4.0 Analyses of Individual Nonattainment Area

4.10 Region 10 Nonattainment Areas

4.10.3 Oregon

Oregon Area Designations For the
24-Hour Fine Particle National Ambient Air Quality Standards

The table below identifies the counties in Oregon that EPA has designated as not attaining the 2006 24-hour fine particle ($PM_{2.5}$) standard.[1] A county (or part thereof) is designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	Oregon Recommended Nonattainment Counties	EPA's Designated Nonattainment Counties
Klamath County, partial	Klamath County, partial, Klamath Falls Air Quality Zone	Klamath County, partial, Klamath Falls Air Quality Zone
Lane County, partial	Lane County, partial, Oakridge Urban Growth Boundary	Lane County, partial; **T37S R9E Sections 31-32** **T38S R8E Sections 1-5, 8-16, 22-26, 35-36** **T38S R9E Sections 5-8, 14-15, 17-36** **T39S R8E Sections 1-2, 11-13, 24** **T39S R9E Sections 1-27** **T39S R10E Sections 3-10, 15-20, 29-30**

Aside from the areas designated nonattainment, EPA has designated the remaining portions of Klamath and Lane Counties and all other counties in the state as "attainment/unclassifiable", including all lands in Oregon within Indian Country. EPA designated a county or portion of a county as unclassifiable only when it did not have any data, or had air quality monitoring data for

[1] EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM2.5 standard was revised from 65 micrograms per cubic meter (average of 98th percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM2.5 remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

the 2005-2007 time period that was not complete and could not be used for determining compliance with the standard.

EPA Technical Analysis for Klamath County 24 hour PM2.5 Nonattainment Area:

Introduction

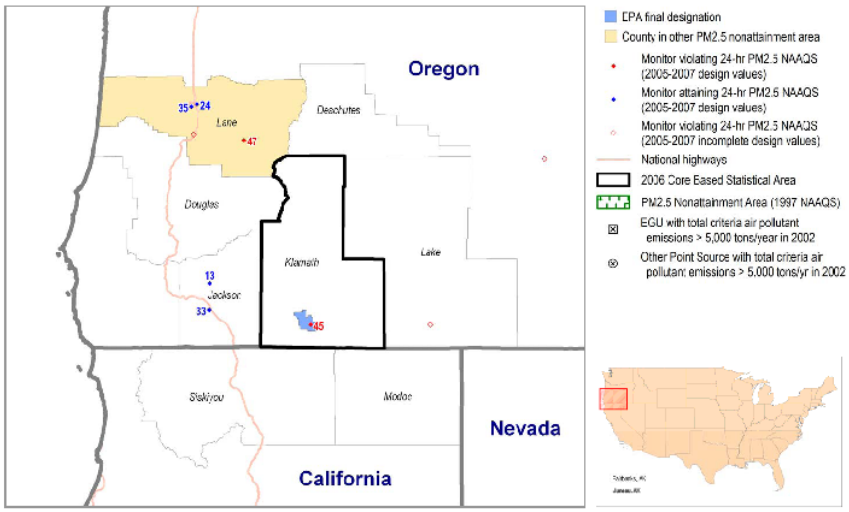
Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those nearby areas that contribute to violations. This technical analysis for Klamath County identifies the counties with monitors that violate the 24-hour $PM_{2.5}$ standard and evaluates nearby counties for contributions to fine particle concentrations in Klamath Falls. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

We also used analytical tools and data such as pollution roses, fine particle composition monitoring data, back trajectory analyses, and the contributing emission score (CES) to evaluate these areas. (See additional discussion of the CES under factor 1 below.)

Figure 5.25 is a map of the counties in the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties or portions of counties recommended as nonattainment by the State.

Figure 5.25 Klamath Falls, OR 24-hr PM2.5 Nonattainment Area

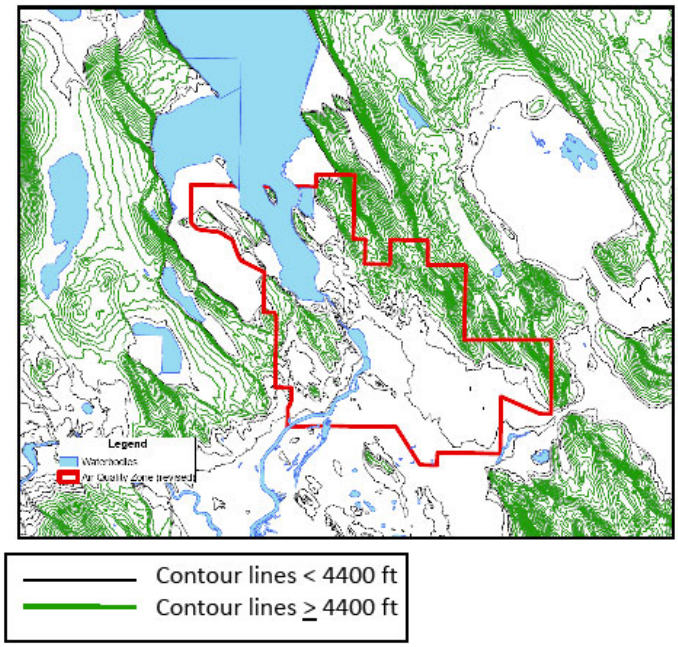


5-25

Figure 5.26 below is a map of the partial Klamath County nonattainment area, including topography. The nonattainment area is also the County designated Air Quality Zone identified by the red boundary line.

Figure 5.26 Nonattainment area (Klamath Falls Air Quality Zone) partial county designation

2) Contour Map of Klamath Basin



In December 2007, the State of Oregon first recommended that the Urban Growth Boundary (UGB) for Klamath Falls be designated as nonattainment for the 2006 24-hour $PM_{2.5}$ standard based on air quality data from the years 2004-2006. In a subsequent letter dated October 2, 2008, Oregon revised its recommendation from the Klamath Falls UGB to the Klamath Falls Air Quality Zone (AQZ). The Klamath Falls AQZ is larger than the Klamath Falls UGB, but is a partial county area. Air quality data used to determine compliance with the **$PM_{2.5}$** NAAQS are from Federal Reference Method (FRM) monitors located in the state.

In August 2008, EPA notified Oregon by letter of its intended designations. EPA's initial intended designation for Klamath Falls was a partial county designation with an area significantly larger than the Klamath Falls UGB that roughly followed mountain ridge topography to the east, north and west of Klamath Falls and south to the California border. In this letter, EPA also requested that if Oregon wished to provide comments on EPA's intended designation, it should do so by October 20, 2008. EPA stated that it would consider any additional information (e.g., on power plants or partial county areas) provided by the state in making final decisions on the designations. Oregon provided two letters dated October 2, 2008 and October 20, 2008, providing additional information on the Klamath Falls area. See letter from Governor Theodore R. Kulongoski dated December 17, 2007, letter from Dick Pederson, Director, Oregon Department of Environmental Quality dated October 2, 2008, and letter from Andy Ginsburg, Air Program Administrator, dated October 20, 2008. In addition, Oregon provided EPA an e-mail "power point" and oral presentation on October 30, 2008, that also included additional information on the Klamath Falls area. All of these materials are included in the docket for this action.

Based on EPA's technical analysis described below, EPA has designated a portion of Klamath County as nonattainment for the 24-hour $PM_{2.5}$ air-quality standard as part of the Klamath Falls nonattainment area, based upon currently available information. The portion of Klamath County designated nonattainment is described below. To clearly define a legal boundary of the nonattainment area, EPA used 'township-range' nomenclature that closely mimicked the Klamath County designated AQZ. Thus, the current AQZ boundary description is slightly different from the nonattainment boundary.

Klamath County	State-Recommended Nonattainment Counties	EPA-Final Designated Nonattainment Counties
Oregon	Klamath County, partial, Air Quality Zone	Klamath County, partial, T37S R9E Sections 31-32 T38S R8E Sections 1-5, 8-16, 22-26, 35-36 T38S R9E Sections 5-8, 14-15, 17-36 T39S R8E Sections 1-2, 11-13, 24

		T39S R9E Sections 1-27 T39S R10E Sections 3-10, 15-20, 29-30

The following is a technical analysis for the Klamath Falls area of Klamath County. This analysis determined whether a multi-county or partial county designation was appropriate

Factor 1: Emissions data

For this factor, EPA evaluated county level emission data for the following $PM_{2.5}$ components and precursor pollutants: "$PM_{2.5}$ emissions total," "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 and NO_x, are part of "$PM_{2.5}$ emissions total," they are not shown in Table 1 as separate items). "$PM_{2.5}$ emissions carbon" represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and "$PM_{2.5}$ emissions other" represents other inorganic particles (crustal). Emissions of SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (ammonia) are also potential $PM_{2.5}$ precursors and are included for consideration.

Annual emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html.

EPA also considered the Contributing Emissions Score (CES) for each nearby county. In general EPA considers nearby counties as potentially contributing to nonattainment in the nonattainment county. The CES is a metric that considers emissions, meteorological and air quality data to provide a relative ranking of counties in and near an area. The CES is not the exclusive determining factor whether or not to include nearby counties in the nonattainment area. A summary of the CES is included in attachment 2, and a more detailed description can be found at:

http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C.]

Table 1 shows annual emissions of $PM_{2.5}$ and precursor pollutant components (given in tons per year) and the CES for violating and potentially contributing counties for the partial Klamath County designation. Counties are listed in descending order by CES.

Table 1. $PM_{2.5}$ Related Emissions and Contributing Emissions Score

County	State Recommended Non-attainment?	CES	$PM_{2.5}$ emissions total (tpy)	$PM_{2.5}$ emissions carbon (tpy)	$PM_{2.5}$ emissions other (tpy)	SO_2 (tpy)	NOx (tpy)	VOCs (tpy)	NH_3 (tpy)
Klamath County	Yes	100	3760	575	7377	2205	1502	15688	2004
Jackson County	No	18	5246	1368	8109	3123	2049	21736	1446
Siskiyou County, Ca.		13	3264	347	4467	2038	1183	10723	1055

Jackson County, Oregon and Siskiyou County, California are identified as two nearby counties that could contribute to violations at the Peterson School site in Klamath Falls. Jackson County is located west of Klamath County. The major urban area in Jackson County is the Medford-Ashland area approximately 60 miles west of Klamath Falls over the Cascade Mountain range.

Siskiyou County, California is located to the south on the Oregon-California border. There is no major metropolitan area in Siskiyou County and is characterized as mountainous forest and wilderness areas with limited ranching and agriculture. Small population centers are located on the north-south Interstate-5 corridor more than 100 miles to the south west of Klamath Falls. The following nine factor analysis will determine whether these counties need to be included in the nonattainment area for Klamath Falls.

As discussed in the air quality section below, all exceedances of the 24 hour standard in Klamath Falls occur during the winter season. Also discussed in the air quality factor below, sulfate comprises 5% or less and nitrate comprises 10% or less of the $PM_{2.5}$ mass on days with high levels of $PM_{2.5}$.. Thus, in considering emissions in Table 1 above, emissions of total $PM_{2.5}$ emissions are of primary concern. $PM_{2.5}$ emissions from each county are of the same order of magnitude, ranging from 3264 t/yr in Siskiyou County to 5246 t/yr in Jackson County.

Due to the large distances between Medford-Ashland and Klamath Falls, topographical barriers, and the meteorological conditions of calm,and low wind speed that lead to high **$PM_{2.5}$**concentrations in Klamath Falls, contribution from nearby counties by transport does not appear to be a concern. Similarly, Siskiyou County emissions are not expected to contribute to Klamath Falls exceedances due to the large distances. Thus, despite similar emissions it is unlikely that any emissions from these counties impact the violating monitor, and that neither of these counties is appropriate for inclusion in the nonattainment area based on this factor.

Table 1 above does not present daily emissions for the winter season when exceedances of the 24-hour **$PM_{2.5}$**standard are recorded. (see air quality factor discussion below.) Rather, Table 1 shows annual emissions. This technical analysis does not significantly rely on annual emissions to determine the appropriate boundary for the nonattainment area. Since only the 24 hour NAAQS is violated in Klamath County, daily worst case emissions during the season when exceedances are recorded, are considered.

Daily worst case emissions were used in previous Oregon SIPs for the purpose of demonstrating that the proposed control strategy would be adequate to attain the 24 hour NAAQS under worst case situations. Oregon continues to use daily worst case emissions in its air quality planning efforts to assess those sources that contribute to high daily levels of air pollution..

Some emission sources such as residential wood combustion (RWC) show a strong seasonal and daily variation, with emission rates dependent on residential heating demand. The most recent particulate matter emission inventory for the daily worst case emissions for the Klamath Falls UGB is found in the PM-10 maintenance plan for Klamath Falls PM-10 nonattainment area. PM-10 is particulate matter with an aerodynamic diameter of 10 micrometers or less. Thus, PM-10 contains the fine particle fraction ($PM_{2.5}$). Wood smoke is primarily in the fine particle fraction and the PM-10 emission inventory can provide some insight into sources that contribute to $PM_{2.5}$ If RWC is a significant contributor to the PM-10 emission inventory, it would also be significant for $PM_{2.5}$.

The PM-10 inventory shows the 1996 emission 24-hour distribution as follows:

Residential Wood Combustion: 75%
Industry: 22%
Winter Road Sanding: 1%
Transportation: 1%

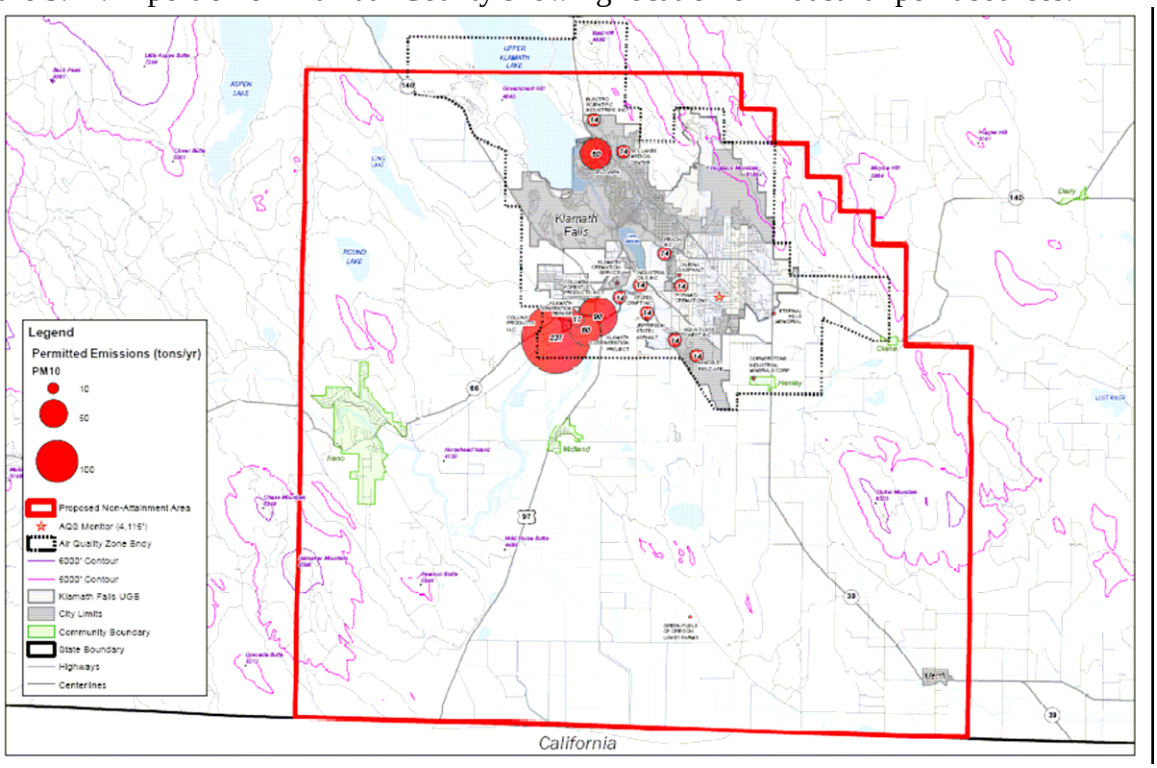
Table 2 below shows emissions of primary **$PM_{2.5}$** for a 'worst case 'emissions' day' for Klamath County and the Klamath Falls AQZ. Data for Table 2 was provided by the State in its Oct 2, 2008 letter.

