

Klamath Falls PM_{2.5} Attainment Plan Appendix 16 Klamath Air Quality Advisory Committee (KAQAC) Report

Submitted to: EPA

December 2013



State of Oregon
Department of
Environmental
Quality

Air Quality Division
811 SW 6th Avenue
Portland, OR 97204
Phone: (503) 229-5696
(800) 452-4011
Fax: (503) 229-6762
Contact: Rachel Sakata
Larry Calkins
www.oregon.gov/DEQ

DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

Klamath Air Quality Advisory Committee Report

Recommendations for the Klamath Falls PM_{2.5} Attainment Plan

Table of Contents

Executive Summary	3
Chapter 1: Background.....	3
1.1 Overview	4
1.2 National Air Quality Standard for PM _{2.5}	4
1.3 Klamath Falls Air Quality Advisory Committee	6
1.3.1 Purpose.....	6
1.3.2 Advisory Committee Members.....	6
1.3.3 Scope.....	6
1.3.4 Public Involvement	7
1.3.5 Timeline/Deadlines	7
1.4 History of Success Addressing PM in Klamath Falls	8
1.4.1 1987 PM ₁₀ Standard.....	9
1.4.2 1997 PM _{2.5} Standard.....	10
1.4.3 2006 Revised PM _{2.5} Standard.....	10
Chapter 2: Description of Problem	10
2.1 Klamath Falls PM _{2.5} Nonattainment Area Boundary	10
2.2 PM _{2.5} Monitoring Data	12
2.3 Emissions Inventory Description	16
2.3.1 Overview.....	16
2.3.2 What Sources of Emissions are Included?.....	16
2.3.3 24-hour Daily Emissions versus Annual Emissions	18
2.3.4 What pollutants contribute to PM _{2.5} concentrations?.....	18
2.3.5 How Are 2014 Emissions Estimated?.....	18
2.4 Emissions Inventory 2008.....	19
2.5 Projected 2014 Emissions	20
2.5.1 Overview.....	20
2.5.2 Growth	20
2.5.3 Emission Reductions from Existing Strategies Implemented 2009 through 2014	21
2.5.4 2014 Emissions Inventory Results.....	22
2.6 Projected 2037 Transportation Emissions.....	23

Chapter 3: Recommended Strategies	24
3.1 Criteria for Selection of Strategies	24
3.2 Recommended Strategies	24
3.2.1 Initial Strategies for 2012 Implementation	25
3.3 Attainment Demonstration	31
3.4 Recommended Contingency Measures	32
3.5 Likely Effect of Recommended Strategies on Local Jobs and Economy	34
Chapter 4: Next Steps	34
5. Signature of Chair	35

Table of Figures

Figure 1: Comparative Size of PM _{2.5} Particles.....	5
Figure 2: Klamath Falls PM _{2.5} Attainment Plan Timeline	8
Figure 3: History of Particulate Matter in Klamath Falls	9
Figure 4: Klamath Falls PM _{2.5} Nonattainment Area	12
Figure 5: Klamath Falls 24-hour Daily Particulate Matter Trend.....	13
Figure 6: Klamath Falls Most Recent Four Years of PM _{2.5} Data.....	14
Figure 7: Klamath Falls Particulate Matter Trend (Annual).....	15
Figure 8: Types of PM _{2.5} Estimated Emission Sources Included in Emissions Inventory	18
Figure 9: Source Characterization of 24-hour PM _{2.5} Worst Case Day Estimate in Lbs per Day (2008 Data).....	20
Figure 10: Source Characterization of 24-hour PM _{2.5} Worst Case Day Estimate in Lbs per Day (2014 Data).....	23

Table of Tables

Table 1: Growth Rates Used in Calculating 2014 Emissions	21
Table 2 Klamath Falls Woodstove Changeouts.....	22

Executive Summary

Klamath Falls has a lengthy history of identifying and successfully working to solve problems with particulate air pollution. In the late 1980s Klamath Falls had particulate pollution that violated federal standards by more than five times. By January 1991 the community's particulate reduction strategies achieved federal standards, and the area was designated as "in attainment" in 2003. With a greater understanding of the health effects of particulates, the federal U.S. Environmental Protection Agency (EPA) revised the standard to lower more protective levels. As a result, Klamath Falls area was again in violation of the federal 24-hour particulate standard (PM 2.5) in 2009. The Oregon Department of Environmental Quality (DEQ), along with representatives of the Klamath Falls community and local government must now develop a new plan to meet the more stringent air quality standard and further reduce emissions. The federal deadline to meet the PM 2.5 standard in Klamath Falls is December 31, 2014.

DEQ, in collaboration with Klamath County, convened the Klamath Air Quality Advisory Committee to help develop and recommend strategies to bring Klamath Falls back into attainment with the federal 24-hour daily PM_{2.5} standard. For over a year the committee met to consider data, community values, and pollution reduction strategies with the highest chance of success in meeting the PM 2.5 standard. The result is a thoroughly considered group of primary emission reduction recommendations and a set of secondary contingency measures and minority opinions to be implemented in the event that the December 2014 deadline is not met. These recommendations form the groundwork for the Board of Klamath County Commissioners to include emission reduction measures in ordinances and DEQ to produce an attainment plan for EPA approval.

In addition to addressing concerns about public health, there are strong economic incentives for Klamath Falls to return to attainment with the federal particulate standard. While in violation of the PM 2.5 standard, the community is subject to more stringent industrial growth rules, the possibility of restrictions on federal transportation funding and impediments to local economic growth in some industrial sectors.

The largest source of particulate in Klamath Falls is residential wood burning, and this category is the primary focus of the committee recommendations. While it is difficult to manage multiple and dispersed emission sources from residences, both local government and DEQ have extensive experience reducing particulate through wood burning curtailment programs. The recommendations will enhance the existing woodstove curtailment and public awareness programs, increase open burning controls, and allow for new and expanded industrial emissions by allowing emission offsets from wood burning appliances. Previous community experience and DEQ's scientific analysis both support the expectation that Klamath Falls will meet the PM 2.5 standard by December 2014.

Chapter 1: Background

This chapter describes:

1. An overview of federal particulate standards
2. The purpose, scope and membership of the advisory committee
3. Next steps and timelines
4. The history of particulate standards and status of Klamath Falls

1.1 Overview

The federal U.S. Environmental Protection Agency establishes health standards for specific air pollutants - carbon monoxide, ozone, particulate matter, sulfur dioxide, nitrogen dioxide, and lead. EPA revised the National Ambient Air Quality Standards for fine particulate matter in 2006. Klamath Falls failed to meet the federal 2006 twenty-four hour fine particulate standard also known as the PM_{2.5} standard. In response to this failure to meet the standard, in December 2009, the EPA designated Klamath Falls, Oregon as a nonattainment area for PM_{2.5}, also known as fine particulate air pollution. The Oregon Department of Environmental Quality must develop a plan specifying how, through particulate reductions, Klamath Falls will attain the federal standard by 2014. DEQ, in collaboration with Klamath County, convened the Klamath Air Quality Advisory Committee (KAQAC) to help develop and recommend strategies to bring Klamath Falls back into attainment with the federal 24-hour PM_{2.5} standard. The committee has recommended strategies to the Board of Klamath County Commissioners for inclusion in their ordinances and to DEQ for incorporation in an attainment plan. Using these recommendations and its own technical analysis, DEQ will propose rules and develop an attainment plan for consideration by the Oregon Environmental Quality Commission¹ and subsequently, EPA.

The Klamath Air Quality Advisory Committee (KAQAC) met during 2011 and 2012 and deliberated on how to improve air quality in the Klamath Basin. The KAQAC identified air quality strategies to bring Klamath Falls into attainment with the PM_{2.5} standard. This report outlines those strategies and categorizes them into recommendations for immediate implementation and contingency strategies that would be implemented in 2015 should Klamath Falls nonattainment area not meet the December 2014 federal deadline for attainment.

Failure to attain the standard by December 2014 will result in the continuation of strict regulations on new and expanding industrial sources attempting to locate within the Klamath Falls nonattainment area and could cause funding consequences for proposed federally funded transportation projects. In addition, the contingency measures would be automatically be instituted, leading to further restrictions on many sources of PM_{2.5} emissions.

The purpose of this document is to recommend emission reduction strategies to DEQ and Klamath County for the PM_{2.5} Attainment Plan.

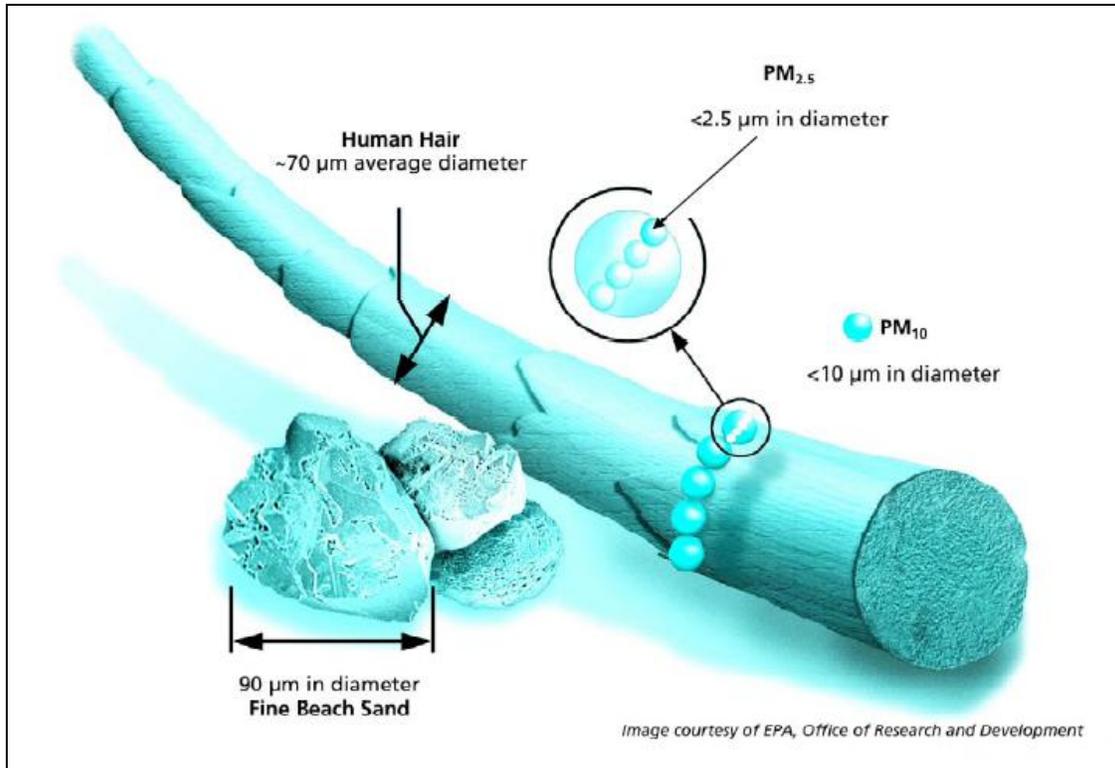
1.2 National Air Quality Standard for PM_{2.5}

Particulate matter is a mixture of very small droplets of smoke, soot, and dust. Particulates less than 2.5 micrometers (µm) in diameter are referred to as fine particulate, and when inhaled, can lodge deep in the human lungs and can cause heart or respiratory ailments especially in the young, the elderly and those with respiratory or circulatory problems. Sources of fine particulate matter include fuel burning equipment (including wood stoves), agricultural burning, automobiles and some dust related sources.

