

ATTACHMENT I

**PROPOSED REVISIONS TO 40 CFR PART 81.327
DESIGNATION OF AREAS FOR AIR QUALITY PLANNING PURPOSES**

§81.327 Montana.

Montana -- PM-2.5

Designated Area	Designation	
	Date ¹	Type
Missoula County Area: Planning Areas 192, 222, 251, 252, and 253 (part) excluding Flathead Indian Reservation. The part of Missoula County defined by the following (Range and Township) sections: T16N, R24W, Sections 1, 12; T16N, R23W, Sections 1-36; T16N, R22W, Sections 19-21, 28-34; T15N, R23W, Sections 1-14, 23, 24; T15N, R22W, Sections 1-30, 32-36; T15N, R21W, Sections 1-36; T15N, R20W, Sections 3, 4-9, 15, 16-23, 25-36; T14N, R22W, Sections 1-5, 8-17, 22-27, 34-36; T14N, R21W, Sections 1-36; T14N, R20W, Sections 1-36; T14N, R19W, Sections 5-8, 13-36; T14N, R18W, Sections 15-22, 27-34; T13N, R22W, Sections 1-3, 10-15, 22-27, 34-36; T13N, R21W, Sections 1-36; T13N, R20W, Sections 1-36; T13N, R19W, Sections 1-36; T13N, R18W, Sections 2-11, 14-23, 26-36; T13N, R17N, Section 31; T12N, R22W, Sections 1-36; T12N, R21W, Sections 1-36; T12N, R20W, Sections 1-36; T12N, R19W, Sections 1-36; T12N, R18W, Sections 1-36; T12N, 17W, Sections 3-10, 14-36; T12N, R16W, Sections 19, 25-36; T11N, R22W, Sections 1-3, 10-15, 22-27, 34-36; T11N, R21W, Sections 1-36; T11N, R20W, Sections 1-36; T11N, R19W, Sections 1-36; T11N, R18W, Sections 1-36; T11N, R17W, Sections 1-36; T11N, R16W, Sections 1-12.		Nonattainment
Ravalli County: Planning Areas 251, 252, 282, 312, 313, 343, 344, 345, 374, 375, 376, 404, and 405. The area encompassed by Ravalli County.		Nonattainment

<i>(Indian Country designations to be included separately)</i> <i>Rest of State:²</i> <i>(Reference to counties designated as "Unclassifiable/Attainment" to be deleted).</i>		Unclassifiable/ Attainment
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¹ The date will eventually refer to the final promulgation of designated areas.

² Rest of State refers to Planning Areas with legal descriptions held by the State of Montana Department of Environmental Quality in a document titled "Montana Clean Air Act Section 107(d) Planning Area Legal Descriptions", excluding the designated areas specifically listed in the table.

ATTACHMENT II

MISSOULA COUNTY NINE FACTOR ANALYSIS

Missoula County PM_{2.5} Nine Factor Analysis

December 6, 2007

1. Introduction

In December of 2006, the United States Environmental Protection Agency (US EPA) promulgated new standards for particulate matter 2.5 microns or smaller (PM_{2.5}). This new standard lowered the permissible 24 hour level of PM_{2.5} from 65 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) to $35\mu\text{g}/\text{m}^3$. Based on monitoring results from 2004-2006, Missoula is likely to be found in non-attainment of this new standard. If the US EPA determines Missoula is not meeting the federal standard based on monitoring results from 2004-2007, it will designate either the county or a portion of the county as a PM_{2.5} non-attainment area.