Table 2 Daily worst day emissions of primary **$PM_{2.5}$**:

	Area sources (lbs/day)	Point sources (lbs/day)	Nonroad mobile sources (lbs/day)	On road mobile sources (lbs/day)	Total **$PM_{2.5}$**emissions
Klamath County	20326	3319	423	205	24273
AQZ	9301	2953	153	149	12556

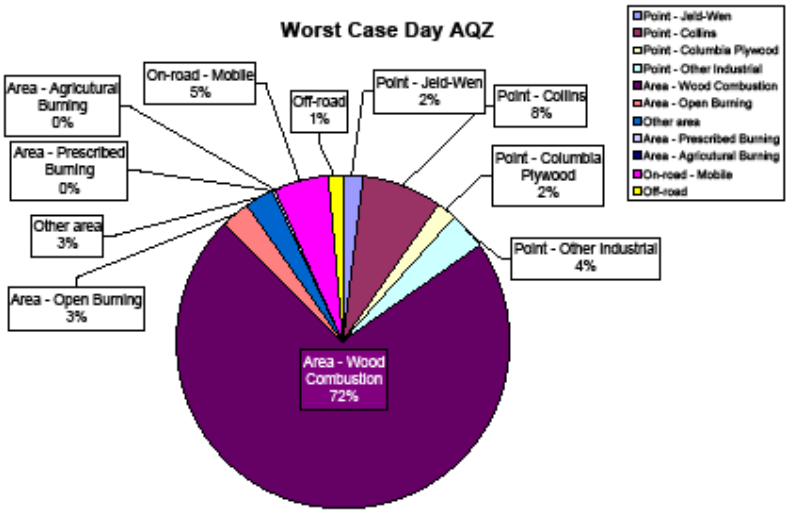
Table 2 shows that approximately half of all county wide emissions are generated within the AQZ. Area source emissions dominate the Klamath County and AQZ emissions. Approximately 84% of the County total emissions are from area sources and area sources account for 75% of the AQZ total emissions. Most of the County industrial point sources are located within the AQZ. Of the area sources, residential wood combustion dominates emissions in the source category, with 11,627 and 8,475 lbs per day respectively for the County and AQZ. Mobile sources account for only approximately 2.5% of total County emissions and 1.2% of the total AQZ emissions. Thus, mobile sources do not contribute significantly to the **$PM_{2.5}$** problem.

Figure 5.27. A portion of Klamath County showing location of industrial point sources:



Both the AQZ and nonattainment boundary encompass the industrial sources of the County.

Figure 5.28 Worst case day emission distribution in the AQZ.



Summary of analysis of emissions: Emissions from nearby counties do not contribute to exceedances in Klamath Falls due to topography and distance. The AQZ incorporates all the industrial sources in Klamath County and most of the county wide area source emission and in

particular residential wood combustion, suggesting that a partial county designation covering the AQZ is appropriate under this factor.

Factor 2: Air quality data

Air quality data are considered in this analysis for three reasons: to determine whether a monitor violates the NAAQS, to help determine the extent of the areas contributing to the violations, and to identify the $PM_{2.5}$ composition on days with exceeedances of the 24-hour $PM_{2.5}$ NAAQS.

Monitors eligible for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr **$PM_{2.5}$**NAAQS for designation purposes. The Klamath Falls air quality data meet these requirements.

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in Klamath County and counties nearby the Klamath Falls area based on data for both the 2004-2006 and 2005-2007 period. A monitor's design value indicates whether that monitor attains a specified air quality standard. The 24-hour $PM_{2.5}$ standards are met when the 3-year average of a monitor's 98^{th} percentile values are 35 $\mu g/m^3$ or less. A design value is only valid if federal minimum data completeness criteria are met.

The 24-hour $PM_{2.5}$ design value for Klamath County is shown in Table 3. The 24 hour design value for the Peterson School site exceeds the level of the 24 hour standard and violates the NAAQS. Klamath Falls must be included in the nonattainment area based on this factor. Klamath County attains the annual **$PM_{2.5}$**NAAQS.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	24-hr **$PM_{2.5}$** Design Values, 2004-2006 ($\mu g/m^3$)	24-hr **$PM_{2.5}$**Design Values, 2005-2007 ($\mu g/m^3$)
Klamath County, Or.	Yes	48	47
Jackson County, Or.	No	34	33
Siskiyou County, Ca.	No	No data available	No data available

Further data for the Peterson School site are shown in Table 4, which lists all of the days that the 24-hour $PM_{2.5}$ NAAQS were exceeded. All exceedances occur during the winter heating season beginning in November and ending by February.

Table4. 2005 – 2007 **$PM_{2.5}$** Exceedance Days & Values: Peterson School, Klamath Falls, Oregon

2005		2006		2007	
Date	Value (ug/m3)	Date	Value (ug/m3)	Date	Value (ug/m3)
1/13/05	49.9	1/23/06	47.5	1/15/07	39.7
1/16/05	46.4	12/4/06	51.2	1/18/07	55.6
1/19/05	50.5	12/31/06	52.6	1/24/07	35.3
1/22/05	49.2			11/23/07	39.6
10/31/05	43.3				
11/18/05	38.7				
11/21/05	37.3				
11/24/05	35.2				
12/06/05	44.2				
12/12/05	46.8				

Jackson County attains the 24 hour **$PM_{2.5}$** NAAQS. There are no monitors in Siskiyou County. However, the absence of a violating monitor alone is not a sufficient reason to eliminate nearby counties as candidates for nonattainment status. Each nearby county has been evaluated based on the weight of evidence of the nine factors and other relevant information. In addition, the technical analysis will determine whether only a portion of Klamath County be designated nonattainment.

EPA considered the chemical composition of the $PM_{2.5}$ collected on filters at the Peterson School site (see the additional information provided to EPA by Oregon in its October 2, 2008 letter in EPA Docket: EPA-HQ-OAR-2007-0562). Data on the composition of fine particle mass are available from the EPA Chemical Speciation Network and the IMPROVE monitoring network. Analysis of these data indicates that the days with the highest fine particle concentrations occur in the winter season. The average chemical composition of the highest days is over 80% elemental and organic carbon typical of wood smoke emissions. See Figure 5.29 and Figure 5.30 below. Other sources of wood combustion in Klamath County could be wild fire or prescribed fire, however neither occur during the wintertime when there is snow cover. The amount of elemental and organic carbon observed on the filters is consistent with the discussion of the emissions factor above. Woodsmoke from residential wood combustion for heating homes appears to be the primary source of emissions that cause violations of the 24-hour **$PM_{2.5}$** NAAQS in this area.

Figure 5.29 – $PM_{2.5}$ Speciation Data from November 8, 2007 (36 ug/m_3) measured at the Peterson School monitor:

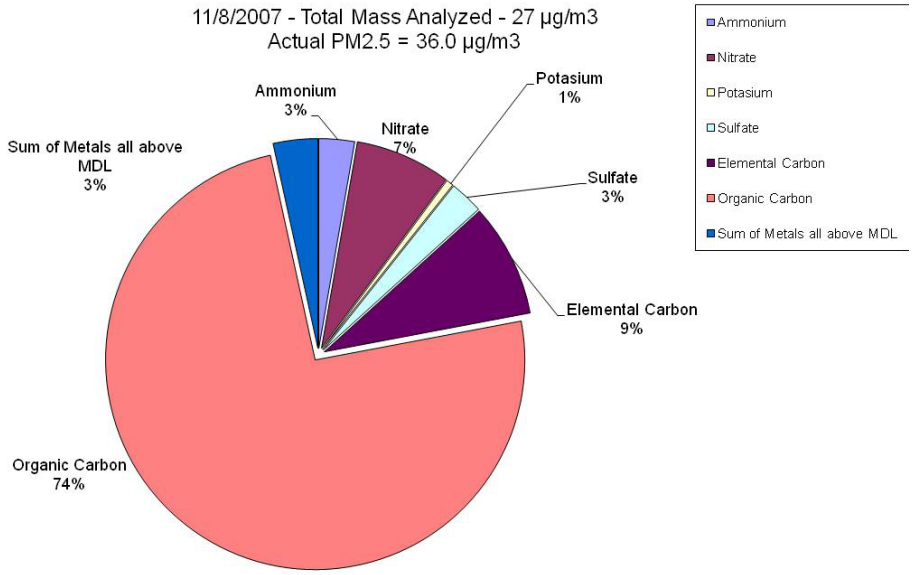
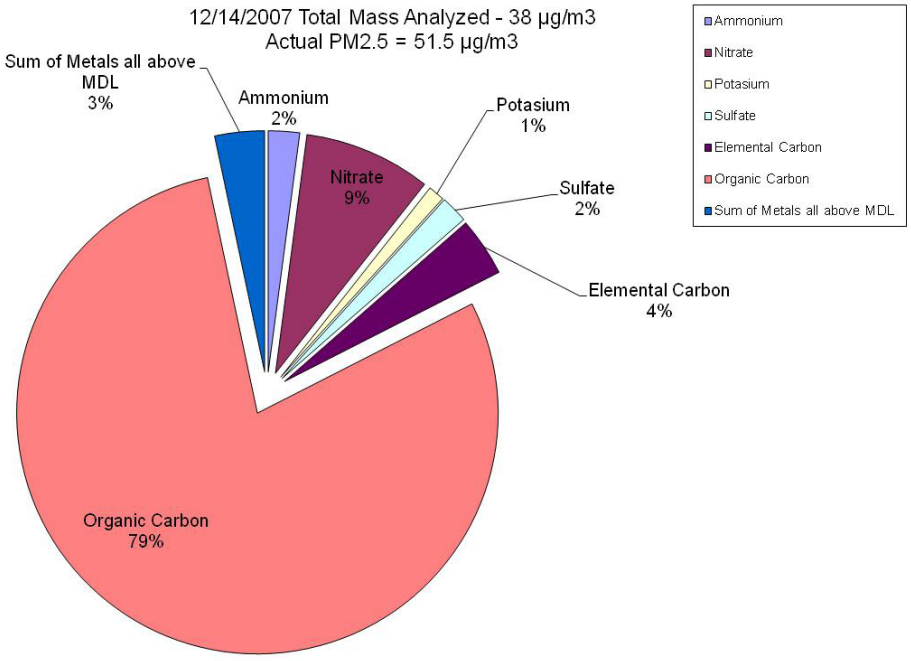
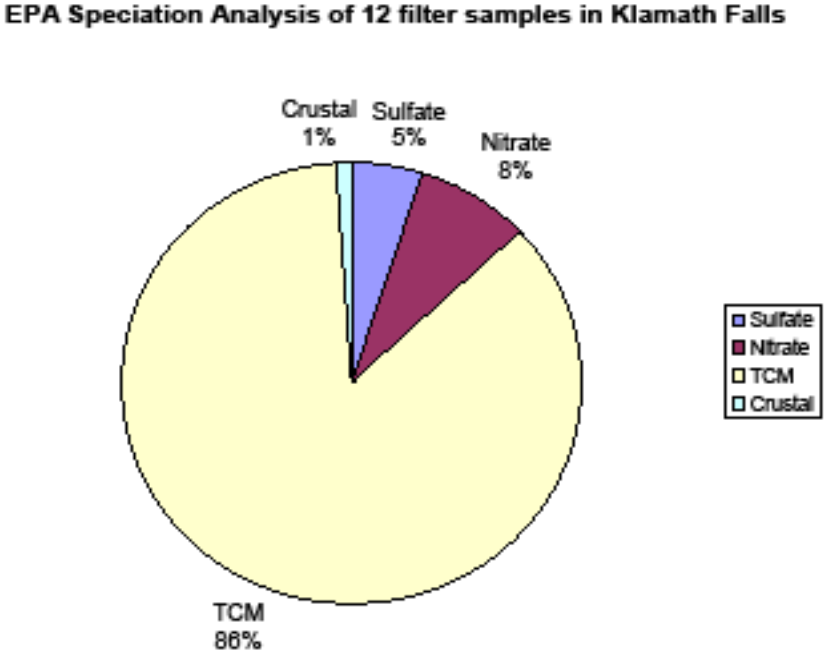


Figure 5.30: **$PM_{2.5}$**Speciation Data from December 14, 2007 (51.5 ug/m3), measured at the Peterson School monitor)



EPA independently analyzed the composition of mass on filters from the Peterson School site. Figure 5.31 below shows this information.

Figure 5.31: EPA analysis of filters from Klamath Falls



Summary of Air Quality Factor:

- Nearby counties with CES scores greater than 10 attain the **$PM_{2.5}$**NAAQS,
- Exceedances in Klamath Falls occur in the winter,
- Chemical composition of filters shows that total carbon dominates filter mass indicating wood smoke.

Based on this factor, areas within Klamath Falls that account for woodsmoke emissions are appropriate for inclusion in the nonattainment area. The AQZ and EPA's nonattainment area encompasses the bulk of woodstove emissions in Klamath Falls.

Factor 3: Population density and degree of urbanization (including commercial development)

Table 5 below shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour $PM_{2.5}$ standards.

Table 5. Population

County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Klamath County, Or.	Yes, partial, Klamath Co. AQZ	65,803	10.6
Jackson County, Or.	No	195,151	70
Siskiyou County, Ca.	No	45,066	7

Klamath County is located in south central Oregon on the east slope of the Cascade mountain range and encompasses 6,135 square miles. Average population density is 10.6 people per square mile. Outside the Klamath Falls AQZ the population density is approximately 3 people per square mile. Klamath County is arid, high elevation, forested and desert land with little population. Over 70% of the county's population resides within the Klamath Falls Air Quality Zone.

Jackson County is located to the west of Klamath Count and is the 6th largest county in Oregon covering 2800 square miles. Seventy one percent of the population resides in 11 incorporated cities centered along the Interstate-5 corridor and includes the cities of Medford and Ashland. Approximately half of the county population lives in Medford and Ashland. Approximately 58,330 live in unincorporated areas. The population centers are separated from Klamath Falls by the Cascade Mountain Range. This topographical barrier prevents Jackson County emissions being transported into Klamath Falls.

Siskiyou County is located to the south of Klamath County and covers 6347 square miles. The largest city in the County is Yreka with a population of approximately 7300 (2000 census). Yreka is approximately 100 miles south-west of Klamath Falls. Due to the distance and low population of Yreka and low population density of the County, emissions from Siskiyou County do not contribute to exceedances recorded in Klamath Falls.

Klamath Falls population based on 2005 U.S. Census Bureau:

Klamath Falls Air Quality Zone: 53,965
Klamath County: 65,055

Most of the population of Klamath County resides within the Klamath Falls AQZ.

Based on this factor in conjunction with information on sources of emissions and topography only the Klamath Falls AQZ should be included in the nonattainment area.

Population Growth
The Klamath Falls area is growing but largely within the urban growth boundary. Klamath County is predicted to have an overall grow rate of 0.5% per year for the next five years. In the city of Klamath Falls, the anticipated growth is slightly less than 1.0%. However, as a result of Oregon's land-use laws much of that growth will occur in the major metropolitan area of Klamath Falls.

<u>Population density and topography maps</u>:

Figure 5.32: This map shows the topography for Klamath County.