The particles in PM 2.5 pollution are extremely small. The average human hair is about 70 micrometers in diameter, making it 30 times larger than the largest fine particle. Figure 1 illustrates the size of a PM_{2.5} particle compared to beach sand and a human hair.

¹ The Environmental Quality Commission is a five-member citizen panel appointed by the governor to four-year terms, serving as Department of Environmental Quality's (DEQ) policy and rulemaking board.

Figure 1: Comparative Size of PM_{2.5} Particles



For PM_{2.5}, EPA sets two “forms of the standard”. There is a 24-hour (daily) standard and an annual standard. The 24-hour daily standard addresses short-term events such as emissions from residential wood combustion. The annual standard addresses long-term events. Emissions associated with this are generally from residential wood combustion, and vehicle and industrial emissions, where sources of particulate matter are constantly contributing emissions into the atmosphere. Together, these two forms of the standard protect against all particulate health effects.

Monitoring data show that Klamath Falls meets the annual PM_{2.5} standard, but fails to meet the 24-hour PM_{2.5} standard.

According to EPA, effects associated with short-term exposure to higher levels of fine PM_{2.5} include:

- Premature death in people with heart and lung disease
- Non-fatal heart attacks
- Increased hospital admissions, emergency room visits and doctor’s visits for respiratory diseases
- Increased hospital admission and emergency room visits for cardiovascular diseases
- Increased respiratory symptoms such as coughing, wheezing and shortness of breath
- Lung function changes, especially in children and people with lung diseases such as asthma
- Changes in heart rate variability
- Irregular heartbeat
- Changes in subtle indicators of cardiovascular health

1.3 Klamath Falls Air Quality Advisory Committee

1.3.1 Purpose

DEQ and Klamath County convened an advisory committee that represents different perspectives in the Klamath Falls area. The Advisory Committee was charged with investigating the contribution and need for emission reductions from all emission source categories, including residential wood heating, residential open burning, motor vehicles, major industry, and other sources. The Committee met 13 times over the course of about a year, approximately once a month from March 2011 through February 2012. DEQ and the County provided technical information and assistance to the committee.

The purpose of the committee was to devise actions, strategies, ideas, rules, incentives and other mechanisms to reduce air pollution in Klamath Falls. Strategies were developed to reduce PM_{2.5} emissions and bring Klamath Falls into attainment by the Clean Air Act deadline of 2014. The committee also recognized the County's 2007 revision of its Clean Air Ordinance in response to the more protective 2006 PM_{2.5} standard. These revisions included a Heat Smart strategy to increase the numbers of clean burning woodstoves and a new 30 µg/m³ threshold for the mandatory curtailment program. These strategies are designed to keep the Klamath Falls area in compliance beyond 2014, and were weighed by the committee to determine their effectiveness in pollution reduction. The group recommended additional strategies to DEQ for inclusion in the Klamath Falls PM_{2.5} Attainment Plan. Additional, contingency measures were also identified that will automatically be undertaken if Klamath Falls does not reach attainment by December 2014, or if it violates the standard in the future. The strategies, when implemented, will improve air quality enough for Klamath Falls to meet the federal air quality standard for PM_{2.5}.

This report is presented to DEQ and the Klamath County Board of Commissioners providing recommended strategies to bring Klamath Falls into attainment.

1.3.2 Advisory Committee Members

Name	Affiliation
Jeff Ball – <i>Advisory Committee chair</i>	Retired, former Klamath Falls City Manager
Kenneth Paul, <i>vice chair</i>	Retired, former US Forest Service
John Elliott	Private citizen, former Klamath County Commissioner
Scott Rice	Deputy Fire Marshal, Klamath County Fire District #1
Edward Fenner	Private citizen
Charles Massie	Klamath County Chamber of Commerce
Kirk Oakes	Private citizen
Ann McGill	Private citizen
Dwayne Arino	Private citizen, environmental engineer
Jim Gillam	Editor, The Chimney Sweep News
Michael Broughton	US Fish and Wildlife, smoke management specialist
Wendy Warren	Physician
Delbert Bell (ex officio)	Environmental Health Manager, Klamath County Health

1.3.3 Scope

The advisory committee focused the scope of its discussion on particulate reduction strategies for sources affecting the air quality problem within the Klamath Falls attainment area. Discussions concerned strategy development, not technical applications. A separate local technical group, called the Klamath Air Quality Science and Technical Committee, was established to review the technical applications DEQ uses to measure emissions and establish its technical approach.

1.3.4 Public Involvement

On behalf of the committee, DEQ provided public notice to the media and acted as point of contact for the general public. All meetings were open to the public and had a limited time set aside each meeting for the public to speak. All meeting summaries, agendas, materials, meeting times and locations were posted on the DEQ web site for public access. The last four meetings were broadcast on public access television. Citizens were also encouraged to comment to the committee through the following channels:

- Website: www.deq.state.or.us/aq/planning/kfallsCommittee.htm
- Mail: Send letters to 811 SW Sixth Ave, Portland, OR 97204
- Phone: Call DEQ at 1-800-452-4011.

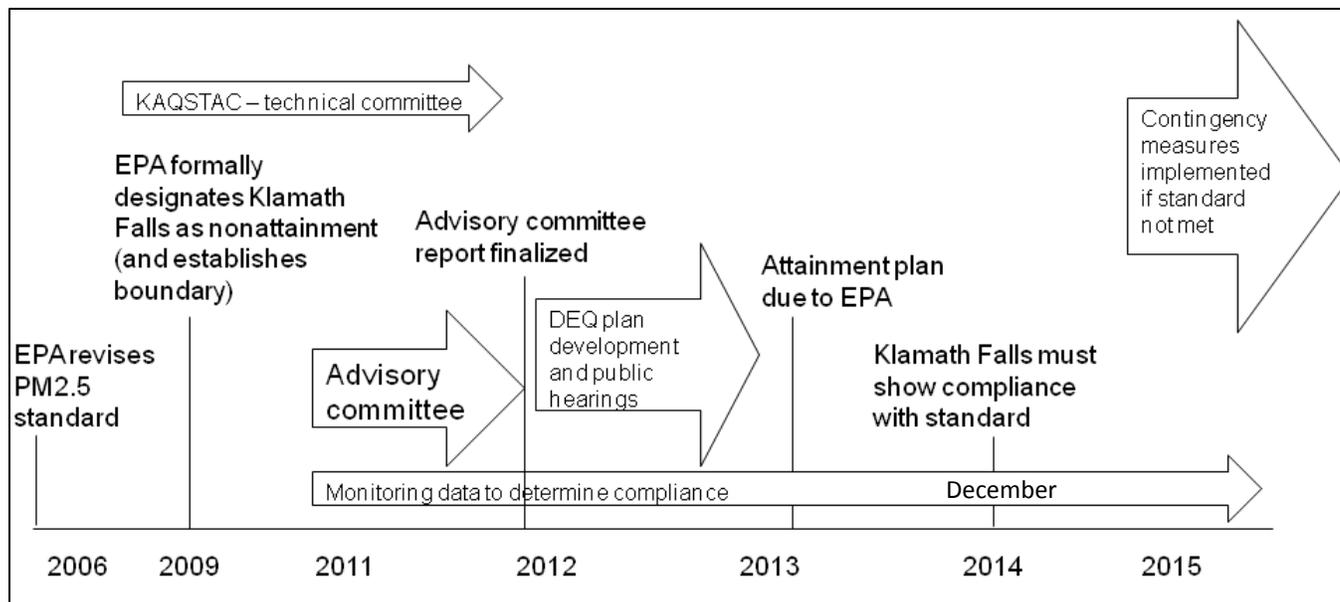
All public comments were compiled by DEQ and discussed with the committee. The comments are also compiled and included as Appendix A6 in the Advisory Committee's final report. The committee considered, but did not necessarily respond to input.

1.3.5 Timeline/Deadlines

After the advisory committee work concludes, DEQ will use committee recommendations and the County Ordinance to develop an attainment plan in collaboration with Klamath County and others as needed. The attainment plan must contain local and state rules which will bring Klamath Falls into attainment with the 24-hour daily PM_{2.5} standard by December 2014. DEQ will initiate rulemaking to implement emission reduction strategies, and as part of the rulemaking process, will hold public hearings in mid 2012. DEQ plans to bring the attainment plan to the Environmental Quality Commission in December 2012 for approval. The attainment plan is due to EPA on December 14, 2012, although DEQ plans to submit it to EPA in January 2013 because of current administrative rule adoption timelines. Figure 2 shows the attainment plan timeline.

If Klamath Falls does not meet the standard in December 2014, contingency measures will be implemented to bring the area into attainment. The advisory committee has recommended contingency measures in section 3.4 of this report.

Figure 2: Klamath Falls PM_{2.5} Attainment Plan Timeline



1.4 History of Success Addressing PM in Klamath Falls

Citizens in Klamath Falls and Klamath County have had a history of addressing particulate matter, and have met the challenge of improving their air quality on several occasions. In the past, EPA has had two other standards related to particulate matter: total suspended particulate and PM₁₀. Originally, EPA regulated total suspended particulate matter which was a category of relatively large particulate matter. PM₁₀, a subset of total suspended particulate, is officially known as “coarse” particulate matter. The expansion of natural gas in Klamath Falls has provided an alternative source of heat to wood burning. For historical perspective, Figure 3 is a graph showing air quality in Klamath Falls since DEQ began monitoring particulate matter in the area.

