Report

2010 Oregon Five Year
Ambient Air Monitoring Assessment

State of Oregon
Department of Environmental Quality

Submitted to: Environmental Protection Agency, Region 10.

This report prepared by:

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Glossary of Air Quality Terms used in this report:

AQI	Air Quality Index – standardized EPA method of reporting air quality
CO	Carbon monoxide – An odorless, colorless gaseous pollutant
HAPs	Hazardous Air Pollutant as defined in Title III of the Clean Air Act
NAAQS	National Ambient Air Quality Standards – federal air quality standards
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides – redish brown gaseous pollutant - mainly NO and NO_2
O_3	Ozone – a gaseous pollutant and a component of smog at ground level
$PM_{2.5}$	Particulate Matter 2.5 micrometers in diameter and smaller
PM_{10}	Particulate Matter 10 micrometers in diameter and smaller
ppm	Parts per million - air pollutant concentration.
ppb	Parts per billion - air pollutant concentration.
SO_2	Sulfur dioxide
$\mu g/m^3$	Microgram per cubic meter - air pollutant concentration
VOC	Volatile Organic Compounds
WAQR	Wildfire Air Quality Rating - wildfire smoke health internet page

1. PURPOSE

Code of Federal regulations (40 CFR 58.10(e) 10/17/06) requires the state and local air quality surveillance agencies to prepare a five year ambient air quality monitoring network assessment every five years. This is the first of those plans and is due to EPA Region 10 by July 1st, 2010. This report is intended to be a comprehensive assessment of the ambient air monitoring network. The plan evaluates the current network with respect to existing and future monitoring needs. State population growth, shifts in pollutant sources, new National Ambient Air Quality Standards (NAAQS), new health information, and new sampling methods are a few of the shifting parameters that require periodic evaluation. This plan does not address specific network changes. Those are included in the Annual Ambient Air Monitoring Network Assessment. The plan also does not include detailed monitoring information; that is included in the air quality data summary at: http://www.deq.state.or.us/aq/forms/annrpt.htm .

2. INTRODUCTION

The Oregon Department of Environmental Quality (ODEQ) and Lane Regional Air Protections Agency's (LRAPA) ambient air quality monitoring network is designed in response to the Environmental Protection Agency's (EPA) National Monitoring Strategy, state and local needs, the requirements of air quality maintenance plans and the State Implementation Plans (SIPs) for non-attainment areas, and CFR requirements.

National Monitoring Strategy

The National Monitoring Strategy directs state and local agency to monitoring for more continuous, real time air quality data. The real time information is available through EPA's AIRNow and ODEQ's Air Quality Index (AQI) web pages. In particular, EPA encouraged states to use real time, continuous $PM_{2.5}$ monitors instead of the filter base samplers when an area is not in danger of violating the standard. The National Monitoring Strategy also created National Core (NCORE) sites which are multi-pollutant stations containing a wide array of pollutant monitoring equipment. ODEQ's NCORE site measures trace Carbon monoxide (CO), all Nitrogen oxides (NOy), trace Sulfur dioxide (SO_2), ozone (O_3), particulate matter 2.5 and 10 micrometers in diameter and smaller ($PM_{2.5}$ and PM_{10}), PM coarse (PM_{10}-$PM_{2.5}$=PMc), $PM_{2.5}$ Speciation, visibility, black carbon, and meteorology. The SE Lafayette site in Portland (EPA#41-051-0080) is Oregon's only NCORE site.

State and Local Support

ODEQ and LRAPA monitors support state and local needs by providing data for the Wildfire Air Quality Rating (WAQR), the wood stove management program, Ozone Clean Air Quality Advisories, the Department of Agriculture's field burning program, and the US Forest Service/BLM forest health program. ODEQ also operates a visibility network in the Cascades and near the Eagle Cap wilderness to support Regional Haze requirements protecting pristine Class 1 areas.

AQ Maintenance and Non-attainment support

ODEQ and LRAPA monitoring supports the maintenance and non-attainment plans developed for many cities. ODEQ also has monitors in attainment areas with fast growing populations to support pollution prevention measures.

CFR requirements

Monitoring objectives were established and siting was selected in accordance with Appendix D of 40 CFR 58. The network was designed to meet the five basic monitoring objectives specified by federal regulations: (1) to determine highest concentrations expected to occur in the area covered by the network; (2) to determine representative concentrations in areas of high population density; (3) to determine the impact of significant sources or source categories on ambient pollution levels; (4) to determine general background concentration levels; and (5) to determine transport characteristics into and out of airsheds.

Sites in the current network were located to match the spatial scale with the monitoring objective of the station. Each station in the SLAMS/NCORE network was sited in accordance with the criteria in 40 CFR Part 58. Quality Assurance requirements have been fully implemented through the Department's Quality Assurance Plan reviewed by EPA.

2.1 Non-attainment and Maintenance Areas

Oregon only has a few non-attainment areas but has many maintenance areas. Listed below are Oregon's current non-attainment and maintenance areas. The PM_{10} non-attainment areas were originally declared non-attainment in the 1980s. All areas are now well below the NAAQS and but a few remain non-attainment because their maintenance plan has not been approved. $PM_{2.5}$ is the only criteria pollutant with actual levels above the NAAQS.

Non-attainment Areas

CO:	None
PM_{10} :	Eugene/Springfield Urban Growth Area (maintenance plan in development)
	Oakridge Urban Growth Boundary (maintenance plan in development)
8hr Ozone	None
$PM_{2.5}$	Klamath Falls Urban Growth Boundary
	Oakridge Urban Growth Boundary

Maintenance Areas in Oregon (formerly non-attainment areas):

CO:	Eugene/Springfield Area
	Grants Pass Central Business District
	Portland Metropolitan Service District Boundary
	Klamath Falls Urban Growth Boundary
	Medford-Ashland Urban Growth Boundary
	Salem-Kaiser Area Transportation Study
PM_{10}:	Grants Pass Urban Growth Boundary
	Klamath Falls Urban Growth Boundary
	Medford-Ashland Air Quality Maintenance Area
	La Grande Urban Growth Boundary
	Lakeview Urban Growth Boundary
Ozone (1hr):	Portland/Vancouver AQMA

3. POPLATION ANALYSIS

Oregon's population continues to grow, creating new development and changing the location of pollution sources and receptors. This network assessment plan will review Oregon's population spatial distribution and growth rate.

The Portland State University Population Research Center (PSU) estimated Oregon's population to be 3,791,060 in 2008, up from 3,436,750 determined in the 2000 Census. Oregon demographics are often described as split between the cities and the rural areas. In 2008, the PSU estimated that 78% of the Oregon's population lived in metropolitan areas. This is largely unchanged from the 77% of the population in metropolitan areas measured in the 2000 census. Table 3.1 shows the metropolitan/non-metropolitan population distribution estimated by PSU.

Table 3.1. Oregon Metropolitan/Non-Metropolitan Population distribution.

	Metropolitan		Non-metropolitan	
Year	Population (1,000)	Percentage	Population (1,000)	Percentage
2000	2,631	77%	806	23%
2008	2,944	78%	847	22%

3.1 Where People Live

Oregon's population is primarily located in the Willamette Valley, encompassing the Portland Metro area, Salem, Eugene, and other large cities. Deschutes and Jackson Counties are the most populated regions outside the Willamette Valley. Figure 3.1shows a 2007 population map of Oregon; only the counties with over 100K people are labeled with the county name. Figure 3.2 shows the Willamette Valley population; the highest density is in the Portland Metro area in the north, Salem, Albany, and Corvallis in the mid valley, and Eugene/Springfield in the south.   By percentage, the Portland Metro counties of Multnomah, Clackamas, and Washington have 43% of the state population. The rest of the Willamette Valley has 27% of the population for a total of 70%. Jackson and Josephine Counties in Southwest Oregon have 8% and Deschutes County in Central Oregon has 4%. The remaining counties make up 18%. Figure 3.3 shows the percent population by county and region.   Figure 3.4 is a labeled county map of Oregon for reference.

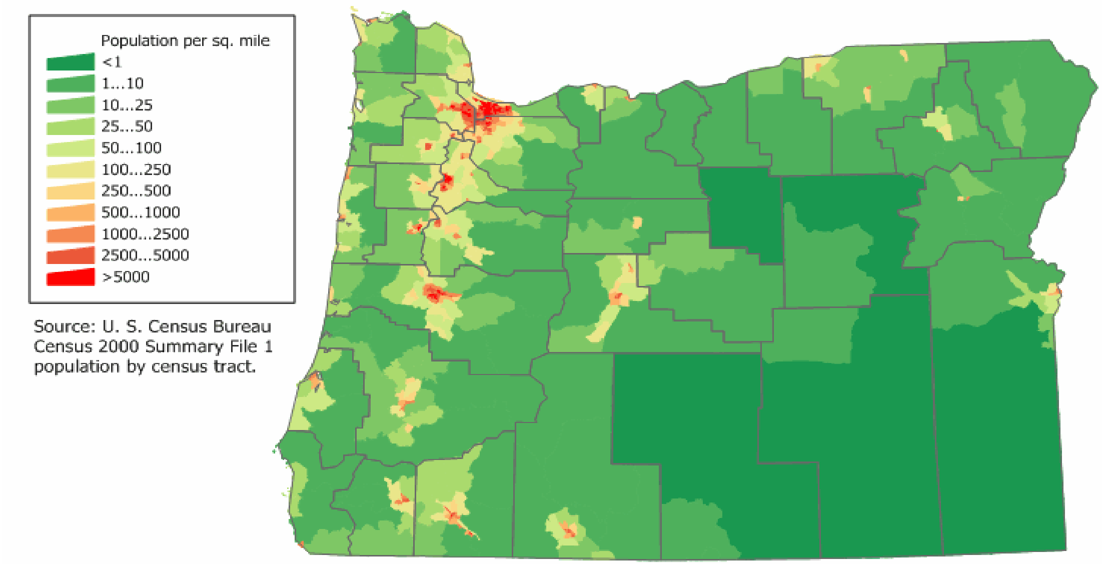

Figure 3.1. 2000 Oregon population map by county.

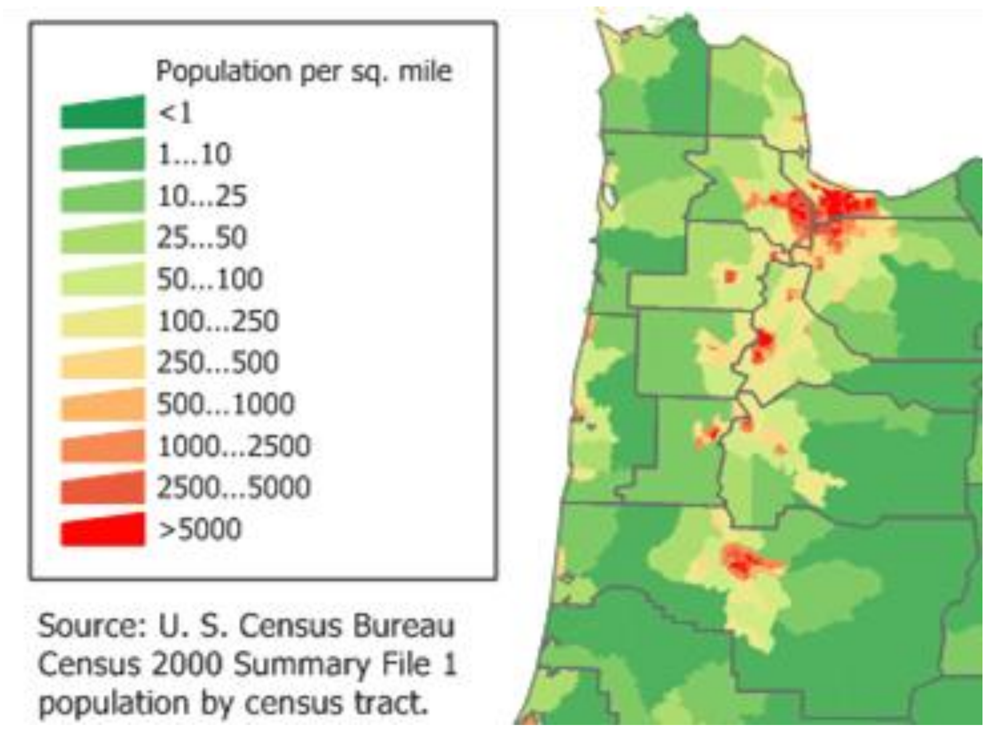

Figure 3.2. 2000 Willamette Valley population density map.

The Portland Metro Area is in the north valley, Salem, Corvallis, and Albany are in the middle valley, and Eugene and Springfield are in the southern valley.

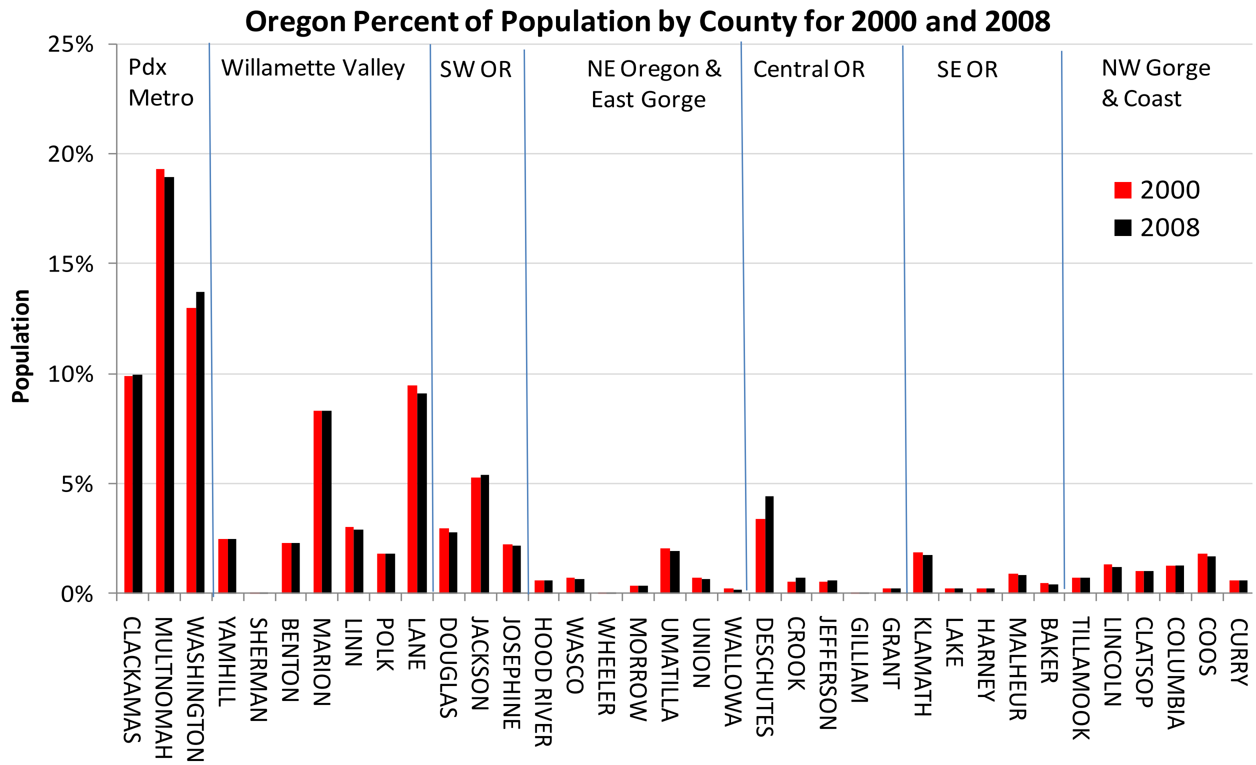

Figure 3.3. 2000 and 2008 Oregon Population by county and region.

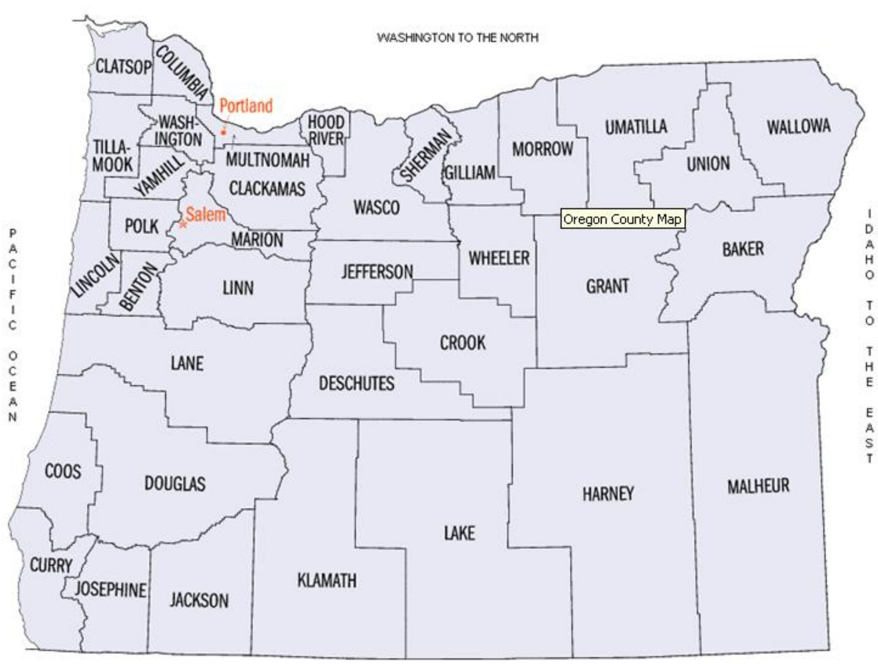

Figure 3.4. Oregon County Map for reference.

<u>Population by city</u>

A map of Oregon's cities in Figure 3.5 shows in more detailed the percentage of population residing in various metro areas and communities around Oregon. The Portland Metro area contains around 43% of the population. Eugene/Springfield has the next highest percent population at 6% followed by Salem/Kaiser at 5%. The Newberg/McMinnville area, Corvallis, and Albany all have about 2% each. The Medford/Ashland AQMA has about 4% and Bend has about 2%. All other communities have less than 1% of the state population individually but account for about 30% all together.

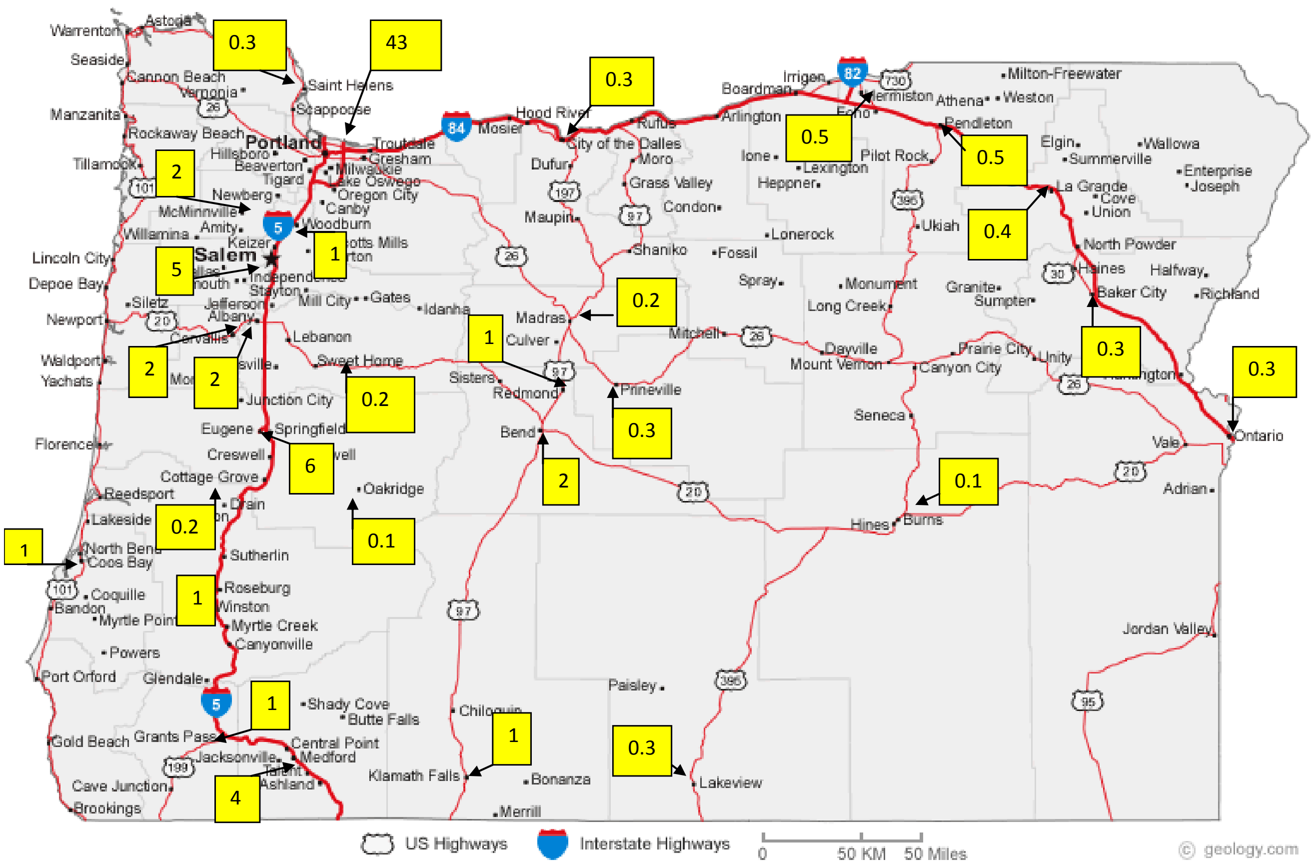

Figure 3.5. 2008 City population map.
Values are in percentage of total population.

Portland Metro Population

A closer look at the Portland Metro Population shows high density in the Portland downtown core, in Gresham on the east side, and west in the Tualatin Valley of Washington County. The population density map in Figure 3.6 shows the metro area in 2007.

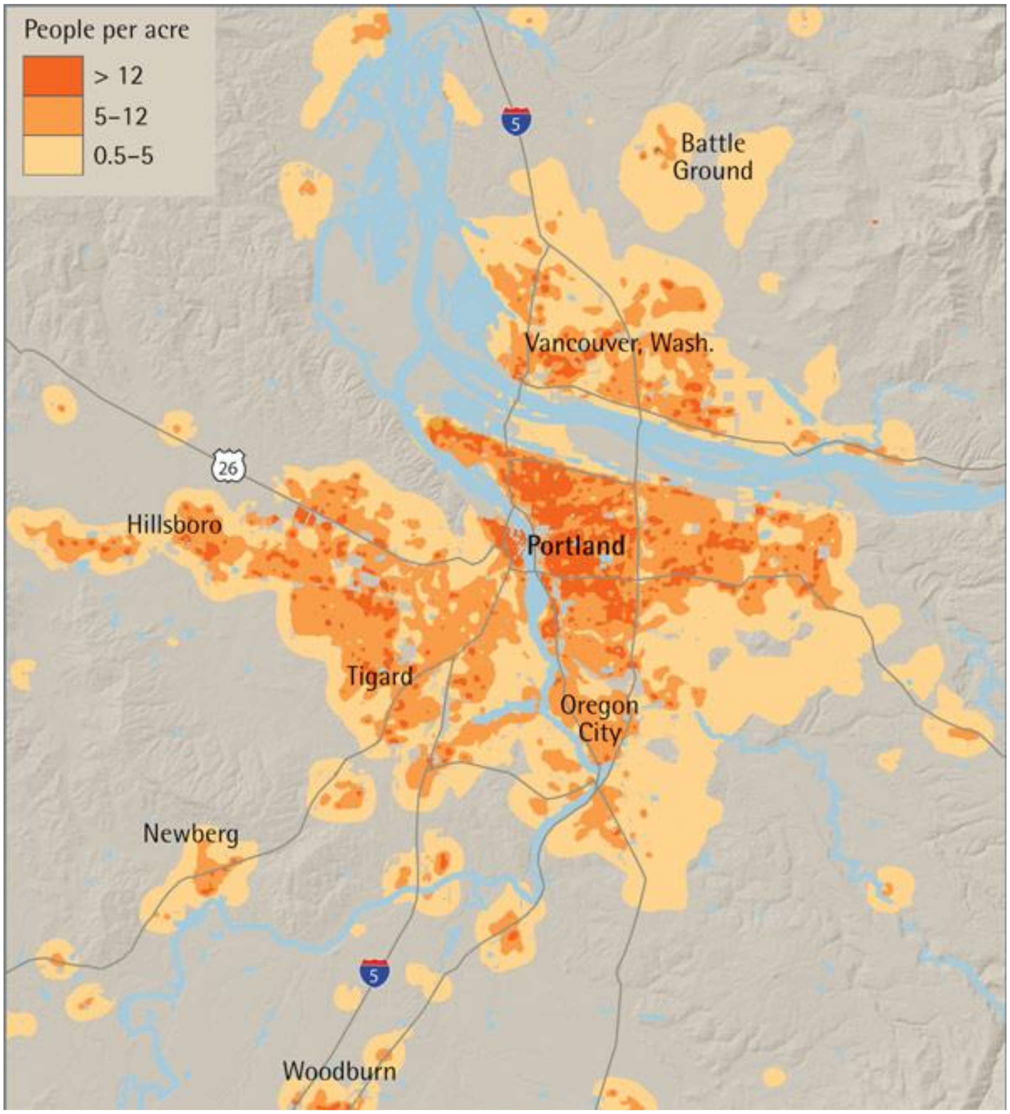

Figure 3.6. 2007 Portland Metro population density map.
Map from Sightline Institute.

Eugene/Springfield Population
Eugene/Springfield is the second largest metro area in the state. The population density map in Figure 3.7 illustrates the population distribution in 2007.

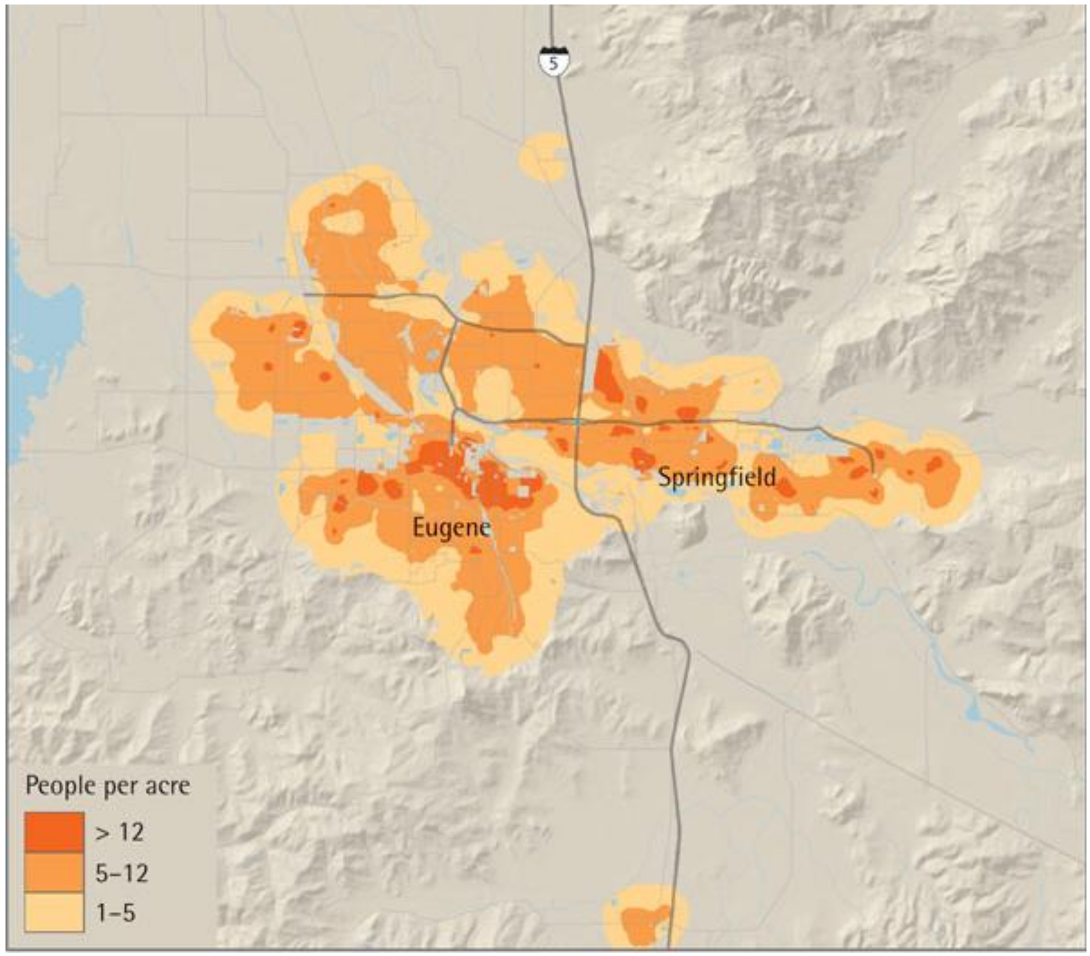

Figure 3.7. Eugene Springfield population density map.
Map from Sightline Institute.

3.2 Population Growth

Since 1990, Oregon's population has been growing rapidly, as have the other western states. The growth has slowed from 19% (1990 to 2000) to 10% (2000 to 2008) (Figure 3.8). Central Oregon has the highest growth rate since 2000, with southwest Oregon and the Willamette Valley close behind. Northeast, Southeast, and Coastal Oregon have seen slow growth or no growth. Figure 3.9 shows the 2000 to 2008 growth rate for counties. The 2008 population was estimated by the Portland State University Population Research Center http://www.pdx.edu/prc/.

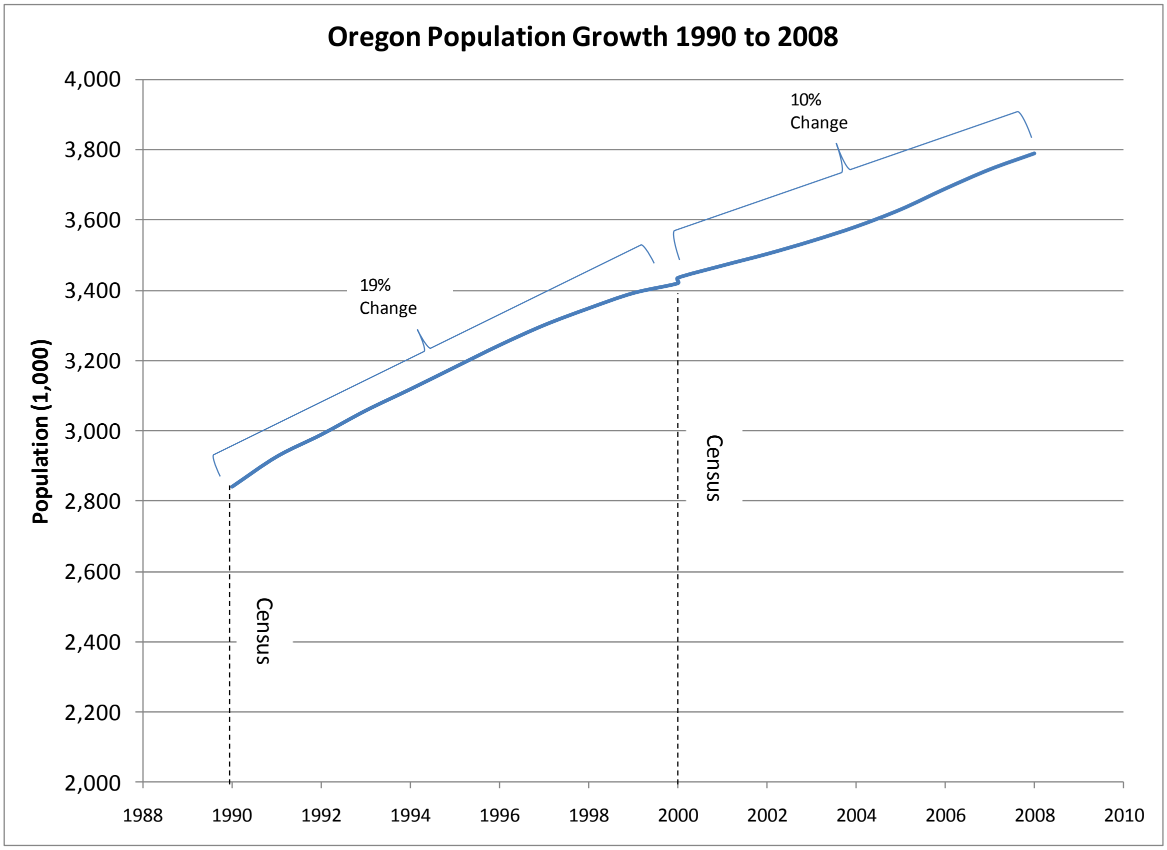

Figure 3.8. Oregon's population growth from 1990 to 2008.

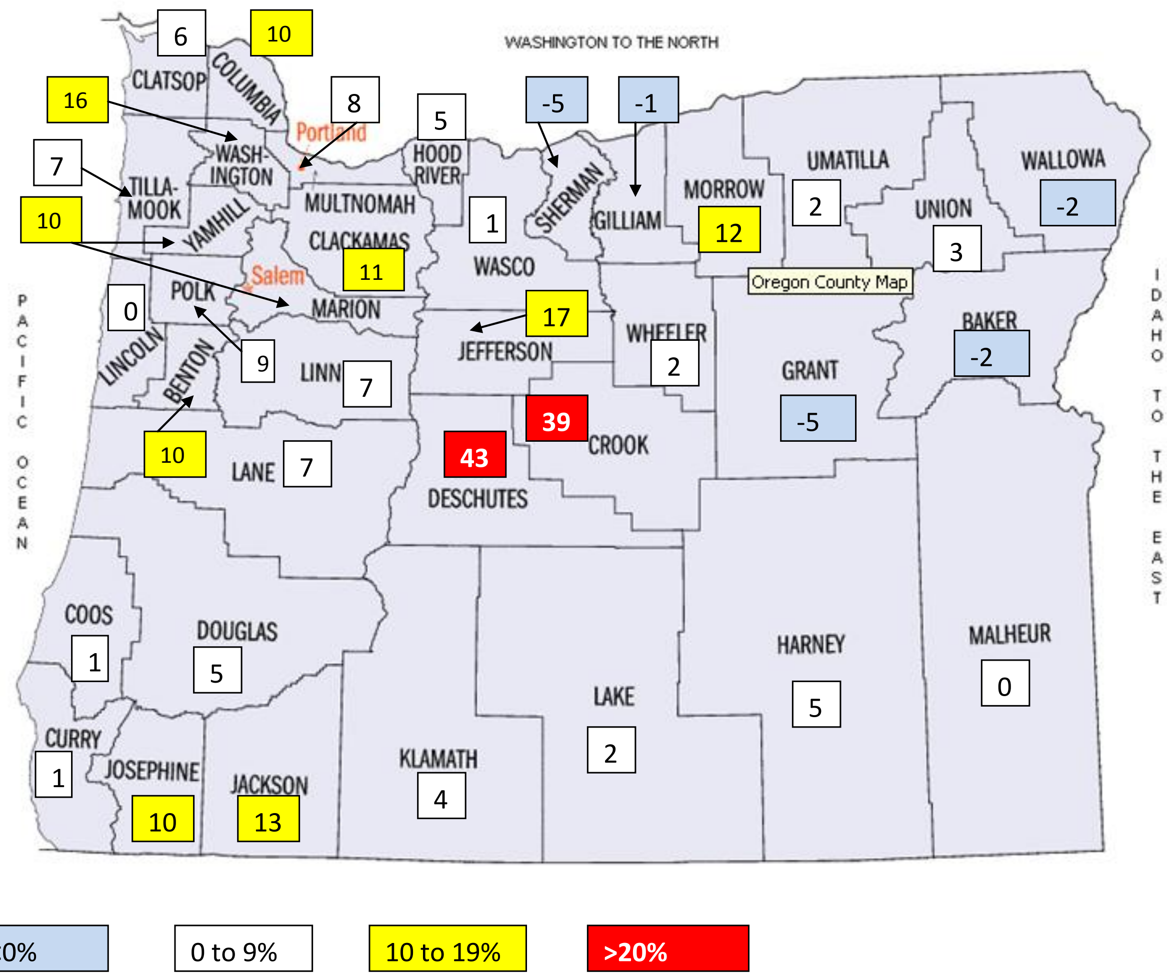

Figure 3.9. Percent growth by county from 2000 to 2008.
(as estimated by the PSU Population Center)

Growth Rates, by City

Bend had the fastest growth rate of any metro area in the state at 53%. Excluding the Portland Metro area, the next fastest rates were in Medford and McMinnville/Newberg at 23%. Figure 3.10 displays the growth rates for the largest Oregon communities (excluding Portland Metro Area). In the Portland Metro area, the fastest growth rates were in the outlying communities. Sherwood grew the fastest at 34%. Forest Grove, Hillsboro, and Troutdale also grew rapidly with rates in the twenties. The Portland Metro growth rates are illustrated in the map in Figure 3.11.

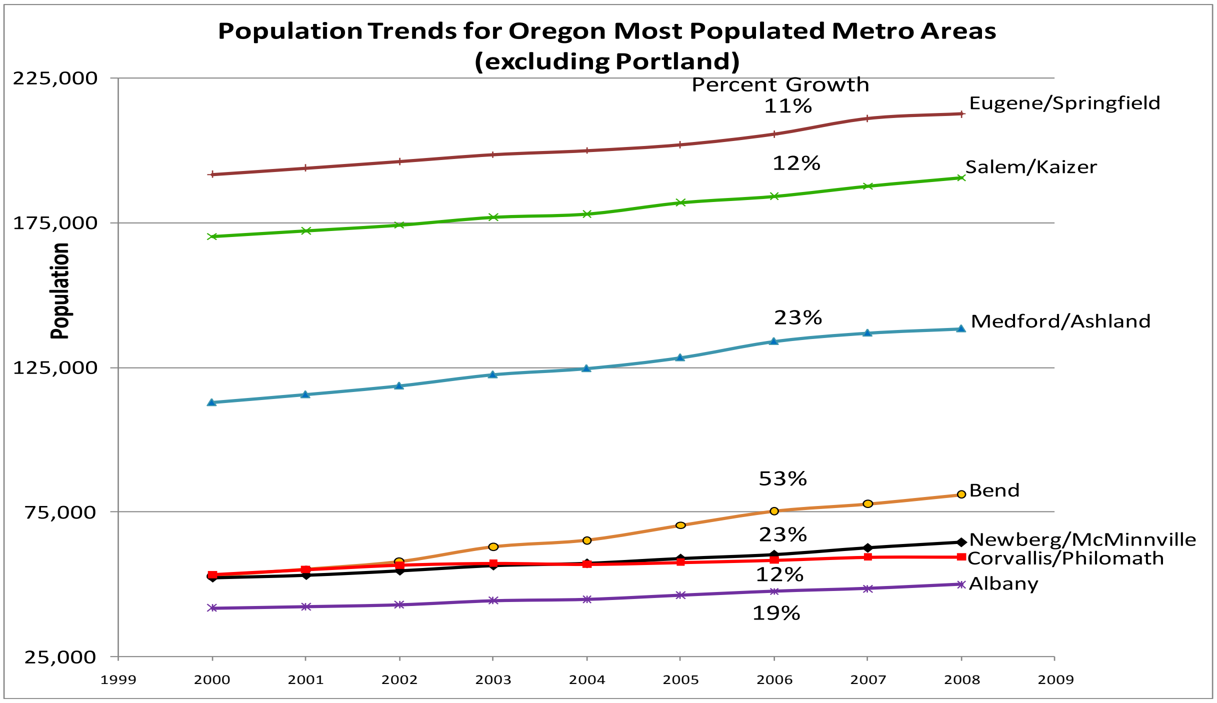

Figure 3.10. Oregon metro area population growth rates and population from 2000 to 2008. (not including Portland Metro).

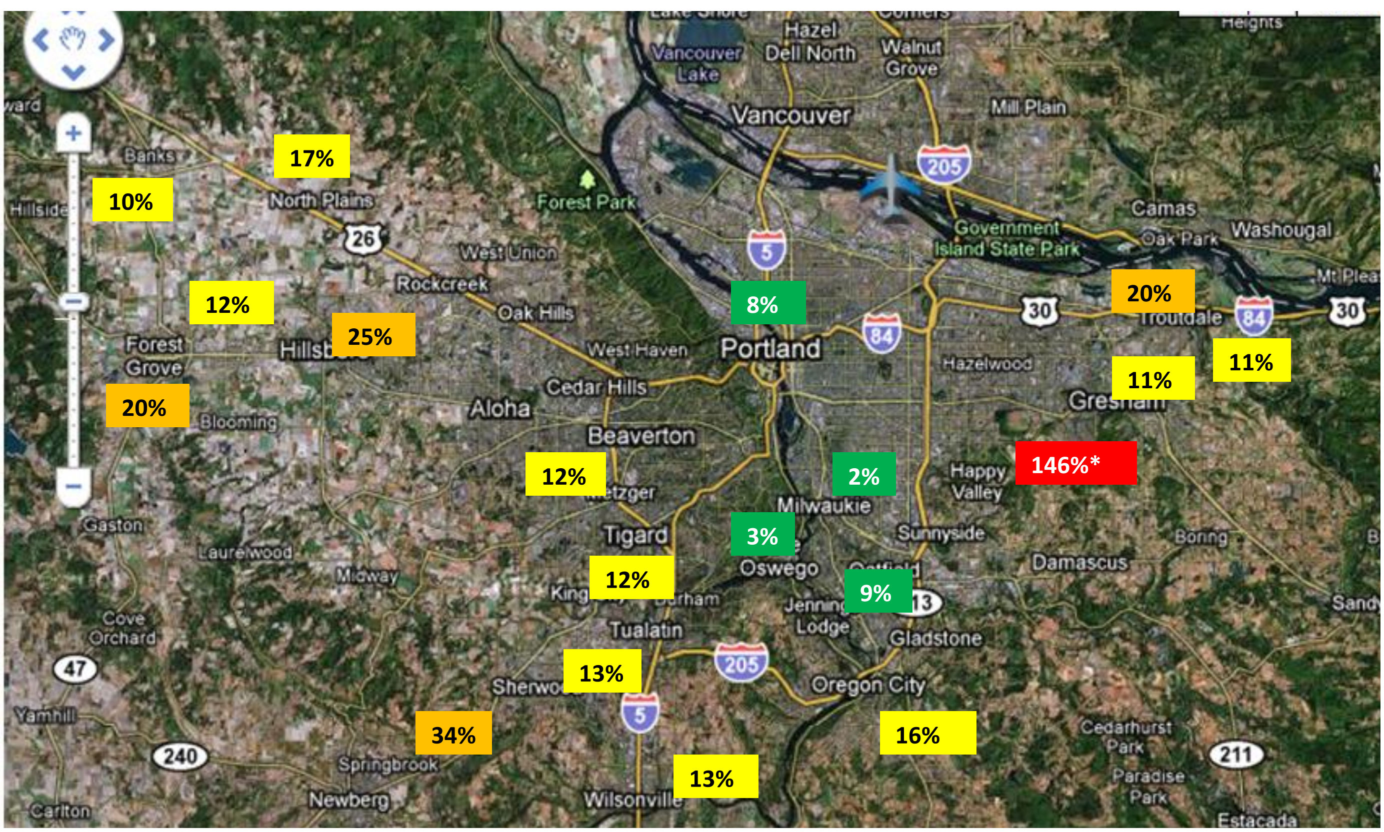

Figure 3.11. Map of Portland Metro area population growth rate from 2000 to 2008.
*Happy Valley experienced rapid growth but its population remains relatively low.

Population Discussion

This population analysis indicates that the largest population areas are still in the Willamette Valley, Central Oregon, and Southwest Oregon. The fastest growing areas are in Washington County in the outlying areas on the west side of the Portland Metro area, in Bend and north of Bend, and in the Rogue Valley (Medford/Ashland). The population is expected to continue to grow in these areas and in the state in general. By 2015 the population will grow by about 6% and by about 30% by 2030. Figure 3.12 shows the population growth projections by the US Census Bureau using the 2000 Census as a baseline year.

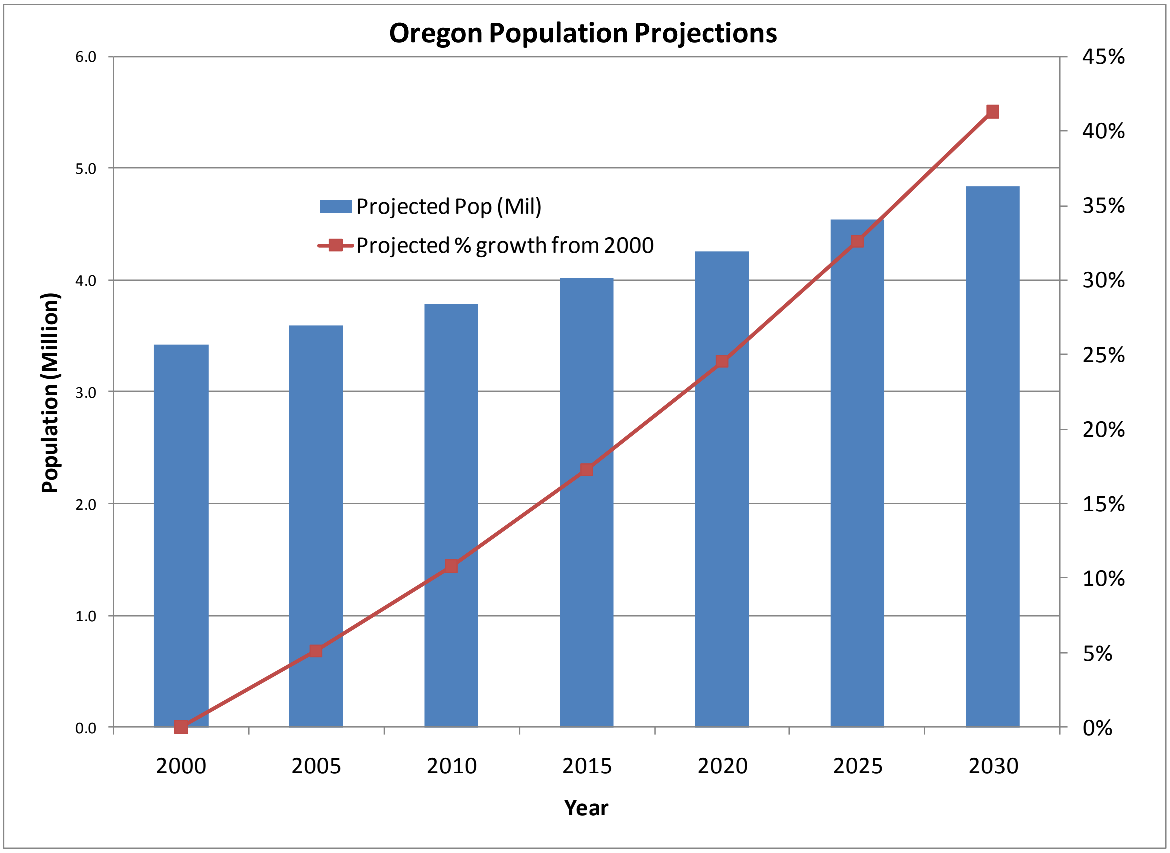

Figure 3.12. Oregon Population Growth Projections
(US Census Bureau from starting with the year 2000)

3.4 Environmental Justice

Oregon DEQ is committed to monitoring in environmental justice areas. The state of Oregon's Environmental Justice Task Force defines environmental justice as:

> "…equal protection from environmental and health hazards, and meaningful public participation in decisions that affect the environment in which people live, work, learn, practice spirituality and play. "Environmental justice communities" include minority and low-income communities, tribal communities, and other communities traditionally underrepresented in public processes."

The Environmental Justice 2008 Annual Report is located at:
http://www.oregon.gov/Gov/GNRO/docs/ejtf-2008-annualreport.pdf .
Based on this definition, air monitoring should be done in minority and low-income communities in locations where people live, work, learn, and play.

3.4.1 Environmental Justice Areas Determination

The counties which need monitoring for environmental justice reasons can be determined using

- the percent of the community in poverty
- the percent minority population in the community
- the communities percent of statewide population

With these criteria in mind, each county was assigned one number if it is either:

1) Greater than the state average percent of minorities per county,
2) Greater than the state average percent of population in poverty per county,
3) Greater than a minority population of 20,000 per county, or
4) Greater than a population in poverty of 10,000 per county.

The Environmental Justice number (EJ) is the sum of these four categories.

The counties with a score of three or more are shown in table 3.4.1. ODEQ or LRAPA currently monitor in all of these counties. The calculations, graphs, and maps used to determine the EJ list are contained in Appendix A.

Table 3.4.1. Environmental Justice Counties
Determined by ODEQ for this report only.

Counties	Minority Population > State Average	Minority Population > 20K	Population in Poverty > State Average	Population in Poverty >10K	**EJ Number**
Marion	1	1	1	1	**4**
Multnomah	1	1		1	**3**
Washington	1	1		1	**3**
Jackson		1	1	1	**3**
Lane		1	1	1	**3**
Umatilla	1	1	1		**3**

Areas on the EJ List
Marion County is at the top of the list scoring high in all categories. Much of the minority and poverty population reside in North Marion County in the Woodburn, Gervis, and North Salem area.

The Portland Metro Area is situated in parts of three counties; Multnomah, Clackamas, and Washington. Of these three Multnomah and Washington Counties have the higher EJ populations. North Portland and Hillsboro have higher poverty rates and larger minority communities than the rest of the area in these counties. To a lesser extent Gresham meets the EJ criteria.

Jackson and Lane Counties have large minority populations but their percent of the total population is low compared to Multnomah, Washington, and Marion Counties. Their poverty percentages are above the state average, however.

Lane County has a large minority population and a higher than state average population in poverty. This may be related to the University of Oregon.

Umatilla County has a large minority population and a high percentage of the county in poverty. The Confederated Tribe of Umatilla accounts for some of the minority population and they have their own air quality monitoring program.

4. CLIMATE ANALYSIS

(from Oregon Climate Service)
TOPOGRAPHIC FEATURES – Oregon enjoys a mild, though varied climate with only a rare occurrence of devastating weather elements such as cloudbursts, tornadoes, or hailstorms severe enough to cause serious widespread damage. The single most important geographic feature of the climate of Oregon is the Pacific Ocean whose coastline makes up the western border. Because of the normal movement of air masses from west to east, most of the systems moving across Oregon have been modified extensively in traveling over the Pacific. As a result, winter minimum and summer maximum temperatures in the west, and to a lesser extent in the eastern portion, are greatly moderated. The occurrence of extreme low or high temperatures is generally associated with the occasional invasion of the continental air masses. The unlimited supply of moisture available to those air masses that move across the Pacific is largely responsible for the abundant rainfall over western Oregon and the higher elevations of the eastern portion.

Beginning near and following the coast the full length of the State, the Coast Range is the farthest west of the three mountain ranges that exert an important influence on Oregon’s climate. This range rises to between 2,000 and 3,000 feet above sea level in the northern part of the State and between 3,000 and 4,000 feet in the southern portion with occasional peaks rising another 1,000 to 1,500 feet. This range, athwart the path of the moisture laden marine air moving in from the Pacific, forces it to rise as it moves eastward. The resultant cooling and condensation produces some of the heaviest annual rainfalls in the United States along the higher western slopes, and materially reduces the available moisture in the air.

The Cascade Mountains parallel the Coast Range about 75 miles to the east and to within 50 to 75 miles of the California border where the two ranges merge, forming a fairly broad, rugged mountain chain known as the Rogue River Mountains. The Cascades rise from the broad valley of the Willamette eastward to an average height of about 5,000 feet, with a few peaks over 10,000 feet. One of these, Mount Hood, at an elevation of 11,245 feet, is the highest point in the State. Once again, the air masses from the west are forced to ascend causing them to give up additional moisture. The rain potential of the marine air, however, was greatly reduced by passage over the Coast Range; therefore, the rainfall on the west slopes of the Cascades at a corresponding elevation is only about one-half to two-thirds as great as on the Coast Range. Precipitation amounts decrease rapidly once the crest is crossed and descent down the eastward side begins.

The Blue Mountains extend from the northeast corner southwestward to the valleys of the John Day and the Deschutes Rivers in central Oregon. Part of the chain projects southeast to the Snake River Valley, while in the northeast a separate branch is known as the Wallowa Mountains. These mountains, roughly between 5,000 and 6,000 feet with peaks from 7,000 to 9,000 feet, also exert an influence on the climate in the immediate area including several sizable valleys, particularly those of the Umatilla and Grand Ronde Rivers. However, the overall effect is much less than that of either the Coast of the Cascade Range.

The Steens Mountains are a short range in the southeast part of the State less than 25 miles in length and only a very local climatic significance. The main crest is slightly more than 8,000 feet above sea level, with one peak of 9,354 feet.

The Columbia River is of vital economic importance to the State, since the large dams along its course generate most of the hydroelectric power in the Northwest. Temperatures are moderated to the east in both summer and winter. Continental air occasionally passes in reverse and produces the more extreme low temperatures in the western valleys.

Winding through the rugged terrain that makes up much of Oregon are the Columbia and Snake River Basins, the valleys of the many streams that head in the mountains and several very wide plateau regions. The valleys, particularly those of the Columbia, Snake, Willamette, Rouge, and Hood Rivers, produce most of Oregon's agricultural wealth; however, the mountain and plateau regions are used extensively for livestock grazing and dryland farming. The Columbia Plateau covers about two-thirds of the State's total area and extends from the eastern border westward to the eastern slopes of the Cascade Mountains and from the southern boarder north to the Columbia River. Its elevations ranges from 4,000 to 6,000 feet and because of its arid nature and scant vegetation, summer heating and winter cooling often becomes extreme.

TEMPERATURE – Few states have greater temperature extremes than Oregon where they have ranged from a low of 54° F below zero to a high of 119° F. Seldom, however, do daily extremes occur even closely approaching these absolute records. In 80 percent of recent years the highest temperature recorded in the State has not exceeded 114° F, nor was the absolute minimum lower than -37° F. In 50 percent of those years no temperature was recorded higher than 110° F. Here the mean of the coldest month, January, is 45° F only 15° less than that of July, the warmest month. In the Willamette Valley few stations have had a maximum temperature greater than 98° F, or a minimum temperature lower than 16° F for over half of their year's record. Temperature of 90° F or more, occur only about six to eight days a year and those below zero occur on an average of once every 25 years. Here the mean temperatures average 38° F in January and 66° F in July. In the inland valleys of the southwest the average summer temperatures are about 5° F higher than in the northwest and maximums of 90° F or more occur 40 to 50 days a year. In south-central Oregon the median annual maximum temperatures over a period of years have been between 95° F and 100° F, varying, of course, with the different stations; in most other areas east of the Cascades this variance is between 100° and 105° F. Median annual minimum temperatures for eastern Oregon vary from near zero in the more protected areas of the Columbia Basin to -26° F in the high mountain and plateau regions. The minima for a majority of these stations, however, lies in the range of –1 to -10° F. The normal mean January temperature in southeast Oregon is 25° to 28° F and in the northeast 29° to 33° F; July normal means range between 65° and 70° F in the central valleys and plateau regions and 70° to 78° F along the eastern border.

PRECIPITATION – The average annual rainfall in Oregon varies from less than eight inches in drier Plateau Regions to as much as 200 inches at points along the upper west slopes of the coast Range. Accordingly, vegetation ranges from the heavily wooded Coast Range and west slopes of the Cascades with their dense undergrowth to only a very sparse growth of sagebrush and desert type grasses over the wide plateau areas of central Oregon. Irrigation projects in recent years have converted thousands of acres of semi desert areas into highly productive farmland.

The State as a whole has a very definite winter rainfall climate. West of the Cascades about one-half of the annual total precipitation falls from December through February; about one-fourth in the spring and fall and very little during the summer months. East of the Cascades the differences are not as pronounced with slightly more precipitation in winter than in spring and fall, while only about 10 percent falls during the summer. Along the coast the normal annual total is from 75 to 90 inches, and increases up the west slopes of the Coast Range to almost 200 inches near the crest. Amounts decrease on the eastern slopes and in the Willamette Valley. On the western slopes of the Cascades there is again a marked increase in precipitation with elevation as annual averages range up to 75 inches. Amounts decrease rapidly on the east side. The annual average precipitation for the great plateau of the State is often less than eight inches. In the Columbia River Basin and the Blue Mountains, totals are about 15 to 20 inches; however, some of the mountain regions receive as much as 35 inches.

SNOWFALL – In the high Cascades, where the State's heaviest snowfalls occur, there are few official observing stations. Considerable reliance must be placed on measurements obtained on various snow courses. It appears that annual average totals can range from 300 t 550 inches. A maximum annual snowfall of 879 inches and a snow depth of 242 inches have been officially recorded at Crater Lake National Park headquarters. Winter precipitation along the Coast Range, due to its lower elevations, occurs largely in the form of rain, although it too is occasionally subject to very heavy snows. In the Blue Mountains, seasonal totals range between 150 to 300 inches and depths on the ground may occasionally exceed 120 inches, but during most years the greatest recorded snow depths are less than 100 inches. The periods of continuous snow cover very with elevation. On the peaks of the Cascades higher than 7,000 feet above sea level it persists in glacial form the year around. In most mountain areas above 4,500 feet snow cover lasts from early December until the latter part of April. Snow courses averages show that above 4,500 feet, snow depths (again varying with elevation) are approximately 50 to 100 inches in the Cascades, 25 to 65 inches in the Blue Mountains at the end of January; 60 to 125 inches and 25 to 70 inches, respectively, at the end of February; 75 to 135 inches and 25 to 80 inches at the end of March; 40 to 120 inches and five to 45 inches at the end of April.

Along the coast the average annual snowfall is only one to three inches, with many years in which there is no measurable amount. In the inland western valleys most yearly totals average between 10 to 15 inches, with snow on the ground seldom lasting more than two to three days at a time. In north-central Oregon the annual average is 15 to 30 inches, while over the higher plateau region that makes up the south-central portion snowfall ranges up to as much as 60 inches. In the valleys of the northeast 40 to 75 inches is normal, while in the Snake River Basin which makes up most of the southeast it is only 15 to 40 inches. Every few years some part of the State, (with the possible exception of the coastal areas), may be visited by heavy snowstorms which even in the Willamette Valley can produce 20 to 25 inches in a 24-hour period.

4.1 Climate Change in Oregon:

Rising temperatures are resulting in more frequent heat waves and longer forest fire seasons. More frequent heat waves will result in more episodes of elevated ozone. Longer forest fire seasons increase the likelihood of devastating wildfires with unhealthy $PM_{2.5}$ impacts. Forest fires also produce ozone precursors raising the ozone levels. Other consequences are more difficult to predict. For example, warmer winters have already resulted in the spread of tree parasites such as the pine beetle which are killing vast tracks of lodge pole pines in the Cascades and Eastern Oregon. One of the consequences of this is the widespread availability of free fire wood across much of Eastern Oregon. Coupled with record high fuel prices, woodstove heating has become an affordable option for many and consequently, the $PM_{2.5}$ levels in many rural communities have been rising.

5. MONITORING NETWORK BY POLLUTANT

The air in Oregon is primarily monitored by Oregon DEQ, Lane Regional Air Protection Agency (LRAPA), EPA, Tribes, and various other smaller networks. This monitoring plan will only encompass the ODEQ and LRAPA monitoring networks. Oregon DEQ and LRAPA measure troposphere ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter 10 microns in diameter (PM_{10}), particulate matter 2.5 microns in diameter ($PM_{2.5}$), lead, air toxics, and meteorology. ODEQ has monitors in 24 of the 36 Oregon counties. LRAPA monitors air quality in Lane County. Of the remaining 11 counties, five are on the Pacific Ocean, four are in the Columbia Gorge, and two are in remote areas of Eastern Oregon. These counties either have very good ventilation, as on the coast and in the Columbia Gorge, or are very sparsely populated. This monitoring network plan will discuss each type of pollutant individually.

5.1 Ozone

In 2010 EPA will lower the ozone NAAQS from its current level of 0.075 ppm to somewhere between 0.060 and 0.070 ppm. EPA is also expected to institute a secondary standard which will be based on accumulative ozone exposure for longer periods of time. The proposed secondary standard is a "seasonal standard expressed as a sum of weighted hourly concentrations, cumulated over the 12-hour daylight period from 8:00 a.m. to 8:00 p.m. local standard time, during the consecutive 3-month period within the ozone monitoring season with the maximum index value. The design value is the average of the maximum 3-month sum from each year in a 3-year period". EPA is proposing a standard between 7 and 15 ppm – hours calculated using the W-126 method.

The monitoring requirements will also be changed to a) require mandatory monitoring in cities over 50K in population, b) to require monitoring in one community with a population between 10 and 20K, and c) to require one monitor at a rural site for comparison to the secondary standard.

5.1.1 Design values

The Design Value (DV) is the concentration that is monitored at a site using EPA federal reference methods and following calculation outlined in 40CFR Part 50 Appendix I. The ozone Design Values is calculated by averaging the fourth highest daily maximum eight hour average over three years. The value is measured in parts per million (ppm) and truncated after the thousandth decimal.

Oregon has no cities with DVs over the current NAAQS of 0.075 ppm. The highest DV is 0.067 ppm in Medford. The remaining cities are all between 0.060 and 0.064 ppm. All Oregon's ozone design values are shown in Table 5.1.1. Table 5.1.2 lists the newer ozone sites with less than three years of data. Figure 5.1.1 illustrates the DV by city.

Table 5.1.1. Oregon Ozone Design Values.
(Years 2007-2009).

CBSA	County	Site	AIRS#	DV 2007-09 PPM
Portland-Vanc.-Beaverton, OR-WA	Clackamas	Carus	410050004	**0.064**
Portland-Vanc.-Beaverton, OR-WA	Columbia	Sauvie Is	410090004	0.058
Portland-Vanc.-Beaverton, OR-WA	Multnomah	SE Lafayette	410510080	0.059
Medford, OR	Jackson	Talent	410290201	0.067
Eugene-Springfield, OR	Lane	Saginaw	410391007	**0.061**
Eugene-Springfield, OR	Lane	Amazon Pk	410390060	0.060
Salem, OR	Marion	Turner	410470004	0.064
Pendleton-Hermiston, OR	Umatilla	Hermiston Airport	410591003	0.063

The design value for the 8-hour O_3 is the 3-year average of the annual 4th highest daily maximum 8-hour O_3.

Table 5.1.2. New ozone sites without three years of data.

CBSA	County	Site	AIRS#	Ozone 2009	Years of Data
Portland-Vanc.-Beaverton, OR-WA	Washington	Sherwood	410671004	-	1
Bend, OR	Deschutes	Bend	410170122	-	1

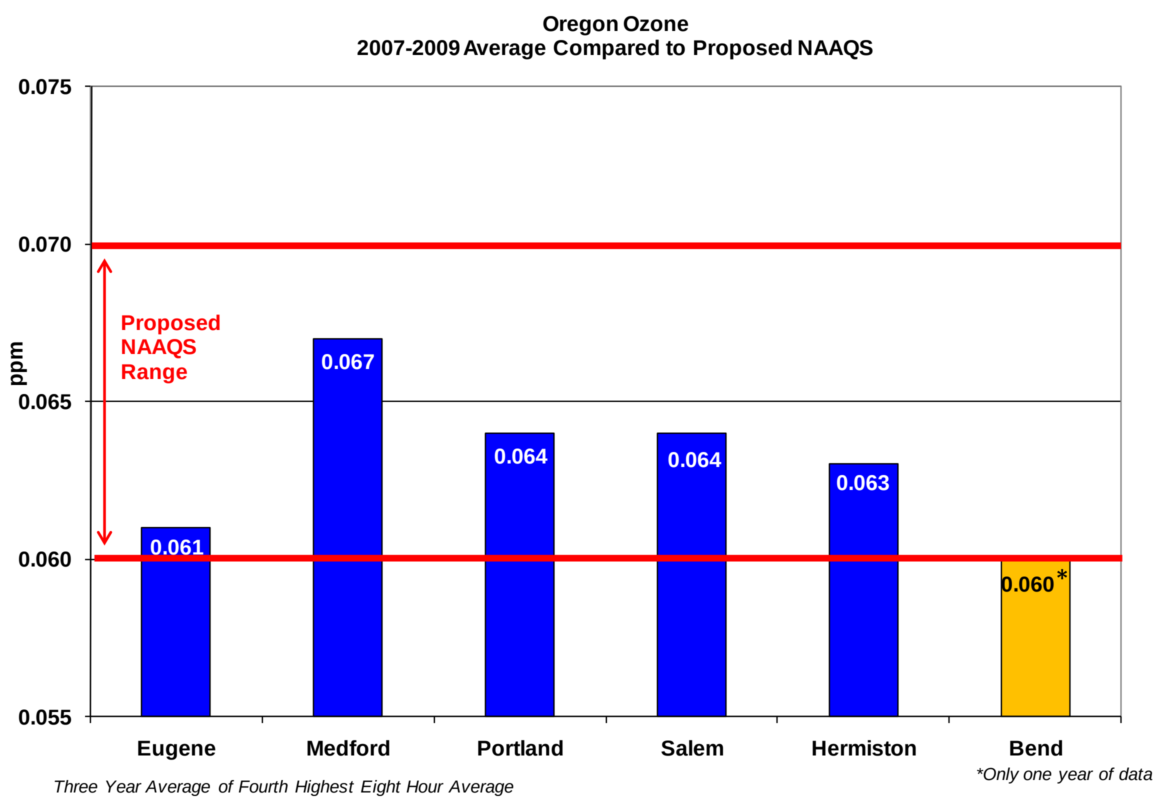

Figure 5.1.13. Oregon 2007-2009 ozone design values by city.

The proposed secondary standard design values are calculated using the W-126 method. Oregon does not have any areas that exceed the lower range of the proposed secondary standard. However, these monitors are sited in or downwind from urban areas and are not ideally situated for comparison to the proposed secondary standard. Figure 5.1.2 includes the W-126 values for current sites and past rural sites. No rural site exceeded the W-126 either.

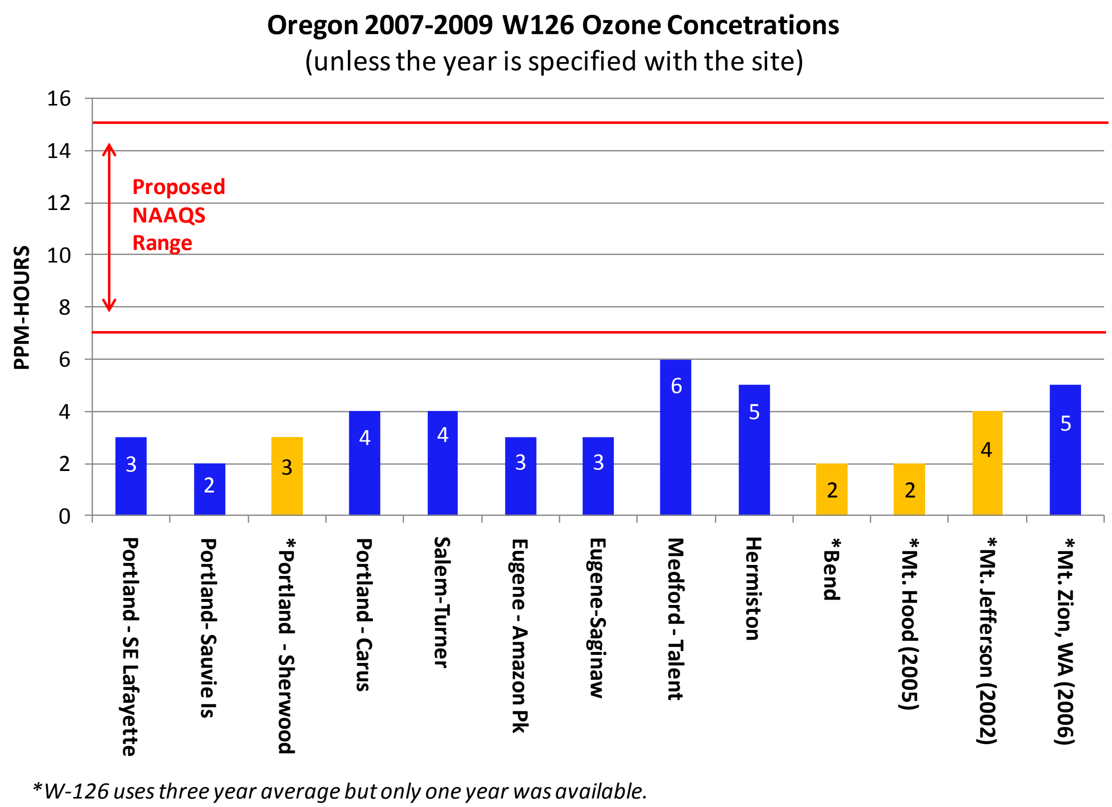

Figure 5.1.2. Oregon 2007-2009 secondary (W-126) ozone design values by site.

5.1.2 Pollutant Trends

Figure 5.1.3 shows the 1990 through 2009 eight hour ozone trend for Oregon cities. In general, all cities show flat or declining ozone levels even with increased population. Figure 5.1.4 provides a good example of how the Portland Metros' population and vehicle miles traveled have gone up while ozone levels have been trending down.

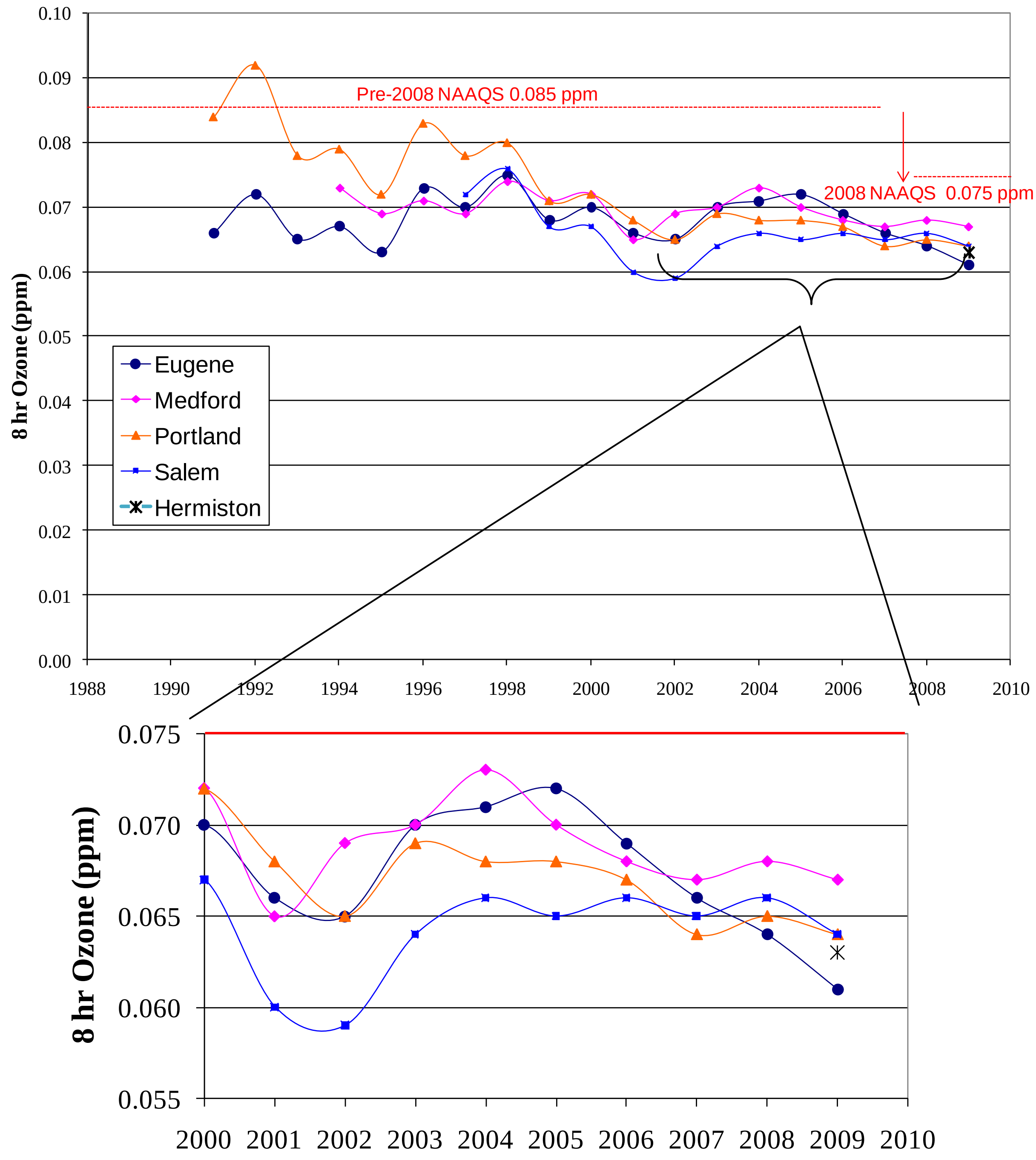

Figure 5.1.3. 2007-2009 Oregon ozone trends.
Values are the three year average of the fourth highest daily max eight hour average.

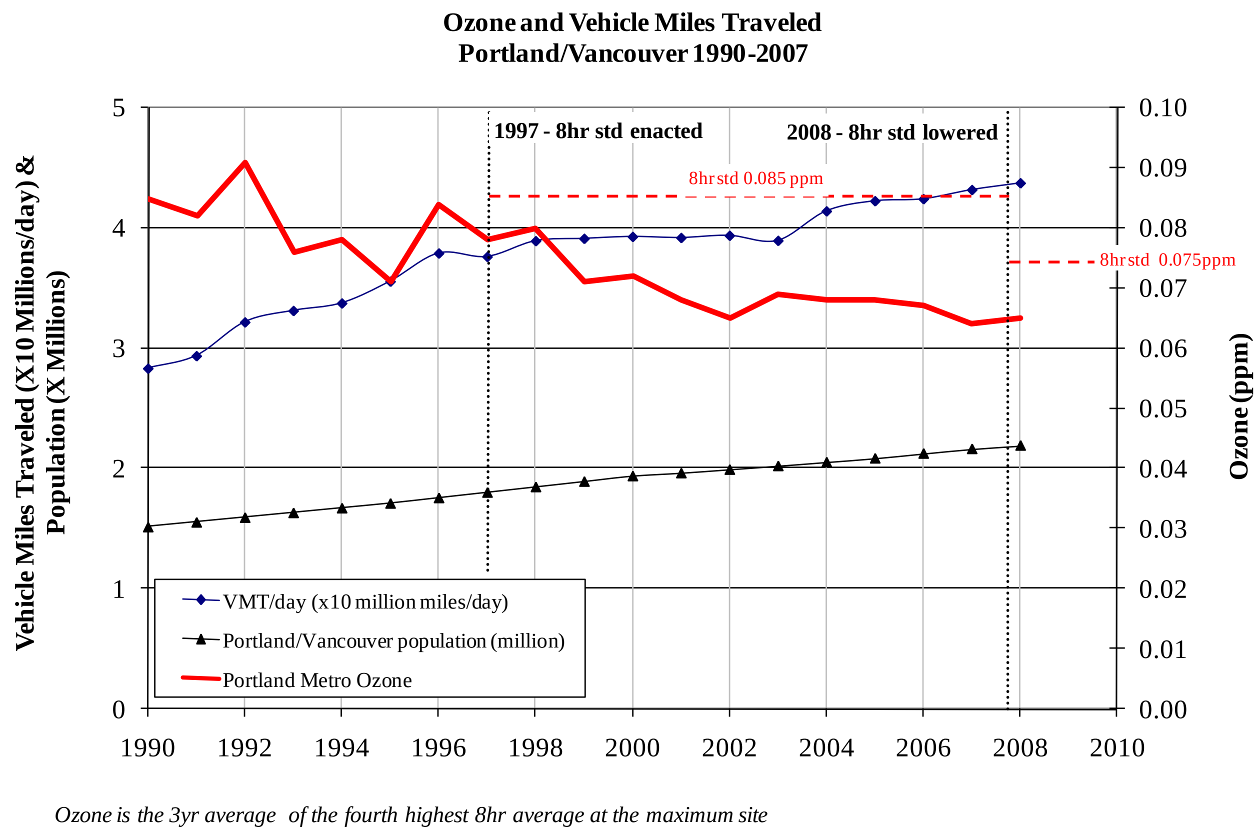

Figure 5.1.4. 1990-2009 Portland/Vancouver Trends - ozone, vehicle miles traveled, and population.
Ozone values are the three year average of the fourth highest daily max eight hour average.

5.1.3 Meteorological Impacts
Ozone is a secondary pollutant created when nitrogen dioxide and oxygen react in the presence of ultra violet (µv) light. The stronger the µv light the more ozone is created. The temperature also influences ozone formation. When temperatures are high, the ozone formation reaction occurs more readily. Other factors such as amount of cloud cover, low wind speeds, and low vertical mixing also contribute to high ozone.

In Oregon, elevated ozone occurs in the summer months and EPA only requires monitoring from May 1st to September 30th in Oregon. This monitoring schedule provides a cushion of about three weeks on either side of the hot months when the temperatures are warm enough, the sun angle is high enough, and sun light duration is long enough to elevate ozone levels near the standard.

Temperatures
In the Willamette Valley, eight hour ozone levels above 0.075 ppm may occur on days with temperatures between 90°F and 100°F. When outdoor temperatures exceed 100°F, ODEQ has observed that Willamette Valley ozone levels do not typically exceed 0.075ppm (8 hour average). This could be a consequence of reduced human activity, lower than expected ozone precursor levels, or improved vertical mixing.

In the Rogue Valley (Medford), elevated ozone may occur when the temperatures exceed 95°F. Elevated ozone levels most frequently occur during consecutive days with maximums over 95°F. Ozone concentrations are also dependent on other meteorological conditions such as vertical mixing, cloud cover, and relative humidity but in general the likelyhood of elevated ozone can be forecasted based on temperatures.

In Figure 5.1.5 the number of days with temperatures over 90°F for Portland is shown along with a trend line. Figure 5.1.6 shows the number of days with temperatures over 95°F for Medford. The number of days with elevated temperature is trending up for Portland and trending down slightly for Medford.

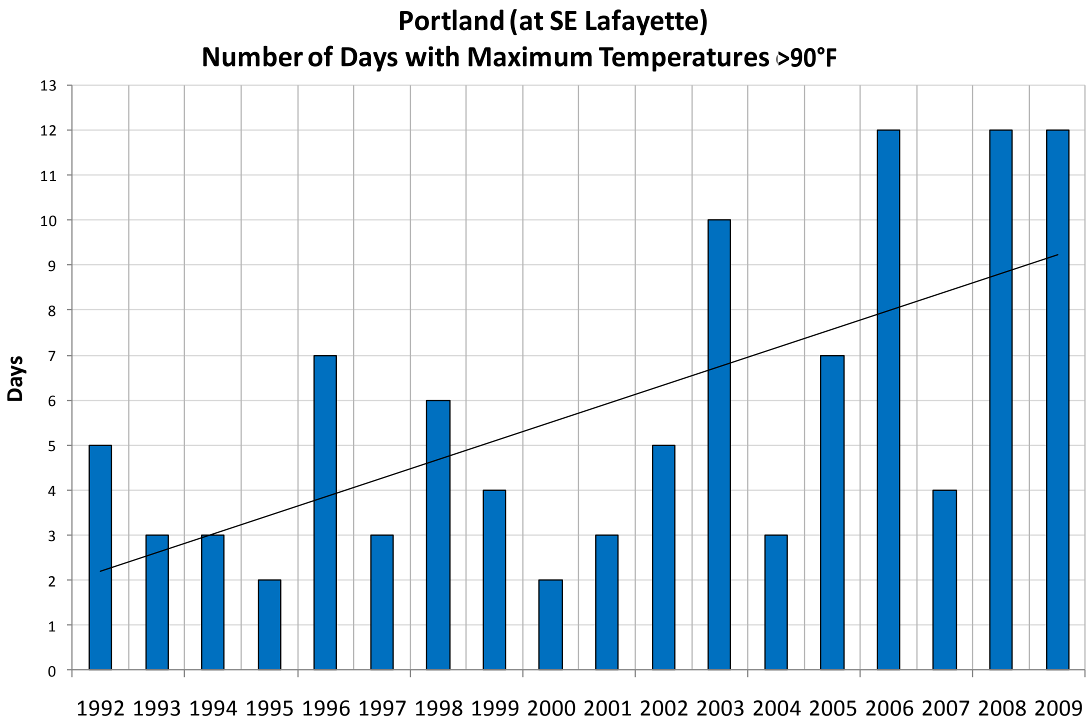

Figure 5.1.5. The number of days per year with maximum temperatures over 90°F (Portland -SE Lafayette).

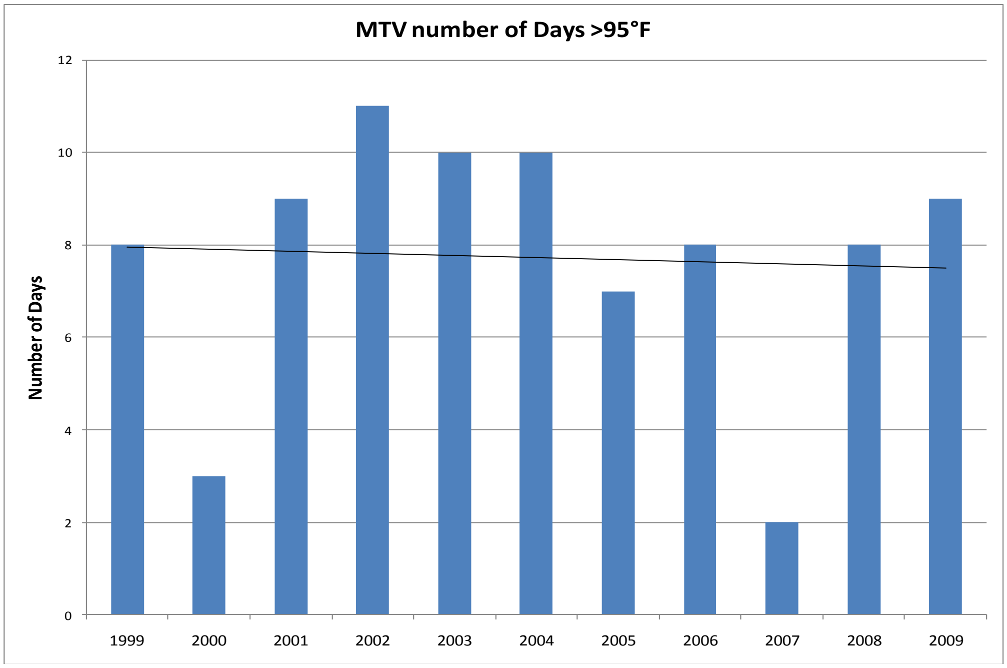

Figure 5.1.6. The number of days per year with maximum temperatures over 95°F in Medford.

The number of consecutive days over 90°F is also critical in determining ozone levels because the ozone does not have time to dissipate when overnight temperatures remain high. The ozone builds up every day, until by the second or third day of the episode, it could exceed the NAAQS. The number of episodes with two or more consecutive days greater than 90°F in Portland and 95°F in Medford has been trending up in recent years. Figures 5.1.7 and 5.1.8 show the number of episodes per year with consecutive days greater than 90°F in Portland from 1992 to 2009 and greater than 95°F in Medford from 1999 to 2009.

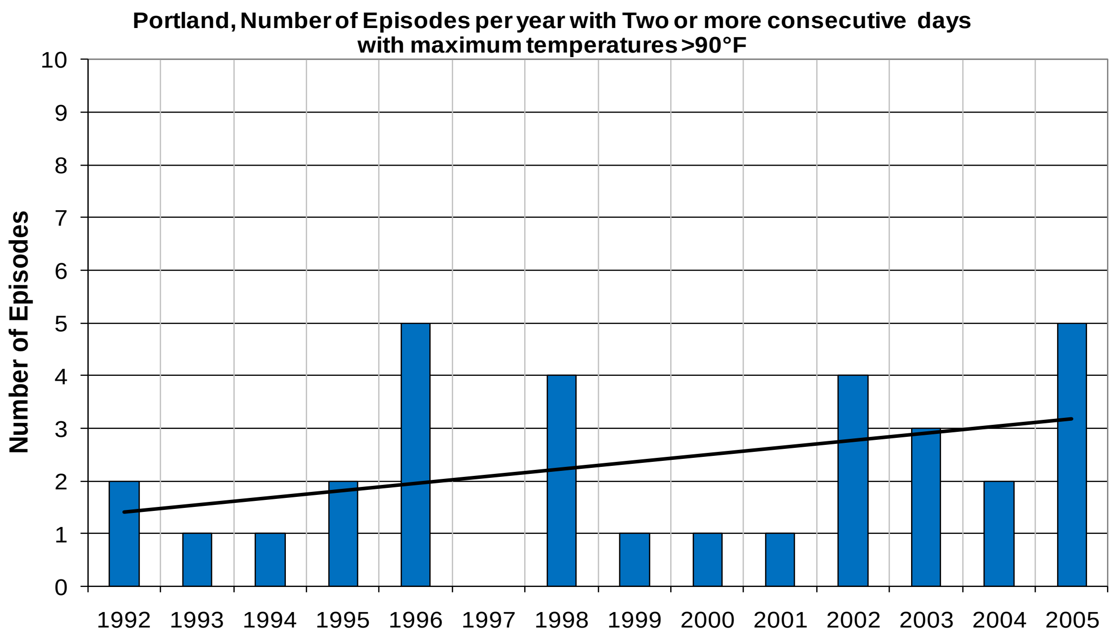

Figure 5.1.7. Number of episodes per year in Portland with two or more consecutive days with maximum temperatures greater than 90°F.

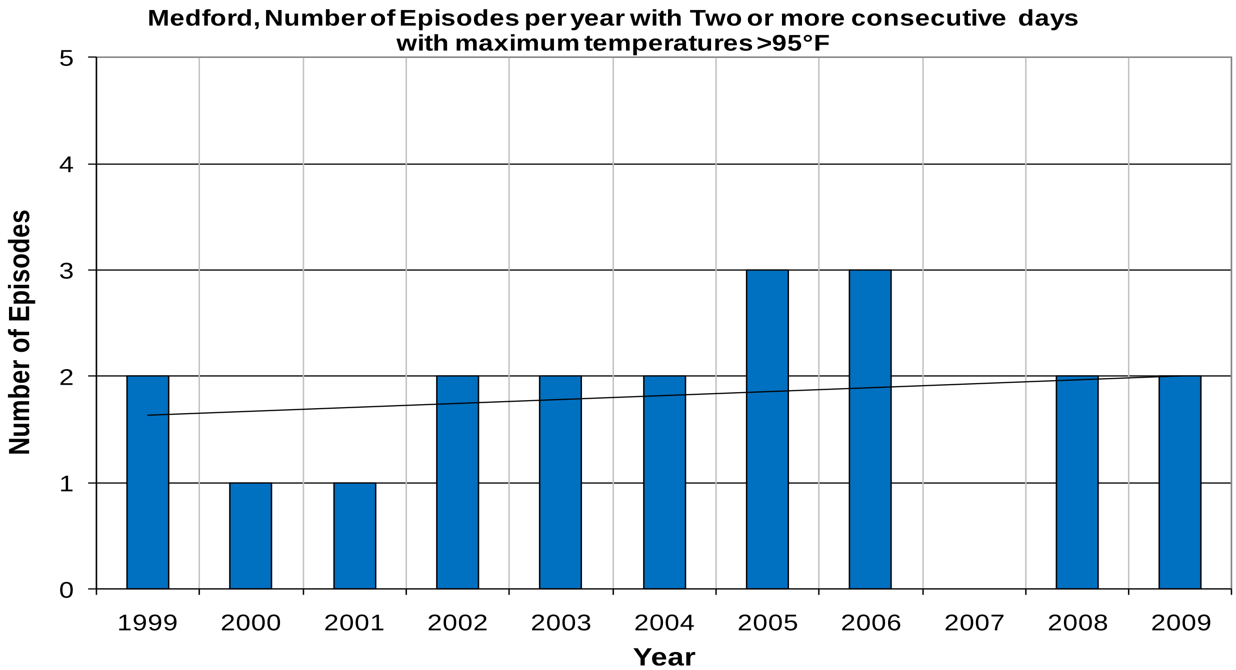

Figure 5.1.8. Number of episodes per year in Medford with two or more consecutive days with maximum temperatures greater than 95°F.

If the episodes are separated into six year segments from 1992 to 2009 for Portland (Figure 5.1.9) the total number of single day and two day episodes greater than 90°F has risen while the number of three plus day episodes has remained almost stagnant. Medford shows a similar pattern in Figure 5.1.10.

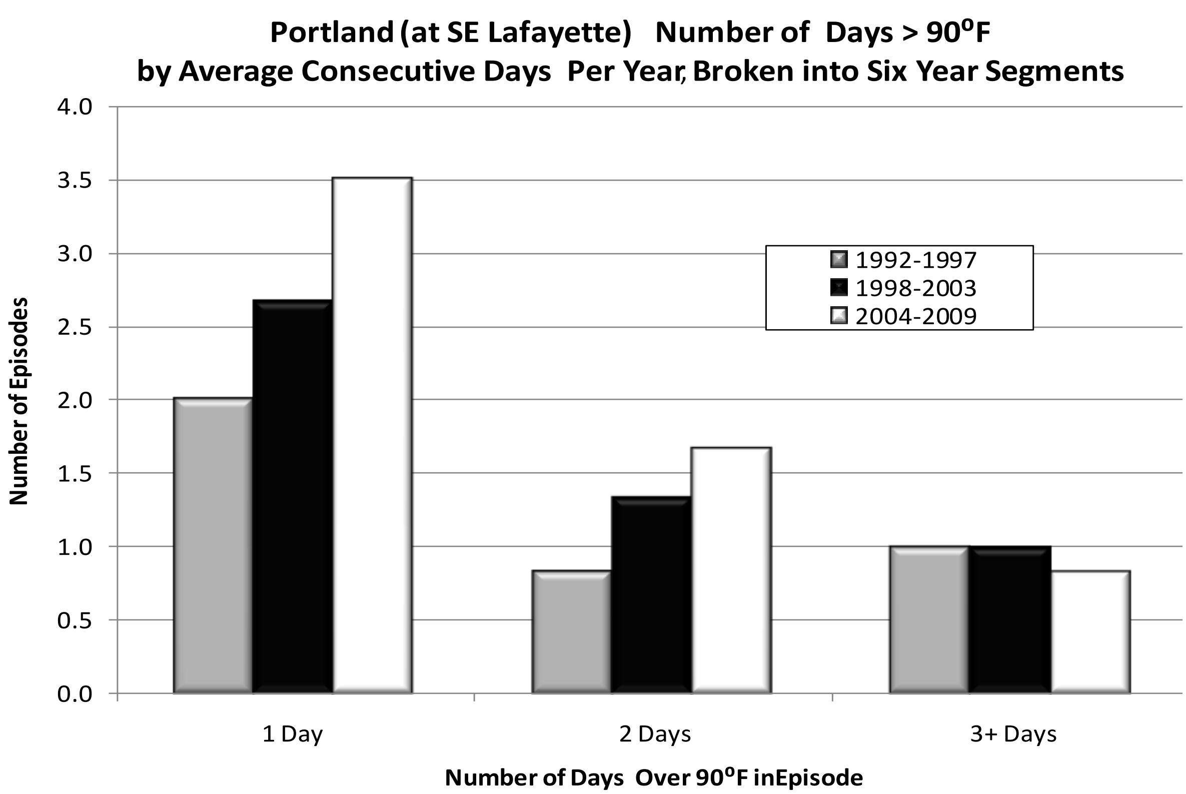

Figure 5.1.9. Portland 1992 to 2009 temperature episodes with one, two, or three plus consecutive days with maximum temperature over 90°F.
(separated into six year blocks)

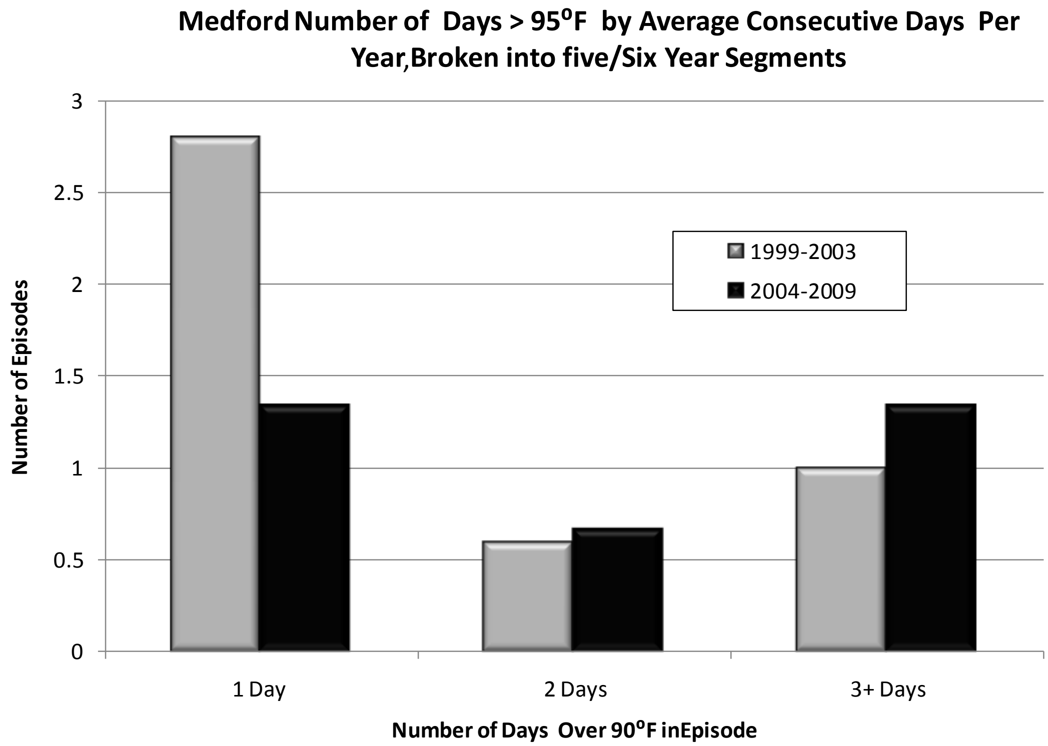

Figure 5.1.10. Medford 1999 to 2009 temperature episodes with one, two, or three plus consecutive days with maximum temperature over 90°F.
(separated into six year blocks)

This indicates that most of the increased temperature days are not part of a heat wave but are one to two day events. In the past these one to two day events would likely have remained below the temperature threshold for ozone exceedences. If this trend continues, Portland and Medford should see higher temperatures in the future with the risk of producing more tropospheric ozone. This is consistent with global warming claims that temperatures are rising.

Wind Direction

In the Willamette Valley, the predominant summer wind direction is from the northwest as shown in Figure 5.1.11. On occasion the wind travels to the SW in the Portland Metro Area or east into the Columbia Gorge. Typically winds from the northwest are associated with onshore flow and result in temperate weather. Occasionally the Portland Metro area is impacted from very hot east winds but this is usually associated with high winds and low relative humidity.

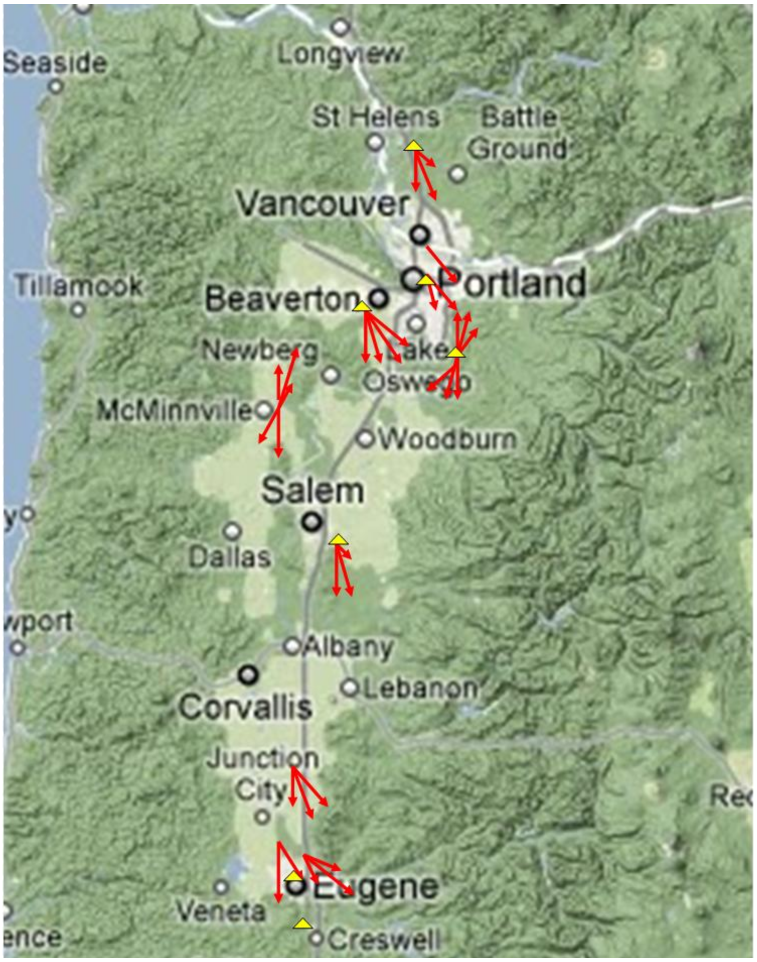

Figure 5.1.11. Predominate summer wind direction for the Willamette Valley.

In Medford the predominant summer winds are from either the north or south (Figure 5.1.12). High winds come from the north where low winds come from either direction.

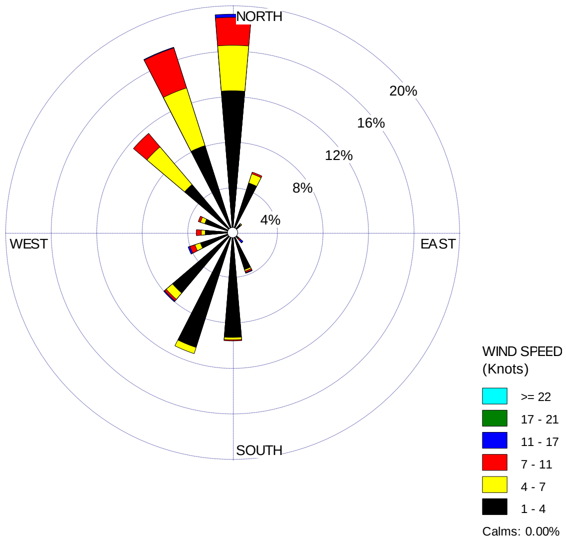

Figure 5.1.12. Predominant summer wind direction for Medford (May-Sep 2009).

Interestingly, on the four highest 2009 ozone days in Medford the wind direction was primarily from the west as shown in Figure 5.1.13. This is consistent with impact from forest fire smoke. The smoke from north or south of Medford travels to the coast then returns inland into Medford from the west.

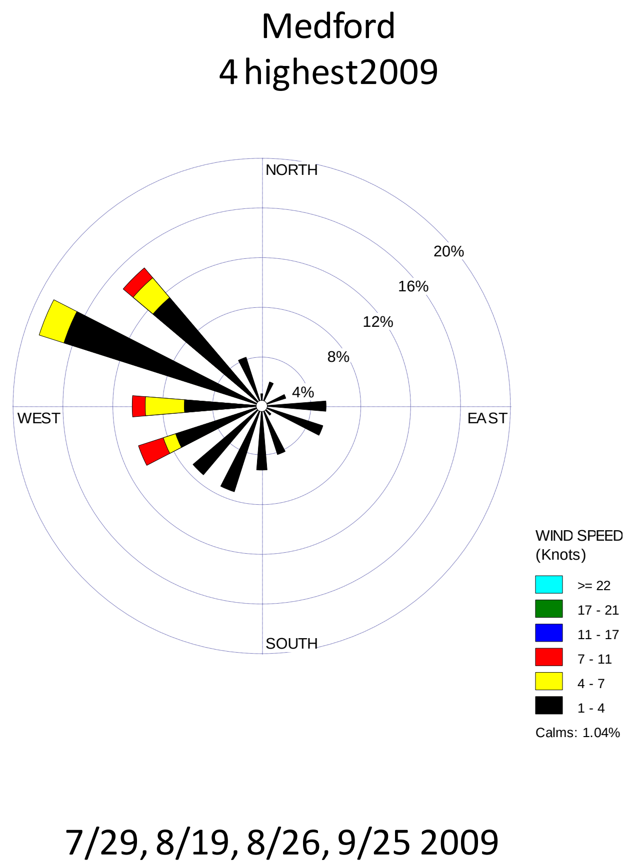

Figure 5.1.13. Wind direction for Medford on the four highest ozone days in 2009.

MODIS satellite photos (Figure 5.1.14 shows Sept 25, 2009) show various levels of smoke in Medford on the 2009 highest ozone days. The levels did not exceed the 0.075ppm standard and were not flagged.

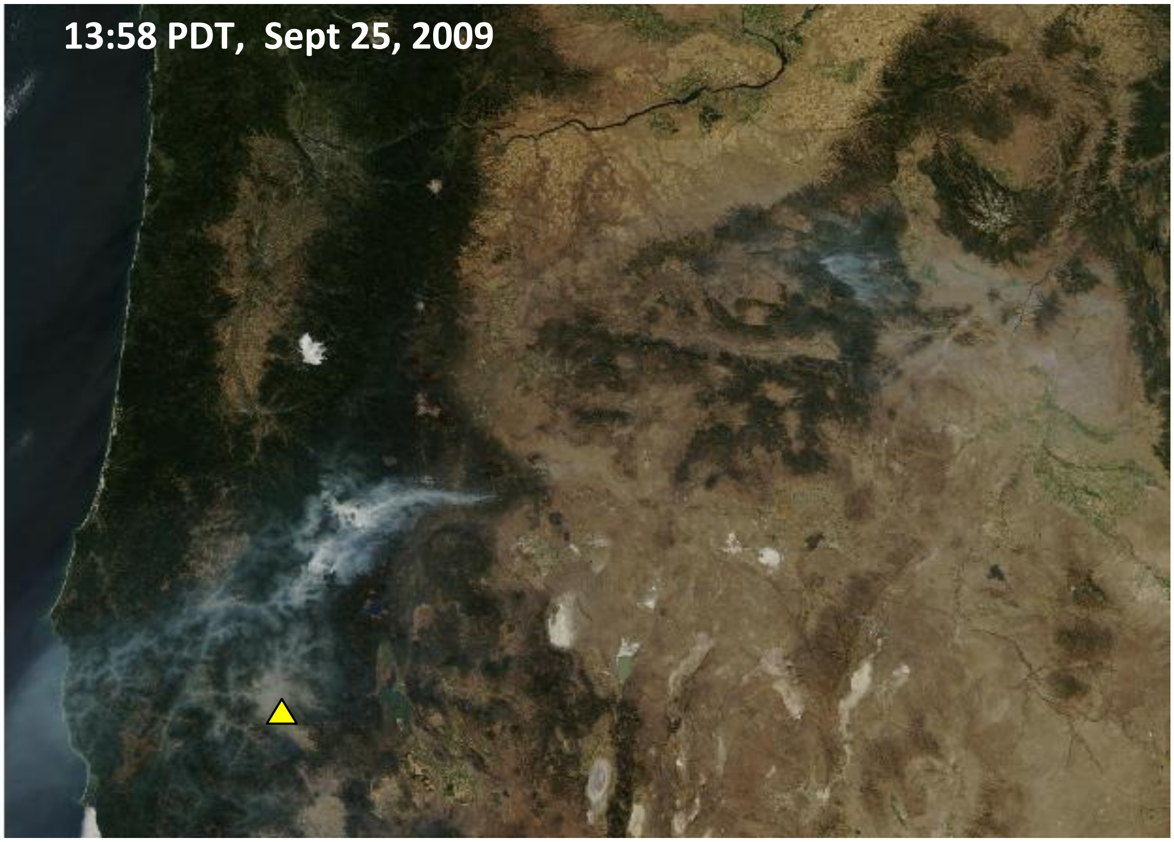

Figure 5.1.14. September 25th, 2009 smoke from the Tumble Bug fire over Medford. The smoke originated near Roseburg and traveled southwest over Medford. Medford had elevated ozone on this day. MODIS Satellite Image

In Eastern Oregon the predominant summer winds are from the southwest and northwest. A closer look at a 2009 day with elevated ozone levels show the predominant wind direction in Hermiston varied from northwest to southwest (Figure 5.1.15).