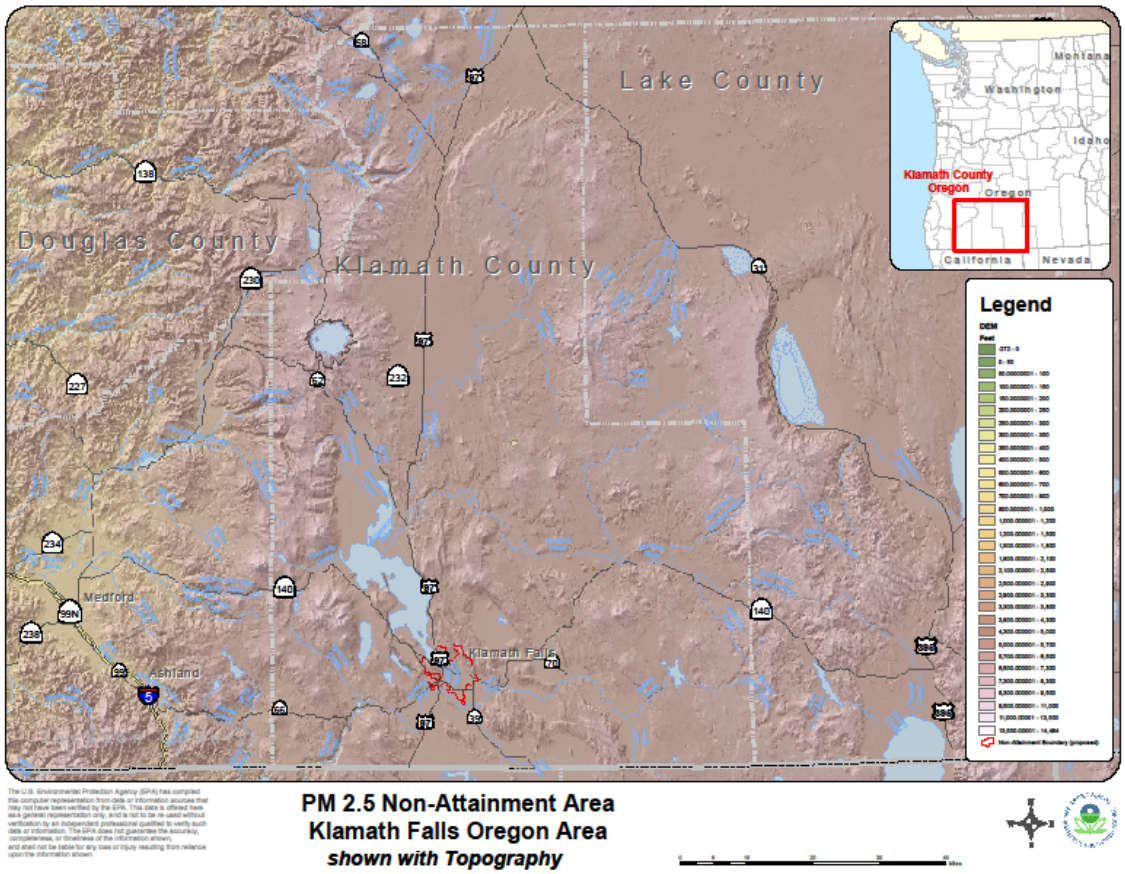


Figure 5.33 Map showing the topography surrounding Klamath Falls:

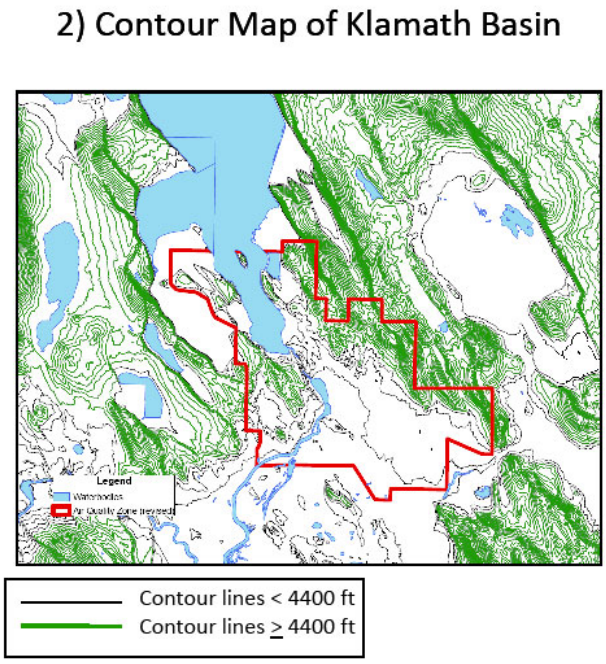
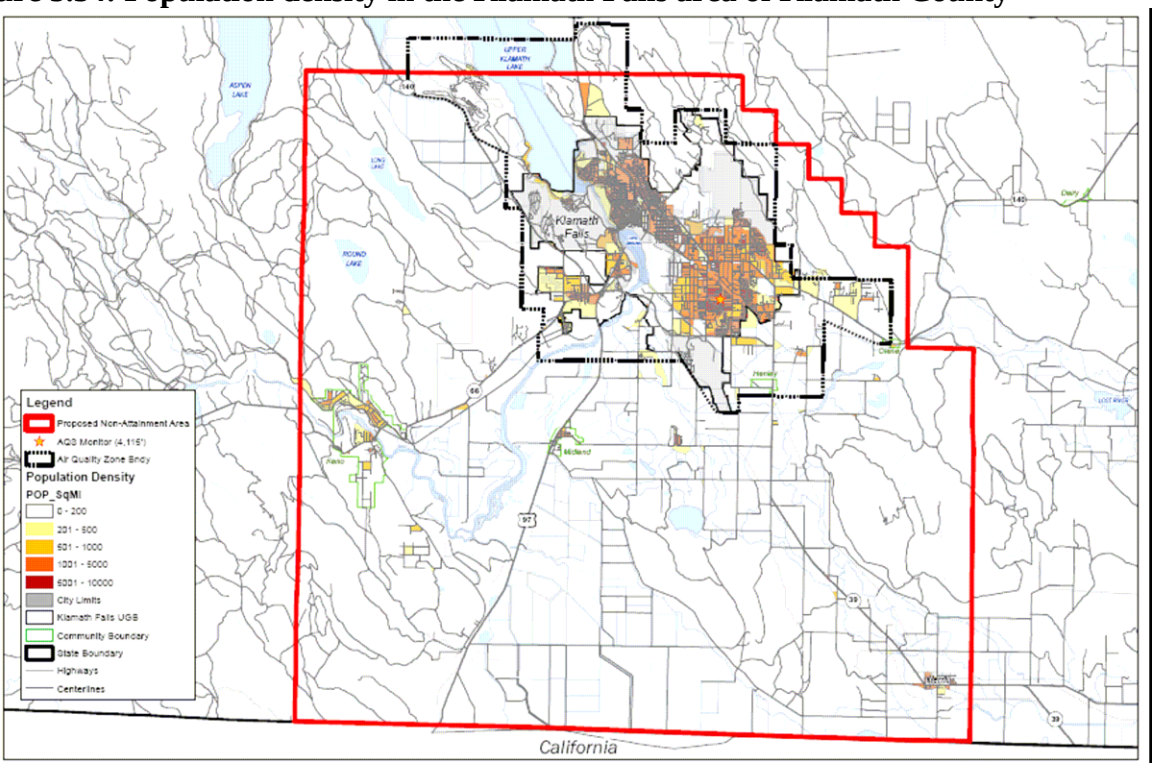


Figure 5.34: Population density in the Klamath Falls area of Klamath County



Klamath Falls has the highest population density in Klamath County, and also contains a major concentration of woodstove usage. Figure 5.35, shows U.S. Census data (2000) for households using wood as the primary source of heat equal or greater than four heating units per square mile.

Figure 5.35: Shows the woodstove density in the Klamath Falls area:

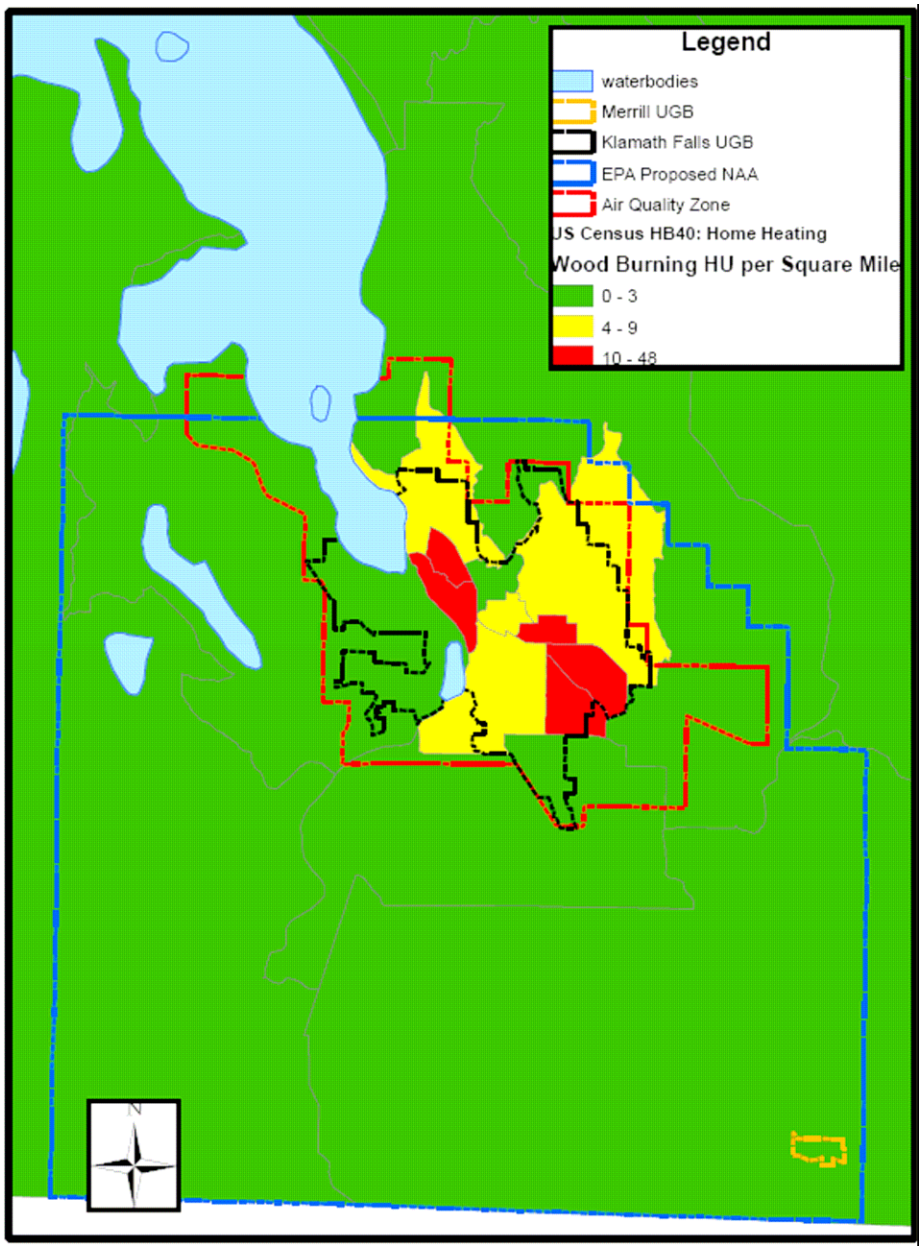
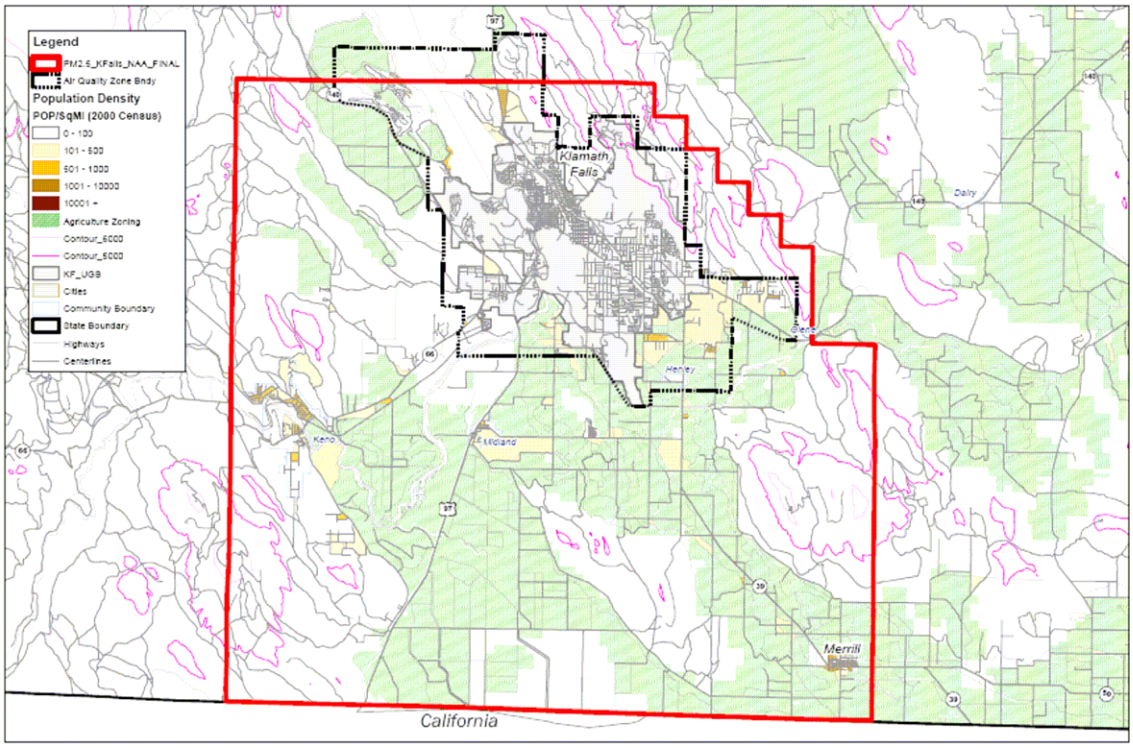
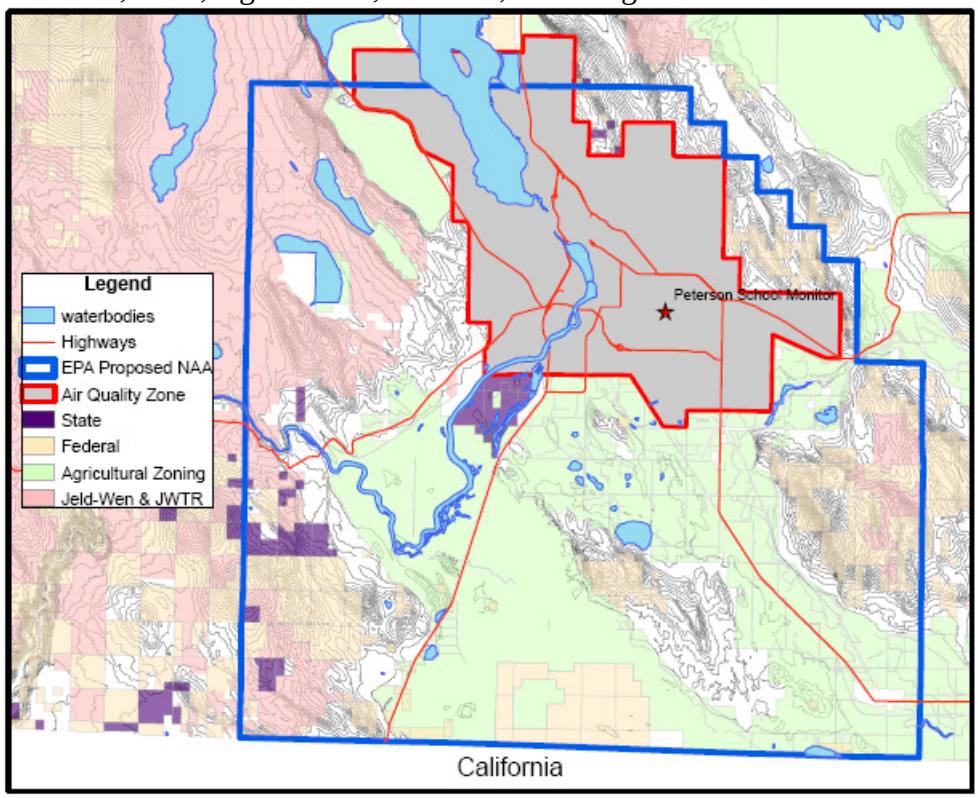


Figure 5.36 Agricultural lands in the Klamath Falls area



There are roughly 16,000 acres of cereal grain, 100,000 acres of forage and 4,000 acres of vegetables grown in the Klamath irrigation project, a major project south of Klamath Falls. Agricultural harvest activity occurs between August and October and field burning is completed by mid-October at the completion of the harvest. Grain fields are flood irrigated beginning in November and remain flooded until March when planting activity begins for the next years crops, preventing any burning from occurring during the periods of violation in Klamath Falls. While some field burning may occur in April to prepare the seed bed for planting, this does not occur during the time when Klamath Falls is experiencing **$PM_{2.5}$** exceedances.