Figure 3: History of Particulate Matter in Klamath Falls

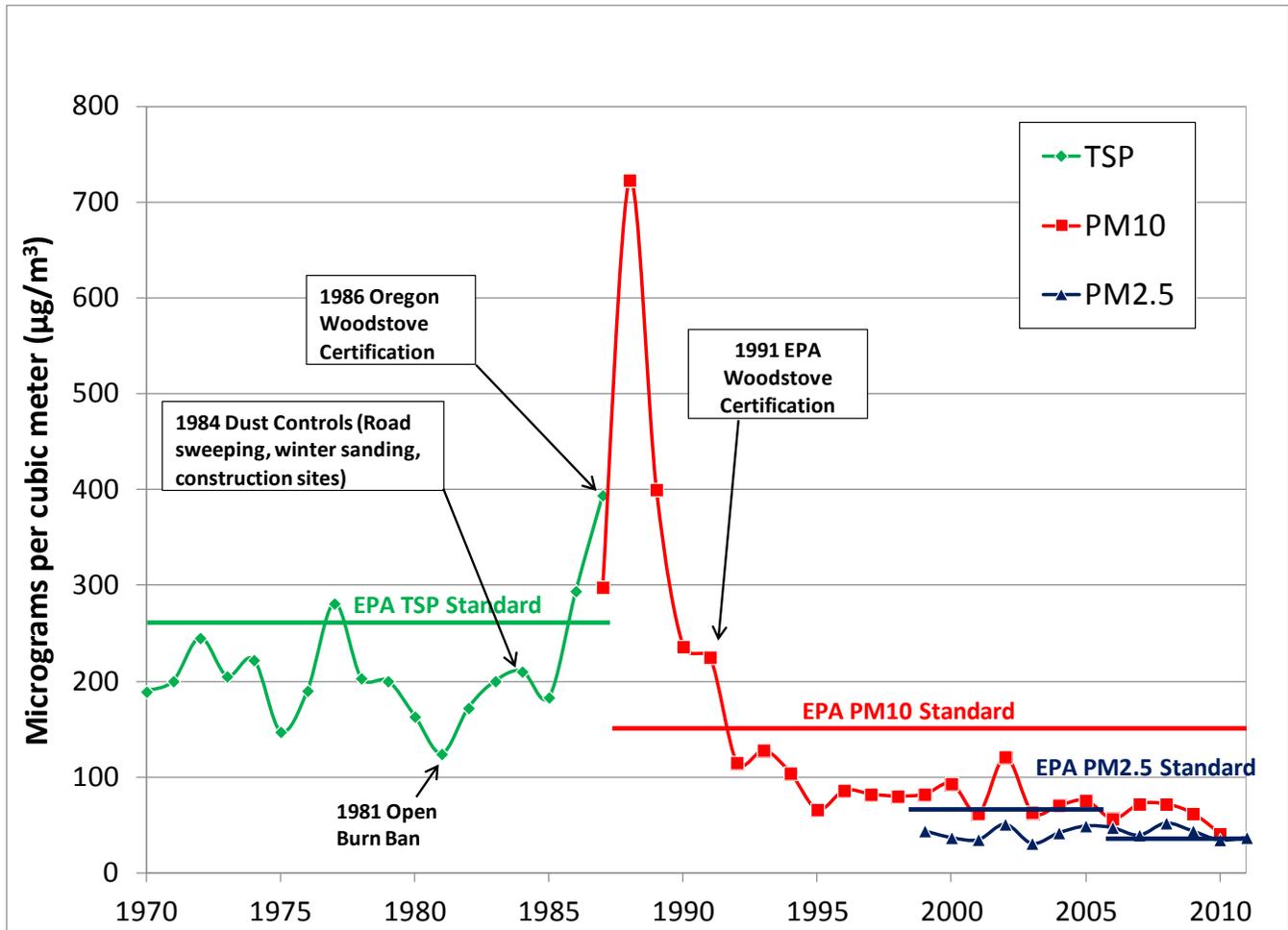


Figure Note: (µg/m³) = micrograms per cubic meter.

1.4.1 1987 PM₁₀ Standard

The green lines in Figure 13 show monitoring results and the value for the first federal standard for total suspended particulate (TSP). As more information became available, EPA finalized PM₁₀ standards in 1987, with a 24-hour daily standard of 150 micrograms per cubic meter (µg/m³), and an annual standard of 50 µg/m³. Klamath Falls was designated as nonattainment for PM₁₀ in 1987. The red lines in Figure 3 show second highest day monitoring results as required for evaluation against the 1987 PM₁₀ standard. The peak value in 1988 resulted from both the switch to a more protective standard and the relocation of the monitor from the downtown fire station to the Peterson School where values were much higher.

An advisory committee convened to develop strategies that included woodstove curtailment, uncertified stove replacement, new road dust controls, and fugitive dust controls. As a result, Klamath Falls met the PM₁₀ standard by 1994, and has continued to meet the standard since then. DEQ convened another advisory committee to develop a maintenance plan and submitted this plan to EPA in 2002. EPA redesignated Klamath Falls as attainment in 2004.

1.4.2 1997 PM_{2.5} Standard

In 1997, EPA tightened the standard by recognizing that the PM_{2.5} particle size was of concern. The 24-hour daily standard was set at 65 µg/m³, and the blue lines on Figure 3 show the monitoring results and standard for PM_{2.5}. Klamath Falls did not violate the 1997 PM_{2.5} standards due to previous successful emission reduction efforts.

1.4.3 2006 Revised PM_{2.5} Standard

In 2006, EPA reviewed hundreds of additional studies and recent health effects information, and determined the standard needed to be lowered to adequately protect public health. The 24-hour daily standard is now 35 µg/m³. The blue line in Figure 3 shows 98th percentile values, all of which are above the current standard.

Unhealthy accumulation of PM_{2.5} continues to be a wintertime occurrence in the Klamath Falls basin due to cold air inversions trapping emissions near the ground. The predominant source of particulate in Klamath Falls in the winter still is residential wood heating. Other sources of PM_{2.5} emissions include fuel oil use, large and small industry, vehicle tailpipe emissions and road dust, forest and agricultural fires, as well as open burning and other fuel combustion sources. Chapter 2 of this report contains detailed information on sources of PM_{2.5} within the Klamath Falls nonattainment area.

Chapter 2: Description of Problem

This chapter describes:

1. The Klamath Falls Nonattainment Area Boundary.
2. Monitoring data for PM_{2.5} in the Klamath Falls area and how results are evaluated against the standards.
3. The emissions inventory that was conducted for Klamath Falls.
4. The sources of PM_{2.5} in the 2008 base year for the worst case day.
5. Projected worst case day PM_{2.5} emissions in 2014 (when Klamath Falls must meet the 24-hour daily PM_{2.5} standard) based on increases in emissions due to growth and decreases in emissions due to local, state, and federal emission control measures.

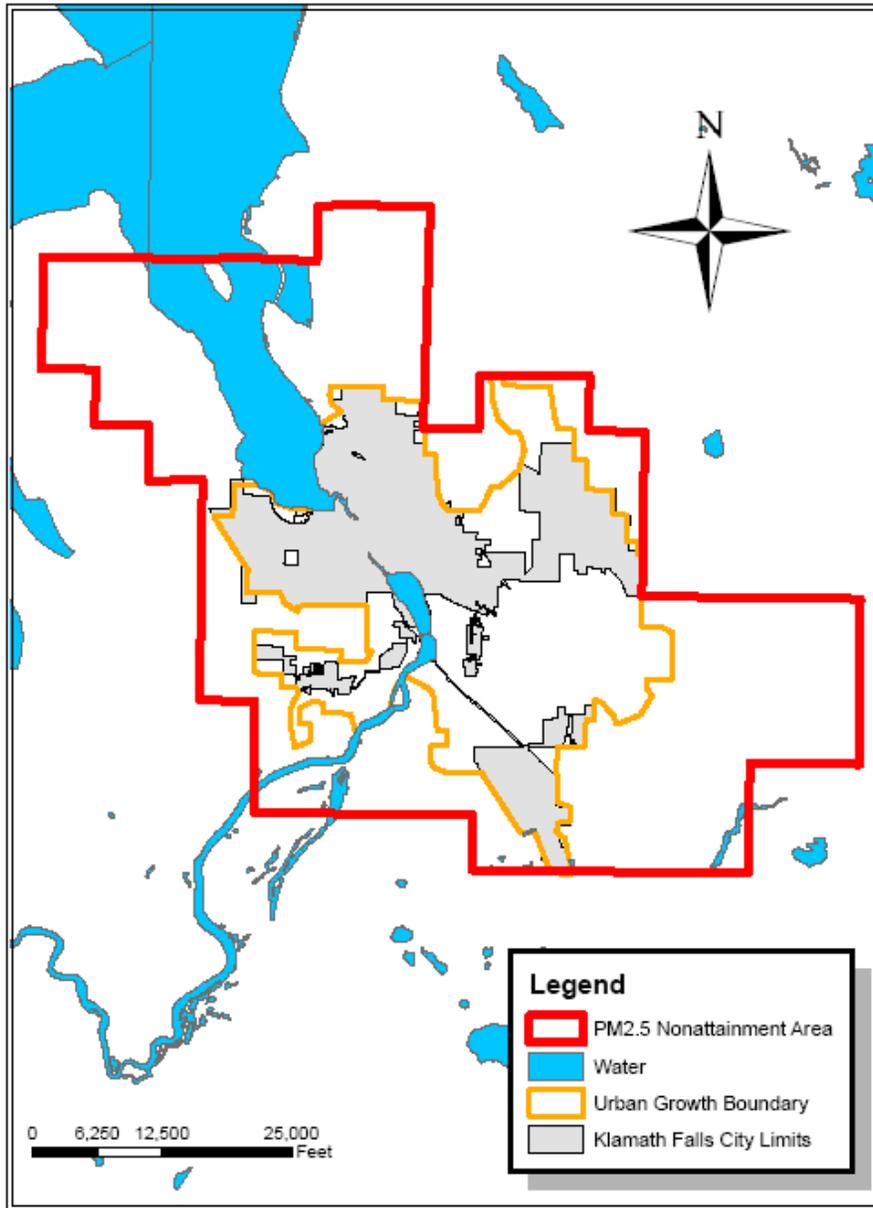
2.1 Klamath Falls PM_{2.5} Nonattainment Area Boundary

In setting the nonattainment area boundary, EPA considered emissions data, air quality monitoring data, meteorology data, Oregon's unique land-use laws, population density and growth estimates, traffic and commuting patterns, and the geography and topography of Klamath County. The nonattainment area boundary includes the sources that contribute to violations of the standard and potential sources that could contribute to violations at the monitor. Exceedances usually occur at night during winter cold air inversions with wind speeds below three miles per hour. A cold air inversion occurs when the sun goes down, the earth cools, and a layer of cooler air is trapped at the surface. During these inversions, there is little or no transport of wood combustion related smoke into or out of the area. Other potential outside sources, such as the small, southern communities of Keno and Merrill are located about 12 miles and 20 miles from Peterson School monitor respectively. They are separated by hills, topography or distance to prevent the buildup and transport of emissions. For this reason, these small communities are not

included within the nonattainment area boundary.

Figure 4 illustrates the PM_{2.5} nonattainment area boundary, which includes existing residential areas and industrial sources. It goes beyond the urban growth boundary to the east to include existing residential subdivisions. The boundary continues south to include the airport (Kingsley Field). Continuing southeast, the boundary includes four major industrial sources (Collins Forest Products, Columbia Plywood, the Peaker Facility and the Klamath Co-Generation facility). The delineation of the PM_{2.5} nonattainment area boundary also considered potential future impacts to the Klamath Falls area, and extends north and east of the urban growth boundary to include a destination resort along Klamath Lake and proposed residential subdivisions and to account for future recreational and residential growth.

Figure 4: Klamath Falls PM_{2.5} Nonattainment Area



Klamath Falls Nonattainment Area Boundary Set by EPA on December 18, 2008
Klamath Falls Urban Growth Boundary and City Limits based on Oregon's Land Use Planning Laws.

2.2 PM_{2.5} Monitoring Data

Klamath Falls has one PM_{2.5} monitor located at the Peterson School, which has the highest particulate levels in the area. DEQ has conducted several saturation surveys where PM_{2.5} monitors have been placed throughout the community to determine that the Peterson School is the most representative of high concentration locations suitable for monitoring violations of the particulate standard. Addressing violations of the standard at the Peterson School monitor will ensure compliance at other locations in the Klamath Falls area.

Exceedances occur when particulate levels are monitored above the standard. Violations consist of one or more exceedances of the standard. For PM₁₀, a violation occurs when there is more than one day above 150 ug/m³ over a three year period. For the PM_{2.5} 24 hour standard, a violation occurs when the three year average of the 98th percentile values exceeds 35 ug/m³. The Klamath Falls area has been in violation of the 2006 revised three year average of the 24 hour daily standard every year since 2006 and has exceeded the standard all but one year. Like Figure 3, Figure 5: Klamath Falls 24-hour Daily Particulate Matter Trend shows the daily particulate matter trends using levels specified by the standards (2nd highest day for PM₁₀, 98th percentile days for PM_{2.5}). The year 2008 is a baseline measurement year for the current PM_{2.5} because it is a year when DEQ had gathered monitoring data sufficient for EPA to make the determination of nonattainment.