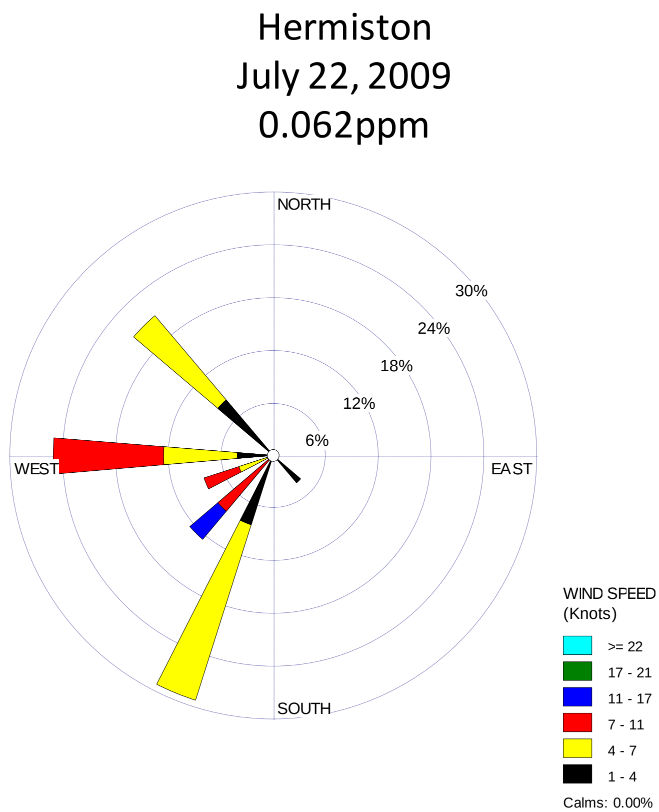

Figure 5.1.15. Wind direction for Hermiston on elevated ozone days in 2009.

On an elevated ozone day in Bend, there were strong winds from the northwest and low winds from the southwest (Figure 5.1.16).

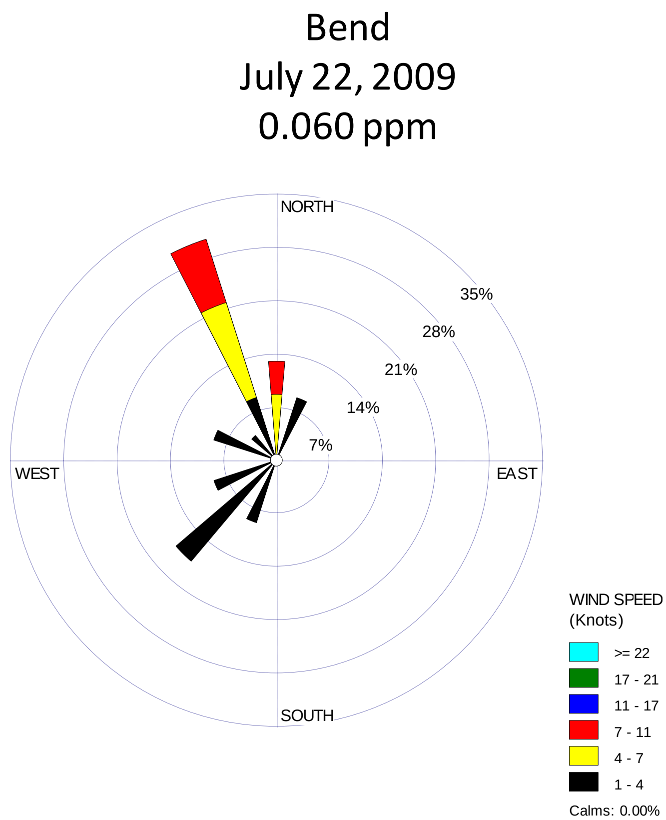

Figure 5.1.16. Wind direction for Bend on elevated 2009 ozone day.

<u>5.1.4 Regional Ozone Levels</u>
Ozone levels around the northwest range from 0.047 to 0.76 ppm (both in the State of Washington). Oregon's levels fall in the middle of these extremes ranging from 0.060 to 0.067 ppm. Central Washington and Northern Central Oregon share the Columbia Basin. Western Washington and Western Oregon have similar agricultural and urban valleys running north to south which may impact one another. Idaho and Oregon may be transporting ozone near the Ontario/Nampa area.

<u>5.1.5 Emission Inventory</u>
2005 is the latest complete emission inventory available at the time of this plan. The emission inventory for the ozone precursor, NOx, is shown in Figures 5.1.17 and 5.1.18 below. NOx is primarily from on-road mobile sources and concentrated in the urban counties. The largest non-road sources are also in urban areas and are often train yards.

Another ozone precursor, Volatile Organic Compounds (VOCs), are largely emitted from biogenic sources, especially in rural areas. In urban counties, area sources also contribute a large amount. The emission inventory for the VOC, is shown in Figures 5.1.19 and 20 for all sources and 5.1.21 and 22 for anthropogenic sources.

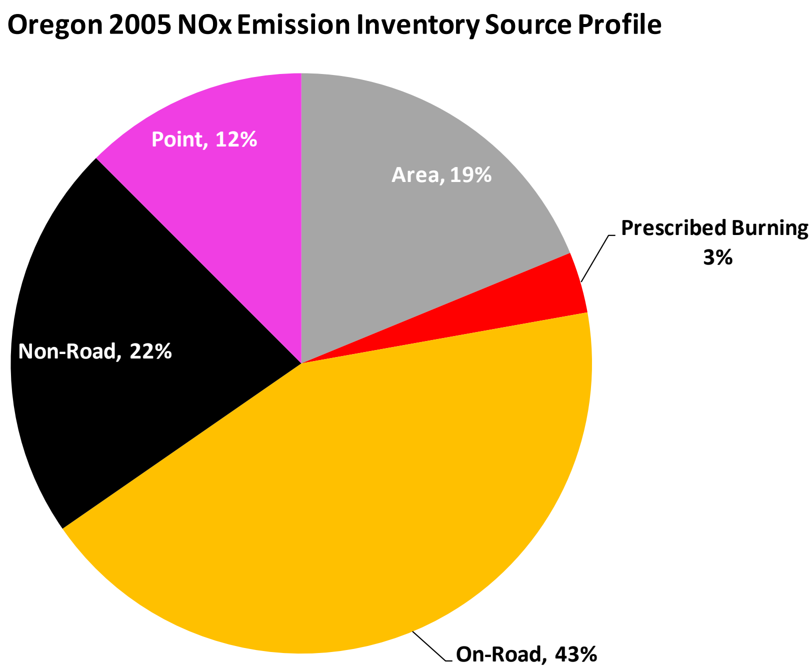

Figure 5.1.17. Ozone precursor NOx 2005 annual emissions by emission type.

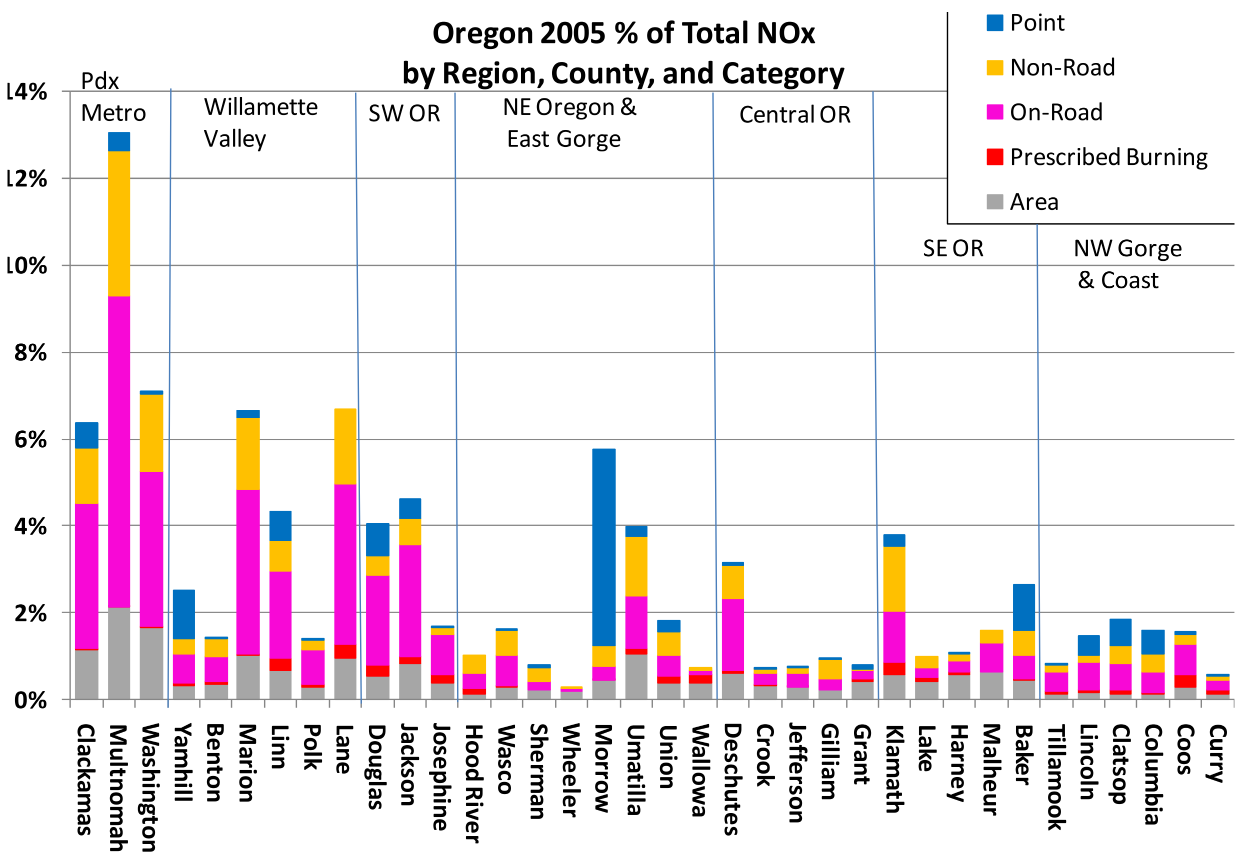

Figure 5.1.18. Ozone precursor NOx 2005 annual emissions by emission type and county.

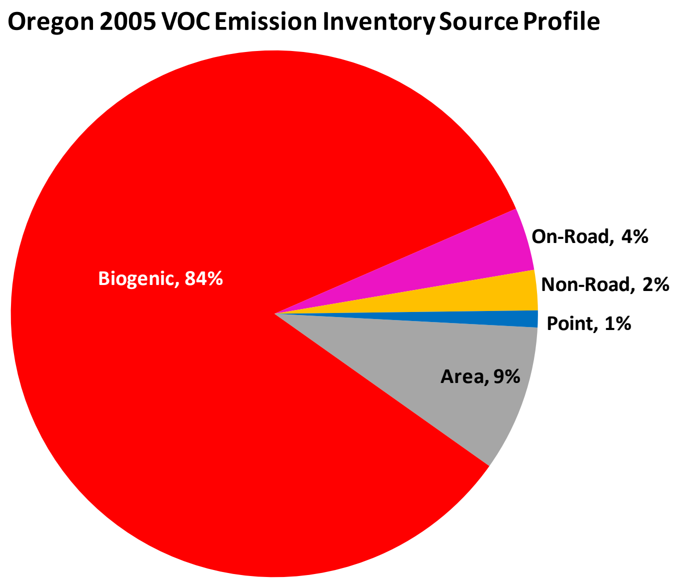

Figure 5.1.19. Ozone precursor VOC 2005 annual emissions by emission type.

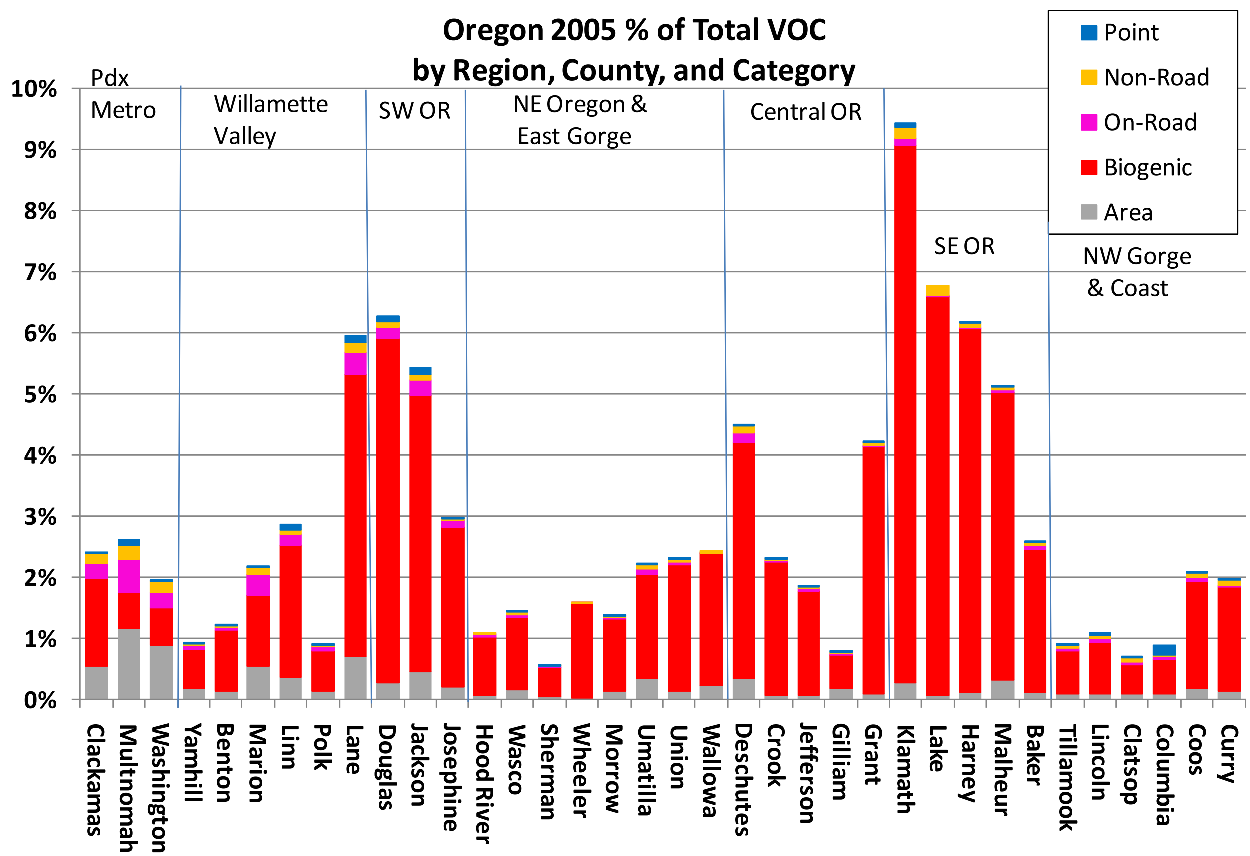

Figure 5.1.20. Ozone precursor VOC 2005 annual emissions by emission type and county.

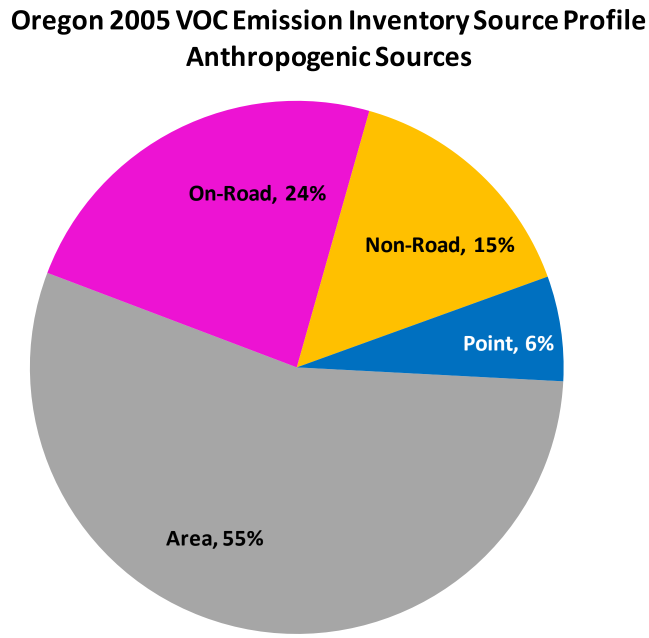

Figure 5.1.21. Ozone precursor VOC 2005 Anthropogenic annual emissions by emission type.

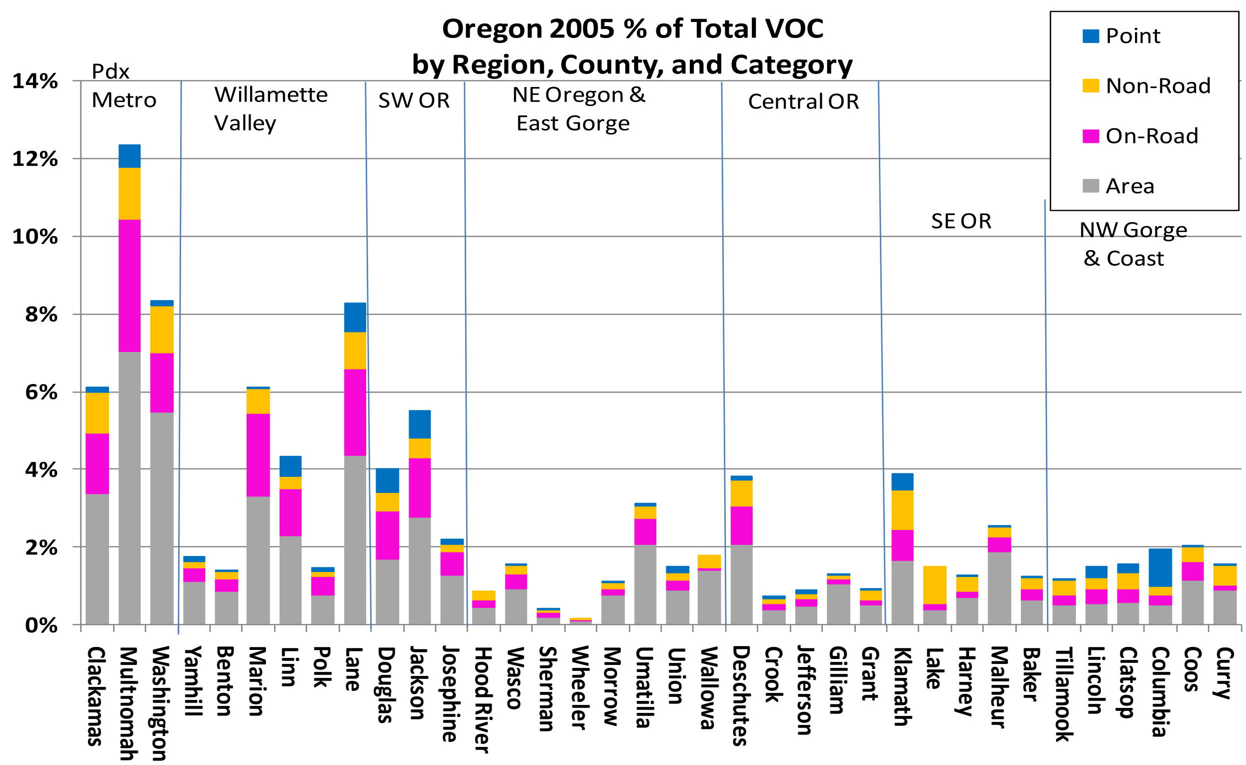

Figure 5.1.22. Ozone precursor VOC 2005 Anthropogenic annual emissions by emission type and county.

5.1.6 Satellite Images of Ozone Precursor (NO_2) - Willamette Valley

In general, the Pacific Northwest has lower NO_2 levels than most of the country. Figure 5.1.23 shows the January average NO_2 calculated from satellite images taken in 2008. The satellite image includes all the NO_2 through the air column but it provides a general idea of ground levels.

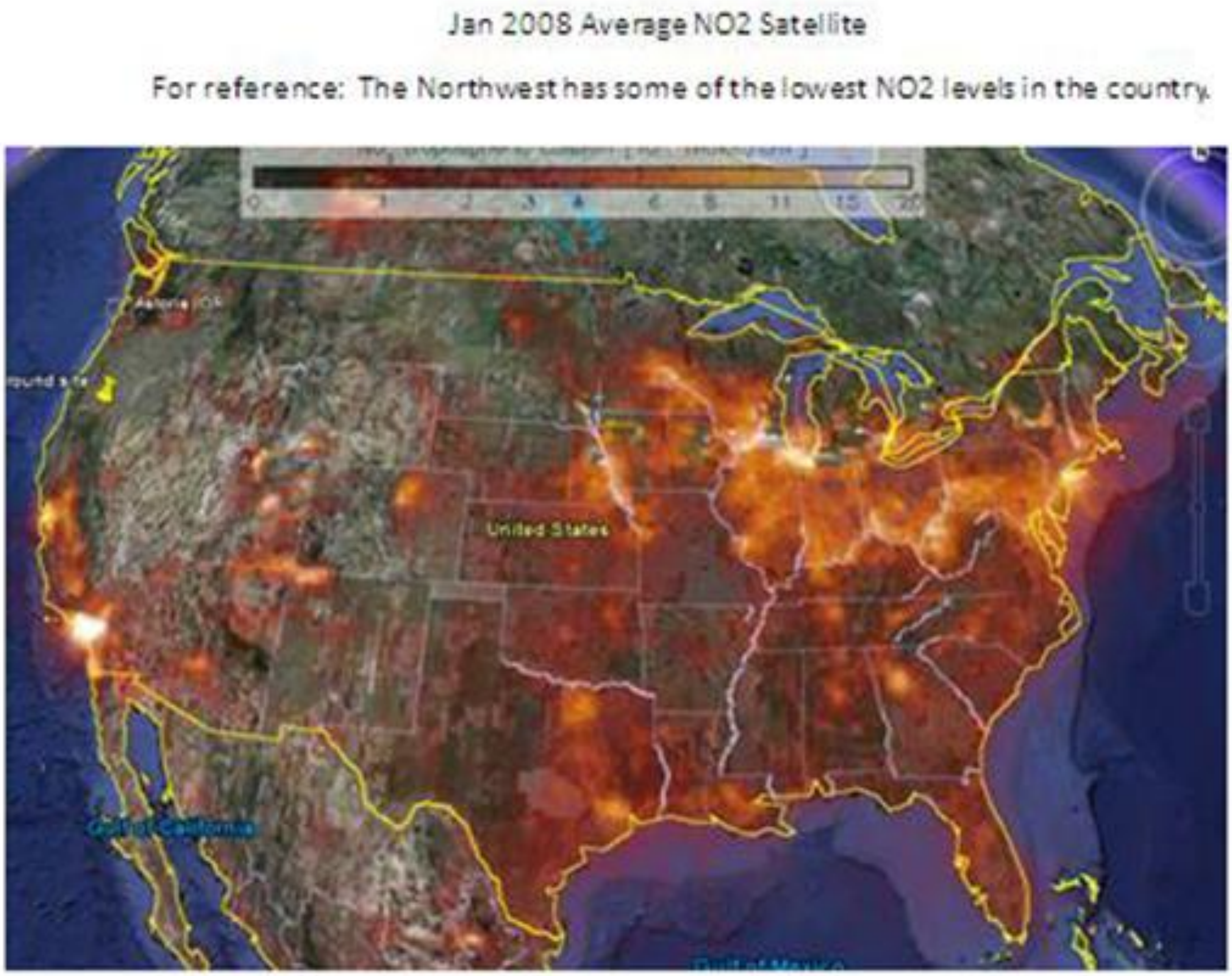

Figure 5.1.23. January 2008 monthly average NO_2 levels for the United States.
Images are through the air column from NASA satellite measurements.

In Oregon most of the NO_2 is centered in the Willamette Valley with the highest levels in the Portland Metro area. The highest NO_2 levels follow I-5 which is where the three largest metropolitan areas are (Portland, Salem, and Eugene). The images also show some NO_2 in North Central Oregon and Central Washington (Figure 5.1.24). In summer monthly averages the NO_2 levels drop but this is presumably because more ozone is being formed (Figure 5.1.25).

Figure 5.1.24. March 2008 monthly average NO_2 levels for Oregon.
Images are through the air column from NASA satellite measurements.

Figure 5.1.25. July 2008 monthly average NO_2 levels for Oregon.
Images are through the air column from NASA satellite measurements.

5.1.7 Available Modeling

The University of Washington produces a meteorology model called MM-5 which Washington State University utilizes in its air pollution model called AIRPACT 3. AIRPACT 3 provides hourly forecasts for various pollutants including ozone. The model is only as good as its emission factor inputs and for some parameters these need some improvement. Ozone is one of the more accurate pollutants modeled.

Willamette Valley

AIRPACT 3 ozone models show ozone plumes moving out of the Portland Metro area to the southeast or east up the gorge. During the highest ozone levels measured in Portland in 2009, both of these plume directions were forecasted. The July 3rd AIRPACT ozone forecast in Figure 5.1.26 shows the ozone plume traveling both south and east but staying at a higher concentration longer to the east. The monitor results for that day in Table 5.1.3 verify this model result with both elevated levels south and east of Portland and low values northwest of Portland. Hermiston also report elevated ozone on July 3rd.

July 29th is an example of ozone levels spreading through the Willamette Valley with the maximum levels in the mid Willamette Valley (Figure 5.1.27). The ozone was likely both transported and created throughout the Valley.

Table 5.1.3. Maximum 8hour average ozone concentrations.
(for two 2009 elevated ozone days with different plume directions)

Plume Direction	Date	NW of Pdx	SE Pdx	SE of Pdx	SW of Pdx	NE of Pdx	SE of Salem	Eugene	S of Eugene	Hermiston
E & S	**7/3**	0.058	0.067	**0.078**	0.066	0.061	0.069	**0.064**	0.054	0.061
S	**7/29**	**0.065**	0.053	0.063	**0.065**	**0.048**	**0.082**	0.063	**0.067**	0.047

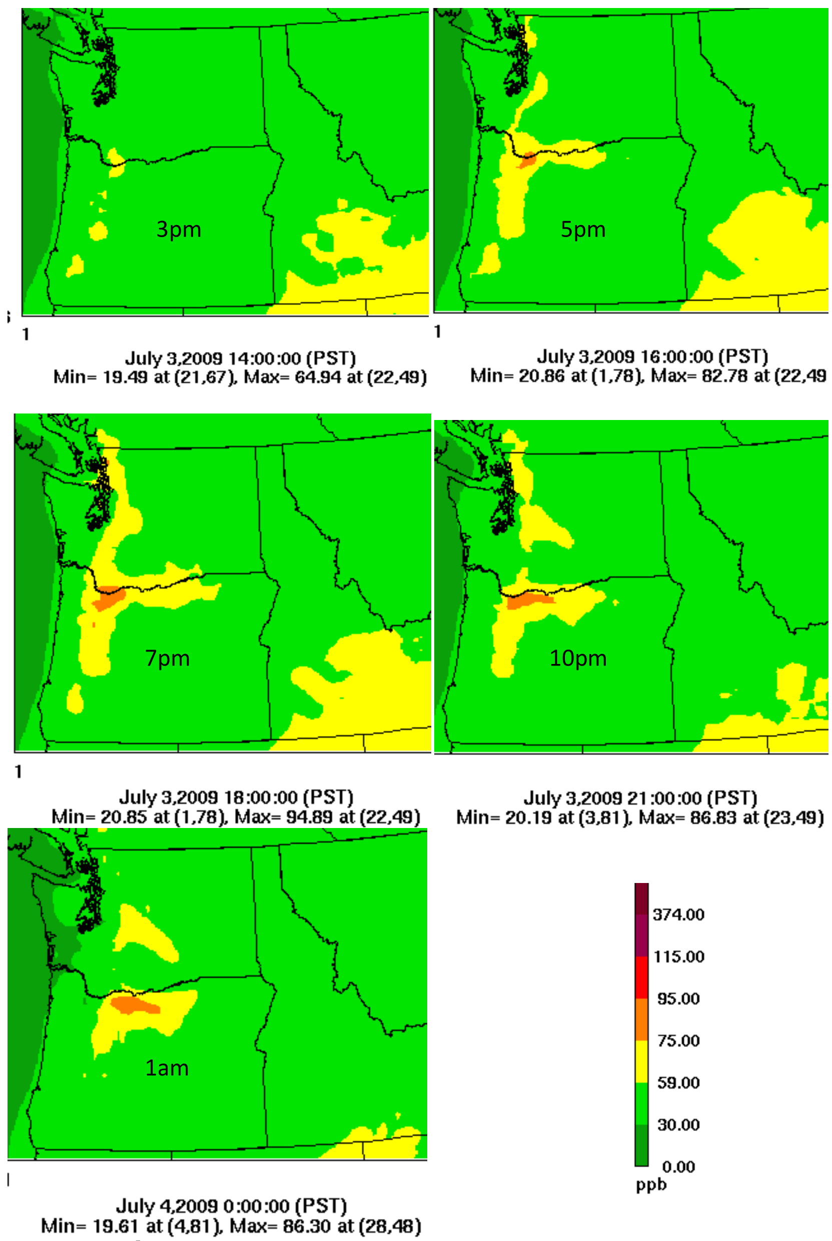

Figure 5.1.26. July 3rd Ozone plume providing an example of plume direction from Portland to the east and south.

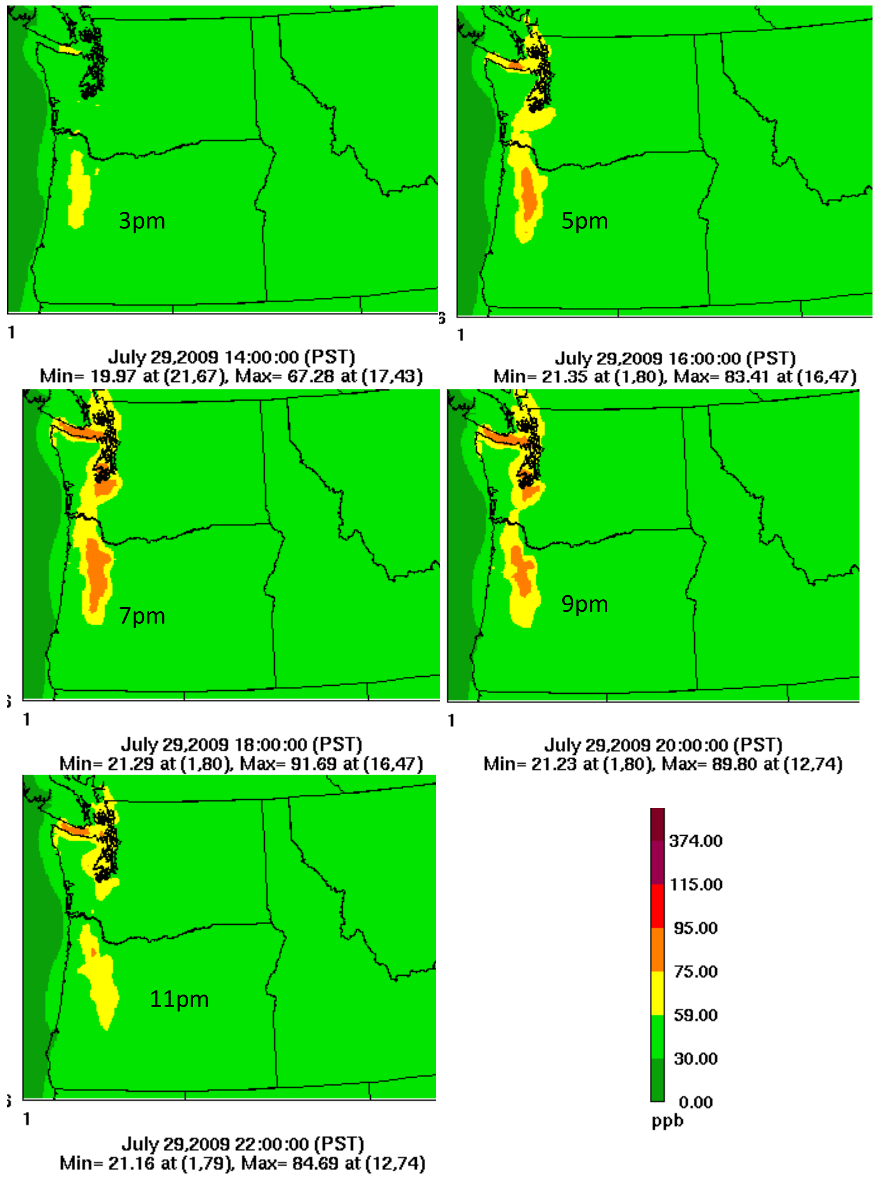

Figure 5.1.27. July 29th Ozone plume providing an example of plume direction from Portland to the south.

<u>5.1.8 Ozone Impacts on Forests</u>

The US Forest Service conducted monitoring in Oregon, Washington, and California to determine ozone's impact of the forests. Their conclusions were that most of Oregon's forests were not at risk from ozone with the exception of North Central Oregon which is at low risk.

Figure 5.1.28 shows the forest risk map published in their report, <u>Ozone Injury in West Coast Forests: 6 Years of Monitoring, June 2007, (US Dept of Agriculture General Technical Report PNW-GTR-722).</u>

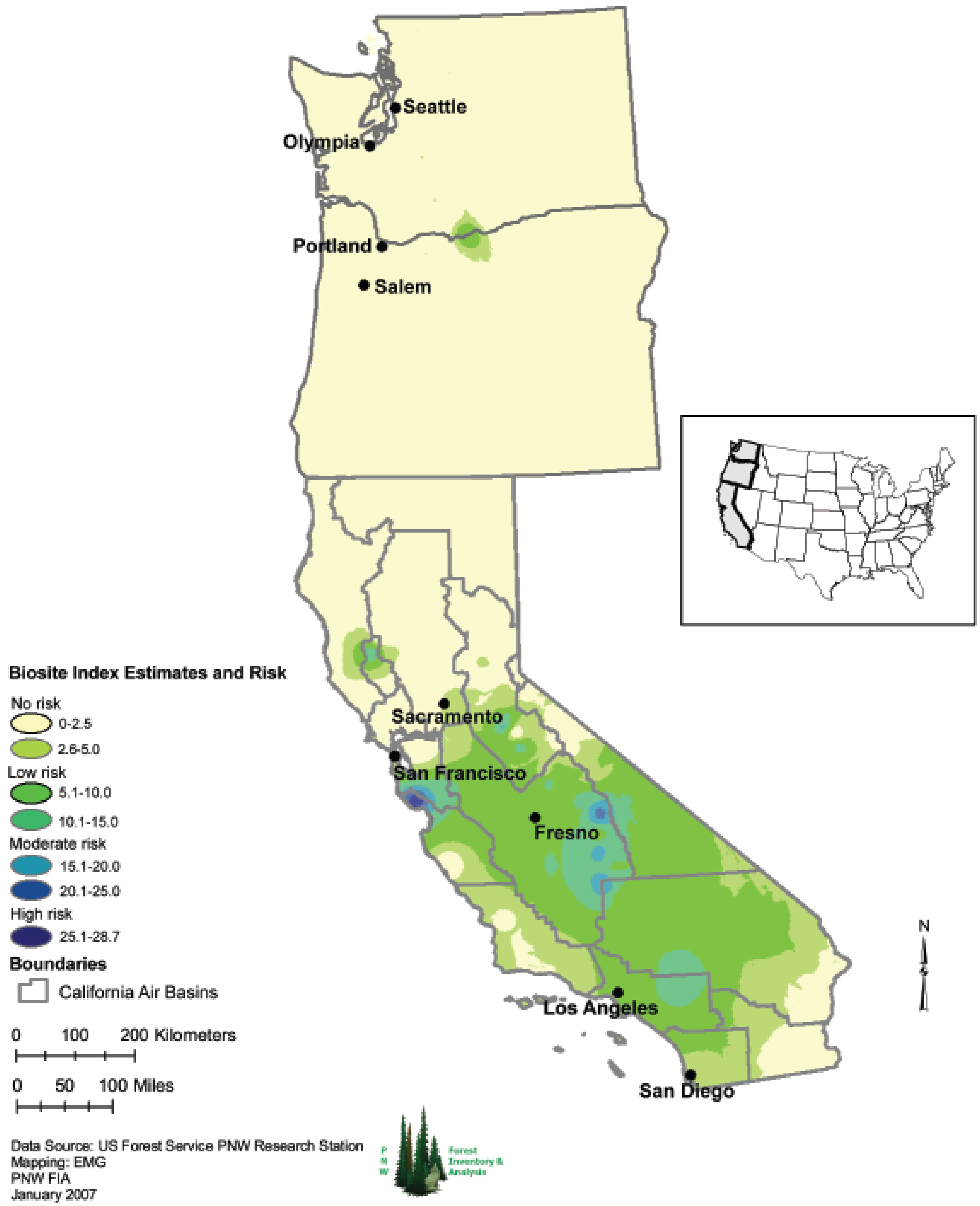

Figure 5.1.28. USFS forest with ozone injury map.
From: Ozone Injury in West Coast Forests: 6 Years of Monitoring, June 2007.

5.1.9 Ozone Monitoring Network

Oregon's ozone monitoring network is primarily located on the west side of the Cascade Range along the I-5 corridor. The majority of the population lives in this area and most of the precursors are emitted here. Figure 5.1.29 is a map of ODEQ and LRAPA's ozone, CO, NO_2, and SO_2 monitoring network.

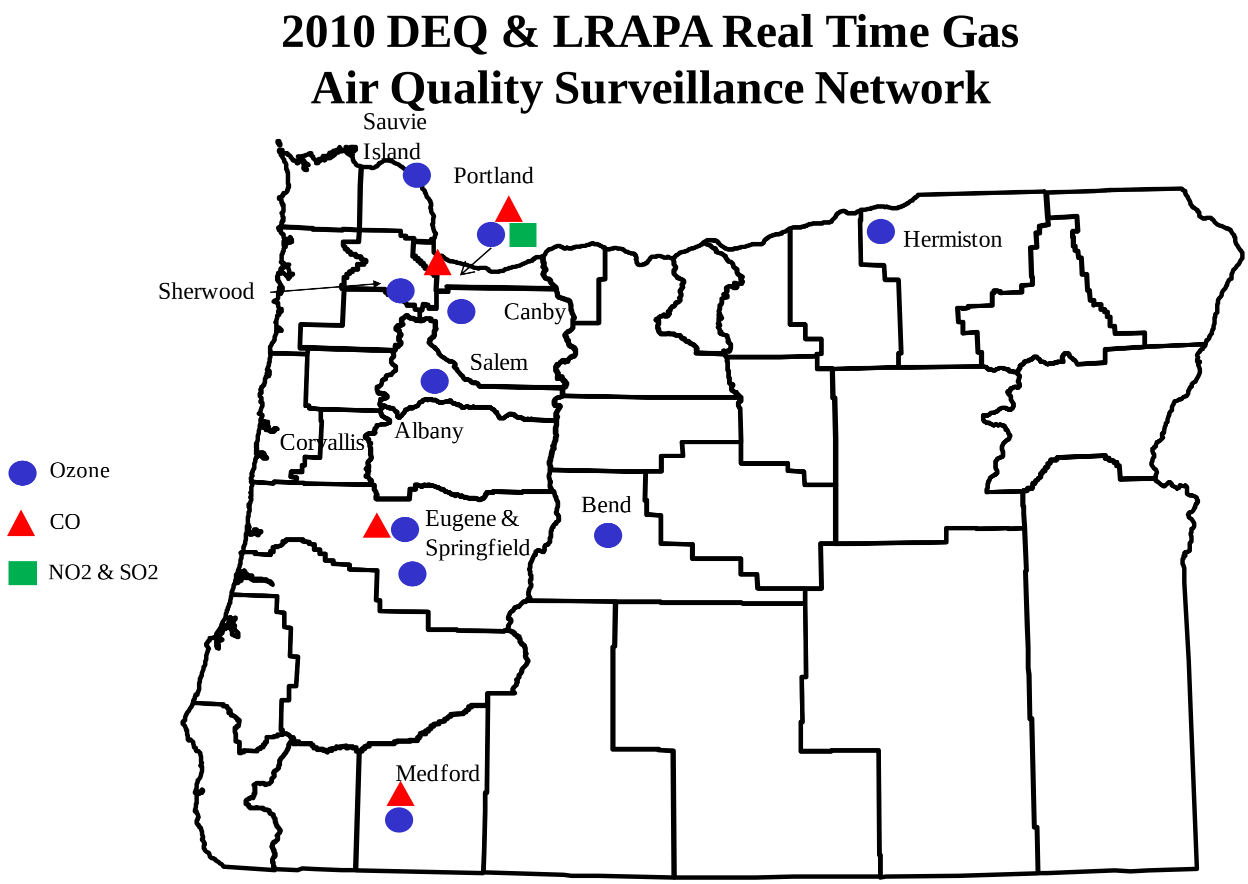

Figure 5.1.29. ODEQ and LRAPA's Ozone, CO, SO_2, and NO_2 monitoring network map.

Willamette Valley

Portland Metro

The Portland/Vancouver Metro area has five ozone monitors. One is upwind of Portland at Sauvie Island on the Columbia River. This is a transport site because it is also 15 miles downwind of Longview, WA. There is an ozone monitor at the NCORE site located in SE Portland. There is a monitor southwest of Portland in Sherwood and one southeast of Portland in Carus. The site SE of Portland at Carus usually records the highest annual eight hour ozone levels. The Southwest Washington Clean Air Agency (SWCAA) operates a monitor near Camas in East Vancouver. This network surrounds the Portland Metro Area and we believe it enables DEQ and SWACCA to get a good idea of upwind and downwind conditions. An additional site to the east of Portland would improve this coverage. A map of the network is shown in Figure 5.1.30.

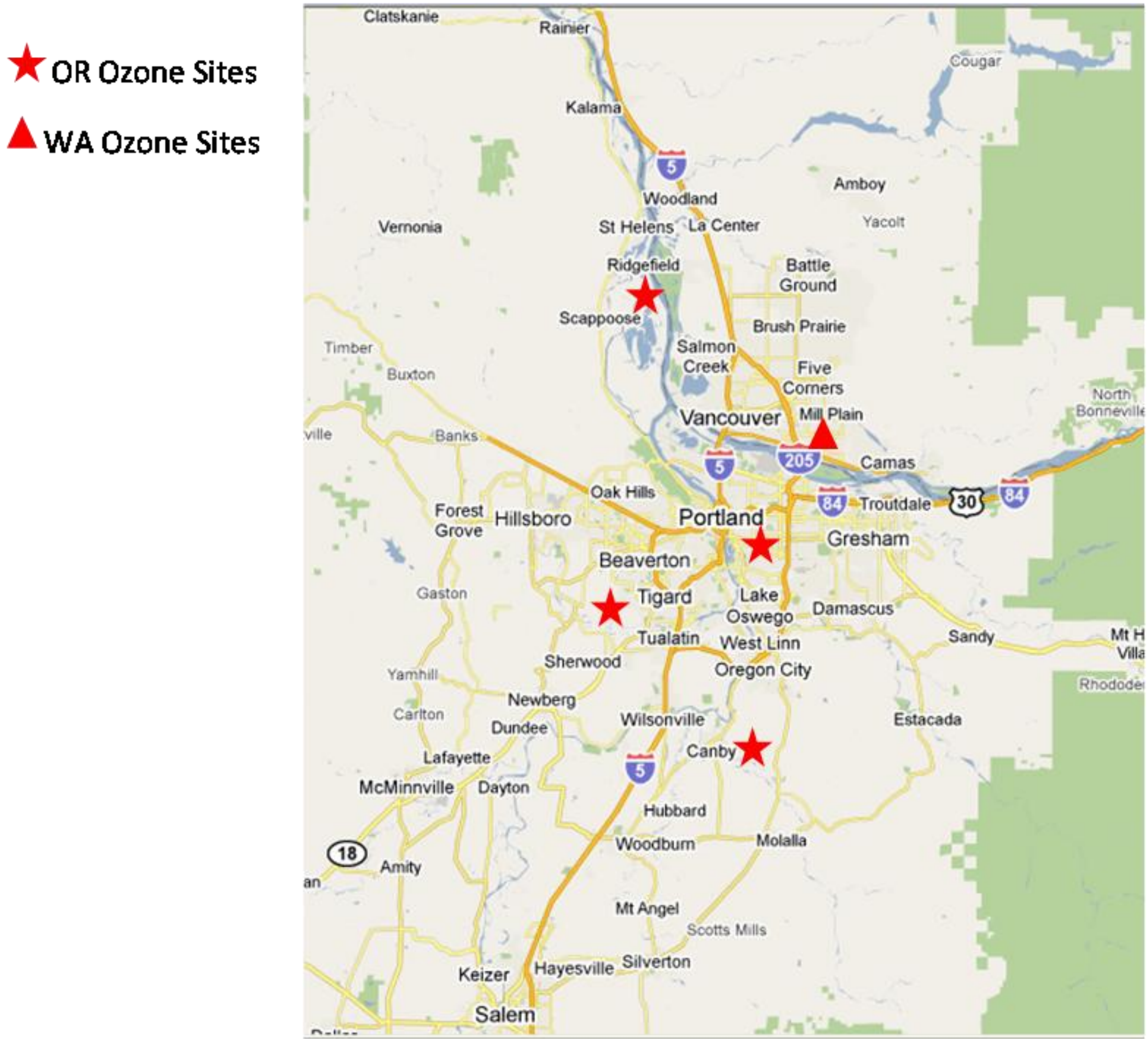

Figure 5.1.30. Portland Metro/Vancouver, WA ozone network map.

<u>Salem</u>

Salem is the third largest metro area in Oregon and the predominant summer wind direction is from the northwest. The ozone monitor for Salem is SE of the metro area near the small town of Turner. Ideally Salem would also have an upwind monitor.

<u>Eugene</u>

Eugene/Springfield is the second largest metro area in Oregon and the predominant summer winds are from the northwest. Eugene has one monitor in the city and one south in Saginaw. Ideally, Eugene would also have an upwind monitor.

<u>Albany/Corvallis</u>

The Albany/Corvallis area now has a population greater than 50,000 people. The proposed ozone monitoring rules would require an ozone monitor for this urban area. The cities are about

15 miles apart and probably both contribute to the same downwind plume. ODEQ currently has no ozone monitoring data for this area. A new site will be established for the summer of 2011.

Medford

The Medford/Ashland area has a monitor south of the Medford city core near Talent.

Bend

Bend has recently had a monitor installed southeast of the city center.

Hermiston

Hermiston has a monitor at the Municipal Airport south of the city core. Hermiston is between 10,000 and 20,000 people and is situated along the Oregon/Washington border 185 miles east of Portland.

5.1.10 Redundancy

ODEQ and LRAPA currently have ten ozone sites for the state of Oregon . Four of the monitors are in Portland, one in Salem, two in Eugene, one in Medford, one in Hermiston, and one in Bend. There is also a monitor in Camas, Washington (northeast of Portland).

The ozone monitoring network has been recently adjusted to account for population growth and gaps in coverage. The Milwaukie monitor was moved to Sherwood to better measure southwest of Portland and southeast of the suburban Tualitan Valley. A Bend ozone site was added to monitor the rapidly growing Central Oregon area and Hermiston was added to measure impacts on smaller communities and impacts coming east out of the Columbia River Gorge. Hermiston may also be impacted by the Boardmen coal fired power plant or sources in Washington's Columbia Basin.

The current network has no redundancies. The redundancy tool provided by EPA indicates the Portland Metro area has the highest R squares of any of Oregon's sites (Figure 5.1.31). With SE Portland and Camas, WA having the highest R squared of 0.8. Every other site is 0.6 and lower.

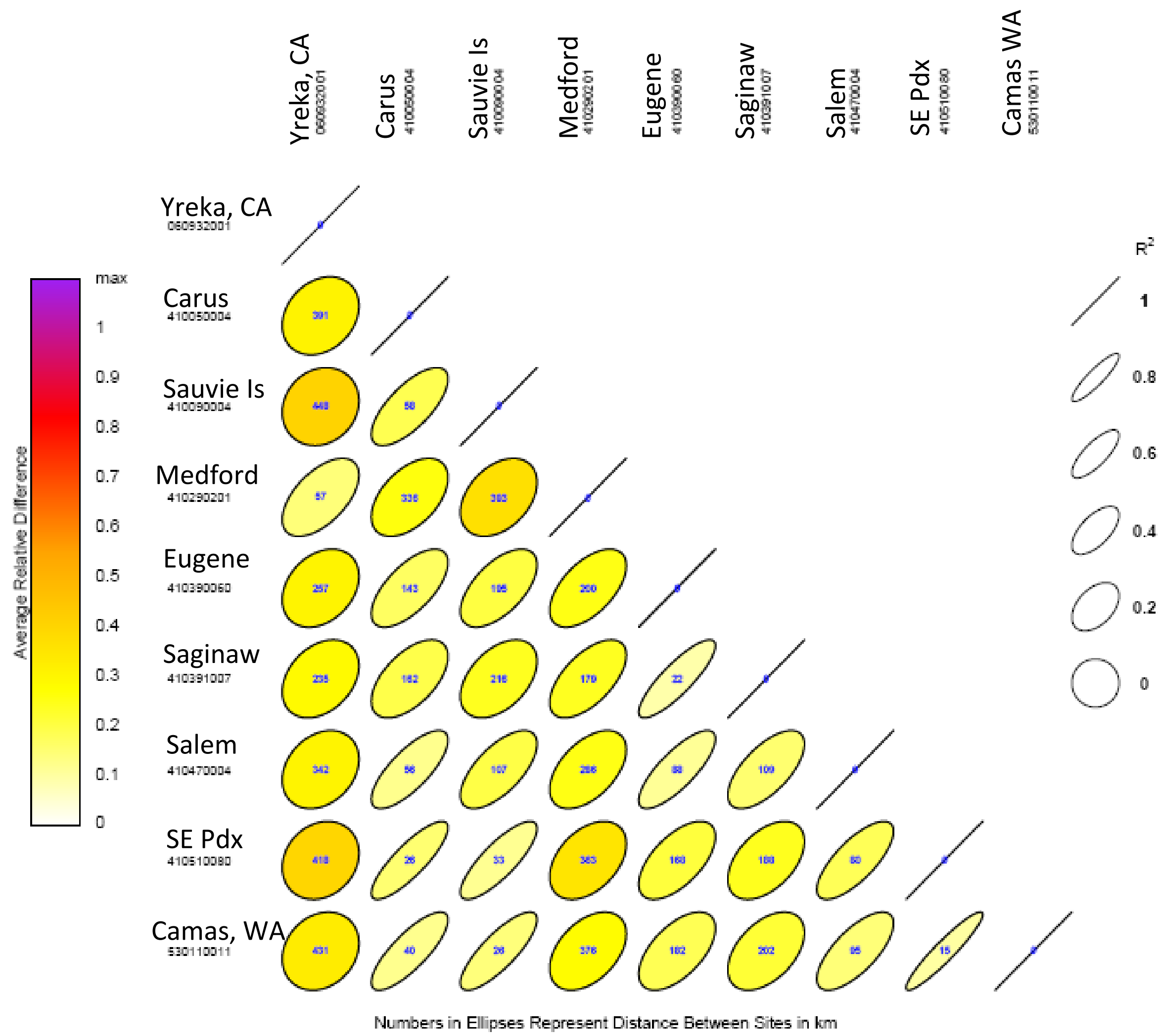

Figure 5.1.31. Oregon ozone sites redundancy graphs
Calculated using EPA's redundancy calculation tool.

The five Portland/Vancouver sites are essential for monitoring the metro area because they are in the four corners of the populated areas and in the urban core. One of the sites will always be upwind and one downwind. Eugene and Saginaw have an R Squared of only about 0.6. This is not higher because the Eugene sites is a community monitor and Saginaw is a downwind monitor. Medford only has one monitor which has a very low R Squared with any other site. Yreka, California is the nearest monitor but the communities are separated by the Siskyou Mountains. Sherwood, Hermiston, and Bend are not included on the redundancy graph because there is not enough data yet.
The Area graph produced by the EPA Assement tool in Figure 5.1.32 shows a good distrubition of monitors in Oregon.

Figure 5.1.32. Regions covered by ozone monitors in Oregon.
Map calculated using EPA's assessment tool.

5.1.11 Discussion

With more frequent heat waves and a growing population, Oregon will need additional reductions in emissions per person to keep the ozone levels from rising. As Oregonians and the country work on reducing emissions, ODEQ and LRAPA will need to have a thorough ozone network to monitor progress.

Oregon currently has good coverage for ozone to meet the existing NAAQS. The new NAAQS will require an additional monitor south of Albany/Corvallis and likely a monitor in an agricultural or forested area. The AIRPACT 3 model indicates that the highest ozone will occur in the Willamette Valley but does not completely answer whether the ozone is created locally or transported south. ODEQ suspects both are occurring. Ideally, the network would have an upwind and downwind monitor in each major MSA. Salem and Eugene currently do not have upwind monitors nor funding for future monitors. The AIRPACT 3 model also shows plumes traveling east into the Columbia Gorge. SWCAA operated an ozone monitor at Mt. Zion until recently and much was learned about ozone impact in the Columbia Gorge. More monitoring here may not be beneficial. Mt. Hood was also monitored within the last ten years.

A background site in an agricultural area north of Salem or Eugene may be beneficial for agriculture. A background site in The Dalles area may be beneficial for forests.

One notable shortcoming of the AIRPACT 3 model is that it doesn't account for forest fire contribution to ozone. This appears to cause elevated ozone levels in the Medford area.

5.2 $PM_{2.5}$

$PM_{2.5}$ is over the NAAQS in three communities in Oregon. $PM_{2.5}$ continues to be a pollutant of focus for Oregon with an extensive monitoring network and continued statewide efforts to lower levels. With further budget cuts imminent, ODEQ plans to refocus resources from other pollutants to $PM_{2.5}$ monitoring.

5.2.1 $PM_{2.5}$ Design Value

The Design Value is the concentration that is monitored at a site using EPA Federal Reference Methods and following calculations outlined in 40CFR Part 50. $PM_{2.5}$ has daily and annual average design values. The daily design value is the three year average of the 98th percentile. The annual design value is the three year average of the annual average of the quarterly averages. The values are measured in micrograms per cubic meter (µg/m^3). Oregon's $PM_{2.5}$ design values are shown in Table 5.2.1. The sites with less than three years of data are shown in Table 5.2.2.

Table 5.2.1. Oregon $PM_{2.5}$ Design Values for 2007-2009 (µg/m3)

Oregon $PM_{2.5}$ Design Values for 2007-2009 (µg/m^3) **CBSA**	**County**	**Site**	**AIRS#**	**2007-2009 Daily DV**	**2007-2009 Annual DV**
Burns	Harney	Madison St.	410250002	33	9.7
Medford, OR	Jackson	Grant and Belmont	410290133	30	9.4
Grants Pass	Joshephine	Parkside School	410330114	31	8.4
Klamath Falls	Klamath	Peterson School	410350004	**45**	11.5
Lakeview	Lake	Center & M	410370001	**42**	10.8
Eugene-Springfield, OR	Lane	Amazon Park	410390060	33	7.8
Eugene-Springfield, OR	Lane	Springfield	410391009	18	6.7
Oakridge	Lane	Willamette Park	410392013	**41**	11.0
Cottage Grove	Lane	City Shops	410399004	29	8.4
Portland-Vancouver-Beaverton, OR-WA	Multnomah	SE Lafayette	410510080	26	8.0
Portland-Vancouver-Beaverton, OR-WA	Multnomah	N. Roselawn	410510246	22	7.3
Pendleton-Hermiston, OR	Umatilla	Pendleton McKay Cr	410591003	26	8.0
La Grande	Union	Ash St.	410610119	18	7.0
Portland-Vancouver-Beaverton, OR-WA	Washington	Hillsboro	410670004	32	8.6

Table 5.2.2. Oregon $PM_{2.5}$ Sites with less than three years of data (µg/m3).

CBSA	County	Site	AIRS#	$PM_{2.5}$	$PM_{2.5}$	Years of Data
Bend, OR	Deschutes	Bend	410170122	18	5.1	**1**
Eugene-Springfield, OR	Lane	Key Bank	410390058	30	8.1	**2**
Prineville, OR	Crook	Davidson Pk	410130100	32	9.0	**1**

Figure 5.2.1 shows the 2007-2009, 98th percentiles for all sites including estimated levels calculated using nephelometers. As indicated in Table 3-1, Oakridge, Klamath Falls, and Lakeview are violating the NAAQS. Portland Metro, Sweet Home, Eugene/Springfield, Grants Pass, and Burns are currently over 30µg/m^3 which may be a possible revised NAAQS level to be announced in 2011. Grants Pass had been below 30µg/m^3 until 2009 when a prescribe burn raised their 98th percentile.

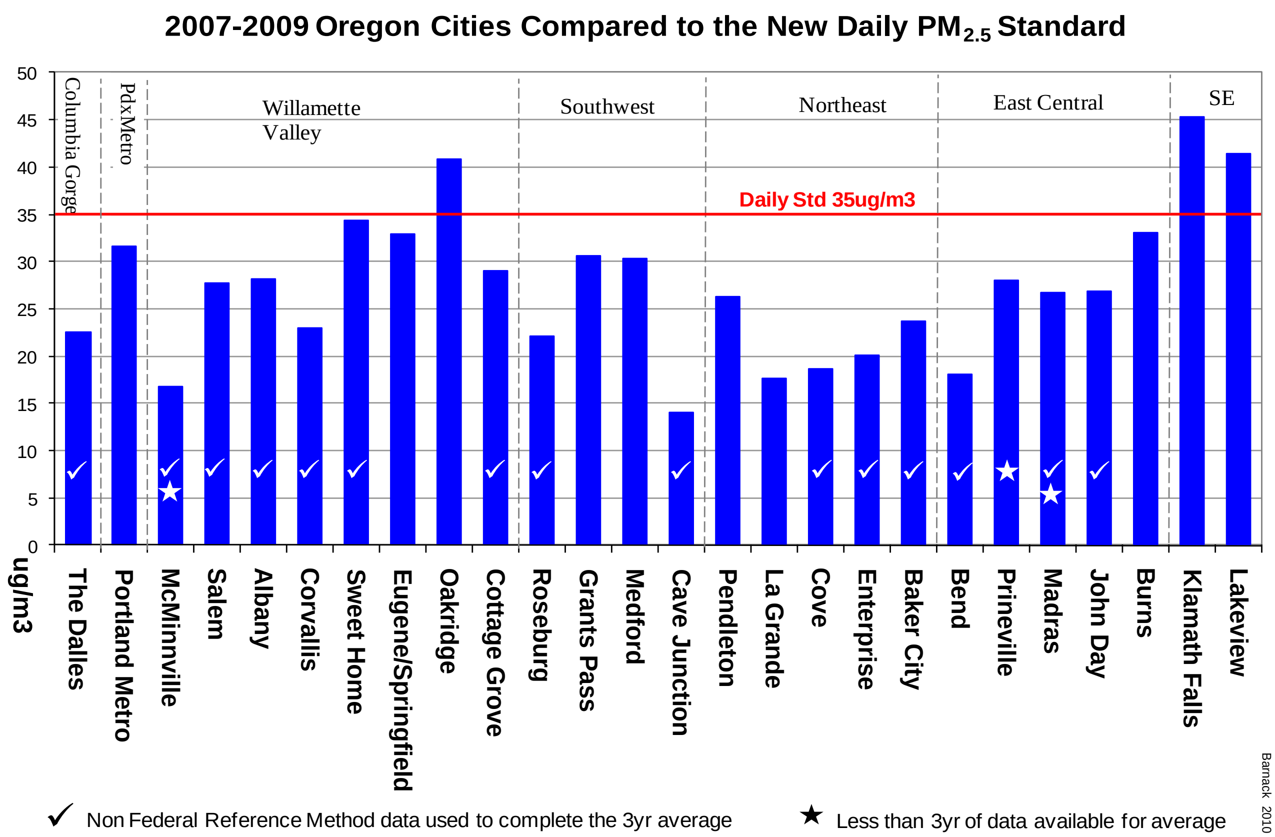

Figure 5.2.1. The Oregon 2007-2009 three year average 98th Percentile.
Non-Federal Reference Method data is used for informational purposes only.

ODEQ considers any city over 25µg/m^3 to be at risk of violating the NAAQS. Figure 5.2.2 provides a less clutter view of the cities over 25 µg/m^3.

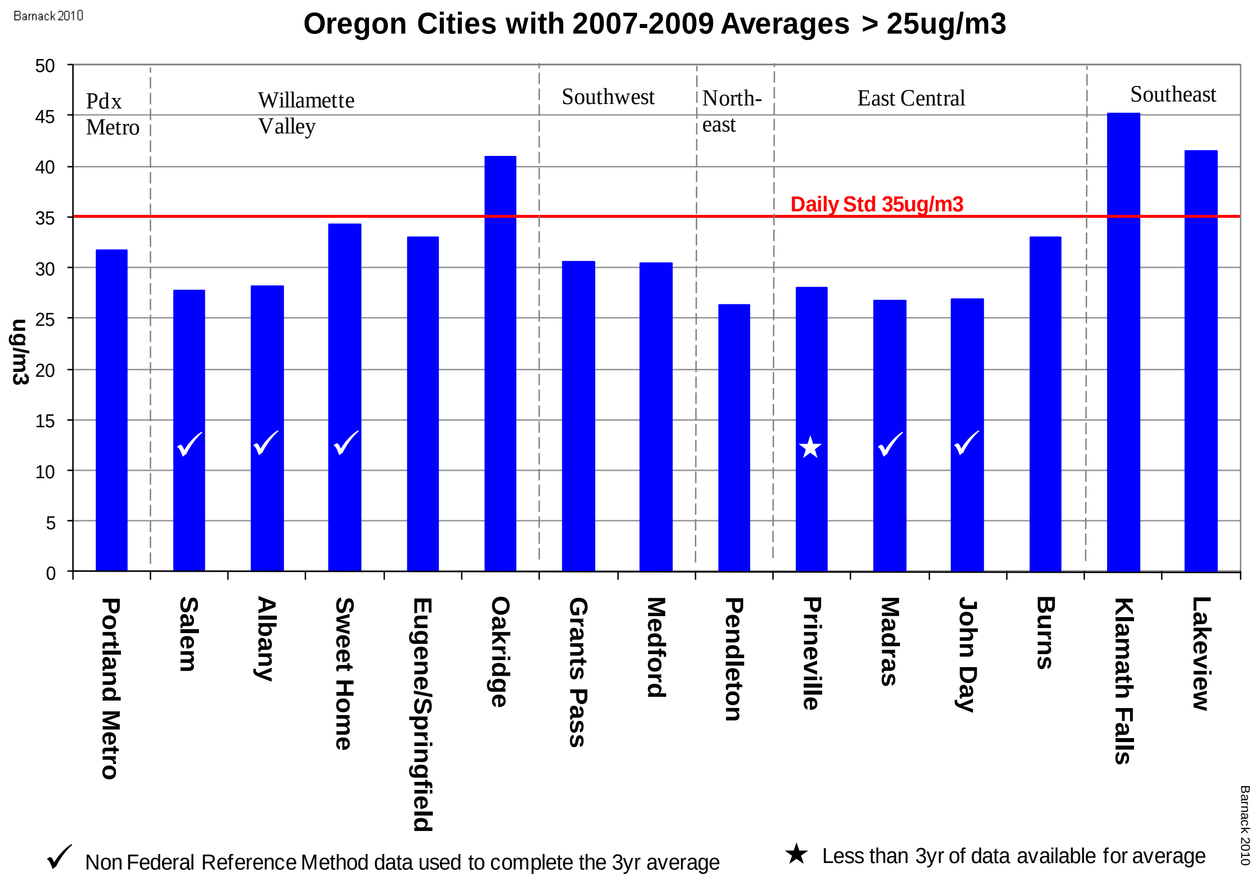

Figure 5.2.2. The Oregon 2007-2009 three year average 98th Percentile over 25ug/m3. Non-Federal Reference Method data is used for informational purposes only and cannot be official compared to the NAAQS.

If the daily standard is lowered to 30µg/m^3, Federal Reference Method sampling may be required in several more cities. Currently EPA requires every third day sampling if a site is within 5 to 10% of the NAAQS. If this condition is retained with a new standard, cities which currently only have $PM_{2.5}$ estimates based on nephelometers that are above 27µg/m^{3}may be required to have FRMs. This currently includes Albany, Salem, John Day, and Madras.

5.2.2 $PM_{2.5}$ Pollutant Trends

ODEQ and LRAPA have been collecting $PM_{2.5}$ Federal Reference Method data from 1999 to present. Medford and Eugene/Springfield have been trending down during this period. Klamath Falls and Lakeview have been trending up. The other cities are mixed. Figures 5.2.3 through 5.2.6 show the $PM_{2.5}$ trends for cities split into Western and Eastern Oregon.

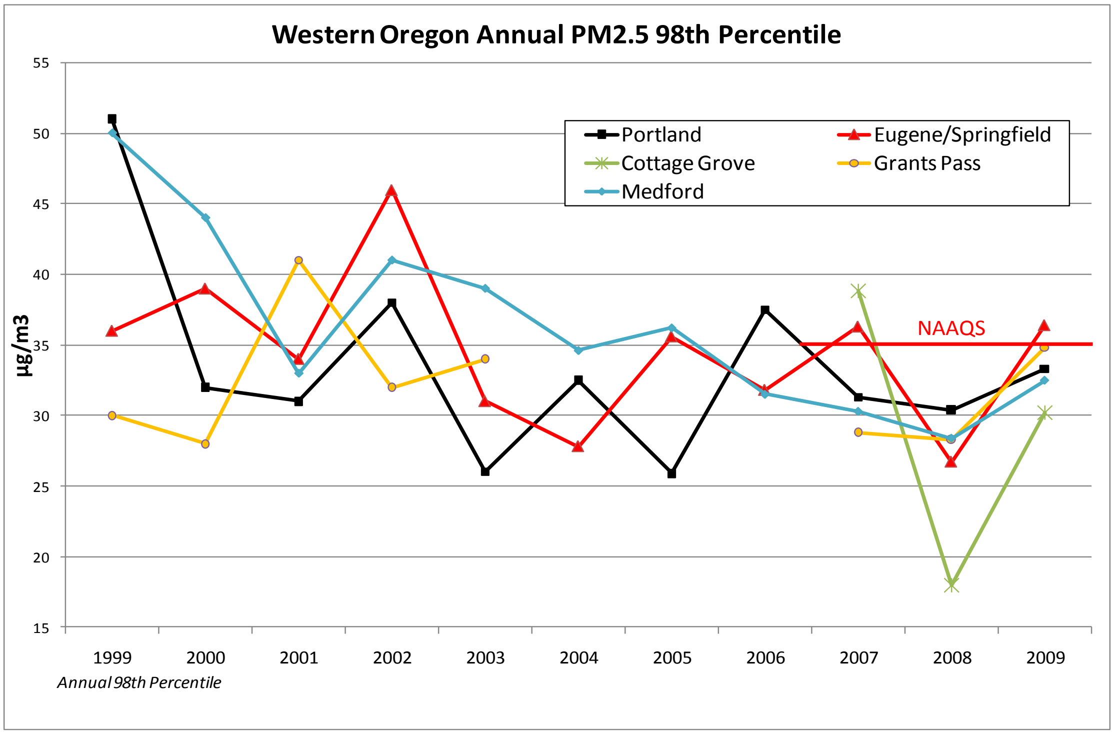

Figure 5.2.3. Western Oregon Annual $PM_{2.5}$ 98th Percentile Trends.

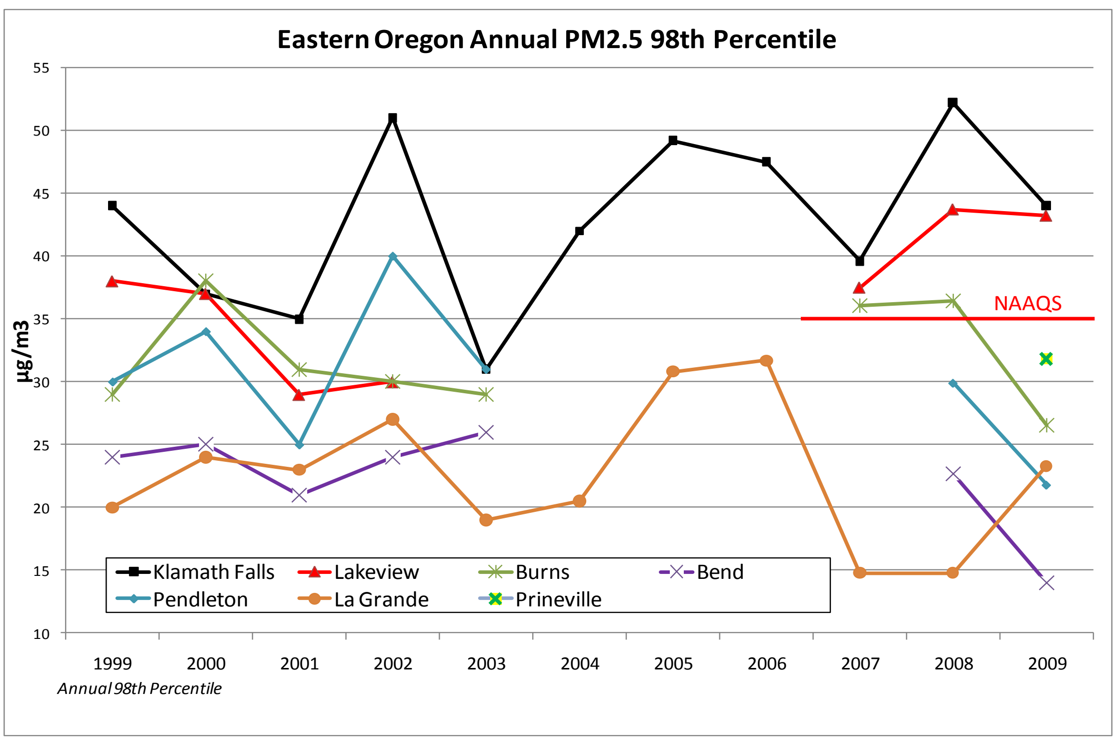

Figure 5.2.4. Eastern Oregon Annual $PM_{2.5}$ 98th Percentile Trends.

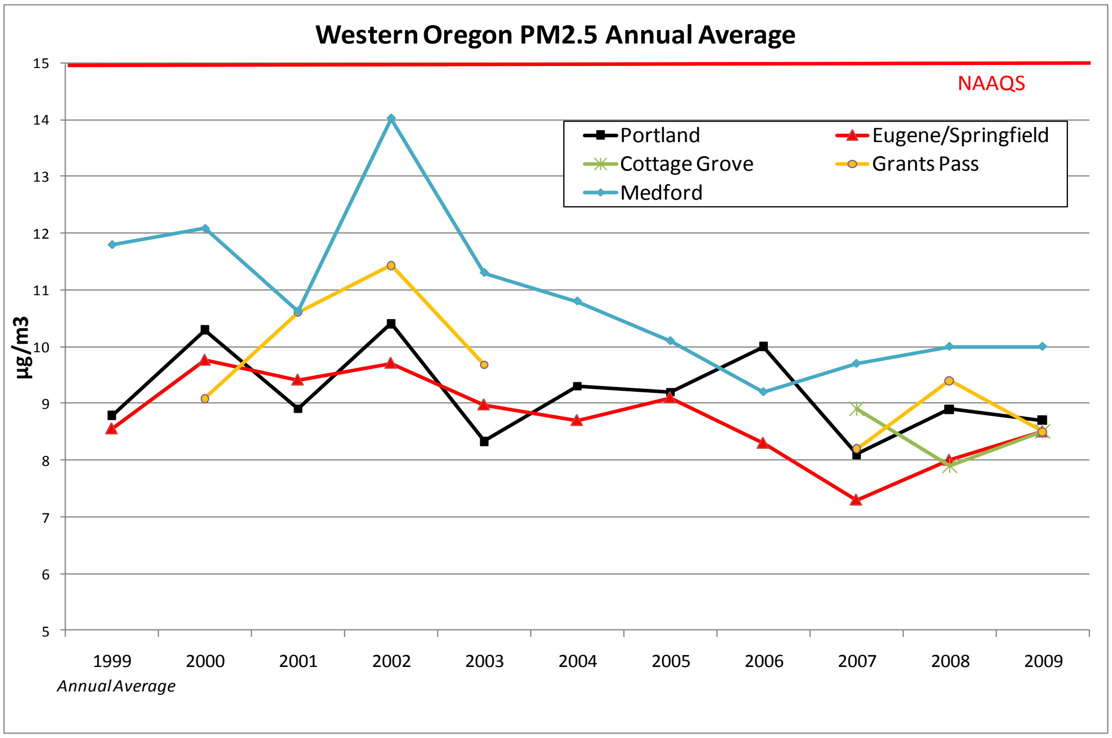

Figure 5.2.5. Western Oregon $PM_{2.5}$ Annual Average Trends.

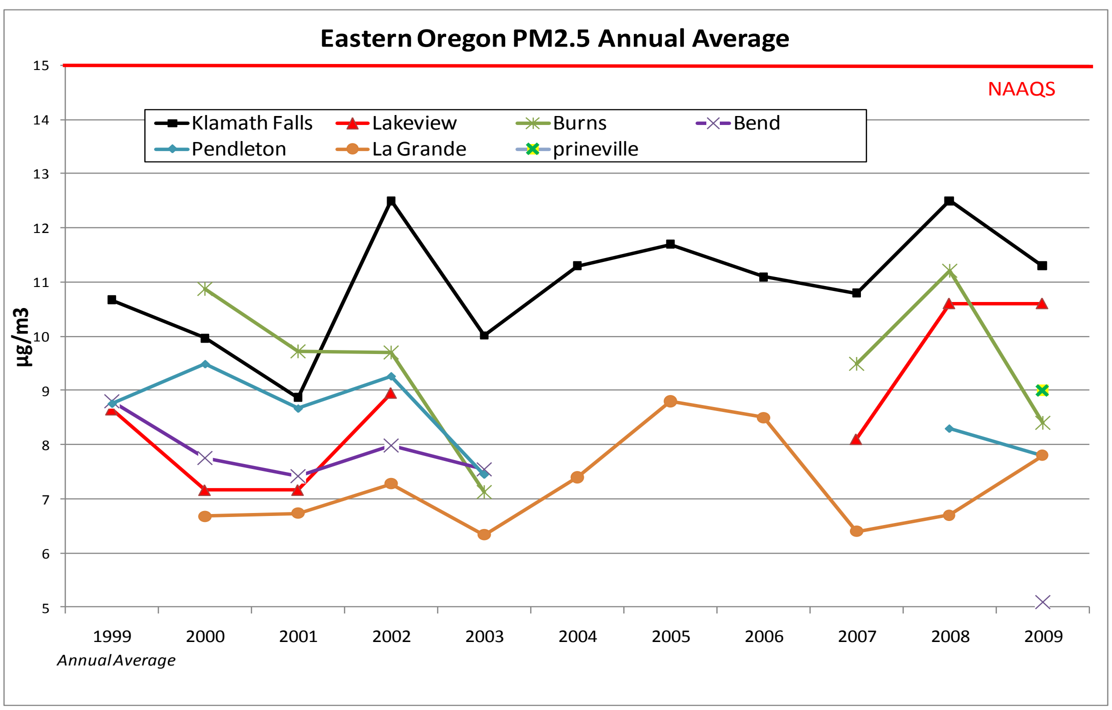

Figure 5.2.6. Eastern Oregon $PM_{2.5}$ Annual Average Trends.

$PM_{2.5}$ Speciation

ODEQ and LRAPA have speciation data for $PM_{2.5}$ in Bend, Eugene, Klamath Falls, La Grande, Lakeview, Medford, Oakridge, and Portland. In all cases, organic and elemental carbon accounted for more than half the mass. Broken down by quarter, the organic and elemental carbon is higher during the winter months relative to the other constituents as shown in Figure 5.2.7 for Portland.

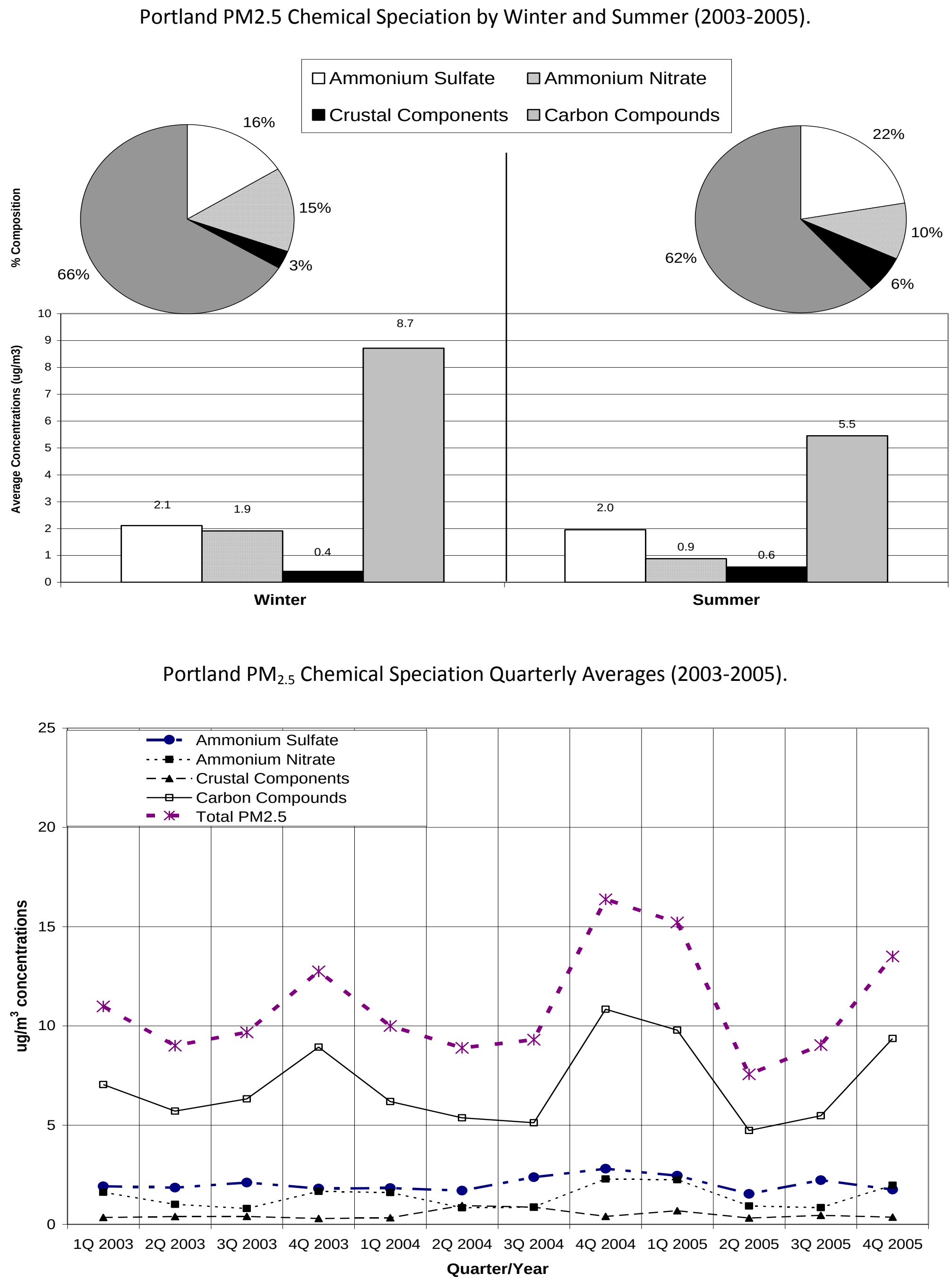

Figure 5.2.7. Portland $PM_{2.5}$ Speciation - percentages and seasonal differences.

5.2.3 Meteorology Impacting $PM_{2.5}$

$PM_{2.5}$ is measured at the neighborhood scale and is influenced by localized weather. $PM_{2.5}$ levels in the breathing zone are mostly impacted by mixing height, horizontal and vertical wind speed, inversions, and humidity. Temperature also influences amount of woodstove smoke emitted.

On the Oregon Coast the temperatures are mild and there is good ventilation.

In Willamette Valley, the winter temperatures are also mild and the ventilation is often good. At the northern end of the Willamette Valley, the Portland area experiences good winter mixing because of the “Gorge Effect”- east winds blowing through the Columbia Gorge from higher pressures east of the metro area. Away from the Columbia Gorge more stagnation and overnight inversions occur. In the central and southern Willamette Valley the inversions often last the entire day. A few times a year there are stagnation events which occur during the fall and winter months that lead to air pollution advisories. The mild winter temperatures do not encourage large scaled woodstove usage and the $PM_{2.5}$ emissions are lower than the smaller, colder Eastern Oregon communities.

Southwestern Oregon also has mild winters but the largest communities are located in valley bowls. Medford/Ashland Air Quality Maintenance Area is located in the Rogue Valley which often has winter inversions. Grants Pass is also located in a valley which experiences inversions.

Eastern Oregon is east of the Cascade Range and is much colder and dryer during the winter months. Some communities are located in valleys or next to bluffs and have poor ventilation. The poor ventilation and colder temperature result in longer overnight inversions. The colder temperatures also contribute to a higher per capita woodstove usage than Western Oregon. Northeastern communities along the Columbia River experience more wind and very good mixing during the winter months.

5.2.4 $PM_{2.5}$ Emission Inventory

The 2005 emission inventory performed by ODEQ indicates that most $PM_{2.5}$ comes from area sources and from combustion. Prescribed burning and on-road mobile also emit a large percentage. Point sources contribute a significant amount at 12%. Figure 5.2.8 and 5.2.9 show the 2005 emission inventory by source category and county.

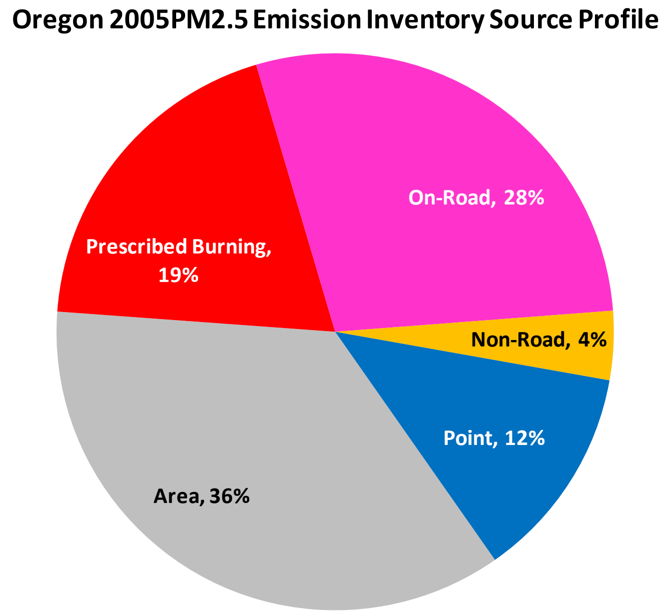

Figure 5.2.8. 2005 $PM_{2.5}$ Emission Inventory by Source Category.

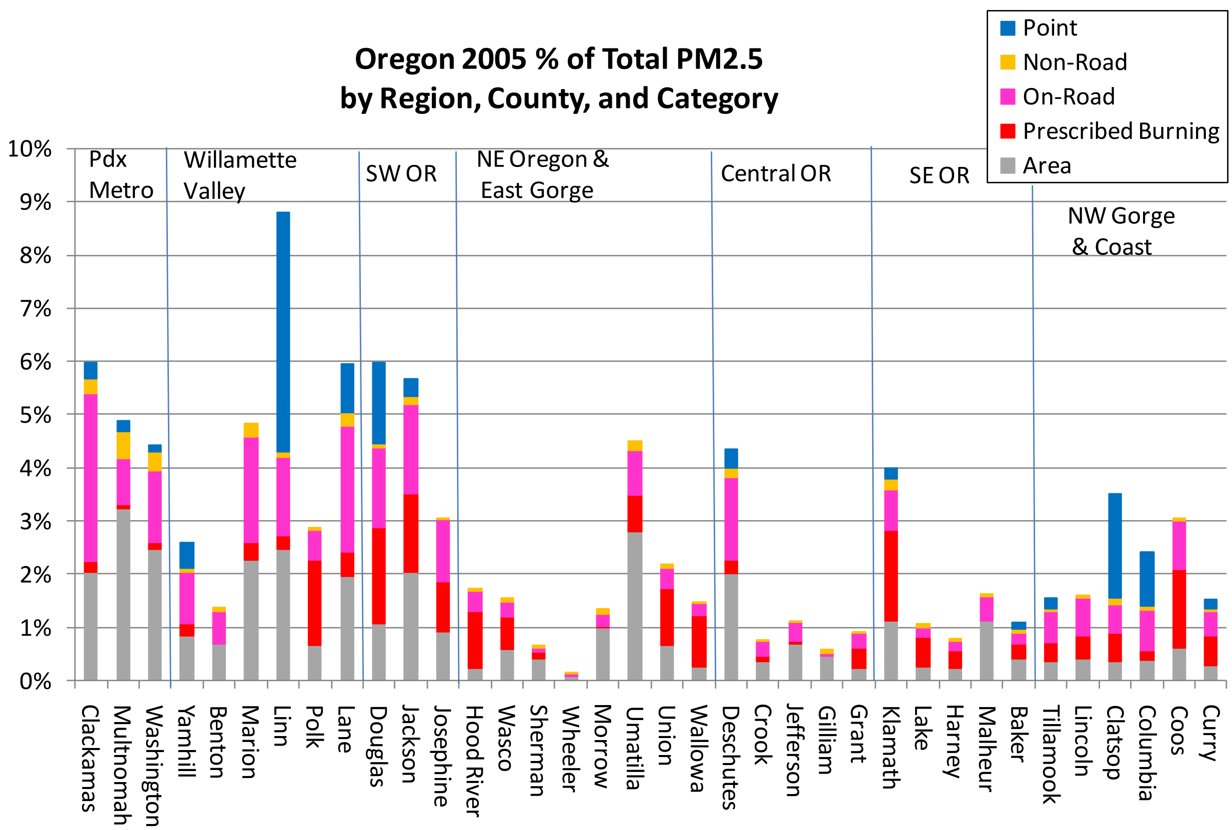

Figure 5.2.9. 2005 $PM_{2.5}$ Emission Inventory by Source Category and County.

5.2.5 $PM_{2.5}$ Emission Sources

In Oregon, the highest $PM_{2.5}$ levels occur between November through February. An example of this is shown for Klamath Falls in Figure 5.2.10.

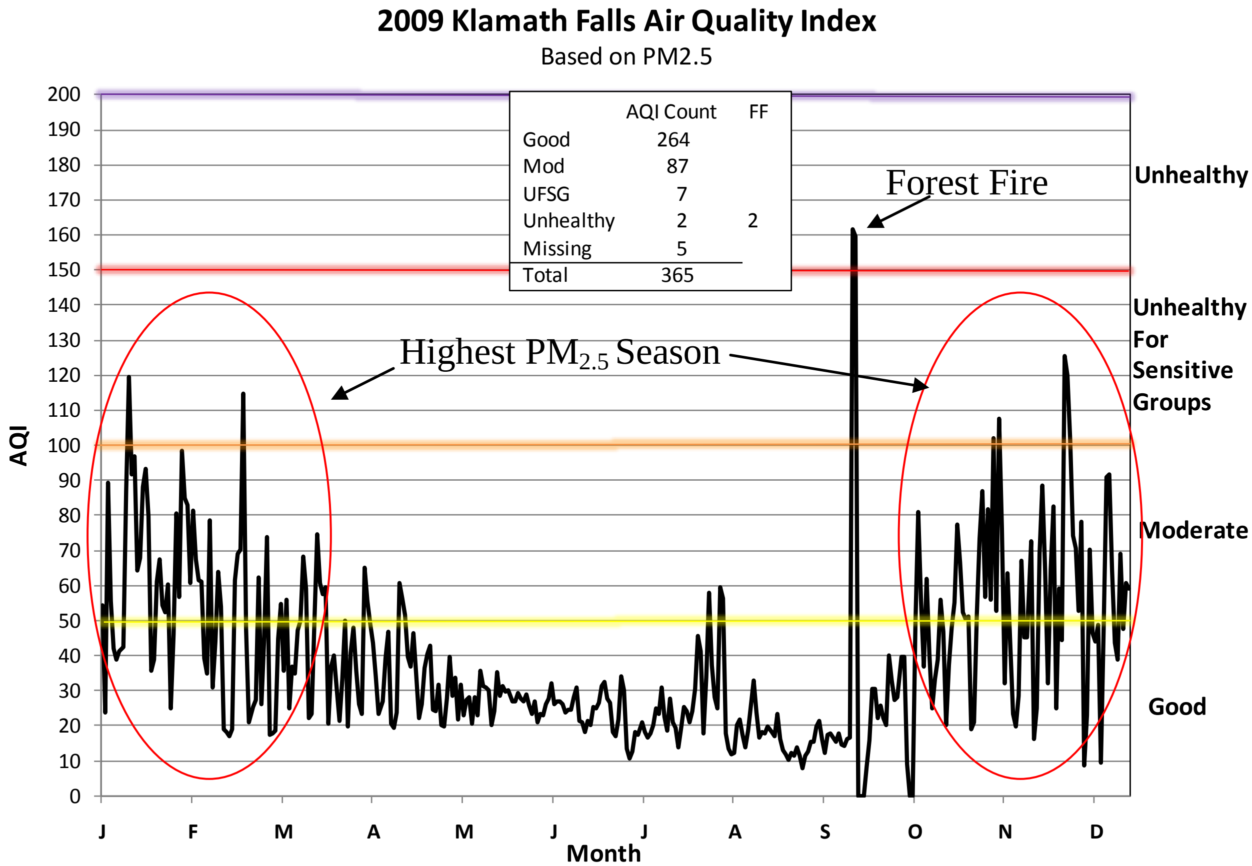

Figure 5.2.10. 2009 Klamath Falls $PM_{2.5}$ daily averages as the Air Quality Index. This shows higher winter time levels other than smoke from a forest fire in September.

During the winter, most of the $PM_{2.5}$ occurs from dusk to dawn as shown in Figure 5.2.11 for Burns. During the evening the $PM_{2.5}$ levels appear to show a pattern similar to woodstove usage. Typically, levels rise around six p.m. and drop after midnight. Elevated $PM_{2.5}$ levels are exacerbated by overnight inversions in valley communities. The speciated data shows the PM is mostly carbon during the winter months, which suggests that evening combustion is the source of $PM_{2.5}$.

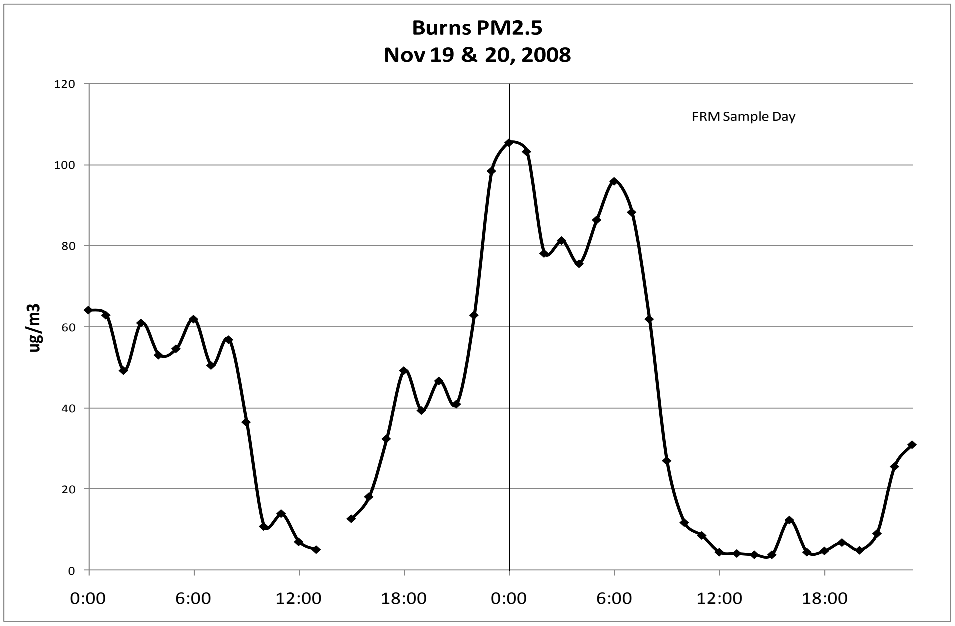

Figure 5.2.11. 2008 Burns $PM_{2.5}$ Evening hourly averages.
Elevated $PM_{2.5}$ levels during cold evenings in Burns indicating evening smoke sources and inversions.

5.2.6 Plan to Remove $PM_{2.5}$ Emission Sources

Based on the emission inventory, the real time visibility data, and the speciation data, ODEQ has concluded that residential wood heating is a major contributor to $PM_{2.5}$ throughout Oregon. In 2009, the Oregon Legislature passed the "Heat Smart" legislation. Heat Smart requires that non-certified woodstoves be removed upon the sale of a home. At the same time, ODEQ is working with local communities to obtain grant money to winterize homes. The $PM_{2.5}$ levels should drop in Eastern Oregon communities where certified woodstoves are not as common and winters are more severe. In large cities like Portland and Salem which do not have woodstove programs, this could also have a large impact over time. Medford has required certified woodstoves for two decades and will not likely see much improvement from Heat Smart.

5.2.7 $PM_{2.5}$ Modeling

ODEQ has not done extensive $PM_{2.5}$ modeling. WSU's AIRPACT 3 provides $PM_{2.5}$ modeled information across the state but the results do not always agree with the monitors. In small Eastern Oregon communities AIRPACT 3 under predicts $PM_{2.5}$. In large Western Oregon communities AIRPACT 3 over predicts. This appears to be due to the demographics of each area. Western Oregonians burn less wood per capita than Eastern Oregonians. This is likely due to warmer Western Oregon winter temperatures, more dense housing, and less available wood.

5.2.8 $PM_{2.5}$ Current Monitoring Network

The $PM_{2.5}$ Federal Reference Method monitoring network consists of 17 DEQ/LRAPA SLAMS sites, one NCORE Site, and one Background Site shown in Figure 5.2.12. Oregon has four State and Local $PM_{2.5}$ Speciation sites co-located at existing FRM sites shown in Figure 5.2.13. Oregon also has 28 sites with continuous $PM_{2.5}$ monitors used to estimate levels based on visibility used for the Air Quality Index, Forest Health, Field Burning, and residential wood heating program work. These sites are shown in Figure 5.2.14. All the sites are listed in Table 5.2.3

2010 Oregon PM2.5 NAAQS Compliance Surveillance Network

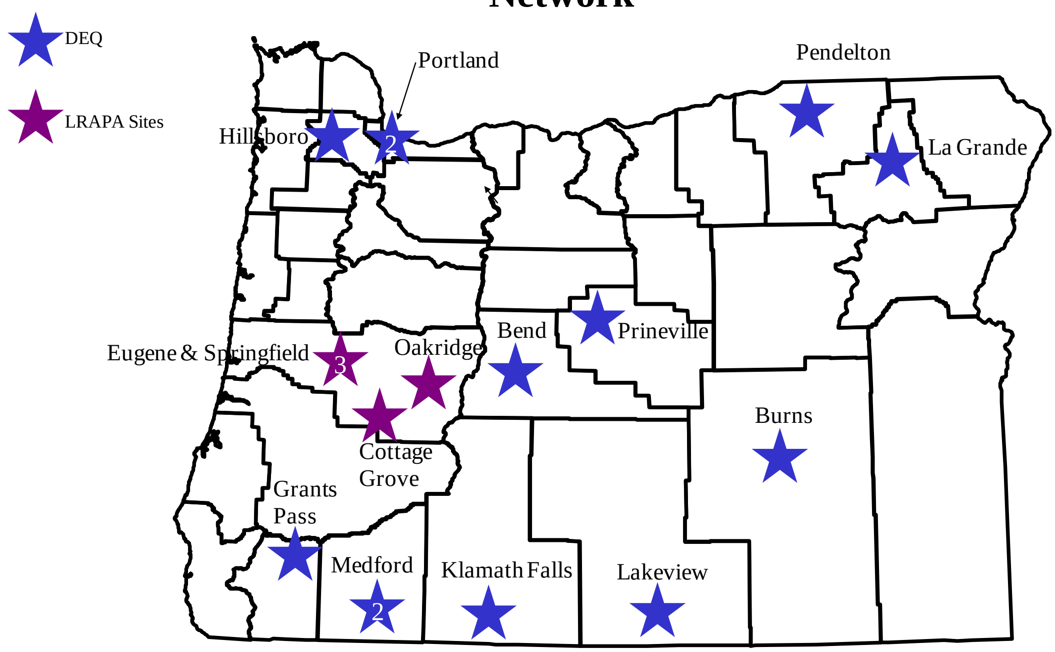

Figure 5.2.12. ODEQ and LRAPA $PM_{2.5}$ NAAQS compliance monitoring network.

2010 Oregon PM2.5 Speciation Surveillance Network

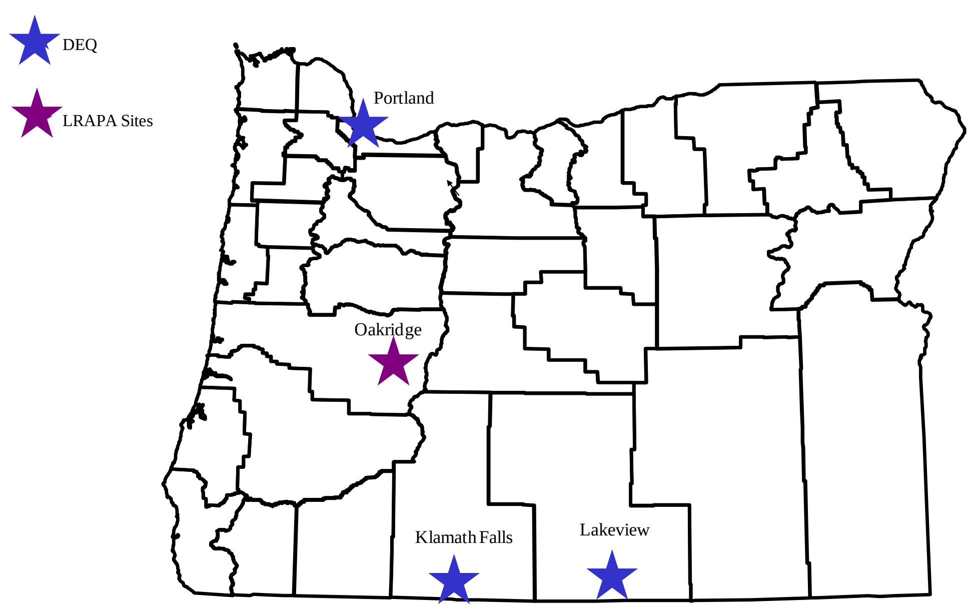

Figure 5.2.13. ODEQ and LRAPA $PM_{2.5}$ Speciation monitoring network

2010 Oregon Real Time Neph
PM Air Quality Surveillance Network

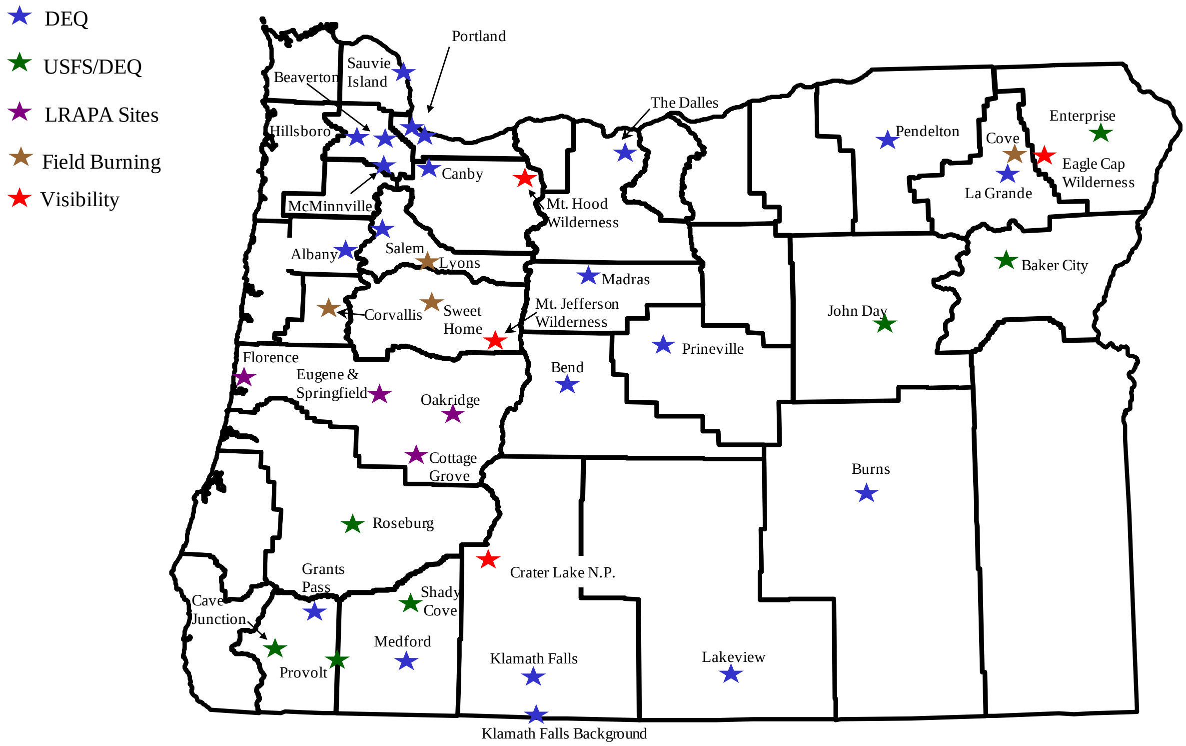

Figure 5.2.14. ODEQ and LRAPA $PM_{2.5}$ continuous monitoring network.

Table 5.2.3. Oregon DEQ and LRAPA $PM_{2.5}$ monitoring network.

City	Address	Site Code	EPA#	MSA	Continuous Estimate	FRM	Spec	Wind	Temp	DT	BP	RH
Albany	Calapooia School	ACS	410430009	0	X							
Bend	Bend Pump Station	BPS	410170120	0	X	X						
Burns	E. Washington St.	BWS	41025003	0	X	X		X	X		X	X
Corvallis	Intermediate School	CCB	410030013	1890	X							
CottageGrove	City Shops	CGH	410399003	0		X						
Eugene	Lane Community College	LCC	410390013	2400	X							
	Pacific Hwy99N	EKB	410390058	2400		X						
	Amazon Park	EAP	410390060	2400	X	X						
Springfield	City Hall	SSH	410391009	2400	X	X		X				
Grants Pass	Parkside School	GPP	410330107	0	X	X		X	X		X	
	Peterson Sch	KFP	410350004	0	X	X	X	X	X	X	X	
Klamath Falls	Klamath Falls Background	KFB	410350015	0	X			X				
La Grande	Ash Street	LAS	410610119	0	X	X		X	X	X	X	X
Lakeview	Center & M Streets	LCM	410370001	0	X	X	X	X	X		X	
Madras	Madras	MWS	410310007	0	X							
McMinnville	Newby School	MNS	410711002	6440	X			X	X			X
Medford	Grant and Belmont	MGB	410290133	4890	X	X						
	Dodge Road	MDR	410291001	4890		X						
Oakridge	School Street	OAK	410392013	0	X	X	X	X				
Pendleton	SW Marshall Pl	PMC	410590121	0	X	X		X	X		X	
Portland	SE Lafayette (NCORE)	SEL	410510080	6440	X	X	X	X	X	X	X	X
	N Roselawn	PNR	410510246	6440	X	X						
Beaverton	Highland Prk School	BHP	410670111	6440	X							
Carus	Spangler Road	SPR	410050004	6440	X			X	X			
Hillsboro	NE Grant St.	HHF	410671003	6440	X	X						
Sauvie Is	Rt 1 Box 442	SIS	410090004	6440	X			X	X			
Prineville	SE Court St.	PDP	410130100	0	X	X		X	X			X
Roseburg	NW Garden Valley Blvd	RGV	410190002	0	X							
Salem	Salem State Hospital	SSH	410470041	7080	X							
Sweet Home	Fire Department	SFD	410432002	0	X							
The Dalles	Cherry Heights	TDC	410650007	0	X							

5.2.9 Continuous $PM_{2.5}$ Monitoring

Oregon DEQ and LRAPA use nephelometers to calculate real time $PM_{2.5}$ estimates used for the Air Quality Index, ODEQ Wildfire Air Quality Rating tool, residential wood heating programs, field burning programs, and forest health programs. ODEQ has many of these co-located with Federal Reference Method (FRM) filter samplers and correlates the two methods frequently.