Figure 5.36 Federal, State, Agricultural, Forested, and Range Lands in the Klamath Falls area



South of Klamath Falls there are over 30,000 acres of federally and state managed lands (Figure 5.36). There are U.S. Fish and Wildlife refuge properties that comprise a total of 11,126 acres. The Bureau of Land Management (BLM) also manages 14,021 acres of land within the boundaries of the EPA proposed NAA. The BLM also manages 41 acres of land within the Air Quality Zone. In addition, the Oregon Department of Forestry manages 2,435 acres.

The U.S. Fish and Wildlife service manage its lands which includes farming and burning of the lands. The BLM activities include managing range resources and a small amount of timberlands. Any burning of these lands does not occur during stagnant periods and is conducted outside of the winter exceedance season

Based on this factor in conjunction with information on sources of emissions and topography only the Klamath Falls AQZ should be included in the nonattainment area.

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Klamath Falls area, the percent of total commuters in each county who commute to other counties within the area, as well as the total Vehicle Miles Traveled (VMT) for each county in thousands of miles (see Table 6). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area.

Table 6. Traffic and Commuting Patterns

County	State Recommended Non-attainment?	2005 VMT (million annually)	Number Commuting within and into any violating counties	Percent Commuting in and into any violating counties	Number Commuting in and into statistical area	Percent Commuting in and into statistical area
Klamath County	Yes	807	24,920	97	24860	97
Jackson County	No	1,948	360	0	200	0
Siskiyou County, Ca.	No	525	220	1	280	1

The listing of counties on Table 5 reflects a ranking based on the number of people commuting within Klamath County and people in nearby counties commuting into Klamath County.

Table 6 indicates traffic and commuting pattern data for Klamath County as well as surrounding counties. The annual VMT in Klamath County is over 800 million miles. For comparison, the annual 2005 VMT for Jackson County, was about 2000 million miles annually. Medford, located in Jackson County is the closest major city to Klamath Falls and is the 8th most populous city in Oregon. Percent commuting into Klamath Counties from surrounding counties is very low, less than 2%. Klamath County is not urbanized. EPA believes that this low VMT commuting from nearby counties into Klamath County, along with the low degree of urbanization and rugged terrain features that separate Klamath Falls from surrounding counties, indicate that commuters from surrounding counties do not contribute to violations. A partial county boundary for Klamath County of the Klamath Falls AQZ is sufficient to capture all potential mobile sources contributing to the violations of the monitor in Klamath Falls.

The 2005 VMT data used for table 5 and 6 of the 9-factor analysis have been derived using methodology such as that described in "Documentation for the 2005 Mobile National Emissions Inventory, Version 2," December 2008, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: ftp://ftp.epa.gov/EmisInventory/2005_nei/mobile_sector/documentation/2005_mobile_nei_version_2_report.pdf

Factor 5: Growth rates and patterns

This factor considers population growth for 2000-2005 and growth in vehicle miles traveled for 1996-2005 for counties in Klamath Falls area, as well as patterns of population and VMT growth. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area.

Table 7, below shows population, population growth for Klamath County compared to statewide projected growth. Klamath County anticipates slower growth than the State as a whole. Due to

the low population of the counties in eastern Oregon, large geographic size, and rural nature of eastern Oregon, growth rates in neighboring counties were not an important consideration in our decision making process. However, EPA did consider growth within Klamath County. According to the State's analysis, the Klamath Falls area is growing with a predicted growth rate of 0.5% per year for the next 5 years. This rate is predicted to increase to 0.71% per year to 2040. Much of that growth will occur in the major metropolitan area of the greater Klamath Falls area.

Table 7; Klamath county Growth Forecasts

Total Population	2000	2003	2005	2010	2015	2030
Oregon Statewide	3,436,750		3,618,200	3,843,900	4,095,708	4,891,225
Klamath County	63,900	64,600	65,330	66,968	68,851	74,924
Population change	'00-'03	'00-'05	'05-'10	'05-'15	'15-'20	'30-'35
Oregon statewide	104,750	181,450	225,700	251,808	263,550	263,568
Klamath County	700	1430	1638	1883	1744	2441
Annual Growth Rate	'00-'03	'00-'05	'05-'10	'05-'15	'15-'20	'30-'35
Oregon	1.00%	1.03%	1.21%	1.27%	1.25%	1.05%
Klamath County	0.36%	0.44%	0.50%	0.55%	0.50%	0.64%

Based on this factor the Klamath Falls AQZ appears to be the appropriate nonattainment area.

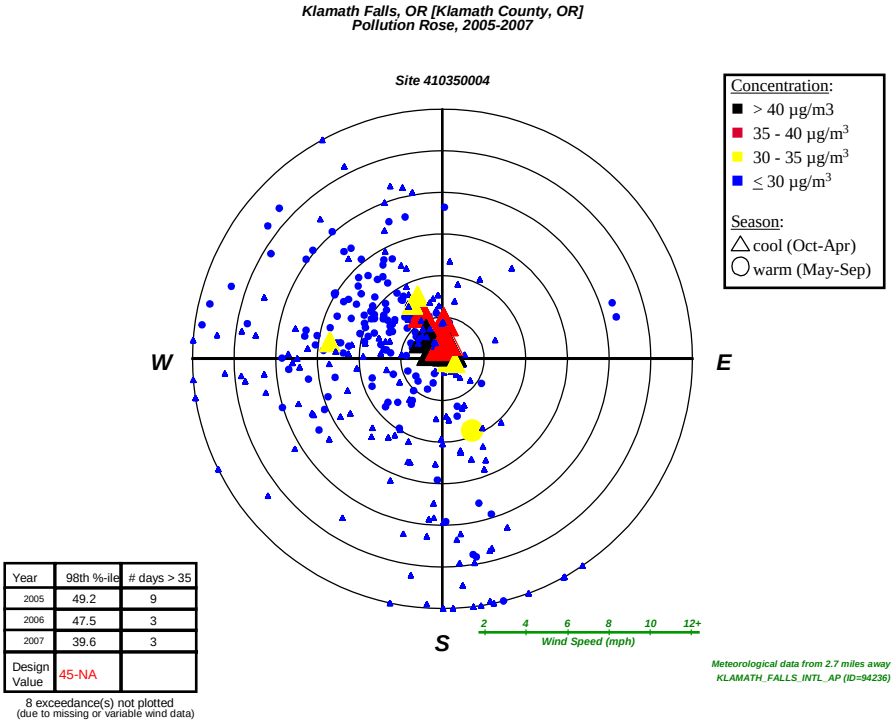
Factor 6: Meteorology (weather/transport patterns)

EPA considered data from National Weather Service monitoring sites, State operated instruments, and other meteorological monitoring sites in the area. Wind direction and wind speed data for 2005-2007 were analyzed, with an emphasis on "high $PM_{2.5}$ days" for each of two seasons (an October-April "cold" season and a May-September "warm" season). These high days are defined as days where any FRM or FEM air quality monitors had 24-hour $PM_{2.5}$ concentrations above 95% on a frequency distribution curve of $PM_{2.5}$ 24-hour values.

For each air quality monitoring site, EPA developed a "pollution rose" to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. Figure 5.37 identifies 24-hour **$PM_{2.5}$** values by color; days exceeding 35 ug/m3 are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from

which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.]

Figure 5.37. Pollution rose for Klamath Falls

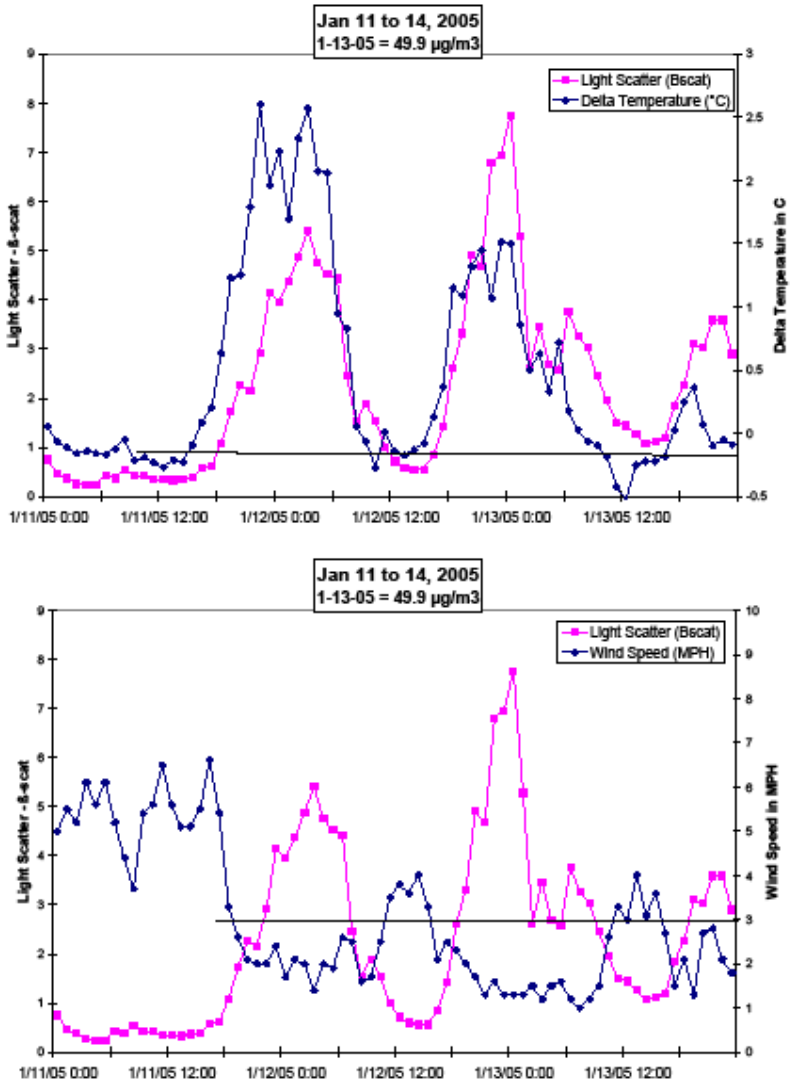


As shown in the pollution rose in Figure 5.37, the average prevailing surface wind directions for high $PM_{2.5}$ days in Klamath County (Peterson School site located in the south-east portion of the City of Klamath Falls) are from the northwest, west and south. The pollution roses show that 24-hour $PM_{2.5}$ concentrations are influenced by low wind speed and with winds from the northwest during the 'cool season' of October through April.

Figure 5.37, above shows that for days with concentrations above 40 ug/m3 the wind speed was calm with no definable wind direction. Similarly, days with concentrations between 35-40 ug/m3 (red triangles) were characterized by calm winds and cold temperatures. High **$PM_{2.5}$**values (30-35 ug/m3; yellow dots) were recorded during the warm season (May through September) with wind direction from the south and southeast. Values below 30 ug/m3 (blue dots) were recorded with the predominant wind from the northwest.

Figure 5.38: Diurnal variation in **$PM_{2.5}$** levels with inversion intensity and windspeed

APPENDIX D – Diurnal effects for each exceedance day in 2005 through 2007



30

Figure 5.38 above shows **$PM_{2.5}$** levels along with inversion intensity and wind speed for several days (January 15, 2005 to January 19, 2005). **$PM_{2.5}$**levels show traditional diurnal variation over a 24 hour period, with levels building in late afternoon as the nighttime ground based inversion is established and woodstoves are stoked for evening residential heating. **$PM_{2.5}$** levels begin to

subside in the late evening. Again in the morning woodstoves are stoked for residential heating but as the inversion 'breaks' and there is vertical mixing in the atmosphere, **$PM_{2.5}$**levels subside. Also as windspeed decreases, **$PM_{2.5}$** levels increase.

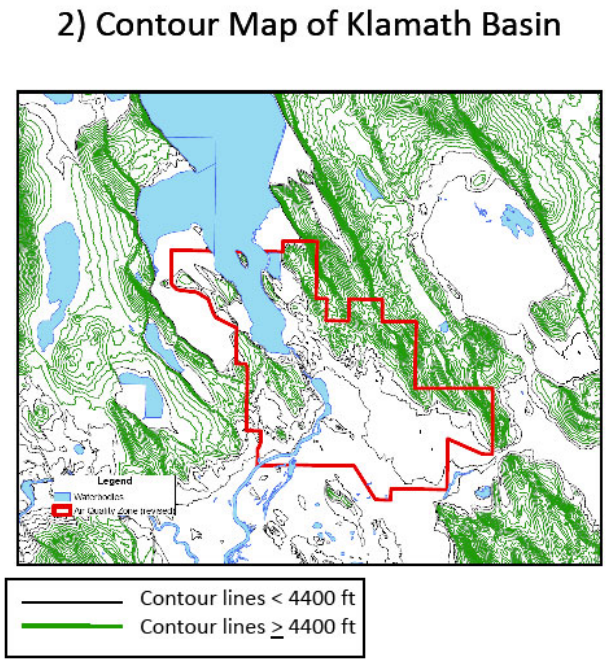
Table 1 presents the CES for Klamath, Jackson and Siskiyou counties. From the meteorological discussion above, high **$PM_{2.5}$** values are recorded with calm or very low wind speeds from the north and north-west. Jackson County is located due west of Klamath Falls over the Cascade Mountain Range. Thus, it is unlikely that emissions from Jackson County (Medford-Ashland area) are transported to contribute to **$PM_{2.5}$**levels in Klamath Falls. Likewise, Siskiyou County is due south of Klamath Falls and emissions from Siskiyou County do not contribute to the high **$PM_{2.5}$**levels in Klamath Falls.

Based on this factor in conjunction with information on sources of emissions and topography only the Klamath Falls AQZ should be included in the nonattainment area.

Factor 7: Geography/topography (mountain ranges or other air basin boundaries)

The geography/topography analysis evaluates the physical features of the land that might have an effect on the air shed and, therefore, on the distribution of $PM_{2.5}$ over the Klamath Falls area.

Figure 5.41: Elevation contours around Klamath Falls



Klamath Falls lies in a valley at the northern end of the Klamath basin, a broad valley that extends south into northern California and surrounded by mountains. Klamath Falls is at an elevation of approximately 4500 ft. above mean sea level (MSL). Surrounding mountains rise to 5000-6000 ft. MSL. Figure 5.41 above shows the contours of the area surrounding Klamath Falls. The AQZ closely follows the ridge lines west, north and east of Klamath Falls. To the south of Klamath Falls is the Klamath Basin extending into California. There are no sources of emissions south of Klamath Falls for several hundred miles that could contribute to the wintertime exceedances, especially since high PM levels are associated with calm to low wind speed. Thus the southern boundary of the AQZ encompasses all the local emission sources that could contribute to high PM levels.

Based on this factor the Klamath Falls AQZ follows topographical features and is an appropriate nonattainment area.

Factor 8: Jurisdictional boundaries

In evaluating the jurisdictional boundary factor, EPA gave consideration to existing jurisdictional boundaries, where relevant.

This factor was a consideration for Klamath Falls. EPA considered both the Klamath Falls UGB as initially recommended by Oregon, as well as the AQZ a subsequent recommendation by Oregon. The AQZ meets the requirements of the Clean Air Act, whereas the UGB does not. The nonattainment area for Klamath Falls uses a legal description of 'township-range' nomenclature that closely follows AQZ boundary.

Factor 9: Level of control of emission sources

Under this factor, the existing level of control of emission sources is taken into consideration. The emissions data used by EPA in this technical analysis and provided in Table 1 (under Factor 1) represent emissions levels taking into account any control strategies implemented in the Klamath Falls area before 2005 on stationary, mobile, and area sources. Data are presented for **$PM_{2.5}$**components that are directly emitted (carbonaceous **$PM_{2.5}$**and crustal **$PM_{2.5}$**) and for pollutants which react in the atmosphere to form fine particles (e.g. SO_2, NOx, VOC, and ammonia).

This factor was not a consideration for the Klamath Falls area.