Figure 5: Klamath Falls 24-hour Daily Particulate Matter Trend

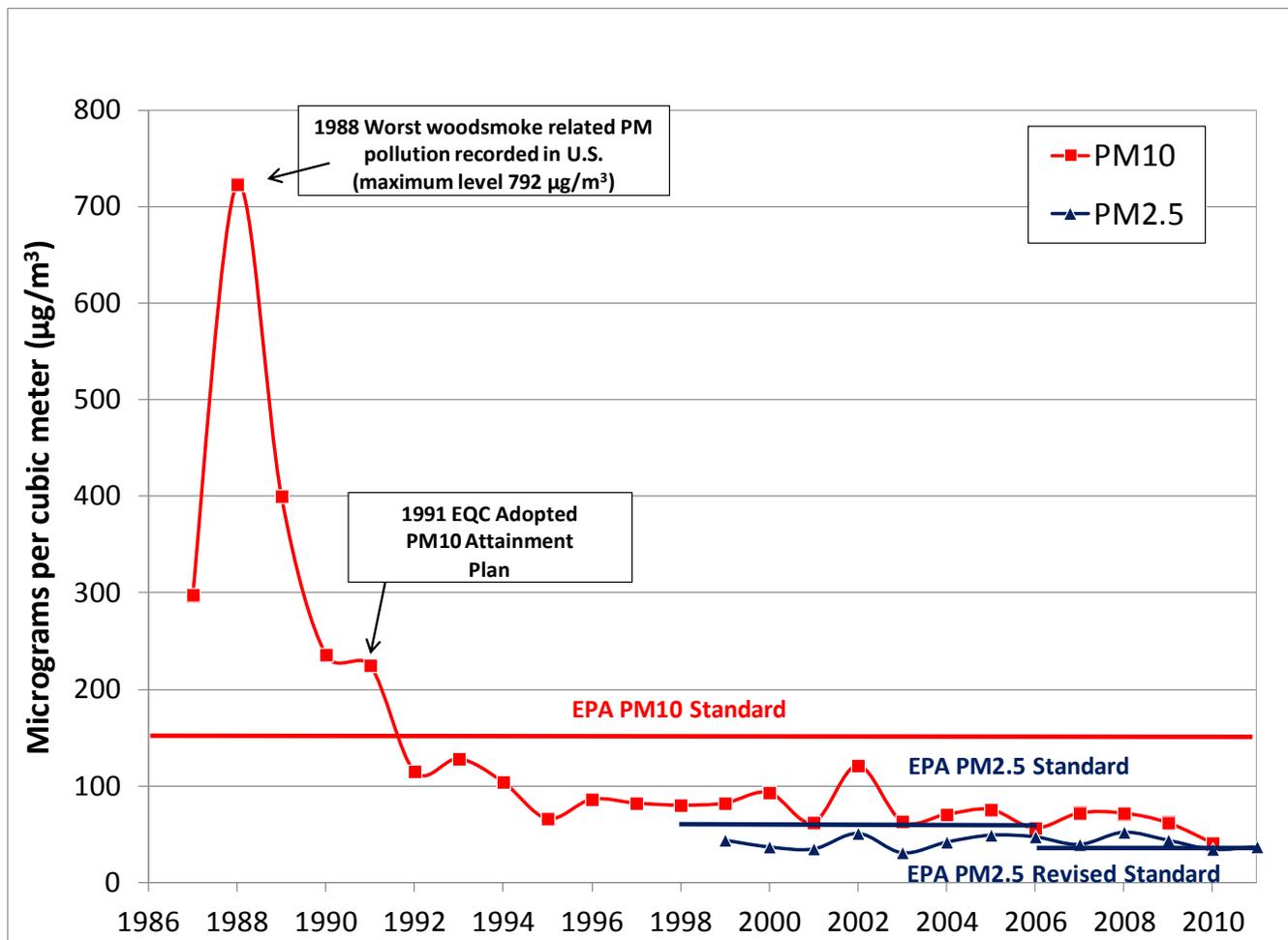
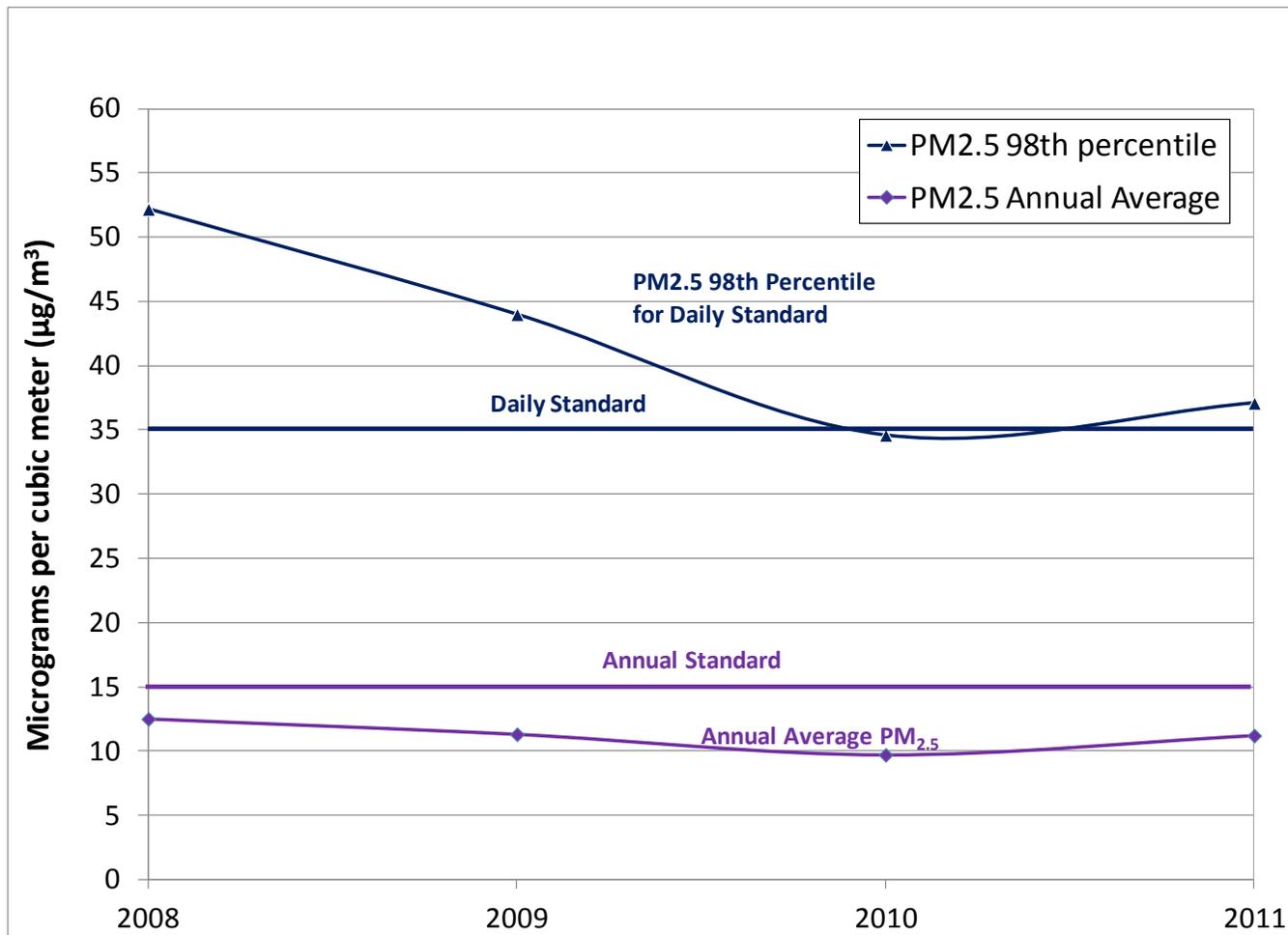


Figure 6 illustrates the most recent four years of 24-hour PM_{2.5} monitoring data at the Peterson School as compared to the 24-hour daily standard. In 2010 there was no exceedance of the 24 hour pm 2.5 standard, but levels were again above the standard in 2011.

Figure 6: Klamath Falls Most Recent Four Years of PM_{2.5} Data



As illustrated by Figure 7, the Klamath Falls area has not violated the PM_{2.5} annual standard since 1990, even with the lower more protective standard of 15 µg/m³.

Figure 7: Klamath Falls Particulate Matter Trend (Annual)

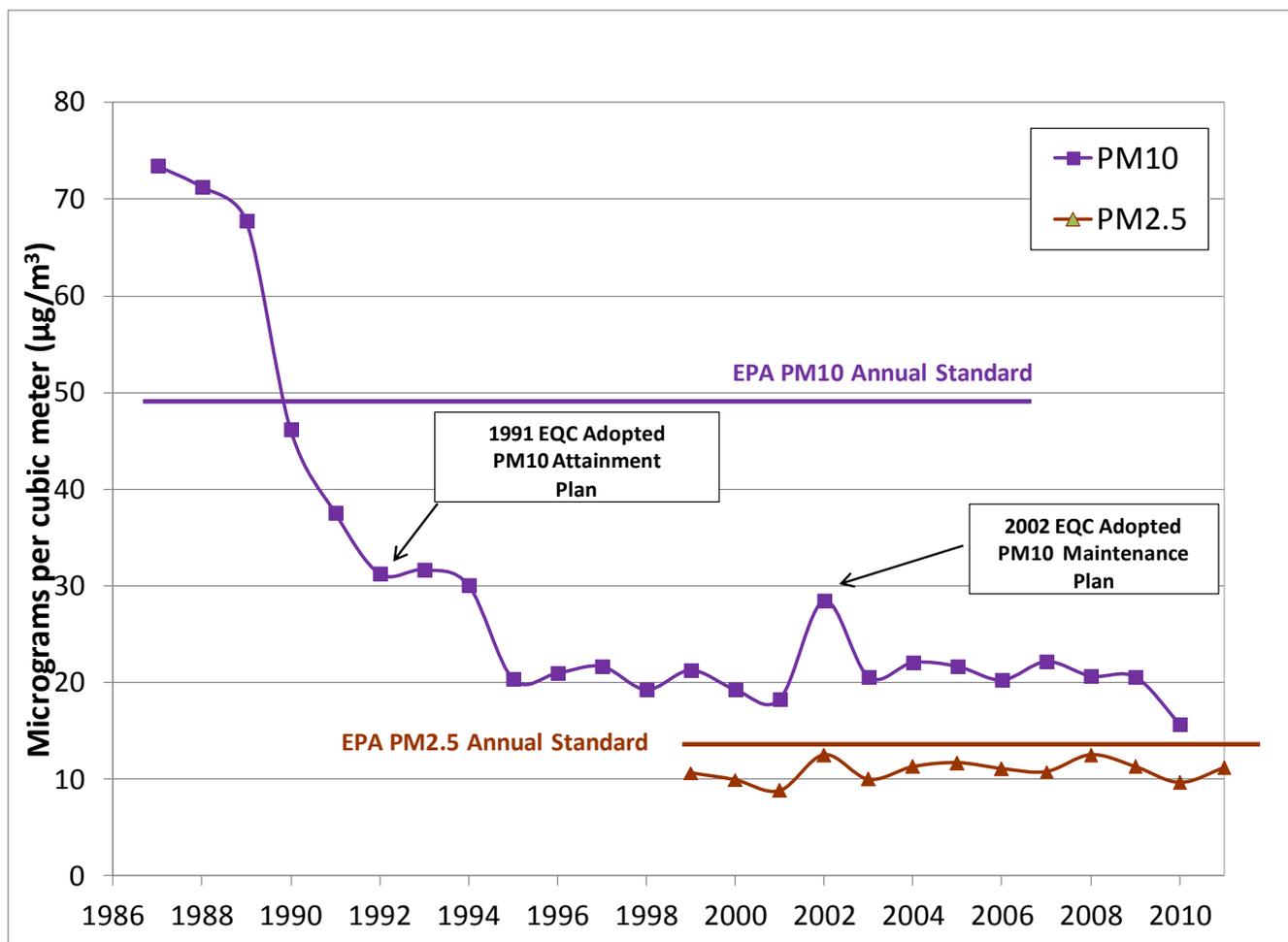


Table 1 illustrates the 24 hour and annual monitored PM_{2.5} levels for the years 2005 through 2011. The table includes three-year rolling averages. These are the values that attainment or nonattainment determinations are based on. As the data show, the rolling averages of Klamath Falls monitored 24-hour PM_{2.5} levels between 2007 and 2011 are all above the standard of 35 µg/m³. Table 1 also shows that rolling averages for monitored annual PM_{2.5} levels during these years met the standard of 15 µg/m³.