The US EPA uses 9 criteria, or factors, to determine the appropriate size of a non-attainment area. States must submit an analysis of these 9 factors, along with a proposed non-attainment boundary, for any areas that are not meeting the federal standard. Because the Missoula Air Pollution Control Board has been designated as the lead planning agency for Missoula County air quality, the Missoula Health Department prepared an analysis of the 9 factors and the Board adopted a proposed boundary to forward to the Montana Department of Environmental Quality (DEQ) on November 15, 2007. DEQ will review the proposal to ensure it meets federal requirements, and will submit Missoula's proposal to the Governor, along with a proposed separate non-attainment boundary for Ravalli County. By law, the Governor has to submit proposed non-attainment boundaries with supporting documentation to the US EPA by December of 2007. The US EPA is required to make the final non-attainment area designations by December of 2008.

The US EPA guidance for PM_{2.5} designations dated June 8th 2007 lists the 9 factors that must be addressed to determine the size of a proposed PM_{2.5} non-attainment area:

1. Emissions in areas potentially included versus excluded from the non-attainment area
2. Air quality in potentially included versus excluded areas
3. Population density and degree of urbanization including commercial development in included versus excluded areas
4. Traffic and commuting patterns
5. Growth rates and patterns
6. Meteorology (weather/transport patterns)
7. Geography/topography (mountain ranges or other air basin boundaries)
8. Jurisdictional boundaries (e.g., counties, air districts, Reservations, etc.)
9. Level of control of emission sources

Since Missoula is currently meeting the annual PM_{2.5} standard and failing to meet the 24-hour PM_{2.5} standard, this document focuses only on issues related to the 24-hour standard. The proposed non-attainment area boundary is given below in section 2. It is described using township, range and sections, based on the Public Land Survey System (PLSS) in order to maintain consistency with the description of other air quality boundaries (PM₁₀, Carbon Monoxide, Air Stagnation Zone, and High Impact Zone M) within Missoula County. The use of the PLSS also allows for greater precision in selecting areas that will be included or excluded from the non-attainment area than the use of larger Universal Transverse Mercator (UTM) grids.

2. Proposed Non-attainment Area

The proposed non-attainment area includes approximately 891 square miles as described below and shown in Figures 1 and 2. It does not include those lands located on the Flathead Indian Reservation.

Township	Range	Sections
16N	24W	1,12
16N	23W	1-36
16N	22W	19-21, 28-34
15N	23W	1-14, 23, 24
15N	22W	1-30, 32-36
15N	21W	1-36
15N	20W	3-9, 15-23, 25-36
14N	22W	1-5, 8-17, 22-27, 34-36
14N	21W	1-36
14N	20W	1-36
14N	19W	5-8, 13-36
14N	18W	15-22, 27-34
13N	22W	1-3, 10-15, 22-27, 34-36
13N	21W	1-36
13N	20W	1-36
13N	19W	1-36
13N	18W	2-11, 14-23, 26-36
13N	17W	31
12N	22W	1-36
12N	21W	1-36
12N	20W	1-36
12N	19W	1-36
12N	18W	1-36
12N	17W	3-10, 14-36
12N	16W	19, 25-36
11N	22W	1-3, 10-15, 22-27, 34-36
11N	21W	1-36
11N	20W	1-36
11N	19W	1-36
11N	18W	1-36
11N	17W	1-36
11N	16W	1-12