ODEQ and LRAPA have operated the Rupprecht and Pattashnick 2000 and 2025 FRM samplers for over ten years. As the samplers wear out, we intend to replace them with Federal Equivalence Method $PM_{2.5}$ continuous samplers. The FEM samplers measure mass hourly and as a result don't lose aerosol mass to evaporation. The FEM values are typically slightly higher than the FRM samplers. The use of FEM monitors could elevate the design values in areas that have more aerosols like Portland and Eugene. Areas that are strictly wood smoke are not expected to rise as much.

5.2.10 $PM_{2.5}$ Monitoring Coverage Area

An analysis of coverage area using EPA's Network Assessment tool (Figure 5.2.15) shows good continuous $PM_{2.5}$ coverage throughout the state with more dense coverage in the highly populated Willamette Valley. This tool is limited because it doesn't appear to consider terrain. The only empty areas are in the Hermiston area and on the coast. The Hermiston area had monitoring recently and was not elevated likely due to its location near the windy Columbia River Gorge. The coast also had recent monitoring in Florence and the values were very low due to good mixing from air off of the Pacific Ocean.

Eugene and Portland are the largest metro areas in Oregon and have the most continuous monitors. Salem is the third largest metro area but only has one monitor. The redundancy analysis in the next section will discuss monitoring in these areas.

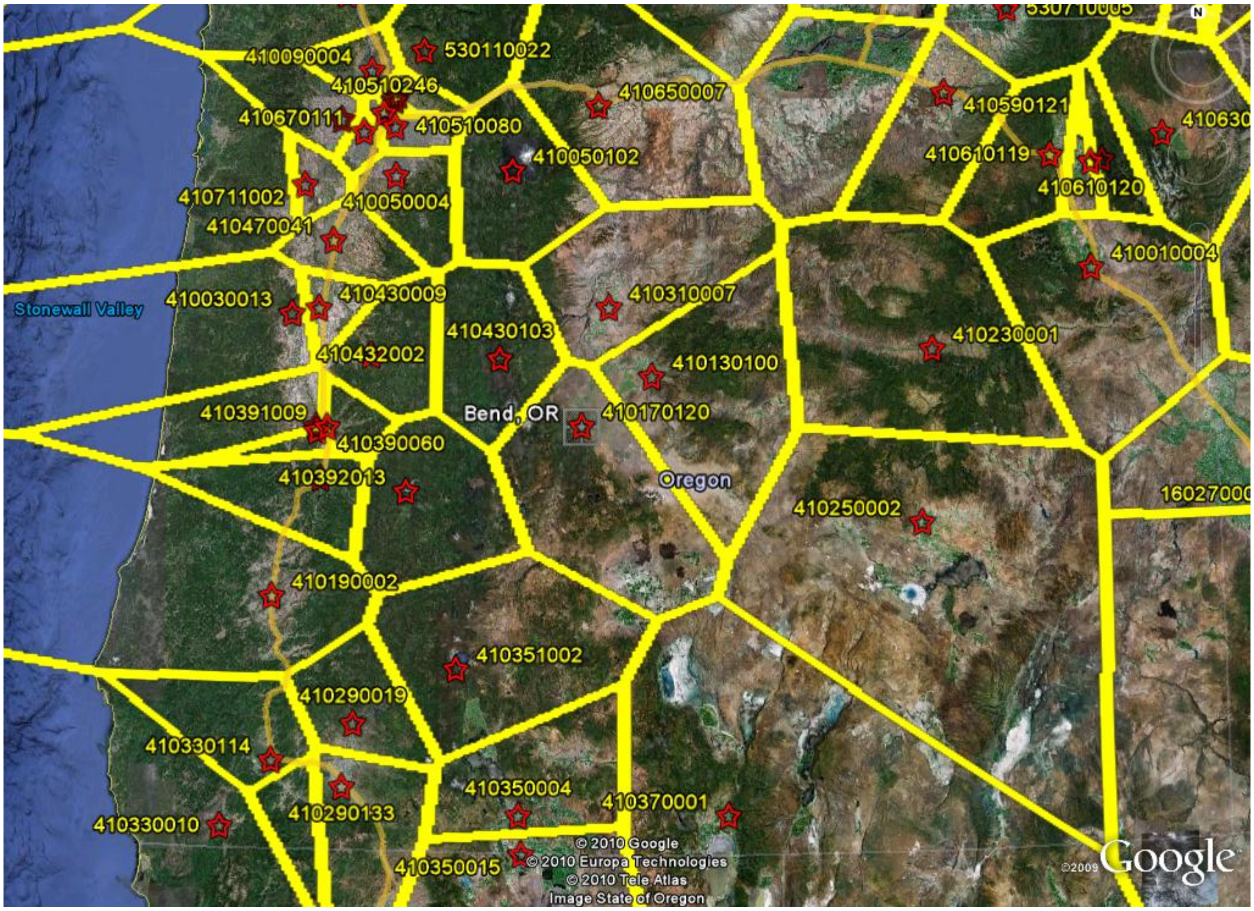

Figure 5.2.15. Monitoring grid coverage map for continuous $PM_{2.5}$.
Grids with no monitors are considered be under represented by the EPA Network Assessment tool. Grids with too many monitors may be over represented.

5.2.11 $PM_{2.5}$ Monitoring Redundancy

Continuous monitoring $PM_{2.5}$ estimate sites are located at every $PM_{2.5}$ FRM site in addition to numerous non-FRM sites. Continuous $PM_{2.5}$ can be used to provide a complete look at $PM_{2.5}$ correlation for both continuous and FRM sites. Figure 5.2.16 below shows the continuous sites in Oregon and the surrounding bordering states used in the redundancy analysis. Using the EPA correlation matrix tool these sites were compared for redundancy. In the past, Region 10 EPA considered two sites which had an R Squared equal or above 0.85 to be redundant.

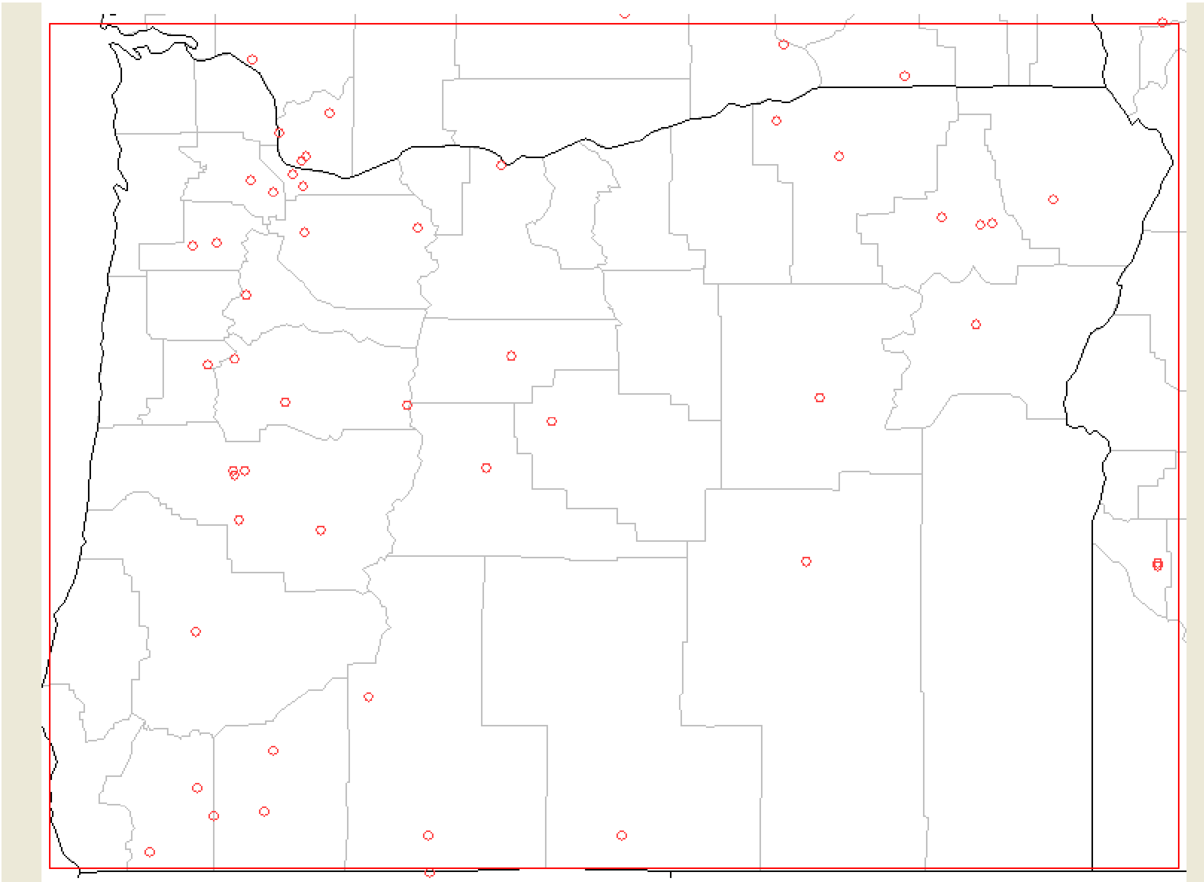

Figure 5.2.16. $PM_{2.5}$ continuous sites used in the redundancy analysis.

<u>Redundancy results</u>
Only four nephelometer site comparisons had R Squares equal or above 0.85. Albany vs. Corvallis, Corvallis vs. Salem, Eugene Amazon Park vs. Eugene LCC, and Eugene LCC vs. Springfield. Salem, Corvallis, and Albany are isolated communities separated by miles of smaller communities and farm land. All these cities are in the mid to lower Willamette Valley and experience similar weather episodes. This most likely explains the similar $PM_{2.5}$ levels, since elevated winter $PM_{2.5}$ levels are more localized than regional. None of these sites currently has an FRM sampler. Eugene LCC and Eugene Amazon Park are only two miles apart and likely experience the same $PM_{2.5}$ episodes. LCC and Springfield also appear to experience similar $PM_{2.5}$. LCC's nephelometer appears to be redundant.

Only two comparisons of $PM_{2.5}$ FRM data were above 0.85: Eugene Amazon Park vs. Eugene Key Bank, and N. Portland vs. S. Portland. The Eugene Key Bank site is the historic PM_{10} nonattainment site and LRAPA has started $PM_{2.5}$ there to understand how much of the current PM_{10} is $PM_{2.5}$. For Portland, SE Lafayette and North Roselawn were redundant. SE Lafayette is Oregon's NCORE site and must be continued. N. Roselawn is an environmental justice site and a National Air Toxics Trend site. The FRM at N. Roselawn is redundant and could be shut down if the NATTS program agrees and if the nephelometer alone is judged sufficient for environmental justice purposes. Table 5.2.4 shows site comparisons which had R Squares down to 0.8.

Table 5.3.4. Nephelometer/FRM correlation values with R Squares greater than 0.8.

City 1	City 2	avg rel diff	med rel diff	sd rel diff	max rel diff	corr	distance
Portland/Vancouver Metro							
N. Pdx (FRM 1/3)	**SE Pdx (FRM 1/3)**	**0.16**	**0.07**	**0.23**	**1.1**	**0.89**	**9**
Beaverton (Neph	N. Pdx	0.29	0.24	0.22	1.80	0.84	15
Beaverton	SE Pdx	0.30	0.21	0.31	2.94	0.82	17
N. Pdx (Neph)	SE Pdx (Neph)	0.20	0.10	0.31	2.86	0.81	9
Central Willamette							
Albany	**Corvallis**	**0.26**	**0.17**	**0.30**	**3.35**	**0.86**	**15**
Salem	**Albany**	**0.22**	**0.11**	**0.30**	**3.23**	**0.85**	**37**
Salem	Corvallis	0.29	0.19	0.35	4.36	0.83	45
Eugene/Springfield							
Eugene KeyBank (FRM)	**Eugene Amazon (FRM)**	**0.16**	**0.10**	**0.21**	**1.2**	**0.89**	**6**
Eugene LCC	**Eugene Amazon**	**0.19**	**0.10**	**0.24**	**1.42**	**0.86**	**2**
Eugene LCC	**Springfield**	**0.20**	**0.09**	**0.30**	**1.91**	**0.85**	**6**

AIRS# Key

Beaverton	410670111
SE Pdx	410510080
N. Pdx	410510246
Albany	410430009
Salem	410470041
Corvallis	410030013
Eugene Amazon Pk	410390060
Eugene LCC	410390013
Eugene Key Bank	410390058
Springfield	410391009

5.2.12. $PM_{2.5}$ Monitoring Methods

$PM_{2.5}$ can be monitored using different methods depending upon the data objective. If the data objective is for Air Quality Index use, $PM_{2.5}$ can be estimated using nephelometers only. Nephelometers are the most cost effective method and provide real time information. Nephelometers cannot be used for NAAQS comparison. If the data is for NAAQS comparison (in cities near or above the standard), the Federal Reference Method (FRM) filter sampler is required. This is more expensive and does not provide hourly or real time information.

ODEQ and LRAPA's FRM network has instruments more than 10 years old. Two newly approved Federal Equivalency Methods (FEM) provide real time, hourly information for the

AQI and can be used for NAAQS compliance. The FEM samplers also have a lower operational cost than the FRMs. ODEQ plans to replace the FRM network with FEMs when they wear out. The FEMs will also replace the nephelometer at the site. The FEM typically collects more $PM_{2.5}$ than the FRM because it measures the mass within an hour whereas the FRM filter can sit at the site unrefrigerated for up to seven days. The FRM filter is believe to lose some of the volatiles. The difference in urban areas can be about $2\mu g/m^3$ on average for comparison to the daily standard.

5.2.13 $PM_{2.5}$ Discussion

The Oregon $PM_{2.5}$ network doesn't have many holes because of the large nephelometer network patched together with sites funded by EPA, DEQ, USFS, BLM, and the Oregon Department of Agriculture. Tribes also have monitors in Coos Bay, near Pendleton, and in Jefferson County. The population growth in communities like Redmond is very high and ODEQ may have to consider monitoring in some of these areas in the future. Large populations in some unmonitored areas, like Gresham, may also require monitoring. The decision matrix in section 6 will provide a more detailed analysis of where additional monitoring may be needed.

There are a few redundancies in the network.

- Eugene Lane Community College (LCC) has a redundant nephelometer with both Eugene Amazon Park and Springfield. LRAPA will relocate the LCC nephelometer in 2010 or 2011. The new location has not been determined.
- Eugene Amazon Park and Eugene Key Bank have redundant $PM_{2.5}$ FRMs. Both of these sites will continue to operate because they represent different monitoring objectives. Amazon Park is in a strictly residential area and Key Bank is in a commercial/Industrial /residential mixed use area.
- Portland N. Roselawn and Portland SE Lafayette have redundant FRMs. Funding for the N. Roselawn FRM will be shifted to support other $PM_{2.5}$ monitoring such as a year round sampler in Sweet Home sampling every third day.

ODEQ and LRAPA have four $PM_{2.5}$ FRM sites below $25\mu g/m^3$ which can be represented by nephelometers only or moved to a location with higher concentrations. (ODEQ considers $25\mu g/m^3$to be the threshold for areas of concern.)

- Portland N. Roselawn has a design value of $22\mu g/m^3$ and is redundant (as discussed above). This FRM will be discontinued but the nephelometer will continue to operate, providing $PM_{2.5}$ estimates, and supporting the NATTs at this site.
- Bend Pump Station has a two year average 98^{th} percentile of $18\mu g/m^3$. This site may not represent air quality in the newer neighborhoods of the fast growing city. ODEQ may conduct a survey to relocate the FRM. If Bend Pump Station is representative of Bend, the FRM will be discontinued and $PM_{2.5}$ will be estimated by the nephelometer.
- La Grande Ash Street has a design value of $18\mu g/m^3$. This FRM will be discontinued but the nephelometer will continue to operate, providing $PM_{2.5}$ estimates, and supporting the NATTs at this site.
- Springfield City Hall has a design value of $18\mu g/m^3$. A survey will be done in Springfield and this site will be relocated to a more appropriate area. This site is locally funded and is important to the residents.
- Medford Dodge Road background FRM site will be discontinued to cut costs.

ODEQ and LRAPA will also begin transitioning the $PM_{2.5}$ FRM network to continuous FEM samplers. These samplers provide real time, hourly data for the AQI and 24 hour average data for comparison to the NAAQS. The continuous FEM sampler has a lower operational cost because it replaces both the FRM filter sampler and the nephelometer. The continuous FEM sampler also has no laboratory filter handling costs. As required, ODEQ will continue to co-locate some filter based FRMs with the new FEMs.

In addition to monitoring, ODEQ should continue to support Washington State University's AIRPACT 3 air quality model provided they commit to improving the model's $PM_{2.5}$ accuracy. AIRPACT 3 has the potential to provide accurate $PM_{2.5}$ forecasts in the many unmonitored, smaller communities in the state. The non-environmental professional forecasters in these areas could benefit from an accurate forecast when calling wood stove and air quality advisories.

5.3 PM_{10}

PM_{10} levels had been greater than the NAAQS in numerous communities in Oregon up until the mid 1990's, but with industrial controls and abatement programs the levels have dropped to well below the federal standard. In the late 1990's and into the 2000's, EPA region 10 and Oregon DEQ have agreed to transfer funding from PM_{10} monitoring to $PM_{2.5}$. $PM_{2.5}$ is currently above or near the standard in numerous communities.

With further budget cuts imminent, ODEQ plans to continue to refocus PM_{10} monitoring resources to pollutants near the federal standard like $PM_{2.5}$ and ozone.

5.3.1 Design Value

The PM_{10} design value is the expected number of days per calendar year when a 24 hour average concentration above 150µg/m^3 is ≤ 1 over a three year period. The expected exceedance is the number of exceedance days expected if sampling occurred every day. In practice, the design value is the second highest PM_{10} concentration for the latest three year period.

Table 5.3.1 shows the design values over the latest three years of data for each PM_{10} site. No PM_{10} site in Oregon has had a concentration over 150µg/m^3 in over ten years. The highest design values ranged from 24% to 58% of the standard.

Table 5.3.1. The latest three year design value for Oregon PM_{10}.

EPA Site Number	City	Airshed	Number of exceedances over past 10 years	Last three year 2nd High	% of Std (Last three year 2nd High)	Last three year period
410292129	Medford	Medford/Ashland AQMA	0.0	78	52%	07-09
410294001	White City	Medford/Ashland AQMA	0.0	69	46%	07-09
410330114	Grants Pass	Grants Pass	0.0	50	33%	06-08
410350004	Klamath Falls	Klamath Falls	0.0	87	58%	07-09
410390013	Eugene LCC	Eugene/Springfield	0.0	42	28%	07-09
410390058	Eugene Key Bank	Eugene/Springfield	0.0	78	52%	07-09
410390060	Eugene Amazon Park	Eugene/Springfield	0.0	47	31%	06-08
410392013	Oakridge	Oakridge	0.0	60	40%	07-09
410510009	NW Portland	Portland Metro	0.0	63	42%	07-09
410510080	SE Portland	Portland Metro	0.0	45	30%	07-09
410510246	N. Portland	Portland Metro	0.0	36	24%	07-09
410590121	Pendleton	Pendleton	0.0	56	37%	07-09
410610119	La Grande	La Grande	0.0	53	35%	07-09

5.3.2 PM_{10} Trends

Oregon's PM_{10} levels have been declining over the last twenty years to where the second highest measured day each year for each site is usually less than one half the NAAQS. Figures 5.3.1 and 5.3.2 show the second highest values of the remaining PM_{10} sites from 1985 to present.

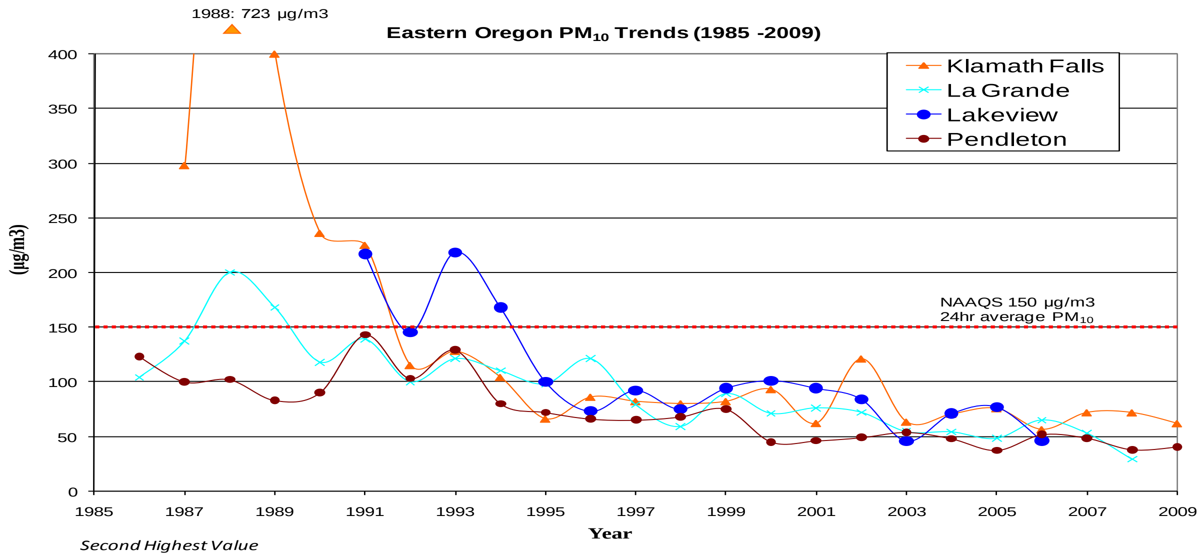

Figure 5.3.1. Eastern Oregon PM_{10} Trends.
(Annual second highest 24hr PM_{10} value)

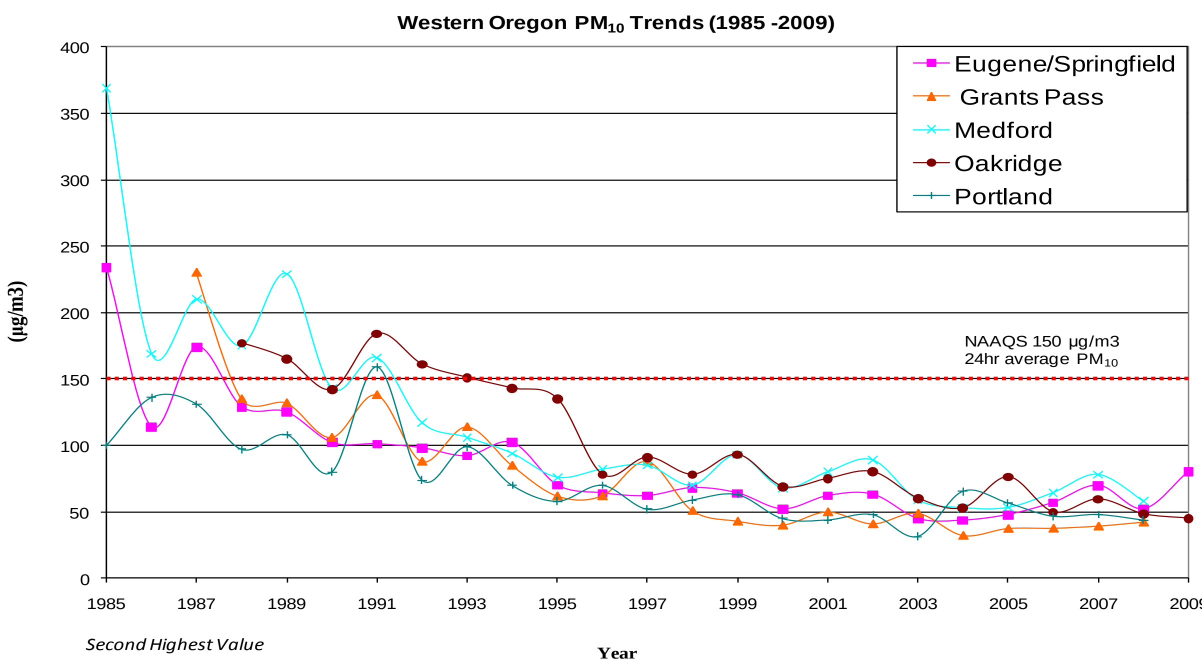

Figure 5.3.2. Western Oregon PM_{10} Trends.
(Annual second highest 24hr PM_{10} value)

5.3.3 Meteorological Impacts on PM_{10}

Much of PM_{10} consists of $PM_{2.5}$ and is influenced by the same meteorology. Inversions, poor mixing, cold weather, and high relative humidity all contribute to elevate levels. This has already been discussed in the $PM_{2.5}$ Section.

The larger particles in PM_{10} are crustal materials and can be entrained and transported by high winds. Snow also results in road sanding which can be crushed by vehicles and re-entrained as PM_{10}. Cinder dust in particular becomes ground and re-entrained as PM_{10}. Eastern Oregon Communities with cinder dust have taken steps to remove the sanding material from the roads after snow melts.

5.3.4 PM_{10} Emission Inventory

2005 is the latest emission inventory available at the time of this plan. The EI estimates that PM_{10} is primarily emitted from non-road fugitive dust across the state. Area sources likely dominated by combustion are the next highest source of emissions. Figure 5.3.3 shows the emissions by source category. Figure 5.3.4 shows the emissions by source category by county.

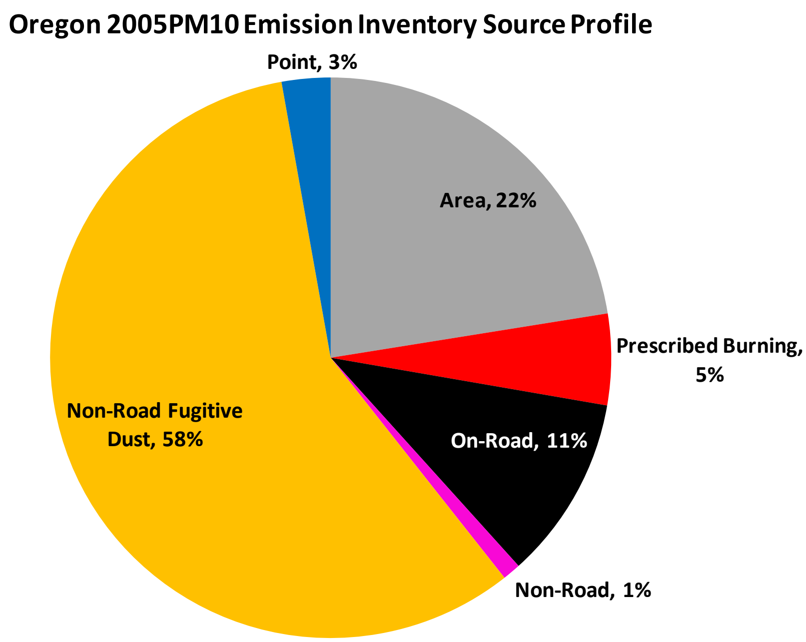

Figure 5.3.3. 2005 Oregon PM_{10} emission inventory by source category.

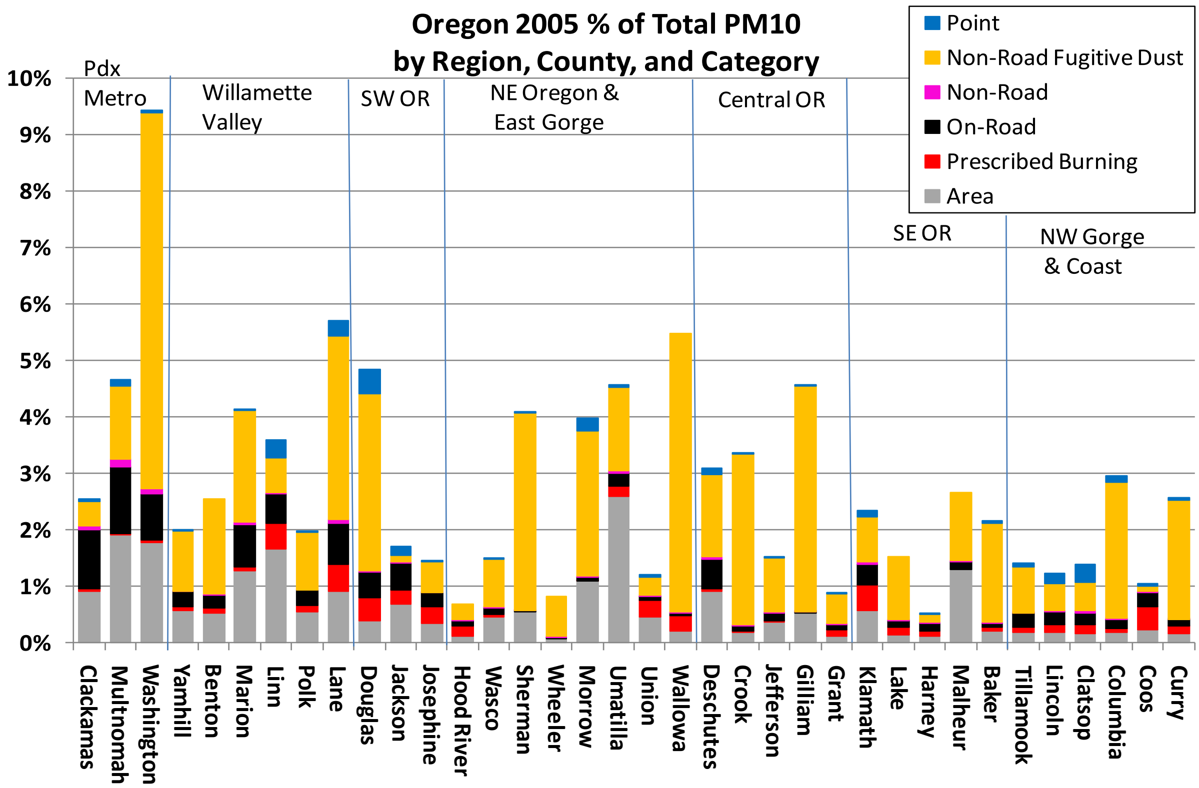

Figure 5.3.4. 2005 Oregon PM_{10} emission inventory by source category and county.

5.3.5 Plans to Remove PM_{10} Sources

Some of the remaining PM_{10} is from residential wood combustion. The Heat Smart Program discussed in the $PM_{2.5}$ Section will lower PM_{10} in communities with high woodstove usage. Summer time smoke emissions will be cut in the Willamette Valley in 2010 with the passage of legislation outlawing most grass seed field burning. Field burning was already greatly reduced from the 1980's.

PM_{10} controls such as cyclones, bag houses, and electrostatic precipitators were placed on industry in the 1980's and 1990's.

5.3.6 Current PM_{10} Monitoring Network

The PM_{10} network has been greatly reduce over the past 15 years due to low values and shifting of resources to $PM_{2.5}$. The current network is shown in Table 5.3.2 and Figure 5.3.5. Several sites in the current network are part of the air toxics PM_{10} metals sampling. This method provides PM_{10} data as well as metals information, but it is funded by the air toxics program.

Table 5.3.2. Oregon 2010 PM_{10} monitoring network.

City	Site Name	EPA #	Site Purpose	Attainment Status	Comments
Medford/Ashland AQMA	White City	410294001	Max Concentration	Maintenance Plan	
	Grant&Belmont	410290133	Population		Toxics PM_{10} Metals
	Welch&Jackson	410292129	Max Concentration		
Klamath Falls	Peterson School	410350004	Population	Maintenance Plan	
Eugene/Springfield AQMA	Lane Comm College	410390013	Concentration	SIP	Plan Pending
	Key Bank	410390058	Population		Plan Pending
	Amazon Park	410390060	Population		Toxics PM_{10} Metals
Oakridge	Willamette Center	410392013	Concentration	SIP	Plan Pending
Salem	State Hospital	410470040	Population	Attainment Area	Toxics PM_{10} Metals
Portland Metro	NW Portland	410510009	Concentration	Attainment Area	
	SE Lafayette	410510080	Population		
	N. Roselawn	410510246	Population		Toxics PM_{10} Metals
Pendleton	McKay Creek	410590121	Population	Attainment Area	Ag Dust concerns
La Grande	Ash Street	410610119	Population	Maintenance Plan	Toxics PM_{10} Metals

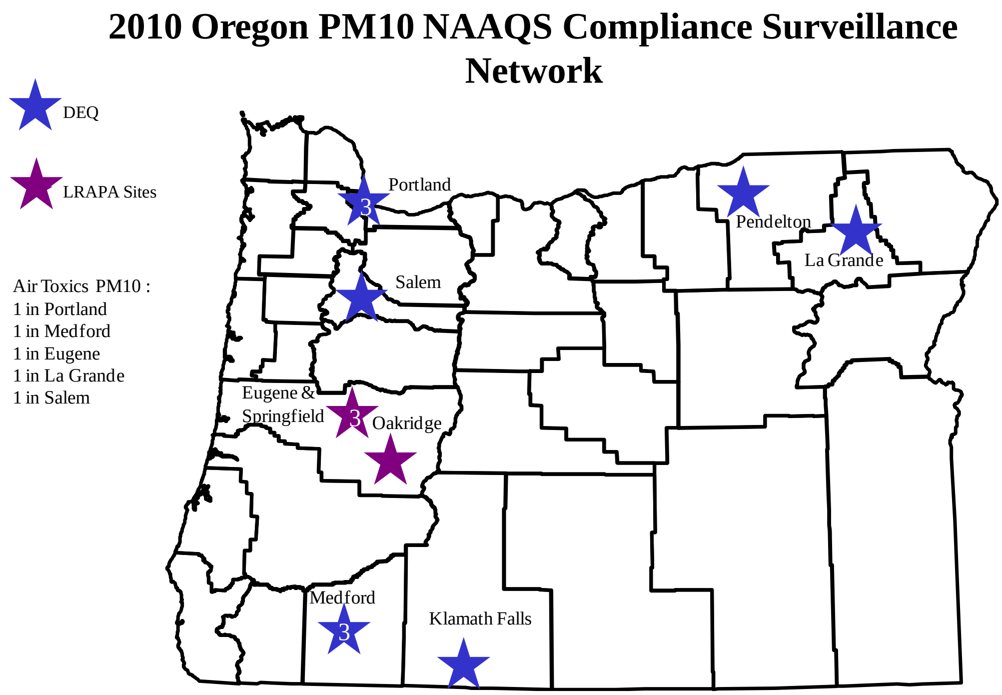

Figure 5.3.5. Oregon's 2010 PM_{10} monitoring network map.

5.3.7 PM_{10} Monitoring Network Redundancy

EPA's network assessment, redundancy tool calculates the correlation between sites throughout the state for PM_{10}. Between 2005 and 2008, only one pair of sites had a correlation with an R Squared greater than 0.85 (EPA Region 10 has considered sites with an R Squared above 0.85 to be redundant in past network assessments). Table 5.3.3 shows the correlation information for highly correlated PM_{10} sites. Eugene Lane Community College and Eugene Key Bank had a correlation of 0.89 which makes them redundant.

Table 5.3.3. Correlation information for two sets of sites with high R-Squares.

From EPA's Correlation Tool	site 1	site 2	avg_rel_diff	median_rel_diff	sd_rel_diff	max_rel_diff	nobs	Correlation – R Squared	Distance
Eugene/Springfield	EKB	LCC	0.27	0.19	0.27	1.57	234	0.89	4

Site Key	Site Number	Site Name
EKB	410390058	Eugene - Key Bank
LCC	410390013	Eugeme - Lane Comm Coll

5.3.8 PM_{10} Site Discontinuation Discussion

ODEQ is facing more budget cuts and needs to refocus resources on pollutants which are near or above the NAAQS or Health Benchmarks (Air Toxics). One way to accomplish this is to eliminate monitoring for pollutants which are not near the NAAQS. ODEQ will remain committed to tracking these pollutants but in more cost effective ways.

PM_{10} is well below the NAAQS in all communities and the network has been drastically reduced in the last 15 years. ODEQ has continued to track PM_{10} levels by monitoring for $PM_{2.5}$ and performing emission inventories every three years. In communities where PMcoarse was measured, $PM_{2.5}$ constituted between 63% to 82% of the PM_{10} at elevated concentrations (Table 5.3.4). A more detailed analysis of the $PM_{2.5}/PM_{10}$ relationship at these sites is in Appendix C.

Table 5.3.4. $PM_{10}/PM_{2.5}$ correlation values.

	Linear Regression R^2	% of PM_{10} which is $PM_{2.5}$	Number of Data Points
Medford	0.82	63%	233
Klamath Falls	0.76	66%	82
Grants Pass	0.81	73%	54
Pendleton	0.82	64%	67
SE Portland	0.90	64%	132
Oakridge	0.95	82%	131
Eugene	0.91	82%	138

R^2 is a statistical value measuring the correlation between PM_{10} and $PM_{2.5}$ in a linear regression. The closer the value is to 1.0 the better the correlation.

5.3.9 PM_{10} Monitoring Discussion:

As PM_{10} levels continue to drop in Oregon, the importance of continued monitoring also declines. With tighter state budgets projected funding must be reallocated from lower priority monitoring to fund pollutants that are near or above the NAAQS. For ODEQ, PM_{10} funding at four sites will be immediately redirected to $PM_{2.5}$ and ozone as needed.

These sites are:

- Medford, Welch and Jackson,
- Klamath Falls, Peterson School,
- Grants Pass, Parkside School, and
- Pendleton, McKay Creek.

Medford, Klamath Falls, and Grants Pass are under PM_{10} maintenance plans and EPA will have to agree to release ODEQ from the plan requirement to monitor (this was previously done with Carbon monoxide monitoring in Klamath Falls, Grants Pass, and Salem). All cities will retain $PM_{2.5}$ filter monitoring and nephelometry. ODEQ will also continue to perform statewide PM_{10} emission inventories every three years.

LRAPA will discontinue one to three PM_{10} sites, depending on EPA approval.

- LRAPA will definitely discontinue PM_{10} monitoring at Eugene, Lane Community College because it is redundant with Eugene, Key Bank.
- LRAPA also wishes to discontinue PM_{10} monitoring at Oakridge and Eugene Key Bank because PMcoarse monitoring shows that PM_{10} consist primarily of $PM_{2.5}$ (PM_{10} is 82% $PM_{2.5}$ in both cities).

Neither of these areas has an approved maintenance plans but they have not violated the NAAQS in 16 years (Oakridge) and 22 years (Eugene/Springfield). Both cities will continue to have $PM_{2.5}$ monitoring and PM_{10} emission inventories done to track PM_{10} levels. Eugene Amazon Park will continue to operate a PM_{10} air toxics monitor if funding is maintained. ODEQ and

LRAPA believe $PM_{2.5}$ monitoring is sufficient because it has a more protective standard and is the AQI driver for public health. Continued PM_{10} monitoring provides very little benefit for the cost.

5.4 Lead

The historical lead network was discontinued in 2001 because the levels were far below the NAAQS and resources needed to be shifted elsewhere. In 2010, the Lead network was restarted because of requirements of the new lead standard.

5.4.1 Lead Design Values

There are no current Lead design values because the network only restarted in 2010.

5.4.2 Lead Pollutant Trends

Historical pollutant trends show declining lead levels coinciding with the removal of lead from automobile gasoline. In Oregon the highest lead sites was outside of a McMinnville steel mill. This site was well below the old NAAQS of 1.5µg/m^3 but would have exceeded the new 0.15µg/m^3 NAAQS five out of the last eight years data was collected. Figure 5.4.1 shows the maximum quarterly average lead from 1990 to 2001 when the last historic TSP site was removed.

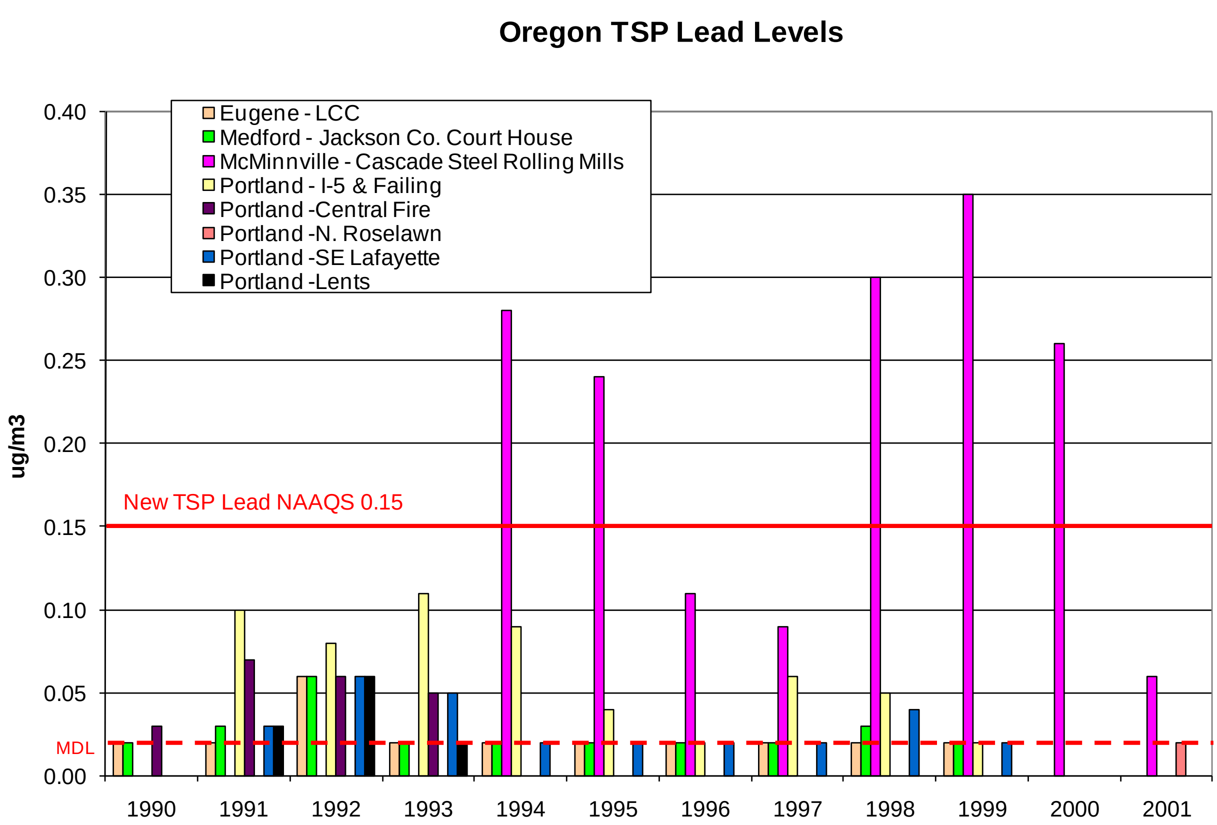

Figure 5.4.1. 1990 to 2001 Oregon TSP Lead trend chart .
Values are the maximum quarterly average.

5.4.3 New Lead Monitoring Requirements

The new lead NAAQS and monitoring rules require monitoring in community metropolitan areas of greater than one million and outside of any point source with estimated emissions greater than one ton per year of lead. A proposed 2010 monitoring revision would lower the population threshold to a CSA of 500K and emitter of 0.5 tpy.

Effects on Oregon

The new NAAQS and monitoring rule resulted in the need for two new sites in Oregon. One in the Portland area which is the only Oregon metropolitan area with over one million people and one in McMinnville outside of Cascade Rolling Mills whose emission estimate is over one tpy of lead. The proposed revision may also result in one new site outside the Hillsboro airport which is estimated to emit over 0.5 tpy lead.

5.4.4 Lead Emission Inventory

2005 emission inventory is the latest complete year available for Oregon. Lead primarily comes from prescribed burning in rural counties and is more prevalent in Eastern Oregon. Forest fire data is not included. Yamhill County has the largest estimated emission source (Cascade Rolling Mills in McMinnville). Washington County also has a large non-road source, the Hillsboro Airport.

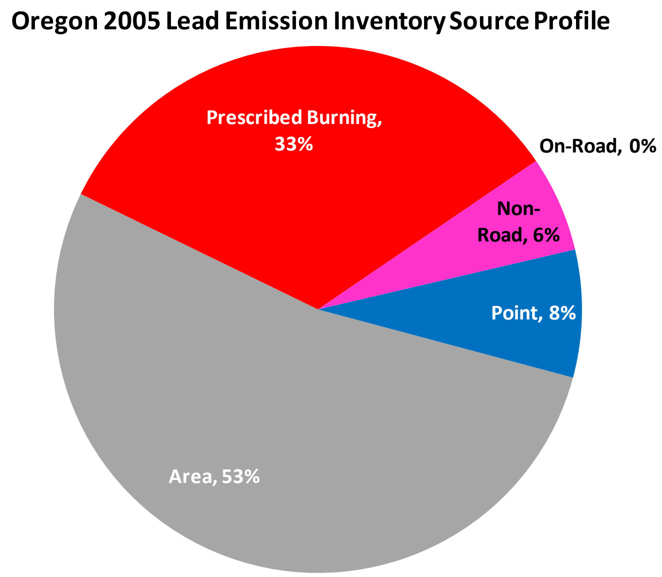

Figure 5.4.2. Oregon 2005 Lead emission inventory by source category.

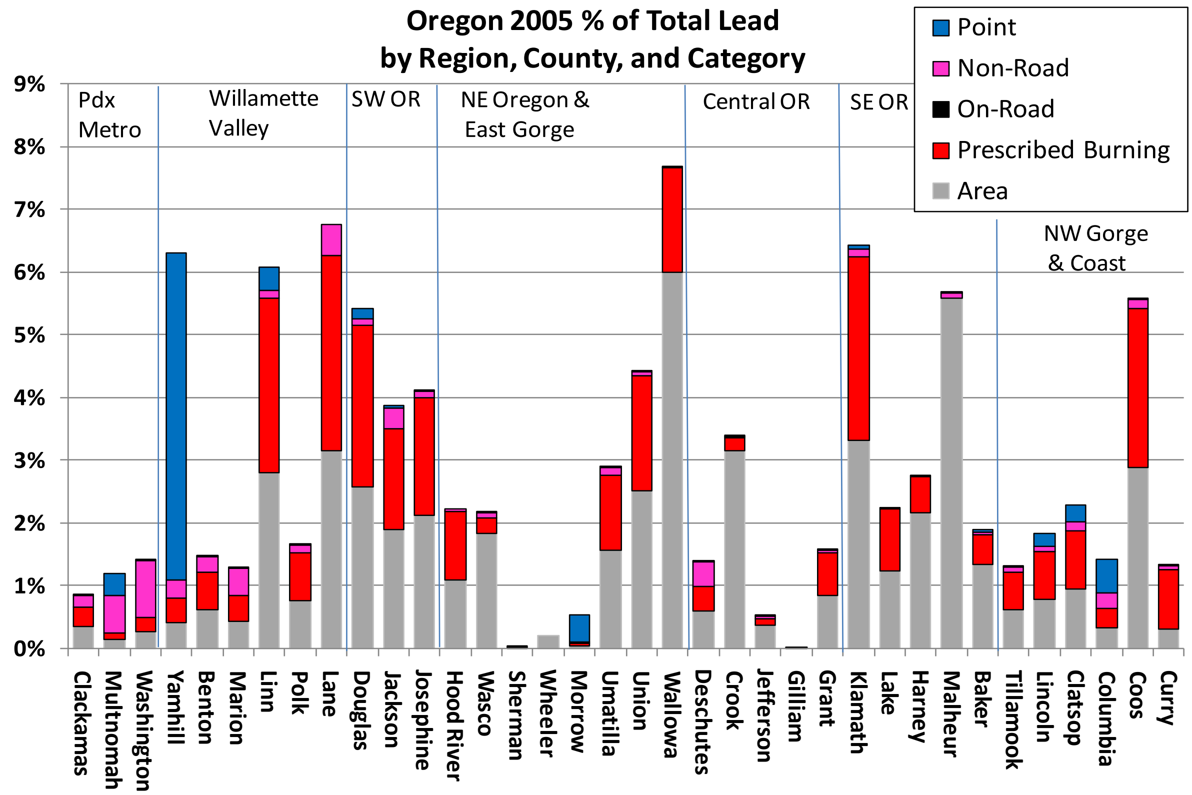

Figure 5.4.3. Oregon 2005 Lead emission inventory by source category and county.

5.4.5 Plan to Remove Lead Emission Sources

There are no current plans to modify or remove the two lead emission sources above 0.5 tpy. ODEQ and the facilities are only beginning monitoring and do not know the accuracy of the emission estimate. The Cascade Rolling Mills management has met with DEQ and discussed several options to control track out on the road in front of the plant and near the monitor. No definite plans have been made.

5.4.6 Lead Monitoring Network

Currently McMinnville is the only TSP lead site in Oregon. The second TSP lead site will be at the NCORE site in Portland at SE Lafayette. A third site may be located in Hillsboro, just west of Portland at the Hillsboro Airport. PM_{10} lead sites exist as part of the air toxics network and are currently located in Portland - N. Roselawn, Medford, Eugene, La Grande, and Klamath Falls. A Lead network map is shown in Figure 5.4.4 .

2010 DEQ & LRAPA Lead
Air Quality Surveillance Network

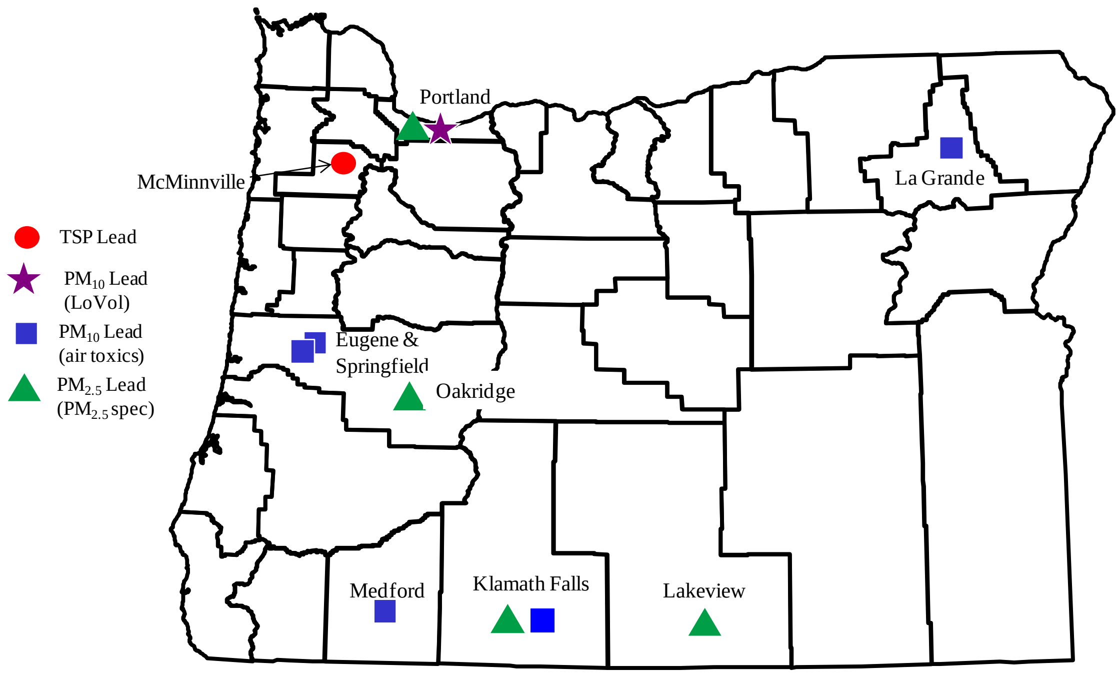

Figure 5.4.4. 2010 Lead monitoring network.
Including TSP, PM_{10}, and $PM_{2.5}$ lead sites.

<u>5.4.7 Available Modeling</u>
There is no TSP lead modeling available. The Portland Air Toxics Solutions project includes PM_{10} lead modeling. This is shown in the air toxics section.

<u>5.4.8 Lead Monitoring Network Redundancy</u>
There are no redundant sites.

<u>5.4.9 Lead Monitoring Discussion</u>
The lead monitoring network will expand by one site in 2011, the NCORE site at Portland SE Lafayette. The network may also expand to include the Hillsboro Airport depending on funding and the final Lead Rule. The NCORE site will operate indefinitely because siting is based on population. The source sites will operate for at least one year at which time ODEQ will assess the monitoring data to determine if the initial emission inventory which triggered monitoring was accurate. If the monitored lead levels are ≤50% of the NAAQS for the year, ODEQ may petition EPA Region 10 to discontinue monitoring. ODEQ will provide evidence as to why the emission inventory over predicted lead at the site.

5.5 Nitrogen Dioxide

In 2010 EPA tightened the Nitrogen dioxide NAAQS to 0.100ppm and changed the monitoring rules to focus on maximum concentration. The new monitoring rule will require a monitor alongside the maximum concentration section of roadway in cities with a Core Based Statistical Areas over 350K. The rule also requires a community monitor in a in cities with Core Based Statistical Areas over one million.

5.5.1 NO_2 Design Value

Oregon currently only has one monitor which monitors at Portland SE Lafayette, the NCORE site. The 2006-2008 one hour design value is 0.041ppm. The annual average is 0.011ppm.

The Confederated Tribes of Umatilla operated a NO_2 site in Hermiston from March 2007 to February 2008 with quality assurance provided by ODEQ. Over this time period, the hourly 98th percentile was 0.037 ppm and average was 0.008 ppm.
These values are shown in Figure 5.5.1.

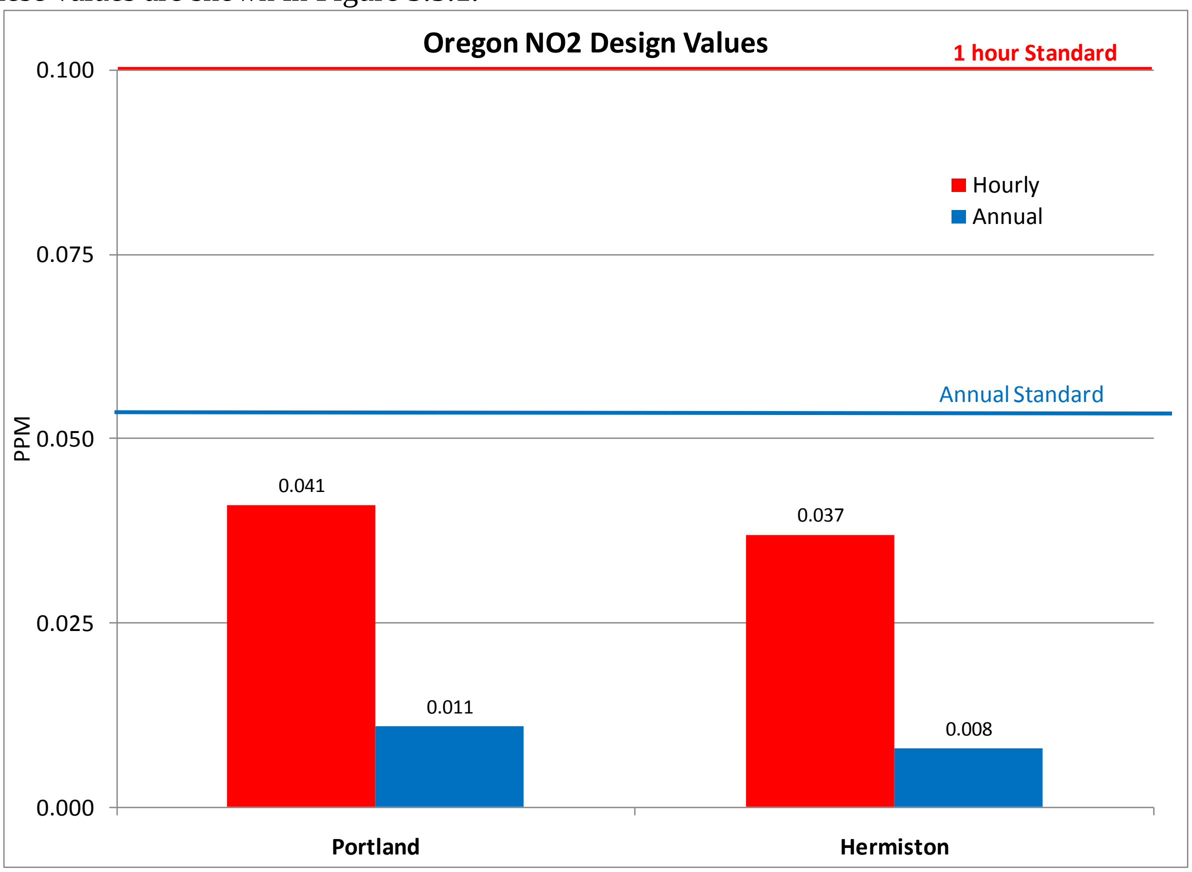

Figure 5.5.1. Oregon NO_2 design values.
Hermiston only has one year of data and the DV is not official

5.5.2 NO_2 Pollutant Trends

Before May 2006, NO_2 was only monitored over the summer. Since that time NO_2 has been collected continuously at Portland SE Lafayette. The Summer Portland SE Lafayette NO_2 Trends are in Figure 5.5.2.

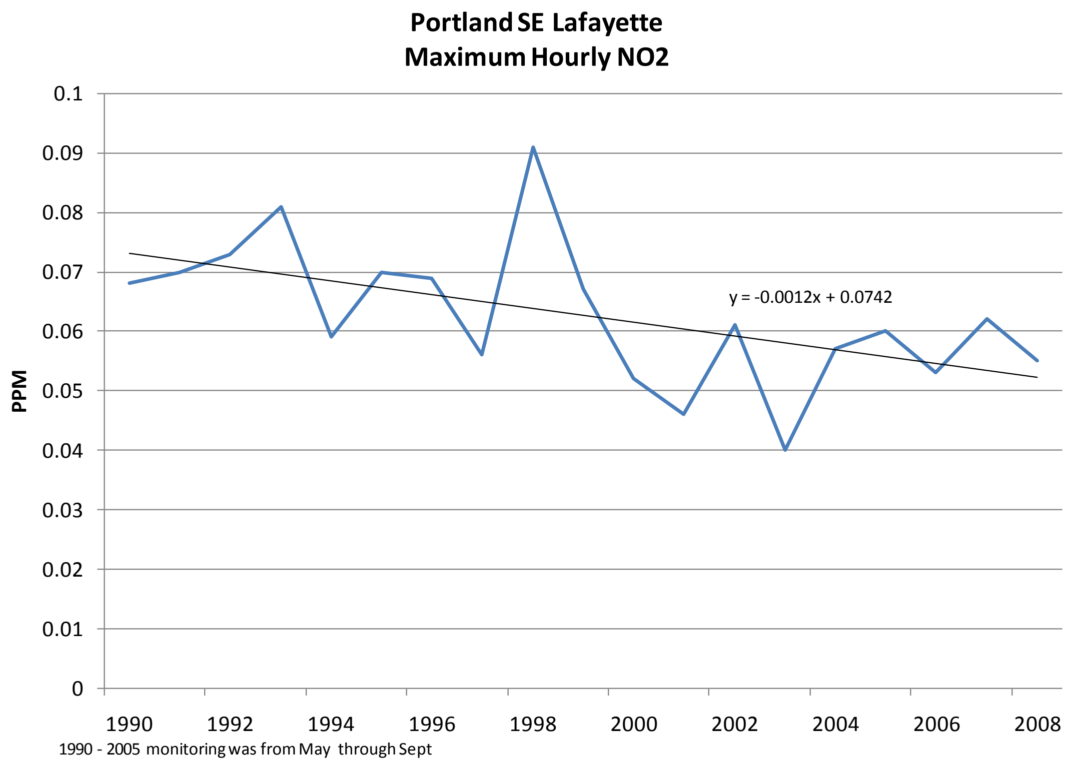

Figure 5.5.2. Summer NO_2 one hour maximum Trend for Portland, SE Lafayette.

5.5.3 Regional NO_2 Levels

As discussed in the ozone section, NASA takes daily NO_2 Satellite measurements over the world. These measurements record NO_2 in the entire air column but can provide some understanding of relative concentration temporally and spatially. The data is available at http://www.temis.nl/airpollution/no2.html . Figure 5.5.3 below shows the January 2008 NO_2 levels across the United States. The Northwest has relatively low levels as compared to the rest of the United States. Appendix D contains the monthly average NO_2 levels for each month from November 2007 to October 2008.

Jan 2008 Average NO2 Satellite

For reference: The Northwest has some of the lowest NO2 levels in the country.

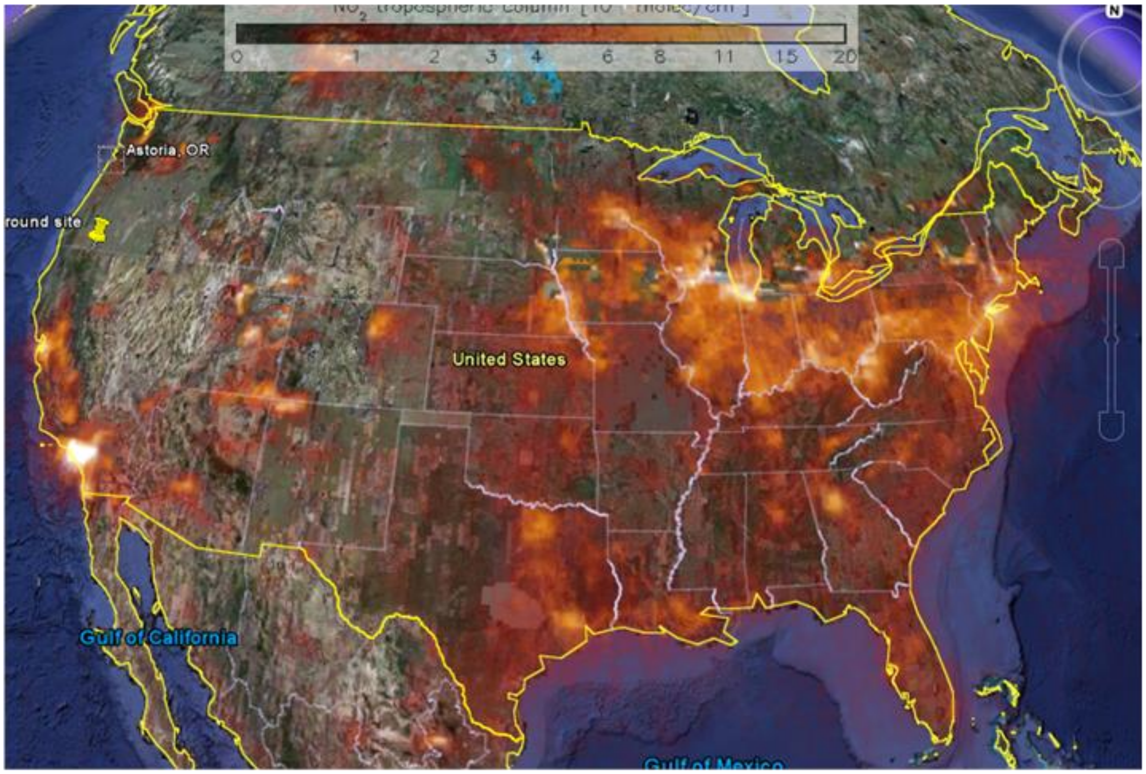

Figure 5.5.3. United States January 2008 Average NO_2 levels across the air column. *Measurements from the TEMIS Satellite. Data from http://www.temis.nl/airpollution/no2.html*

In Figure 5.5.4 the satellite image is zoomed in over Oregon and Southern Washington showing the average January 2008 NO_2 across the air column. The highest concentrations of Oregon NO_2 are in the Portland Metro area and north central Oregon. The summer NO_2 concentrations are much lower than the winter levels, as shown in the August 2008 satellite photos in Figure 5.5.5.

Jan
2008
Monthly
Mean

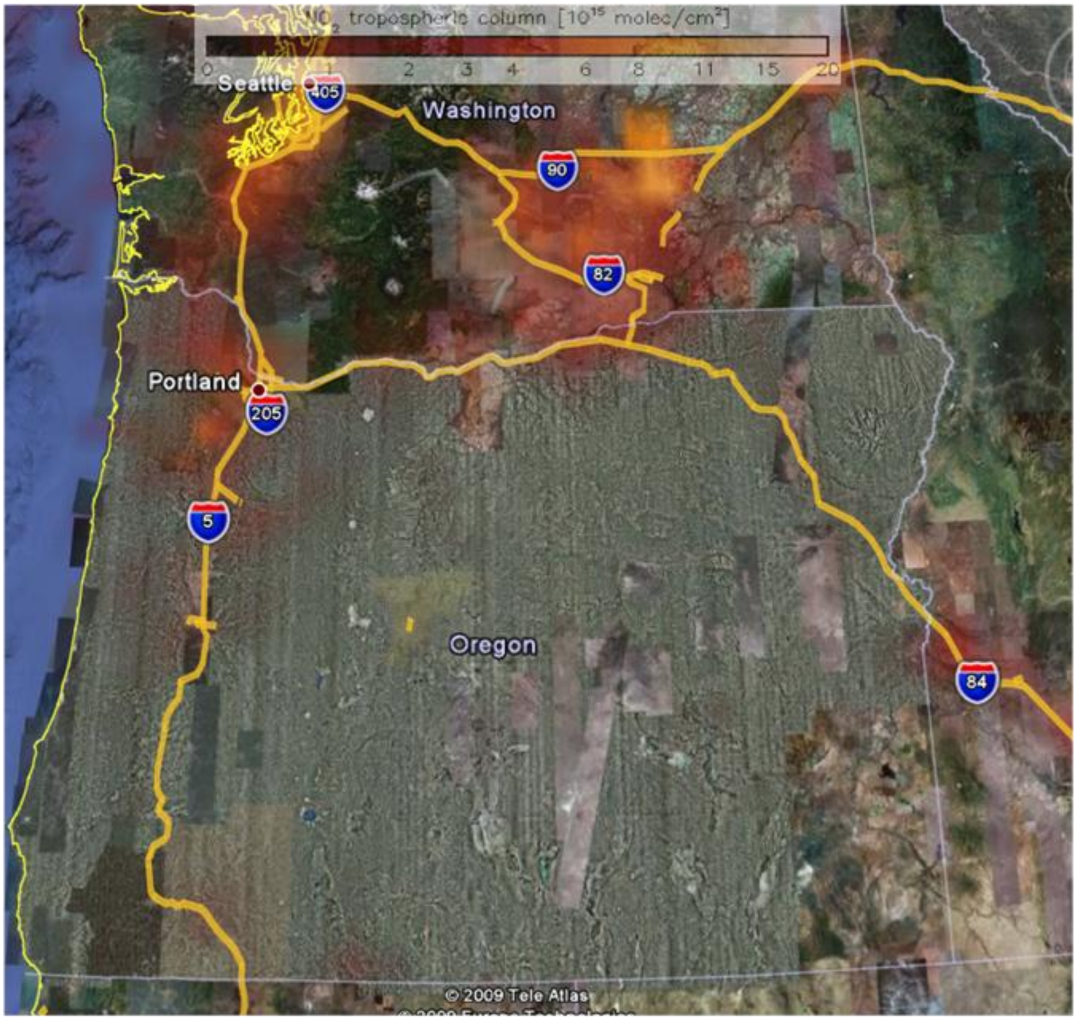

Figure 5.5.4. Oregon, January 2008 Average NO_2 levels across the air column.
Measurements from the TEMIS Satellite. Data from *http://www.temis.nl/airpollution/no2.html*

Aug 2008
Average NO2
Satellite

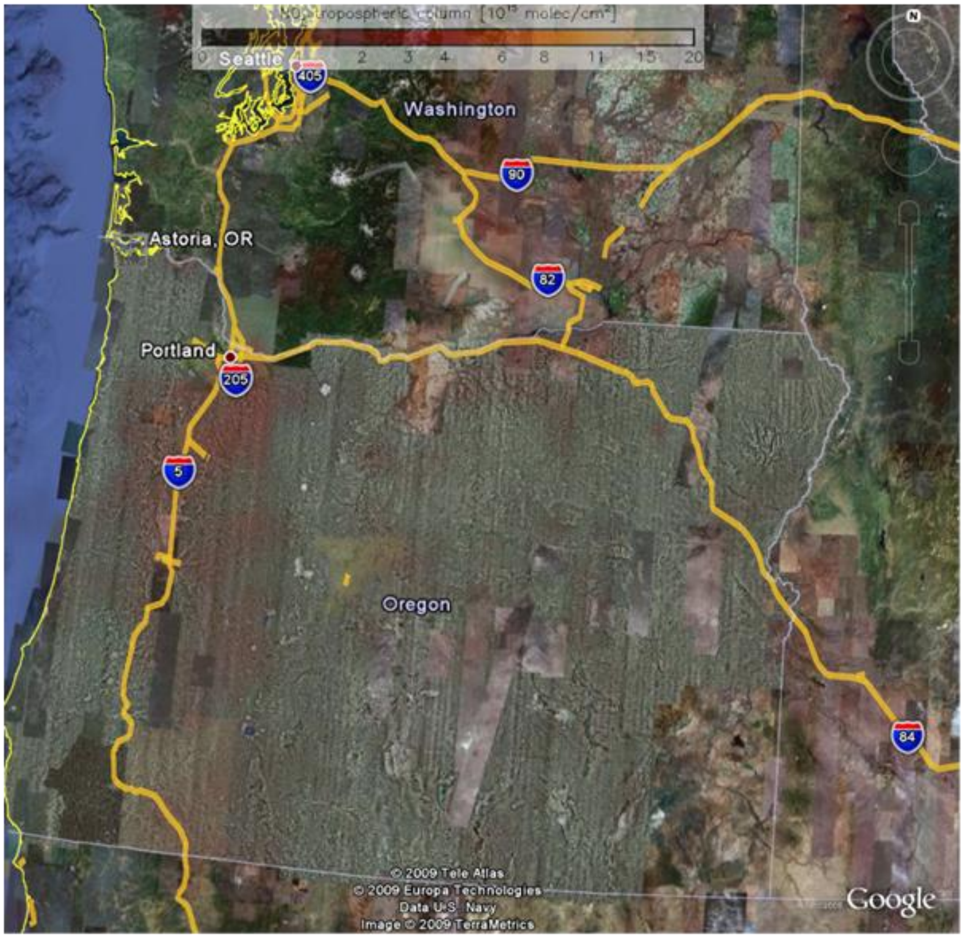

Figure 5.5.5. Oregon, August 2008 Average NO_2 levels across the air column.
Measurements from the TEMIS Satellite. Data from http://www.temis.nl/airpollution/no2.html

5.5.4 NO_2 Emission Inventory

The 2005 emission inventory is the latest complete year available for Oregon (Figures 5.5.6 and 5.5.7). The NOx inventory shows 43% of emissions come from mobile sources and the majority of emissions are from the Portland metro area followed by the Willamette Valley. Lane and Marion Counties dominate the Willamette Valley because they contain Eugene/Springfield and Salem/Kaiser respectively. The largest point source in the state is the Portland General Electric Boardman coal plant in Morrow County. In 2007 its actual emissions were reported as 10,656 tpy and it was permitted to emit 12,687 tpy.

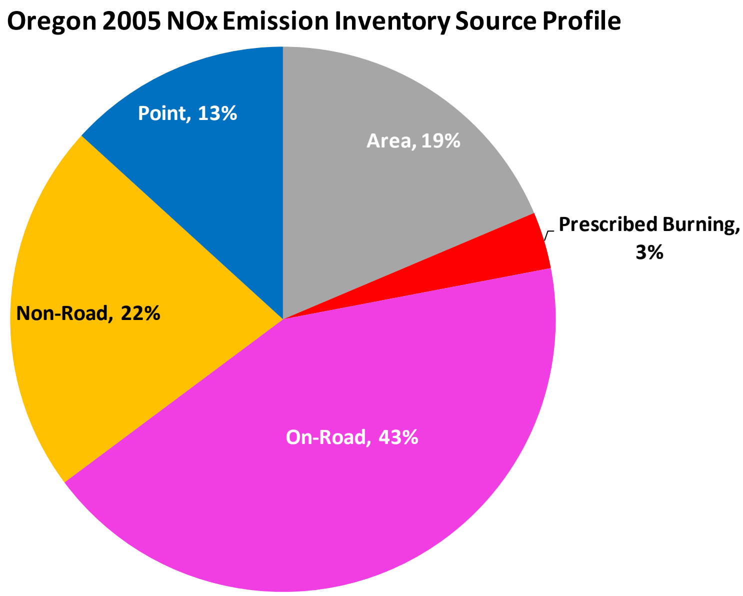

Figure 5.5.6. 2005 NOx Emission Inventory by Source Category.

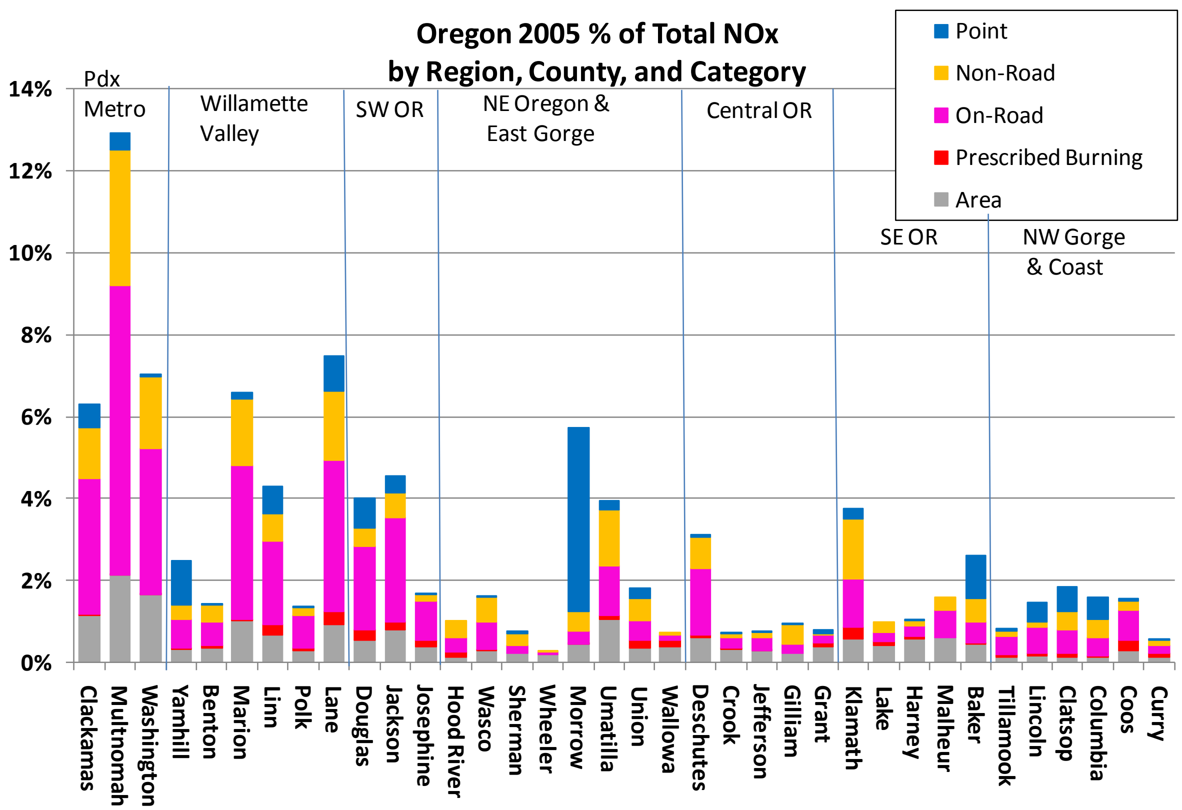

Figure 5.5.7. 2005 NOx Emission Inventory by County and Source Category.

5.5.5 NO_2 Emission Source Removal

Mobile sources are a large source of emissions in Oregon. Oregon DEQ is working on a clean diesel initiative which will encourage retrofitting of diesel engines with clean burning technology. http://www.deq.state.or.us/aq/diesel/initiative.htm

EPA's 2007 Highway Rule required refiners to produce ultra low sulfur diesel in 2006 and heavy duty truck and buses manufacturers to install pollution control devices in 2007. EPA estimates these actions will reduce NO_2 by 2.6 million tons per year nationally.
http://www.epa.gov/otaq/highway-diesel/index.htm

The Portland General Electric Boardmen coal fire power plant is the largest single source of NO_2 in Oregon. ODEQ has been working with PGE and stakeholders to reduce NO_2 and SO_2 emissions from the plant. ODEQ is requiring that "state-of-the-art burners" be installed by July 1, 2011 and SCR NOx controls be installed by 2017. The controls should cut NOx emissions by over one half. Figure 5.5.8 shows the NOx and SO_2 control installation timeline initially agreed upon by all parties. In 2010, PGE has sought a renegotiation of its permit which may result in a different NO_2 reduction schedule.

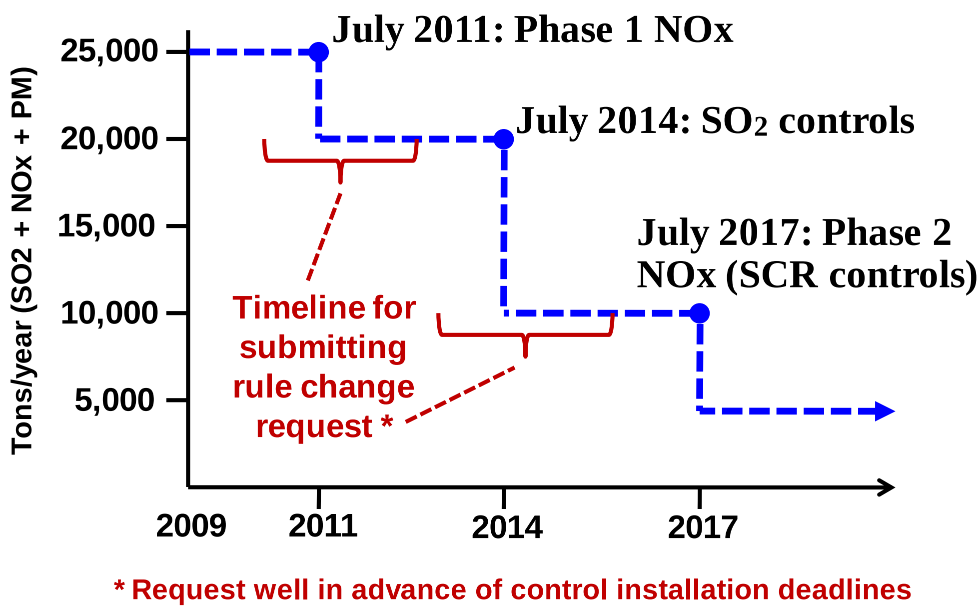

Figure 5.5.8. Timeline for PGE Boardman NOx and SO_2 emission controls.

5.5.6 NO_2 Current Network

ODEQ currently only monitors for NO_2 at Portland SE Lafayette (41-051-0080). This is the NCORE site. This monitor will be upgraded to a trace NOy monitor by the end of 2010.

5.5.7 Available NO_2 Modeling

Portland State University conducted a land regression modeling project and published a paper titled "**A Sub-neighborhood Scale Land Use Regression Model for Predicting NO_2**". The study used 80 passive sensors to monitor NO_2 across north Portland for six weeks in the summer of 2006. The monitoring data was used to calibrate a regression model applied over all of Portland. The results show elevated NO_2 levels near the major freeways and roadways. The maximum non-freeway hot spot was at the Brooklyn train yard in SE Portland.

Figure 5.5.9 from the study shows the modeled results for the Portland Metro Area and 5.5.10 zooms in on downtown Portland.

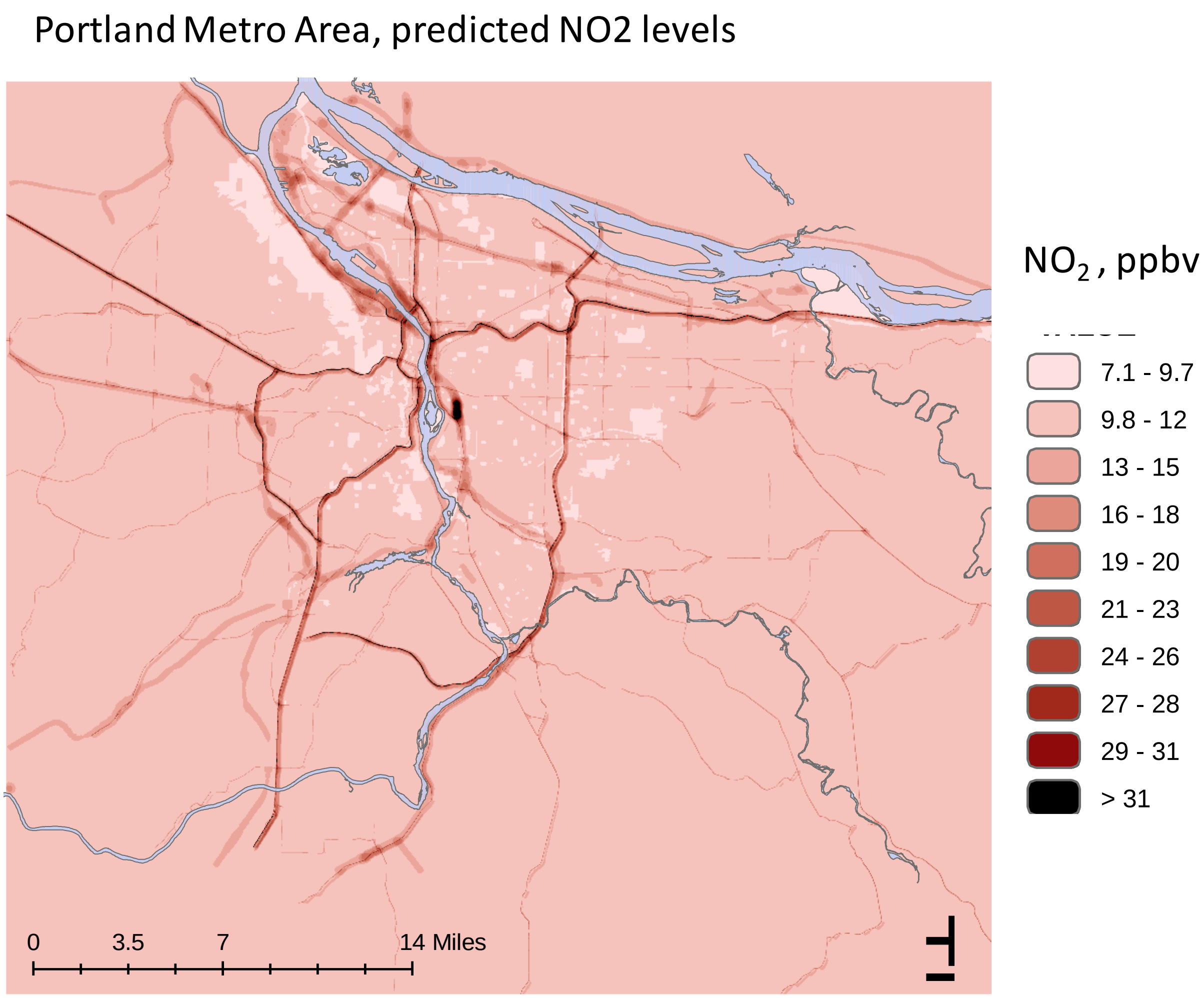

Figure 5.5.9. Portland Metro Area modeled map of NO_2 concentrations.

Map generated from model described in: M. Mavko and L. George, "Sub-Neighborhood Scale Geographic Regression Model for Predicting Nitrogen Dioxide Levels", Science of the Total Environment **398**, 68-75, 2008. (Figure 5 in Report)

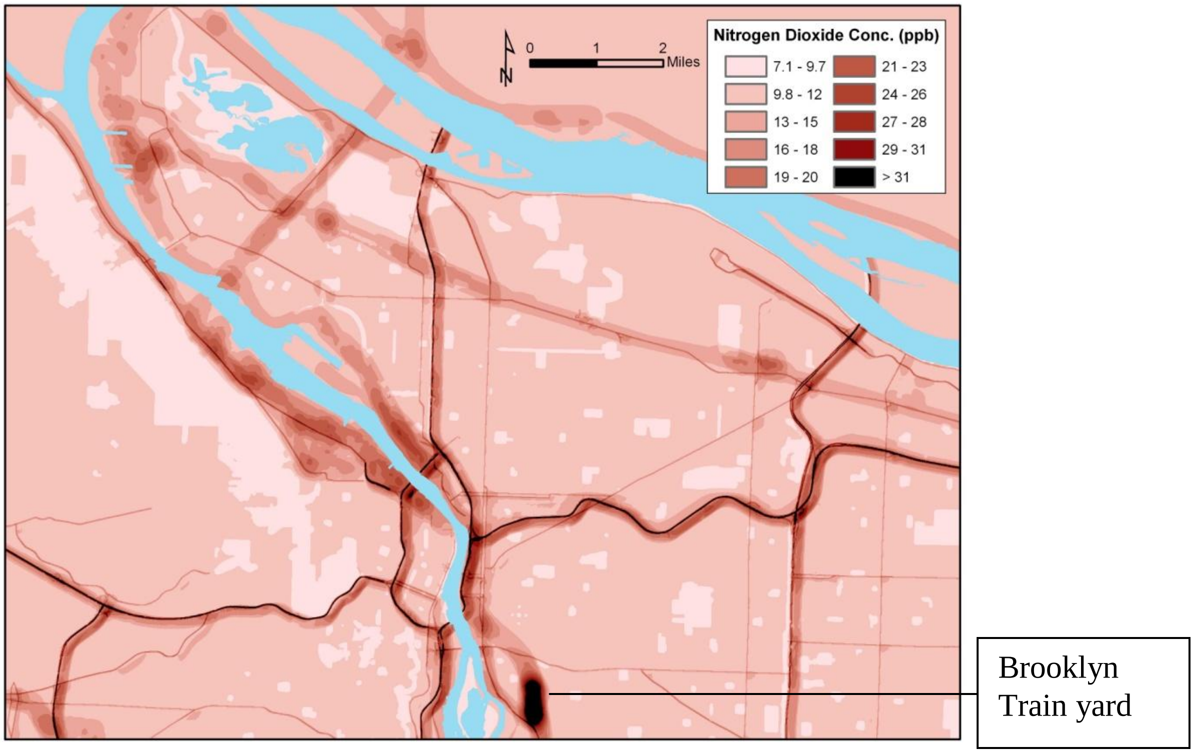

Figure 5.5.10. Portland modeled map of NO_2 concentrations.
A Sub-neighborhood Scale Land Use Regression Model for Predicting NO2, by Mavko, Tang, and L. George.

5.5.8 Redundancy
Only one site.

5.5.9 Discussion
The 2010 NO_2 monitoring rule in 40 CFR Parts 50 and 58 requires Portland/Vancouver to install one NO_2 monitor near a roadway and one community wide monitor. DEQ will have to identify a location for one roadside monitor. The only currently NO_2 monitor is a community monitor at the NCORE site. DEQ will have to determine if monitoring at the NCORE site alone can represent neighborhoods surrounding the Brooklyn train yard which the model shows to be the maximum non-road area.

The north central part of Oregon shows some NO_2 levels in the satellite photos but recent monitoring done in Hermiston indicates levels do not exceed the new NAAQS. With Boardman installing controls, NO_2 concentrations should drop further. Agriculture fertilizing operations and dairy operations in north central Oregon will continue to contribute NO_2 and DEQ will continue to analyze the satellite measurements and perform emission inventories to monitor trends.

5.6 Sulfur Dioxide

In 2010 EPA released a new one hour Sulfur dioxide NAAQS of 75 ppb and changed the monitoring rules to focus on maximum concentration. In the new rule, EPA combined SO_2 emissions and Core Based Statistical Areas (CBSA) population to calculate a Population Weighted Emission Index (PWEI) for all states. EPA used the PWEI to determine the number of monitors required in each state. The Portland, OR /Vancouver, WA CBSA is the only area in Oregon with a high enough PWEI (27,863) to require monitoring. This PWEI falls in between 5,000 and 100,000, which means Portland/Vancouver will be require operate one maximum concentration monitor.

5.6.1 SO_2 Design Value

Oregon currently only has one monitor which is located at Portland SE Lafayette, the NCORE site. The 2009 annual design value was 1.6ppb, and the 24 hour was 4ppb. Both are well below the current NAAQS. In comparison to the three year average 99th percentile of the daily one hour maximum, Portland SE Lafayette was 10ppb.

The Confederated Tribes of Umatilla operated a SO_2 site in Hermiston from March 2007 to February 2008 with Technical Assistance and Quality Assurance provided by ODEQ. Over this time period, the maximum hourly value was 11 ppb. The 99th percentile was 9ppb.

In 2004 ODEQ performed five months of fenceline SO_2 monitoring in Toledo, Oregon outside of Georgia Pacific's pulp mill. The maximum hour over this period was 52ppb. The 99th percentile was 21ppb. Figure 5.6.1 compares the recent and current SO_2 design values with the standard.

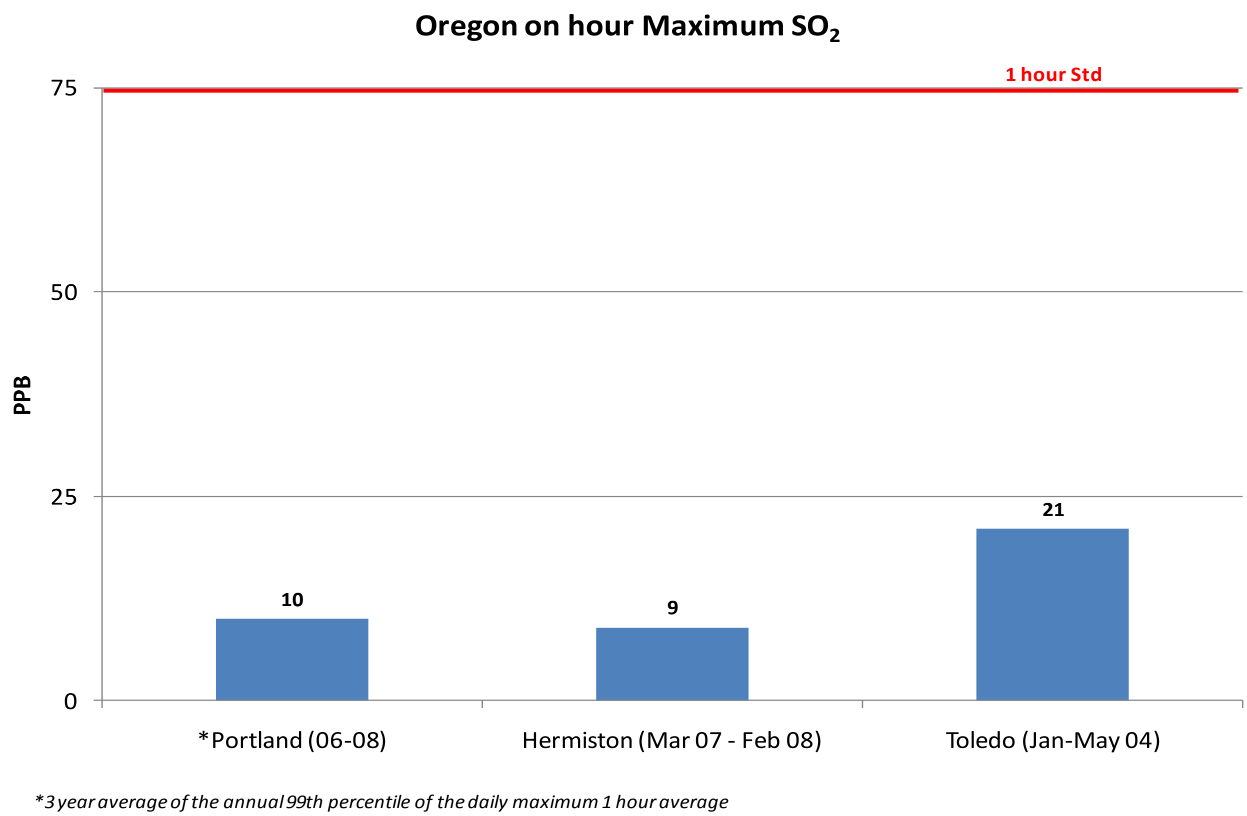

Figure 5.6.1. Oregon SO_2 one hour 99 percentile.

5.6.2 Pollutant Trends

ODEQ did not monitor for SO_2 from 1995 to January 2005 because of low concentration and resource limitations. Since that time SO_2 has been collected continuously at Portland SE Lafayette. The Portland SE Lafayette SO_2 Trends are in Figure 5.6.2.

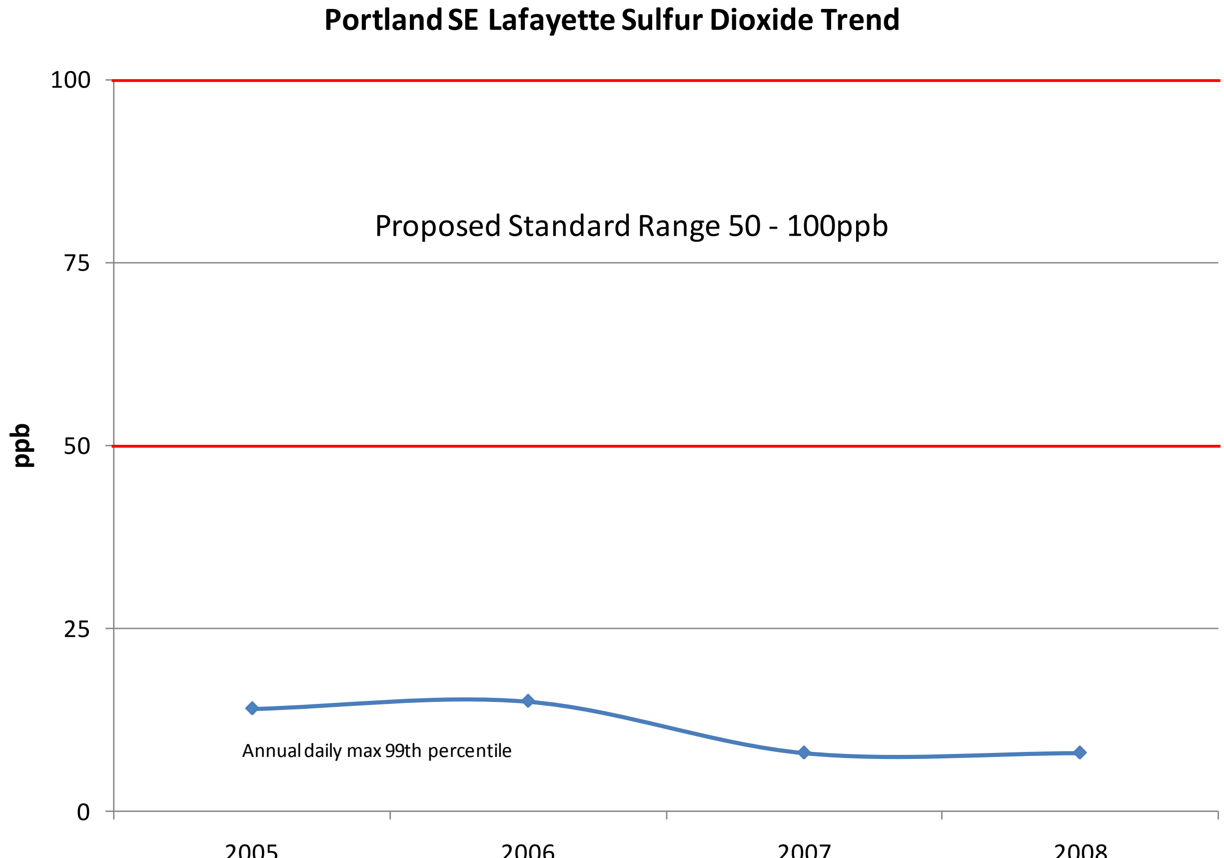

Figure 5.6.2. Portland SO_2 Trends using the daily maximum 99th percentile for each year. (at SE Lafayette)

5.6.3 SO_2 Regional Levels

The Northwest has lower SO_2 concentrations compared to other parts of the country. Northwest SO_2 sources are limited to pulp mills and a few coal plants.

5.6.4 SO_2 Emission Inventory

2005 emission inventory is the latest complete year available for Oregon. The SO_2 inventory shows 55% of emissions come from point sources and the majority of emissions are from the Portland General Electric Boardman coal plant in Morrow County. Its 2007 actual emissions were 14,037 tpy and it was permitted to emit 30,450 tpy. Figure 5.6.3 shows the emission inventory by source and Figure 5.6.4 shows the EI by source and county.

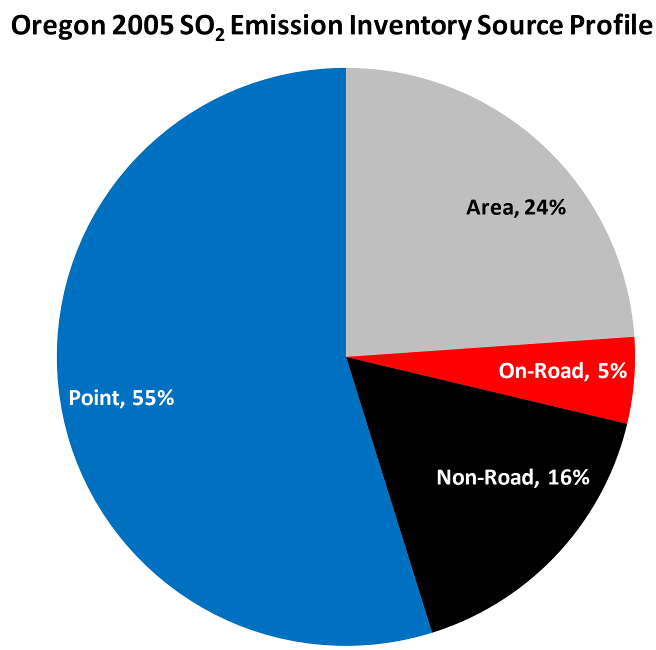

Figure 5.6.3. 2005 SO_2 Emission Inventory by Source Category.

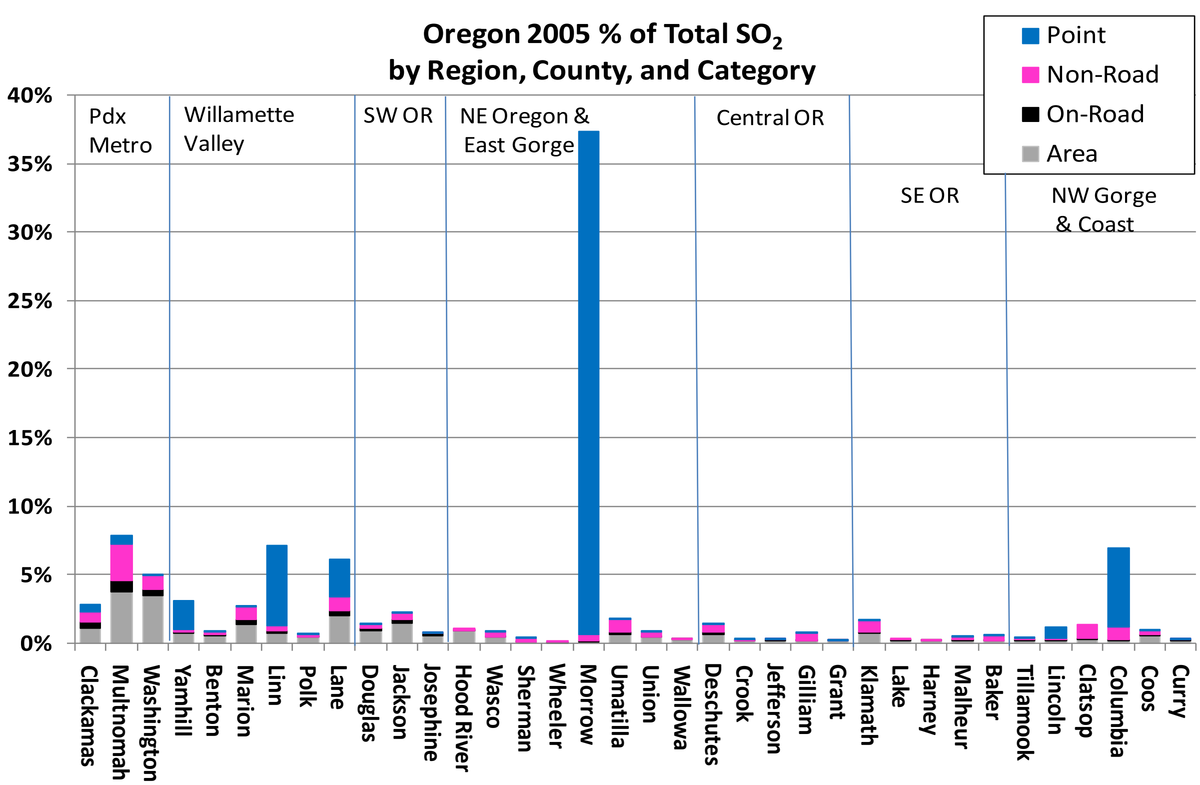

Figure 5.6.4. 2005 SO_2 Emission Inventory by County and Source Category.

5.6.5 SO_2 Emission Source Removal

Portland General Electric Boardman coal fire power plant is the single largest SO_2 source in Oregon. In July of 2014, PGE is expected to place controls on their plant. This should reduce emissions by about 80% or from roughly 14 thousand to three thousand tpy. In 2010, PGE has sought a renegotiation of its permit which may result in a different SO_2 reduction schedule.

Non-road sources were also a large source of SO_2. Since 2005, the Northwest is getting lower Sulfur content diesel and gasoline.

5.6.6 SO_2 Modeling

There is no SO_2 modeling available for this report in Oregon. The new SO_2 rules may require monitoring around large sources. Boardman is by far the largest single SO_2 emitter and future modeling may be required.

5.6.7 SO_2 Current Network

ODEQ currently only monitors for SO_2 at Portland SE Lafayette (41-051-0080). This is the NCORE site and a trace level monitor is used.

5.6.8 SO_2 Redundancy

Only one site.

5.6.9 SO_2 Monitoring Discussion

The new 2010 SO_2 monitoring rule in 40 CFR Parts 50 and 58 will require ODEQ or Southwest Washington Clean Air Agency (SWCAA) to install one monitor at maximum SO_2 concentration sites in the Portland/Vancouver CBSA. ODEQ will also have to continue operating the NCORE trace SO_2 monitor. EPA may require SO_2 modeling near large point sources which may result in modeling around PGE Boardman. Boardman's SO_2 controls may eliminate the modeling requirement. ODEQ is not anticipating SO_2 to be above or near the NAAQS.
ODEQ would like EPA, Region 10 to re-evaluate the need for maximumSO_2 monitoring in Portland in five years if the levels prove to be far below the standard.

5.7 Carbon Monoxide

In the past, Oregon had numerous CO non-attainment areas. In the last decades these areas have been re-designated as maintenance areas. ODEQ and LRAPA continued to monitor in these areas for years to track CO as a condition of the maintenance plans. The CO levels have not violated the NAAQS in almost 20 years. In the mid 2000s Oregon, LRAPA, and EPA Region 10 agreed that some of these sites could be discontinued to refocus resources on $PM_{2.5}$, air toxics, and real time reporting. Oregon and LRAPA continue to maintain a minimum network to monitor CO trends.

5.7.1 CO Design Value

The 2007-2008 CO design values are far below the NAAQS. The eight hour design values are shown in Figure 5.7.1.

