%	94847940	9665692
>=10000	12	133900	98315.4	-26.6%	30%	37983	27342	-28.0%	36%	127104093	14457561
Total	1131	833500	674060.9	-19.1%	36%	322589	278008	-13.8%	32%	399249597	46320202

Obs/Cap Group	Number Links	Obs vs Est Counts Obs	Est	(E-O)/O	%RMSE	Obs vs Est VMT Obs VMT	Est VMT	(E-O)/O	%RMSE	SSE Vol	SSE VMT
0	906	-	-	-	-	-	-	-	-	-	-
<0.5	17	21200	22157.8	4.5%	32%	6072	6180	1.8%	22%	2487850.347	101533
<1.0	23	32800	36767.6	12.1%	44%	13316	14938	12.2%	43%	8543336	1363581
<1.5	20	46100	40684.4	-11.7%	36%	22109	19826	-10.3%	21%	12892534	1049197
<2.0	36	105900	88419.2	-16.5%	28%	64194	57949	-9.7%	19%	23522325	4204704
<3.0	69	339600	265446.3	-21.8%	36%	123749	102019	-17.6%	33%	208954153	23666141
>=3.0	60	287900	220585.6	-23.4%	32%	93149	77095	-17.2%	33%	142849398.9	15935046
Total	1131	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	399249597	46320202

Figure 17.


Daily volume vs obs counts
y = 0.7091x + 376.33
R² = 0.8643
Daily Volume
16000
12000
8000
4000
0
0
4000
8000
12000
16000
Observed Count
VOLAU
Linear (VOLAU)

APPENDIX E: EMISSION FORECAST TABLES

Appendix E, Table E-1. Klamath Falls UGB 1996 TO 2015 CO SOURCE GROWTH FACTORS

POINT SOURCE Growth	Growth Rate	Growth Area	Growth Rate Description	Growth Type
Point Source growth from 1996	1.40%	UGB	Industrial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding

AREA Source Growth	Growth Rate	Growth Area	Growth Rate Description	Growth Type
WASTE DISPOSAL, TREATMENT, & RECOVERY				
Commercial / Institutional On-Site Incineration	1.1%	UGB	Commercial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Commercial / Institutional Open Burning	1.1%	UGB	Commercial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Industrial Open Burning	1.40%	UGB	Industrial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Residential Open Burning	1.1%	UGB	Household Land Use / Zoning Based (Ref.333)	Compound rate
SMALL STATIONARY FUEL & WOOD USE				
Industrial				
Fuel Oil Combustion	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Distillate	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Residual	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Kerosene	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Natural Gas Combustion	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Liquid Petroleum Gas Combustion	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
Commercial / Institutional				
Fuel Oil Combustion				
Distillate	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Residual	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Kerosene	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Natural Gas Combustion	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Liquid Petroleum Gas Combustion	1.1%	UGB	Commercial Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Residential				
Fuel Oil Combustion				
Distillate	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
Residual	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
Kerosene	1.1%	UGB	Household Land Use / Zoning Based (Ref.333)	Compound rate
Natural Gas Combustion	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate
Liquid Petroleum Gas Combustion	1.1%	UGB	Household Land Use / Zoning Based (Ref.333)	Compound rate
Wood Combustion				
Fireplaces	1.20%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Woodstoves - Certified Catalytic	1.06%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Woodstoves - Certified Non-Catalytic	1.06%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Woodstoves - Conventional	-0.96%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Fire Place Inserts	-0.22%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
Exempt Pellet Stoves	0.20%	UGB	1999 Oregon Woodburning survey analysis (DEQ)	Linear, Non-Compounding (calc. In Table 12a)
SMALL POINT SOURCES				
Permitted Sources (>5 tons/year, <100 tons/yr.)	1.40%	UGB	Industrial Land Use / Zoning Based (Ref.333)	Linear, Non-Compounding
MISCELLANEOUS AREA SOURCES				
Other Combustion				
Forest Wild Fires	0.00%	UGB	No Growth - no increase in forest resources	No Growth
Slash Burning	0.00%	UGB	No Growth - no increase in forest resources	No Growth
Structural Fires	1.1%	UGB	Household Land Use / Zoning Based (Ref. 333)	Compound rate

NON-ROAD Growth	Growth Rate	Growth Area	Growth Rate Description	Growth Type
2-, 4-Stroke & Diesel				
Recreational Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Construction Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Industrial Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Lawn / Garden Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Agricultural Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Light Commercial Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Logging Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Air Service Equipment	1.28%	UGB	Population Land Use / Zoning Based (Ref. 333)	Linear, Non-Compounding
Railroads	1.40%	UGB	BEA, Industrial Employment (SIC Employees)	Linear, Non-Compounding

MOBILE SOURCE Growth	Growth Rate	Growth Area	Growth Rate Description	Growth Type
Mobile Sources - average all vehicle types		UGB	ODOT Travel Demand Model	Linear

ssl 7/23/99,10/1/99, 12/27/99 adjusted RWC growth rates

Appendix E, Table 2. Klamath Falls UGB 1996 CO Season: Summary of Annual and Seasonal Emissions Growth from 1996 to 2015

Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Tons per Year																			
	Actuals																			
POINT SOURCES (1)	705	715	725	632	641	649	588	596	603	611	619	626	634	641	649	657	664	672	679	687
Percent of Category	8%	8%	8%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	8%	8%	8%
	PSELs																			
POINT SOURCES psels	1,106	1,106	1,121	994	1,008	1,580	1,601	1,622	1,644	1,665	1,687	1,708	1,729	1,751	1,772	1,794	1,815	1,837	1,858	1,879
AREA SOURCES	1,766	1,775	1,784	1,846	1,860	1,870	1,880	1,890	1,900	1,910	1,920	1,930	1,940	1,950	1,960	1,970	1,980	1,990	2,000	2,010
Percent of Category	20%	20%	20%	21%	21%	21%	21%	21%	21%	21%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%
NON-ROAD SOURCES	1,664	1,686	1,707	1,729	1,750	1,771	1,793	1,814	1,836	1,857	1,878	1,900	1,921	1,943	1,964	1,986	2,007	2,028	2,050	2,071
Percent of Category	19%	19%	19%	19%	20%	20%	20%	20%	21%	21%	21%	21%	22%	22%	22%	22%	22%	23%	23%	23%
MOBILE SOURCES	4,795	4,764	4,732	4,701	4,669	4,637	4,606	4,574	4,543	4,511	4,479	4,448	4,416	4,385	4,353	4,321	4,290	4,258	4,227	4,195
Percent of Category	54%	53%	53%	53%	52%	52%	52%	52%	51%	51%	50%	50%	50%	49%	49%	48%	48%	48%	47%	47%
TOTAL ALL SOURCE	8,930	8,939	8,948	8,907	8,919	8,928	8,866	8,874	8,881	8,889	8,896	8,904	8,911	8,919	8,926	8,934	8,941	8,949	8,956	8,964
Total Percent	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Lbs per Day																			
	Actuals																			
POINT SOURCES (1)	3923	3978	4033	3528	3,575	3,623	3,288	3,331	3,373	3,416	3,458	3,501	3,543	3,586	3,628	3,671	3,713	3,756	3,798	3,841
Percent of Category	8%	9%	9%	8%	8%	8%	7%	7%	7%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	9%
	PSELs																			
POINT SOURCES psels	10,382	10,382	10,496	8,510	8,627	12,567	12,738	12,908	13,079	13,249	13,420	13,591	13,761	13,932	14,102	14,273	14,444	14,614	14,785	14,955
AREA SOURCES	11,586	11,617	11,649	12,067	12,095	12,124	12,153	12,181	12,210	12,238	12,267	12,295	12,324	12,352	12,381	12,409	12,438	12,467	12,495	12,524
Percent of Category	25%	25%	25%	26%	26%	26%	27%	27%	27%	27%	27%	27%	27%	27%	27%	28%	28%	28%	28%	28%
NON-ROAD SOURCES	4,074	4,126	4,179	4,231	4,284	4,336	4,389	4,441	4,494	4,546	4,599	4,651	4,704	4,756	4,809	4,861	4,914	4,967	5,019	5,072
Percent of Category	9%	9%	9%	9%	9%	9%	10%	10%	10%	10%	10%	10%	10%	11%	11%	11%	11%	11%	11%	11%
MOBILE SOURCES	26,734	26,558	26,383	26,207	26,032	25,856	25,681	25,506	25,330	25,155	24,979	24,804	24,628	24,453	24,278	24,102	23,927	23,751	23,576	23,400
Percent of Category	58%	57%	57%	57%	57%	56%	56%	56%	56%	55%	55%	55%	54%	54%	54%	54%	53%	53%	53%	52%
TOTAL ALL SOURCE	46,316	46,280	46,244	46,033	45,986	45,940	45,511	45,459	45,407	45,355	45,303	45,251	45,199	45,148	45,096	45,044	44,992	44,940	44,888	44,836
Total Percent	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Annual Mobile Source Growth as Generated from Season Day Emissions Above

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mobile Source Growth		0.993438	0.9869	0.9803	0.9738	0.967188	0.9606	0.95406	0.9475	0.9409	0.9344	0.9278	0.9213	0.9147	0.9081	0.9016	0.895002	0.8884	0.8819	0.8753

Note:
1) Point sources PSEL are included here for comparison purposes only. Actual point sources projected emissions are included in the total calculations.

Appendix E, Table E-3. Klamath Falls UGB CO SIP - 2015 Growth: Industrial Sources Emission Projections Using Actual Emissions

	Company Name	(1) 1996 Annual (tons/yr)	Daily (lbs/day)	(1) 2005 Annual (tons/yr)	Daily (lbs/day)	(1,2) 2015 Annual (tons/yr)	Daily (lbs/day)	1997 Plant Site Emission Limits Annual (tons/yr)	Seasonal (lbs/day)
18-0003	Co-Gen (3)	0	0	589	4,037	667	4572	558	3,823
18-0006	Jeld-Wen, Inc.	121	909	136	779	153	876	142	2,187
18-0013	Collins products, LLc	166	909	4	22	4	24	262	4,032
18-0014	Columbia Forest Products, Ink.	256	1,434	288	1614	324	1,815	499	3,050
18-0072	PG&E Gas Transmission	162	889	183	1,000	205	1,125	203	1,112
Total CO		(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)
Klamath Falls UGB + 25 mile radius		705	3,923	1,200	7,453	1,354	8,413	1,867	14,205

Notes:

1) Summary of the point source projection table and the PSEL table.
2) The 2015 projected actual emissions and the latest PSELs were compared for each source to determine if any excedences had occurred.
   Columbia Forest Product's baseline and current CO emission factors are changed in the Columbia Plywood draft Title V permit
   (Public Hearing is scheduled for October 27, 1999). The draft permit lists the CO baseline and current CO PSEL to be 90 tons/year and 14.4 lbs/hr.
   Since the EFs in the draft permit were not reproduced in the source test, the permit writer Thane Jennings recommended using the emission factors and
   PSEL values from the 1993 ACDP for this forecast. Both actual and PSEL emissions are likely to be overestimated by taking this approach.
   Jeld-Wen, Inc. is likely to exceed the PSEL by 2009.
3) 2001 is the starting year for Co-Gen because Co-Gen is currently under construction and likely to begin operation in the year 2001(According to Thane Jennings, Ref. 330).

ajb 7/29/97
ssl modified for Grants Pass 2/1/99
ssl modified for Klamath Falls 4/5/99, 9/30/99
ssl, 12/21/99

Appendix E, Table E-4. Klamath Falls UGB - CO Emission Growth Forecast 1996 - 2015 (SIP): Industrial Point Sources, Actual Emissions Basis (Without Co-Gen, Inc.[4])

	Company Name	1996 Annual (tons/yr)	1996 Daily (lbs/day)	1997 Annual (tons/yr)	1997 Daily (lbs/day)	1998 Annual (tons/yr)	1998 Daily (lbs/day)	1999 Annual (tons/yr)	1999 Daily (lbs/day)	2000 Annual (tons/yr)	2000 Daily (lbs/day)	2001 Annual (tons/yr)	2001 Daily (lbs/day)	2002 Annual (tons/yr)	2002 Daily (lbs/day)
	Growth Years from 1996 →	0		1		2		3		4		5		6	
SCC 21-02-004-000 & 21-02-006-001															
18-0006	Jeld-Wen, Inc.	[redacted]		123	702	125	712	126	721	128	731	130	741	131	750
18-0013	Collins products, LLC (5)	166	909	168	922	170	934	70	397	71	392	72	397	4	21
18-0014	Columbia Forest Prod., Inc.(6)	256	1,434	259	1454	263	1474	267	1494	270	1514	274	1534	277	1554
18-0072	PG&E Gas Transmissions	162	889	164	901	167	913	169	926	171	938	174	951	176	963
	Total CO	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)
	(Klamath Falls UGB + 25 mile radius)	705	3,923	715	3,978	725	4,033	632	3,528	641	3,575	649	3,623	588	3,288

	Company Name	2003 Annual (tons/yr)	2003 Daily (lbs/day)	2004 Annual (tons/yr)	2004 Daily (lbs/day)	2005 Annual (tons/yr)	2005 Daily (lbs/day)	2006 Annual (tons/yr)	2006 Daily (lbs/day)	2007 Annual (tons/yr)	2007 Daily (lbs/day)	2008 Annual (tons/yr)	2008 Daily (lbs/day)	2009 Annual (tons/yr)	2009 Daily (lbs/day)
	Growth Years from 1996 →	7		8		9		10		11		12		13	
SCC 21-02-004-000 & 21-02-006-001															
18-0006	Jeld-Wen, Inc.	133	760	135	770	136	779	138	789	140	799	141	809	143	818
18-0013	Collins products, LLC (5)	4	21	4	21	4	22	4	22	4	22	4	22	4	23
18-0014	Columbia Forest Prod., Inc.(6)	281	1574	285	1594	288	1614	292	1634	295	1654	299	1,675	302	1695
18-0072	PG&E Gas Transmissions	178	976	180	988	183	1000	185	1013	187	1025	189	1,038	192	1050
	Total CO	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)
	(Klamath Falls UGB + 25 mile radius)	596	3,331	603	3,373	611	3,416	619	3,458	626	3,501	634	3,543	641	3,586

	Company Name	2010 Annual (tons/yr)	2010 Daily (lbs/day)	2011 Annual (tons/yr)	2011 Daily (lbs/day)	2012 Annual (tons/yr)	2012 Daily (lbs/day)	2013 Annual (tons/yr)	2013 Daily (lbs/day)	2014 Annual (tons/yr)	2014 Daily (lbs/day)	2015 Annual (tons/yr)	2015 Daily (lbs/day)
	Growth Years from 1996 →	14		15		16		17		18		19	
SCC 21-02-004-000 & 21-02-006-001													
18-0006	Jeld-Wen, Inc.	145	828	147	838	148	847	150	857	152	867	153	876
18-0013	Collins products, LLC (5)	4	23	4	23	4	24	4	24	4	24	4	24
18-0014	Columbia Forest Prod., Inc.(6)	306	1715	310	1735	313	1755	317	1775	320	1795	324	1815
18-0072	PG&E Gas Transmissions	194	1063	196	1075	198	1088	201	1100	203	1112	205	1125
	Total CO	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)
	(Klamath Falls UGB + 25 mile radius)	649	3,628	657	3,671	664	3,713	672	3,756	679	3,798	687	3,841

Notes:
1) Actual emissions were used in the starting year of 1996.
2) The Growth Factor used in this Forecast is: 1.4% The source of this Growth factor is the Klamath Falls Industrial Employees Growth Factor (Ref.333)
3) A linear growth rate was used to project emissions out to 2015 using the 1996 actual emissions as a starting year. The equation used was:
"Emissions for a particular year" = "Starting Year Emissions" + [("Ind. pop. growth" * # of years after Starting Year") * "Starting Year Emissions"]
4) Co-Gen, Inc. is under construction as of the date of this future years projections (Fall 1999). Operation is likely to begin in year 2001accordingly to DEQ Inspector Thane Jennings, Ref. 330). However, Co-Gen was excluded from this forecast based on the recommendation of Tracy Oliver of the EPA, Ref. 406.
5) Collins Products permanently shut down boiler #7 in 1998. Average emissions from boiler #7 in 1996, 1997, an d1998 were 101 tons/yr (553 lbs/day).
Starting in year 1999 emissions from boiler 7 are subtracted from the total Collins Products emissions.
Collins Products' Emissions for years 2000 and 2001 were projected with the year 1999 as a starting year.
Collins Products' two remaining boilers (#8 and #9) are scheduled to be shut down shortly after CO Gen begins operation in 2001.
Co-Gen will cogenerate steam as part of the power production process. Collins Products will buy the steam from Co-Gen
to replace the steam it now generates from boilers 8 and 9. Therefore, Collins Products CO actual emissions will come from their core dryers and defibrators only
and emissions from boilers 8 and 9 are subtracted from the total actual emissions.
Collins Products' Emissions for the years 2003 - 2015 were projected with the year 2002 as a starting year based on 1996, 1997 and 1998 average of 3.7 tons/yr. or 20.7 lbs./day emitted from dryers and defibrators.
The information is from 11/25/99 conversation with Peter Brewer, Ref 351.
6) Columbia Forest Products Actual Emissions were estimated using the 1999 EPA AP-42 External Draft "Wood Waste Combustion in Boilers" EFs for boilers.
The choice of the Emission Factors is documented in Ref. 355.

Appendix E, Table E-4a. Klamath Falls UGB CO SIP - 2015 Growth: Industrial Sources Using PSEL Emissions (Without Co-Gen, Inc.[6])

	Company Name	1997 Annual (tons/yr)	1997 Daily (lbs/day)	1998 Annual (tons/yr)	1998 Daily (lbs/day)	1999 Annual (tons/yr)	1999 Daily (lbs/day)	2000 Annual (tons/yr)	2000 Daily (lbs/day)	2001 Annual (tons/yr)	2001 Daily (lbs/day)	2002 Annual (tons/yr)	2002 Daily (lbs/day)
Growth Years from 1997 SCC 21-02-004-000 & 21-02-006-001				1		2		3		4		5	
18-0006	Jeld-Wen, Inc. (note 1,4)	[redacted]	2,187	144	[redacted]	146	2218	148	2248	150	2279	152	2309
18-0013	Collins products (note 1, 5)	[redacted]	[redacted]	266	4088	127	2013	129	2041	130	2069	132	2098
18-0014	Columbia Forest Prod., Inc.(1)	[redacted]	[redacted]	506	3093	513	3136	520	3179	527	3221	534	3264
18-0072	PG&E Gas Transmission (1)	[redacted]	[redacted]	206	1,128	209	1,143	212	1,159	214	1,175	217	1,190
	Total CO (Klamath Falls UGB + 25 mile radius)	(tons/yr) 1,106	(lbs/day) 10,382	(tons/yr) 1,121	(lbs/day) 10,496	(tons/yr) 994	(lbs/day) 8,510	(tons/yr) 1,008	(lbs/day) 8,627	(tons/yr) 1,022	(lbs/day) 8,744	(tons/yr) 1,035	(lbs/day) 8,861

	Company Name	2003 Annual (tons/yr)	2003 Daily (lbs/day)	2004 Annual (tons/yr)	2004 Daily (lbs/day)	2005 Annual (tons/yr)	2005 Daily (lbs/day)	2006 Annual (tons/yr)	2006 Daily (lbs/day)	2007 Annual (tons/yr)	2007 Daily (lbs/day)	2008 Annual (tons/yr)	2008 Daily (lbs/day)
Growth Years from 1997 SCC 21-02-004-000 & 21-02-006-001		6		7		8		9		10		11	
18-0006	Jeld-Wen, Inc.	154	2,340	156	2,371	158	2,401	160	2,432	162	2,463	164	2,493
18-0013	Collins products, LLc	134	2126	136	2154	138	2182	139	2210	141	2238	143	2267
18-0014	Columbia Forest Prod., Inc.	541	3307	548	3349	555	3392	562	3435	569	3477	576	3520
18-0072	PG&E Gas Transmission	220	1,206	223	1,221	226	1,237	229	1,252	231	1,268	234	1,284
	Total CO (Klamath Falls UGB + 25 mile radius)	(tons/yr) 1,049	(lbs/day) 8,978	(tons/yr) 1,062	(lbs/day) 9,095	(tons/yr) 1,076	(lbs/day) 9,212	(tons/yr) 1,090	(lbs/day) 9,329	(tons/yr) 1,103	(lbs/day) 9,447	(tons/yr) 1,117	(lbs/day) 9,564

	Company Name	2009 Annual (tons/yr)	2009 Daily (lbs/day)	2010 Annual (tons/yr)	2010 Daily (lbs/day)	2011 Annual (tons/yr)	2011 Daily (lbs/day)	2012 Annual (tons/yr)	2012 Daily (lbs/day)	2013 Annual (tons/yr)	2013 Daily (lbs/day)	2014 Annual (tons/yr)	2014 Daily (lbs/day)	2015 Annual (tons/yr)	2015 Daily (lbs/day)
Growth Years from 1997 SCC 21-02-004-000 & 21-02-006-001		12		13		14		15		16		17		18	
18-0006	Jeld-Wen, Inc.	166	2,524	168	2,554	170	2,585	172	2,616	174	2,646	176	2,677	178	2,708
18-0013	Collins products, LLc	145	2295	146	2323	148	2351	150	2379	152	2408	153	2436	155	2464
18-0014	Columbia Forest Prod., Inc.	583	3563	590	3606	597	3648	604	3691	611	3734	618	3776	625	3819
18-0072	PG&E Gas Transmission	237	1,299	240	1,315	243	1,330	246	1,346	248	1,361	251	1,377	254	1,393
	Total CO (Klamath Falls UGB + 25 mile radius)	(tons/yr) 1,130	(lbs/day) 9,681	(tons/yr) 1,144	(lbs/day) 9,798	(tons/yr) 1,158	(lbs/day) 9,915	(tons/yr) 1,171	(lbs/day) 10,032	(tons/yr) 1,185	(lbs/day) 10,149	(tons/yr) 1,198	(lbs/day) 10,266	(tons/yr) 1,212	(lbs/day) 10,383

Notes:

1) PSELs are for 1997.
2) Growth Factor is a Klamath Falls Industrial Employees 1.4%
Growth Factor Ref.333.
3) A linear growth rate was used to project PSELs out to 2015 using the 1997 as a starting year.
The equation used was: Emissions for a particular year = Starting Year Emissions + [(Ind. empl growth factor * # of years after Start. Year) * Start. Year Emiss.]
4) Short term PSEL (Ref.330) :
Jeld Wen - 2187 lb./day in 1998 TV Permit.
Collins Products - 4032lb/day.
Columbia Forest Products - 127.1 lbs./hr in 3/31/93 ACDP.
Daily PSEL Emissions were calculated as 127.1 lbs./hr * 24hours/day.
PGE - short term PSEL in permit is an average of the annual.
5) Collins products PSEL is 126.85 tons/yr. and 2013 lbs./day in 1995 draft TV permit.
Collins Products permanently shut down boiler #7 in 1998.
Collins Products' PSEL Emission for years 2000-2015 were projected with the year 1999 as a starting year.
6) Co-Gen, Inc. is under construction as of the date of this future years projections (Fall 1999). Operation is likely to begin in year 2001accordingly to DEQ Inspector Thano Jennings, Ref. 330).
However, Co-Gen was excluded from this forecast based on the recommendation of Tracy Oliver of the EPA, Ref. 406.

Appendix E, Table E- 5. Klamath Falls UGB 1996 CO Season: Area Source Summary -
Annual & Seasonal CO Emission Growth for 1996, 2009, & 2015

Type of Growth	AREA SOURCE Category	1996 Annual Ton/yr	1996 Seasonal Lbs/DaY	2009 Annual Ton/yr	2009 Seasonal Lbs/Day	2015 Annual Ton/yr	2015 Seasonal Lbs/Day
	WASTE DISPOSAL, TREATMENT, & RECOVERY						
3	Commercial / Institutional On-Site Incineration	0.2	0.7	0.2	0.7	0.2	0.8
3	Commercial / Institutional Open Burning	6.1	33.3	6.9	38.0	7.3	40.2
4	Industrial Open Burning	27.9	153.3	33.0	181.2	35.3	194.0
2	Residential Open Burning	625.9	1,276.2	715.4	1,458.7	756.8	1,542.9
	Subtotal	660.1	1,463.4	755.5	1,678.6	799.6	1,778.0
	SMALL STATIONARY FUEL & WOOD USE						
	Industrial						
	Fuel Oil Combustion						
4	Distillate	3.3	21.0	3.9	24.8	4.1	26.5
4	Residual	0.3	1.6	0.3	1.9	0.3	2.1
4	Kerosene	Combined with Distillate					
4	Natural Gas Combustion	27.4	175.7	32.4	207.7	34.7	222.5
4	Liquid Petroleum Gas Combustion	1.2	7.8	1.4	9.2	1.5	9.9
	Industrial Subtotal	32.2	206.1	38.0	243.7	40.7	261.0
	Commercial / Institutional						
	Fuel Oil Combustion						
3	Distillate	0.9	8.1	1.0	9.3	1.1	9.8
3	Residual	0.1	1.0	0.1	1.2	0.1	1.3
3	Kerosene	Combined with Distillate					
3	Natural Gas Combustion	3.6	32.1	4.1	36.7	4.3	38.8
3	Liquid Petroleum Gas Combustion	0.0	0.4	0.0	0.4	0.1	0.5
	Commercial / Institutional Subtotal	4.6	41.7	5.3	47.6	5.6	50.4
	Residential						
	Fuel Oil Combustion						
2	Distillate	1.1	10.7	1.3	12.2	1.4	13.0
2	Residual	NA	NA	NA	NA	NA	NA
2	Kerosene	Combined with Distillate					
2	Natural Gas Combustion	8.4	78.2	9.6	89.4	10.1	94.6
2	Liquid Petroleum Gas Combustion	0.4	3.6	0.4	4.1	0.5	4.3
	Wood Combustion (note 1)						
6	Fireplaces	284.7	2,659.6	329.3	3,076.2	349.9	3,268.5
7	Woodstoves - Certified Catalytic	42.5	396.6	48.4	451.4	51.1	476.6
7	Woodstoves - Certified Non-Catalytic	171.9	1,605.9	195.7	1,827.4	206.6	1,929.6
8	Woodstoves - Conventional & FP Insert	511.9	4,781.3	447.8	4,183.1	418.3	3,907.0
9	Exempt Pellet Stoves	8.4	78.3	8.6	80.3	8.7	81.2
	RWC Subtotal	1,019.4	9,521.7	1,029.8	9,618.3	1,034.6	9,662.9
	Residential Subtotal	1,029.3	9,614.2	1,041.1	9,724.0	1,046.5	9,774.7
	SMALL POINT SOURCES (note 2)						
4	Permitted Sources (act. >5, PSELs <100 tons/year)	36.2	242.6	106.5	638.5	114.1	638.5
	SPS Subtotal	36.2	242.6	106.5	638.5	114.1	638.5
	MISCELLANEOUS AREA SOURCES						
	Other Combustion						
5	Forest Wild Fires	0.0	0.0	0.0	0.0	0.0	0.0
5	Slash Burning	0.0	0.0	0.0	0.0	0.0	0.0
2	Structural Fires	3.2	17.4	3.6	19.9	3.8	21.1
	Misc. Subtotal	3.2	17.4	3.6	19.9	3.8	21.1
	TOTAL EMISSIONS FROM AREA SOURCES	1,766	11,586	1,950	12,352	2,010	12,524

Notes: This table is a summary of data provided in detail in Table 6. "Area Source Summary - Annual Emission Growth from 1996 to 2015" and in Table 7, "Area Sources - Seasonal Emission Growth from 1996 to 2015."

Appe. E, Table E-6. Klamath Falls UGB 1996 CO Season: Area Sources - Summary of Annual Emission Growth from 1996 to 2015

Type of Growth	Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Years of Growth	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		Tons per Year																			
	WASTE DISPOSAL, TREATMENT, & RECOVERY																				
3	Commercial / Institutional On-Site Incineration	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
3	Commercial / Institutional Open Burning	6.1	6.1	6.2	6.3	6.3	6.4	6.5	6.5	6.6	6.7	6.7	6.8	6.9	6.9	7.0	7.1	7.1	7.2	7.3	7.3
4	Industrial Open Burning	27.9	28.3	28.7	29.1	29.5	29.8	30.2	30.6	31.0	31.4	31.8	32.2	32.6	33.0	33.4	33.8	34.1	34.5	34.9	35.3
2	Residential Open Burning	625.9	632.8	639.7	646.6	653.5	660.4	667.3	674.1	681.0	687.9	694.8	701.7	708.6	715.4	722.3	729.2	736.1	743.0	749.9	756.8
	Subtotal	660.1	667.4	674.7	682.1	689.4	696.8	704.1	711.5	718.8	726.2	733.5	740.8	748.2	755.5	762.9	770.2	777.6	784.9	792.3	799.6
	SMALL STATIONARY FUEL & WOOD USE																				
	Industrial																				
	Fuel Oil Combustion																				
4	Distillate	3.3	3.3	3.4	3.4	3.5	3.5	3.5	3.6	3.6	3.7	3.7	3.8	3.8	3.9	3.9	4.0	4.0	4.0	4.1	4.1
4	Residual	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
4	Kerosene	Combined with Distillate																			
4	Natural Gas Combustion	27.4	27.8	28.2	28.6	29.0	29.3	29.7	30.1	30.5	30.9	31.3	31.6	32.0	32.4	32.8	33.2	33.6	33.9	34.3	34.7
4	Liquid Petroleum Gas Combustion	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5
	Industrial Subtotal	32.2	32.6	33.1	33.5	34.0	34.4	34.9	35.3	35.8	36.2	36.7	37.1	37.6	38.0	38.5	38.9	39.4	39.8	40.3	40.7
	Commercial / Institutional																				
	Fuel Oil Combustion																				
3	Distillate	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1
3	Residual	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
3	Kerosene	Combined with Distillate																			
3	Natural Gas Combustion	3.6	3.6	3.7	3.7	3.7	3.8	3.8	3.9	3.9	3.9	4.0	4.0	4.1	4.1	4.1	4.2	4.2	4.2	4.3	4.3
3	Liquid Petroleum Gas Combustion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
	Commercial / Institutional Subtotal	4.6	4.7	4.7	4.8	4.8	4.9	4.9	5.0	5.1	5.1	5.2	5.2	5.3	5.3	5.4	5.4	5.5	5.5	5.6	5.6
	Residential																				
	Fuel Oil Combustion																				
2	Distillate	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4
2	Residual	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Kerosene	Combined with Distillate																			
2	Natural Gas Combustion	8.4	8.5	8.6	8.7	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.8	9.9	10.0	10.1
2	Liquid Petroleum Gas Combustion	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5
	Wood Combustion (note 1)																				
6	Fireplaces	284.7	288.2	291.6	295.0	298.5	301.9	305.3	308.8	312.2	315.6	319.0	322.5	325.9	329.3	332.8	336.2	339.6	343.1	346.5	349.9
7	Woodstoves - Certified Catalytic	42.5	42.9	43.4	43.8	44.3	44.8	45.2	45.7	46.1	46.6	47.0	47.5	47.9	48.4	48.8	49.3	49.7	50.2	50.6	51.1
7	Woodstoves - Certified Non-Catalytic	171.9	173.8	175.6	177.4	179.2	181.1	182.9	184.7	186.5	188.4	190.2	192.0	193.8	195.7	197.5	199.3	201.1	202.9	204.8	206.6
8	Woodstoves - Conventional & FP Insert	511.9	507.0	502.0	497.1	492.2	487.2	482.3	477.4	472.5	467.5	462.6	457.7	452.8	447.8	442.9	438.0	433.1	428.1	423.2	418.3
9	Exempt Pellet Stoves	8.4	8.4	8.4	8.4	8.4	8.5	8.5	8.5	8.5	8.5	8.5	8.6	8.6	8.6	8.6	8.6	8.6	8.7	8.7	8.7
	RWC Subtotal	1,019.4	1,020.2	1,021.0	1,021.8	1,022.6	1,023.4	1,024.2	1,025.0	1,025.8	1,026.6	1,027.4	1,028.2	1,029.0	1,029.8	1,030.6	1,031.4	1,032.2	1,033.0	1,033.8	1,034.6
	Residential Subtotal	1,029.3	1,030.2	1,031.1	1,032.0	1,033.0	1,033.9	1,034.8	1,035.7	1,036.6	1,037.5	1,038.4	1,039.3	1,040.2	1,041.1	1,042.0	1,042.9	1,043.8	1,044.7	1,045.6	1,046.5
	SMALL POINT SOURCES (note 2)																				
4	Permitted Sources (act. >5, PSELs <100 tons/year	36.2	36.7	37.2	90.1	95.1	96.4	97.7	98.9	100.2	101.5	102.7	104.0	105.2	106.5	107.8	109.0	110.3	111.5	112.8	114.1
	SPS Subtotal	36.2	36.7	37.2	90.1	95.1	96.4	97.7	98.9	100.2	101.5	102.7	104.0	105.2	106.5	107.8	109.0	110.3	111.5	112.8	114.1
	MISCELLANEOUS AREA SOURCES																				
	Other Combustion																				
5	Forest Wild Fires	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Slash Burning	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Structural Fires	3.2	3.2	3.2	3.3	3.3	3.3	3.4	3.4	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.7	3.8	3.8	3.8
	Misc. Subtotal	3.2	3.2	3.2	3.3	3.3	3.3	3.4	3.4	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.7	3.8	3.8	3.8
	TOTAL EMISSIONS FROM AREA SOURCES	1,766	1,775	1,784	1,846	1,860	1,870	1,880	1,890	1,900	1,910	1,920	1,930	1,940	1,950	1,960	1,970	1,980	1,990	2,000	2,010

Appendix E, Table E-6. Klamath Falls UGB 1996 CO Season: Area Sources - Summary of Annual Emission Growth from 1996 to 2015

Type	Klamath Falls UGB Growth Factors	%	Growth Parameter Data
1	Population (Zoning & Land Use Based)	1.28%	Linear, Non-Compounding
2	Housing Zoning & Land Use Projections	1.10%	Linear, Non-Compounding
3	Commerical Zoning & Land Use Projections	1.10%	Linear, Non-Compounding
4	Industrial Zoning & Land Use Projections	1.40%	Linear, Non-Compounding
See Below	Residential wood combustion	-	Housing, Wood Usage, Fraction of Existing &
"	"	see shaded	New Housing Equipped with Wood Burning Units
"	"	area below	(Linear, Non-Compounding)
5	Wildfires, Slashburning	0.00%	No Growth
	See DEQ reference 333 Growth formula applied to years 1997 to 2015 = (1996 lbs/day) + ((applicable growth rate) * (years of growth) * (1996 lbs/day))		

Special Growth Rate Break Down for Residential Wood Combustion Subcategories

Type	RWC Device Type	Device Growth Rates		Emissions Growth Rates	
6	Fireplace (No Insert)	1.16%	Linear, calculated in Table 12a based on the Oregon 1999 Woodheating Survey, Ref. 348	[illegible]	Linear, calculated as (2015 est. emissions - 1996 est. emissions)/1996 est. emissions/19
7	Total Certified Woodstoves	1.03%		[illegible]	
8	Woodstove (Non-Cert.) & FP Inserts	-0.96%		[illegible]	
9	Woodburning Pellet Stove	0.20%		[illegible]	
	Total	0.22%		[illegible]	

Notes:
1) RWC (Residential Wood Combustion) growth data is explained in the Table11, "Summary of Emission Growth from Residential Wood Combustion".
1996 values are from Table 2.4.6 in the base year inventory; 1997-2015 projected values are from Table 11 in 1996-2015 forecast.
2) Kingsley Field ANB (18-0097) PSEL (13 tons/yr in 1996) were increased to 54.6 tons/yr in 1999 ACDP.

Klamath Veneer PSEL in1999 ACDP is 35.5 tons/yr. 2000-2015 projections are based on the 1999 ACDP PSEL for both sources.

Small point sources total PSELs are calculated as 54.6 + 35.5.
1996-1998 projections are based on the 1996 ACDP PSEL for Kingsley Field ANB and 1996 actual reported emissions for Klamath Veneer.
See Table 2.4.14 in the base year inventory for detailed explanation.

pendix E, Table E-7. K ... th Falls UGB 1996 CO Season: Area Sources - Summary of Seasonal Emission G... th from 1996 to 2015

e of wth	Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Years of Growth:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		Lbs per Day																			
	WASTE DISPOSAL, TREATMENT & RECOVERY																				
	Commercial / Institutional On-Site Incineration	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Commercial / Institutional Open Burning	33	34	34	34	35	35	35	36	36	37	37	37	38	38	38	39	39	40	40	40
	Industrial Open Burning	153	155	158	160	162	164	166	168	170	173	175	177	179	181	183	185	188	190	192	194
	Residential Open Burning	1276	1290	1304	1318	1332	1346	1360	1374	1388	1403	1417	1431	1445	1459	1473	1487	1501	1515	1529	1543
	sposal, Treatment & Recovery" Area Sources - Subtotal	1463	1480	1496	1513	1530	1546	1563	1579	1596	1612	1629	1646	1662	1679	1695	1712	1728	1745	1761	1778
	SMALL STATIONARY FUEL & WOOD USE																				
	Industrial																				
	Fuel Oil Combustion																				
	Distillate	21	21	22	22	22	22	23	23	23	24	24	24	24	25	25	25	26	26	26	27
	Residual	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Kerosene	Combined with Distillate																			
	Natural Gas Combustion	176	178	181	183	186	188	191	193	195	198	200	203	205	208	210	213	215	218	220	222
	Liquid Petroleum Gas Combustion	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	10	10	10	10
	Industrial Subcategory - Subtotal	206	209	212	215	218	221	223	226	229	232	235	238	241	244	247	249	252	255	258	261
	Commercial / Institutional																				
	Fuel Oil Combustion																				
	Distillate	8	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9	10	10	10	10
	Residual	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Kerosene	Combined with Distillate																			
	Natural Gas Combustion	32	32	33	33	34	34	34	35	35	35	36	36	36	37	37	37	38	38	38	39
	Liquid Petroleum Gas Combustion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Commercial / Institutional Subcategory - Subtotal	42	42	43	43	44	44	44	45	45	46	46	47	47	48	48	49	49	49	50	50
	Residential																				
	Fuel Oil Combustion																				
	Distillate	11	11	11	11	11	11	11	12	12	12	12	12	12	12	12	12	13	13	13	13
	Residual	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kerosene	Combined with Distillate																			
	Natural Gas Combustion	78	79	80	81	82	83	83	84	85	86	87	88	89	89	90	91	92	93	94	95
	Liquid Petroleum Gas Combustion	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Wood Combustion (see note 1)																				
0	Fireplaces	2660	2692	2724	2756	2788	2820	2852	2884	2916	2948	2980	3012	3044	3076	3108	3140	3172	3204	3236	3268
1	Woodstoves - Certified Catalytic	397	401	405	409	413	418	422	426	430	435	439	443	447	451	456	460	464	468	472	477
1	Woodstoves - Certified Non-Catalytic	1606	1623	1640	1657	1674	1691	1708	1725	1742	1759	1776	1793	1810	1827	1844	1861	1878	1896	1913	1930
2	Woodstoves - Conventional & FP Insert	4781	4735	4689	4643	4597	4551	4505	4459	4413	4367	4321	4275	4229	4183	4137	4091	4045	3999	3953	3907
3	Exempt Pellet Stoves	78	78	79	79	79	79	79	79	80	80	80	80	80	80	80	81	81	81	81	81
	esidential Woodstove Combustion Grouping - Subtotal	9522	9529	9537	9544	9551	9559	9566	9574	9581	9589	9596	9603	9611	9618	9626	9633	9641	9648	9655	9663
	Residential Subcategory - Subtotal	9614	9623	9631	9640	9648	9656	9665	9673	9682	9690	9699	9707	9716	9724	9732	9741	9749	9758	9766	9775
	SMALL POINT SOURCES (see note 2)																				
	Permitted Sources (>5, <100 tons/year)	243	246	249	638	638	638	638	638	638	638	638	638	638	638	638	638	638	638	638	638
	Small Point Sources - Subtotal	243	246	249	638	638	638	638	638	638	638	638	638	638	638	638	638	638	638	638	638
	MISCELLANEOUS AREA SOURCES																				
	Other Combustion																				
	Forest Wild Fires	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Slash Burning	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Structural Fires	17	18	18	18	18	18	19	19	19	19	19	20	20	20	20	20	21	21	21	21
	Miscellaneous Area Sources - Subtotal	17	18	18	18	18	18	19	19	19	19	19	20	20	20	20	20	21	21	21	21
	TOTAL EMISSIONS FROM AREA SOURCES	11,586	11,617	11,649	12,067	12,095	12,124	12,153	12,181	12,210	12,238	12,267	12,295	12,324	12,352	12,381	12,409	12,438	12,467	12,495	12,524

Appendix E, Table E-7. Klamath Falls UGB 1996 CO Season: Area Sources - Summary of Seasonal Emission Growth from 1996 to 2015

Growth Rate Factors and Types

Type	Klamath Falls UGB Growth Factors	Annual Growth	Growth Parameter Data
1	Population (Zoning & Land Use Based)	1.28%	Linear, Non -compounding
2	Housing Zoning & Land Use Projections	1.10%	Compound rate
3	Commercial Zoning & Land Use Projections	1.10%	Linear, Non-Compounding
4	Industrial Zoning & Land Use Projections	1.40%	Linear, Non-Compounding
see next table below	Residential wood combustion " " " " " " " "	*see shaded area below* " " " "	Housing, Wood Usage, Fraction of Existing & New Housing Equipped with Wood Burning Units (Linear, Non-Compounding)
5	Wildfires, Slashburning	0.00%	No Growth

Growth rates are from DEQ Reference # 333
Growth formula applied, years 1997 to 2015 = (1996 lbs/day) + [(applicable growth rate) * (years of growth) * (1996 lbs/day)]

Special Growth Rate Break Down for Residential Wood Combustion (RWC) Subcategories

Type	RWC Device Type	Device Growth Rates		Emissions Growth Rates	
6	Fireplace (No Insert)	1.16%	Linear, calculated in Table 12a based on the Oregon 1999 Woodheating Survey data, Ref.348	[illegible]	Linear, calculated as (2015 est. emissions - 1996 est. emissions)/1996 est. emissions/19
7	Total Certified Woodstoves	1.03%		[illegible]	
8	Woodstove (Non-Cert.) & FP Inserts	-0.96%		[illegible]	
9	Woodburning Pellet Stove	0.20%		[illegible]	
	Total	0.22%		[illegible]	

Notes
1) RWC (Residential Wood Combustion) growth data is explained in the Table11, "Summary of Emission Growth from Residential Wood Combustion".
1996 values are from Table 2.4.6 in the base year inventory; 1997-2015 projected values are from Table 11 in 1996-2015 forecast.
2) 1996-1998 projections are based on the 1996 ACDP PSEL for Kingsley Field AND and 1996 actual reported emissions for Klamath Veneer.
2000-2015 projections are based on the 1999 ACDP PSEL. Kingsley Field ANB (18-0097) PSEL (13 tons/yr in 1996) were increased to 54.6 tons/yr in 1999 ACDP.

Appendix E, Table 8 Klamath Falls UGB 1996 CO Season: Non-Road Summary Annual & Seasonal Emission Growth from 1996 to 2015

Type of Growth	Category	1996 Tons/Yr	1996 Lbs/Day	2009 Tons/Yr	2009 Lbs/Day	2015 Tons/Yr	2015 Lbs/Day
	GASOLINE VEHICLES, TWO CYCLE						
1	Recreational Equipment	0.0	0.0	0.0	0.0	0.0	0.0
1	Construction Equipment	2.2	6.6	2.6	7.7	2.8	8.2
1	Industrial Equipment	20.7	112.4	24.1	131.1	25.7	139.8
1	Lawn / Garden Equipment	132.9	8.8	155.1	10.3	165.4	11.0
1	Agricultural Equipment	0.0	0.0	0.0	0.0	0.0	0.0
1	Light Commercial Equipment	17.1	92.5	19.9	108.0	21.3	115.1
1	Logging Equipment	0.0	0.0	0.0	0.0	0.0	0.0
1	Air Service Equipment	0.1	0.0	0.1	0.0	0.1	0.0
	Two Cycle Subtotal	173.0	220.3	201.9	257.1	215.3	274.1
	GASOLINE VEHICLES, FOUR CYCLE						
1	Recreational Equipment	0.0	0.0	0.0	0.0	0.0	0.0
1	Construction Equipment	28.5	61.7	33.2	72.0	35.4	76.8
1	Industrial Equipment	68.1	368.0	79.5	429.4	84.8	457.8
1	Lawn / Garden Equipment	742.8	24.2	866.9	28.3	924.2	30.2
1	Agricultural Equipment	0.0	0.0	0.0	0.0	0.0	0.0
1	Light Commercial Equipment	335.2	1,811.2	391.2	2,113.8	417.1	2,253.4
1	Logging Equipment	0.0	0.0	0.0	0.0	0.0	0.0
1	Air Service Equipment	20.7	112.4	24.1	131.1	25.7	139.8
	Four Cycle Subtotal	1,195.3	2,377.5	1,395.0	2,774.6	1,487.1	2,957.9
	GASOLINE VEHICLES, DIESEL CYCLE						
1	Recreational Equipment	0.0	0.0	0.0	0.0	0.0	0.0
1	Construction Equipment	43.7	97.0	51.0	113.1	54.3	120.6
1	Industrial Equipment	3.6	17.6	4.2	20.6	4.4	21.9
1	Lawn / Garden Equipment	0.4	0.0	0.5	0.0	0.6	0.0
1	Agricultural Equipment	0.0	0.0	0.0	0.0	0.0	0.0
1	Light Commercial Equipment	1.5	8.8	1.7	10.3	1.8	11.0
1	Logging Equipment	0.0	0.0	0.0	0.0	0.0	0.0
1	Air Service Equipment	8.5	46.3	9.9	54.0	10.6	57.6
	Diesel Subtotal	57.6	169.7	67.3	198.0	71.7	211.1
	VEHICLE SUBTOTAL	1,426.0	2,767.5	1,664.2	3,229.8	1,774.1	3,443.1
3	*AIRCRAFT*	208.5	1,142.6	243.4	1,333.5	259.4	1,421.5
	AIRCRAFT SUBTOTAL	208.5	1,142.6	243.4	1,333.5	259.4	1,421.5
2	*RAILROADS*	29.7	163.4	35.2	193.2	37.7	206.9
	RAILROAD SUBTOTAL	29.7	163.4	35.2	193.2	37.7	206.9
	TOTAL NON-ROAD	1,664	4,074	1,943	4,756	2,071	5,072

Appendix E, Table 9. Klamath Falls UGB 1996 CO Season: Non-Road Summary Annual Emission Growth from 1996 to 2015

Type of Growth	Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
(1)	Years of Growth	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		Tons per Year																			
	GASOLINE VEHICLES, TWO CYCLE																				
1	Recreational Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Construction Equipment	2.2	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.6	2.6	2.6	2.7	2.7	2.7	2.8	2.8
1	Industrial Equipment	20.7	20.9	21.2	21.5	21.7	22.0	22.3	22.5	22.8	23.1	23.3	23.6	23.9	24.1	24.4	24.6	24.9	25.2	25.4	25.7
1	Lawn / Garden Equipment	132.9	134.6	136.3	138.0	139.8	141.5	143.2	144.9	146.6	148.3	150.0	151.7	153.4	155.1	156.8	158.5	160.3	162.0	163.7	165.4
1	Agricultural Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Light Commercial Equipment	17.1	17.3	17.5	17.7	18.0	18.2	18.4	18.6	18.8	19.1	19.3	19.5	19.7	19.9	20.2	20.4	20.6	20.8	21.0	21.3
1	Logging Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Air Service Equipment	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Two Cycle Subtotal	173.0	175.2	177.5	179.7	181.9	184.1	186.4	188.6	190.8	193.0	195.3	197.5	199.7	201.9	204.1	206.4	208.6	210.8	213.0	215.3
	GASOLINE VEHICLES, FOUR CYCLE																				
1	Recreational Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Construction Equipment	28.5	28.8	29.2	29.6	29.9	30.3	30.7	31.0	31.4	31.8	32.1	32.5	32.9	33.2	33.6	34.0	34.3	34.7	35.1	35.4
1	Industrial Equipment	68.1	69.0	69.9	70.8	71.6	72.5	73.4	74.3	75.1	76.0	76.9	77.8	78.6	79.5	80.4	81.3	82.1	83.0	83.9	84.8
1	Lawn / Garden Equipment	742.8	752.4	761.9	771.4	781.0	790.5	800.1	809.6	819.2	828.7	838.3	847.8	857.3	866.9	876.4	886.0	895.5	905.1	914.6	924.2
1	Agricultural Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Light Commercial Equipment	335.2	339.5	343.8	348.1	352.4	356.8	361.1	365.4	369.7	374.0	378.3	382.6	386.9	391.2	395.5	399.8	404.1	408.4	412.7	417.1
1	Logging Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Air Service Equipment	20.7	20.9	21.2	21.5	21.7	22.0	22.3	22.5	22.8	23.1	23.3	23.6	23.9	24.1	24.4	24.6	24.9	25.2	25.4	25.7
	Four Cycle Subtotal	1,195.3	1,210.7	1,226.0	1,241.4	1,256.8	1,272.1	1,287.5	1,302.8	1,318.2	1,333.5	1,348.9	1,364.3	1,379.6	1,395.0	1,410.3	1,425.7	1,441.1	1,456.4	1,471.8	1,487.1
	GASOLINE VEHICLES, DIESEL CYCLE																				
1	Recreational Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Construction Equipment	43.7	44.2	44.8	45.4	45.9	46.5	47.0	47.6	48.2	48.7	49.3	49.8	50.4	51.0	51.5	52.1	52.7	53.2	53.8	54.3
1	Industrial Equipment	3.6	3.6	3.7	3.7	3.8	3.8	3.9	3.9	3.9	4.0	4.0	4.1	4.1	4.2	4.2	4.3	4.3	4.4	4.4	4.4
1	Lawn / Garden Equipment	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6
1	Agricultural Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Light Commercial Equipment	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.8
1	Logging Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Air Service Equipment	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0	10.1	10.2	10.3	10.5	10.6
	Diesel Subtotal	57.6	58.4	59.1	59.9	60.6	61.3	62.1	62.8	63.6	64.3	65.0	65.8	66.5	67.3	68.0	68.7	69.5	70.2	71.0	71.7
	VEHICLE SUBTOTAL	1,426.0	1,444.3	1,462.6	1,481.0	1,499.3	1,517.6	1,535.9	1,554.2	1,572.6	1,590.9	1,609.2	1,627.5	1,645.8	1,664.2	1,682.5	1,700.8	1,719.1	1,737.5	1,755.8	1,774.1
3	AIRCRAFT	208.5	211.2	213.9	216.6	219.2	221.9	224.6	227.3	230.0	232.6	235.3	238.0	240.7	243.4	246.0	248.7	251.4	254.1	256.8	259.4
	AIRCRAFT SUBTOTAL	208.5	211.2	213.9	216.6	219.2	221.9	224.6	227.3	230.0	232.6	235.3	238.0	240.7	243.4	246.0	248.7	251.4	254.1	256.8	259.4
2	RAILROADS	29.7	30.2	30.6	31.0	31.4	31.8	32.2	32.7	33.1	33.5	33.9	34.3	34.7	35.2	35.6	36.0	36.4	36.8	37.2	37.7
	RAILROAD SUBTOTAL	29.7	30.2	30.6	31.0	31.4	31.8	32.2	32.7	33.1	33.5	33.9	34.3	34.7	35.2	35.6	36.0	36.4	36.8	37.2	37.7
	TOTAL NON-ROAD	1,664	1,686	1,707	1,729	1,750	1,771	1,793	1,814	1,836	1,857	1,878	1,900	1,921	1,943	1,964	1,986	2,007	2,028	2,050	2,071

	Growth Factors - Klamath Falls UGB:	% Growth Parameter Data
1	Population	1.28% (Linear, Non-Compounding)
2	Railroads	1.40% Industrial Employment (Linear, Non-Compounding)
	Growth formula applied to years 1997 to 2015 = (1996 tons/year) + ((applicable growth rate) * (years of growth) * (1996 tons/year))	

1) Nonroad vehicles, excluding Railroads, were grown at the rate of linear population growth for the Klamath Falls UGB.
The population growth rate was applied to these nonroad categories because the base conversion from EPA's Spokane Nonroad Emission Study was proportioned on a per capita basis. In keeping with the reallocation to Klamath Falls on a per capita basis, the growth should also be applied using estimated population growth rates for the UGB.
The Klamath Falls population growth factor was estimated by K. Falls City Planner Cameron Gloss (Ref. 333) as 1.16% / year compound rate based on land use forecast.
However, a 1.28%/year linear population growth rate (which is equivalent to 1.16% compound rate, i.e. calculated based on the same 1996 and 2015 population numbers) was applied here to project the emissions assuming the linear growth better reflects the growth of the emissions than compound rate.

Appendix E, Table 10. Klamath Falls UGB 1996 CO Season: Non-Road Summary Seasonal Emission Growth from 1996 to 2015

Type of Growth	Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
(1)	Years of Growth	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Lbs per Day																				
	GASOLINE VEHICLES, TWO CYCLE																				
1	Recreational Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Construction Equipment	6.6	6.7	6.8	6.9	7.0	7.0	7.1	7.2	7.3	7.4	7.5	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.1	8.2
1	Industrial Equipment	112.4	113.8	115.3	116.7	118.2	119.6	121.0	122.5	123.9	125.4	126.8	128.3	129.7	131.1	132.6	134.0	135.5	136.9	138.4	139.8
1	Lawn / Garden Equipment	8.8	8.9	9.0	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.9	11.0
1	Agricultural Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Light Commercial Equipment	92.5	93.7	94.9	96.1	97.3	98.5	99.7	100.9	102.1	103.2	104.4	105.6	106.8	108.0	109.2	110.4	111.6	112.8	113.9	115.1
1	Logging Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Air Service Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Two Cycle Subtotal	220.3	223.2	226.0	228.8	231.7	234.5	237.3	240.2	243.0	245.8	248.7	251.5	254.3	257.1	260.0	262.8	265.6	268.5	271.3	274.1
	GASOLINE VEHICLES, FOUR CYCLE																				
1	Recreational Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Construction Equipment	61.7	62.5	63.3	64.1	64.9	65.7	66.5	67.2	68.0	68.8	69.6	70.4	71.2	72.0	72.8	73.6	74.4	75.2	76.0	76.8
1	Industrial Equipment	368.0	372.7	377.4	382.2	386.9	391.6	396.3	401.1	405.8	410.5	415.3	420.0	424.7	429.4	434.2	438.9	443.6	448.3	453.1	457.8
1	Lawn / Garden Equipment	24.2	24.5	24.9	25.2	25.5	25.8	26.1	26.4	26.7	27.0	27.4	27.7	28.0	28.3	28.6	28.9	29.2	29.5	29.8	30.2
1	Agricultural Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Light Commercial Equipment	1,811.2	1,834.5	1,857.8	1,881.0	1,904.3	1,927.6	1,950.9	1,974.1	1,997.4	2,020.7	2,043.9	2,067.2	2,090.5	2,113.8	2,137.0	2,160.3	2,183.6	2,206.8	2,230.1	2,253.4
1	Logging Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Air Service Equipment	112.4	113.8	115.3	116.7	118.2	119.6	121.0	122.5	123.9	125.4	126.8	128.3	129.7	131.1	132.6	134.0	135.5	136.9	138.4	139.8
	Four Cycle Subtotal	2,377.5	2,408.1	2,438.6	2,469.1	2,499.7	2,530.2	2,560.8	2,591.3	2,621.9	2,652.4	2,683.0	2,713.5	2,744.1	2,774.6	2,805.2	2,835.7	2,866.3	2,896.8	2,927.4	2,957.9
	GASOLINE VEHICLES, DIESEL CYCLE																				
1	Recreational Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Construction Equipment	97.0	98.2	99.4	100.7	101.9	103.2	104.4	105.7	106.9	108.2	109.4	110.7	111.9	113.1	114.4	115.6	116.9	118.1	119.4	120.6
1	Industrial Equipment	17.6	17.9	18.1	18.3	18.5	18.8	19.0	19.2	19.4	19.7	19.9	20.1	20.3	20.6	20.8	21.0	21.3	21.5	21.7	21.9
1	Lawn / Garden Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Agricultural Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Light Commercial Equipment	8.8	8.9	9.0	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.9	11.0
1	Logging Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Air Service Equipment	46.3	46.9	47.5	48.1	48.7	49.2	49.8	50.4	51.0	51.6	52.2	52.8	53.4	54.0	54.6	55.2	55.8	56.4	57.0	57.6
	Diesel Subtotal	169.7	171.8	174.0	176.2	178.4	180.6	182.7	184.9	187.1	189.3	191.5	193.6	195.8	198.0	200.2	202.4	204.5	206.7	208.9	211.1
	VEHICLE SUBTOTAL	2,767.5	2,803.1	2,838.6	2,874.2	2,909.7	2,945.3	2,980.9	3,016.4	3,052.0	3,087.5	3,123.1	3,158.7	3,194.2	3,229.8	3,265.3	3,300.9	3,336.4	3,372.0	3,407.6	3,443.1
3	AIRCRAFT	1,142.6	1,157.3	1,172.0	1,186.6	1,201.3	1,216.0	1,230.7	1,245.4	1,260.1	1,274.7	1,289.4	1,304.1	1,318.8	1,333.5	1,348.1	1,362.8	1,377.5	1,392.2	1,406.9	1,421.5
	AIRCRAFT SUBTOTAL	1,142.6	1,157.3	1,172.0	1,186.6	1,201.3	1,216.0	1,230.7	1,245.4	1,260.1	1,274.7	1,289.4	1,304.1	1,318.8	1,333.5	1,348.1	1,362.8	1,377.5	1,392.2	1,406.9	1,421.5
2	RAILROADS	163.4	165.7	168.0	170.3	172.6	174.9	177.1	179.4	181.7	184.0	186.3	188.6	190.9	193.2	195.4	197.7	200.0	202.3	204.6	206.9
	RAILROAD SUBTOTAL	163.4	165.7	168.0	170.3	172.6	174.9	177.1	179.4	181.7	184.0	186.3	188.6	190.9	193.2	195.4	197.7	200.0	202.3	204.6	206.9
	TOTAL NON-ROAD	4,074	4,126	4,179	4,231	4,284	4,336	4,389	4,441	4,494	4,546	4,599	4,651	4,704	4,756	4,809	4,861	4,914	4,966	5,019	5,072

	Klamath Falls UGB Growth Factors	%	Growth Parameter Data
1	Population (Zoning & Land Use Projection data)	1.28%	(Linear, Non - Compounding)
2	Railroads	1.40%	Industrial Employment (Linear, Non-Compounding)
	Growth formula applied to years 1997 to 2015 = (1996 lbs/day) + ((applicable growth rate) * (years of growth) * (1996 lbs/day))		

(1) Nonroad vehicles, excluding Railroads, were grown at the rate of linear population growth for the Klamath Falls UGB.
The Klamath Falls population growth factor was estimated by K. Falls City Planner Cameron Gloss (Ref. 333) as 1.16% / year compound rate based on land use forecast.
However, a 1.28%/year linear population growth rate (which is equivalent to 1.16% compound rate, i.e. calculated based on the same 1996 and 2015 population numbers) was applied here to project the emissions assuming the linear growth better reflects the growth of the emissions than compound rate.

Appendix E-11, Table E-11 Klamath Falls UGB 1996 to 2015 CO Season: Summary Emission Growth From Residential Wood Combustion

Actual Emissions Forecast

ANNUAL Emissions Growth from Residential Wood Combustion, Klamath Falls CO EI 1996 to 2015 (see note 11 for calculations methodology explanation).