Conclusion

A multi-county designation for Klamath Falls nonattainment area is not warranted or appropriate. Emissions from surrounding counties do not contribute to violations in Klamath Falls. This fact is due to:

- isolation of Klamath County from surrounding counties by topography and distance,
- the large counties in eastern Oregon,

- negligible emissions from surrounding counties,
- negligible commute traffic from surrounding counties, and
- great distances to urban areas in surrounding counties.

A partial county designation is appropriate because:

- pollutant emissions are locally generated, primarily from residential wood combustion,
- speciation data indicate that, on exceedance days, the vast majority of the $PM_{2.5}$ mass is composed of carbon, an indication of wood combustion,
- exceedances occur during winter heating season where residential wood combustion is the significant source of pollution,
- exceedances occur with calm to low wind speeds where transport from outside the area is not a consideration,
- strong ground-based temperature inversions trap emissions, and
- topographical features further trap pollution in the air shed.

Based on analysis of all the factors and analytical tools, EPA concludes that only the Klamath Falls AQZ is appropriate for designation as nonattainment for the 24 hour $PM_{2.5}$ NAAQS in Klamath Falls. The AQZ includes all the areas of significant wood smoke emissions and all areas of potential growth of emissions within the geographic area contributing to violating monitor.

EPA Technical Analysis for Oakridge 24 Hour PM2.5 Nonattainment Area

Introduction

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those nearby areas that contribute to violations. This technical analysis for Oakridge, Oregon identifies the monitor that violates the 24-hour PM2.5 standard and evaluates nearby counties for contributions to fine particle concentrations in Oakridge. EPA has evaluated these counties, and a partial county boundary designation based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

We also used analytical tools and data such as pollution roses, fine particle composition monitoring data, back trajectory analyses, and the contributing emission score (CES) to evaluate these areas. (See additional discussion of the CES under factor 1 below.)

Figure 5.40 below is a map of the partial Lane County nonattainment area and other relevant information such as the locations and design values of air quality monitors in nearby counties.

Figure 5.40 Oakridge, OR 24-hr PM2.5 Nonattainment Area

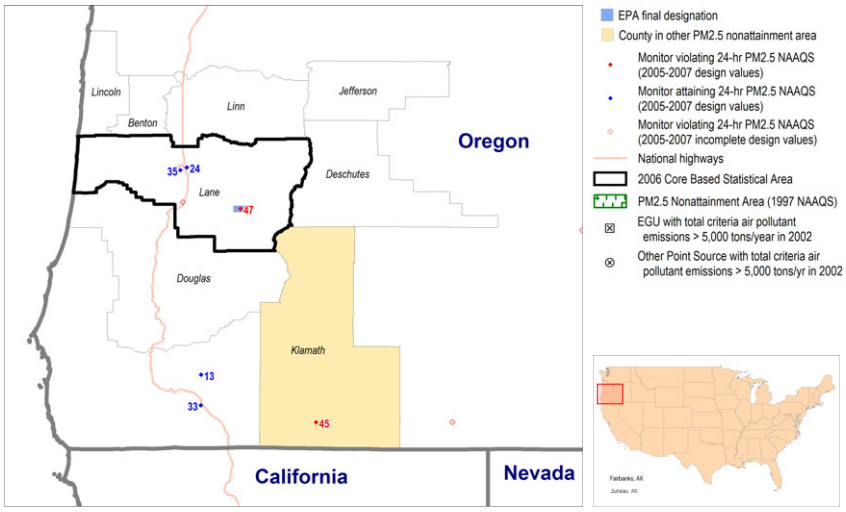


Figure 5.41 Oakridge nonattainment area

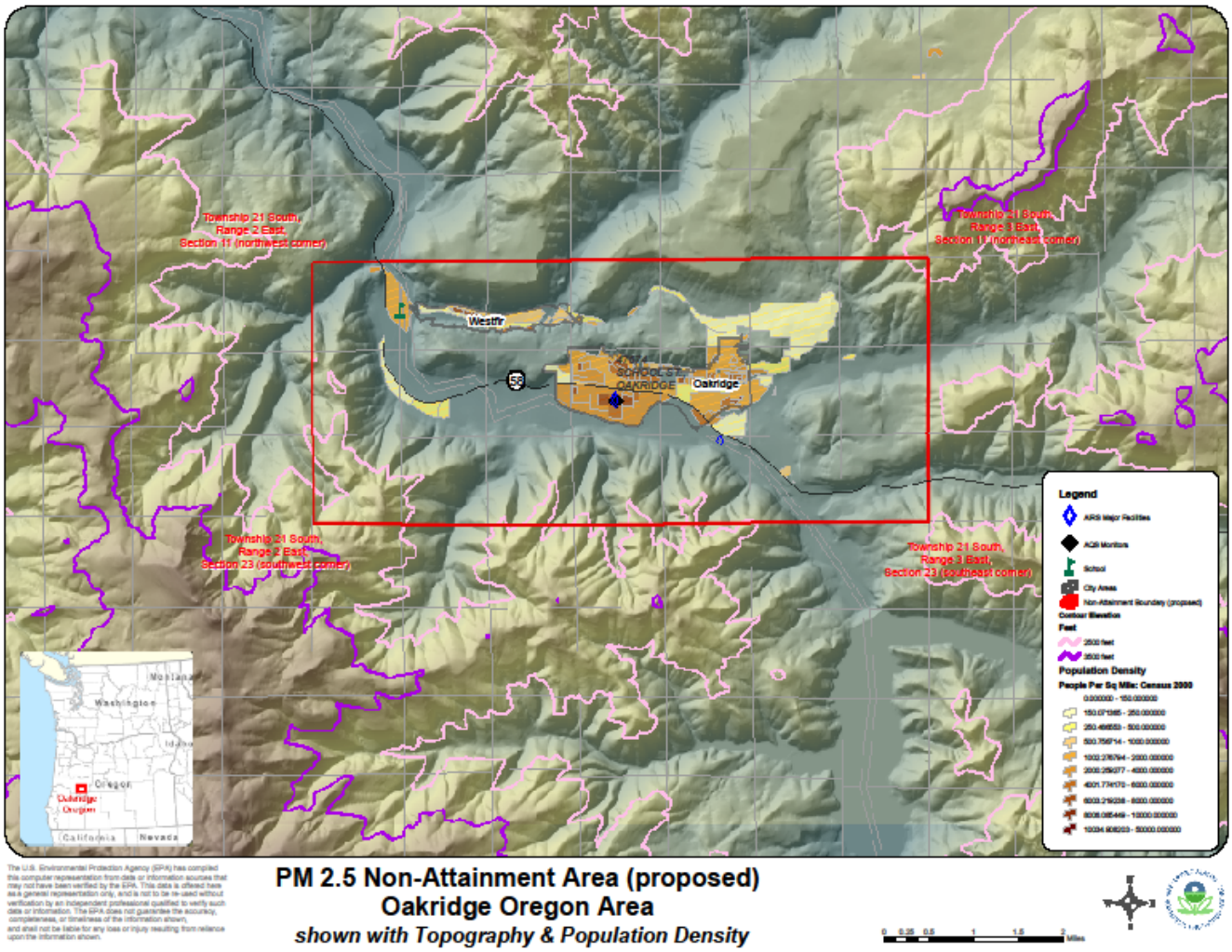


Figure 5.41 above is a map of the Oakridge nonattainment area with topography.

Oakridge is a PM_{10} nonattainment area with a boundary of the Oakridge Urban Growth Boundary. Oakridge is designated as "attainment/unclassifiable for the 1997 PM2.5 NAAQS, so there is no existing $PM_{2.5}$ nonattainment area boundary.

In December 2007, the State of Oregon recommended that the Oakridge Urban Growth Boundary (UGB) be designated as nonattainment for the 2006 24-hour $PM_{2.5}$ standard based on air quality data from the years 2004-2006. These data are from Federal Reference Method (FRM) monitors located in the state. See letter from Governor Theodore R. Kulongoski, dated December 17, 2007.

In August 2008, EPA notified Oregon of its intended designation for Oakridge as incorporating an area slightly larger than the Oakridge UGB, but still a partial county designation. In this letter,

EPA also requested that if Oregon wished to provide comments on EPA's intended designation, it should do so by October 20, 2008. EPA stated that it would consider any additional information (e.g., on power plants or partial county areas) provided by the state in making final decisions on the designations.

Oregon submitted additional information for the Oakridge area in a letter from Andy Ginsberg, Air Quality Division Administrator, dated October 20, 2008. In that letter, Oregon also endorsed the information and recommendations submitted by the Lane Regional Air Protection Agency (LRAPA). Oregon and LRAPA provided additional information in an October 30, 2008 telephone conference call with EPA.

Based on EPA's technical analysis described below, EPA has designated a portion of Lane County Oregon as nonattainment for the 24-hour $PM_{2.5}$ air-quality standard as part of the Oakridge nonattainment area, based upon currently available information.

Oakridge, Oregon	State-Recommended Nonattainment Counties	EPA-Final Designated Nonattainment Counties
Oregon	Lane County, Partial, Urban Growth Boundary	Lane County, Partial

The following is a technical analysis for the Oakridge, Or. 24-hour $PM_{2.5}$ nonattainment area.

Factor 1: Emissions data

For this factor, EPA evaluated county level emission data for the following $PM_{2.5}$ components and precursor pollutants: "$PM_{2.5}$ emissions total," "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 and NO_x, are part of "$PM_{2.5}$ emissions total," they are not shown in Table 1 as separate items). "$PM_{2.5}$ emissions carbon" represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and "$PM_{2.5}$ emissions other" represents other inorganic particles (crustal). Emissions of SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (ammonia) are also potential $PM_{2.5}$ precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html.

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive manner for considering data for these factors. A summary of the CES is included in attachment 2, and a more detailed description can be found at http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C.]

Table 1 shows emissions of $PM_{2.5}$ and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties for the Oakridge area. Counties are listed in descending order by CES.

Table 1. $PM_{2.5}$ Annual Emissions and Contributing Emissions Score for Surrounding Counties:

County	Contributing Emissions Score	Preliminary Daily Des Val 0507	PM2.5 emissions - total (tpy)	PM2.5 emissions - carbon (tpy)	PM2.5 emissions - other (tpy)	SO2 emissions (tpy)	NOx emissions (tpy)	VOC emissions (tpy)	NH3 emissions (tpy)
OAKRIDGE, OR		47	0	0	0	0	0	0	0
Lane	**100**	**47**	**5,353**	**3,143**	**2,210**	**1,341**	**12,365**	**33,290**	**1,852**
Douglas	48		4,615	2,675	1,940	640	6,900	16,658	1,179
Klamath	27	45	3,760	2,205	1,555	575	7,377	15,688	2,004
Linn	13		3,246	1,479	1,768	1,151	6,621	14,271	3,756
Deschutes	9	0	3,883	1,876	2,007	524	5,716	14,276	639
Benton	2	0	1,424	761	664	322	2,299	8,275	1,112
Lincoln	1	0	1,635	709	926	454	2,625	6,363	175
Jefferson	0	0	1,049	501	547	116	1,297	3,476	869

In addition to Lane County with a CES of 100, Douglas, Klamath and Linn Counties have CES of 48, 27 and 13 respectively. Due to topographrical barriers and complex meteorology, as well as the nature of the exceedances of the 24-hour $PM_{2.5}$ NAAQS in the Oakridge area, the CES was not given as much consideration as other information in the assessment of this area. Other than the monitors located in Oakridge and Klamath Falls, all other monitors in Oregon show attainment of the 2006 24-hour $PM_{2.5}$ NAAQS. Due to the isolated, rural, and sparsely populated nature of Douglas and Linn Counties, there are no monitors.

Douglas County is located south of Lane County and has a population of 105,000 (2006 estimate) and covers approximately 5134 square miles. Population density for the County is 20 people per square mile. Roseburg is the largest metropolitan area in the county with a population of 20,000. Douglas County extends from the Pacific Ocean on the west, to the Cascade Mountain Range on the east. Most of the population is centered along the north-south Interstate 5 corridor. Roseburg is located approximately 50 miles south-west of Oakridge, separated by mountainous terrain of the west slope of the Cascades. Since exceedances in Oakridge occur during winter inversions and low windspeed, emissions from Roseburg and Douglas County do not traverse this mountainous terrain and thus do not contribute to the violating monitor.

Linn County is located north of Lane County and has a population of 111,500 (2006 estimate) and covers approximately 2300 square miles. Population density is 45 people per square mile. Linn County covers the Willamette Valley from the Coast Range to the Cascade Range. The

largest urban area is the Albany-Lebanon area with a population of 46,200. Albany is located approximately 50 miles north-west of Oakridge separated by mountainous terrain of the west slope of the Cascades. Since exceedances in Oakridge occur during winter inversions and low windspeeds, emissions from Albany and Linn County similarly do not traverse this mountainous terrain and thus do not contribute to exceedances of the standard.

In the technical analysis for the Klamath Falls nonattainment area, it is demonstrated that the Klamath Falls violating monitor is isolated from surrounding counties due to topography and large distances. Thus, for the same reasons explained in that TSD emission sources in Klamath County do not contribute to violations in Oakridge.

Discussed below in the factors considering meteorology and topography, Oakridge is an isolated rural mountain community where violations of the PM2.5 NAAQS occur during the winter when strong ground based nighttime inversions and calm to low wind speed trap emissions in the valley community. Thus, emissions from nearby counties are not transported into Oakridge and is a significant factor in determining the nonattainment boundary for Oakridge.

Table 1 above provides annual emissions. Since exceedances of the 24 hour PM2.5 NAAQS occur only during the winter, a daily worst case emission inventory provides emission rates when exceedances occur. The most recent daily emission inventory is for 1991 and provides the following distribution of emissions by source category. (see Oakridge PM_{10} Nonattainment Plan, dated 1996). A PM_{10} emission inventory is useful for estimating emissions of $PM_{2.5}$ since $PM_{2.5}$ is a subset of PM_{10}.

Residential Wood Combustion:	76.3%
Paver Roads:	12.6%
Unpaved Roads:	7.6%
Winter Road Sanding:	0.9%
Transportation (mobile sources):	1.9%
Industrial Point:	0.6%
Other:	0.3%

EPA believes that due to the low growth rate in Oakridge, this distribution is still relevant. This slow growth rate is primarily due to the decline in the logging and wood products industry. Emissions in the area are dominated by residential wood combustion during the time of year when exceedances of the PM2.5 NAAQS are reported.

The small community of Westfir, with a population of 375, is located approximately 1 mile northwest of Oakridge over a mountain ridge. Westfir, by road, is only 3-4 miles from Oakridge. Since Westfir was not included in the PM_{10} nonattainment area boundary, its emissions are not included in the distribution above. Westfir is a residential community with no commercial or industrial sources of emissions. However, EPA believes residential wood combustion (RWC) emissions in Westfir are equivalent, on a per capita basis, with emissions in Oakridge. Thus Westfir could comprise about 10% of the total combined Westfir-Oakridge area source emissions and increase the percentage contribution in the area. Emissions in both Oakridge and Westfir are dominated by residential wood combustion. As explained below in factor 6, emissions from

Westfir can be transported down river to Oakridge. Thus based on this factor in conjunction with factor 6, Oakridge and Westfir would be appropriate for inclusion in the nonattainment area.

Factor 2: Air quality data

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in Oakridge and nearby areas based on data for the 2004-2006 and 2005-2007 periods. A monitor's design value indicates whether that monitor attains a specified air quality standard. The 24-hour $PM_{2.5}$ standards are met when the 3-year average of a monitor's 98^{th} percentile values are 35 $\mu g/m^3$ or less. A design value is only valid if minimum data completeness criteria are met.

This technical analysis of air quality data answers three questions: what monitors violate the PM2.5 NAAQS, is a multi-county designation appropriate, and if a partial county designation is appropriate, what should be the boundary.

The 24-hour $PM_{2.5}$ design values for counties in Lane County are shown in Table 2.

Other than the monitors located in Oakridge and Klamath Falls all other Oregon monitors show attainment of the 2006 PM2.5 NAAQS. Due to the isolated, rural, and sparsely populated nature of Douglas and Linn Counties, there are no monitors.