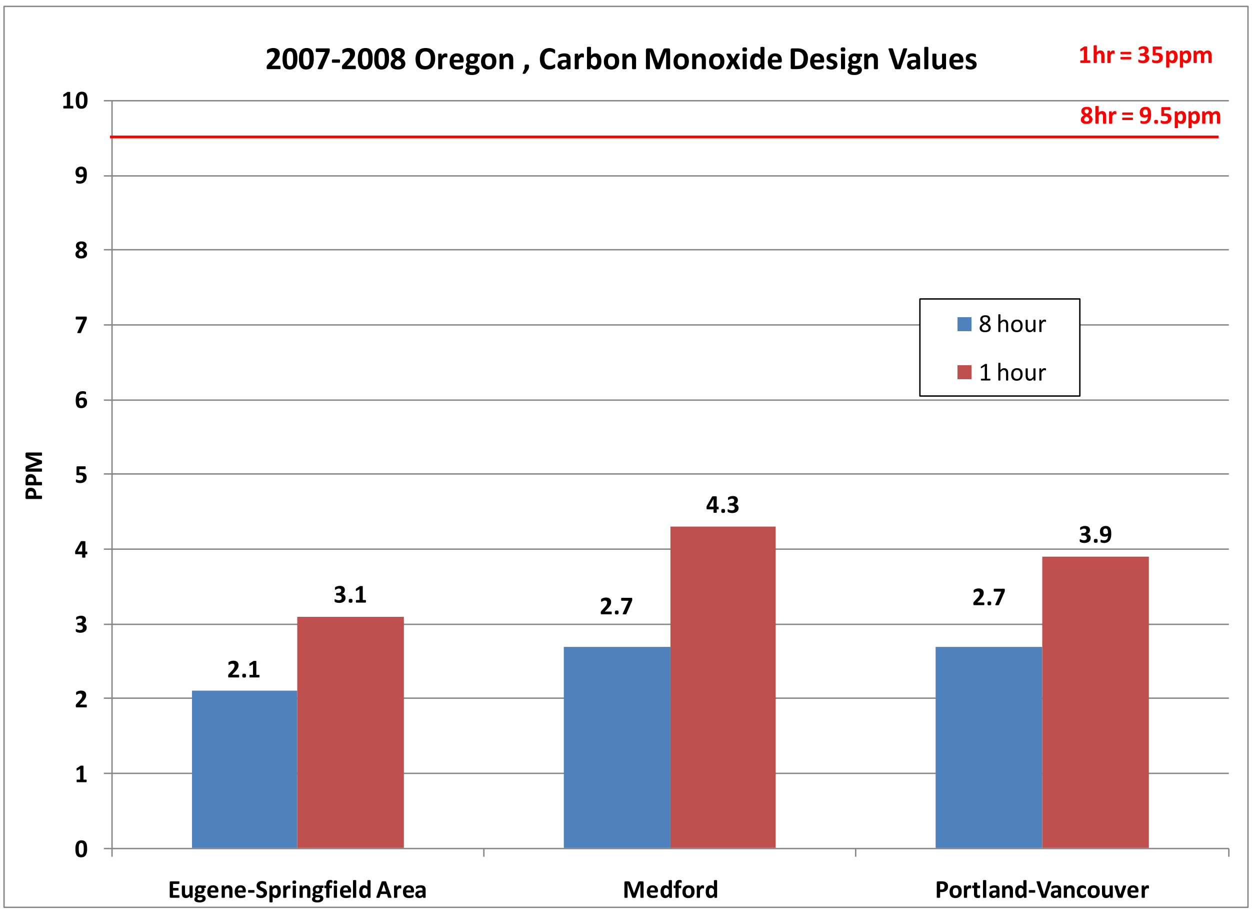

Figure 5.7.1. Oregon 2009 CO Design Values.
(second highest eight hour value)

5.7.2 CO Pollutant Trends

Carbon monoxide has been trending down over the last two decades and is well below the current NAAQS. The 1985 to 2009 trends for the annual CO second highest eight hour daily max are in Figure 5.7.2.

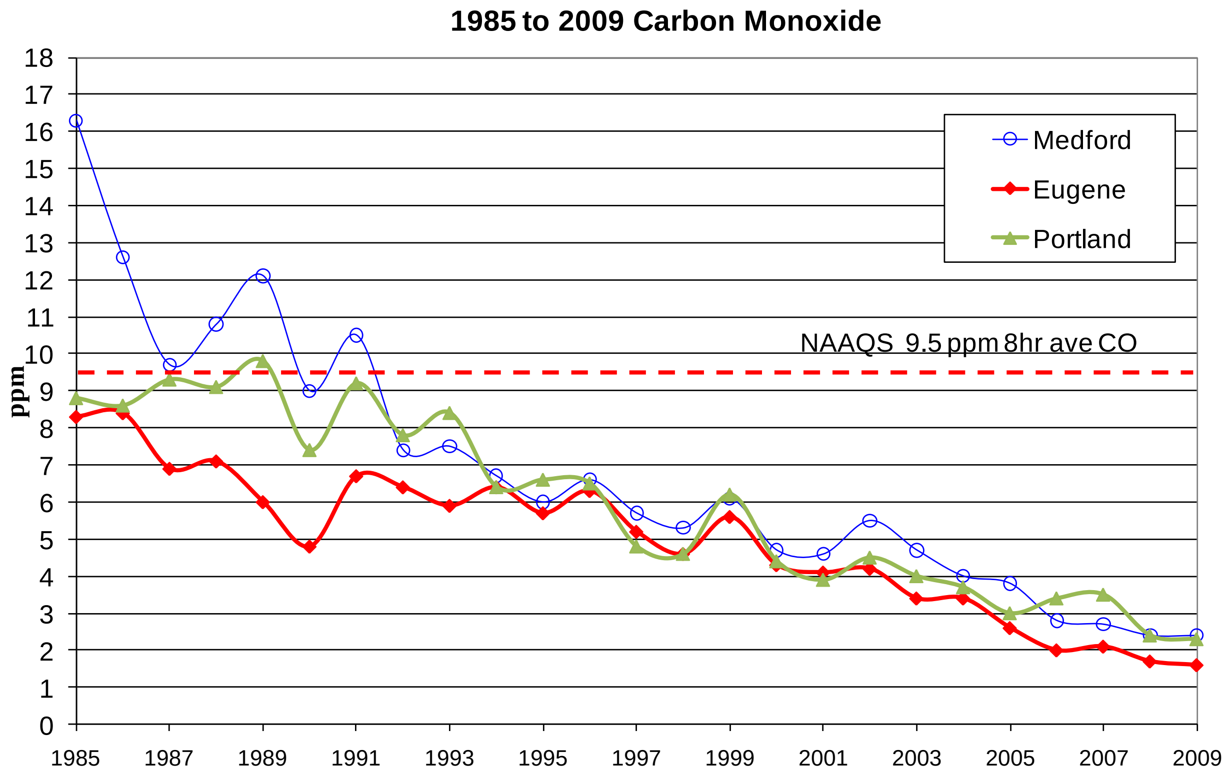

Figure 5.7.2. Carbon monoxide trends

(Annual second highest eight hour average daily maximum)

5.7.3 CO Regional Levels

Carbon monoxide levels have dropped regionally as well as across the country to levels well below the current NAAQS.

5.7.4 CO Emission Inventory

2005 emission inventory is the latest complete year available for Oregon. The CO inventory shows 40% of emissions come from On-road mobile sources and the majority of emissions are from the Portland metro area, followed by the Willamette Valley. Lane and Marion Counties dominate the Willamette Valley because they contain Eugene/Springfield and Salem/Kaiser respectively. Area sources comprise the next sector and this is primarily from wood combustion. Figures 5.7.3 and 5.7.4 show the 2005 emission inventories by source category and by county.

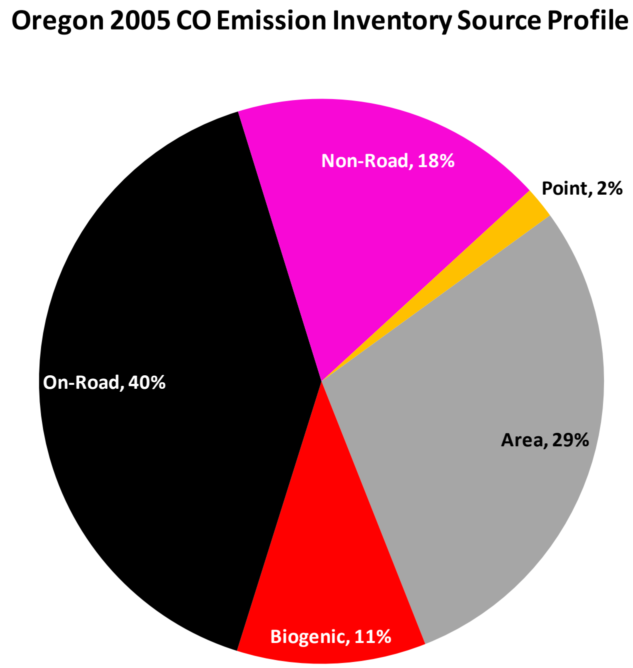

Figure 5.7.3. 2005 CO emission inventory by source category.

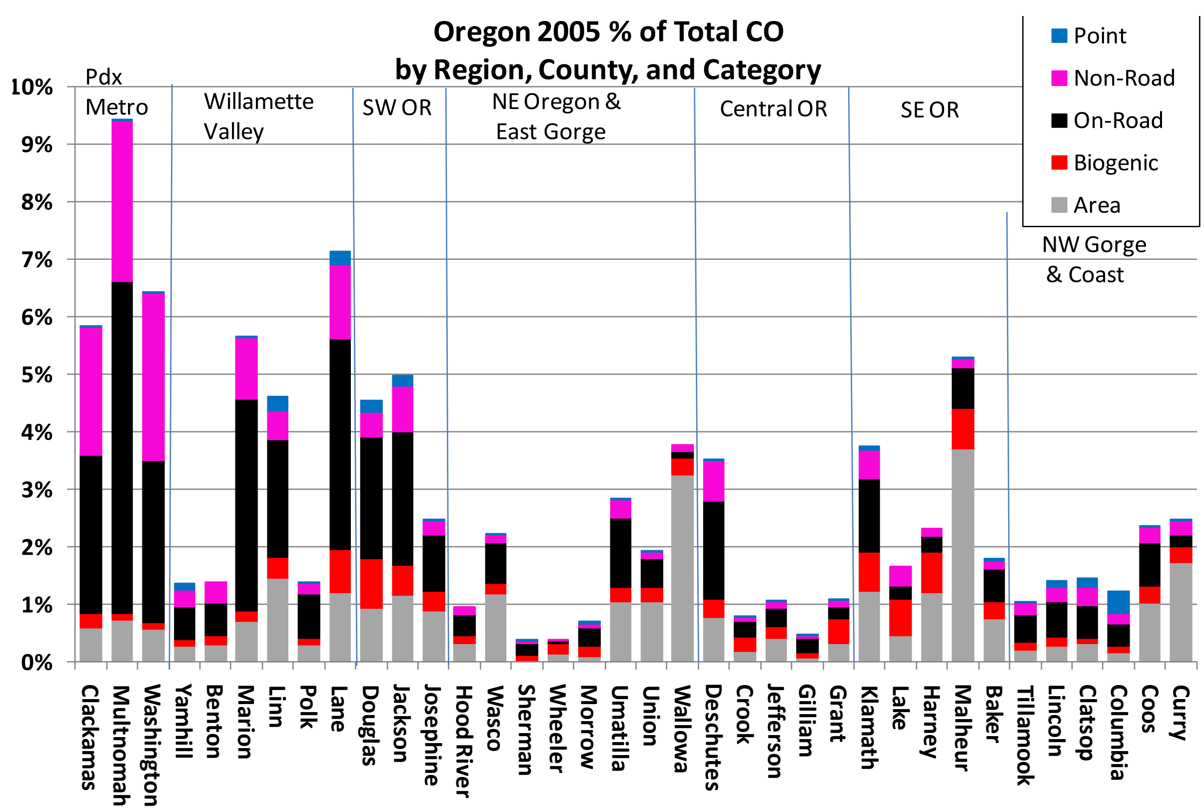

Figure 5.7.4. 2005 emission inventories by source category and by county.

5.7.5 CO Emission Source Removal

Oregon's Low Emission Vehicle program is focusing its efforts on requiring new vehicles to have 35mpg in the next five years. Recent federal efforts to raise fuel standards may eclipse Oregon's efforts.

Heat Smart will result in cleaner burning woodstoves which should reduce CO.

5.7.6 Current CO Monitoring Network

In 2004, Oregon reduced our CO network to four sites, one neighborhood "trace CO" site at Portland SE Lafayette (NCORE), one urban maximum concentration site at Portland, SW 3rd Avenue, one suburban maximum concentration site at Medford, Rogue Valley Mall, and one population site at Eugene, Lane Community College. ODEQ and LRAPA use the non-trace sites for trending. The CO site map is shown in Figure 5.7.5. CO sites are the red triangles.

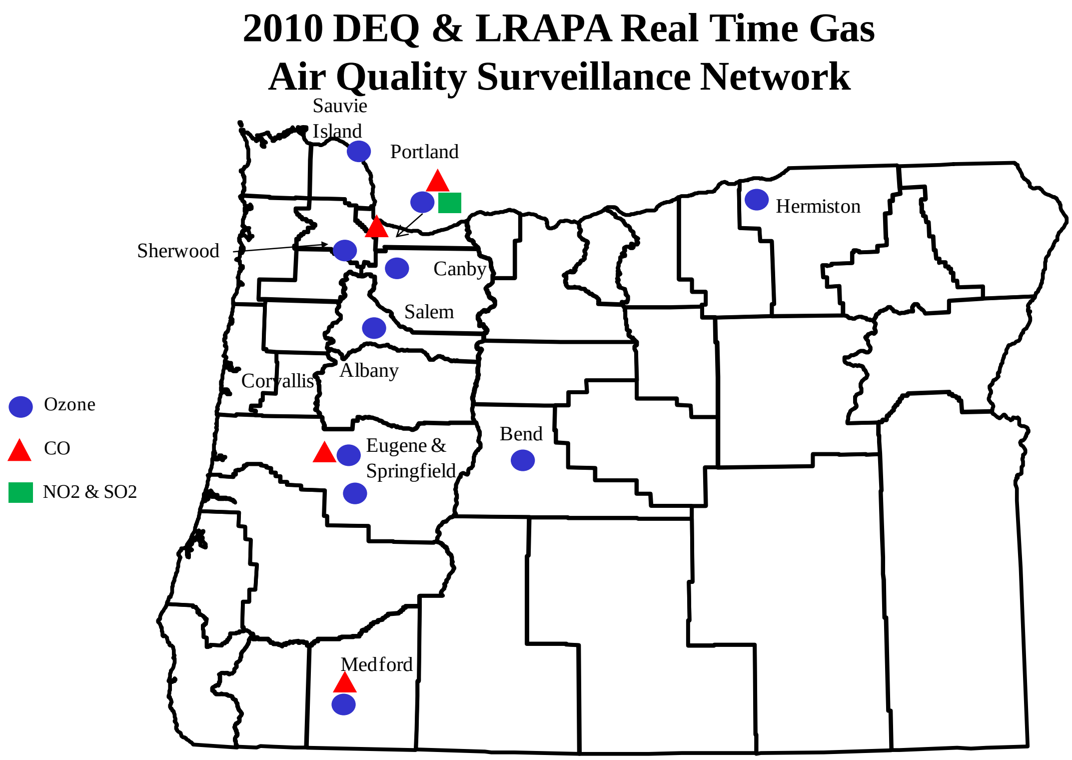

Figure 5.7.5. ODEQ and LRAPA's Ozone, CO, SO2, and NO2 monitoring network map.

5.7.7 CO Monitoring Network Redundancy

There are no redundant sites as CO is a very localized pollutant and Oregon's sites are mostly in different cities.

5.7.8 CO Monitoring Discussion

Carbon monoxide levels have dropped dramatically over the last two decades and the need to monitor CO is currently at a minimum. The remaining CO sites in Oregon are long term sites which continue to track CO's decline. Other uses for CO data, such as a surrogate for air toxics have not been thoroughly explored and may not be fruitful. The remaining non-NCORE CO sites are of low value and their resources will be used to monitor ozone, $PM_{2.5}$, or air toxics.

Medford Rogue Valley Mall, Portland Postal Building, and Eugene LCC will all be discontinued in 2010. The NCORE trace CO monitor will continue to operate indefinitely.

5.8 Air Toxics

Out of the 188 air toxics listed in Title III of the Clean Air Act, EPA selected 33 as the toxics of concern in the nation's air. Of these, ODEQ identified air toxics of concern in Oregon which include 17 compounds, diesel particulate, and a group of 32 Polycyclic Aromatic Hydrocarbons collectively known as PAHs. The compounds can be separated into categories based on their collection method.

Table 5.8.1 lists the Oregon compounds of concern. All of these substances, except Acrolein, are known or suspected to cause cancer.

Table 5.8.1. ODEQ Air Toxics of Concern

Volatile Organic Carbons (VOC)	Carbonyls	Metals	PAH	Other
1,3-Butadiene	Acetaldehyde	Arsenic	15 PAH	Diesel PM
Benzene	Acrolein	Cadmium	Naphthalene	
1,4-Dichlorobenzene	Formaldehyde	Hexavalent Chrome		
Ethylbenzene		Lead		
Methylene chloride		Manganese		
Perchloroethylene		Nickel		
Trichloroethylene				

5.8.1 Benchmarks

Air Toxics don't have design values because they are not criteria pollutants and are not included in the National Ambient Air Quality Standards. EPA and Oregon DEQ have each developed their own health benchmarks for a one in one million risk of getting cancer. The benchmarks provide a metric for ambient monitoring concentration comparisons. The Air Toxics Ambient Benchmark Concentrations (ABC) levels are listed in Appendix E. Tables 5.8.2 and 5.8.3 show the air toxics annual averages compared to the benchmark for the latest year sampled in the last 10 years.

Table 5.8.2. VOC and Carbonyl annual averages compared to the benchmarks.

All Pollutants are in µg/m³	Latest Year	Tetrachloroethylene	1,3-Butadiene	1 4-Dichlorobenzene	Benzene	Ethyl Benzene	Methylene Chloride	Trichloroethylene	Acetaldehyde	Formaldehyde
N. Portland	2009	<0.3	**<0.2**	**0.8**	**1.1**	**0.6**	**2.6**	<0.3	**1.4**	2.1
NW Portland	2005	<0.7	**<0.2**	**<0.6**	**1.5***	**0.5**	1.4	**<0.5**	**1.7**	2.4
SW Portland	2005	<0.7	**<0.2**	**<0.6**	**-**	**<0.4**	0.4	**<0.5**	**1.5**	2.2
SE Portland	2005	<0.7	**<0.2**	**<0.6**	**1.6**	**0.4**	1.2	**<0.5**	**1.6**	2.2
Beaverton	2005	<0.7	**<0.2**	**<0.6**	**-**	**<0.4**	1.3	**<0.5**	**1.3**	1.6
Vancouver WA	2005	<0.7	**<0.2**	**<0.6**	**-**	**<0.4**	0.5	**<0.5**	**1.5**	2.0
Salem	2009	<0.3	**<0.2**	**<0.3**	**0.8**	**0.9**	1.9	<0.3	**1.1**	1.5
Eugene	2008	<0.3	**<0.2**	**<0.3**	**0.8**	**0.4**	1.5	<0.3	**1.2**	1.5
Medford	2009	<0.7	**<0.2**	**<0.3**	**1.5**	**0.7**	1.9	<0.3	**1.8**	2.2
La Grande	2009	<0.7	**<0.4**	**<0.3**	**0.8**	**0.4**	1.1	<0.3	**1.4**	1.8
ODEQ Benchmark		**35**	**0.03**	**0.09**	**0.13**	**0.4**	**2.1**	**0.5**	**0.45**	**3**

Pollutants over the benchmark are bolded

*2004 data used for benzene because 2005 was an incomplete year.

Table 5.8.3. PM_{10} metals, TSP $Cr6^{+}$, and Naphthalene annual averages compared to the benchmarks.

All Pollutants are in ng/m³	Latest Year	Arsenic (PM10)	Cadmium (PM10)	Lead (PM10)	Manganese PM10	Nickel (PM10)	Hexavalent Chrome (TSP)	Naphthalene
N. Portland	2009	**1.1**	**1.5**	5	9	< 1	<0.04	45
NW Portland	2005	**1.0**	**0.6**	7	43	**4**	<0.04	-
SW Portland	2005	**1.1**	**0.9**	6	20	**2**	<0.04	-
SE Portland	2005	**1.4**	0.4	6	7	**2**	<0.04	-
Beaverton	2005	**1.1**	0.4	3	4	< 1	<0.04	-
Vancouver WA	2005	**1.1**	**0.6**	4	8	1	<0.04	-
Salem	2009	**0.8**	0.2	3	4	< 1	<0.04	47
Eugene	2008	**0.6**	0.1	2	5	< 1	-	-
Medford	2009	**0.6**	0.1	2	5	< 1	-	65
La Grande	2009	0.1	<0.1	< 1	5	< 1	<0.04	38
ODEQ Benchmark		**0.2**	**0.6**	**500**	**200**	**2**	**0.08**	**300**

Pollutants ≥ the benchmark are bolded

5.8.2 Air Toxics Pollutant Trends

ODEQ has monitored air toxics continuously in Portland since 1999, Eugene since 2002, and La Grande since 2004. The Portland Air Toxics trends for air toxics of concern in Oregon are in Tables 5.8.4 through 5.8.9. Several air toxics have annual averages which are often over the minimum detection limits (MDL) and the benchmarks. They are Benzene, Acetaldehyde, Formaldehyde, Arsenic, and Cadmium. The level of other compounds are uncertain because they are below the MDL. This is only of concern when the benchmark is also below the MDL. These compounds are 1,3-Butadiene, 1,4-Dichlorobenzene, Trichloroethylene, and many PAHs.

Table 5.8.4. N. Portland annual average trends for VOC, Carbonyls, & PAH Air toxics of concern.

All Pollutants are in $\mu g/m^3$	Tetrachloroethylene	1,3-Butadiene	1 4-Dichlorobenzene	Benzene	Ethyl Benzene	Methylene Chloride	Trichloroethylene	Acetaldehyde	Formaldehyde	Naphthalene
2001	<0.7	<0.2	0.6	1.5	0.10	0.08	<0.5	2.1	2.6	-
2002	<0.7	<0.2	<0.6	1.6	0.07	0.13	<0.5	1.9	2.8	-
2003	<0.7	<0.2	<0.6	1.5	0.10	0.08	<0.5	2.0	4.2	-
2004	<0.5	<0.2	<0.6	1.6	0.07	0.06	<0.5	1.7	2.9	2
2005	<0.7	<0.2	<0.6	-	0.07	0.04	<0.5	1.5	2.2	34
2006	<0.7	<0.2	<0.6	1.2	<0.04	0.05	<0.5	1.5	1.9	51
2007	<0.7	<0.4	<0.6	1.2	<0.04	0.07	<0.5	1.4	2.0	50
2008	<0.7	<0.2	<0.6	0.8	0.05	0.24	<0.5	1.4	1.9	33
2009	<0.4	<0.2	0.8	1.1	0.06	0.26	<0.3	1.4	2.1	45
ODEQ Benchmark	35	0.03	0.09	0.1	0.4	2.1	0.5	0.45	3	300

Table 5.8.5. N. Portland annual average trends for PM_{10} air toxic metals of concern. Hexavalent Chrome is collected as Total Suspended Particles not PM_{10}.

All Pollutants are in ng/m^3	Arsenic (PM10)	Cadmium (PM10)	Hexavalent Chrome (TSP)	Lead (PM10)	Manganese (PM10)	Nickel (PM10)
2005	**1.8**	2.4	<0.04	**12**	15	**<0.8**
2006	**1.7**	2.0	-	**7**	12	**<1.0**
2007	**1.4**	1.4	-	**7**	12	**<1.0**
2008	**1.4**	1.3	<0.04	**5**	11	1.7
2009	**1.1**	1.5	<0.04	**5**	9	**<1.0**
ODEQ Benchmark	0.2	0.6	0.08	500	200	2.0

Table 5.8.6. Eugene annual average trends for VOC, Carbonyls, and PAH Air toxics.

All Pollutants are in $\mu g/m^3$	Tetrachloroethylene	1,3-Butadiene	1 4-Dichlorobenzene	Benzene	Ethyl Benzene	Methylene Chloride	Trichloroethylene	Acetaldehyde	Formaldehyde
2002	<0.2	<0.2	<0.6	1.6	0.8	1.1	<0.5	1.6	2.5
2003	<0.2	<0.2	<0.6	1.1	2.8	3.3	<0.5	1.4	4.3
2004	<0.2	<0.2	<0.6	1.4	1.2	49.6	<0.5	1.3	2.8
2005	<0.2	<0.2	<0.6	1.6	0.7	1.3	<0.5	1.5	1.9
2006	<0.2	<0.2	<0.6	1.0	<0.4	2.5	<0.5	1.4	1.8
2007	<0.4	<0.4	<0.6	1.1	<0.4	1.3	<0.5	1.6	1.5
2008	<0.2	<0.2	<0.3	0.8	<0.4	1.5	<0.5	1.2	1.5
ODEQ Benchmark	35	0.03	0.09	0.13	0.4	2.1	0.5	0.45	3

Table 5.8.7. Eugene annual average trends for PM10 air toxic metals.

All Pollutants are in ng/m^3	Arsenic (PM10)	Cadmium (PM10)	Lead (PM10)	Manganese (PM10)	Nickel (PM10)
2005	**0.7**	**<0.1**	**2.3**	**5.7**	**<1**
2006	0.8	**0.1**	**2.5**	**5.4**	**<1**
2007	**0.6**	**<0.1**	**1.7**	**5.2**	**<1**
2008	**0.5**	**<0.1**	**1.9**	**5.1**	**<1**
ODEQ Benchmark	0.2	0.6	500	200	2.0

Table 5.8.8. La Grande annual average trends for VOC, Carbonyls, and PAH Air toxics of concern.

All Pollutants are in µg/m³	Tetrachloroethylene	1,3-Butadiene	1 4-Dichlorobenzene	Benzene	Ethyl Benzene	Methylene Chloride	Trichloroethylene	Acetaldehyde	Formaldehyde
2004	<0.5	<0.2	<0.6	0.8	<0.4	<0.3	**<0.5**	**1.7**	**3.2**
2005	**<0.7**	**<0.2**	**<0.6**	**0.6**	**<0.4**	***0.5***	**<0.5**	**1.8**	**2.6**
2006	**<0.7**	**<0.2**	**<0.6**	**0.5**	**<0.4**	**<0.4**	**<0.5**	**1.8**	**2.7**
2007	**<0.7**	**<0.4**	**<0.6**	**0.8**	**<0.4**	**<0.4**	**<0.5**	**1.4**	**2.1**
2008	**<0.3**	**<0.2**	**<0.3**	**0.6**	**<0.2**	***0.9***	**<0.3**	**1.3**	**1.7**
2009	**<0.3**	**<0.2**	**<0.3**	**0.8**	***0.4***	***1.1***	**<0.3**	**1.4**	**1.8**
Benchmark	35	0.03	0.09	0.13	0.4	2.1	0.5	0.45	3

Table 5.8.9. La Grande annual average trends for air toxic metals of concern.

All Pollutants are in ng/m³	Arsenic (PM10)	Cadmium (PM10)	Lead (PM10)	Manganese (PM10)	Nickel (PM10)	Naphthalene
2005	*0.33*	**<0.1**	*1.6*	***5.7***	**<1**	-
2006	*0.23*	**<0.1**	*3*	***10.2***	**<1**	-
2007	***0.19***	**<0.1**	***1***	***7.9***	**<1**	-
2008	***0.21***	**<0.1**	***1***	***4.8***	**<1**	-
2009	***0.14***	**<0.1**	***1***	***5***	**<1**	
Benchmark	0.2	0.6	500	200	2.0	300

5.8.3 Meteorology related to Air Toxics

The state meteorology is discussed in the $PM_{2.5}$ and ozone sections.

The Portland Metro area Meteorology is dominated by wind flow along the Columbia and Willamette rivers in the central and east Portland Metro area. The west side of the Metro area is in the Tualatin Valley and is separated from the east side by the West Hills. The Tualatin Valley has its own unique air flow patterns. This is illustrated in the Figures 5.8.1 and 5.8.2 wind fields created by CALMET model for Portland Metro Area.

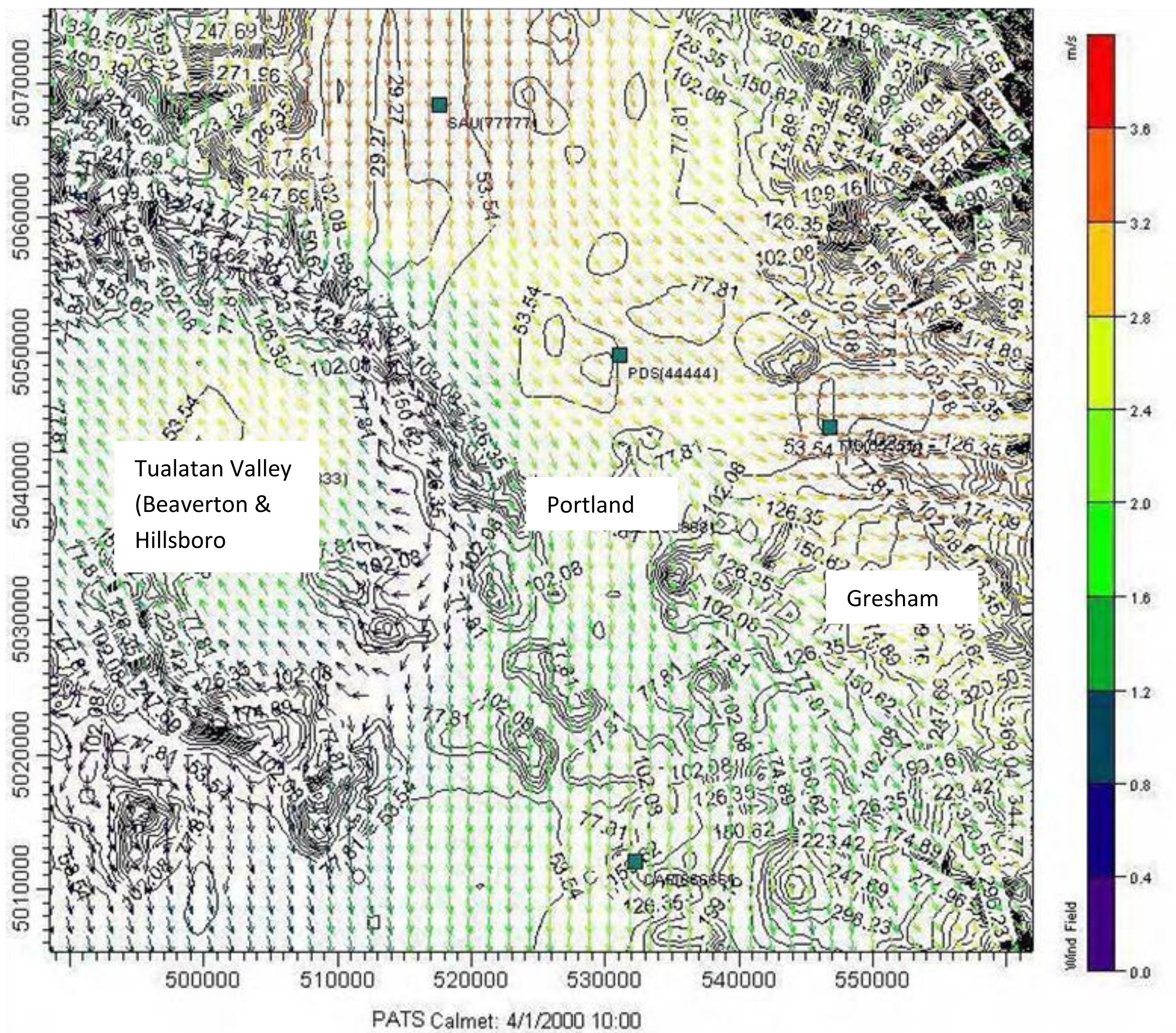

Figure 5.8.1. CALMET model wind field for Portland Metro Area scenario 1.
Wind field shows two separate airsheds. East Portland Metro and Tualatin Valley in West Metro Area.

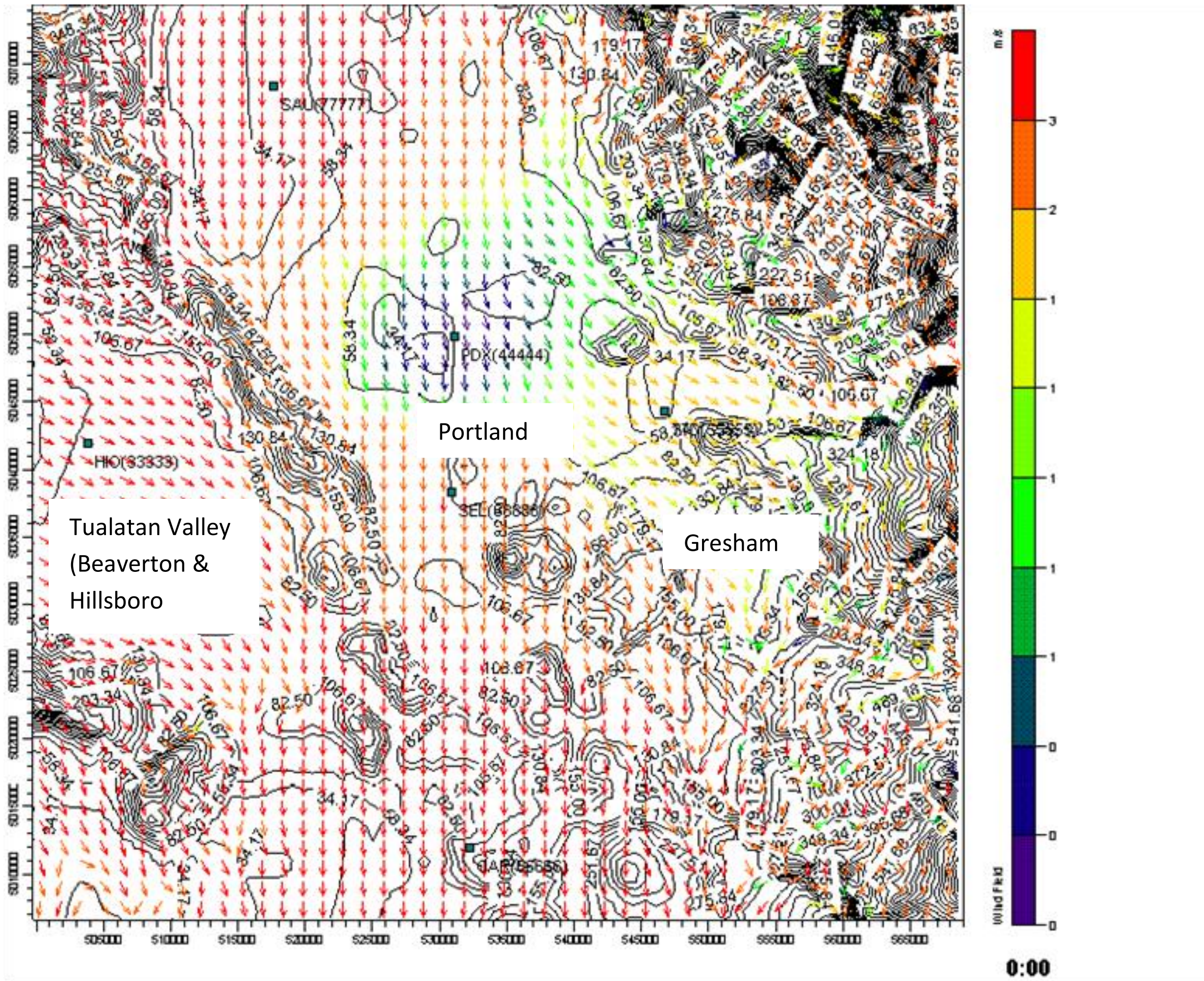

Figure 5.8.2. CALMET Wind field for Portland Metro Area, scenario 2.
Wind field shows two separate airsheds. East Portland Metro and Tualatin Valley in West Metro Area.

5.8.4 Air Toxics Emission Inventory

Air toxics are emitted across the state and from different sources. The emission inventory helps isolate where these emissions are occurring and from what type of sources. The emissions were categorized by Area Source, Point Source, Non-road mobile, and On-road mobile. If a category is made up from an overwhelming sub-source that source is shown as a separate category. For example, the vast majority of Area Sources for Formaldehyde are from Biogenic sources.

2005 is the latest emission inventory year available. Table 5.8.10 lists the 2005 estimated emissions for each air toxics of concern shown in Table 5.8.1 above. Figures 5.8.3 to 5.8.10 show the emission inventories for these air toxics by county and by source category.

Table 5.8.10. Estimated 2005 emissions for air toxics of concern in Oregon.

Pollutant	Emissions (tons per year)	Pollutant Type
Acetaldehyde	1851	Carbonyl
Acrolein	955	Carbonyl
Formaldehyde	36354	Carbonyl
Arsenic	1	Metal
Cadmium	13	Metal
Lead	58	Metal
Manganese	10	Metal
Nickel	4	Metal
Naphthalene	416	PAH
15-Pah	10	PAH
1,3-Butadiene	958	VOC
1,4-Dichlorobenzene(P)	136	VOC
Benzene	5822	VOC
Ethyl Benzene	1730	VOC
Methylene Chloride	2482	VOC
Perchloroethylene	278	VOC
Trichloroethylene	477	VOC

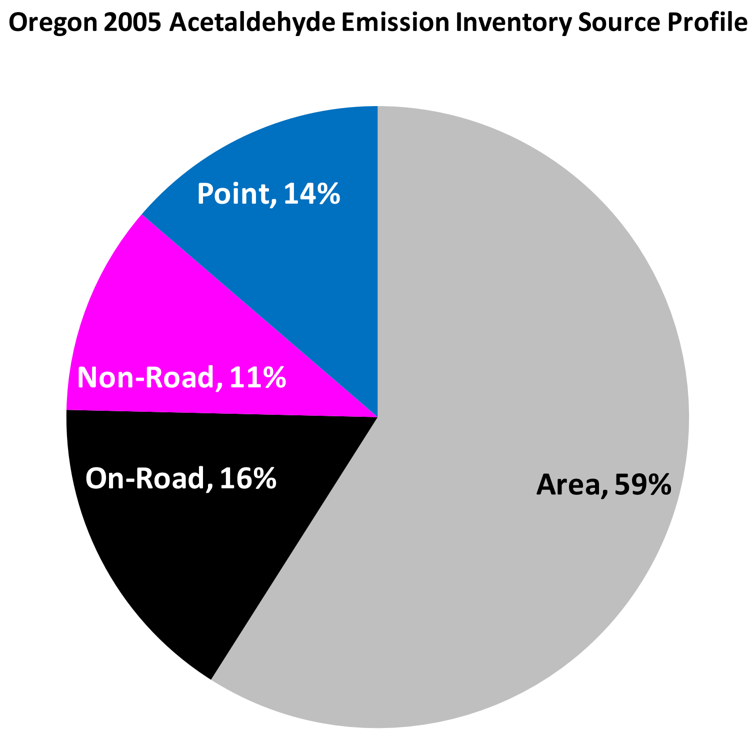

Figure 5.8.3. 2005 Acetaldehyde Emission Inventory by source category.

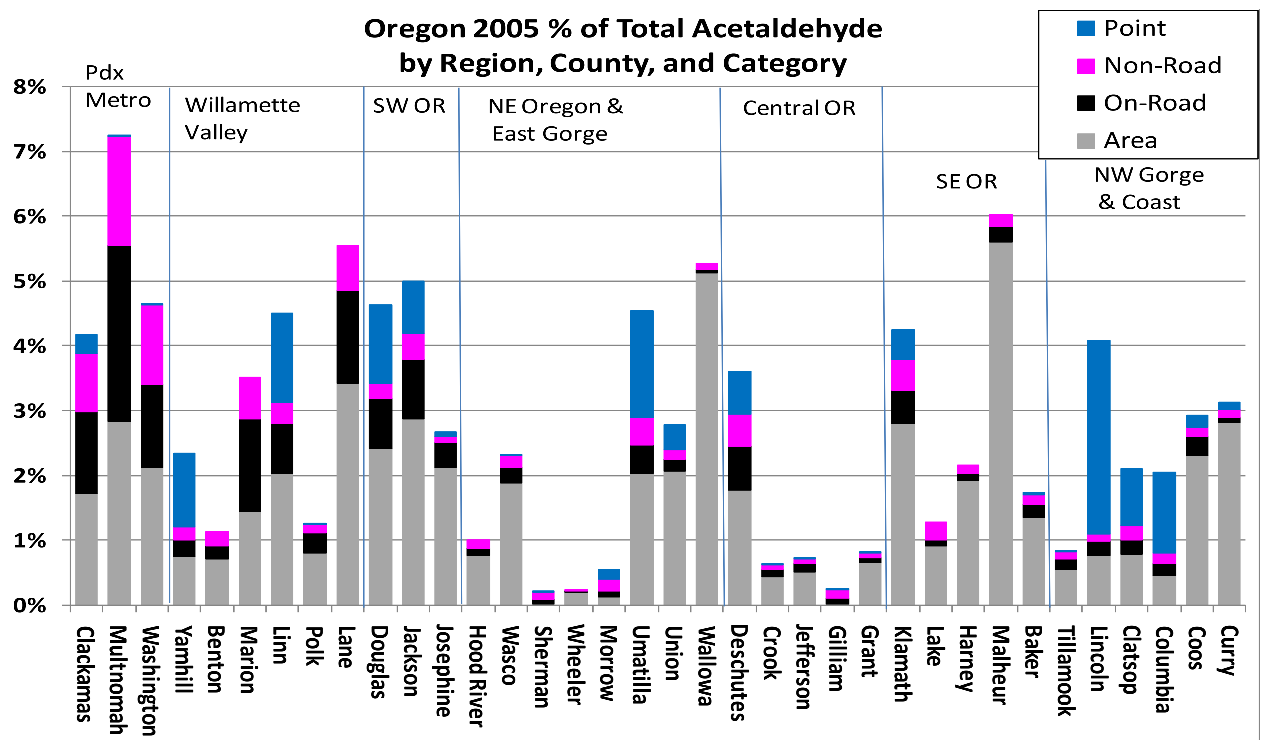

Figure 5.8.4. 2005 Acetaldehyde Emission Inventory, by source category and county.

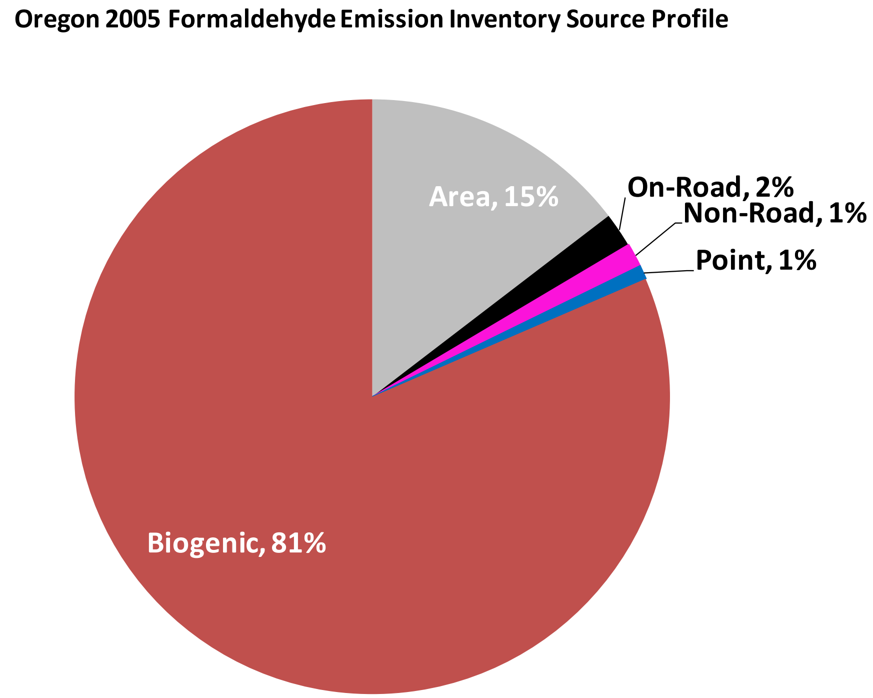

Figure 5.8.5. 2005 Formaldehyde Emission Inventory, by source category.

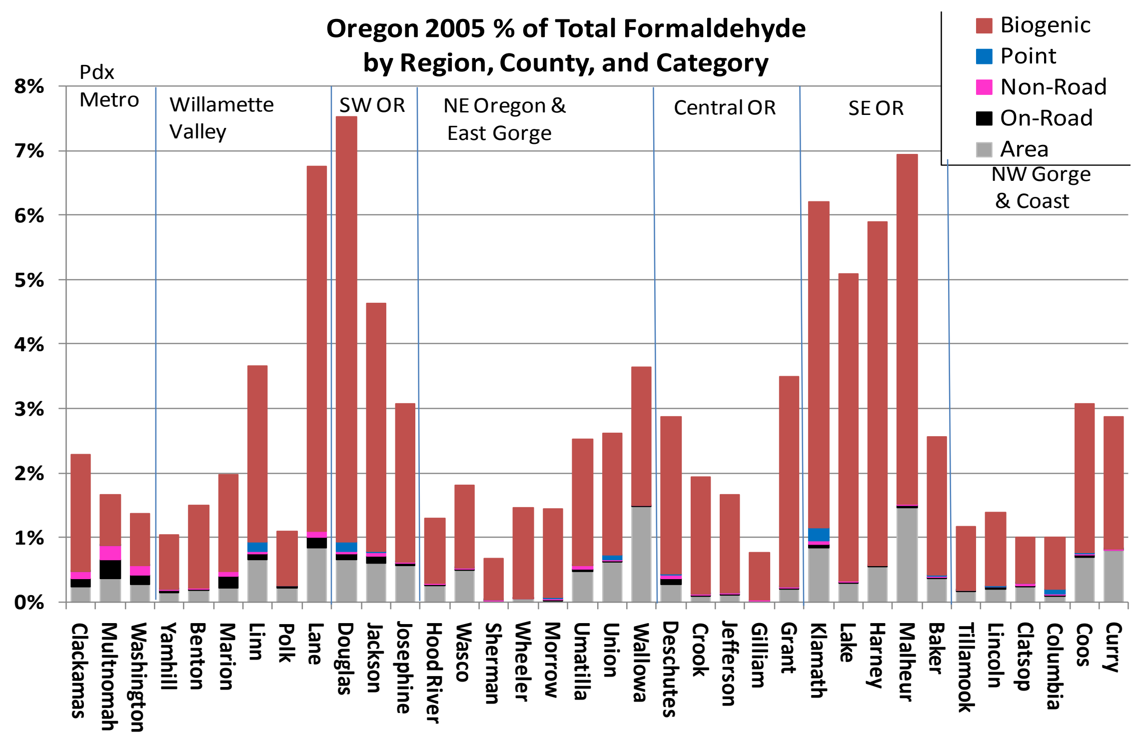

Figure 5.8.6. 2005 Formaldehyde Emission Inventory, by county and source category.

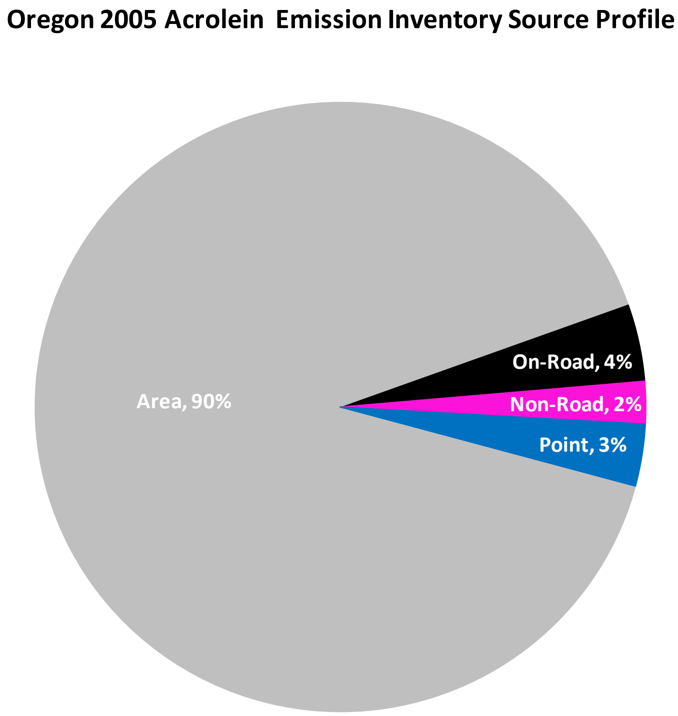

Figure 5.8.7. 2005 Acrolein Emission Inventory, by source category.

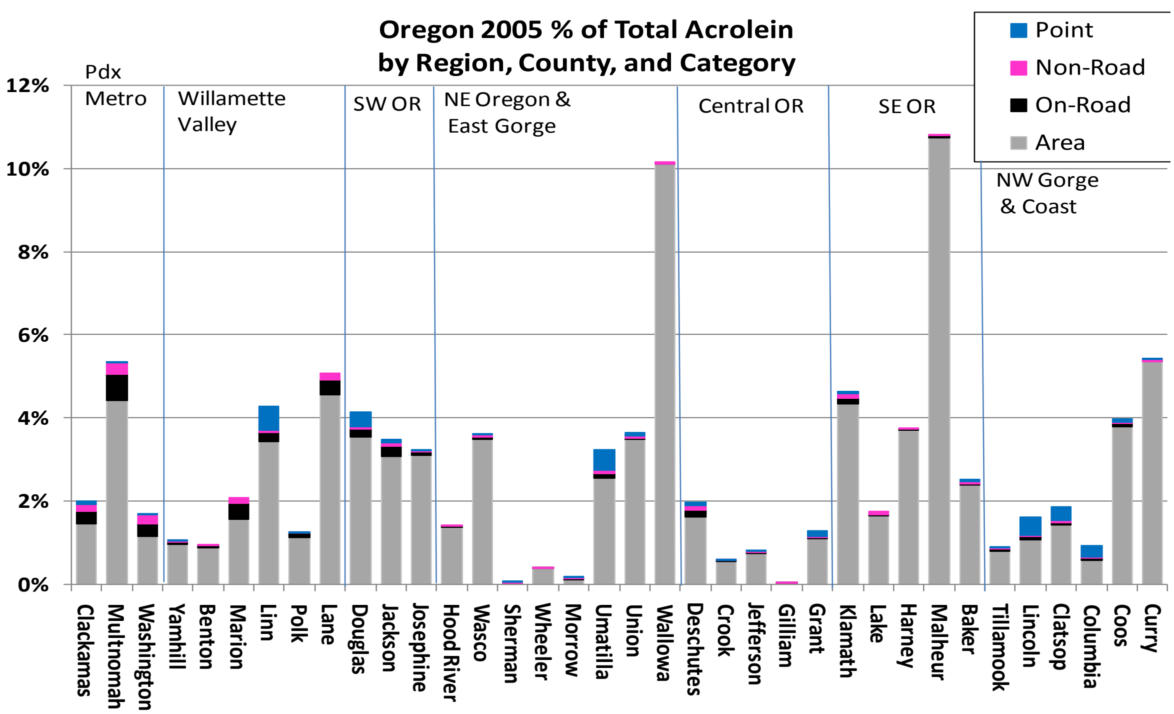

Figure 5.8.8. 2005 Acrolein Emission Inventory, source category and county.

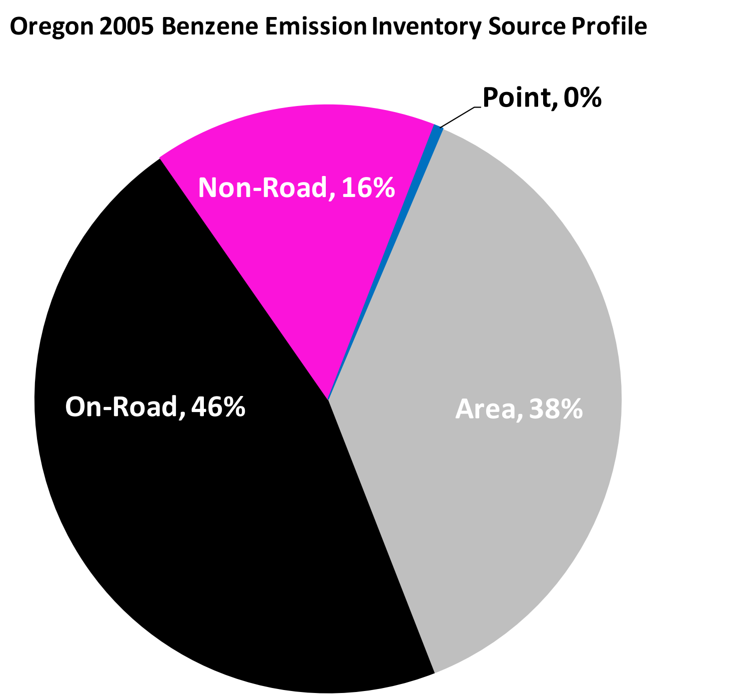

Figure 5.8.9. 2005 Benzene Emission Inventory, source category.

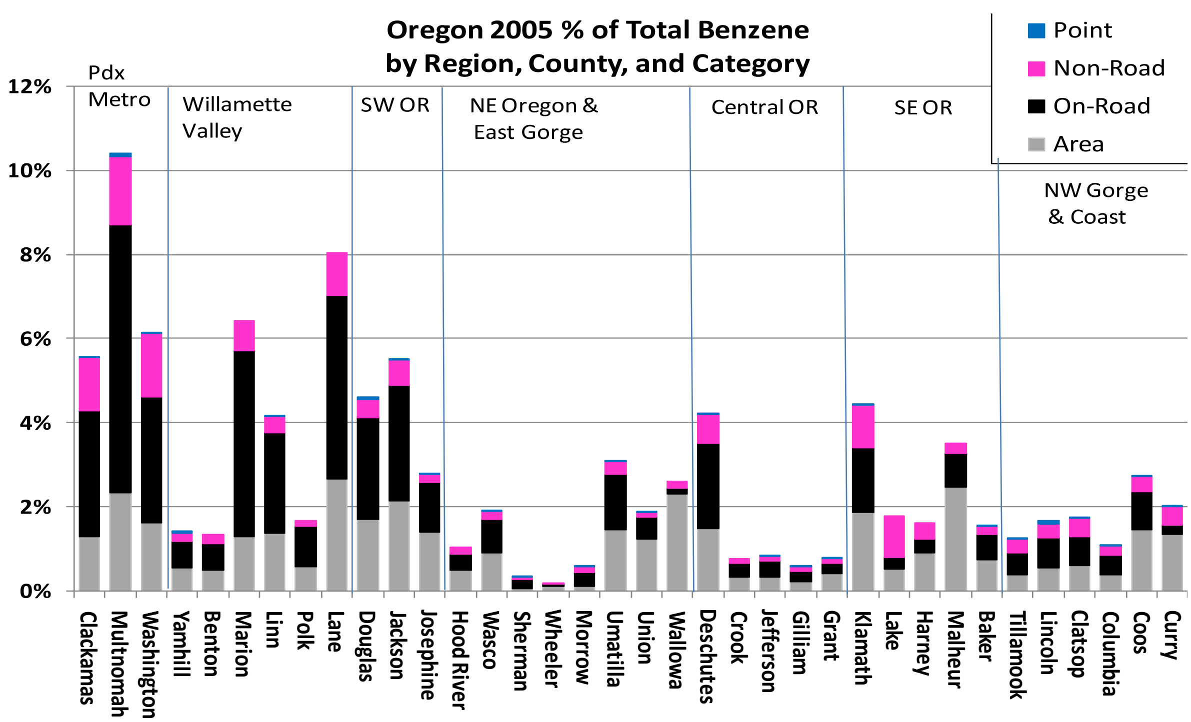

Figure 5.8.10. 2005 Benzene Emission Inventory, by source category and county.

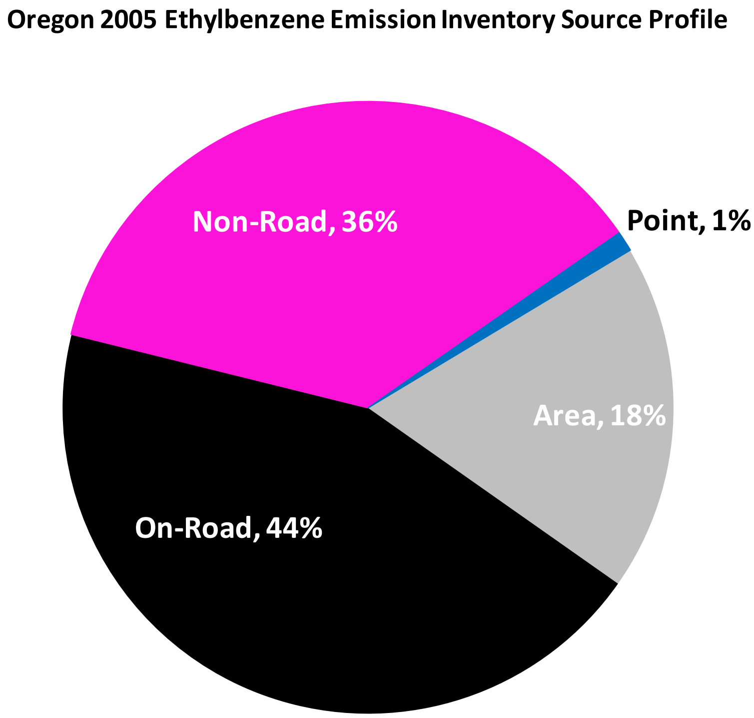

Figure 5.8.11. 2005 Ethylbenzene Emission Inventory, by source category.

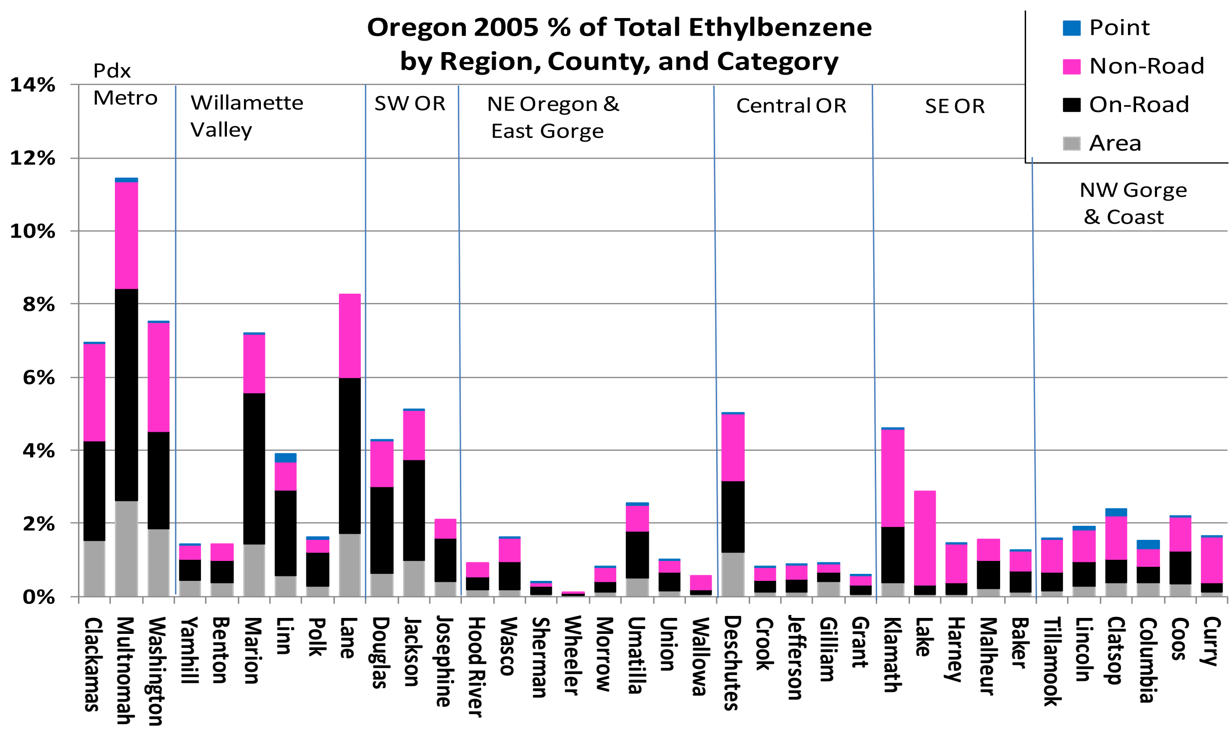

Figure 5.8.12. 2005 Ethylbenzene Emission Inventory, source category.

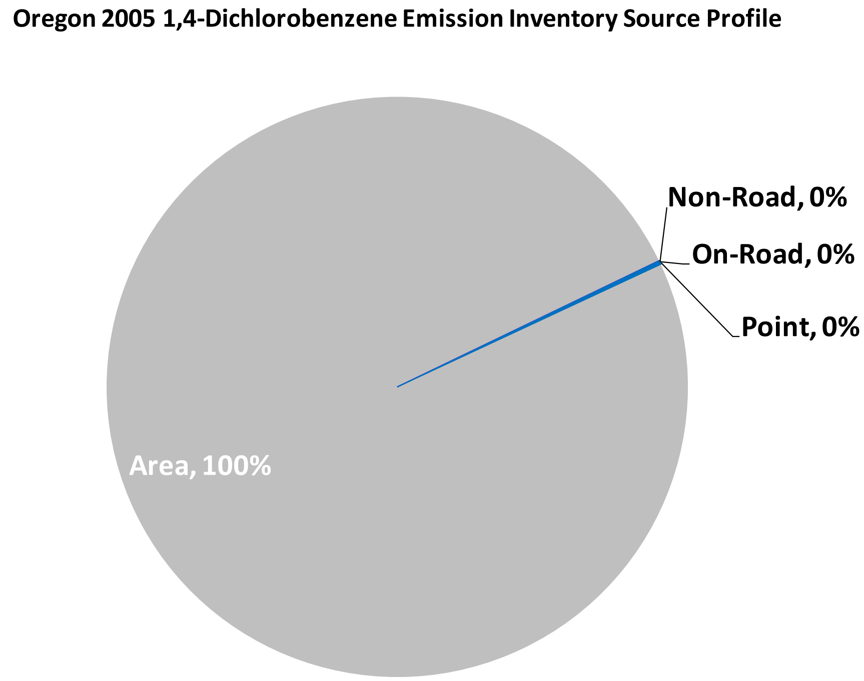

Figure 5.8.13. 2005 1,4-Dichlorobenzene Emission Inventory, by source category.

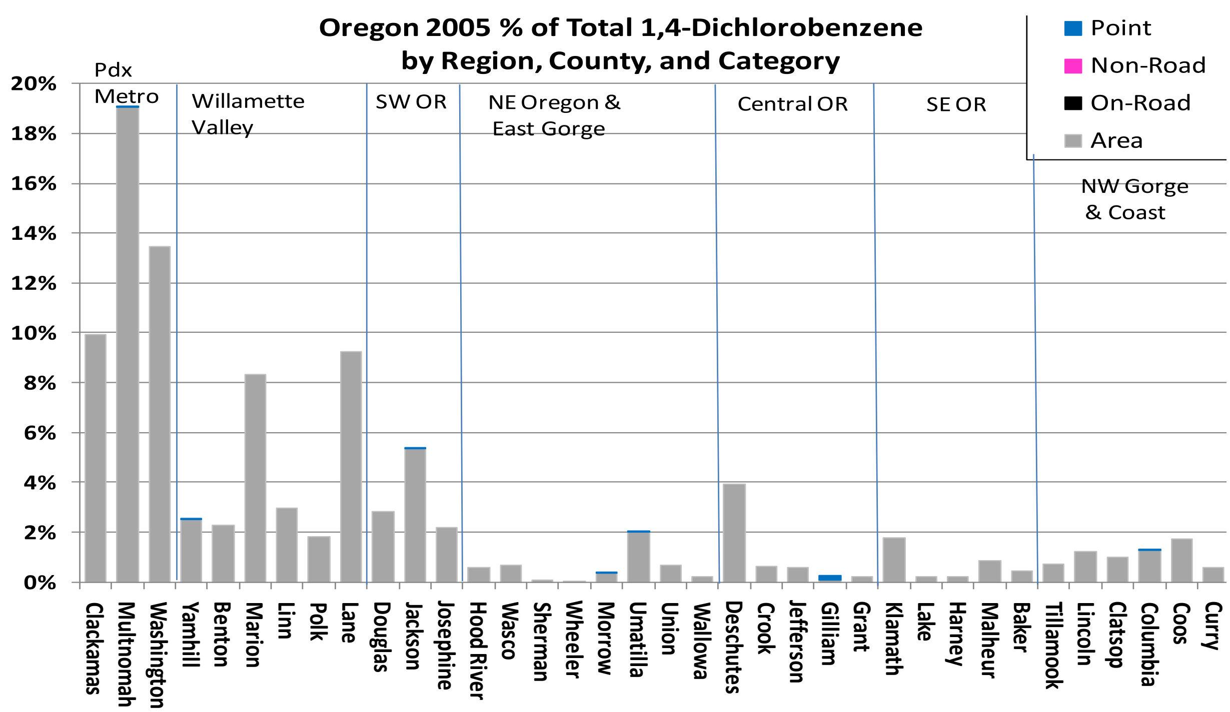

Figure 5.8.14. 2005 1,4-Dichlorobenzene Emission Inventory, source category and county.

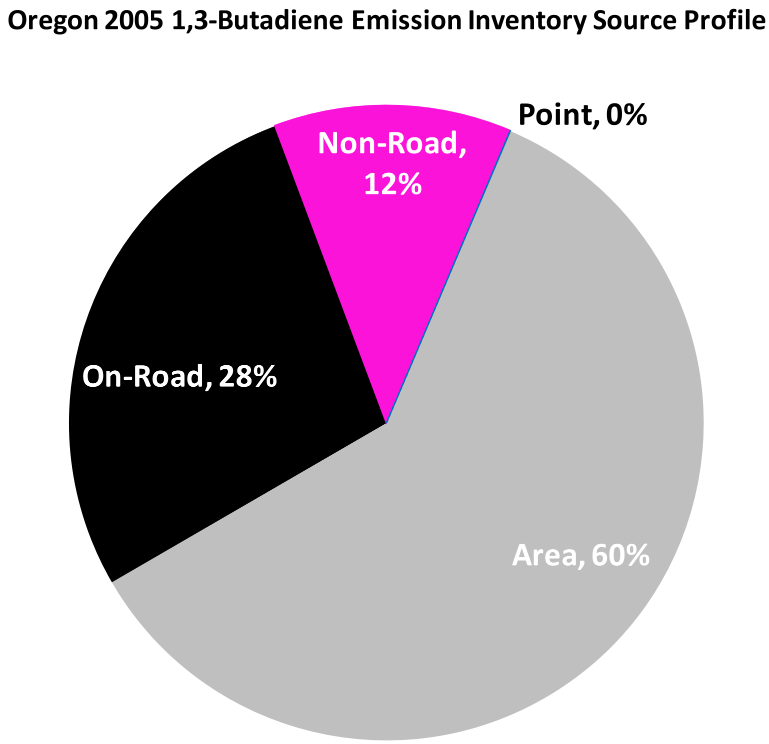

Figure 5.8.15. 2005 1,3-Butadiene Emission Inventory, by source category.

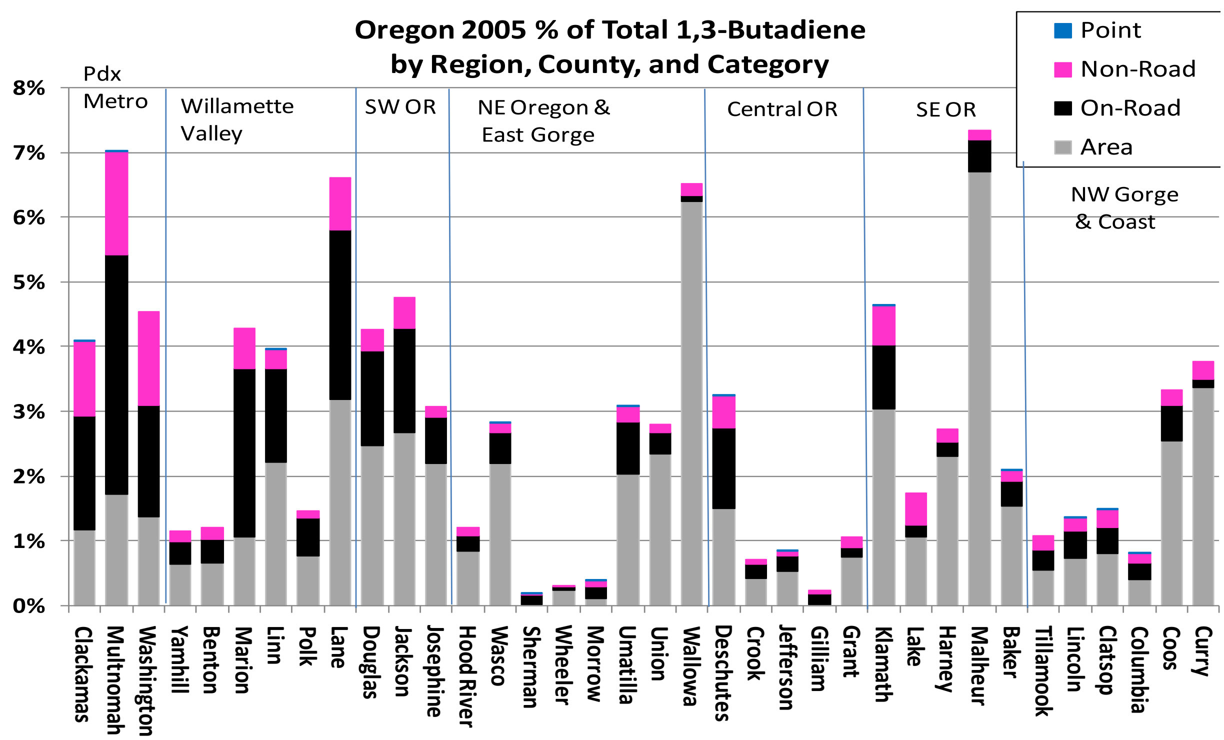

Figure 5.8.16. 2005 1,3-Butadiene Emission Inventory, source category and county.

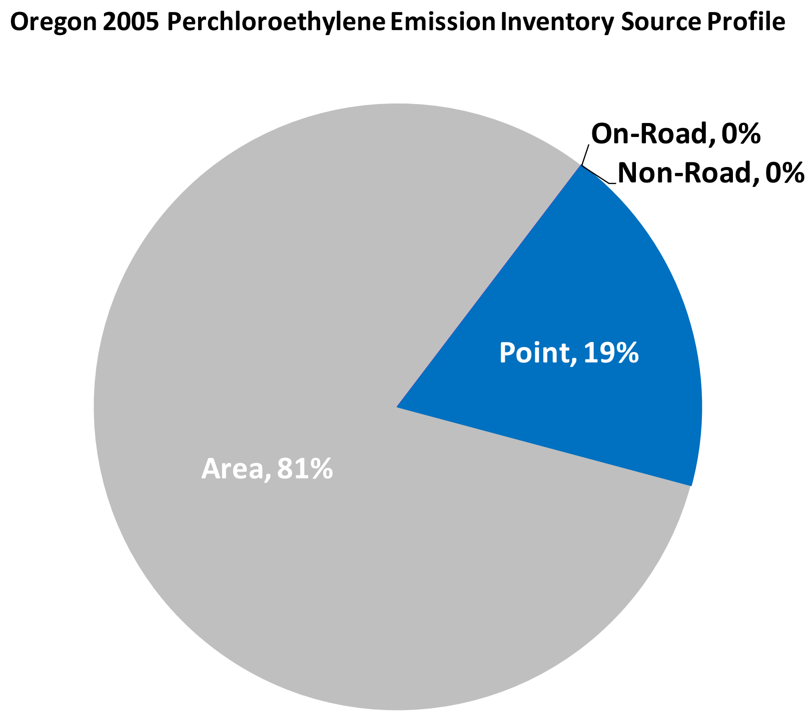

Figure 5.8.17. 2005 Perchloroethylene Emission Inventory, by source category.

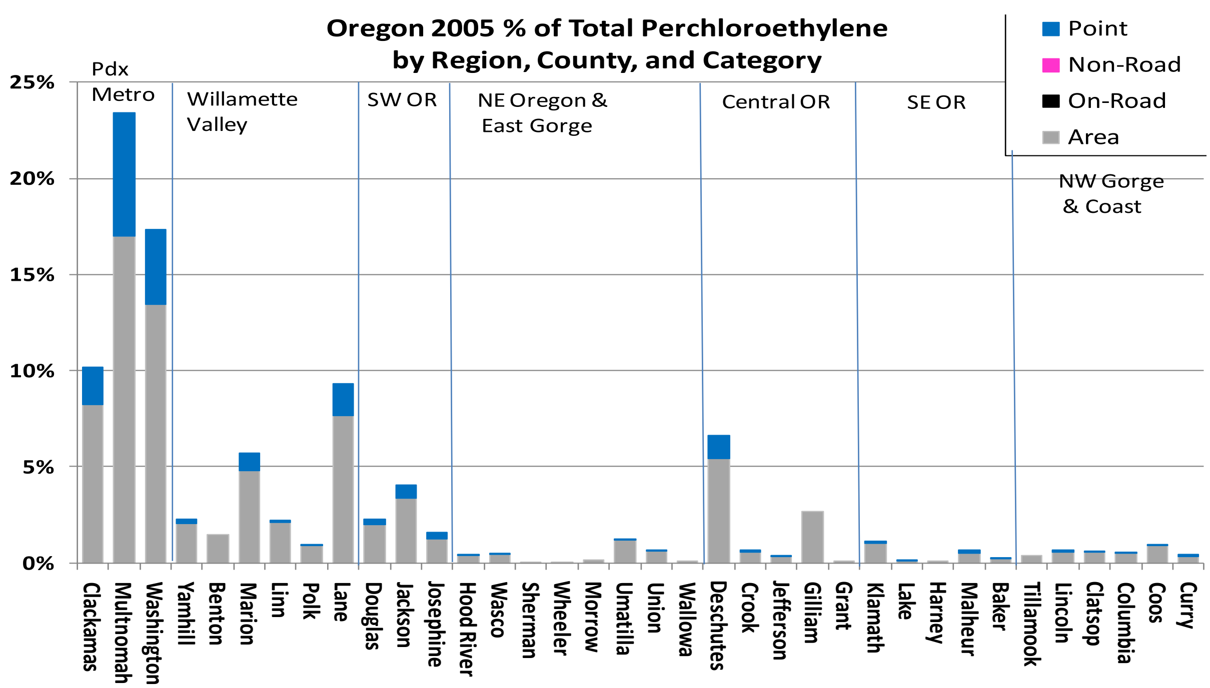

Figure 5.8.18. 2005 Perchloroethylene Emission Inventory, source category and county.

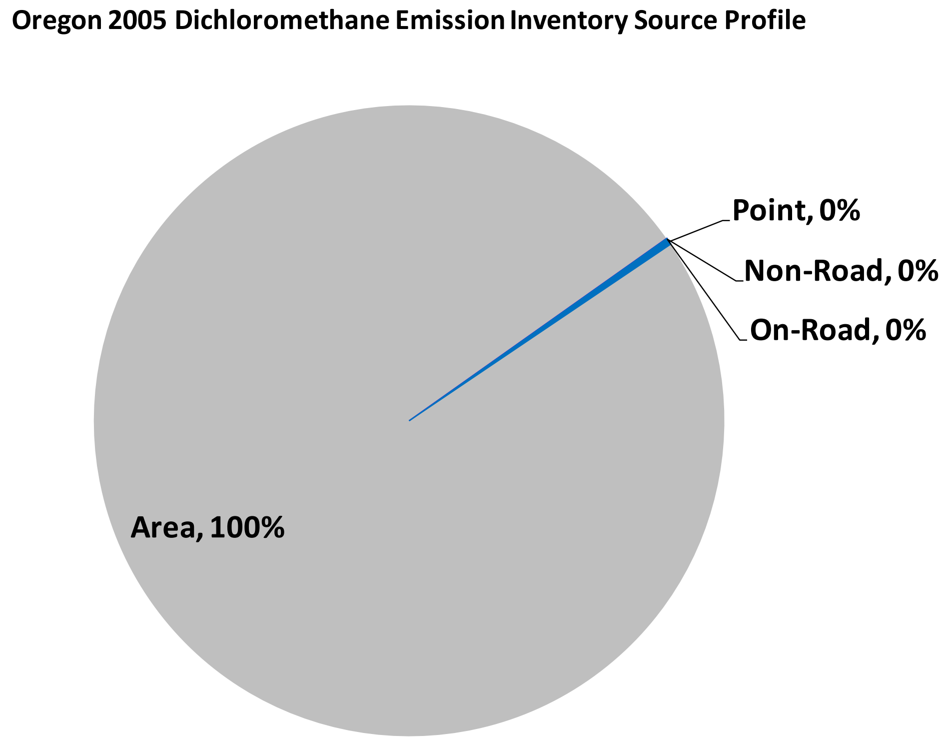

Figure 5.8.19. 2005 Dichloromethane Emission Inventory, by source category.

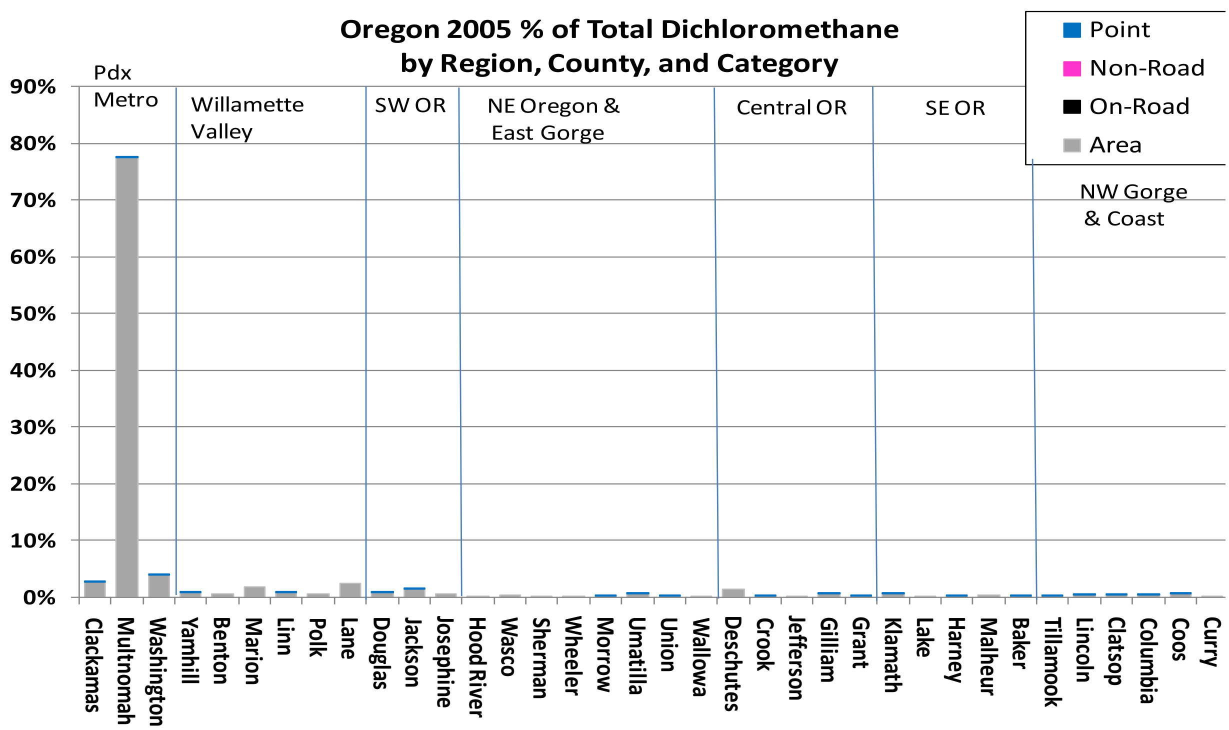

Figure 5.8.20. 2005 Dichloromethane Emission Inventory, source category and county.

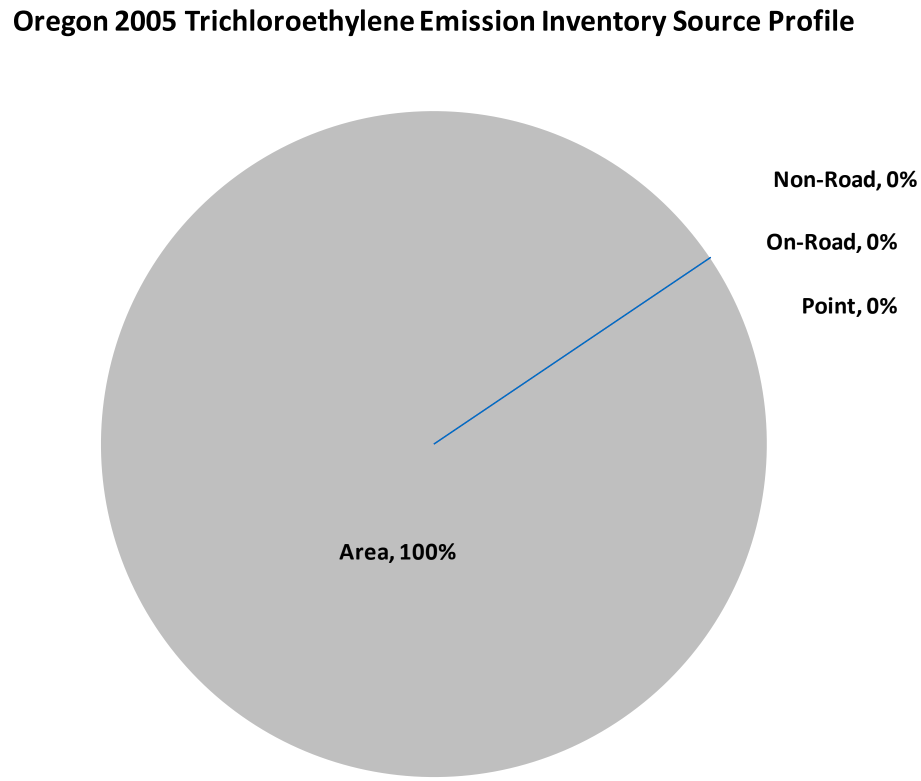

Figure 5.8.21. 2005 Trichloroethylene Emission Inventory, by source category.

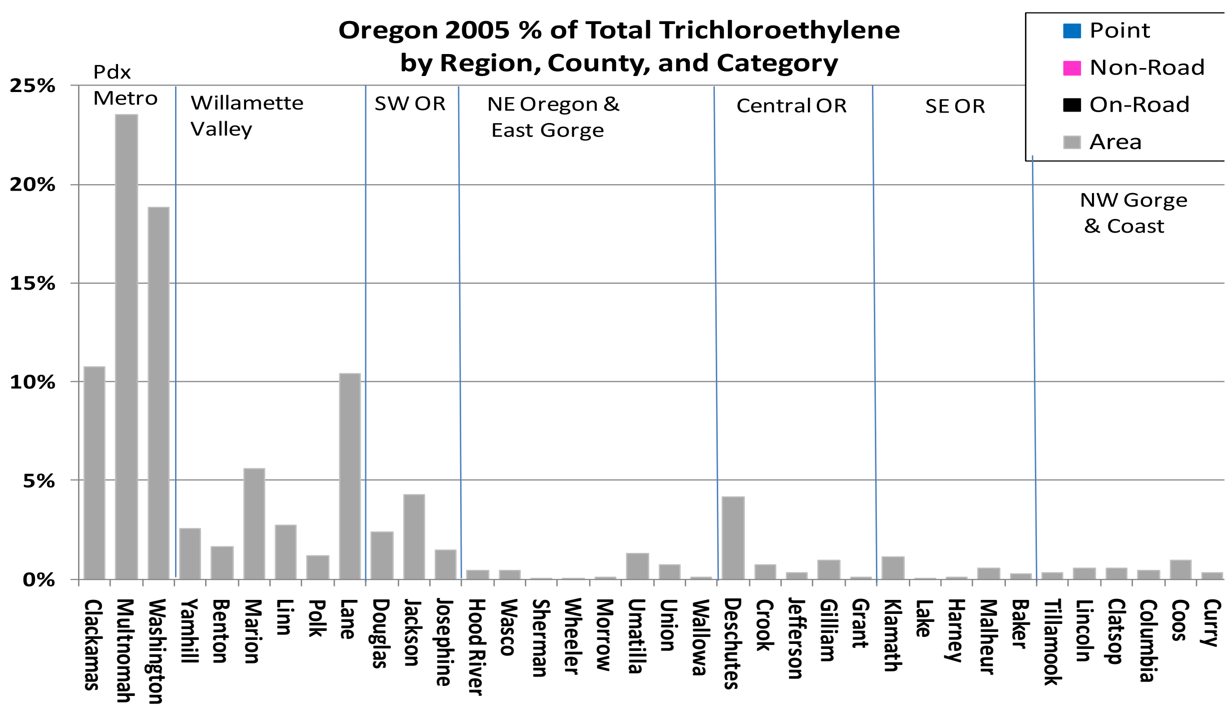

Figure 5.8.22. 2005 Trichloroethylene Emission Inventory, source category and county.

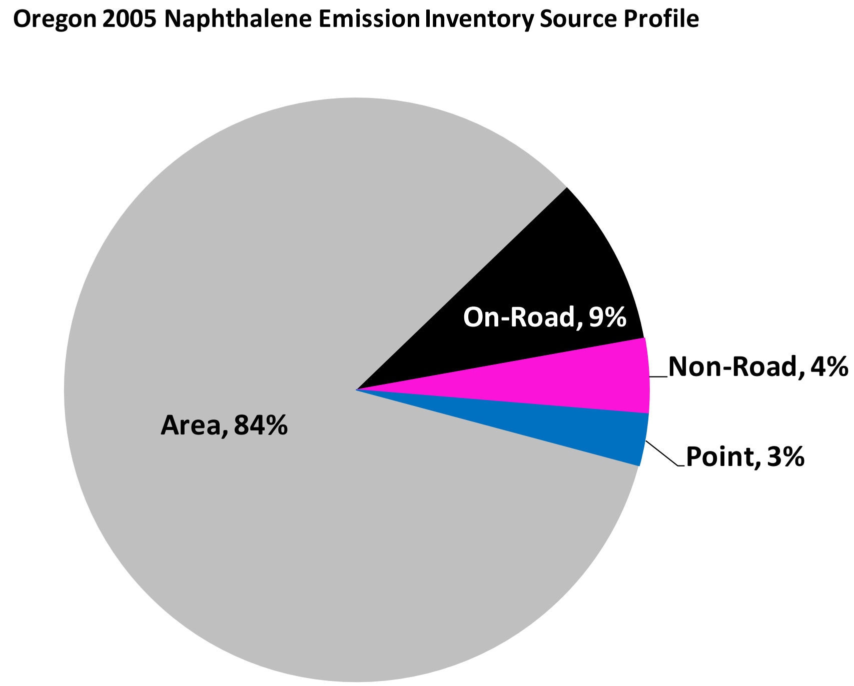

Figure 5.8.23. 2005 Naphthalene Emission Inventory, by source category.

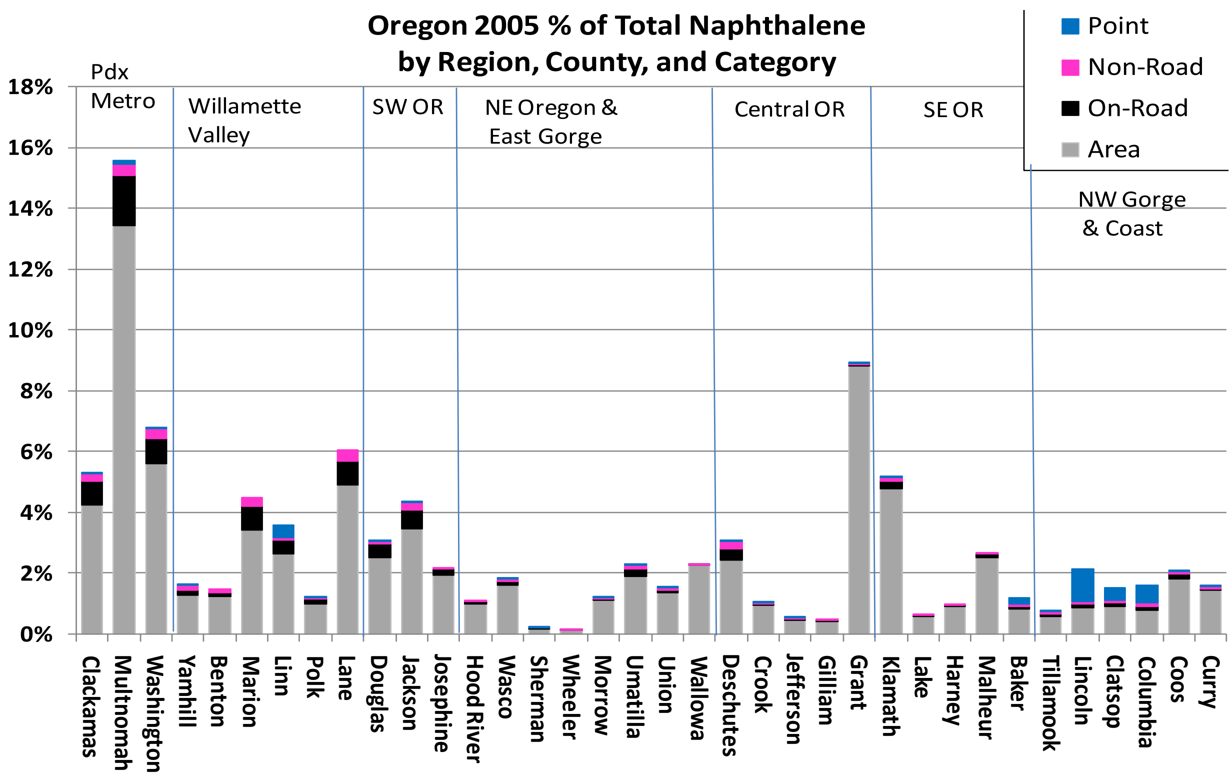

Figure 5.8.24. 2005 Naphthalene Emission Inventory, source category and county.

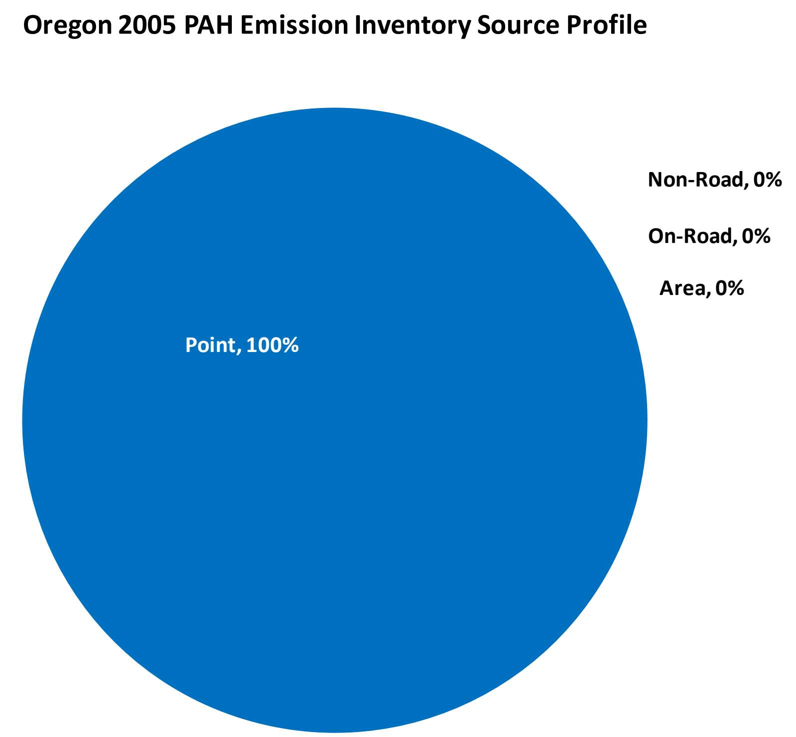

Figure 5.8.25. 2005 Non-Naphthalene PAH Emission Inventory, by source category.

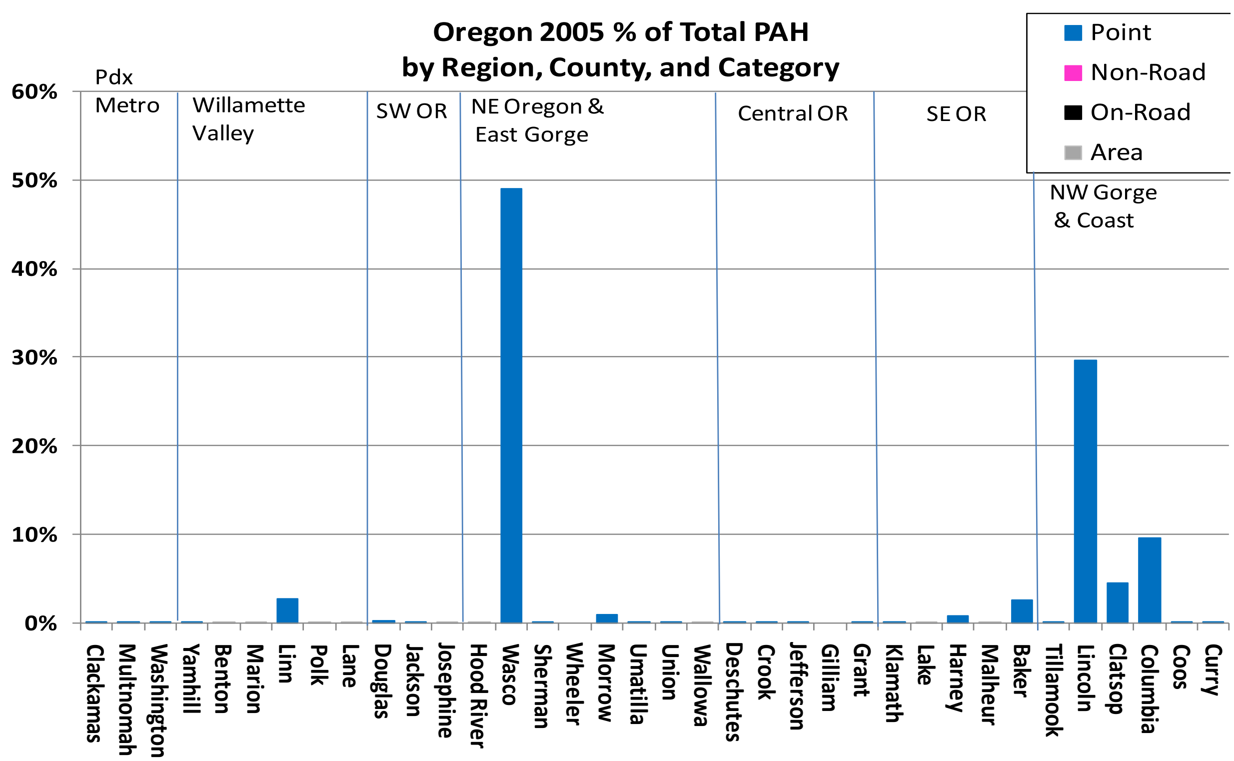

Figure 5.8.26. 2005 Non-Naphthalene PAH Emission Inventory, source category &county.

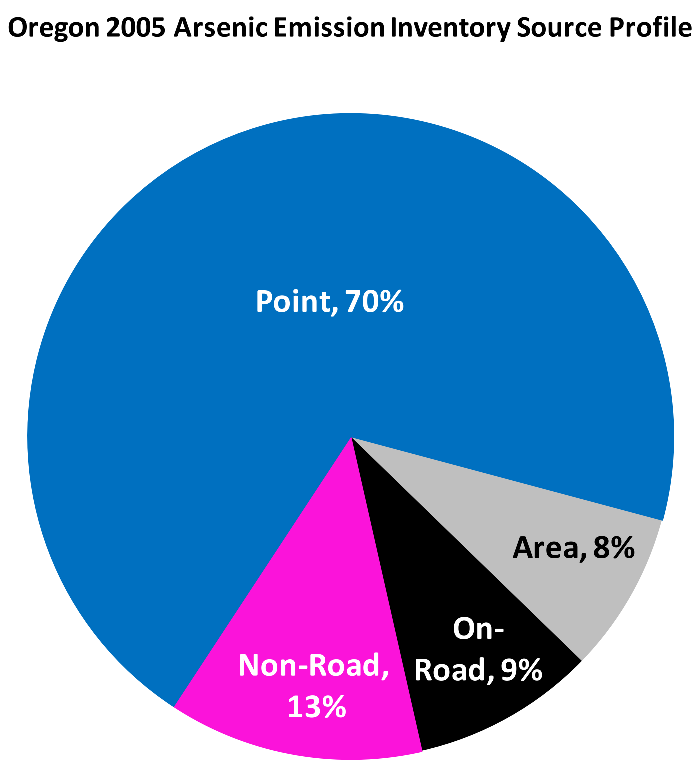

Figure 5.8.27. 2005 Arsenic Emission Inventory, by source category.

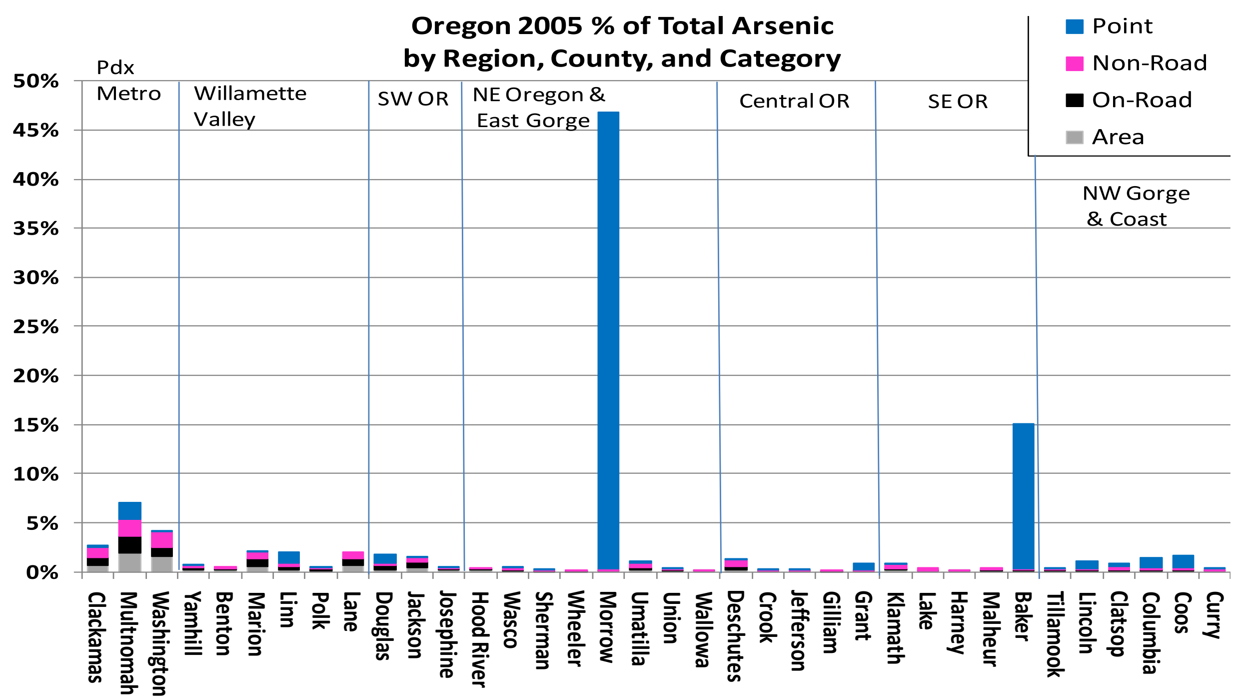

Figure 5.8.28. 2005 Arsenic Emission Inventory, source category and county.

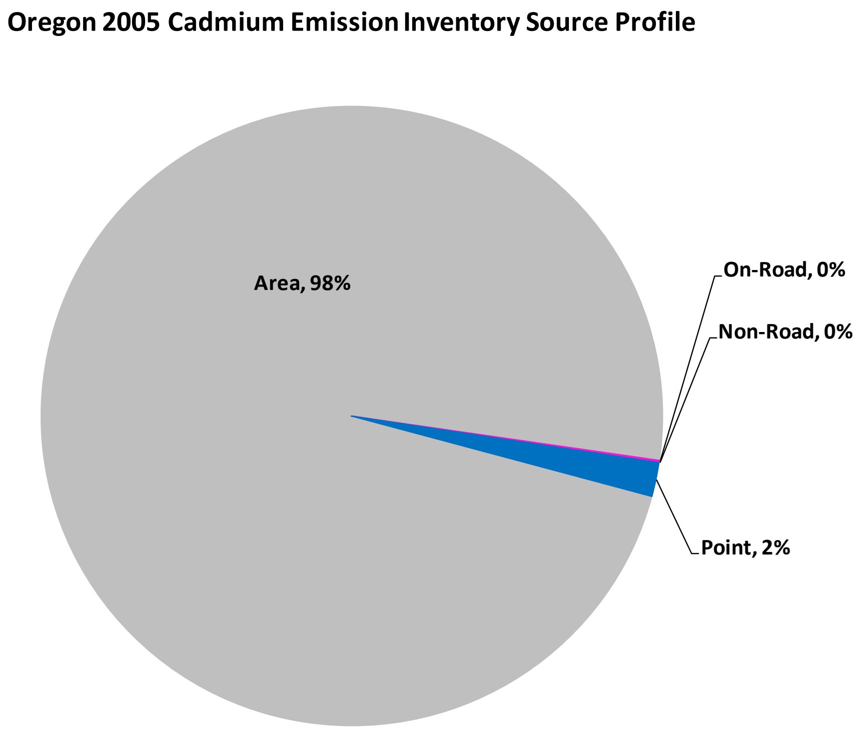

Figure 5.8.29. 2005 Cadmium Emission Inventory, by source category.

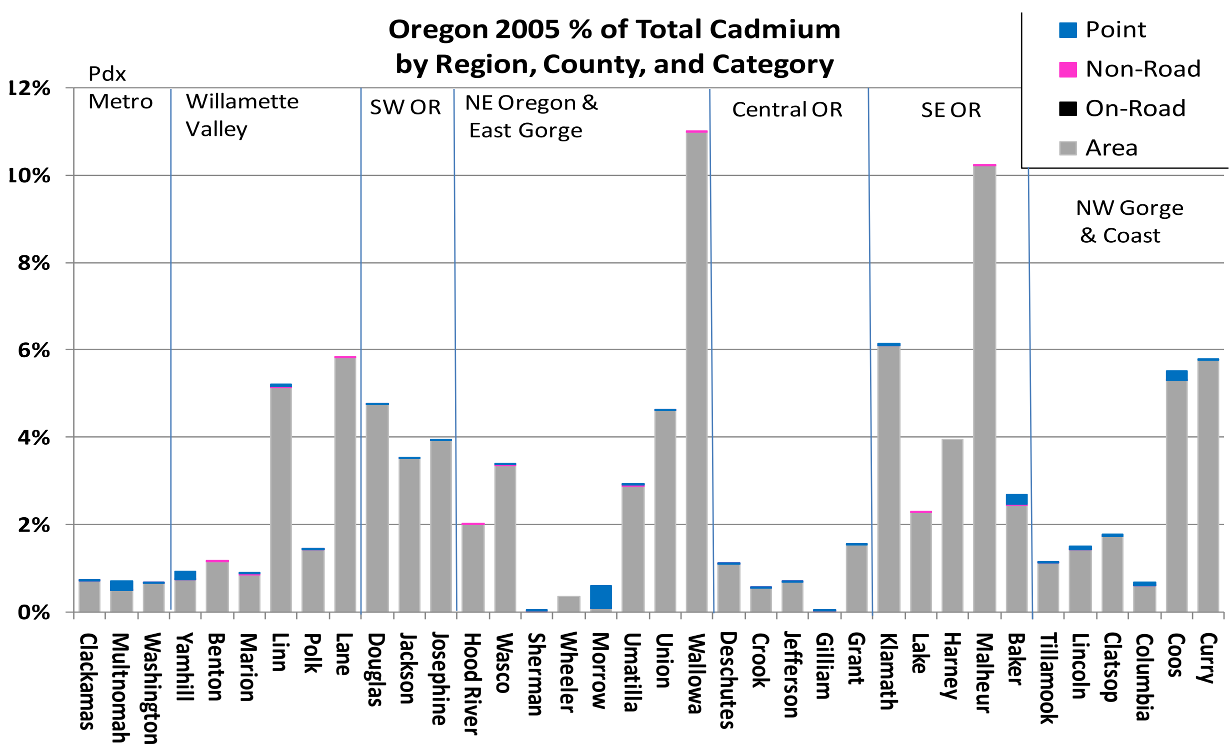

Figure 5.8.30. 2005 Cadmium Emission Inventory, source category and county.

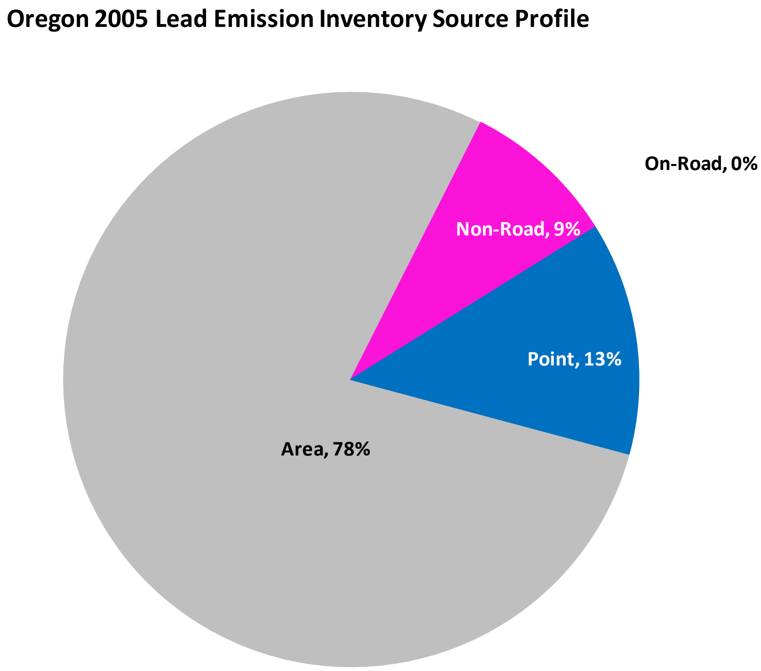

Figure 5.8.31. 2005 Lead Emission Inventory, by source category.