Year:	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Years from 1996 >>>	[illegible]	1	2	3	4	5	6	7	8	9	10	11
	TONS/YEAR											
SCC 21-04-008-001 Fireplaces w/o insert	284.7	288.2	291.6	295.0	298.5	301.9	305.3	308.8	312.2	315.6	319.0	322.5
SCC 21-04-008-030 Certified Catalytic Wood-Stove	42.5	42.9	43.4	43.8	44.3	44.8	45.2	45.7	46.1	46.6	47.0	47.5
SCC 21-04-008-050 Cert. Non-Catalytic Wood Stove	171.9	173.8	175.6	177.4	179.2	181.1	182.9	184.7	186.5	188.4	190.2	192.0
SCC 21-04-008-051												
Conventional Wood-Stove or Fireplace Insert	511.9	507.0	502.0	497.1	492.2	487.2	482.3	477.4	472.5	467.5	462.6	457.7
SCC 21-04-008-053 Exempt Pellet Stoves	8.4	8.4	8.4	8.4	8.4	8.5	8.5	8.5	8.5	8.5	8.5	8.6
TOTAL	1,019	1,020	1,021	1,022	1,023	1,023	1,024	1,025	1,026	1,027	1,027	1,028

Year:	2008	2009	2010	2011	2012	2013	2014	2015
Years from 1996 >>>	12	13	14	15	16	17	18	19
TONS/YEAR								
SCC 21-04-008-001 Fireplaces w/o insert	325.9	329.3	332.8	336.2	339.6	343.1	346.5	349.9
SCC 21-04-008-030 Certified Catalytic Wood-Stove	47.9	48.4	48.8	49.3	49.7	50.2	50.6	51.1
SCC 21-04-008-050 Cert. Non-Catalytic Wood Stove	193.8	195.7	197.5	199.3	201.1	202.9	204.8	206.6
SCC 21-04-008-051								
Conventional Wood-Stove or Fireplace Insert	452.8	447.8	442.9	438.0	433.1	428.1	423.2	418.3
SCC 21-04-008-053 Exempt Pellet Stoves	8.6	8.6	8.6	8.6	8.6	8.7	8.7	8.7
TOTAL	1,029	1,030	1,031	1,031	1,032	1,033	1,034	1,035

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SEASONAL Emissions Growth from Residential Wood Combustion, Klamath Falls CO EI 1996 to 2015

Year:	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Years from 1996 >>>		1	2	3	4	5	6	7	8	9	10	11
	LBS/DAY											
SCC 21-04-008-001 Fireplaces w/o insert	2,660	2,692	2,724	2,756	2,788	2,820	2,852	2,884	2,916	2,948	2,980	3,012
SCC 21-04-008-030 Certified Catalytic Wood-Stove	397	401	405	409	413	418	422	426	430	435	439	443
SCC 21-04-008-050 Cert. Non-Catalytic Wood Stove	1,606	1,623	1,640	1,657	1,674	1,691	1,708	1,725	1,742	1,759	1,776	1,793
SCC 21-04-008-051												
Conventional Wood-Stove or Fireplace Insert	4,781	4,735	4,689	4,643	4,597	4,551	4,505	4,459	4,413	4,367	4,321	4,275
SCC 21-04-008-053 Exempt Pellet Stoves	78	78	79	79	79	79	79	79	80	80	80	80
TOTAL	9,532	9,529	9,537	9,544	9,551	9,559	9,566	9,574	9,581	9,589	9,596	9,603

Year:		2008	2009	2010	2011	2012	2013	2014	2015
Years from 1996 >>>		12	13	14	15	16	17	18	19
	LBS/DAY								
SCC 21-04-008-001 Fireplaces w/o insert		3,044	3,076	3,108	3,140	3,172	3,204	3,236	3,268
SCC 21-04-008-030 Certified Catalytic Wood-Stove		447	451	456	460	464	468	472	477
SCC 21-04-008-050 Cert. Non-Catalytic Wood Stove		1,810	1,827	1,844	1,861	1,878	1,896	1,913	1,930
SCC 21-04-008-051									
Conventional Wood-Stove or Fireplace Insert		4,229	4,183	4,137	4,091	4,045	3,999	3,953	3,907
SCC 21-04-008-053 Exempt Pellet Stoves		80	80	80	81	81	81	81	81
TOTAL		9,611	9,618	9,626	9,633	9,641	9,648	9,655	9,663

1996 Emission Calculations for Klamath Falls UGB CO

(1) Woodburning Device by Type & SCC No.	(2) CO NAA Wood Fuel Use (tons)	(3) CO EF (lbs/ton)	(4) Control Efficiency (CE) %	(5) Rule Effectiveness (RE)	(6) Rule Penetration (RP)	(7) Activity (d/wk)	(8) CO Season Adjustment (SAF)	(9) — CO Emissions — Annual (t/yr)	(10) — CO Emissions — CO Season (lbs/day)	(11) No. of Residential Wood Combustion (RWC) Devices in UGB for 1996
Klamath falls UGB Klamath County										
SCC 21-04-008-001 Fireplace w/out Insert	2,254	252.6		100	100	7	1.7	284.7	2,660	1269
	UGB Device Population:		1,269		Emissions per Device (14):			0.224	2.0954	
SCC 21-04-008-030 Certified Catalytic Wood-Stove	814	104.4	55	100	100	7	1.7	42.50	397	311
	UGB Device Population:		311		Emissions per Device (14):			0.137	1.2749	
SCC 21-04-008-050 Certified Non-Catalytic Wood-Stove	2,442	140.8	39	100	100	7	1.7	171.9	1,606	933
	UGB Device Population:		933		Emissions per Device (14):			0.184	1.721	
SCC 21-04-008-051 Conv. Wood-Stove or Fireplace Insert	4,436	230.8		100	100	7	1.7	511.9	4,781	1,652
	UGB Device Population:		1,652		Emissions per Device (14):			0.310	2.895	
SCC 21-04-008-053 Exempt Pellet Stoves	321	52.2		100	100	7	1.7	8.4	78	247
	UGB Device Population:		247		Emissions per Device (14):			0.034	0.316	
TOTAL	10,268							1,019	9,522	4,413
	UGB Device Population:		4,413		Emissions per Device (14):			0.231	2.158	

Notes:

1) Woodburning Device categories include:

Conventional Fireplaces without Inserts

DEQ Certified Catalytic Wood Stoves

DEQ Certified Non-Catalytic Wood Stoves

Total Conventional Wood Stoves and Fireplaces with Inserts

Exempt Pellet Stoves

2) Klamath Falls Tons Burned in wood stove devices =

(UGB Cords Burned per HU(for device)) * (Tons/Cord of wood) * (Number of K. Falls Housing Units) * (Distribution of the devices within RWC UGB HU).

For more detailed explanation see Appendix B, Table B-6.

3) Emission Factors (EF) are from AP-42 (Ref. 216), Table 1.9-2 and Table 1.10-2.

4) Control Efficiency (CE) estimated based on EPA guidance (Ref 165) and according to EIIP (Ref. 321)

reflected in lower emission factors of certified catalytic and non-catalytic woodstoves.

Control Efficiency = (1 - (Controlled Emissions / Uncontrolled Emissions)) catalytic woodstoves CE = (1-(104.4*1023.76)/(230.8*1023.76) = 54.77%

non-catalytic wood stoves CE = (1-(140.8*3071)/(230.8*3071) = 39%

5) Rule Effectiveness:

Rule Effectiveness is indicated through survey questionnaire results;

(see EPA guidance; EPA-452/R-92-010, Nov. 1992 (Ref. 165).

The survey was funded by Oregon DEQ

The effect of Oregon Administrative Rules (Chapter 340-34-010 and Chapter 340-3-400) is included in the calculations in Appendix B, Table B-6.

The percent rule effectiveness is directly determined as a result of this survey.

Rule Effectiveness applied to this category = 100 %

6) Rule Penetration:

Rule Penetration is indicated through survey questionnaire results; (see EPA guidance; EPA-452/R-92-010, Nov. 1992 (Ref. 165).

The survey was funded by Oregon DEQ

The effect of Oregon Administrative Rules (Chapter 340-34-010 and Chapter 340-3-400) is included in the calculations in Appendix B, Table B-6.

The percent rule penetration is directly determined as a result of this survey.

Rule Penetration applied to this category = 100 %

7) Activity is as the indicated number of days/week.

8) The Season Adjustment Factor (SAF) is taken from the EPA Procedures Document, Table 5.8-1 (Ref. 2a).

9) Annual Emissions (t/yr) = (Wood Fuel Use [tons] * EF [lbs/ton])/2000 [lbs/ton]. Control Efficiency is reflected in the EF

10) Season Emissions [lbs/day] = (((Annual Emissions [tons/yr] * 2000 [lbs/ton])*SAF) / (Activity [days/wk] * 52 [wks/yr])) * (1 - CE/100 * RE/100 * RP/100))

If uncontrolled EF is used to estimate annual emissions or ((Annual Emissions [tons/yr] * 2000 [lbs/ton])*SAF) / (Activity [days/wk] * 52 [wks/yr])

if controlled EF is used to estimate annual emissions.

11) The number of devices in the UGB (both main and back-up) in 1996 was calculated in Table 12a based on 1998/99 survey as follows:

1999 # of devices -((avg.# of devices added into existing HUs/year + avg. # of devices added in new HUs/year)* (1999-1996));

# of devices after 1999 was calculated as 1999 # of devices + (avg.# of devices added into existing HUs/year + avg. # of devices added in new HUs/year)* (# of years after 1999).

Since the survey does not break down the Cert. WS category , the Cert. Cat. Emissions are assumed to be 25% and non-cat. emissions are assumed to be 75% of the cert.ws category.

WS emissions and cert. Non-cat. are assumed to be 75% of certified.

GROWTH FACTORS

NEW and existing UGB RWC Housing Profile	Estimated UGB Annual Growth (main devices only) Devices/yr	Growth rates calculated in Table 12 and 12a :
Fireplace (No Insert)	15	(# of fireplaces in 2015 - # of fireplaces in 1996)/19 years
Total Certified WS	13	(# of Cert. WS in 2015 - 3 of Cert. WS in 1996)/19 years
Woodstove (Non-Cert.)	-16	(# of Non-Cert. WS in 2015 - # of Non-Cert. WS in 1996)/19 years
Non-Cert. Inserts	-1	(# of Non-Cert. Inserts in 2015 - # of Non-Cert. Inserts in 1996)/19 years
Woodburning Pellet Stove	0	(# of pellet stoves in 2015 - # of pelletstoves in 1996)/19 years

According to 1999 Survey about 55% of the UGB Population own woodburning devices while only about 26% of the UGB populaiton use their woodburning devices as a main device.

Potential device (main and back-up) population forecast is analyzed in Table 12a.

Actual device (main only) population forecast is analyzed in Table 12. Actual devices are assumed to grow with the growth rate similar to that of potential devices.

12) The number of actual (main) devices in the UGB was calculated in Table 12 as follows:

1999 # of actual devices in the UGB (from the 1999 Survey) + (1999 # of actual devices in the UGB *device specific growth rate * years since 1999).

Device specific growth rates were calculated in Table 12a as (2015 # of devices - 1996 # of devices)/1996# of devices/(2015-1996).

13) 1996 - 2015 emissions were projected as follows:

1996 emission + (((emissions/device * estimated # of new devices/year, existing housing profile) + (emissions/device * estimated # of new devices/year, new housing profile))* # of years since 1996)

14) Emissions per devices were calculated as follows:
Annual emissions per device = UGB annual CO emissions / UGB number of devices
Seasonal emissions per device = UGB seasonal CO emissions / UGB number of devices.

ssl, 9/23/99, 10/4/99
QA'd sda 09/29/1999

Appendix E, Table E-12. 1996-2015 Klamath Falls Actual (main devices) Woodstove Population Forecast

Device type	(4) 1996-2015 Growth rates
Fireplace (No Insert) (2)	1.16%
Woodstove (certified) (2)	1.03%
Noncertified Stoves (2)	-1.70%
Noncertified Inserts (2)	-0.22%
Pellet Stove (2)	0.20%
Total	0.22%

Distribution of devices used as a main device in the UGB

	Distribution of devices within wood burning HUs (7)	1996	1997	1998	1999 (3)	2000	2001	2002	2003	2004	2005	1996 number of devices	1996 Distribution of devices
PCT Housing Units Burning Wood (1)		27.2%	27.0%	26.7%	26.5%	26.3%	26.1%	25.9%	25.7%	25.4%	25.2%		
# of years since 1999		-3	-2	-1		1	2	3	4	5	6		
Total # of HUs in UGB (6)		16,223	16,402	16,583	16,767	16,952	17,139	17,328	17,520	17,713	17,909		
# of Devices (8)													
Woodburning HU with Fireplace (No Insert) (8)	29.6%	1,269	1,285	1,300	1,315	1,330	1,346	1,361	1,376	1,392	1,407	1,269	29%
Woodburning HU with Woodstove (certified) (8)	28.9%	1,244	1,258	1,271	1,284	1,297	1,310	1,324	1,337	1,350	1,363	1,244	28%
Noncertified Stoves(8)	21.1%	985	969	953	937	922	906	890	874	858	842	985	22%
Noncertified Inserts(8)	14.9%	666	665	664	662	661	659	658	656	655	653	666	15%
Woodburning HU with Pellet Stove(8)	5.6%	247	248	248	249	249	250	250	251	251	252	247	6%
Total	100%	4,413	4,424	4,436	4,443	4,459	4,471	4,482	4,494	4,506	4,517	4413	100%

Device/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2015 Number of devices	2015 Distribution of devices
PCT Housing Units Burning Wood (1)	25%	25%	25%	24%	24%	24%	24%	24%	23%	23%		
# of years since 1999	7	8	9	10	11	12	13	14	15	16		
Total # of HUs in UGB	18,107	18,307	18,509	18,713	18,920	19,129	19,340	19,554	19,770	19,988		
Woodburning HU with Fireplace (No Insert)	1,422	1,438	1,453	1,468	1,483	1,499	1,514	1,529	1,545	1,560	1,560	34%
Woodburning HU with Woodstove (certified)	1,376	1,390	1,403	1,416	1,429	1,442	1,456	1,469	1,482	1,495	1,495	32%
Noncertified Stoves	826	810	794	779	763	747	731	715	699	683	683	15%
Noncertified Inserts	652	650	649	647	646	644	643	641	640	638	638	14%
Woodburning HU with Pellet Stove	252	253	253	254	254	255	255	256	256	257	257	6%
Total	4,529	4,541	4,552	4,564	4,575	4,587	4,599	4,610	4,622	4,633	4,633	100%

This spreadsheet is used as a base for 1996 - 2015 CO emissions forecast.

Notes

(1) Calculated as Total number of main (excluding back-up)devices/Total # of HUs in UGB.

(2) Growth rates are calculated in Table 12a for potential (main and back-up devices) devices growth.

(3) 1998/99 Survey results are entered in 1999 column and used as base for 1996-1998 adjustment and 2000-2015 projections.

Number of devices in 1999 is calculated as pct of devices from the survey * total number of the main devices from the survey.

Total # of devices is calculated as 26.5% (HUs burning wood from the survey) * 1999 # of HUs in UGB.

26.5% of the UGB HUs are equipped with main wood burning devices according to *1999 Oregon Woodheating Survey*.

(4) Total Device (main and back-up) linear, non-compounding growth rates calculated in Table 12a as (2015 # of devices - 1996 # of devices)/1996 # of devices/19 years.

(5) Stove (Device) growth rate form 1996 to 2015	0.26%	Per year.
HUs growth rate is	1.1%	compound (Ref. 333) or
	1.2%	equivalent linear rate .

(6) Number of HUs in the UGB is calculated based on the 1996 number of HUs (Ref. 333) as follows:

1996 # of HUs * (1+ 1.1%) ^ # years since 1996.

(7) Survey data from "*Oregon DEQ Wood Heating Survey, 1999*" *explained in Appendix B*, Table B-6.

(8) Number of devices in 1996-1998 and 2000-2015 is projected based on the 1999 number of devices as follows:

1999 # of devices + (1999 # of devices * device specific growth rate (i.e. 1.16% for fireplaces) * # years since 1999).

Appendix E, Table E-12a. 1996-2015 Klamath Falls Potential (main and back-up devices) Woodstove Population Forecast

For detailed explanation of the growth rates see Table 13 "RWC Growth Rates"

New Construction Growth Rates	Units/yr	Notes
Fireplaces	30	(4)
Certified Stoves	4	(2)
Pellet Stoves	1	(2)
Noncertified Stoves	0	(3)
Change over in existing housing		
	Units/yr	Notes
Fireplaces	0	(8)
Certified Stoves	22	(5)
Pellet Stoves	0	(8)
Noncertified Stoves	-34	(11)
Noncertified Inserts	-3	(11)

1996-2015 HU growth rate (14): 1.1% (compound rate)

Main & Backup Wood Stoves

	Note #	1996 (10)	1997 (10)	1998 (10)	1999 (6)	2000 (10)	2001	2002	2003	2004	2005	1996 Number of devices	1996 Distribution of devices
PCT Housing Units Burning Wood (main and backup devices) (1)		55.2%	54.8%	54.3%	53.8%	53.3%	52.9%	52.4%	51.9%	51.5%	51.0%		
# of years since 1996			1	2	3	4	5	6	7	8	9		
Total # of HUs in the UGB	(9)	16,223	16,402	16,583	16,766	16,951	17,138	17,328	17,519	17,713	17,908	(12)	
# of Devices													
Woodburning HU with Fireplace (No Insert)		2,580	2,610	2,640	2,670	2,700	2,730	2,760	2,790	2,820	2,850	2,580	28.8%
Woodburning HU with Woodstove (certified)		2,529	2,555	2,581	2,607	2,633	2,659	2,685	2,711	2,737	2,763	2,529	28.2%
Noncertified Stoves		2,005	1,971	1,937	1,903	1,869	1,835	1,801	1,767	1,733	1,699	2,005	22.4%
Noncertified Inserts		1,344	1,341	1,338	1,335	1,332	1,329	1,326	1,323	1,320	1,317	1,344	15.0%
Woodburning HU with Pellet Stove		502	503	504	505	506	507	508	509	510	511	502	5.6%
Total # of the HUs with main and backup devices		8,960	8,980	9,000	9,020	9,040	9,060	9,080	9,100	9,120	9,140	8960	100%

Device/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2015 Number of devices	2015 Distribution of devices	1996-2015 Growth rates
PCT Housing Units Burning Wood (3)	50.6%	50.1%	49.7%	49.3%	48.8%	48.4%	48.0%	47.6%	47.1%	46.7%			
	10	11	12	13	14	15	16	17	18	19			
Total # of HUs in UGB	18,106	18,306	18,508	18,713	18,919	19,128	19,340	19,553	19,769	19,987			(13)
Woodburning HU with Fireplace (No Insert)	2,880	2,910	2,940	2,970	3,000	3,030	3,060	3,090	3,120	3,150	3,150	34%	1.16%
Woodburning HU with Woodstove (certified) (4)	2,789	2,815	2,841	2,867	2,893	2,919	2,945	2,971	2,997	3,023	3,023	32%	1.03%
Noncertified Stoves	1,665	1,631	1,597	1,563	1,529	1,495	1,461	1,427	1,393	1,359	1,359	15%	-1.70%
Noncertified Inserts	1,314	1,311	1,308	1,305	1,302	1,299	1,296	1,293	1,290	1,287	1,287	14%	-0.22%
Woodburning HU with Pellet Stove	512	513	514	515	516	517	518	519	520	521	521	6%	0.20%
Total	9,160	9,180	9,200	9,220	9,240	9,260	9,280	9,300	9,320	9,340	9,340	100%	0.22%

Notes

This spreadsheet was used for developing the device growth rates, but not the emission forecasts.

It is assumed that the growth rate for both the main and back-up wood stove heating devices as represented in the survey results

1) Calculated as Total number of devices/Total # of HUs in UGB.
2) According to David Collier's conversation with Allan Barnes, the Klamath County Building Department issues about 4-5 stove permits/year. Klamath County handles permitting for the City.
3) Illegal to install uncertified stoves.
4) Alan Barnes (@ 1-800-387-1304, County Building) says there would probably be about 30-40 wood burning fireplaces per year in new construction.
5) According to Carolyn Noller with Orley Stove & Spa who was contacted by David Collier, they typically sell 20--30 woodstoves/yr in the K. Falls urban area (combination new stoves & old stove replacements). Big R Stores sells 40-50 stoves/year , approximately 5% of which go to K. Falls UGB area (Ref. 353).
6) 1998/99 Survey results (from Table 13 RWC Growth Rates) are entered in 1999 column and used as base for 1996-1998 and 2000-2015 projections.

7) Device growth rate form 1996 to 2015 is 0.22% per year (linear rate).

8) We assume that there is no growth in fireplaces and pellet stoves in existing HUs.

9) HU estimated as follows: 1996 HUs in the UGB (Ref. 333)*(1+1.1% 1996-2015 HUs growth rate (Ref. 333)^ # of years since 1996.

10) Formula used for estimation # of devices in 1996-1998:

Woodburning HU with Fireplace (No Insert)	1998 =1999 # of fireplaces without inserts - # fireplaces installed in the existing HUs during 1999 - # fireplaces installed in new HUs during 1999.
Woodburning HU with Woodstove (certified)	1997 =1998 # of woodstoves - # woodstoves installed in the existing HUs during 1998 - # woodstoves installed in new HUs during 1998.
Noncertified Stoves	1996 =1997 # of noncertified stoves - # nonsertified stoves installed in the existing HUs during 1997 - # noncertified stoves installed in new HUs during 1997.
Noncertified Inserts	1996 =1997 # of noncertified inserts - # nonsertified inserts installed in the existing HUs during 1997 - # noncertified inserts installed in new HUs during 1997.
Woodburning HU with Pellet Stove	1996 =1997 # of pellet stoves - # pelletstoves installed in the existing HUs during 1997 - # pelletstoves installed in new HUs during 1997.

Formula used for estimation # of devices in 2000-2015:

2000 =1999 # of devices + # devices installed in the existing HUs during 2000 + # devices installed in new HUs during 2000.

11) Changeover in noncertified stoves in the existing HUs is from Table 13 RWC Growth Rates.

12) 1996 numbers were extrapolated from the 1999 survey.

Distribution of devices PCT calculated as number of particular kind of devices (i.e. 2,565 fireplaces) / total number of devices in the UGB (8,810).

13) Device growth rates calculated as (2015 # of devices - 1996 # of devices)/1996 # of devices/19 years.

14) HU compounded annual growth rate is from the Ref. 333 and was calculated as follows:((2015 estimated # of HUs/ 1996 3 of HUs) ^ 1/19) - 1

Appendix E, Tab... -13. Klamath Falls RWC Growth Rates

Population/Dwelling Projections (Growth rates are from Ref. 333)

1996 estimated UGB population	40,365	
1996 estimated UGB dwellings	16,223	
Est 1991 population based on 1991-1996 0.9%/yr linear annual growth	38,627	
Est 1991 dwellings based on 1991 - 1996 0.9%/yr linear annual growth	15,524	
Est 1993 population based on1993 -1996 0.9%/yr linear annual growth	39,304	HUs compound annual
Est 1993 dwellings based on 1993 - 1996 0.9%/yr annual linear growth	15,796	1996-2015 rate (7)
		1.1%
Est 1999 pop. based on 1996 -2015 1.16%/yr compounded annual growth	41,786	
Est 1999 dwellings based on 1996 - 2015 1.1%/yr comp.annual growth	16,766	

	1993 Klamath Falls UGB PCT	1993 Klamath # of Devices	Klamath Falls 1999 Based on 1998/99 survey results	KFalls 1999 # of Devices [redacted]	Six Year Trend 93-99 Based on # of Devices Total Change Device per year
Note	(8)	(9)	(10)	(11)	(12)
Housing Units with main & backup woodburning devices	48%	7,629			
			53.8%	9,020	232
Woodburning HU with Fireplace (No Insert)	19.0%	1,450			
Woodburning HU with Woodstove (certified) (4)	28.9%	2,205	29.6%	2,670	203
Woodburning HU with Woodstove (non-certified)	27.6%	2,106	28.9%	2,607	67
Woodburning HU with Fireplace Insert (non-cert.conventional)	17.7%	1,350	21.1%	1,903	-34
Total combined conventional stoves	45.3%	3,456	14.8%	1,335	-3
Woodburning HU with Pellet Stove	6.8%	519	35.9%	3,238	
	100%	7,629	5.6%	505	-2
			100.0%	9,020	

New Construction Growth Rates

	Units/yr	Notes
Fireplaces	30	(4)
Certified Stoves	4	(2)
Pellet Stoves	1	(2)
Noncertified Stoves	0	(3)
Change over in existing housing		
	Units/yr	Notes
Fireplaces	0	
Certified Stoves	22	(5,6)
Pellet Stoves	0	
Noncertifies Stoves	-37	(6)

1993 a... Klamath Falls survey data was analyzed along with the information received from the Klamath County Building Depa... d a local WS retailer " Orley Stove & SPA" in order to develop 1999-2015 RWC growth rates.

Notes

1) According to David Collier's conversation with Allan Barnes, the Klamath County Building Department issues about 4-5 stove permits/year. Klamath County handles permitting for the City.
2) Illegal to install uncertified stoves.
3) Alan Barnes (@ 1-800-387-1304, County Building) says there would probably be about 30-40 wood burning fireplaces per year in new construction.
4) According to Carolyn Noller with Orley Stove & Spa who was contacted by David Collier, they typically sell 20--30 woodstoves/yr in the K. Falls urban area (combination new stoves & old stove replacements).
5) 1998/99 Survey results are entered in 1999 column and used as base for 1996-1998 and 2000-2015 projections.
Big R stores sell 40-50 stoves/year approximately 5% of which go to K.Falls UGB area.
6) Non-certified stoves growth rates are based on the 1993-1999 trend.
7) HU compounded annual growth rate is from the Ref. 333 and was calculated as follows:((2015 estimated # of HUs/ 1996 3 of HUs) ^ 1/19) - 1

Appendix E, Table E14a: Klamath Falls UGB CO 2015 Summary of On Road Mobile Emissions by Vehicle Class

Inventory	Description	LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC	Total	Units
2015 CO	Annual	2,194	956	403	172	8	21	420	21	4195	Tons/year
2015 CO	Seasonal	12,238	5,335	2,246	959	47	117	2,340	117	23400	Lbs/day

Appendix E, Table E14b: Klamath Falls UGB CO 2015 Summary On Road Mobile Emissions by Roadway Type

Inventory	Description	Pural Principal Arterial	Rural Minor Arterial	Rural Major Collector	Minor Collector	Rural Local	Ramps	Off Network VMT Est.	Total/Units	Units
1996 CO	Annual	2,061	904	486	9	114	51	570	4195	Tons/year
1996 CO	Seasonal	11,029	4,839	3,063	54	719	321	3,375	23400	Lbs/day

Appendix E, Table 15a: Klamath Falls 2015 Mobile 5b Multiple Speed Input File

```
5
2015 Klamath Falls CO w/out Oxy, custom LDGV/LDDV 96 KFalls registration
1       TAMFLG  default
1       SPDFLG  One avg speed for all veh types
1       VMFLAG  MOBILE5 VMT mix
3       MYMRFG  input regist dist by age
1       NEWFLG  MOBILE5 basic exhaust emission rates
1       IMFLAG  No IM program
1       ALHFLG  No exhaust emission factor corrections
1       ATPFLG  No ATP is assumed
5       RLFLAG  Zero out no refueling EF's calculated
2       LOCFLG  One LAP record to apply to all scenarios
1       TEMFLG  Calculated from min max temperatures
4       OUTFMT  80 column format
2       PRTFLG  CO output only
1       IDLFLG  No idle emission factors calculated
3       NMHFLG  VOC emission factors
1       HCFLAG  Print only sum of all HC components
.046 .050 .054 .054 .049 .053 .049 .056 .057 .049    LDGV
.050 .047 .045 .030 .022 .024 .022 .034 .033 .029
.021 .013 .013 .015 .087
.055 .099 .098 .092 .097 .073 .062 .033 .027 .029    LDGT1
.031 .047 .044 .037 .028 .017 .023 .023 .019 .013
.010 .009 .008 .006 .020
.038 .072 .071 .059 .064 .070 .067 .056 .046 .039    LDGT2
.029 .069 .060 .051 .039 .025 .023 .025 .018 .014
.010 .011 .010 .007 .027
.036 .062 .063 .056 .058 .063 .062 .049 .042 .035    HDGV
.031 .065 .056 .050 .039 .032 .029 .033 .024 .018
.016 .016 .011 .011 .043
.046 .050 .054 .054 .049 .053 .049 .056 .057 .049    LDDV
.050 .047 .045 .030 .022 .024 .022 .034 .033 .029
.021 .013 .013 .015 .087
.055 .099 .098 .092 .097 .073 .062 .033 .027 .029    LDDT
.031 .047 .044 .037 .028 .017 .023 .023 .019 .013
.010 .009 .008 .006 .020
.057 .107 .103 .075 .080 .097 .089 .052 .046 .035    HDDV
.042 .047 .034 .028 .012 .014 .017 .019 .012 .009
.006 .005 .005 .002 .007
.144 .168 .135 .109 .088 .070 .056 .045 .036 .029    MC
.023 .097 .000 .000 .000 .000 .000 .000 .000 .000
.000 .000 .000 .000 .000
KF   2015 CO EF    17.3 41.9 13.6 13.6 20 1 1
4 15  5.0 27.3 20.6 27.3 20.6
01 1
4 15  6.0 27.3 20.6 27.3 20.6
01 1
4 15  7.0 27.3 20.6 27.3 20.6
01 1
4 15  8.0 27.3 20.6 27.3 20.6
01 1
4 15  9.0 27.3 20.6 27.3 20.6
01 1
4 15 10.0 27.3 20.6 27.3 20.6
01 1
4 15 11.0 27.3 20.6 27.3 20.6
01 1
4 15 12.0 27.3 20.6 27.3 20.6
```

```
01 1
4 15 13.0 27.3 20.6 27.3 20.6
01 1
4 15 14.0 27.3 20.6 27.3 20.6
01 1
4 15 15.0 27.3 20.6 27.3 20.6
01 1
4 15 16.0 27.3 20.6 27.3 20.6
01 1
4 15 16.8 27.3 20.6 27.3 20.6
01 1
4 15 17.0 27.3 20.6 27.3 20.6
01 1
4 15 17.8 27.3 20.6 27.3 20.6
01 1
4 15 18.0 27.3 20.6 27.3 20.6
01 1
4 15 19.0 27.3 20.6 27.3 20.6
01 1
4 15 20.0 27.3 20.6 27.3 20.6
01 1
4 15 21.0 27.3 20.6 27.3 20.6
01 1
4 15 22.0 27.3 20.6 27.3 20.6
01 1
4 15 22.9 27.3 20.6 27.3 20.6
01 1
4 15 23.0 27.3 20.6 27.3 20.6
01 1
4 15 24.0 27.3 20.6 27.3 20.6
01 1
4 15 25.0 27.3 20.6 27.3 20.6
01 1
4 15 26.0 27.3 20.6 27.3 20.6
01 1
4 15 26.1 27.3 20.6 27.3 20.6
01 1
4 15 27.0 27.3 20.6 27.3 20.6
01 1
4 15 28.0 27.3 20.6 27.3 20.6
01 1
4 15 29.0 27.3 20.6 27.3 20.6
01 1
4 15 30.0 27.3 20.6 27.3 20.6
01 1
4 15 31.0 27.3 20.6 27.3 20.6
01 1
4 15 32.0 27.3 20.6 27.3 20.6
01 1
4 15 33.0 27.3 20.6 27.3 20.6
01 1
4 15 34.0 27.3 20.6 27.3 20.6
01 1
4 15 35.0 27.3 20.6 27.3 20.6
01 1
4 15 36.0 27.3 20.6 27.3 20.6
01 1
4 15 37.0 27.3 20.6 27.3 20.6
01 1
4 15 38.0 27.3 20.6 27.3 20.6
```

```
01 1
4 15 39.0 27.3 20.6 27.3 20.6
01 1
4 15 40.0 27.3 20.6 27.3 20.6
01 1
4 15 41.0 27.3 20.6 27.3 20.6
01 1
4 15 42.0 27.3 20.6 27.3 20.6
01 1
4 15 43.0 27.3 20.6 27.3 20.6
01 1
4 15 44.0 27.3 20.6 27.3 20.6
01 1
4 15 45.0 27.3 20.6 27.3 20.6
01 1
4 15 46.0 27.3 20.6 27.3 20.6
01 1
4 15 47.0 27.3 20.6 27.3 20.6
01 1
4 15 48.0 27.3 20.6 27.3 20.6
01 1
4 15 49.0 27.3 20.6 27.3 20.6
01 1
4 15 50.0 27.3 20.6 27.3 20.6
01 1
4 15 51.0 27.3 20.6 27.3 20.6
01 1
4 15 52.0 27.3 20.6 27.3 20.6
01 1
4 15 53.0 27.3 20.6 27.3 20.6
01 1
4 15 54.0 27.3 20.6 27.3 20.6
01 1
4 15 55.0 27.3 20.6 27.3 20.6
01 1
4 15 56.0 27.3 20.6 27.3 20.6
01 1
4 15 57.0 27.3 20.6 27.3 20.6
01 1
4 15 58.0 27.3 20.6 27.3 20.6
01 1
4 15 59.0 27.3 20.6 27.3 20.6
01 1
4 15 60.0 27.3 20.6 27.3 20.6
01 1
4 15 61.0 27.3 20.6 27.3 20.6
01 1
4 15 62.0 27.3 20.6 27.3 20.6
01 1
4 15 63.0 27.3 20.6 27.3 20.6
01 1
4 15 64.0 27.3 20.6 27.3 20.6
01 1
4 15 65.0 27.3 20.6 27.3 20.6
01 1
```

Appendix E, Table 15b: Klamath Falls 2015 Mobile 5b multiple Speed Output File

2015 Klamath Falls CO w/out Oxy, custom LDGV/LDDV 96 KFalls registration
MOBILE5b (14-Sep-96)
0
-M 49 Warning:
+ 1.00 MYR sum not = 1. (will normalize)
-M 49 Warning:
+ 1.00 MYR sum not = 1. (will normalize)
-M170 Warning:
+ Exhaust emissions for gasoline fueled vehicles beginning in 1995 have been reduced as a result of Gasoline Detergent Additive Regulations (1994).
0KF 2015 CO EF
Minimum Temp: 17. (F) Maximum Temp: 42. (F)
Period 1 RVP: 13.6 Period 2 RVP: 13.6 Period 2 Yr: 2020
0VOC HC emission factors include evaporative HC emission factors.
0

0Emission factors are as of Jan. 1st of the indicated calendar year.
LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.532	0.223	0.094		0.040	0.002	0.005	0.098	0.005	
ZEV Fract:	0.00%	0.00%								
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	97.00	83.58	123.71	95.51	69.92	3.86	4.10	28.35	127.19	88.26

0Emission factors are as of Jan. 1st of the indicated calendar year.
LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	
VMT Mix:	0.532	0.223	0.094		0.040	0.002	0.005	0.098	0.005	
ZEV Fract:	0.00%	0.00%								
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	84.29	73.03	108.10	83.46	64.17	3.57	3.79	26.22	106.14	77.11

0Emission factors are as of Jan. 1st of the indicated calendar year.
LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits

0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	
VMT Mix:	0.532	0.223	0.094		0.040	0.002	0.005	0.098	0.005	
ZEV Fract:	0.00%	0.00%								
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	75.22	65.50	96.95	74.85	59.01	3.31	3.52	24.30	90.28	69.07

0Emission factors are as of Jan. 1st of the indicated calendar year.
LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0	
VMT Mix:	0.532	0.223	0.094		0.040	0.002	0.005	0.098	0.005	
ZEV Fract:	0.00%	0.00%								
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	68.41	59.85	88.59	68.40	54.39	3.07	3.26	22.56	78.12	62.97

0Emission factors are as of Jan. 1st of the indicated calendar year.
LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 34.2 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	
VMT Mix:	0.532	0.223	0.094		0.040	0.002	0.005	0.098	0.005	
ZEV Fract:	0.00%	0.00%								
0Composite Emission Factors (Gm/Mile)										
Exhst CO:	63.11	55.46	82.08	63.37	50.25	2.85	3.04	20.98	68.63	58.18

0Emission factors are as of Jan. 1st of the indicated calendar year.
LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015 Region: Low Altitude: 500. Ft.

```
                 I/M Program: No        Ambient Temp:   34.2 (F)
          Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
           Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 10.0   10.0   10.0           10.0   10.0   10.0   10.0   10.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 58.87  51.94  76.88  59.36  46.52   2.66   2.83  19.55  61.11  54.32

_______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                 I/M Program: No        Ambient Temp:   34.2 (F)
          Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
           Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 11.0   11.0   11.0           11.0   11.0   11.0   11.0   11.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 55.41  49.07  72.63  56.07  43.16   2.48   2.64  18.24  55.05  51.14

_______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                 I/M Program: No        Ambient Temp:   34.2 (F)
          Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
           Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 12.0   12.0   12.0           12.0   12.0   12.0   12.0   12.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 52.52  46.67  69.08  53.33  40.14   2.32   2.47  17.06  50.11  48.47

_______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                 I/M Program: No        Ambient Temp:   34.2 (F)
          Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
           Reformulated Gas: No
```

```
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 13.0   13.0   13.0           13.0   13.0   13.0   13.0   13.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 50.08  44.64  66.08  51.02  37.40   2.17   2.31  15.98  46.03  46.19

_____________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015             Region: Low           Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 14.0   14.0   14.0           14.0   14.0   14.0   14.0   14.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 47.98  42.90  63.50  49.03  34.93   2.04   2.17  15.00  42.60  44.23

_____________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015             Region: Low           Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 15.0   15.0   15.0           15.0   15.0   15.0   15.0   15.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 46.16  41.40  61.27  47.31  32.70   1.92   2.04  14.10  39.69  42.52

_____________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015             Region: Low           Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
```

```
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 16.0    16.0   16.0           16.0   16.0   16.0   16.0   16.0
   VMT Mix:  0.532  0.223  0.094           0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 44.58  40.08  59.32  45.80  30.68   1.81   1.92  13.29  37.19  41.02

______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low           Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 16.8    16.8   16.8           16.8   16.8   16.8   16.8   16.8
   VMT Mix:  0.532  0.223  0.094           0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 43.44  39.14  57.93  44.73  29.19   1.73   1.84  12.68  35.42  39.95

______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low           Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 17.0    17.0   17.0           17.0   17.0   17.0   17.0   17.0
   VMT Mix:  0.532  0.223  0.094           0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 43.17  38.92  57.60  44.47  28.84   1.71   1.81  12.54  35.01  39.70

______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low           Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 17.8    17.8   17.8           17.8   17.8   17.8   17.8   17.8
```

```
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 42.17  38.08  56.36  43.52  27.49   1.63   1.73  11.98  33.45  38.74
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 18.0   18.0   18.0          18.0   18.0   18.0   18.0   18.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 41.93  37.88  56.07  43.29  27.17   1.61   1.72  11.85  33.09  38.51
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 19.0   19.0   19.0          19.0   19.0   19.0   19.0   19.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 40.81  36.96  54.70  42.23  25.66   1.53   1.62  11.23  31.37  37.45
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                     I/M Program: No       Ambient Temp:   34.2 (F)
                Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 20.0   20.0   20.0          20.0   20.0   20.0   20.0   20.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
```

```
 Exhst  CO: 39.09  35.55  52.63  40.63  24.29   1.45   1.54  10.65  29.83  35.91
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 21.0   21.0   21.0           21.0   21.0   21.0   21.0   21.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 36.87  33.67  49.84  38.48  23.03   1.38   1.47  10.13  28.42  33.93
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 22.0   22.0   22.0           22.0   22.0   22.0   22.0   22.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 34.84  31.96  47.30  36.52  21.90   1.31   1.40   9.64  27.13  32.13
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 22.9   22.9   22.9           22.9   22.9   22.9   22.9   22.9
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 33.18  30.54  45.21  34.91  20.96   1.26   1.34   9.24  26.06  30.64
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 23.0   23.0   23.0          23.0   23.0   23.0   23.0   23.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 33.00  30.39  44.99  34.73  20.86   1.25   1.33   9.20  25.94  30.49

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 24.0   24.0   24.0          24.0   24.0   24.0   24.0   24.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 31.30  28.96  42.87  33.10  19.91   1.20   1.27   8.79  24.83  28.98

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 25.0   25.0   25.0          25.0   25.0   25.0   25.0   25.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 29.75  27.64  40.91  31.59  19.06   1.15   1.22   8.42  23.79  27.59

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
```

```
)User supplied veh registration distributions.
0Cal. Year: 2015              Region: Low          Altitude:  500. Ft.
                       I/M Program: No         Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 26.0   26.0   26.0           26.0   26.0   26.0   26.0   26.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 28.31  26.42  39.11  30.20  18.27   1.10   1.17   8.08  22.81  26.32

________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015              Region: Low          Altitude:  500. Ft.
                       I/M Program: No         Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 26.1   26.1   26.1           26.1   26.1   26.1   26.1   26.1
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 28.17  26.31  38.94  30.06  18.20   1.09   1.16   8.04  22.71  26.19

________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015              Region: Low          Altitude:  500. Ft.
                       I/M Program: No         Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No       Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 27.0   27.0   27.0           27.0   27.0   27.0   27.0   27.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 26.98  25.30  37.44  28.91  17.56   1.06   1.12   7.76  21.88  25.13

________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015              Region: Low          Altitude:  500. Ft.
                       I/M Program: No         Ambient Temp:   34.2 (F)
```

```
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 28.0   28.0   28.0           28.0   28.0   28.0   28.0   28.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 25.74  24.25  35.89  27.71  16.92   1.02   1.08   7.47  21.01  24.04

_______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low           Altitude:  500. Ft.
                     I/M Program: No         Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 29.0   29.0   29.0           29.0   29.0   29.0   29.0   29.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 24.59  23.28  34.45  26.60  16.33   0.98   1.04   7.21  20.19  23.02

_______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low           Altitude:  500. Ft.
                     I/M Program: No         Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
_____
 Veh. Spd.: 30.0   30.0   30.0           30.0   30.0   30.0   30.0   30.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 23.52  22.37  33.11  25.56  15.80   0.95   1.01   6.96  19.41  22.06

_______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low           Altitude:  500. Ft.
                     I/M Program: No         Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
```

```
0Veh. Type:  LDGV   LDGT1  LDGT2   LDGT    HDGV    LDDV    LDDT    HDDV    MC     All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 31.0   31.0   31.0           31.0    31.0    31.0    31.0    31.0
   VMT Mix:  0.532  0.223  0.094          0.040   0.002   0.005   0.098   0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 22.51  21.52  31.85  24.59  15.32   0.92    0.98    6.74   18.68  21.18

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV   LDGT1  LDGT2   LDGT    HDGV    LDDV    LDDT    HDDV    MC     All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 32.0   32.0   32.0           32.0    32.0    32.0    32.0    32.0
   VMT Mix:  0.532  0.223  0.094          0.040   0.002   0.005   0.098   0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 21.57  20.72  30.67  23.68  14.88   0.89    0.95    6.54   17.99  20.34

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV   LDGT1  LDGT2   LDGT    HDGV    LDDV    LDDT    HDDV    MC     All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 33.0   33.0   33.0           33.0    33.0    33.0    33.0    33.0
   VMT Mix:  0.532  0.223  0.094          0.040   0.002   0.005   0.098   0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 20.68  19.97  29.56  22.82  14.49   0.86    0.92    6.35   17.34  19.56

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
                 Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV   LDGT1  LDGT2   LDGT    HDGV    LDDV    LDDT    HDDV    MC     All
Veh
```

```
+                ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 34.0   34.0   34.0           34.0   34.0   34.0   34.0   34.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 19.85  19.26  28.51  22.01  14.15   0.84   0.89   6.18  16.74  18.83

________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+                ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 35.0   35.0   35.0           35.0   35.0   35.0   35.0   35.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 19.07  18.60  27.53  21.25  13.84   0.82   0.87   6.03  16.17  18.14

________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+                ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 36.0   36.0   36.0           36.0   36.0   36.0   36.0   36.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 18.32  17.97  26.60  20.54  13.56   0.80   0.85   5.89  15.65  17.49

________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+                ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 37.0   37.0   37.0           37.0   37.0   37.0   37.0   37.0
```

```
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 17.62  17.38  25.72  19.86  13.33   0.78   0.83   5.76  15.16  16.88
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                   I/M Program: No        Ambient Temp:   34.2 (F)
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 38.0   38.0   38.0          38.0   38.0   38.0   38.0   38.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 16.96  16.81  24.89  19.21  13.12   0.77   0.82   5.65  14.71  16.30
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                   I/M Program: No        Ambient Temp:   34.2 (F)
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 39.0   39.0   39.0          39.0   39.0   39.0   39.0   39.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 16.33  16.28  24.10  18.60  12.95   0.76   0.80   5.55  14.30  15.75
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low          Altitude:  500. Ft.
                   I/M Program: No        Ambient Temp:   34.2 (F)
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 40.0   40.0   40.0          40.0   40.0   40.0   40.0   40.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
```

```
 Exhst  CO: 15.73  15.77  23.35  18.02  12.81   0.74   0.79   5.46  13.92  15.23
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low          Altitude:  500. Ft.
                       I/M Program: No       Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 41.0   41.0   41.0          41.0   41.0   41.0   41.0   41.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 15.16  15.29  22.63  17.47  12.69   0.73   0.78   5.38  13.58  14.73
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low          Altitude:  500. Ft.
                       I/M Program: No       Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 42.0   42.0   42.0          42.0   42.0   42.0   42.0   42.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 14.62  14.83  21.95  16.95  12.61   0.72   0.77   5.32  13.27  14.27
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low          Altitude:  500. Ft.
                       I/M Program: No       Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 43.0   43.0   43.0          43.0   43.0   43.0   43.0   43.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 14.10  14.39  21.30  16.45  12.55   0.72   0.76   5.26  12.99  13.82
```

```
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015             Region: Low          Altitude:  500. Ft.
                        I/M Program: No       Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 44.0   44.0   44.0          44.0   44.0   44.0   44.0   44.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 13.60  13.97  20.68  15.97  12.52   0.71   0.75   5.21  12.73  13.40

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015             Region: Low          Altitude:  500. Ft.
                        I/M Program: No       Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 45.0   45.0   45.0          45.0   45.0   45.0   45.0   45.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 13.13  13.57  20.09  15.51  12.52   0.70   0.75   5.18  12.50  13.00

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015             Region: Low          Altitude:  500. Ft.
                        I/M Program: No       Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 46.0   46.0   46.0          46.0   46.0   46.0   46.0   46.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 12.68  13.19  19.53  15.08  12.55   0.70   0.75   5.15  12.29  12.62

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
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0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
               Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 47.0   47.0   47.0          47.0   47.0   47.0   47.0   47.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 12.25  12.83  18.98  14.66  12.60   0.70   0.74   5.13  12.10  12.26

------------------------------------------------------------------------------
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
               Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 48.0   48.0   48.0          48.0   48.0   48.0   48.0   48.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 11.83  12.48  18.47  14.26  12.68   0.70   0.74   5.13  11.92  11.91

------------------------------------------------------------------------------
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
               Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 49.0   49.0   49.0          49.0   49.0   49.0   49.0   49.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 11.83  12.48  18.47  14.26  12.79   0.70   0.74   5.13  11.92  11.91

------------------------------------------------------------------------------
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low          Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
```

```
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 50.0   50.0   50.0           50.0   50.0   50.0   50.0   50.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 11.83  12.48  18.47  14.26  12.93   0.70   0.74   5.14  11.92  11.92

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015              Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 51.0   51.0   51.0           51.0   51.0   51.0   51.0   51.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 11.83  12.48  18.47  14.26  13.10   0.70   0.75   5.16  11.92  11.93

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015              Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 52.0   52.0   52.0           52.0   52.0   52.0   52.0   52.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 11.83  12.48  18.47  14.26  13.31   0.71   0.75   5.19  11.92  11.94

0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015              Region: Low          Altitude:  500. Ft.
                      I/M Program: No        Ambient Temp:   34.2 (F)
              Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
               Reformulated Gas: No
```

```
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 53.0   53.0   53.0           53.0   53.0   53.0   53.0   53.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 11.83  12.48  18.47  14.26  13.54   0.71   0.76   5.23  11.92  11.95

_________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low           Altitude:  500. Ft.
                    I/M Program: No        Ambient Temp:   34.2 (F)
               Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 54.0   54.0   54.0           54.0   54.0   54.0   54.0   54.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 11.83  12.48  18.47  14.26  13.81   0.72   0.76   5.28  11.92  11.97

_________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low           Altitude:  500. Ft.
                    I/M Program: No        Ambient Temp:   34.2 (F)
               Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
+            ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 55.0   55.0   55.0           55.0   55.0   55.0   55.0   55.0
   VMT Mix:  0.532  0.223  0.094          0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 11.83  12.48  18.47  14.26  14.12   0.73   0.77   5.34  11.92  11.99

_________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low           Altitude:  500. Ft.
                    I/M Program: No        Ambient Temp:   34.2 (F)
               Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC    All
Veh
```

```
+          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 56.0   56.0   56.0          56.0   56.0   56.0   56.0   56.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 12.92  13.48  19.96  15.41  14.46   0.74   0.78   5.41  14.79  12.97

______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low           Altitude:  500. Ft.
                       I/M Program: No        Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 57.0   57.0   57.0          57.0   57.0   57.0   57.0   57.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 14.00  14.49  21.45  16.56  14.85   0.75   0.79   5.49  17.66  13.95

______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low           Altitude:  500. Ft.
                       I/M Program: No        Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 58.0   58.0   58.0          58.0   58.0   58.0   58.0   58.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 15.08  15.50  22.94  17.71  15.28   0.76   0.81   5.58  20.53  14.93

______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015            Region: Low           Altitude:  500. Ft.
                       I/M Program: No        Ambient Temp:   34.2 (F)
                  Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                   Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+          ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 59.0   59.0   59.0          59.0   59.0   59.0   59.0   59.0
```

```
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 16.17  16.51  24.43  18.86  15.75   0.77   0.82   5.68  23.40  15.92

________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low           Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 60.0   60.0   60.0          60.0   60.0   60.0   60.0   60.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 17.25  17.51  25.92  20.01  16.28   0.79   0.84   5.80  26.27  16.91

________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low           Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 61.0   61.0   61.0          61.0   61.0   61.0   61.0   61.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 18.33  18.52  27.41  21.17  16.86   0.81   0.86   5.93  29.14  17.90

________________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015          Region: Low           Altitude:  500. Ft.
                     I/M Program: No        Ambient Temp:   34.2 (F)
                Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
                 Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV    MC   All
Veh
+           ______ ______ ______ ______ ______ ______ ______ ______ ______
______
 Veh. Spd.: 62.0   62.0   62.0          62.0   62.0   62.0   62.0   62.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
```

```
 Exhst  CO: 19.42  19.53  28.91  22.32  17.50   0.83   0.88   6.07  32.01  18.90

______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low         Altitude:  500. Ft.
                      I/M Program: No       Ambient Temp:  34.2 (F)
                 Anti-tam. Program: No     Operating Mode:  20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           _____  _____  _____  _____  _____  _____  _____  _____  _____
_____
 Veh. Spd.: 63.0   63.0   63.0          63.0   63.0   63.0   63.0   63.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 20.50  20.54  30.40  23.47  18.21   0.85   0.90   6.23  34.88  19.90

______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low         Altitude:  500. Ft.
                      I/M Program: No       Ambient Temp:  34.2 (F)
                 Anti-tam. Program: No     Operating Mode:  20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           _____  _____  _____  _____  _____  _____  _____  _____  _____
_____
 Veh. Spd.: 64.0   64.0   64.0          64.0   64.0   64.0   64.0   64.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 21.58  21.54  31.89  24.62  18.98   0.87   0.93   6.41  37.75  20.90

______________________________________________________________________________
0Emission factors are as of Jan. 1st of the indicated calendar year.
 LEV phase-in begins in 2001 without using (4/8/94) Guidance Memo Credits
0LEV phase-in data read from file: Fedlev.d
0User supplied veh registration distributions.
0Cal. Year: 2015           Region: Low         Altitude:  500. Ft.
                      I/M Program: No       Ambient Temp:  34.2 (F)
                 Anti-tam. Program: No     Operating Mode:  20.6 / 27.3 / 20.6
                  Reformulated Gas: No
0Veh. Type:  LDGV  LDGT1  LDGT2   LDGT   HDGV   LDDV   LDDT   HDDV   MC   All
Veh
+           _____  _____  _____  _____  _____  _____  _____  _____  _____
_____
 Veh. Spd.: 65.0   65.0   65.0          65.0   65.0   65.0   65.0   65.0
   VMT Mix:  0.532  0.223  0.094         0.040  0.002  0.005  0.098  0.005
 ZEV Fract:  0.00%  0.00%
0Composite Emission Factors (Gm/Mile)
 Exhst  CO: 22.67  22.55  33.38  25.77  19.83   0.90   0.95   6.60  40.62  21.91
```

Appendix E, Table E-16a: Klamath Falls UGB CO 2015 On Road Mobile Sources CO Annual Emissions by Vehicle Class (without oxygenated fuel)

Area Facility Type	(1) Average Week Day VMT by road type [Miles/day]	(2) Avg. Wkdy CO Emissions by Road Type [lbs/day]	(3) Avg. Wkdy to Avg. day Adjustment Factor	(4) Adj Avg. day Emissions All Veh ([lbs/dy]	(5) Annual CO Emissions All Veh [tons/yr]	(6) CO Emissions LDGV SCC 21-01-001 000 [tons/yr]	LDGT1 SCC 22-01-020 000 [tons/yr]	LDGT2 SCC 22-01-040 000 [tons/yr]	HDGV SCC 22-01-070 000 [tons/yr]	LDDV SCC 22-30-001 000 [tons/yr]	LDDT SCC 22-30-060 000 [tons/yr]	HDDV SCC 22-30-070 000 [tons/yr]	MC SCC 22-01-080 000 [tons/yr]
Klamath Falls UGB													
VMT Mix (7)						0.523	0.228	0.096	0.041	0.002	0.005	0.100	0.005
Klamath Falls UGB													
Rural Principal Arterial	372,849	11,885	0.95	11,291	2,061	1,078	470	198	84	4	10	206	10
Rural Minor Arterial	122,514	5,214	0.95	4,954	904	473	206	87	37	2	5	90	5
Rural Major Collector	72,583	3,063	0.87	2,665	486	254	111	47	20	1	2	49	2
Minor Collector	895	54	0.87	47	9	5	2	1	0	0	0	1	0
Rural Local	13,566	719	0.87	625	114	60	26	11	5	0	1	11	1
Ramps	8,032	321	0.87	279	51	27	12	5	2	0	0	5	0
Off network VMT Est.	59,044	3,592	0.87	3,125	570	298	130	55	23	1	3	57	3
Total Klamath Falls UGB	649,482	24,849		22,986	4,195	2,194	956	403	172	8	21	420	21
Notes:						LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC

1) From ODOT EMME/2 output Miles/day: Appendix E, Table E-17.
2) Average Week Day All Vehicle Emissions (lbs/day) = VMT ([miles/day], ODOT EMME/2 model output) * EPA Mobile 5b predicted emissions factors [grams/mile] *0.002205[gm/lb].
Off Network VMT using emission factor for vehicle speed at 25 miles per hour.
3) AAWD to AAD adjustment factor , Ref. 313.
4) Adjusted Emissions, All vehicles [lbs/day] =
average weekday emissions by facility type [g/dy] * Average Day adjusment factor.
5) Annual CO emissions, all vehicles [tons/yr] =
Average Day adjusted emissions, all vehicles [lbs/day] * 365 days per year / 2000.
6) CO emissions by vehicle class = weighted fleet VMT mix (%) * annual CO emissions (all vehicles, tons/year).
7) VMT mix by vehicle class (a weighted percentage established using the EPA Mobile 5b) (Ref 332).

Vehicle Class	VMT Mix
LDGV	0.523
LDGT1	0.228
LDGT2	0.096
HDGV	0.041
LDDV	0.002
LDDT	0.005
HDDV	0.100
MC	0.005
Total:	1.000

Appendix E, Table E-16b: Klamath Falls UGB CO 2015 On Road Mobile Seasonal Emissions by Vehicle Class (without oxygenated fuel)

Area Facility Type	(1) Avg. Wkdy Vehicle Miles Traveled by Facility Type (Miles/day)	(2) Seasonal Wkdy CO Emissions by Road Type (Gm/day)	(3) CO Season Emissions All Veh (lbs/day)	(4) CO Emissions LDGV SCC 21-01-001 000 (lbs/day)	LDGT1 SCC 22-01-020 000 (lbs/day)	LDGT2 SCC 22-01-040 000 (lbs/day)	HDGV SCC 22-01-070 000 (lbs/day)	LDDV SCC 22-30-001 000 (lbs/day)	LDDT SCC 22-30-060 000 (lbs/day)	HDDV SCC 22-30-070 000 (lbs/day)	MC SCC 22-01-080 000 (lbs/day)
Klamath Falls UGB VMT Mix (5)				0.523	0.228	0.096	0.041	0.002	0.005	0.100	0.005
Klamath Falls UGB Trip											
ural Principal Arterial	345,999	5,001,919	11,029	5,768	2,515	1,059	452	22	55	1,103	55
Rural Minor Arterial	113,691	2,194,540	4,839	2,531	1,103	465	198	10	24	484	24
Rural Major Collector	72,583	1,389,071	3,063	1,602	698	294	126	6	15	306	15
Minor Collector	895	24,684	54	28	12	5	2	0	0	5	0
Rural Local	13,566	325,952	719	376	164	69	29	1	4	72	4
Ramps	8,032	145,646	321	168	73	31	13	1	2	32	2
Off network VMT Est	55,477	1,530,600	3,375	1,765	769	324	138	7	17	337	17
Total Klamath Falls U	610,243	10,612,411	23,400	12,238	5,335	2,246	959	47	117	2,340	117
Notes:				LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC

1) From RVCOG EMME/2 output Miles/da from the Appendix E, Table E-17.
2) All Vehicle Emission Factors (Gm/Mile) from EPA Mobile 5b run using 27.5 average speed (Ref: 332).
Off Network VMT using emission factor for vehicle speed at 20 miles per hour.
3) CO Emissions, All vehicles [lbs/day] =
averages weekday emissions by facility type [g/dy] * 0.002205 [g/lb]
4) CO emissions by vehicle class = weighted fleet VMT mix (%) * CO season emissions (all vehicles,lbs/day)
5) VMT mix by vehicle class (a weighted percentage established using the EPA Mobile 5b) (Ref 332).