Table 2. Air Quality Data

County: Lane	State Recommended Nonattainment?	24-hr PM2.5 Design Values, 2004-2006 ($\mu g/m^3$)	24-hr PM2.5 Design Values, 2005-2007 ($\mu g/m^3$)
Lane County, Part, Oakridge	Yes	48	47
Lane County, Eugene	No	32	35

The monitor located in the City of Oakridge shows a violation of the 24-hour $PM_{2.5}$ standard. However, the absence of a violating monitor alone is not a sufficient reason to eliminate nearby counties as candidates for nonattainment status. Similarly, it may not be appropriate to designate the entire county nonattainment. Each county has been evaluated based on the weight of evidence of the nine factors and other relevant information. Evaluation of whether a partial county designation is appropriate is likewise based on the nine factors and other relevant information.

Eugene, Oregon, the monitor closest to the violating Oakridge monitor attains the PM2.5 NAAQS.

A special intensive PM_{10} monitoring study was conducted by LRAPA in the winter of 1994. Eight temporary monitoring sites were established throughout the Oakridge community and operated from mid-January through February, 1994. Daily samples were collected and analyzed for chemical composition. The average composition of all sites for all days was over 80% residential wood combustion. On average, soil accounted for 13-15% of the PM_{10} mass. (see

"Oakridge, Oregon 1994 PM_{10} Saturation Monitoring Study", July 1995, Lane Regional Air Pollution Agency).

The permanent monitoring site in Oakridge has meteorological monitoring instrumentation which includes wind speed, wind direction and temperature at 2 and 10 meters. Table 3 below shows that exccedances of the 24 hour $PM_{2.5}$ NAAQS occur during the winter heating season of late October through February.

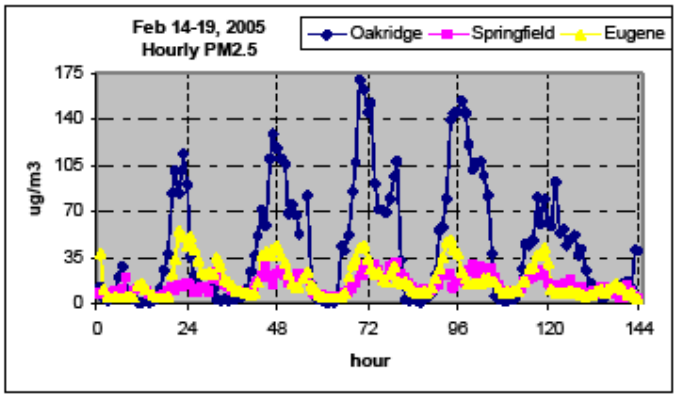
Table 3 Exceedance days for 2005 through 2007, PM2.5 concentrations, number of stable hours and number of hours with calm windspeed.

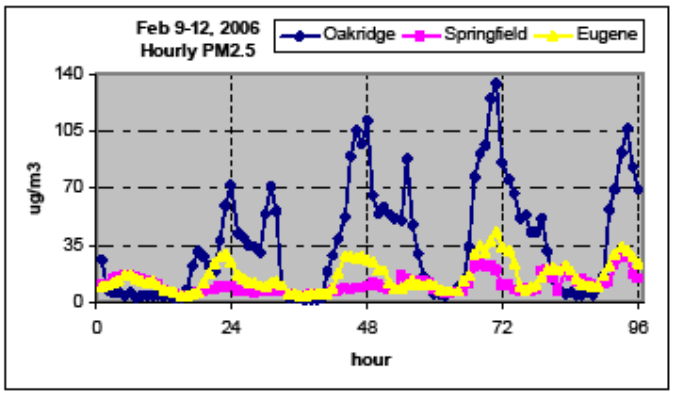
Date	PM2.5 ug/m3	# Stable Hours	# Calm Hours
1/5/2005	57.4	17	24
1/6/2005	57.6	16	24
1/14/2005	45.7	16	24
1/22/2005	43.3	17	24
1/23/2005	42.0	17	24
1/24/2005	46.1	19	24
1/25/2005	58.3	17	24
1/30/2005	35.9	16	23
1/31/2005	48.9	14	19
2/1/2005	42.4	18	23
2/2/2005	43.7	19	24
2/3/2005	58.4	18	23
2/4/2005	36.5	15	16
2/10/2005	37.4	16	22
2/11/2005	47.7	16	21
2/16/2005	62.6	17	19
2/17/2005	63.2	17	19
2/18/2005	65.3	18	21
2/23/2005	44.8	18	18
2/24/2005	40.6	16	18
12/15/2005	73.0	19	21
12/21/2005	49.0	16	20
2/10/2006	40.8	18	13
2/19/2006	35.5	16	12
2/22/2006	38.6	12	14
12/7/2006	47.0	18	21
1/12/2007	38.3	17	24
1/24/2007	42.7	21	20
1/27/2007	40.5	20	19
1/30/2007	51.0	18	16
2/2/2007	52.5	20	22
10/27/2007	39.6	18	18
11/8/2007	36.3	17	22

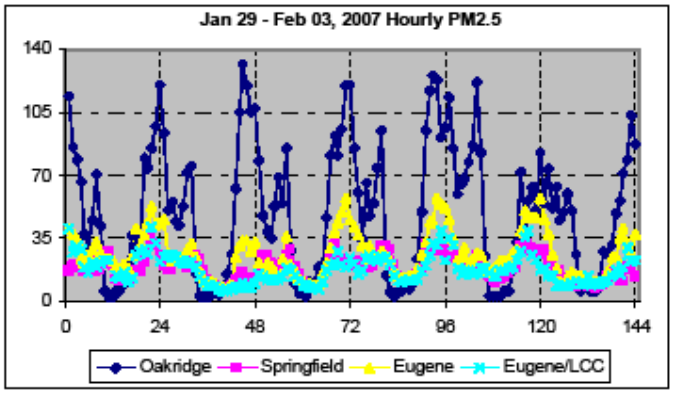
The number of stable hours is determined when the temperature at 10 meters is higher than the temperature at 2 meters. Stable atmospheric conditions restrict vertical mixing and traps cold air at the surface. Calm hours are when windspeed is less than, or equal to 2 miles per hour. This table demonstrates that exceedances occur during extended night time inversions and low wind speed.

Figure 5.42 Diurnal PM2.5 readings in Eugene, Springfield and Oakridge for three episodes

Figures 5-7 PM2.5 readings from continuous monitors for three PM2.5 episodes in the Cities of Oakridge, Eugene and Springfield, Oregon







12

The graphs in Figure 5.42 show the diurnal variation in PM2.5 levels for monitors in Oakridge, Springfield, and Eugene, Oregon. Eugene and Springfield are the largest urban areas in Lane County and are 35-40 miles west of Oakridge and separated by mountainous terrain..

In general, PM2.5 levels begin to increase in the late afternoon, reach a peak at midnight and then begin to decrease. A slight increase is observed in the early morning and decreases again until late afternoon. This variation is characteristic of residential wood combustion of stoking the stove in the afternoon-evening, and again in the morning. The $PM_{2.5}$ levels in Oakridge are significantly higher at night than for the larger cities of Eugene and Springfield. And, Oakridge $PM_{2.5}$ levels drop below the levels reported for Eugene Springfield. These data suggest that air quality levels in Oakridge are locally generated with no contribution from other urban areas within Lane County.

Figure 5.43 Plots of PM2.5 concentrations in Oakridge as a function of $PM_{2.5}$ concentrations in Eugene

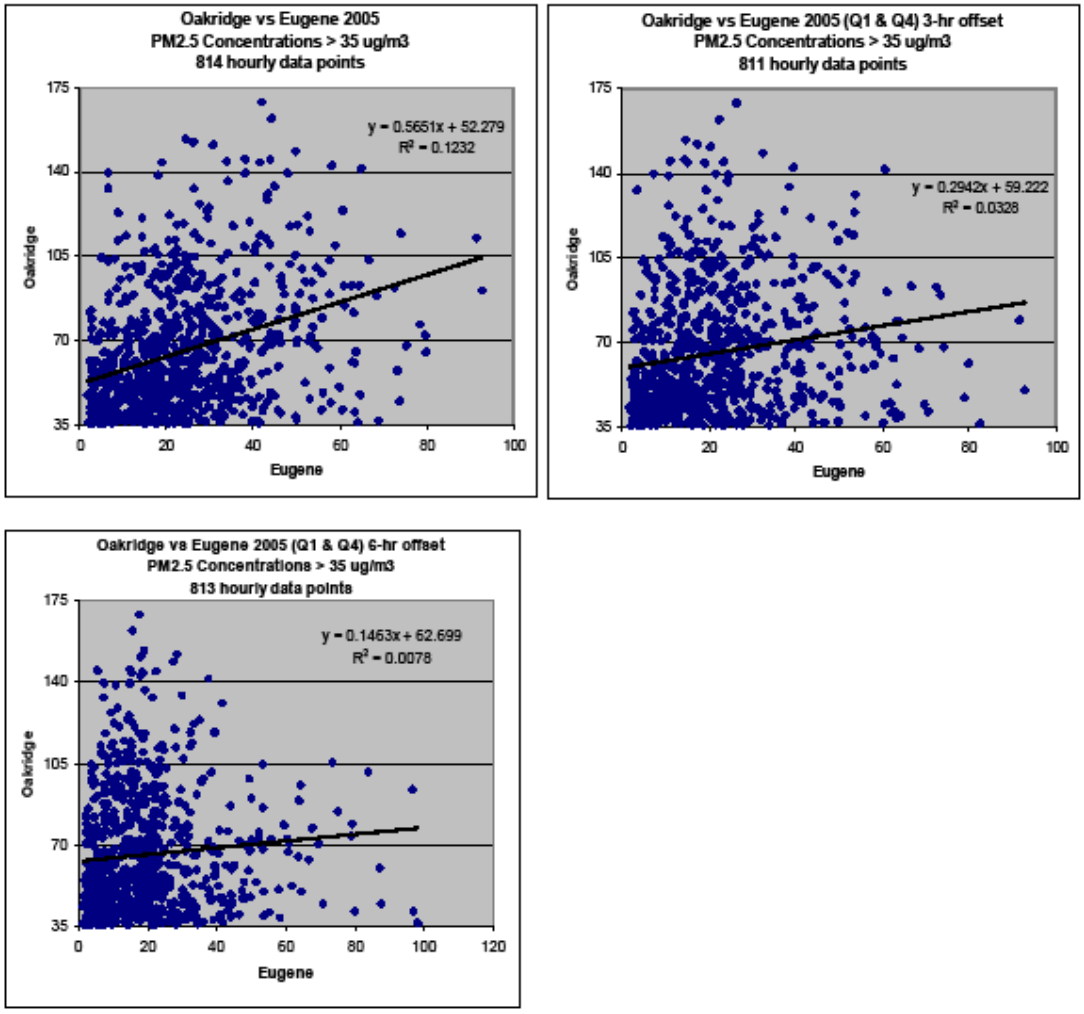


Figure 5.43 above suggests that there is little to no correlation between PM $_{2.5}$ levels in Oakridge and Eugene. This lack of correlation is likely due to differing source mix and meteorology and suggests that high air quality levels in Oakridge are not due to transport from Eugene or

Springfield. Based on this factor Oakridge would be appropriate for inclusion in the nonattainment area.

Factor 3: Population density and degree of urbanization (including commercial development)

Table 4 shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour $PM_{2.5}$ standards.

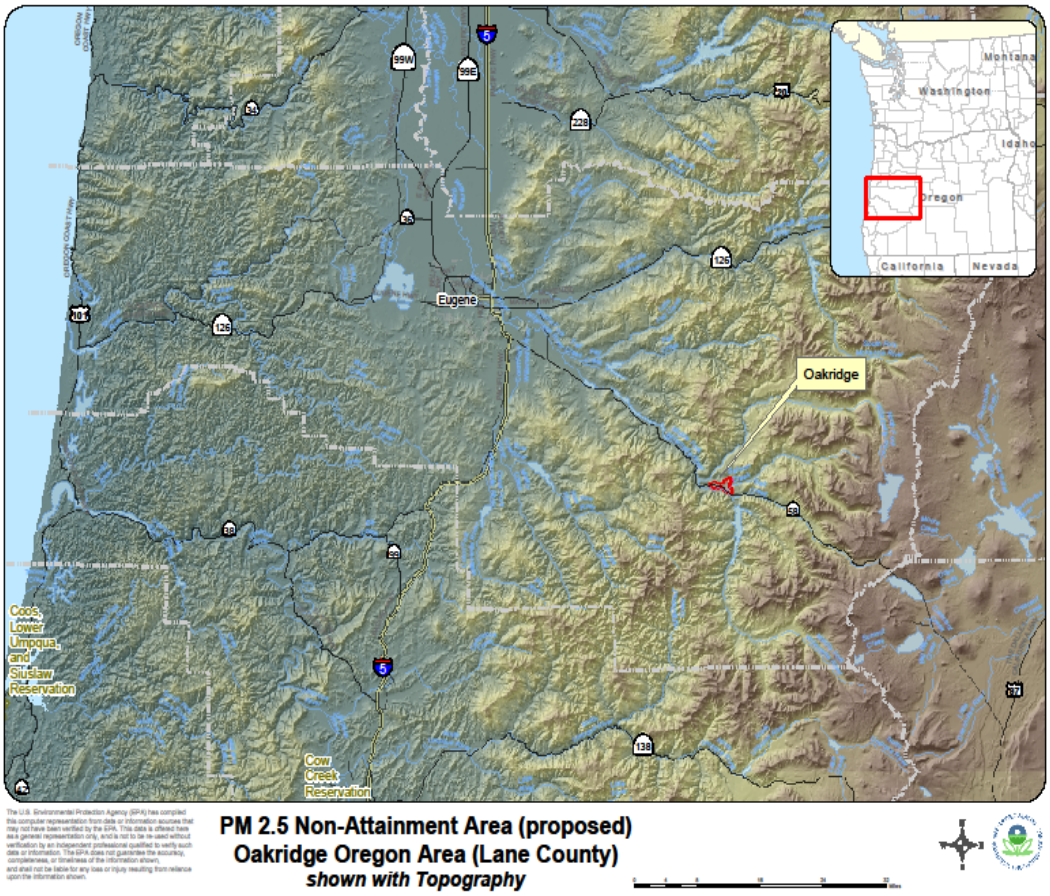
Table 4. Population

Area	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)	Area (sq. miles)
Lane County	Yes	334,486	72.4	4620
Eugene	No	142,185	3403	
Springfield	No	52,864	3670	
Oakridge	Yes	3,100	1660	

Population density of Lane County varies greatly depending on the sub-county area of consideration. Lane County stretches from the Pacific Ocean to the Cascade mountain range approximately 100 miles east. Vast areas of Lane County are forested mountains of the Coast Range and Cascade Range. The urban areas of Eugene and Springfield contain approximately 60% of the County's population.

Oakridge is a small, isolated mountain community 35-40 miles east of Eugene Oregon, and is surrounded by national forest. Thus, relative population numbers were not a significant consideration in the decision making process.

Figure 5.55 Lane County with topography



Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the [area], the percent of total commuters in each county who commute to other counties within the [area], as well as the total Vehicle Miles Traveled (VMT) for each county in millions of miles (see Table 5). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area.

Table 5. Traffic and Commuting Patterns

Factor 4: Traffic and commuting patterns

Traffic and commuting pattern information is displayed in Table 5 for Lane County and for surrounding counties. This information indicates that traffic has grown in the whole of Lane County by about 8 percent from 1996 to 2005. Given the low population of the Oakridge area, isolation, large county size, and rural nature, traffic and commuting patterns between surrounding counties and Oakridge growth in VMT was not an important consideration in our decision making process.

Table 5 Traffic and commuting patterns in Lane County, OR and surrounding counties

County	Vehicle Miles Traveled in 2005 (millions annually)	Percent VMT Growth (1996-2005)	Number commuting into any violating counties	Percent commuting into any violating counties
OAKRIDGE, OR			0	
Lane	**2,723**	**8**	**146,470**	**96**
Douglas	1,485	7	1,130	3
Klamath	807	85	24,920	97
Linn	1,433	28	2,160	5
Deschutes	1,227	25	420	1
Benton	450	(5)	950	3
Lincoln	480	30	90	0
Jefferson	217	44	0	0

The 2005 VMT data used for table 4 and 5 of the 9-factor analysis have been derived using methodology such as that described in "Documentation for the 2005 Mobile National Emissions Inventory, Version 2," December 2008, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: ftp://ftp.epa.gov/EmisInventory/2005_nei/mobile_sector/documentation/2005_mobile_nei_version_2_report.pdf

Factor 5: Growth rates and patterns

Due to the decline of the logging and forest products industry, the City of Oakridge has not grown since 1990. Lane County, by contrast, has grown approximately 30% over this same period. EPA does not believe that growth in the nonattainment area is a significant consideration in the decision making process.