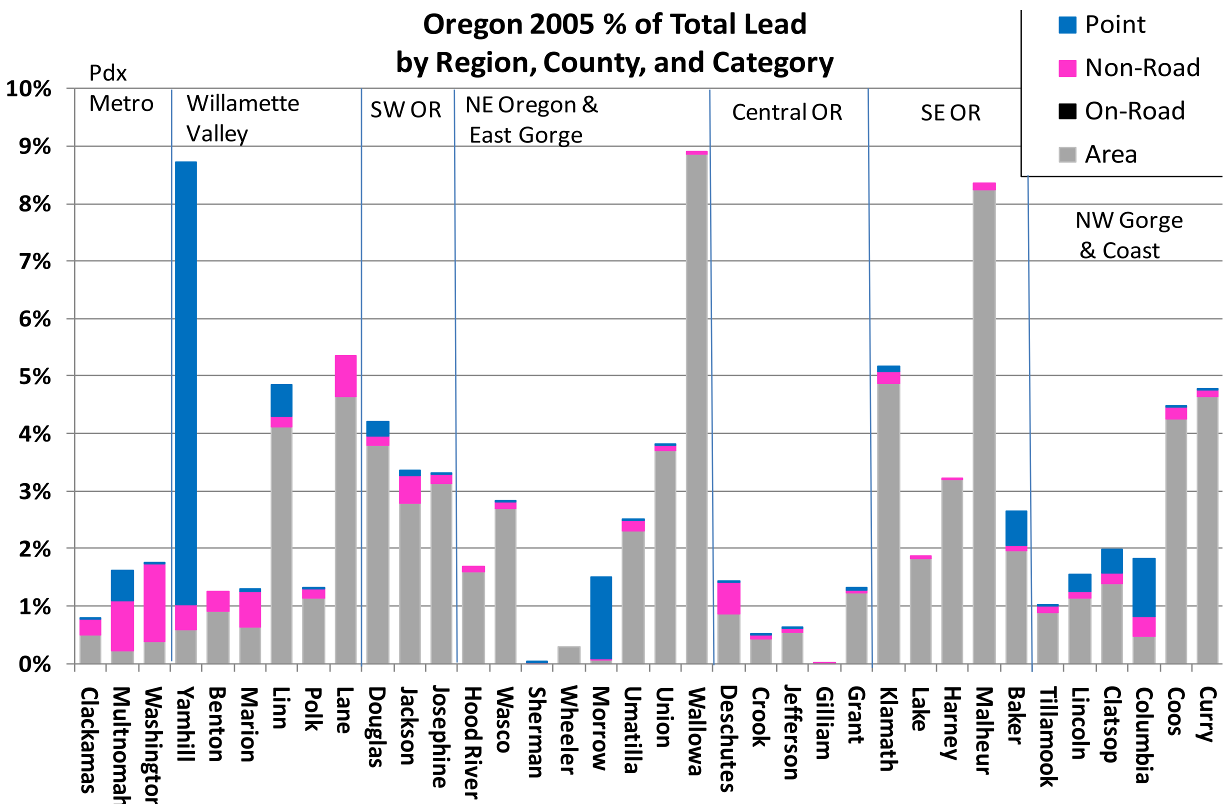

Figure 5.8.32. 2005 Lead Emission Inventory, source category and county.

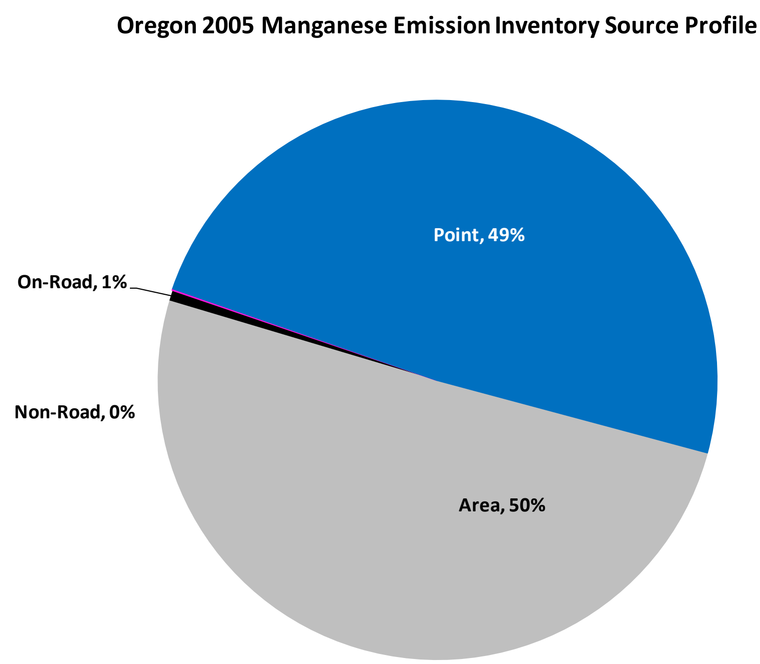

Figure 5.8.33. 2005 Manganese Emission Inventory, source category.

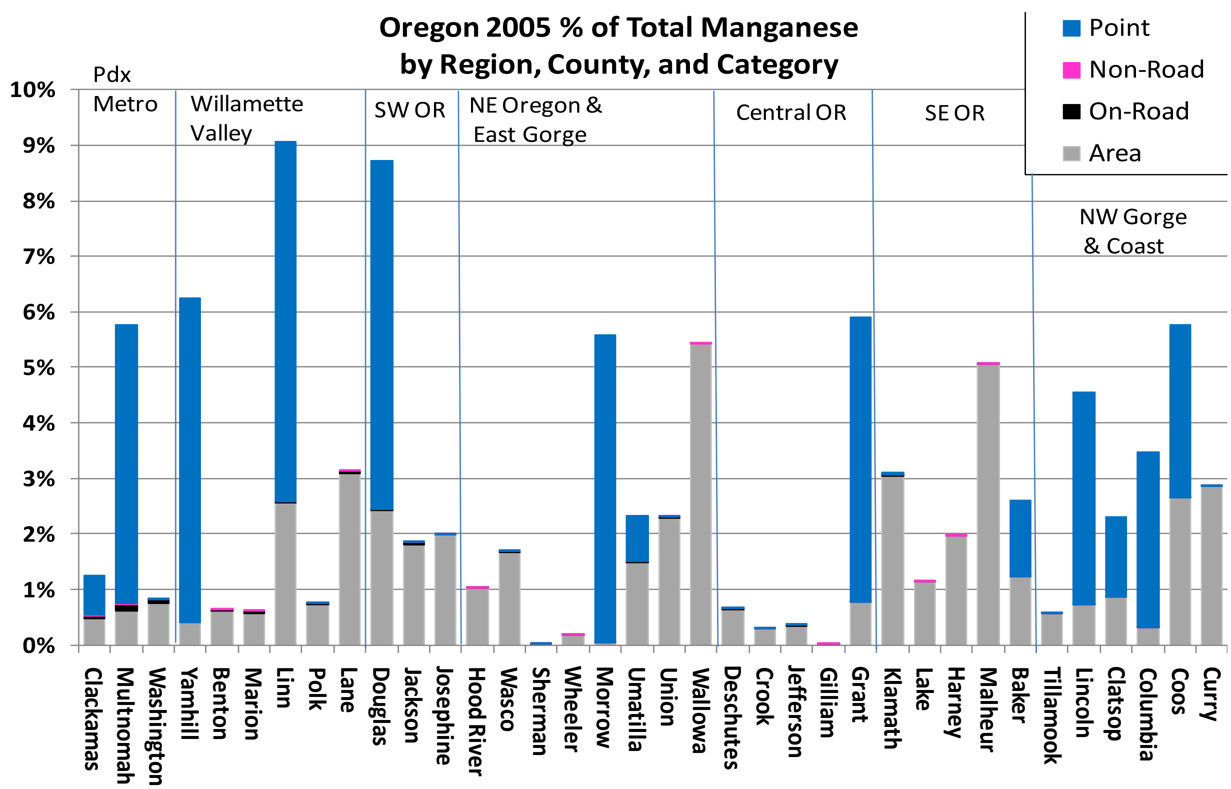

Figure 5.8.34. 2005 Manganese Emission Inventory, by source category and county.

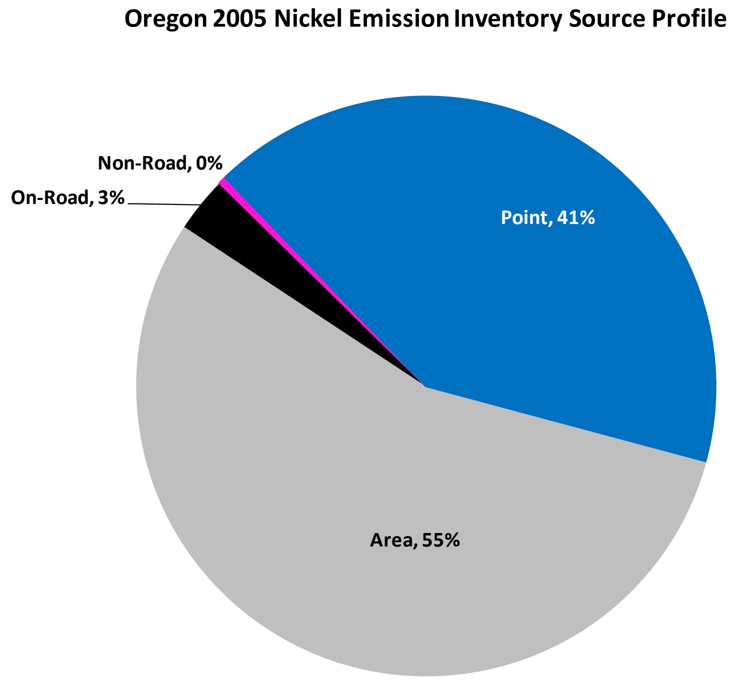

Figure 5.8.35. 2005 Nickel Emission Inventory, by source category.

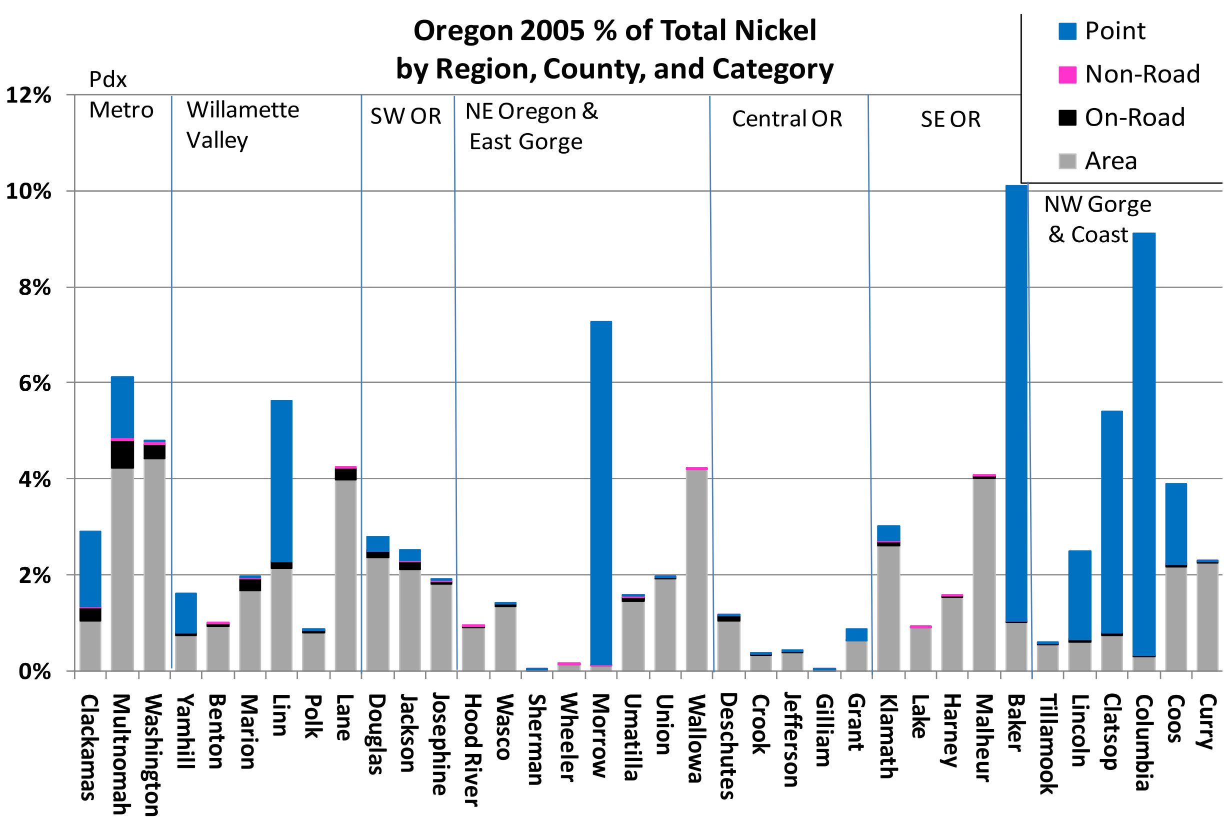

Figure 5.8.36. 2005 Nickel Emission Inventory, source category and county.

Emission Inventory Summary

If the emission inventory of air toxics near or above the benchmark is tallied, the counties with the largest populations and most industry have the most air toxics. Table 5.8.11 is a summary of the 2005 emission inventories in percent of emissions by county. The Multnomah, Clackamas, and Washington Counties are all in the top seven counties and collectively have the highest percentage of air toxics. These three counties are home to the Portland Metro area. Wasco County is the second highest because of PGE Boardman's coal fired plant.

Table 5.8.11. Percent of total air toxics by county.

County	Benzene	Cadmium	Arsenic	Acetaldehyde	Formaldehyde	1,3-Butadiene	1,4Dichlorobenzene	Trichloroethylene	15-PAH	Total Percent
Multnomah	10%	1%	7%	7%	2%	7%	19%	24%	0%	**77%**
Wasco	2%	3%	0%	2%	2%	3%	1%	0%	**49%**	63%
Lane	8%	6%	2%	6%	7%	7%	9%	10%	0%	**55%**
Washington	6%	1%	4%	5%	1%	5%	13%	19%	0%	**54%**
Morrow	1%	1%	47%	1%	1%	0%	0%	0%	1%	**52%**
Lincoln	2%	2%	1%	4%	1%	1%	1%	1%	**30%**	43%
Clackamas	6%	1%	3%	4%	2%	4%	10%	11%	0%	**40%**
Malheur	4%	10%	0%	6%	7%	7%	1%	1%	0%	36%
Jackson	5%	4%	2%	5%	5%	5%	5%	4%	0%	**35%**
Douglas	5%	5%	2%	5%	8%	4%	3%	2%	0%	**33%**
Marion	6%	1%	2%	4%	2%	4%	8%	6%	0%	33%
Linn	4%	5%	2%	5%	4%	4%	3%	3%	3%	32%
Wallowa	3%	11%	0%	5%	4%	7%	0%	0%	0%	29%
Klamath	4%	6%	1%	4%	6%	5%	2%	1%	0%	29%
Baker	2%	3%	15%	2%	3%	2%	0%	0%	3%	29%
Deschutes	4%	1%	1%	4%	3%	3%	4%	4%	0%	24%
Coos	3%	6%	2%	3%	3%	3%	2%	1%	0%	22%
Umatilla	3%	3%	1%	5%	3%	3%	2%	1%	0%	21%
Josephine	3%	4%	0%	3%	3%	3%	2%	1%	0%	20%
Curry	2%	6%	0%	3%	3%	4%	1%	0%	0%	19%
Columbia	1%	1%	1%	2%	1%	1%	1%	0%	10%	18%
Harney	2%	4%	0%	2%	6%	3%	0%	0%	1%	18%
Union	2%	5%	0%	3%	3%	3%	1%	1%	0%	16%
Clatsop	2%	2%	1%	2%	1%	1%	1%	1%	4%	15%
Lake	2%	2%	0%	1%	5%	2%	0%	0%	0%	13%
Yamhill	1%	1%	1%	2%	1%	1%	2%	3%	0%	13%
Benton	1%	1%	1%	1%	1%	1%	2%	2%	0%	11%
Polk	2%	1%	0%	1%	1%	1%	2%	1%	0%	10%
Grant	1%	2%	1%	1%	4%	1%	0%	0%	0%	9%
Hood River	1%	2%	0%	1%	1%	1%	1%	0%	0%	8%
Tillamook	1%	1%	0%	1%	1%	1%	1%	0%	0%	7%
Crook	1%	1%	0%	1%	2%	1%	1%	1%	0%	6%
Jefferson	1%	1%	0%	1%	2%	1%	1%	0%	0%	6%
Gilliam	1%	0%	0%	0%	1%	0%	0%	1%	0%	3%
Wheeler	0%	0%	0%	0%	1%	0%	0%	0%	0%	3%
Sherman	0%	0%	0%	0%	1%	0%	0%	0%	0%	2%
Oregon	100%	100%	100%	100%	100%	100%	100%	100%	100%	

5.8.5 Plan to Remove Air Toxics Emission Sources

The Portland Air Toxics Solutions (PATS) program is currently identifying areas with air toxics problems with the ultimate goal of bringing ambient levels below the ambient benchmark concentrations. The specific solutions have not yet been identified; however, other programs such as the Oregon Low Emission Vehicle program and the Diesel Initiative program should help to reduce toxics. The permitting program is also actively working to lower emissions in industrial and commercial sources.

5.8.6 Air Toxics Modeling

National Air Toxics Assessment Modeling

At the time of this report, EPA had a draft 2005 National Air Toxics Assessment. The draft results for Oregon were sent to ODEQ for review. ODEQ will use the final version to inform air toxics monitoring site locations in the next five years. The preliminary NATA results show the highest risk in the counties in Table 5.8.12.

Table 5.8.12. Ranking of counties by risk from air toxics.

Rank	County	Previous Air Toxics Monitoring
1	Multnomah	Yes
2	Washington	Yes
3	Clackamas	No
4	Jackson	Yes
5	Marion	Yes
6	Josephine	No
7	Lane	Yes
8	Wasco	No
9	Yamhill	No
10	Klamath	No

Portland Air Toxics Solutions Modeling

ODEQ is currently working on a new air toxics model for Portland called the Portland Air Toxics Solutions (PATS) model. A summary of the Preliminary results for this updated 2005 model are shown in Table 5.8.13 expressed as the percentage of the benchmark. Most of the air toxics of concern modeled in PATS are above the benchmarks. Some of these levels are more elevated than the monitoring results discussed above. New iterations of the model are expected later in 2010 which will adjust some modeled values downward. The final modeled values will be used to help place future monitors. The preliminary modeled maps are displayed in Appendix F.

Table 5.8.13. Modeled percent of benchmark for Portland Metro areas.

% of Benchmark/ Compound	Hillsboro	N. Portland	Gresham	NW Portland	OR City	Beaverton
1,3-Butadiene	2080%	1023%	2080%	1033%	633%	2080%
Ethylbenzene	830%	275%	425%	825%	275%	830%
1,4-Dichlorobenzene	4400%	244%	244%	244%	244%	4400%
Benzene	4769%	4769%	4769%	4769%	1692%	4769%
Methylene Chloride	100%	952%	952%	2190%	276%	276%
Trichloroethylene	11%	25%	11%	100%	11%	11%
PERC	1%	0%	1%	1%	0%	3%
Acetaldehyde	460%	227%	460%	227%	140%	460%
Formaldehyde	100%	100%	100%	100%	47%	100%
Acrolein	1100%	1800%	1800%	1100%	750%	750%
Naphthalene	1%	1%	1%	3%	1%	1%
Diesel Particulate	6300%	3600%	3600%	6300%	3600%	6300%
PM_{10} Arsenic	500%	300%	300%	500%	200%	500%
PM_{10} Cadmium	100%	100%	100%	1167%	100%	100%
TSP Hexavalent Chrome	750%	100%	100%	100%	3750%	100%
PM_{10} Lead	1%	1%	1%	14%	1%	1%
PM_{10} Manganese	43%	43%	43%	650%	43%	43%
PM_{10} Nickel	2500%	2500%	2500%	27000%	2500%	2500%

5.8.7 Air Toxics Monitoring Redundancy

LRAPA is currently running a one year study of two sites in Eugene to determine the air toxics variability across town. All other sites are located in separate communities and are not redundant.

5.8.8 Air Toxics Monitoring Network

ODEQ currently operates five air toxic sites and LRAPA operates two. The sites are located in Portland at N. Roselawn, Medford, two in Eugene, La Grande, and Klamath Falls. The air toxics network map is shown in Figure 5.8.37.

2010 DEQ & LRAPA Air Toxics and TSP Lead Air Quality Surveillance Network

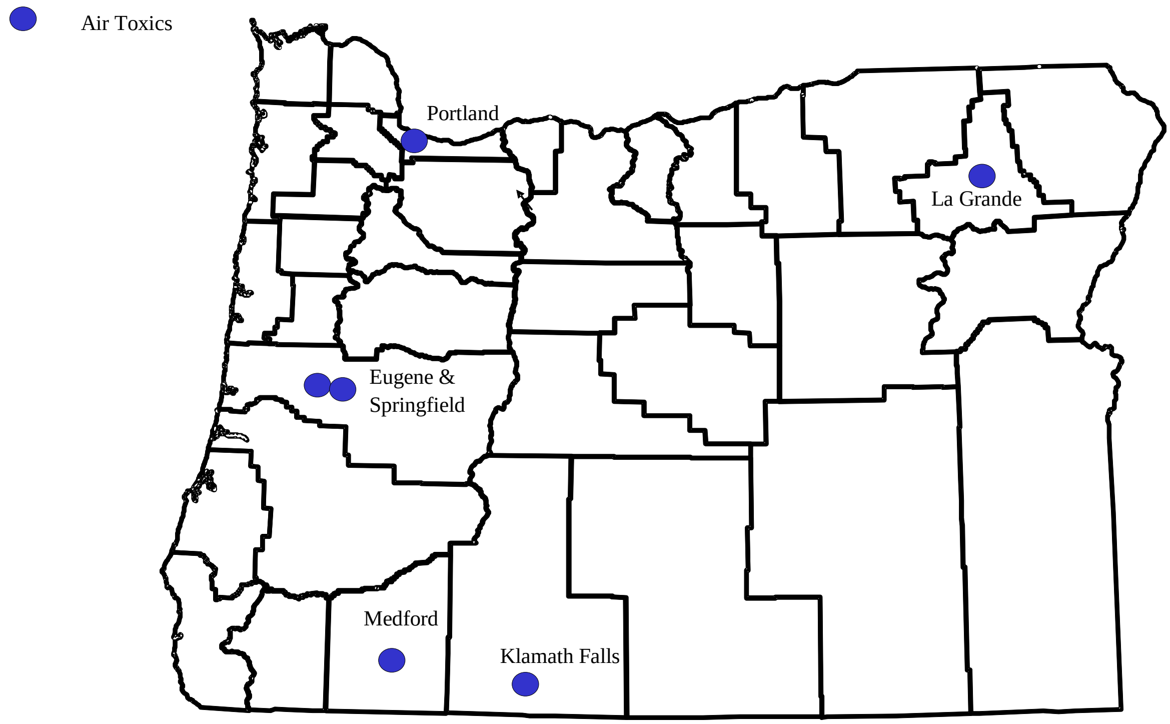

Figure 5.8.37. Air Toxics Monitoring Network Map.

5.8.9 Air Toxics Monitoring Network Cost

The operational cost for a full air toxics network is approximately $165K per site per year.
Air toxics contains separate methods for VOCs, Carbonyls, PAHs, PM_{10} metals, TSP Hexavalent Chrome, and Diesel particulates. All these methods require their own sampling and analysis equipment.

5.8.10 Air Toxics Discussion

Oregon has air toxics monitoring data for Portland, Beaverton, Vancouver WA, Eugene, Salem, Medford, and La Grande. These data show levels above the benchmarks for Benzene, Acetaldehyde, Formaldehyde, Arsenic, and Cadmium. 1,3-Butadiene, 1,4-Dichlorobenzene, Trichloroethylene, and many PAHs may be above the benchmark but their analytical MDLs are too high to detect measurable concentrations. If the emission inventory is limited to these air toxics, Washington, Clackamas, and Multnomah Counties have the most air toxics emissions. The statewide modeling from NATA has not been completed but the preliminary results indicate that the Portland area counties have the most risk. Within the Portland Metro area, modeling shows Hillsboro, Gresham, Beaverton, N. Portland, NW Portland, and Oregon City to have the highest modeled levels.

ODEQ will continue to operate the Portland N. Roselawn and La Grande NATTS sites indefinitely as these are part of the NATTS. ODEQ will continue to move the two state funded sites to new communities provided that funding continues. ODEQ expects one of these sites to be defunded in 2011. LRAPA will complete the two site Eugene study in 2011 then continue Eugene Amazon Park monitoring provided that funding continues.

6. Air Quality Monitoring Funding

ODEQ Air Quality Monitoring receives funding from the EPA, the state of Oregon, LRAPA, state fees, the US Forest Service/BLM, and the Oregon Department of Agriculture. The EPA 105 Grant is a matching funds grant which requires the State of Oregon to match it with a 40% level of effort and is used to support the criteria pollutant monitoring outside of $PM_{2.5}$ and the NATTS sites. The EPA 103 Grant is a non-matching fund which supports $PM_{2.5}$ and some air toxics monitoring. The US forest Service and BLM provide funding to ODEQ to operate the forest health network. The ODOA provides funding to ODEQ to operate the Willamette Valley field burning network. The State of Oregon general funds are used to operate sites in areas of concern for Oregonians but not covered by other funding. LRAPA funds the analysis of air toxics samples collected in Lane County. LRAPA receives funding from the EPA 105 and 103 Grants, Lane County, and major cities in their jurisdiction.

As the funding source amounts change every biennium, ODEQ and LRAPA must adjust the networks to accommodate the new fiscal reality. In 2010, the state of Oregon will make a 9% across the board cut. In 2011, the State of Oregon may cut the general fund up to 25%. These cuts will result in the loss of two CO sites, four PM_{10} sites, and possibly an air toxic site (in 2011). If all the cuts are not realized, the saving from the site closures will go toward funding the non 103 grant $PM_{2.5}$ network and adding FRM or FEM samplers where needed. Currently, there are two nephelometer sites which have estimated $PM_{2.5}$ levels over 10% of the standard which will need FRM samplers. If the $PM_{2.5}$ NAAQS is lowered, additional $PM_{2.5}$ FRM or FEMs will be needed. ODEQ and LRAPA may also need to replace some aging $PM_{2.5}$ FRMs with $PM_{2.5}$ FEMs over the next five years. The FEMs have a lower operating cost than FRMs so they will pay for themselves over several years depending on the sampling schedule, but the capital cost are prohibitive without new funding.

Because of the new NAAQS and monitoring rules, ODEQ will also have to locate funding to equip and operate up to two new ozone sites, one to two new Lead sites, one new SO_2 site, and up to two new NO_2 sites. It is also likely that ODEQ will need additional speciation samplers if the current NAAQS for $PM_{2.5}$ is lowered. The estimated equipment costs alone for all of the new required monitoring for Oregon will be approximately $400,000. An estimated four additional FTE will also be needed to operate the new equipment and analyze additional samples.

7. Ambient Air Monitoring Decision Matrix

7.1 Criteria Pollutant Decision Matrix

ODEQ has developed a decision matrix tool to assist in determining monitoring priorities. The decision matrix is a way to quantitatively include all the factors discussed in this document. The matrix is made up of categories ODEQ deems significant which are given points based on their relative importance to the decision as a whole. Each city or site is ranked using the matrix to inform ODEQ of its relative value. The decision matrix is only meant to be a guide and will not be the final determinant of siting. The decision matrix contains the following parameters:

1. The current design value (official concentration used to compare to the NAAQS)
2. Whether the design value is over the NAAQS
3. The population in each city
4. The population growth for each city

5. The ventilation properties of each area
6. Whether an area conducts woodstove advisories based on the monitor
7. Whether the monitor is funded by other agencies for special purposes (i.e. field burning)
8. Whether the monitor is at the national core (NCORE) site
9. Whether the monitor is the sole monitor in the air shed
10. Whether the monitor or area is in an environmental justice community
11. Whether the monitor is required by the CFR
12. Whether there is a strong community interest in monitoring

If a design value is over the NAAQS it is heavily weighted because it cannot be discontinued. For instance, Oakridge and Lakeview have small populations and low population growths and would be ranked lower on the matrix if their DV were not exceeding the NAAQS.

All the existing criteria pollutant monitors were ranked in the matrix. The matrix also includes communities without monitors. This was accomplished by using design values from similar cities. The non-monitored communities were included to ascertain whether ODEQ or LRAPA should be monitoring in other areas. The ranking is only an estimate and not an indication that a community may have an air quality problem. Tables 7.1 through 7.4 rank the communities with and without monitors. The tables contain 97 site/parameters and are split roughly into groups of 25. Appendix G. contains the decision matrix spreadsheet.

Table 7.1. The ambient air monitoring decision matrix top 24 ranking.

Rank	City	Site Code	Parameter	Comment
1	Klamath Falls[1]	KFP	PM2.5FRM	Pop & NAAQS
2	Portland	SEL	Ozone	NCORE
3	Portland	SPR	Ozone	Pop & NAAQS
4	Portland	SLR	Ozone	Pop & NAAQS
5	Portland	SIS	Ozone	Pop & NAAQS
6	Medford	MGB	PM2.5FRM	Pop & NAAQS
7	Portland	SEL	PM2.5FRM	NCORE
8	Hillsboro	HHF	PM2.5FRM	Pop & NAAQS
9	Eugene	SAG	Ozone	Pop & NAAQS
10	Eugene	EAP	Ozone	Pop & NAAQS
11	Salem	CJH	Ozone	Pop & NAAQS
12	Medford	TAL	Ozone	Pop & NAAQS
13	Bend	BRD	Ozone	Pop & NAAQS
14	Eugene	EAP	PM2.5FRM	Pop & NAAQS
15	Salem	SSH	PM2.5Est	Pop & NAAQS
16	Grants Pass	GPP	PM2.5FRM	Pop & NAAQS
17	Lakeview[1]	LCM	PM2.5FRM	NAAQS
18	Eugene	EKB	PM2.5FRM	**Redundant**
19	Central Point[2]	Used MGB DV	PM2.5Est	Pop & NAAQS
20	Corvallis[2]	Used Salem & Eugene DV	Ozone	Pop & NAAQS
21	Prineville	PDP	PM2.5FRM	NAAQS
22	Albany[2]	Used Salem & Eugene DV	Ozone	Pop & NAAQS
23	Albany	ACS	PM2.5Est	Pop & NAAQS
24	Corvallis	CCB	PM2.5Est	Pop

[1] Over the NAAQS for the pollutant in the Network Parameter Column.
[2] No current monitor in city for the pollutant in the Network Parameter Column.

Table 7.2. The ambient air monitoring decision matrix second 25 ranking.

Rank	City	Site	Parameter	Comment
25	Bend	BPS	PM2.5Est	Pop
26	Eagle Point[2]	Used MGB DV	PM2.5Est	NAAQS
27	Forest Grove[2]	Used HHF DV	PM2.5Est	Pop & NAAQS
28	Beaverton	BHP	PM2.5Est	Pop & NAAQS
29	Oakridge[1]	OAK	PM2.5FRM	**NAAQS**
30	Gresham[2]	Used SEL DV	PM2.5Est	Pop & NAAQS
31	Hermiston	HMA	Ozone	Pop & NAAQS
32	Happy Valley[2]	Used MNS DV	PM2.5Est	Pop Growth
33	Madras	MWS	PM2.5Est	NAAQS
34	Lebanon[2]	Used SFD DV	PM2.5Est	Pop & NAAQS
35	Cottage Grove	CGC	PM2.5FRM	NAAQS
36	Sweet Home	SFD	PM2.5Est	NAAQS
37	Pendleton	PMC	PM2.5FRM	Pop & NAAQS
38	Portland	PNR	PM2.5FRM	**Pop**
39	Phoenix/Talent[2]	Used MGB DV	PM2.5Est	Pop & NAAQS
40	Dallas[2]	Used SSH-CCB DV	PM2.5Est	Pop & NAAQS
41	Portland	SEL (06-08)	SO2	NCORE
42	Portland	SEL	NOx	NCORE
43	Springfield	SCH	PM2.5FRM	**Pop**
44	Redmond[2]	Used PDP-BPS-MWS DV	PM2.5Est	**Pop**
45	Burns	BMS	PM2.5FRM	NAAQS
46	The Dalles[2]	Used HMA DV	Ozone	NAAQS
47	Roseburg	RGV	PM2.5Est	**Pop/USFS**
48	St. Helens[2]	Used SEL DV	PM2.5Est	Pop & NAAQS
49	Portland	TTT	PM10	Pop

[1] Over the NAAQS for the pollutant in the Network Parameter Column.
[2] No current monitor in city for the pollutant in the Network Parameter Column.

Table 7.3. The ambient air monitoring decision matrix third 25 ranking.

Rank	City	Site	Parameter	Comment
50	Klamath Falls	KFP	PM10	Pop
51	Scappoose[2]	Used SEL DV	PM2.5Est	NAAQS
52	Portland	SEL	CO	NCORE
53	Ontario[2]	Used Meridian ID DV	PM2.5Est	NAAQS
54	Portland	SEL	PM10	NCORE
55	Sisters[2]	Used PDP-BPS-MWS DV	PM2.5Est	**USFS Future Funded?**
56	Woodburn[2]	Used MNS-SSH DV	PM2.5Est	**Pop**
57	Hermiston[2]	HMA	PM2.5Est	**Pop**
58	Cove	CCH	PM2.5Est	Union County funded
59	McMinnville	MNS	PM2.5Est	population
60	Medford	MGB (08)	PM10	air toxics - population
61	Salem[3]	SSH	PM10	**shut down**
62	Eugene	EKB	PM10	**Maintenance plan pending**
63	Medford	MRM	CO	**Will shut down**
64	Medford	MWJ	PM10	**Will shut down**
65	La Grande	LAS	PM2.5FRM	**Will shut down**
66	The Dalles	TDC	PM2.5Est	Gorge monitor
67	Eugene	EAP (08)	PM10	air toxics - population
68	White City	WPO	PM10	NAAQS
69	Grants Pass	GPP (08)	PM10	**Will shut down**
70	Baker City	BKF	PM2.5Est	USFS Funded
71	Portland	PPB	CO	**Will shut down**
72	Portland	PNR (08)	PM10	NATTS
73	John Day	JBM	PM2.5Est	**USFS Funded**
74	Eugene	LCC	PM10	**Redundant**

[1] Over the NAAQS for the pollutant in the Network Parameter Column.
[2] No current monitor in city for the pollutant in the Network Parameter Column.
[3] Previous monitoring was done for the pollutant in the Network Parameter column.

Table 7.4. The ambient air monitoring decision matrix lowest 25 ranking.

Rank	City	Site	Parameter	Comment
75	Eugene	LCC	CO	
76	Silverton[2]	Used MNS-SSH DV	PM2.5Est	**NAAQS**
77	Sherwood[2]	Used MNS DV	PM2.5Est	Pop
78	Hermiston[3]	HMA (07-08)4	NOx	**shut down**
79	Wilsonville	Used MNS DV	PM2.5Est	**Population**
80	Hermiston[3]	HMA (07-08)4	SO2	**shut down**
81	Oregon City[2]	Used MNS DV	PM2.5Est	**Population**
82	Florence	FDF	PM2.5Est	**shut down**
83	Shady Cove	SCS	PM2.5Est	**USFS Funded**
84	Coos Bay[2]	Used FDF DV	PM2.5Est	**Population**
85	Enterprise	EFS	PM2.5Est	**USFS Funded**
86	Pendleton	PMC	PM10	**Will shut down**
87	Cave Junction	IVA	PM2.5Est	**USFS Funded**
88	Newport[2]	Used FDF DV	PM2.5Est	
89	La Grande	LAS (08)	PM10	Air toxics
90	Toledo[3]	Used Toledo (04)4 DV	SO2	**shut down**
91	Astoria-Warrenton[2]	Used FDF DV	PM2.5Est	
92	Oakridge	OAK	PM10	**Maintenance plan pending**
93	Mt. Hood[3]	Mt. Hood (2005)4	Ozone	**shut down**
94	Mt. Jefferson[3]	Mt. Jefferson (2001-02)4	Ozone	**shut down**
95	Provolt	PSO	PM2.5Est	**USFS Funded**
96	Portland	SPR	PM2.5Est	**ODOA Funded**
97	Unincorporated JO CO	PSO-IVA	PM2.5Est	

[1] Over the NAAQS for the pollutant in the Network Parameter Column.
[2] No current monitor in city for the pollutant in the Network Parameter Column.
[3] Previous monitoring was done for the pollutant in the Network Parameter column.

7.2 Air Toxics Decision Matrix

7.2.1 Oregon Counties

The statewide decision matrix was unable to be completed at the time of this report because only draft National Air Toxic Assessment data was available. EPA's preliminary ranking for the ten counties with the most air toxics is shown in Figure 7.5. This may change when the final NATA data is released.

Table 7.5. Oregon air toxics monitoring decision matrix ranking.

EPA Ranking	County	Previous monitoring
1	Multnomah	Yes
2	Washington	Yes
3	Clackamas	No
4	Jackson	Yes
5	Marion	Yes
6	Josephine	No
7	Lane	Yes
8	Wasco	No
9	Yamhill	No
10	Klamath	No

7.2.2 Portland Metro

The Portland Metro decision matrix is much more detailed and uses the preliminary Portland Air Toxics Solutions modeled data available at the time of this report. This model may be altered in the next year while it is it being validated, which could impact the Decision Matrix. The Portland decision matrix ranking is shown in Table 7.6. The Portland decision matrix is included in Appendix H.

The Portland air toxics decision matrix has a few different parameters than the criteria pollutant tool. The categories are:

1. the modeled value
2. the modeled value relative to the benchmark
3. the area population
4. the area population growth
5. is it an EJ community,
6. the set up and operational costs,
7. has previous air toxics monitoring been done in the airshed,
8. would it be the sole monitor in the air shed
9. is there strong community interest

Table 7.6. Portland Metro air toxics monitoring decision matrix ranking.

City	**Ranking**
Hillsboro	6
Gresham	4
Bearverton	3
N. Portland	3
NW Pdx	3
OR City	2

6 is the highest rating 1 is the lowest.

8.0 Summary of Ambient Monitoring Five Year Plan

In summary, ODEQ and LRAPA monitoring plan for the next five years will shift toward more ozone and $PM_{2.5}$ monitoring and away from PM_{10} and CO. ODEQ will add one ozone site downwind of Albany and Corvallis and possibly one in an agricultural or forested area. An existing ozone site may be appropriate for the required transport site, but that is yet to be determined. The ozone sites will include wind direction, wind speed, temperature, solar radiation, and relative humidity. ODEQ may have to add $PM_{2.5}$ FRM monitors at several existing nephelometers sites if the NAAQS is lowered. ODEQ and LRAPA will also be able to shutdown or relocate some existing $PM_{2.5}$ sites because they are either redundant or have very low levels. ODEQ will also add SO_2, NO_2, NOy, and lead monitors in the Portland area to satisfy EPA requirements.

8.1 Ozone Plan

ODEQ will continue monitoring all the existing ozone sites over the next five years. ODEQ will add one site downwind of Albany and Corvallis at a yet to be determined location. ODEQ will use available modeling to site the monitor.

ODEQ may also have to site an ozone monitor for comparison to the secondary standard being proposed. The site may have to be in a forested area or and agricultural area. If it is to be in a forested area, the US Forest Service has produced a study which shows the highest ozone impact near The Dalles. ODEQ has also done monitoring in the Mt. Hood Wilderness Area, and near Mt. Jefferson and may decide to return there. If the siting is to protect farm land, the Willamette Valley is already heavily monitored and this may mean no additional sites. Eastern Oregon may also be a consideration for an agricultural site. The ODEQ planning, modeling, regional, and monitoring sections will have to decide what the focus will be.

Revisions to the ozone network design requirements also potentially call for a site in the “far- downwind transport zones of currently well-monitored urban areas.” The location of such a site has not been determined, but could include a site further north of Portland or between Portland and Salem.

8.2 $PM_{2.5}$ Plan

ODEQ and LRAPA will discontinue or relocate Federal Reference Method monitoring at redundant sites and sites with design values below 25µg/m^3. The FRM monitors to be discontinued are Portland N. Roselawn, La Grande Ash Street, and the Medford Dodge Road background site. The Springfield FRM will be relocated following a survey study. The Bend Pump Station FRM may be relocated or discontinued following more analysis of $PM_{2.5}$ distribution in the area. Site changes will occur in 2010 and 2011.

ODEQ will add an FRM sampler in Sweet Home in 2011. ODEQ is anticipating a lowered NAAQS in the next five years. If the FRM monitoring requirements remain the same, ODEQ may need to add FRM or FEM monitors in Albany, Salem, John Day, and Madras because their estimated design values will be within 10% of the daily NAAQS. Additional speciation data will also be needed if a lower standard puts more areas into non-attainment.

ODEQ and LRAPA will continue to operate the $PM_{2.5}$ continuous network without major changes other than funding shifts from state funding to federal funding. One exciting change will be the replacement of both the FRM sampler and nephelometer at a few sites with one FEM continuous monitor. The FEM can provide hourly data for the AQI and 24 hour data for compliance. The FEM has a much lower operating cost than the filter based FRM and will pay for itself within four years for every third day sampling or higher sites. The FEM measures particulate within the hour and will not experience the volatilization that FRMs have. The consequence of this may be a about a $2\mu g/m^3$ higher daily design values.   LRAPA currently owns three continuous FEMs and ODEQ owns one and has funding for one more. The likely FEM sites are Eugene Amazon Park, Oakridge, Hillsboro, and Medford.

If additional funding becomes available in the next five years, new nephelometer sites may be placed in locations determined to be of higher priority based on the decision matrix in section 7. The possible new continuous sites are shown in order of ranking in Table 8.1.

Table 8.1. Ranking of possible $PM_{2.5}$ continuous sites.

Rank	City	Surrogate Site	Reason for consideration
19	Central Point	Used MGB DV	Pop & NAAQS
26	Eagle Point	Used MGB DV	NAAQS
27	Forest Grove	Used HHF DV	Pop & NAAQS
30	Gresham	Used SEL DV	Pop & NAAQS
32	Happy Valley	Used MNS DV	Pop Growth
34	Lebanon	Used SFD DV	Pop & NAAQS
39	Phoenix/Talent	Used MGB DV	Pop & NAAQS
40	Dallas	Used SSH-CCB DV	Pop & NAAQS
44	Redmond	Used PDP-BPS-MWS DV	Pop & Pop Growth
48	St. Helens	Used SEL DV	Pop & NAAQS
51	Scappoose	Used SEL DV	NAAQS
53	Ontario	Used Meridian ID DV	NAAQS
55	Sisters	Used PDP-BPS-MWS DV	**USFS Future Funded?**
56	Woodburn	Used MNS-SSH DV	Pop
57	Hermiston	HMA	Pop
76	Silverton	Used MNS-SSH DV	NAAQS
77	Sherwood	Used MNS DV	Pop
81	Oregon City	Used MNS DV	Pop
84	Coos Bay	Used FDF DV	Pop
91	Astoria-Warrenton	Used FDF DV	

Total ranking of criteria site importance includes existing sites and goes from 1 to 98.

8.3 PM_{10} Monitoring Plan

Ambient PM_{10} levels have dropped significantly over the last 20 years because of the industrial permitting and control programs, wood stove smoke reductions, and fugitive dust maintenance efforts. As a result, the remaining PM_{10} mostly consists of $PM_{2.5}$. PM_{10} levels can be effectively tracked using $PM_{2.5}$ monitors and emission inventory. ***Note: PM_{10} control in industry is critical and remains a high priority for ODEQ and LRAPA's permitting programs.***

PM_{10} monitoring will be discontinued in Klamath Falls, Grants Pass, Pendleton, Medford – Welch and Jackson, and Eugene-LCC. LRAPA will discontinue PM_{10} at Eugene – Key Bank and Oakridge if they are not obligated to continue monitoring because these maintenance plans are not finalized. Medford will continue to monitor PM_{10} in White City. Eugene will continue PM_{10} monitoring at Amazon Park as part of the Air Toxics Method. The PM_{10} funds will be redirected to $PM_{2.5}$ and ozone monitoring.

8.4 NO_2 Monitoring Plan

In 2013, ODEQ will add one roadside NO_2 monitor in Portland alongside the freeway with the highest VMT and most stagnation. ODEQ will consult the available modeling to site the monitor. ODEQ will locate the community NO_2 monitor at the NCORE site unless it is deemed not sufficient for the NO_2 hot spot in Brooklyn. Further modeling is required to determine this. The NCORE site will start monitoring for NOy in 2011.

8.5 SO_2 Monitoring Plan

ODEQ or SWCAA will add one SO_2 monitor in the maximum Portland/Vancouver concentration location. This location will be determined by emission inventory and any available modeling. The monitor will start up in 2013.

The NCORE site in Portland will continue to operate the trace SO_2 monitor indefinitely.

8.6 Lead Monitoring Plan

ODEQ will add a PM_{10} lead monitor at the NCORE site in 2011. ODEQ may be required to add a TSP lead monitor at the Hillsboro Airport sometime after 2011. This should be determined by EPA in the next year. ODEQ will continue to operate the TSP lead site at Cascade Rolling Mills in McMinnville at least until one year of data can be analyzed and compared to the NAAQS. If the data is less than 50% of the NAAQS, ODEQ will conduct a current emission inventory and petition EPA to allow the site to be discontinued.

8.7 CO Monitoring Plan

ODEQ and LRAPA will discontinue the three remaining SLAMS CO monitors. The Portland- Postal Building, the Medford-Rogue Valley Mall will be shut down in 2010. Eugene – LCC in 2010 or 2011. ODEQ will continue to operate the trace CO monitor at the NCORE site indefinitely.

8.8 Air Toxics Monitoring Plan

ODEQ will follow the decision matrix and continue to monitor at sites on the list as funding is available. ODEQ may target areas with specific methods to evaluate the pollutants the model shows to be high. In 2010/2011, ODEQ will operate state funded air toxics sites in Medford and Klamath Falls. In the 2011-2013 state budget ODEQ may lose funding for one site of the air toxics sites. The remaining state funded air toxics site will be moved to either Gresham, Hillsboro, or a maximum concentration site in Medford. LRAPA will continue the two site Eugene survey in 2010/2011. Afterwards, LRAPA will continue the Eugene-Amazon Park monitoring if funding is still available.

Appendix A. Environmental Justice

A.1 Population in Poverty

U.S. Census poverty and minority data can be used to identify both low income and minority communities in Oregon.   For 2008, the Census Bureau's estimated the largest poverty population to be in the Portland Metro area followed by Eugene (Lane County), and Salem (Marian County). The population in poverty by county is shown in Figure A.1 for all ages and Figure A.2 for children under 18. In general, both age groups mirror the total county population distribution.

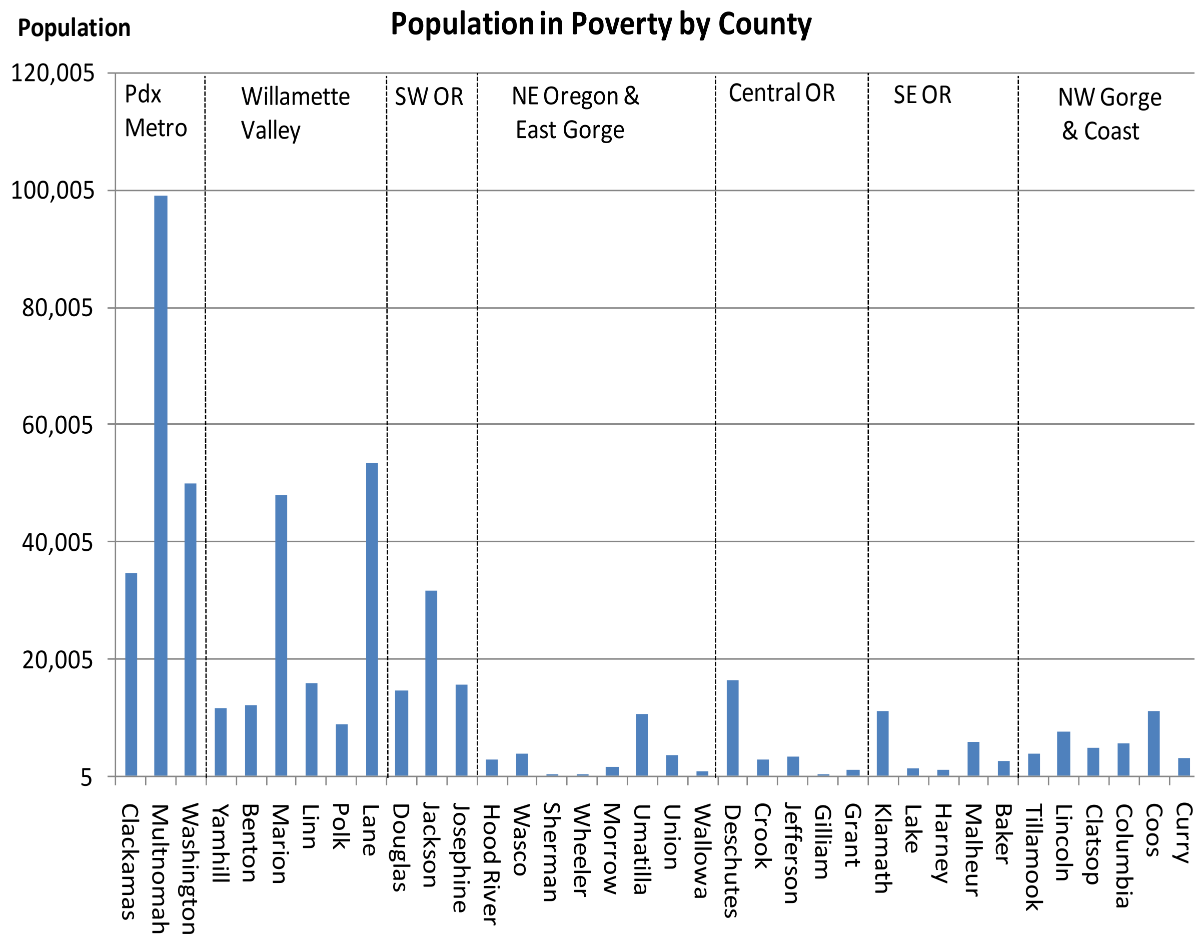

Figure A.1. 2008 Oregon population in poverty by county – all ages.

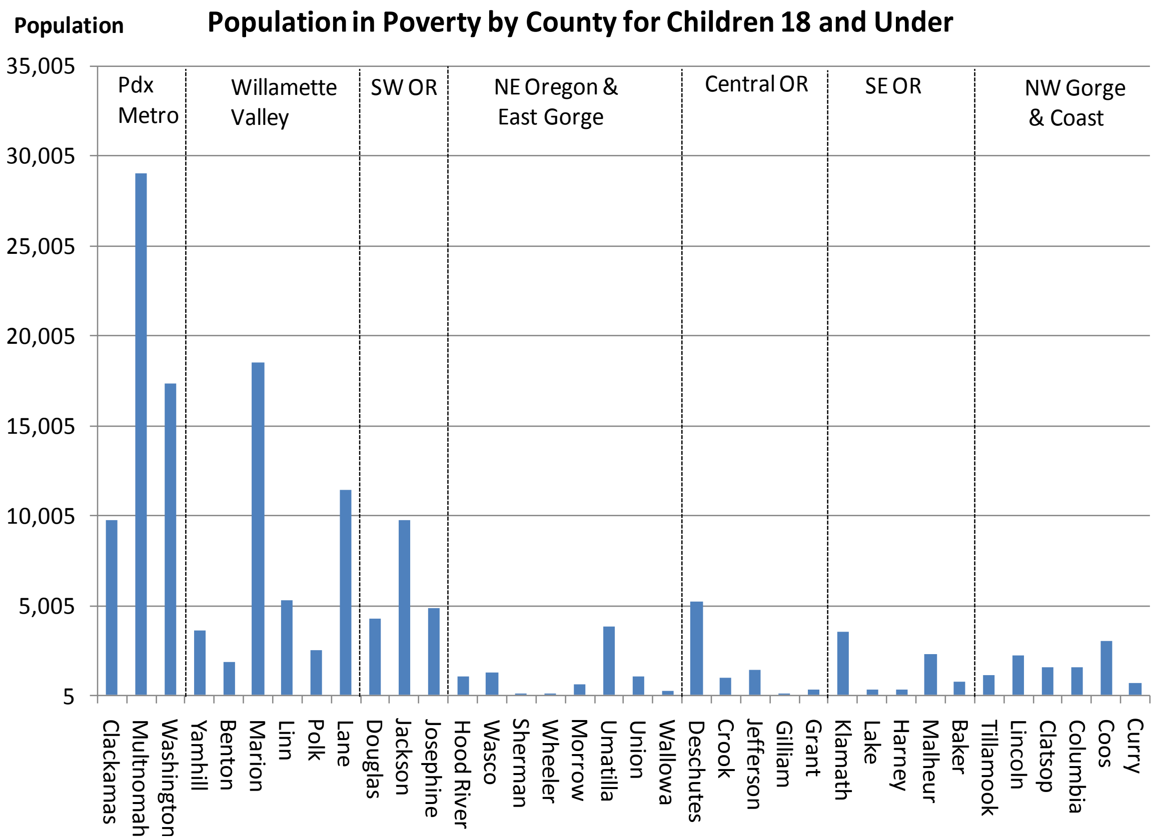

Figure A.2. 2008 Oregon population in poverty by county – 18 and under.

A.2 Percent of County in Poverty

The percent of a county in poverty is a bit more informative when understanding the poverty level within of each county. Figures A.3 through A.6 show the percent of a county in poverty for all ages and for children 18 and under. Of the more urbanized counties, only Marion and Jackson are far above the state average. Most of the rural counties are above the state average.

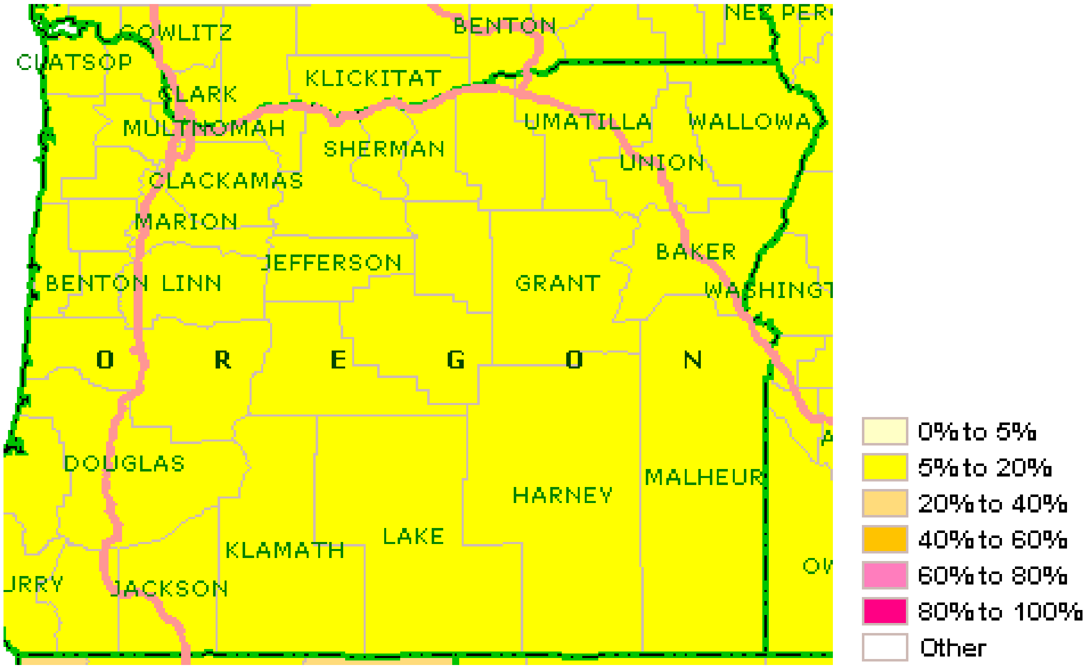

Figure A.3. Map of Oregon population in poverty by county – all ages.

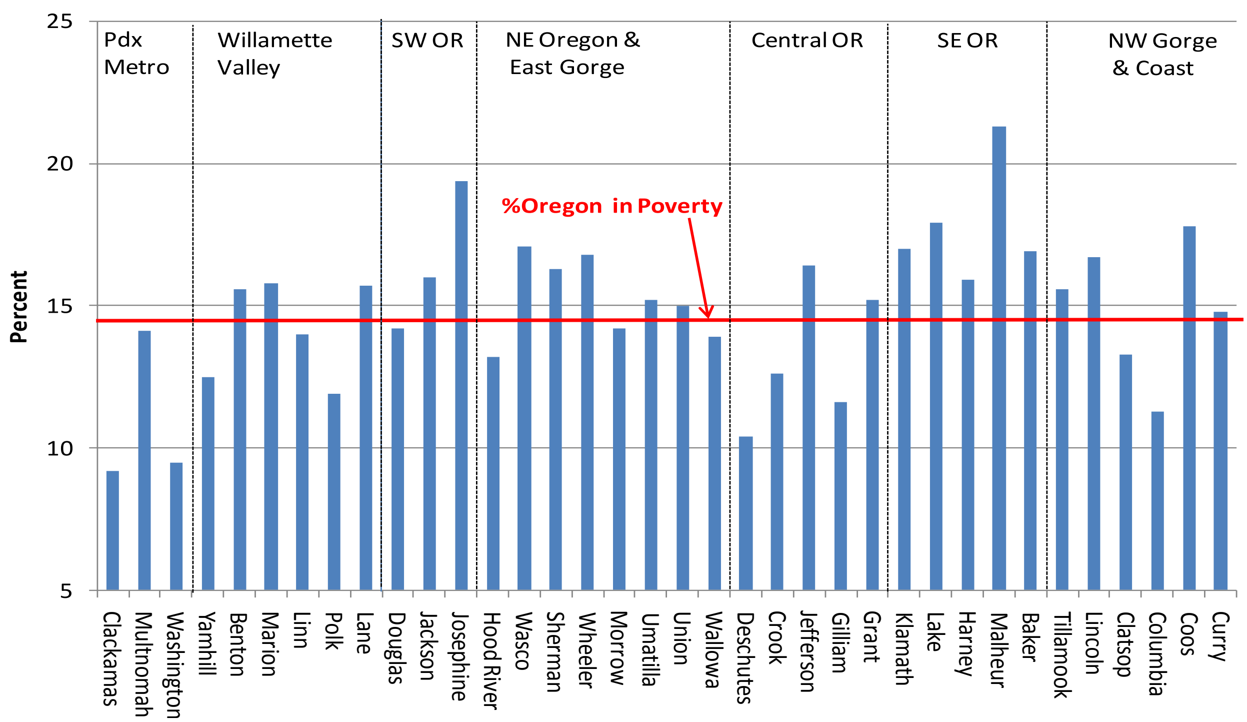

Figure 14. 2008 Oregon percent of population in poverty by county – all ages.

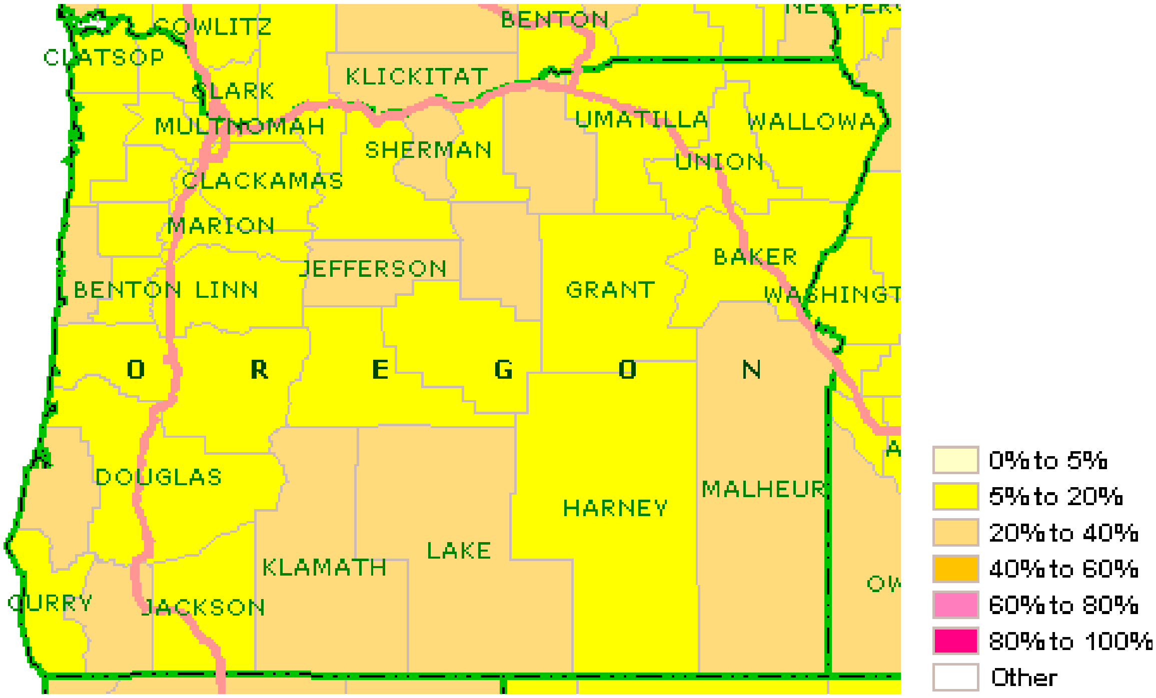

Figure A.5. Map of Oregon population in poverty by county -18 and under.

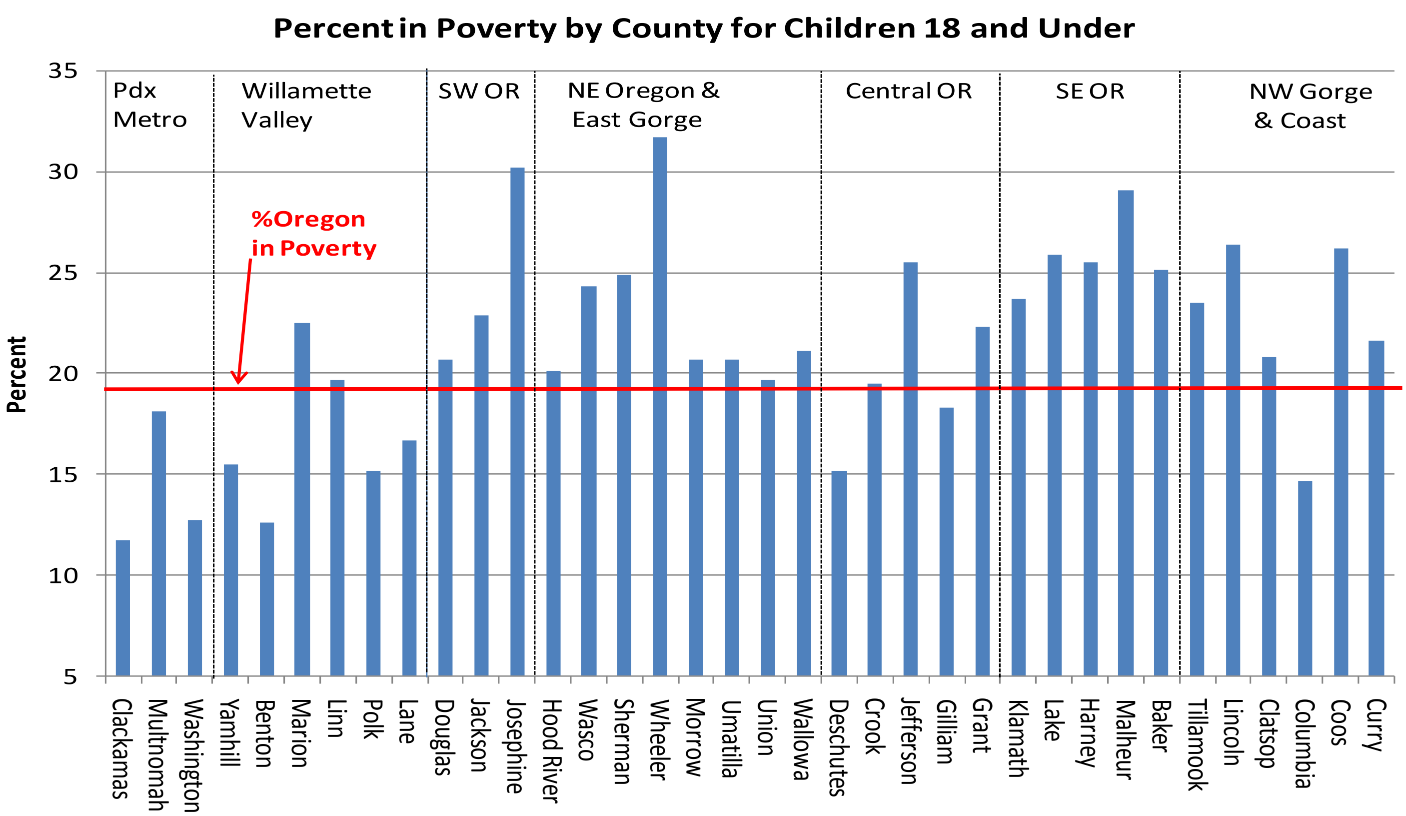

Figure A.6. 2008 Oregon percent of population in poverty by county - 18 and under.

A.3 Poverty Trend

Between 2000 and 2008 all counties showed an increase in the percent of people in poverty for all ages with the largest rises in Benton, Wheeler, and Wasco - all rural areas. Multnomah had an increase in poverty above the state average which is significant because it is the most populace county. Jackson was the only county with a large urban population to show a large increase in poverty among children. Figures A.7 and A.8 show the percent change in poverty in Oregon counties between 2000 and 2008.

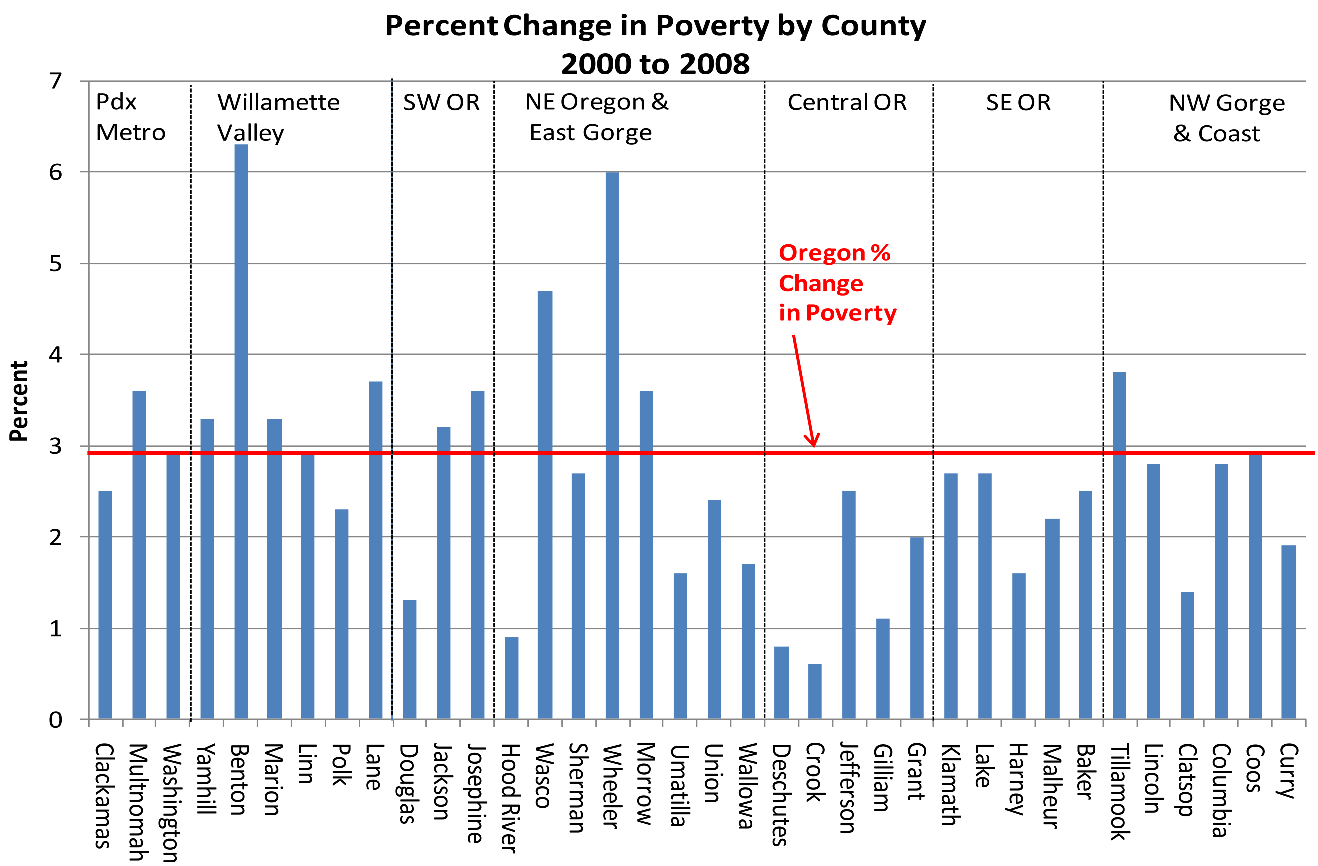

Figure A.7. 2008 Oregon percent of population in poverty by county - all ages.

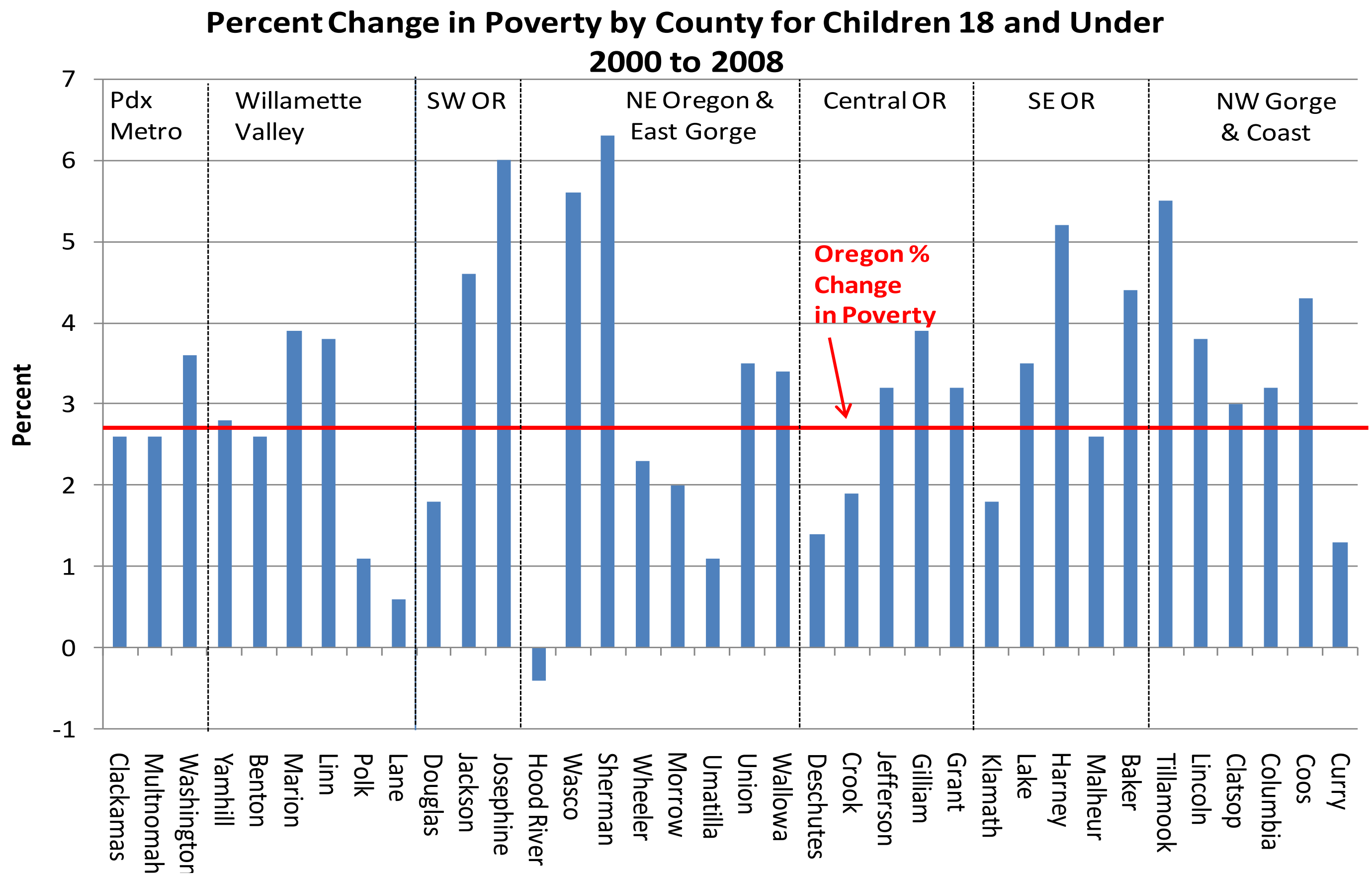

Figure A.8. 2008 Oregon percent of population in poverty by county – 18 and under.

A.4 Minority Population

To conduct an environmental justice analysis, the location of minority communities has to be determined. Fortunately, the US Census Bureau tracks minority status by census blocks. Unfortunately, the latest available data is from the 2000 census and no new projections are available.

The 2000 census data shows that most minorities live in Multnomah and Washington Counties (Figure A.9). This is not unexpected because these are two of the most populace counties and they also are home to large African American, Asian American, and Hispanic populations.

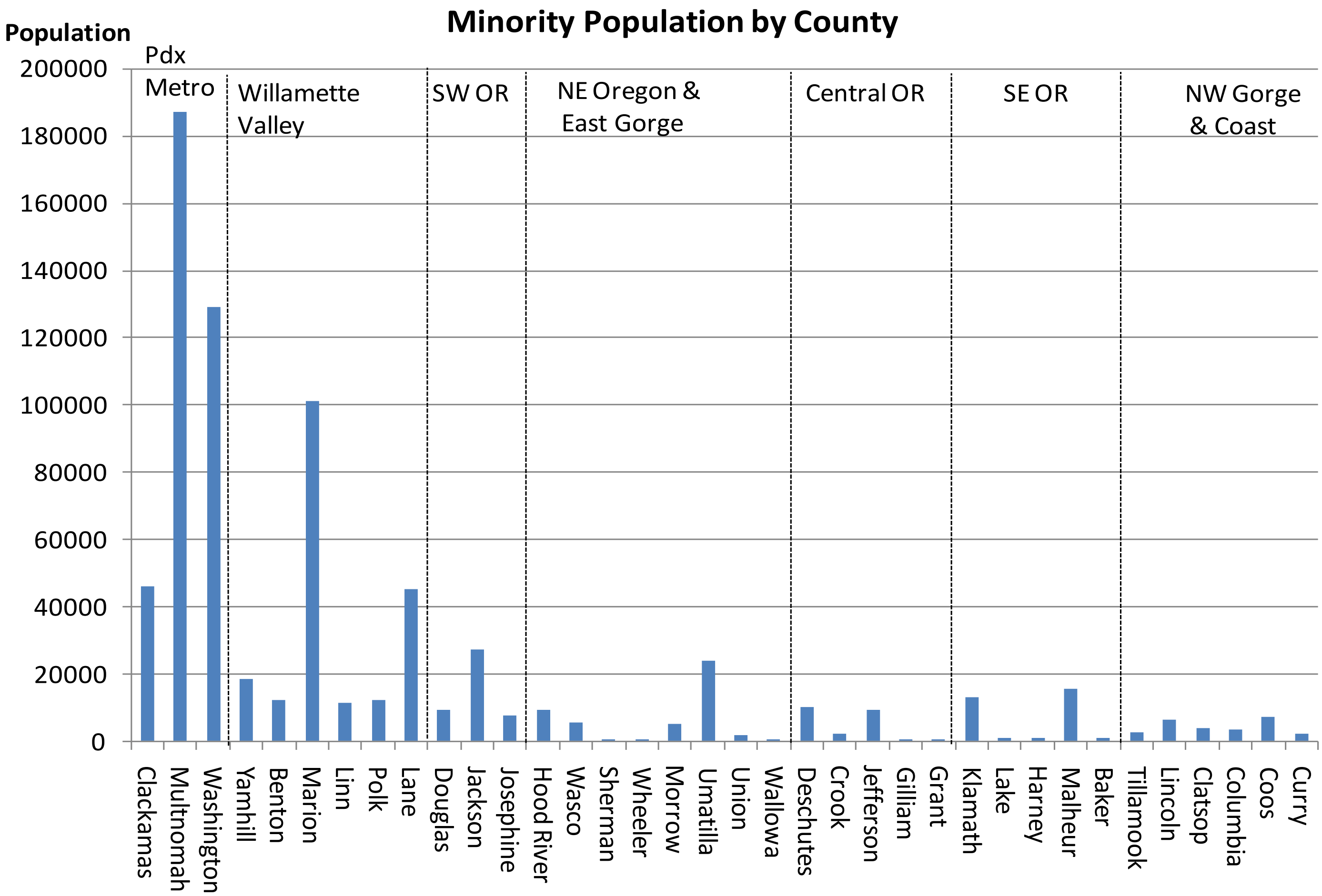

Figure A.9. Oregon minority population distribution map and graph.
(2000 census data)

A.5 Minority Percent of County

By percent of county, Marion has the highest minority population of any urban county. There are several rural counties with high minority populations - Hood River, Morrow, Jefferson, and Malhuer Counties have between 40 and 50% minorities. Figure A.10 shows the 2008 percent minority in each county. Figure A.11 shows a map of the 2000 percent minority.

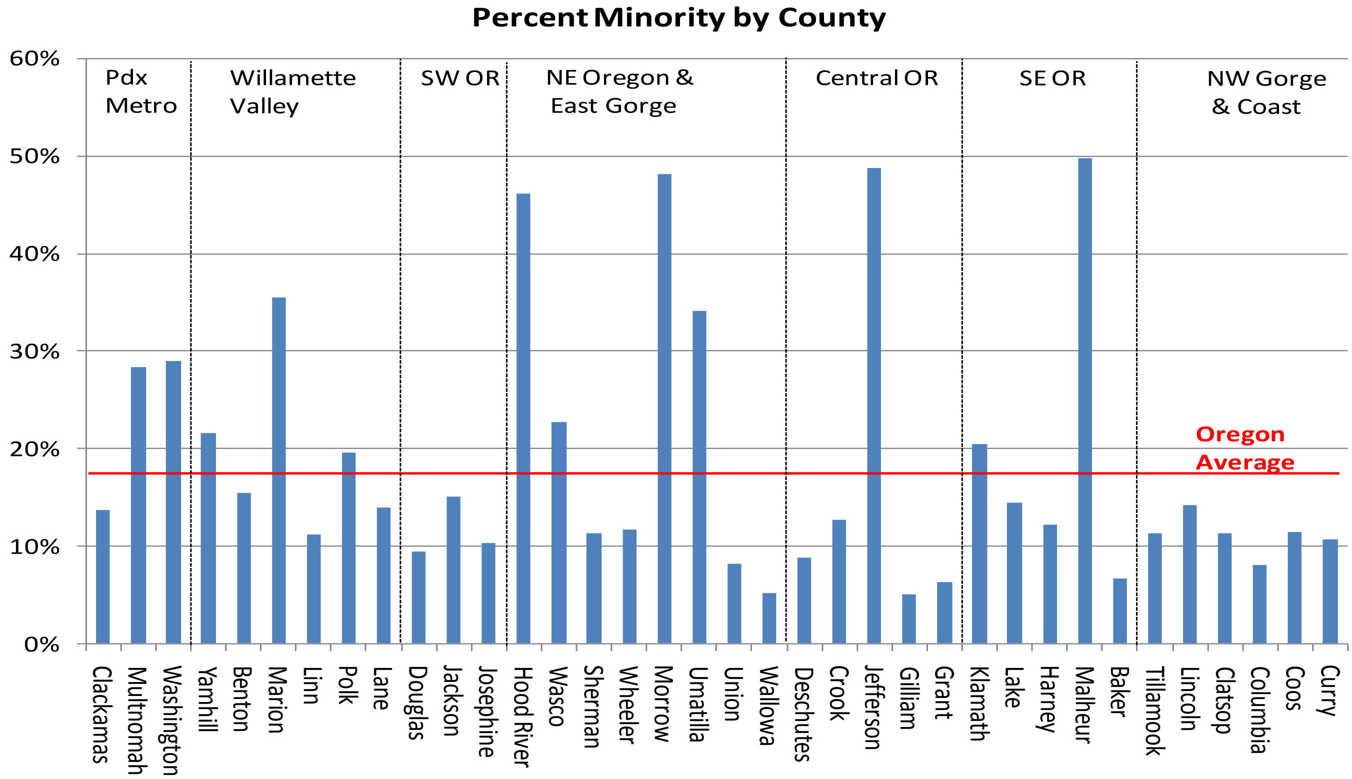

Figure A.10. Oregon percent minority in county.
(2000 census data)

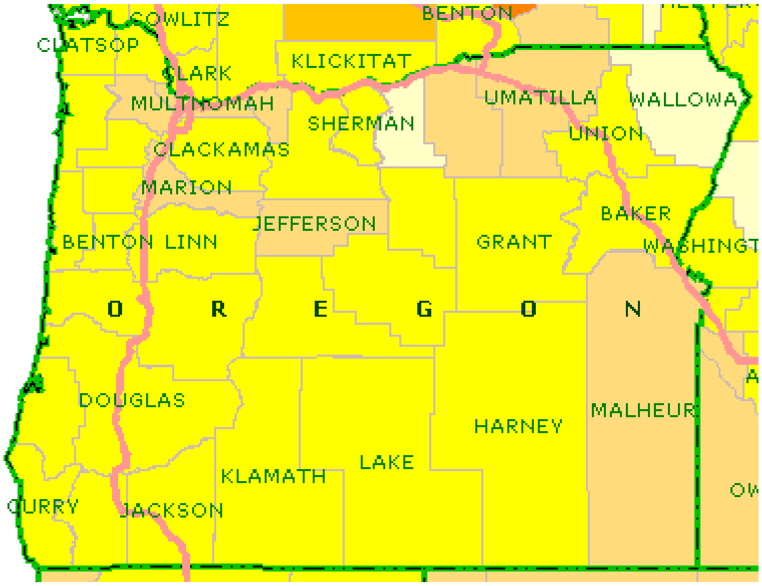

Figure A.11. Map of Oregon percent minority in county.
(2000 census data)

A.6. County Environmental Justice Summary

The four categories discussed above are used to rank the environmental justice status of each county. Specifically, each county was assigned one number if it is either:

1) Greater than the state average percent of minorities per county,
2) Greater than the state average percent of population in poverty per county,
3) Greater than a minority population of 20,000 per county, or
4) Greater than a population in poverty of 10,000 per county.

The environmental justice number (EJ) is the sum of these four categories. Figure A.1 shows the county environmental justice rankings.

Table A.1. Oregon county environmental justice ranking.

Counties	Minority Population > State average	Minority Population > 20K	Population in Poverty > State average	Population in Poverty >10K	EJ Number
Marion	1	1	1	1	4
Jackson		1	1	1	3
Lane		1	1	1	3
Multnomah	1	1		1	3
Umatilla	1	1	1		3
Washington	1	1		1	3
Clackamas		1		1	2
Jefferson	1		1		2
Klamath	1		1		2
Malheur	1		1		2
Wasco	1		1		2
Baker			1		1
Benton			1		1
Coos			1		1
Curry			1		1
Grant			1		1
Harney			1		1
Hood River	1				1
Josephine			1		1
Lake			1		1
Lincoln			1		1
Morrow	1				1
Polk	1				1
Sherman			1		1
Tillamook			1		1
Union			1		1
Wheeler			1		1
Yamhill	1				1
Clatsop					0
Columbia					0
Crook					0
Deschutes					0
Douglas					0
Gilliam					0
Linn					0
Wallowa					0

A.7 Poverty and Minority by City

For monitoring in large counties it is helpful to understand environmental justice in more geographical detail. For the Portland Metro Area, the highest percent of poverty are in Hillsboro, Forest Grove, North Portland, and Gresham. Most of these areas have 20 to 40% poverty for all ages. Figure A.12 is a map of the Portland Metro Area showing % poverty using the 2000 census. Figure A.13 zooms in for the Portland -Gresham area, and Figure A.14 zooms in for the Hillsboro area.

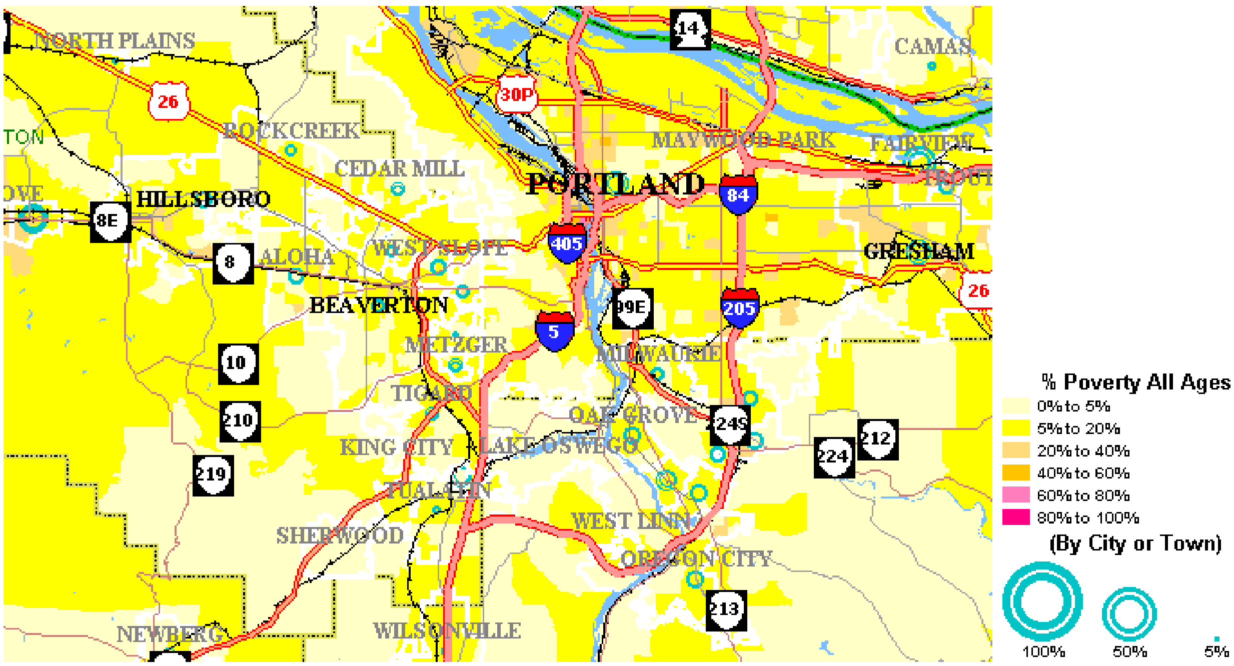

Figure A.12. 2000 Portland Metro percent of population in poverty-all ages.

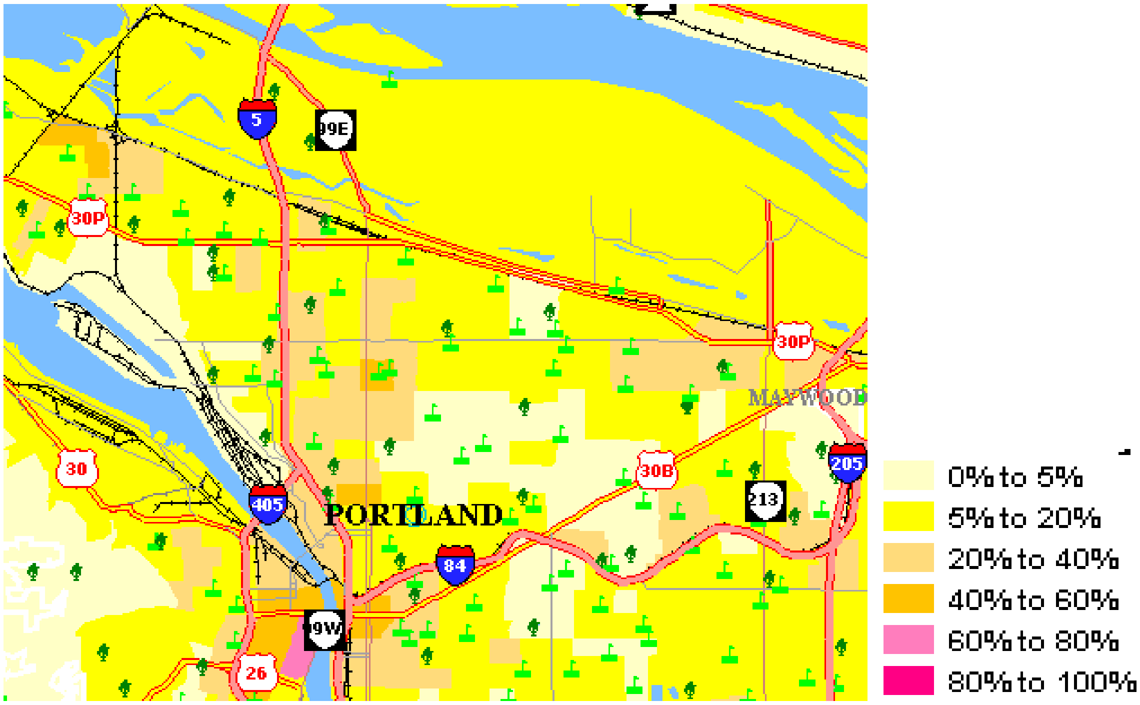

Figure A.13. 2000 Portland percent of population in poverty all ages.

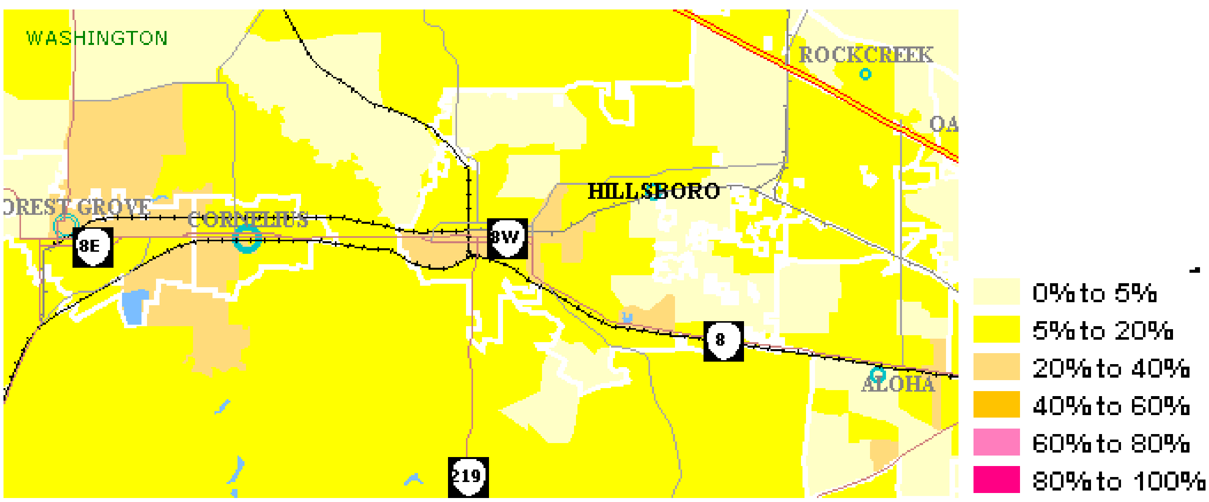

Figure A.14. 2000 Hillsboro percent of population in poverty-all ages.

Portland Metro area minority population mainly lives within Washington and Multnomah Counties, specifically, North Portland and Hillsboro. Figure A.15 shows a map of the percent minority population for the Portland Metro Area. Figure A.16 zooms in on the east and central Portland Metro Area showing that according to the 2000 census North Portland has a minority population of 60 to 80%. Hillsboro also has a minority population of 60 to 80% in some areas. Figures A.17 and A.18 show minority populations in the west Portland Metro area and zooms into Hillsboro specifically. Gresham also has a 40 to 60% minority population downtown (Figure A.19). This seems to be confined to one census block and seems suspicious.

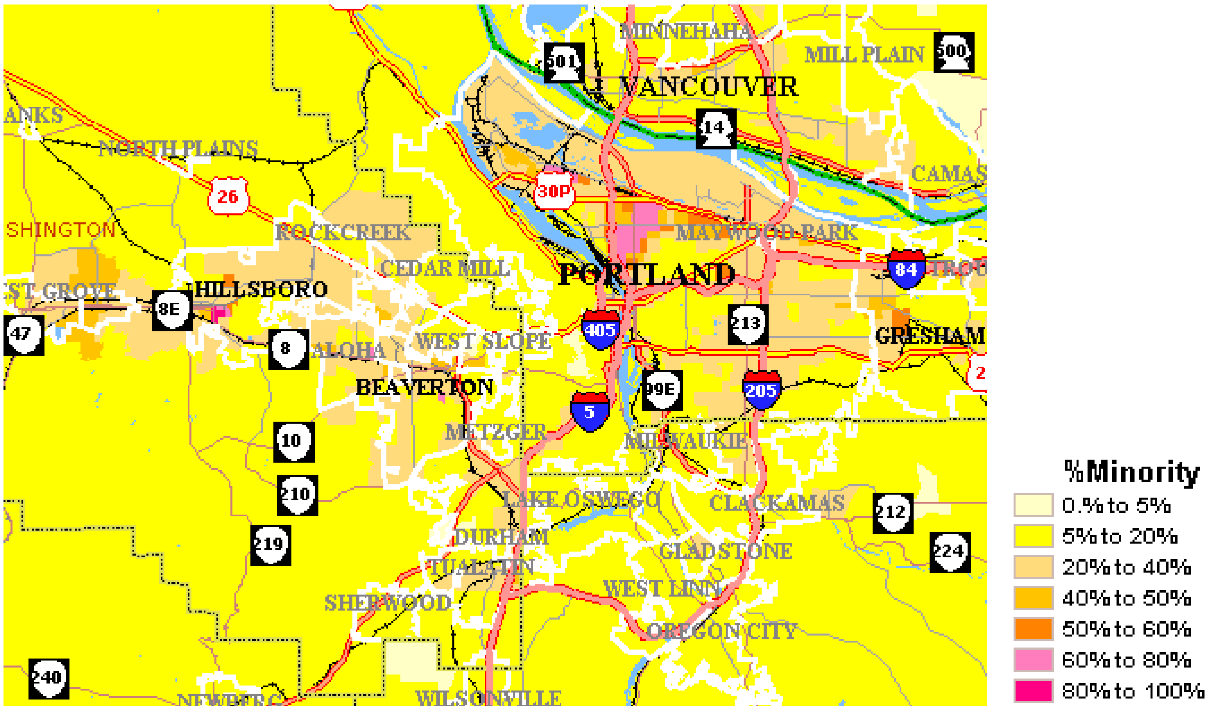

Figure A.15. 2000 Portland Metro percent of minority population-all ages.

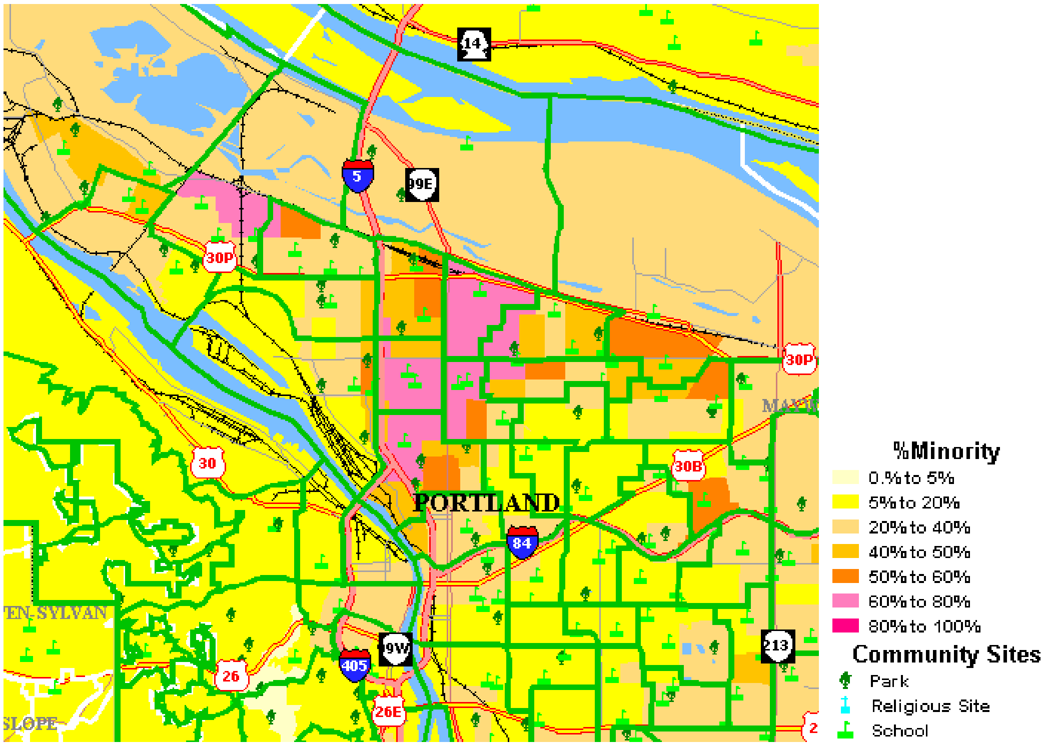

Figure A.16. 2000 Portland percent of minority population-all ages.

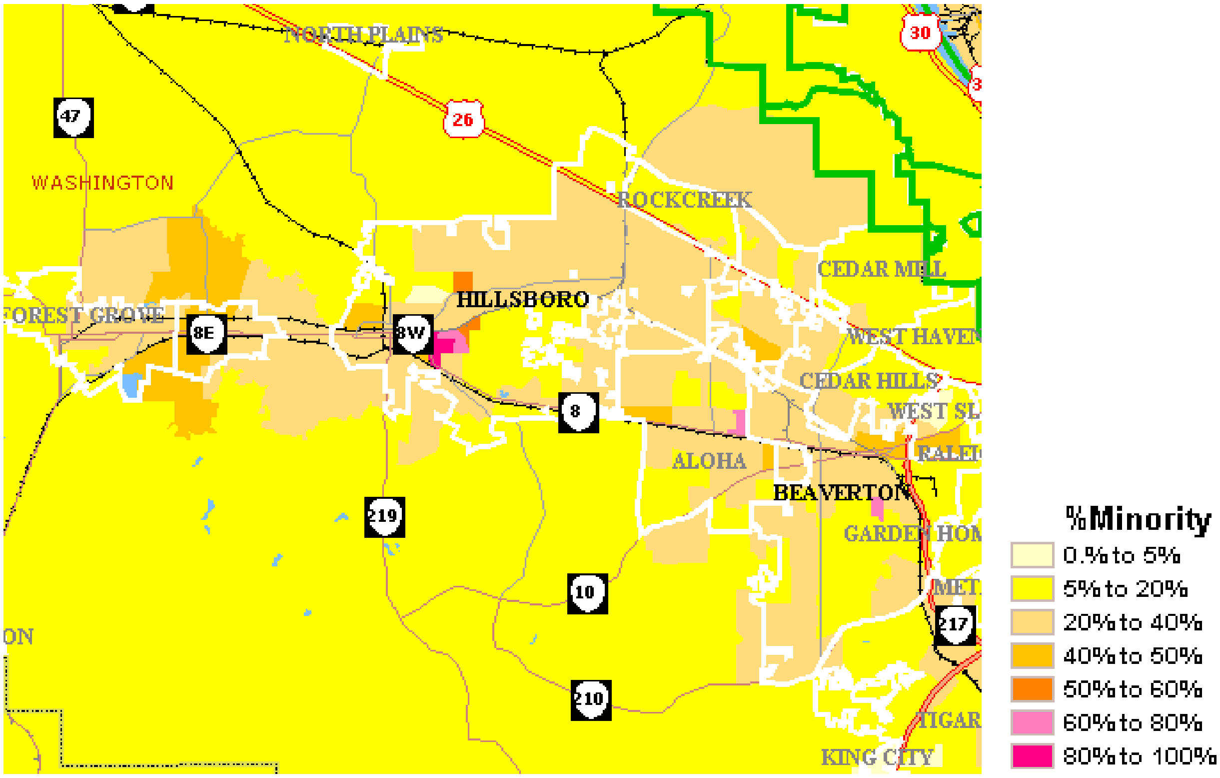

Figure A.17. 2000 Hillsboro percent of minority population-all ages.

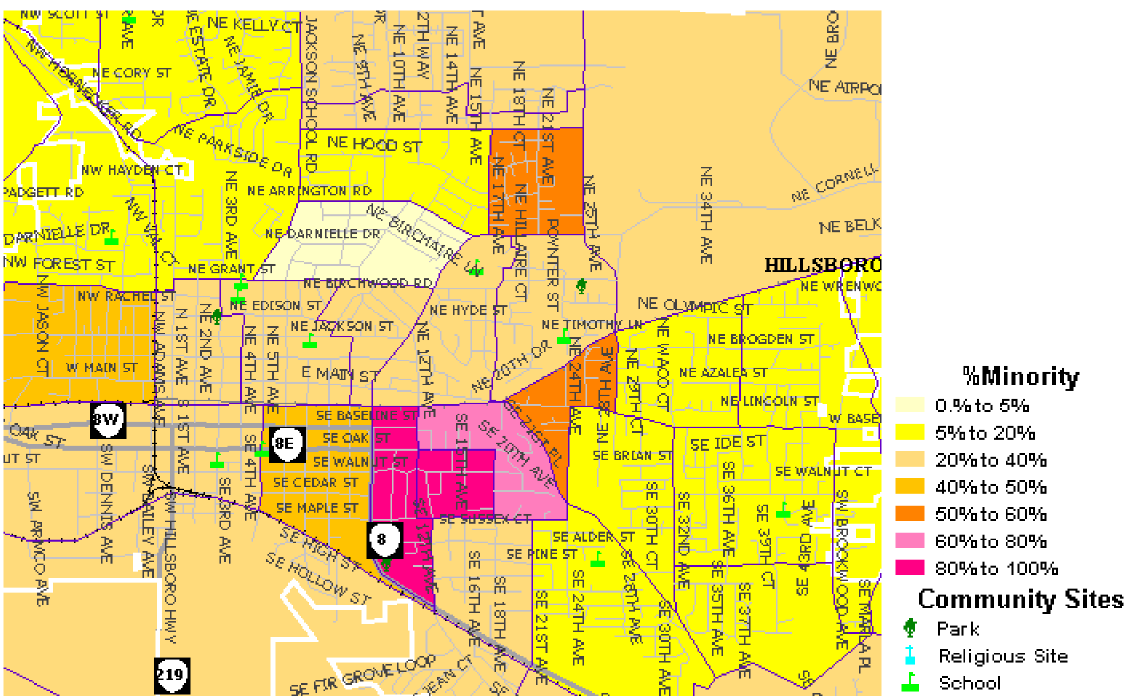

Figure A.18. 2000 Hillsboro (zoom) percent of minority population-all ages.