Table 1: Klamath Falls Monitored PM_{2.5} Levels

	Monitored 24 hour concentration (µg/m ³)	Rolling average 24 hour concentrations (24 hr PM _{2.5} standard = 35 µg/m ³)	Monitored annual average concentrations (µg/m ³)	Rolling average annual concentrations (Annual PM _{2.5} standard = 15 µg/m ³)
2005	49		11.7	
2006	48		11.1	
2007	40	45.7	10.8	11.2
2008	52	46.7	12.5	11.5
2009	44	45.3	11.3	11.5
2010	34.6	43.5	9.7	11.2
2011	37.2	38.6	11.2	10.7

Table Notes: (µg/m³) = micrograms per cubic meter. Wildfire Data Removed in 2008 and 2009

2.3 Emissions Inventory Description

2.3.1 Overview

Klamath Falls must show the EPA that they will meet the federal 24-hour daily PM_{2.5} standard by December 2014 by implementing emission control strategies to reduce PM_{2.5} emissions. In order to determine the sources of PM_{2.5} emissions in Klamath Falls, EPA requires DEQ to develop an emissions inventory within the nonattainment area boundary (See Figure 4). An emissions inventory is a comprehensive estimation of air pollutant emissions by source in a geographic area during a specific time period. DEQ selected 2008 as the base year because it was the most recent data available. Using the 2008 emissions inventory, DEQ estimated the emissions for the future year of 2014 based on a growth rate and implementation of emission reduction measures at the local, state, and federal levels. The 2014 emission inventory is the basis for DEQ’s attainment demonstration to EPA. Section 2.4 describes the result of the 2008 emissions inventory, and section 2.5 describes the results of the 2014 emissions inventory.

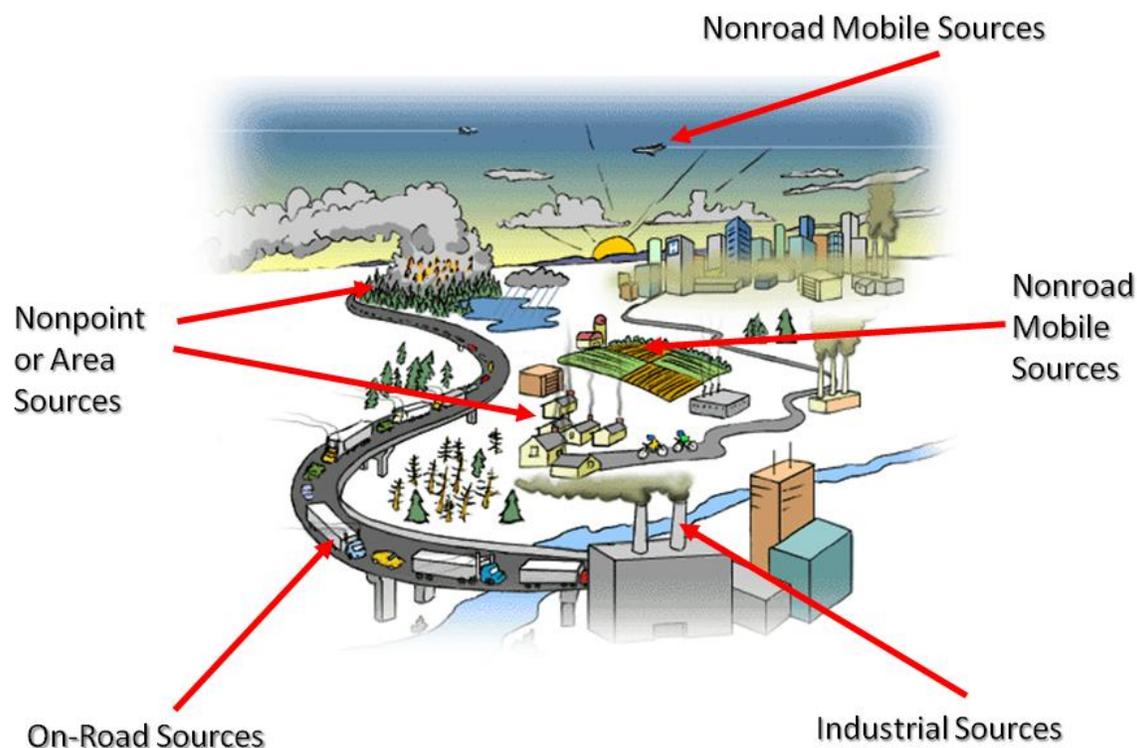
2.3.2 What Sources of Emissions are Included?

Emissions are described by source categories, and for each source category the emissions are calculated using specific methodologies. Most of the emissions are calculated using emission factors from the U.S. EPA. This information, in some cases, was further refined using information from surveys, information gathered from other government agencies (such as ODOT), and industrial permits.

There are four major emission source categories that EPA requires be addressed. Figure 8 illustrates the main emission source categories:

- **Nonpoint or Area** emission sources include woodstove emissions, open burning emissions, small business or industry emissions, fugitive dust from construction and agricultural operations, and agricultural and forest burning. EPA only expects DEQ to categorize emissions within the nonattainment area. Agreements on forest and agriculture activities outside the nonattainment area will be considered when developing agreements to prevent or limit intrusions into the nonattainment area.
- **Point** emission sources include major industrial complexes that are permitted by the DEQ and could contribute PM_{2.5} emissions to the Klamath Falls Nonattainment Area.
- **On-road mobile** emission sources include cars, buses and trucks. The Oregon Department of Transportation (ODOT) used a model to determine the number and type of vehicles traveling along each segment of roadway. PM_{2.5} from vehicles is predominately from re-entrained road dust and diesel engines. Roadway dust includes re-entrained dust produced from vehicles traveling over a roadway, and also fugitive dust produced from wind blowing across paved and unpaved roads. Gas powered vehicle tailpipe PM_{2.5} emissions are rather low compared to re-entrained dust estimates.
- **Non-road mobile** emission sources include airplanes, railroads, lawn mowers and watercraft. This category does not constitute a major part of the total emission inventory, but is a requirement for analysis.

Figure 8: Types of PM_{2.5} Estimated Emission Sources Included in Emissions Inventory



2.3.3 24-hour Daily Emissions versus Annual Emissions

Because Klamath Falls meets the annual standard for PM_{2.5}, sections 2.4 through 2.7 of this report focus on information used to identify emissions potentially contributing to the violation of the 24-hour daily standard. Worst-case day emissions are important because they correspond with the daily 24-hour National Ambient Air Quality Standard (NAAQS) for PM_{2.5}. The annual average emissions correspond to the annual NAAQS for PM_{2.5} and are based on an average of all typical daily emissions. EPA also requires the annual emissions be included in the inventory. Information on annual PM_{2.5} emissions can be found in Appendix A4.

2.3.4 What pollutants contribute to PM_{2.5} concentrations?

Particulate matter is composed of fine particulate matter as well as particulate matter formed in the atmosphere from precursors. Sulfates, nitrates, volatile organic compounds, and ammonia all contribute to the formation of particulate matter. DEQ included sulfates, nitrates, volatile organic compounds, and ammonia in the inventory as well as PM_{2.5}.

2.3.5 How Are 2014 Emissions Estimated?

Future year emission inventories are affected by several factors including growth, which can increase emissions, and new regulations at the local, state, or federal level, which can decrease emissions. In addition, technology changes such as further expansion of natural gas, certified stoves and alternative energy sources can decrease emissions by allowing people to switch away from wood as a heat source. In Klamath Falls, emissions changes are based on estimated changes in indicators such as population, economic and industrial activity, and vehicle traffic. DEQ calculated emissions for 2014 using growth assumptions and other knowledge about emission sources in Klamath Falls. For most categories of

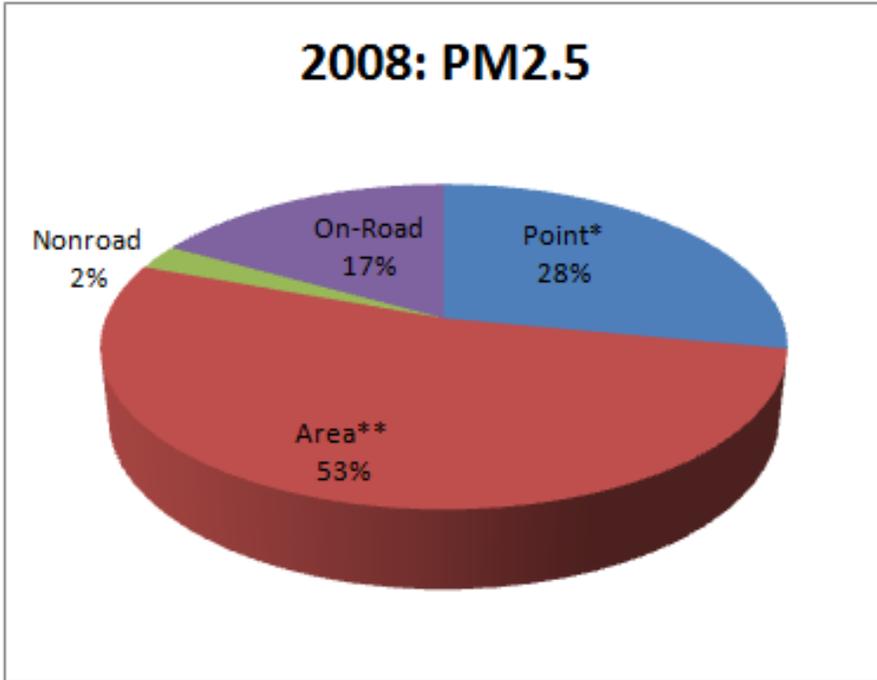
emissions, DEQ used growth assumptions from the Oregon Office of Economic Analysis. Growth in woodstove emissions was based on construction and change out information. Projections for industrial emissions were based on a no growth scenario. Several local, state, and federal regulations will decrease emissions from some source categories between 2008 and 2014. The emissions inventory is a catalog of the best estimate of 2008 emissions, and an informed prediction of what is likely to happen by 2014. Both present and future year inventories are critical components of air quality planning. Section 2.5 describes growth factors and the 2014 emissions inventory.

2.4 Emissions Inventory 2008

Unhealthy accumulation of $PM_{2.5}$ is typically a wintertime problem in the Klamath Falls basin, due to cold air inversions that trap emissions near the ground. The predominant source of particulates in Klamath Falls in the winter is residential wood combustion, including wood combustion in fireplaces. Other sources of $PM_{2.5}$ emissions include industrial, transportation and forest and agricultural burning emissions. Figure 9 shows the contribution of each of these source categories in the Klamath Falls area based on the 2008 inventory.