Vehicle Class	VMT Mix
LDGV	0.523
LDGT1	0.228
LDGT2	0.096
HDGV	0.041
LDDV	0.002
LDDT	0.005
HDDV	0.100
MC	0.005
Total:	1.000

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only Included area inside UGB and no centroid connections)

[illegible]	[illegible]	Length	[illegible]	Speed	Volume	VMT	FCLASS	EF by speed (without oxy) [Gm CO/ mile]	Total CO GM	Seasonal VMT	Seasonal Total CO [Gm]
229	829	0.04	.12	20	3096	123.84	2	35.91	4447.0944	114.92	4,126.85
230	246	0.07	.21	20	3559	249.13	2	35.91	8946.2583	231.19	8,302.02
239	353	0.04	.12	20	4821	192.84	2	35.91	6924.8844	178.95	6,426.21
240	852	0.06	.12	30	6717	403.02	2	22.06	8890.6212	374.00	8,250.39
245	229	0.09	.27	20	2243	201.87	2	35.91	7249.1517	187.33	6,727.13
246	356	0.12	.36	20	3362	403.44	2	35.91	14487.5304	374.39	13,444.26
249	849	0.15	.30	30	6746	1011.90	2	22.06	22322.514	939.03	20,715.03
251	252	0.09	.18	30	3396	305.64	2	22.06	6742.4184	283.63	6,256.88
251	839	0.05	.15	20	5020	251:00	2	35.91	9013.41	232.93	8,364.34
252	360	0.07	.21	20	2747	192.29	2	35.91	6905.1339	178.44	6,407.88
252	403	0.13	.27	29	8711	1132.43	2	23.02	26068.5386	1,050.88	24,191.29
253	363	0.13	.27	29	9214	1197.82	2	23.02	27573.8164	1,111.56	25,588.17
255	359	0.09	.27	20	2239	201.51	2	35.91	7236.2241	187.00	6,715.13
256	259	0.07	.21	20	3370	235.90	2	35.91	8471.169	218.91	7,861.14
258	255	0.07	.21	20	2479	173.53	2	35.91	6231.4623	161.03	5,782.72
259	859	0.03	.09	20	3370	101.10	2	35.91	3630.501	93.82	3,369.06
260	357	0.05	.15	20	2576	128.80	2	35.91	4625.208	119.52	4,292.14
260	362	0.06	.18	20	3379	202.74	2	35.91	7280.3934	188.14	6,756.12
309	315	0.43	.47	55	4512	1940.16	2	11.99	23262.5184	1,800.45	21,587.34
309	319	0.5	.55	55	4402	2201.00	2	11.99	26389.99	2,042.50	24,489.60
314	315	0.36	.40	54	5271	1897.56	2	11.97	22713.7932	1,760.91	21,078.13
314	372	0.3	.33	55	4324	1297.20	2	11.99	15553.428	1,203.79	14,433.40
315	309	0.43	.47	55	5271	2266.53	2	11.99	27175.6947	2,103.31	25,218.72
315	314	0.36	.39	55	4512	1624.32	2	11.99	19475.5968	1,507.35	18,073.12
319	309	0.5	.55	55	4512	2256.00	2	11.99	27049.44	2,093.54	25,101.56
319	323	0.57	.63	54	4402	2509.14	2	11.97	30034.4058	2,328.45	27,871.57
323	319	0.57	.62	55	4338	2472.66	2	11.99	29647.1934	2,294.60	27,512.24
323	327	1.19	1.30	55	4153	4942.07	2	11.99	59255.4193	4,586.18	54,988.33
327	323	1.19	1.31	55	7074	8418.06	2	11.99	100932.5394	7,811.86	93,664.20
327	347	0.93	1.04	54	9567	8897.31	2	11.97	106500.8007	8,256.60	98,831.48
343	539	0.45	.90	30	5573	2507.85	2	22.06	55323.171	2,327.26	51,339.25
347	327	0.93	1.02	55	7171	6669.03	2	11.99	79961.6697	6,188.78	74,203.48
347	546	0.5	.56	54	9092	4546.00	2	11.97	54415.62	4,218.63	50,497.05
353	370	0.06	.18	20	4821	289.26	2	35.91	10387.3266	268.43	9,639.32
354	240	0.07	.14	30	6717	470.19	2	22.06	10372.3914	436.33	9,625.46
355	245	0.11	.33	20	2127	233.97	2	35.91	8401.8627	217.12	7,796.83
355	357	0.07	.21	20	1320	92.40	2	35.91	3318.084	85.75	3,079.14
356	355	0.08	.19	25	1320	105.60	2	27.59	2913.504	98.00	2,703.70
357	260	0.05	.15	20	2803	140.15	2	35.91	5032.7865	130.06	4,670.37

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

357	355	0.07	.21	20	617	43.19	2	35.91	1550.9529	40.08	1,439.27
359	251	0.08	.24	20	5297	423.76	2	35.91	15217.2216	393.24	14,121.40
360	359	0.08	.16	30	6282	502.56	2	22.06	11086.4736	466.37	10,288.12
360	860	0.06	.18	20	2661	159.66	2	35.91	5733.3906	148.16	5,320.52
362	260	0.06	.18	20	3159	189.54	2	35.91	6806.3814	175.89	6,316.24
362	601	0.1	.30	20	3497	349.70	2	35.91	12557.727	324.52	11,653.42
363	249	0.07	.14	30	7944	556.08	2	22.06	12267.1248	516.04	11,383.75
363	700	0.05	.10	30	8936	446.80	2	22.06	9856.408	414.63	9,146.63
370	537	0.04	.12	20	4821	192.84	2	35.91	6924.8844	178.95	6,426.21
371	354	0.06	.12	30	6717	403.02	2	22.06	8890.6212	374.00	8,250.39
372	314	0.3	.33	55	4778	1433.40	2	11.99	17186.466	1,330.18	15,948.84
403	253	0.12	.25	29	9214	1105.68	2	23.02	25452.7536	1,026.06	23,619.85
411	703	0.05	.09	33	9133	456.65	2	19.56	8932.074	423.77	8,288.86
411	704	0.04	.07	34	9069	362.76	2	18.83	6830.7708	336.64	6,338.87
413	708	0.27	.46	35	8130	2195.10	2	18.14	39819.114	2,037.03	36,951.66
413	709	0.23	.40	35	9028	2076.44	2	18.14	37666.6216	1,926.91	34,954.18
424	704	0.25	.43	35	5176	1294.00	2	18.14	23473.16	1,200.82	21,782.81
424	705	0.19	.33	35	5604	1064.76	2	18.14	19314.7464	988.08	17,923.86
426	518	0.09	.10	54	3845	346.05	2	11.97	4142.2185	321.13	3,843.93
502	552	0.22	.24	55	4745	1043.90	2	11.99	12516.361	968.73	11,615.03
503	527	0.37	.40	56	2185	808.45	2	12.97	10485.5965	750.23	9,730.51
505	506	0.49	.54	54	4591	2249.59	2	11.97	26927.5923	2,087.59	24,988.49
506	508	0.46	.50	55	4261	1960.06	2	11.99	23501.1194	1,818.91	21,808.76
507	557	0.14	.15	56	4723	661.22	2	12.97	8576.0234	613.60	7,958.45
508	509	0.72	.79	55	6349	4571.28	2	11.99	54809.6472	4,242.09	50,862.70
509	510	0.4	.44	55	6349	2539.60	2	11.99	30449.804	2,356.72	28,257.06
510	511	0.27	.30	54	6349	1714.23	2	11.97	20519.3331	1,590.79	19,041.70
511	512	0.13	.14	56	5403	702.39	2	12.97	9109.9983	651.81	8,453.97
512	513	0.4	.44	55	8673	3469.20	2	11.99	41595.708	3,219.38	38,600.32
513	514	1.04	1.14	55	8673	9019.92	2	11.99	108148.8408	8,370.38	100,360.84
514	515	0.3	.33	55	8673	2601.90	2	11.99	31196.781	2,414.53	28,950.24
515	516	0.22	.24	55	2720	598.40	2	11.99	7174.816	555.31	6,658.14
516	426	0.19	.21	54	3845	730.55	2	11.97	8744.6835	677.94	8,114.96
517	544	0.08	.09	53	2913	233.04	2	11.95	2784.828	216.26	2,584.29
518	564	0.08	.09	53	3775	302.00	2	11.95	3608.9	280.25	3,349.02
518	819	0.1	.11	55	3845	384.50	2	11.99	4610.155	356.81	4,278.17
524	525	0.06	.07	51	2851	171.06	2	11.93	2040.7458	158.74	1,893.79
524	600	1.17	1.31	54	9664	11306.88	2	11.97	135343.3536	10,492.65	125,597.02
525	524	0.06	.07	51	4557	273.42	2	11.93	3261.9006	253.73	3,027.01
525	555	0.02	.02	60	2851	57.02	2	16.91	964.2082	52.91	894.77
526	554	0.16	.17	56	2851	456.16	2	12.97	5916.3952	423.31	5,490.34
527	555	0.08	.09	53	4686	374.88	2	11.95	4479.816	347.88	4,157.22

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

528	554	0.1	.11	55	3104	310.40	2	11.99	3721.696	288.05	3,453.69
534	535	0.17	.34	30	2102	357.34	2	22.06	7882.9204	331.61	7,315.26
535	534	0.17	.34	30	4134	702.78	2	22.06	15503.3268	652.17	14,386.90
535	536	0.06	.12	30	1675	100.50	2	22.06	2217.03	93.26	2,057.38
536	535	0.06	.12	30	4978	298.68	2	22.06	6588.8808	277.17	6,114.40
536	537	0.06	.12	30	6717	403.02	2	22.06	8890.6212	374.00	8,250.39
537	371	0.06	.12	30	6717	403.02	2	22.06	8890.6212	374.00	8,250.39
537	536	0.06	.12	30	4821	289.26	2	22.06	6381.0756	268.43	5,921.56
538	567	0.16	.17	56	1677	268.32	2	12.97	3480.1104	249.00	3,229.50
538	569	1.01	1.35	45	2071	2091.71	2	13	27192.23	1,941.08	25,234.07
539	343	0.45	.90	30	5573	2507.85	2	22.06	55323.171	2,327.26	51,339.25
539	540	0.45	.90	30	5440	2448.00	2	22.06	54002.88	2,271.71	50,114.03
540	539	0.45	.90	30	5440	2448.00	2	22.06	54002.88	2,271.71	50,114.03
540	541	0.07	.09	47	7352	514.64	2	12.26	6309.4864	477.58	5,855.13
541	540	0.07	.09	47	7352	514.64	2	12.26	6309.4864	477.58	5,855.13
541	542	0.05	.07	43	9424	471.20	2	13.82	6511.984	437.27	6,043.04
541	569	0.62	.83	45	2071	1284.02	2	13	16692.26	1,191.56	15,490.22
542	541	0.05	.07	43	9423	471.15	2	13.82	6511.293	437.22	6,042.40
542	543	0.04	.06	40	13261	530.44	2	15.23	8078.6012	492.24	7,496.85
543	542	0.04	.06	40	13260	530.40	2	15.23	8077.992	492.20	7,496.28
543	545	0.17	.24	43	13086	2224.62	2	13.82	30744.2484	2,064.42	28,530.30
544	805	0.37	.41	54	10914	4038.18	2	11.97	48337.0146	3,747.38	44,856.18
545	543	0.17	.23	44	8258	1403.86	2	13.4	18811.724	1,302.77	17,457.06
545	546	0.04	.05	48	6357	254.28	2	11.91	3028.4748	235.97	2,810.39
546	347	0.5	.55	55	6489	3244.50	2	11.99	38901.555	3,010.86	36,100.18
546	545	0.04	.06	40	8668	346.72	2	15.23	5280.5456	321.75	4,900.28
551	503	0.11	.12	55	6775	745.25	2	11.99	8935.5475	691.58	8,292.08
552	502	0.22	.24	55	4746	1044.12	2	11.99	12518.9988	968.93	11,617.48
552	1501	0.67	.74	54	4745	3179.15	2	11.97	38054.4255	2,950.21	35,314.05
553	552	0.14	.15	56	4746	664.44	2	12.97	8617.7868	616.59	7,997.20
554	1500	0.43	.48	54	5955	2560.65	2	11.97	30650.9805	2,376.25	28,443.75
555	525	0.02	.02	60	4686	93.72	2	16.91	1584.8052	86.97	1,470.68
555	526	0.21	.23	55	2851	598.71	2	11.99	7178.5329	555.60	6,661.59
556	528	0.14	.15	56	3104	434.56	2	12.97	5636.2432	403.27	5,230.37
557	556	0.58	.63	55	5606	3251.48	2	11.99	38985.2452	3,017.33	36,177.84
558	507	0.29	.32	54	7028	2038.12	2	11.97	24396.2964	1,891.35	22,639.47
559	558	0.72	.79	55	7028	5060.16	2	11.99	60671.3184	4,695.77	56,302.26
560	807	0.03	.03	60	7028	210.84	2	16.91	3565.3044	195.66	3,308.56
561	560	0.27	.30	54	5715	1543.05	2	11.97	18470.3085	1,431.93	17,140.23
562	561	0.52	.57	55	10914	5675.28	2	11.99	68046.6072	5,266.59	63,146.44
563	562	1.1	1.21	55	10914	12005.40	2	11.99	143944.746	11,140.87	133,579.01
564	517	0.19	.21	54	3775	717.25	2	11.97	8585.4825	665.60	7,967.23

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table: Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

565	566	0.73	.80	55	1677	1224.21	2	11.99	14678.2779	1,136.05	13,621.27
566	565	0.73	.80	55	1677	1224.21	2	11.99	14678.2779	1,136.05	13,621.27
566	567	0.41	.45	55	1677	687.57	2	11.99	8243.9643	638.06	7,650.30
567	538	0.16	.17	56	1677	268.32	2	12.97	3480.1104	249.00	3,229.50
567	566	0.41	.45	55	1677	687.57	2	11.99	8243.9643	638.06	7,650.30
569	538	1.01	1.35	45	2071	2091.71	2	13	27192.23	1,941.08	25,234.07
569	541	0.62	.83	45	2071	1284.02	2	13	16692.26	1,191.56	15,490.22
576	519	0.8	.87	55	3223	2578.40	2	11.99	30915.016	2,392.72	28,688.77
576	1034	0.45	.49	55	3359	1511.55	2	11.99	18123.4845	1,402.70	16,818.38
600	524	1.17	1.31	54	9693	11340.81	2	11.97	135749.4957	10,524.14	125,973.92
600	960	0.28	.34	49	10903	3052.84	2	11.91	36359.3244	2,833.00	33,741.02
601	362	0.1	.30	20	3170	317.00	2	35.91	11383.47	294.17	10,563.72
601	602	0.28	.34	49	11020	3085.60	2	11.91	36749.496	2,863.40	34,103.10
601	960	0.03	.04	45	11130	333.90	2	13	4340.7	309.86	4,028.12
602	601	0.28	.34	49	10780	3018.40	2	11.91	35949.144	2,801.04	33,360.38
602	603	0.24	.29	50	12408	2977.92	2	11.92	35496.8064	2,763.47	32,940.61
603	602	0.24	.29	50	12170	2920.80	2	11.92	34815.936	2,710.47	32,308.78
603	1523	0.37	.46	48	14204	5255.48	2	11.91	62592.7668	4,877.02	58,085.34
604	811	0.04	.05	48	9425	377.00	2	11.91	4490.07	349.85	4,166.73
604	1523	0.15	.18	50	13509	2026.35	2	11.92	24154.092	1,880.43	22,414.71
605	1527	0.5	.60	50	9323	4661.50	2	11.92	55565.08	4,325.82	51,563.73
605	1528	0.24	.29	50	9637	2312.88	2	11.92	27569.5296	2,146.33	25,584.20
606	1528	0.12	.14	51	9536	1144.32	2	11.93	13651.7376	1,061.92	12,668.65
606	1529	0.13	.16	49	8322	1081.86	2	11.91	12884.9526	1,003.95	11,957.08
700	363	0.05	.10	30	7667	383.35	2	22.06	8456.701	355.74	7,847.72
700	701	0.07	.14	30	9287	650.09	2	22.06	14340.9854	603.28	13,308.26
701	700	0.07	.14	30	7919	554.33	2	22.06	12228.5198	514.41	11,347.92
701	702	0.46	.79	35	9917	4561.82	2	18.14	82751.4148	4,233.31	76,792.33
702	701	0.46	.79	35	8165	3755.90	2	18.14	68132.026	3,485.43	63,225.71
702	703	0.09	.16	34	9917	892.53	2	18.83	16806.3399	828.26	15,596.08
703	411	0.05	.09	33	10915	545.75	2	19.56	10674.87	506.45	9,906.15
703	702	0.09	.15	36	8165	734.85	2	17.49	12852.5265	681.93	11,926.99
704	411	0.04	.07	34	7559	302.36	2	18.83	5693.4388	280.59	5,283.44
704	424	0.25	.43	35	5604	1401.00	2	18.14	25414.14	1,300.11	23,584.02
705	424	0.19	.33	35	5176	983.44	2	18.14	17839.6016	912.62	16,554.94
705	706	0.17	.29	35	7204	1224.68	2	18.14	22215.6952	1,136.49	20,615.90
706	705	0.17	.29	35	7205	1224.85	2	18.14	22218.779	1,136.65	20,618.76
706	707	0.4	.69	35	7476	2990.40	2	18.14	54245.856	2,775.06	50,339.51
707	706	0.4	.69	35	6934	2773.60	2	18.14	50313.104	2,573.87	46,689.96
707	708	0.05	.09	33	8087	404.35	2	19.56	7909.066	375.23	7,339.54
708	413	0.27	.46	35	7935	2142.45	2	18.14	38864.043	1,988.17	36,065.37
708	707	0.05	.09	33	7488	374.40	2	19.56	7323.264	347.44	6,795.90

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

709	413	0.23	.40	35	9252	2127.96	2	18.14	38601.1944	1,974.72	35,821.45
709	710	0.07	.15	31	12138	849.66	2	21.18	17995.7988	788.47	16,699.89
710	709	0.07	.12	35	11785	824.95	2	18.14	14964.593	765.54	13,886.96
710	810	0.09	.11	49	7709	693.81	2	11.91	8263.2771	643.85	7,668.22
710	1028	0.16	.33	30	14413	2306.08	2	22.06	50872.1248	2,140.01	47,208.73
711	712	0.13	.26	30	10827	1407.51	2	22.06	31049.6706	1,306.15	28,813.73
711	713	0.23	.49	30	10671	2454.33	2	22.06	54142.5198	2,277.59	50,243.62
712	711	0.13	.26	30	11203	1456.39	2	22.06	32127.9634	1,351.51	29,814.37
712	751	0.07	.14	30	11194	783.58	2	22.06	17285.7748	727.15	16,040.99
713	711	0.23	.46	30	10295	2367.85	2	22.06	52234.771	2,197.34	48,473.25
713	814	0.16	.32	30	8637	1381.92	2	22.06	30485.1552	1,282.41	28,289.86
714	715	0.23	.46	30	8191	1883.93	2	22.06	41559.4958	1,748.26	38,566.72
714	814	0.13	.26	30	8205	1066.65	2	22.06	23530.299	989.84	21,835.84
715	714	0.23	.46	30	7617	1751.91	2	22.06	38647.1346	1,625.75	35,864.08
715	1026	0.17	.23	44	8237	1400.29	2	13.4	18763.886	1,299.45	17,412.66
716	1026	0.49	.65	45	7556	3702.44	2	13	48131.72	3,435.82	44,665.66
716	1027	0.12	.16	45	8200	984.00	2	13	12792	913.14	11,870.82
717	718	0.07	.10	42	7476	523.32	2	14.27	7467.7764	485.63	6,930.01
717	1027	0.24	.32	45	7023	1685.52	2	13	21911.76	1,564.14	20,333.85
718	717	0.07	.09	47	2291	160.37	2	12.26	1966.1362	148.82	1,824.55
718	719	0.07	.09	47	4414	308.98	2	12.26	3788.0948	286.73	3,515.31
718	725	0.07	.12	35	4733	331.31	2	18.14	6009.9634	307.45	5,577.17
719	718	0.07	.09	47	2291	160.37	2	12.26	1966.1362	148.82	1,824.55
719	720	0.14	.19	44	4414	617.96	2	13.4	8280.664	573.46	7,684.36
720	719	0.14	.19	44	3962	554.68	2	13.4	7432.712	514.74	6,897.47
720	1021	0.12	.13	55	4188	502.56	2	11.99	6025.6944	466.37	5,591.77
721	1021	0.46	.50	55	2684	1234.64	2	11.99	14803.3336	1,145.73	13,737.32
725	718	0.07	.12	35	1672	117.04	2	18.14	2123.1056	108.61	1,970.22
725	726	0.5	.60	50	6405	3202.50	2	11.92	38173.8	2,971.88	35,424.83
726	725	0.5	.60	50	6404	3202.00	2	11.92	38167.84	2,971.42	35,419.30
751	712	0.07	.14	30	11570	809.90	2	22.06	17866.394	751.58	16,579.80
751	1028	0.13	.26	30	12776	1660.88	2	22.06	36639.0128	1,541.28	34,000.57
805	563	0.03	.03	60	10914	327.42	2	16.91	5536.6722	303.84	5,137.97
807	559	0.38	.42	54	7028	2670.64	2	11.97	31967.5608	2,478.32	29,665.52
810	710	0.09	.11	49	8322	748.98	2	11.91	8920.3518	695.04	8,277.98
810	1529	0.41	.49	50	7709	3160.69	2	11.92	37675.4248	2,933.08	34,962.35
811	604	0.04	.05	48	9323	372.92	2	11.91	4441.4772	346.07	4,121.64
811	1527	0.17	.21	49	9425	1602.25	2	11.91	19082.7975	1,486.87	17,708.61
814	713	0.16	.33	30	8205	1312.80	2	22.06	28960.368	1,218.26	26,874.88
814	714	0.13	.26	30	8637	1122.81	2	22.06	24769.1886	1,041.95	22,985.51
819	518	0.1	.11	55	3775	377.50	2	11.99	4526.225	350.32	4,200.28
819	1034	0.09	.10	54	3845	346.05	2	11.97	4142.2185	321.13	3,843.93

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

829	258	0.04	.12	20	3124	124.96	2	35.91	4487.3136	115.96	4,164.17
839	239	0.06	.18	20	3675	220.50	2	35.91	7918.155	204.62	7,347.95
849	360	0.14	.28	30	6195	867.30	2	22.06	19132.638	804.84	17,754.86
852	252	0.05	.10	30	8063	403.15	2	22.06	8893.489	374.12	8,253.05
859	230	0.03	.09	20	3342	100.26	2	35.91	3600.3366	93.04	3,341.07
860	256	0.05	.15	20	3370	168.50	2	35.91	6050.835	156.37	5,615.10
960	600	0.28	.34	49	11130	3116.40	2	11.91	37116.324	2,891.98	34,443.51
960	601	0.03	.04	45	10903	327.09	2	13	4252.17	303.54	3,945.96
1021	720	0.12	.13	55	3735	448.20	2	11.99	5373.918	415.92	4,986.93
1021	721	0.46	.50	55	3137	1443.02	2	11.99	17301.8098	1,339.11	16,055.87
1026	715	0.17	.23	44	7798	1325.66	2	13.4	17763.844	1,230.20	16,484.64
1026	716	0.49	.66	45	7999	3919.51	2	13	50953.63	3,637.26	47,284.36
1027	716	0.12	.16	45	7747	929.64	2	13	12085.32	862.69	11,215.03
1027	717	0.24	.32	45	7476	1794.24	2	13	23325.12	1,665.03	21,645.43
1028	710	0.16	.43	24	13448	2151.68	2	28.98	62355.6864	1,996.73	57,865.34
1028	751	0.13	.27	30	13742	1786.46	2	22.06	39409.3076	1,657.81	36,571.37
1034	576	0.45	.49	55	3223	1450.35	2	11.99	17389.6965	1,345.91	16,137.43
1034	819	0.09	.10	54	3775	339.75	2	11.97	4066.8075	315.28	3,773.95
1500	553	0.57	.63	54	4746	2705.22	2	11.97	32381.4834	2,510.41	30,049.63
1501	551	0.21	.23	55	6775	1422.75	2	11.99	17058.7725	1,320.30	15,830.34
1523	603	0.37	.45	49	13509	4998.33	2	11.91	59530.1103	4,638.39	55,243.24
1523	604	0.15	.22	41	14204	2130.60	2	14.73	31383.738	1,977.17	29,123.74
1527	605	0.5	.60	50	9425	4712.50	2	11.92	56173	4,373.14	52,127.88
1527	811	0.17	.21	49	9323	1584.91	2	11.91	18876.2781	1,470.78	17,516.96
1528	605	0.24	.29	50	9536	2288.64	2	11.92	27280.5888	2,123.83	25,316.06
1528	606	0.12	.15	48	9637	1156.44	2	11.91	13773.2004	1,073.16	12,781.37
1529	606	0.13	.16	49	7709	1002.17	2	11.91	11935.8447	930.00	11,076.32
1529	810	0.41	.49	50	8322	3412.02	2	11.92	40671.2784	3,166.31	37,742.46
204	523	0.29	.70	25	3016	874.64	6	27.59	24131.3176	811.66	22,393.58
204	655	0.23	.55	25	2023	465.29	6	27.59	12837.3511	431.78	11,912.91
208	221	0.26	.62	25	1498	389.48	6	27.59	10745.7532	361.43	9,971.93
208	533	0.3	.72	25	2272	681.60	6	27.59	18805.344	632.52	17,451.14
218	219	0.51	1.02	30	1498	763.98	6	22.06	16853.3988	708.96	15,639.75
218	572	0.55	.94	35	525	288.75	6	18.14	5237.925	267.96	4,860.73
219	218	0.51	1.02	30	1498	763.98	6	22.06	16853.3988	708.96	15,639.75
219	220	0.16	.32	30	1498	239.68	6	22.06	5287.3408	222.42	4,906.59
220	219	0.16	.32	30	1498	239.68	6	22.06	5287.3408	222.42	4,906.59
220	221	0.22	.44	30	1498	329.56	6	22.06	7270.0936	305.83	6,746.56
221	208	0.26	.62	25	1498	389.48	6	27.59	10745.7532	361.43	9,971.93
221	220	0.22	.44	30	1498	329.56	6	22.06	7270.0936	305.83	6,746.56
222	223	0.14	.34	25	1415	198.10	6	27.59	5465.579	183.83	5,071.99
222	530	0.07	.17	25	1543	108.01	6	27.59	2979.9959	100.23	2,765.40

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

223	222	0.14	.34	25	1314	183.96	6	27.59	5075.4564	170.71	4,709.96
223	405	0.05	.12	25	2175	108.75	6	27.59	3000.4125	100.92	2,784.35
223	655	0.13	.31	25	740	96.20	6	27.59	2654.158	89.27	2,463.03
224	405	0.25	.60	25	593	148.25	6	27.59	4090.2175	137.57	3,795.67
224	407	0.07	.17	25	1742	121.94	6	27.59	3364.3246	113.16	3,122.05
225	226	0.07	.17	25	2897	202.79	6	27.59	5594.9761	188.19	5,192.07
225	407	0.22	.53	25	222	48.84	6	27.59	1347.4956	45.32	1,250.46
226	227	0.21	.50	25	2897	608.37	6	27.59	16784.9283	564.56	15,576.21
227	228	0.24	.58	25	3069	736.56	6	27.59	20321.6904	683.52	18,858.29
228	229	0.07	.17	25	1069	74.83	6	27.59	2064.5597	69.44	1,915.89
229	230	0.09	.22	25	217	19.53	6	27.59	538.8327	18.12	500.03
260	261	0.09	.22	25	832	74.88	6	27.59	2065.9392	69.49	1,917.17
261	260	0.09	.22	25	824	74.16	6	27.59	2046.0744	68.82	1,898.73
261	262	0.07	.17	25	569	39.83	6	27.59	1098.9097	36.96	1,019.78
261	355	0.13	.39	20	1511	196.43	6	35.91	7053.8013	182.28	6,545.84
261	861	0.11	.22	30	2757	303.27	6	22.06	6690.1362	281.43	6,208.37
262	261	0.07	.17	25	2716	190.12	6	27.59	5245.4108	176.43	4,867.68
262	263	0.34	.82	25	569	193.46	6	27.59	5337.5614	179.53	4,953.19
263	262	0.34	.82	25	673	228.82	6	27.59	6313.1438	212.34	5,858.52
263	734	0.25	.60	25	945	236.25	6	27.59	6518.1375	219.24	6,048.75
268	861	0.09	.18	30	2382	214.38	6	22.06	4729.2228	198.94	4,388.66
268	1018	0.26	.78	20	652	169.52	6	35.91	6087.4632	157.31	5,649.09
268	1019	0.08	.16	30	2509	200.72	6	22.06	4427.8832	186.27	4,109.02
269	270	0.1	.30	20	806	80.60	6	35.91	2894.346	74.80	2,685.92
269	1018	0.06	.18	20	733	43.98	6	35.91	1579.3218	40.81	1,465.59
270	269	0.1	.30	20	733	73.30	6	35.91	2632.203	68.02	2,442.65
270	408	0.18	.54	20	806	145.08	6	35.91	5209.8228	134.63	4,834.65
271	408	0.09	.27	20	1776	159.84	6	35.91	5739.8544	148.33	5,326.52
271	703	0.37	1.11	20	1601	592.37	6	35.91	21272.0067	549.71	19,740.17
272	273	0.6	1.44	25	720	432.00	6	27.59	11918.88	400.89	11,060.58
272	534	0.1	.24	25	1674	167.40	6	27.59	4618.566	155.35	4,285.97
273	272	0.6	1.44	25	1013	607.80	6	27.59	16769.202	564.03	15,561.62
273	274	0.62	1.06	35	720	446.40	6	18.14	8097.696	414.25	7,514.57
274	273	0.62	1.06	35	1013	628.06	6	18.14	11393.0084	582.83	10,572.58
274	275	0.36	.62	35	816	293.76	6	18.14	5328.8064	272.61	4,945.07
275	274	0.36	.62	35	1109	399.24	6	18.14	7242.2136	370.49	6,720.69
275	276	0.2	.27	44	816	163.20	6	13.4	2186.88	151.45	2,029.40
276	275	0.2	.27	44	1109	221.80	6	13.4	2972.12	205.83	2,758.09
276	546	0.52	.69	45	816	424.32	6	13	5516.16	393.76	5,118.93
277	364	0.15	.36	25	5967	895.05	6	27.59	24694.4295	830.60	22,916.14
277	1524	0.3	.72	25	3932	1179.60	6	27.59	32545.164	1,094.65	30,201.53
278	279	0.22	.38	35	3700	814.00	6	18.14	14765.96	755.38	13,702.64

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

278	364	0.17	.41	25	5984	1017.28	6	27.59	28066.7552	944.02	26,045.62
278	409	0.14	.24	35	2275	318.50	6	18.14	5777.59	295.56	5,361.53
278	1033	0.07	.17	25	6717	470.19	6	27.59	12972.5421	436.33	12,038.36
279	278	0.22	.38	35	3385	744.70	6	18.14	13508.858	691.07	12,536.06
279	280	0.02	.03	40	4039	80.78	6	15.23	1230.2794	74.96	1,141.68
280	279	0.02	.03	40	4309	86.18	6	15.23	1312.5214	79.97	1,218.00
280	281	0.19	.33	35	5137	976.03	6	18.14	17705.1842	905.74	16,430.20
281	280	0.19	.33	35	5408	1027.52	6	18.14	18639.2128	953.53	17,296.97
281	1530	0.16	.27	36	5010	801.60	6	17.49	14019.984	743.88	13,010.38
282	414	0.18	.36	30	3965	713.70	6	22.06	15744.222	662.31	14,610.45
282	1531	0.13	.26	30	4775	620.75	6	22.06	13693.745	576.05	12,707.63
283	284	0.29	.58	30	3242	940.18	6	22.06	20740.3708	872.48	19,246.82
283	414	0.32	.64	30	3757	1202.24	6	22.06	26521.4144	1,115.66	24,611.56
284	283	0.29	.58	30	3462	1003.98	6	22.06	22147.7988	931.68	20,552.89
284	418	0.25	.43	35	1313	328.25	6	18.14	5954.455	304.61	5,525.66
284	840	0.16	.32	30	2191	350.56	6	22.06	7733.3536	325.32	7,176.46
285	286	0.22	.44	30	2248	494.56	6	22.06	10909.9936	458.95	10,124.34
285	840	0.13	.26	30	2351	305.63	6	22.06	6742.1978	283.62	6,256.68
286	285	0.22	.44	30	2370	521.40	6	22.06	11502.084	483.85	10,673.80
286	416	0.07	.12	35	2078	145.46	6	18.14	2638.6444	134.99	2,448.63
287	902	0.23	.36	38	12428	2858.44	6	16.3	46592.572	2,652.60	43,237.35
287	1120	0.27	.47	34	8126	2194.02	6	18.83	41313.3966	2,036.02	38,338.34
290	304	0.24	.33	44	10528	2526.72	6	13.4	33858.048	2,344.77	31,419.87
290	902	0.2	.30	40	7878	1575.60	6	15.23	23996.388	1,462.14	22,268.36
292	1012	0.42	.72	35	4513	1895.46	6	18.14	34383.6444	1,758.96	31,907.61
292	1017	0.12	.21	34	4249	509.88	6	18.83	9601.0404	473.16	8,909.65
299	899	0.12	.21	34	2895	347.40	6	18.83	6541.542	322.38	6,070.47
299	1505	0.23	.39	35	1680	386.40	6	18.14	7009.296	358.57	6,504.54
300	301	0.22	.38	35	1723	379.06	6	18.14	6876.1484	351.76	6,380.98
300	1505	0.13	.22	35	1916	249.08	6	18.14	4518.3112	231.14	4,192.94
301	300	0.22	.38	35	1959	430.98	6	18.14	7817.9772	399.94	7,254.99
301	302	0.32	.77	25	885	283.20	6	27.59	7813.488	262.81	7,250.82
301	310	0.29	.50	35	2509	727.61	6	18.14	13198.8454	675.21	12,248.37
302	301	0.32	.77	25	875	280.00	6	27.59	7725.2	259.84	7,168.89
302	1029	0.18	.43	25	732	131.76	6	27.59	3635.2584	122.27	3,373.48
303	1022	0.28	.42	40	258	72.24	6	15.23	1100.2152	67.04	1,020.99
303	1029	0.48	1.15	25	258	123.84	6	27.59	3416.7456	114.92	3,170.70
304	290	0.24	.32	45	8188	1965.12	6	13	25546.56	1,823.61	23,706.90
304	321	0.26	.31	50	10123	2631.98	6	11.92	31373.2016	2,442.45	29,113.96
305	306	0.34	.58	35	2951	1003.34	6	18.14	18200.5876	931.09	16,889.93
305	1017	0.23	.40	35	4283	985.09	6	18.14	17869.5326	914.15	16,582.71
306	305	0.34	.58	35	3580	1217.20	6	18.14	22080.008	1,129.55	20,489.99

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

306	307	0.04	.07	34	2951	118.04	6	18.83	2222.6932	109.54	2,062.63
307	306	0.04	.07	34	3580	143.20	6	18.83	2696.456	132.89	2,502.28
307	308	0.39	.67	35	1575	614.25	6	18.14	11142.495	570.02	10,340.10
308	307	0.39	.67	35	2389	931.71	6	18.14	16901.2194	864.62	15,684.13
308	1512	0.2	.34	35	2063	412.60	6	18.14	7484.564	382.89	6,945.59
309	1020	0.33	.57	35	996	328.68	6	18.14	5962.2552	305.01	5,532.90
310	301	0.29	.50	35	2757	799.53	6	18.14	14503.4742	741.95	13,459.05
310	311	0.07	.12	35	2191	153.37	6	18.14	2782.1318	142.33	2,581.79
311	310	0.07	.12	35	2385	166.95	6	18.14	3028.473	154.93	2,810.39
311	312	0.22	.38	35	2191	482.02	6	18.14	8743.8428	447.31	8,114.18
312	311	0.22	.38	35	2385	524.70	6	18.14	9518.058	486.92	8,832.64
312	313	0.22	.38	35	2376	522.72	6	18.14	9482.1408	485.08	8,799.31
313	312	0.22	.38	35	2571	565.62	6	18.14	10260.3468	524.89	9,521.48
313	813	0.14	.24	35	1031	144.34	6	18.14	2618.3276	133.95	2,429.78
314	813	0.43	.74	35	949	408.07	6	18.14	7402.3898	378.68	6,869.33
321	304	0.26	.29	54	7783	2023.58	6	11.97	24222.2526	1,877.86	22,477.96
321	322	0.79	.87	54	4512	3564.48	6	11.97	42666.8256	3,307.80	39,594.31
322	321	0.79	.88	54	6961	5499.19	6	11.97	65825.3043	5,103.18	61,085.10
322	1509	0.18	.20	54	4409	793.62	6	11.97	9499.6314	736.47	8,815.55
323	1509	0.32	.36	53	7796	2494.72	6	11.95	29811.904	2,315.07	27,665.09
341	402	0.55	.73	45	490	269.50	6	13	3503.5	250.09	3,251.21
341	568	0.27	.36	45	1092	294.84	6	13	3832.92	273.61	3,556.90
342	343	0.3	.40	45	698	209.40	6	13	2722.2	194.32	2,526.17
342	402	0.1	.13	46	444	44.40	6	12.62	560.328	41.20	519.98
343	342	0.3	.40	45	698	209.40	6	13	2722.2	194.32	2,526.17
355	261	0.13	.39	20	0	0.00	6	35.91	0	-	-
364	277	0.15	.36	25	5180	777.00	6	27.59	21437.43	721.05	19,893.68
364	278	0.17	.41	25	6772	1151.24	6	27.59	31762.7116	1,068.34	29,475.42
402	341	0.55	.73	45	490	269.50	6	13	3503.5	250.09	3,251.21
402	342	0.1	.13	46	444	44.40	6	12.62	560.328	41.20	519.98
405	223	0.05	.12	25	1430	71.50	6	27.59	1972.685	66.35	1,830.63
405	224	0.25	.60	25	1316	329.00	6	27.59	9077.11	305.31	8,423.45
407	224	0.07	.17	25	414	28.98	6	27.59	799.5582	26.89	741.98
407	225	0.22	.53	25	1550	341.00	6	27.59	9408.19	316.44	8,730.69
408	270	0.18	.54	20	733	131.94	6	35.91	4737.9654	122.44	4,396.78
408	271	0.09	.27	20	1849	166.41	6	35.91	5975.7831	154.43	5,545.46
409	278	0.14	.24	35	3317	464.38	6	18.14	8423.8532	430.94	7,817.24
409	704	0.23	.39	35	2383	548.09	6	18.14	9942.3526	508.62	9,226.39
414	282	0.18	.36	30	4775	859.50	6	22.06	18960.57	797.61	17,595.18
414	283	0.32	.64	30	2947	943.04	6	22.06	20803.4624	875.13	19,305.37
416	286	0.07	.12	35	2210	154.70	6	18.14	2806.258	143.56	2,604.17
416	1025	0.34	.58	35	1413	480.42	6	18.14	8714.8188	445.82	8,087.25

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

418	284	0.25	.43	35	1313	328.25	6	18.14	5954.455	304.61	5,525.66
418	713	0.25	.43	35	1277	319.25	6	18.14	5791.195	296.26	5,374.16
523	204	0.29	.70	25	3914	1135.06	6	27.59	31316.3054	1,053.32	29,061.16
525	523	0.07	.12	35	129	9.03	6	18.14	163.8042	8.38	152.01
530	222	0.07	.17	25	1363	95.41	6	27.59	2632.3619	88.54	2,442.80
530	532	0.09	.22	25	2617	235.53	6	27.59	6498.2727	218.57	6,030.32
532	530	0.09	.22	25	1015	91.35	6	27.59	2520.3465	84.77	2,338.85
532	533	0.06	.14	26	2795	167.70	6	26.32	4413.864	155.62	4,096.01
533	208	0.3	.72	25	2116	634.80	6	27.59	17514.132	589.09	16,252.91
533	532	0.06	.14	26	863	51.78	6	26.32	1362.8496	48.05	1,264.71
534	272	0.1	.24	25	1382	138.20	6	27.59	3812.938	128.25	3,538.36
538	568	0.41	.55	45	1092	447.72	6	13	5820.36	415.48	5,401.22
546	276	0.52	.69	45	1109	576.68	6	13	7496.84	535.15	6,956.98
568	341	0.27	.36	45	1092	294.84	6	13	3832.92	273.61	3,556.90
568	538	0.41	.55	45	1092	447.72	6	13	5820.36	415.48	5,401.22
570	571	0.49	.84	35	525	257.25	6	18.14	4666.515	238.72	4,330.47
571	570	0.49	.84	35	525	257.25	6	18.14	4666.515	238.72	4,330.47
571	572	0.3	.51	35	525	157.50	6	18.14	2857.05	146.16	2,651.31
572	218	0.55	.94	35	525	288.75	6	18.14	5237.925	267.96	4,860.73
572	571	0.3	.51	35	525	157.50	6	18.14	2857.05	146.16	2,651.31
603	1019	0.17	.34	30	2191	372.47	6	22.06	8216.6882	345.65	7,624.99
604	1524	0.16	.38	25	4485	717.60	6	27.59	19798.584	665.92	18,372.85
606	1530	0.13	.22	35	5309	690.17	6	18.14	12519.6838	640.47	11,618.12
606	1531	0.16	.32	30	3965	634.40	6	22.06	13994.864	588.72	12,987.07
655	204	0.23	.55	25	1286	295.78	6	27.59	8160.5702	274.48	7,572.91
655	223	0.13	.31	25	1384	179.92	6	27.59	4963.9928	166.96	4,606.53
703	271	0.37	1.11	20	1571	581.27	6	35.91	20873.4057	539.41	19,370.27
704	409	0.23	.40	35	3465	796.95	6	18.14	14456.673	739.56	13,415.62
705	903	0.08	.14	34	9838	787.04	6	18.83	14819.9632	730.36	13,752.75
705	1122	0.04	.10	24	5312	212.48	6	28.98	6157.6704	197.18	5,714.24
709	1012	0.09	.16	34	4611	414.99	6	18.83	7814.2617	385.11	7,251.54
713	418	0.25	.43	35	1277	319.25	6	18.14	5791.195	296.26	5,374.16
713	899	0.24	.41	35	2248	539.52	6	18.14	9786.8928	500.67	9,082.12
715	1025	0.17	.29	35	1277	217.09	6	18.14	3938.0126	201.46	3,654.43
721	1022	0.29	.44	40	426	123.54	6	15.23	1881.5142	114.64	1,746.02
734	263	0.25	.60	25	463	115.75	6	27.59	3193.5425	107.41	2,963.57
813	313	0.14	.24	35	741	103.74	6	18.14	1881.8436	96.27	1,746.33
813	314	0.43	.74	35	1239	532.77	6	18.14	9664.4478	494.40	8,968.49
840	284	0.16	.32	30	2351	376.16	6	22.06	8298.0896	349.07	7,700.53
840	285	0.13	.26	30	2191	284.83	6	22.06	6283.3498	264.32	5,830.87
861	261	0.11	.22	30	2113	232.43	6	22.06	5127.4058	215.69	4,758.17
861	268	0.09	.18	30	2918	262.62	6	22.06	5793.3972	243.71	5,376.20

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

899	299	0.12	.21	34	2658	318.96	6	18.83	6006.0168	295.99	5,573.51
899	713	0.24	.42	34	2305	553.20	6	18.83	10416.756	513.36	9,666.63
902	287	0.23	.35	39	10083	2319.09	6	15.75	36525.6675	2,152.09	33,895.39
902	290	0.2	.31	39	10223	2044.60	6	15.75	32202.45	1,897.36	29,883.49
903	705	0.08	.14	34	7854	628.32	6	18.83	11831.2656	583.07	10,979.27
903	1120	0.08	.14	34	9222	737.76	6	18.83	13892.0208	684.63	12,891.63
1012	292	0.42	.72	35	3936	1653.12	6	18.14	29987.5968	1,534.08	27,828.13
1012	709	0.09	.16	34	5188	466.92	6	18.83	8792.1036	433.30	8,158.97
1017	292	0.12	.21	34	4826	579.12	6	18.83	10904.8296	537.42	10,119.55
1017	305	0.23	.40	35	3706	852.38	6	18.14	15462.1732	791.00	14,348.71
1018	268	0.26	.78	20	580	150.80	6	35.91	5415.228	139.94	5,025.27
1018	269	0.06	.18	20	806	48.36	6	35.91	1736.6076	44.88	1,611.55
1019	268	0.08	.16	30	2045	163.60	6	22.06	3609.016	151.82	3,349.12
1019	603	0.17	.34	30	2655	451.35	6	22.06	9956.781	418.85	9,239.77
1020	309	0.33	.57	35	128	42.24	6	18.14	766.2336	39.20	711.06
1020	1512	0.16	.27	36	1493	238.88	6	17.49	4178.0112	221.68	3,877.14
1022	303	0.28	.42	40	258	72.24	6	15.23	1100.2152	67.04	1,020.99
1022	721	0.29	.44	40	425	123.25	6	15.23	1877.0975	114.37	1,741.92
1025	416	0.34	.58	35	1544	524.96	6	18.14	9522.7744	487.16	8,837.02
1025	715	0.17	.29	35	1141	193.97	6	18.14	3518.6158	180.00	3,265.23
1029	302	0.18	.43	25	731	131.58	6	27.59	3630.2922	122.10	3,368.87
1029	303	0.48	1.15	25	258	123.84	6	27.59	3416.7456	114.92	3,170.70
1033	278	0.07	.17	25	5203	364.21	6	27.59	10048.5539	337.98	9,324.94
1033	1122	0.04	.10	24	6904	276.16	6	28.98	8003.1168	256.27	7,426.80
1120	287	0.27	.47	34	10233	2762.91	6	18.83	52025.5953	2,563.95	48,279.13
1120	903	0.08	.14	34	7157	572.56	6	18.83	10781.3048	531.33	10,004.92
1122	705	0.04	.10	24	6866	274.64	6	28.98	7959.0672	254.86	7,385.92
1122	1033	0.04	.10	24	5349	213.96	6	28.98	6200.5608	198.55	5,754.05
1505	299	0.23	.39	35	1916	440.68	6	18.14	7993.9352	408.95	7,418.28
1505	300	0.13	.22	35	1680	218.40	6	18.14	3961.776	202.67	3,676.48
1509	322	0.18	.20	54	6857	1234.26	6	11.97	14774.0922	1,145.38	13,710.18
1509	323	0.32	.35	55	5378	1720.96	6	11.99	20634.3104	1,597.03	19,148.39
1512	308	0.2	.34	35	2869	573.80	6	18.14	10408.732	532.48	9,659.18
1512	1020	0.16	.27	36	625	100.00	6	17.49	1749	92.80	1,623.05
1524	277	0.3	.72	25	4485	1345.50	6	27.59	37122.345	1,248.61	34,449.10
1524	604	0.16	.39	25	3932	629.12	6	27.59	17357.4208	583.82	16,107.48
1530	281	0.16	.27	36	5309	849.44	6	17.49	14856.7056	788.27	13,786.85
1530	606	0.13	.23	34	5010	651.30	6	18.83	12263.979	604.40	11,380.83
1531	282	0.13	.26	30	3965	515.45	6	22.06	11370.827	478.33	10,551.99
1531	606	0.16	.41	23	4775	764.00	6	30.49	23294.36	708.98	21,616.89
201	202	0.51	.76	40	77	39.27	7	15.23	598.0821	39.27	598.08
201	573	0.17	.25	41	152	25.84	7	14.73	380.6232	25.84	380.62

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

202	201	0.51	.76	40	77	39.27	7	15.23	598.0821	39.27	598.08
202	400	0.06	.09	40	1197	71.82	7	15.23	1093.8186	71.82	1,093.82
203	204	0.23	.40	35	3026	695.98	7	18.14	12625.0772	695.98	12,625.08
203	400	0.49	.74	40	3187	1561.63	7	15.23	23783.6249	1,561.63	23,783.62
204	203	0.23	.40	35	3187	733.01	7	18.14	13296.8014	733.01	13,296.80
210	211	0.17	.30	34	4366	742.22	7	18.83	13976.0026	742.22	13,976.00
210	1500	0.74	1.27	35	999	739.26	7	18.14	13410.1764	739.26	13,410.18
211	210	0.17	.31	33	5193	882.81	7	19.56	17267.7636	882.81	17,267.76
211	212	0.21	.37	34	8230	1728.30	7	18.83	32543.889	1,728.30	32,543.89
212	211	0.21	.37	34	9057	1901.97	7	18.83	35814.0951	1,901.97	35,814.10
212	213	0.23	.55	25	455	104.65	7	27.59	2887.2935	104.65	2,887.29
212	524	0.11	.19	35	8299	912.89	7	18.14	16559.8246	912.89	16,559.82
213	212	0.23	.55	25	317	72.91	7	27.59	2011.5869	72.91	2,011.59
213	214	0.41	.98	25	720	295.20	7	27.59	8144.568	295.20	8,144.57
214	213	0.41	.98	25	582	238.62	7	27.59	6583.5258	238.62	6,583.53
214	215	0.43	1.03	25	1380	593.40	7	27.59	16371.906	593.40	16,371.91
215	214	0.43	1.03	25	1241	533.63	7	27.59	14722.8517	533.63	14,722.85
215	216	0.26	.63	25	2523	655.98	7	27.59	18098.4882	655.98	18,098.49
216	215	0.26	.63	25	2384	619.84	7	27.59	17101.3856	619.84	17,101.39
216	217	0.16	.38	25	2204	352.64	7	27.59	9729.3376	352.64	9,729.34
216	410	0.06	.14	26	319	19.14	7	26.32	503.7648	19.14	503.76
217	216	0.16	.38	25	2066	330.56	7	27.59	9120.1504	330.56	9,120.15
217	601	0.07	.17	25	3334	233.38	7	27.59	6438.9542	233.38	6,438.95
222	231	0.36	.86	25	0	0.00	7	27.59	0	-	-
225	406	0.18	.43	25	1148	206.64	7	27.59	5701.1976	206.64	5,701.20
228	244	0.1	.24	25	2215	221.50	7	27.59	6111.185	221.50	6,111.19
228	257	0.06	.14	26	2612	156.72	7	26.32	4124.8704	156.72	4,124.87
231	222	0.36	.86	25	281	101.16	7	27.59	2791.0044	101.16	2,791.00
231	232	0.07	.17	25	0	0.00	7	27.59	0	-	-
232	231	0.07	.17	25	281	19.67	7	27.59	542.6953	19.67	542.70
232	233	0.23	.55	25	0	0.00	7	27.59	0	-	-
233	232	0.23	.55	25	281	64.63	7	27.59	1783.1417	64.63	1,783.14
233	234	0.23	.55	25	42	9.66	7	27.59	266.5194	9.66	266.52
233	406	0.18	.43	25	392	70.56	7	27.59	1946.7504	70.56	1,946.75
234	233	0.23	.55	25	673	154.79	7	27.59	4270.6561	154.79	4,270.66
234	235	0.07	.17	25	42	2.94	7	27.59	81.1146	2.94	81.11
235	234	0.07	.17	25	76	5.32	7	27.59	146.7788	5.32	146.78
235	236	0.35	.84	25	42	14.70	7	27.59	405.573	14.70	405.57
235	237	0.26	.62	25	0	0.00	7	27.59	0	-	-
236	235	0.35	.84	25	0	0.00	7	27.59	0	-	-
236	535	0.31	.74	25	42	13.02	7	27.59	359.2218	13.02	359.22
237	235	0.26	.62	25	76	19.76	7	27.59	545.1784	19.76	545.18

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

237	238	0.2	.48	25	0	0.00	7	27.59	0	-	-
238	237	0.2	.48	25	76	15.20	7	27.59	419.368	15.20	419.37
238	239	0.07	.17	25	1480	103.60	7	27.59	2858.324	103.60	2,858.32
238	250	0.1	.24	25	258	25.80	7	27.59	711.822	25.80	711.82
239	238	0.07	.17	25	334	23.38	7	27.59	645.0542	23.38	645.05
239	240	0.09	.22	25	0	0.00	7	27.59	0	-	-
241	243	0.26	.62	25	519	134.94	7	27.59	3722.9946	134.94	3,722.99
242	225	0.14	.34	25	1195	167.30	7	27.59	4615.807	167.30	4,615.81
243	241	0.26	.62	25	293	76.18	7	27.59	2101.8062	76.18	2,101.81
243	242	0.2	.48	25	1734	346.80	7	27.59	9568.212	346.80	9,568.21
244	228	0.1	.24	25	1875	187.50	7	27.59	5173.125	187.50	5,173.13
244	243	0.18	.43	25	1508	271.44	7	27.59	7489.0296	271.44	7,489.03
245	244	0.08	.19	25	692	55.36	7	27.59	1527.3824	55.36	1,527.38
246	245	0.1	.24	25	808	80.80	7	27.59	2229.272	80.80	2,229.27
246	247	0.17	.41	25	346	58.82	7	27.59	1622.8438	58.82	1,622.84
247	246	0.17	.41	25	958	162.86	7	27.59	4493.3074	162.86	4,493.31
250	238	0.1	.24	25	1480	148.00	7	27.59	4083.32	148.00	4,083.32
250	358	0.1	.24	25	0	0.00	7	27.59	0	-	-
254	257	0.07	.17	25	616	43.12	7	27.59	1189.6808	43.12	1,189.68
254	358	0.09	.22	25	2503	225.27	7	27.59	6215.1993	225.27	6,215.20
257	228	0.06	.14	26	952	57.12	7	26.32	1503.3984	57.12	1,503.40
257	254	0.07	.17	25	2922	204.54	7	27.59	5643.2586	204.54	5,643.26
286	1599	0.29	.50	35	1180	342.20	7	18.14	6207.508	342.20	6,207.51
287	288	0.14	.34	25	3264	456.96	7	27.59	12607.5264	456.96	12,607.53
288	287	0.14	.34	25	3503	490.42	7	27.59	13530.6878	490.42	13,530.69
288	289	0.36	.87	25	3026	1089.36	7	27.59	30055.4424	1,089.36	30,055.44
289	288	0.36	.87	25	3263	1174.68	7	27.59	32409.4212	1,174.68	32,409.42
289	708	0.07	.12	35	4108	287.56	7	18.14	5216.3384	287.56	5,216.34
289	891	0.12	.21	34	1816	217.92	7	18.83	4103.4336	217.92	4,103.43
290	1011	0.14	.34	25	908	127.12	7	27.59	3507.2408	127.12	3,507.24
291	891	0.31	.53	35	983	304.73	7	18.14	5527.8022	304.73	5,527.80
291	892	0.32	.77	25	151	48.32	7	27.59	1333.1488	48.32	1,333.15
291	1011	0.36	.86	25	477	171.72	7	27.59	4737.7548	171.72	4,737.75
291	1013	0.24	.41	35	1532	367.68	7	18.14	6669.7152	367.68	6,669.72
292	892	0.18	.43	25	313	56.34	7	27.59	1554.4206	56.34	1,554.42
293	1016	0.12	.29	25	918	110.16	7	27.59	3039.3144	110.16	3,039.31
293	1504	0.07	.17	25	993	69.51	7	27.59	1917.7809	69.51	1,917.78
294	295	0.14	.34	25	657	91.98	7	27.59	2537.7282	91.98	2,537.73
294	1031	0.11	.26	25	696	76.56	7	27.59	2112.2904	76.56	2,112.29
294	1032	0.29	.70	25	215	62.35	7	27.59	1720.2365	62.35	1,720.24
295	294	0.14	.34	25	657	91.98	7	27.59	2537.7282	91.98	2,537.73
295	296	0.1	.24	25	146	14.60	7	27.59	402.814	14.60	402.81

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

296	295	0.1	.24	25	93	9.30	7	27.59	256.587	9.30	256.59
296	297	0.29	.70	25	146	42.34	7	27.59	1168.1606	42.34	1,168.16
297	296	0.29	.70	25	93	26.97	7	27.59	744.1023	26.97	744.10
297	298	0.14	.34	25	146	20.44	7	27.59	563.9396	20.44	563.94
298	297	0.14	.34	25	93	13.02	7	27.59	359.2218	13.02	359.22
298	310	0.29	.70	25	505	146.45	7	27.59	4040.5555	146.45	4,040.56
298	420	0.24	.58	25	465	111.60	7	27.59	3079.044	111.60	3,079.04
301	1032	0.22	.53	25	215	47.30	7	27.59	1305.007	47.30	1,305.01
303	1514	1.13	1.70	40	0	0.00	7	15.23	0	-	-
307	420	0.27	.65	25	1511	407.97	7	27.59	11255.8923	407.97	11,255.89
307	1508	0.15	.36	25	490	73.50	7	27.59	2027.865	73.50	2,027.87
310	298	0.29	.70	25	451	130.79	7	27.59	3608.4961	130.79	3,608.50
313	1513	0.24	.41	35	2432	583.68	7	18.14	10587.9552	583.68	10,587.96
314	337	0.29	.32	54	1803	522.87	7	11.97	6258.7539	522.87	6,258.75
317	318	0.22	.38	35	1048	230.56	7	18.14	4182.3584	230.56	4,182.36
317	321	0.5	1.20	25	508	254.00	7	27.59	7007.86	254.00	7,007.86
317	1013	0.26	.45	35	704	183.04	7	18.14	3320.3456	183.04	3,320.35
317	1014	0.24	.58	25	178	42.72	7	27.59	1178.6448	42.72	1,178.64
318	317	0.22	.38	35	491	108.02	7	18.14	1959.4828	108.02	1,959.48
318	950	0.58	.99	35	1048	607.84	7	18.14	11026.2176	607.84	11,026.22
319	1511	0.28	.48	35	0	0.00	7	18.14	0	-	-
319	1516	0.18	.31	35	0	0.00	7	18.14	0	-	-
320	325	0.35	.38	55	895	313.25	7	11.99	3755.8675	313.25	3,755.87
320	1516	0.33	.57	35	68	22.44	7	18.14	407.0616	22.44	407.06
321	317	0.5	1.20	25	328	164.00	7	27.59	4524.76	164.00	4,524.76
321	326	0.57	.84	41	5832	3324.24	7	14.73	48966.0552	3,324.24	48,966.06
323	834	0.44	.50	53	3294	1449.36	7	11.95	17319.852	1,449.36	17,319.85
324	325	0.22	.24	55	1403	308.66	7	11.99	3700.8334	308.66	3,700.83
324	824	0.51	.56	55	2019	1029.69	7	11.99	12345.9831	1,029.69	12,345.98
324	834	0.06	.07	51	2726	163.56	7	11.93	1951.2708	163.56	1,951.27
325	320	0.35	.38	55	978	342.30	7	11.99	4104.177	342.30	4,104.18
325	324	0.22	.24	55	1327	291.94	7	11.99	3500.3606	291.94	3,500.36
325	335	0.8	1.07	45	493	394.40	7	13	5127.2	394.40	5,127.20
326	321	0.57	.62	55	864	492.48	7	11.99	5904.8352	492.48	5,904.84
326	327	0.32	.47	41	5832	1866.24	7	14.73	27489.7152	1,866.24	27,489.72
327	326	0.32	.35	55	864	276.48	7	11.99	3314.9952	276.48	3,315.00
327	373	0.22	.24	55	514	113.08	7	11.99	1355.8292	113.08	1,355.83
328	373	0.46	.50	55	864	397.44	7	11.99	4765.3056	397.44	4,765.31
335	325	0.8	1.07	45	500	400.00	7	13	5200	400.00	5,200.00
337	314	0.29	.32	54	1818	527.22	7	11.97	6310.8234	527.22	6,310.82
358	250	0.1	.25	24	5110	511.00	7	28.98	14808.78	511.00	14,808.78
358	254	0.09	.22	25	616	55.44	7	27.59	1529.5896	55.44	1,529.59

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

373	327	0.22	.24	55	864	190.08	7	11.99	2279.0592	190.08	2,279.06
373	328	0.46	.50	55	514	236.44	7	11.99	2834.9156	236.44	2,834.92
400	202	0.06	.09	40	1440	86.40	7	15.23	1315.872	86.40	1,315.87
400	203	0.49	.74	40	3026	1482.74	7	15.23	22582.1302	1,482.74	22,582.13
406	225	0.18	.43	25	1521	273.78	7	27.59	7553.5902	273.78	7,553.59
406	233	0.18	.43	25	42	7.56	7	27.59	208.5804	7.56	208.58
410	216	0.06	.14	26	318	19.08	7	26.32	502.1856	19.08	502.19
410	600	0.09	.22	25	319	28.71	7	27.59	792.1089	28.71	792.11
420	298	0.24	.58	25	465	111.60	7	27.59	3079.044	111.60	3,079.04
420	307	0.27	.65	25	1503	405.81	7	27.59	11196.2979	405.81	11,196.30
523	524	0.05	.09	33	3016	150.80	7	19.56	2949.648	150.80	2,949.65
524	212	0.11	.19	35	9264	1019.04	7	18.14	18485.3856	1,019.04	18,485.39
524	523	0.05	.09	33	3784	189.20	7	19.56	3700.752	189.20	3,700.75
535	236	0.31	.74	25	0	0.00	7	27.59	0	-	-
573	201	0.17	.25	41	149	25.33	7	14.73	373.1109	25.33	373.11
600	410	0.09	.22	25	318	28.62	7	27.59	789.6258	28.62	789.63
601	217	0.07	.17	25	3195	223.65	7	27.59	6170.5035	223.65	6,170.50
604	1526	0.16	.27	36	2263	362.08	7	17.49	6332.7792	362.08	6,332.78
708	289	0.07	.13	32	4902	343.14	7	20.34	6979.4676	343.14	6,979.47
712	1016	0.24	.58	25	479	114.96	7	27.59	3171.7464	114.96	3,171.75
715	1521	0.35	.60	35	192	67.20	7	18.14	1219.008	67.20	1,219.01
716	1514	0.3	.51	35	689	206.70	7	18.14	3749.538	206.70	3,749.54
824	324	0.51	.56	55	1528	779.28	7	11.99	9343.5672	779.28	9,343.57
834	323	0.44	.49	54	2726	1199.44	7	11.97	14357.2968	1,199.44	14,357.30
834	324	0.06	.07	51	3294	197.64	7	11.93	2357.8452	197.64	2,357.85
891	289	0.12	.21	34	1259	151.08	7	18.83	2844.8364	151.08	2,844.84
891	291	0.31	.53	35	1540	477.40	7	18.14	8660.036	477.40	8,660.04
892	291	0.32	.77	25	151	48.32	7	27.59	1333.1488	48.32	1,333.15
892	292	0.18	.43	25	313	56.34	7	27.59	1554.4206	56.34	1,554.42
950	318	0.58	.99	35	491	284.78	7	18.14	5165.9092	284.78	5,165.91
950	1511	0.22	.38	35	3173	698.06	7	18.14	12662.8084	698.06	12,662.81
950	1512	0.51	.88	35	3732	1903.32	7	18.14	34526.2248	1,903.32	34,526.22
1011	290	0.14	.34	25	903	126.42	7	27.59	3487.9278	126.42	3,487.93
1011	291	0.36	.86	25	480	172.80	7	27.59	4767.552	172.80	4,767.55
1013	291	0.24	.41	35	972	233.28	7	18.14	4231.6992	233.28	4,231.70
1013	317	0.26	.45	35	1264	328.64	7	18.14	5961.5296	328.64	5,961.53
1014	317	0.24	.58	25	355	85.20	7	27.59	2350.668	85.20	2,350.67
1014	1508	0.2	.48	25	312	62.40	7	27.59	1721.616	62.40	1,721.62
1018	293	0.12	.29	25	919	110.28	7	27.59	3042.6252	110.28	3,042.63
1016	712	0.24	.58	25	479	114.96	7	27.59	3171.7464	114.96	3,171.75
1023	1521	0.21	.36	35	891	187.11	7	18.14	3394.1754	187.11	3,394.18
1031	294	0.11	.26	25	695	76.45	7	27.59	2109.2555	76.45	2,109.26