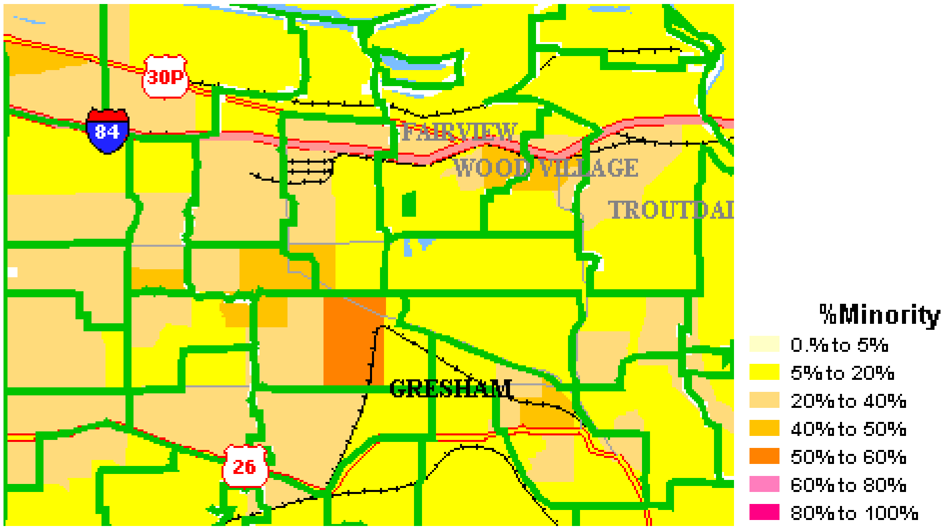

Figure A.19. 2000 Gresham percent of minority population-all ages.

Salem and North Marion County

North and East Salem are the only areas in Marion County to have over 40% poverty with 40 to 60%. Marion County has large geographical areas with 20 to 40% poverty north of Salem. Figure A.20 shows the poverty map for the Salem to Woodburn area in Marion County.

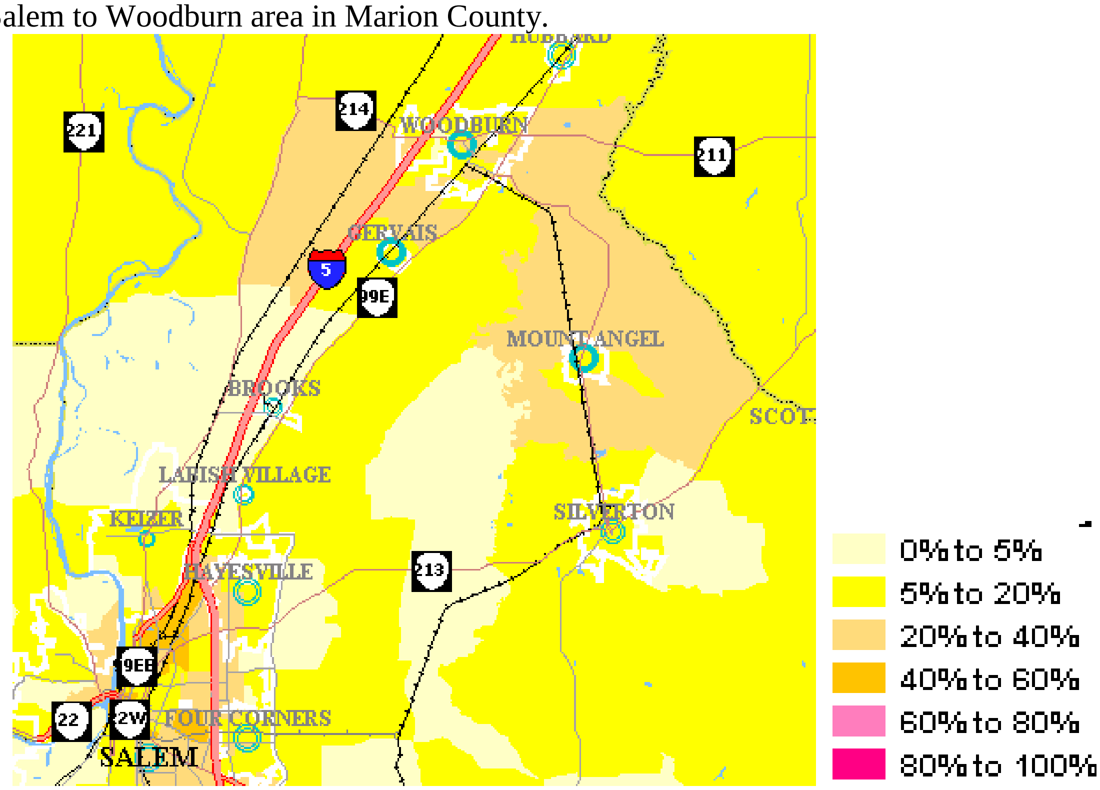

Figure A.20. 2000 Marion County cities percent of population in poverty-all ages.

Marion County has a large percentage of minorities in several areas. The Woodburn and Gervais areas have 60 to 80% minority population with part of Gervais at 80 to 100%. Salem is between 20 and 60%. Poverty rates are at 40 to 60% in parts of Salem and 20 to 40% around Gervais and Woodburn as shown in Figure A.21.

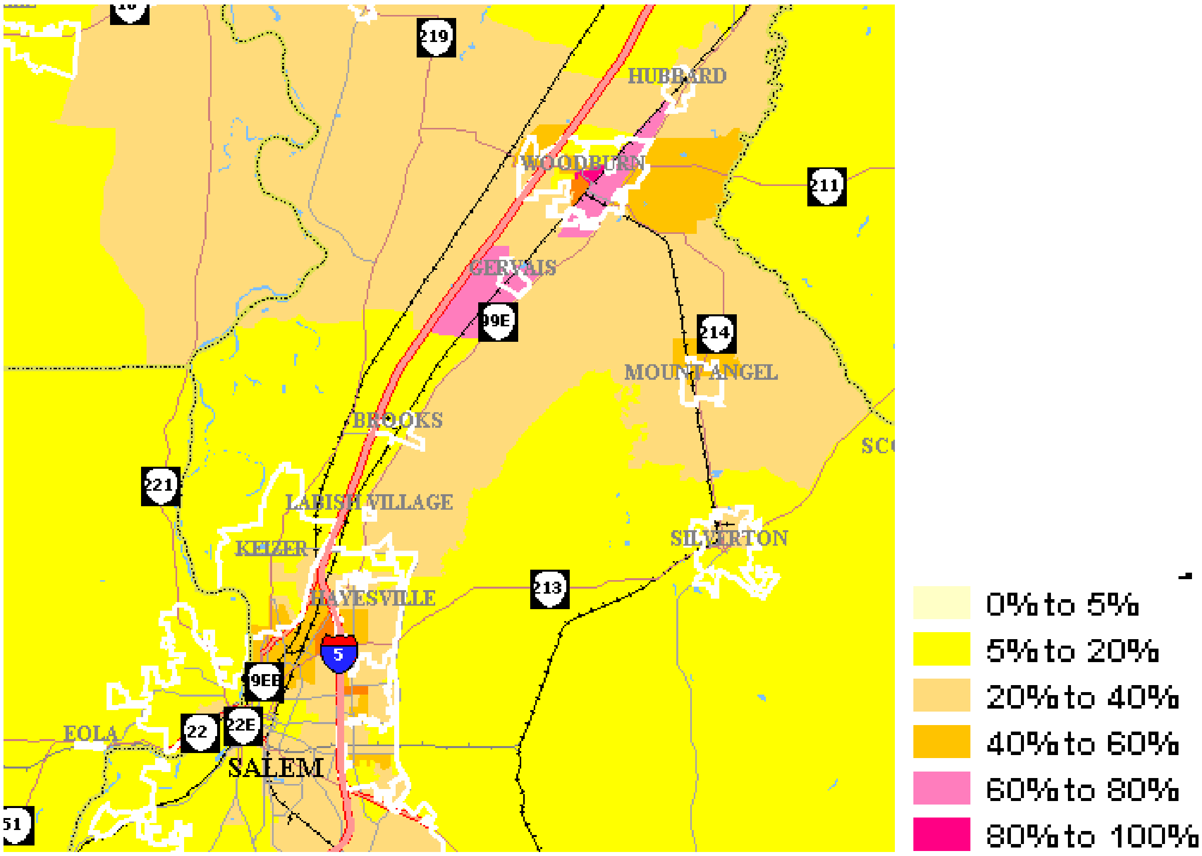

Figure A.21. 2000 Marion County cities percent minority-all ages.

Hood River County

Hood River County is mostly rural and is home to many fruit orchards. Much of the minority population in Hood River County is centered around agriculture. The map of minority distribution by census blocks in Figure A.22 shows the highest minority population around Parkdale and south. The same area has a poverty rate of 20 to 40% shown in Figure A.23.

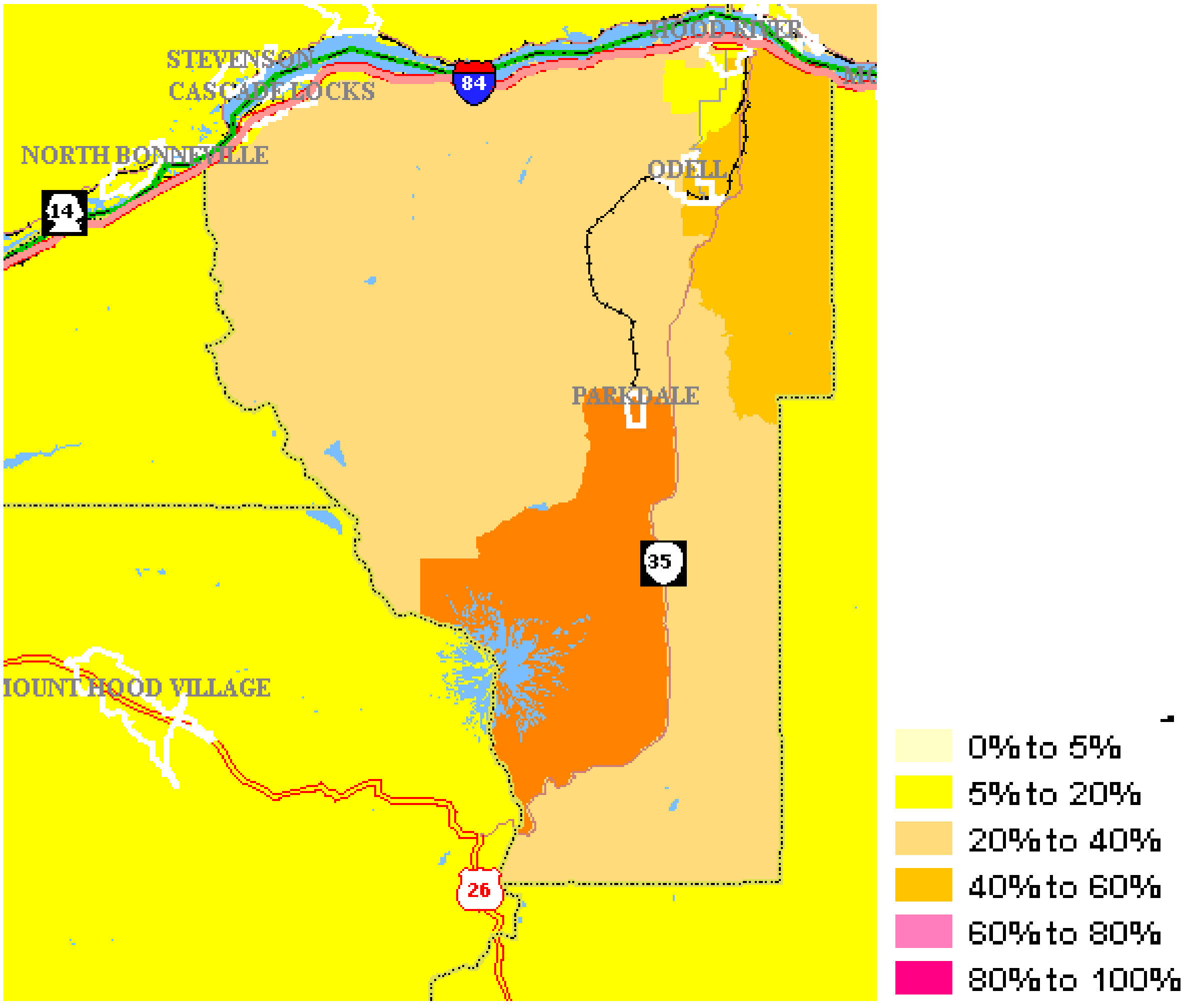

Figure A.22. Percent minority population for Hood River County.

(available in the 2000 census)

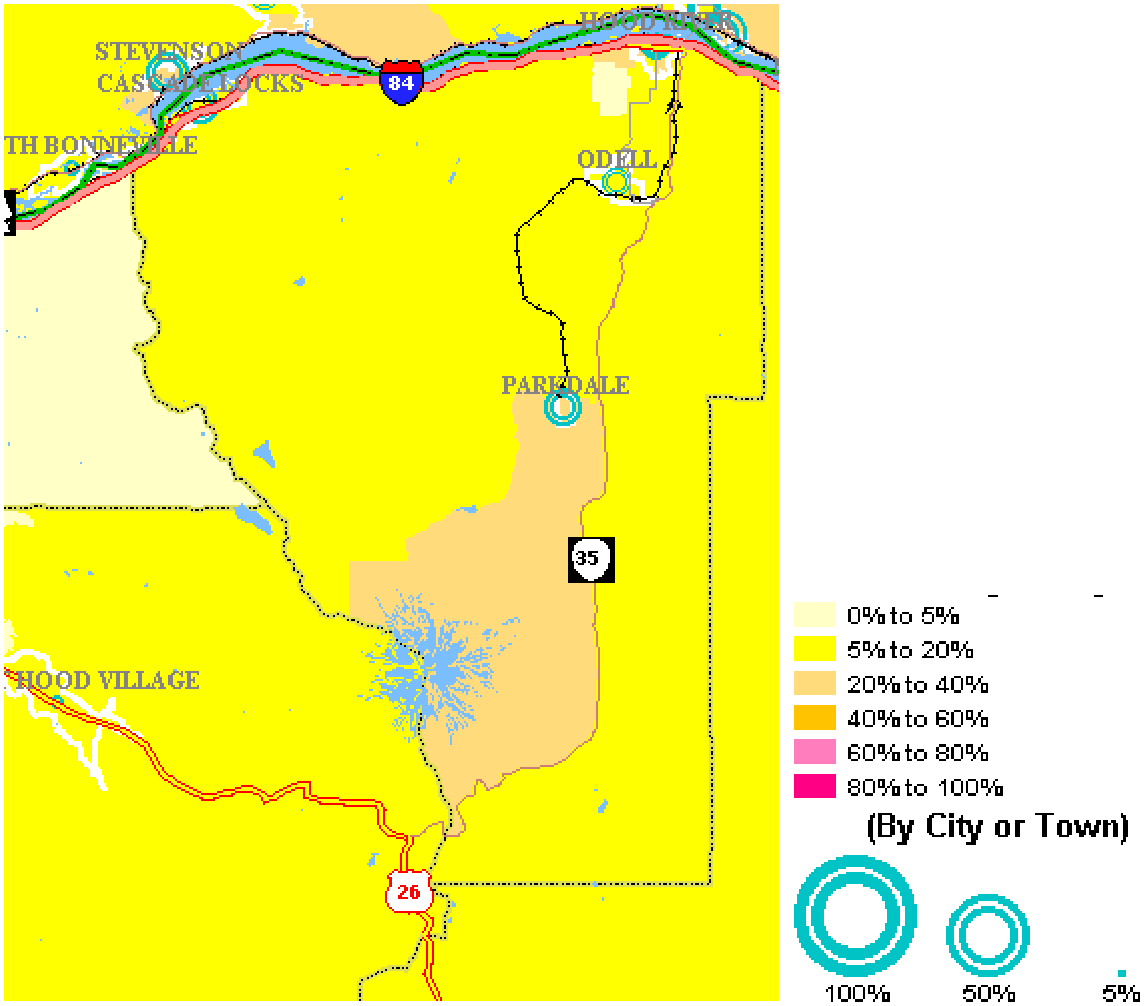

Figure A.23. Percent of poverty in Hood River County.
(available in the 2000 census)

Jefferson County
Jefferson County has a minority population of 80 to 100%. Most are Native American's living within the Confederated Tribes of Warm Springs Tribal Lands which is a sovereign state outside of ODEQ's jurisdiction. The government of the Confederated Tribes of Warm Springs communicates directly with EPA about monitoring within its own borders.

Appendix B. Summer wind roses for Oregon Ozone impacted communities.

Wind Roses in Appendix:

Fig	Site Name	Area of State	Represented City	Measurement area
B.1	Sauvie Island	North Willamette Valley	Portland Metro	Upwind, NW of urban core
B.2	N. Portland, Jefferson HS	North Willamette Valley	Portland Metro	N. urban core
B.3	Portland at SE Lafayette	North Willamette Valley	Portland Metro	SE urban core
B.4	Carus, Spangler Rd	North Willamette Valley	Portland Metro	Downwind, SE of urban core
B.5	Sherwood	North Willamette Valley	Portland Metro	Downwind, SW of urban core
B.6	McMinnville	North Willamette Valley	McMinnville/Newberg	Downwind of Portand Metro, upwind of Salem
B.7	Turner	Central Willamette Valley	Salem	Downwind of Salem
B.8	Halsey	South Willamette Valley	Halsey	Upwind, Eugene/Springfield
B.9	Eugene Wilkes Dr	South Willamette Valley	Eugene	Urban core
B.10	Springfield	South Willamette Valley	Springfield	Urban core
B.11	Medford	Southwest Oregon	Medford	Urban core
B.12	Hermiston	Northeast Oregon	Hermiston	Urban core
B.13	Pendleton	Northeast Oregon	Pendleton	Urban core
B.14	Bend	Central Oregon	Bend	Urban core
B.15	Klamath Falls	Southeast Oregon	Klamath Falls	Urban core

Portland Metro:

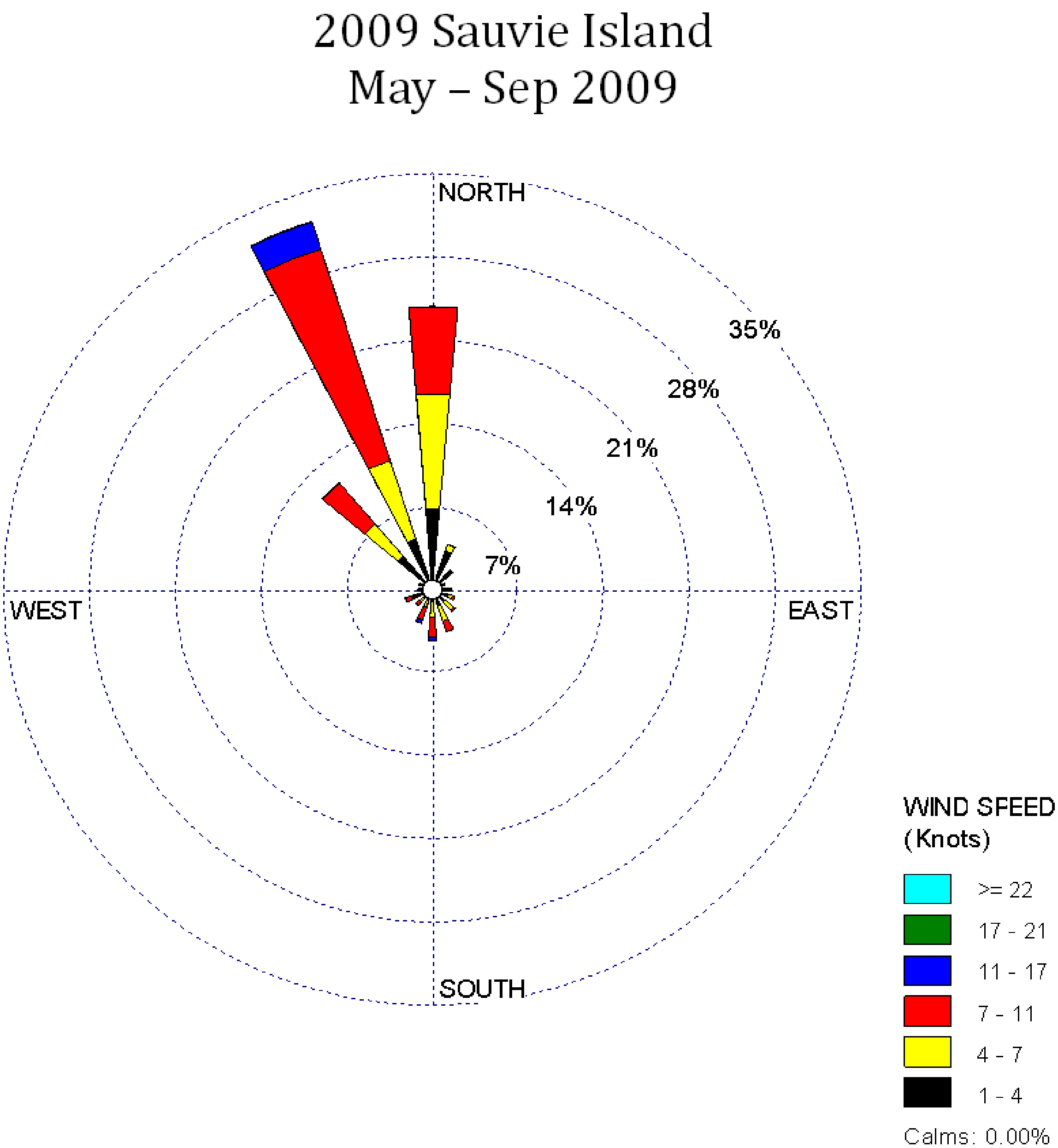

Figure B.1. Portland Metro ozone upwind site (northwest of city center).

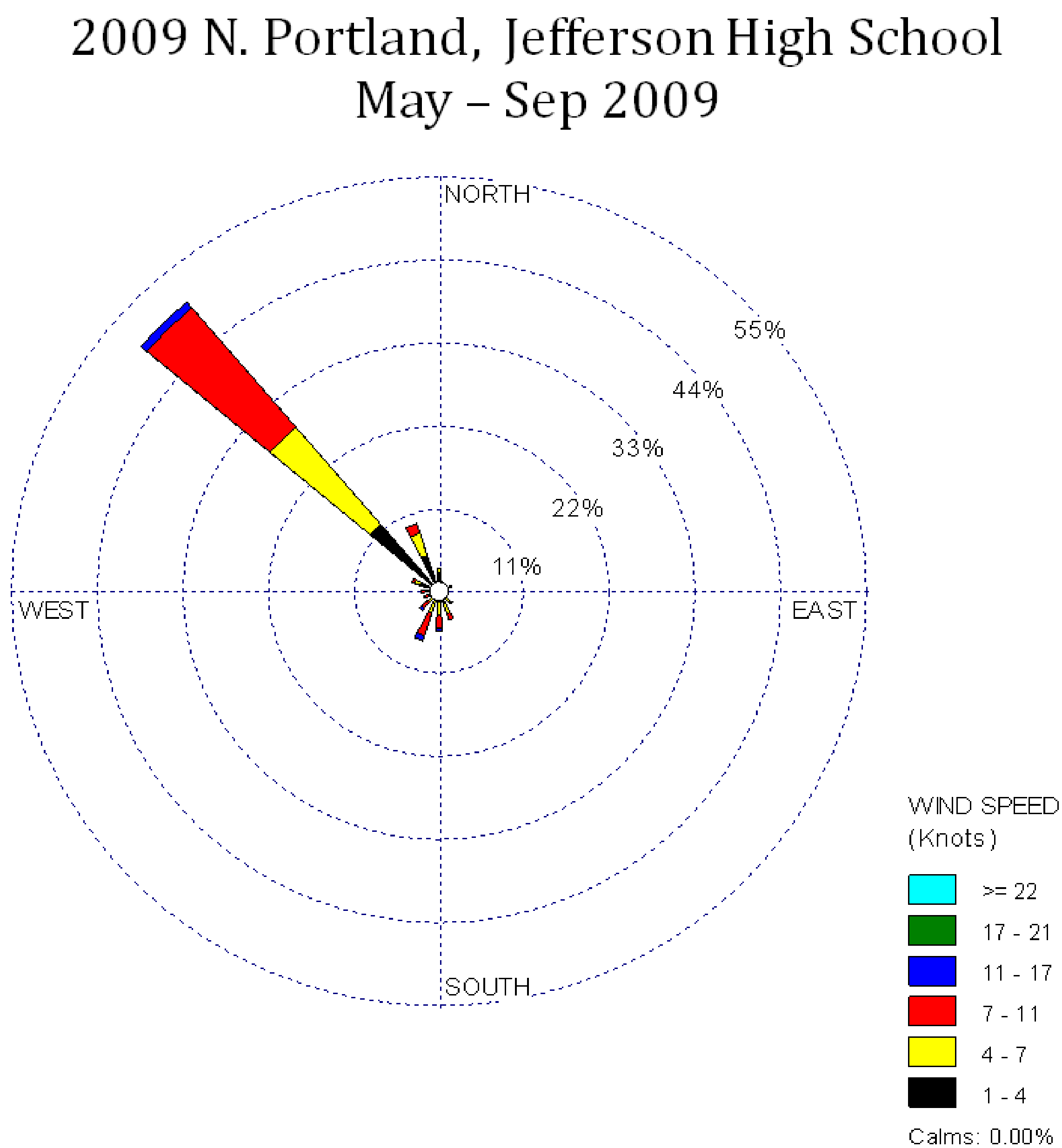

Figure B.2. Portland Metro non-ozone urban site (in north city center).

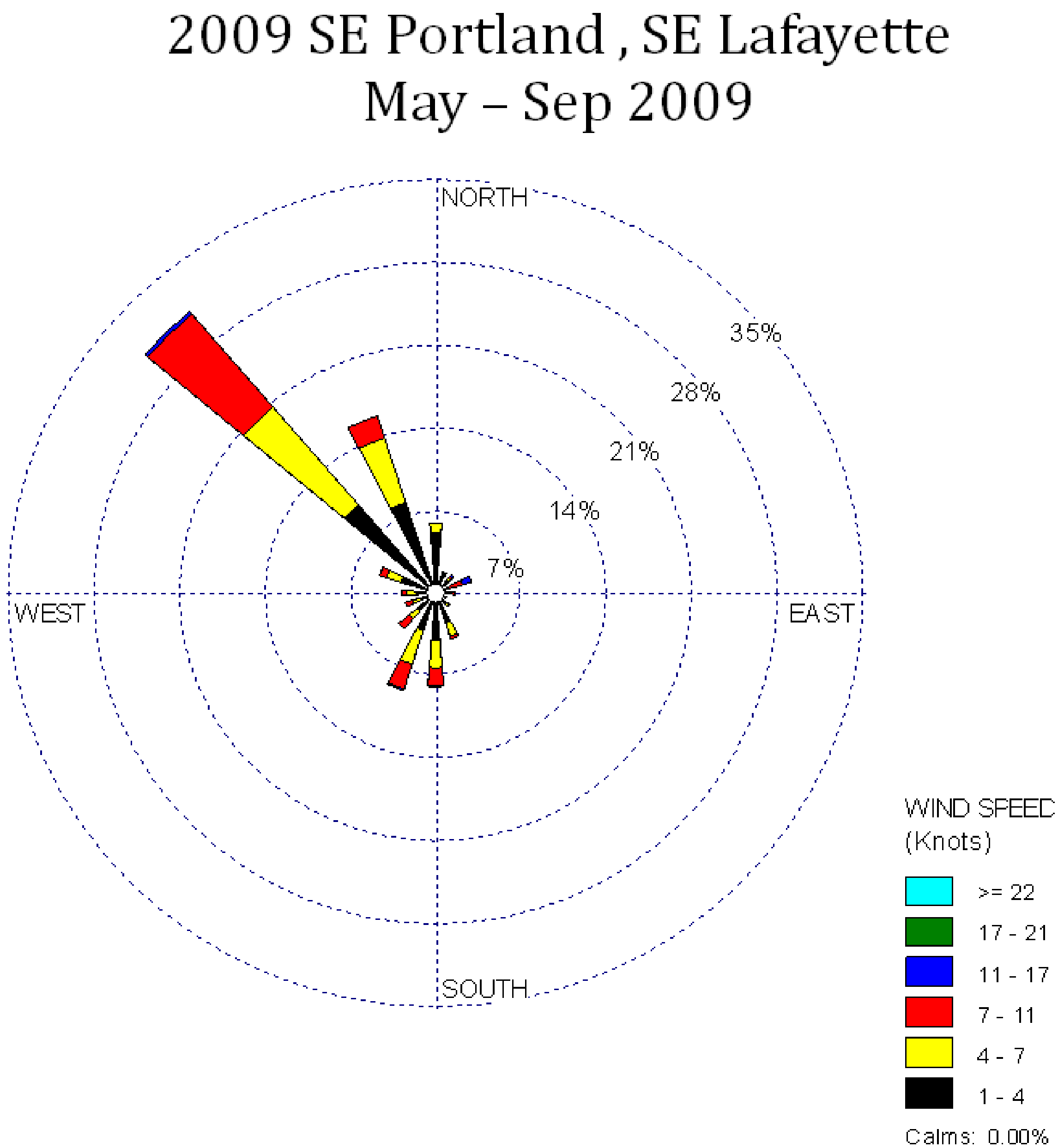

Figure B.3. Portland Metro ozone urban site (in southeast city center).

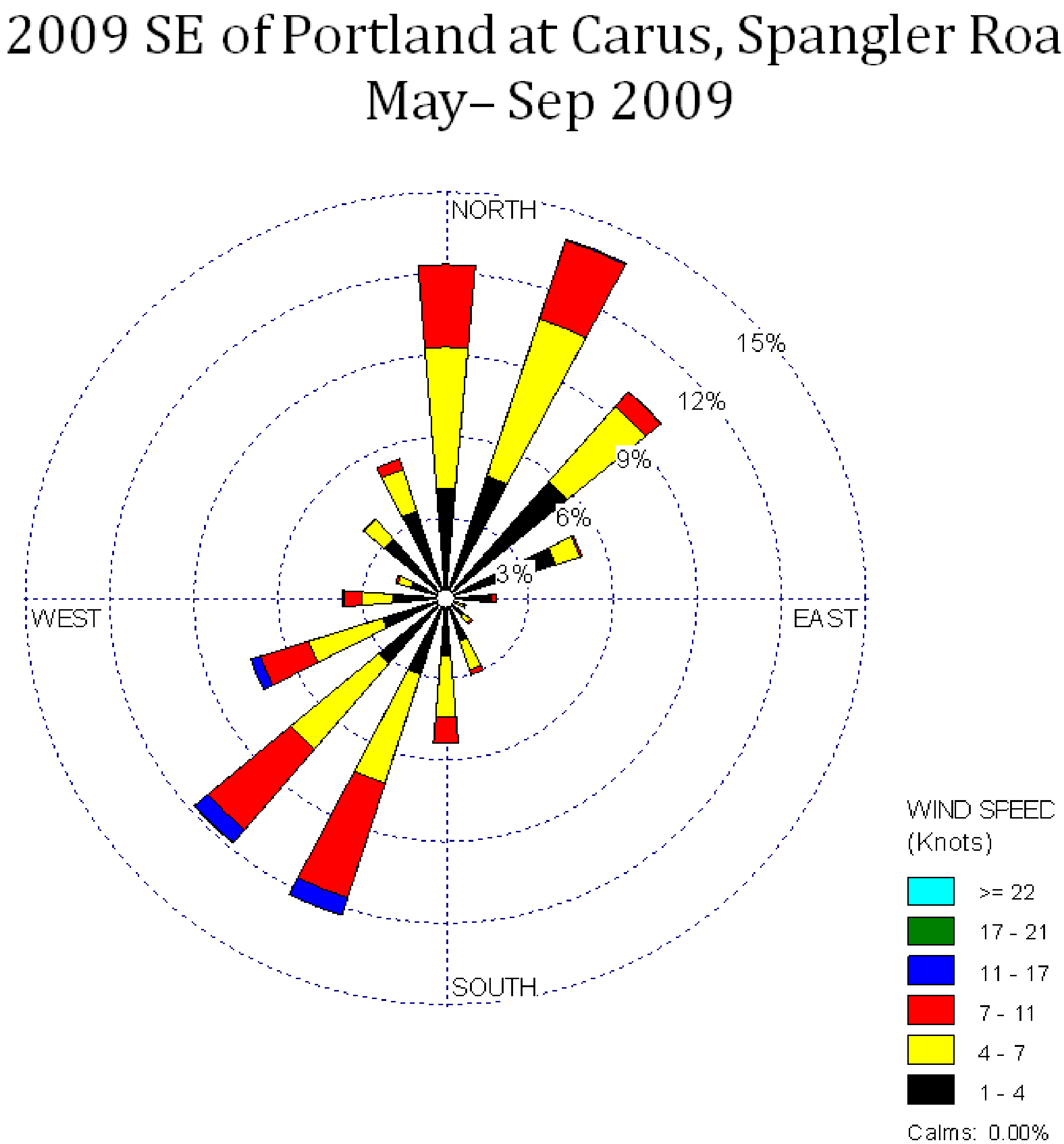

Figure B.4. Portland Metro downwind ozone site (southeast of city center).

2009 SW of Portland at Sherwood
May – Sep 2009

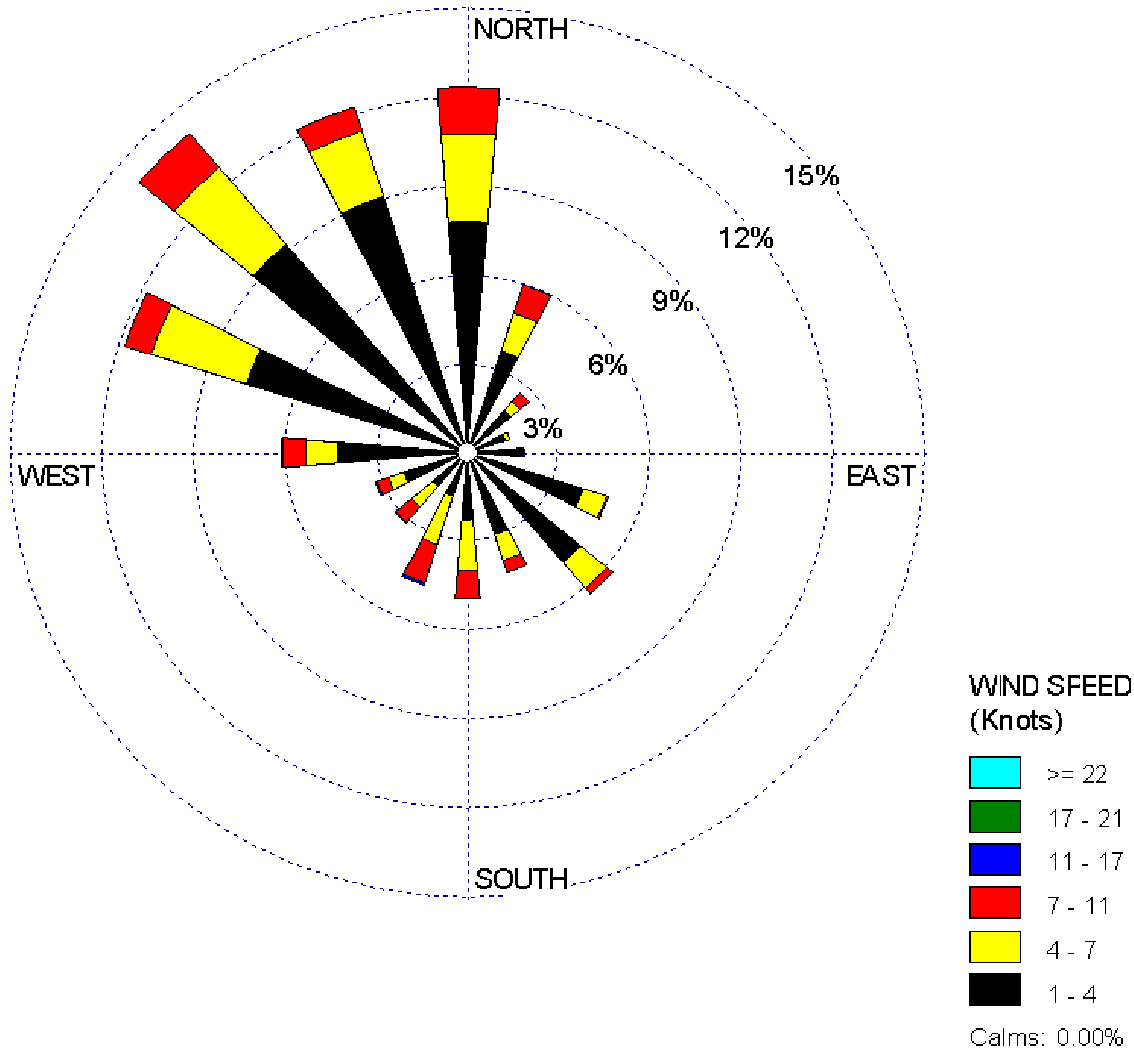

Figure B.5. Portland Metro downwind ozone site (southwest of city center).

Willamette Valley (outside of Portland Metro):

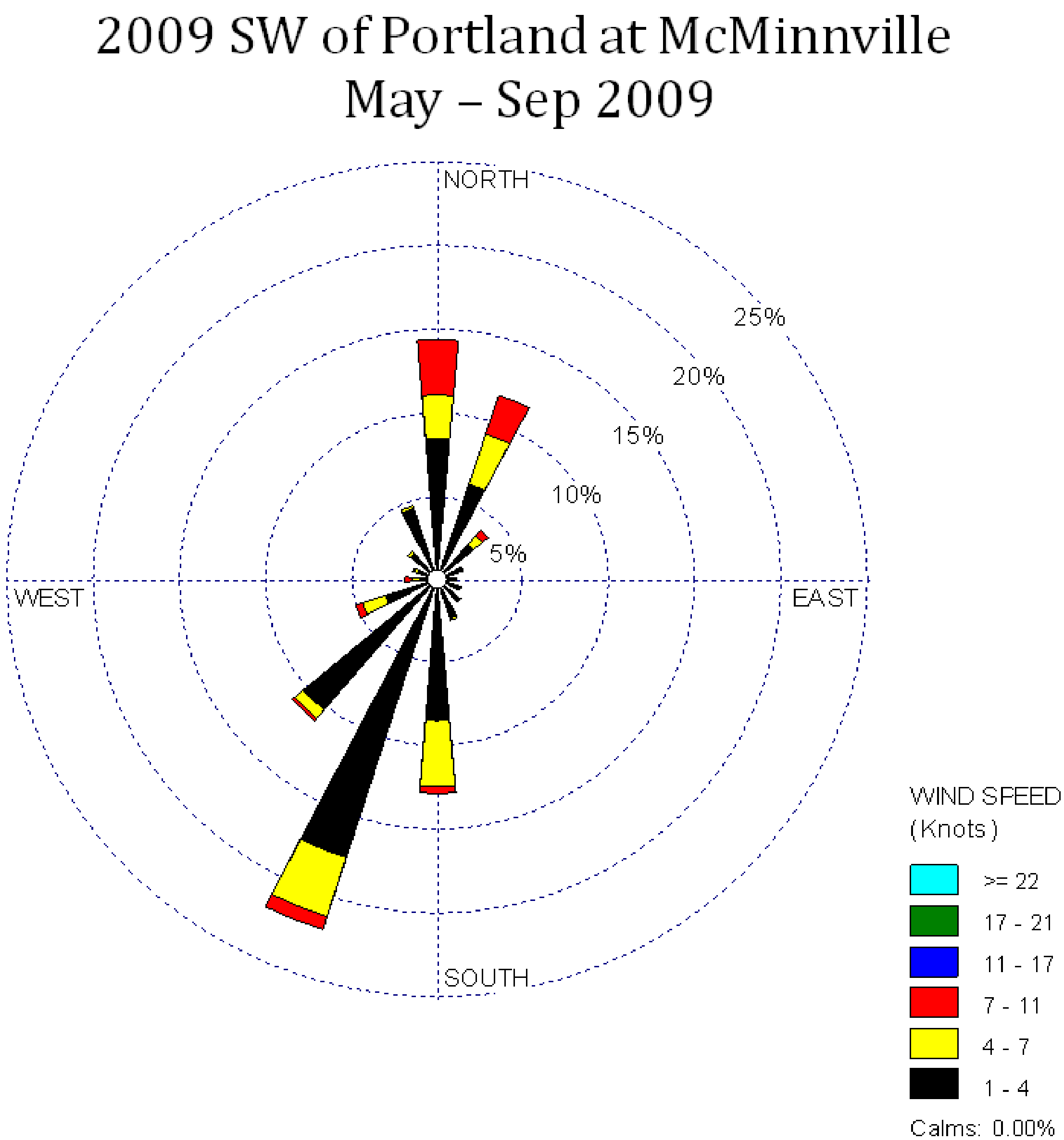

Figure B.6. Downwind of Portland Metro, non-ozone site (northwest Willamette Valley).

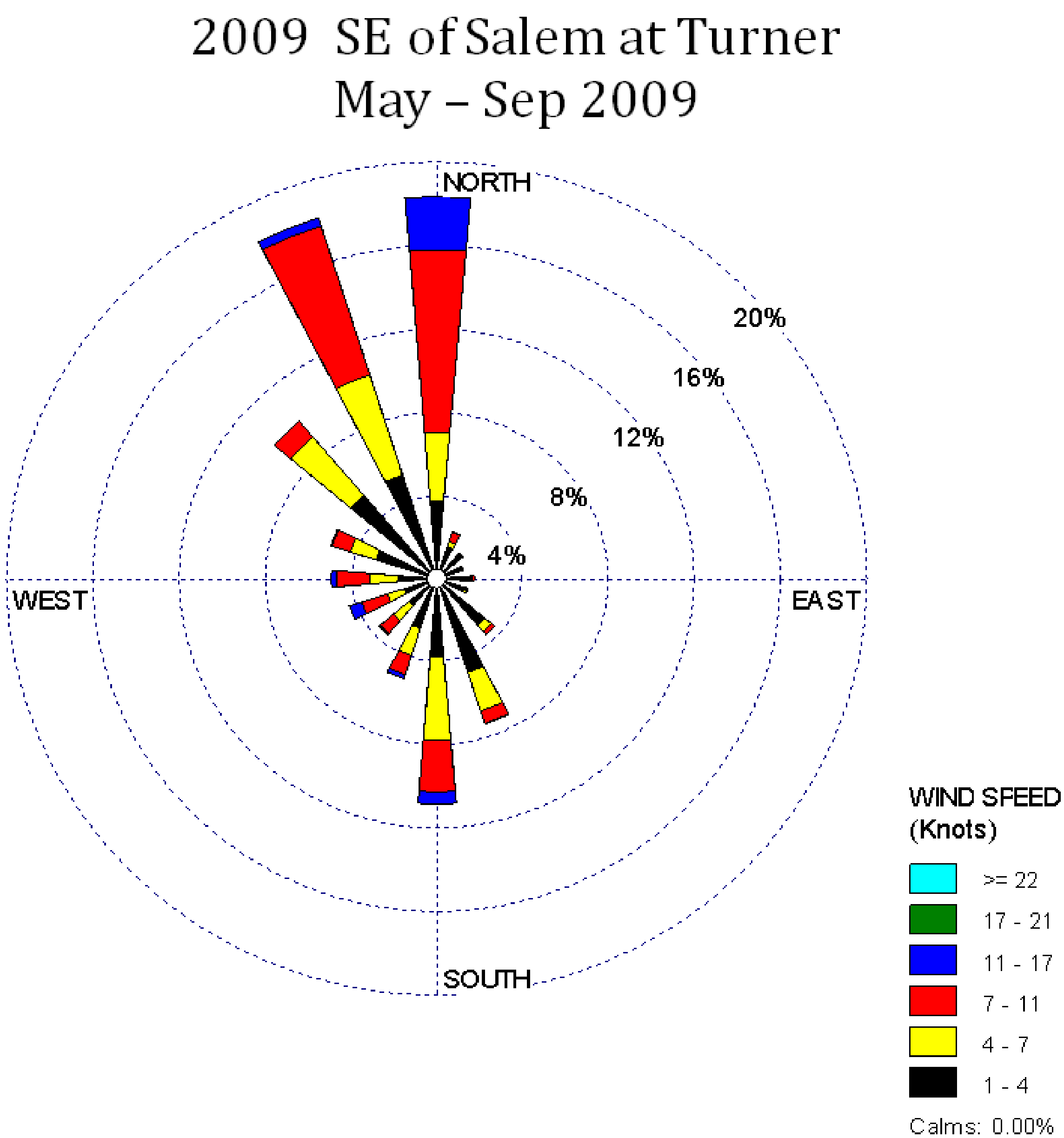

Figure B.7. Downwind of Salem ozone site (central Willamette Valley).

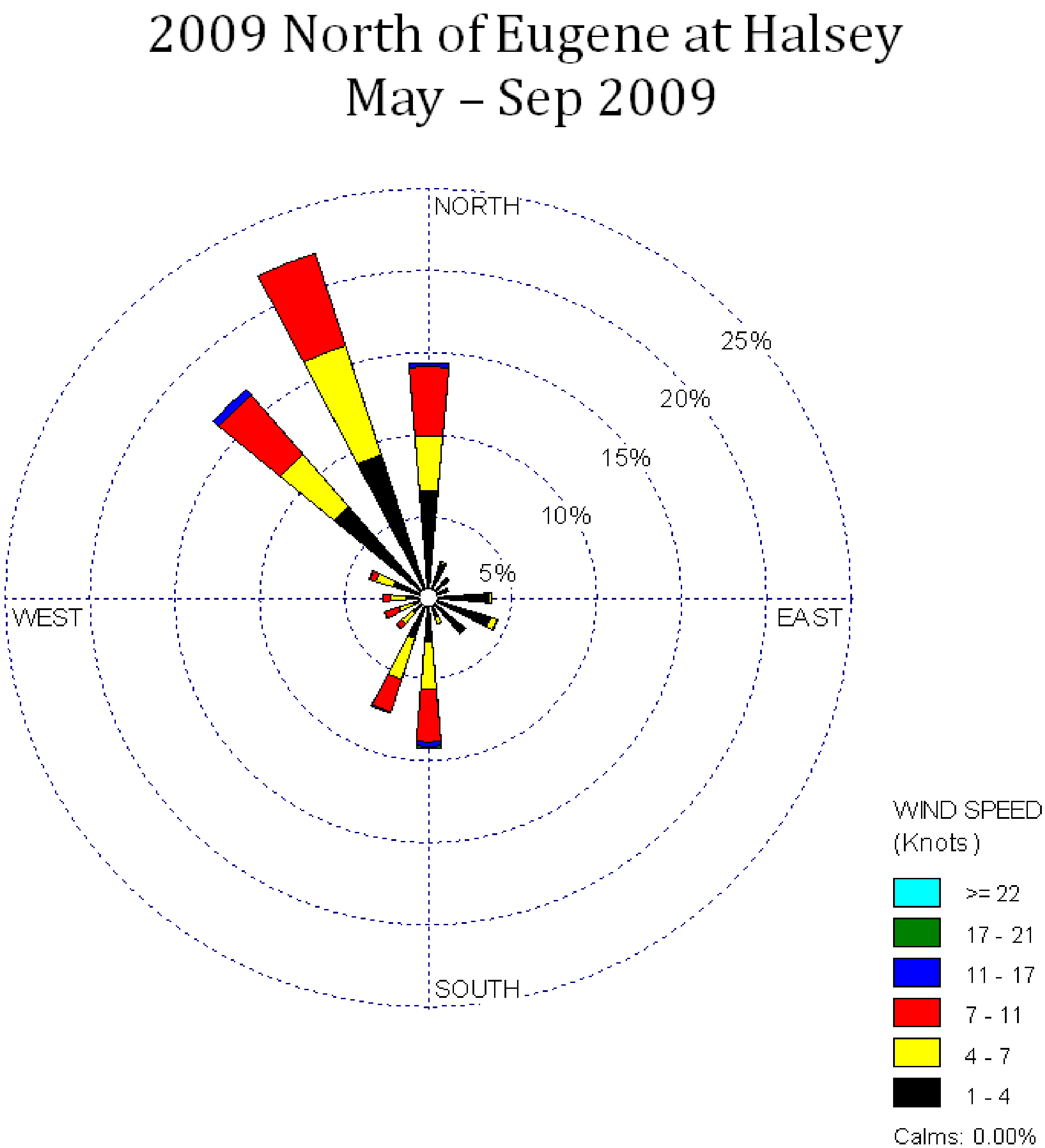

Figure B.8. Upwind of Eugene non-ozone site (south Willamette Valley).

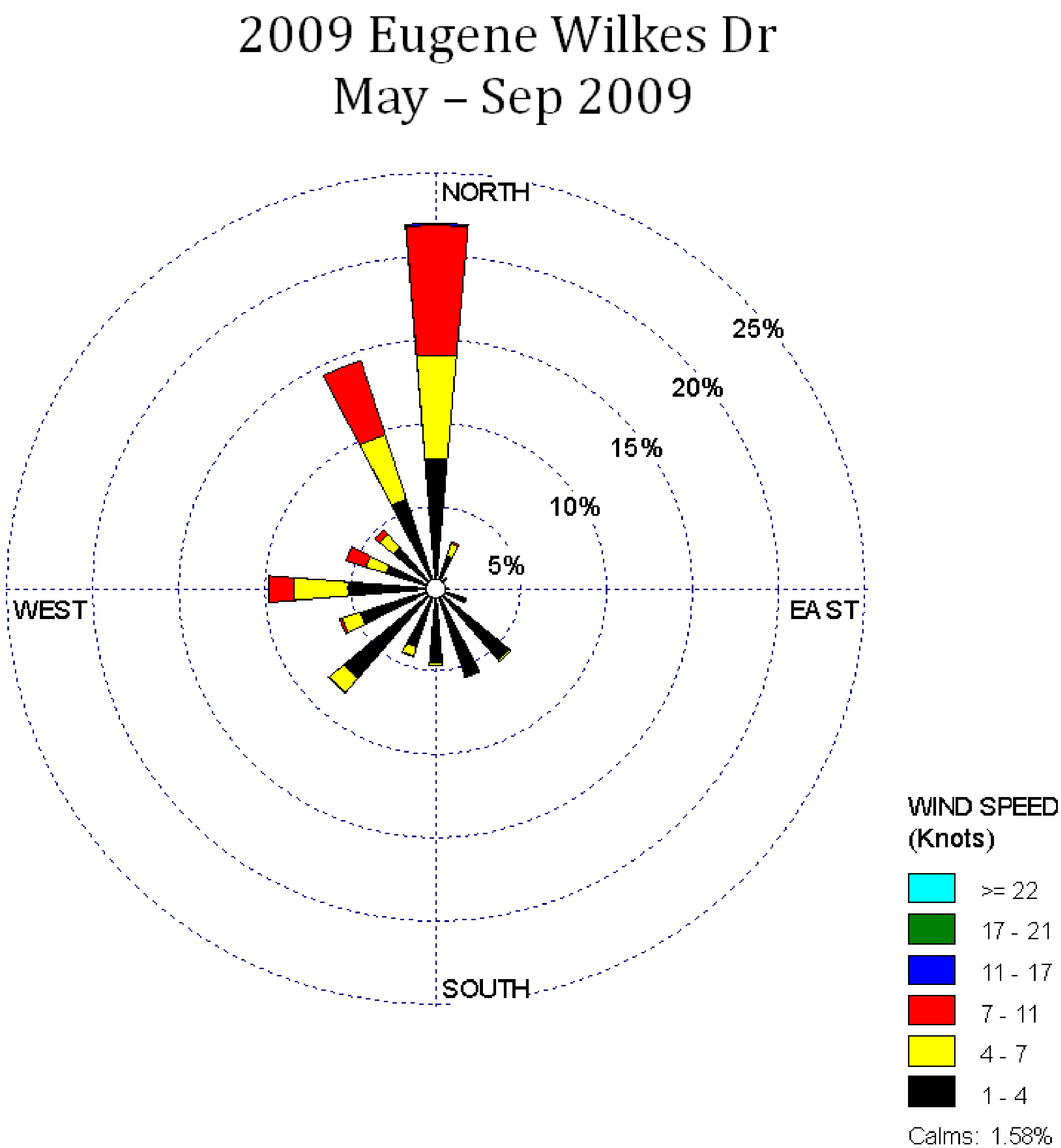

Figure B.9. Eugene urban ozone site (south Willamette Valley).

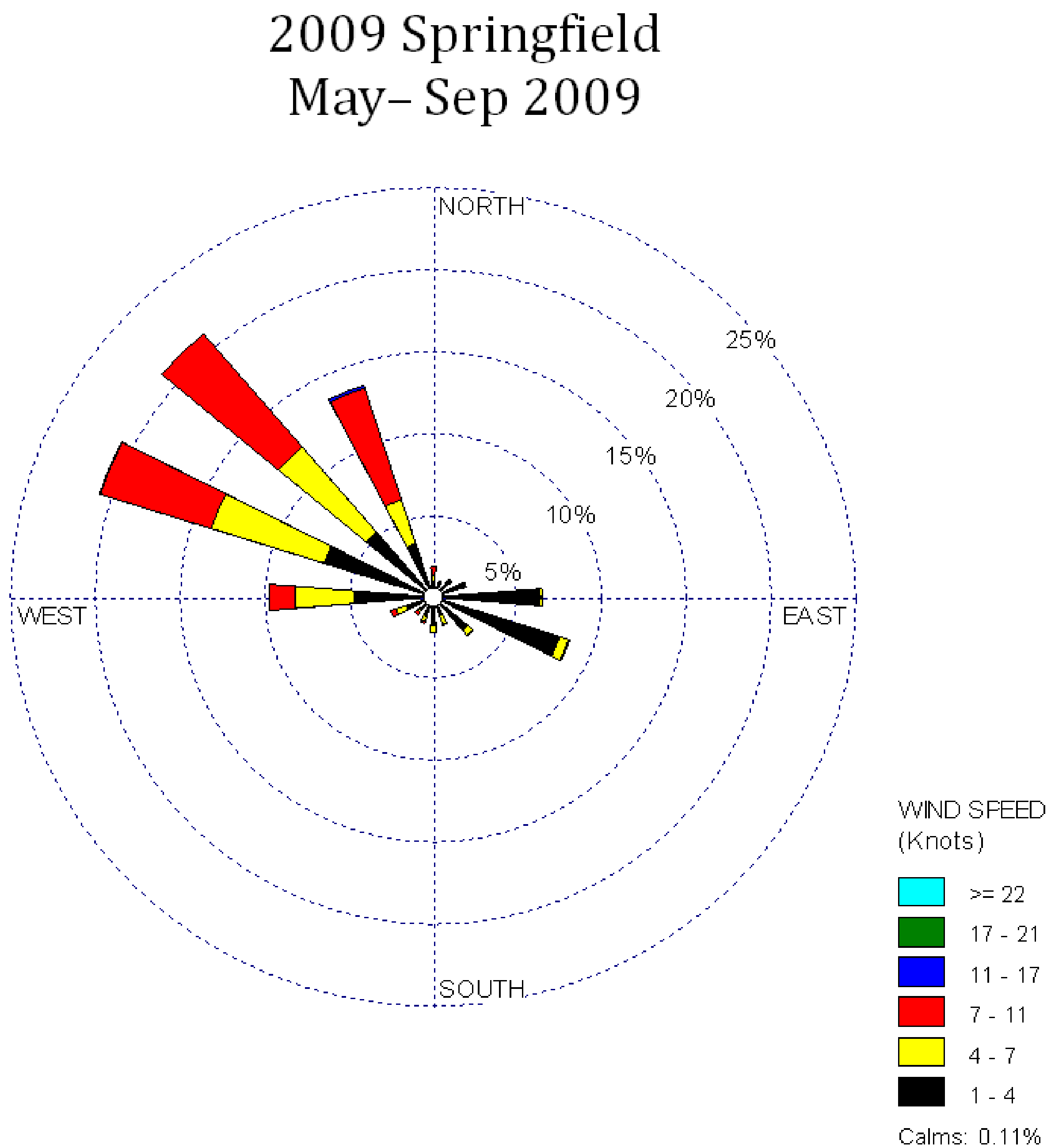

Figure B.10. Springfield urban ozone site (south Willamette Valley).

Southwest Oregon:

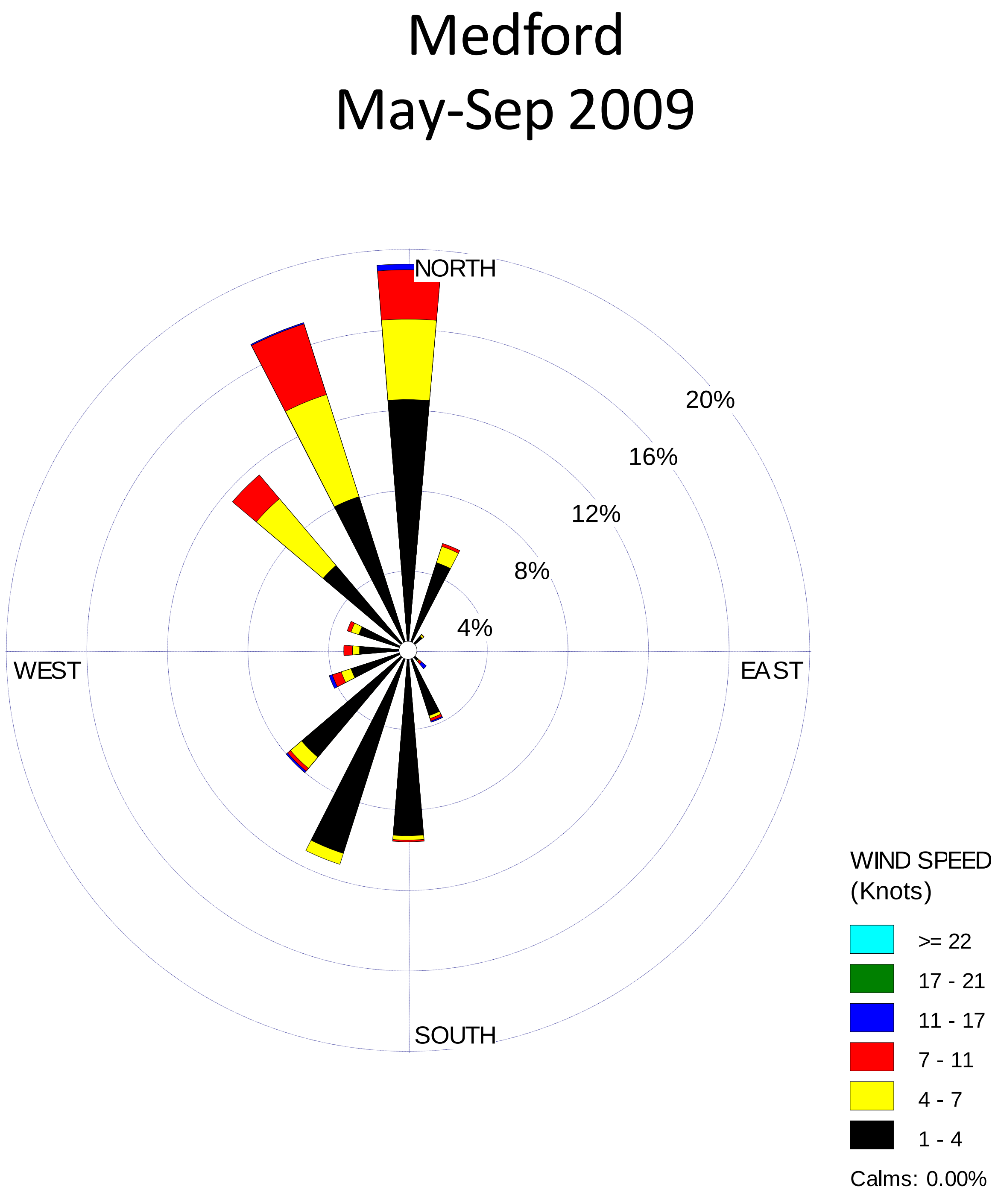

Figure B.11. Medford urban ozone site (Southwest Oregon).

Eastern Oregon:

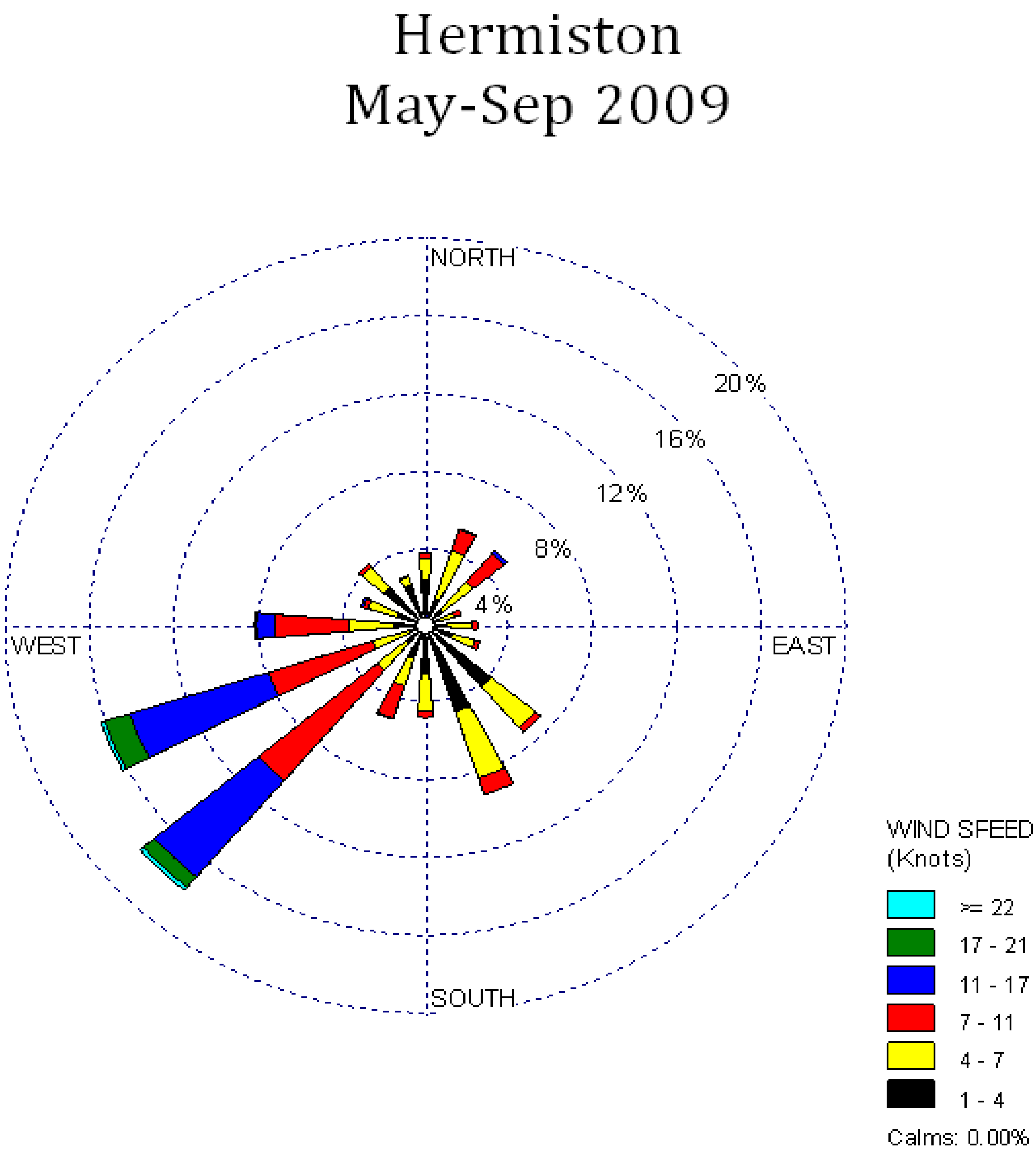

Figure B.12. Hermiston urban ozone site (Northeast Oregon).

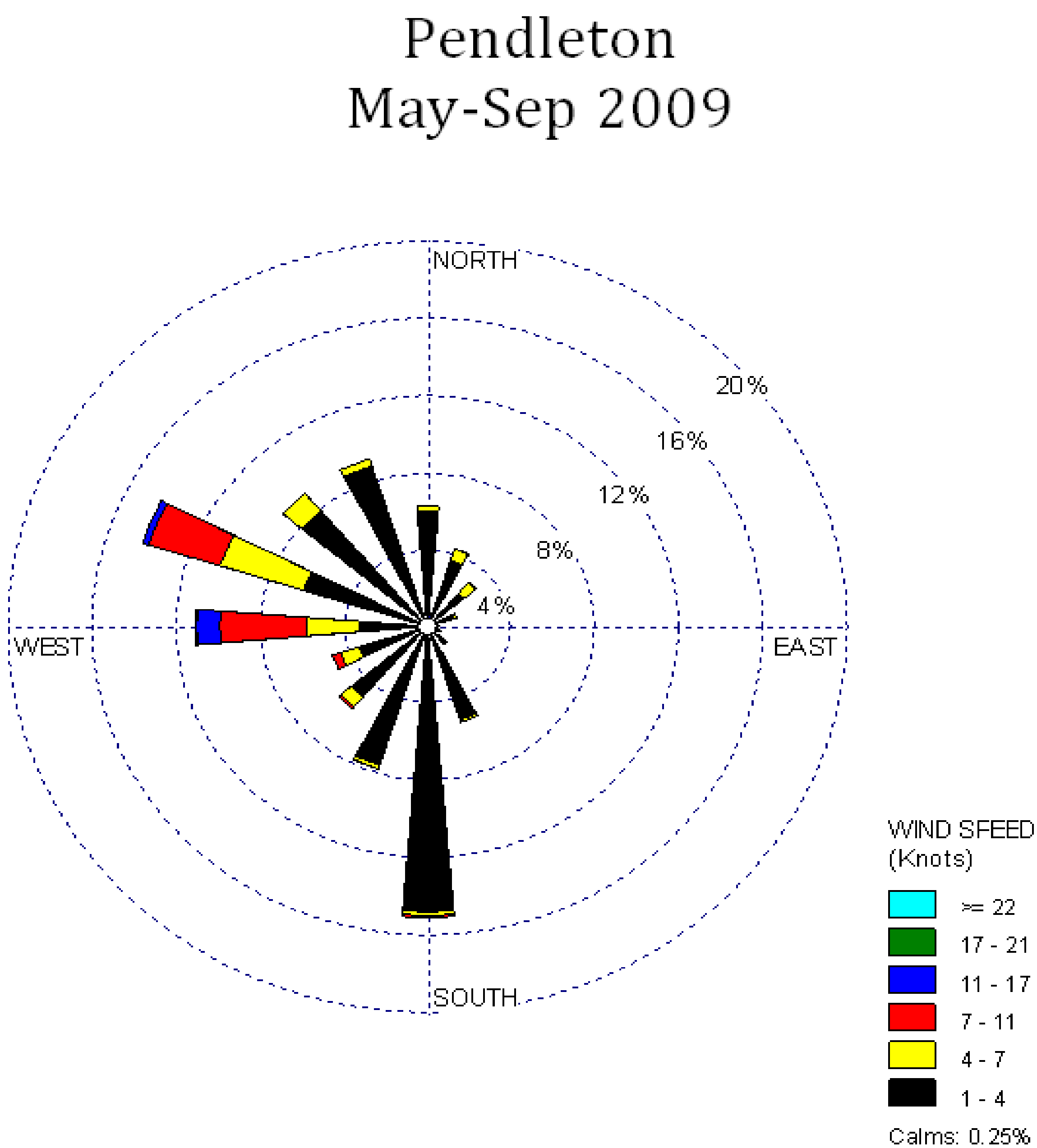

Figure B.13. Pendleton urban non-ozone site (Northeast Oregon).

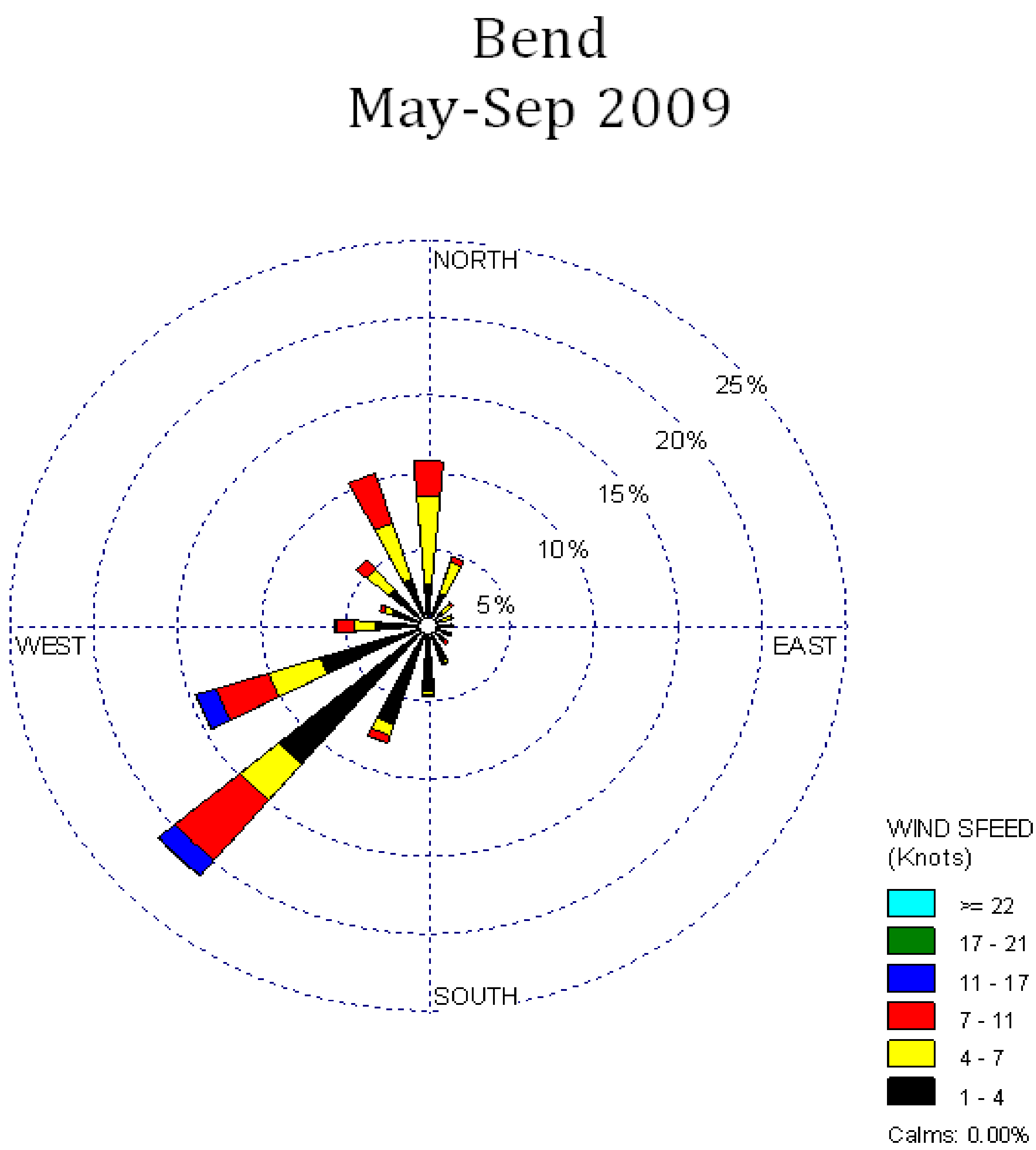

Figure B.14. Bend urban ozone site (Central Oregon).

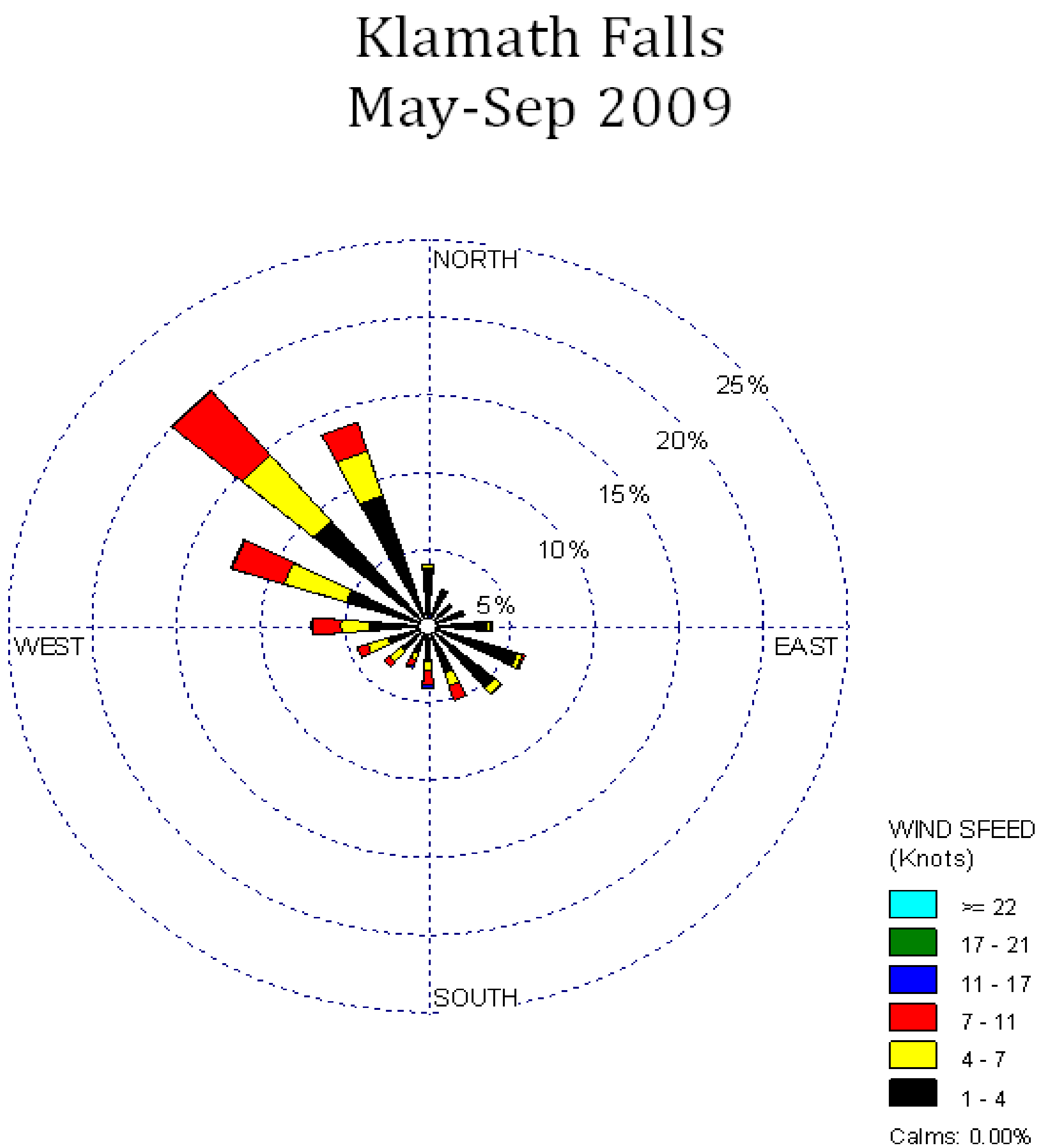

Figure B.15. Klamath Falls urban non-ozone site (Southeast Oregon).

Appendix C. PM_{10} Monitor Importance Analysis

C.1 Medford PM_{10} Monitor Importance Analysis (Should ODEQ continue PM_{10} monitoring)

Analysis:
The Medford Welch & Jackson site had sampled for PM_{10} and $PM_{2.5}$ from 1999 to 2004 after which it only sampled for PM_{10}. The winter 2001 through 2004 $PM_{2.5}$ and PM_{10} correlation has an R Squared of 0.83 (Figure C.1). During this period there were no PM_{10} samples greater than ½ the NAAQS. The highest value in 2006-2008 was only 41% of the PM_{10} NAAQS.

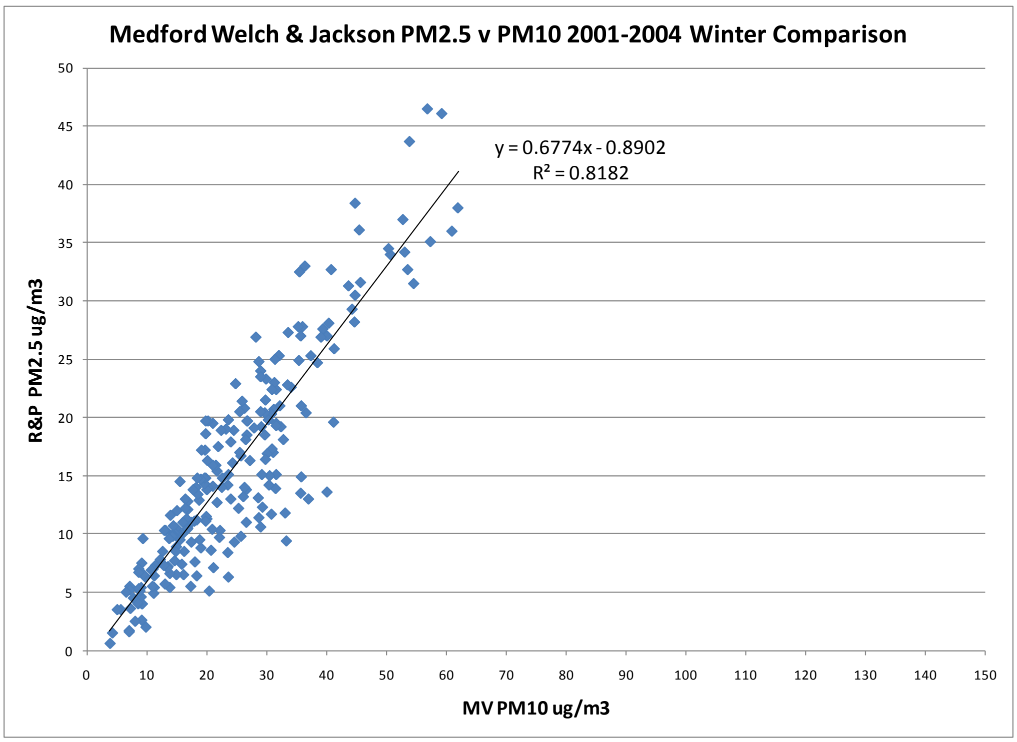

Figure C.1. Medford, Welch & Jackson PM_{10}/$PM_{2.5}$ Correlation.

On average, winter PM_{10} are 63% $PM_{2.5}$ by weight. Figure C.2 shows the $PM_{2.5}$ and PMcoarse fractions for the highest winter values for 2001-2004.

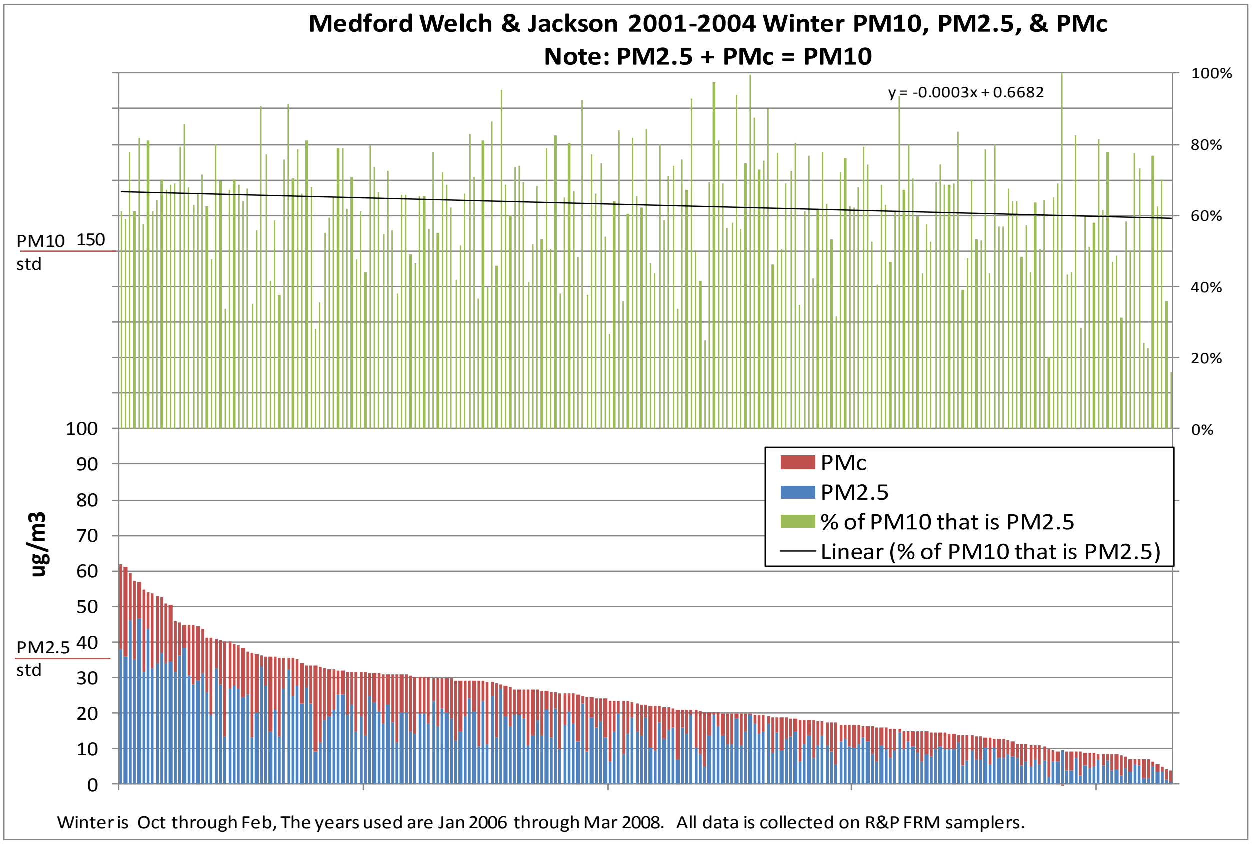

Figure C.2. Medford, Welch & Jackson PM_{10} - PMcoarse/$PM_{2.5}$ distribution.

Medford Welch & Jackson PM_{10} vs. Medford Grant & Belmont PM_{10}

A redundancy analysis was performed on Medford Welch and Jackson vs. Medford Grants & Belmont. The sites are two miles apart but Grant & Belmont is in a residential neighborhood and Welch & Jackson is in a small commercial area. During the winter of 2007, DEQ operated PM_{10} Rupprecht and Patashnick samplers at both sites. The results are shown in Figure C.3. Welch & Jackson had slightly higher values than Grant & Belmont but they tracked each other very well. The $PM_{2.5}$ at Grant & Belmont also mirrored the PM_{10} at both sites but with a lower concentration. A linear regression of the PM_{10} had an R Squared value of 0.90 (shown in Figure C.4).

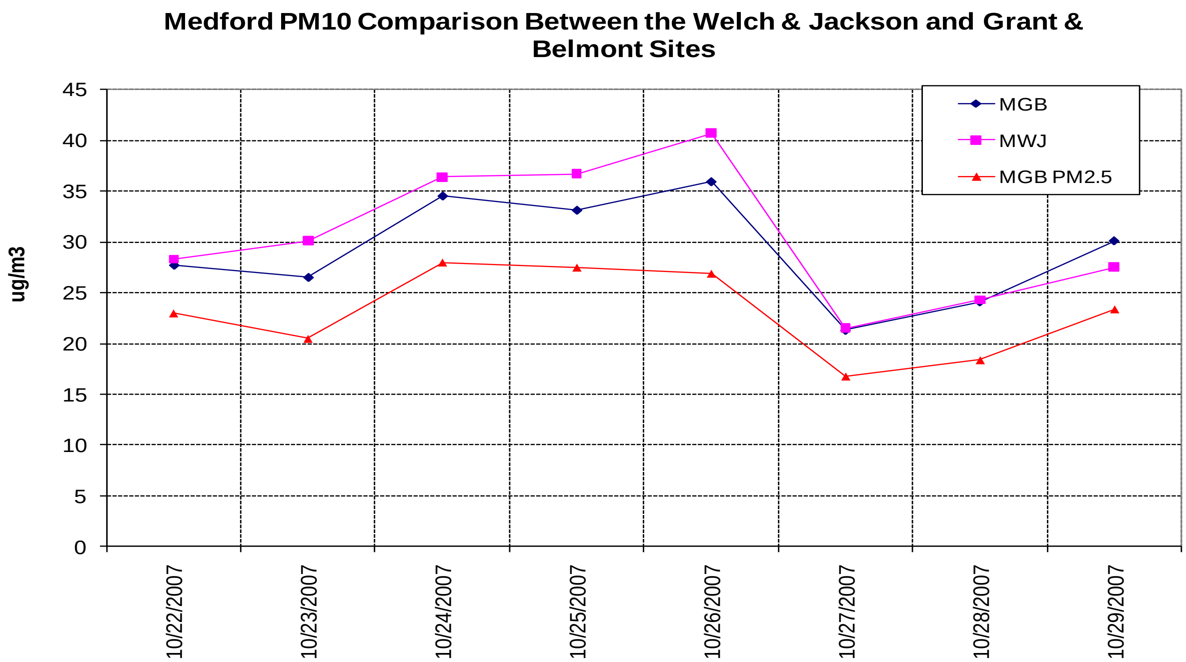

Figure C.3. Medford, Welch & Jackson PM_{10}/Grant & Belmont PM_{10} and $PM_{2.5}$ *(October 2007). MGB = Grant and Belmont, MWJ = Welch and Jackson.*

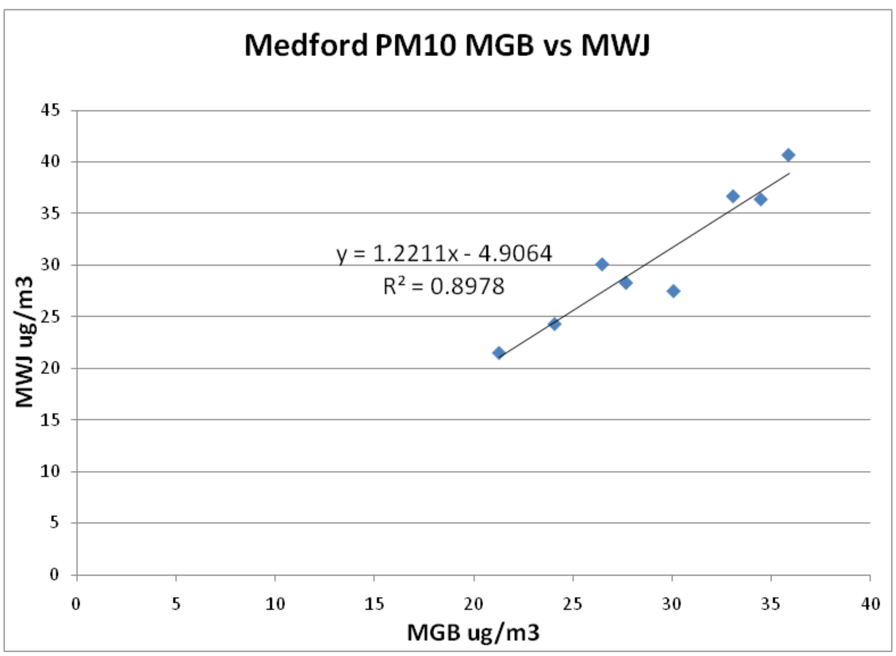

Figure C.4. Medford, Welch & Jackson/Grant & Belmont PM_{10} Linear Regression.

Medford Welch & Jackson PM_{10} vs. White City PM_{10}

An analysis of existing data was performed to determine if White City can represent Medford if the Welch and Jackson site was discontinued. White city has historically had the highest PM_{10} values in the Medford/Ashland AQMA. The second highest values have been at Welch and Jackson the majority of the time in the last 10 years. Neither site is near the NAAQS. Table C.1 compares the percent of the NAAQS for the maximum and second highest values at White City and Welch and Jackson. The maximum values occur in White City nine out of 10 years. The second highest value is more varied with Welch and Jackson being higher seven out of the 10 years, however, seven out of the 10 years had a difference in the percent of the NAAQS of 5% and under. This indicates that for most years the second highest values are very similar. Regardless, the ten year maximum value for either site is only 63% of the NAAQS.

Taking all of this into consideration, it is very unlikely that Welch and Jackson would exceed the PM_{10} NAAQS without White City also exceeding. It is far more likely that an elevated PM_{10} reading would coincide with a $PM_{2.5}$ exceedance. PM_{10} and $PM_{2.5}$ have similar mitigation strategies and PM_{10} would be addressed with any corrective action taken to address $PM_{2.5}$.

DEQ plans to discontinue Welch and Jackson and continue monitoring PM_{10} in the Medford/Ashland area using the White City monitor and the three year interval emission inventory. $PM_{2.5}$ monitoring will continue at Grant and Belmont.

Table C.1. Medford Welch&Jackson/Grant&Belmont PM_{10} redundancy comparison.

	% of Daily Standard					
	Maximum Value			Second Highest Value		
YEAR	**White City**	**Welch & Jackson**	**Diff**	**White City**	**Welch & Jackson**	**Diff**
2000	**49%**	48%	1%	**45%**	45%	1%
2001	**59%**	43%	17%	42%	**53%**	-11%
2002□	**60%**	53%	7%	49%	**59%**	-11%
2003	**45%**	39%	7%	38%	**39%**	-1%
2004	**39%**	35%	4%	33%	**35%**	-3%
2005	**47%**	35%	12%	34%	**35%**	-1%
2006	**60%**	43%	17%	41%	**43%**	-1%
2007	62%	**63%**	-1%	**52%**	46%	6%
2008□	**39%**	35%	3%	31%	**36%**	-5%
2009	**39%**	33%	6%	31%	31%	0%
Average Difference		max	7%		2nd High	-3%

□ Heavy Forest Fire Smoke impact

C.2 Klamath Falls PM_{10} Monitoring Value Analysis

The Klamath Falls Peterson School site has sampled for PM_{10} and $PM_{2.5}$ from 1999 to 2009. More recently the site has used the Rupprecht and Pataschnict FRM samplers for both parameters. The winter 2007 through 2009 $PM_{2.5}$ and PM_{10} correlation has an R Squared of 0.76 (Figure C.5). During this period there were 17 samples greater than ¼ of the PM_{10} NAAQS, three of which were greater than ½ the PM_{10} NAAQS. The highest value in the past three winters was 57% of the PM_{10} NAAQS.

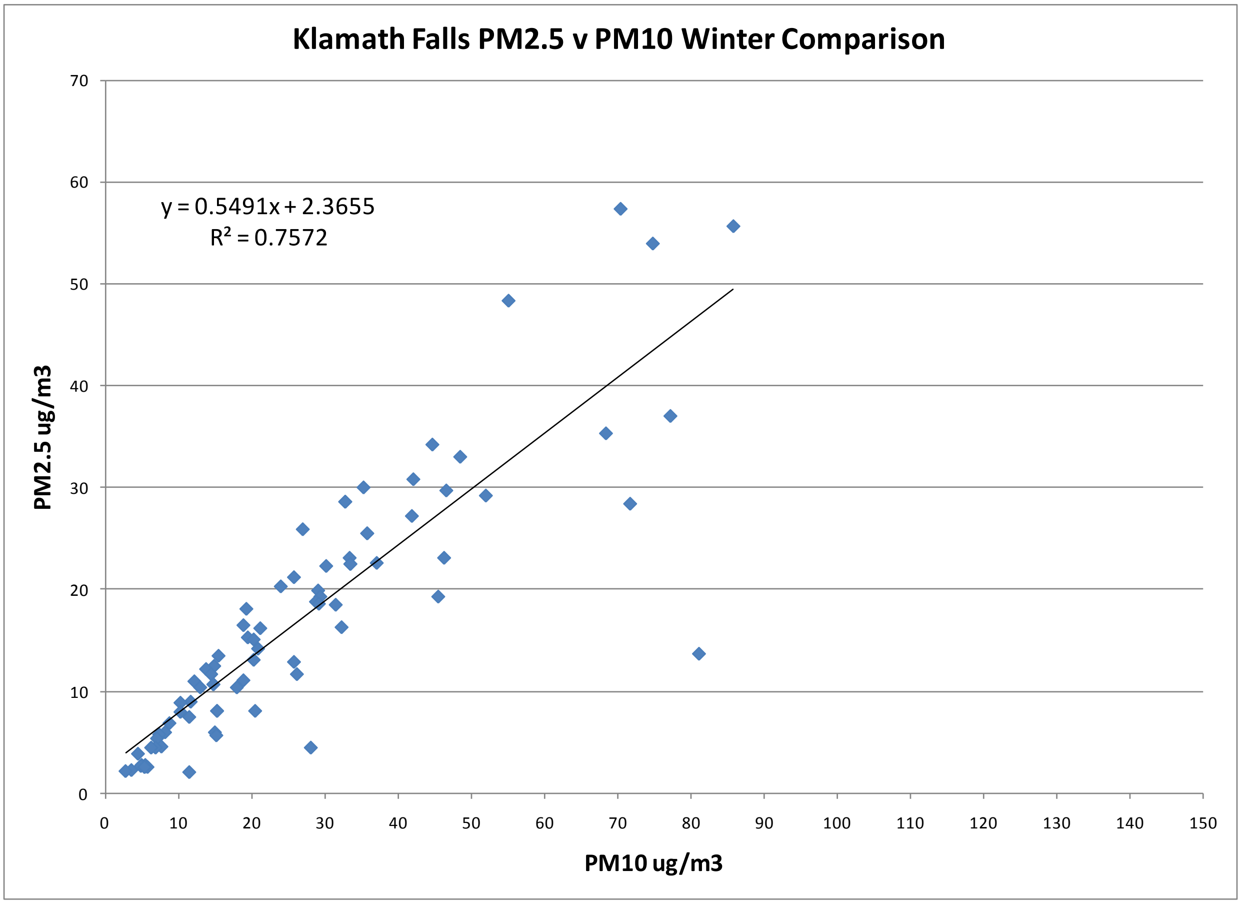

Figure C.5. Klamath Falls, Peterson School PM_{10}/$PM_{2.5}$ Correlation.

On average, winter PM_{10} are 66% $PM_{2.5}$ by weight. Figure C.6 shows the $PM_{2.5}$ and PMcoarse fractions for the highest winter values for 2007-2009. There are a couple of values with relatively low $PM_{2.5}$ fractions. These are likely dust events, but are far below the NAAQS.

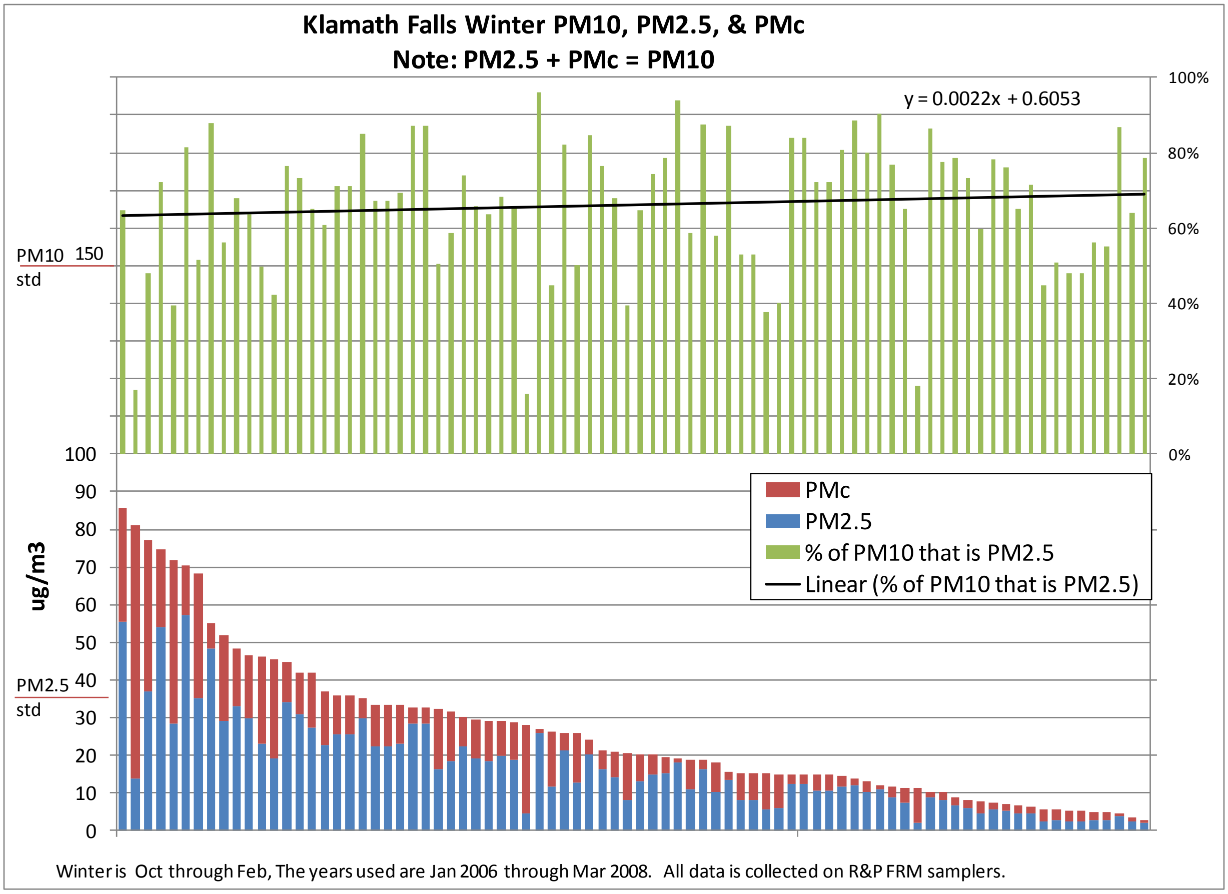

Figure C.6. Klamath Falls, Peterson School PM_{10} - PMcoarse/$PM_{2.5}$ distribution.

C.3 Grants Pass PM_{10} Monitoring Value Analysis

The Grants Pass Parkside School site has sampled for PM_{10} and $PM_{2.5}$ since 1999. More recently the site has used the Rupprecht and Pataschnict FRM samplers for both parameters. The winter 2006 through 2008 $PM_{2.5}$ and PM_{10} correlation has an R Squared of 0.94 (Figure C.7). From 2006 to 2008 there were only four samples over ¼ of the PM_{10} NAAQS, and none over ½ the PM_{10} NAAQS. The highest value in the past three winters was only 29% of the PM_{10} NAAQS.

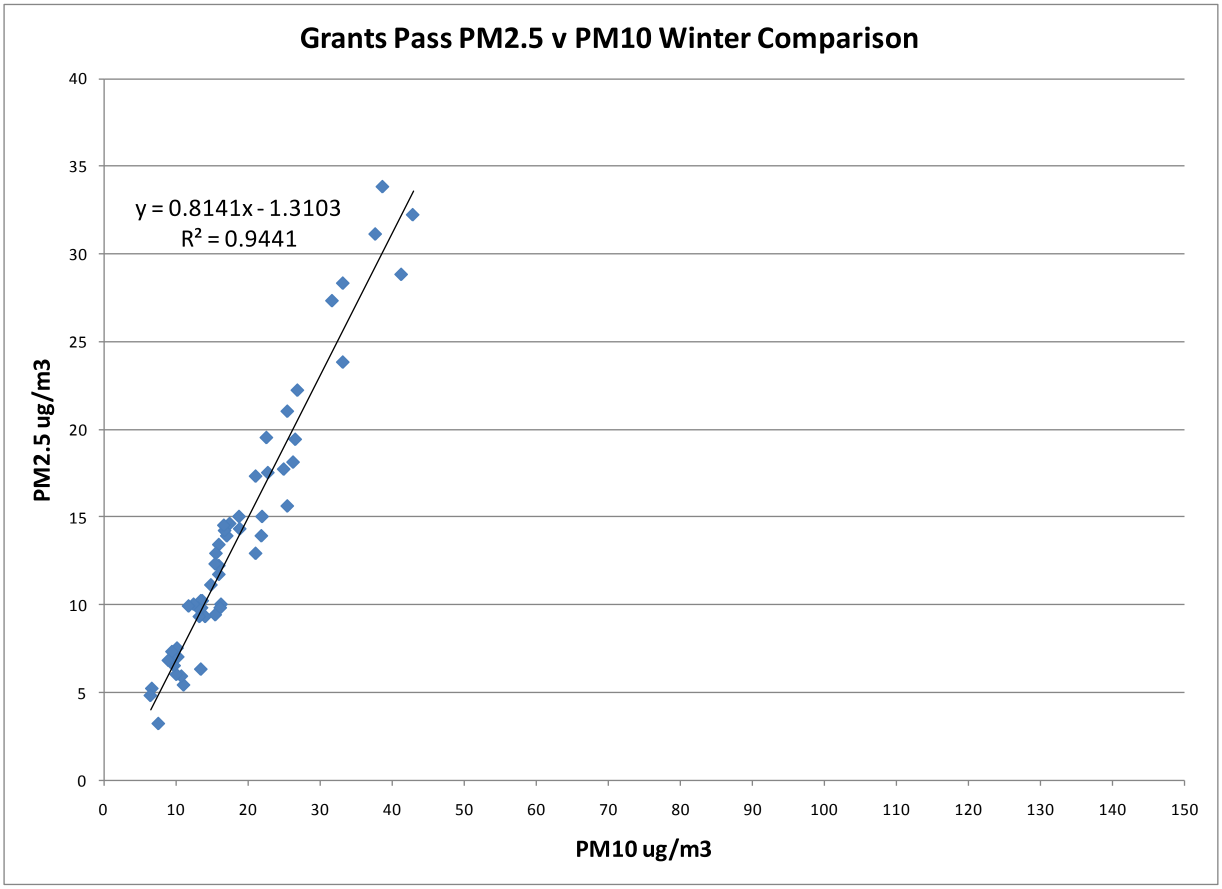

Figure C.7. Grants Pass, Parkside School PM_{10}/$PM_{2.5}$ Correlation.

On average, winter PM_{10} is 73% $PM_{2.5}$ by weight. Figure C.8 shows the $PM_{2.5}$ and PMcoarse fractions for the winter values for 2006-2008.

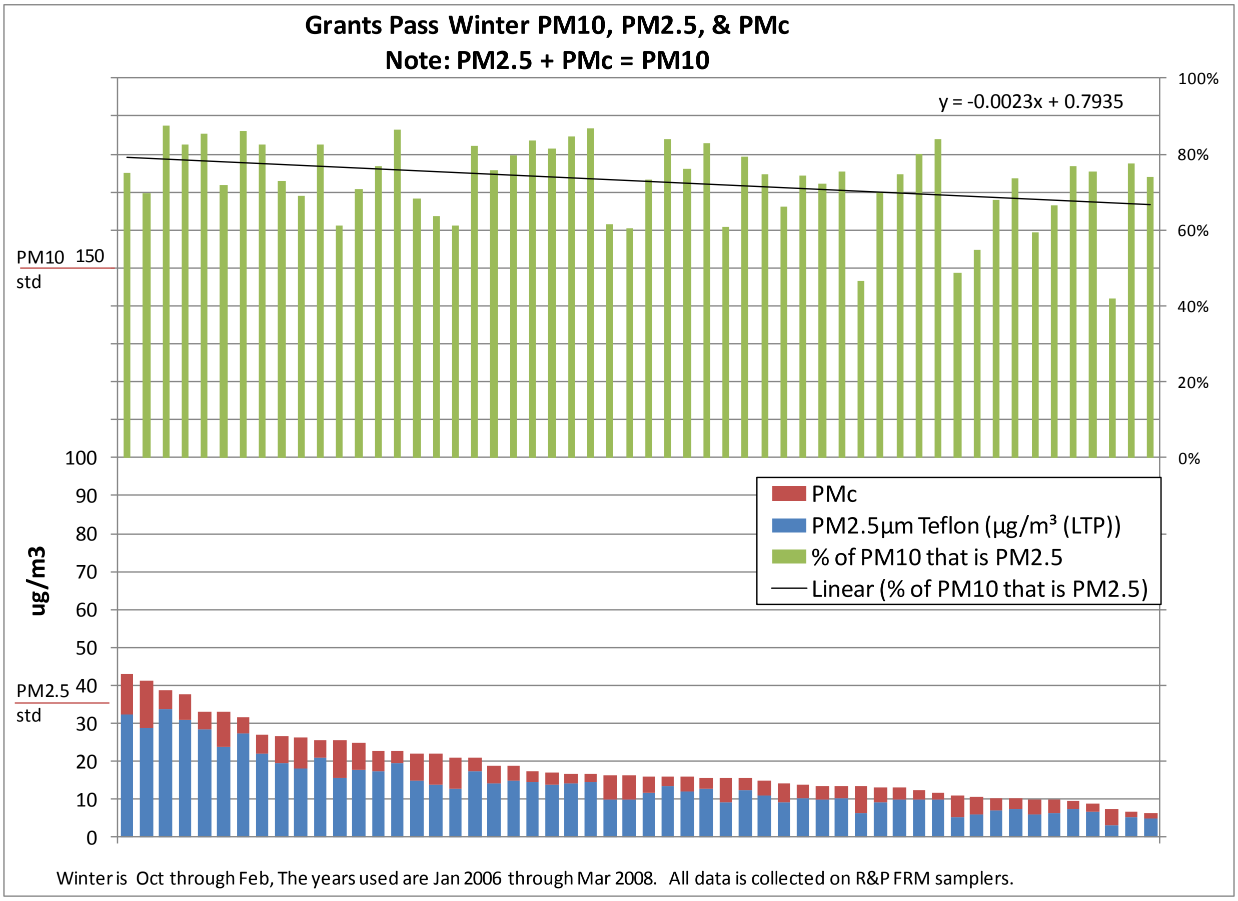

Figure C.8. Grants Pass, Parkside School PM_{10} - PMcoarse/$PM_{2.5}$ distribution.