Residential wood combustion makes up 76% percent of the area source category. Because residential wood emissions are released in neighborhoods near the Peterson School monitor, usually at low heights in evening hours with low wind speeds, and shallow, capping temperature inversions, these emissions have the highest impacts at the monitor. While industrial emissions make up 28% of total $PM_{2.5}$ emissions, they only comprise about 2-3% of the measured concentration of $PM_{2.5}$ at the monitor. This is in large part because of higher release heights, more buoyant plumes, greater distance from the monitor, and greater dispersion. Emission sources contributing the smallest proportion of $PM_{2.5}$ emission include non road and on road emissions. Non Road emission from sources such as airplanes, railroads, watercraft and lawnmowers represent only 2% of emissions. Other area emissions from sources such as residential heating other than wood (natural gas, for example), fugitive dust from agricultural and construction operations, small business and small industry emissions, and open burning represent 2% of all emissions.

Figure 9: Source Characterization of 24-hour PM_{2.5} Worst Case Day Estimate in Lbs per Day (2008 Data)



* 80% permitted daily operating capacity

** Area source residential wood combustion emissions are advisory controlled

2.5 Projected 2014 Emissions

2.5.1 Overview

The 2014 emissions inventory is calculated using growth assumptions, based on estimated changes in indicators such as population, economic and industrial activity, and vehicle traffic. The 2014 forecast is produced by applying growth factors to 2008 emissions, and then subtracting any emissions controlled by local, state, or federal regulations. Examples of these regulatory controls include the Klamath County Air Quality Ordinance, Oregon’s Heat Smart rules, new passenger car fuel economy requirements, and new lower sulfur requirements in fuel.

2.5.2 Growth

DEQ used growth factors from the Oregon Office of Economic Analysis (OEA) (<http://www.oea.das.state.or.us/>) in the Department of Administrative Services, as required by executive order of the governor’s office. OEA predicted Klamath County’s growth based on historic growth rates. Table 2 provides the growth factors DEQ used to project 2014 emissions.

Table 2: Growth Rates Used in Calculating 2014 Emissions

Growth	Average Annual Growth Rate	Based on
Population And Household	0.54%	Oregon Office of Economic Assessment County estimate
Employment	0.85%	Oregon Office of Economic Assessment County estimate for 2008-2024
Vehicle Miles Travelled	1.29%	Estimated by ODOT to 2014

OEA estimated an average annual growth rate from 2008 to 2014 of 0.03%, but because of the recession, this growth rate is likely to be too low for future years. DEQ used the average annual growth rate for employment from the time period 2008-2024 because it more realistic for the long term. The change in number of residential wood combustion devices from 2008 to 2014 is based on the household growth rate. However, other factors are also taken into account, such as the rule that no uncertified stove can be installed. To calculate emissions from on-road transportation, DEQ used ODOT’s projections of vehicle miles travelled for 2014 and the MOVES model, as required by EPA.

2.5.3 Emission Reductions from Existing Strategies Implemented 2009 through 2014

Several emission reduction strategies will reduce emissions in 2014. These include local, state, and federal rules which are currently in effect, or will be in effect by 2014.

2.5.3.1 Klamath County Clean Air Ordinance

In November 2007, Klamath County revised several aspects of their Clean Air Ordinance. Changes fully implemented by 2009 included:

- Revised woodstove curtailment levels. Instead of issuing red advisories at 65 µg/m³ for PM_{2.5}, they are issued at 30 µg/m³. As a result, there are more red and yellow days.
- Required removal of an uncertified woodstove upon sale of a home.
- Open burn – 2 periods, 15-day windows within the air quality zone. This reduced the number of days in the open burn window from 30 to 15 days. The county now has the option to not open a fall window at all.
- Burn barrel prohibition.
- Tightened enforcement. This includes more patrols and active enforcement such as sending letters and knocking on doors of repeated violators. There is the potential for court citations.

2.5.3.2 *Woodstove Changeout Program.*

Since 2008, DEQ’s emission inventory and records of woodstove changeouts reflect a decrease of 769 uncertified wood burning units in the Klamath Falls area. This includes uncertified woodstoves that were replaced with certified stoves or inserts, pellet stoves, heat exchangers, or natural gas furnaces .Table 3 shows the number of uncertified stoves changed out since 2008 year and projected numbers for 2012 through 2014. The number of changeouts between 2008 and 2012 are related to EPA, the City of Klamath Falls and American Recovery and Reinvestment Act funding.

Table 3 Klamath Falls Woodstove Changeouts

Year	2008	2009	2010	2011	2012 Projected	2013 Projected	2014 Projected
Number of uncertified wood burning units	2,783	2,599	2,456	2,261	2,067	1,995	1,936
Changeouts		185	143	196	194	72	59

2.5.3.3 *Road Paving.* Six miles of road have been paved in the nonattainment area since 2008.

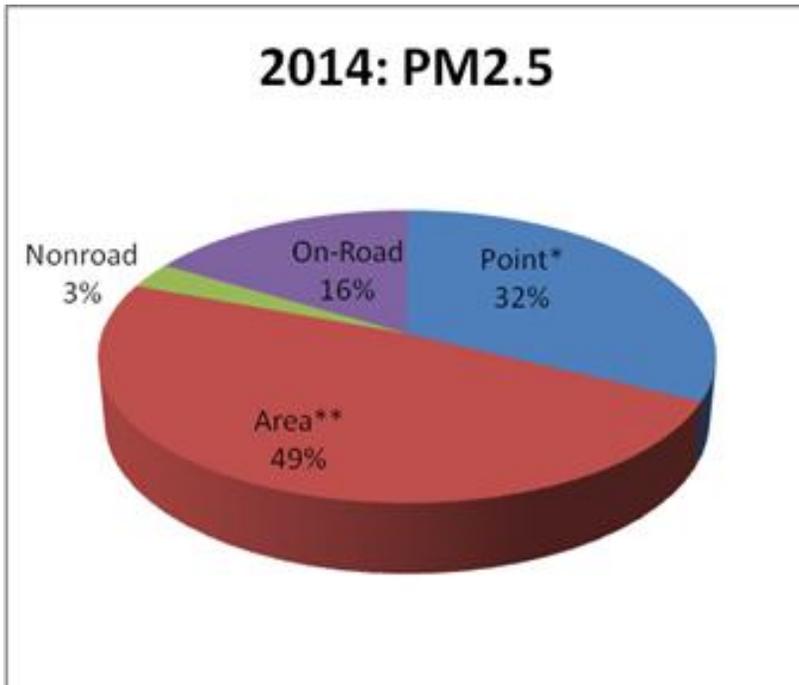
2.5.3.4 *Transportation and Fuel-Related Emissions.* Federal and state transportation emission reductions are calculated as part of the emissions inventory. These strategies include:

- Reduced sulfur content of gasoline and diesel due to federal regulations.
- Increased fuel economy due to federal regulations.
- Oregon’s Low Emissions Vehicle fleet 2009 model years and newer.
- Oregon’s renewable fuel standard for Bio-diesel, 5%.
- Diesel retrofits of City of Klamath Falls and Klamath County bus and school buses.

2.5.4 2014 Emissions Inventory Results

Figure 10 illustrates the worst case day projected 2014 PM2.5 emissions. This includes current strategies including recent woodstove changeouts and the current ordinance changes as of 2007. Between 2008 and 2014, residential wood combustion from sources other than fireplaces will have been reduced dramatically.

Figure 10: Source Characterization of 24-hour PM_{2.5} Worst Case Day Estimate in Lbs per Day (2014 Data)



* 80% permitted daily operating capacity

** Area source residential wood combustion emissions are advisory controlled

2.6 Projected 2037 Transportation Emissions

Transportation conformity is a process required by the Clean Air Act (CAA) which establishes the framework for improving air quality to protect public health and the environment. The goal of transportation conformity is to ensure that Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) funding and approvals are given to highway and transit activities that are consistent with air quality goals.

The CAA requires that metropolitan transportation plans, metropolitan transportation improvement programs and Federal projects will not cause or contribute to any new violations of the National Ambient Air Quality Standards (NAAQS); increase the frequency or severity of NAAQS violations; or delay timely attainment of the NAAQS or any required interim milestone.

DEQ is currently working to determine whether or not transportation emissions in Klamath Falls are insignificant. If EPA determines that transportation emissions are insignificant, then some of the conformity requirements will not apply in the Klamath Falls area.

Chapter 3: Recommended Strategies

3.1 Criteria for Selection of Strategies

In recommending strategies, the committee considered if the potential strategy is technologically possible, if the strategy meets EPA/DEQ requirements, and if the strategy is within legal authority. The committee also evaluated potential strategies based on the following criteria:

Environmental

- Effect on PM_{2.5} level

Health

- Likely effect on pollution related illness
- Effect on quality of life

Economic

- Likely effect on local jobs
- Cost to those affected
- Costs to state/taxpayers
- Level of financial incentive to comply
- Level of financial deterrent to violate

Social

- Level of public support
- Difficulty of explaining idea to those affected
- Relative impact on under-served communities

Technological Feasibility

- Degree of difficulty to implement

3.2 Recommended Strategies

The Klamath Air Quality Advisory Committee has developed recommendations for strategies to bring Klamath Falls nonattainment area into compliance with the federal PM_{2.5} air quality standards by 2014. As described in the Committee Charter, where members did not reach consensus, minority opinions are included in the recommendations. The committee is recommending a two-step approach:

1. An initial package of strategies, of lesser impact on residents which modify and strengthen the current approach to keep us on track,
2. A second set of contingency strategies of greater impact, but only to be implemented in the event that the federal PM_{2.5} is not met in 2014.

3.2.1 Initial Strategies for 2012 Implementation

3.2.1.1 Boundaries

3.2.1.1.1 Air Quality Zone Change: enlarge the Air Quality Zone (AQZ) to the same boundaries as the EPA non-attainment area .

The advisory committee recommends that Klamath County change its rules to enlarge the AQZ to the same boundary as the EPA non-attainment area for consistency and to reduce confusion.

- **Reduction in PM_{2.5} emissions.** This strategy will have a small reduction in PM_{2.5}.
- **Likely effect on local jobs and the economy.** The effect on local jobs and the economy is likely to be negligible.

3.2.1.1.2 Open Burning Setback Change: request that DEQ change their Open Burning Rules setback from city limits of Klamath Falls to the Nonattainment Area.

The advisory committee recommends that DEQ amend their regulations to enlarge their Open Burning Boundary to include the Nonattainment Area. This would require permits for the open burning of commercial and demolition debris.

- **Reduction in PM_{2.5} emissions.** This strategy will have a small reduction in PM_{2.5} caused by increased permitting requirements.
- **Likely effect on local jobs and the economy.** The effect on local jobs and the economy is likely to be negligible; there will be slightly higher permitting costs for businesses that previously disposed of waste by burning.

3.2.1.2 Wood burning

3.2.1.2.1 Changeout Program: Continue the wood stove change out program.

The advisory committee recommends that the City of Klamath Falls, Klamath County, and DEQ pursue funds to continue offering woodstove change outs and fireplace conversions within the nonattainment area. This has been an effective strategy in the past, and continued implementation will provide substantial reductions in PM_{2.5} in the future. The program has been successfully implemented through South Central Oregon Economic Development District (SCOEDD) and Klamath County Environmental Health program with no technological difficulty. Some funding considerations for future woodstove change out incentives include:

1. Incentives must cover all or substantially all of the cost of replacement for low income individuals in order to be effective; and
2. Funding sources should be identified to provide substantial (at least 50%) incentives to residents who are not “low income” (as defined in County ordinance) to increase the program's impact on PM_{2.5}.