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

1031	1504	0.04	.10	24	993	39.72	7	28.98	1151.0856	39.72	1,151.09
1032	294	0.29	.70	25	215	62.35	7	27.59	1720.2365	62.35	1,720.24
1032	301	0.22	.53	25	215	47.30	7	27.59	1305.007	47.30	1,305.01
1500	210	0.74	1.27	35	174	128.76	7	18.14	2335.7064	128.76	2,335.71
1500	1501	0.09	.15	36	2240	201.60	7	17.49	3525.984	201.60	3,525.98
1501	1500	0.09	.15	36	206	18.54	7	17.49	324.2646	18.54	324.26
1502	1520	1.39	2.38	35	1953	2714.67	7	18.14	49244.1138	2,714.67	49,244.11
1502	1526	0.26	.45	35	2215	575.90	7	18.14	10446.826	575.90	10,446.83
1504	293	0.07	.17	25	993	69.51	7	27.59	1917.7809	69.51	1,917.78
1504	1031	0.04	.10	24	993	39.72	7	28.98	1151.0856	39.72	1,151.09
1507	1522	0.14	.24	35	730	102.20	7	18.14	1853.908	102.20	1,853.91
1507	1599	0.36	.62	35	719	258.84	7	18.14	4695.3576	258.84	4,695.36
1508	307	0.15	.36	25	312	46.80	7	27.59	1291.212	46.80	1,291.21
1508	1014	0.2	.48	25	490	98.00	7	27.59	2703.82	98.00	2,703.82
1509	1510	0.44	.75	35	3037	1336.28	7	18.14	24240.1192	1,336.28	24,240.12
1510	1509	0.44	.75	35	3067	1349.48	7	18.14	24479.5672	1,349.48	24,479.57
1510	1511	0.17	.29	35	3037	516.29	7	18.14	9365.5006	516.29	9,365.50
1511	319	0.28	.48	35	106	29.68	7	18.14	538.3952	29.68	538.40
1511	950	0.22	.38	35	3037	668.14	7	18.14	12120.0596	668.14	12,120.06
1511	1510	0.17	.29	35	3067	521.39	7	18.14	9458.0146	521.39	9,458.01
1512	950	0.51	.87	35	3311	1688.61	7	18.14	30631.3854	1,688.61	30,631.39
1512	1513	0.57	.98	35	3834	2185.38	7	18.14	39642.7932	2,185.38	39,642.79
1513	313	0.24	.41	35	2916	699.84	7	18.14	12695.0976	699.84	12,695.10
1513	1512	0.57	.98	35	3349	1908.93	7	18.14	34627.9902	1,908.93	34,627.99
1514	303	1.13	1.70	40	0	0.00	7	15.23	0	-	-
1514	716	0.3	.51	35	698	209.40	7	18.14	3798.516	209.40	3,798.52
1514	1521	0.2	.34	35	689	137.80	7	18.14	2499.692	137.80	2,499.69
1516	319	0.18	.31	35	68	12.24	7	18.14	222.0336	12.24	222.03
1516	320	0.33	.57	35	0	0.00	7	18.14	0	-	-
1520	1502	1.39	2.38	35	1905	2647.95	7	18.14	48033.813	2,647.95	48,033.81
1520	1522	0.22	.38	35	719	158.18	7	18.14	2869.3852	158.18	2,869.39
1521	715	0.35	.60	35	192	67.20	7	18.14	1219.008	67.20	1,219.01
1521	1514	0.2	.34	35	698	139.60	7	18.14	2532.344	139.60	2,532.34
1522	1507	0.14	.24	35	719	100.66	7	18.14	1825.9724	100.66	1,825.97
1522	1520	0.22	.38	35	730	160.60	7	18.14	2913.284	160.60	2,913.28
1526	604	0.16	.27	36	2215	354.40	7	17.49	6198.456	354.40	6,198.46
1526	1502	0.26	.45	35	2263	588.38	7	18.14	10673.2132	588.38	10,673.21
1599	286	0.29	.50	35	1169	339.01	7	18.14	6149.6414	339.01	6,149.64
1599	1507	0.36	.62	35	730	262.80	7	18.14	4767.192	262.80	4,767.19
265	1525	0.63	1.51	25	577	363.51	8	27.59	10029.2409	363.51	10,029.24
604	1525	0.15	.36	25	570	85.50	8	27.59	2358.945	85.50	2,358.95
1525	265	0.63	1.51	25	570	359.10	8	27.59	9907.569	359.10	9,907.57

Appendix E, Table E-17: Klamath Falls UGB CO 2016 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

1525	604	0.15	.36	25	577	86.55	8	27.59	2387.9145	86.55	2,387.91
202	205	0.07	.17	25	1363	95.41	9	27.59	2632.3619	95.41	2,632.36
204	1519	0.37	.89	25	0	0.00	9	27.59	0	-	-
205	202	0.07	.17	25	1119	78.33	9	27.59	2161.1247	78.33	2,161.12
205	206	0.2	.48	25	381	76.20	9	27.59	2102.358	76.20	2,102.36
206	205	0.2	.48	25	143	28.60	9	27.59	789.074	28.60	789.07
206	207	0.36	.86	25	267	96.12	9	27.59	2651.9508	96.12	2,651.95
207	206	0.36	.86	25	29	10.44	9	27.59	288.0396	10.44	288.04
207	208	0.26	.62	25	981	255.06	9	27.59	7037.1054	255.06	7,037.11
208	207	0.26	.62	25	825	214.50	9	27.59	5918.055	214.50	5,918.06
241	1518	0.07	.17	25	1850	129.50	9	27.59	3572.905	129.50	3,572.91
244	357	0.2	.48	25	1483	296.60	9	27.59	8183.194	296.60	8,183.19
247	248	0.16	.38	25	437	69.92	9	27.59	1929.0928	69.92	1,929.09
248	247	0.16	.38	25	1634	261.44	9	27.59	7213.1296	261.44	7,213.13
248	249	0.08	.19	25	373	29.84	9	27.59	823.2856	29.84	823.29
248	856	0.11	.33	20	64	7.04	9	35.91	252.8064	7.04	252.81
249	248	0.08	.19	25	1571	125.68	9	27.59	3467.5112	125.68	3,467.51
250	251	0.07	.17	25	3119	218.33	9	27.59	6023.7247	218.33	6,023.72
254	255	0.07	.17	25	419	29.33	9	27.59	809.2147	29.33	809.21
255	256	0.09	.22	25	659	59.31	9	27.59	1636.3629	59.31	1,636.36
256	856	0.14	.42	20	659	92.26	9	35.91	3313.0566	92.26	3,313.06
258	257	0.07	.21	20	646	45.22	9	35.91	1623.8502	45.22	1,623.85
259	258	0.09	.27	20	0	0.00	9	35.91	0	-	-
262	356	0.11	.33	20	0	0.00	9	35.91	0	-	-
264	575	0.49	.65	45	0	0.00	9	13	0	-	-
265	266	0.56	1.12	30	546	305.76	9	22.06	6745.0656	305.76	6,745.07
265	574	0.27	.36	45	0	0.00	9	13	0	-	-
266	265	0.56	1.12	30	552	309.12	9	22.06	6819.1872	309.12	6,819.19
266	267	0.16	.32	30	507	81.12	9	22.06	1789.5072	81.12	1,789.51
267	266	0.16	.32	30	514	82.24	9	22.06	1814.2144	82.24	1,814.21
267	603	0.07	.14	30	507	35.49	9	22.06	782.9094	35.49	782.91
284	412	0.36	.86	25	1397	502.92	9	27.59	13875.5628	502.92	13,875.56
285	1024	0.24	.41	35	580	139.20	9	18.14	2525.088	139.20	2,525.09
302	1030	0.17	.29	35	153	26.01	9	18.14	471.8214	26.01	471.82
351	752	0.23	.56	25	2802	644.46	9	27.59	17780.6514	644.46	17,780.65
352	412	0.15	.36	25	1605	240.75	9	27.59	6642.2925	240.75	6,642.29
352	1520	0.25	.60	25	1285	321.25	9	27.59	8863.2875	321.25	8,863.29
356	262	0.11	.33	20	2043	224.73	9	35.91	8070.0543	224.73	8,070.05
357	244	0.2	.48	25	1959	391.80	9	27.59	10809.762	391.80	10,809.76
359	358	0.07	.21	20	3223	225.61	9	35.91	8101.6551	225.61	8,101.66
412	284	0.36	.86	25	1457	524.52	9	27.59	14471.5068	524.52	14,471.51
412	352	0.15	.36	25	1546	231.90	9	27.59	6398.121	231.90	6,398.12

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

574	265	0.27	.36	45	0	0.00	9	13	0	-	-
574	575	0.24	.32	45	0	0.00	9	13	0	-	-
575	264	0.49	.65	45	0	0.00	9	13	0	-	-
575	574	0.24	.32	45	0	0.00	9	13	0	-	-
600	1518	0.09	.22	25	2049	184.41	9	27.59	5087.8719	184.41	5,087.87
603	267	0.07	.14	30	514	35.98	9	22.06	793.7188	35.98	793.72
714	1015	0.17	.29	35	1972	335.24	9	18.14	6081.2536	335.24	6,081.25
714	1024	0.26	.45	35	775	201.50	9	18.14	3655.21	201.50	3,655.21
752	351	0.23	.56	25	2801	644.23	9	27.59	17774.3057	644.23	17,774.31
752	1520	0.1	.24	25	2802	280.20	9	27.59	7730.718	280.20	7,730.72
856	248	0.11	.33	20	63	6.93	9	35.91	248.8563	6.93	248.86
856	256	0.14	.42	20	0	0.00	9	35.91	0	-	-
899	1015	0.29	.50	35	864	250.56	9	18.14	4545.1584	250.56	4,545.16
899	1016	0.37	.63	35	440	162.80	9	18.14	2953.192	162.80	2,953.19
1015	714	0.17	.29	35	2153	366.01	9	18.14	6639.4214	366.01	6,639.42
1015	899	0.29	.50	35	684	198.36	9	18.14	3598.2504	198.36	3,598.25
1015	1023	0.2	.34	35	1768	353.60	9	18.14	6414.304	353.60	6,414.30
1016	899	0.37	.63	35	439	162.43	9	18.14	2946.4802	162.43	2,946.48
1023	1015	0.2	.34	35	1769	353.80	9	18.14	6417.932	353.80	6,417.93
1023	1506	0.35	.60	35	1857	649.95	9	18.14	11790.093	649.95	11,790.09
1024	285	0.24	.41	35	619	148.56	9	18.14	2694.8784	148.56	2,694.88
1024	714	0.26	.45	35	736	191.36	9	18.14	3471.2704	191.36	3,471.27
1030	302	0.17	.29	35	143	24.31	9	18.14	440.9834	24.31	440.98
1030	1506	0.2	.34	35	1868	373.60	9	18.14	6777.104	373.60	6,777.10
1506	1023	0.35	.60	35	1868	653.80	9	18.14	11859.932	653.80	11,859.93
1506	1030	0.2	.34	35	1857	371.40	9	18.14	6737.196	371.40	6,737.20
1518	241	0.07	.17	25	2049	143.43	9	27.59	3957.2337	143.43	3,957.23
1518	600	0.09	.22	25	1850	166.50	9	27.59	4593.735	166.50	4,593.74
1518	1519	0.65	1.56	25	0	0.00	9	27.59	0	-	-
1519	204	0.37	.89	25	0	0.00	9	27.59	0	-	-
1519	1518	0.65	1.56	25	0	0.00	9	27.59	0	-	-
1520	352	0.25	.60	25	1344	336.00	9	27.59	9270.24	336.00	9,270.24
1520	752	0.1	.24	25	2801	280.10	9	27.59	7727.959	280.10	7,727.96
1521	1023	0.21	.36	35	881	185.01	9	18.14	3356.0814	185.01	3,356.08
370	371	0.05	.10	30	0	0.00	30	22.06	0	-	-
503	504	0.17	.19	54	4591	780.47	30	11.97	9342.2259	780.47	9,342.23
504	505	0.19	.21	54	4591	872.29	30	11.97	10441.3113	872.29	10,441.31
506	532	0.25	.43	35	330	82.50	30	18.14	1496.55	82.50	1,496.55
507	531	0.03	.06	30	2305	69.15	30	22.06	1525.449	69.15	1,525.45
511	534	0.1	.24	25	946	94.60	30	27.59	2610.014	94.60	2,610.01
515	543	0.19	.33	35	5953	1131.07	30	18.14	20517.6098	1,131.07	20,517.61
517	545	0.18	.31	35	862	155.16	30	18.14	2814.6024	155.16	2,814.60

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

530	531	0.07	.12	35	883	61.81	30	18.14	1121.2334	61.81	1,121.23
531	530	0.07	.12	35	2305	161.35	30	18.14	2926.889	161.35	2,926.89
531	557	0.14	.24	35	883	123.62	30	18.14	2242.4668	123.62	2,242.47
533	508	0.23	.46	30	2088	480.24	30	22.06	10594.0944	480.24	10,594.09
534	512	0.21	.36	35	3270	686.70	30	18.14	12456.738	686.70	12,456.74
535	560	0.14	.24	35	1313	183.82	30	18.14	3334.4948	183.82	3,334.49
543	516	0.05	.09	33	1125	56.25	30	19.56	1100.25	56.25	1,100.25
545	820	0.07	.15	28	8001	560.07	30	24.04	13464.0828	560.07	13,464.08
556	527	0.07	.14	30	2501	175.07	30	22.06	3862.0442	175.07	3,862.04
561	536	0.16	.32	30	5199	831.84	30	22.06	18350.3904	831.84	18,350.39
700	730	0.12	.24	30	1018	122.16	30	22.06	2694.8496	122.16	2,694.85
700	732	0.04	.08	30	0	0.00	30	22.06	0	-	-
701	732	0.06	.12	30	0	0.00	30	22.06	0	-	-
701	733	0.08	.16	30	247	19.76	30	22.06	435.9056	19.76	435.91
719	725	0.1	.17	35	1671	167.10	30	18.14	3031.194	167.10	3,031.19
725	717	0.1	.13	46	4732	473.20	30	12.62	5971.784	473.20	5,971.78
730	701	0.07	.14	30	630	44.10	30	22.06	972.846	44.10	972.85
730	731	0.08	.16	30	1018	81.44	30	22.06	1796.5664	81.44	1,796.57
731	730	0.08	.16	30	630	50.40	30	22.06	1111.824	50.40	1,111.82
731	734	0.17	.34	30	590	100.30	30	22.06	2212.618	100.30	2,212.62
732	700	0.04	.08	30	1117	44.68	30	22.06	985.6408	44.68	985.64
732	733	0.06	.12	30	0	0.00	30	22.06	0	-	-
733	732	0.06	.12	30	1117	67.02	30	22.06	1478.4612	67.02	1,478.46
733	734	0.06	.12	30	247	14.82	30	22.06	326.9292	14.82	326.93
734	731	0.17	.34	30	200	34.00	30	22.06	750.04	34.00	750.04
734	733	0.06	.12	30	1117	67.02	30	22.06	1478.4612	67.02	1,478.46
820	544	0.03	.05	36	8001	240.03	30	17.49	4198.1247	240.03	4,198.12
				0							
Total		183.87	320.13	35	2574062	590438.35			9640256.061	554,766.39	
Off System Estimated Speed &				25		59,044		27.59	1629019.408	55,476.64	1530600.463

Links highlighted are those within 1/4 mile of the Hope and 6th Street intersection, Node 712
Links highlighted in green are functional class changes from FCLASS 9 to FCLASS 7 for projects # 5 Anderson Ave. and # 6 Foothills Blvd.

Appendix E, Table E-17: Klamath Falls UGB CO 2015 EMME/2 Roadway Type lbs/day Calculation Table. Model Run Output for Klamath Falls Model Study Area (only included area inside UGB and no centroid connections)

Functional Class	Legend	VMT AAWD (1)	AAWD [Gm CO]	AAWD [Lbs CO/day]	Average Seasonal Day VMT	Seasonal AWD [Gm CO]	Average Seasonal Day [Lbs CO/day]
2	Rural Principal Arterial	372,849	5,390,067	11,885	345,999	5,001,919	11,029
6	Rural Minor Arterial	122,514	2,364,836	5,214	113,691	2,194,540	4,839
7	Rural Major Collector	72,583	1,389,071	3,063	72,583	1,389,071	3,063
8	Minor Collector	895	24,684	54	895	24,684	54
9	Rural Local	13,566	325,952	719	13,566	325,952	719
30	Ramps	8,032	145,646	321	8,032	145,646	321
	Off Network VMT Est.	59,044	1,629,019	3,592	55,477	1,530,600	3,375
	Total	649,482	11,269,275	24,849	610,243	10,612,411	23,400

1. Vehicle Miles Traveled on an annual average week day (Monday - Friday) . April/ October are chosen by ODOT to represent the annual day as the most neutral months.
2. Seasonal Adjustment factor is from Table 2.6.1 - CO Season VMT Adjustment Determination.
SAF is applied to Calss 2 and Class 6 roads only. The activity on the other roads (class 7, 8, 9, and 30) is assumed to be uniformed throughout a year.
ssl, 3/31/2000
QC sda 4/11/2000

Attachments

B-1 through B-5

Notice of Public Hearing on Proposed Air Quality Rule Amendments – Oxygenated Fuel and Klamath County Clean Air Ordinance

The Department of Environmental Quality (DEQ) is proposing that the Environmental Quality Commission adopt a Carbon Monoxide (CO) maintenance plan for the Klamath Falls Urban Growth Boundary (UGB) and revisions to the Klamath County Clean Air Ordinance as an amendment to the State Implementation Plan. The carbon monoxide maintenance plan demonstrates that Klamath Falls will comply with carbon monoxide health standards for at least the next fifteen years, and will allow the oxygenated fuel requirement for Klamath Falls to be eliminated. The plan includes a carbon monoxide emission inventory, establishes a transportation conformity emissions budget for Klamath Falls, and includes a contingency plan.

If adopted, the maintenance plan will be submitted to the U.S. Environmental Protection Agency with a request that EPA repeal the CO nonattainment status for Klamath Falls and eliminate the oxygenated fuel requirement. Revisions to the Klamath County Clean Air Ordinance are scheduled for consideration by the Klamath County Board of Commissioners. If adopted, the revised ordinance will be submitted to EPA as an amendment to the Klamath Falls PM10 Attainment Plan. Summaries of the carbon monoxide maintenance plan, emission inventory, proposed rule amendments, and a copy of the Klamath County Clean Air Ordinance, are available upon request from DEQ in Klamath Falls, 700 Main Street, Suite 202, Klamath Falls, Oregon 97601, (541) 883-5603, or DEQ in Portland, 811 SW Sixth Avenue, Portland, Oregon, 97204, (800) 452-4011. A complete copy of the draft maintenance plan and emission inventory is available for inspection at either of these DEQ offices.

DEQ will hold a public hearing for this proposal on Thursday, June 29, 2000 in the Klamath County Courthouse (Room 20), 316 Main Street, Klamath Falls. DEQ staff will be available from 5:00 to 6:00 p.m. to informally answer questions. The public hearing will begin at 6:00 p.m. and conclude at or before 8:00 p.m. This is a drop-in public hearing and oral or written testimony can be given at any time during the hours of 5:00 to 8:00 p.m. Written comments will also be accepted through July 3, 1999 at 5 p.m. and should be mailed to David Collier, Air Quality Division, DEQ, 811 SW Sixth Avenue, Portland, Oregon 97204 or faxed to (503) 229 5675.

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY

Rulemaking Proposal
for
Klamath Falls Carbon Monoxide Maintenance Plan/Redesignation Request

Fiscal and Economic Impact Statement

Introduction

This rulemaking proposes to adopt a carbon monoxide maintenance plan for the Klamath Falls area and redesignate the Klamath Falls Urban Growth Boundary from a nonattainment area to a maintenance area. The proposal also adopts rule amendments to eliminate the wintertime oxygenated fuel requirement for Klamath Falls. This action will result in a minor cost savings to those involved in the sale and distribution of gasoline, and may result in some cost savings to the general public. Because ethanol is the oxygenate used in Klamath Falls, eliminating the oxygenated fuel requirement will have a minor negative economic impact on producers of ethanol. The oxygenated fuel program in Klamath Falls will be discontinued once the Environmental Protection Agency (EPA) approves the maintenance plan.

Once Klamath Falls has been redesignated to attainment by EPA, stringent nonattainment area New Source Review requirements for new and expanding major industry will be replaced by less stringent requirements for major facilities in maintenance areas. This results in an economic benefit to existing major industries that wish to expand, or to companies considering Klamath Falls for a new facility.

This rulemaking also proposes to adopt recent amendments to the Klamath County Clean Air ordinance.

Oxygenated Fuel

General Public

Oxygenated fuel can come with a slightly higher cost at the pump, generally no more than one or two cents per gallon. Oxygenated fuel is also reported to cause performance problems in some older vehicles. There is also some evidence that fuel economy decreases in older vehicles with the use of oxygenated fuel. These factors will result in a slight economic benefit to the general public in Klamath Falls if the oxygenated fuel requirement is eliminated.

Small Business

There are about 30 gasoline service stations in the Klamath Falls area, both large and small. Eliminating oxygenated fuel will relieve gasoline stations in Klamath Falls, regardless of size, of the additional paperwork and expense associated with selling oxygenated fuel during the winter months. There will also be some simplification for fuel distributors of any size who will no longer have to carry two grades of fuel when making deliveries to both the Klamath Falls area and the surrounding areas of south-central Oregon. The majority of gasoline sold in the Klamath Falls area comes from a terminal in Eugene. Gasoline can also be supplied to the Klamath Falls area through terminals in California and Utah. The ethanol oxygenate is added by blenders to the gasoline when it is loaded into multi-compartmented delivery trucks. Since gasoline is typically delivered to communities in area specific batches, discontinuing oxygenated fuels in Klamath Falls should not affect the ability of fuel suppliers to meet oxygenated fuel requirements in other areas.

Large Business

Gasoline retailers, distributors, and terminals are required to have a permit to sell oxygenated fuel. The permit is free to retailers, $250 to distributors, and $2,500 to terminals. Distributors and terminals will continue to need a permit and to document operations as they supply oxygenated fuel to other areas in Oregon. Removing oxygenated fuel in Klamath Falls will provide a minor benefit in terms of reduced record keeping to retailers and distributors serving Klamath Falls.

Ethanol suppliers will experience a small loss of ethanol sales; however, the Klamath Falls market does not represent a significant percentage of the ethanol volume sold in Oregon. Fourteen blenders are registered to sell oxygenated fuel in the Klamath Falls area, with only four blending last winter season. During the 1998-99 winter season these blenders reported selling approximately 4 million gallons of oxygenated fuel in the Klamath Falls area. (This compares to approximately 189 million gallons sold in the Portland area.)

New Source Review

Small Business

Some small businesses in Klamath Falls may have the potential for major emission increases. Such businesses could be subject to requirements for new or expanding major industry, if proposed emission increases are sufficiently large. See the next section (Large Business) for a discussion of the New Source Review program for new and expanding major industry.

Large Business

Under state rules, new or expanding major industry in nonattainment areas like Klamath Falls must install pollution control equipment and demonstrate that air quality standards will not be violated as a result of the proposed emission increase. This process is known as New Source Review (NSR). New or expanding major industry is required to comply with nonattainment NSR requirements until EPA redesignates the area as attainment (the area then becomes a CO maintenance area). Nonattainment area requirements include Lowest Achievable Emission Rate (LAER) control technology and emission offsets. LAER technology draws from the most effective emission control methods achieved at similar facilities nationwide, and does not consider cost as a factor is determining whether an emission control approach is feasible.

Once redesignated to attainment, new or expanding major sources of CO in Klamath Falls will be subject to New Source Review requirements for maintenance areas. The LAER requirement will be replaced by Best Available Control Technology (BACT). Unlike LAER, BACT does allow cost to be considered in evaluating the feasibility of emission controls. Maintenance area NSR requirements will make it easier for new industry to locate in the Klamath Falls area or for existing industry to expand.

Local Governments

Local governments are not involved with the administration of the oxygenated fuel requirements. Local governments with fleet vehicles will experience the same savings as other motor vehicle users.

State Agencies

DEQ is the agency responsible for enforcing the oxygenated fuel requirement in the Klamath Falls area. Staff inspect and sample gasoline stations each winter for oxygenate in fuel sold during the winter months. DEQ Medford Office staff administer the oxygenated fuel program in Klamath Falls and Medford. The Klamath Falls market is small and eliminating the program there will not significantly reduce the workload. Therefore, no significant impact on staff resources is expected.

Klamath County Clean Air Ordinance

General Public

The proposed new ordinance contains a modest expansion of the boundary within which restrictions on residential woodburning and open burning apply. Certain administrative requirements such as the permitting of woodstoves are being removed at the County's request. This will increase staff resources available for more environmentally beneficial work such as increased public outreach and enforcement. The revised ordinance also establishes an open burning "window" for County residents within the Air Quality Zone, and aligns the County program with the approach currently used by the City of Klamath Falls. This will provide uniform open burning requirements and a consistent message to the public (both City and County residents) within the Air Quality Zone. The majority of Klamath Falls citizens should see no change in the economic impact associated with the ordinance. Those citizens living in the expanded portions of the boundary may see a modest economic impact as they comply with burn restrictions. The ordinance contains exemptions for low income residents and others based on hardship or special circumstances. The ordinance will be considered for adoption by the Klamath County Board of Commissioners after completion of the local rulemaking process, which includes a public hearing.

Local Governments

The Klamath County Clean Air Ordinance has been revised to enhance the efficiency and effectiveness of the County's air quality program. The elimination of certain administrative burdens such as the permitting of woodstove ownership will free up local staff resources for work producing a greater environmental benefit such as increased public outreach and enforcement.

Assumptions

Cost assumptions assumed that current general practice by the fuel industry with regard to the sales and distribution of oxygenated fuel will not change significantly in the near future.

Housing Cost Impact Statement

The Department has determined that this proposed rulemaking will have no effect on the cost of development of a 6,000 square foot parcel and the construction of a 1,200 square foot detached single family dwelling on that parcel.

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY

Rulemaking Proposal
for
Klamath Falls Carbon Monoxide Maintenance Plan/Redesignation Request

Land Use Evaluation Statement

1. Explain the purpose of the proposed rules.

The carbon monoxide maintenance plan is designed to maintain compliance with the carbon monoxide health standard in Klamath Falls through 2015. The federal Clean Air Act requires a maintenance plan for areas seeking redesignation from nonattainment to attainment with national ambient air quality standards. The oxygenated fuel requirement is no longer needed to keep the area in attainment with the carbon monoxide standard.

2. Do the proposed rules affect existing rules, programs or activities that are considered land use programs in the DEQ State Agency Coordination (SAC) Program? [X] Yes [ ] No

a. If yes, identify existing program/rule/activity:

Under state rules, new or expanding major industry in nonattainment areas like Klamath Falls must install pollution control equipment and demonstrate that air quality standards will not be violated as a result of the proposed emission increase. This process is known as New Source Review (NSR). New or expanding major industry is required to comply with nonattainment NSR requirements until EPA redesignates the area as attainment (the area then becomes a CO maintenance area). Nonattainment area requirements include Lowest Achievable Emission Rate (LAER) control technology and emission offsets.

Once redesignated to attainment, new or expanding major sources of CO in Klamath Falls will be subject to New Source Review requirements for maintenance areas. The LAER requirement will be replaced by Best Available Control Technology (BACT). Maintenance area NSR requirements will make it easier for new industry to locate in the Klamath Falls area or for existing industry to expand.

b. If yes, do the existing statewide goal compliance and local plan compatibility procedures adequately cover the proposed rules? [X] Yes [ ] No (if no, explain):

In the space below, state if the proposed rules are considered programs affecting land use. State the criteria and reasons for the determination.

The New Source Review program is covered by DEQ's State Agency Coordination agreement. The department's permitting program for industrial sources requires an evaluation of land use and confirmation that the proposed facility location is consistent with state and local land use plans.

3. **If the proposed rules have been determined a land use program under 2. above, but are not subject to existing land use compliance and compatibility procedures, explain the new procedures the Department will use to ensure compliance and compatibility.**

Not applicable.

Division	Intergovernmental Coordinator	4/13/00 Date

Questions to be Answered to Reveal
Potential Justification for Differing from Federal Requirements.

1. Are there federal requirements that are applicable to this situation? If so, exactly what are they?

Yes, the federal Clean Air Act requires that a redesignation request be accompanied by a maintenance plan. This maintenance plan must demonstrate that the area will not violate the applicable air quality standard for ten years after the Environmental Protection Agency approves the maintenance plan.

2. Are the applicable federal requirements performance based, technology based, or both with the most stringent controlling?

The federal requirements are performance based. A maintenance plan must demonstrate that future emissions will not cause a violation of the carbon monoxide standard.

3. Do the applicable federal requirements specifically address the issues that are of concern in Oregon? Was data or information that would reasonably reflect Oregon's concern and situation considered in the federal process that established the federal requirements?

No, the federal requirements are general in nature and allow states flexibility to design maintenance plans to meet local conditions. DEQ has used this flexibility to design the Klamath Falls carbon monoxide maintenance plan with a local air quality advisory committee in order to accommodate local concerns.

4. Will the proposed requirement improve the ability of the regulated community to comply in a more cost effective way by clarifying confusing or potentially conflicting requirements (within or cross-media), increasing certainty, or preventing or reducing the need for costly retrofit to meet more stringent requirements later?

Yes. The carbon monoxide maintenance plan will allow the removal of carbon monoxide emission control requirements that are no longer needed in Klamath Falls.

5. Is there a timing issue which might justify changing the time frame for implementation of federal requirements?

There is no deadline in the federal Clean Air Act for submitting a maintenance plan.

6. Will the proposed requirement assist in establishing and maintaining a reasonable margin for accommodation of uncertainty and future growth?

Yes, the carbon monoxide maintenance plan assumes a rate of growth consistent with the local comprehensive plan and the Oregon Office of Economic Analysis. Growth assumptions used in the plan were also approved by the local air quality advisory committee. The maintenance plan demonstrates that the Klamath Falls UGB can experience anticipated growth without jeopardizing air quality standards.

7. Does the proposed requirement establish or maintain reasonable equity in the requirements for various sources? (level the playing field)

Yes, the maintenance plan reduces the emission control requirements for major new and expanding industry, and removes oxygenated fuel requirements for motorists, gasoline distributors and retailers.

8. Would others face increased costs if a more stringent rule is not enacted?

The proposed carbon monoxide maintenance plan will not result in more stringent requirements.

9. Does the proposed requirement include procedural requirements, reporting or monitoring requirements that are different from applicable federal requirements? If so, Why? What is the "compelling reason" for different procedural, reporting or monitoring requirements?

No.

10. Is demonstrated technology available to comply with the proposed requirement?

The carbon monoxide maintenance plan will not impose new requirements.

11. Will the proposed requirement contribute to the prevention of pollution or address a potential problem and represent a more cost-effective environmental gain?

The carbon monoxide maintenance plan demonstrates that air quality will continue to improve, even when the oxygenated fuels program is removed. There is no need at this time for additional pollution prevention measures.

State of Oregon
Department of Environmental Quality **Memorandum**

Date: April 7, 2000

To: Interested and Affected Public

Subject: Rulemaking Proposal and Rulemaking Statements -

Klamath Falls Carbon Monoxide (CO) Maintenance Plan, and Klamath County Particulate (PM10) Clean Air Ordinance.

This memorandum contains information on a proposal by the Department of Environmental Quality (Department) to adopt new rules/rule amendments regarding a Carbon Monoxide (CO) Maintenance Plan for Klamath Falls, and adoption of revisions to the Klamath County Clean Air Ordinance. Pursuant to ORS 183.335, this memorandum also provides information about the Environmental Quality Commission's intended action to adopt a rule.

This proposal, if adopted by the Environmental Quality Commission, would:

1. *Establish a Carbon Monoxide Maintenance Plan for the Klamath Falls Urban Growth Boundary.*

   The maintenance plan would be adopted as an amendment to the Oregon Clean Air Act State Implementation Plan (SIP); and submitted to the Environmental Protection Agency for approval together with a request that the Klamath Falls Carbon Monoxide nonattainment area be redesignated to attainment. If so designated, Klamath Falls would become a Carbon Monoxide Maintenance Area.

2. *Establish a motor vehicle emissions budget for transportation* conformity purposes within the Klamath Falls Urban Growth Boundary.

3. *Eliminate the oxygenated fuel requirement for Klamath Falls.*

   The oxygenated fuel requirement would be removed upon approval of the maintenance plan by the Environmental Protection Agency.

4. *Adopt a revision to the Klamath County Clean Air Ordinance as an amendment to the Oregon Clean Air Act State Implementation Plan (SIP).*

   The Klamath Falls Air Quality Advisory Committee is using the opportunity of this rulemaking to enhance the Klamath Falls PM10 Attainment Plan by adopting revisions to the Klamath County Clean Air Ordinance. The ordinance contains emission reduction strategies for particulate (PM10), and has been revised to improve the efficiency and effectiveness of the local air quality program. Klamath County will follow local rulemaking procedures in adopting the revised ordinance, including a public hearing and consideration by the Klamath County Board of Commissioners. During the EQC rulemaking action the department will review the ordinance for stringency to ensure that adoption of the revised ordinance does not constitute a relaxation of the EPA approved SIP.

These amendments, if adopted, will be submitted to the US Environmental Protection Agency (EPA) as a revision to the State Implementation Plan, which is a requirement of the Clean Air Act. This action will also amend OAR 340-200-0040.

The department has the statutory authority to address oxygenated fuels under ORS 468A.420. The maintenance plan and associated rules implement ORS 468A.035 regarding the state's comprehensive plan.

Acronyms and Keywords used in this package

Conformity	The transportation conformity program establishes state and federal requirements that ensure consistency between air quality and transportation plans.
DEQ	Oregon Department of Environmental Quality.
EQC	Environmental Quality Commission.
Oxygenated Fuel	Oxygenated fuel is gasoline that is blended with additives that contain oxygen. The extra oxygen provided to the fuel blend promotes more complete combustion and lower emissions. The predominant oxygenate used in Oregon is ethanol.

What's in this Package?

Attachments to this memorandum provide details on the proposal as follows:

Attachment A	The official statement describing the fiscal and economic impact of the proposed rule. (required by ORS 183.335)
Attachment B	A statement providing assurance that the proposed rules are consistent with statewide land use goals and compatible with local land use plans.
Attachment C	Questions to be Answered to Reveal Potential Justification for Differing

	from Federal Requirements.
Attachment D-1	Executive Summary: Klamath Falls Carbon Monoxide Maintenance Plan. *A complete copy of the maintenance plan is available upon request to: David Collier, Oregon Department of Environmental Quality, 811 SW Sixth Ave., Portland, Oregon 97204, (503) 229-5177 or toll free at (800) 452-4011.* *OR* *A complete copy of the maintenance plan and appendices is available for inspection from June 1, 2000 to July 3, 2000 at the Department of Environmental Quality's Klamath Falls Office, 700 Main St., Suite 202, Klamath Falls (97601) during the hours: Monday through Friday, 8 a.m. to 11:45 a.m. and 1:00 p.m. to 5:00 p.m.* ***Please call (541) 883-5603 in advance to schedule a time.***
Attachment D-2	Actual language of proposed rule amendments. Proposed rule revisions include nonsubstantive administrative changes to area designation descriptions for Medford, Grants Pass, Eugene-Springfield, Lakeview, Oakridge, and La Grande.
Attachment D-3	Klamath County Clean Air Ordinance.

Hearing Process Details

The department is conducting a public hearing at which comments will be accepted either orally or in writing. **DEQ staff will be available before the hearing to informally and individually answer questions about the air quality plans.** The hearing will be held as follows:

Date: June 29, 2000
Time: Informal question and answer period begins at 5:00 p.m., public hearing will begin at 6:00 p.m.
Place: Klamath County Courthouse, 316 Main Street, Room 20 (large meeting room on lower floor), Klamath Falls.

David Collier will be the Presiding Officer at the hearing.

Deadline for submittal of Written Comments: Written comments can be presented at the hearing or to the department any time prior to 5:00 p.m. on July 3, 2000. Written comments should be mailed to: David Collier, Air Quality Division, Department of Environmental Quality, 811 SW Sixth Ave. Portland, OR 97204-1390.

In accordance with ORS 183.335(13), no comments from any party can be accepted after the deadline for submission of comments has passed. Thus if you wish for your comments to be considered by the department in the development of these rules, **your comments must be received prior to the close of the comment period.** The department recommends that comments are submitted as early as possible to allow adequate review and evaluation of the comments submitted.

What Happens After the Public Comment Period Closes

Following close of the public comment period, the Presiding Officer will prepare a report which summarizes the oral testimony presented and identifies written comments submitted. The Environmental Quality Commission (EQC) will receive a copy of the Presiding Officer's report. The public hearing will be tape recorded, but the tape will not be transcribed.

The department will review and evaluate the rulemaking proposal in light of all information received during the comment period. Following the review, the rules may be presented to the EQC as originally proposed or with modifications made in response to public comments received.

The EQC will consider the department's recommendation for rule adoption during one of their regularly scheduled public meetings. The targeted meeting date for consideration of this rulemaking proposal **is September 29, 2000**. This date may be delayed if needed to provide additional time for evaluation and response to testimony received in the hearing process.

You will be notified of the time and place for final EQC action if you present oral testimony at the hearing or submit written comment during the comment period. Otherwise, if you wish to be kept advised of this proceeding, you should request that your name be placed on the mailing list.

Background on Development of the Rulemaking Proposal

<u>Why is there a need for the rule?</u>

Monitoring for carbon monoxide (CO) began in Klamath Falls in 1988. Violations of the 8-hour average CO standard were measured in both 1988 and 1989, and the Klamath Falls area was redesignated to nonattainment under the 1990 Clean Air Act amendments. The Act required that an oxygenated fuels program be adopted for the wintertime CO season and the program was implemented in Klamath Falls in October of 1992. Oxygenated fuels was initially needed to bring the area into compliance with CO standards, and the on-going change over to cleaner vehicles has helped maintained compliance over the past eight years. The last exceedance of CO standards occurred in 1991 and since then CO levels in Klamath Falls have been well below standards, making the area eligible for maintenance planning and redesignation to attainment. A maintenance plan has been developed that demonstrates continued compliance with (CO) standards. EPA approval of this plan will allow redesignation of the Klamath Falls Urban Growth Boundary (UGB) to attainment and removal of the oxygenated fuels requirement. Once redesignated by EPA, new or expanding major industry in Klamath Falls will become subject to less stringent emission control technology requirements. These requirements are outlined in the department's New Source Review program for maintenance areas (OAR 340-224-0060).

The State Implementation Plan (SIP) is also being amended to incorporate revisions to the Klamath County Clean Air Ordinance. The ordinance is an important part of the PM10 attainment strategy initially adopted in 1991. Key changes to the ordinance include the following: (1) The primary control area in the ordinance (Air Quality Zone) will be expanded to include new or anticipated housing development that may impact Klamath Falls; (2) Certain administrative requirements, such as the permitting of woodstoves, are being removed at the County's request. This will increase staff resources available for more environmentally beneficial work such as increased public outreach and enforcement; (3) The revised ordinance establishes an open burning "window" for County residents within the Air Quality Zone, and aligns the County program with the approach currently used by the City of Klamath Falls. This will provide uniform open burning requirements and a consistent message to the public (both City and County residents) within the Air Quality Zone.

The revised ordinance is being presented to the Klamath County Board of Commissioners as a recommendation from the Klamath Falls Air Quality Advisory Committee. The proposed ordinance is subject to approval by the Board of Commissioners. If approved, Klamath County will follow local rulemaking procedures in adopting the revised ordinance, including an opportunity for public comment. During the EQC rulemaking action, the department will review the ordinance for stringency to ensure that adoption of the revised ordinance does not constitute a relaxation of the EPA approved SIP provisions for Klamath Falls.

How was the rule developed?

An advisory committee of local stakeholders has advised the department throughout the development of the CO maintenance plan. Revisions to the Klamath County Clean Air Ordinance also reflect the recommendations of the advisory committee. The proposed ordinance will be reviewed and either approved or amended by the Klamath County Board of Commissioners.

Copies of the documents relied upon in the development of this rulemaking proposal can be reviewed at the Department of Environmental Quality's office at 811 S.W. 6th Avenue, Portland, Oregon. These documents include, 1990 Clean Air Act Amendments, Technical Support Document To Aid States With The Development of Carbon Monoxide Implementation Plans, July 1992. Please contact David Collier at (503) 229-5177 or collier.david@deq.state.or.us for times when the documents are available for review.

Whom does this rule affect including the public, regulated community or other agencies, and how does it affect these groups?

Adoption of the CO Maintenance Plan demonstrates ongoing compliance with CO standards and ensures that public health is protected throughout the life of the plan.

Eliminating the oxygenated fuel requirement will affect the general public as well as gasoline retailers and suppliers. Eliminating oxygenated fuel in Klamath Falls will result in a slight cost savings (about one to two cents per gallon) to gasoline distributors that supply oxygenate to retailers. Klamath Falls area gasoline retailers should also see a small cost savings, and will no longer have to maintain records of oxygenated fuel shipments received. Retailers and distributors will no longer have to switch between selling oxygenated fuel during the winter months and traditional fuels during the remainder of the year.

The general public may see the cost savings reflected at the pump. The public may also experience improved vehicle operation without oxygenated fuel. (Some owners of older vehicles have reported problems of reduced gas mileage or vehicle performance with the use of oxygenated fuels). Ethanol suppliers (ethanol being the preferred oxygenate used in Oregon) will experience a small economic loss when oxygenated fuels are discontinued in Klamath Falls.

Establishing a motor vehicle emissions budget in the maintenance plan will affect the Oregon Department of Transportation (ODOT) and other local transportation planning agencies. Under the state conformity program ODOT has primary responsibility to ensure consistency between transportation and air quality plans for Klamath Falls. ODOT will use the emissions budget established in this plan in making conformity determinations for all future regionally significant transportation plans, programs and projects.

EPA redesignation of Klamath Falls from a CO nonattainment area to a CO maintenance area will relax emission control requirements for new or expanding major industry in the Klamath Falls area. As a CO nonattainment area, new or expanding major industry in Klamath Falls is subject to stringent requirements including Lowest Achievable Emission Rate (LAER) control technology and emission offsets. LAER technology draws from the most effective emission control methods achieved at similar facilities nationwide, and does not consider cost as a factor in determining whether an emission control approach is feasible. Once redesignated, the LAER requirement will be replaced by Best Available Control Technology (BACT). Unlike LAER, BACT does allow cost to be considered in evaluating the feasibility of emission controls. Sources must still provide an analysis demonstrating that the proposed emissions increase will have no significant impact on the maintenance area. Maintenance Area New Source Review (NSR) requirements will make it easier for new industry to locate in the Klamath Falls area or for existing industry to expand.

How will the rule be implemented?

The change in oxygenated fuel requirements will be implemented through the DEQ office in Medford. Affected gasoline suppliers will be notified of the proposed change; however, the oxygenated fuel requirement can not be eliminated until the CO maintenance plan is formally approved by the Environmental Protection Agency. We anticipate that the earliest the oxygenated fuels program could be removed from Klamath Falls is the winter of 2001/2002.

Are there time constraints?

There are no time constraints for the Klamath Falls carbon monoxide maintenance plan, redesignation request, and related rule amendments. The incentive to move forward now is to acknowledge that Klamath Falls has been in compliance with CO standards since 1991, to remove unnecessarily stringent requirements for major industry, and to remove the oxygenated fuel requirement, which is no longer needed to maintain healthy air quality in Klamath Falls.

Contact for More Information

If you would like more information on this rulemaking proposal, or would like to be added to the mailing list, please contact:

David Collier
Department of Environmental Quality
811 SW Sixth Ave.
Portland, OR 972004-1390
(503) 229-5177 or toll free in Oregon (800) 452-4011

This publication is available in alternate format (e.g. large print, Braille) upon request. Please contact DEQ Public Affairs at 503-229-5317 to request an alternate format.

State of Oregon

Department of Environmental Quality — Memorandum

Date: July 7, 2000

To: Environmental Quality Commission

From: David Collier

Subject: Presiding Officer's Report for Rulemaking Hearing
Hearing Date and Time: June 29, 2000, beginning at 6 p.m.
Hearing Location: Klamath County Courthouse, 316 Main Street, Room 20, Klamath Falls.

Title of Proposal: **Klamath Falls Carbon Monoxide (CO) Maintenance Plan**

An informal question and answer session with department staff began at 5 p.m. The presiding officer was prepared to begin the formal hearing at 6 p.m., however no members of the public wished to testify. The department has received no testimony or written comments regarding the proposed Carbon Monoxide Maintenance Plan for Klamath Falls.

Summary of Oral Testimony

None given

Written Testimony

None submitted

The hearing was closed at 7:30 p.m.

Klamath Falls Air Quality Advisory Committee

Name	Organization
Leisa Cook (Chair)	Klamath County Environmental Health
Mike O'Brien	Senior Citizens Council
Jim Bryant	Region Resource Center, ODOT
Jim Carpenter	Private Citizen
Ted DeVore	Collins Products, LLC
Bob Doran	ODOT Dist. Manager
Margueritte Root	Klamath County Fire District #1
Robert Flowers	Farm Bureau
Bill Garrard	Klamath County Commissioner
Jim Gilliam	Ash Brothers Chimney Sweeps
Bill Hunt	Oregon Department of Forestry
Todd Kellstrom	Mayor, City of Klamath Falls
LouEllyn Kelley	SoCo Development
Mavis McCormick	League of Women Voters
Stan Meyers	Jeld-Wen
John Yarbrough	Citizens for Quality Living

Environmental Quality Commission

☒ Rule Adoption Item
☐ Action Item
☐ Information Item

Agenda Item H
September 29, 2000 Meeting

Title:

On-boad Diagnostic (OBD) Vehicle Emission Test Method

Summary:

This proposed rule and policies and procedures will require OBD testing as a replacement for the current tailpipe test for 1996 and newer model year gasoline powered vehicles up to a gross vehicle weight rating of 14,000 lbs, and for 1997 and newer model year diesel vehicles up to a gross vehicle weight rating of 8,500 lbs. The OBD test consists of downloading diagnostic information from the vehicle's computer to determine if the vehicle is functioning properly. OBD testing is scheduled to begin December 1, 2000. OBD testing will then be a madatory requirement in the Portland area, and will initially be used only as a screening technique in the Medford area. Once EPA mandates OBD testing for all inspection/maintenance areas, OBD testing will become madatory in Medford.

Department Recommendation:

It is recommended that the Commission adopt the rules, rule amendments and policies and procedures regarding OBD vehicle testing as presented in Attachment A of the department staff report as a revision to the State of Oregon Clean Air Act Implementation Plan

Report Author Division Administrator Director

Accommodations for disabilities are available upon request by contacting the Public Affairs Office at (503)229-5317(voice)/(503)229-6993(TDD).

State of Oregon
Department of Environmental Quality Memorandum

Date: September 11, 2000

To: Environmental Quality Commission

From: Langdon Marsh

Subject: Agenda Item H, On-board diagnostic (OBD) Vehicle Emission Test Method, EQC Meeting September 29, 2000

Background

On June 14, 2000, the Director authorized the Air Quality Division/Vehicle Inspection Program to proceed to a rulemaking hearing on proposed rules that would require on-board diagnostic (OBD) testing of 1996 and newer vehicles for both the Portland and Medford areas. If EQC approval is granted, Portland would begin mandatory OBD testing in October-November 2000, while in Medford, OBD testing would be used only as a screening tool until EPA mandates OBD testing there. Mandatory OBD testing is recommended for implementation in Portland due to needed emission reductions identified in the Portland ozone maintenance plan.

Pursuant to the authorization, hearing notice was published in the Secretary of State's Bulletin on July 1, 2000. The Hearing Notice and informational materials were mailed to the mailing list of those persons who have asked to be notified of rulemaking actions, and to a mailing list of persons known by the Department to be potentially affected by or interested in the proposed rulemaking action on June 20, 2000.

A Public Hearing was held in Portland on July 25, 2000 with Bruce Arnold serving as Presiding Officer. A second Public Hearing was held in Medford on July 28, 2000 with Ted Wacker serving as Presiding Officer. Written comment was received through August 2, 2000. The Presiding Officer's Report (Attachment C) summarizes the oral testimony presented at the hearing and lists all the written comments received. (A copy of the comments is available upon request.)

Department staff have evaluated the comments received (Attachment D). Based upon that evaluation, modifications to the initial rulemaking proposal are being recommended by the Department. These modifications are summarized below and detailed in Attachment E.

The following sections summarize the issue that this proposed rulemaking action is intended to address, the authority to address the issue, the process for development of the rulemaking proposal

Accommodations for disabilities are available upon request by contacting the Public Affairs Office at (503) 229-5317 (voice)/(503) 229-6993 (TDD).

including alternatives considered, a summary of the rulemaking proposal presented for public hearing, a summary of the significant public comments and the changes proposed in response to those comments, a summary of how the rule will work and how it is proposed to be implemented, and a recommendation for Commission action.

<u>Issue this Proposed Rulemaking Action is Intended to Address</u>

This memorandum contains information on a proposal by the Department of Environmental Quality (DEQ) to adopt new rules/rule amendments regarding a new vehicle emissions test method. Pursuant to ORS 183.335, this memorandum also provides information about the Environmental Quality Commission's intended action to adopt a rule.

This proposal, if adopted by the Environmental Quality Commission, would establish the on-board diagnostic (OBD) vehicle testing method for 1996 and newer vehicles in the Portland and Medford areas. The rule amendments, if adopted, would be submitted to the Environmental Protection Agency as an amendment to the Oregon State Implementation Plan (SIP) under the Clean Air Act.

If adopted, the proposed OBD test method will replace the tailpipe test for 1996 and newer vehicles by identifying emissions problems using the vehicle's computer system. The newer vehicles contain OBD systems that consist of the vehicle's on-board computer coupled with sensors (such as the oxygen sensor) and actuators (such as the fuel injectors). The OBD system can detect problems that impact the vehicle's emissions before there is a noticeable problem with the vehicle's performance. When the OBD system determines that a problem exists, a corresponding diagnostic trouble code is stored in the computer's memory. The computer also illuminates a malfunction indicator light (MIL) that is located on the vehicle's dashboard. At the DEQ vehicle inspection station, the inspector will observe the MIL, check to see if the vehicle's OBD system is ready and properly functioning, and use computer software to retrieve stored trouble codes. When a vehicle fails an OBD test, any stored diagnostic trouble codes and the status of the MIL will be printed for the vehicle owner. These same trouble codes can be downloaded at a repair shop and be used to assist a technician in diagnosing required vehicle repairs.

The Portland ozone maintenance plan, which includes strategies for maintaining compliance with the national ambient air quality standard (NAAQS) for ozone, relies on the implementation of OBD testing for 1996 and newer vehicles. The OBD test will result in increased emission reductions, which are needed in the Portland area. In addition to the Maintenance Plan requirement, federal rules currently require states that conduct either enhanced or basic vehicle inspection programs to implement OBD testing by January 1, 2001. Although EPA has indicated that it intends to delay the implementation date by one year, the department recommends proceeding in Portland in order to meet the maintenance plan commitment.

Although the Medford air quality plans do not rely on OBD testing as a reduction strategy, the department proposes to use OBD testing in the Medford area as a pass screen for 1996 and newer vehicles until EPA requires OBD as a pass/fail test. A "pass screen" means that a vehicle will not be failed under an OBD test, but if it passes the OBD test, no further testing is required. Prior to the federal OBD requirement, vehicles that fail OBD testing in Medford will receive a basic test. The initiation of the OBD test method will benefit the Medford vehicle owners by providing them with additional information about the performance of their vehicle's emission control system, without increasing repair costs while the test is used as a pass-screen. Also, this test method may result in reduced inspection times, since it is expected to be slightly faster than the basic test. The department intends to reassess the entire inspection and maintenance program in the Medford area in 2004-2006, as a part of the carbon monoxide maintenance plan update.

Relationship to Federal and Adjacent State Rules

OBD testing is part of the Portland ozone maintenance plan's strategy to maintain compliance with the national ambient air quality standards (NAAQS) for ozone. The Environmental Protection Agency (EPA) approved the Portland ozone maintenance plan in 1997 as part of Oregon's State Implementation Plan under the Clean Air Act, which is federally enforceable.

The current federal rules require that states with vehicle inspection and maintenance programs initiate on-board diagnostic (OBD) testing by January 1, 2001 for all 1996 light-duty trucks and light-duty vehicles equipped with certified OBD systems. The OBD testing requirement applies both to enhanced and basic vehicle inspection test programs. Under federal regulations, a vehicle will fail an inspection if the OBD connector is tampered with, the malfunction indicator light is illuminated, the vehicle computer has not completed self-testing, and if the malfunction indicator light is commanded to be on but is not visually illuminated. The federal rules allow states to initiate OBD testing prior to 2001.

EPA is revising the current rules for the implementation of OBD testing. The rule is expected to allow emission reduction credits at least equivalent to the IM240 tailpipe test for OBD testing as a stand-alone test (no tailpipe testing required). EPA is expected to issue a Notice of Proposed Rulemaking in the near future, to delay the mandatory implementation of OBD testing until January 1, 2002.

The state of Washington does not plan to do any OBD testing until the year 2002 when their current vehicle testing contract expires. They do plan to require OBD testing as a part of that contract. California had scheduled voluntary OBD testing to begin July 2000. However, OBD testing equipment and software delivery is late. They expect to begin voluntary testing in the next few months and will move to mandatory testing if and when OBD proves a viable test for California vehicles.

Authority to Address the Issue

The department has the statutory authority to address this issue under ORS 468A.380(1)(c) which allows the Environmental Quality Commission to adopt rules to "establish criteria and examinations for the testing of motor vehicles." The statute implemented is ORS 468A.365, "certification of motor vehicle pollution control systems and inspection of motor vehicles."

Process for Development of the Rulemaking Proposal (including Advisory Committee and alternatives considered)

OBD testing is included as a strategy in the 1996 Portland ozone maintenance plan. The maintenance plan underwent extensive public involvement with advisory committees and local planning agencies. Additionally, in April 2000, DEQ met with several workgroups to determine the impact of OBD testing on their operations and to obtain further guidance for this rulemaking. On April 11, 2000, DEQ met with representatives of the auto repair industry and affected organizations in the Portland area. Members of the Pacific Automotive Trades Association, the Automotive Service Association, the American Automobile Association, the Oregon Environmental Council and the federal EPA were invited. On April 18, 2000, DEQ met with the Medford Automotive Service Association. Input received from these workgroups has been incorporated into the design of the OBD test procedure.

In addition to the workgroup meetings, on March 8, 2000, DEQ met with the Medford-Ashland Clean Air Advisory Committee to discuss the implementation of OBD testing in the Medford area and found that the committee supports the implementation of OBD testing. DEQ also met with representatives of 26 of the 44 self-testing fleets in Portland to discuss fleet related issues on April 17, 2000. There are currently no self-testing fleets in Medford.

In developing the rules, DEQ designed the OBD test procedure in accordance with the draft guidelines issued by EPA in September of 1999, with additional updates that were presented at the May 17-19 On-Board Diagnostics Conference 2000.

Summary of Rulemaking Proposal Presented for Public Hearing and Discussion of Significant Issues Involved.

In general, 1996 and newer model year vehicles will no longer receive a basic or enhanced tailpipe emissions test but will be given an OBD test where the vehicle's computer is downloaded and no measurement of tailpipe emissions takes place. During the first year of OBD testing it is estimated that OBD tests will comprise 30 percent of all the department's vehicle tests. For the next several years thereafter, OBD tests will be done on an additional 6 percent each year, making OBD the majority test by the year 2005.

In Portland under the proposed rule, 1996 and newer vehicles will be required to pass the OBD test. OBD testing will replace the basic test that is currently performed on the first three vehicle model years tested in Portland. OBD will replace the enhanced test method on 1996 and newer vehicles that are more than five model years old. Based on DEQ's prototype OBD testing and the EPA FTP study of OBD and IM240 testing, the department anticipates that the OBD failure rate will be similar to the enhanced test failure rate. As the Portland fleet ages, the overall failure rate is anticipated to be about the same as the current overall failure rate, since OBD testing of these older vehicles will displace the enhanced test which has an equivalent failure rate.

EPA has estimated that the average cost of repairing a vehicle to comply with OBD testing will be approximately $280 (which is the same as the cost of repairs to meet an enhanced test and about double the cost of repairs to meet a basic test). There is a potential for increased cost of vehicle repairs for new model year vehicles (five years old or newer). As the test method for these vehicles changes from the basic to the OBD testing method, both the failure rate and the cost of repairs may double. The cost of vehicle repairs for vehicles six years and older is not expected to significantly increase since the test method for these vehicles will change from the enhanced test to an OBD test and the repair costs and failure rates of the OBD and enhanced tests are approximately equivalent.

In Medford, under the proposed rule, the OBD test will be used as a "pass screen" on 1996 and newer vehicles until the EPA requires implementation of OBD as a pass/fail test. In this interim time period, vehicles that fail the OBD test in Medford will be required to pass the basic test. When OBD is used as a pass screen, the vehicle owner may experience shorter test times and will receive more information regarding the vehicle's emissions system.

In Medford, after the EPA implementation date when vehicles are failed under OBD, initially a modest increase is expected in the failure rate for the 1996 and newer vehicles. In 16 years when all vehicles tested are equipped with OBD technology, the overall failure rate in Medford is expected to reach a level equivalent to the Portland enhanced test failure rate; approximately 21 percent (the current overall failure rate in Medford is 13%). The cost of vehicle repairs for a failed OBD test is expected to be about twice that of repairing for a failed basic test. Many of the repairs of the newer vehicles are expected to be made under manufacturer warrantees that cover up to 8 years/80,000 miles.

Customers receiving the new OBD test will be required to leave their vehicle during the test, as is currently practiced in the enhanced vehicle test in the Portland area. This will be a new experience for the Medford citizens.

Some automotive repair shops may want to purchase an OBD scan tool valued at $300 to $2,000 so that they can perform OBD repairs. However, the majority of repair shops already use this equipment as a part of routine maintenance on 1996 and newer vehicles. Medford area shops may see additional business, as the 1996 vintage vehicles age.

There are advantages of the OBD test that facilitate repair. First, the OBD scan tool is relatively inexpensive (compared to a $15,000 exhaust gas analyzer that diagnosis tailpipe emissions for example), and can look at exactly the same information seen by the DEQ during the OBD test. This information will be also displayed on the OBD emissions test report, so the vehicle owner will know exactly why their vehicle failed the OBD test. Second, with the scan tool, repair shops will be able to more accurately replicate a DEQ test, ensuring that repairs made will result in a successful retest.

Summary of Significant Public Comment and Changes Proposed in Response

Two Public Hearing were held, one in Portland, the other in Medford. Public testimony consisted of two written and one oral presentation. The significant testimony and department's response is summarized below. A complete summary is shown in Attachments D and E.

Diesel Vehicles:

Comment: The Alliance of Automobile Manufacturers (AAM) stated that diesel vehicles were not equipped with OBDII until model year 1997 rather than 1996. Therefore, testing of 1996 model year diesels should not be required.
Response: The department found that EPA agrees with AAM, stating that EPA granted the diesel vehicle manufacturers a one year waiver from the OBD requirement. The department proposes to not do OBD tests on 1996 model year light-duty diesel vehicles. An enhanced test would be given

to light-duty1996 model year diesel vehicles. The department is also proposing that we would not test any heavy-duty diesel vehicles at this time as discussed below.

Heavy-Duty Vehicles:

Comment: Heavy-duty vehicles (8,500 – 14,000 lbs gross vehicle weight rating (GVWR)) manufactured for sale in California were designed with testable OBD systems beginning in 1996 for gasoline powered vehicles and 1997 for diesel powered vehilces. AAM recommends we test these vehicles.
Response: The department's original proposal assumed there were no heavy-duty vehicles currently equipped for OBD testing. We appreciate the comment bring to our attention that these vehicles are so equipped. The department proposes to conduct OBD tests on all Heavy-duty vehicles with 8,500 – 14,000 GVWR that are equipped for OBD testing, except heavy-duty diesel vehicles. Heavy-duty diesel vehicles are not currently subject to testing in Oregon. At this time DEQ is not considering expanding the testing requirement to include new types of vehicles, but only to add the OBD test where applicable for vehicles already subject to the test. If it becomes necessary to test additional vehicles to protect air quality, DEQ will propose that in a separate rulemaking.

Readiness Status Failures, Number of "Not Ready" Parameters:

Comment: AAM recommends that Oregon fail for only one "not ready" for model years 2001+ vehicles rather than the "more than two" requirement that the department proposed.
Response: The department proposes to continue with the more lenient "more than two" requirement until we can review actual mandatory test data. We may increase stringency after the review.

Readiness Status Failures,Vehicles that Reset Readiness with Key Off:

Comment: For vehicles where the manufacturer resets readiness status whenever the engine is turned off, AAM recommends dropping the readiness requirement and proceeding with the OBD test.
Response: The department is concerned that not requiring a readiness test on these vehicles provides an opportunity for the customer to circumvent the OBD test. As such the department proposes to perform an enhanced test on these vehilces instead of following the AAM recommendation. If one of these vehicles is all-wheel-drive, it would be given a basic backup test.

Readiness Status Failures,Vehicles that Fail Readiness on Retest:

Comment: AAM recommends for vehicles that fail readiness on retest that the readiness portion of the test be bypassed if the customer displays a related repair receipt.
Response: This is the same concept as above where AAM requests that a part of the test be waived. Here again, the department is concerned about those who would use this loophole to avoid repairing a vehicle. It would be impossible for an inspector to determine from a repair receipt if the work was related to the problems of the vehicle, and also determine that the repair fixed the vehicle's emissions problems. The department proposes to continue to require the readiness testing upon retest.

Summary of How the Proposed Rule Will Work and How it Will be Implemented

The department has been performing voluntary OBD testing for six months and has conducted over 5,000 OBD tests. These tests have shown an OBD failure rate of 2.6 percent of the 1996 and newer model year vehicles. We have also determined that we can use the OBD test on about 99 percent of the vehicles assigned to be OBD tested. The small number of vehicles in which the test cannot be used due to manufacturer defects or aberrations with the DEQ software will be given an enhanced emissions test as a backup. Those all-wheel-drive vehicles that can not be enhanced-tested on the dynamometer, will be granted a basic test.