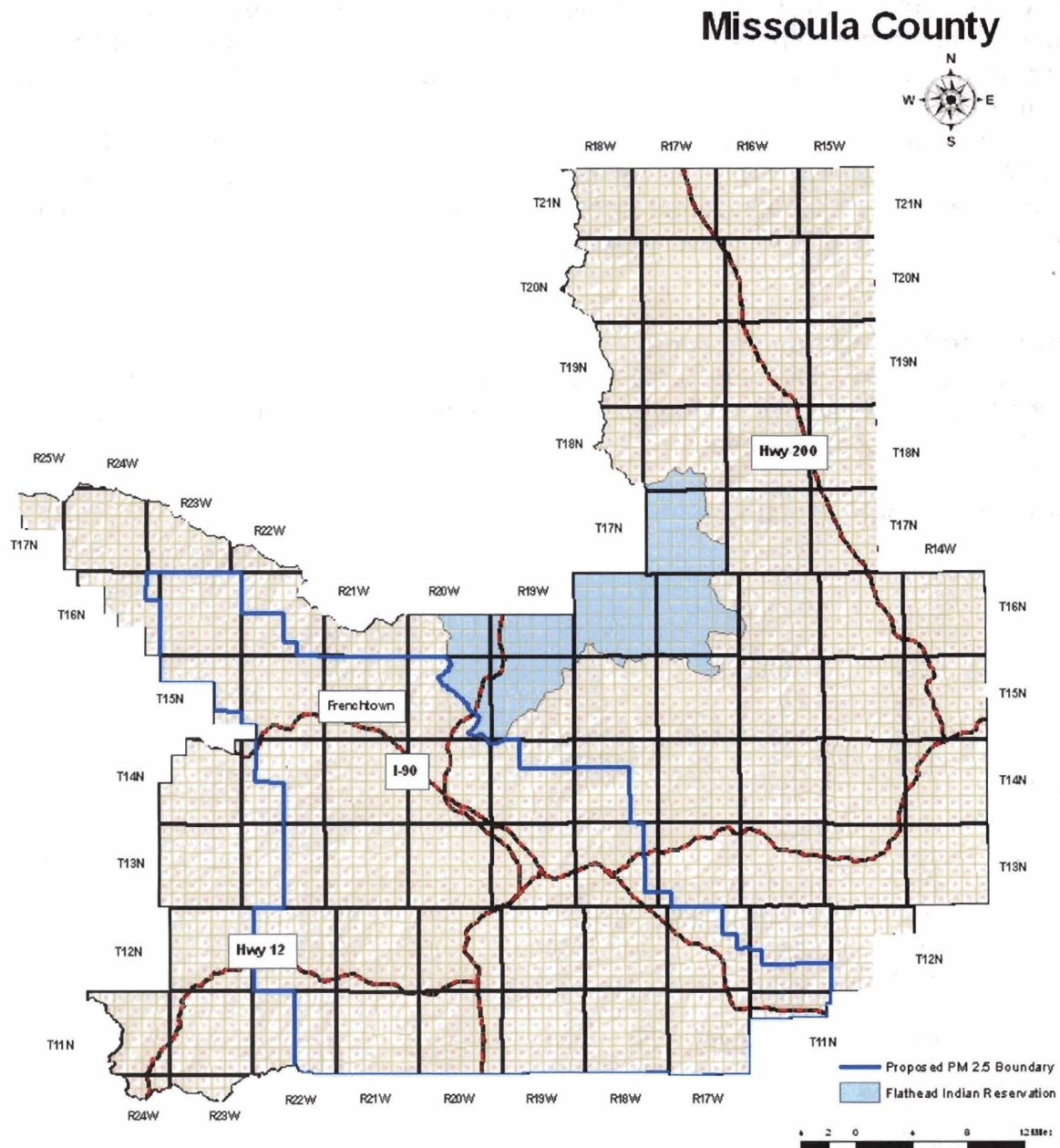


Figure 1. Map showing the boundaries of the proposed PM_{2.5} non-attainment area.