- **Reduction in PM_{2.5} emissions.** The effectiveness of this strategy is dependent on the number of stoves changed out, which in turn is dependent on the funding which can be raised for the

incentive program. (Approximately a 1.4% reduction in PM_{2.5} concentration per 100 stoves). Certified stoves will provide more heat, with lower emissions.

- **Likely effect on local jobs and the economy.** This strategy is likely to have some positive effect on the economy associated with the removal of old stoves and installation of the new. This program entails a major cost to the state/taxpayers in order to fund the incentives unless alternative funding sources can be identified.

3.2.1.2.2 State Industrial Offsets: DEQ to modify or clarify requirements to allow woodstove change outs as offsets for new or expanding industry.

The advisory committee recommends DEQ clarify or change state industrial offset rules so that new or expanding industry could contribute to a woodstove change out program for emission offsets in Klamath Falls.

A new or expanding industry in the Klamath Falls Non-attainment area is required to obtain “offsets” if their PM_{2.5} emissions are above a significant level. In the past, this has meant buying “offsets” from an industry that is not using them, or paying for emission reductions at another industrial facility. The program should be modified so that industry seeking offsets has the additional option of contributing to a woodstove change out program as a one-time cost to purchase offsets. The program could use a formula along the lines of: Average daily PM_{2.5} industrial emissions divided by 1.2kg (daily uncertified stove output) times \$2,000 (cost of one woodstove change out). The Commissioners may wish to consider a cap (i.e. \$500,000). This strategy is dependent on new industry locating in the community or expansion of existing industry.

- **Reduction in PM_{2.5} emissions.** The effectiveness of this strategy is dependent on new or expanding industry. There is the potential for large reductions in PM_{2.5} in areas where it has the most impact.
- **Likely effect on local jobs and the economy.** This strategy may benefit new or expanding industry by providing an additional source of offsets. The committee recommends that DEQ consider ways of structuring this recommendation to address the potentially unfair burden on industries expanding in the area first.
- **Minority opinion.** This strategy is not a reliable source of woodstove change outs, and it would be difficult to influence the number of change outs. Industry's use of technological improvements could allow for more control of potential reductions. Under this recommendation, consider whether residents rather than industry are unfairly bearing the burden of improving air quality. For example, residents choosing to participate in industry funded change outs could bear the burden of higher cost if they move away from wood as a source of heat. Depending on heating devices, residents rather than industry would be responsible for maintenance and upkeep.

3.2.1.2.3 Local Industrial Offsets: implement City and County siting requirements which allow new and expanding industry to contribute to a woodstove change out program as an offset to increased emissions.

If DEQ cannot allow woodstove change outs as offsets for new or expanding industry, or this provision is not effective the advisory committee recommends the City of Klamath Falls and Klamath County

implement siting requirements which require new and expanding industry that emit PM_{2.5} to contribute to a woodstove change out program as an offset to increased PM_{2.5} emissions. This strategy is dependent on new industry locating in the community or expansion of existing industry.

- **Reduction in PM_{2.5} emissions.** The effectiveness of this strategy is dependent on new or expanding industry. There is the potential for large reductions in PM_{2.5}.
- **Likely effect on local jobs and the economy.** This strategy may adversely impact new and expanding industry, but if there are caps imposed, industry in the past has demonstrated a willingness to make up front contributions to improving the air shed. The impact could be high to affected industry as a one-time cost. The program could use a formula along the lines of: average daily PM_{2.5} industrial emissions divided by 1.2kg (daily uncertified stove output) times \$2,000 (cost of one change out). The Commissioners may wish to consider a cap (i.e. \$500,000).
- **Minority opinion**
New industry should use technology that reduces emissions. This strategy would impose an additional cost for industry to develop business in Klamath Falls. Some industries may not want to bear the additional costs and choose not to do business in the area.

3.2.1.2.4 County Enterprise Zone: Change County Enterprise Zone conditions to obtain funds from new and/or expanding industry to support woodstove change outs.

The advisory committee recommends that Klamath County change the County Enterprise Zone to require new or expanding industry that has PM_{2.5} emissions to contribute to a woodstove change out program. The Commissioners may wish to consider applying this requirement to new industry that is located beyond the nonattainment zone.

- **Reduction in PM_{2.5} emissions.** The effectiveness of this strategy is dependent on new industry locating in the community or expansion of an existing industry. There is the potential for large reductions in PM_{2.5}.
- **Likely effect on local jobs and the economy.** This strategy may adversely impact new and expanding industry because industry would need to pay more money for startup or expansion, but if there are caps imposed, industry in the past has demonstrated a willingness to make up front contributions to improving the air shed. For example, Aqua Glass (currently Masco Bath), purchased a number of woodstoves in the 1990s as an act of good will to establish themselves in the community. The impact could be high to affected industry as a one-time cost. The program could use a formula along the lines of: average daily PM_{2.5} industrial emissions divided by 1.2kg (daily uncertified stove output) times \$2,000 (cost of one change out). The Commissioners may wish to consider a cap (i.e. \$500,000).
- **Minority opinion**
New industry should use technology that reduces emissions. This strategy would impose an additional cost for industry to develop business in Klamath Falls. Some industries may not want to bear the additional costs and choose not to do business in the area.

3.2.1.2.5 Rental Unit Change Outs: Mandate that a rental must have a certified stove, if there is a stove in the residence (within 2 years from effective rule date).

The advisory committee recommends that Klamath County change its rules to mandate that within the AQZ, any stoves, fireplace inserts and pellet stoves in rental units must be certified. Replacement of uncertified woodstoves with certified models in rentals will reduce levels of PM_{2.5} generated by those houses.

- **Reduction in PM_{2.5} Emissions.** Replacement of uncertified woodstoves with certified models in rentals will reduce levels of PM_{2.5} generated by those houses. The current Clean Air ordinance stipulates that woodstoves cannot be the sole source of heat in rental properties. The recommendation could result in a large PM_{2.5} reduction if landlords decide to remove the woodstove without replacing it, requiring tenants to use alternative heat sources such as gas or electric.
- **Likely effect on local jobs and the economy.** Replacement of uncertified woodstoves in rentals would generate some work, and would force landlords to incur some expenses. Tenants might need to pay more for heat from non-wood sources.
- **Minority opinion**
Use the woodstove change out program to offset costs to landlords on a voluntary basis. Do not mandate this strategy.

3.2.1.2.6 Wood Combustion Enforcement, Heat Smart: Confirm Heat Smart change-outs.

The advisory committee recommends that Klamath County confirm the residences where owners removed or changed-out uncertified woodstoves upon home sale as required by the state Heat Smart law. Heat Smart is administered by DEQ which receives electronic or paper certifications of woodstove removal and destruction. Heat Smart records are available to Klamath County in the form of a database from DEQ, and can be used to estimate the level of compliance and need for additional education and compliance follow-up. Currently, DEQ has no budget for enforcement of Heat Smart. While the committee does not see the need for extensive County enforcement at this time, the County may consider improving compliance by amending ordinances to provide appropriate penalties.

In addition, the committee recommends that the county ordinance should be changed to specify that woodstoves need to be removed from outbuildings and shops to be consistent with the State Heat Smart law.

- **Reduction in PM_{2.5} Emissions** The estimated effect on overall PM levels is small, although locally impacts could be more significant.
- **Likely effect on local jobs and the economy** There is no estimated effect on local jobs or the economy.

3.2.1.2.7 Wood Combustion Enforcement, Habitual Violators: Focus enforcement of woodstove curtailment on habitual violators.

The advisory committee recommends that Klamath County continue its existing focus of enforcement on habitual violators. Experience with this program shows that personal visits usually result in compliance; and that the existing enforcement for habitual violators structure is adequate. A summary of the enforcement program is included in Appendix A5 of this report.

- **Reduction in PM_{2.5} Emissions** The estimated effect on overall PM levels is small, although the impacts to the local neighborhood could be more significant.
- **Likely effect on local jobs and the economy** There is no estimated effect on local jobs or the economy although the cost to violators can be significant.

3.2.1.2.8 Wood Combustion Enforcement, Minimum Fine: Amend the County ordinance to mandate a minimum fine for a second burning violation.

The advisory committee recommends that the County amend its ordinance to mandate a minimum fine for a second burning violation.

- **Reduction in PM_{2.5} Emissions** The estimated effect on overall PM levels is small.
- **Likely effect on local jobs and the economy** There is no estimated effect on local jobs or the economy although the cost to violators could be significant.

3.2.1.2.9 Alternatives to Wood Energy: Identify and create incentives to develop and use non- wood energy sources. The City and County to review existing codes and ordinances to remove barriers to alternative energy sources.

The advisory committee recommends that the City and County review existing codes and ordinances to remove any obstacles and create incentives for the development and use of non-wood energy sources. Examples are ground source heat or solar.

- **Reduction in PM_{2.5} Emissions** The estimated effect on overall PM levels is small.
- **Likely effect on local jobs and the economy** The effect on local jobs or the economy is unknown, although development of alternative energy sources could increase economic opportunities and jobs.

3.2.1.2.10 Wood Burning Survey: The County to inventory all wood burning devices through tax statements.

The advisory committee recommends that the County inventory all wood burning devices through a survey enclosed with tax statements received by all homeowners in the county. Coordinate with OIT surveys.

- **Reduction in PM_{2.5} Emissions** There is no effect on overall PM levels.
- **Likely effect on local jobs and the economy** There is no effect on local jobs and the economy.

3.2.1.2.11 New Fireplace Standard: in new residential construction, only allow fireplaces that meet the most current ASTM international standard. Incorporate the ASTM international fireplace emission standards of 5.1 g/kg or less into the county building code.

The advisory committee recommends that Klamath County require that fireplaces in new homes are built using the most stringent ASTM international standards. ASTM standards were developed by EPA and the Hearth, Patio and Barbeque Association. Phase 2 ASTM standards of 5.1 gr/kg start in 2012. This would be a 2/3 reduction from current fireplace emissions.

- **Reduction in PM_{2.5} Emissions** The estimated effect on overall PM levels is small, although impacts to the local neighborhood could be more significant. Over time, as new houses are built, neighborhoods with ASTM compliant fireplaces would experience less PM_{2.5} exposure compared to building with traditional fireplaces.
- **Likely effect on local jobs and the economy** There is no estimated effect on local jobs or the economy.

3.2.1.3 Education and Outreach

3.2.1.3.1 Education

The advisory committee recommends that the City of Klamath Falls and Klamath County continue and expand educational efforts regarding reducing PM_{2.5} from wood smoke. Education has had an impact and reduced wood smoke in the past, and can be a relatively inexpensive strategy; newspaper articles, staffers in city water bills, and the existing website are all inexpensive methods of reaching the public. However, some funding needs to be available at the city and county level to enhance educational strategies: including hands-on demonstration of stove use, wood smoke health effects, the economics of a new wood stove, videos on public access and government websites, television spots, and outreach to teach homeowners appropriate wood selection. This strategy could also include wood smoke education in the schools.

The advisory committee recommends that the education program encourage people to use local utility company weatherization rebate programs and state tax credits.