The preface to the current OBD software is being rewritten to allow the test to be performed at the first test position in the department's three-position enhanced test. Currently, the voluntary test is being conducted in the third position as was required for comparison testing with the BAR31 enhanced test.

The OBD software is also being integrated into the basic test, so that OBD testing can be conducted in both enhanced and basic test lanes, providing an immediate backup test capability in case the OBD test cannot be performed.

The software changes are currently being made with a scheduled completion date of October 1, 2000.

In addition to software issues, the department is purchasing additional OBD testing units (approximate cost $1,400 each) to allow testing in all of the existing 39 test lanes. We are currently performing voluntary tests in only the 18 enhanced test lanes. Also, we are currently purchasing new printers to allow flexibility in test report format for OBD testing for the 21 basic test lanes (approximately $1,100 each).

Once the software is received and tested and all the hardware is installed, the department plans to conduct voluntary testing for a few weeks before making the program mandatory. After this trial period, and after making any required software changes, full mandatory OBD testing will be implemented in Portland and pre-screen only testing in Medford. The estimated date for implementing the mandatory program is December 1, 2000.

Development of OBD testing software for self-testing fleets is underway, and we anticipate that it will be available by the December 1, 2000 startup date of the centralized testing operations. If the fleet software is not complete at that time, fleets will continue vehicle testing using the currently approved equipment and procedures for tailpipe emissions testing, until the fleet OBD software is completed and the prototype is tested.

A two-hour OBD introductory training course for auto repair shops and fleets is being developed which will be offered by the department to any shop or fleet technician. The objective of the training will be to limit the possibility of confusion after the testing starts by introducing DEQ's OBD test to the automotive professionals and talking about special issues and procedures. This course is not designed to be a comprehensive treatise on OBD theory. It will be offered before startup of mandatory OBD testing. In addition, all vehicle inspectors will receive four hours of OBD training before OBD testing becomes mandatory.

Recommendation for Commission Action

It is recommended that the Commission adopt the rules, rule amendments and policies and procedures regarding OBD vehicle testing as presented in Attachment A of the Department Staff Report as a revision to the State of Oregon Clean Air Act Implementation Plan.

Attachments

A Rule (Amendments) Proposed for Adoption
1. Proposed Rule Amendments
2. Proposed OBD Policies and Procedures
3. Proposed SIP Amendments

B. Supporting Procedural Documentation:
1. Legal Notice of Hearing
2. Fiscal and Economic Impact Statement
3. Land Use Evaluation Statement
4. Questions to be Answered to Reveal Potential Justification for Differing from Federal Requirements
5. Cover Memorandum from Public Notice

C. Presiding Officer's Report on Public Hearing

D. Department's Evaluation of Public Comment
E. Detailed Changes to Original Rulemaking Proposal made in Response to Public Comment
F. Advisory Committee Membership and Reports
G. Rule Implementation Plan

Reference Documents (available upon request)

Written Comments Received (listed in Attachment C)

The following documents were relied upon in developing this rule: EPA draft document entitled ***Performing On-Board Diagnostic System Checks as Part of a Vehicle Inspection and Maintenance Program*** dated September 1999; materials entitled *OBD 2K On-Board Diagnostics Conference 2000*, Center for Automotive Science and Technology at Weber State University dated May 17, 2000; *OBD Training Course Manual*, Weber State University, dated May 2000; OAR chapter 340 Division 256; 40 CFR Part 51 (July 1999); and EPA FTP study *Analysis of On-Board Diagnostics for use in Inspection/Maintenance dated November 30, 1999.*

Approved:

Section: Ted Kotsakis

Division: Andrew Ginsburg

Report Prepared By: Jerry Coffer

Phone: 503-731-3050 E229

Date Prepared: August 18, 2000

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10/19/95

340-200-0040

State of Oregon Clean Air Act Implementation Plan

(1) This implementation plan, consisting of Volumes 2 and 3 of the State of Oregon Air Quality Control Program, contains control strategies, rules and standards prepared by the Department of Environmental Quality and is adopted as the state implementation plan (SIP) of the State of Oregon pursuant to the federal Clean Air Act, Public Law 88-206 as last amended by Public Law 101-549.

(2) Except as provided in section (3) of this rule, revisions to the SIP shall be made pursuant to the Commission's rulemaking procedures in Division 11 of this Chapter and any other requirements contained in the SIP and shall be submitted to the United States Environmental Protection Agency for approval.

(3) Notwithstanding any other requirement contained in the SIP, the Department is authorized:

(a) To submit to the Environmental Protection Agency any permit condition implementing a rule that is part of the federally-approved SIP as a source-specific SIP revision after the Department has complied with the public hearings provisions of 40 CFR 51.102 (July 1, 1992); and

(b) To approve the standards submitted by a regional authority if the regional authority adopts verbatim any standard that the Commission has adopted, and submit the standards to EPA for approval as a SIP revision.

[NOTE: Revisions to the State of Oregon Clean Air Act Implementation Plan become federally enforceable upon approval by the United States Environmental Protection Agency. If any provision of the federally approved Implementation Plan conflicts with any provision adopted by the Commission, the Department shall enforce the more stringent provision.]

[Publications: The publication(s) referred to or incorporated by reference in this rule are available from the agency.]

Stat. Auth.: ORS 468.020

Stats. Implemented: ORS 468A.035

Hist.: DEQ 35, f. 2-3-72, ef. 2-15-72; DEQ 54, f. 6-21-73, ef. 7-1-73; DEQ 19-1979, f. & ef. 6-25-79; DEQ 21-1979, f. & ef. 7-2-79; DEQ 22-1980, f. & ef. 9-26-80; DEQ 11-1981, f. & ef. 3-26-81; DEQ 14-1982, f. & ef. 7-21-82; DEQ 21-1982, f. & ef. 10-27-82; DEQ 1-1983, f. & ef. 1-21-83; DEQ 6-1983, f. & ef. 4-18-83; DEQ 18-1984, f. & ef. 10-16-84; DEQ 25-1984, f. & ef. 11-27-84; DEQ 3-1985, f. & ef. 2-1-85; DEQ 12-1985, f. & ef. 9-30-85; DEQ 5-1986, f. & ef. 2-21-86; DEQ 10-1986, f. & ef. 5-9-86; DEQ 20-1986, f. & ef. 11-7-86; DEQ 21-1986, f. & ef. 11-7-86; DEQ 4-1987, f. & ef. 3-2-87; DEQ 5-1987, f. & ef. 3-2-87; DEQ 8-1987, f. & ef. 4-23-87; DEQ 21-1987, f. & ef. 12-16-87; DEQ 31-1988, f. 12-20-88, cert. ef. 12-23-88; DEQ 2-1991, f. & cert. ef. 2-14-91; DEQ 19-1991, f. & cert. ef. 11-13-91; DEQ 20-1991, f. & cert. ef. 11-13-91; DEQ 21-1991, f. & cert. ef. 11-13-91; DEQ 22-1991, f. & cert. ef. 11-13-91; DEQ 23-1991, f. & cert. ef. 11-13-91; DEQ 24-1991, f. & cert. ef. 11-13-91; DEQ 25-1991, f. & cert. ef. 11-13-91; DEQ 1-1992, f. & cert. ef. 2-4-92; DEQ 3-1992, f. & cert. ef. 2-4-92; DEQ 7-1992, f. & cert. ef. 3-30-92; DEQ 19-1992, f. & cert. ef. 8-11-92; DEQ 20-1992, f. & cert. ef. 8-11-92; DEQ 25-1992, f. 10-30-92, cert. ef. 11-1-92; DEQ 26-1992, f. & cert. ef. 11-2-92; DEQ 27-1992, f. & cert. ef. 11-12-92; DEQ 4-1993, f. & cert. ef. 3-10-93; DEQ 8-1993, f. & cert. ef. 5-11-93; DEQ 12-1993, f. & cert. ef. 9-24-93; DEQ 15-1993, f. & cert. ef. 11-4-93; DEQ 16-1993, f. & cert. ef. 11-4-93; DEQ 17-1993, f. & cert. ef. 11-4-93; DEQ 19-1993, f. & cert. ef. 11-4-93; DEQ 1-1994, f. & cert. ef. 1-3-94; DEQ 5-1994, f. & cert. ef. 3-21-94; DEQ 14-1994, f. & cert. ef. 5-31-94; DEQ 15-1994, f. 6-8-94, cert. ef. 7-1-94; DEQ 25-1994, f. & cert. ef. 11-2-94; DEQ 9-1995, f. & cert. ef. 5-1-95; DEQ 10-1995, f. & cert. ef. 5-1-95; DEQ 14-1995, f. & cert. ef. 5-25-95; DEQ 17-1995, f. & cert. ef. 7-12-95; DEQ 19-1995, f. & cert. ef. 9-1-95; DEQ 20-1995 (Temp), f. & cert. ef. 9-14-95; DEQ 8-1996(Temp), f. & cert. ef. 6-3-96; DEQ 15-1996, f. & cert. ef. 8-14-96; DEQ 19-1996, f. & cert. ef. 9-24-96; DEQ 22-1996, f. & cert. ef. 10-22-96; DEQ 23-1996, f. & cert. ef. 11-4-96; DEQ 24-1996, f. & cert. ef. 11-26-96; DEQ 10-1998, f. & cert. ef. 6-22-98; DEQ 15-1998, f. & cert. ef. 9-23-98; DEQ 16-1998, f. & cert. ef. 9-23-98; DEQ 17-1998, f. & cert. ef. 9-23-98; DEQ 20-1998, f. & cert. ef. 10-12-98; DEQ 21-1998, f. & cert. ef. 10-12-98; DEQ 1-1999, f. & cert. ef. 1-25-99; DEQ 5-1999, f. & cert. ef. 3-25-99; DEQ 6-1999, f. & cert. ef. 5-21-99; DEQ 10-1999, f. & cert. ef. 7-1-99; DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-020-0047; DEQ 15-1999, f. & cert. ef. 10-22-99; DEQ 2-2000, f. 2-17-00, cert. ef. 6-1-01

DIVISION 256

MOTOR VEHICLES

340-256-0010

Definitions

The definitions in OAR 340-200-0020, 340-204-0010 and this rule apply to this division. If the same term is defined in this rule and OAR 340-200-0020 or 340-204-0010, the definition in this rule applies to this division.

(1) "Basic test" means an inspection and maintenance program designed to measure exhaust emission levels during an unloaded idle or an unloaded raised idle mode as described in OAR 340-256-0340.

(2) "Carbon dioxide" means a compound consisting of the chemical formula (CO_2).

(3) "Carbon monoxide" means a compound consisting of the chemical formula (CO).

(4) "Certificate of Compliance" means a certification issued by a Private Business Fleet or a Public Agency Fleet Vehicle Emission Inspector or a Vehicle Emissions Inspector employed by the Department of Environmental Quality or an Independent Contractor that the vehicle identified on the certificate is equipped with the required functioning motor vehicle pollution control systems and otherwise complies with the emission control criteria, standards, and rules of the Commission.

(5) "Certified Repair Facility" means an automotive repair facility, possessing a current and valid certificate issued by the Department, that employs automotive technicians certified by the Department's Automotive Technician Emission Training Program (ATETP).

(6) "Commission" means the Environmental Quality Commission.

(7) "Crankcase emissions" means substances emitted directly to the atmosphere from any opening leading to the crankcase of a motor vehicle engine.

(8) "Dealer" means any person who is engaged wholly or in part in the business of buying, selling, or exchanging, either outright or on conditional sale, bailment lease, chattel mortgage, or otherwise, motor vehicles.

(9) "Department" means the Department of Environmental Quality.

(10) "Diesel motor vehicle" means a motor vehicle powered by a compression-ignition internal combustion engine.

(11) "Director" means the director of the Department.

(12) "Electric vehicle" means a motor vehicle which uses a propulsive unit powered exclusively by electricity.

(13) "Emissions Inspection Station" means an inspection facility, operated by the Department of Environmental Quality or an Independent Contractor, for the purpose of conducting emissions inspections of all vehicles required to be inspected pursuant to this Division.

(14) "Enhanced test" means an inspection and maintenance program designed to measure exhaust and fuel evaporative system emissions levels using a loaded transient driving cycle and other measurement techniques as described in OAR 340-256-0350.

(15) "Exhaust emissions" means substances emitted into the atmosphere from any opening downstream from the exhaust ports of a motor vehicle engine.

(16) "Factory-installed motor vehicle pollution control system" means a motor vehicle pollution control system installed by the vehicle or engine manufacturer to comply with United States motor vehicle emission control laws and regulations.

(17) "Gas analytical system" means a device which measures the amount of contaminants in the exhaust emissions of a motor vehicle, and which has been issued a license by the Department pursuant to OAR 340-256-0450 and ORS 468A.380.

(18) "Gaseous fuel" means, but is not limited to, liquefied petroleum gases and natural gases in liquefied or gaseous forms.
(19) "Gasoline motor vehicle" means a motor vehicle powered by a spark-ignition internal combustion engine.
(20) "GPM" means Grams Per Mile.
(21) "Gross vehicle weight rating" or "GVWR" means the value specified by the manufacturer as the maximum design loaded weight of a single vehicle.
(22) "Heavy duty motor vehicle" means any motor vehicle rated at more than 8500 pounds GVWR or that has an actual vehicle curb weight as delivered to the ultimate purchaser of 6000 pounds or over.
(23) "Hydrocarbon gases" means a class of chemical compounds consisting of hydrogen and carbon.
(24) "Idle speed" means the unloaded engine speed when accelerator pedal is fully released.
(25) "Independent Contractor" means any person, business firm, partnership or corporation with whom the Department enters into an agreement providing for the construction, equipment, maintenance, personnel, management or operation of emissions inspection stations or activities pursuant to ORS 468A.370.
(26) "Inspection and Maintenance Program (I/M) means a program of conducting regular inspections of motor vehicles, including measurement of air contaminants in the vehicle exhaust and an inspection of emission control systems, to identify vehicles that do not meet the standards of this Division or which have malfunctioning, maladjusted or missing emission control systems, and, when necessary, of requiring the repair or adjustment of vehicles to make the emission control systems function as intended and to reduce tailpipe emissions of air contaminants.
(27) "In-use motor vehicle" means any motor vehicle which is not a new motor vehicle.
(28) "Light duty motor vehicle" means any motor vehicle rated at 8500 pounds GVWR or less and has an actual vehicle curb weight as delivered to the ultimate purchaser of under 6000 pounds.
(29) "Medford-Ashland Air Quality Maintenance Area (AQMA) has the meaning given in OAR 340-204-0010.
(30) "Model year" means the annual production period of new motor vehicles or new motor vehicle engines designated by the calendar year in which such period ends. If the manufacturer does not designate a production period, the model year with respect to such vehicles or engines shall mean the 12-month period beginning January of the year in which production thereof begins.
(31) "Motorcycle" means any motor vehicle, including mopeds, having a seat or saddle for the use of the rider and designed to travel on not more than three wheels in contact with the ground and having a mass of 680 kilograms (1500 pounds) or less with manufacturer recommended fluids and nominal fuel capacity included.
(32) "Motor vehicle" means any self-propelled vehicle used for transporting persons or commodities on public roads.
(33) "Motor vehicle pollution control system" means equipment designed for installation on a motor vehicle for the purpose of reducing the pollutants emitted from the vehicle, or a system or engine adjustment or modification which causes a reduction of pollutants emitted from the vehicle, or a system or device which inhibits the introduction of fuels which can adversely affect the overall motor vehicle pollution control system.
(34) "Motor Vehicle Fleet Operation" means ownership, control, or management or any combination thereof by any person of five or more motor vehicles.
(35) "New motor vehicle" means a motor vehicle whose equitable or legal title has never been transferred to a person who in good faith purchases the motor vehicle for purposes other than resale.
(36) "Noise level" means the sound pressure level measured by use of metering equipment with an "A" frequency weighting network and reported as dBA.

(37) "OBD" means the On Board Diagnostic system in a vehicle that tracks the effectiveness of the vehicle's emissions control systems. These OBDII (or higher systems) have typically been placed on 1996 and newer motor vehicles.
(38) "OBD Test" means an emissions related test in which the vehicle's On Board Diagnostic computer is downloaded, supplying diagnostic information to evaluate the effectiveness of the vehicle emissions control systems.
(39~~7~~) "Owner" means the person having all the incidents of ownership in a vehicle or where the incidents of ownership are in different persons, the person, other than a security interest holder or lessor, entitled to the possession of a vehicle under a security agreement, or a lease for a term of ten or more successive days.
(40~~38~~) "Opacity" means the degree to which transmitted light is obscured, expressed in percent.
(41~~39~~) "Oxides of Nitrogen" or NO_x means oxides of nitrogen except nitrous oxides.
(42~~40~~) "Person" means any individual, public or private corporation, political subdivision, agency, board, department, or bureau of the state, municipality, partnership, association, firm, trust, estate, or any other legal entity whatsoever which is recognized by law as the subject of rights and duties.
(43~~41~~) "Portland Vehicle Inspection Area" has the meaning given in OAR 340-204-0010.
(44~~42~~) "PPM" means parts per million by volume.
(45~~43~~) "Private Business Fleet" means ownership by any person of 100 or more Oregon-registered, in-use, motor vehicles, excluding those vehicles held primarily for the purpose of resale.
(46~~44~~) "Private Business Fleet Vehicle Emissions Inspector" means any person employed on a full-time basis by a Private Business Fleet that possesses a current and valid license issued by the Department pursuant to OAR 340-256-0440 and ORS 468A.380.
(47~~45~~) "Propulsion exhaust noise" means that noise created in the propulsion system of a motor vehicle that is emitted into the atmosphere from any opening downstream from the exhaust ports. This definition does not include exhaust noise from vehicle auxiliary equipment such as refrigeration units powered by a secondary motor.
(48~~46~~) "Public Agency Fleet" means ownership of 50 or more government-owned vehicles registered pursuant to ORS 805.040.
(49~~47~~) "Public Agency Fleet Vehicle Emissions Inspector" means any person employed on a full-time basis by a Public Agency Fleet that possesses a current and valid license issued by the Department pursuant to OAR 340-256-0440 and ORS 468A.380.
(50~~48~~) "Public roads" means any street, alley, road, highway, freeway, thoroughfare, or section thereof used by the public or dedicated or appropriated to public use.
(51~~49~~) "Regional Authority" means a regional air quality control authority established under the provisions of ORS 468A.005 to 468A.035, 468A.075, 468A.100 to 468A.130, and 468A.140 to 468A.175.
(52~~50~~) "Ringlemann Smoke Chart" means the **Ringlemann Smoke Chart** with instructions for use as published in May, 1967, by the U.S. Department of Interior, Bureau of Mines.
(53~~51~~) "RPM" means engine crankshaft revolutions per minute.
(54~~52~~) "Two-stroke cycle engine" means an engine in which combustion occurs, within any given cylinder, once each crankshaft revolution.
(55~~53~~) "Vehicle Emission Inspector" means any person employed by the Department or an Independent Contractor that possesses a current and valid license issued by the Department pursuant to OAR 340-256-0440 and ORS 468A.380.
(56~~54~~) "Visible Emissions" means those gases or particulates, excluding uncombined water, which separately or in combination are visible upon release to the outdoor atmosphere.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the Environmental Quality Commission under OAR 340-200-0040.]
Stat. Auth.: ORS 467.030 & ORS 468A.360
Stats. Implemented: ORS 467.030 & ORS 468A.350 - ORS 468A.400
Hist.: [DEQ 8, f. 4-7-70, ef. 5-11-70; DEQ 4-1993, f. & cert. ef. 3-10-93]; [DEQ 89, f. 4-22-75, ef. 5-25-75; DEQ 139, f. 6-30-77, ef. 7-1-77; DEQ 9-1978, f. & ef. 7-7-78; DEQ 22-1979, f. & ef. 7-5-79; DEQ 18-1980, f. & ef. 6-25-80; DEQ 12-1982, f. & ef. 7-21-82; DEQ 23-1984, f. 11-19-84, ef. 4-1-85; DEQ 4-1993, f. & cert.

ef. 3-10-93; DEQ 15-1994, f. 6-8-94, cert. ef. 7-1-94; DEQ 25-1996, f. & cert. ef. 11-26-96]; DEQ14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-024-0005, 340-024-0305

Emission Control System Inspection

340-256-0300
Scope

Pursuant to ORS 467.030, 468A.350 to 468A.400, 803.350, and 815.295 to 815.325, OAR 340-256-0300 through 340-256-04650 establish the criteria, methods, and standards for inspecting motor vehicles to determine eligibility for obtaining a Certificate of Compliance or inspection.

(1) After September 1, 1997, in addition to the basic test an enhanced test, may be established in the Portland Vehicle Inspection Area. 1975 and newer model year vehicles in the Portland Vehicle Inspection Area must meet the requirements of one of the following emission tests:

(a) A light duty vehicle that is five (5) or less model years old or is a 1975 through 1980 model year is required to must meet the basic test requirements of OAR 340-256-0340, 340-256-0380, 340-256-0400 and 340-256-0430.

(b) A light duty vehicle that is a 1981 through 1995 model year six (6) or more model years old and is a 1981 or newer model year is required to must meet the enhanced test requirements of OAR 340-256-0350 and 340-256-0410. These vehicles found to be safe but unable to be dynamometer tested due to drive line configuration and these vehicles equipped with All Wheel Drive (AWD) will shall meet the basic test requirements of OAR 340-256-0340, 340-256-0380, 340-256-0400 and 340-256-0430.

(c) Once the vehicle inspection program establishes OBD testing, then a light duty vehicle that is a 1996 and newer model year must meet the OBD test requirements of OAR 340-256-0355. For those vehicles that cannot be OBD tested due to manufacturer defects in the vehicle (where EPA has not issued an associated recall), vehicle incompatibility with the OBD test system, or other similar manufacturing problems, the vehicle must meet either the enhanced test requirements of OAR 340-256-0350 and 340-256-0410, the basic test requirements of OAR 340-256-0340, 340-356-0380, 340-256-0400, or other test criteria as determined by the Department.

(de) A heavy duty vehicle is required to must meet the basic test requirements of OAR 340-256-0340, 340-256-0390 and 340-256-0420. Once the vehicle inspection program establishes an OBD test for heavy-duty vehicles, the heavy duty vehicles equipped with OBDII or higher systems must meet the OBD test requirements of OAR 340-256-0355. For those vehicles that cannot be OBD tested due to manufacturer defects in the vehicle (where EPA has not issued an associated recall), vehicle incompatibility with the OBD test system, or other similar manufacturing problems, the vehicle must meet either the enhanced test requirements of OAR 340-256-0350 and 340-256-0410, the basic test requirements of OAR 340-256-0340, 340-356-0380, 340-256-0400, or other test criteria as determined by the Department.

(2) The Department may use the OBD testing in Medford as a pass screen before or instead of the basic test. Once EPA mandates OBD testing in the Medford-Ashland Air Quality Maintenance Area, a light duty vehicle that is a 1996 and newer model year must meet the OBD test requirements of OAR 340-256-0355. For those vehicles that cannot be OBD tested due to manufacturer defects in the vehicle (where EPA has not issued an associated recall), vehicle incompatibility with the OBD test equipment, or other similar manufacturing problems, the vehicle must meet the basic test requirements of OAR 340-256-0340, 340-256-0380, 340-256-0400 and 340-256-0430 or other test criteria as determined by the Department.

(a) All other light duty vehicles tested that are up to 20 model years in age, basic test shall continue in the Medford-Ashland Air Quality-Maintenance Area, must meet the basic test for vehicles to meet the requirements of OAR-340-256-0340, 340-256-0380, 340-256-0390, 340-256-0400 and 340-256-0420.

(b) A heavy duty vehicle in the Medford- Ashland Air Quality Maintenance Area must meet the basic test requirements of OAR 340-256-0340, 340-256-0390 and 340-256-0420. Once the vehicle inspection program establishes an OBD test for heavy-duty vehicles in the Medford area, the heavy duty vehicles equipped with OBDII or higher systems must meet the OBD test requirements of OAR 340-256-0355. For those vehicles that cannot be OBD tested due to manufacturer defects in the vehicle (where EPA has not issued an associated recall), vehicle incompatibility with the OBD test equipment, or other similar manufacturing problems, the vehicle must meet the basic test requirements of OAR 340-256-0340, 340-256-0380, 340-256-0400 and 340-256-0430 or other test criteria as determined by the Department.

(3) Vehicle owners may apply for a waiver from the enhanced test requirements in OAR 340-256-0300(1)(b) and 340-256-0350. Vehicle owners are eligible in the year 2000 if their net household income is less than or equal to that established by multiplying the year 2000 Federal Poverty Guideline amounts by 1.3. For each year after the year 2000, the calculated year 2000 numbers are adjusted using the Oregon Consumer Price Index for the Portland Metro Regional Area. Proof of eligibility and vehicle ownership may be required by the Department. Providing false information may result in revocation of the low income waiver. If the Department approves the waiver, the owner must pass the basic motor vehicle emissions test requirements in OAR 340-256-0300(1)(a) and 340-256-0340 and pay the required fees in order to receive a certificate of compliance.

[**NOTE:** This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the Environmental Quality Commission under OAR 340-200-0040.]
[ED. NOTE: The Chart referenced in this rule is not printed in the OAR Compilation. Copies are available from the agency.]
Stat. Auth.: ORS 467.030 & ORS 468A.350 - ORS 468A.400
Stats. Implemented: ORS 468A.350 - ORS 468A.400, ORS 803.350 & ORS 815.295
Hist.: DEQ 89, f. 4-22-75, ef. 5-25-75; DEQ 139, f. 6-30-77, ef. 7-1-77; DEQ 23-1984, f. 11-19-84, ef. 4-1-85; DEQ 4-1993, f. & cert. ef. 3-10-93; DEQ 25-1996, f. & cert. ef. 11-26-96; DEQ 2-1998, f. & cert. ef. 3-5-98; DEQ14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-024-0300

340-256-0355

Emissions Control Test Method for OBD Test Program

The OBD test must be performed in accordance with the Vehicle Inspection Program Inspection and Maintenance Policies and Procedure Number 225.00, which includes downloading computerized vehicle OBD information, observing trouble codes, and observing the malfunction indicator lights located on vehicle dashboards.

[**NOTE:** This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the Environmental Quality Commission under OAR 340-200-0040.]
Stat. Auth.: ORS 468A.380
Stats. Implemented: ORS 468A.365

340-256-0440

Criteria for Qualifications of Persons Eligible to Inspect Motor Vehicles and Motor Vehicle Pollution Control Systems and Execute Certificates

(1) Five separate classes of licenses are established as follows:
(a) Private Business Fleet;
(b) Public Agency Fleet;
(c) Private Business Fleet Vehicle Emission Inspector;
(d) Public Agency Fleet Vehicle Emission Inspector;
(e) Vehicle Emission Inspector.
(2) Application for a license must be completed on a form provided by the Department.
(3)(a) Each fleet's license is valid for not more than a one year period and expires on December 31 of each year unless revoked, suspended, or returned to the Department;
(b) Each Inspector's license is valid for not more than a two year period and expires on December 31 of every other year unless revoked, suspended, or returned to the Department.
(4) The Department willshall not issue any license until the applicant has fulfilled all requirements and paid the required fee.
(5) No license is transferable.

(6) Each license may be renewed upon application and receipt of renewal fee if the application for renewal is made within the 30-day period prior to the expiration date and the applicant complies with all other licensing requirements.
(7) A license may be suspended, revoked, or not renewed if the licensee has violated this Division or ORS 468A.350 to 468A.400, 815.295 to 815.325.
(8) A Private Business Vehicle Emission Inspector or Public Agency Fleet Vehicle Emission Inspector license is valid only for inspection of and execution of Certificates of Compliance for motor vehicle pollution control systems and motor vehicles of the Private Business Fleet or Public Agency Fleet that employs~~by which~~ the Private Business Fleet Vehicle Emission Inspector or Public Agency Fleet Vehicle Emission Inspector ~~is employed~~ on a full time basis. The Department may authorize a ~~A~~ Public Agency Fleet Vehicle Emission Inspector ~~may be authorized by the Department~~ to perform inspections and execute Certificates of Compliance for vehicles of other governmental agencies ~~that have~~if the inspector has contracted with that agency for that service and ~~that contract having the approval of~~ the Director approves the contract.
(9) To initially receive or renew a license as a Private Business Fleet Vehicle Emission Inspector, a Public Agency Fleet Vehicle Emission Inspector or a Vehicle Emission Inspector, the applicant must be an employee of a Private Business Fleet, a Public Agency Fleet, the Vehicle Inspection Program of the Department, or an employee of an Independent Contractor and submit a completed application. All Inspectors ~~shall~~must receive formal training and be licensed or certified to perform inspections pursuant to this Division. The duration of the training program for persons employed by a Private Business Fleet or a Public Agency Fleet ~~shall not~~must be at~~less than~~ least 16 hours.
(a) Training.
(A) Inspector training ~~shall~~ must include the following subjects:
(i) The air pollution problems, its causes and effects;
(ii) The purpose, function and goal of the inspection program;
(iii) Inspection regulations and procedures;
(iv) Technical details of the test procedure and the rationale for their design;
(v) Test equipment operation, calibration and maintenance;
(vi) Emission control device function, configuration and inspection;
(vii) Quality control procedures and their purpose;
(viii) Public relations; ~~and~~
(ix) Safety and health issues related to the inspection process and;~~.~~
(x) OBD test systems
(B) In order to complete the training requirement, a trainee ~~shall~~must pass (minimum of 80% correct responses) a written test covering all aspects of the training. In addition, a hands-on test must~~shall~~ be administered in which the trainee demonstrates without assistance the ability to conduct a proper inspection, to properly utilize equipment and to follow other procedures. Inability to properly conduct all test procedures shall constitute failure of the test. The Department will~~shall~~ take appropriate steps to insure the security and integrity of the testing process.
(b) Licensing and certification.
(A) All Inspectors ~~shall~~ must be either licensed or certified by the Department in order to perform official inspections.
(B) Completion of Inspector training and passing required tests ~~shall be~~is a condition of licensing or certification.
(C) Inspector licenses and certificates ~~shall be~~are valid for no more than 2 years, at which point refresher training and testing ~~shall be~~are required ~~prior to~~before renewal. Alternative approaches based on more comprehensive skill examination and determination of Inspector competency may be used.
(D) Licenses ~~or~~and certificates ~~is~~are not a legal right, but rather, are a privilege bestowed by the Department and conditional upon adherence to Department requirements.

(c) Enforcement against Inspectors. ~~Enforcement against licensed Inspectors shall include swift, sure, effective, and consistent penalties for violation of program requirements.~~ Any violations are subject to the Department's enforcement procedures.

(A) Whenever an Inspector intentionally improperly passes a vehicle for any required portion of the test, the Department will either suspend the Inspector for at least 6 months or assess a penalty equivalent to the Inspector's salary for the same time period.
~~Substantial penalties shall be imposed on the first offense for violations that directly affect emission reduction benefits. At a minimum, whenever a vehicle is intentionally improperly passed for any required portion of the test, Inspectors shall be removed from Inspector duty for at least 6 months or a retainage penalty equivalent to the Inspector's salary for that period shall be imposed.~~
(B) License or certificate suspension or revocation ~~shall~~ means the individual is barred from direct or indirect involvement in any inspection operation during the term of the suspension or revocation.
(10) To be licensed as a Private Business Fleet or a Public Agency Fleet, the applicant must:
(a) Employ on a full time basis a Private Business Fleet Vehicle Emission Inspector or;
(b) Employ on a full time basis a Public Agency Fleet Vehicle Emission Inspector; and
(c) Be equipped with an gas analytical system complying with criteria established in OAR 340-256-0450 or 340-256-0460;
(d) Be equipped with a sound level meter conforming to "**Requirements for Sound Measuring Instruments and Personnel**" (NPCS-2) manual, revised September 15, 1974, of this Department.
(e) If 1996 and newer light duty vehicles are a part of the self-inspected fleet of vehicles, the fleet must be equipped by January 1, 2001 with a scan tool for downloading vehicle OBD emissions data with criteria established in OAR 340-256-0465.
(11) No person licensed as a Private Business Fleet or Public Agency Fleet ~~shall~~ may advertise or represent himself as being licensed to inspect motor vehicles to determine compliance with the criteria and standards of OAR 340-256-0380 and 340-256-0400.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the Environmental Quality Commission under OAR 340-200-0040.]
[Publication: The Publication(s) referred to or incorporated by reference in this rule are available from the office of the agency.]
Stat. Auth.: ORS 468A.380
Stats. Implemented: ORS 468A.380
Hist.: DEQ 89, f. 4-22-75, ef. 5-25-75; DEQ 136, f. 6-10-77, ef. 7-1-77; DEQ 3-1978, f. 3-1-78, ef. 4-1-78; DEQ 9-1978, f. & ef. 7-7-78; DEQ 14-1978, f. & ef. 10-3-78; DEQ 6-1980, f. & ef. 1-29-80; DEQ 12-1982, f. & ef. 7-21-82; DEQ 19-1983, f. 11-29-83, ef. 12-31-83; DEQ 4-1993, f. & cert. ef. 3-10-93; DEQ 16-1993, f. & cert. ef. 11-4-93; DEQ 15-1994, f. 6-8-94, cert. ef. 7-1-94; DEQ 25-1996, f. & cert. ef. 11-26-96; DEQ14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-024-0340

340-256-0465

Test Equipment Licensing Criteria for OBD Test Program

This equipment must contain the standard terminal Diagnostic Link Connector for OBD systems and be capable of the following:
(1) Making an automatic pass/fail decision based on malfunction indicator light observations and vehicle OBD system download.
(2) Transferring electronic vehicle test result to the VIP central data server for emissions data.
(3) Meeting additional fleet operations specifications as prescribed- by the Department.

NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the Environmental Quality Commission under OAR 340-200-0040.]
Stat. Auth.: ORS 468A.380
Stats. Implemented: ORS 468A.380

PROCEDURE:

OBD TESTING

SUBJECT: OBD Testing Procedure	
POLICY/PROCEDURE NUMBER: 225.00	**EFFECTIVE DATE:**
SUPERSEDES: NONE	**DATE SIGNED:**
APPROVED BY:	
ORIGINATING SECTION: ENGINEERING	

PURPOSE: To establish the OBD testing procedure.

REFERENCE:

General Comments:

The OBD test procedure will be conducted on all 1996 and newer gasoline powered vehicles with a gross vehicle weight less than or equal to 14,000 lbs, and all 1997 and newer diesel powered vehicles with GVWR less than or equal to 8,500 lbs. Model year 1996 light duty diesel vehicles will receive an enhanced test. All vehicles fitting this criteria will be directed at the entrance kiosk to the appropriate test lane. For all 1996 and newer light duty vehicles, without 2WD dyne operational problems, the vehicle will be directed to an OBD/enhanced test lane. For those 1996 and newer vehicles known to have difficulty driving on a 2WD dyne, the vehicle will be directed to an OBD/basic test lane. (This procedure is appropriate for Portland area testing. All Medford vehicles will be tested in the OBD/basic lanes[1]).

The new OBD software will provide for an OBD test first. If a download of the vehicle's OBD data is unsuccessful because of observable vehicle tampering by the vehicle owner, the vehicle will be failed and the reason for failure given to the customer. If you are unable to download

[1] In Medford OBD will be used as a pass only test for 1996 and newer light duty vehicles, until the EPA requires OBD as a pass/fail test. As a pass screen, Vehicles that fail OBD will receive a basic test.

because the vehicle's Diagnostic Link Connector (DLC) cannot be located, the DEQ software is unable to communicate with the vehicle, or the vehicle is exempted from the test by EPA, an enhanced test will be granted that vehicle. Non-conforming imported vehicles with proper paperwork will be given an enhanced test or basic test depending on the ability to use the 2WD dyne as discussed above.

1) The lane inspector will input vehicle ID information on the vehicle following existing data entry procedures.

2) In an OBD/enhanced lane, the DEQ computer will initially prompt with the OBD inspection screen, if the test vehicle is a 1996+ light duty vehicle. The computer screen will indicate if an OBD-related EPA recall has been issued on the vehicle. If so, you must check under the hood to insure the recall work has been completed. If not, you must turn away the vehicle until the recall repairs are completed. If you proceed with the test, you will need to ask the customer to leave the vehicle at this time. You will instruct the customer to wait close to the vehicle while your perform the OBD test. If you cannot successfully complete the OBD test, an enhanced test is required. Ask the customer to wait for his/her vehicle in the waiting room. If you are able to perform an OBD test on the vehicle, continue with the following procedure.

3) Turn the vehicle off and connect the OBD DLC connector. If the vehicle connector is damaged, press the "damaged DLC connector" option on your screen and the vehicle will fail the OBD test. If you are unable to quickly locate the vehicle's connector, press the "connector locator" option on your screen, and a picture with a circle around the connector location will be displayed on your screen. If the vehicle is not listed in the "connector locator," check the EPA label under the hood. If the vehicle does not have an OBDII system and the vehicle is an import (no EPA underhood label), give the customer an enhanced test by pressing the OBD bypass option, following normal import testing procedures for documentation. If an EPA label is present and it states that OBDII is used, call the station manager and do an extensive search for the connector. If you cannot find the vehicle connector, give the vehicle the enhanced test by pressing the OBD bypass option.

4) If you find the DLC connector and there are no problems with the vehicle's DLC connector, connect the DLC lead to the vehicle.

5) Next, turn the vehicle ignition key to the key on/engine off position without starting the engine. Look for the MIL light on the dash. You must make this observation immediately after the key is switched, because for some vehicles, the MIL is only illuminated for a short period. It will say **"Check Engine," "Service Engine Soon," or "Service Powertrain Soon".** An engine symbol could also be used as a substitute for the word "engine." The MIL light should be lit at this time. **Record its status on the computer screen.**

6) The computer will ask you to start the vehicle and **observe the MIL** with the engine running. The computer will ask if you want to download the vehicle computer. Say yes. The

download should take about 15 seconds. If the DEQ computer is unable to download the vehicle OBD records, the OBD test will be aborted. and a complete enhanced fall-back test will be run.

7) After a successful download, and using the MIL information you input, the computer will determine if the vehicle passed or failed the OBD test. If any of the follow are true, the vehicle will fail the OBD test.

   a) More than two readiness parameters indicated by the vehicle computer as "not ready".
   b) MIL off when key is on with engine off.
   c) MIL on with engine running.
   d) Vehicle computer is commanding the MIL be illuminated.

8) After completion of the OBD download, the screen will prompt for you to input if the vehicle is smoking or is excessively noisy. Use existing procedures to respond to these questions. After these questions are answered and a noise test is performed if required, the ETR will be printed. The status of the eleven readiness codes, the status of MIL (in both operational modes), and all DTC codes will be printed for any vehicle that fails the OBD test. If a vehicle passes the OBD test, the only OBD information printed on the ETR will be the indication of pass for OBD. During the printing operation, ask the customer to re-enter the vehicle.

9) Money collection and DMV registration will be conducted following existing procedures.

10) If the vehicle fails the OBD test for more than two readiness codes "not ready," the customer will receive a failing ETR, and will also be given a paper indicating the recommended driving cycle to activate the readiness for the "not ready" systems.

11) The test sequence is the same for an OBD/basic test lane, except the backup test is a standard basic test.

ATTACHMENT A-2

SIP REVISION

5.4 Motor Vehicle Inspection and Maintenance

5.4.1 Applicability

Inspection/Maintenance (I/M) programs are operated in the Portland and Medford urban areas within the State of Oregon. A program meeting basic I/M requirements, as outlined in Section 5.4.2 of this plan, will be operated in the Medford area. A program meeting enhanced I/M requirements, as outlined in Section 5.4.7 of this plan, will be operated in the Portland area. On-board diagnostic (OBD) testing will be conducted on 1996 and newer vehicles in both the Medford and Portland areas. In Portland, OBD will replace the basic and enhanced emission test methods for 1996 and new vehicles. In Medford, the OBD testing will replace the basic test for 1996 and newer vehicles. This I/M program will remain in effect until a redesignation is made that demonstrates that the subject areas can maintain the ambient carbon monoxide and ozone standards for the maintenance period without the emission reductions attributable to the I/M program.

The Portland I/M boundary incorporates portions of Clackamas, Columbia, Multnomah, Washington, and Yamhill counties. The 1990 population of the Portland I/M area, estimated from the 1990 federal census, is 1,300,703. Appendix A contains a list of all the U.S. postal zip codes included in whole or in part within the Portland I/M area. It also contains a map of the Portland I/M area. The Portland I/M program consists of seven testing centers and a total of 2~~1~~8 test lanes.

The Medford I/M boundary is ~~that of~~ the Medford-Ashland Air Quality Maintenance Area (AQMA), which includes approximately 85 percent of the population of Jackson County. The 1990 AQMA population, estimated from the 1990 federal census, is 124,430. Appendix A contains a list of all the U.S. postal zip codes included in whole or in part within the Medford I/M area. It also contains a map of the Medford I/M area. The Medford I/M program consists of one testing center with three test lanes.

The legal authority for the I/M program is found in Oregon Revised Statutes (ORS) 468A.360 to 468A.405, ORS 803.070 through 803.375 and ORS 815.095 through 815.325. These statutes are included in Section 2.2.11 of the State Implementation Plan (SIP). Regulations for program operations, Division 256 of the Oregon Administrative Rules, ~~340-24-005 through 340-24-350,~~are located in Section 2.2.7 of the SIP. The rules were revised to meet the requirements for basic program and enhanced programs as outlined in EPA Inspection/Maintenance Program Requirements; Final Rule (40 CFR Part 51, 1993). This final rule revision was approved by the Oregon Environmental Quality Commission on November 14, 1996. DEQ proposed further revisions to include OBD testing, which were adopted by the EQC during their September 29, 2000 meeting.

5.4.2 Basic I/M Performance Standard

Appendix B contains the input and output files for Mobile 5A runs performed to evaluate the emission reduction benefits of the I/M areas in the State of Oregon. Appendix C shows the local inputs to the model, including their source and derivation. The table below summarizes the projected emission factor levels at the attainment date for the program for each I/M area:

Portland I/M Area

	Summer 1997	
VOC		
	Without I/M Program	3.05 g/mi
	Performance Standard	2.72 g/mi
	Program Target	2.54 g/mi
	Winter 1996	
CO		
	Without I/M Program	28.04 g/mi
	Performance Standard	24.07 g/mi
	Program Target	22.09 g/mi
	Summer 1997	
NOx		
	Without I/M Program	2.45 g/mi
	Performance Standard	2.42 g/mi

Program Target 2.38 g/mi

Medford I/M Area

Winter 1996

CO

Without I/M Program	33.73 g/mi
Performance Standard	28.98 g/mi
Program Target	27.30 g/mi

The I/M programs meet the emission reduction targets in the attainment year. The State of Oregon commits to meeting the performance standard during actual implementation of the revised basic programs.

In addition, calculated emissions reductions for the ~~proposed~~ enhanced test, including the phase-in of OBD testing, are displayed in the Ozone Maintenance Plan and Redesignation Requirements for the Oregon portion of the Portland/Vancouver AQMA in Section 4.50 of Volume 2. The Plan was approved by EPA and assumes that OBD credit is equivalent to I/M 240.

The Medford area calculations do not include OBD emission reduction credits. Final emission reduction credit numbers are not yet available for OBD testing, although it is anticipated that EPA will grant further reduction credits.

5.4.3 Network Type and Program Evaluations

In the Medford area, the I/M program is~~will be~~ basic centralized, test-only operated by the Department of Environmental Quality (DEQ). In the Portland area, the I/M program is~~will be~~ enhanced centralized, test-only operated by DEQ. OBD testing applies in the Portland and Medford areas on 1996 and newer vehicles. In Medford, until EPA requires mandatory OBD testing, the OBD test will be a pass-only screen. Vehicles that fail the OBD test must pass the basic test. In Portland. OBD replaces tailpipe testing for 1996 and newer vehicles that are equipped with test compatible OBD systems after the EQC approves the proposed revisions.

The Oregon I/M programs, in both Portland and Medford, operate fleet self-testing programs with oversight by DEQ employees. In Portland, there are currently 53 fleets which test approximately 13,350 vehicles. In Medford, there are currently 10 fleets, testing approximately 1,069 vehicles.

5.4.4 Adequate Tools and Resources

The I/M program, as stipulated in ORS 468A.405, is funded solely by collection of fees from vehicle owners. In both the Portland and Medford areas, the test fees ~~is~~are collected at the time of passing the I/M test, as stipulated in ORS 468A.405. ~~In the Portland area, collection of these fees will be altered to allow collection for each emission test. Statutory authority for this collection is pending in the Oregon Legislature. These fees are to be adjusted by the Oregon Environmental Quality Commission to cover the costs of administering the I/M program.~~ The current fee in Medford is $10 per certificate issued for DEQ inspected vehicles and $5 each for certificates issued by fleets. The fee for all centralized Portland area tests (both basic and enhanced) is ~~proposed as~~ $~~18~~21 per test, and $5 each for certificates issued by Portland fleets. Fees did not change with the introduction of OBD testing on 1996 and newer vehicles.

The fees are collected and deposited on a monthly basis into the Department of Environmental Quality Motor Vehicle Pollution Account. The monies from this account are continuously appropriated to the Department to be used solely for operations related to the I/M program.

Appendix D shows the ~~proposed~~ budget for the vehicle inspection program operations. DEQ expects to maintain staffing levels approximately as follows:

Overt and covert auditing	1.0 FTE
Data Collection and analysis	0.4 FTE
Performance monitoring	2.8 FTE
Technician assistance	0.7 FTE
Consumer assistance	10.3 FTE
Waiver oversight	~~N/A~~0.1 FTE
Employee management	3.0 FTE
Building Maintenance	2.0 FTE
Testing Equipment Maintenance and Quality Control	5.0 FTE
Special Technical Projects	0.8 FTE
Rule Development	0.5 FTE
Fleet Oversight	0.5 FTE
Public Response & Records Keeping	2.0 FTE
DEQ Testing Inspectors	95.0 FTE

The DEQ Vehicle Inspection Program operates the I/M program, including overseeing the construction of testing facilities, purchasing ~~of~~ testing equipment, develop~~menting~~ing ~~of~~ testing procedures, actual testing of vehicles, and over~~sight~~seeing ~~of~~ program operations. Currently, none of the vehicle testing operations (except self-inspecting fleet testing) is contracted to a source outside the Department.

The DEQ expects to allocate 0.2 FTE to the oversight of the registration denial enforcement mechanism. This is included in the above FTE summary.

5.4.5 Test Frequency and Convenience

The test frequency is biennial for all subject vehicles. For new vehicles, the first test is required for re-registration two years after initial registration. ~~Since~~ Because the inspection program has been operating in this manner since 1975, no special vehicle testing sequence scheme is required to accomplish a steady month to month flow of vehicles. Vehicles are merely re-registered periodically two years after the previous registration. Used vehicles newly arriving into the I/M area are required to be inspected and registered within 30 days of establishing residence if the vehicle does not have an Oregon license plate. Such vehicles with Oregon plates are not tested until current registration expires. Statutory authority is contained in ORS 803.400, 803.415 and 803.350, which are shown in Appendix E.

The inspection is required within 90 days ~~prior to~~ before the ~~expiration of~~ vehicle registration expires. Registration is good for two years and expires on the anniversary of initial titling. ~~Vehicles that change ownership receive a shortened registration, valid only until the next anniversary of initial titling.~~

The test stations are located such that approximately 85 percent of all motorists are within five miles of a test facility and 95 percent are within 12 miles of a facility. Monthly average waiting times range between 5 minutes and 12 minutes varying with station location and time of month. Regular testing hours are posted at all stations. The public is notified of station closure in the case of holidays by posting signs at stations two weeks in advance.

The Oregon basic two speed idle test procedure offers a second chance idle test for all vehicles. Certain Ford Motor Company and Honda vehicles are allowed a key off/restart if they fail the first idle test ~~is failed~~.

5.4.6 Vehicle Coverage

Vehicle tests must be performed on all the following types of vehicles:

> Passenger cars (gasoline, diesel, and alternative fuels except electric)
> Light duty trucks (gasoline, diesel, and alternative fuels except electric)
> Medium and heavy duty trucks (all gasoline, diesels up to 8,500 GVWR, all alternative fuels except electric)

The total estimated number of vehicles licensed for road use in the I/M areas in Oregon is 1,110,000 vehicles. Approximately 45,000 of these vehicles appear to avoid the I/M test by improperly registering outside the test area.

The following types of vehicles, with estimated numbers in parenthesis, are exempt from the testing requirement:

> All vehicles model year 1974 and older (36,000 in Portland, 4,000 in Medford)
> All vehicles less than 2 years old (151,000 in Portland, 18,000 in Medford).
> Electric Vehicles (N/A)
> Farm Vehicles (3,520 in Portland, 480 in Medford)
> Fixed load vehicles (1,056 in Portland, 114 in Medford)
> Apportioned plate vehicle (N/A)
> Motorcycles (14,080 in Portland, 1,920 in Medford)
> Snowmobiles (2,816 in Portland, 384 in Medford)
> All terrain vehicles (6,512 in Portland, 888 in Medford)

DEQ does~~will~~ not test rental car agency and private and public fleets that operate vehicles in the I/M areas, but whose fleets are not registered in the I/M areas. Instead, DEQ ~~will~~ accepted a reduction in emissions benefits calculated by Mobile 5A based on the associated reduced vehicle coverage compared to the EPA standard basic I/M program. DEQ estimates the quantity of fleet vehicles in this category to be approximately 10,000 vehicles (8,800 in Portland, 1,200 in Medford). Vehicle coverage was reduced by this quantity in the "program target" Mobile 5A computer calculations.

Federal fleet vehicles garaged in I/M areas are required to be tested. The federal General Services Administration reported approximately 800 vehicles fall into this category (704 in Portland, 96 in Medford). An ~~It is~~ estimated ~~that~~ 100 federal vehicles are registered to agencies based outside of the I/M program areas~~,~~ but are routinely operated within the program area (88 in Portland and 12 in Medford).

NoneAll of these vehicles is will not be required to be tested. Vehicles owned by federal employees living outside the program areas, but working at federal facilities inside the program areas with employee parking provided, will not be tested. It is estimated this will impact about 250 vehicles (220 in Portland and 30 in Medford). As discussed above under private fleet vehicles, DEQ will accept a reduction in emissions testing benefits in the Mobile 5A model via a reduction in vehicle coverage by the amounts indicated.

Private fleets and local government fleets mayare allowed to test their own vehicles. Test records are tracked by the DEQ. DEQ employees visit fleet operations periodicallyon a periodic basis to insure proper test procedures are used and testing equipment is properly calibrated. Fleet licenses can be removed if fleet operations do not meet standards. Alternatively, fleets can be tested in the DEQ operated centralized testing facilities.

DEQ has procedures for testing vehicles registered in an Oregon I/M area but temporarily driven in an I/M area of another state. Prior to registration of such vehicles, the out of state vehicle owner is will be notified that an I/M test certification of compliance from the other state iswill be required before Oregon registration can proceed. If a vehicle is temporarily located in another state, but not based in an I/M area of that state, the owner is will be required to complete an Oregon DEQ form DEQ/VIP9401. This form will allows registration without an I/M test. The owner is required on the form to notify DEQ when the vehicle is scheduled back into Oregon. At that time the vehicle will requires an I/M test. DEQ will insures that such delayed testing is completed by the vehicle owner.

A table showing the number of vehicles in each weight class in each model year in 1992 is contained in Appendix F.

5.4.7 Test Procedures and Standards

The authority to establish test procedures and standards is contained in Oregon statutes ORS 468A.360 through 468A.460 in Section 2.2.11 of the Oregon SIP. The test procedures and test standards are specified in the regulation in Section 2.2.7 of the Oregon SIP.

In the Portland area:

The first two model years are exempt.
Next three model year vehicles - basic test

1981 - to 6 year old vehicles - enhanced test
1975 -1980 model year vehicles - basic test

The restructuring of the vehicle test schedule above, by adding the OBD test for 1996 to three year old vehicles, will begin on or before January 1, 2001. OBD testing for light duty passenger vehicles and light duty trucks (GVWR less than or equal to 8500 lbs) will begin January 1, 2001, as these vehicles are currently equipped with advanced OBD systems (OBDII or higher). OBD testing of gasoline powered heavy duty vehicles (greater than 8500 lbs GVWR) will begin when advanced OBD systems are available on these vehicles.

In the Medford area:

The first two model years are exempt
Next 19 model year vehicles – basic test

The restructuring of the vehicle test schedule above, by adding the OBD test for 1996 to three year old vehicles, will begin on the date that is mandated by EPA for the OBD testing in Medford. Before the mandatory implementation, OBD testing will be used as a pass only screen; vehicles that fail the OBD test will receive a basic emissions test. The following is the estimated implementation schedule for OBD based on vehicle types:

- OBD testing for light duty passenger vehicles and light duty trucks (GVWR less than or equal to 8500 lbs) will begin when mandated by EPA, as these vehicles are currently equipped with advanced OBD systems (OBDII).
- OBD testing of gasoline powered heavy duty vehicles (greater than 8500 lbs GVWR) will begin when advanced OBD systems are available on these vehicles and EPA mandates OBD testing of these vehicles.

In both the Portland and Medford test areas, vVehicles ~~shall~~will be rejected for unsafe conditions, including overheating, fluid leaks, or other conditions determined to be unsafe to the inspection program operations.

For the basic test, vehicles 1981 and newer ~~are required to~~ must pass both an idle and 2500 rpm emissions standards for carbon monoxide and hydrocarbons. Subject vehicles with model years older than 1981 are not judged at the 2500 rpm test point. All basic tested vehicles are given a second chance idle test

In the Portland area, a gas cap test will be performed for all basic tests. Also, a cap test and an evaporative system purge test will be done as part of all Portland area tailpipe enhanced tests. In the Medford area, neither the cap nor the purge test will be performed in conjunction with their basic test. Finally, the purge tests will not be done as an add-on to the OBD test in either the Medford or Portland area and the cap test may be done on OBD tested vehicles in Portland and Medford.

The enhanced test is a 31 second loaded transient cycle as outlined in the test procedures. ~~It includes a canister purge test and a gas cap leak test.~~

Detailed testing procedures for the basic test are shown in Appendix H Section 710.00 and Appendix K. Detailed testing procedures for the enhanced test are shown in OAR340-256-0350 and OAR340-256-0410. The OBD test procedure is outlined in OAR340-256-0355. ~~will be developed after equipment is received.~~

Both the Portland and Medford inspection areas will continue using self-testing fleet operations, including requiring that these fleets perform OBD tests on 1996 and newer vehicles where OBD testing is required as a part of the centralized testing operations.

5.4.8 Test Equipment

All basic tests will be conducted with garage style idle emissions measuring equipment with computer-timed measurements, automatic calibration and computerized test data storage. Equipment must meet California BAR 90 accuracy standards. Vehicles failing an initial tailpipe emissions test for any pollutant or pollutants must pass a retest for all pollutants in order to receive a certificate of compliance.

All 1975 and newer vehicles are examined to insure original factory pollution control equipment is in place. Vehicles 1975-1980 are required to maintain catalytic converters only. Vehicles newer than 1980 are required to maintain all factory installed pollution control equipment.

Test equipment will have access lock-outs to insure inspectors do not alter test parameters. VIN codes are intended to be read with a bar code reader where possible. Other procedures will be streamlined as much as possible within the guidelines of the program regulations.

The test process is completely computer controlled. The process begins with vehicle identification data entry, including full VIN and license number. An I/M vehicle data-base with full vehicle identification and test history accessed by entry of vehicle license plate has been established. The inspector verifies vehicle identity with license plate and VIN. The inspector initiates the test procedure with the customer operating the vehicle. The test proceeds as programmed by the computer. After vehicle readings are taken, the computer establishes pass/fail and print out emission report. Detailed equipment specifications are shown as Appendix I and Appendix J.

The enhanced testing equipment ~~will~~ meets the requirements specified in EPA's "High-Tech I/M Testing Procedures, Emission Standards, Quality Control Requirements, and Equipment Specifications" or EPA specified Inspection Grade (IG) 240 equipment.

OBD equipment will meet the operational specifications of Society of Automotive Engineers (SAE) J1978.

5.4.9 Quality Control

The Department's quality control, record keeping and security procedures for the computerized testing program are shown as Appendix H Section 700.04 and Appendix I Sections 4.5, 5, and 6. DEQ fully implemented enhanced testing in the Portland area in May 1998. ~~Authorization and funding for enhanced testing equipment and personnel is currently pending before the Oregon. Final legislative approval for the personnel is anticipated prior to July 1997. The Department has written specifications for purchasing equipment and is preparing to issue the document as soon as legislative approval is granted. Final implementation of the mandatory enhanced testing is anticipated between July and September, 1997.~~

5.4.10 Waivers and Compliance Via Diagnostic Inspection

A test report will be provided to all vehicle owners whose vehicles fail an inspection test. The report will alert that they should pursue warranty repairs if the vehicle meets the age and mileage criteria.

The Oregon basic I/M program does not allow vehicles to by-pass the test with use of a waiver. All vehicles must be repaired and meet basic testing standards before a certificate is issued and registration can be accomplished. A waiver is available for vehicles that fail an enhanced inspection test if the department's waiver rule (OAR 340-256-0300) requirements are met. The testing waiver applies to vehicles that fail an enhanced test and are owned by households with incomes at or below 130% of the federal poverty guideline. The waiver applicants will be required to submit a completed application to the vehicle inspection Tech Center. The applicant will need to include proof of eligibility and ownership with the application. Tech Center personnel will review the application and provide the owner with a waiver if eligibility requirements are met.

~~The test report will alert motorists that failed the vehicle test that they should pursue warranty repairs if the vehicle meets the age and mileage criteria.~~

Appendix L contains information regarding the waiver program, including program procedures and calculations that estimate air quality impact of the waiver program.

5.4.11 Motorist Compliance Enforcement

The legal authority in Appendix E includes the authority necessary to develop and implement the enforcement element of the I/M program. A penalty schedule for violation of the regulation is included.

The motorist compliance enforcement program is to be implemented, in part, by the Oregon Drivers and Motor Vehicle Services Branch (DMV), which will take the lead in ensuring that owners of all subject vehicles are denied registration unless they provide valid proof of having received a certificate indicating they passed an emissions test in Oregon. State and local police agencies have the authority to cite motorists with expired registration tags. Periodic parking lot surveys will be used to evaluate motorist compliance with the I/M program.

The following vehicle types are exempt from the I/M program:

All vehicle model years 1974 and older (in Portland)
All vehicle model years older than 20 years (in Medford)
First two model years
Electric vehicles
Farm Vehicles

Fixed load vehicles
Apportioned plate vehicles
Motorcycles
Snowmobiles
All terrain vehicles (not licensed for street use)
<u>Golf carts</u>

Studies were conducted of vehicles parked in I/M areas in 1983 and 1987. This data was reviewed with DMV registration records and phone book address look-up and tracing of vehicles that initially failed the DEQ test and did not return for retest, but were found to be registered. Based on these studies it is estimated that the current compliance rate 95 percent in the Portland I/M area and 90 percent in the Medford I/M area. Studies are shown in Appendix G. It is estimated that essentially all of the non-compliance is due to test avoidance either by people who knowingly register inappropriately outside the inspection area or those who unknowingly register at the correct address inside the test area but indicate to DMV the address is outside the I/M area.

Oregon commits to a level of motorist enforcement necessary to ensure a compliance rate of no less than 90% among subject vehicles in the Portland I/M program and no less than 80% in the Medford I/M program. Mobile 5A calculations for these compliance rates are shown in Appendices B and C. If compliance rate is not achieved, Oregon commits to work with DMV to establish a specific strategies to insure compliance is achieved.

5.4.12 Motorist Compliance Enforcement Program Oversight

The Department will periodically review the compliance rates of both the Portland and Medford area I/M programs via parking lot surveys.

5.4.13 Quality Assurance

The Department's quality assurance program is shown in Appendix H Section 709.00. It will be used by program auditors for conducting overt and covert audits.

5.4.14 Enforcement Against Inspectors

Oregon Revised Statute 815.320 "Unlawful certification of compliance with pollution control requirements; penalty" describes that the unlawful certification of compliance with pollution control requirements is a Class A misdemeanor. This statute would apply when an Inspector is found to have intentionally improperly passed a vehicle that would not otherwise have been issued a Certificate of Compliance. The maximum penalty for a Class A misdemeanor is a $2,500.00 fine and/or a 1 year jail sentence. Additionally, Article 12 of the current collective bargaining agreement between the Department and American Federation of State, County and Municipal Employees (AFSCME) Local 3336 details the process for disciplining and discharging State Employed Vehicle Emission Inspectors.

Oregon Administrative Rule 340-~~24-340~~256-0440 provides the Inspector's license may be suspended, revoked or removed if the Inspector fails to follow proper test procedures. This would include removal from testing duties for up to 6 months. However, Article 52 of the DEQ/AFSCME agreement requires that an State Employed Vehicle Emission Inspector shall be given at least fifteen (15) calendar days notice before any permanent change of an Inspector from one duty station to another. Where both parties agree, the required notice may be waived.