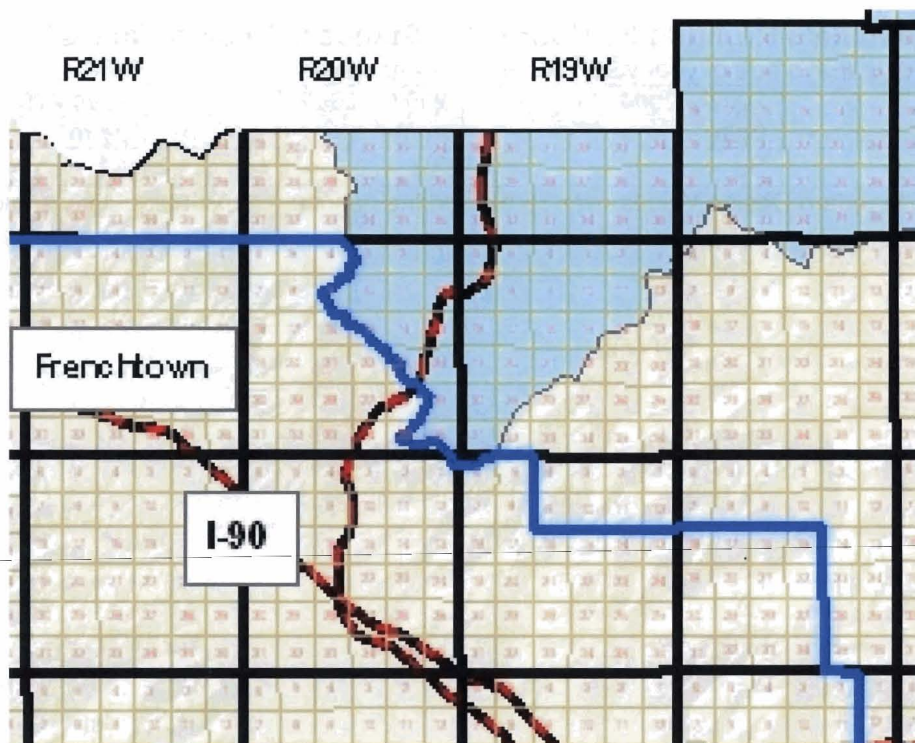


Figure 2. Area of proposed boundary adjacent to the Flathead Indian Reservation.

3. Latest PM_{2.5} Data

Unless otherwise noted, samples are collected every 3rd day at a monitoring site. Typically, Missoula violates the 24 hour PM_{2.5} standard a few times each year, generally during the winter months. In fact, all of the recorded exceedance days (with the exception of exceedances due to wildfire smoke) for 2001-2006 occurred in November, December, or January. Data shown in Tables 1 & 2 below were collected using equipment located on the roof of the Missoula City-County Health Department near downtown Missoula.

Table 1. Missoula's 24-Hour High PM_{2.5} Values

2001		2002		2003		2004		2005		2006	
Date	µg/m ³	Date	µg/m ³	Date	µg/m ³	Date	µg/m ³	Date	µg/m ³	Date	µg/m ³
1/10	47.9	1/11	32.4	1/24	41.6	1/16	62.3	1/19	62.5	11/28	43.2
1/19	45.4	11/28	29.2	11/8	32.9	1/10	55.4	12/12	54.0	12/10	36.2
1/13	43.7	11/25	24.8	12/2	27.1	1/19	46.8	12/9	42.5	8/30 ¹	34.3
1/4	42.9	11/22	23.0	8/25	24.9	12/17	36.6	8/8	30.8	9/05 ¹	31.5
1/1	34.9	11/4	20.8	8/10	24.7	2/15	30.8	1/16	30.8	12/22	30.2

¹Values on August 30, 2006 and September 5, 2006, were influenced by wildfire smoke and may be flagged in the future. If flagged, these values will no longer be used to determine compliance or non-compliance with the PM_{2.5} standard.

Table 2. Missoula's Running 24-Hour PM_{2.5} Standard Design Values¹

(Based on three year average of yearly 98th percentile 24-hr values)

2001 – 2003 µg/m ³	2002 – 2004 µg/m ³	2003 – 2005 µg/m ³	2004 - 2006 µg/m ³
32	33	39	41

¹24-hour PM_{2.5} Standard Design Values over 35 exceed the national ambient air quality standard.