C.4 Pendleton PM_{10} Monitoring Value Analysis

The Pendleton McKay Creek site has sampled for PM_{10} and $PM_{2.5}$ since 1999. More recently the site has used the Rupprecht and Pataschnict FRM samplers for both parameters. The winter 2006 through 2009 $PM_{2.5}$ and PM_{10} correlation has an R Squared of 0.82 (Figure C.9). From 2006 to 2009 there were only five samples over ¼ of the PM_{10} NAAQS, and none over ½ the PM_{10} NAAQS. The highest value in the past three winters was only 34% of the PM_{10} NAAQS.

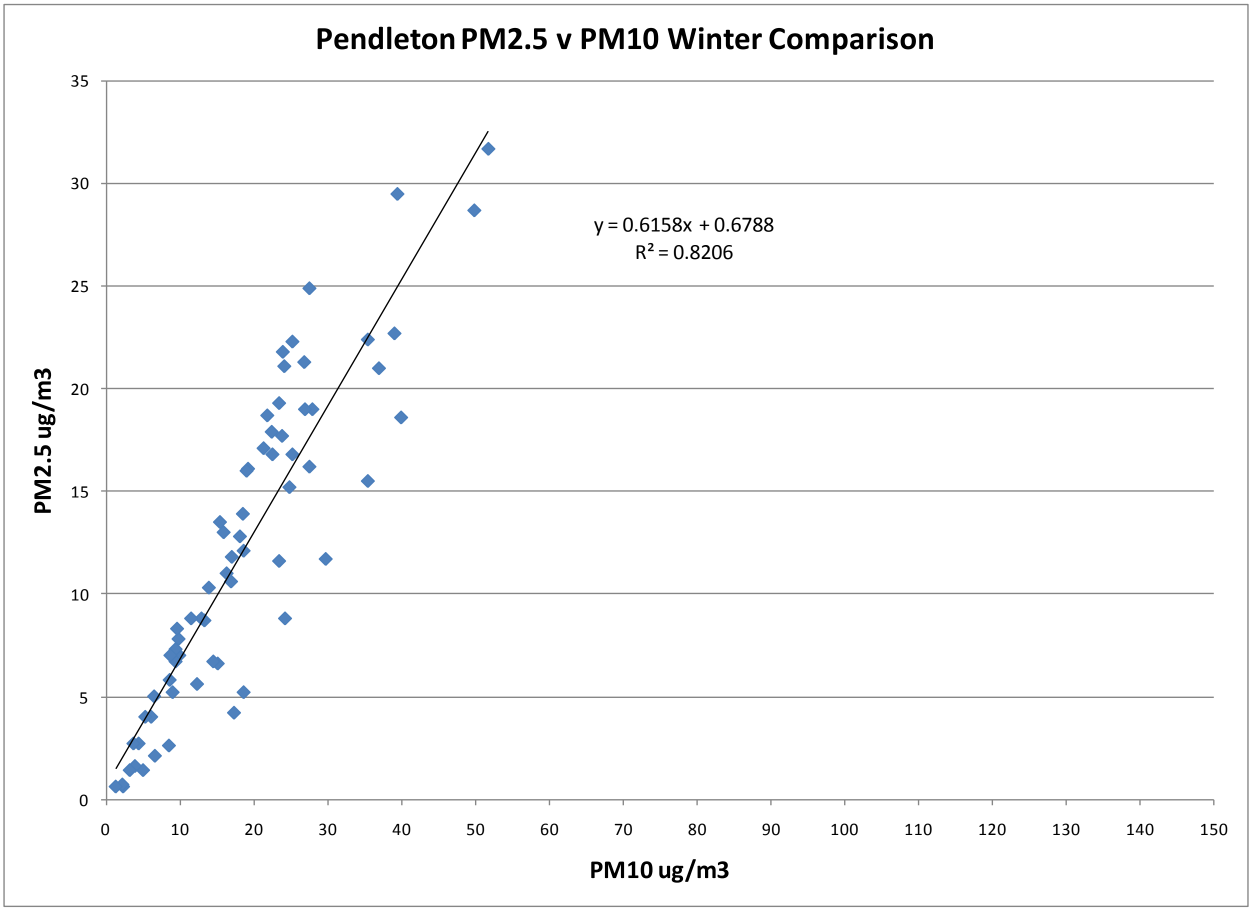

Figure C.9. Pendleton, McKay Creek PM_{10}/$PM_{2.5}$ Correlation.

On average winter PM_{10} is 64% $PM_{2.5}$ by weight. Figure C.10 shows the $PM_{2.5}$ and PMcoarse fractions for the winter values for 2006-2009.

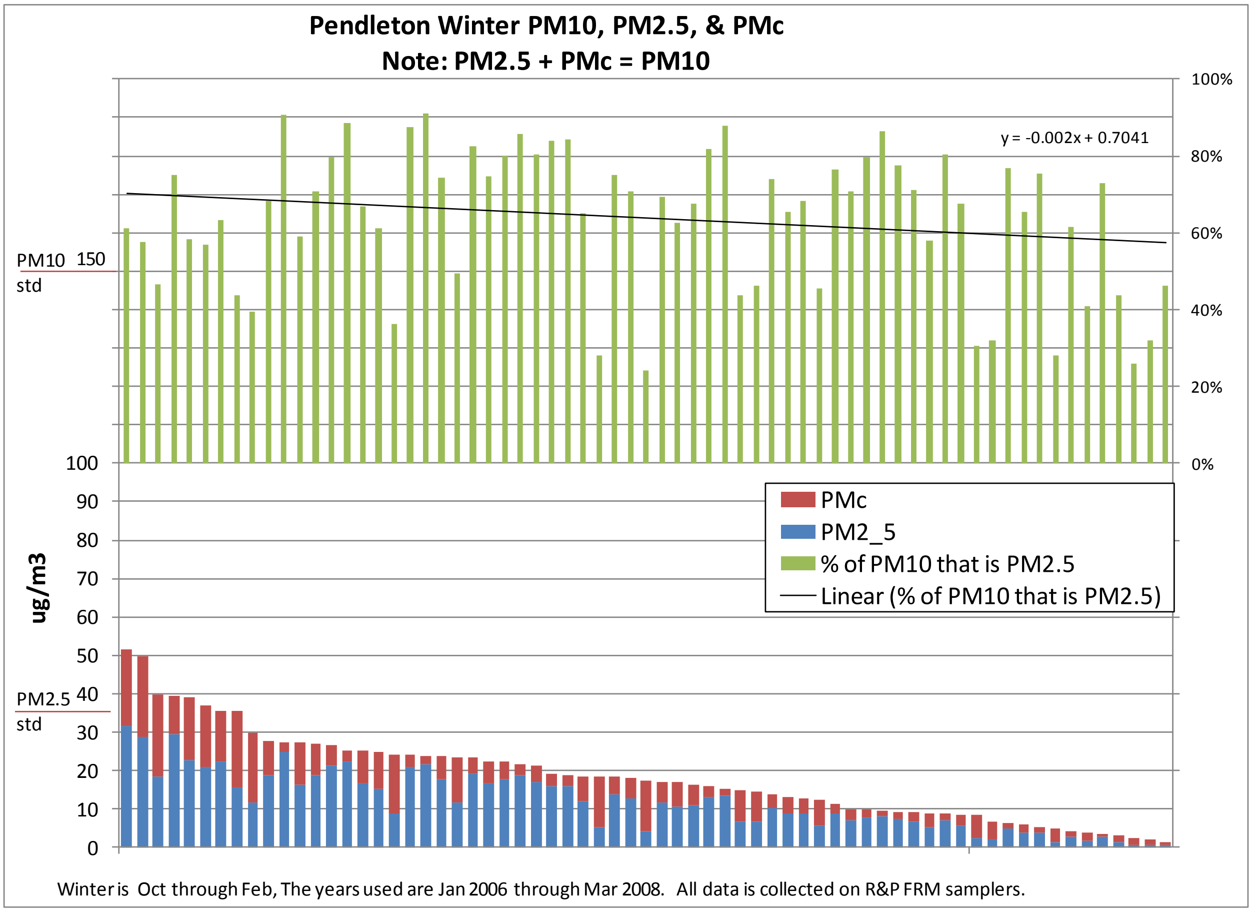

Figure C.10. Pendleton, McKay Creek PM_{10} - PMcoarse/$PM_{2.5}$ distribution.

C.5 Portland PM_{10} Monitoring Value Analysis

SE Lafayette

The Portland SE Lafayette site is the NCORE site and is required to have both PM_{10} and $PM_{2.5}$ monitoring. However, it is still useful to review the PM_{10} fraction for comparison to the other sites. SE Lafayette has sampled for PM_{10} and $PM_{2.5}$ since 1999. More recently the site has used the Rupprecht and Pataschnict FRM samplers for both parameters. The winter 2007 through 2009 $PM_{2.5}$ and PM_{10} correlation has an R Squared of 0.90 (Figure C.11). From 2006 to 2009 there were only four samples over ¼ of the PM_{10} NAAQS, and none over ½ the PM_{10} NAAQS. The highest value in the past three winters was 33% of the PM_{10} NAAQS.

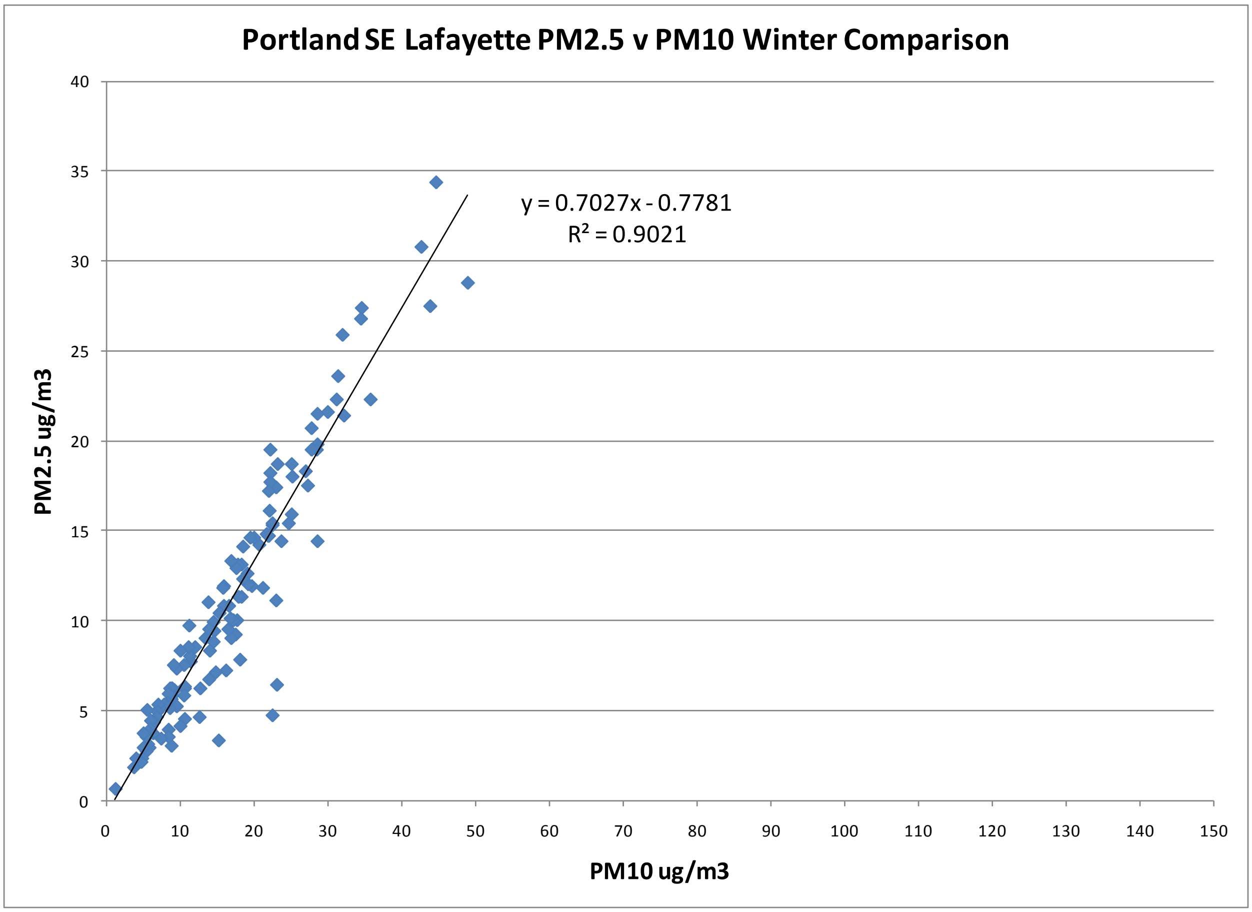

Figure C.11. Portland, SE Lafayette, $PM_{10}/PM_{2.5}$ Correlation.

On average, winter PM_{10} is 64% $PM_{2.5}$ by weight. Figure C.12 shows the PM2.5 and PMcoarse fractions for the winter values for 2007-2009.

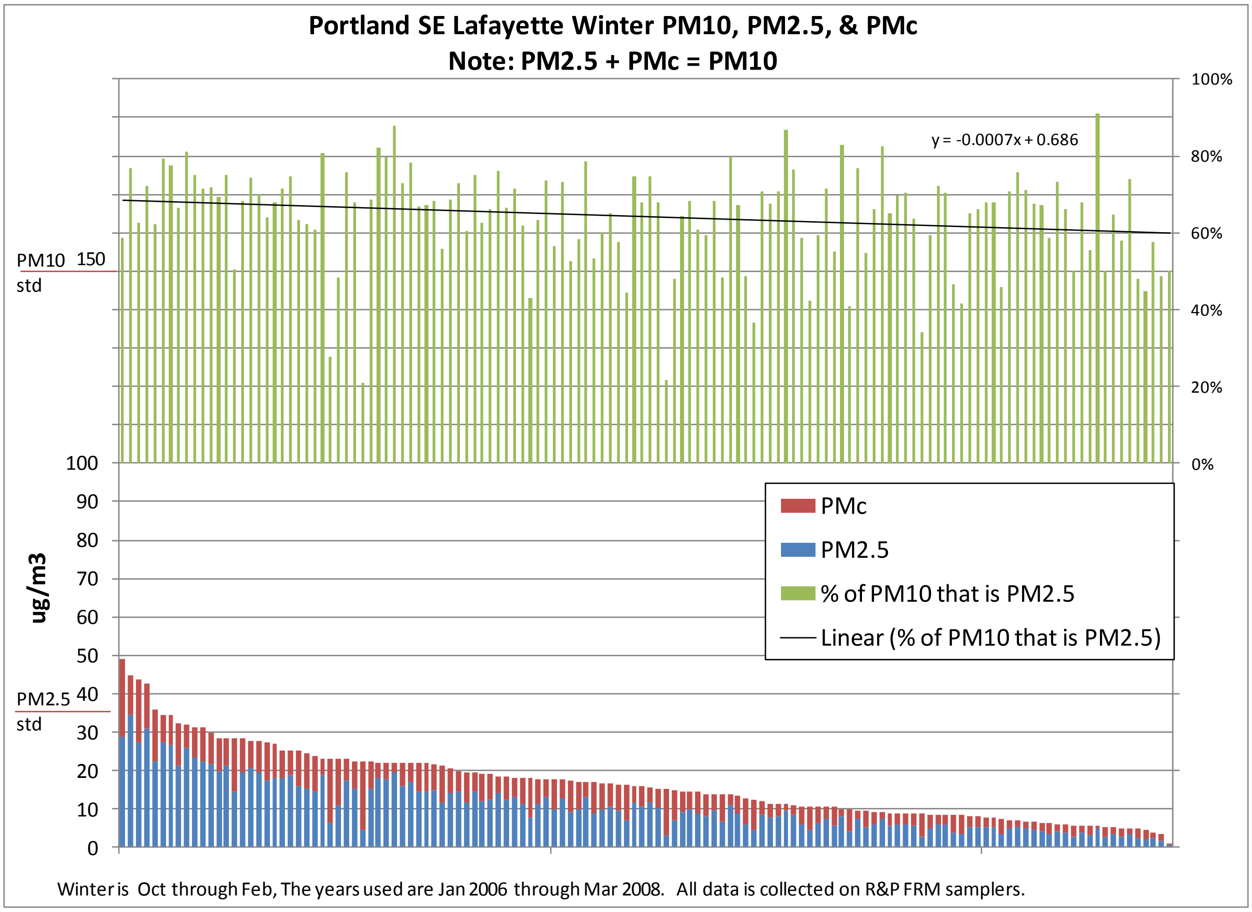

Figure C.12. Portland, SE Lafayette PM_{10} - PMcoarse/$PM_{2.5}$ distribution.

C.6 Oakridge PM_{10} Monitoring Value Analysis

The Oakridge site was a non-attainment area but has had PM_{10} below the standard over 10 years. Oakridge has sampled for PM_{10} and $PM_{2.5}$ since 1999. More recently the site has used the Rupprecht and Pataschnict FRM samplers for both parameters. The winter 2007 through 2009 $PM_{2.5}$ and PM_{10} correlation has an R Squared of 0.95 (Figure C.13). From 2007 to 2009 there were 21 samples over ¼ of the NAAQS, and none over ½ the NAAQS. The highest value in the past three winters was only 42% of the PM_{10} NAAQS.

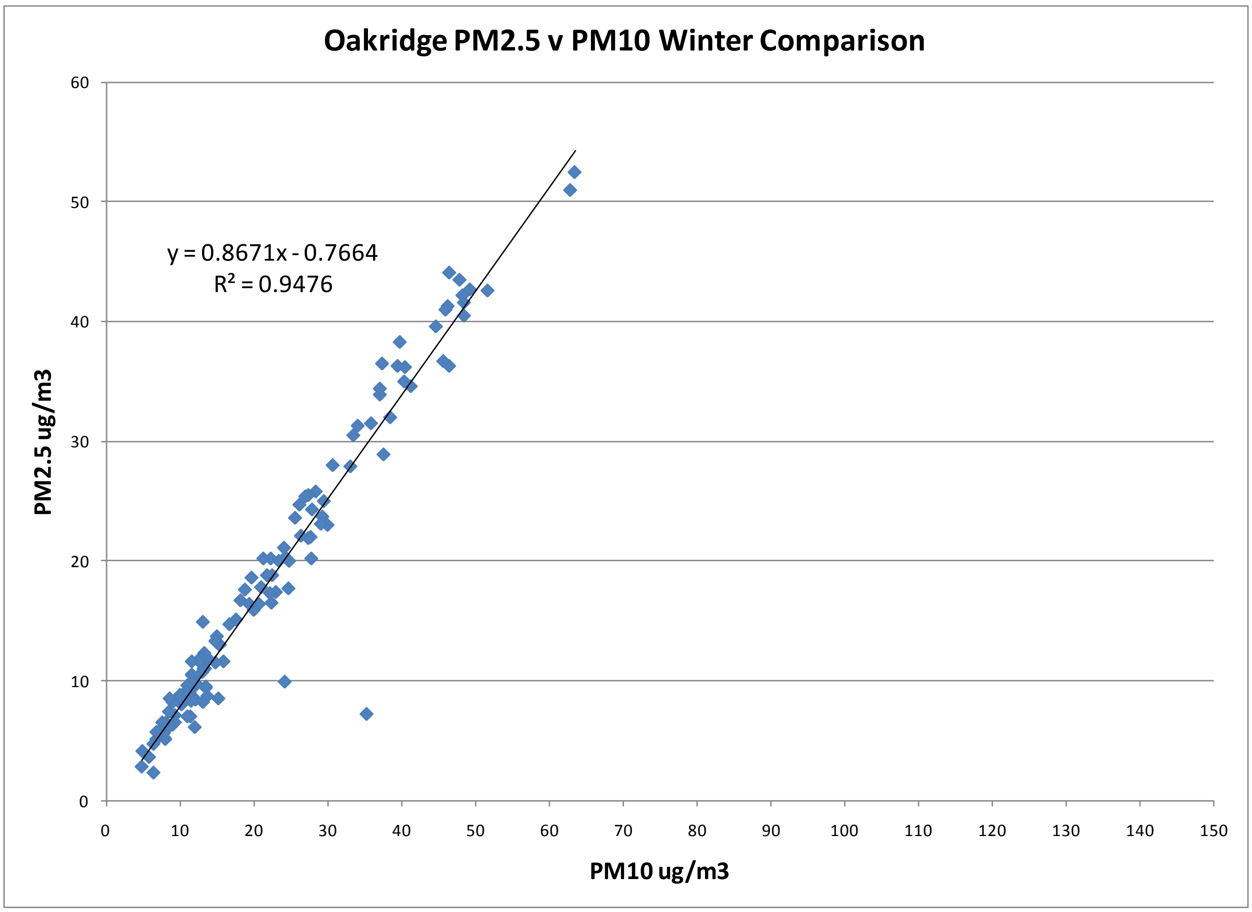

Figure C.13. Oakridge PM_{10}/$PM_{2.5}$ Correlation.

On average, winter PM_{10} is 82% $PM_{2.5}$ by weight. Figure C.14 shows the $PM_{2.5}$ and PMcoarse fractions for the winter values for 2007-2009.

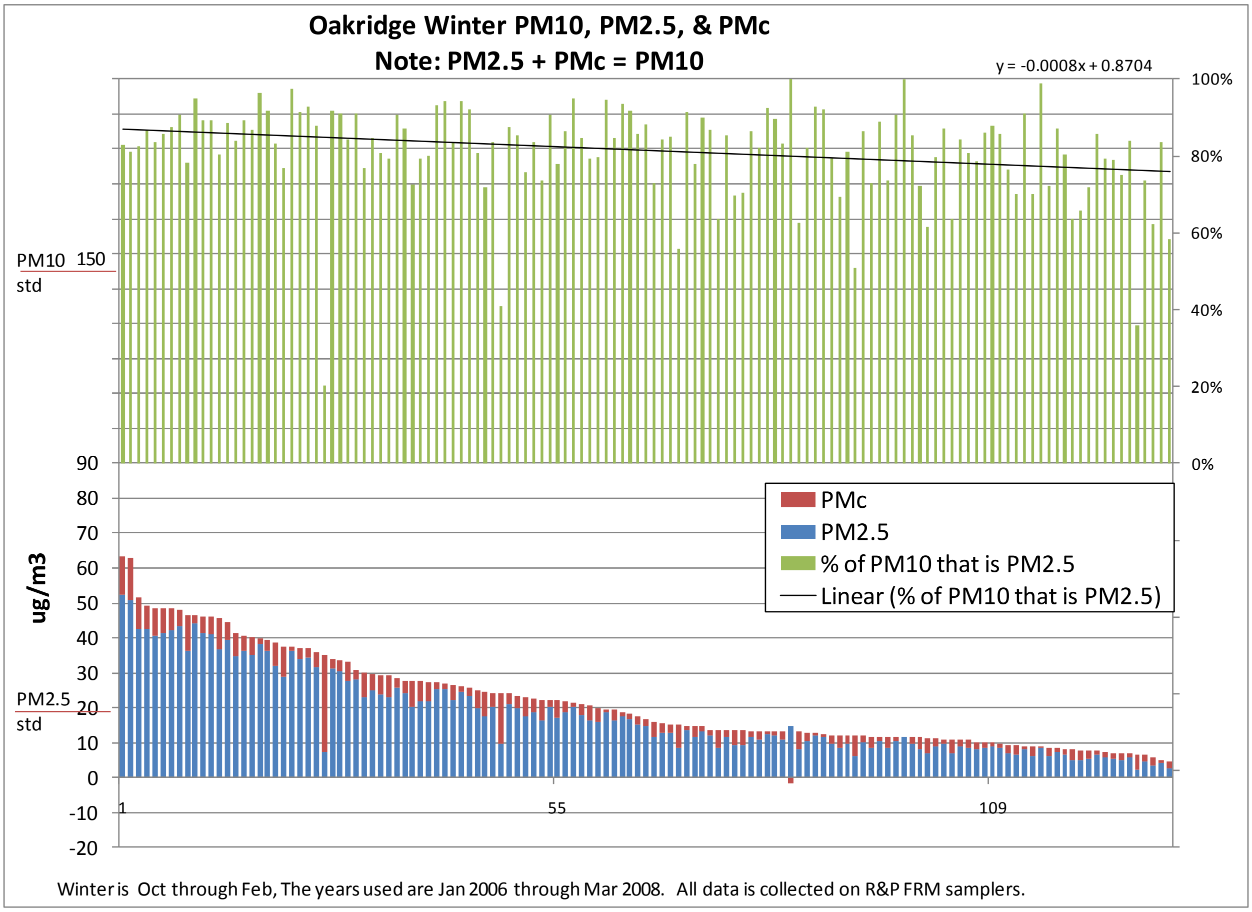

Figure C.14. Oakridge PM_{10} - PMcoarse/$PM_{2.5}$ distribution.

C.7 Eugene PM_{10} Monitoring Value Analysis

Key Bank

The Eugene Key Bank Site was a non-attainment area but has had PM_{10} below the standard over 10 years. Key Bank has sampled for PM_{10} and $PM_{2.5}$ since 2007. The site has used the Rupprecht and Pataschnict FRM samplers for both parameters. The winter 2007 through 2009 PM_{10} and $PM_{2.5}$ correlation has an R Squared of 0.91 (Figure C.15). From 2007 to 2009 there were 16 samples over ¼ of the PM_{10} NAAQS, and three over ½ the PM_{10} NAAQS. The highest value in the past three winters was only 42% of the PM_{10} NAAQS.

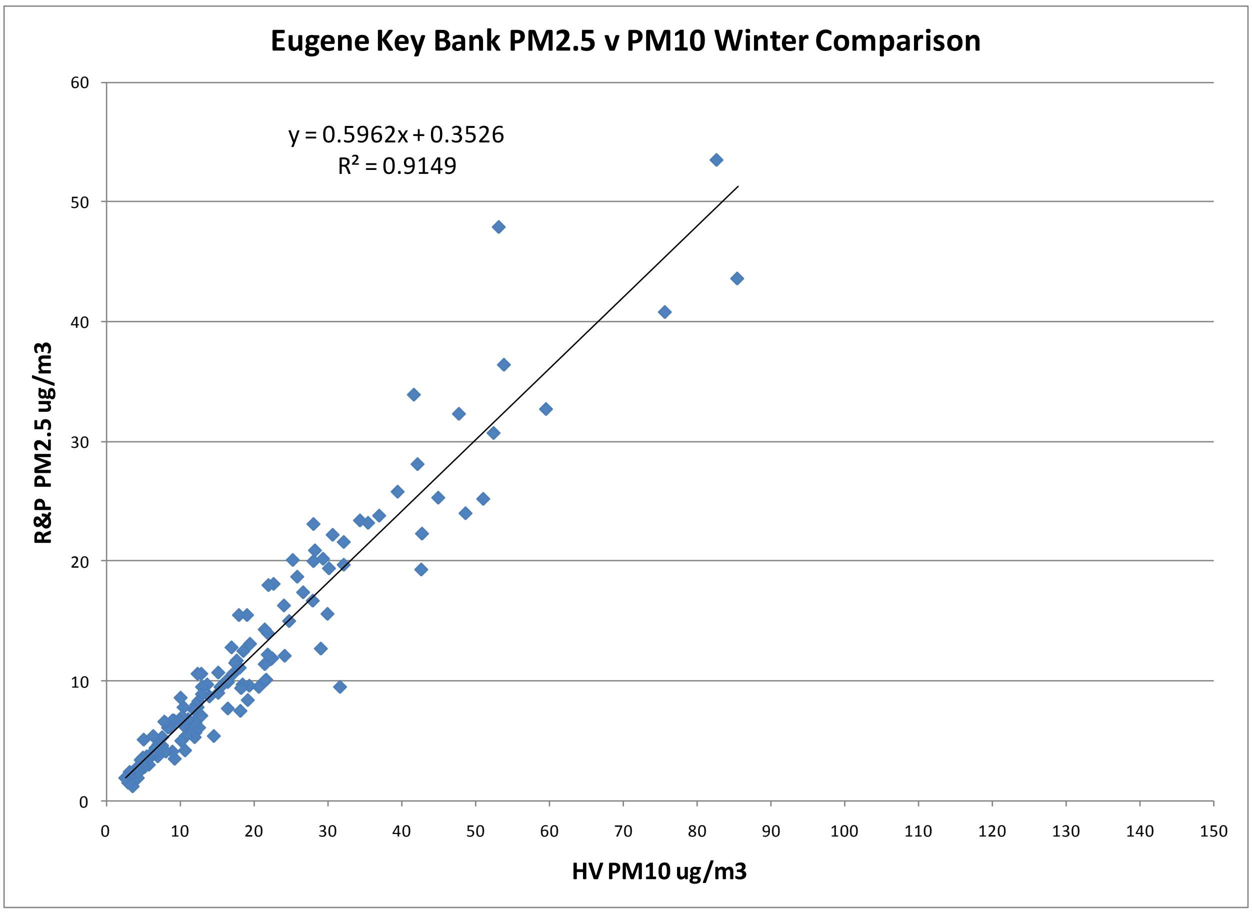

Figure C.15. Eugene, Key Bank $PM_{10}/PM_{2.5}$ Correlation.

On average, winter PM_{10} is 82% $PM_{2.5}$ by weight. Figure C.16 shows the $PM_{2.5}$ and PMcoarse fractions for the winter values for 2007-2009.

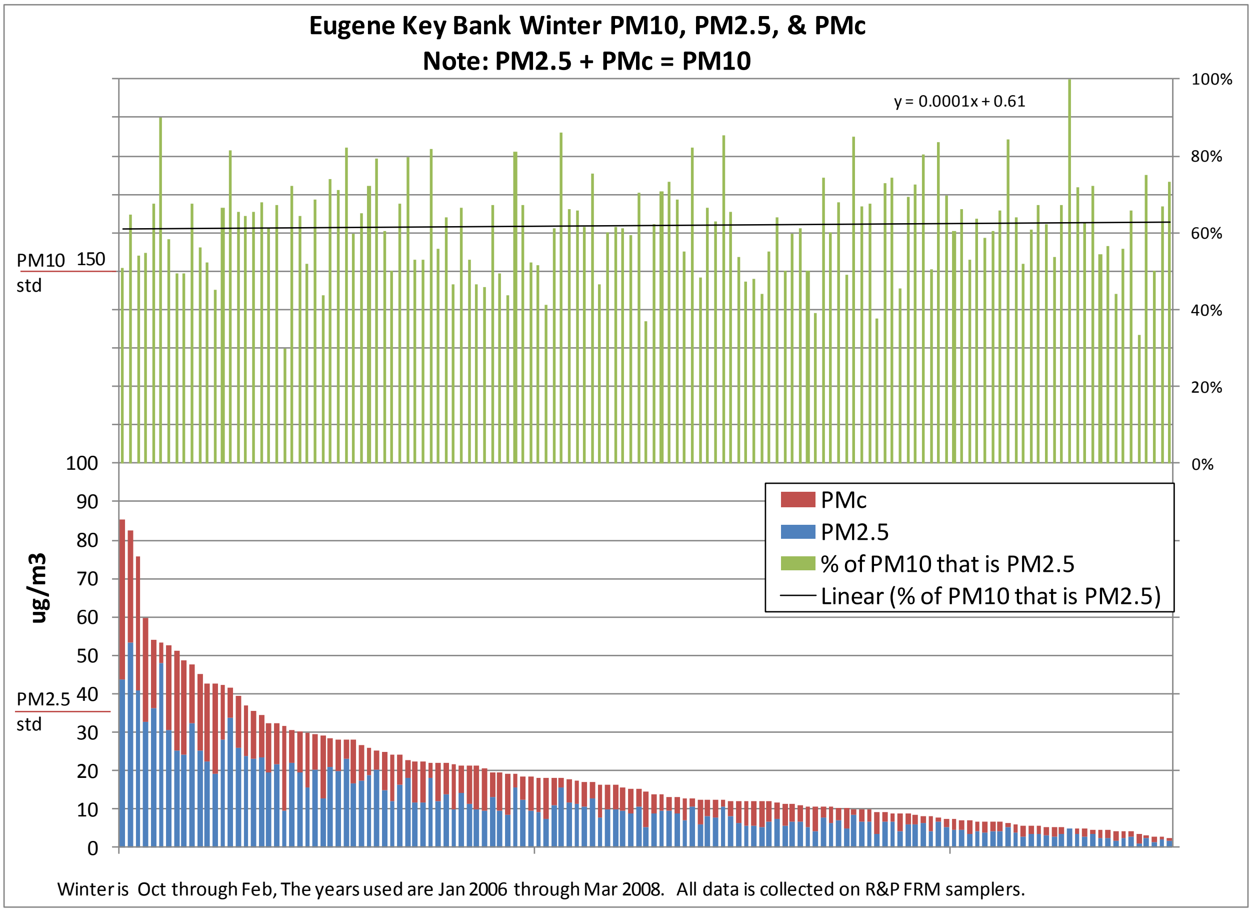

Figure C.16. Eugene, Key Bank PM_{10} - PMcoarse/$PM_{2.5}$ distribution.

Appendix D. NO_2 Satellite Images by Monthly Average.
November 2007 to October 2008.

The scale used for the images is:

This Appendix contains two images per month.

1. Oregon and surrounding borders
2. Portland and lower Columbia

Comments:

1. The unit Molec./cm2 is a troposheric concentration and is not necessarily at ground level. This should be used for relative comparisons.
2. Oregon has very low NO_2 levels in comparison to other parts of the United States.
3. Central Washington has elevated levels at times.
4. The lower Columbia River is overshadowed by influences from Interstate – 5.
5. Summer NO2 levels are lower than winter possibly because of conversion to ozone by higher temperatures and stronger ultraviolet light.
6. Satellite images are taken from WWW.TEMIS.nl/airpollution/no2

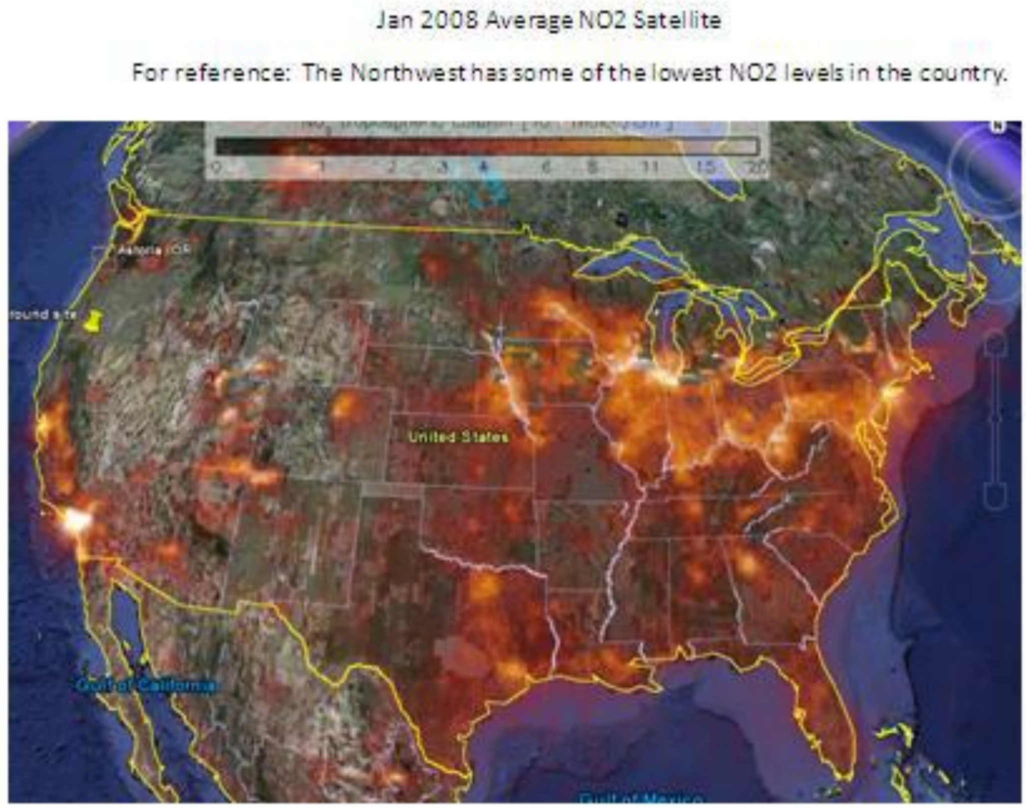

Figure D.1 . January 2008 Average NO_2 levels through air column for the United States.

Jan
2008
Monthl
y Mean

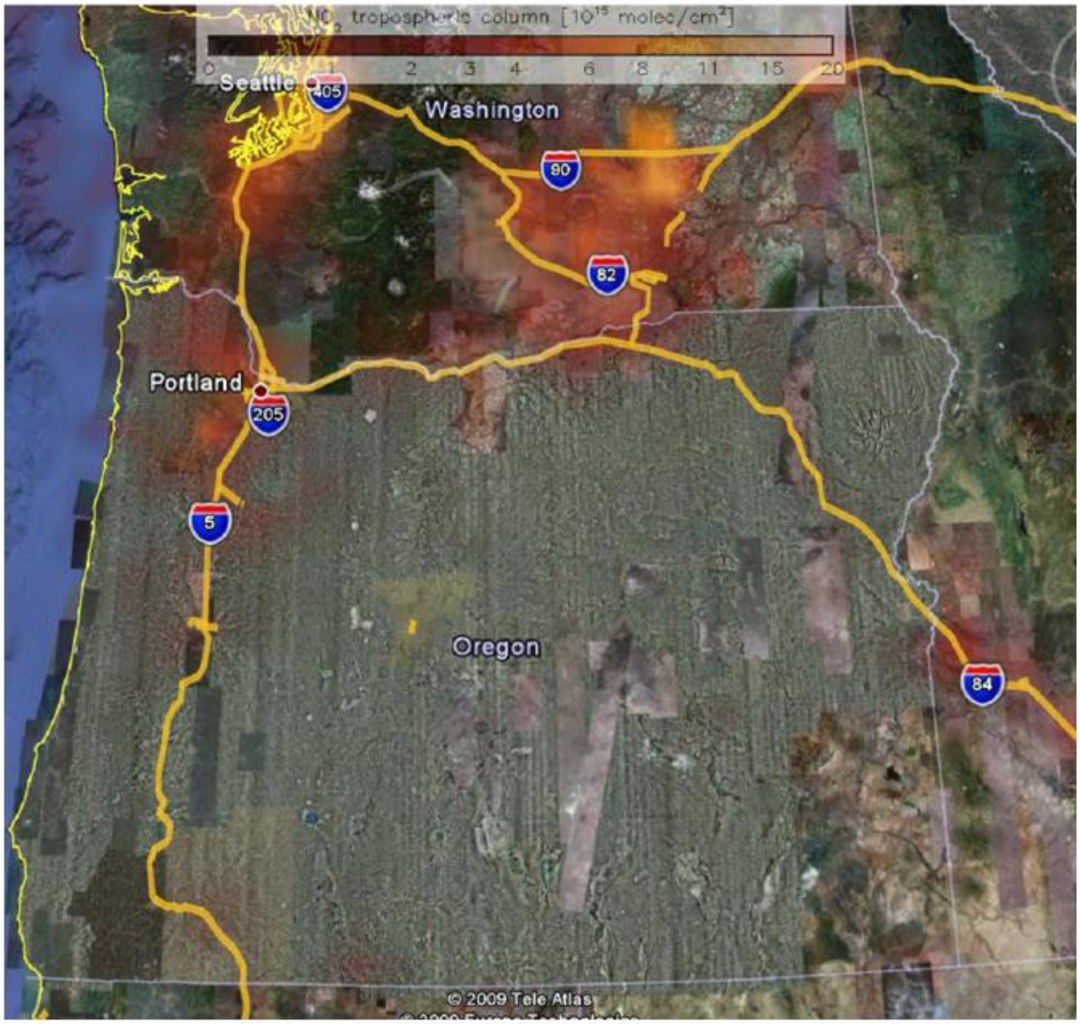

Figure D.2. January 2008 Average NO_2 levels through air column for Oregon.

Jan 2008
Monthly
Mean

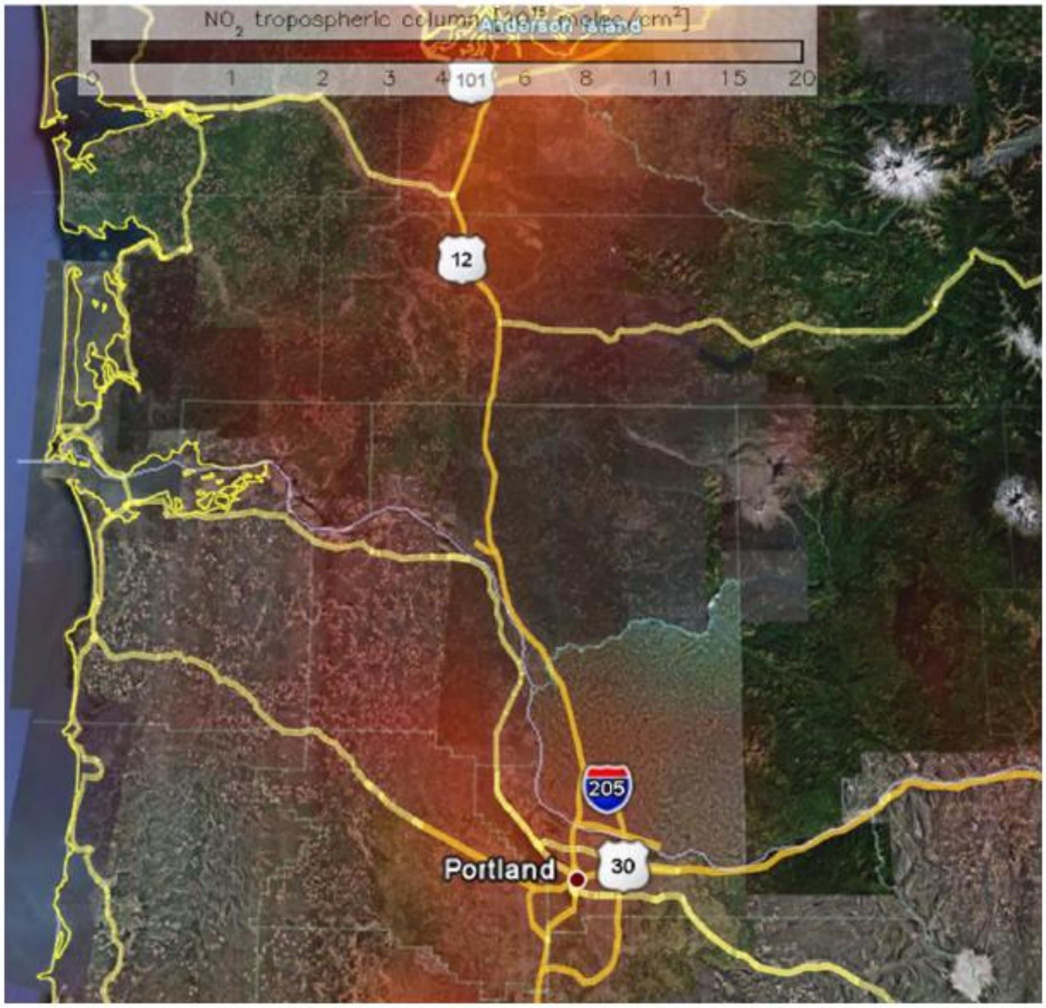

Figure D.3. January 2008 Average NO$_2$ levels through the air column for Portland Metro.

Feb 2008
Average
NO2
Satellite

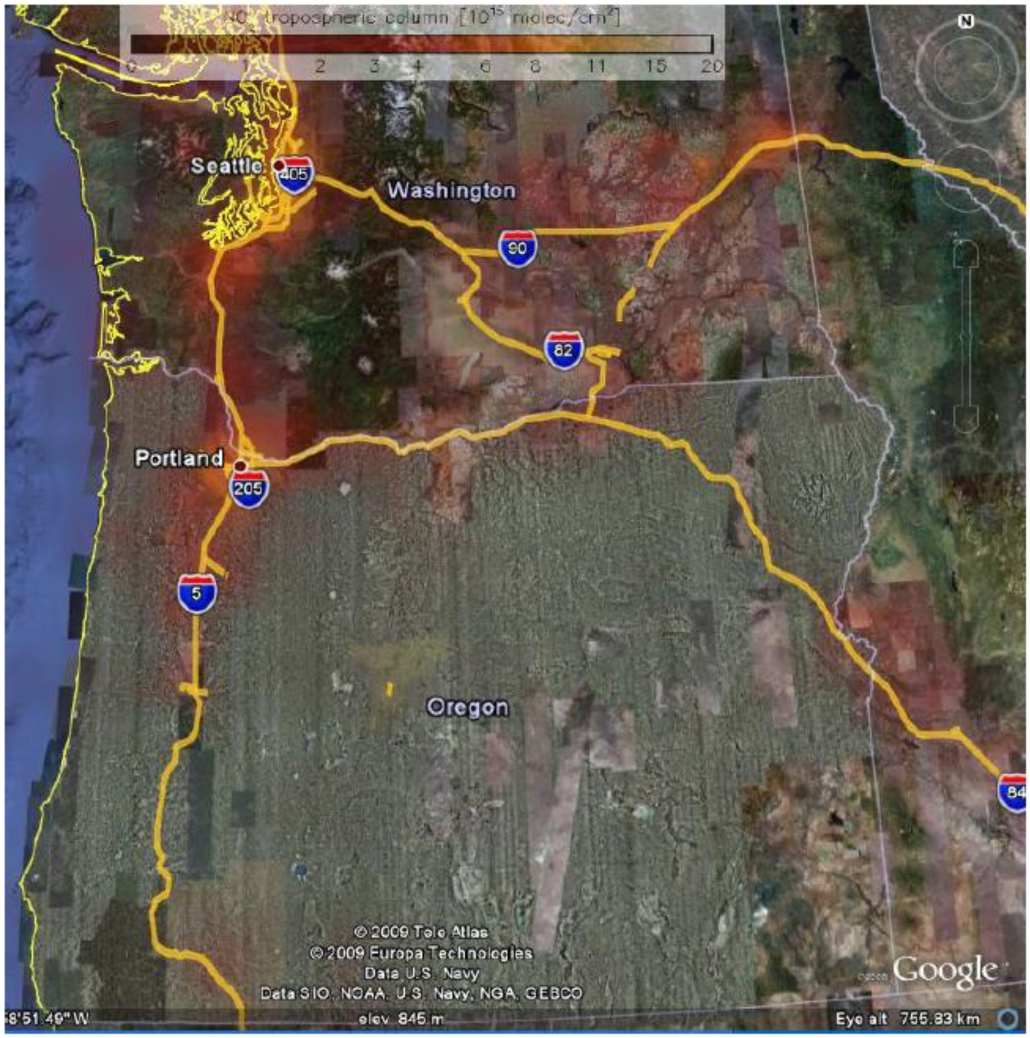

Figure D.4. February 2008 Average NO_2 through the air column for Oregon.

Feb 2008
Average NO2
Satellite

Figure D.5. February 2008 Average NO_2 through the air column for Portland Metro.

Mar2008
Average NO2
Satellite

Figure D.6. March 2008 Average NO_2 through the air column for Oregon.

Mar2008
Average
NO2
Satellite

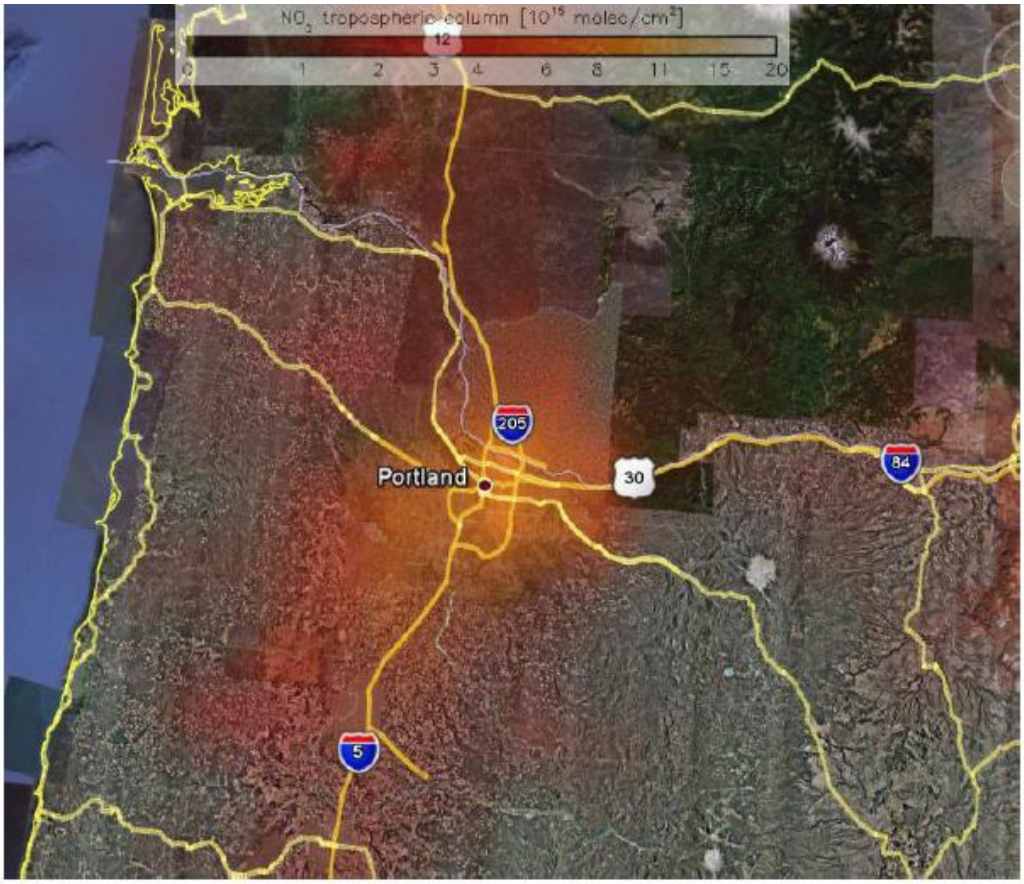

Figure D.7. March 2008 Average NO_2 through the air column for Portland Metro.

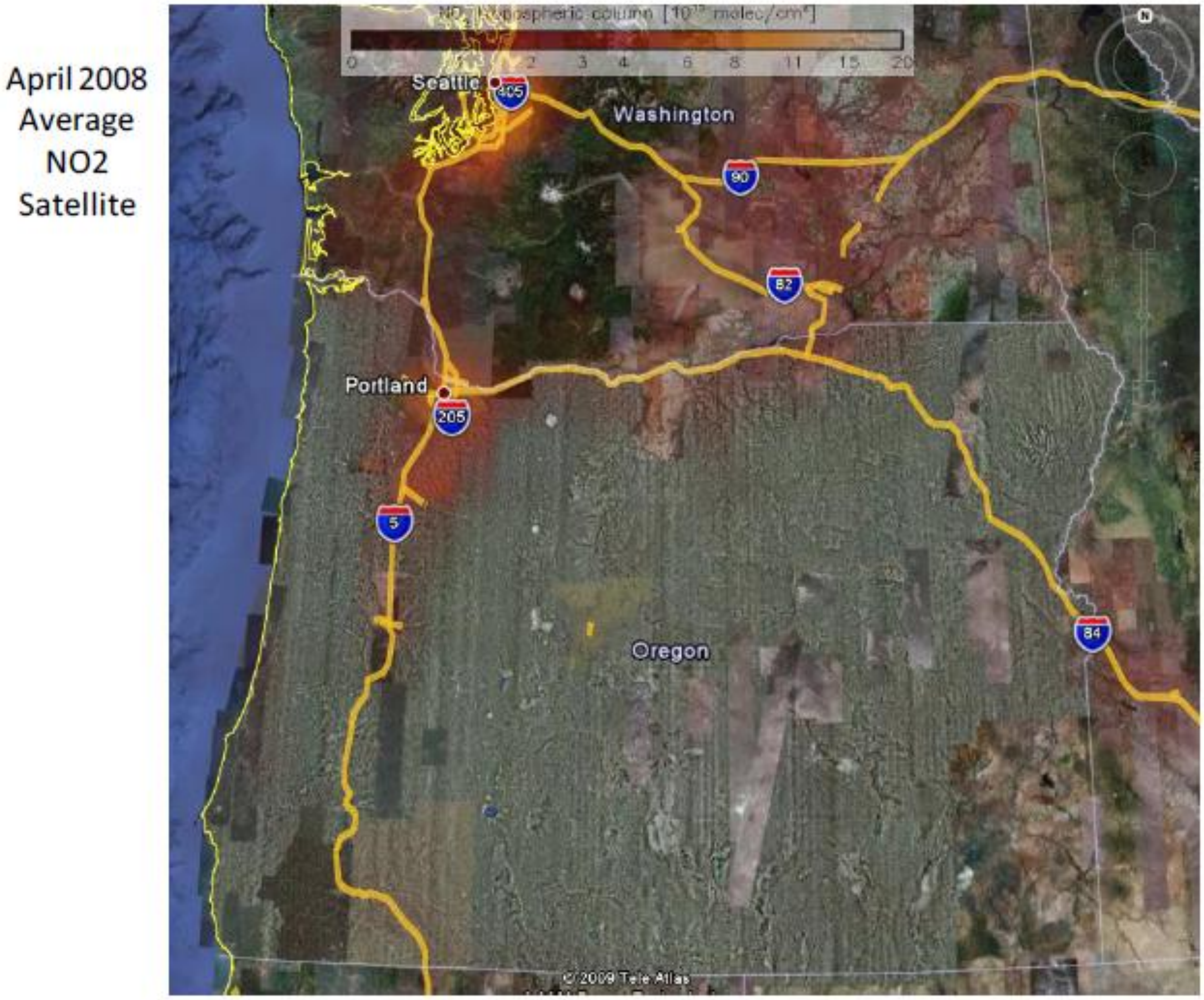

Figure D.8. April 2008 Average NO_2 through the air column for Oregon.

April 2008
Average
NO2
Satellite

Figure D.9. April 2008 Average NO_2 through the air column for Portland Metro.

May 2008
Average
NO2
Satellite

Figure D.10. May 2008 Average NO_2 through the air column for Oregon.

May 2008
Average
NO2
Satellite

Figure D.11. May 2008 Average NO_2 through the air column for Portland Metro.

June2008
Average
NO2
Satellite

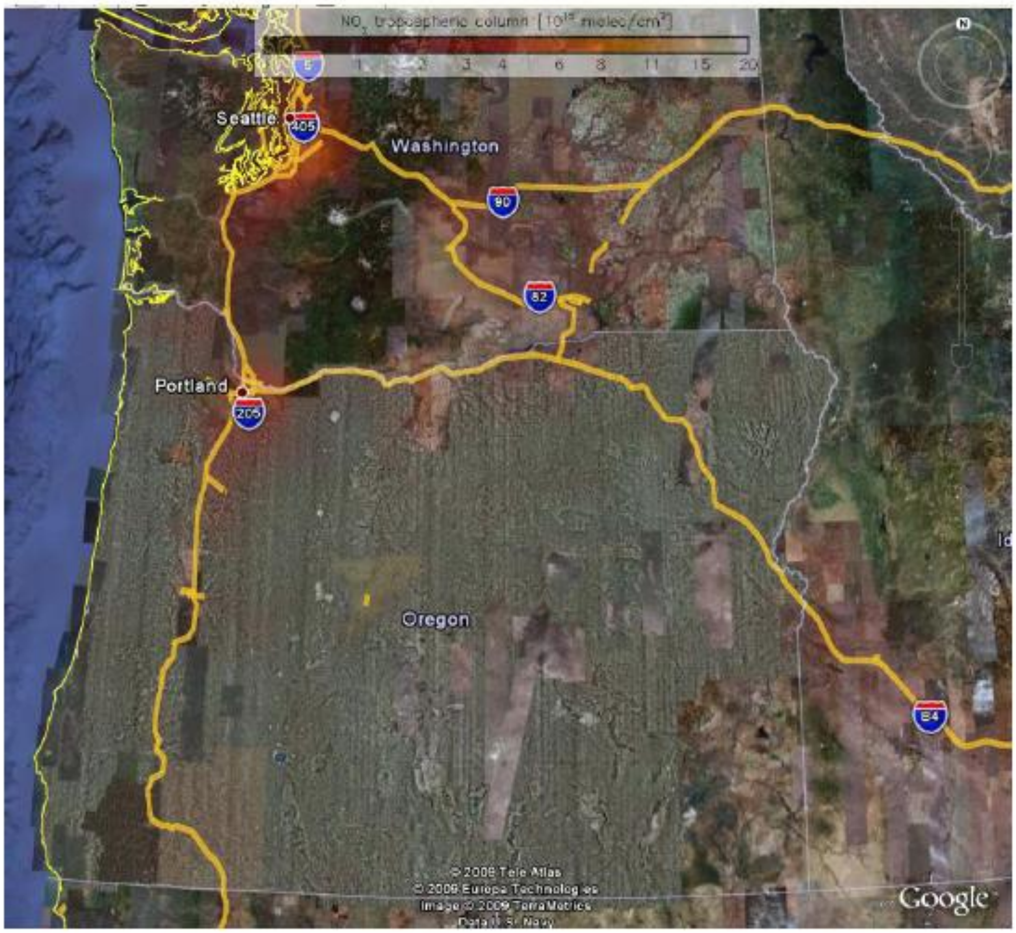

Figure D.12. June 2008 Average NO_2 through the air column for Oregon.

June2008
Average
NO2
Satellite

Figure D.13. June 2008 Average NO_2 through the air column for Portland Metro.

July2008
Average NO2
Satellite

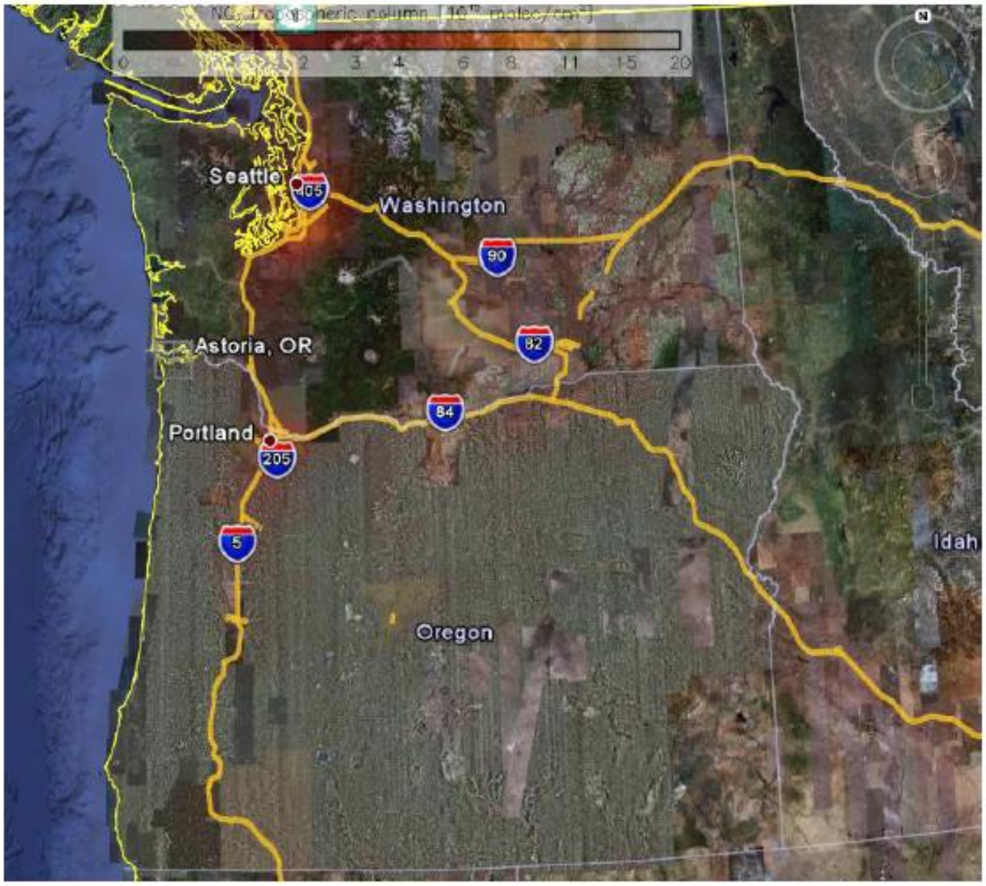

Figure D.14. July 2008 Average NO_2 through the air column for Oregon.

July2008
Average NO2
Satellite

Figure D.15. July 2008 Average NO_2 through the air column for Portland Metro.

Aug 2008
Average NO2
Satellite

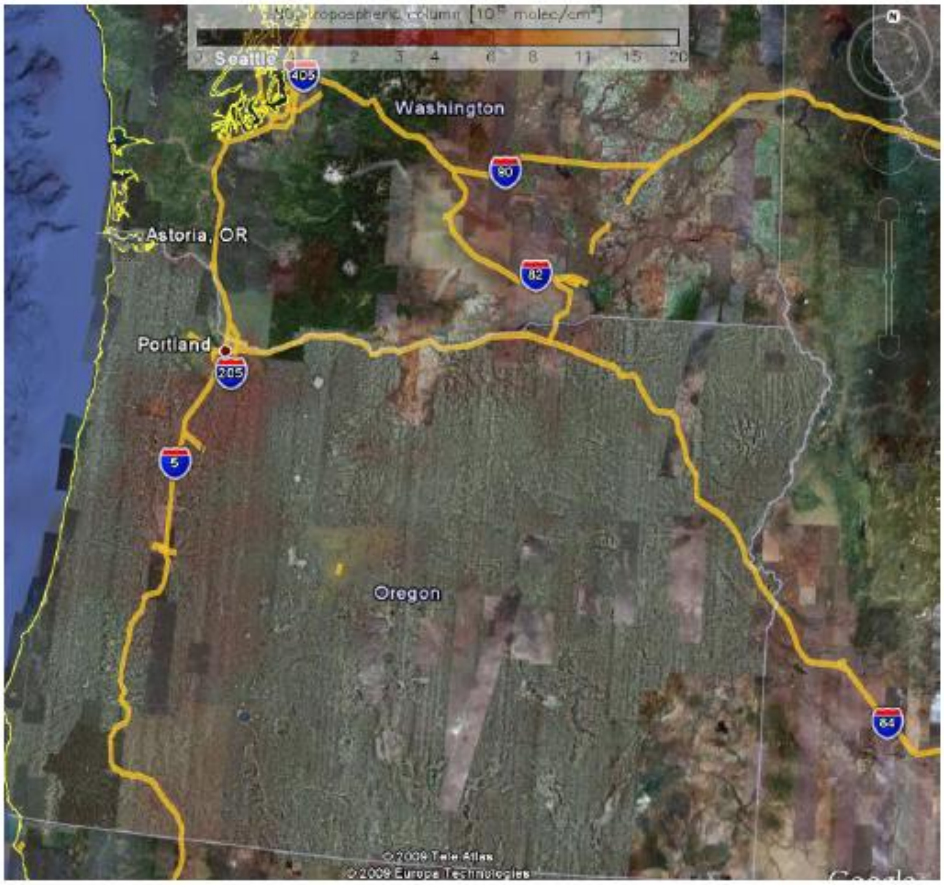

Figure D.16. August 2008 Average NO_2 through the air column for Oregon.

Aug 2008
Average NO2
Satellite

Figure D.17. August 2008 Average NO_2 through the air column for Portland Metro.

Sep 2008
Average NO2
Satellite

Figure D.18. September 2008 Average NO_2 through the air column for Oregon.

Sep 2008
Average NO2
Satellite

Figure D.19. September 2008 Average NO_2 Portland Metro.

Oct 2008
Average
NO2
Satellite

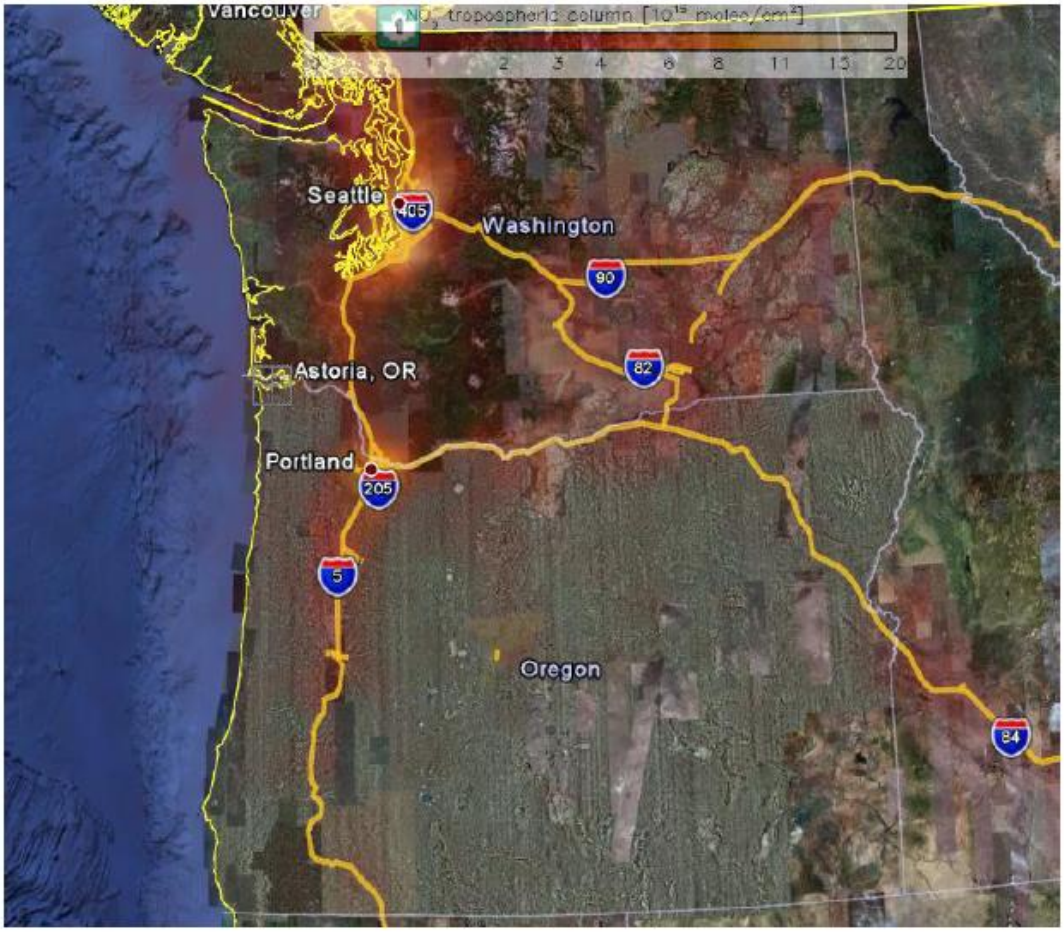

Figure D.20. October 2008 Average NO_2 through the air column for Oregon.

Oct 2008
Average
NO2
Satellite

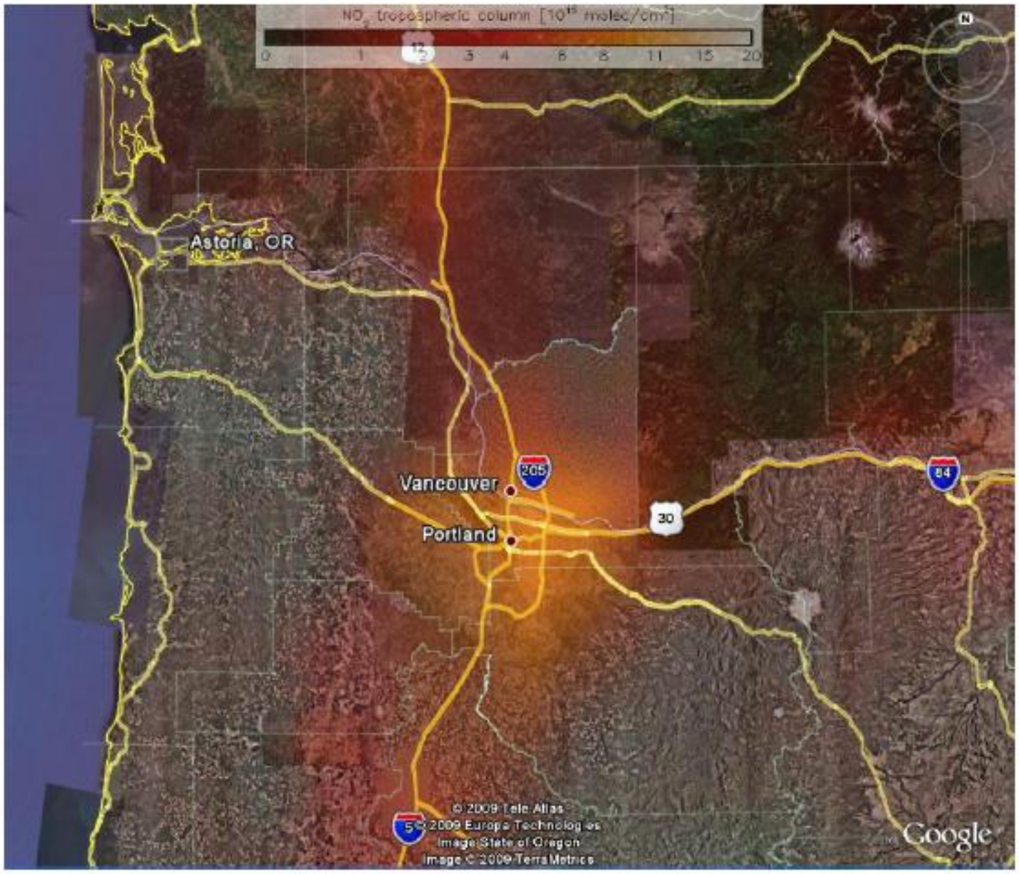

Figure D.21. October 2008 Average NO_2 through the air column for Portland Metro.

Nov 2007
Average NO2
Satellite

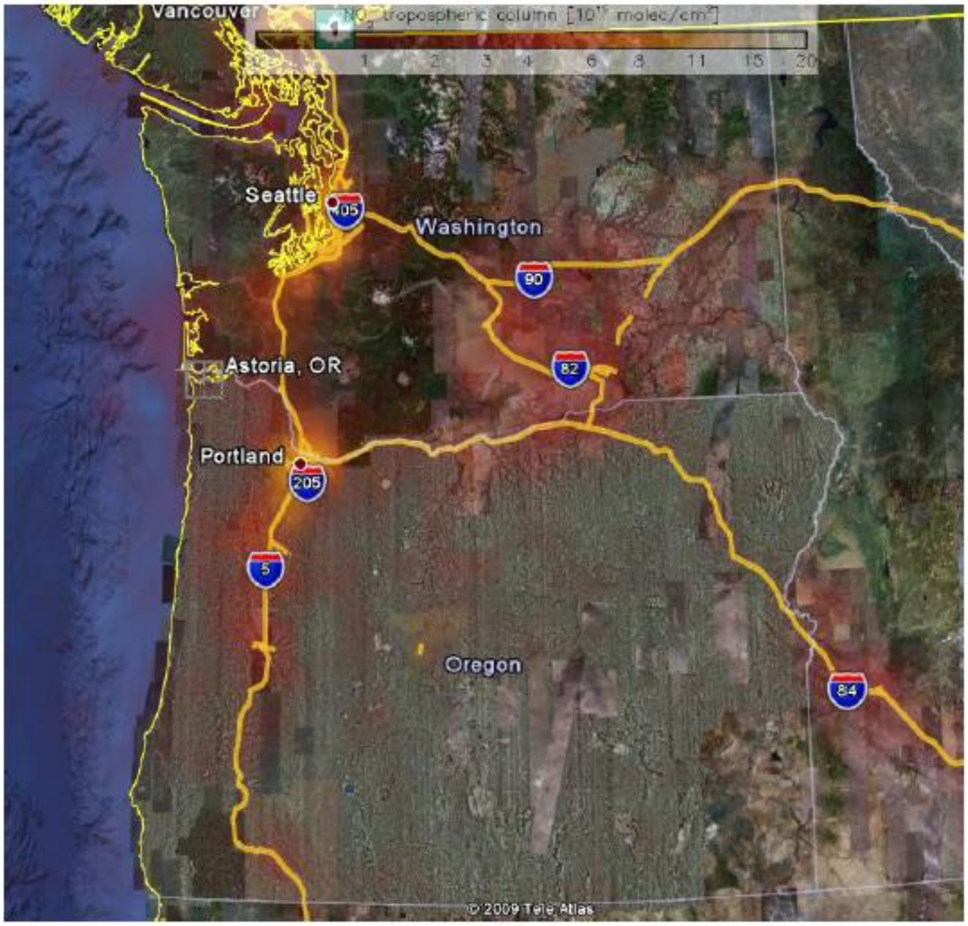

Figure D.22. Nov 2007 Average NO_2 through the air column for Oregon.

Figure D.23. Nov 2007 Average NO_2 through the air column for Portland Metro.

Dec 2007
Average NO2
Satellite

Figure D.24. Dec 2007 Average NO_2 through the air column for Oregon.

Dec 2007
Average NO2
Satellite

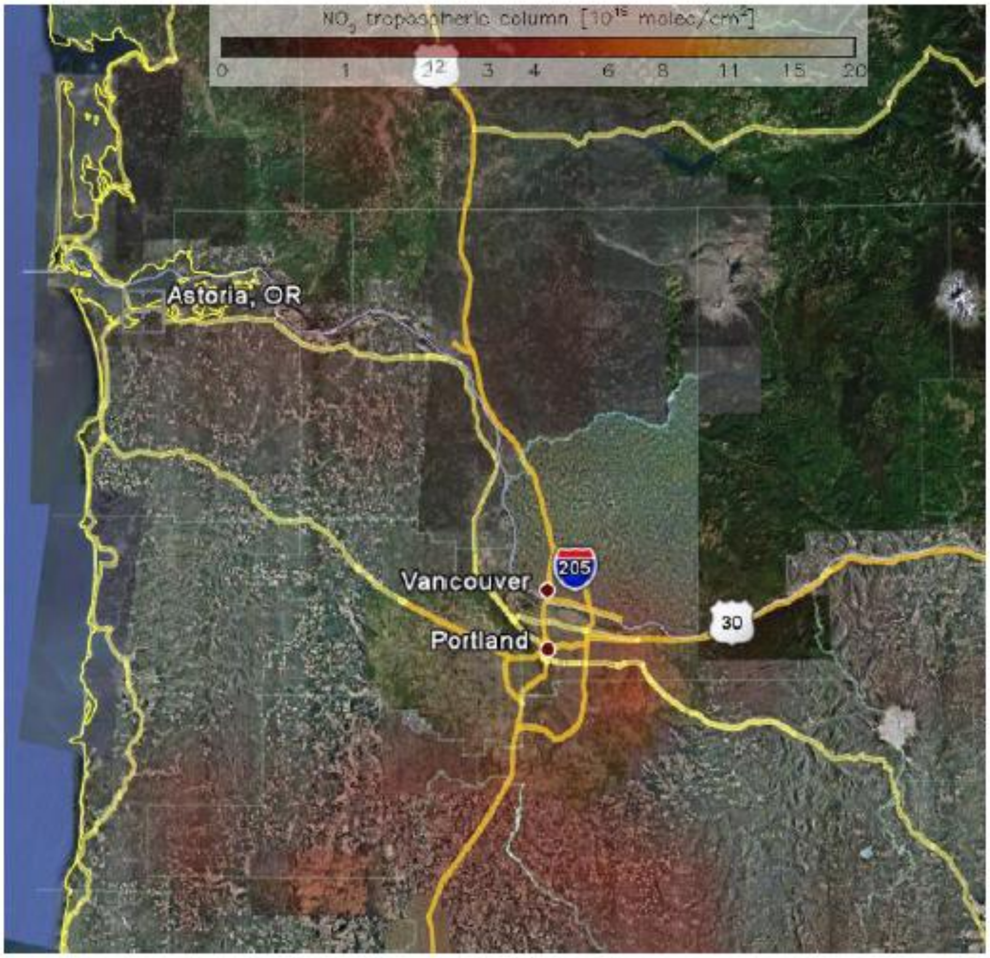

Figure D.25. Dec 2007 Average NO_2 through the air column for Portland Metro.

Appendix E: ODEQ Air Toxics Program Ambient Benchmark Concentration (ABC)

CASRN	CHEMICAL NAME	ABC ug m-3	DERIVATION
75-07-0	ACETALDEHYDE [CANCER] ‡	0.45 {2} †	ABC calculated using the 1997 USEPA IRIS URE of 2.2 □ 10-6. OEHHA URE is similar (2.7 □ 10-6), newer (1999), and would give a similar ABC (0.37). Choice of ABC based on preference for USEPA toxicity information.
107-02-8	ACROLEIN [NON-CANCER]	0.02	ABC is the 2002 USEPA IRIS RfC. OEHHA REL is higher (0.06) and older (2001). Choice of ABC based on preference for USEPA toxicity information, which is also newer.
107-13-1	ACRYLONITRILE [CANCER]	0.01 {2}	ABC calculated using the 1991 USEPA IRIS URE of 6.8 □ 10-5. OEHHA URE is higher (2.9 □ 10-4), newer (1999), and would give a lower ABC (0.003). OEHHA analysis was more recent but based on the same study used by USEPA. Choice of ABC based on preference for USEPA toxicity information, because the ATSAC did not accept the uncertainty factors applied by OEHHA.
A7664-41-7	AMMONIA [NON-CANCER]	200	ABC is the 2000 OEHHA REL. USEPA IRIS RfC is lower (100) and older (1991). Choice of ABC based on preference for newer OEHHA toxicity data.
7440-38-2	ARSENIC [CANCER]	0.0002 {4}	ABC calculated using the 1997 USEPA IRIS URE of 4.3 □ 10-3 for elemental As. OEHHA URE is lower 3.3 □ 10-3), older (1990), and would give a similar ABC (0.0003). Choice of ABC based on preference for USEPA toxicity information.
71-43-2	BENZENE [CANCER]	0.13 {2}	ABC calculated using the high end (7.8 □ 10-6) of the 2000 USEPA IRIS URE range. OAQPS also uses the high end of the USEPA IRIS URE range. OEHHA URE is higher (2.9 □ 10-5), older (1985), and would give a lower (0.03) ABC. Choice of ABC based on preference for USEPA (OAQPS) toxicity information.
7440-41-7	BERYLLIUM [CANCER]	0.0004 {4}	ABC calculated using the 1998 USEPA IRIS URE of 2.4 □ 10-3. Both OEHHA and NATA 1999 use this URE. Choice of ABC based on preference for USEPA toxicity information.
106-99-0	1,3-BUTADIENE [CANCER]	0.03 {2}	ABC calculated using the 2003 USEPA IRIS URE of 3.0 □ 10-5. OEHHA URE is higher (1.7 □ 10-4), older (1992), and would give a lower (0.006) ABC. Choice of ABC based on preference for USEPA toxicity information, which is also newer.

CASRN	CHEMICAL NAME	ABC ug m^{-3}	DERIVATION
7440-43-9 1306-19-0	CADMIUM CADMIUM FUMES [CANCER]	0.0006 {4}	ABC calculated using the 1998 USEPA IRIS URE of 1.8 □ 10-3. OEHHA URE is higher (4.2 □ 10^{-3}), older (1974-1987), and would give a lower (0.0002) ABC. The OEHHA REL is 0.02. Choice of ABC based on preference for USEPA toxicity information, which is also newer.
75-15-0	CARBON DISULFIDE [NON-CANCER]	800	ABC is the 2002 OEHHA REL. USEPA IRIS RfC is lower (700) and older (1995). Choice of ABC based on the newer OEHHA value.
56-23-5	CARBON TETRACHLORIDE [CANCER]	0.07 {2}	ABC calculated using the 1991 USEPA IRIS URE of 1.5 □ 10-5. E is higher (4.2 □ 10^{-5}), older (1987), and would give a ABC. Choice of ABC based on preference for USEPA toxicity information, which is also newer.
7782-50-5	CHLORINE [NON-CANCER]	0.2	ABC is the 2000 OEHHA REL. Same RfC is used by NATA 1999. Choice of ABC based on only available toxicity information, which is also consistent with that used by USEPA.
67-66-3	CHLOROFORM [NON-CANCER]	98	ABC is the 1998 ATSDR MRL. USEPA IRIS uses ATSDR MRL (which dates from 1976) because of low confidence in potency estimates. OEHHA REL is higher (300) and newer (2000) but is not an inhalation study. ATSAC had low confidence in the OEHHA cancer study. Choice of ABC based on only available toxicity information.
18540-29-9	CHROMIUM, HEXAVALENT [CANCER]	0.00008 {5}	ABC calculated using the 1998 USEPA IRIS URE of 1.2 □ 10-2. OEHHA URE is higher (1.5 □ 10^{-1}), older (1986), and would give a lower (0.0000067) ABC. Choice of ABC based on preference for USEPA toxicity information, which is also newer.
7440-48-4	COBALT COMPOUNDS	0.1	ABC is the 2001 ATSDR MRL. Same RfC is used by OEHHA and NATA 1999. Choice of ABC based on only available toxicity information, which is also consistent with that used by USEPA.
106-46-7	1,4-DICHLOROBENZENE [CANCER]	0.09 {2}	ABC calculated using the 1999 OEHHA URE of 1.1 □ 10-5. Same URE is used by NATA 1999. Choice of ABC based on only available toxicity information, which is also consistent with that used by USEPA.
542-75-6	1,3-DICHLOROPROPENE [CANCER]	0.25 {2}	ABC calculated using the 2000 USEPA IRIS URE of 4.0 □ 10-6. There is no OEHHA URE. Same URE is used by NATA 1999. Choice of ABC based on preference for USEPA toxicity information.

CASRN	CHEMICAL NAME	ABC ug m^{-3}	DERIVATION
(none)	DIESEL PARTICULATE MATTER [CANCER]	0.1	ABC is the highest credible value reflecting the carcinogenic potential of this material. The 2003 USEPA IRIS RfC is 5; NATA 1999 uses this RfC; there is no URE. The 1998 OEHHA REL is 5, their 1998 URE is of 3.4 □ 10^{-4} (which would give an ABC of 0.003). Choice of ABC based on an extensive review and discussion of the available literature and best professional judgment on the part of the ATSAC. The selected value is close to that suggested by the World Health Organization.
1746-01-6	DIOXINS & FURANS, CHLORINATED [CANCER]	3.0E-08 {8}	ABC calculated using the 1999 OEHHA URE of 38. OAQPS uses the lower (33) and older (1994) USEPA ORD URE, which would give the same (3.0E-08) ABC. The measured mean total dioxin ambient concentration in Oregon is 51.3 femtograms (5.1 □ 10^{-14} g), close to the benchmark value (3.0 □ 10^{-14} g) Choice based on newer OEHHA toxicity information for children.
100-41-4	ETHYL BENZENE [CANCER]	0.40 {2}*	ABC calculated using the 2007 OEHHA URE of 2.5 □ 10-6. 1991 USEPA IRIS RfC of 3000. Choice of ABC based on newer and lower CalEPA value derived from recent studies demonstrating carcinogenicity.
106-93-4	ETHYLENE DIBROMIDE [CANCER]	0.002 {3}	ABC calculated using the 2004 USEPA IRIS URE of 6.0 □ 10-4. OEHHA URE is lower (7.1 □ 10^{-5}), older (1985), and would give a higher (0.01) ABC. Choice of ABC based on preference for USEPA toxicity information, which is also newer.
107-06-2	ETHYLENE DICHLORIDE [CANCER]	0.04 {2}	ABC calculated using the 2004 USEPA IRIS URE of 2.6 □ 10-5. OEHHA URE is lower (2.1 □ 10^{-5}), older (1985), and would give a higher (0.05) ABC. Choice of ABC based on preference for USEPA toxicity information, which is also newer.
75-21-8	ETHYLENE OXIDE [CANCER]	0.01 {2}	ABC calculated using the 1987 OEHHA URE of 8.8 □ 10-5. Same URE is used by NATA 1999. Choice of ABC based on only available toxicity information, which is also consistent with that used by USEPA.
50-00-0	FORMALDEHYDE [NON-CANCER]	3	ABC is the 2000 OEHHA REL. OAQPS uses the higher (9.8) and older (1999) ATSDR MRL. The USEPA IRIS URE of 1.30 □ 10^{-5} gives a benchmark of 0.07; the OEHHA URE of 6.0 □ 10^{-6} a benchmark of 0.17; the CIIT URE of 5.5 □ 10^{-9} a benchmark of 182. Choice of ABC based on the newer OEHHA REL until the cancer potency issue is fully resolved by USEPA.

CASRN	CHEMICAL NAME	ABC ug m^{-3}	DERIVATION
110-54-3	n-HEXANE [NON-CANCER]	7000	ABC is the 2000 OEHHA REL. USEPA IRIS RfC is lower (200) and older (1991). OEHHA discredited USEPA study due to confounding presence of acetone. Choice of ABC based on newer OEHHA toxicity information.
7647-01-0	HYDROGEN CHLORIDE [NON-CANCER]	20	ABC is the 1995 USEPA IRIS RfC value. OEHHA REL is lower (9) and newer (2000). Both USEPA and OEHHA relied on the same study but used different analysis assumptions. Choice of ABC based on preference for newer USEPA toxicity information, because the ATSAC did not accept the uncertainty factors applied by OEHHA.
74-90-8	HYDROGEN CYANIDE [NON-CANCER]	9	ABC is the 2000 OEHHA REL. USEPA IRIS RfC is lower (3) and older (1994). Choice of ABC based on newer OEHHA toxicity information.
7664-39-3	HYDROGEN FLUORIDE [NON-CANCER]	14	ABC is the 2003 OEHHA REL. OAQPS uses this RfC but NATA 1999 uses an older (1999) and higher (30) California RfC. Both OEHHA and USEPA based values on same study but USEPA had added uncertainty because multi-generational study was lacking. Choice of ABC based on newer, multi-generational OEHHA toxicity information.
7783-06-4	HYDROGEN SULFIDE [NON-CANCER]	2	ABC is the 2003 USEPA IRIS RfC. OEHHA REL is higher (10) and older (2000). The ATSDR intermediate duration MRL is 28. Choice of ABC based on preference for USEPA toxicity information, which is also newer.
74-90-8	HYDROGEN CYANIDE [NON-CANCER]	9	ABC is the 2000 OEHHA REL. USEPA IRIS RfC is lower (3) and older (1994). Choice of ABC based on newer OEHHA toxicity information.
7439-92-1	LEAD COMPOUNDS [NON-CANCER]	0.15*	ABC based on new National Ambient Air Quality Standard (NAAQS) adopted by USEPA. OAQPS and NATA use the NAAQS. OEHHA has a cancer potency factor. Choice of ABC based on preference for USEPA information, which is also newer.
7439-96-5	MANGANESE COMPOUNDS [NON-CANCER]	0.2	ABC is the 2000 OEHHA REL. USEPA IRIS RfC is lower (0.05) and older (1993). Both OEHHA and USEPA values based on same study of ingestion but with different uncertainty factors. Choice of ABC based on newer OEHHA toxicity information.

CASRN	CHEMICAL NAME	ABC ug m^{-3}	DERIVATION
67-56-1	METHANOL [NON-CANCER]	4000	ABC is the 2000 OEHHA REL. Same RfC is used by NATA 1999. Choice of ABC based on only available toxicity information.
74-83-9	METHYL BROMIDE [NON-CANCER]	5	ABC is the 1992 USEPA IRIS RfC. OEHHA REL is the same (5) and newer (2000). Choice of ABC based on preference for USEPA toxicity information, which is consistent with OEHHA.
74-87-3	METHYL CHLORIDE [NON-CANCER]	90	ABC is the 2001 USEPA IRIS RfC. Same RfC is used by NATA 1999. ATSDR MRL is 95. Choice of ABC based on only available toxicity information.
71-55-6	METHYL CHLOROFORM [NON-CANCER]	1000	ABC is the 2000 OEHHA REL. NATA 1999 also uses this RfC. There is no USEPA IRIS value. Choice of ABC based on only available toxicity information, which is also consistent with that used by USEPA.
75-09-2	METHYLENE CHLORIDE [CANCER]	2.1 {1}	ABC calculated using the 1997 USEPA IRIS URE of 4.7 □ 10-7. OEHHA URE is higher (1.0 □ 10^{-6}), older (1989), and would give a lower (1.0) ABC (because a USDA adjustment divided the value by 2). Choice of ABC based on preference for USEPA toxicity information, which is also newer.
91-20-3	NAPHTHALENE [CANCER]	0.03 {2}	ABC calculated using the 2004 OEHHA URE of 3.4 □ 10-5. Both OEHHA and NATA 1999 use this URE. Choice of ABC based on only available toxicity information, which is also consistent with that used by USEPA.
(none)	NICKEL REFINERY DUST	0.004 {3}	ABC calculated using the 1991 USEPA IRIS URE of 2.4 □ 10^{-4} for nickel refinery dust. The OEHHA URE is almost identical (2.6 □ 10^{-4}), the same age (1991), and would give the same (0.004) ABC. The 2004 USEPA OAQPS uses a URE of 1.6 □ 10^{-4}) which would give an ABC of 0.004. Choice of ABC based on preference for USEPA toxicity information, which is also consistent with OEHHA.
12035-72-2	NICKEL SUBSULFIDE	0.002 {3}	ABC calculated using the 1991 USEPA IRIS URE of 4.8 □ 10^{-4} for nickel subsulfide. OEHHA groups this with other Ni compounds with a value of 0.05. Choice of ABC based on preference for USEPA toxicity information.

CASRN	CHEMICAL NAME	ABC ug m^{-3}	DERIVATION
373-02-4 7718-54-9 3333-39-3 13463-39-3 12054-48-7 1271-28-9 7786-81-4	NICKEL COMPOUNDS (SOLUBLE) [NON-CANCER] Nickel acetate Nickel chloride Nickel carbonate Nickel carbonyl Nickel hydroxide Nickelocene Nickel sulfate	0.05	ABC is the 2000 OEHHA REL. ATSDR (2005) has chronic MRL of 0.09 based on nickel sulfate. USEPA has no inhalation values for these compounds. OAQPS uses the ATSDR value. Choice of ABC based on OEHHA toxicity information when USEPA information was not available.
7803-51-2	PHOSPHINE [NON-CANCER]	0.3	ABC is the 1995 USEPA IRIS RfC. OEHHA REL is higher (0.8) and newer (2002). Choice of ABC based on USEPA information because the ATSAC did not accept the uncertainty factors applied by OEHHA.
7664-38-2	PHOSPHORIC ACID [NON-CANCER]	10	ABC is the 2004 USEPA IRIS RfC. OEHHA REL is higher (70) and older (2000). Choice of ABC based on preference for USEPA toxicity information, which is also newer.
1336-36-3	POLYCHLORINATED BIPHENYLS (PCB) [CANCER]	0.01 {2}	ABC calculated using the 1999 USEPA IRIS URE of 1.0×10^{-4}. ABC is for total PCB. OEHHA URE for high risk PCB group is higher (5.7×10^{-4}), the same age (1999), and would give a lower (0.002) ABC. Choice of ABC based on preference for USEPA toxicity information.
various	POLYCYCLIC AROMATIC HYDROCARBONS (PAH) [CANCER]	0.0009 {4}	ABC calculated using the 1999 OEHHA URE of 1.1×10^{-3} for benzo(a)pyrene. Benchmark is compared to the toxicity equivalency factor weighted sum of concentrations for 32 individual PAHs. Choice of ABC based on only available toxicity information.
127-18-4	TETRACHLOROETHYLENE [CANCER]	35	ABC is the 1991 OEHHA REL. There is no USEPA IRIS RfC. The 1999 ATSDR chronic inhalation MRL is 270. The 1991 OEHHA URE is 5.9×10^{-6}; NATA 1999 and OEHHA 1999 use a URE of 5.0×10^{-6}. OAQPS 2005 and NATA 1999 use the ATSDR MRL and the OEHHA URE. Choice of ABC based on OEHHA REL due to lack of clear evidence of significant cancer potency in humans.
108-88-3	TOLUENE [NON-CANCER]	400	ABC is the 1995 USEPA IRIS RfC. OEHHA REL is lower (300) and newer (2000). ATSDR MRL is 376. Choice of ABC based on preference for USEPA toxicity information, which is similar to that used by ATSDR.

CASRN	CHEMICAL NAME	ABC ug m^{-3}	DERIVATION
26471-62-5	2,4-/2,6-TOLUENE DIISOCYANATE (MIXTURE) [NON-CANCER]	0.07	ABC is the 1995 USEPA IRIS RfC. OEHHA REL is the same and newer (1999). An ABC calculated using the 1999 OEHHA URE of 1.1×10^{-5} would be higher (0.09). Choice of ABC based on preference for USEPA toxicity information.
79-01-6	TRICHLOROETHYLENE [CANCER]	0.5 {1}	ABC calculated using the 1990 OEHHA URE of 2.0 × 10-6. OAQPS 2005 and NATA 1999 also use this URE. Choice of ABC based on preference for USEPA toxicity information for air quality programs.
75-01-4	VINYL CHLORIDE [CANCER]	0.1 {1}	ABC calculated using the 2000 USEPA IRIS URE of 8.8 × 10-6. OEHHA URE is higher (7.8×10^{-5}), older (1990) and would give a lower (0.01) ABC. Guidance must indicate that this be used with an Early Life Stage adjustment factor. Choice of ABC based on preference for USEPA toxicity information, which is also newer.
7723-14-0	WHITE PHOSPHORUS [NON-CANCER]	0.07	ABC is the 1991 OEHHA REL. Choice of ABC based on only available toxicity information.
1330-20-7	XYLENES (MIXED) [NON-CANCER]	700	ABC is the 2000 OEHHA REL. USEPA IRIS RfC is lower (100) and newer (2003). Choice of ABC is based on the OEHHA human (LOAEL) study, rather than the USEPA animal-only study.

ACRONYMS

ABC	Ambient benchmark concentration for Oregon
ATSAC	Air Toxics Science Advisory Committee (for DEQ's Air Quality Division)
ATSDR	Agency for Toxic Substances and Disease Registry (part of U.S. Public Health Service)
CalEPA	California Environmental Protection Agency
CIIT	Chemical Industry Institute of Toxicology
DEQ	Oregon Department of Environmental Quality
IRIS	Integrated Risk Information System
MRL	Minimum risk level
NATA	National Air Toxics Assessment (by USEPA)
OAQPS	USEPA Office of Air Quality Planning and Standards
OEHHA	Office of Environmental Health Hazard Assessment (within CalEPA)
ORD	Office of Research and Development (USEPA)
REL	Reference exposure level
RfC	Reference concentration
URE	Unit risk estimate
USEPA	U. S. Environmental Protection Agency

Appendix F. Portland Air Toxics Solutions Preliminary Modeling.

The PATS modeling for 1,3-Butadiene shows the highest levels in Hillsboro, Beaverton, the downtown Portland Core, and Gresham. ODEQ has monitored in Beaverton, and the Portland Core but not Gresham and Hillsboro. The modeled concentrations in most areas are above the benchmark of 0.03μg/m^3.

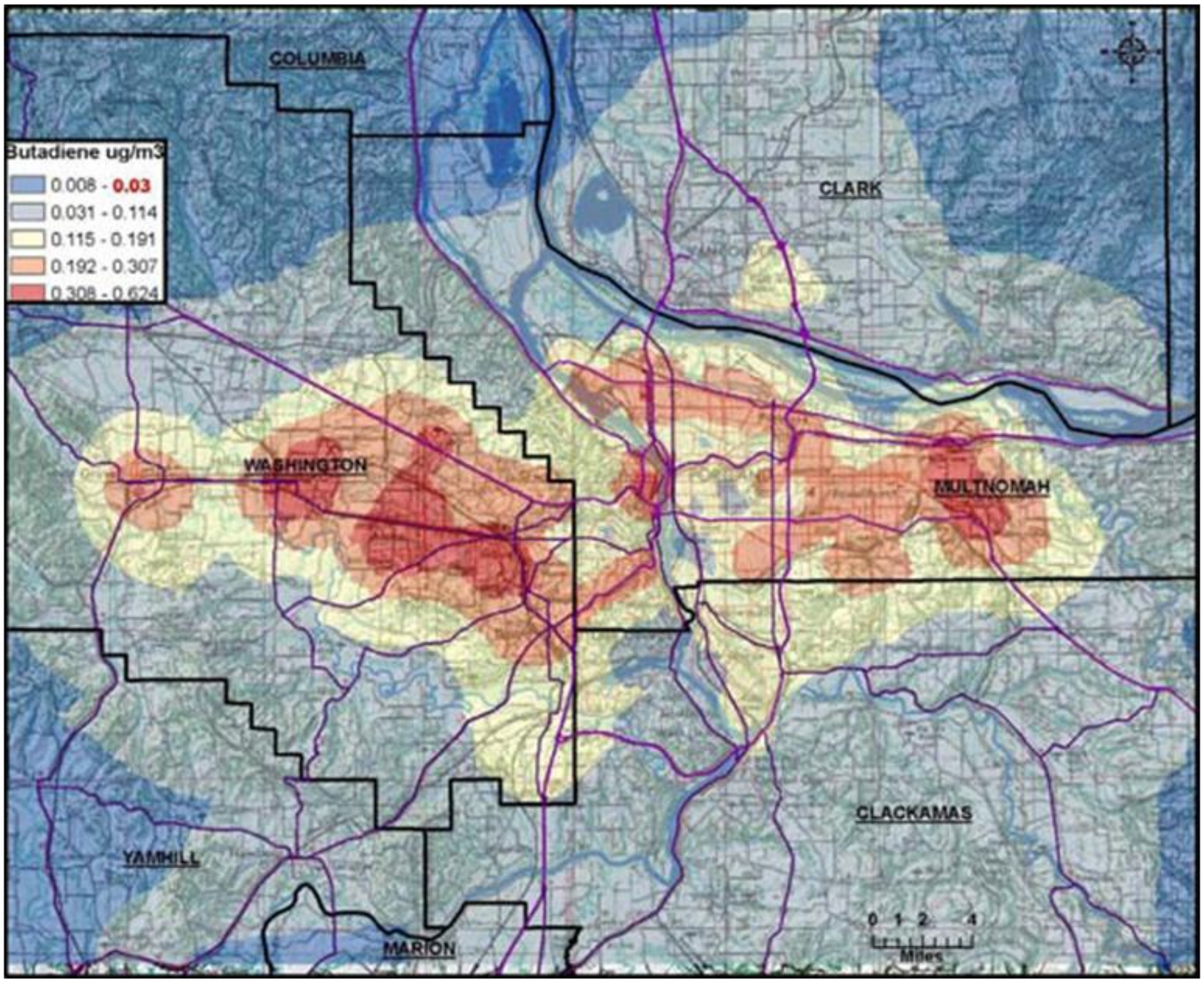

Figure F.1. PATS 2005 modeled results for 1,3-Butadiene in the Portland Metro Area.

The PATS modeling for Ethylbenzene shows the highest levels in Hillsboro, Beaverton, the downtown Portland Core, and North Portland. ODEQ has monitored in Beaverton, the Portland Core, and N. Portland but not Hillsboro. The modeled concentrations in most areas are above the benchmark of 0.4 μg/m^3.

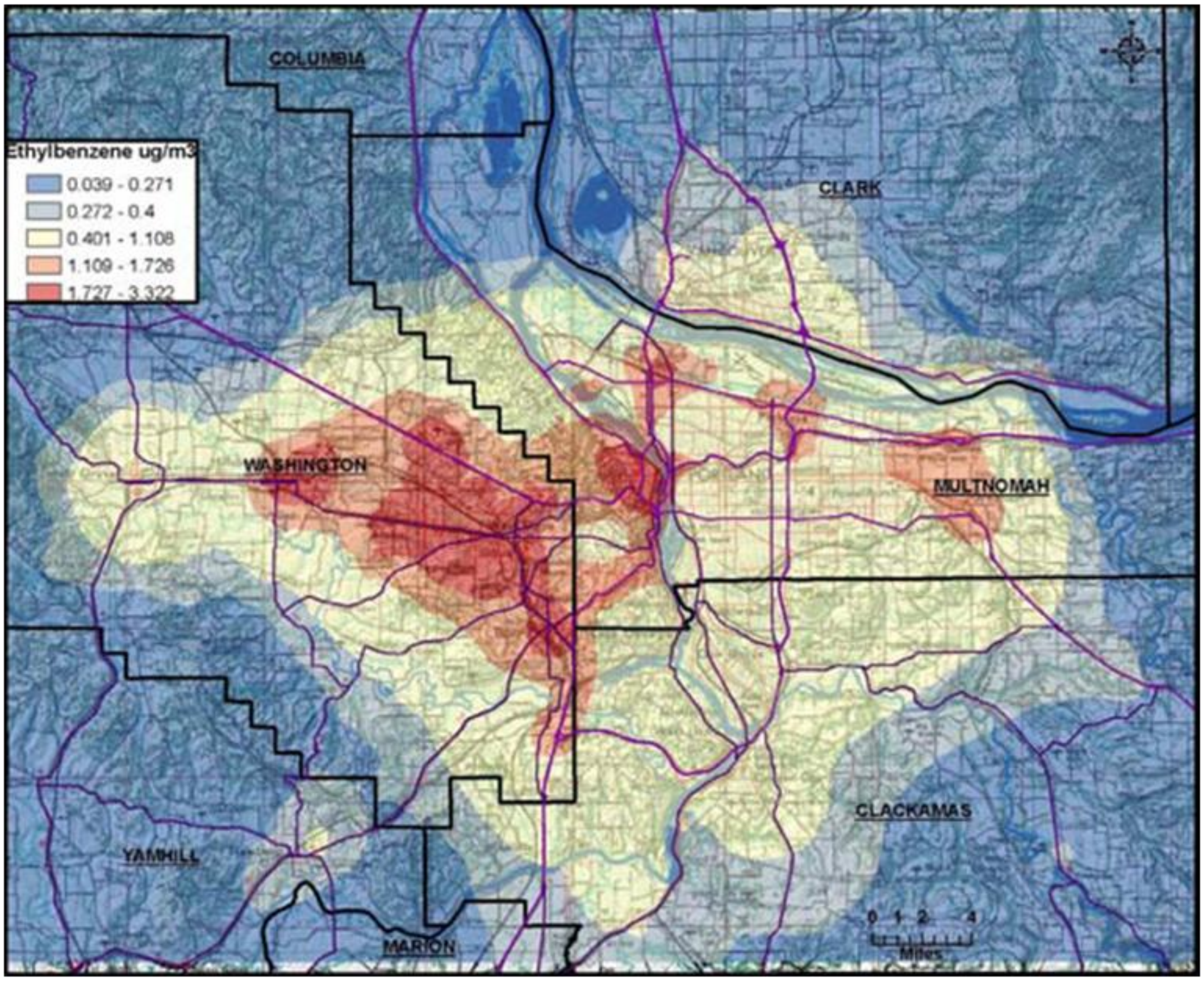

Figure F.2. PATS 2005 modeled results for Ethylbenzene in the Portland Metro Area.

The PATS modeling for 1,4-Dichlorobenzene shows the highest levels in Hillsboro and Beaverton. ODEQ has monitored in Beaverton but not Hillsboro. The modeled concentrations in most areas are above the benchmark of 0.09 µg/m^3.