5.4.15 Data Collection

Oregon commits to collect the data elements listed in EPA regulations 40 CFR 51.365. The test equipment will be capable of tying specific test results to a specific vehicle, test site, test lane and inspector. The details of this record keeping are shown as Appendix I Sections 4.5, 5 and 6.

Oregon will summarize and report to EPA the results of quality control checks performed on testing equipment, the concentration values of the calibration gases used and the time of the quality control check.

During the first four years after initiation of the enhanced vehicle maintenance program, DEQ will conduct an IM240 test on a randomly selected sample of 0.1% of vehicles that are tested with the BAR31 test. DEQ will submit the test results to EPA Office of Mobile Sources and EPA Region 10 after each year of testing. At the end of the four year period. DEQ will confer with EPA Region 10 to determine if any changes are needed to the Ozone Maintenance Plan for the Portland AQMA because of the test results.

5.4.16 Data Analysis and Reporting

Beginning July 1, 1996 and annually thereafter the Department ~~shall~~ will report to EPA summary data based upon program activities taking place from January through December of the previous year. This report will provide statistics for the testing program, the quality control program, the quality assurance program, and the enforcement program. At a minimum, Oregon commits to address all of the data elements listed in 51.366 of the federal EPA's November 5, 1992 I/M rule.

Beginning with July 1, 1996 and biennially thereafter the DEQ ~~shall~~ will report to EPA on all changes made in the program design, funding, personnel levels, procedures, regulations and legal authority, and shall supply a detailed discussion of the impact of such changes upon the program. This report shall also detail and discuss any weaknesses or problems discovered in the program over the previous two-year period, as well as the steps that were taken to address those problems, the result of those corrective actions, and any future efforts planned.

5.4.17 Inspector Training and Licensing or Certification

Section 2.2.7 of the SIP contains rules requiring vehicle inspectors to be formally trained and licensed to conduct inspections. Refresher training and relicensing is required every two years thereafter. Training will include all the elements required by 51.367(a) of the EPA I/M rule. Inspector candidates must pass a written test with at least 80 percent correct responses and a hands-on test to be certified

The Department will be responsible for training and testing all inspectors.

5.4.18 Public Information and Consumer Protection

DEQ commits to an ongoing public information and consumer protection program. DEQ dispenses warranty information with each failed test report. ~~The~~ DEQ currently operates a referee facility capable of conducting basic I/M tests. When the enhanced testing is implemented, DEQ will operate an enhanced/basic referee lane at each of the seven Portland area test stations. In Medford, a basic only referee lane will be operated at the single Medford test station. DEQ accepts smokey vehicle reports from the general public and sends a letter to the subject vehicle owner to resolve the problem. This program has been effective in correcting the problems of some smoking vehicles.

5.4.19 Improving Repair Effectiveness

As in the past, the program's engineering and supervisory staff will continue to work with both motor vehicle owners and the automotive service industry regarding ~~their~~ vehicles failing to meet the exhaust emission levels. As such, a significant amount of staff time will be devoted to direct interactions with the customers. These direct contacts are normally either by telephone or person-to-person. The customers vary from the typical vehicle owner/operator to the automotive service industry technician that is trying to accomplish the necessary repairs within reasonable costs and still maintain a satisfied customer.

Customers with vehicles that present unusual testing problems or situations are referred by the inspector staff to the program's field supervisors. Initially, ~~the~~ staff ~~problems are~~ attempted to ~~be~~ resolve~~d~~ problems over the telephone ~~through the staff's utilization of~~ by using the program's reference and technical manuals. If the problems can not be resolved over the telephone, an appointment can be made to have a vehicle brought into the program's Tech Center, 1240 SE 12th Street, ~~1301 SE Morrison Street~~, Portland or to the Rogue Valley station for further testing. At that time, a diagnostic evaluation to identify the cause(s) of failure may be done.

For the new OBD~~enhanced~~ testing program to succeed, trained technicians will be needed to repair cars with computerized air pollution control systems that fail the new test. DEQ expects as vehicles equipped with OBD test compatible systems age, ~~there will be more vehicles~~ the emissions test ~~to~~ fail~~ing~~ure rate will increase using the OBD test ~~method~~, more significantly where OBD replaces the basic test. However, the diagnosis of emissions related problems will be easier with OBD testing when technicians are fully trained on OBD systems.

Since November 1995, a volunteer advisory committee representing a cross section of the auto repair industry has been working to develop a DEQ Auto Technician Emission Training. The DEQ Auto Technician Emission Training Advisory Committee has evaluated training programs from other states and will make recommendations for Oregon's program.

The program will be designed to help improve technicians' skills in diagnosing and repairing modern vehicle emissions systems. Another goal of the program is to ensure that trained technicians receive recognition that will distinguish them from mechanics who have not gone through the DEQ approved training program.

The Committee is proposing the training program be voluntary and consist of two certification levels of proficiency; Emissions Technician (Level 1) and Advanced Emissions Specialist (Level 2).

Direct personal contacts by the program's field supervisors with customers who have encountered difficulties in meeting the testing program standards and criteria is expected to average between 20 and 25 per week. Although these personal contacts in addition to the telephone contacts are extremely time consuming, it enhances the staff's ability to effectively relate to and understand the customer's concerns about the operation of the inspection and maintenance program.

5.4.20 Compliance with Recall Notices

For basic and enhanced testing, DEQ does not ~~intend to~~ require vehicle owners to comply with EPA recall notices in order to complete vehicle registration. For vehicles subject to the OBD test method, DEQ will require vehicle owners to comply with EPA recall notices to complete vehicle registration.

5.4.21 On-road Testing

DEQ does not intend to perform on-road testing of motorist vehicles as an enhancement to DEQ's basic program.

5/1/96
revised ~~4/11/00~~5/25/00

Attachment B1

Secretary of State
NOTICE OF PROPOSED RULEMAKING HEARING
A Statement of Need and Fiscal Impact accompanies this form.

DEQ – Air Quality Agency and Division	Chapter 340 Administrative Rules Chapter Number
Susan M. Greco Rules Coordinator	(503) 229-5213 Telephone

811 S.W. 6th Avenue, Portland, OR 97213
Address

Hearing Date	Time	Location	Hearings Officer
July 25, 2000	3:00 p.m.	Executive Building, Rm 3A 811 SW 6th Avenue, Portland, OR	Bruce Arnold
July 28, 2000	2:00 p.m.	Jackson County Courthouse 10 S. Oakdale, Medford, OR	Ted Wacker

Are auxiliary aids for persons with disabilities available upon advance request?
☒ Yes ☐ No

RULEMAKING ACTION

ADOPT:
OAR 340-256-0355, OAR 340-256-0465

AMEND:

OAR 340-200-0040, OAR 340-256-0010, OAR 340-256-0300, OAR 340-256-0440

Stat. Auth.: ORS 468A.380(1)(c)
Stats. Implemented: ORS 468A.365

RULE SUMMARY

The rule proposal would establish the on-board diagnostic (OBD) vehicle testing method for 1996 and newer vehicles in the Portland and Medford areas. The proposed OBD test method will replace the tailpipe test for 1996 and newer vehicles by identifying emissions problems using the vehicle's on-board computer. The Portland ozone maintenance plan, which includes strategies for maintaining compliance with the national ambient air quality standard (NAAQS) for ozone, relies on the implementation of OBD testing for 1996 and newer vehicles. Initially (prior to EPA's requirement for mandatory OBD), the OBD test will be used as a pass screen in Medford; vehicles that fail the OBD in Medford will receive a basic test. The OBD test will result in increased emissions reductions in both the Medford and Portland airsheds. The rule amendments will be submitted, if adopted, to the Environmental Protection Agency as a revision to the Oregon State Implementation Plan (340-200-0040) as required by the Clean Air Act. Copies of the proposal are available for review at the Vehicle Inspection Technical Center at 1240 SE 12th Avenue, Portland, OR 97214 or by calling Jerry Coffer at 503-731-3050 E229

August 2, 2000 5:00 p.m.
Last Day for Public Comment

Susan M. Greco 6/13/00
Authorized Signer and Date

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY

Rulemaking Proposal
for
On-board Diagnostic (OBD) Vehicle Emission Test Method

Fiscal and Economic Impact Statement

Introduction

This rulemaking proposes to adopt on board diagnostic (OBD[1]) vehicle testing for 1996 and newer vehicles in the Portland and Medford areas.

In the Portland area, initially there will be a modest percent increase in the overall program failure rate due to an increase in failure rate for the new vehicles (five to three years old) that will be changing from the current basic test to the proposed OBD test. In Medford, initially there will be no increase in failure rate since OBD will be used as a pass screen. Once EPA mandates OBD testing, this failure rate increase will also be seen in the Medford program as emission testing for 1996 and newer vehicles changes from the basic test to OBD. It is estimated that the failure rate on these newer vehicles will increase from 0.6 percent (basic tested) to about 2 percent (OBD tested).

Under current rules for Portland area vehicles, the first two vehicle model years are exempt from emissions testing, the next three model year vehicles are required to pass the basic test, and 1981 to 6 year old vehicles are required to pass an enhanced test. In the future, for the Portland area, as the vehicles that are equipped with OBD systems become over 5 years old, instead of receiving an enhanced test, under the proposed rules they will receive an OBD test. The failure rate for these vehicles, switching from the enhanced test to the OBD test, is expected to remain about the same.

In the Medford test area, a basic test is currently performed on all vehicles. As the vehicles receiving OBD tests become a larger part of the total test population, there is expected to be a significant increase in overall failure rate for the total Medford testing program once the OBD test becomes mandatory. The higher failure rate will lead to required repairs of more vehicles for the general public.

[1] OBD means OBDII or higher systems.

General Public

At the startup of the OBD test program in the Portland area and at the point when OBD testing becomes mandatory in Medford, people with the newest tested model year vehicles (three to five years old), will experience an increase in repair costs due to an increase in failure rates (from 0.6% to 2.0%) with the new OBD test. The average cost for repairs for enhanced test failure has been estimated by EPA at about $280 per vehicle. EPA estimates show a similar price for OBD test vehicle repair costs. In the first biennium after startup of OBD testing, the total increase in the cost of repairs for both programs is estimated at $750,000 {(800,000 vehicles)(0.014 change in fail rate of OBD verses basic test)(0.24 fraction of vehicles changing from basic to OBD)($280/average OBD repair cost)}.

This first biennium estimate of repair costs does not consider that vehicle repairs may be covered under manufacturer's warranty. The EPA required 2 year (or 24,000 mile) warranty mandates manufacturers to repair emissions related systems for vehicles that fail a state IM program (including the OBD test) at no cost to the vehicle owner. The EPA 8 year (or 80,000 mile) warranty covers the vehicle catalyst and OBD computer, but not any other repairs related to failure of an IM test (including the OBD test). Since, DEQ does not generally have a required test for the first two years of a vehicle's life, the impact of the DEQ test on 2 year warranty repairs is expected to be minimal. However, it is expected that owners of OBD (1996 and newer model year) vehicles will bring vehicles in for 2 year warranty repair when the OBD malfunction indicator light (MIL) indicates malfunction. Manufacturer warranties that extend beyond the EPA required two-year period will reduce the repair cost impact of the OBD test calculated above.

In the Medford area, where all model years currently receive a basic test, the failure rate for the 1996 and newer vehicles will increase slightly once OBD is mandatory (while used as a pass screen no increased repair cost is anticipated). As time passes, the failure rate of these OBD-tested vehicles is expected to increase significantly. Eventually, the overall failure rate for the Medford program is estimated to reach approximately 21 percent (the current failure rate for the Portland area enhanced test); the current Medford failure rate is 13 percent. The cost of vehicle repairs for a failed OBD test is expected to be about twice that of repairing for a failed basic test. Combined with the higher failure rate, the total cost of repairs in the Medford area is expected to increase from approximately $1,500,000 per biennium {(0.13 fraction failing)(800,000 total IM vehicles)(0.10 fraction vehicles in Medford)($150 repair cost per failure)} to a cost of $4,700,000 per biennium {(0.21 fraction failing)(800,000 total IM vehicles)(0.10 fraction vehicles in Medford)($280 repair cost per failure)} over the next sixteen years.

Small Business

The Portland and Medford area garages will likely want to purchase OBD scan tools at a cost of $300 to $2000, if they have not already purchased this equipment. This equipment is required to diagnose the operation of the vehicle computer. This tool will be essential to repair the 1996 and newer model year vehicle emission systems to pass the new OBD test. Most garages, (estimated 90 percent) have already purchased this equipment to perform routine repairs on OBD equipped vehicles. Since the purchase was previous to the implementation of the OBD test, the equipment costs cannot be directly attributed to this rulemaking. Most auto repair shops are considered small businesses, except for the relatively small number of repair facilities associated with dealerships. There are an estimated 2,000 independent repair shops in the Portland/Medford areas.

The shops that participate in repairing vehicles that fail the OBD test stand to have a moderate increase in business immediately in the Portland areas and at the time of mandatory testing in Medford; totaling about $750,000 (about 90 percent in Portland and 10 percent in Medford). In Medford, however, as the 1996 vintage vehicles age, the repair work on emissions systems will increase over time. It is not expected for the Portland area to see a large increase in repair work over time, since Portland already has an enhanced test.

Large Business

Private self-testing fleets will be required to purchase specific equipment for OBD testing required by DEQ to match DEQ's database at an approximate cost of $1,000 each. There are approximately 20 of these fleets in Portland for a total expenditure of $20,000. (There are currently no private self-testing fleets in Medford.)

Local Governments

Local government self-testing fleets will be required to purchase specific equipment for OBD testing required by DEQ to match DEQ's database at an approximate cost of $1,000 each. There are approximately 20 of these fleets in Portland for a total expenditure of $20,000. (There are currently no local government self-testing fleets in Medford.)

State Agencies

DEQ

DEQ will install the new OBD testing operations in both the Medford and Portland test stations. There will potentially be a need for 37 lanes of OBD testing equipment at a hardware/installation cost of approximately $4,000 per lane for a total cost of $148,000. Additionally, DEQ will be required to purchase software to streamline and integrate the OBD test into DEQ's existing vehicle testing software at a programming rate of approximately $80 per hour. DEQ has requested a quote for this software change. DEQ plans to give each inspector a total of five hours of training on the OBD system prior to fully implementing the program. The estimated total cost for inspector training is approximately $20,000.

DEQ also plans to provide OBD download software for the 40 self-testing fleets. An initial cost estimate for this work is approximately $20,000. This software will allow all fleets to use the same OBD testing procedure, and create a homogeneous OBD database for DEQ review.

The test time for OBD testing (approximately 4 minutes per test) is expected to be less than either the current basic test (approximately 5 minutes) or current enhanced test (approximately 9 minutes). Initially, this has the potential of reducing the wait times currently experienced during our busy test days. Over time, as the OBD vehicles become a larger share of the tested population, if the OBD test proves to be significantly faster than our current test methods, there is potential for reduced labor requirements. However, the reduced testing cost will need to be balanced against the increased operating costs. These new operating costs include a potential increase in test facility requirements due to overall increases in vehicle population, the potential implementation of additional fuel evaporative system testing, and the increase in additional Portland area testing locations (providing better service for the remote areas of the Portland metropolitan area). Consequently, it appears that any OBD provided labor savings will likely be consumed by statutorily required testing enhancements (such as evaporative testing) or consumer service enhancements (such as new test facilities).

The current test fee in the Portland area is $21 per certificate and $10 per certificate in Medford. No change in either test fee is proposed in this rule. There will be no increase in revenue by this proposed rule.

Other Agencies

State agency self-testing fleets will be required to purchase an OBD scanner to continue to test 1996 and newer vehicles at a cost ranging from $300- $2,000. Most fleets have already purchased this equipment to perform routine repairs on the newer vehicles (1996 and newer).

Assumptions

Assumes the scanner equipment costs remain the same as current costs. Assumes OBD failure rates, which are essentially identical with final-standard enhanced failure rates for 1996 through 1998 model year vehicles, will maintain the same relationship as vehicles age. The repair cost assumptions are based on an EPA study. The first biennium estimate of repair costs does not consider that some vehicle repairs will be covered under manufacturer's warranty.

Housing Cost Impact Statement

The Department has determined that this proposed rulemaking will have no effect on the cost of development of a 6,000 square foot parcel and the construction of a 1,200 square foot detached single family dwelling on that parcel.

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY

Rulemaking Proposal
for
On-board diagnostic (OBDII) Vehicle Emission Test Method

Land Use Evaluation Statement

1. **Explain the purpose of the proposed rules.**

   To establish the OBD vehicle testing method for 1996 and newer vehicles in the Portland and Medford vehicle inspection areas.

2. **Do the proposed rules affect existing rules, programs or activities that are considered land use programs in the DEQ State Agency Coordination (SAC) Program?** ☐ Yes ☒ No

   a. **If yes, identify existing program/rule/activity: N/A**

   b. **If yes, do the existing statewide goal compliance and local plan compatibility procedures adequately cover the proposed rules?** ☐ Yes ☐ No (if no, explain): N/A

   c. **If no, apply the following criteria to the proposed rules.**

      Staff should refer to Section III, subsection 2 of the SAC document in completing the evaluation form. Statewide Goal 6 - Air, Water and Land Resources is the primary goal that relates to DEQ authorities. However, other goals may apply such as Goal 5 - Open Spaces, Scenic and Historic Areas, and Natural Resources; Goal 11 - Public Facilities and Services; Goal 16 - Estuarine Resources; and Goal 19 - Ocean Resources. DEQ programs and rules that relate to statewide land use goals are considered land use programs if they are:

      1. Specifically referenced in the statewide planning goals; or

      2. Reasonably expected to have significant effects on
         a. resources, objectives or areas identified in the statewide planning goals, or
         b. present or future land uses identified in acknowledged comprehensive plans.

      In applying criterion 2 above, two guidelines should be applied to assess land use significance:
      - The land use responsibilities of a program/rule/action that involved more than one agency, are considered the responsibilities of the agency with primary authority.
      - A determination of land use significance must consider the Department's mandate to protect public health and safety and the environment.

In the space below, state if the proposed rules are considered programs affecting land use. State the criteria and reasons for the determination.

It has previously been determined through the DEQ SAC program that the Vehicle Inspection Program is not a program that significantly affects land use. These proposed rules, which address only a change in the testing procedure for newer model vehicle, do not contain program changes that significantly affect land use.

3. **If the proposed rules have been determined a land use program under 2. above, but are not subject to existing land use compliance and compatibility procedures, explain the new procedures the Department will use to ensure compliance and compatibility.**

N/A

Air Quality	[signature]	6/8/00
Division	Intergovernmental Coordinator	Date

Questions to be Answered to Reveal Potential Justification for Differing from Federal Requirements.

1. Are there federal requirements that are applicable to this situation? If so, exactly what are they?

Yes. OBD testing is part of the Portland ozone maintenance plan's strategy to maintain compliance with the national ambient air quality standards (NAAQS) for ozone. The Environmental Protection Agency (EPA) approved the Portland ozone maintenance plan in 1997 as part of Oregon's State Implementation Plan under the Clean Air Act, which is federally enforceable.

The current federal rules require that states with vehicle inspection and maintenance programs initiate on-board diagnostic (OBD) testing by January 1, 2001 for all 1996 light duty trucks and light duty vehicles equipped with certified OBD systems. The OBD testing requirement applies both to enhanced and basic vehicle inspection test programs. Under federal regulations, a vehicle will fail an inspection if the OBD connector is tampered with, the malfunction indicator light (MIL) is illuminated, the vehicle computer has not completed self-testing, and if the malfunction indicator light is commanded to be on but is not visually illuminated. The federal rules allow states to initiate OBD testing prior to 2001.

EPA is revising the current rules for the implementation of OBD testing. The rule is expected to allow emission reduction credits at least equivalent to the IM240 tailpipe test for OBD testing as a stand-alone test (no tailpipe testing required). EPA is expected to issue a Notice of Proposed Rulemaking in July 2000 to delay the mandatory implementation of OBD testing until January 1, 2002.

2. Are the applicable federal requirements performance based, technology based, or both with the most stringent controlling?

OBD testing is a technology-based standard, which will replace the current tailpipe test on 1996 and newer model years. The federal rules require states with vehicle inspection and maintenance programs to incorporate the OBD test requirement into their State Implementation Plans (SIP).

3. Do the applicable federal requirements specifically address the issues that are of concern in Oregon? Was data or information that would reasonably reflect Oregon's concern and situation considered in the federal process that established the federal requirements?

Yes. OBD testing is included in the Portland ozone maintenance plan as an emission reduction strategy. The OBD test is expected to be at least as effective as the enhanced test in detecting vehicle equipment malfunctions that result in excessive emissions. This test method will result in increased emission reductions, which are needed in the Portland area to maintain compliance with the ozone NAAQS.

The OBD test may eventually reduce vehicle emissions testing time. Initially, the OBD test will replace the basic test, which is currently required for newer vehicles in the Portland area and all vehicles inspected in the Medford area. Eventually, the test will apply to vehicles that would have received an enhanced emissions test in the Portland area. The OBD test is less time consuming than the enhanced test.

DEQ has provided comments to EPA on its proposals regarding OBD and believes that the planned federal rule amendments will support OBD stand-alone testing with the necessary emission reduction credits.

4. Will the proposed requirement improve the ability of the regulated community to comply in a more cost effective way by clarifying confusing or potentially conflicting requirements (within or cross-media), increasing certainty, or preventing or reducing the need for costly retrofit to meet more stringent requirements later?

The OBD codes that are downloaded from the computer for failing vehicles will give an indication of the emissions problems. This will assist vehicle repair technicians in diagnosing and repairing vehicle emission problems.

The OBD testing may eventually reduce emissions testing time. The time reduction will be most significant in the Portland area, where eventually OBD will replace enhanced testing on 1996 and newer vehicles. The enhanced test averages 9 minutes to complete; after full implementation and automation the OBD test is anticipated to be completed in approximately 4 minutes.

5. Is there a timing issue which might justify changing the time frame for implementation of federal requirements?

The 1996 Portland ozone maintenance plan emission projections assume OBD testing would begin in 1998, EPA's original implementation date for OBD testing. There is a shortfall in emission reductions in the Portland airshed due to the delayed implementation of OBD testing. Monitored levels of ozone in the Portland region exceeded the public health standard in 1998. DEQ is recommending implementation of OBD as soon as possible in order to reduce the shortfall of the planned emission reductions.

In the Medford area, implementation of OBD testing as a pass screen will offer an early advantage to owners of 1996 and newer vehicles in the form of a quicker, simpler test. The current federal rules require that states initiate OBD by January 1, 2001; according to EPA staff this deadline may be extended by EPA to January 1, 2002. EPA is encouraging states to implement the OBD test prior to the mandated date. This proposed rulemaking allows DEQ to begin OBD testing as a stand-alone emissions test. The OBD testing will benefit the VIP program because it will provide a more efficient test method for 1996 and newer vehicles, with increased air quality benefits.

6. Will the proposed requirement assist in establishing and maintaining a reasonable margin for accommodation of uncertainty and future growth?

The Portland ozone maintenance plan relied on OBD testing on 1996 and newer vehicles as an emission reduction strategy. The plan projects future ozone levels and identifies strategies to insure compliance with the federal ambient air quality standard. The implementation of OBD will assist the Portland area in meeting the ambient air quality standards and therefore assist in complying with the standards as the population and number of vehicles increases.

Additionally, the OBD test will accommodate growth by decreasing motor vehicle inspection test time and minimizing wait times.

7. Does the proposed requirement establish or maintain reasonable equity in the requirements for various sources? (level the playing field)

The OBD rules will be applied to all 1996 and newer light duty cars and trucks and heavy-duty gasoline powered trucks.

8. Would others face increased costs if a more stringent rule is not enacted?

This is not a more stringent rule, and for the Portland area, implementation of OBD testing is relied on in the Portland ozone maintenance plan.

9. Does the proposed requirement include procedural requirements, reporting or monitoring requirements that are different from applicable federal requirements? If so, Why? What is the "compelling reason" for different procedural, reporting or monitoring requirements?

No. This rulemaking provides DEQ with the legal authority to conduct OBD testing as part of the Vehicle Inspection Program. Specific OBD test procedures will parallel federal requirements as they are promulgated.

10. Is demonstrated technology available to comply with the proposed requirement?

Yes, OBD equipment has been installed on the applicable vehicles and the necessary OBD communicators used in the test method are available. The information stored in the vehicle's computer can be downloaded into a DEQ operated computer to diagnose the effectiveness of the vehicle's emission control systems. The equipment has been used in Oregon on a trial basis successfully.

11. Will the proposed requirement contribute to the prevention of pollution or address a potential problem and represent a more cost effective environmental gain?

The OBD test is one of the Portland ozone maintenance plan strategies to reduce ozone in the Portland area. The OBD test is thought by EPA to be at least equivalent to the IM240 enhanced tailpipe test. For 1996 and new vehicles, the OBD test will replace the basic test in Medford. In Portland, the OBD test will replace the basic or enhanced tests on 1996 and newer vehicles. As vehicles age and the number of vehicles equipped with OBD increases, more significant emission reductions will result.

State of Oregon
Department of Environmental Quality **Memorandum**

Date: June 14, 2000

To: Interested and Affected Public

Subject: Rulemaking Proposal and Rulemaking Statements - On-board diagnostic (OBD) Vehicle Emission Test Method

This memorandum contains information on a proposal by the Department of Environmental Quality (DEQ) to adopt new rules/rule amendments regarding a new vehicle emissions test method. Pursuant to ORS 183.335, this memorandum also provides information about the Environmental Quality Commission's intended action to adopt a rule.

This proposal, if adopted by the Environmental Quality Commission, would establish the on-board diagnostic (OBD) vehicle testing method for 1996 and newer vehicles in the Portland and Medford areas. The OBD test would replace tailpipe tests on 1996 and newer vehicles by identifying emissions problems through information stored in the vehicle's on-board computer system. The rule amendments, if adopted, will be submitted to the Environmental Protection Agency (EPA) as a revision to the Oregon State Implementation Plan (SIP) under the Clean Air Act.

The Portland ozone maintenance plan, which includes strategies for maintaining compliance with the national ambient air quality standard (NAAQS) for ozone, relies on the implementation of OBD testing for 1996 and newer vehicles. The OBD test will result in increased emission reductions, which are needed in the Portland area. In addition to the Maintenance Plan requirement, federal rules currently require states that conduct either enhanced or basic vehicle inspection programs to implement OBD testing by January 1, 2001. However, EPA has indicated that it intends to delay the implementation date by one year.

Although the Medford air quality plans do not rely on OBD testing as a reduction strategy, the department proposes to use OBD testing in the Medford area as a pass screen for 1996 and newer vehicles until EPA requires OBD as a pass/fail test. A "pass screen" means that a vehicle will not be failed under an OBD test, but if it passes the OBD test, no further testing is required. Prior to the federal OBD requirement, vehicles that fail OBD testing in Medford will receive a basic test. The initiation of the OBD test method will benefit the Medford vehicle owners by providing them with additional information about the performance of their vehicle's emission control system, without increasing repair costs, while the test is used as a pass screen. Also, this test method may result in reduced inspection times, since it is expected to be slightly faster than the basic test.

The department has the statutory authority to address this issue under ORS 468A.380(1)(c) that allows the Environmental Quality Commission to adopt rules to "establish criteria and examinations for the testing of motor vehicles." The statute implemented is ORS 468A.365, "certification of motor vehicle pollution control systems and inspection of motor vehicles."

Key Words & Acronyms

OBD	The on-board diagnostic computerized quality control system in automobiles. This system tests the vehicle's emissions equipment operations. The EPA required 1996 and newer vehicles to be equipped with standardized OBD systems.
OBD Test	A DEQ test of the vehicle's computerized OBD quality control system in which the inspector observes the "malfunction indicator light" and the vehicle's computer is downloaded into a vehicle inspection program (VIP) computer program for pass/fail determination. The OBD test is expected to be at least as effective as the enhanced test in detecting vehicle equipment malfunctions that result in excessive emissions.
VIP	Vehicle Inspection Program operates as part of DEQ and tests vehicles to insure that vehicles with excessive emissions in the Portland and Medford airsheds are repaired.
DEQ	Department of Environmental Quality
EQC	Environmental Quality Commission
I/M Program	Vehicle Inspection/Maintenance Testing Program
Basic Test	A vehicle tailpipe emissions test performed while the vehicle is idling. This test is currently performed on all vehicles tested in Medford. It is performed in Portland for the following vehicle model years: 1) three through five model years old and 2) model years 1975 through 1980. A basic test is approximately half as effective as the enhanced test in detecting vehicle malfunctions that result in excessive emissions.
Enhanced Test	A transient vehicle emissions test with emission measurements taken while vehicle is driven under load on rollers (a BAR31 trace is driven in the Oregon enhanced lanes, which consists of a 31 second transient driving cycle). This test is currently used in Portland on vehicle model years 1981 through 1995.
MIL	Malfunction Indicator Light located on a vehicle's dash area to alert owner of emissions-related problems.
IM240	A transient vehicle emissions test with a 240 second driving cycle. This is

	EPA's primary standard enhanced emissions test as described in 40 CFR 51.351.
DTC	Diagnostic trouble code is the numerical code downloaded from the vehicle's computer that indicates a vehicle emission problem.
NO_x	Nitrogen Oxides, an EPA listed priority pollutant.

What's in this Package?

Attachments to this memorandum provide details on the proposal as follows:

Attachment A	The official statement describing the fiscal and economic impact of the proposed rule (required by ORS 183.335).
Attachment B	A statement providing assurance that the proposed rules are consistent with statewide land use goals and compatible with local land use plans.
Attachment C	Questions to be Answered to Reveal Potential Justification for Differing from Federal Requirements.
Attachment D	The actual language of the proposed rule (amendments).
Attachment E	Proposed OBD Testing Procedure (Draft)
Attachment F	Revised Motor Vehicle Inspection State Implementation Plan

Public Comment Period

DEQ is conducting two public hearings, one in Medford and one in Portland, at which comments will be accepted by the hearings officer either orally or in writing. The hearings will be held as follows:

Date: Tuesday, July 25, 2000
Time: 3:00 p.m.
Place: Executive Building, Room 3A, 811 SW 6th Avenue, Portland, OR
Presiding Officer: Bruce Arnold

Date: Friday, July 28, 2000
Time: 2:00 p.m.
Place: Jackson County Courthouse, 10 S. Oakdale, Medford, OR
Presiding Officer: Ted Wacker

Deadline for Submittal of Written Comments: 5:00 p.m., Wednesday, August 2, 2000. (*This is not a postmark date, written comments must be received at the address below by this date.*)

Written comments can be presented at the hearings or to DEQ any time prior to the deadline date above. Comments should be sent to: **Department of Environmental Quality, Vehicle Inspection Program, Attn: Bruce Arnold, 1240 SE 12th Street, Portland, Oregon 97214 or faxed to (503) 731-3269.**

In accordance with ORS 183.335(13), no comments can be accepted after the close of the comment period. Thus, if you wish for your comments to be considered by the department in the development of these rules, your comments **must** be received prior to the close of the comment period. Interested parties are encouraged to present their comments as early as possible prior to the close of the comment period to ensure adequate review and evaluation of the comments presented.

What Happens After the Public Comment Period Closes

Following close of the public comment period, the department will prepare a report which summarizes the comments received. The Environmental Quality Commission (EQC) will receive a copy of this report.

The department will review and evaluate the rulemaking proposal in light of all information received during the comment period. Following the review, the rules may be presented to the EQC as originally proposed or with modifications made in response to the public comments received.

The EQC will consider the department's recommendation for rule adoption during one of its regularly scheduled public meetings. The targeted meeting date for consideration of this rulemaking proposal is September 29, 2000. This date may be delayed if needed to provide additional time for evaluation and response to the public comments received.

You will be notified of the time and place for final EQC action if you submit written comment during the comment period or ask to be notified of the proposed final action on this rulemaking proposal.

Background on Development of the Rulemaking Proposal

Why is there a need for the rule?

OBD is needed in Portland because the 1996 Portland ozone maintenance plan relies on OBD testing on 1996 and newer vehicles as an emission reduction strategy. The OBD test will result in increased emission reductions, which are needed in the Portland area to maintain compliance with federal health-based standards for ozone (smog). A recent EPA study dramatizes the potential effectiveness of OBD as a test method. The study suggests a potential 90 percent increase in hydrocarbon emissions reduction if OBD (instead of IM240) is used to test light-duty vehicles, and a 40 percent increase in hydrocarbon emissions reduction if OBD (instead of IM240) is used to test light-duty trucks. Similar results were seen for NO_x with 115 percent reductions for light duty vehicles and 42 percent reductions for light duty trucks. EPA is currently modifying the MOBILE emissions model to establish the precise emissions reduction credit they will grant the OBD test.

In Medford, the department proposes using OBD testing as a pass-only-screen for 1996 and newer vehicles until EPA requires mandatory implementation. As a pass screen, vehicles that fail the OBD test will be required to pass a basic test. The Medford area will benefit from initiating OBD testing early because the OBD test will provide information regarding emissions problems to the vehicle owner and the information will assist repair shops in identifying emissions related problems.

EPA will likely require OBD in all vehicle inspection programs in the future, in which case OBD will become mandated in Medford. Current federal rules require states to implement OBD testing by January 2001; however, DEQ believes that EPA will likely delay mandatory OBD until 2002.

How was the rule developed?

OBD testing is included as a strategy in the 1996 Portland ozone maintenance plan. The maintenance plan underwent extensive public involvement with advisory committees and local planning agencies. Additionally, in April 2000, DEQ met with several workgroups to determine the impact of OBD testing on their operations and to obtain further guidance for this rulemaking. On April 11, 2000, DEQ met with representatives of the auto repair industry and affected organizations in the Portland area. Members of the Pacific Automotive Trades Association, the Automotive Service Association, the American Automobile Association, the Oregon Environmental Council, and the federal EPA were invited. On April 18, 2000, DEQ met with the

Medford Automotive Service Association. Input received from these workgroups has been incorporated into the design of the OBD test procedure.

In addition to the workgroup meetings, on March 8, 2000, DEQ met with the Medford-Ashland Clean Air Advisory Committee to discuss the implementation of OBD testing in the Medford area and found that the committee supports the implementation of OBD testing. DEQ also met with representatives of 26 of the 44 self-testing fleets in Portland to discuss fleet related issues on April 17, 2000. There are currently no self-testing fleets in Medford.

In developing the rules, DEQ designed the OBD test procedure in accordance with the draft guidelines issued by EPA in September of 1999, with additional updates that were presented at the May 17-19 On-Board Diagnostics Conference 2000.

The following documents were relied upon in developing this rule: the EPA draft document entitled *Performing On-Board Diagnostic System Checks as Part of a Vehicle Inspection and Maintenance Program* dated September 1999; materials entitled *OBD 2K On-Board Diagnostics Conference 2000*, Center for Automotive Science and Technology at Weber State University dated May 17, 2000; the *OBD Training Course Manual*, Weber State University, dated May 2000; OAR chapter 340 Division 256; 40 CFR Part 51 (July 1999); and an EPA Federal Test Procedure (FTP) study entitled *Analysis of On-Board Diagnostics for use in Inspection/Maintenance* dated November 30, 1999.

Copies of the documents relied upon in the development of these rulemaking proposals can be reviewed at the Department of Environmental Quality's Vehicle Inspection Technical Center at 1240 SE 12th Street, Portland, Oregon 97214. Summaries of each of the workgroup meetings are available upon request. Please contact Bruce Arnold at (503) 731-3050 ext. 237 for times when the documents are available for review.

Whom does this rule affect including the public, regulated community or other agencies, and how does it affect these groups?

In Portland under the proposed rule, 1996 and newer vehicles will be required to pass the OBD test. OBD testing will replace the basic test that is currently performed on vehicles that are three to five model years old. OBD will replace the enhanced test method on 1996 and newer vehicles that are more than five model years old. The EPA presented information at the On-Board Diagnostics 2000 Conference, comparing OBD and IM240 testing, and found that although the failure rates for OBD testing and IM240 were similar, the emission reductions using the OBD test method appear to be greater because it better targets the high emitting vehicles. Therefore, the department anticipates that the OBD failure rate will be similar to the enhanced test failure rate. As the Portland fleet ages, the overall failure rate is anticipated to be about the same as the current overall failure rate, since OBD testing of these older vehicles will displace the enhanced test which has an equivalent failure rate.

EPA has estimated that the average cost of repairing a vehicle to comply with OBD testing will be approximately $280 (which is the same as the cost of repairs to meet an enhanced test and about double the cost of repairs to meet a basic test). There is a potential for increased cost of vehicle repairs for new model year vehicles (five years old or newer). As the test method for these vehicles changes from the basic to the OBD testing method, both the failure rate and the cost of repairs may double. The cost of vehicle repairs for vehicles six years and older is not expected to significantly increase since the test method for these vehicles will change from the enhanced test to an OBD test and the repair costs and failure rates of the OBD and enhanced tests are approximately equivalent.

In Medford, under the proposed rule, the OBD test will be used as a "pass screen" on 1996 and newer vehicles until the EPA requires implementation of OBD as a pass/fail test. In this interim time period, vehicles that fail the OBD test in Medford will be required to pass the basic test. When OBD is used as a pass screen, the vehicle owner may experience shorter test times and will receive more information regarding the vehicle's emissions system.

In Medford, after the EPA implementation date when vehicles are failed under OBD, initially, a modest increase is expected in the failure rate for the 1996 and newer vehicles. In 16 years when all vehicles tested are equipped with OBD technology, the overall failure rate in Medford is expected to reach a level equivalent to the Portland enhanced test failure rate; approximately 21 percent (the current overall failure rate in Medford is 13%). The cost of vehicle repairs for a failed OBD test is expected to be about twice that of repairing for a failed basic test. Additionally, customers receiving the new OBD test will be required to leave their vehicle during the test, as is currently practiced in the enhanced vehicle test in the Portland area. This will be a new experience for the Medford citizens.

Some automotive repair shops may want to purchase an OBD scan tool valued at $300 to $2,000 so that they can perform OBD repairs. However, the majority of repair shops already use this equipment as a part of routine maintenance on 1996 and newer vehicles. Medford area shops may see additional business, as the 1996 vintage vehicles age.

There are advantages of the OBD test that facilitate repair. First, the OBD scan tool is relatively inexpensive (compared to a $15,000 exhaust gas analyzer that diagnosis tailpipe emissions for example), and can look at exactly the same information seen by the DEQ during the OBD test. This information will be also displayed on the OBD emissions test report, so the vehicle owner will know exactly why their vehicle failed the OBD test. Second, with the scan tool, repair shops will be able to more accurately replicate a DEQ test, ensuring that repairs made will result in a successful retest.

How will the rule be implemented?

In 1999, DEQ commissioned a contractor to develop software for a prototype OBD test lane, integrating OBD computer information downloading into DEQ's current enhanced emissions test. This programming was funded by a grant from Honda Corporation. DEQ has been performing OBD testing in one lane at each Portland area test station for the last several months using this software. The prototype testing consists of back-to-back OBD testing with enhanced tests on the same vehicles, using volunteer vehicle owners. During this development period the vehicles are not failed under the OBD test. To date DEQ has tested in excess of 2,000 vehicles using this process and concluded that the test process of OBD memory downloading can be successfully performed on more than 99 percent of the 1996 and newer vehicles, and that the OBD test can be automated resulting in about a 4 minute total test time. This compares to the 9 minutes for an enhanced test.

All inspectors in the Portland area have been trained to perform the OBD test as a part of this trial process with a one-hour functional instruction program. Prior to conducting OBD testing on a pass/fail basis, all inspectors (Medford and Portland) will be given a four hour extensive training on OBD vehicle systems and how they relate to the DEQ test.

A draft of the proposed OBD test procedures is contained in Attachment E. Under these OBD test procedures a vehicle inspector will observe the vehicle's malfunction indicator light (MIL), check to see if the vehicle's OBD system is ready and properly functioning, and use computer software to retrieve stored diagnostic trouble codes (DTC). If a vehicle fails an OBD test, any stored DTCs and the status of the MIL will be printed for the vehicle owner. These same trouble codes can be downloaded at a repair shop and be used to assist a technician in diagnosing required vehicle repairs.

To fully implement OBD testing for 1996 and newer vehicles, DEQ is in the process of contracting a company to write software to make OBD the primary test option for both the basic and enhanced test lanes. DEQ is also requesting pricing from a contractor for hardware and installation of the OBD test equipment in all test lanes where OBD testing will be conducted. DEQ will ask for priority delivery of the software and hardware to meet the implementation date.

Are there time constraints?

The 1996 Portland ozone maintenance plan emission projections assume OBD testing would begin in 1998, EPA's original implementation date for OBD testing. There is a shortfall in emission reductions in the Portland airshed due to the delayed implementation of OBD testing. Monitored levels of ozone in the Portland region exceeded the public health standard in 1998. DEQ is recommending implementation of OBD testing as soon as possible in order to reduce the shortfall of the planned emission reductions.

In the Medford area, implementation of OBD testing as a pass screen will offer an early advantage to owners of 1996 and newer vehicles in the form of a quicker, simpler test. This test method will be required by EPA as part of the vehicle inspection program, likely in 2002.

Contact for More Information

If you would like more information on this rulemaking proposal, or would like to be added to the mailing list, please contact:

Bruce Arnold
Department of Environmental Quality
Vehicle Inspection Program
1240 SE 12th Street
Portland, Oregon 97214

This publication is available in alternate format (e.g. large print, Braille) upon request. Please contact DEQ Public Affairs at 503-229-5317 to request an alternate format.

State of Oregon
Department of Environmental Quality — Memorandum

Date: August 3, 2000

To: Environmental Quality Commission

From: Bruce Arnold (Portland) and Ted Wackier (Medford)
Vehicle Inspection Program/Air Quality Division

Subject: Presiding Officers' Report for OBD Vehicle Emissions Test Rulemaking Hearings of July 25, 2000 in Portland and July 28, 2000 in Medford

Portland, Oregon Hearing July 25, 2000

The rulemaking hearing in Portland for the above proposal was convened at 3:09pm and ended at 3:29pm. People were asked to sign witness registration forms if they wished to present testimony. People were also advised that the hearing was being recorded and of the procedures to be followed.

Prior to receiving testimony, Jerry Coffer briefly explained the specific rulemaking proposal, the reason for the proposal, and responded to questions from the audience.

Five people were in attendance, Mr Takami Yano from American Honda Motor Co., Inc was the only person who gave testimony. He submitted both written and oral testimony, making the following points. He said that American Honda basically supports the implementation of OBD and was particularly interested in Oregon's proposed rules, as they are the first OBD rules submitted by any state. Mr. Yano noted that the proposed rules fail for key on/engine off with the MIL not lighted. He said that some vehicles only leave the MIL on in this situation for a short period and we should note this in our procedures. He wanted to make sure Oregon looks at only current status of MIL commanded on when we elctronically query the vehicles computer and not all past history of MIL commanded on.. Finally he was concerned that the generic driving cycle DEQ plans to give the customer that fails for readiness would successfully erase not-ready status to avoid customer return problems.

Medford, Oregon Hearing July 28. 2000

The OBD rulemaking hearing in Medford was convened at 2:12pm. People were asked to sign witness registration forms if they wished to present testimony. People were also advised that the hearing was being recorded and of the procedures to be followed.

Four people were in attendance, no one signed up to give testimony.

Prior to receiving testimony, Jerry Coffer briefly explained the specific rulemaking proposal, the reason for the proposal, and responded to questions from the audience.

The hearing was closed at 2:31pm

<u>Written Testimony Not Offered at Public Hearings Received before the 5:00 PM August 2, 2000 Deadline</u>

The Alliance of Automobile Manufacturers and the Association of International Automobile Manufactures sent a letter supporting the adoption of OBD for clean air and consumer convenience during emission testing. The letter made the following suggested changes to the proposed DEQ test porcedure:

1) Light duty diesel vehicles OBD tested starting with model year 1997 rather than 1996
2) California vehicles OBD tested to 14,000 lbs GVWR rather than limited to 8,500 lbs and under.
3) Failing for two or more "not-ready" status for 2001+ model year vehicles rather than Oregon's proposal of failing for three or more "not-ready".
4) For vehicles where the manufacturer resets readiness status whenever the engine is turned off, AAM recommends dropping the readiness requirement and proceeding with the OBD test. Oregon is currently proposing that these vehicles receive an enhanced test.
5) When a vehicle returns to the DEQ test station for a retest after repairs, AAM suggests that the vehicle not be failed for "not ready" if a receipt for repairs is submitted by the customer.

Attachment D

State of Oregon
Department of Environmental Quality

Rulemaking Proposal
On-board Diagnostic (OBD) Vehicle Emission Test Method

Department Response to Public Comment

As outlined in the Presiding Officer's Report, a number of issues were raised about the proposed OBD testing process.

1) **MIL Illumination Computer Commands.**
Comment: Mr Yano of American Honda Motor Co., Inc. said that the grammatical tense was incorrect in one of the DEQ's fail criteria. The current fail criteria statement is that the vehicle will fail if "vehicle computer has commanded the MIL be illuminated" with the engine running. He suggested this be changed to "vehicle computer is commanding the MIL be illuminted".
Response: The comment from Honda was technically correct in that the department will not be looking at the past history of the computer's MIL status, but only the current status. We recommend making the suggested change.

2) **MIL Illumination with Key On Engine Off**

Comment: Mr.Yano noted that the proposed rules fail for key on/engine off with the MIL not lighted. He said that some vehicles only leave the MIL on in this situation for a short period and we should note this in our procedures.

Response: Mr. Yano is correct about the short duration of the MIL in this situation. We recommend that the policy and procedures document be amended to pointed this out to the DEQ vehicle inspectors.

3) **Diesel Vehicles**
Comment: The Alliance of Automobile Manufacturers (AAM) stated that diesel vehicles were not equipped with OBDII until model year 1997 rather than 1996. Therefore, testing of 1996 model year diesels should not be required.
Response: EPA agrees with AAM, stating that EPA granted the diesel vehicle manufacturers a one year waiver from the OBDII requirement. The department proposes to not do an OBD test 1996 model year diesel vehicles. An enhanced test would be given to light duty1996 model year diesel vehicles.

4) **Heavy Duty Vehicles**
Comment: California vehicles OBD tested to 14,000 lbs GVWR rather than limited to 8,500 lbs and under.

Response: Although AAM recommended that only California heavy duty vehicles be tested, the department found that when meeting the California heavy duty requirement some manufacturers of heavy duty vehicles converted their whole fleet (less than or equal to 14,000 lb GVWR) to OBDII, allowing testing of all these vehicles. DEQ proposes to test all heavy duty vehicles to a GVWR of 14,000 lbs, except diesels. Any manufacturers that did not provide for heavy duty OBDII would be given a basic test if GVWR > 8,500 lbs and an enhanced test if GVWR < or equal to 8,500 lbs. This would allow DEQ to test these vehicles without having to raise the vehicle hood and review the EPA/California emissions label. The reasoning for not proceeding to do heavy duty diesel OBD tests at this time, is that heavy-duty diesel vehicles are not currently subject to testing in Oregon. At this time DEQ is not considering expanding the testing requirement to include new types of vehicles, but only to add the OBD test where applicable for vehicles already subject to the test. If it becomes necessary to test additional vehicles to protect air quality, DEQ will propose that in a separate relemaking.

5) **Readiness Status Failures – Number of "Not Ready" Parameters**
Comment: AAM recommended that Oreogn fail for only one "not ready" for model years 2001+ vehicles rather than the more than two requiremnt that DEQ proposed.
Response: AAM recommended that data be reviewed before moving ahead with this more stringent requirement. The department recommends starting with failing for more than two "not ready" and reviewing the mandatory program data, prior to switching to the criteria of more than one "not ready".

6) **Readiness Status Failures – Vehicles that Reset Readiness with Key Off**
Comment: For vehicles where the manufacturer resets readiness status whenever the engine is turned off, AAM recommends dropping the readiness requirement and proceeding with the OBD test.
Response: DEQ is currently proposing that these vehicles receive an enhanced test or a basic test if these vehicles have all wheel drive transmissions. The department is concerned that bypassing the OBD readiness status check would provide a ready avenue to pass the OBD test with a defective vehicle. All that would be require on most vehicles to bypass the OBD test is for the customer to disconnect and reconnect the battery just prior to the test to eliminate most MIL light failures. The department proposes to continue to require a backup basic or enhanced test rather than by-pass the readiness requirement.

7) **Readiness Status Failures – Vehicles that Fail Rediness on Retest**
Comment: AAM recommends for vheicles that fail readiness on retest that the readiness portion of the test be bypassed if the customer displays a related repair receipt.
Response: This is the same concept as item 6 above where AAM is requesting that a part of the test be waived. Here again, the department is concerned that there is no control for those that would use this loophole to avoid repairing a vehilce. It would be impossible for an inspector to evaluate a repair receipt to determine if the work was related to the problems of the vehicle and also determine that this type of repair fixed the vehicle's emissions problems. The department proposes to continue to require the readiness testing.

Attachment E

State of Oregon
Department of Environmental Quality

Rulemaking Proposal
On-board Diagnostic (OBD) Vehicle Emission Test Method

Detailed Changes in Response to Public Comment

The policies and procedures were changed as indicated by strikeout underline attached.

OAR340-256-0010 (37) was changed to show a more complete listing of the types of vehicles tested with OBD under the definition of OBD.

OAR340-256-0300(2)(a) was changed to accurately represent the model years of vehicles tested in the Medford area.

OAR340-256-0355 was corrected by eliminating the term "Light Duty" to avoid confusion as to whether OBD procedures apply for heavy duty vehicles. Heavy duty vehicle test prescriptions were directed to this procedure in the proposed rules.

~~DRAFT~~

PROCEDURE:

OBD TESTING

SUBJECT: OBD Testing Procedure	
POLICY/PROCEDURE NUMBER: 225.00	**EFFECTIVE DATE:**
SUPERSEDES: NONE	**DATE SIGNED:**
APPROVED BY:	
ORIGINATING SECTION: ENGINEERING	

PURPOSE: To establish the OBD testing procedure.

REFERENCE:

General Comments:

The OBD test procedure will be conducted on all 1996 and newer gasoline powered vehicles with a gross vehicle weight less than or equal to 14,000~~8,500~~ lbs, and all 1997 and newer diesel powered vehicles with GVWR less than or equal to 8,500 lbs. Model year 1996 light duty diesel vehicles will receive an enhanced test. All vehicles fitting this criteria will be directed at the entrance kiosk to the appropriate test lane. For all 1996 and newer light duty vehicles, without 2WD dyne operational problems, the vehicle will be directed to an OBD/enhanced test lane. For those 1996 and newer vehicles known to have difficulty driving on a 2WD dyne, the vehicle will be directed to an OBD/basic test lane. (This procedure is appropriate for Portland area testing. All Medford vehicles will be tested in the OBD/basic lanes[1]).

The new OBD software will provide for an OBD test first. If a download of the vehicle's OBD data is unsuccessful~~,~~ because of observable vehicle tampering by the vehicle owner, the vehicle

[1] In ~~the~~ Medford OBD will be used as a pass only test for 1996 and newer light duty vehicles, until the EPA requires OBD as a pass/fail test. As a pass screen, Vehicles that fail OBD will receive a basic test.

will be failed and the reason for failure given~~submitted~~ to the customer. If you are unable to download because the vehicle's Diagnostic Link Connector (DLC) can-not be located,~~-or~~ the DEQ software is unable to communicate with the vehicle, or the vehicle is exempted from the test by EPA, an enhanced test will be granted that vehicle. Non-conforming imported vehicles with proper paperwork will be given an enhanced test or basic test depending on the ability to use the 2WD dyne as discussed above.

1) The lane inspector will input vehicle ID information on the vehicle following existing data entry procedures.

2) In an OBD/enhanced lane, the DEQ computer will initially prompt with the OBD inspection screen, if the test vehicle is a 1996+ light duty vehicle. The computer screen will indicate if an OBD-related EPA recall has been issued on the vehicle. If so, you must check under the hood to insure the recall work has been completed. If not, you must turn away the vehicle ~~will be turned away~~ until the recall repairs are completed. If you proceed with the test, y~~Y~~ou will need to ask the customer to leave the vehicle at this time. You will instruct t~~T~~he customer~~ will be allowed~~ to wait close to the vehicle while your perform~~as~~ the OBD test~~ is performed~~. If you cannot~~the OBD test can not be~~ successfully complete~~d~~ the OBD test, an enhanced test is required. Ask~~, and~~ the customer ~~will be asked~~ to wait for his/her vehicle in the waiting room. If you are able to perform an OBD test on the vehicle, continue with the following procedure.

3) Turn the vehicle off and connect the OBD DLC connector. If the vehicle connector is damaged, press the "damaged DLC connector" option on your screen and the vehicle will fail the OBD test. If you are unable to quickly locate the vehicle's connector, press the "connector locator" option on your screen, and a picture with a circle around the connector location will be displayed on your screen. If the vehicle is not listed in the "connector locator," check the EPA label under the hood. If the vehicle does not have an OBDII system~~,~~ and the vehicle is an import (no EPA underhood label), give the customer an enhanced test by pressing the OBD bypass option, following normal import testing procedures for documentation. If an EPA label is present and it states that OBDII is used, call the station manager~~ should be called~~ and do an extensive search for the connector~~ should be made~~. If you cannot~~unable to~~ find the vehicle connector, give the vehicle the enhanced test by pressing the OBD bypass option.

4) If you find the -DLC connector~~ is found~~ and there are no problems with the vehicle's DLC connector, connect the DLC lead to the vehicle.

5) Next, turn the vehicle ignition key~~ will be turned~~ to the key on/-engine off position without starting the engine. Look for the MIL light on the dash. You must make this observation immediately after the key is switched, because for some vehicles, the MIL is only illuminated for a short period. It will say **"Check Engine," "Service Engine Soon," or "Service Powertrain Soon"**. An engine symbol could also be used as a substitute for the word

"engine." The MIL light should be lit at this time. **Record its status on the computer screen.**

6) The computer will~~You will be~~ asked~~d~~ you to start the vehicle and **observe the MIL** with the engine running. The computer will ask if you want to download the vehicle computer. Say yes. The download should take about 15 seconds. If the DEQ computer is unable to download the vehicle OBD records, the OBD test will be aborted. and a complete enhanced fall-back test will be run.

7) After a successful download, and using the MIL information you input, the computer will determine if the vehicle passed or failed the OBD test. If any of the follow are true, the vehicle will fail the OBD test.

   a) More than two readiness parameters indicated by the vehicle computer as "not ready".
   b) MIL off when key is on with engine off.
   c) MIL on with engine running.
   d) Vehicle computer is~~has~~ commanding~~ed~~ the MIL be illuminated.

8) After completion of the OBD download, the screen will prompt for you to input if the vehicle is smoking or is excessively noisy. Use existing procedures to respond to these questions. After these questions are answered and a noise test is performed if required, the ETR will be printed. The status of the eleven readiness codes, the status of MIL (in both operational modes), ~~will be printed~~ and all DTC codes will be printed for any vehicle that fails the OBD test. If a vehicle passes the OBD test, the only OBD information printed on the ETR will be the indication of pass for OBD. During the printing operation, ask the customer ~~will be asked~~ to re-enter the vehicle.

9) Money collection and DMV registration will be conducted following existing procedures.

10) If the vehicle~~customer~~ fails the OBD test for more than two readiness codes "not ready," the customer will receive a failing ETR, and will also be given a paper indicating the recommended driving cycle to activate the readiness for the "not ready" systems.

11) The test sequence is the same for an OBD/basic test lane, except the backup test is a standard basic test.

State of Oregon
Department of Environmental Quality — Memorandum

To: OBD Workgroup Members **Date:** April 13, 2000

From: Jerry Coffer
Vehicle Inspection Program

Subject: OBD Workgroup Meeting of April 11, 2000

Present at the meeting were: Christine Vail and Stan Sumich representing Pacific Automotive Trades Association (PATA), Jim Houser from Hawthorne Auto Clinic representing Automotive Service Association of Oregon (ASA), Dave Hodge with Alexander Motor Company, Paul Koprowski from the federal Environmental Protection Agency (EPA). And from DEQ attending were Mickey Hunt, Frank Reed, Bruce Arnold, Ted Kotasakis, and Jerry Coffer. Those who were invited but could not attend the meeting were: Deb Elkins of the Automotive Service Association of Oregon, Inc. (ASA), Anne O'Ryan of AAA, Wayne Elson of EPA.

Ted Kotsakis presented an overview of the proposed DEQ OBD testing operations to bring everyone up to speed. Then specific OBD test procedures were discussed. Below is a summary of these discussions. A full listing of the issues and proposed actions with explanation is attached.

1) **Should DEQ discontinue OBD testing as OBDII vehicles age?** Most thought it was much too early to seriously discuss this issue, because we know so little about vehicle deterioration of OBDII vehicles. However, it was generally believed that it was best to continue to fully maintain OBD vehicles as they age, and that therefore the DEQ should continue to OBD test these vehicles. One comment was that a defect of one component can injure other vehicle systems in an OBDII environment. Therefore, it is best that all emissions related systems are properly maintained.
2) **OBD testing of gasoline powered heavy duty vehicles.** All agreed that OBD testing of these vehicles should be done when the heavy duty vehicles are manufactured with OBDII systems.
3) **Requiring OBD test upon title transfer.** Jim Houser was a bit concerned that too many trip permits were being used and he thought that testing upon title transfer might have some merit. However, most agreed that such testing would be unnecessary since DEQ offers a free voluntary test and it is to the benefit of the vehicle buyer to have the test done.
4) **Readiness status.** All agreed that DEQ should start with the more lenient procedure of failing with three "not ready" status. They recommended that the test data be reviewed after a year and perhaps dropping to only allowing one readiness status as "not ready" or even go to not allowing any "not ready" depending on the data records.
5) **ETR confirmation box.** All agreed that having the mechanic check a confirmation box would help remind mechanics to eliminate all "not ready" status before releasing the repaired vehicle to the customer.

6) **Not resetting non-continuous DTC codes.** All thought this would likely be a good idea. Christine Vail thought it might be a good cost cutting issue for PATA to report to shops.
7) **OBD tests that can not be done because of manufacturer's defect, but with no EPA recall**. Most thought it a good idea to give these vehicles an enhanced test, but Dave Hodge was concerned that some vehicles can not be driven on the dynamometer because of ABS brakes, traction issues, etc. If the vehicle has both OBD and dynamometer problems, DEQ proposes to give the vehicle a basic test as is currently done with vehicles that can not be driven on a two-wheel drive dynamometer.
8) **Drivers guide for OBD failed vehicles**. DEQ proposes to include general OBD information and a generic driving trace for vehicles failing for readiness. A generic driving trace recommended by EPA. Davis County Utah says that driving this trace will eliminate "not ready" for all but catalyst and EVAP for most vehicles. Frank Reed has searched what other states are doing for this type of handout. This information is attached.
9) **OBD training for shops prior to OBD testing begins**. All thought this a good idea. DEQ plans two hour training session covering OBD testing issues.
10) **Preventative measures to avoid customer cheating on OBD test**. Jim Houser and Dave Hodge were concerned that it may be very difficult to track computer module ID numbers as a deterrent to cheating, since module ID numbers are changed with EPA recalls. DEQ continues to consider some interactive communication where real time engine parameter measurements are assured.
11) **DEQ checks for recall label.** Dave Hodge indicated that recall labels are not required on all recall repairs. They are required if a computer re-flash is required, but not for just hardware changes. After the meeting, DEQ checked with Utah and got a much clearer picture of the Davis County Utah OBD operations. Jim Duckworth who heads the OBD operations in Davis County, said there are currently no EPA recalls for OBD. There are only Technical Service Bulletins that were induced by the Davis County OBD testing, all related to readiness reset problems. Jim Duckworth said that reset to "not ready" when the engine is turned off occurs with all 1996 Subarus, 1/3rd of all 1996 and newer Chryslers and 1/3 of 1996 and 1997 Nissans. Technical Service Bulletin repair for Chryslers and Nissans range between $300 and $400, and is sometimes not be covered under warranty. According to Mr. Duckworth, these bulletins may not be applicable outside the state of Utah. Mr. Duckworth believes that EPA must take a part in this process and require recall repairs on vehicles with defective OBD systems, but so far EPA has shown little interest in doing so. Attached is a summary of OBD Technical Bulletins induced by Davis County. Technical Service Bulletins do not necessarily require underhood stickers showing the work was completed. So the procedure of requiring this work before OBD testing is a little messy.

    Davis County continues to recommend failure for any readiness with a status of "not ready" because they have seen several vehicles attempting to pass the OBD test by disconnecting batteries near the testing site. Also, several shops in Davis County report they have been asked by their customers to turn off the MIL without fixing the problem.
12) **Will manufacturers cover repair costs for pending trouble codes**. Most at the meeting thought manufacturers covered emissions components when the vehicle fails a state emissions test, but do not have warranty coverage for pending or intermittent trouble codes. Rob Klausmeir, DEQ consultant, said he talked with GM and Toyota about warranty coverage for fixing "Pending Codes". "Both had the same answer – they would not provide

warranty coverage unless there was a driveability problem, the MIL was on or commanded on, or the vehicle failed an approved exhaust emission test."