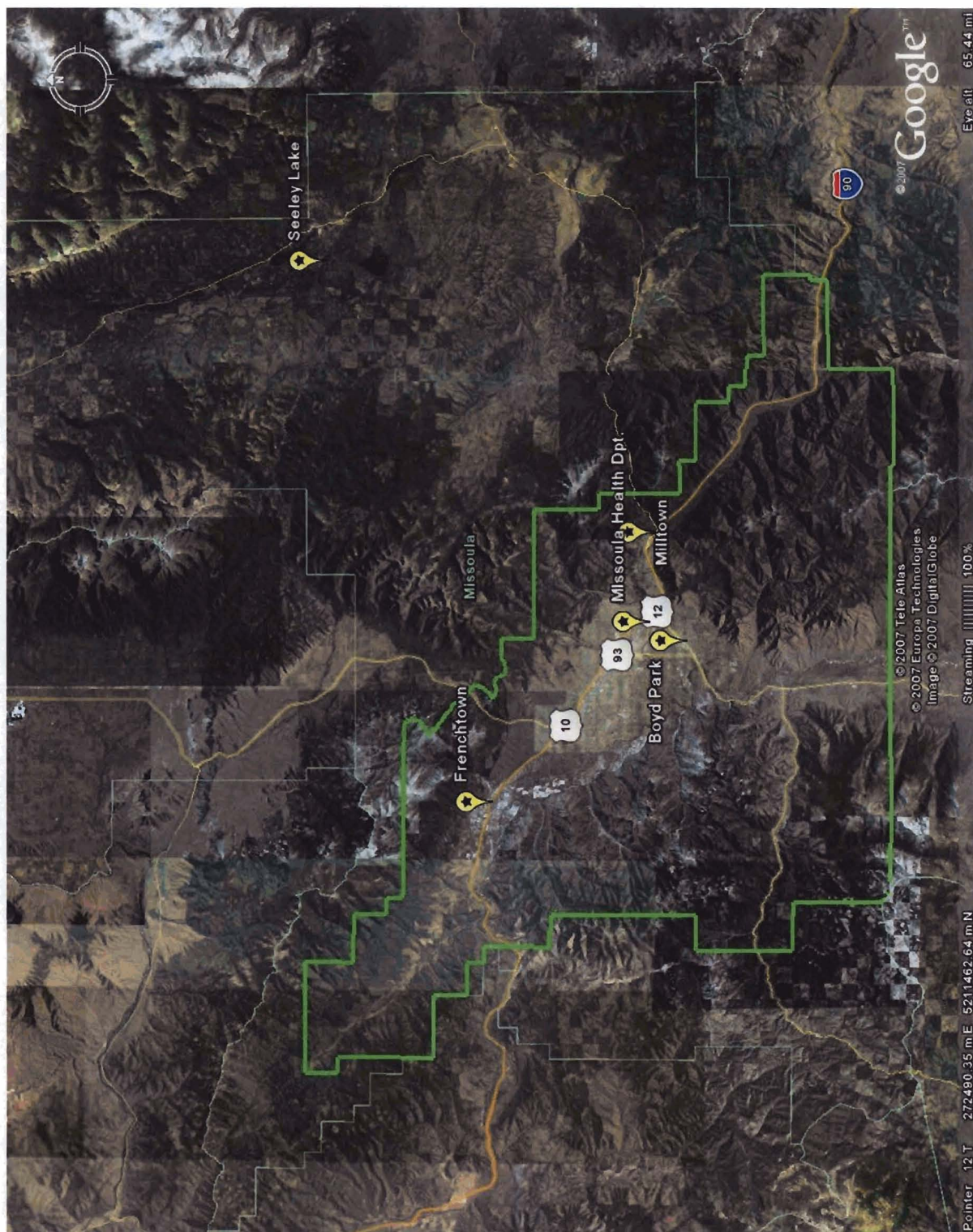


Figure 3. Map showing the location of monitoring sites in Missoula County at Frenchtown, Boyd Park in Missoula, Milltown, and Seeley Lake.