- **Reduction in PM_{2.5} Emissions** This strategy is estimated to have a positive impact of 0.5 to 6% reduction in wood smoke emissions (depending on magnitude and effectiveness of effort).
- **Likely effect on local jobs and the economy** This will have very little impact on local jobs and the economy, but some funding would be necessary from local governments.

3.2.1.4 Open Burning

3.2.1.4.1 Fall open burning: Decrease the fall open burn window and provide free drop off during that time with unloading assistance on Saturdays.

The advisory committee recommends reducing the fall 15-day open burning window to 8 days including two Saturdays during which time the County would offer free disposal. This would decrease PM levels in the fall, while still allowing a limited opportunity for open burning in situations where people would have difficulty disposing of debris. Appropriate agencies should coordinate. In addition, it is more accurate to forecast optimal weather conditions for one week rather than two weeks of open burning.

- **Reduction in PM_{2.5} Emissions** The estimated effect on overall PM levels is small, although locally impacts could be more significant.
- **Likely effect on local jobs and the economy** The existing free debris dumping day results in a \$36,000 reduction in revenue. Increasing this opportunity over the period of a week would

increase the revenue reduction. Staff costs to unload debris are \$1,500 per day. Adding an additional Saturday of unloading assistance would double that cost. The county may consider applying for a grant to cover the loss of revenue.

3.2.1.5 Monitoring

3.2.1.5.1 Identify options for increased air sampling including feasibility, use of results and cost.

The advisory committee recommends that the County in partnership with DEQ identify options for increased monitoring in Klamath Falls. This investigation would include information on feasibility, cost and potential use of results. More monitoring would advance understanding of air quality, and it relates directly to the goals of lowering emissions. Additional data could lead to a better understanding of PM problems and solutions. However the data from the Peterson school is definitive. Data from different sites cannot be averaged.

- **Reduction in PM_{2.5} Emissions** There is no effect on overall PM levels.
- **Likely effect on local jobs and the economy** There is no effect on local jobs and the economy.

3.3 Attainment Demonstration

EPA requires DEQ to develop emission reduction strategies and to demonstrate that these strategies will bring Klamath Falls into attainment by 2014 for PM_{2.5} pollution within the nonattainment area boundary. The analysis to show that reduction strategies will reduce emissions enough so that Klamath Falls will meet the federal PM_{2.5} standard is called the “attainment demonstration.”

DEQ used a mathematical model to generate estimates that show future compliance with the PM_{2.5} standard in the Klamath Falls Nonattainment Area. This estimation method, called a “proportional rollback/rollforward analysis” or “rollback model” is based on the assumption that there is a direct correlation between emissions of a pollutant and measured concentrations of that pollutant in the same airshed, and that changes in emissions will result in corresponding changes in concentration. This correlation is used to predict future concentrations. In the rollback model DEQ applied expected emission changes in Klamath Falls PM_{2.5} concentrations to the 2008 base year worst case day emission data to predict concentrations in the future year 2014. For the purposes of this exercise the worst case day emissions are the 98th percentile ambient concentration.

There are four basic steps in the Klamath Falls rollback model: determining the relative impact of emissions on the reference location at the DEQ Peterson School monitor, determining emissions growth or change within the community, including planned emission reductions, getting results from the model, and characterizing strengths, limitations and uncertainties of the results.

To determine the extent to which various source emissions impacted the Peterson School monitor and prepare data for use in the rollback model, DEQ compared 2008 estimated emissions to monitored concentrations for the period of 2006-2010. These emissions were estimated for a range of source types, including industrial sources, on-road vehicles, commercial activities, and residential wood heating. DEQ also studied the impacts of prescribed forest burning and other burning activity outside of Klamath Falls area. To accurately estimate source impacts, DEQ used tools that account for emissions travel distance, release heights, pollutant movement in the atmosphere, meteorological effects and other

factors. Air dispersion and source apportionment models were used to adjust emissions from prescribed burning, industrial sources, and road dust. These adjustments were made in the emission inventory to accurately reflect estimated impacts at the Peterson School reference monitor.

To estimate expected changes in emissions between 2008 and 2014, DEQ evaluated changes in the community including the local economy, population growth, expansion of commercial activity, heating trends, and increase in vehicle traffic on highways. The most significant changes evaluated for 2014 are those from reductions in residential wood heating as a result of control strategies. These strategies include designation of no-burn days during periods of potential high pollution, and wood stove change-out programs that are ongoing or will be implemented.

After completing the future year 2014 inventory DEQ compared to the 2008 emissions concentration correlation to predict a 2014 concentration. A sufficient decrease in emissions, for example from reductions in residential wood heating, will result in decreased future year concentrations for attainment of the 35 ug/m³ PM_{2.5} standard. For Klamath Falls, the measured concentration determined as representative of the 2006-2010 period is 45.1 ug/m³, and is called the 2008 Design Value. Based on the rollback model, using a predicted 2014 emissions inventory incorporating current reduction strategies for wood heating, the estimated 2014 ambient air concentration, or the 2014 Design Value, is 31.8 ug/m³. This concentration is lower than 35 ug/m³, and shows attainment with the EPA standard.

There are several areas of uncertainty in the Klamath Falls rollback model but they do not affect its overall accuracy and utility. One area of uncertainty is the assumption that PM_{2.5} emissions are well-mixed in the airshed. DEQ believes that this is generally the case given the shape of the local airshed, and the typically low wind speeds and mixing heights during winter time periods when the highest concentrations are measured. In addition, emissions from distant sources have been adjusted to reflect that condition. Another uncertainty in the model is the emissions estimates themselves, primarily emissions from wood heating devices since they comprise the largest component. These emissions are based on a comprehensive wood heating survey, and have undergone extensive scrutiny and analysis. However, as noted in the advisory committee recommendations, wood heating emissions could be more accurately estimated with additional data gathered through surveys or other means. The rollback model has been constructed to allow further evaluation of data uncertainty if needed.

DEQ believes that the predicted 2014 Design Value of 31.8 ug/m³ is a robust value based on a comprehensive and detailed inventory including consideration of varying impacts due to distance and other factors. Adding to the accuracy of the rollback model is a speciation analysis, in which DEQ refined the Klamath Falls PM_{2.5} emission inventory by using source profiles to divide PM_{2.5} emissions into constituent chemical components. These components include organic carbon, an important product of wood burning; elemental carbon, an industrial and diesel engine combustion product; SO₄ and NO₃, both minor components; and other particulate matter, including earth crustal material from road dust. The chemical speciation data supports model assumptions about the importance of wood burning emissions. Finally, the roll back model has been designed to be flexible, and can be used to study different levels of residential wood heating and industrial activity to assess various control strategies and contingency measures in the attainment demonstration.

3.4 Recommended Contingency Measures

The committee anticipates that if all of the above recommended actions are taken, attainment will be achieved, however if it is not, the implementation of contingency measures will be necessary.

Contingency measures are additional controls needed to further reduce emissions in the event that monitoring shows that Klamath Falls fails to attain the 24-hour daily PM_{2.5} standard by its attainment date of 2014. These contingency measures must be fully adopted rules or measures that are ready for implementation without further action by the state of Oregon or the EPA upon failure to reach attainment.

The advisory committee recommends the following contingency measures:

3.4.1 Boundaries

3.4.1.1 Expand the AQZ beyond the EPA Non Attainment Boundary (#41)

Emissions outside the current AQZ are a contributing factor to non attainment within the current AQZ. Under this recommendation, the AQZ would be expanded to include contributing areas.

3.4.2 Woodburning

3.4.2.1 Prohibit the use of all uncertified wood heating stoves and inserts inside the AQZ (#3)

Uncertified wood heating stoves and uncertified fireplace inserts would be prohibited from use at all times except during power failures.

3.4.2.2 Prohibit the use of open structurally integrated fireplaces within the AQZ (#1)

Large amounts of wood are burned in fireplaces and they are not efficient. Based on the survey and emission factors 40 to 50% of particulate pollution is coming from fireplaces. This strategy would allow use of ASTM International certified fireplaces and fireplaces with certified inserts in conformity with the existing ordinance.

- Minority opinion

Although the Klamath Falls community is considered a "non-attainment" area regarding federal air pollution standards for particulate matter, members of the community recognize that many days during the winter are not impacted by air pollution. The air pollution episodes coincide with wintertime temperature inversions. Banning the use of fireplaces when the Klamath Basin's air quality far exceeds federal standards would be perceived as overkill. To retain community support for the total air quality improvement package, it must be perceived as reasonable.

Fireplaces exist in a large percentage of homes in this area, and many people enjoy having fires in their fireplaces. Enforcement of a ban on the use of fireplaces would prove to be very difficult. Differentiating between fireplace users and woodstove users would add to this difficulty. It should be noted that the advisory committee is not recommending a similar ban on the use of woodstoves.

Furthermore, while the majority of fireplaces are not considered "clean burning", some are comparable to most EPA certified wood stoves. There are some models that achieve no visible emissions and very low measured emissions. It would be grossly unfair to those members of the community who have invested in a cleaner burning fireplace to ban them altogether.

3.4.3 Open Burning

3.4.3.1 Eliminate the fall open burning window as needed (#39)

Further reduction of the fall open burning window would be impractical.

See appendix A7 for a list of strategies that were considered by the advisory committee, but are not recommended at this time.

3.5 Likely Effect of Recommended Strategies on Local Jobs and Economy

Klamath County has been losing jobs since 2006, one year longer than the state and most other counties in the state. In 2011, jobs loss was small compared to the previous year's but still adds to the county's employment losses which now total over 2,500 jobs lost (over 10 percent of the county's 2006 employment). Klamath County is beginning to recover from their high unemployment rate. The strategies recommended in this report would likely have no negative effect on local jobs and the economy. The committee was careful to consider these criteria and avoided strategies that could hinder economic recovery.

Because the Klamath Falls area is currently designated as nonattainment, new and expanded industrial facilities are subject to the most stringent emission requirements called "Lowest Achievable Control Technology." The attainment plan does not in and of itself make it easier for the regulated community to do business, but it is the first step towards less restrictive requirements. Over time, the attainment plan will help the community meet PM standards and eventually achieve a maintenance designation under which new and expanded facilities will have more flexibility.

During the last two years, DEQ has consulted with stakeholders and local air quality committees, which include members from the chamber of commerce and business. DEQ is sensitive to the economic needs of this community and plans to revise its regulations to provide additional opportunities for new or expanding industry while ensuring public health protection. For example, new facilities may be able to change-out dirty woodstoves as a way to offset their emissions in the airshed.

Chapter 4: Next Steps

Klamath County will consider the recommendations from the advisory committee to help determine if refinements to the local air quality ordinance are needed. After County consideration, DEQ will use these recommendations to develop the Klamath Falls PM_{2.5} Attainment Plan. The attainment plan could contain rules, permit conditions, agreements, and local rules. DEQ will hold public hearings on the attainment plan in June 2012, and present the attainment plan to the Environmental Quality Commission by December 2012.

DEQ and local partners will implement the plan and rules to reach attainment with the PM_{2.5} standard. If Klamath Falls fails to come into compliance with the standard, transportation funds can be withheld. In addition, contingency strategies (see section 3.4) would automatically be implemented, should Klamath Falls not meet the standard by 2014. Most importantly, the attainment of the PM_{2.5} standard will safeguard the health of citizens.

5. Signature of Chair

On behalf of the Klamath Falls Air Quality Advisory Committee, the Chair Jeff Ball agrees that this report accurately represents the work and recommendations of the Committee.

Jeff Ball

Date

Chair, Klamath Falls Air Quality Advisory Committee