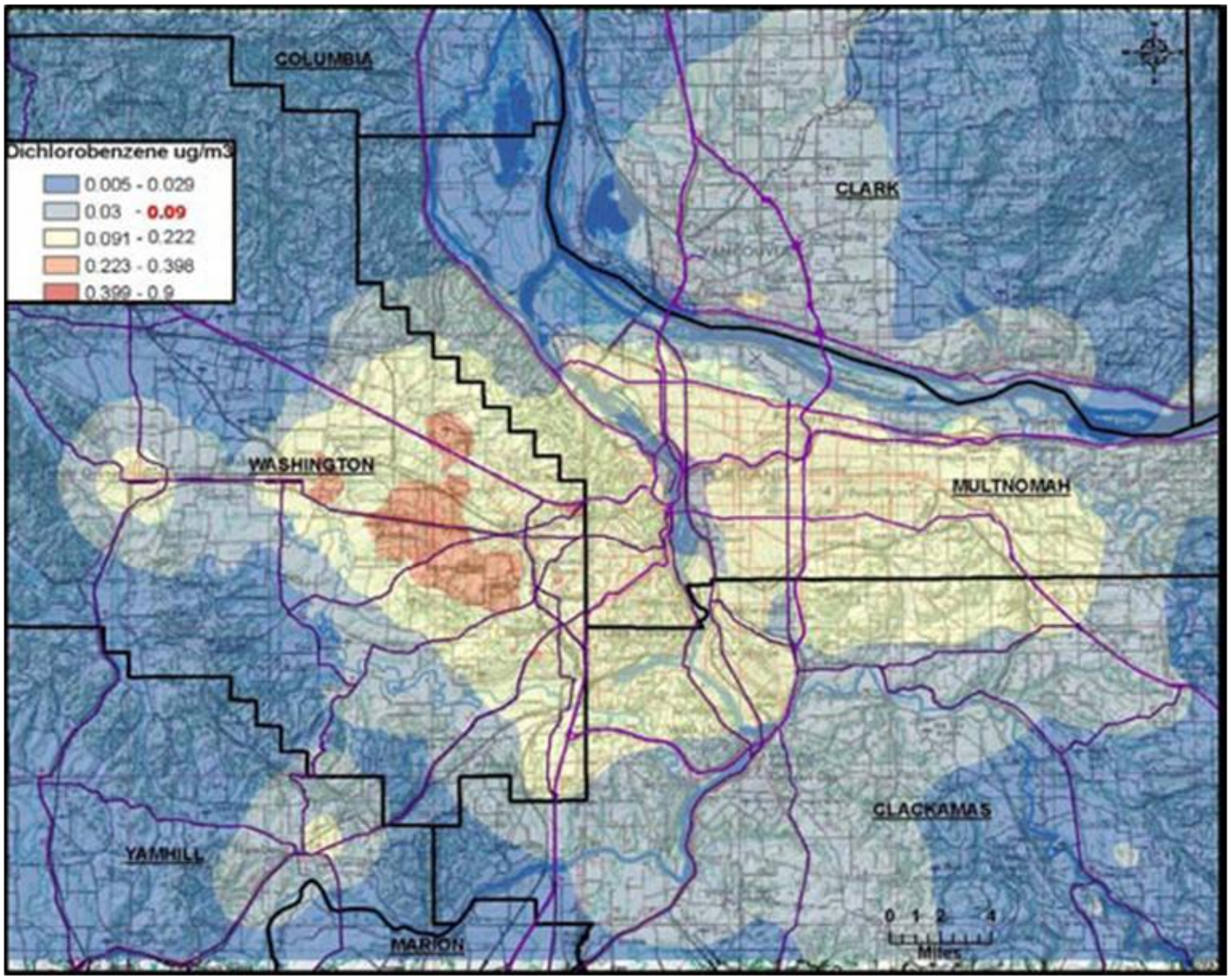

Figure F.3. PATS 2005 modeled results for 1,4-Dichlorobenzene in the Portland Metro Area.

The PATS modeling for Benzene shows the highest levels in Hillsboro, Beaverton, the downtown Portland Core, North Portland, and Gresham. ODEQ has monitored in Beaverton, the Portland Core, and N. Portland but not Hillsboro or Gresham. The modeled concentrations in most areas are above the benchmark of 0.13µg/m^3.

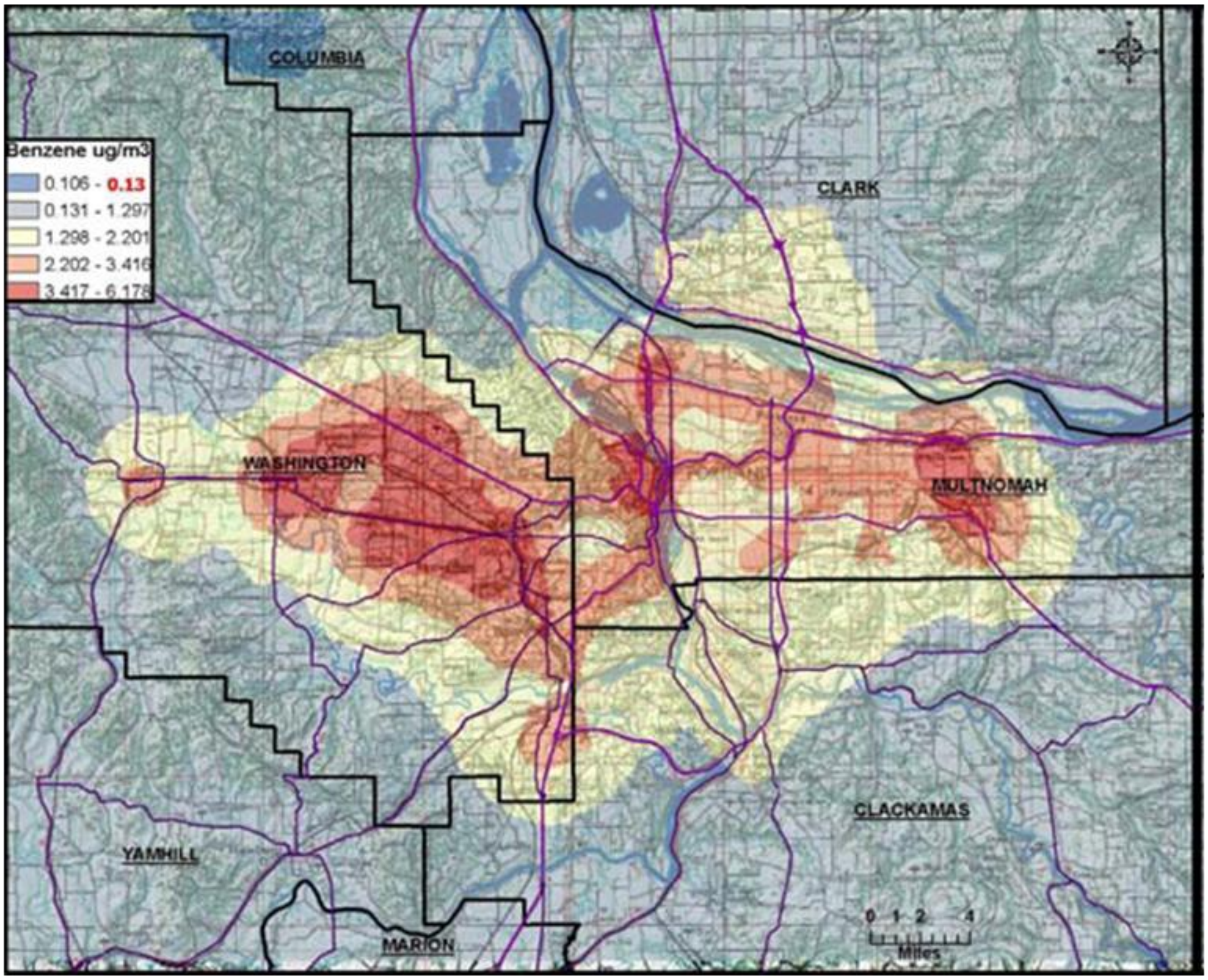

Figure F.4. PATS 2005 modeled results for Benzene in the Portland Metro Area.

The PATS modeling for Methylene Chloride shows the highest levels in the downtown Portland Core, NW Portland, N. Portland, and Gresham. ODEQ has monitored in the Portland Core, N. Portland, NW Portland but not Gresham. The modeled concentrations in most areas are above the benchmark of 2.1μg/m^3.

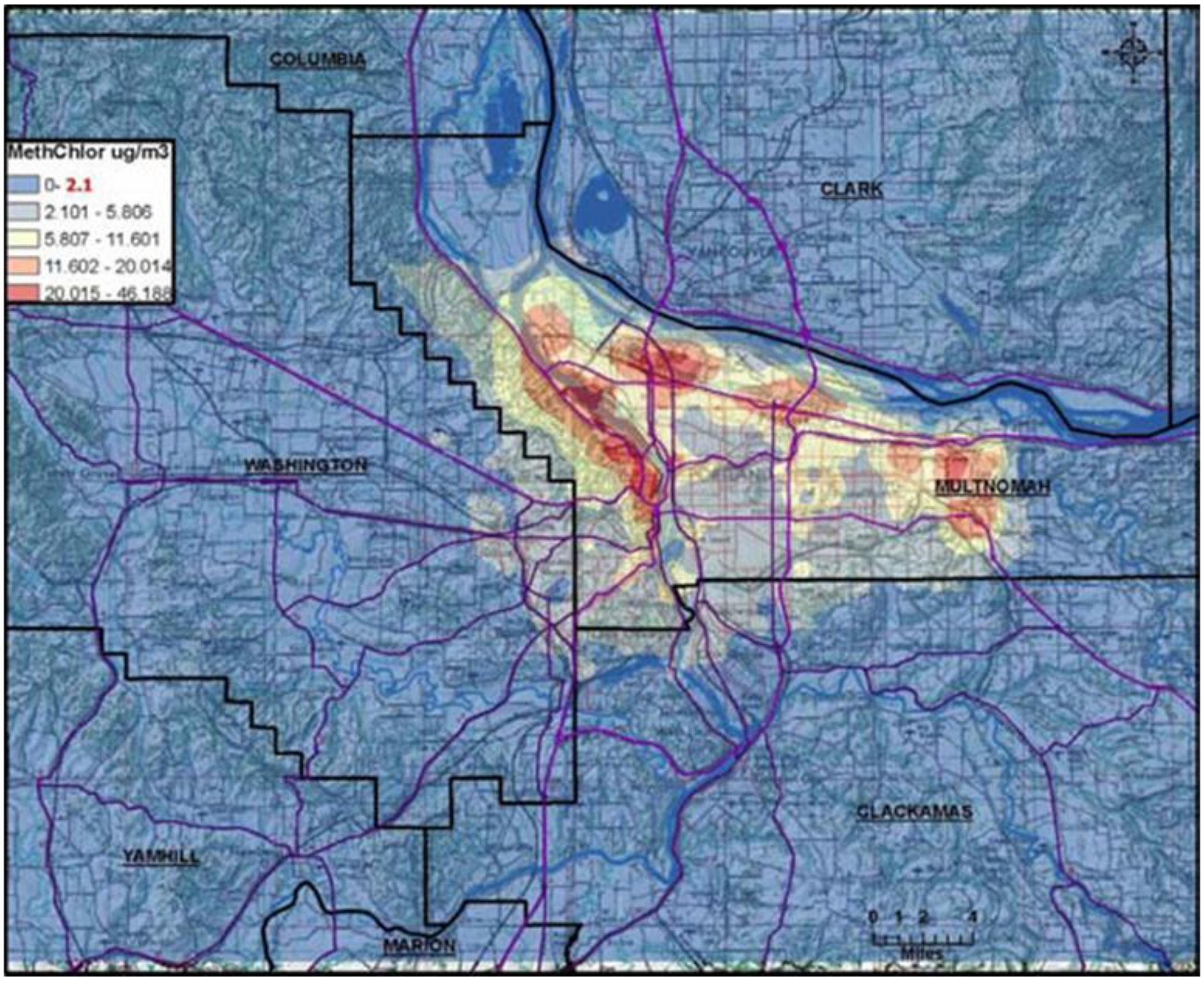

Figure F.5. PATS 2005 modeled results for Methylene Chloride in the Portland Metro Area.

The PATS modeling for Trichloroethylene shows the highest levels in Beaverton, NW Portland, and N. Portland. ODEQ has monitored in all these areas. The modeled concentrations in most areas are below the benchmark of 0.5µg/m^3. Only the maximum areas mentioned above are modeled at or above the benchmark.

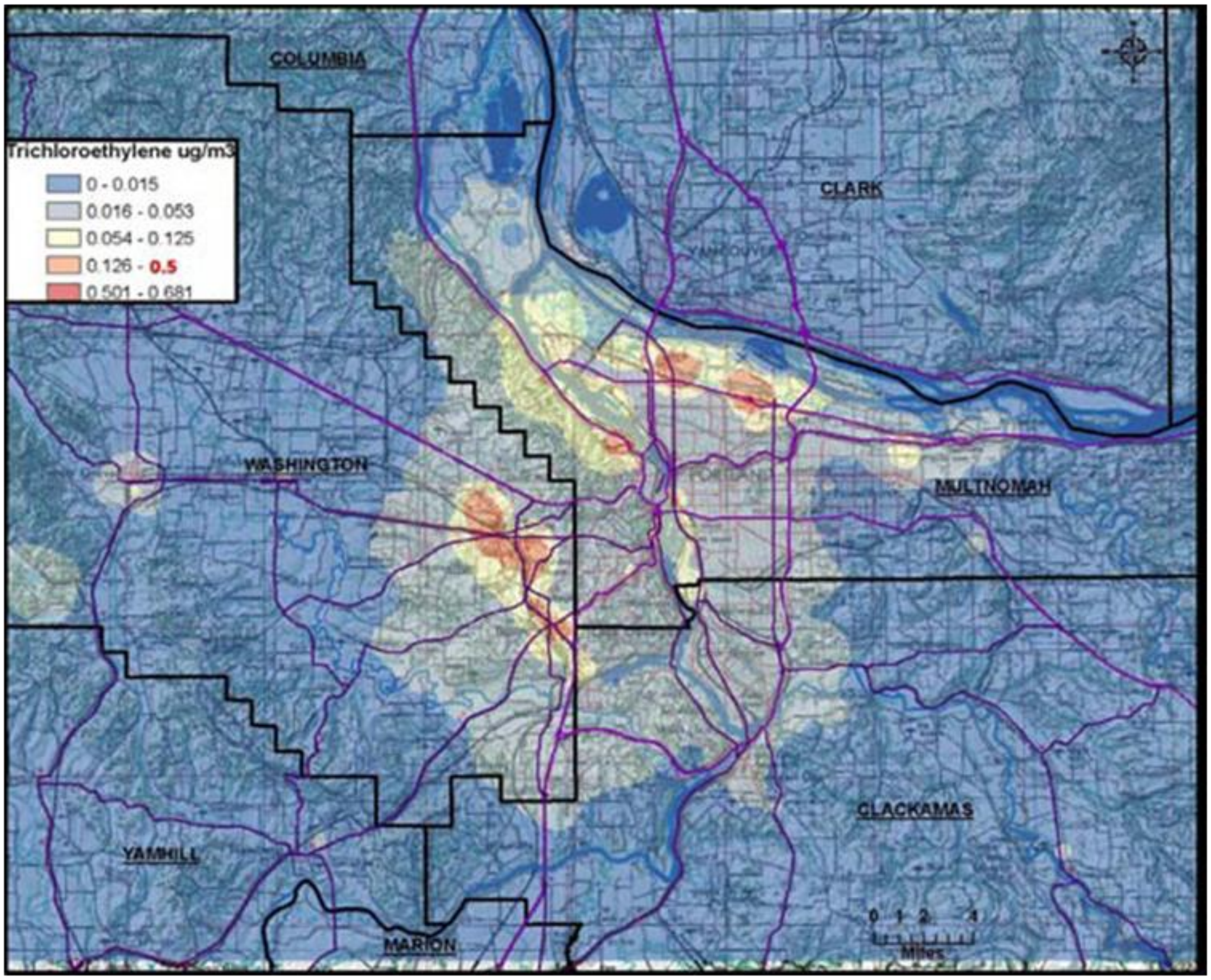

Figure F.6. PATS 2005 modeled results for Trichloroethylene in the Portland Metro Area.

The PATS modeling for Perchloroethylene shows the highest levels in the Beaverton, downtown Portland Core, and Gresham. ODEQ has monitored in Beaverton and the Portland Core, but not Gresham. The modeled concentrations in all areas are below the benchmark of 35µg/m^3.

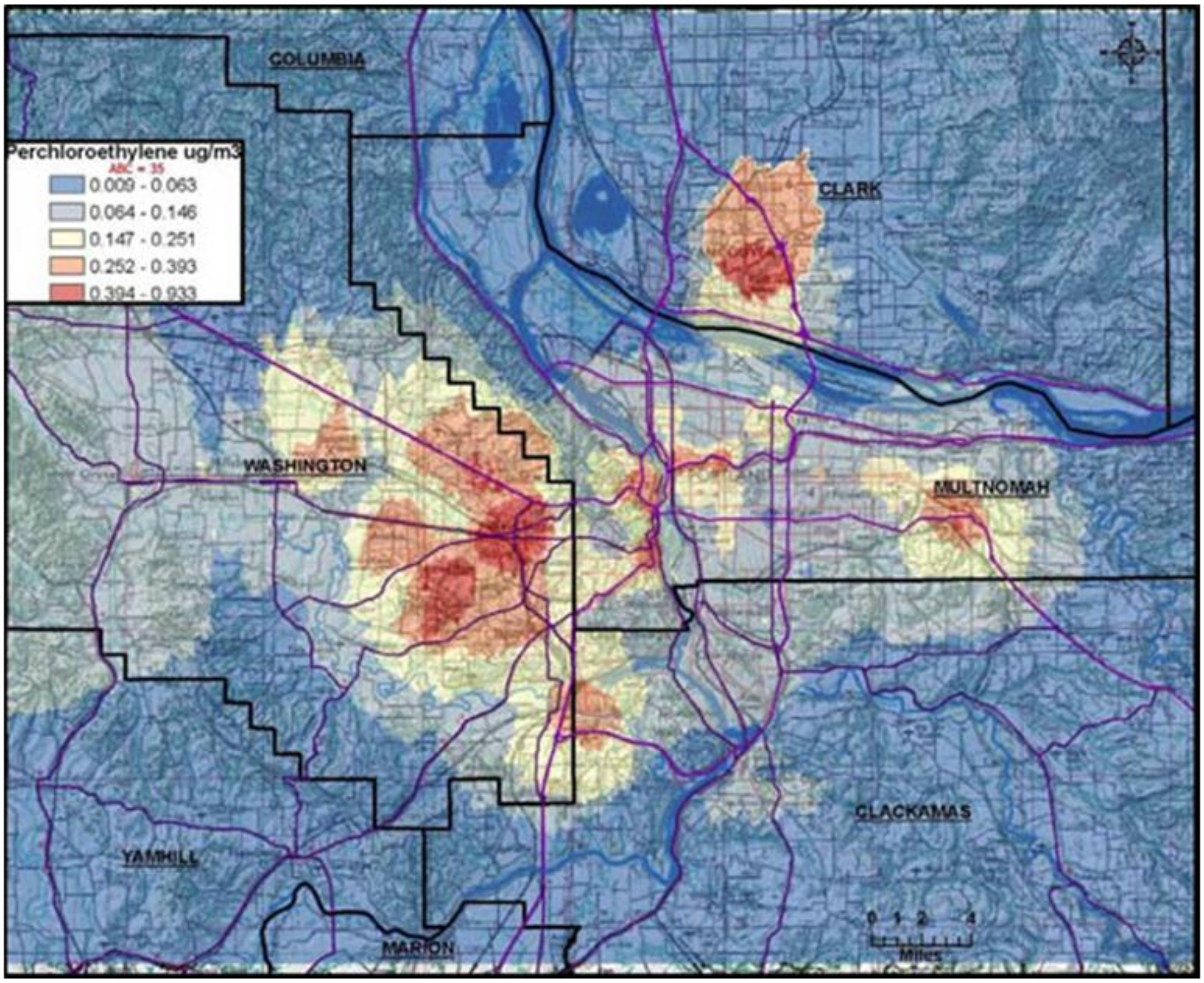

Figure F.7. PATS 2005 modeled results for Perchloroethylene in the Portland Metro Area.

The PATS modeling for Acetaldehyde shows the highest levels in the Forest Grove, Hillsboro, Beaverton, downtown Portland Core, N. Portland, and Gresham. ODEQ has monitored in Beaverton and the Portland Core, but not Forest Grove, Hillsboro, or Gresham. The modeled concentrations in the maximum areas are above the benchmark of 0.45µg/m^3.

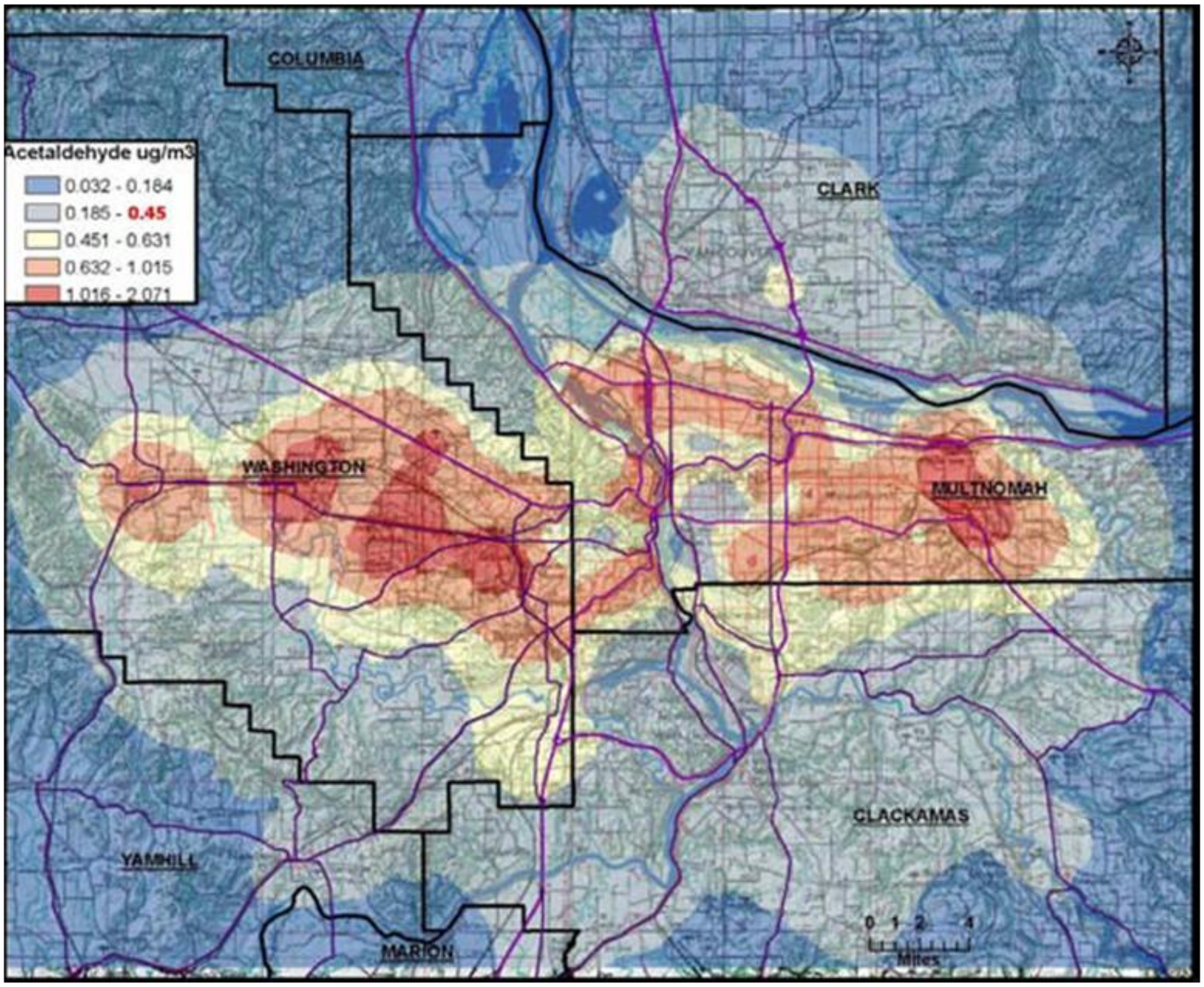

Figure F.8. PATS 2005 modeled results for Acetaldehyde in the Portland Metro Area.

The PATS modeling for Formaldehyde shows the highest levels in Hillsboro, Beaverton, and Gresham. ODEQ has monitored in Beaverton but not Hillsboro or Gresham. The modeled concentrations in the maximum areas are above the benchmark of $3 \mu g/m^3$.

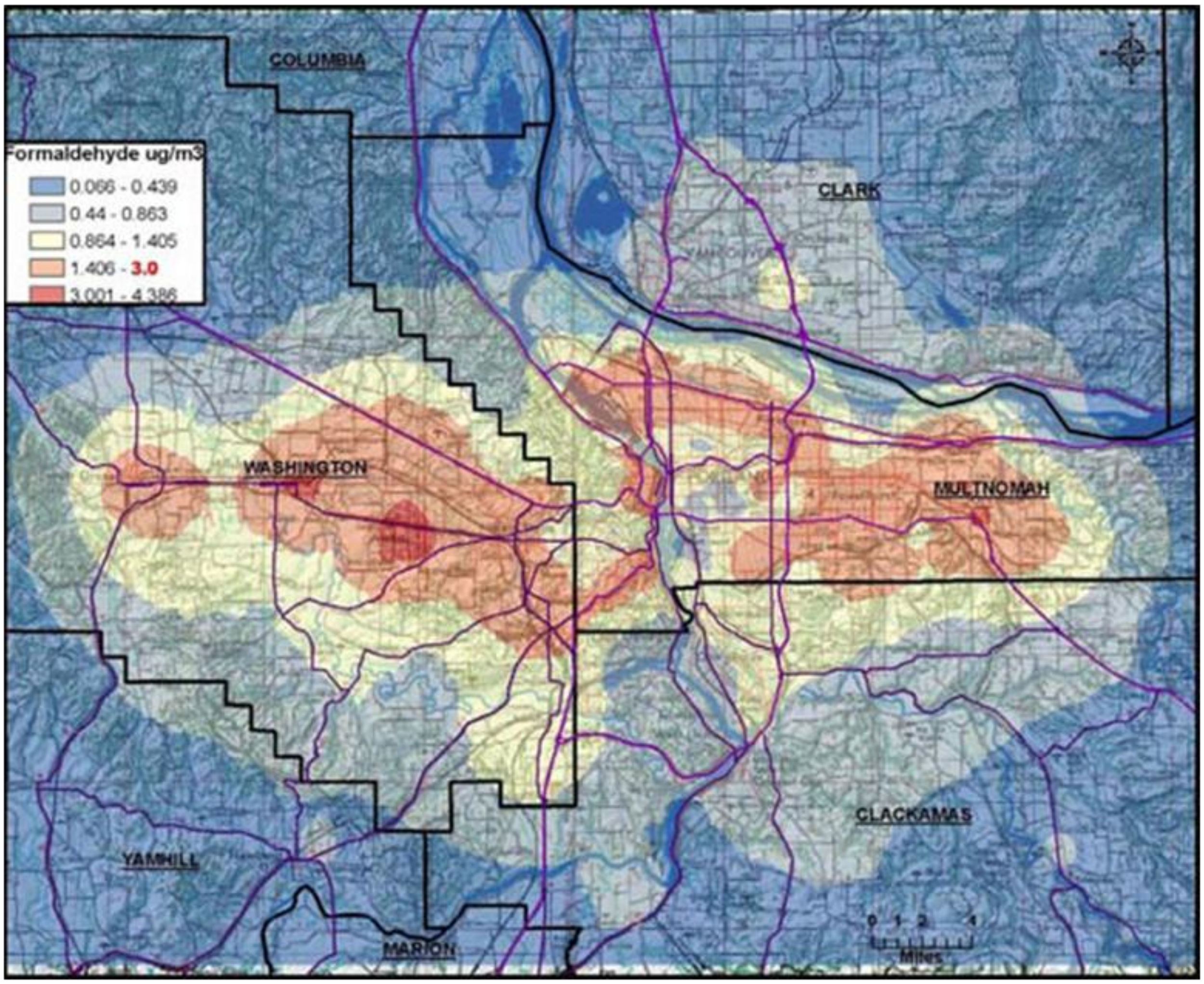

Figure F.9. PATS 2005 modeled results for Formaldehyde in the Portland Metro Area.

The PATS modeling for Acrolein shows the highest levels in Hillsboro, SW Portland, NW Portland, N. Portland, and Gresham. ODEQ has not monitored for Acrolein anywhere because the analytical method is still under development. We expect to begin analysis for acrolein by the end of 2010. The modeled concentrations in all areas are above the benchmark of $0.02 \mu g/m^3$.

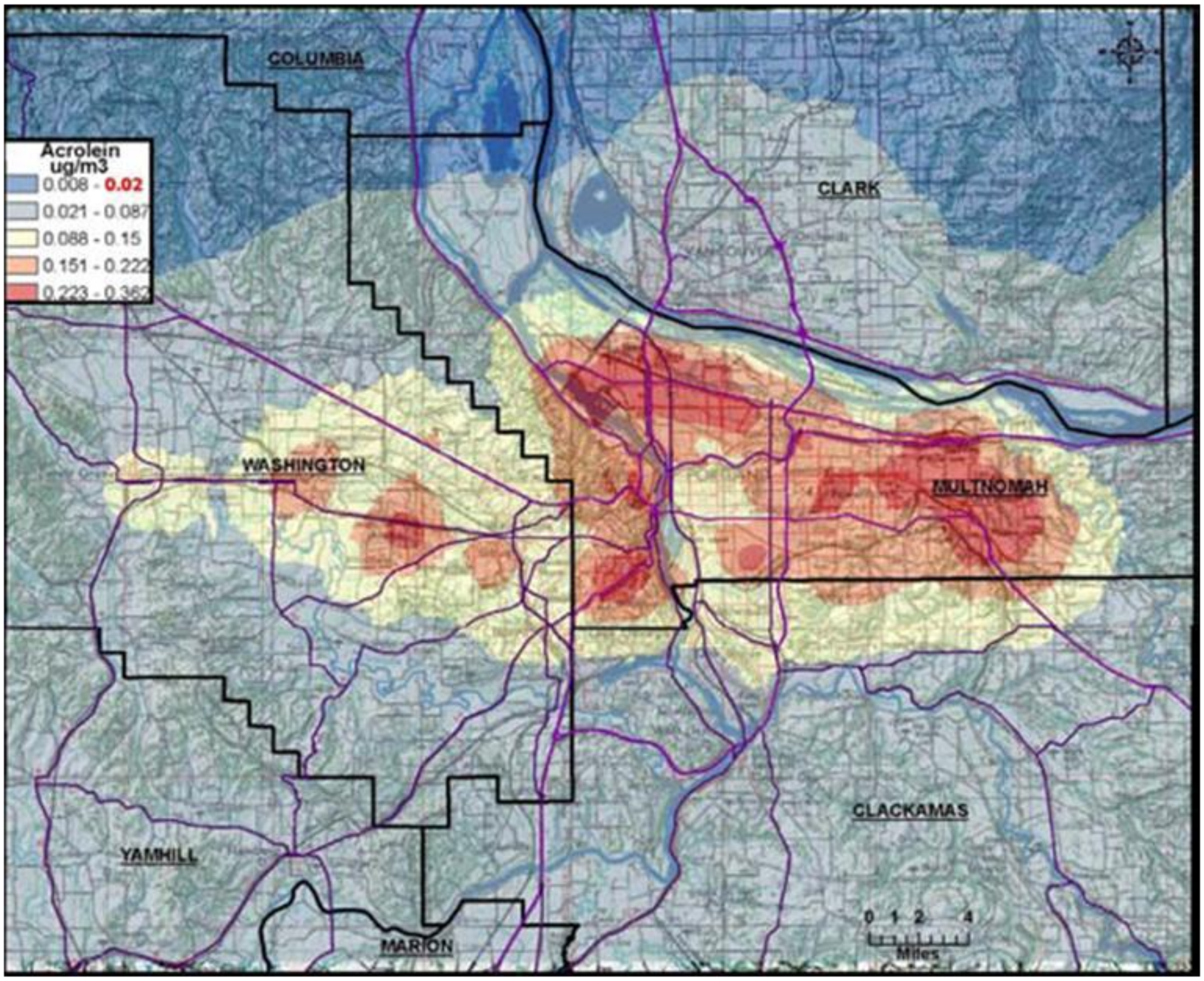

Figure F.10. PATS 2005 modeled results for Acrolein in the Portland Metro Area.

The PATS modeling for the 15-Polyaromatic Hydrocarbons (PAH) shows the highest levels in Hillsboro, Beaverton, and Gresham. ODEQ has monitored in Beaverton but not Hillsboro or Gresham. The modeled concentrations in all areas are above the benchmark of 0.0009µg/m^3.

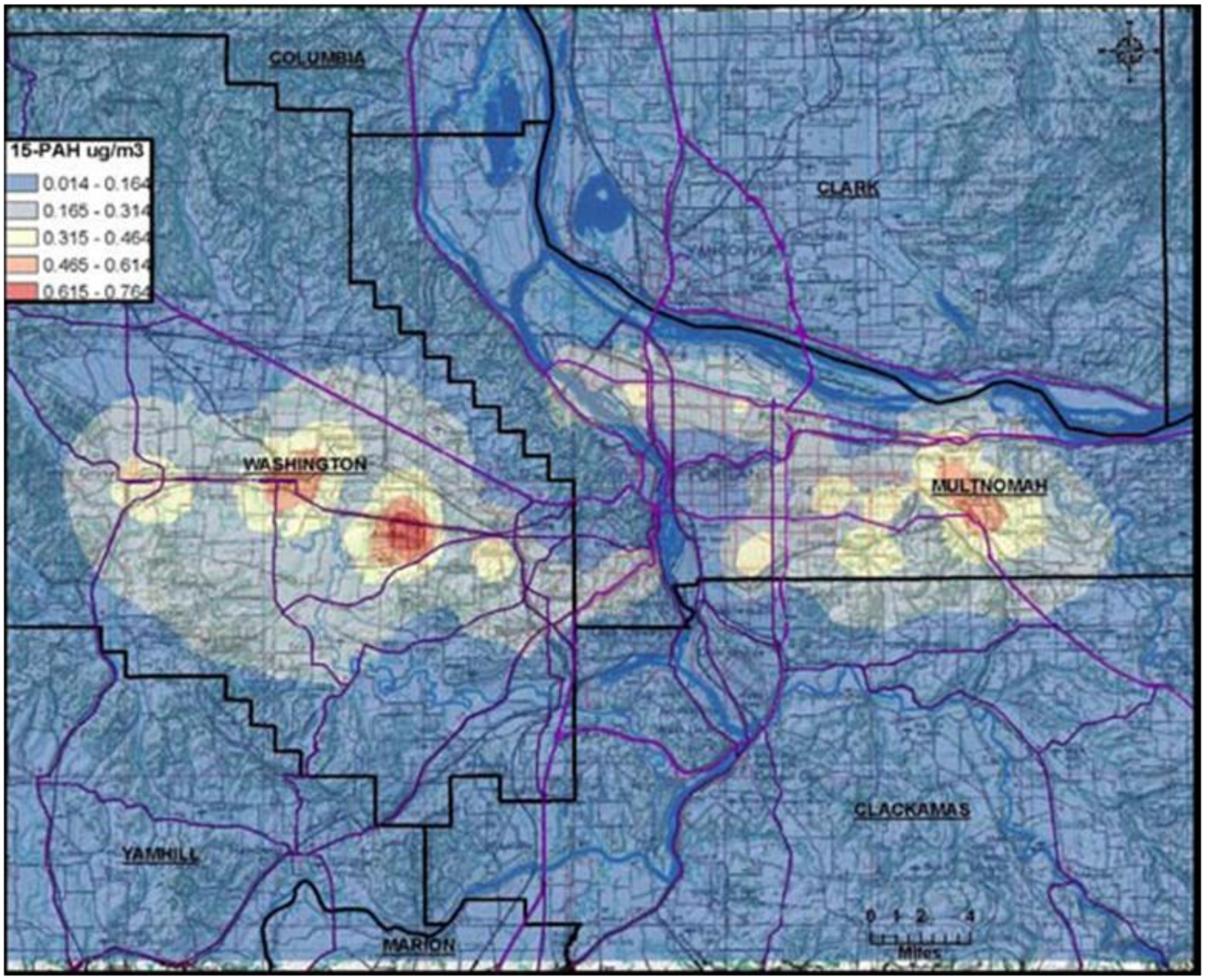

Figure F.11. PATS 2005 modeled results for 15-Polyaromatic Hydrocarbons (15-PAH) in the Portland Metro Area.

The PATS modeling for Naphthalene shows the highest levels in the downtown Portland core. The modeled concentration in this area is above the benchmark of 0.03µg/m^3.

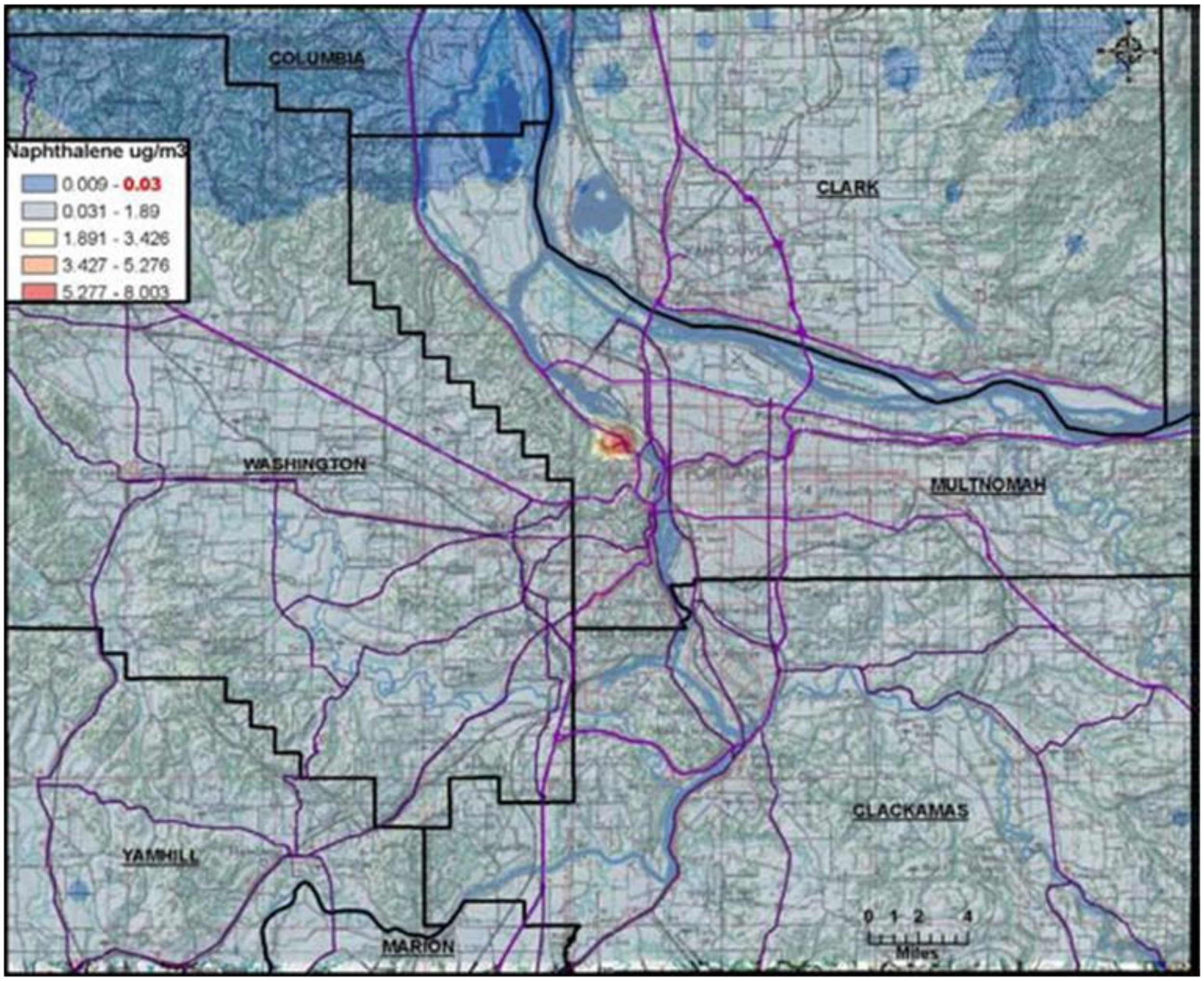

Figure F.12. PATS 2005 modeled results for Naphthalene in the Portland Metro Area.

The PATS modeling for Diesel Particulate shows the highest levels in Hillsboro, Beaverton, the downtown Portland core, and N. Portland. ODEQ has monitored in N. Portland but not Hillsboro, Beaverton, and the downtown Portland core. The modeled concentrations in all areas are above the benchmark of 0.1µg/m^3.

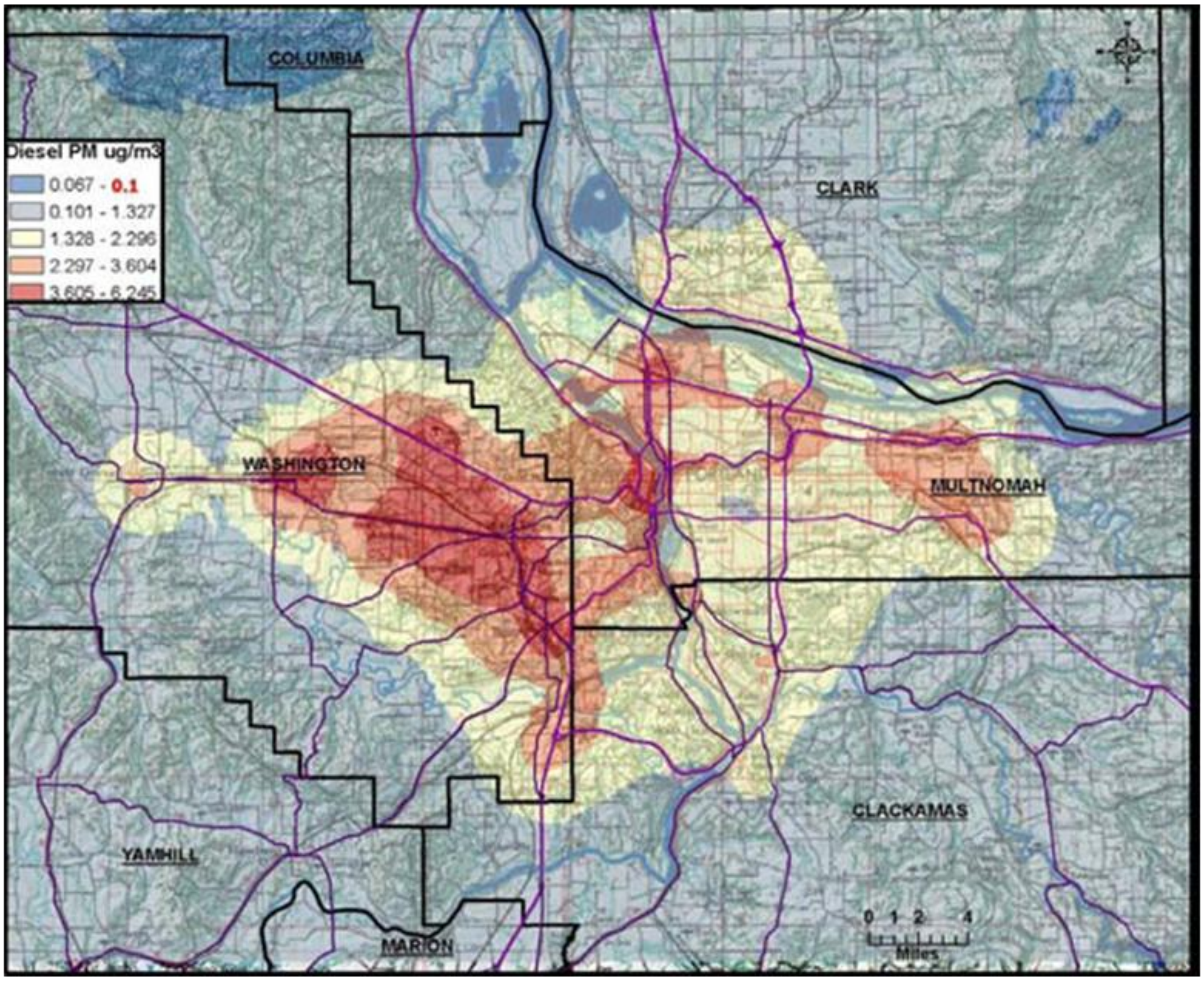

Figure F.13. PATS 2005 modeled results for Diesel Particulate in the Portland Metro Area.

The PATS modeling for Arsenic shows the highest levels in Beaverton, NW Portland, and N. Portland. ODEQ has monitored in all these areas. The modeled concentrations in all areas are above the benchmark of 0.0002µg/m^3.

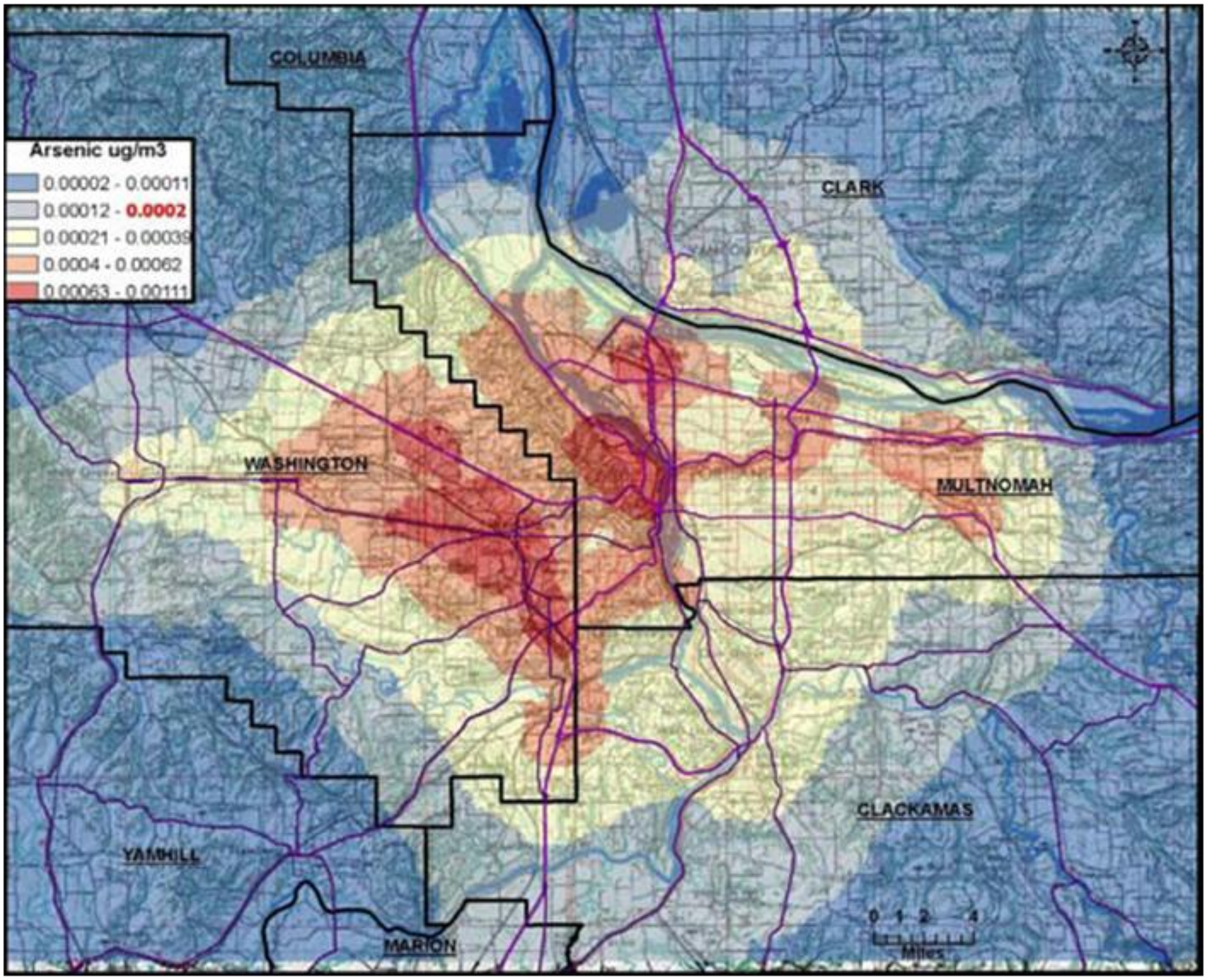

Figure F.14. PATS 2005 modeled results for Arsenic in the Portland Metro Area.

The PATS modeling for the Cadmium shows the highest levels in NW Portland and N. Portland. ODEQ has monitored in both these areas. The modeled concentrations in the maximum areas are above the benchmark of 0.0006µg/m^3.

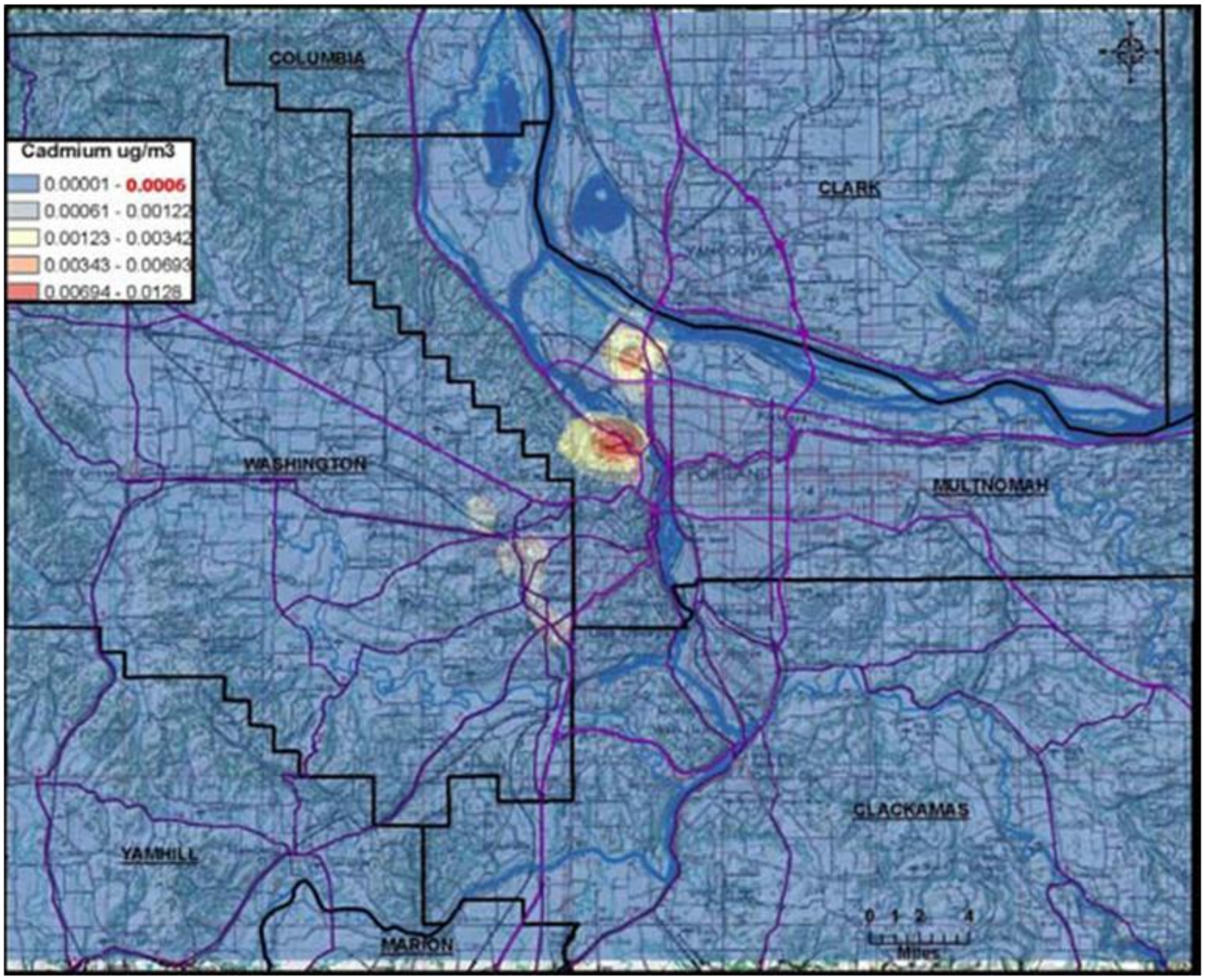

Figure F.15. PATS 2005 modeled results for Cadmium in the Portland Metro Area.

The PATS modeling for Chromium shows the highest levels in The Gladstone and Oregon City areas.   ODEQ has not monitored in these areas. The modeled concentrations in the maximum areas are above the benchmark of 0.00008µg/m^3.

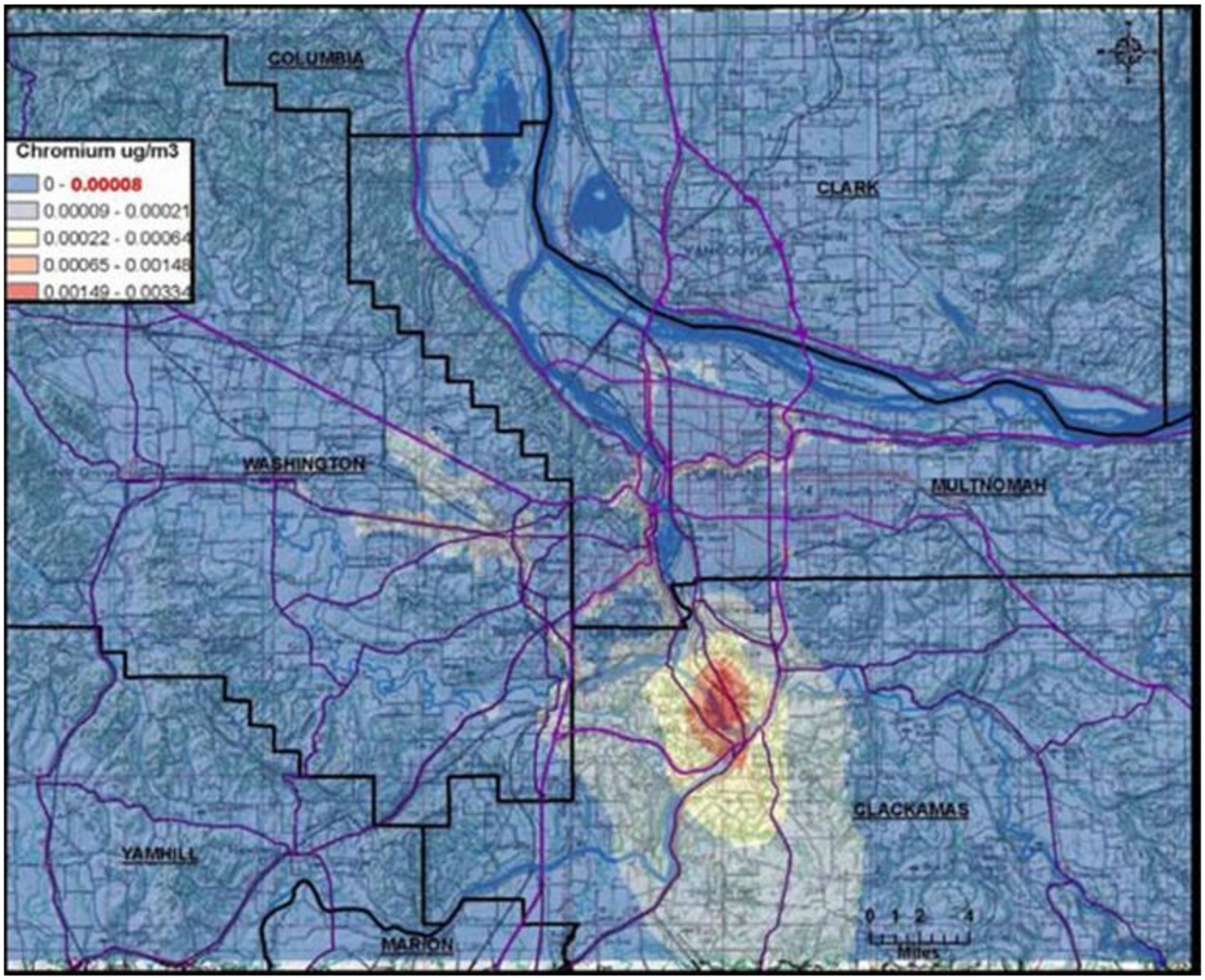

Figure F.16. PATS 2005 modeled results for Chromium in the Portland Metro Area.

The PATS modeling for Lead shows the highest levels in NW Portland.   ODEQ has monitored in this area. The modeled concentrations in all areas are below the benchmark of 0.5 µg/m^3.

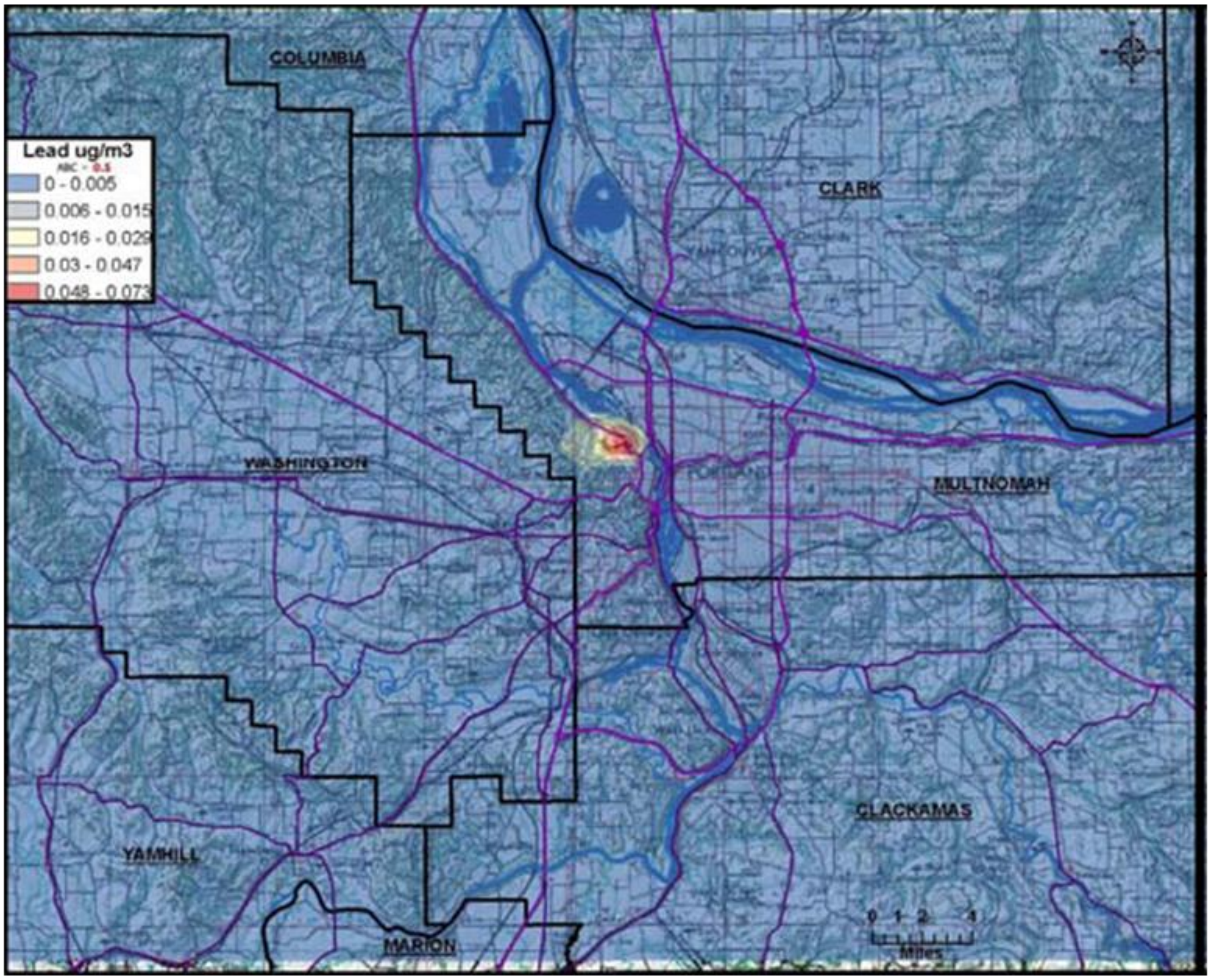

Figure F.17. PATS 2005 modeled results for Lead in the Portland Metro Area.

The PATS modeling for Manganese shows the highest levels in NW Portland. ODEQ has monitored in this area. The modeled concentrations in the maximum areas are above the benchmark of 0.2 µg/m^3.

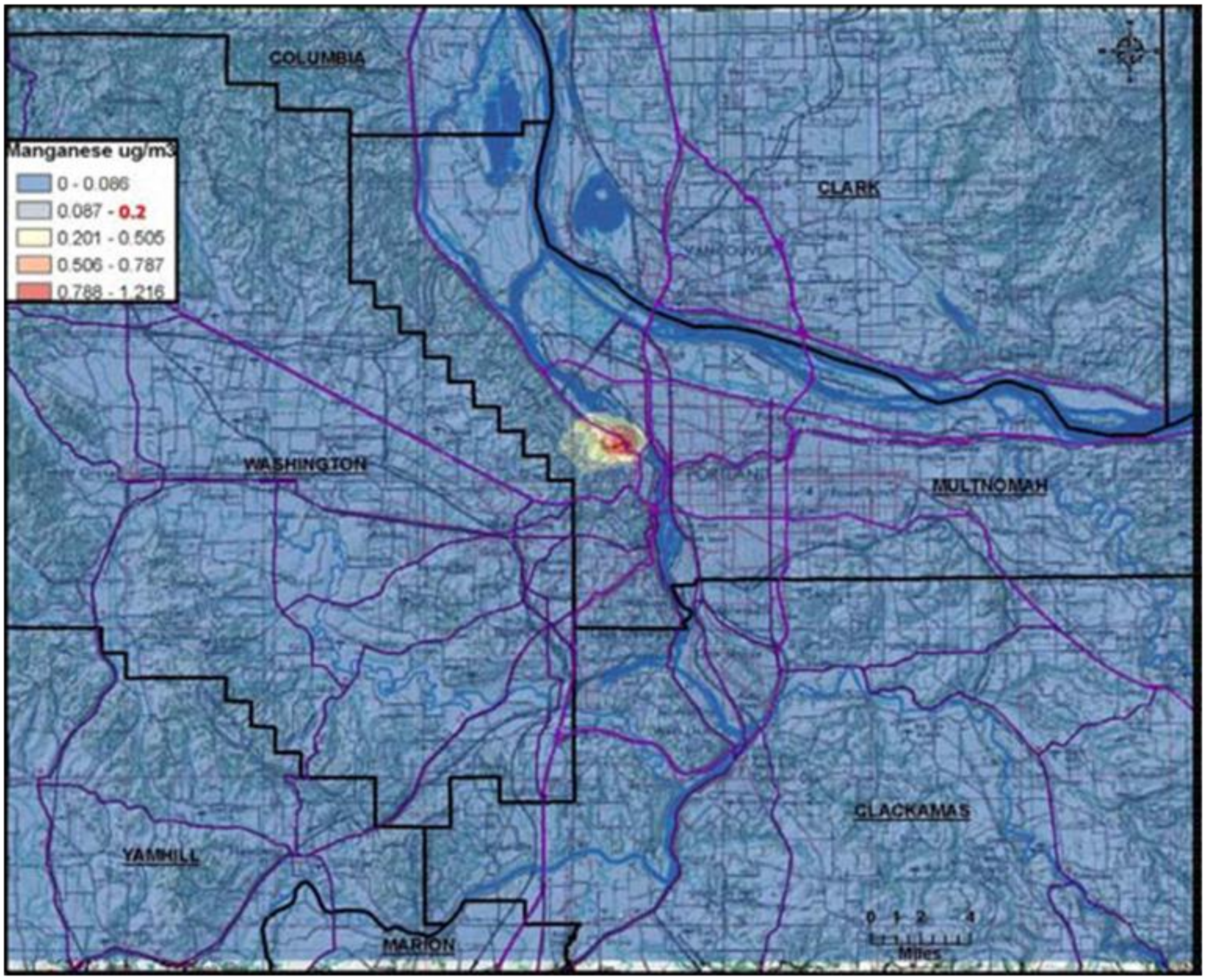

Figure F.18. PATS 2005 modeled results for Manganese in the Portland Metro Area.

The PATS modeling for Nickel shows the highest levels in NW Portland. ODEQ has monitored in this area. The modeled concentrations in the maximum areas are above the benchmark of 0.05 µg/m^3.

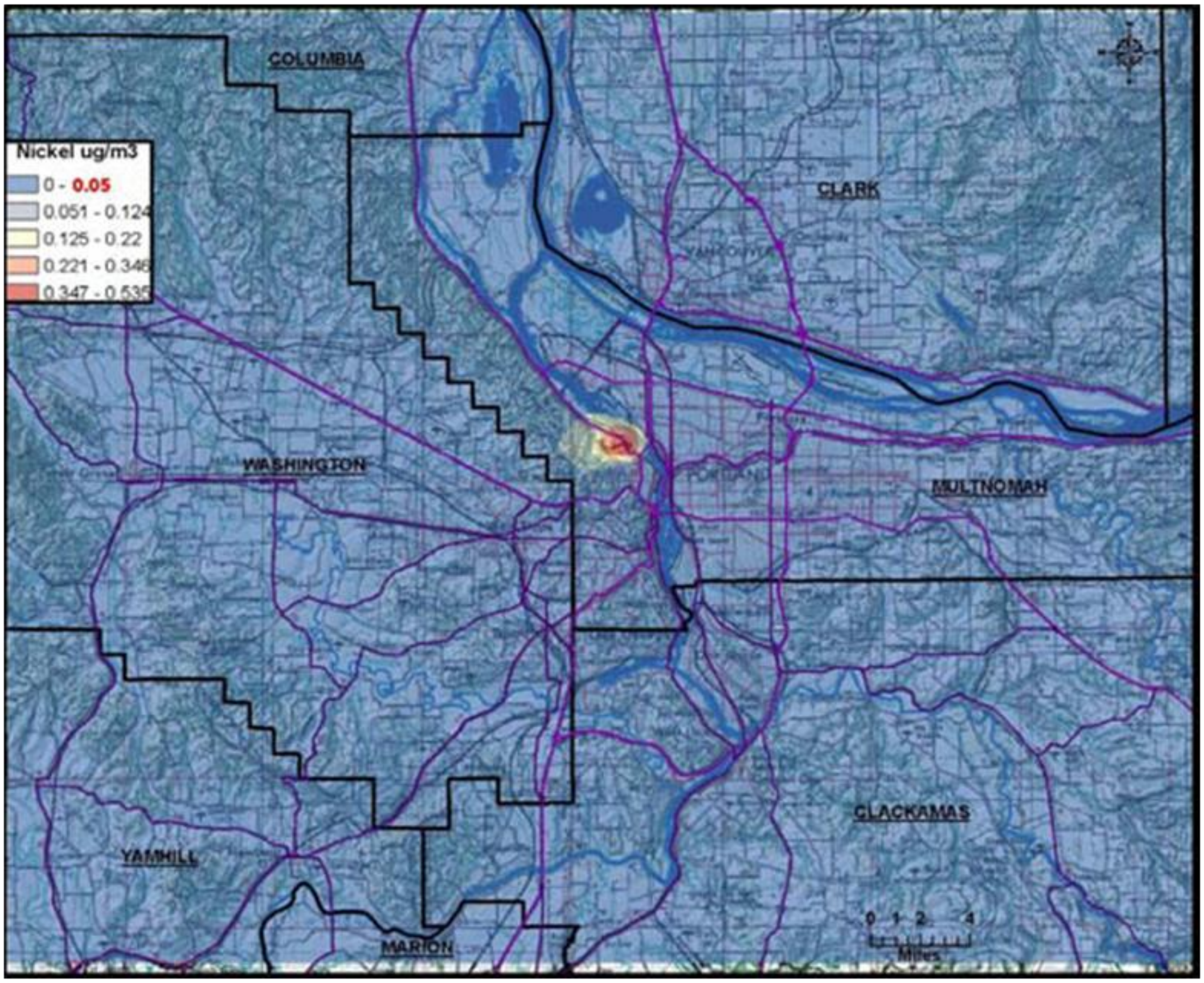

Figure F.19. PATS 2005 modeled results for Nickel in the Portland Metro Area.

Appendix G: Oregon Criteria Pollutant Monitoring Decision Matrix

			Categories:	Design Value			Population				Met	PreSum	Qualitative Categories							PreSum	Sum
			Notes:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Overall Rank (note 19)	City	Site	Network Parameter (F = FRM, E = Estimate)	2009 "Design value	% of Std (%)	DV vs. NAAQS: DV < 50% = 0.1,DV 50 to 70%=1,70% to 100% = 5,DV>100% =100	Population (1000)	Percent of total OR Pop (%)	Pop Growth (%)	Population Factor	4) 1 good 4 poor	DV, Pop, & Met Score	Used for Forecast/WSA	Other agency Site	NCORE Site	Sole monitor in airshed	EJ area (y =1, no=0)	Required by the CFR	Political pressure	Qualitative Score	Overall Score
1	Klamath Falls	Peterson Sch	$PM_{2.5}$F	45.3	12.8	100	21	1	9	0.1	4	258.0	1	1	0	1	0	1	0	5	1290
2	Portland	SE Lafayette	Ozone	0.059	9.1	5	1,567	41	11	4.5	1	206.4	1	0	0	0	0	1	0	3	619
3	Portland	Carus	Ozone	0.064	9.8	5	1,567	41	11	4.5	1	223.9	1	0	0	0	0	1	0	3	672
4	Portland	Sherwood	Ozone	0.065	10.0	5	1,567	41	11	4.5	1	227.4	1	0	0	0	0	0	0	2	455
5	Portland	Sauvie Is	Ozone	0.058	8.9	5	1,567	41	11	4.5	1	202.9	1	0	0	0	0	0	0	2	406
6	Medford	Grant/Belmnt	$PM_{2.5}$F	30.4	8.6	5	76	2	23	0.5	4	79.9	1	0	0	0	1	1	0	4	319
7	Portland	SE Lafayette	$PM_{2.5}$F	25.7	7.2	5	573	15	8	1.2	2	87.6	1	0	1	0	0	1	0	4	351
8	Hillsboro	Hare Field	$PM_{2.5}$F	31.7	8.9	5	89	2	25	0.6	3	78.8	1	0	0	0	1	1	0	4	315
9	Eugene	Saginaw	Ozone	0.061	9.4	5	212	6	11	0.6	2	57.9	1	0	0	0	1	1	1	5	290
10	Eugene	Amazon Pk	Ozone	0.06	9.2	5	212	6	11	0.6	2	56.9	1	0	0	0	1	1	1	5	285
11	Salem	Turner	Ozone	0.064	9.8	5	191	5	12	0.6	2	59.4	1	0	0	0	1	1	0	4	238
12	Medford	Talent	Ozone	0.067	10.3	5	138	4	23	0.8	1	43.3	1	0	0	1	1	1	0	5	216
13	Bend	Road Dept	Ozone	0.06	9.2	5	81	2	53	1.1	2	104.5	0	0	0	0	0	1	0	2	209
14	Eugene	Amazon Pk	$PM_{2.5}$F	33.0	9.3	5	155	4	11	0.4	2	41.7	1	0	0	0	1	1	1	5	208
15	Salem	State Hosp	$PM_{2.5}$F	27.7	7.8	5	191	5	12	0.6	2	47.1	0	1	0	1	1	0	0	4	189

			Categories:	Design Value			Population				Met	PreSum	Qualitative Categories							PreSum	Sum
			Notes:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Overall Rank (note 19)	City	Site	Network Parameter (F = FRM, E = Estimate)	2009 "Design value	% of Std (%)	DV vs. NAAQS: DV < 50% = 0.1,DV 50 to 70%=1,70% to 100% = 5,DV>100% =100	Population (1000)	Percent of total OR Pop (%)	Pop Growth (%)	Population Factor	4) 1 good 4 poor	DV, Pop, & Met Score	Used for Forecast/WSA	Other agency Site	NCORE Site	Sole monitor in airshed	EJ area (y =1, no=0)	Required by the CFR	Political pressure	Qualitative Score	Overall Score
16	Grants Pass	Parkside Sch	$PM_{2.5}$F	**30.6**	**8.6**	5	32	1	**39**	**0.3**	2	**28.6**	1	1	0	1	0	1	0	5	143
17	Lakeview	Center & M	$PM_{2.5}$F	**41.5**	**11.7**	100	3	0	**11**	**0.0**	3	**28.0**	1	1	0	1	0	1	0	5	**140**
18	Eugene	99 -Key Bank	$PM_{2.5}$F	**30.2**	**8.5**	5	155	4	**11**	**0.4**	2	**38.2**	0	0	0	0	1	0	0	2	76
19	Central Pt.	Medfrd-G&B	$PM_{2.5}$E	**30.4**	**8.6**	5	17	0	**35**	**0.2**	4	**27.1**	1	0	0	0	1	0	0	2	54
20	Corvallis	Circle Drive	Ozone	0.062	9.5	5	59	2	**12**	**0.2**	2	**18.0**	0	0	0	1	0	1	0	3	54
21	Prineville	Davidson Pk	$PM_{2.5}$F	28.0	**7.9**	5	10	0	**40**	**0.1**	4	**17.3**	1	0	0	1	0	0	0	3	52
22	Albany	Calooia Sch	Ozone	0.062	9.5	5	50	1	**19**	**0.3**	2	**23.9**	0	0	0	0	0	1	0	2	48
23	Albany	Calooia Sch	$PM_{2.5}$E	**28.1**	**7.9**	5	50	1	**19**	**0.3**	2	**19.8**	0	0	0	1	0	0	0	2	40
24	Corvallis	Circle Drive	$PM_{2.5}$E	**23.0**	**6.5**	5	59	2	**12**	**0.2**	2	**12.2**	0	0	0	1	0	0	1	3	37
25	Bend	Pump Station	$PM_{2.5}$E	**18.0**	**5.1**	1	81	2	**53**	**1.1**	3	**17.3**	1	0	0	0	0	0	0	2	35
26	Eagle Point	Medfrd-G&B	$PM_{2.5}$E	**30.4**	**8.6**	5	9	0	**80**	**0.2**	4	**31.6**	1	0	0	0	0	0	0	1	32
27	Forest Grve	Hillsboro	$PM_{2.5}$E	**31.7**	**8.9**	5	21	1	**20**	**0.1**	3	**15.2**	1	0	0	1	0	0	0	2	30
28	Beaverton	Highland Pk	$PM_{2.5}$E	**25.9**	**7.3**	5	86	2	**12**	**0.3**	1	**10.0**	1	0	0	1	0	0	0	3	30
29	Oakridge	WillamettePk	$PM_{2.5}$F	**40.9**	**11.5**	100	4	0	**2**	**0.0**	3	**6.8**	1	0	0	1	0	1	0	4	**27**
30	Gresham	SE Lafayette	$PM_{2.5}$E	**25.7**	**7.2**	5	101	3	**11**	**0.3**	1	**10.6**	1	0	0	0	1	0	0	2	21
31	Hermiston	M. Airport	Ozone	0.063	9.7	5	16	0	**21**	**0.1**	1	**4.3**	0	0	0	1	1	1	0	4	17
32	Happy	McMinnville	$PM_{2.5}$E	**25.7**	**7.2**	5	11	0	**14**	**0.4**	1	**16.0**	1	0	0	0	0	0	0	1	16

			Categories:	Design Value			Population				Met	PreSum	Qualitative Categories							PreSum	Sum
			Notes:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Overall Rank (note 19)	City	Site	Network Parameter (F = FRM, E = Estimate)	2009 "Design value	% of Std (%)	DV vs. NAAQS: DV < 50% = 0.1,DV 50 to 70%=1,70% to 100% = 5,DV>100% =100	Population (1000)	Percent of total OR Pop (%)	Pop Growth (%)	Population Factor	4) 1 good 4 poor	DV, Pop, & Met Score	Used for Forecast/WSA	Other agency Site	NCORE Site	Sole monitor in airshed	EJ area (y =1, no=0)	Required by the CFR	Political pressure	Qualitative Score	Overall Score
	Valley	-Newby Sch							6												
33	Madras	Washington	$PM_{2.5}$E	26.7	7.5	5	7	0	29	0.1	3	5.7	0	0	0	1	0	0	0	2	12
34	Lebanon	Sweet Home	$PM_{2.5}$E	34.3	9.7	5	15	0	17	0.1	3	9.9	0	0	0	1	0	0	0	1	9.9
35	CottageGrv	City Shops	$PM_{2.5}$F	29.0	8.2	5	9	0	11	0.0	2	2.2	1	0	0	1	0	1	0	4	9.0
36	Sweet Home	Fire Dept	$PM_{2.5}$E	34.3	9.7	5	9	0	12	0.0	3	4.2	0	0	0	1	0	0	0	2	8.3
37	Pendleton	Mckay Cr	$PM_{2.5}$F	26.3	7.4	5	17	0	6	0.0	2	2.0	1	0	0	1	0	1	0	4	8.1
38	Portland	N. Roselawn	$PM_{2.5}$F	21.9	6.2	1	574	15	8	1.2	1	7.5	0	0	0	0	0	0	0	1	7.5
39	Phoenix/Talent	Medford G&B	$PM_{2.5}$E	30.4	8.6	5	11	0	18	0.1	3	7.0	1	0	0	0	0	0	0	1	7.0
40	Dallas	Salem/Corvallis	$PM_{2.5}$E	25.4	7.1	5	15	0	22	0.1	2	6.4	0	0	0	1	0	0	0	1	6.4
41	Portland	SE Lafayette	SO_2	10	2.0	0.1	1,567	41	11	4.5	2	1.8	0	0	1	0	0	1	0	3	5.5
42	Portland	SE Lafayette	NOx	41	4.1	0.1	574	15	11	1.7	2	1.4	0	0	0	0	0	1	0	2	2.7
43	Springfield	City Hall	$PM_{2.5}$F	18.3	5.2	1	58	2	11	0.2	2	1.7	0	0	0	0	0	0	1	2	3.5
44	Redmond	Prineville, Madras, Bend	$PM_{2.5}$E	24.2	6.8	1	25	1	85	0.6	2	1.1	1	0	0	1	1	0	0	3	3.4
45	Burns	Madison St.	$PM_{2.5}$F	33.0	9.3	5	5	0	4	0.0	3	0.7	1	1	0	1	0	0	0	4	2.9

			Categories:	Design Value			Population				Met	PreSum	Qualitative Categories							PreSum	Sum
			Notes:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Overall Rank (note 19)	City	Site	Network Parameter (F = FRM, E = Estimate)	2009 "Design value	% of Std (%)	DV vs. NAAQS: DV < 50% = 0.1,DV 50 to 70%=1,70% to 100% = 5,DV>100% =100	Population (1000)	Percent of total OR Pop (%)	Pop Growth (%)	Population Factor	4) 1 good 4 poor	DV, Pop, & Met Score	Used for Forecast/WSA	Other agency Site	NCORE Site	Sole monitor in airshed	EJ area (y =1, no=0)	Required by the CFR	Political pressure	Qualitative Score	Overall Score
46	The Dalles	Hermiston	Ozone	0.063	9.7	5	13	0.35	**8**	**0.0**	1	**1.3**	0	1	0	0	0	0	1	2	2.7
47	Roseburg		$PM_{2.5}$E	**22.0**	**6.2**	1	27	1	**10**	**0.1**	2	**0.9**	0	1	0	1	0	0	0	3	2.7
48	St. Helens	SE Lafayette	$PM_{2.5}$E	**25.7**	**7.2**	5	12	0	**22**	**0.1**	1	**2.6**	0	0	0	1	0	0	0	1	2.6
49	Portland	NW (TTT)	PM_{10}	43	**2.9**	0.1	574	15	**8**	**1.2**	2	**0.7**	0	0	0	0	1	1	0	3	2.1
50	Klamath Falls	Peterson Sch	PM_{10}	75	**5.0**	1	21	1	**9**	**0.1**	4	**1.0**	0	0	0	1	0	0	0	2	2.0
51	Scappoose	SE Lafayette	$PM_{2.5}$E	**25.7**	**7.2**	5	7	0	**31**	**0.1**	1	**1.9**	0	0	0	1	0	0	0	1	1.9
52	Portland	SE Lafayette	CO	2.3	2.4	0.1	574	15	**8**	**1.2**	2	**0.6**	0	0	0	0	0	1	0	2	1.2
53	Ontario	Meridian ID	$PM_{2.5}$E	29.4	**8.3**	5	11	0	**4**	**0.0**	3	**1.5**	0	0	0	1	0	0	0	1	1.5
54	Portland	SE Lafayette	PM_{10}	29	**1.9**	0.1	574	15	**8**	**1.2**	2	**0.5**	0	0	1	0	0	1	0	3	1.4
55	Sisters	Prineville, Madras, Bend	$PM_{2.5}$E	24.2	**6.8**	1	2	0	**92**	**0.0**	2	**0.6**	0	0	0	1	0	0	1	2	1.2
56	Woodburn	McMinnville/ Salem	$PM_{2.5}$E	**22.3**	**6.3**	1	23	1	**15**	**0.1**	2	**1.2**	0	0	0	1	0	0	0	1	1.2
57	Hermiston	M. Airport	$PM_{2.5}$E	**22.0**	**6.2**	1	16	0	**21**	**0.1**	1	**0.6**	0	0	0	1	0	0	0	2	1.1
58	Cove	Circle Drive	$PM_{2.5}$E	**18.7**	**5.3**	1	14	0	**5**	**0.0**	2	**0.2**	0	1	0	1	0	0	1	4	0.8
59	McMinnvil	Newby Sch	$PM_{2.5}$E	**16.8**	**4.7**	0.1	65	2	**23**	**0.4**	2	**0.4**	0	0	0	1	0	0	0	2	0.7

		Categories:		Design Value			Population				Met	PreSum	Qualitative Categories							PreSum	Sum
		Notes:		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Overall Rank (note 19)	City	Site	Network Parameter (F = FRM, E = Estimate)	2009 "Design value	% of Std (%)	DV vs. NAAQS: DV < 50% = 0.1,DV 50 to 70%=1,70% to 100% = 5,DV>100% =100	Population (1000)	Percent of total OR Pop (%)	Pop Growth (%)	Population Factor	4) 1 good 4 poor	DV, Pop, & Met Score	Used for Forecast/WSA	Other agency Site	NCORE Site	Sole monitor in airshed	EJ area (y =1, no=0)	Required by the CFR	Political pressure	Qualitative Score	Overall Score
	le																				
60	Medford	Grant/Belmnt	PM_{10}	58	3.9	0.1	77	2	23	0.5	4	0.7	0	0	0	0	0	0	0	1	0.7
61	Salem	State Hosp	PM_{10}	43	2.9	0.1	191	5	12	0.6	2	0.3	0	0	0	1	0	0	0	2	0.7
62	Eugene	99 -Key Bank	PM_{10}	55.0	3.7	0.1	155	4	11	0.4	2	0.3	0	0	0	0	1	0	0	2	0.7
63	Medford	RogueVMall	CO	2.4	2.5	0.1	77	2	21	0.4	3	0.3	0	0	0	0	1	0	0	2	0.6
64	Medford	Welch & Jackson	PM_{10}	46	3.1	0.1	77	2	23	0.5	4	0.6	0	0	0	0	0	0	0	1	0.6
65	La Grande	Ash St	$PM_{2.5}$F	17.6	5.0	1	14	0	5	0.0	2	0.2	1	0	0	1	0	0	0	3	0.5
66	The Dalles	Cherry Lane	$PM_{2.5}$E	22.5	6.3	1	13	0	8	0.0	1	0.2	0	0	0	1	0	0	1	3	0.5
67	Eugene	Amazon Pk	PM_{10}	41.0	2.7	0.1	155	4	11	0.4	2	0.2	0	0	0	0	1	0	0	2	0.5
68	Medford	White City	PM_{10}	46	3.1	0.1	9	0	80	0.2	4	0.2	0	0	0	0	0	0	1	2	0.5
69	Grants Pass	Parkside Sch	PM_{10}	42	2.8	0.1	32	1	39	0.3	2	0.2	0	0	0	1	0	0	0	2	0.4
70	Baker City	Fire Dept	$PM_{2.5}$E	23.6	6.7	1	10	0	3	0.0	2	0.1	0	1	0	1	0	0	0	3	0.3
71	Portland	Postal Bld	CO	2	2.1	0.1	574	15	8	1.2	1	0.3	0	0	0	0	0	0	0	1	0.3
72	Portland	N. Roselawn	PM_{10}	31	2.1	0.1	574	15	8	1.2	1	0.3	0	0	0	0	0	0	0	1	0.3
73	John Day	Blue Mt. Sch	$PM_{2.5}$E	26.9	7.6	5	3	0	1	0.0	3	0.1	0	1	0	1	0	0	0	3	0.2
74	Eugene	Comm Coll	PM_{10}	37	2.5	0.1	574	4	11	0.4	2	0.2	0	0	0	0	0	0	0	1	0.2

			Categories:	Design Value			Population				Met	PreSum	Qualitative Categories							PreSum	Sum
			Notes:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Overall Rank (note 19)	City	Site	Network Parameter (F = FRM, E = Estimate)	2009 "Design value	% of Std (%)	DV vs. NAAQS: DV < 50% = 0.1,DV 50 to 70%=1,70% to 100% = 5,DV>100% =100	Population (1000)	Percent of total OR Pop (%)	Pop Growth (%)	Population Factor	4) 1 good 4 poor	DV, Pop, & Met Score	Used for Forecast/WSA	Other agency Site	NCORE Site	Sole monitor in airshed	EJ area (y =1, no=0)	Required by the CFR	Political pressure	Qualitative Score	Overall Score
75	Eugene	Comm Coll	CO	1.6	1.7	0.1	574	4	**12**	**0.5**	2	**0.2**	0	0	0	0	0	0	0	1	0.2
76	Silverton	Mcminnville & Salem	$PM_{2.5}$E	**22.3**	**6.3**	1	10	0	**28**	**0.1**	2	**0.1**	0	1	0	0	0	0	0	1	0.1
77	Sherwood	Mcminnville	$PM_{2.5}$E	**16.8**	**4.7**	0.1	16	0	**34**	**0.1**	2	**0.1**	0	0	0	0	0	0	0	1	0.1
78	Hermiston	Airport (08)	NOx	37	3.7	0.1	16	0	**21**	**0.1**	2	**0.1**	0	0	0	1	0	0	0	2	0.1
79	Wilsonvill	Mcminnville	$PM_{2.5}$E	**16.8**	**4.7**	0.1	16	0	**13**	**0.1**	2	**0.1**	1	0	0	1	0	0	0	2	0.1
80	Hermiston	Airport (08)	SO_2	9	1.8	0.1	16	0	**21**	**0.1**	2	**0.0**	0	0	0	1	0	0	0	2	0.1
81	OR City	Mcminnville	$PM_{2.5}$E	**16.8**	**4.7**	0.1	30	1	**16**	**0.1**	1	**0.1**	1	0	0	0	0	0	0	1	0.1
82	Florence	Dept Forestry	$PM_{2.5}$E	**12.4**	**3.5**	0.1	9	0	**28**	**0.1**	1	**0.0**	0	0	0	1	0	0	0	2	0.0
83	ShadyCove	SC Sch	$PM_{2.5}$E	**15.5**	**4.4**	0.1	3	0	**22**	**0.0**	2	**0.0**	0	1	0	1	0	0	0	3	0.0
84	Coos Bay	Florence	$PM_{2.5}$E	12.4	**3.5**	0.1	27	1	**6**	**0.0**	1	**0.0**	0	0	0	1	0	0	0	1	0.0
85	Enterprise	USFS	$PM_{2.5}$E	**20.1**	**5.7**	1	2	0	**4**	**0.0**	1	**0.0**	0	1	0	1	0	0	0	3	0.0
86	Pendleton	Mckay Cr	PM_{10}	40	**2.7**	0.1	17	0	**6**	**0.0**	2	**0.0**	0	0	0	1	0	0	0	2	0.0
87	Cave Junct	Airport	$PM_{2.5}$E	**14.1**	**4.0**	0.1	2	0	**26**	**0.0**	2	**0.0**	0	1	0	1	0	0	0	3	0.0
88	Newport	Florence	$PM_{2.5}$E	12.4	**3.5**	0.1	11	0	**11**	**0.0**	1	**0.0**	0	0	0	1	0	0	1	2	0.0
89	La Grande	Ash St	PM_{10}	29	**1.9**	0.1	14	0	**5**	**0.0**	2	**0.0**	0	0	0	1	0	0	0	2	0.0
90	Toledo (04)	Toledo (04)	SO2	21	4.2	0.1	4	0	**4**	**0.0**	2	**0.0**	0	0	0	1	0	0	1	3	0.0

			Categories:	Design Value			Population				Met	PreSum	Qualitative Categories							PreSum	Sum
			Notes:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Overall Rank (note 19)	City	Site	Network Parameter (F = FRM, E = Estimate)	2009 "Design value	% of Std (%)	DV vs. NAAQS: DV < 50% = 0.1,DV 50 to 70%=1,70% to 100% = 5,DV>100% =100	Population (1000)	Percent of total OR Pop (%)	Pop Growth (%)	Population Factor	4) 1 good 4 poor	DV, Pop, & Met Score	Used for Forecast/WSA	Other agency Site	NCORE Site	Sole monitor in airshed	EJ area (y =1, no=0)	Required by the CFR	Political pressure	Qualitative Score	Overall Score
91	Astoria-Warrenton	Florence	PM$_{2.5}$E	12.4	**3.5**	0.1	15	0	**6**	**0.0**	1	**0.0**	0	0	0	1	0	0	0	1	0.0
92	Oakridge	WillamettePk	PM$_{10}$	45	**3.0**	0.1	4	0	**2**	**0.0**	3	**0.0**	0	0	0	1	1	1	0	4	0.0
93	Mt. Hood	Multopor(05)	Ozone	0.063	9.7	5					1	**0.0**	1	1	0	1	0	0	0	4	0.0
94	Mt. Jeffereson	Big Lake (01-02)	Ozone	0.062	9.5	5					1	**0.0**	1	1	0	1	0	0	0	4	0.0
95	Provolt	BLM	PM$_{2.5}$E	**18.6**	**5.2**	1		0	**0**	**0.0**	2	**0.0**	0	1	0	1	0	0	0	3	0.0
96	Portland	Carus	PM$_{2.5}$E		**0.0**	0.1	15	0	**17**	**0.1**	2	**0.0**	0	1	0	0	0	0	0	2	0.0
97	Toledo	Newport (Impact from Toledo)	SO_2		0.0	0.1	11	0	**11**	**0.0**	1	**0.0**	0	0	0	0	0	0	1	2	0.0
98	Unincorporated JO CO	Provolt-Cave Junct	PM$_{2.5}$E	16.35	**4.6**	0.1	50	1	**-4**	**-0.1**	2	**0.0**	0	0	0	1	0	0	0	1	0.0

Notes:

1 The 2009 design value was obtained for each available site and pollutant parameter.
For non- monitored sites, the nearest sites DV was used as a surrogate.
For PM2.5 the daily DV is used not the annual.

2 The 2009 design value was divided by the NAAQS to get the percent of standard.
0.065ppm NAAQS was used for ozone because it is in the middle of the proposed NAAQS range.

3 The DV wasweighted to give more importance to sites near or above the NAAQS.

4 2008 Population estimate taken from the PSU Population Research Center. For Ozone, NO2, and SO2 the whole Metro Area Population is used.
For CO more localized community populations are used.

5 The 2008 estimated city population is divided by the 2008 estimated state population.

6 The 2000 to 2007 percent population growth for each city.

7 Population factor is the population multiplied by the population growth and further multiplied by 100 to remove the percentage.

8 Meteorological mixing. This ranks mixing from 1 to 4 to account for stagnation occurrences.
The more stagnant an area is the higher the score. Stagnant air traps pollutants at ground level.

9 The % of std, design value vs. NAAQS, population factor, and met mixing scores are multiplied give a preliminary quantitative score.

10 Does the site provide Forecasting or Woodstove smoke advisory information? Yes = 1, No = 0.

11 Is the site funded and used by other agencies? Yes = 1, No = 0.

12 Is this an National Core site (NCORE) required by EPA? Yes = 1, No = 0.

13 Is this the only monitor in an airshed? Yes = 1, No = 0.

14 Is this an environmental justice site? Yes = 1, No = 0.

15 Is this site required by the EPA in the CFR? Yes = 1, No = 0.

16 Is there a lot of local interest and pressure to monitor here? Yes = 1, No = 0.

17 The Qualitative scores are summed and one is added so no sites have zero (for mathematical reasons)

18 The overall score is the DV, Pop, & Met Score multiplied by the qualitative score.

19 The overall rank is determined by the overall score, with 1 being the most important City/Site and 98 being the least.

Appendix H: Oregon Air Toxics Monitoring Decision Matrix

This matrix could not be completed in time for the submission of the plan because the 2005 National Air Toxics Assessment had not been released at the time of this report. An addendum to this report will be filed including this decision matrix at a later time.

Appendix I: Portland area Decision Matrix

Name	Network Parameter	Sum of Modeled value (1 to 5 per pollutant, 5=highest site, 1=lowest site)[1]	Modeled % of Benchmark[2]	Order of magnitude over benchmark (1= ≤ BM to 20xBM, 2= ≥20xBM)[3]	Over BM no=1, yes=2	Concentration Score[4]	Weighted Concentration Score[5]	Population (1000)[6]	% of total Pdx Metro Pop[7]	Pop Growth (%)[8]	Population Factor[9]	Meteorological Mixing (1 to 4) 1 good 4 poor[10]	Conc *Population*Mixing Score[11]	EJ community yes = 2, no = 1[12]	Setup costs (1 to 2) 1 = high 2 = low[13]	Previous AT monitoring (1 = yes, 5 = none)[14]	Sole monitor in airshed (1 = no, 2 = yes)[15]	Political pressure[16]	Qualitative Score[17]
Hillsboro	VOC	38	1742	1	2	76	2.0	89	6%	**25**	**1.4**	**3**	**8.7**	2	2	5	1	1	2.2
	Metals	31	649	1	2	62													
	Carbonyls	16	553	1	2	32													
	PAH	10	1	1	1	10													
	Aethalometer	6	6300	2	2	24													
	Total	**101**				**204**													
N. Portland	VOC	24	1041	1	2	48	1.5	61	4%	8	0.3	2	**1.0**	2	1	1	2	1	1.4
	Metals	28	507	1	2	56													
	Carbonyls	14	709	1	2	28													
	PAH	9	1	1	1	9													
	Aethalometer	3	3600	2	2	12													
	Total	**78**				**153**													
Gresham	VOC	36	1212	1	2	72	1.9	**101**	6%	11	0.7	1	**1.3**	2	1	5	2	1	2.2
	Metals	28	507	1	2	56													
	Carbonyls	17	787	1	2	34													
	PAH	11	1	1	1	11													
	Aethalometer	3	3600	2	2	12													
	Total	**95**				**185**													

Name	Network Parameter	Sum of Modeled value (1 to 5 per pollutant, 5=highest site, 1=lowest site)[1]	Modeled % of Benchmark[2]	Order of magnitude over benchmark (1= ≤ BM to 20xBM, 2= ≥20xBM)[3]	Over BM no=1, yes=2	Concentration Score[4]	Weighted Concentration Score[5]	Population (1000)[6]	% of total Pdx Metro Pop[7]	Pop Growth (%)[8]	Population Factor[9]	Meteorological Mixing (1 to 4) 1 good 4 poor[10]	Conc *Population*Mixing Score[11]	EJ community yes = 2, no = 1[12]	Setup costs (1 to 2) 1 = high 2 = low[13]	Previous AT monitoring (1 = yes, 5 = none)[14]	Sole monitor in airshed (1 = no, 2 = yes)[15]	Political pressure[16]	Qualitative Score[17]
NW Portland	VOC	34	1309	1	2	68	2.3	41	3	8	0.2	2	**1.0**	1	1	1	2	2	1.4
	Metals	27	4905	2	2	108													
	Carbonyls	12	476	1	2	24													
	PAH	8	3	1	1	8													
	Aethalometer	6	6300	2	2	24													
	Total	**87**				**232**													
Oregon City	VOC	19	447	1	2	38	1.2	30	2	16	0.3	**1**	**0.4**	1	1	5	2	1	2
	Metals	27	1099	1	2	54													
	Carbonyls	4	312	1	2	8													
	PAH	7	1	1	1	7													
	Aethalometer	3	3600	2	2	12													
	Total	**60**				**119**													
Beaverton	VOC	39	1767	1	2	78	2.0	86	6	12	0.7	**2**	**2.6**	1	2	1	1	1	1.2
	Metals	31	541	1	2	62													
	Carbonyls	13	437	1	2	26													
	PAH	9	1	1	1	9													
	Aethalometer	6	6300	2	2	24													
	Total	**98**				**199**													

Final Portland Metro Air Toxics Ranking		Concentration, Population, and mixing Score[11]	Qualitative Score[17]	Total [18]
1	**Hillsboro**	8.7	2.2	19.2
2	**Beaverton**	2.6	1.2	3.2
3	**Gresham**	1.3	2.2	2.9
4	**NW Portland**	1.0	1.4	1.4
5	**N. Portland**	1.0	1.4	1.3
6	**OR City**	0.4	2	0.7

Notes:

	Pollutant	Modeled concentration (ug/m3)							Ranking of areas by conc. 1 to 6, 6 is the highest					
1)	**Sites were ranked from 1 to 5 based on their modeled concentration using the 2005 PATS modeling results.**													
	Pollutant	**Hillsboro**	**N. Portland**	**Gresham**	**NW Portland**	**Oregon City**	**Beaverton**	**Method >MDL**	**Hillsboro**	**N. Portland**	**Gresham**	**NW Portland**	**Oregon City**	**Beaverton**
	1,3-Butadiene	**0.6**	0.3	**0.6**	0.3	0.2	**0.6**	n	**6**	3	**6**	3	1	**6**
	Ethylbenzene	**3.3**	1.1	1.7	**3.3**	1.1	**3.3**	s	**6**	**2**	**3**	**6**	**2**	**6**
	1,4Dichlorobenzene	**4.0**	0.2	0.2	0.2	0.2	**4.0**	s	**6**	4	4	4	4	**6**
	Benzene	6.2	6.2	6.2	6.2	2.2	6.2		6	6	6	6	1	**6**
	DCM	5.8	46	46	46	5.8	5.8	y	3	6	6	**6**	3	3
	TCE	0.05	0.1	0.05	0.5	0.05	0.05	n	6	1	6	6	6	**6**
	PERC	0.4	0.1	0.4	0.3	0.2	0.9	n	5	2	5	3	2	6
								subtotal	**38**	**24**	**36**	**34**	**19**	**39**
	Acetaldehyde	2.1	1.0	2.1	1.0	0.6	2.1	y	6	3	6	3	1	6
	Formaldehyde	4.3	3	3	3	1.4	3	y	6	5	5	5	1	5
	Acrolein	0.2	0.4	0.4	0.2	0.15	0.15	na	4	6	6	4	2	2
								subtotal	**16**	**14**	**17**	**12**	**4**	**13**
	15-PAH	0.4	0.3	0.6	0.2	0.2	0.3	?	5	4	6	2	2	4
	Naphthalene	1.9	1.9	1.9	8	1.9	1.9	y	5	5	5	6	5	5
								subtotal	**10**	**9**	**11**	**8**	**7**	**9**
	Diesel PM	6.3	3.6	3.6	6.3	3.6	6.3	y	**6**	**3**	**3**	**6**	**3**	**6**
	As	0.001	0.0006	0.0006	0.001	0.0004	0.001	n	6	3	3	6	1	6
	Cd	0.0006	0.0006	0.0006	0.007	0.0006	0.0006	s	5	5	5	6	5	5
	Cr6+	0.0006	0.00008	0.00008	0.00008	0.003	0.00008	n	5	5	5	5	6	5
	Lead	0.005	0.005	0.005	0.07	0.005	0.005	y	5	5	5	6	5	5
	Mn	0.086	0.086	0.086	1.3	0.086	0.086	y	5	5	5	6	5	5
	Ni	0.05	0.05	0.05	0.54	0.05	0.05	s	5	5	5	6	5	5
								Subtotal	**31**	**28**	**28**	**35**	**27**	**31**
								Total	**101**	**78**	**95**	**95**	**60**	**98**

2)	The model percentage of the benchmark for each pollutant and city												
		Modeled concentration (ug/m3)						% of benchmark					
	ug/m3	**Hillsboro**	**N. Portland**	**Gresham**	**NW Portland**	**OR City**	**Beaverton**	**Hillsboro**	**N. Portland**	**Gresham**	**NW Portland**	**OR City**	**Beaverton**
	1,3-Butadiene	0.6	0.3	0.6	0.3	0.2	**0.6**	2080	1023	2080	1033	633	2080
	Ethylbenzene	3.3	1.1	1.7	3.3	1.1	**3.3**	830	275	425	825	275	830
	1,4Dichlorobenzene	4	0.2	0.2	0.2	0.2	**4**	4400	244	244	244	244	4400
	Benzene	6.2	6.2	6.2	6.2	2.2	6.2	4769	4769	4769	4769	1692	4769
	DCM	2.1	20	20	46	5.8	5.8	100	952	952	2190	276	276
	TCE	0.05	0.1	0.05	0.5	0.05	0.05	11	25	11	100	11	11
	PERC	0.4	0.1	0.4	0.3	0.1	0.9	1	0	1	1	0	3
	Acetaldehyde	2	1	2	1	0.6	2	460	227	460	227	140	460
	Formaldehyde	3	3	3	3	1	3	100	100	100	100	47	100
	Acrolein	0.22	0.4	0.4	0.2	0.15	0.15	1100	1800	1800	1100	750	750
	15-PAH	0.4	0.3	0.6	0.2	0.2	0.3						
	Naphthalene	1.9	1.9	1.9	8	1.9	1.9	1	1	1	3	1	1
	DPM	6.3	3.6	3.6	6.3	3.6	6.3	6300	3600	3600	6300	3600	6300
	As	0.001	0.0006	0.0006	0.001	0.0004	0.001	5	3	3	5	2	5
	Cd	0.0006	0.0006	0.0006	0.007	0.0006	0.0006	1	1	1	12	1	1
	Cr6+	0.0006	0.00008	0.00008	0.00008	0.003	0.00008	8	1	1	1	38	1
	Lead	0.005	0.005	0.005	0.07	0.005	0.005	0	0	0	0	0	0
	Mn	0.086	0.086	0.086	1.3	0.086	0.086	0	0	0	7	0	0
	Ni	0.05	0.05	0.05	0.54	0.05	0.05	25	25	25	270	25	25
							max	25	25	25	270	38	25
							ave	6	5	5	49	11	5
							med	3	1	1	6	2	1

3) Order of magnitude over benchmark (1= ≤ BM to 20xBM, 2= ≥20xBM). Breakpoints were arbitrarily chosen
Modeled value over the ODEQ Benchmark 1= no, 2 = yes.
4) Concentration score is the product of the Model value score in 1), the percent over benchmark in 2), and over benchmark in 3).
5) Concentration score is divided by 100 to weight it to the qualitative score below.
6) Population taken from the PSU Population Research Center (2008) for Hillsboro, Gresham, and OR City and the Portland Plan (2009) for N. Portland and NW Portland (Central Pdx in the plan)
7) % of Portland Metro Population (PSU Pop Research Center is the city divided by the metro population. 2008 = 1567180
8) Pop growth determined from subtracting 2008 by 2000 pop and dividing by 2000
9) Population Factor = % of total pop*pop growth. This was done to factor in both city size and growth. Total Metro Population is from the PSU pop research center.
10) A stagnation factor was included to account for mixing. 1-4 was assigned based on knowledge of winter time stagnation occurrences
11) Conc*Population*Mixing Score: Concentration factor (5) *Pop Factor (9)*Mixing (10)
12) Is this an environmental justice site? Yes =2, No = 1.
13) Are the setup costs high? Yes =2, No = 1. High set up cost can use up the monitoring budget for a site and shorten sampling time.
14) Previous Air Toxics Monitoring in city? Yes =2, No = 5. This is very important because toxics is costly and there are limited monitoring opportunities. ODEQ hopes to gather AT information in unknown areas.
15) Is this the only monitor in an airshed? Yes = 2, No = 1.
16) Is there a lot of local interest and pressure to monitor here? Yes = 2, No = 1.
17) The Qualitative scores are averaged to get a Qualitative score factor.
18) The overall score is the (Concentration, Pop, & Met Score) multiplied by the (qualitative score).