4. Nine Factor Analysis

1. Emissions in areas potentially included versus excluded from the non-attainment area.

A chemical mass balance (CMB) study was recently completed to help determine the sources of fine particulate pollution within the Missoula area. A graph representing the results of this study may be seen in Figure 4. This study used a Chemical Mass Balance (CMB) computer model to apportion the sources of the fine fraction, where information on the $PM_{2.5}$ chemical composition and anticipated sources in the Missoula Valley served as model inputs. Ambient air sample data collected every three days from November 1, 2006 through February 27, 2007 from the $PM_{2.5}$ chemical speciation sampler (SASS) was used for the model. In addition, a Federal Reference Method (FRM) $PM_{2.5}$ sampler was collocated with the speciation sampler. The FRM sampler collected samples of the ambient air on quartz filters on the same sample days.

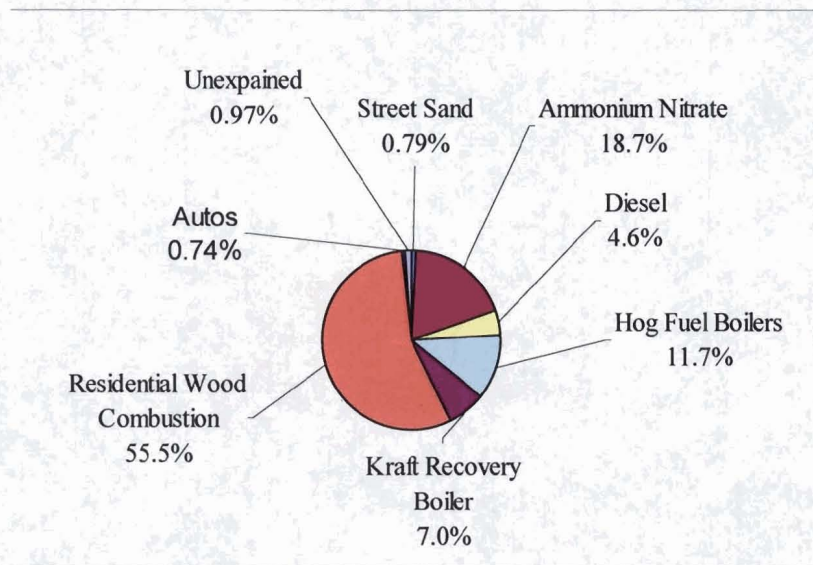


Figure 4. Graph showing results of the chemical mass balance (CMB) study conducted in Missoula during the winter of 2006-2007 showing the relative contributions from several sources to total $PM_{2.5}$ pollution.

The CMB study showed that in the winter, the major source of $PM_{2.5}$ pollution is residential wood burning. Additionally, a Missoula residential wood burning survey was conducted in 1996. It assessed woodstove and fireplace use in a 288 square mile grid, approximately 100 square miles larger than the Air Stagnation Zone (ASZ) (Figure 7), but smaller than the proposed $PM_{2.5}$ non-attainment boundary. That study concluded that 19.64% of all residences burned wood. DEQ extrapolated those numbers for a 2000 carbon monoxide emission inventory and concluded that in the ASZ where strict woodstove regulations apply, 17.62% of the households burn wood.

In the ASZ, regulations prohibit the installation of new woodstoves or fireplaces and require most woodstoves be removed when the house is sold. Given these provisions,

it is reasonable to expect that the number of homes in the ASZ with stoves has continued to decrease, even as the number of housing units has increased. However, the Air Stagnation Zone, encompassing 188 square miles, only comprises 21% of the proposed non-attainment area. Houses and businesses in the remaining 79% of the proposed area have not been subject to residential wood burning device regulations. Thus, it is reasonable to expect that a higher percentage of the homes outside the ASZ burn wood than within it.

With the exception of the Seeley Lake area, relatively few homes and residents are located in areas not proposed for inclusion in the non-attainment boundary. For example, extending the non-attainment area to the extreme northwest end of the Nine Mile Valley (adding over 100 square miles in this area) would add fewer than 20 residents, many of which may only be seasonal. In fact, it has been noted by staff at the Missoula County Office of Planning and Grants that the proposed non-attainment area encompasses 93% of the current county population. (See Factor 3 for more information.) However, even if a higher percentage of these excluded homes use woodstoves, their relative contribution of PM_{2.5} is insignificant given their small number.