Factor 6: Meteorology (weather/transport patterns)

For this factor, EPA considered data from National Weather Service monitoring sites and other meteorological monitoring sites in the area. Wind direction and wind speed data for 2005-2007 were analyzed, with an emphasis on "high $PM_{2.5}$ days" for each of two seasons (an October-April "cold" season and a May-September "warm" season). These high days are defined as days where any FRM or FEM air quality monitors had 24-hour $PM_{2.5}$ concentrations above 95% on a frequency distribution curve of $PM_{2.5}$ 24-hour values.

Table 6. Exceedance Days, $PM_{2.5}$ concentrations, number of stable hours and number of hours with calm windspeed:

Date	PM2.5 ug/m3	# Stable Hours	# Calm Hours
1/5/2005	57.4	17	24
1/6/2005	57.6	16	24
1/14/2005	45.7	16	24
1/22/2005	43.3	17	24
1/23/2005	42.0	17	24
1/24/2005	46.1	19	24
1/25/2005	58.3	17	24
1/30/2005	35.9	16	23
1/31/2005	48.9	14	19
2/1/2005	42.4	18	23
2/2/2005	43.7	19	24
2/3/2005	58.4	18	23
2/4/2005	36.5	15	16
2/10/2005	37.4	16	22
2/11/2005	47.7	16	21
2/16/2005	62.6	17	19
2/17/2005	63.2	17	19
2/18/2005	65.3	18	21
2/23/2005	44.8	18	18
2/24/2005	40.6	16	18
12/15/2005	73.0	19	21
12/21/2005	49.0	16	20
2/10/2006	40.8	18	13
2/19/2006	35.5	16	12
2/22/2006	38.6	12	14
12/7/2006	47.0	18	21
1/12/2007	38.3	17	24
1/24/2007	42.7	21	20
1/27/2007	40.5	20	19
1/30/2007	51.0	18	16
2/2/2007	52.5	20	22
10/27/2007	39.6	18	18
11/8/2007	36.3	17	22

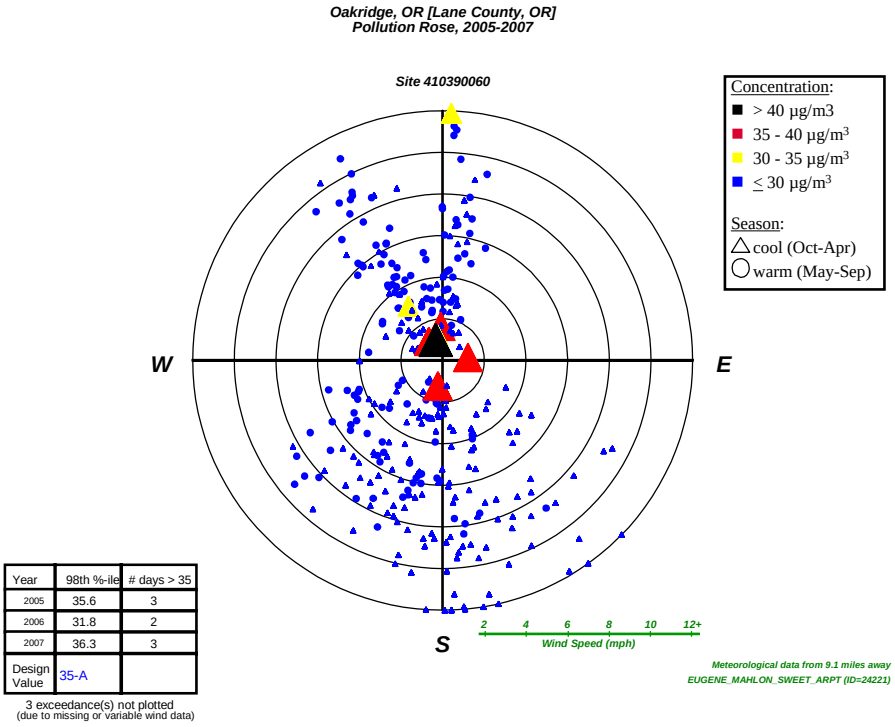
Table 6 shows that ‘exceedance days’ occur during days with stable atmospheric conditions persistent for 15-20 hours and calm winds (<2mph) persistent for 13-24 hours. The number of hours with calm wind speed suggests that transport of emissions from either nearby counties or from Eugene-Springfield do not contribute to exceedances in Oakridge.

For each air quality monitoring site in Lane County, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. The figures below identify 24-hour PM2.5 values by color; days exceeding 35 ug/m3 are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

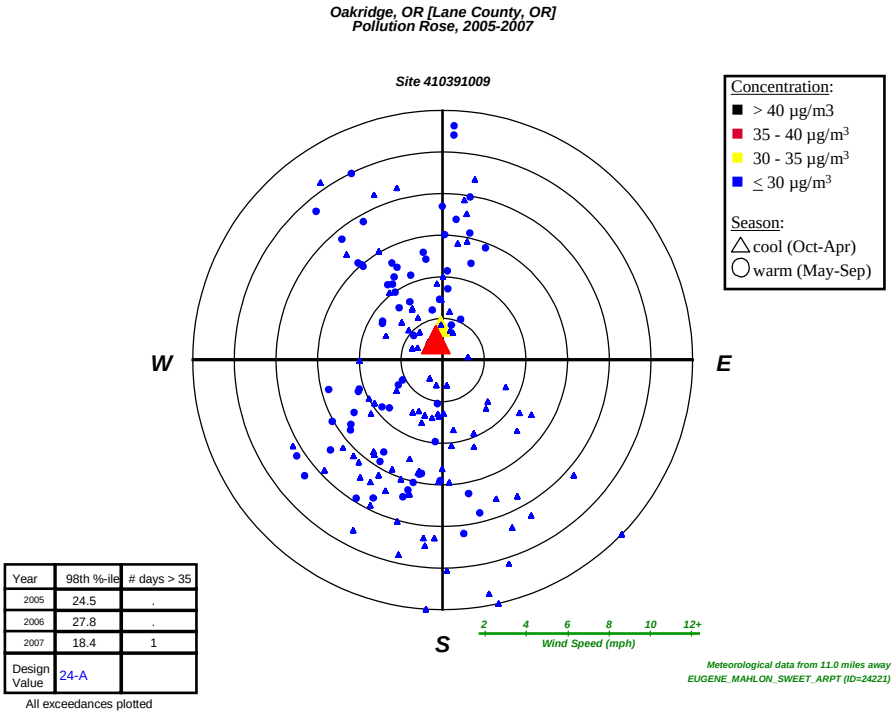
There are five sites for which pollution roses were developed for Lane County. Two sites are in Eugene, the population center of the County. Two sites are located to the south of Eugene along

Interstate-5 at the extreme southern end of the Willamette Valley; Saginaw and Cottage Grove. One site is located in Oakridge 35 miles east of Eugene in the Cascade Range. Only the Oakridge site violates the $PM_{2.5}$ NAAQS.

The pollution rose below is for downtown Eugene. It suggests that exceedances of the PM $_{2.}$ NAAQS occur in the cool season with low wind speeds. Low wind speeds with wind directions from the north, east and south would tend to indicate that transport of emissions from Eugene east into Oakridge is unlikely.



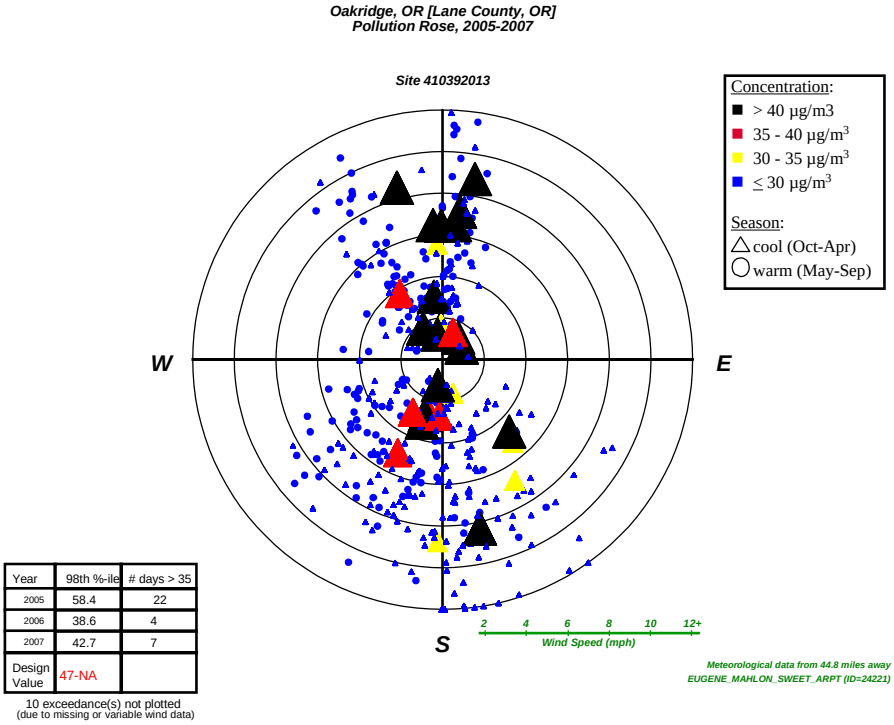
The pollution rose below is also from the Eugene area just east of Interstate 5. It suggests that generally wind direction is from the north or south. One exceedance day was reported with calm winds in the cool season. This pollution rose likewise suggests that emission transport from Eugene into Oakridge is unlikely as there are no westerly winds on days with high PM in the cool season.



The pollution roses from Saginaw and Cottage Grove are in an air shed that does not accurately present information relevant to a discussion of emission transport into Oakridge. Saginaw and Cottege Grove monitoring sites are located in complex terrain and represent micro-meteorological conditions in the vicinity of the monitoring site.

The pollution rose below is from Oakridge. Because Oakridge is in a confined narrow river valley, the pollution rose is representative of local (micro-scale) meteorology and provides little accurate information on a regional scale. What this pollution rose suggests is that exceedances of the $PM_{2.5}$ NAAQS occur during the cool season with winds from both the north and south. This result seems to be contradictory to the wind rose provided by LRAPA which shows that during the cool season up-valley down-valley (east-west) wind flow predominates. Regardless of this apparent contradiction in windflow patterns in this complex terrain, the pollution rose indicates that exceedances of the $PM_{2.5}$ NAAQS can occur with wind speeds of up to 8 mph. The fact that exceedances of the $PM_{2.5}$ NAAQS occur with wind speeds greater than ‘calm’ suggests that emissions from residential wood combustion in the city of Westfir can be transported into Oakridge.

Figure 5.54 Oakridge pollution rose

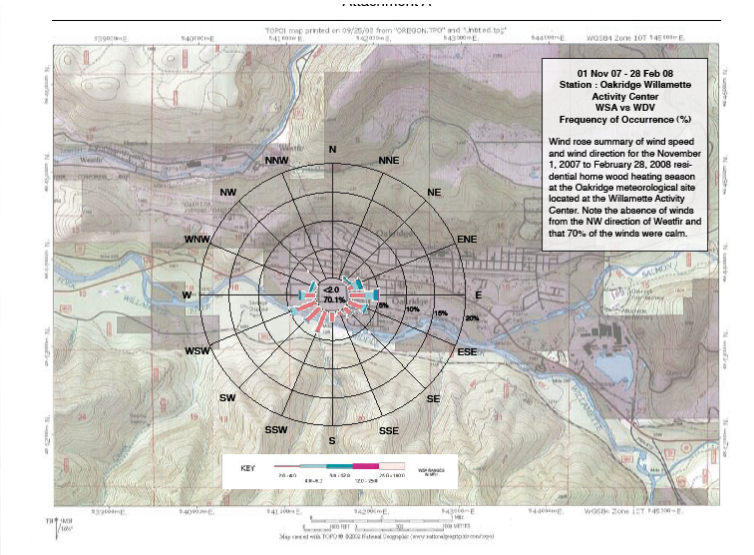


Year	98th %-ile	# days > 35
2005	58.4	22
2006	38.6	4
2007	42.7	7
Design Value	47-NA	

10 exceedance(s) not plotted
(due to missing or variable wind data)

The Lane Regional Air Pollution Agency provided a windrose for Oakridge for the months of November through February 2008.

Figure 5.56 Windrose for Oakridge (LRAPA)



This windrose provided by LRAPA for the Oakridge area shows that winter windflow s is associated with calm wind speed 70% of the time. It also demonstrates the up-valley down-valley flow expected in a mountain community. Emissions generated in Westfir from RWC could migrate during down valley flow to the confluence of the North Fork of the Middle Fork of the Willamette River and the Middle Fork of the Willamette River, mix with air mass from the down valley flow from Oakridge and during daytime up-valley flow return to Oakridge. EPA believes, due to this potential contribution from Westfir, that Westfir should be included in the Oakridge nonattainment area.

Figure 5.56 Air quality levels as a function of wind speed for Oakridge

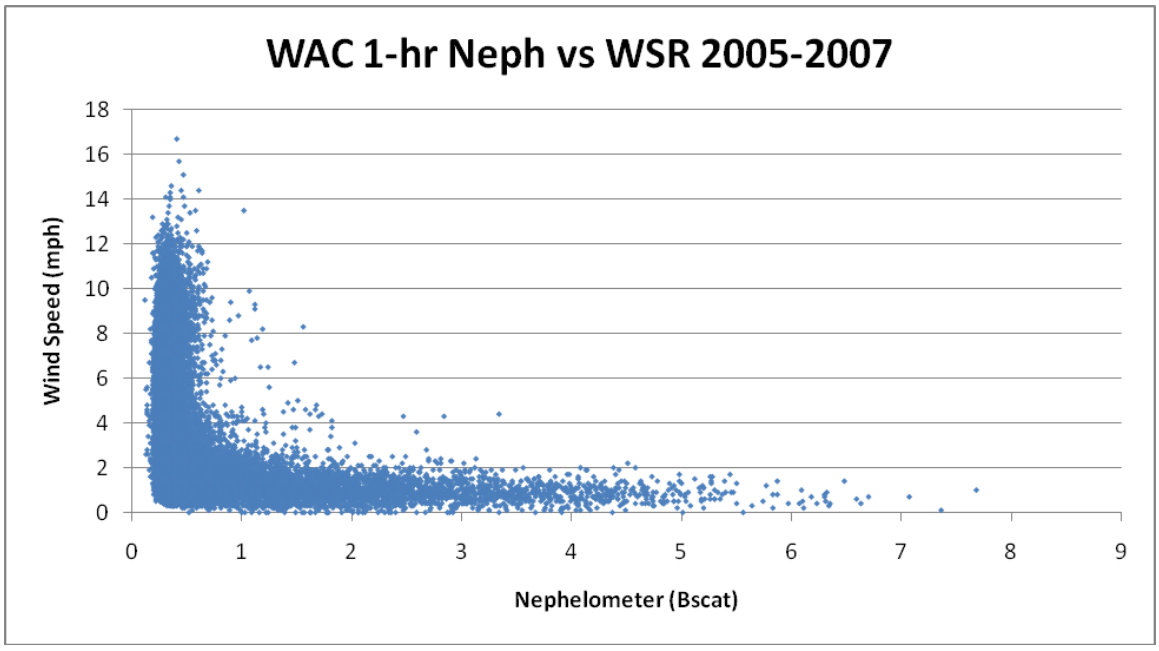
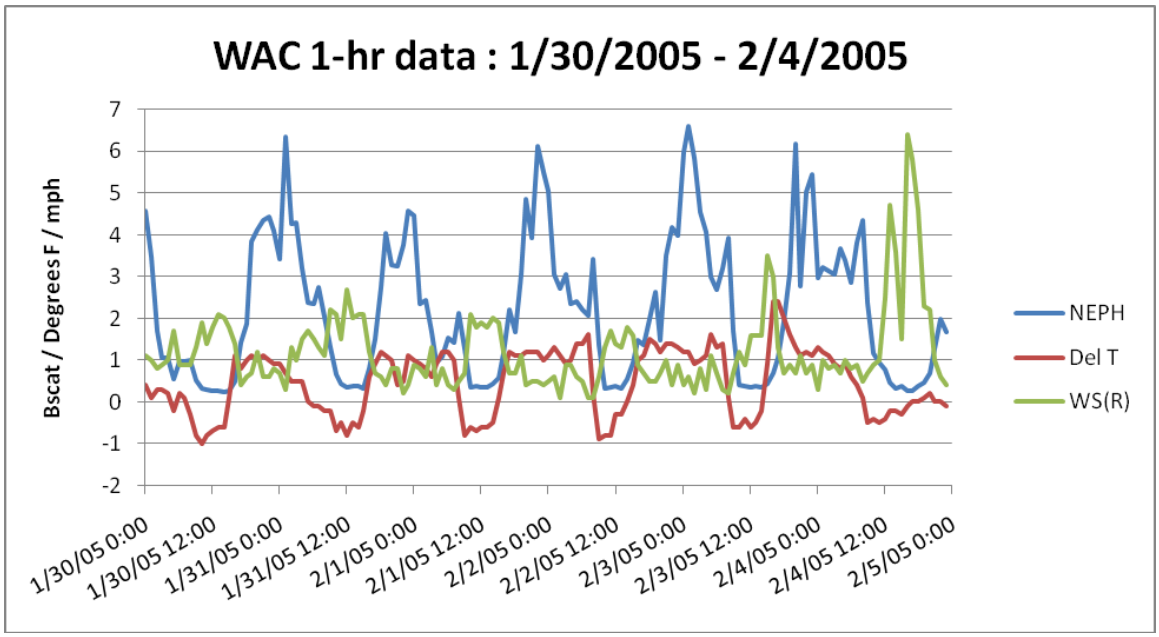