13) **Should DEQ fail for DTC with engine running MIL off.** The meeting discussion revolved around whether this failure would be covered under manufacturer warranty. DEQ does not propose to begin the OBD testing operation failing for this scenario, however, DEQ will review test data and warranty issues, and make a decision at a later data. Rob Klausmeier did not ask the manufacturers the question about "mature" DTC's that were still in memory, with the MIL turned off, but said he expected he would get the same answer as item 12 above for this case.
14) **DTC's printed on a passed vehicle emissions report.** All suggested that DTCs should not be printed on an emissions test report unless DEQ was willing to enforce it by failing the vehicle. Also, there was discussion that shops would not want to see DTC's full description shown on a failed vehicle, but that just the DTC code number be displayed. DEQ is reluctant to withhold this information from the public and is considering instead putting a disclaimer on these OBD generated statements. This DEQ statement would say something to the effect that the description shows only a preliminary evaluation of the general area of the problem, and that additional diagnostic work will need to be done by the shop to more precisely pinpoint the problem.
15) **Readiness status printed when vehicle passes.** Most thought this to be a bad idea; that it would confuse the customer by indicating there may be a vehicle defect even though the vehicle passed the OBD test.
16) **Remote OBD testing.** All were concerned about the "big brother" issue. Options might develop in the future that are more palatable.

One other issue was discussed. Workgroup members were concerned that Washington state may not be following the same stringency requirements as Oregon and that this might have negative impact on Oregon shop business. John Raymond of Washington Department of Ecology said Washington is now doing a voluntary OBD test alone with their existing test on vehicles where OBD access is easy. DOE does not plan on performing pass/fail stand alone OBD testing until mid 2002.

State of Oregon

Department of Environmental Quality — Memorandum

To: OBD Fleet Workgroup Member **Date:** May 10, 2000

From: Jerry Coffer
Vehicle Inspection Program

Subject: OBD Fleet Issues

This memo summarizes the comments of the OBD fleet workgroup held April 17, 2000. Present were representatives from both private and public fleets. A complete list of attendees is shown on the attached page.

Attached also is the agenda for the fleet meeting. At the meeting Ted Kotsakis presented an introduction of the DEQ OBD program and Mic Hunt outlined the special provisions DEQ intends to make to coordinate fleet OBD testing.

Special issues regarding fleet OBD testing were discussed with the fleet representatives. This issues are outlined in the attached agenda and summarized below.

1) **Will the shops be willing the pay for OBD diagnostic software?** Shop members were hesitant to comment on this issue until a diagnostic package was better understood and the price was know. However, in general, fleets already have OBD diagnostic hardware and were not certain why they would need to duplicate something they already own.
2) **Best means of test data transfer to DEQ?** Since existing basic and enhanced fleet testing use floppies to do data transfer, many wanted to continue to use floppies. Other fleet members wanted some automatic file transfer option rather than hand-carry. A combination of both floppy and auto transfer seemed to satisfy both concerns.
3) **EPA recalls and Technical Service Bulletins.** Fleets were concerned about flash calibration of computer by the manufacturer. They do not receive many of the TSBs or EPA recalls. Therefore, this work requirement would be difficult for them to keep updated on.
4) **Backup test if OBD test is inoperable on a vehicle.** DEQ intends to require the enhanced test as a backup. Those fleets without enhanced test equipment will need to take their vehicle through a DEQ Clean Air Station. If there is a problem with the OBD test fleet software, DEQ will insure that software manufacturer makes correction. More than likely, networking of the OBD software will not be an option.
5) **Fail Criteria for readiness status.** DEQ plans to allow up to two "not ready" codes. Fleet representatives were concerned about how long it might take to achieve "not ready" using manufacturer driving cycles, after repair and reset. Some thought it might take up to 2 hours of driving.
6) **Failing for DTC without MIL lighted.** This is an option DEQ is considering. Fleets were concerned that some DTCs may not be emission related and failure for these DTC would not be appropriate.

7) **Training for OBD test.** DEQ plans to present a two hour training course on DEQ OBD testing prior to initiating mandatory OBD testing. Fleets were interested in attending such a course.
8) **Should diagnostic link connector location finder be in fleet OBD software?** Fleets wanted it on a CD to avoid computer space issues. They were also interested that this information be available on the WEB.

Other issues discussed not on the agenda were:

1) **What happens when an enhanced test model year vehicle is 4WD or for other reasons can not be driven on a 2WD dyne?** A basic test can be used on these vehicles. If a 1996 OBD test vehicle can not be OBD tested due to OBD test program software problems, and this vehicle can not be tested on a 2WD dyne, then a basic test can be used as a backup test.
2) **Paper trail for fleet OBD tests.** A test report of vehicle passing the OBD test will be submitted to DMV for registration. DEQ does not need a hard copy of test record. OBD software will facilitate printing of test report.

Department of Environmental Quality
Vehicle Inspection Program
OBD Fleet Work Group Meeting
April 17, 2000

Attendance List

Name	Organization	Address	Phone
Ron Pairesson	Pass Jenings	501 N. Dixon, Portland 97214	916-3777
Steve Keppler	NW Natural	7100 SW McEwan, Lake Oswego	226-4211
Ron Westphal	NW Natural	7100 SW McEwan, Lake Oswego	226-4211
Larry Ostermiller	City of OR City		657-8241
Don Taylor	City of Portland	2835 N. Kerby, Portland 97227	823-1804
Rodger Johnson	City of Portland	2835 N. Kerby, Portland 97227	823-2277
Greg Haley	Tri-Met		962-6432
Rockne Lechelt	Tri-Met		962-6473
Greg Grochowsky	PGE		669-5275
Duane Davis	PGE		463-4391
Mack Pennington	Lake Oswego SD	4301 SW Beasley Way Lake Oswego 97035	534-2332
Jeff Hill	Lake Oswego SD	4301 SW Beasley Way Lake Oswego 97035	534-2332
Roger Zivney	City of Lake Oswego	5705 SW Jeun Road Lake Oswego 97035	635-0280
George Cartales	City of Hillsboro	123 W Main Street Hillsboro 97123	615-6569
Mike Cardinal	Washington County	1400 SW Walnut Hillsboro 97123	846-7712
Troy Carriera	Forest Grove	PO Box 326, Forest Grove 97116	992-3116
Kelly Somers	City of Milwaukie	6101 SE Johnson Creek Blvd Milwaukie 97206	786-7619
Ernie Roger	City of Milwaukie	6101 SE Johnson Creek Blvd Milwaukie 97206	786-7619
Reitienon Cline	State of OR PMP	6402 N. Cutler Circle, Portland	240-5661
Fred Greathouse	State of OR PMP	6402 N. Cutler Circle, Portland	240-5681
Steve Keener	Multnomah County	1620 SE 190th Portland 97233	988-5265
Matt King	Multnomah County	1620 SE 190th Portland 97233	988-5050
Wendall Powell	US West Communications	310 SW Park Ave, Rm 1010 Portland 97205	242-4490
Tony Shiere	US West Communications	2111 NE Argyle	249-1248
Gene Berry	Clackamas County	902 Abernethy Road Oregon City	650-3369

Ted Kotsakis	DEQ	1301 SE Morrison Street Portland 97214	731-3050 E231
Frank Reed	DEQ	811 SW Sixth Ave. Portland 97204	229-5680
Mic Hunt	DEQ	1301 SE Morrison Street Portland 97214	731-3050 E239
Jerry Coffer	DEQ	1301 SE Morrison Street Portland 97214	731-3050 E229
Gary Beyer	DEQ	1301 SE Morrison Street Portland 97214	731-3050 E225

State of Oregon
Department of Environmental Quality — Memorandum

To: Medford Area ASA Members **Date:** May 10, 2000

From: Jerry Coffer
Vehicle Inspection Program

Subject: April 18, 2000 ASA Meeting

At the April 18th meeting the following people were present:

Name	Organization	Address	Phone
Ken Cook	"The Shop"		541-776-6149
Robert Henderson	Hendersons	2757 Highland Ave Grants Pass, OR 97526	541-474-2949
Dale Turner	RCC Automotive	3345 Redwood Hwy Grants Pass, OR 97527	541-956-7175
Chris Simper	RCC Automotive	3345 Redwood Hwy Grants Pass, OR 97527	541-956-7174
Stan Sumich	CAR	PO Box 130 Oregon City, OR 97045	503-518-3083
Mickey Hunt	DEQ	1240 SE 12th Avenue Portland, OR 97214	503-731-3050 E239
Gary Miller	Miller Motor Serv.	127 S. Bartlett Street	541-772-2901
Joe Smith	Keith Schulz Garage	400 E. McAndrews Medford	541-772-4756
James W. Baird	Bairds Auto Repair	Medford	541-772-7311
Vince Clark Matt Andrade	Auto Air and Automotive Co	907 N. Central Avenue Medford, OR 97501	541-770-5605
Ray Melby	Ray's Speed&Electric	943 Rogue River Hwy Grants Pass, OR 97527	541-476-0037
Deb Elkins	ASA	8855 SW Holly Lane Wilsonville, OR 97070	503-582-8875

Ted Kotsakis presented a general overview of the proposed DEQ OBD testing operations in the Medford area. Mic Hunt discussed some of the results of our remote sensing study in the Bend, Salem, Woodburn and Portland areas.

Jerry Coffer requested response from the attendees on some of the issues involved in the implementation of OBD in the Medford area. The readiness status issue was discussed with most agreeing that is was a problem area.

Most were interested in the OBD training that DEQ is offering before OBD testing startup.

There was some concern about the future use of OBD as a remote sensing testing technique.

Attachment G

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY

Rulemaking Proposal
For
On-board Diagnostic (OBD) Vehicle Emission Test Method

Rule Implementation Plan

Summary of the Proposed Rule

Vehicle emissions testing is performed in the Medford and Portland Metropolitan areas. Vehicle testing in the Portland area currently consists of a "basic" test for 1975-81 and 1996-98 model year light duty vehicles and an "enhanced" test for 1981-95 model year light duty vehicles. Gasoline powered heavy duty vehicles (with a gross vehicle weight rating (GVWR) greater than 8,500 lbs) all receive a "basic" test. A "basic" test is a simple test of exhaust emissions at idle and 2500 rpm engine speed, while the "enhanced" (or BAR31) test measures exhaust emissions while the vehicle is driven on a set of rollers under road load conditions. In the Medford test area the "basic" test is currently performed on all vehicles both light and heavy duty.

The department is proposing to implement OBD testing for all 1996 and newer model year vehicles, which were manufactured with the OBD test technology, except heavy duty diesel powered vehicles. This includes all light duty vehicles, except 1996 model year diesel powered vehicles. It also includes all statutorily allowed heavy duty vehicles (with GVWR rating between 8,500 and 14,000 lbs), except heavy duty diesel powered vehicles.

In the Portland area, when implemented, OBD testing will be mandatory for the vehicles listed above; meaning passing the OBD test will be required before vehicle registration can be completed. In the Medford area, the OBD test will initially be used as a screening tool. If the OBD test is failed in the Medford area, a backup "basic" test will be conducted on that vehicle. However, once EPA requires OBD testing for all current IM programs, now anticipated in January 1, 2002, OBD testing will become mandatory in the Medford area.

These newer vehicles contain OBD systems that consist of the vehicle's on-board computer coupled with sensors (such as the oxygen sensor) and actuators (such as the fuel injectors). The OBD system can detect problems that impact the vehicle's emissions before there is a noticeable problem with the vehicle's performance. When the OBD system determines that a problem exists, a corresponding diagnostic trouble code is stored in the computer's memory. The computer also illuminates a malfunction indicator light (MIL) that is located on the vehicle's dashboard. At the DEQ vehicle inspection station, the inspector will observe the MIL, check to see if the vehicle's OBD system is ready and properly functioning, and use computer software to retrieve stored trouble codes. When a vehicle fails an OBD test, any stored diagnostic trouble codes and the status of the MIL will be printed for the vehicle owner. These same trouble codes can be downloaded at a repair shop and be used to assist a technician in diagnosing required vehicle repairs.

Proposed Effective Date of the Rule

OBD testing is proposed to begin December 1, 2000.

Proposal for Notification of Affected Persons

Prior to requiring mandatory testing, the public will be notified in their DMV registration packet that their vehicles will be tested using the new OBD testing procedures. Also, public announcements will be made via radio, newspaper, and television talking about the new testing program. In addition, after rule adoption by the Environmental Quality Commission, the Vehicle Inspection Program will begin distributing a leaflet at the Clean Air Stations which describes the OBD test.

Proposed Implementing Actions

The department has been performing voluntary OBD testing for six months, and has conducted over 5,000 OBD tests. These tests have shown an OBD failure rate 2.6 percent of the 1996 and newer model year vehicles. We have also determined that we are able to use the OBD test on about 99 percent of the vehicles, which are in the categories to be OBD tested. The small number of vehicles in which the test can not be used due to manufacturer defects or aberrations with the DEQ software, will be given an enhanced emissions test as a backup. Those all-wheel-drive vehicles that can not be enhanced tested on the dynamometer, will be granted a basic test.

The preface of the current OBD software is now being rewritten to allow the test to be performed at the first test position in the department's three-position enhanced test. Currently the voluntary test is being conducted in the third position since it was required for accurate comparison testing with the BAR31 enhanced test.

The OBD software is also being integrated into the basic test, so that OBD testing can be conducted in both enhanced and basic test lanes, providing an immediate backup test capability in case the OBD test can not be performed.

The software changes are currently being made with a scheduled completion date of October 1, 2000.

In addition to the software, the department is purchasing additional OBD testing units (approximate cost $1,400 each) to allow testing in the remainder of the existing 39 test lanes. We are currently performing voluntary tests in only the 18 enhanced test lanes. Also, we are currently purchasing new printers to allow flexibility in test report format for OBD for the 21 basic test lanes (approximately $1,100 each).

Once the software is received and tested and all the hardware is installed, the department plans to conduct voluntary testing for a several weeks before making the program mandatory. After this trial period and after making any required software changes, full mandatory OBD testing will be implemented in Portland with pre-screen-only testing in Medford. The estimated date for implementation of the mandatory program is December 1, 2000.

Development of OBD testing software for self-testing fleets is underway, and it is anticipate that it will be available by the December 1, 2000 startup date of the OBD centralized testing operations.

Proposed Training/Assistance Actions

A two hour OBD introductory training course for auto repair shop and fleet technicians is being developed which will be offered by the department to any interested shop or fleet technician. The objective of the training will be to introduce DEQ's OBD test to these professionals. We will talk about special issues and procedures to limit the possibility of confusion after the testing starts. It is not designed to be a comprehensive treatise on OBD theory. It will be offered prior to startup of mandatory OBD testing.

In addition, all vehicle inspectors will receive four hours of OBD training prior to the time OBD becomes mandatory.

State of Oregon
Department of Environmental Quality

Memorandum

Date: September 29, 2000

To: Environmental Quality Commission

From: Lydia Taylor, Deputy Director

Subject: Agenda Item J, September 29, 2000, EQC Meeting
Standards, Criteria, Policy Directives and Hiring procedures in Hiring Director of Department of Environmental Quality

Statement of Purpose

The Commission has indicated it wishes to meet in executive session to interview candidates and deliberate on the selection of a director. Prior to meeting in executive session, state law requires an opportunity for public comment on the standards, criteria, policy directives and hiring procedures to be used in this process. After consideration of public comments, the Commission may adopt and utilize these standards and procedures in recruiting and selecting a director, and may meet in executive session for this purpose.

Background

Oregon's Public Meeting Law (ORS 192.660) allows the Commission to meet in executive session for the purpose of interviewing candidates and deliberating on the selection of a director, provided it has first received public comment on the standards and procedures to be used in the process. Obtaining public comment on the standards and procedures also allows the Commission to maintain the anonymity of candidates (if requested at the time of application), which will encourage the broadest range of qualified candidates to apply.

The Commission, at its special phone meeting September 6, 2000, instructed DEQ to request public comment on the hiring standards and criteria, and set the September 29, 2000 Commission meeting for adoption of the criteria. Information on the comment process, with the proposed standards and procedures, were mailed to all individuals on the "EQC Rules" mailing list, comprised of approximately 500 individuals and organizations. The mailing announcement (Attachment B) was made on September 6, 2000, with the written comment period closing September 25, and the public comment period closing September 29, 2000. Four written responses were received.

Authority of the Commission with Respect to the Issue

ORS 192.660 specifically addresses the criteria necessary for the Commission to meet in executive session. Adopting standards and procedures after consideration of public comments will allow the Commission to meet in executive session to interview and deliberate on the selection of a director.

Alternatives and Evaluation

1. The Commission could elect to do all interviewing and discussion of candidates in public, negating the need to formally adopt standards, criteria, policy directives and hiring procedures. Such an alternative could severely limit the number of serious applicants for the position.

2. The Commission could adopt standards, criteria, policy directives and hiring procedures, after public input, allowing the Commission to meet in executive session to interview and discuss candidates.

3. The proposed standards, criteria, policy directives and hiring procedures include minimum qualifications for candidates. The minimum qualifications, as proposed by the Commission, are very general and would allow a broad range of candidates to qualify. The Commission has deliberately left these broad, so that excellent people are not inadvertently excluded. The Commission could add to the minimum qualifications to narrow the applicant pool.

Summary of Public Input Opportunity

The issue of standards, criteria, policy directives and hiring procedures for hiring a director was discussed by the Commission in its September 6, 2000 meeting. Following the Commission's instructions to request public comment, DEQ mailed notice of the chance to comment and the draft standards and procedures to approximately 500 individuals and organizations on the mailing lists for those interested in notice of EQC agenda items. The notice for chance to comment was mailed on September 6, 2000 and written comments were requested by September 25, 2000. The comment period was held open through September 29, 2000 Commission consideration, allowing three weeks for response by the public. Responses in order received:

Oregon Environmental Council (Jeff Allen) suggested the director must have the ability to work with elected officials and that it is more important for the director to possess strong leadership skills than extensive management skills.

Associated Oregon Industries (John Ledger) suggested the director should possess experience managing a state environmental program, be willing to increase the use of technical assistance and incentive based programs to augment enforcement and be a leader in evaluating DEQ programs against environmental performance benchmarks.

Glen Carter suggested the Director have a university degree in one of the sciences that rule the environment.

Northwest District Association (Sharon Genasci) recommended that the DEQ director be responsive to neighborhood concerns and have the health of the environment and people as a priority.

Conclusions

- Adoption of standards, criteria, policy directives and hiring procedures for selection of a new director, after an opportunity for public input, is necessary for the Commission to meet in executive session and to maintain the anonymity (if requested) of applicants.
- Four written comments were received from the public addressing qualities desired in a director.
- The Commission may direct DEQ to request the Department of Administrative Services to close the requirement for director October 6th, or extend that date.
- The Commission may direct DEQ to immediately follow the hiring standards and procedures as adopted by the Commission.

Intended Future Actions

The Commission will proceed with the hiring process.

Department Recommendation

It is recommended that the Commission adopt the standards, criteria, policy directives and hiring procedures for selection of a new director as proposed (Attachment A).

Attachments

A. Standards, Criteria, Policy Directives and Hiring Procedures as proposed
B. Chance to Comment
C. Letters from the Public

Section: Lydia Taylor

Division: ______________________

Report Prepared By: Lydia Taylor
Phone: 503.229.6110

Standards, Criteria, Policy Directives and Hiring Procedures in Hiring the Director of the Department of Environmental Quality (DEQ)

The Environmental Quality Commission (EQC) is proposing to adopt the following standards, criteria and policy directives in recruiting for and hiring a Director for the Department.

Standards

The following are minimum qualifications which individuals must meet in order to be considered for the position:

1. A bachelor's degree from an accredited university
2. Demonstrated knowledge of and experience in working with local units of government, industry and/or non-profit organizations
3. Demonstrated knowledge of and experience in managing a complex public or private organization with more than one program

Preference may be given to candidates who have the following qualifications:

1. Have a demonstrated knowledge of environmental issues and controls
2. Have a demonstrated knowledge of Oregon government, geography, business and industry
3. Demonstrated knowledge of and experience in working with elected officials

Criteria

Candidates will be evaluated on the following basis:

1. The extent and breadth of their minimum qualifications
2. Any additional qualifications
3. The results of an interview with the Commission
4. The responses to any requested reference inquiries

Policy Directives

The Commission will employ a competitive recruitment method including proactive recruitment strategies designed to attract a talented and diverse applicant pool.

Hiring Procedures

1. Advertisements recruiting for candidates will be sent to newspapers of general circulation, targeted newspapers, professional organizations, employee networks, community organizations and resume banks.
2. Applicants will be asked to furnish an application and a brief narrative demonstrating how they meet the minimum qualifications for the position. Additional information about desired qualifications should also be included. Applicants who wish to have their applications remain anonymous must request non-disclosure with their application.
3. Recruitment will be held open until October 6, 2000. The EQC may extend the recruitment period if sufficient applications have not been received.
4. A preliminary review of applicant's qualifications to judge whether the minimum qualifications have been met will be completed by the Human Resources Services Division of the Department of Administrative Services (DAS). Those applications which meet the minimum qualifications will be forwarded to the Commission.
5. The Commission will select candidates to be interviewed, and will conduct the interviews.
6. The Commission will cause reference checks to occur if appropriate.

Public Notice: Request for Comments

Standards, Criteria, Policy Directives and Hiring Procedures for Hiring the Department of Environmental Quality Director

State of Oregon
Department of Environmental Quality

Office of the Director
811 SW Sixth
Portland, OR 97204
Phone:(503) 229-5300
Toll free number
1-800-452-4011
Fax: (503) 229-5850
Contact: Kitty Purser

www.deq.state.or.us

Notice Issued: September 6, 2000

Written Comments due: by 5 p.m. on September 25, 2000

Oral Comments:
Beginning at 1 p.m. during the September 29, 2000 Environmental Quality Commission (EQC) meeting at Sleep Inn & Suites, 2855 NW Edenbower Blvd., Roseburg, Oregon

Where Can I Get More Information Send Comments?
DEQ accepts comments by mail, fax and e-mail.

Phone: (503) 229-5300 or toll free in Oregon (800) 452-4011

Mailing Address: Office of the Director, 811 SW Sixth, Portland, Oregon 97204

Fax: (503)-229-5850

E-mail: purser.kitty@deq.state.or.us

(E-mail comments will be acknowledged immediately. If there is a delay between servers, e-mails may not be received before the deadline.)

DEQ Responsibilities

The Oregon Department of Environmental Quality (DEQ) is the regulatory agency that protects and preserves Oregon's environment. DEQ is responsible for protecting and enhancing Oregon's water and air quality, for cleaning up spills and releases of hazardous materials, and for managing the proper disposal of hazardous and solid wastes

What is Proposed?

The proposed standards, criteria, policy directives and hiring procedures attached to this public notice will be used by the EQC to recruit, screen, interview and select a director for the Department of Environmental Quality. The opportunity to comment on these standards and procedures is being presented prior to selection so that the EQC may, in compliance with ORS 192.660 (Public Meetings), use these standards to evaluate, interview and select a director while meeting in executive session. This process will also allow the EQC to honor requests for anonymity by candidates, and will permit the EQC to attract and retain highly qualified candidates.

What Are the Highlights

STANDARDS are the minimum qualifications that an individual must meet to be considered for this position. CRITERIA are used to measure the qualifications of the candidates. POLICY DIRECTIVES are the instructions from the EQC to DEQ to conduct a proactive recruitment for a director. HIRING PROCEDURES describe the general steps used to recruit for the position.

What Happens Next?

DEQ will evaluate comments received and will make a recommendation to the Environmental Quality Commission on September 29, 2000. Following consideration of public comments, the EQC is expected to adopt the standards and procedures (with revisions, as appropriate).

Accessibility Information

DEQ is committed to accommodating people with disabilities at our hearings. Please notify DEQ of any special physical or language accommodations, or if you need information in large print, Braille or another format. To make these arrangements, contact DEQ Public Affairs toll free in Oregon at (800) 452-4011.

People with hearing impairments may call DEQ's TTY number, (503) 229-6993.

Standards, Criteria, Policy Directives and Hiring Procedures in Hiring the Director of the Department of Environmental Quality (DEQ)

The Environmental Quality Commission (EQC) is proposing to adopt the following standards, criteria and policy directives in recruiting for and hiring a Director for the Department.

Standards

The following are minimum qualifications which individuals must meet in order to be considered for the position:

1. A bachelor's degree from an accredited university
2. Demonstrated knowledge of and experience in working with local units of government, industry and/or non-profit organizations
3. Demonstrated knowledge of and experience in managing a complex public or private organization with more than one program

Preference may be given to candidates who have the following qualifications:

1. Have a demonstrated knowledge of environmental issues and controls
2. Have a demonstrated knowledge of Oregon government, geography, business and industry
3. Demonstrated knowledge of and experience in working with elected officials

Criteria

Candidates will be evaluated on the following basis:

1. The extent and breadth of their minimum qualifications
2. Any additional qualifications
3. The results of an interview with the Commission
4. The responses to any requested reference inquiries

Policy Directives

The Commission will employ a competitive recruitment method including proactive recruitment strategies designed to attract a talented and diverse applicant pool.

Hiring Procedures

1. Advertisements recruiting for candidates will be sent to newspapers of general circulation, targeted newspapers, professional organizations, employee networks, community organizations and resume banks.
2. Applicants will be asked to furnish an application and a brief narrative demonstrating how they meet the minimum qualifications for the position. Additional information about desired qualifications should also be included. Applicants who wish to have their applications remain anonymous must request non-disclosure with their application.
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5. The Commission will select candidates to be interviewed, and will conduct the interviews.
6. The Commission will cause reference checks to occur if appropriate.

Oregon Environmental Council

Clean air
Clean water
Clear thinking

September 14, 2000

Attention: Kitty Purser
Office of the Director
DEQ HQ
811 SW Sixth
Portland, OR 97204

Re: The Next Director of the Department of Environmental Quality

Dear EQC Members:

The Oregon Environmental Council has been working to protect Oregon's air and water since 1968

The *State of the Environment Report* recently produced by a team of Oregon's leading scientists clearly documents the fact that Oregon's environment remains seriously degraded, particularly in the Willamette River watershed. Oregon's reputation for environmental excellence is founded on programs established by Tom McCall nearly three decades ago. It is becoming increasingly unclear whether we still deserve to claim that reputation.

The person you choose to lead DEQ into the 21st century must be prepared to reverse that trend by taking strong steps to address Oregon's key environmental challenges, such as persistent bioaccumulative toxics (PBTs); watershed and salmon recovery; nonpoint source pollution; and a host of others. Governor Kitzhaber has set the tone with his recent executive orders committing Oregon to zero discharge of PBTs by 2020, and directing state agencies to move toward sustainability by 2025. The next DEQ Director must play a leadership role in translating these orders into "on the ground" changes.

The next DEQ Director should be someone who will provide bold vision, strong leadership, and be able to clearly communicate the importance of DEQ mission and work to the public, stakeholders, and the Oregon legislature.

Specific Comments

Standard #2. We believe this should not be an and/or statement, but an inclusive one. Furthermore, the past few sessions of the Oregon Legislature have demonstrated that most legislators do not understand or support DEQ's work. Therefore, the ability to work with elected officials should be a minimum qualification, not simply a

520 SW 6th Avenue, Suite 940
Portland, Oregon 97204-1535
Voice (503) 222-1963 Fax (503) 222-1405
oec@orcouncil.org www.orcouncil.org

preference. The next director should have a demonstrated ability to work effectively with businesses, local governments, environmental advocates, elected officials, and other stakeholders to make environmental progress with the broadest possible consensus of support.

Standard #3. Demonstrated knowledge of how to manage a complex organization is important. However, we believe the leadership skills discussed above are more important than detailed knowledge of agency procedures or public management, particularly given DEQ's recent steps to make the Director more of an externally-focused spokesperson. Staff at DEQ, EPA, and other government agencies are hard working, committed, and do excellent work with limited resources and under a great deal of outside pressure. However, it is quite possible that the kind of bold vision and leadership DEQ needs can best be found outside of government service.

Thank you for the opportunity to comment, and best of luck in your search and your deliberations.

Sincerely,

Jeff Allen
Executive Director

1149 Court Street NE
Salem, OR 97301-4030

Telephone:
Salem 503/588-0050
Portland 503/227-5636
Oregon 800/452-7862
FAX 503/588-0052
E-mail: aoi@aoi.org
Web page: http://www.aoi.org

State of Oregon
Department of Environmental Quality
Received
SEP 20 2000
OFFICE OF THE DIRECTOR

ASSOCIATED OREGON INDUSTRIES

September 18, 2000

Ms. Melinda S. Eden, Chair
Environmental Quality Commission
811 SW Fifth Avenue
Portland OR 97204

Re: Suggestions Regarding Desirable Attributes for Selection of New DEQ Director

Dear Chair Eden:

Thank you for accepting comments on the attributes to be used in selecting the next director of DEQ. Associated Oregon Industries (AOI) represents over 18,000 Oregon business of all types ranging from high-tech to gas stations, from law firms to tourism. Hundreds of businesses fall under direct regulatory control of the agency and many thousands more are directly or indirectly affected by agency actions. Consequently, selection of the director is of great importance of Oregon businesses.

Oregon's environment and economy are intertwined: we cannot have a healthy economy without Oregon's wonderful environment, and we cannot have environmental improvement without a strong economy. The purchase of new cleaner cars, new more stringent permits for expanded facilities, the taxes needed for stormwater control, and ability to attract top-notch employees are just a few examples. Further, the ability of a director to separate fact from conventional wisdom, as well as to focus on the areas yielding the greatest results, are all important if we are to move forward.

With that in mind, AOI suggests that selection process address the following:

1) **Experience managing major elements of a <u>state</u> environmental program or agency and dealing effectively with state legislators.**

State programs are intrinsically different from local or federal programs. State programs span a much larger range of geographical, social, environmental, managerial, and political issues than local programs, no matter how large. Moreover, a critical element in the success of the new director will be the director's ability to interact effectively with legislators on important state issues. While federal-level agency experience may be helpful, it usually lacks the "on

Attachment C-2

the ground" exposure to the array of citizen concerns as well as the political experience needed for this job.

2) **The ability and willingness to address, by cooperative and innovative means, all sources of pollution in Oregon to speed environmental progress.**

DEQ estimates show that the agency has been so successful in reducing industrial emissions that only about five percent of the state's air and eight percent of its water contamination is from industrial sources. Now, in order to make the gains necessary to keep Oregon's environment and economy healthy and sustainable, the general populace must be motivated to change behaviors to those having less impact. This will take considerable public education and the director must be capable and willing to energetically further this effort. Absent this, significant environmental gains are impossible and the public's frustration will erode the state's ability to deal with important critical environmental issues.

3) **The ability and willingness to operate as an independent state agency implementing state rules, including the Oregon Plan.**

Much of the decision and policy-making authority for environmental issues has moved from the state to the federal level. In some cases, the state operates, much to its displeasure, almost as a contractor for the federal government. The essence of the Oregon Plan and all major state environmental protection efforts is that Oregon is best equipped to deal with Oregon issues. This principle is vital to maintaining the continued strong support of the business community and the well being of Oregon's environment. It should be strongly upheld by the new director.

4) **A willingness and ability to increase the use of technical assistance and incentive-based programs to augment enforcement efforts in order to achieve environmental benchmarks.**

A focus on performance measures means that environmental success will be achieved through a combination of traditional enforcement and increasingly, technical assistance and innovative, incentive-based programs. One such example is the DEQ Green Permits Program fostering "beyond compliance" gains. Both the United States and the international community are beginning to focus on innovative, performance-based environmental programs. Oregon should continue to be in the forefront of this effort and the new director of DEQ will need to provide the leadership to keep us there.

5) **A willingness and ability to try new methods of meeting internal objectives.**

Economic growth in Oregon is excepted to flatten in the next few years and funding will become increasingly difficult. Consequently, the director should aggressively look for creative and innovative means of streamlining agency performance in such areas as permitting to speed up environmental improvements while meeting the economic needs of communities.

6) The understanding of and willingness to be a leader in evaluating DEQ program success against objective environmental performance benchmarks.

Oregon leads a national effort, encouraged by EPA, to measure a state's environmental performance against objective and scientifically justified performance indicators and to find innovative ways to measurably improve the environment. Oregon has begun to develop and refine ways to benchmark measures of environmental performance, particularly in the Water Quality Program. This should be strengthened.

I hope this will be helpful in your selection process. Again, thank you for the opportunity to comment, and best wishes for your efforts in making this important decision.

Sincerely,

JOHN LEDGER
Legislative Representative
Environment & Natural Resources

cc: EQC Commissioners

156 N.E. 9th Ave.
Hillsboro, OR 97124
September 22, 2000

State of Oregon
Department of Environmental Quality
Received
SEP 26 2000
OFFICE OF THE DIRECTOR

Office of the Director
D.E.Q.
811 S.W. 6th Ave.
Portland, OR 97204

Subject: standards, criteria, Policy Directives and Hiring Procedures for Hiring the D.E.Q. Director.

Having worked under six different directors of the D.E.Q. and predecessor Oregon State Sanitary Authority; I offer the following comments for hiring a new director.

In order to have a keen understanding of the hard sciences that rule the environment, the director should have a university level degree in one of those sciences or combination of those sciences.

The director should have a minimum of 10 years progressive responsibility and experience in some field of environmental science. At least 5 of those years should be in a major management position.

The director should have at least 10 years residence in Oregon in order to be familiar with the state's resources, politics, and issues that must be dealt with. The D.E.Q's director position is not one for on-the-job training.

Sincerely,
Glen D. Carter

Attachment C-5

15

State of Oregon
Department of Environmental Quality
Received
SEP 20 2000
OFFICE OF THE DIRECTOR

Postmark Sept 22, 2000

NORTHWEST
DISTRICT ASSOCIATION
1819 N.W. EVERETT STREET #205
PORTLAND, OREGON 97209
(503) 223-3331
NWDA

September 21,2000
Attention: Kitty Purser
Office of the Director, DEQ HQ
811 SW Sixth Ave.
Portland, OR 97204

Re: Procedures for appointing a new Director of ODEQ

We are a neighborhood association committee that has worked with the DEQ for over six years, monitoring our airshed and trying to discover what is in the foul smelling industrial odors that plague us. This densest neighborhood in the state is expanding its residential population. We have three schools in our neighborhood and several parks, where people exercise in the open air.

During this time little progress has been made in cleaning up the airshed. Neighbors still complain regularly to the DEQ about the odors, and one of the major polluters still allows fugitive emissions through open doors and windows and holes in the roof, pouring noxious odors into the neighborhood after years of complaints. Working with the DEQ we found over 70 toxic compounds in our air, including levels of benzene and lead and at least ten other toxic compounds over EPA benchmark levels.

In addition, PSU students and faculty completed a health survey of the neighborhood this year, and concluded that we (and SE Portland) have significantly higher rates of asthma than in the state in general and significantly higher than the national average.

In spite of these problems we have found the DEQ leadership to be generally unfriendly to neighborhood concerns. The emphasis in the state on economic development is often at the expense of healthy neighborhoods and a healthy environment.

Now we are looking forward to new leadership at the DEQ. But what is the selection process? Who is contributing to your selection of this extremely important post? We would like to take this opportunity to request a more public process, in order to turn the tide back toward the Tom McCall era, when the health of our environment and the public was clearly seen to be instrumental in maintaining the economic health of our beautiful state.

The next DEQ Director should above all, consider the health of our environment and our people. If the DEQ continues on its present course, all of us will suffer, and Oregon will ultimately lose the battle to attract clean industry as well. Obviously, we need someone with the backbone to stand up to the chronic polluters in this state and their legislative defenders and demand change. I hope you will have the courage to open the selection process to public input, and help us to choose the right person to protect our air and water and land. With best wishes.

Yours sincerely,
Sharon G. Genasci
Sharon Genasci, Chairman
NWDA Health & Environment Committee

c.c. Governor Kitzhaber

Attachment C-6

35 YEARS 1965-2000
HELLS CANYON PRESERVATION COUNCIL

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY COMMISSIONERS

Melinda S. Eden, Chair
85170 March Rd
Milton-Freewater, OR 97862

Harvey Bennett
551 Towne Street
Grants Pass, OR 97527

Deirdre Malarkey
996 Lincoln St
Eugene, OR 97401

Mark Reeve
610 SW Alder, Suite 803
Portland, OR 97205

Tony Van Vliet
1530 N.W. 13th
Corvallis, OR 97330

September 15, 2000

Dear Commissioners:

The future of the social, cultural and economic prosperity of Oregon will revolve around quality of life. A clean, unpolluted, untrammeled landscape will set us apart as responsible stewards of our home and as caretakers of the inheritance of future generations. It will define Oregon as a healthy, satisfying place to live.

We must not simply prevent pollution and irresponsible land management, we must also correct the mistakes we have made in the past. Recently, we have made some poor choices that have set us back to the days when ignorance and a "short-term industry expansion at any cost" attitude ruled our environmental policy.

We have learned so much. The Hells Canyon Preservation Council believes we have the ambition, technology and conscience to prosper economically without poisoning our land and water and using up our natural resources. That is why, on behalf of our 2,400 members, we are writing to urge you to go the direction of vision and responsibility in your selection of a new head of the Department of Environmental Quality.

Please make environmental protection the key issue in your selection criteria and select the candidate who will put the quality of our land and water, and our own dignity, first.

Sincerely,

Ric Bailey

Ric Bailey
Executive Director

Post Office Box 2768 LaGrande, Oregon 97850 Phone (541) 963-3950 Fax (541) 963-0584
E-Mail: hcpc@hellscanyon.org Web Page: www.hellscanyon.org

Clean air
Clean water
Clear thinking

Oregon Environmental Council

September 14, 2000

Attention: Kitty Purser
Office of the Director
DEQ HQ
811 SW Sixth
Portland, OR 97204

Re: The Next Director of the Department of Environmental Quality

Dear EQC Members:

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The *State of the Environment Report* recently produced by a team of Oregon's leading scientists clearly documents the fact that Oregon's environment remains seriously degraded, particularly in the Willamette River watershed. Oregon's reputation for environmental excellence is founded on programs established by Tom McCall nearly three decades ago. It is becoming increasingly unclear whether we still deserve to claim that reputation.

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preference. The next director should have a demonstrated ability to work effectively with businesses, local governments, environmental advocates, elected officials, and other stakeholders to make environmental progress with the broadest possible consensus of support.

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Thank you for the opportunity to comment, and best of luck in your search and your deliberations.

Sincerely,

Jeff Allen
Executive Director

RECRUITMENT FOR DIRECTOR
Proposed elements and timelines

September 6
Proposed criteria for selection sent out for public comment, closes September 29th (done)
September 7
Draft Job Announcement including a current position description and organization chart provided to DAS Human Resources Services Division (done)
September 8-11
DAS announces open competitive recruitment with applications being accepted through October 6, advertises, including minority papers, Internet (done)
September 11-18
DEQ drafts interview questions and reference check questions
September 29
EQC selects a Vice Chair
EQC adopts criteria for selection of new director after any public comment
EQC decides whether or not to extend recruitment beyond October 6
EQC appoints a Search Committee, typically the Chair and Vice Chair (cannot be a quorum).
October 10
Search committee meets to review applications and narrow pool to 6 to 8
Search committee reviews interview questions and reference questions, makes any changes.
October 10-16
DAS/DEQ set up interview times with the 6 to 8 candidates on behalf of Search Committee
October 18
Search Committee conducts first interviews, narrows down pool to 2 to 3
Interview materials sent to other EQC members, Search Committee job done
October 18-25
DEQ Human Resources does reference checks and shares with all EQC members
Governor's office does security checks (Lisa Howard)
October 18-27
Governor interviews top 2 to 3 candidates and conveys comments to Chair Eden
November 2 or 3 (Proposed)
EQC executive session in AM to interview top candidates, make choice
EQC chair conveys offer, (DAS can be used if EQC desires, to negotiate salary).
EQC public session mid-afternoon to formally vote.
November 6-15
New director on board

Memorandum

To: Environmental Quality Commission Date: September 27, 2000
From: Langdon Marsh
RE: Director's Report

Portland Harbor

The Portland Harbor Cleanup will be directed by a joint Environmental Protection Agency (EPA)/Department of Environmental Quality (DEQ) Project Team. On September 11, both agencies met to start outlining roles and responsibilities, and raise issues that need to be addressed in a Cooperative Agreement. DEQ will have lead technical and legal responsibility for the upland, or on-shore, contamination cleanup and for coordinating with EPA on upland contamination that may impact in-water contamination. DEQ will also ensure that ongoing efforts, such as the Combined Sewer Overflow project, Total Maximum Daily Load development and the Oregon Plan, are coordinated with the Superfund process and potential conflicts are minimized wherever possible. EPA will have lead technical and legal responsibility for in-water (sediment) contamination. EPA and DEQ will work together on community outreach activities.

Waste Policy Leadership Group

The Waste Policy Leadership Group (WPLG) is finalizing recommendations that include establishing a new statewide recovery goal, adopting new required wasteshed recovery rates, and developing new recovery programs and policies that would increase recycling statewide. The proposed new statewide goals are 45 percent recovery by 2005 and 50 percent by 2009. The rate for 1999 was 36.8 percent. The program recommendations under review would target key wastestreams such as construction/demolition debris, food waste, mixed waste paper, and scrap tires. In addition, the WPLG is examining extended product responsibility proposals for specific materials such as waste electronics, mercury-containing wastes, and scrap tires, as well as other waste prevention program and policy recommendations. The final recommendations may include changes to administrative rules, legislation, and DEQ Solid Waste program priorities and activities.

National Performance Track

EPA launched its National Performance Track program on June 26, 2000. The program rewards top performing facilities, and is based largely on the Green Permits program. Four Oregon facilities have applied to the National Environmental Achiever Track: Epson Portland, Inc., LSI Logic, Kinglsey Field (US Air Force), and Kerr-McGee. DEQ is working closely with EPA on this program. EPA was able to launch its program fairly quickly because we had tested these ideas in Oregon and they collaborated with states as they developed program elements. Because of this close coordination, our facilities are finding it easy to apply to both programs for added benefits.

The State of the Environment Report

DEQ was part of the "stewardship group" that first recommended, then helped initiate and guide, the production of The State of the Environment Report, released Sept. 1. The group agreed that new options for Oregon's environmental management should be based on sound science, but quickly recognized that choices about selecting and reporting data were not value-neutral. To allow the fledging effort to proceed, the politically diverse stewardship group agreed to turn over responsibility to independent scientists in Oregon's universities. The science panel chose to emphasize ecosystems and natural functions of the environment, and the interconnection of these systems, in a way that provides a fresh look at how we address environmental management. Each section of the report suggests indicators to be used in tracking trends in the environment. DEQ will now have the opportunity to engage in discussions with the scientists and the Oregon Progress Board regarding individual recommendations.

Willamette Restoration Initiative

Over the past several months, the Willamette Restoration Initiative (WRI) has developed a detailed draft workplan with specific action items and timelines. Paul Risser, President of Oregon State University and WRI Chair, prepared the Draft Overview, a policy-level document that outlines an overall conservation strategy for the basin. Recommended actions deal with clean water, water quantity, habitat, hydropower processes, and institutional and policy actions needed to support restoration strategy. The Draft Overview specifies stewardship objectives; identifies indicators and benchmarks for how we'll know if we are successful (from State of Environment Report); and identifies WRI's current and future roles. The WRI Board will be meeting all day on October 26 for its final review of the Willamette Restoration Initiative Strategy.

National Air Toxics Assessment

On August 15th, the Environmental Protection Agency released the first phase of an important study called the National Air Toxics Assessment (NATA). Toxic air pollutants are chemicals known or suspected to cause serious health problems such as cancer and birth defects. The NATA estimated that there are 16 toxic air pollutants in Oregon above levels believed to be safe, and that every county in the state has some toxic air pollutants above these levels. This confirms the need for the Oregon air toxics program recommended by DEQ's advisory committee known as the Hazardous Air Pollutant Consensus Group. The group recommended that DEQ form a scientific advisory panel to help provide and evaluate more detailed information about toxics in local areas, and then work with communities to design plans to reduce health risks from air toxics. The Air Quality Division expects to propose rules to implement this program in about a year.

SOME EXAMPLES OF WESTERN OREGON COMMUNITIES RECENTLY OR CURRENTLY UPGRADING WASTEWATER FACILITES AND IMPACTS ON SEWER RATES

This survey was compiled by DEQ staff over the telephone November 29-December 1, 1999. Informants were city public works, finance and management staff who generously provided the information. Any errors or omissions in the information presented herein are the responsibility of the compiler, with apologies to the respondents.

The selection of communities surveyed was rather arbitrary, other than meeting the criteria of being in western Oregon and being in the midst of a major capital project. Communities were contacted in a completely random sequence. If more time had been allotted, other communities that meet the criteria could have been contacted.

This is not a "scientific survey". The information presented here is not amenable to statistical analysis or generalization. It should be considered simply a compilation of anecdotal information that gives some examples and perhaps a sense of "what's going on" with sewer rates.

Because the duration of projects varies between communities, and because many communities have not projected future sewer rates beyond the end of the current major project, it was not possible get comparative rates for the same future year, 2010 for example.

For each community, the following information is presented:

- A brief statement of the project type, cost in current dollars (unless otherwise noted), and projected completion date.
- The current monthly sewer rate for the "average" single family residence. Some recent rate history where applicable. If a community uses sources in addition to the sewer rate and systems development charges (SDCs) to fund wastewater improvements, these are identified.
- Projected monthly sewer rate after completion of capital improvements in current dollars (unless otherwise noted). The relative share of capital improvement costs covered by the rate and SDCs, if this information is known.

ALBANY

- Treatment plant and collection system upgrades. $63.5milliion by 2010.
- $17.80. Started raising rates 10 years ago above system costs to accumulate capital reserve.
- With project rate projected to be $43.18 in 2010 (future dollars). Without project, current rate would inflate to $27.60. SDCs will raise about $10 million of $63.5million.

AMITY

- In early planning stage for estimated $5million treatment plant expansion. 3-5 year schedule.
- $23.00.
- Estimated $83 rate at end of 3-5 year project with no grant assistance. With anticipated grants, $50-$60 range. SDCs cover small share of costs.

ASTORIA

- CSO correction program only. $22million by 2020. Other long-term treatment plant and collection system improvements not programmed.
- $10.00.
- $27.00 in 2022 from CSO project alone. Likely to actually be higher (in current dollars) when other non-CSO system improvements are identified and factored in. No SDC revenue.

BROOKINGS

- Solids handling, treatment plant hydraulic capacity, UV disinfection. $13million by 2001.
- $27.00. Raised from $22 in 1998 to raise revenue to pay for improvements.
- Rate after project likely to be the same. SDCs will cover 73% of project cost.

CLACKAMAS COUNTY SERVICE DISTRICT #1 (Serves Milwaukie and parts of unincorporated Clackamas County)

- Treatment capacity expansion. $50-$60million by 2003. Capacity expansion will actually be at Tri-Cities Service District plant to serve CCSD population growth.
- $21.45.
- Estimated to be about $26.65 in 2003. SDCs will cover "significant" portion of costs.

CRESWELL

- Treatment plant upgrade. $4.7million by 2001.
- $18.80.
- $28.00 in 2002. Have not yet calculated rate-SDC share of cost.

DALLAS

- New treatment plant, major collection system improvements, effluent irrigation. Total estimated cost $26million (in 1995 dollars). $16million expended 1996-1999. Projected $10million to be expended 1999-2010.
- $33.00. Began ramping up rate in 1994 from $13.00 to accumulate capital reserve.
- Rate projected to be in the $40-$45 range (1995 dollars) at end of project in 2010. SDCs will cover about 10% of cost.

FLORENCE

- Complete rebuild of treatment plant. $12.8million by 2001.
- $19.00. Started ramping up from $16.80 in 1998.
- $22.50 in 2001. SDCs projected to cover 48% of project cost.

GARIBALDI

- New treatment plant and collection system improvements. $4.2million by 2001.
- $35.56. $40,000/year is raised from property tax to pay debt service for earlier I/I project.
- $42.00 in 2001. Very limited revenue from SDCs.

GOVERNMENT CAMP SANITARY DISTRICT

- New treatment plant and outfall. About $3million by 2001.
- $24.00.
- $40.00 in 2001 unless part of the cost is put on the property tax.

MCMINNVILLE

- In last phases of major treatment plant and collection system upgrades. $22million from now until 2006 primarily on collection system.
- Ranges from $45 to $52 based on water consumption.
- $62 in 2006 based on 1000 c.f. water consumption. SDCs about 15% of revenues.

MOLLALA

- First phase of major system expansion includes new outfall line and effluent irrigation. $5million by 2002.
- $16.00.
- Estimated about $32 in 2002. SDCs will cover only about 5%. Rates beyond 2002 for future phases not yet estimated.

NEWPORT

- Major system upgrade. $41million by 2003.
- $21.00. Additionally, property tax, tax increment financing, room tax are used to raise the equivalent of about $40 of sewer rate.
- Sewer rate *per se* $30.00, plus the equivalent of $40 from the other sources.

SILVERTON

- New interceptor. $1million by 2002. This is last phase of major system upgrade started in 1997.
- $34.28. Rate at start of upgrade project in 1997 was $24.27.
- Estimated to be $38.00 in 2002. SDCs will cover only about 5% of costs.

TROUTDALE

- New treatment plant. $16million by 2002.
- $24.75. Rate raised from $18.75 in 1996 to raise funds for project. Passed $16million G.O. bond. Source of revenue to retire bond: 28% from sewer rate, 39% from SDCs, 33% from property tax.
- Will still be at $24.75 in 2002. If other sources were not also used to retire debt, rate would be about $37.00.

UNIFIED SEWAGE AGENCY (urban Washington County)

- Expansion of USA's several treatment plants over next 5 years at about $200million.
- $23.70.
- $26.00 by 2005. SDCs and rate will each pay about half of the cost of the planned capital improvements.

VENETA

- New $7.5million treatment plant will be completed in 2002.
- $46.00. Raised rates from $20.00 in 1998 to pay for project.
- Will remain at $46 for immediate future. SDCs about 15% of revenue.

WOODBURN

- Will complete major $35million system upgrade in 2000.
- $27.38. In November 1995 rate was jumped from $14.20 to raise funds for project.
- Upon completion of project, rate expected to remain about the same for immediate future.

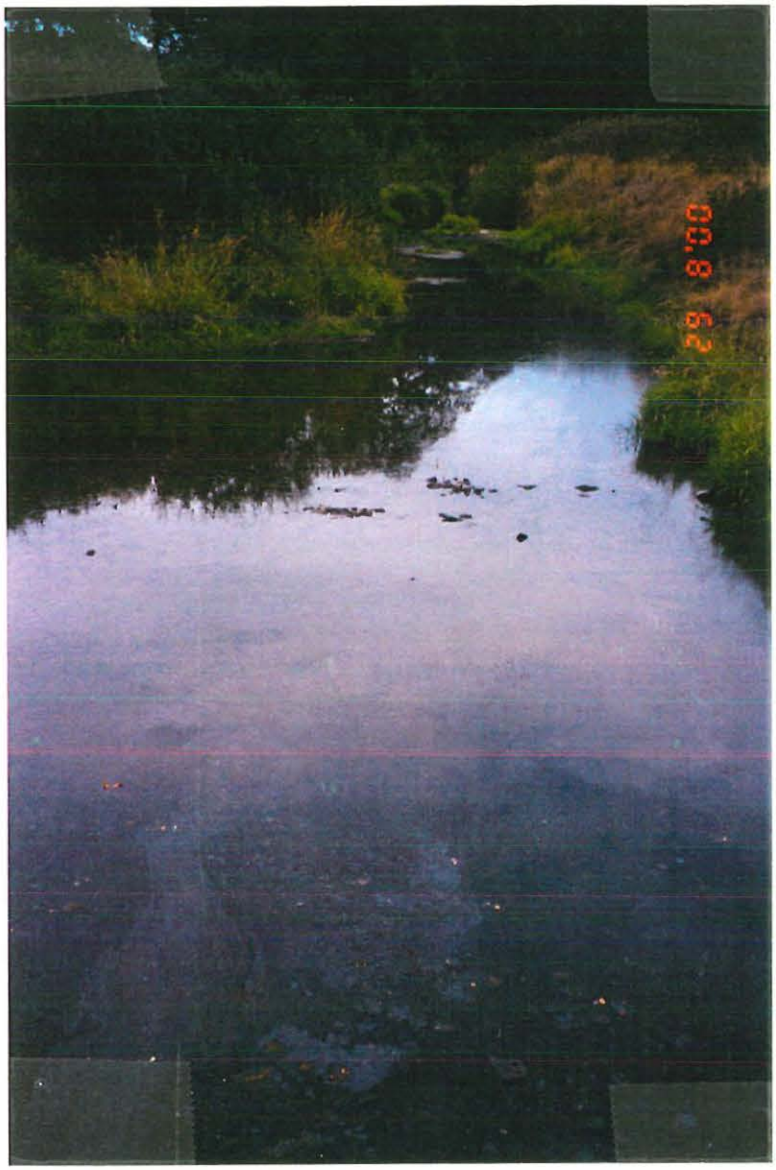
THE FOLLOWING SET OF PHOTOS WERE TAKEN ON AUGUST 29, 2000, SHOWING OAK CREEK UPSTREAM AND DOWNSTREAM OF THE OREMET WETLAND SEEPAGE DISCHARGES

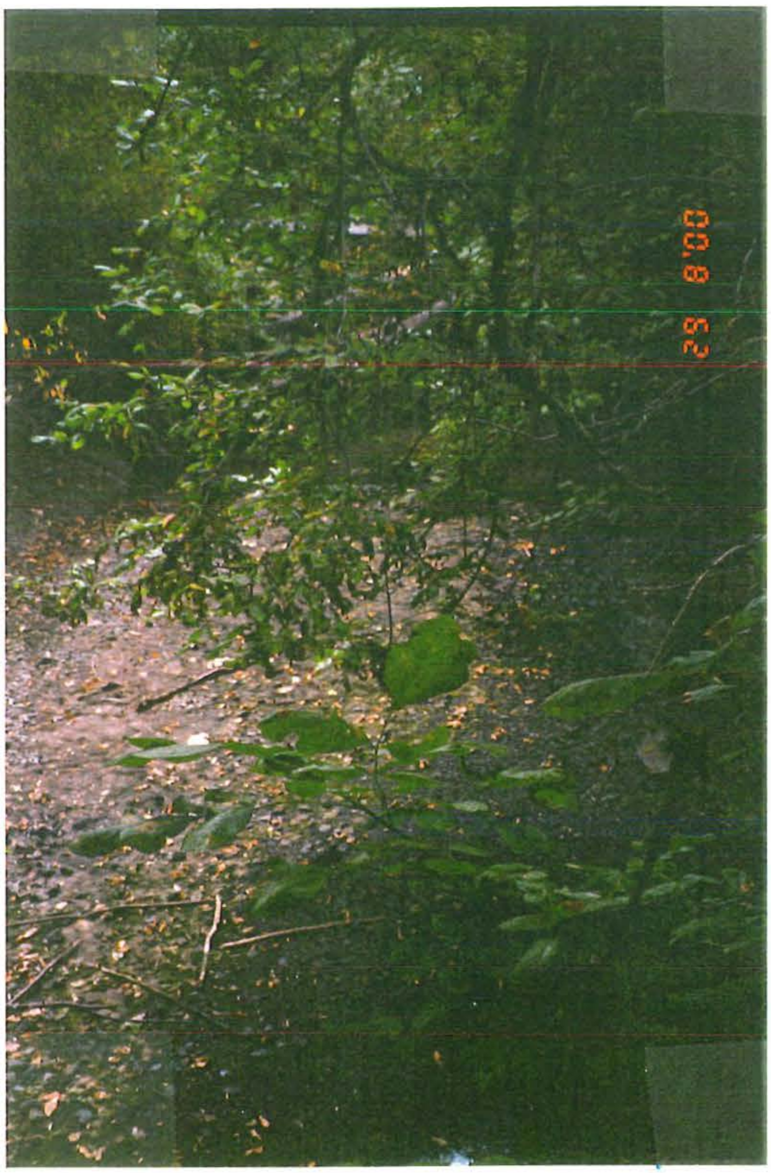
THE UPPER PHOTO SHOWS OAK CREEK AT N. FRY ROAD LOOKING UPSTREAM. THE CREEK BED IS DRY AND THIS LOCATION IS APPROXIMATELY 1 CREEK MILE UPSTREAM FROM WHERE OAK CREEK ENTERS FREEWAY LAKE # 1.

THE LOWER PHOTO SHOWS OAK CREEK AT THE SAME LOCATION LOOKING DOWNSTREAM. THERE IS NO CREEK FLOW, BUT A SMALL RESIDUAL POND WAS PRESENT IN A DEEPER POCKET AREA OF THE CREEK BED.