The CMB study showed that another significant source of PM_{2.5} emissions is industry. All major Missoula County industrial PM_{2.5} point sources, excluding Pyramid Mountain Lumber in Seeley Lake, are in the proposed PM_{2.5} non-attainment area (Figure 5). These industrial point sources include: Smurfit-Stone Container, Stimson Lumber and Roseburg Forest Products. The other major industrial sources, which are included in Table 8 below, are not significant PM_{2.5} contributors.

All of the county's smaller industrial point sources are located in the proposed PM_{2.5} non-attainment area. These small industrial sources include a bulk portland cement transfer station, a paper incinerator, two animal crematoriums and two crematoriums.

Portable industrial sources such as concrete plants, asphalt plants and gravel crushers are generally closed November through February and thus are insignificant sources of PM_{2.5} during winter inversion conditions (when air pollution problems most often occur). Additionally, most of these portable sources operate in the proposed PM_{2.5} non-attainment area, where most county construction and road building activities occur.

The only significant industrial PM_{2.5} source outside the proposed non-attainment area is Pyramid Mountain Lumber in Seeley Lake. The mountain chains and distance between Seeley Lake and Missoula (~32mi over land, or ~52mi via road) create separate air sheds that should be considered independently. Because there are many air pollution control regulations in the Missoula valley and relatively few controls in Seeley Lake, the sources of PM_{2.5} pollution are quite different between the two sites. Moreover, a PM_{2.5} sampling station is operating within Seeley Lake, and thus any violations of the PM_{2.5} standard occurring in that area will be detected. For all these reasons, neither Seeley Lake nor the Swan Valley is included in the proposed PM_{2.5} non-attainment area.

Another major contributor to winter PM_{2.5} emissions is transportation, which is discussed in greater detail under Factor 4, Traffic and Commuting Patterns. In general, most of the vehicle emissions will occur within the proposed non-attainment area boundary,

which includes major traffic corridors as well as the entire Missoula urban area and surrounding communities.

Many areas within the proposed non-attainment area are under public ownership (including US Forest Service and US Bureau of Land Management), and thus not likely to be developed for industrial uses, travel, or dwellings (Figure 6). In addition, the steep gradient of the hills and mountains surrounding the urban area make these locations unsuitable for widespread future development. Many of these publicly held lands excluded from the proposed boundary to the west and northwest are classified by the US Forest Service as either:

- 1) "large, roadless blocks of land distinguished primarily by their natural environmental character managed to provide for a wide variety of dispersed recreation activities in a near-natural setting and for old-growth dependent wildlife species; classified as unsuitable for timber production" or
- 2) "of varying physical environments which are classified as suitable for timber production; management provides for healthy stands of timber and optimizing timber growing potential and sustained timber production"

and thus are not likely to be developed for mining, ski resorts, or grazing. As such, these areas are unlikely to represent a significant source of $PM_{2.5}$ emissions. In addition, the US Forest Service participates in the Montana/Idaho Airshed Group's Smoke Monitoring Unit, which coordinates the amount of prescribed burning that takes place in a given airshed at a given time. This way, smoke impacts from forestry practices are greatly reduced.

Generally, outdoor burning from public and private lands is not a significant contributor to $PM_{2.5}$ exceedances, due to the closure of the burning season December 1-February 28.

In summary, with the exception of Seeley Lake, which is located in a separate airshed, areas excluded from the proposed non-attainment area have no major industrial sources, and few sparsely distributed area sources of $PM_{2.5}$ or precursor emissions.