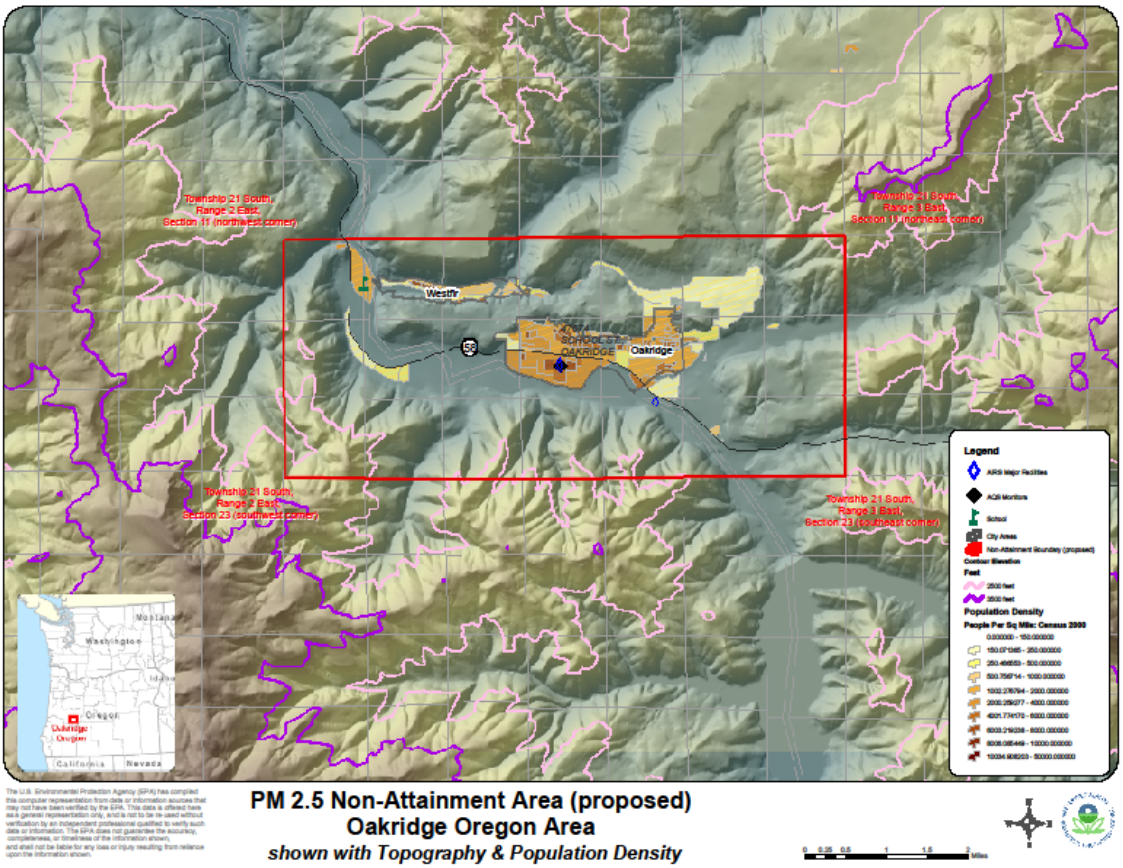
Figure 5.56 is a graph of nephelometer readings (an alternative monitoring method for PM levels that provide hourly values) as a function of windspeed suggests that high PM2.5 concentrations are correlated with low wind speed.

Figure 5.57 Diurnal variation of PM levels, inversion strength and wind speed for Oakridge



The graph in Figure 5.57 shows diurnal variation of nephelometer readings, wind speed and inversion strength (delta T) over several days in Oakridge. As the inversion is established, PM levels begin to rise. As windspeed decreases PM levels rise. Thus, high PM levels are associated with ground based temperature inversion and low wind speed.

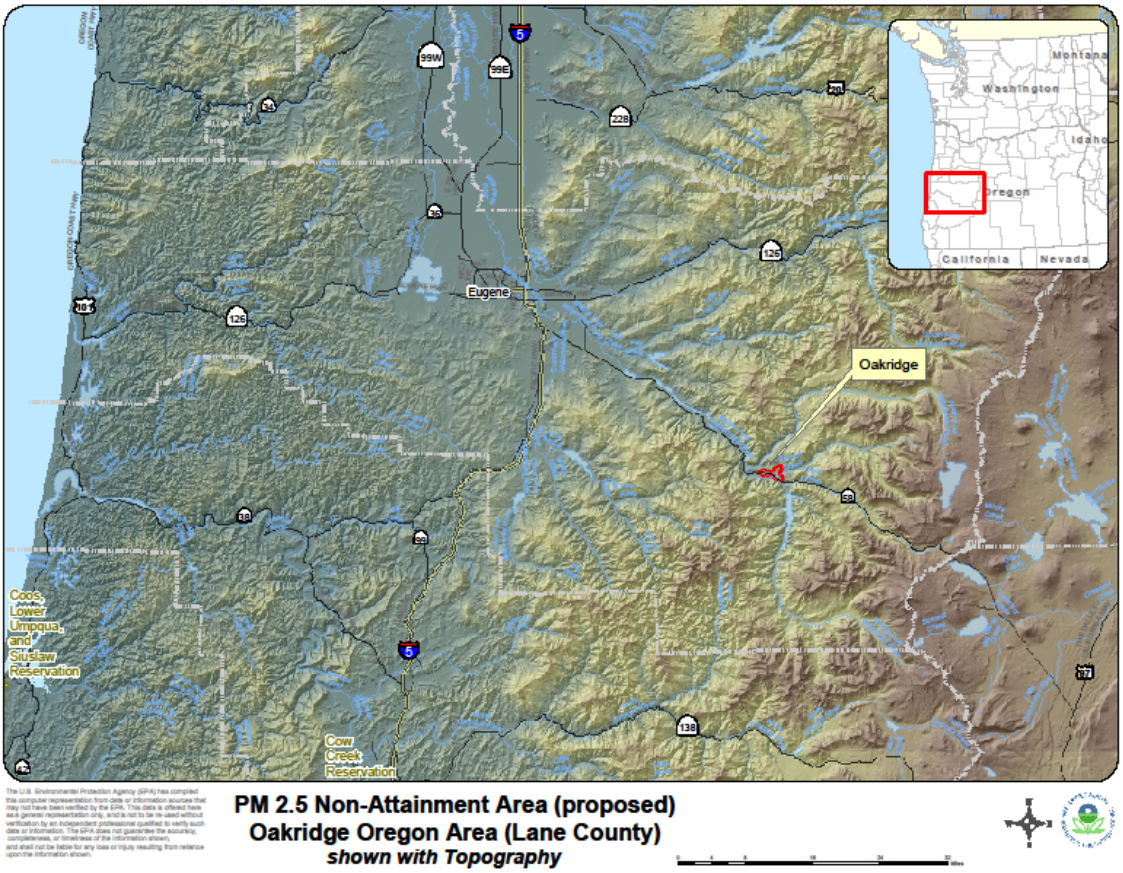
This photograph, provided by LRAPA, demonstrates the strength of ground based inversion and low wind speed trapping wood smoke in the Oakridge area. The photograph is from the ridge separating Oakridge from the city of Westfir, looking into Oakridge.



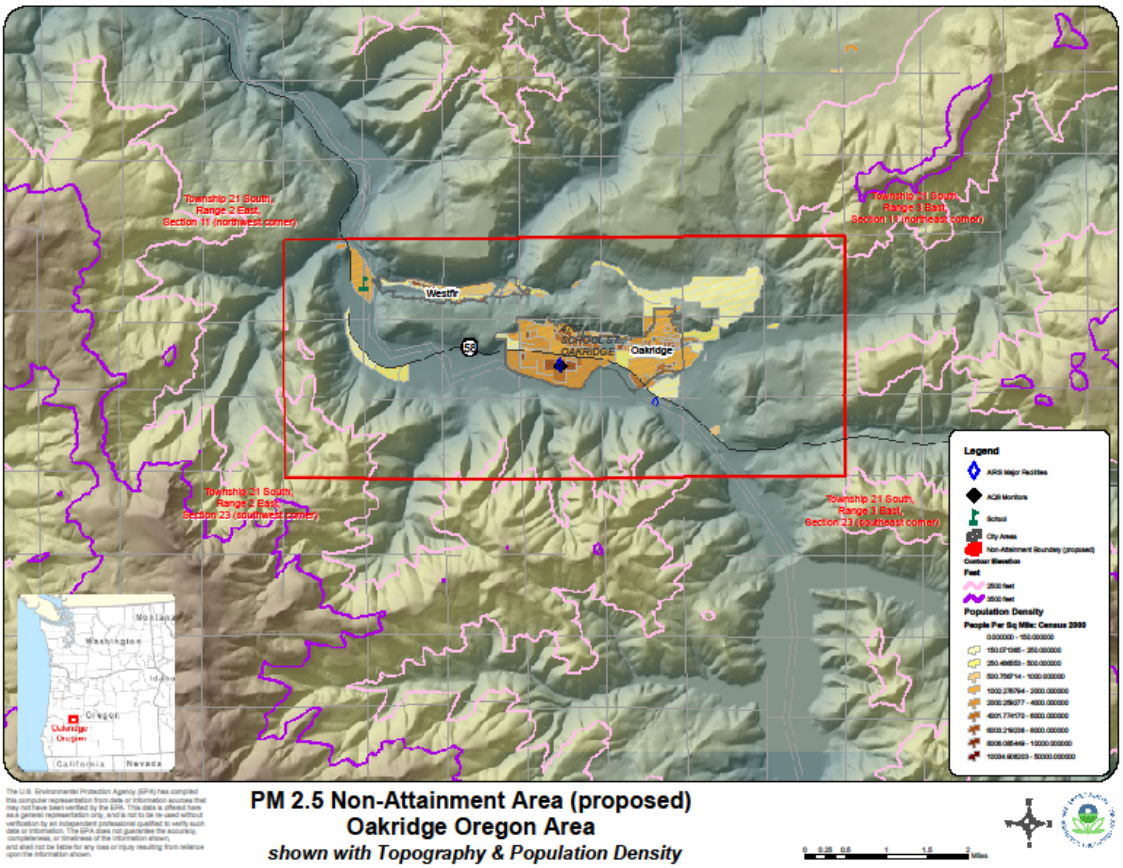
Analysis of meteorology suggests that a multi-county designation is not appropriate due to the low wind speeds associated with exceedance days. A partial county designation is appropriate for the Oakridge area as exceedances appear to be from local emission sources. Due to the proximity of Westfir to Oakridge, the extent of the NAA should be larger than the Oakridge UGB and include the city of Westfir.

Factor 7: Geography/topography (mountain ranges or other air basin boundaries)

The geography and topography analysis evaluates the physical features of the land that might have an effect on the air shed and, therefore, on the distribution of $PM_{2.5}$ over the Oakridge area.



This map shows Lane County, extending from the Pacific Ocean eastward approximately 100 miles over the crest of the Cascade Mountain range. Oakridge is located in the eastern portion of the County in the Cascade range. With the exception of development along the Pacific Coast and in the Willamette Valley, the County is mountainous forested and wild land. The communities of Oakridge and Westfir are residential and small commercial communities that once supported the logging and forest products industry.



This topographical map of the Oakridge and Westfir area shows the mountain valleys where these communities are located. Oakridge and Westfir are at an elevation of approximately 1200 feet and the mountain ridges rise to 3500-4500 feet. Based on this factor, no areas outside of Oakridge and Westfir should be included in the nonattainment area.

Factor 8: Jurisdictional boundaries (e.g., existing PM2.5 areas)

In evaluating the jurisdictional boundary factor, EPA gave consideration to areas that were already designated nonattainment in 2005 for violating the 1997 fine particle standards. Oakridge attained the 1997 $PM_{2.5}$ NAAQS and this factor is not a consideration in determining the boundary of the 2006 24 hour $PM_{2.5}$ nonattainment area.

Factor 9: Level of control of emission sources

The Oakridge UGB is a maintenance area for PM_{10} and has emission reduction measures in effect, primarily for residential wood combustion, including woodstove change out and episodic curtailment programs. The State and EPA believe that residential wood combustion is the primary cause of violations of the PM2.5 standard. However, Oakridge violates the 24 hour $PM_{2.5}$ standard even with the RWC controls in place for the PM $_{10}$ standard. Thus for this factor

EPA concludes that the areas of predominant RWC in Oakridge and Westfir should be included in the nonattainment area.

Conclusion

A multi-county designation is not appropriate for the following reasons:

- Emissions from surrounding counties are not transported into Oakridge due to distance, topography, and meteorology.

A partial county designation is appropriate for the following reasons:

- Oakridge and Westfir are isolated rural mountain communities separated by distance and topography from other urban areas;
- Both emission inventory and air quality data indicate that $PM_{2.5}$ from residential wood combustion dominates the airshed on days with exceedances of the 24-hour $PM_{2.5}$ NAAQS;
- Major urban areas of Eugene and Springfield should not be included in the partial county boundary due to distance, topography, and data showing a lack of correlation between air quality in Eugene-Springfield and that in Oakridge; and,
- Oakridge violations are from locally generated emissions during night time inversions and low wind speed.

Based on all the factors and analytical tools, EPA has designated a nonattainment area that includes the cities of Oakridge and Westfir as the Oakridge nonattainment area. This area uses 'township-range' nomenclature that roughly follows the mountain ridge top that contain the cities.

Attachment 2
Description of the Contributing Emissions Score

The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact $PM_{2.5}$ transport:

- Major $PM_{2.5}$ components: total carbon (organic carbon (OC) and elemental carbon (EC)), SO_2, NO_x, and inorganic particles (crustal).
- $PM_{2.5}$ emissions for the highest (generally top 5%) $PM_{2.5}$ emission days (herein called "high days") for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The "urban increment" of a violating monitor, which is the urban $PM_{2.5}$ concentration that is in addition to a regional background $PM_{2.5}$ concentration, determined for each $PM_{2.5}$ component
- Distance from each potentially contributing county to a violating county or counties

[A more detailed description of the CES can be found at http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C.]

Additional information regarding responses to specific State comments can be found in EPA's Response to Comments document at http://www.epa.gov/pmdesignations/2006standards/tech.htm.]

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