OAK CREEK WHERE IT ENTERS FREEWAY LAKE # 1 ON EAST SIDE OF HWY 5. OAK CREEK WAS DRY AND NO FLOWS WERE ENTERING THE LAKE

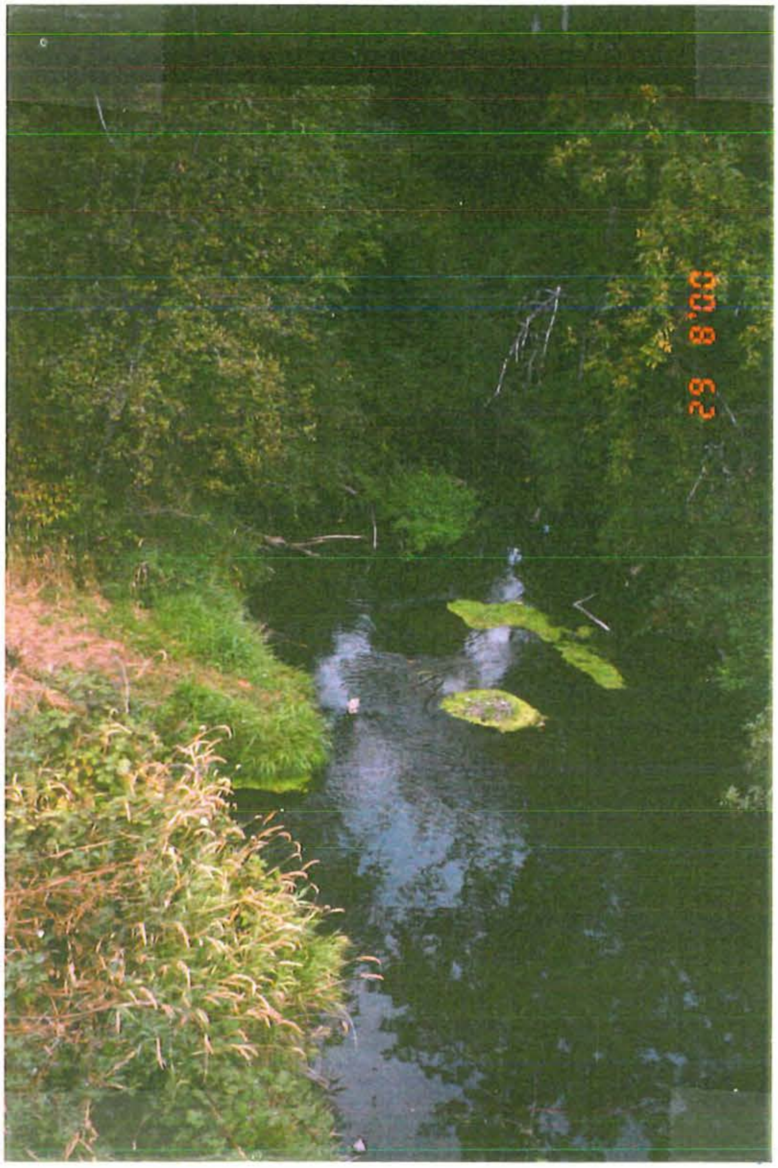
OAK CREEK AT COLUMBUS ST. BRIDGE AS COLUMBUS ST. ENTERS ALBANY. THERE WAS NO CREEK FLOW AND THE WATERS WOULD BE DESCRIBED AS STAGNANT





OAK CREEK AT SE CORNER OF OREMET LOOKING UPSTREAM AND SHOWING DRY CREEK BED

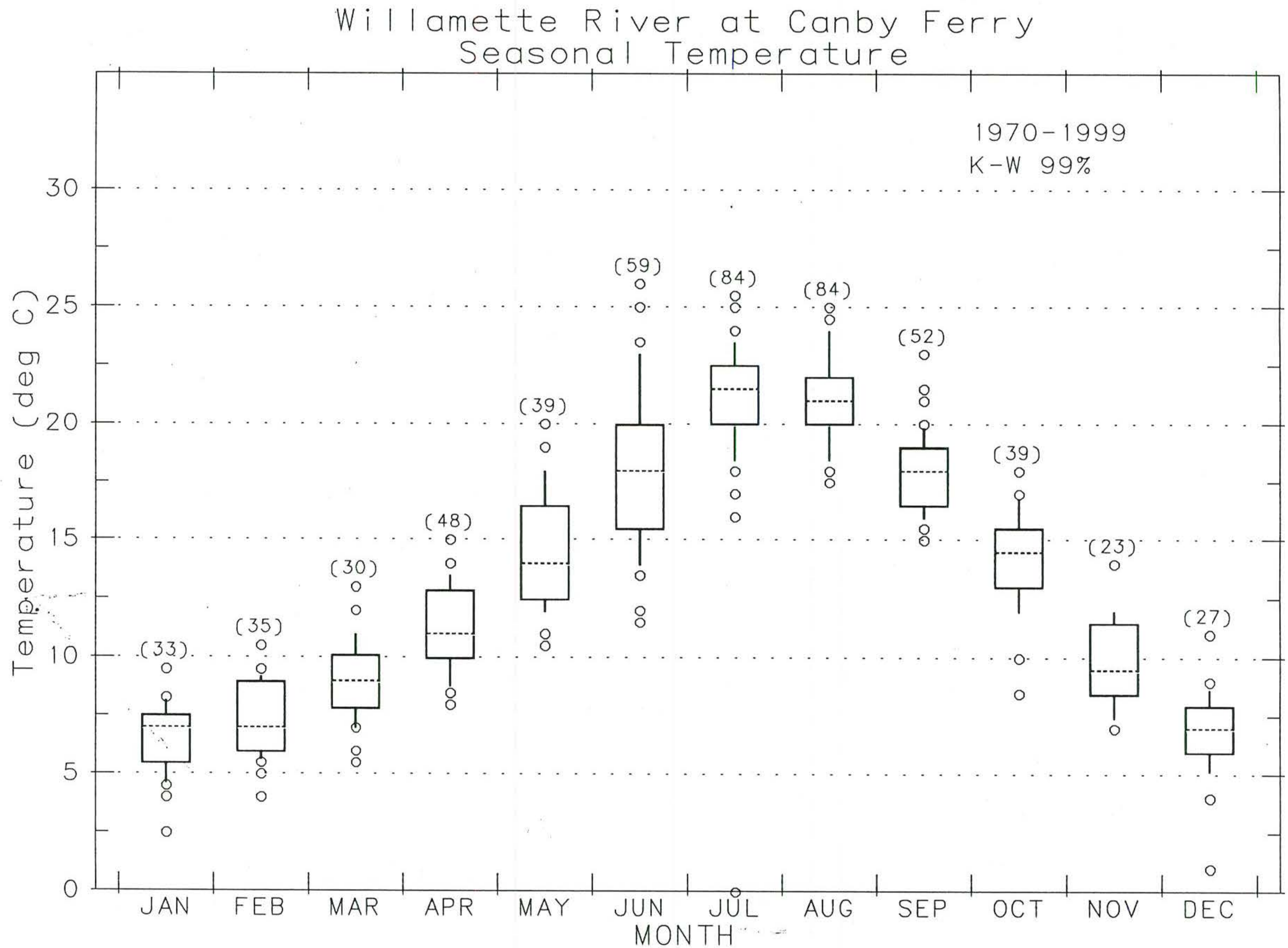
OAK CREEK AT SE CORNER OF OREMET LOOKING DOWNSTREAM AND SHOWING DRY CREEK BED

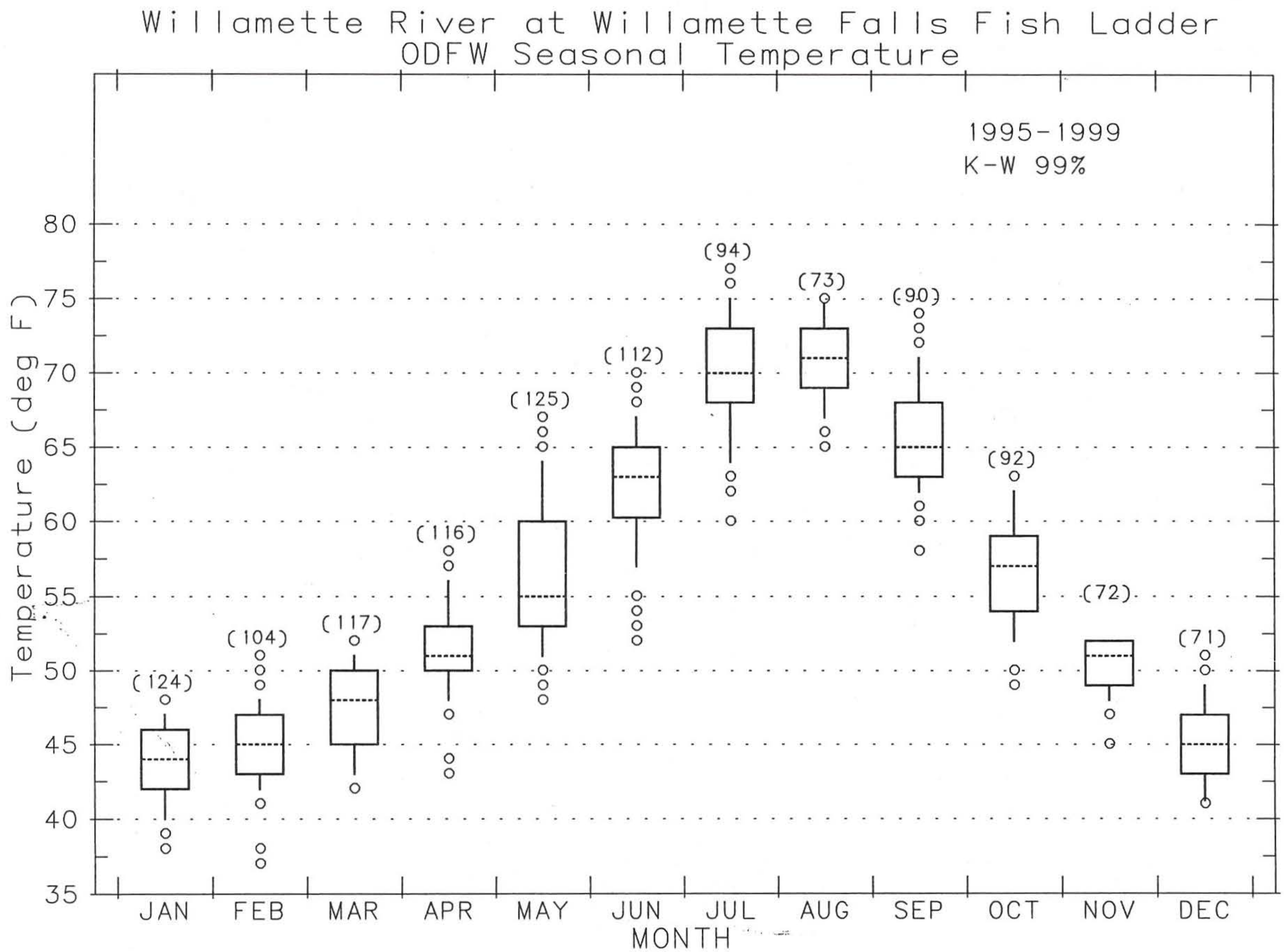


OAK CREEK AT S.P. RAILROAD BRIDGE
AT S.W. CORNER OF OREMET PROPERTY
DOWNSTREAM FROM WHERE OREMET WET LAND
SEEPAGE ENTERS OAK CREEK.

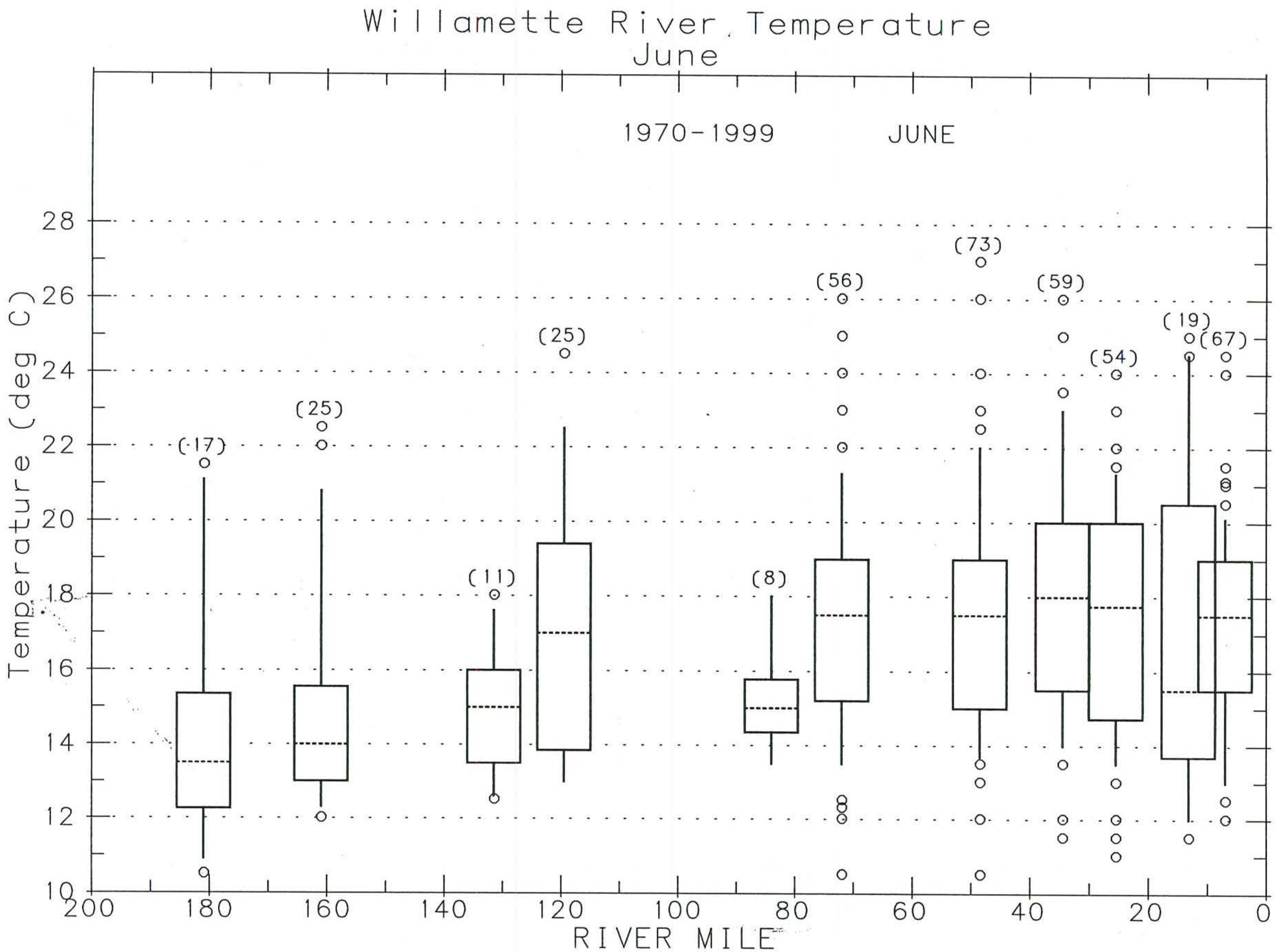
OAK CREEK ON DOWNSTREAM SIDE OF S.P RR
BRIDGE

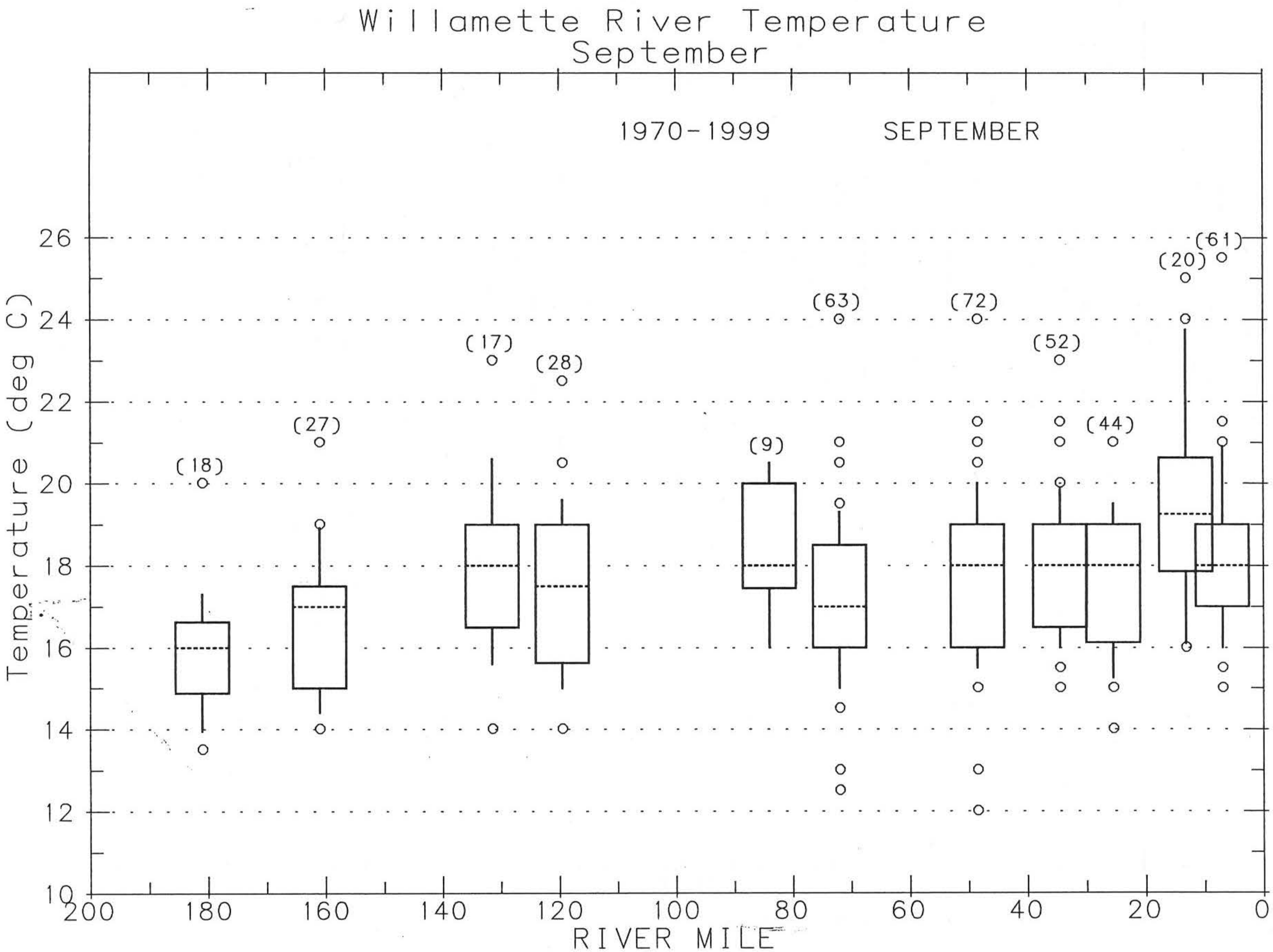
OAK CREEK AT HWY 99 BRIDGE DOWNSTREAM OF OREMET


Willamette River at Canby Ferry
Seasonal Temperature
1970-1999
K-W 99%
Temperature (deg C)
0
5
10
15
20
25
30
(33)
(35)
(30)
(48)
(39)
(59)
(84)
(84)
(52)
(39)
(23)
(27)
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
MONTH

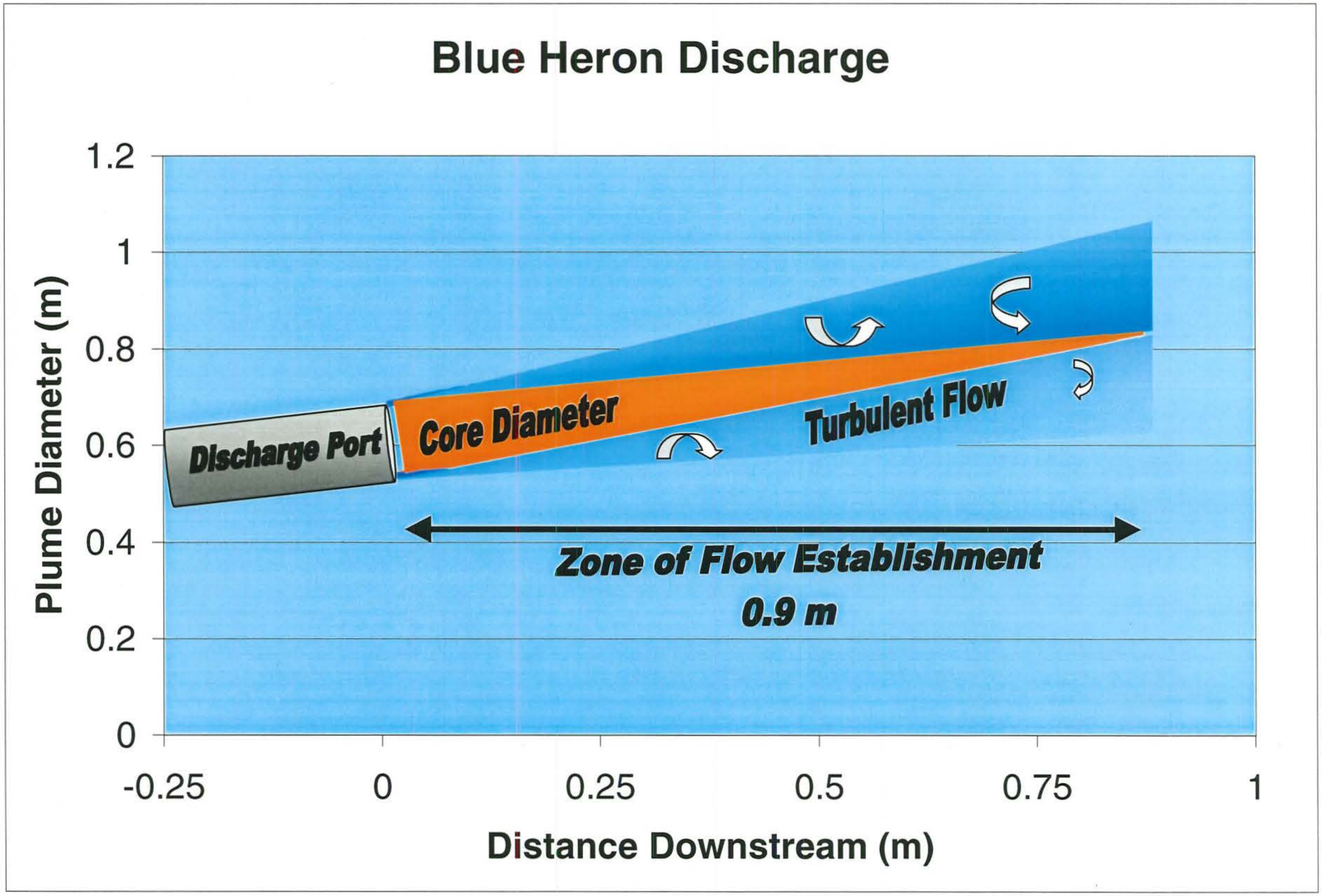


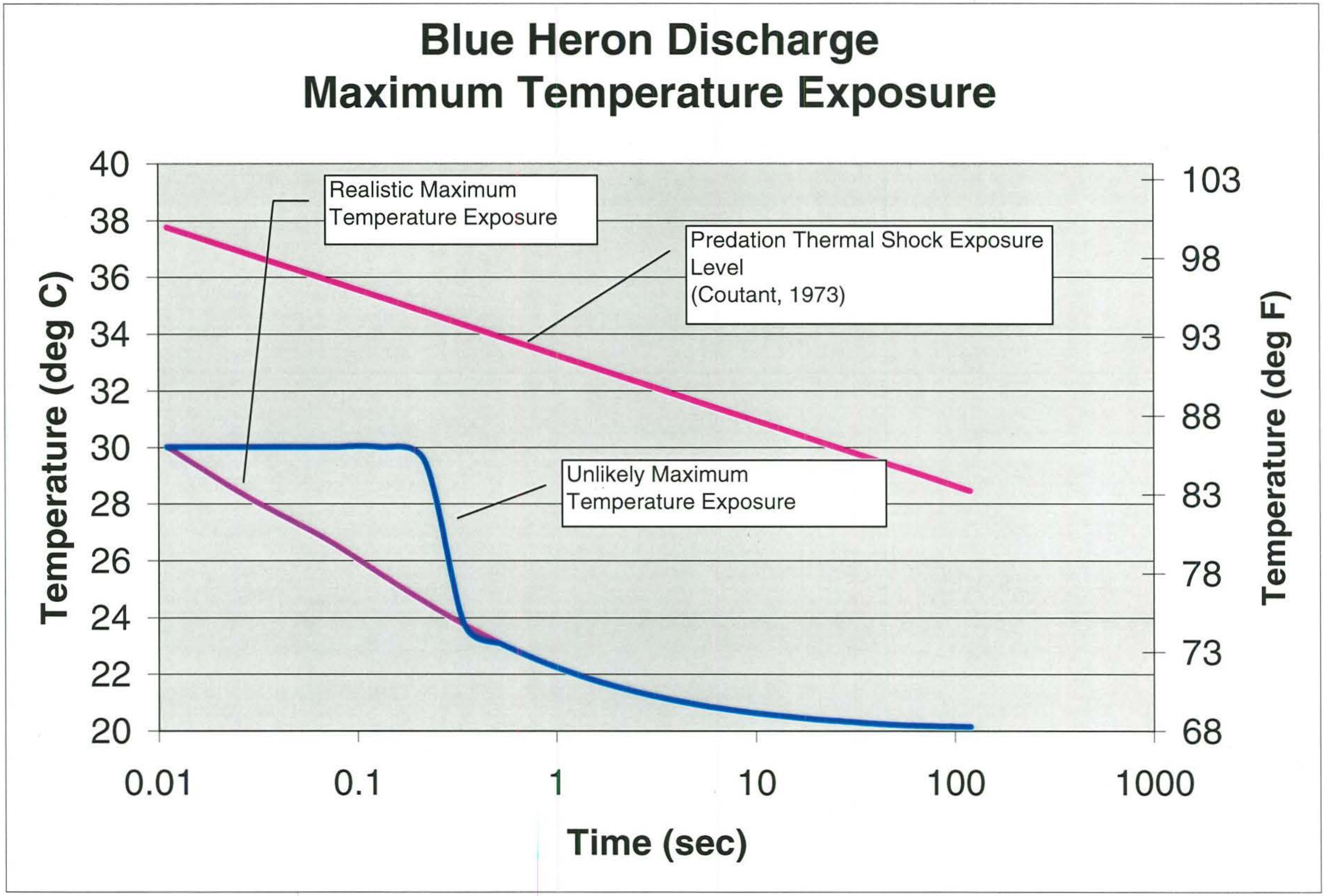
Willamette River at Willamette Falls Fish Ladder
ODFW Seasonal Temperature
1995-1999
K-W 99%
Temperature (deg F)
80
75
70
65
60
55
50
45
40
35
(124)
(104)
(117)
(116)
(125)
(112)
(94)
(73)
(90)
(92)
(72)
(71)
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
MONTH


Willamette River Temperature
June
1970-1999
JUNE
Temperature (deg C)
RIVER MILE
10
12
14
16
18
20
22
24
26
28
200
180
160
140
120
100
80
60
40
20
0
(17)
(25)
(11)
(25)
(8)
(56)
(73)
(59)
(54)
(19)
(67)

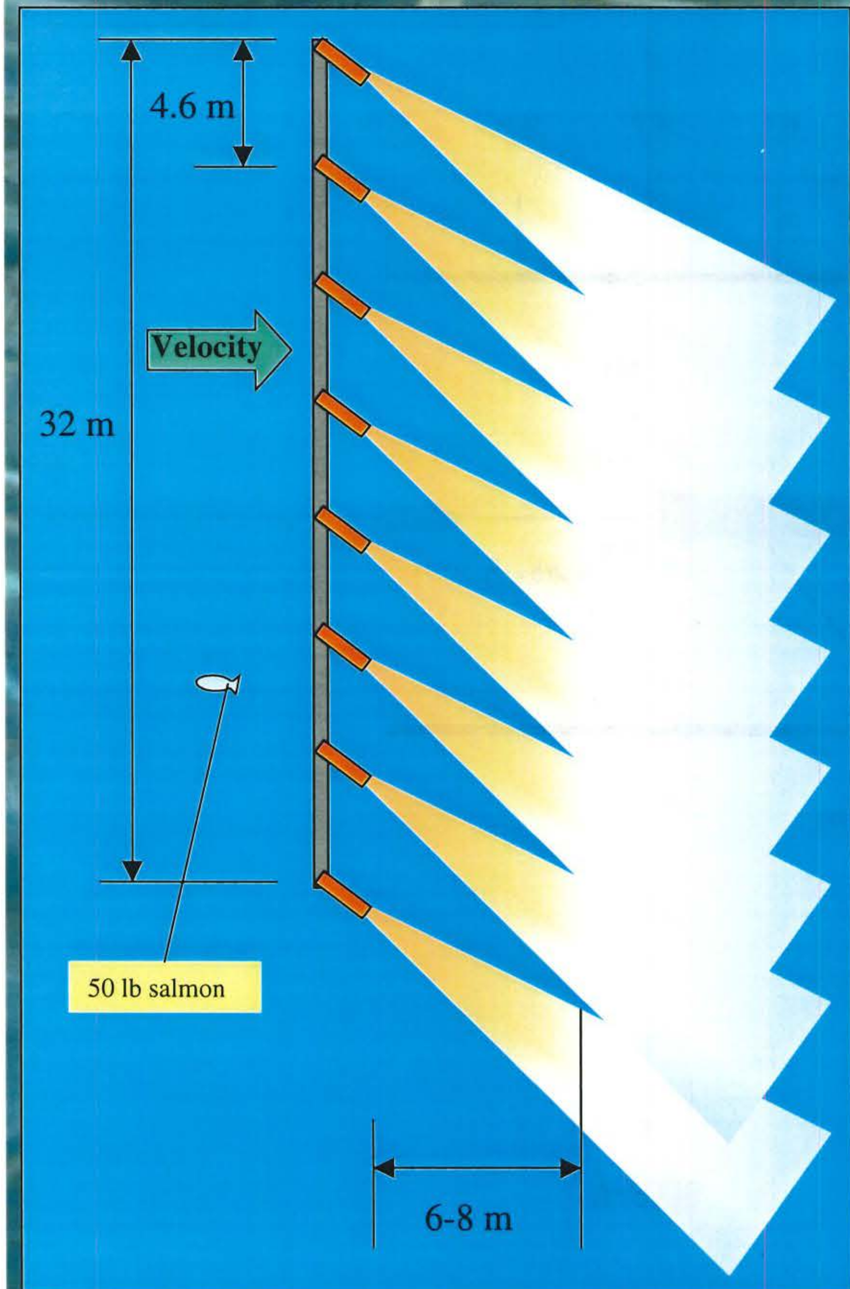


Willamette River Temperature
September
1970-1999
SEPTEMBER
Temperature (deg C)
RIVER MILE
26
24
22
20
18
16
14
12
10
200
180
160
140
120
100
80
60
40
20
0
(18)
(27)
(17)
(28)
(9)
(63)
(72)
(52)
(44)
(20)
(61)


Blue Heron Discharge
Plume Diameter (m)
1.2
1
0.8
0.6
0.4
0.2
0
-0.25
0
0.25
0.5
0.75
1
Distance Downstream (m)
Discharge Port
Core Diameter
Turbulent Flow
Zone of Flow Establishment
0.9 m



Blue Heron Discharge
Maximum Temperature Exposure
Realistic Maximum Temperature Exposure
Predation Thermal Shock Exposure Level (Coutant, 1973)
Unlikely Maximum Temperature Exposure
Temperature (deg C)
40
38
36
34
32
30
28
26
24
22
20
Temperature (deg F)
103
98
93
88
83
78
73
68
0.01
0.1
1
10
100
1000
Time (sec)



River Width = 260 m

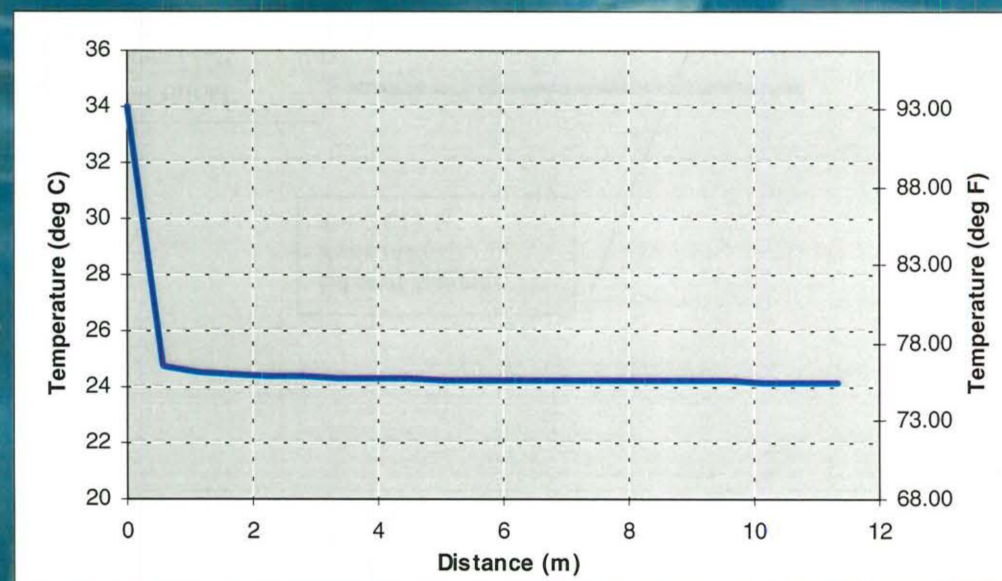
Diffuser Width = 32 m

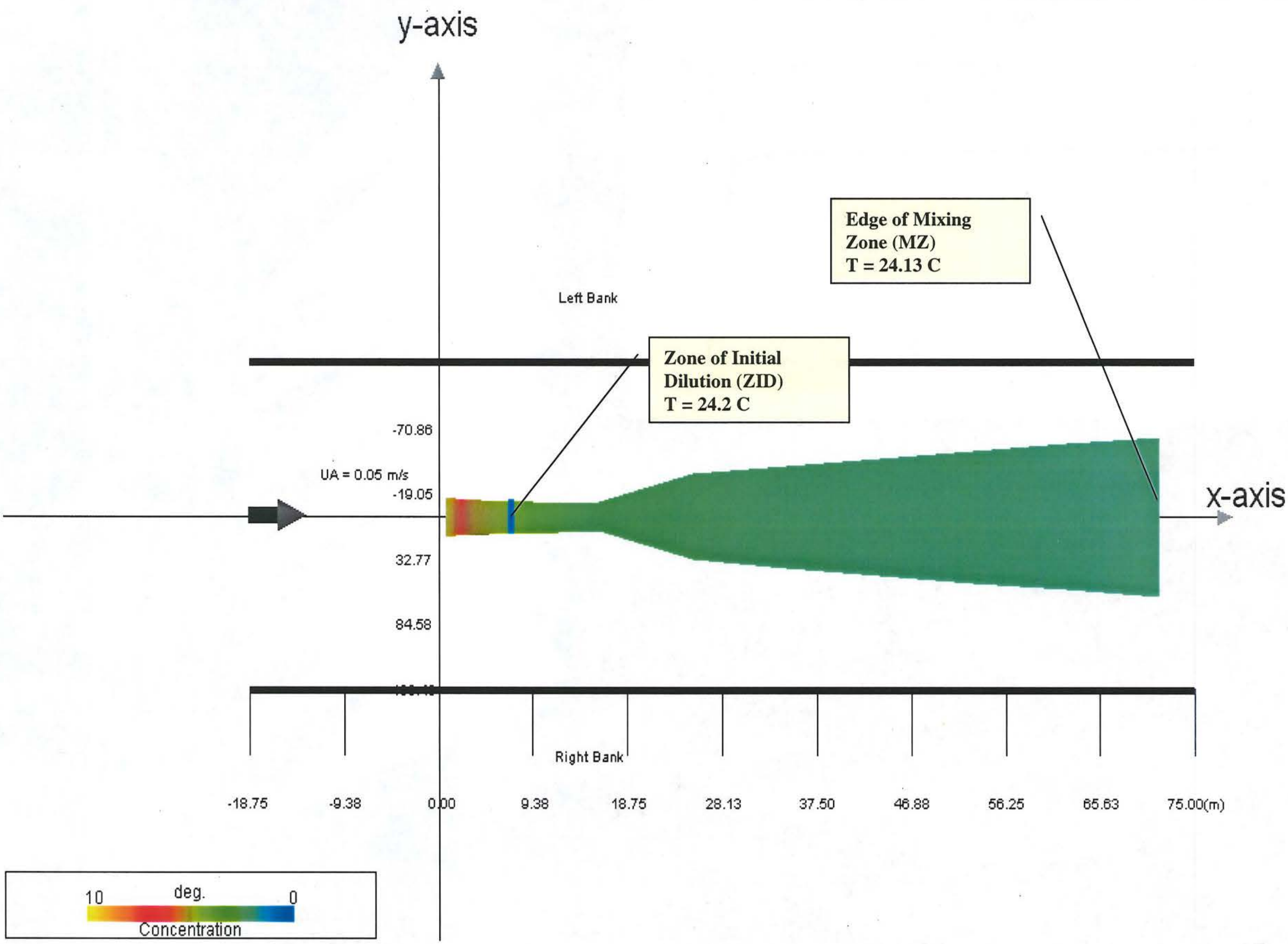
Distance to Merging Plumes = 6-8 m

Background Temperature = 24 C

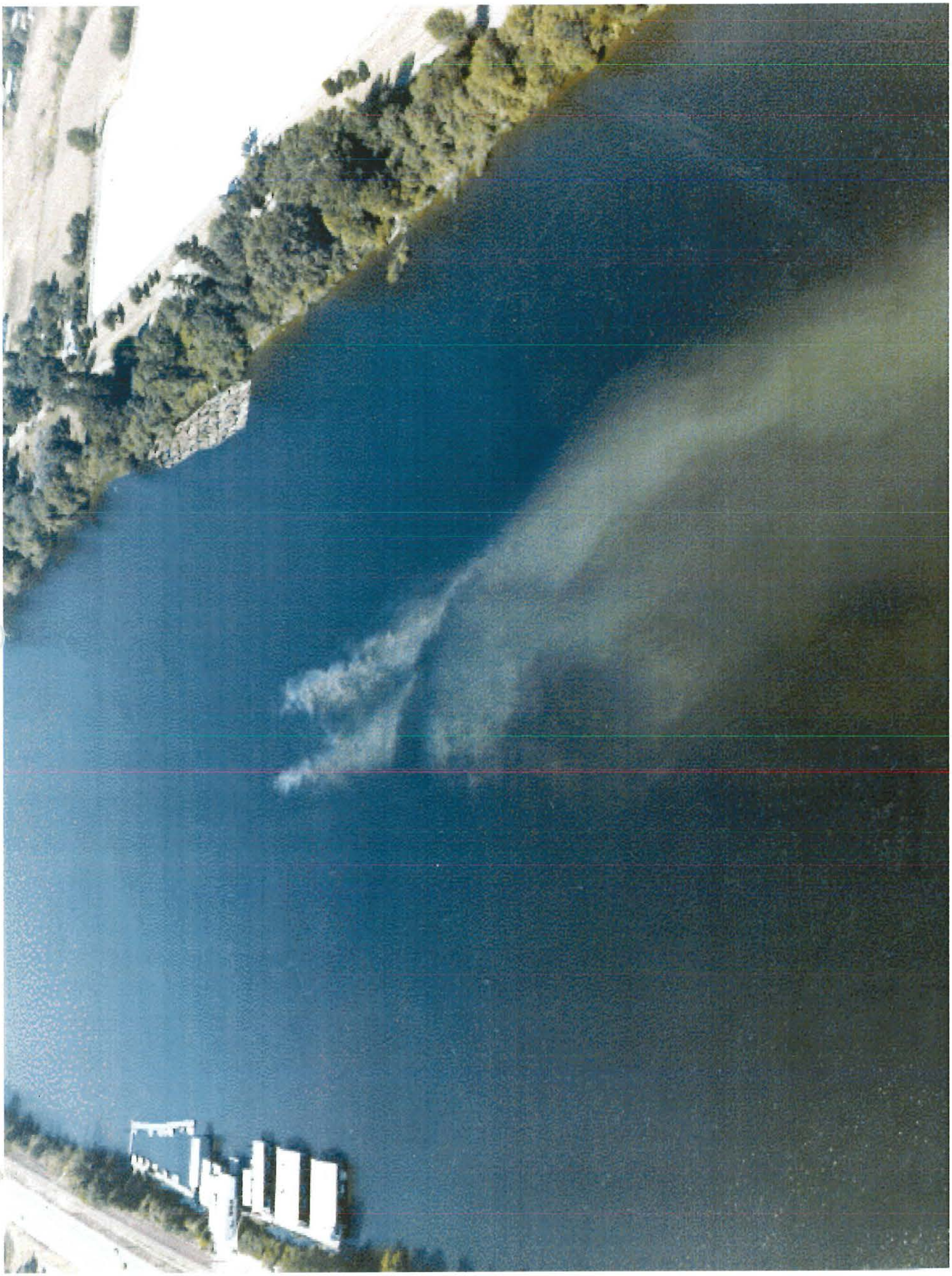
Temperature at 1 m d/s = 24.7 C

Temperature at merging plumes = 24.2 C





y-axis
Edge of Mixing
Zone (MZ)
T = 24.13 C
Left Bank
Zone of Initial
Dilution (ZID)
T = 24.2 C
-70.86
UA = 0.05 m/s
-19.05
x-axis
32.77
84.58
Right Bank
-18.75
-9.38
0.00
9.38
18.75
28.13
37.50
46.88
56.25
65.63
75.00(m)
10
deg.
0
Concentration



Approved_____
Approved with Corrections____

Minutes are not final until approved by the EQC

Environmental Quality Commission
Minutes of the Two Hundred and Eighty-Eighth Meeting

September 28-29, 2000
Regular Meeting

On September 28, 2000, the Environmental Quality Commission (EQC) traveled to Roseburg, Oregon where they toured the Formosa Mine near Riddle and the Calapooya Project in the Sutherlin Area. That evening they had dinner with local officials at the Sleep Inn and Suites, Umpqua Room, 2855 NW Edenbower Blvd, Roseburg, Oregon. The following Environmental Quality Commission members were present:

Melinda Eden, Chair
Tony Van Vliet, Member
Mark Reeve, Member
Deirdre Malarkey, Member

On September 29, 2000, the regular meeting of the EQC was held at the Sleep Inn and Suites. The following EQC members were present:

Melinda Eden, Chair
Tony Van Vliet, Member
Mark Reeve, Member
Deirdre Malarkey, Member
Harvey Bennett, Member

Also present were Larry Knudsen, Assistant Attorney General, Oregon Department of Justice (DOJ); Langdon Marsh, Director, Department of Environmental Quality (DEQ); and other staff from DEQ.

Note: The Staff reports referred to at this meeting, are on file in the Office of the Director, 811 SW Sixth Avenue, Portland, Oregon 97204. Written material submitted at this meeting is made a part of the record and is on file at the above address. These written materials are incorporated in the minutes of the meeting by reference.

Chair Eden called the meeting to order at 8:30 a.m. on Friday, September 29.

A. Approval of Minutes

Minutes from the May 17-18, 2000 meeting: A correction was made on page 7, 6th paragraph, the 5th line should read "...requiring the Department of Corrections to comply with statewide land use goals and ~~act~~ local land use..." A motion was made by Commissioner Van Vliet to approve the minutes as corrected. Commissioner Reeve seconded the motion and it passed with five "yes" votes.

Minutes from the July 13-14, 2000 meeting: On page 3, Transfer section, 3rd paragraph, 4th line, it was noted that the word primer was misspelled. On page 5, Agenda Item K, 1st line, the committee should read "*Technical* Education *Advisory* Committee." A motion was made by Commissioner Van Vliet to approve the minutes as corrected. Commissioner Bennett seconded the motion and it carried with five "yes" votes.

Minutes from the August 22, 2000 meeting: On page 1, last paragraph, the third line should read "...DEQ intended to try to define the performance of the standard trench ~~through a contract~~. If criteria were..." On line 5 of the same paragraph there should be a space between not and able. A motion was made by Commissioner Van Vliet to approve the minutes as corrected. The motion was seconded by Commissioner Malarkey and carried with five "yes" votes.

Minutes from the September 6, 2000 meeting: A motion was made by Commissioner Reeve to approve the minutes as written. Commissioner Bennett seconded the motion and it carried with five "yes" votes.

B. Consideration of Request for Preliminary Certification on Tax Credit No. 5009, Portland General Electric Company's Independent Spent Fuel Storage Installation at the Trojan Nuclear Power Plant Site in Rainier

Maggie Vandehey, Tax Credit Manager, presented this item. See attached edited transcript.

C. Consideration of Tax Credit Requests

Chair Eden stated when VanBeek Dairy came up she would recuse herself because VanBeek Dairy is a client of her family firm.

Maggie Vandehey, Tax Credit Manager, presented the tax credits in Agenda Item C.

Ms. Vandehey asked to remove several items from the agenda.

Willamette Industries asked that application 4979 be removed from the agenda due to a scheduling conflict. Ms. Vandehey noted this application had been on the EQC agenda a number of times.

The attorney representing Smurfit Newsprint Corporation requested application 5236 be removed from the agenda.

By mutual agreement of the Department and the applicant, the Department requested removal of application 5345 from consideration. The Department reviewed the facility as though it were a replacement facility. The applicant presented information that the Department's assessment was incorrect.

Corvallis Disposal requested removal of application 5434. The applicant reallocated the use of several components presented on the application. The Department will rework the application once they have the information.

Willamette Industries asked that application 5167 be removed from the agenda due to a scheduling conflict. This application has been on the EQC agenda several times.

Ms. Vandehey asked the Chair to verify if there was a representative from Wah Chang in the audience. With no representative present, Ms. Vandehey asked to remove applications 5276 and 5286.

Willamette Industries asked that application 5299 be removed from the agenda due to a scheduling conflict.

She asked to remove application 5373, Sanders Forest Products, Inc. and hold the application over until the applicant's two-year filing period passes to provide the applicant with an opportunity to bring the facility into compliance. Ms. Vandehey explained that should the Commission deny the application at this time, the applicant would not be able to seek a tax credit for the log yard should they come into compliance.

A motion was made by Commissioner Bennett to approve the tax credits found in attachment A with the exception of those applications that have been removed during the course of this meeting. Commissioner Van Vliet seconded the motion and it carried with five "yes" votes.

App.No.	Media	Applicant	Certified Cost	% Allocable	Value
5159	Water	Deschutes Brewery	$ 714,103	100%	$ 357,052
5162	Air	Ohka America, Inc.	$ 509,938	100%	$ 254,969
5163	Water	Ohka America, Inc.	$ 114,425	100%	$ 57,213
5195	Water	Sabroso Corporation	$ 65,854	100%	$ 32,927
5196	Noise	Sabroso Corporation	$ 4,208	100%	$ 2,104
5197	SW	Sabroso Corporation	$ 32,062	100%	$ 16,031
5198	Water	Sabroso Corporation	$ 37,557	100%	$ 18,778
5199	SW	Sabroso Corporation	$ 9,914	100%	$ 4,957
5297	Air	Synthetech, Inc.	$ 346,554	100%	$ 173,277
5331	Noise	Oregon Steel Mills, Inc.	$ 96,790	100%	$ 48,395

5353	Air	Schrock Cabinet Company	$ 68,912	100%	$ 34,456
5358	Air	Schrock Cabinet Company	$ 75,760	100%	$ 37,880
5363	SW	United Disposal Service, Inc.	$ 128,030	100%	$ 64,015
5384	Air	Ash Grove Cement Co.	$ 307,596	67%	$ 102,891
5386	Field Burning	Oregon Rootstock & Tree Co., Inc. dba TRECO	$ 148,842	100%	$ 74,421
5388	Air	Foster Auto Parts, Inc.	$ 1,754	100%	$ 877
5389	Air	U Pull It Tigard, Inc.	$ 1,754	100%	$ 877
5390	Air	Damascus U Pull It, Inc.	$ 1,754	100%	$ 877
5391	Air	U Pull It Salem Auto Wrecking, Inc.	$ 1,754	100%	$ 877
5392	Water	Damascus U Pull It Inc.	$ 7,295	100%	$ 3,648
5393	Water	U Pull It Tigard, Inc.	$ 8,804	100%	$ 4,402
5394	Water	Foster Auto Parts, Inc.	$ 10,513	100%	$ 5,257
5395	Water	Foster Auto Parts, Inc.	$ 45,823	100%	$ 22,912
5419	SW	Newberg Garbage Service, Inc.	$ 42,810	100%	$ 21,405
5420	SW	Newberg Garbage Service, Inc.	$ 30,000	100%	$ 15,000
5425	SW	Bend Garbage Company	$ 215,104	100%	$ 107,552
5429	SW	Newberg Garbage Service, Inc.	$ 14,918	100%	$ 7,459
5430	SW	Newberg Garbage Service, Inc.	$ 4,796	100%	$ 2,398
5441	Plastics	Denton Plastics, Inc.	$ 9,000	100%	$ 4,500
5450	SW	American West Leasing	$ 45,995	100%	$ 22,998
5456	Perc	Midway Cleaners, Inc.	$ 49,814	100%	$ 24,907
5459	USTs	Devon Oil Company, Inc	$ 99,099	90%	$ 44,595
5460	USTs	Devon Oil Company, Inc	$ 124,917	87%	$ 54,339
		Total	**$ 3,376,450**		**$1,624,243**

Ms. Vandehey presented certificates 3825, 3038, and 4000 for transfer.

A motion was made by Commissioner Van Vliet to approve the transfers. Commissioner Malarkey seconded the motion and it carried with five "yes" votes.

D. Informational Item: Update from the Department's Chemical Demilitarization Program

Wayne Thomas, Chemical Demilitarization Program Administrator, provided a brief update to the Commission on the current status of the Department's Chemical Demilitarization Program. Mr. Thomas discussed the Hazardous Waste Storage and Treatment Permit (HW Permit) for the Umatilla Chemical Agent Disposal Facility (UMCDF) that was issued in February 1997. As of September 25, 2000 the Department has received 95 permit modification requests (72 were designated as Class 1 modifications, 18 as Class 2 modifications, and 5 as Class 3 modifications). Class 3 permit modifications are the most significant modifications and require Commission approval. A summary was provided of the four Class 3 permit modification requests currently under consideration by the Department (one of the Class 3 modifications has already been approved by the Commission). It was requested the Commissioners consider whether they wanted to delegate decision-making authority to the Department for any of the Class 3 modifications (Storage of UMCDF secondary wastes in "J" Block, Secondary Waste Compliance Schedule, Incorporation of Air Emissions Standards, or Dunnage Incinerator and Associated Pollution Abatement System Improvements).

The rule-making process the Department has initiated to bring all of the stockpiled chemical weapons at the Umatilla Chemical Depot under regulatory authority was discussed. Following the public comment period, the draft rule will be presented to the Commission in March, 2001. Mr. Thomas discussed the Department's public outreach efforts, and made special mention of his appreciation for the assistance the Department has received from the U.S. Army's Public Outreach Office. A memorandum was distributed that included information on other Chemical Demilitarization subjects including the Inspection Program and Compliance Status, Secondary Wastes, Post Trial Burn Health Risk Assessment, and the requirement that the Army demonstrate compliance with permit emission standards "upstream" of each furnace's Pollution Abatement System Carbon Filter System (PFS).

E. Informational Item: Update on the May Incident at the Tooele Chemical Agent Disposal Facility (TOCDF) at Tooele, Utah

Timothy Thomas of the Army's Program Manager for Chemical Demilitarization and Loren Sharp of the Washington (Raytheon) Demilitarization Company gave the Commission a summary of the chemical agent release that occurred at the Tooele Chemical Agent Disposal Facility in May, 2000. Mr. Thomas discussed the investigations that were undertaken, the lessons learned, and how those lessons are being applied both at the Tooele facility and at other chemical demilitarization facilities, including UMCDF. The Commissioners asked several questions for clarification. Commissioner Reeve requested the Department return to the Commission at a future meeting and provide clarification and an affirmative statement on the Army's capabilities to review and implement the Programmatic Lessons Learned Program.

Staff Recognitions: Steve Greenwood and Kerri Nelson presented Mari, Belsky, Cheryll Hutchins, and Ruben Kretzschmar plaques for their years of service with the Department.

Public Comment: There was no general public comment.

F. Rule Adoption: Public Participation in Permit Process Rules

Susan Greco, Rules Coordinator, presented this rulemaking which creates a system of categories that would provide increased public participation depending on the anticipated level of public concern, potential environmental harm and legal requirements regarding the permit action. The lowest category will include those permit actions over which the Department has no discretion and which have no environmental impact. The highest category (Category IV) requires public participation earlier in the process on "major" permitting decisions by requiring the Department to hold a community involvement session in the community surrounding the site of the facility. This "open house" is in addition to the public hearing that occurs after a draft permit has been developed. The proposal adopts rules categorizing water quality and solid waste permit actions. The proposed rules also incorporate process requirements that used to be housed in Division 14. The air quality program will be doing the same as they redefine their permitting programs in late 2000 or early 2001. The category process will cover all permit applications received prior to the rule changes as best as practicable.

Ms. Greco pointed out two errors in the staff report. The first was on page 17 of Attachment A, 340-045-0060---change "public health or safety of the environment" to "public health, safety or the environment." The second is on page 31 of Attachment A, 340-071-0100(96)---add after the word "Department" the phase "or its agent." Commissioner Van Vliet made a motion to adopt the public participation in permit process rules with the above amendments. Commissioner Reeve seconded the motion and it carried with five "yes" votes.

G. Rule Adoption: Klamath Falls Carbon Monoxide (CO) Maintenance Plan

Andy Ginsburg, Air Quality Administrator, gave the Commission a brief summary of CO planning in the State. David Collier, Air Quality staff, summarized the key points for the proposed Klamath Falls CO Maintenance Plan, emphasizing the Plan will allow EPA to eliminate the oxygenated fuel requirement in Klamath Falls. Commissioner Malarkey inquired about the Klamath County adoption of an air quality ordinance. Staff clarified that a revision to the Klamath County Air Quality Ordinance, addressing particulate pollution, was initially part of the rulemaking package as a pollution prevention measure. However, prior to the public hearing the Klamath County Commissions decided they needed more time to review the proposed changes and the Klamath County ordinance was not part of the final CO plan rulemaking brought before the Commission. The advisory committee was unanimous in their recommendation to eliminate oxygenated fuels.

A motion was made by Commissioner Bennett to adopt the Klamath Falls Carbon Monoxide Maintenance Plan as a revision to the State Implementation Plan (SIP). Commissioner Van Vliet seconded the motion and it carried with five "yes" votes.

H. Rule Adoption: On-Board Diagnostic (OBII) Vehicle Emission Test Method

Andy Ginsburg, Air Quality Administrator, and Ted Kotsakis, Vehicle Inspection Program (VIP) Manager, presented this item. Mr. Kotsakis reviewed the history of VIP operations. DEQ has progressed to more sophisticated testing over the years beginning with a manual basic test, then to a computerized basic test, then to a BAR31 test, and currently asking the Commission to approved the new on-board diagnostic (OBD) test.

EPA has required auto manufacturers to install second generation OBD systems on vehicles beginning with the 1996 model year. For this OBD system the connectors under the vehicle dashboard are all the same, The OBD test provided more emissions reduction credit than our existing BAR31 test, and the duration of the OBD test is 3.5 minutes compare to the current 10 minute BAR31 test. The scheduled implementation date for OBD testing is December 1, 2000. Repair shops and fleets in the Portland area would receive training offered by the Department to introduce the new OBD test to the repair industry prior to the implementation date. The OBD download information would be printed out for the customer when the vehicle fails; so the information can be used by the repair technician to facilitate repairs.

Commissioner Bennett noted "on-board" was misspelled on the front page of the rule package. He also stated the name of the VIP's Medford station manager, Ted Wacker, was misspelled. Commissioner Bennett questioned why VIP was not considering using community college instructors for the OBD training. Staff responded that community college auto shop training has become manufacturer specific and was not appropriate for VIP's purpose; and VIP has in-house expertise. Commissioner Van Vliet asked about the cost of the OBD testing equipment. Staff stated the cost was about $2,500 per test lane compared to a market cost for the enhanced test of about $150,000 per test lane.

A motion was made by Commissioner Bennett to adopt the new rules and include the rules in the Clean Air Implementation Plan with the above corrections noted. It was seconded by Commissioner Van Vliet and carried with five "yes" votes.

I. Action Item: Possible Commission Action on the Petition Filed by NEDC et al. For Reconsideration of the Civil Penalty Assessed by the Department Against Smurfit News Print Corp.

Larry Knudsen, Commission legal counsel, reviewed the Petition for Reconsideration of the Department's Notice of Assessment of Civil Penalty Against Smurfit Newsprint Corporation filed by the Northwest Environmental Defense Center, Willamette Riverkeepers, Oregon State Public Interest Research Group, Oregon Chapter of the Sierra Club and the Oregon Environmental Council. Mr. Knudsen advised that penalty and penalty mitigation determinations had been delegated to the Director and the Commission's role was generally limited to review of contested case hearing orders. He also noted there was a significant legal question regarding whether such a determination was subject to review under ORS 183.484 and OAR 137-004-0080. He recommended the Commission find that the matter of reconsideration should be undertaken, if at all, by the Director and not the Commission.

Commissioner Van Vliet made a motion to delegate to the Director the review and action of this case. Commissioner Malarkey seconded the motion and it carried with five "yes" votes.

There being no oral public comment on agenda item J, the public comment period was closed.

J. Action Item: Standards, Criteria, Policy Directives and Hiring Procedures to be Used in Hiring the Director of the Department of Environmental Quality

Lydia Taylor, Deputy Director, presented this item. When reviewing the criteria, Commissioner Bennett indicated that in Attachment A, Standards section, Item 1, he would like it to read "a Bachelor of Science degree in an appropriate field of study from an accredited college or university." One additional letter of comment from Hells Canyon Preservation Council was received by the Commission but not received by the Department. It was reviewed and incorporated into the staff report with no changes made to the staff report.

Commissioner Malarkey made a motion to adopt the Standards, Criteria, Policy Directives and Hiring Procedures to be used in hiring the Director of DEQ including the amendment made by Commissioner Bennett. Commissioner Van Vliet seconded the motion and it carried with five "yes" votes.

Deputy Director Taylor then went over the hiring timelines with the Commission. It was decided that Chair Eden and Commissioner Van Vliet would form the search committee. They would review the applications and interview the first round of candidates. All applications would be mailed to the entire Commission for review. Questions to ask the interviewees will be drafted by the Department with Commission input. The final candidates will be interviewed by the entire Commission at DEQ headquarters on November 6, 2000. This will be in executive session.

At this time, the role of vice-chair was discussed. Commissioner Malarkey made a motion to elect Commissioner Van Vliet as vice-chair. It was seconded by Commissioner Reeve and carried with five "yes" votes.

K. Action Item: Appointment of an Interim Director

Commissioner Malarkey made a motion to appoint DEQ Deputy Director, Lydia Taylor, as Interim Director. This appointment would be in effect until a new director is hired, and would be with all benefits and salary of the position. The motion was seconded by Commissioner Van Vliet and carried with five "yes" votes.

L. Commissioners' Reports

Commissioners Bennett and Van Vliet commended Director Marsh on his tenure at DEQ. Commissioner Malarkey reported she had seen the Air Quality Division's presentation on upcoming rule revisions and complemented the staff on their interactions with the community. She also indicated that metropolitan Eugene had adopted a wetwater management plan. Chair Eden had attended the Governor's Executive Review Panel regarding the Umatilla Chemical Depot. The next meeting will be October 5, 2000.

M. Director's Report

The Portland Harbor Cleanup will be directed by a joint Environmental Protection Agency (EPA)/Department of Environmental Quality (DEQ) Project Team. DEQ will have lead technical and legal responsibility for the upland, or on-shore, contamination cleanup and for coordinating with EPA on upland contamination that may impact in-water contamination. DEQ will also ensure that ongoing efforts, such as the Combined Sewer Overflow project, Total Maximum Daily Load development and the Oregon Plan, are coordinated with the Superfund process so that potential conflicts are minimized wherever possible. EPA will have lead technical and legal responsibility for in-water (sediment) contamination. EPA and DEQ will work together on community outreach activities.

The Waste Policy Leadership Group (WPLG) is finalizing recommendations that include establishing a new statewide recovery goal, adopting new required wasteshed recovery rates, and developing new recovery programs and policies that would increase recycling statewide. The program recommendations under review would target key wastestreams such as construction/demolition debris, food waste, mixed waste paper, and scrap tires. In addition, the WPLG is examining extended product responsibility proposals for specific materials such as waste electronics, mercury-containing wastes, and scrap tires, as well as other waste prevention program and policy recommendations. The final recommendations may include changes to administrative rules, legislation, and DEQ Solid Waste program priorities and activities.

EPA launched its National Performance Track program on June 26, 2000. The program rewards top performing facilities, and is based largely on the Green Permits Program. Four Oregon facilities have applied to the National Environmental Achiever Track: Epson Portland, Inc., LSI Logic, Kinglsey Field (US Air Force), and Kerr-McGee. DEQ is working closely with EPA on this program. EPA was able to launch its program fairly quickly because we had tested these ideas in Oregon and they collaborated with states as they developed program elements. Because of this close coordination, our facilities are finding it easy to apply to both programs for added benefits.

DEQ was part of the "stewardship group" that first recommended, then helped initiate and guide, the production of The State of the Environment Report, released Sept. 1, 2000. The group agreed that new options for Oregon's environmental management should be based on sound science, but quickly recognized choices about selecting and reporting data were not value-neutral. The stewardship group turned over responsibility to independent scientists in Oregon's universities. This science panel chose to emphasize ecosystems and natural functions of the environment, and the interconnection of these systems, in a way that provides a fresh look at how we address environmental management. Each section of the report suggests indicators to be used in tracking trends in the environment. DEQ will now have the opportunity to engage in discussions with the scientists and the Oregon Progress Board regarding individual recommendations.

Over the past several months, the Willamette Restoration Initiative (WRI) has developed a detailed draft workplan with specific action items and timelines. Paul Risser, President of Oregon State University and WRI Chair, prepared the Draft Overview, a policy-level document that outlines an overall conservation strategy for the basin. Recommended actions deal with clean water, water quantity, habitat, hydropower processes, and institutional and policy actions needed to support restoration strategy. The Draft Overview specifies stewardship objectives; identifies indicators and benchmarks for how we'll know if we are successful (from State of Environment Report); and identifies WRI's current and future roles. The WRI Board will be meeting all day on October 26 for its final review of the Willamette Restoration Initiative Strategy.

On August 15th, EPA released the first phase of the National Air Toxics Assessment (NATA). Toxic air pollutants are chemicals known or suspected to cause serious health problems such as cancer and birth defects. The NATA estimated there are 16 toxic air pollutants in Oregon above levels believed to be safe, and every county in the state has some toxic air pollutants above these levels. This confirms the need for the Oregon air toxics program recommended by DEQ's advisory committee known as the Hazardous Air Pollutant Consensus Group. The group recommended DEQ form a scientific advisory panel to help provide and evaluate more detailed information about toxics in local areas, and then work with communities to design plans to reduce health risks from air toxics. The Air Quality Division expects to propose rules to implement this program in about a year.

Gary Messer, Water Quality Manager for Western Region, and Barbara Burton, updated the Commission on Oregon Metallurgical Corporation (Oremet) Water Quality Permit. Oremet is located in Albany, produces Titanium and has storm and process wastewater discharges of up to 1.9 million gallons/day. After treatment this wastewater is discharged to a 5 acre wetland area adjacent to Oak Creek, and the seepage from this wetland area discharges to Oak Creek. From about mid-July until the start of seasonal rains in the fall, Oak Creek has no flow upstream of the Oremet facility, but the Oremet discharges maintain a flow in Oak Creek that supports aquatic life and wetland habitats year round from their facility for a distance of about 2 miles downstream to where Oak Creek enters the Calapooia River.

When the Oremet WQ permit was issued in 1991, an environmental organization successfully filed suit against DEQ for issuing a permit which violated the Department's mixing zone rules, in that our rules do not allow a discharge to take up more than 50% of the receiving stream's width. In response, the Department, working in cooperation with environmental groups, developed new mixing zone rules (OAR 340-041-0445(4)(g)) that allows for extended mixing zones where it is demonstrated the discharge creates an overall environmental benefit. In the Oremet renewal permit, the Department found that Oremet's discharge did provide an overall environmental benefit and established an extended mixing zone to be Oak Creek to its point of discharge into the Calapooia River and 375 feet downstream.

At the public hearing on August 29, 2000, 49 people were in attendance and 13 comments were entered into the record, all in support of the permit. On the last day of the Public Comment period (Sept 22), 3 environmental organizations submitted lengthy written comments in opposition to the Department issuing an extended mixing zone. The way the current rules are written, either the Department <u>or</u> the EQC can grant the extended mixing zone and permit. As soon as the Department reviews and responds to all the written comments submitted, we will determine if the Department should proceed with permit issuance, or if the matter should be brought before the EQC to make the final determination.

Bob Baumgartner, Water Quality Manager at Northwest Region, briefed the Commission on the Blue Heron permit that is currently open for public comment.

There being no further business, the meeting was adjourned at 3:15 p.m.