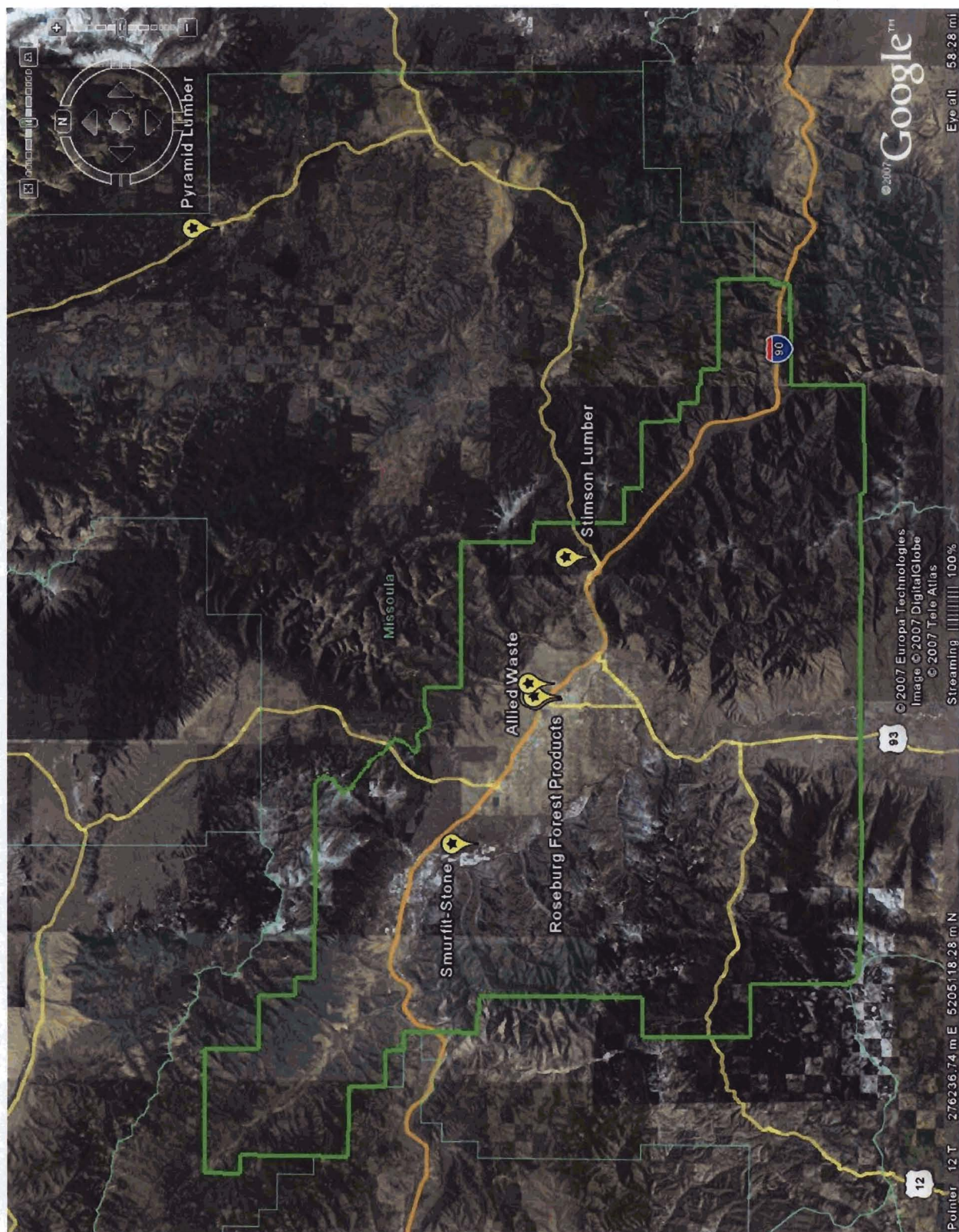


Figure 5. Location of major Industrial Point Sources in Missoula County in relation to the proposed $PM_{2.5}$ non-attainment area. The cluster of sources at the north end of Missoula includes Roseburg, Hexion, ConocoPhillips, and Allied Waste.

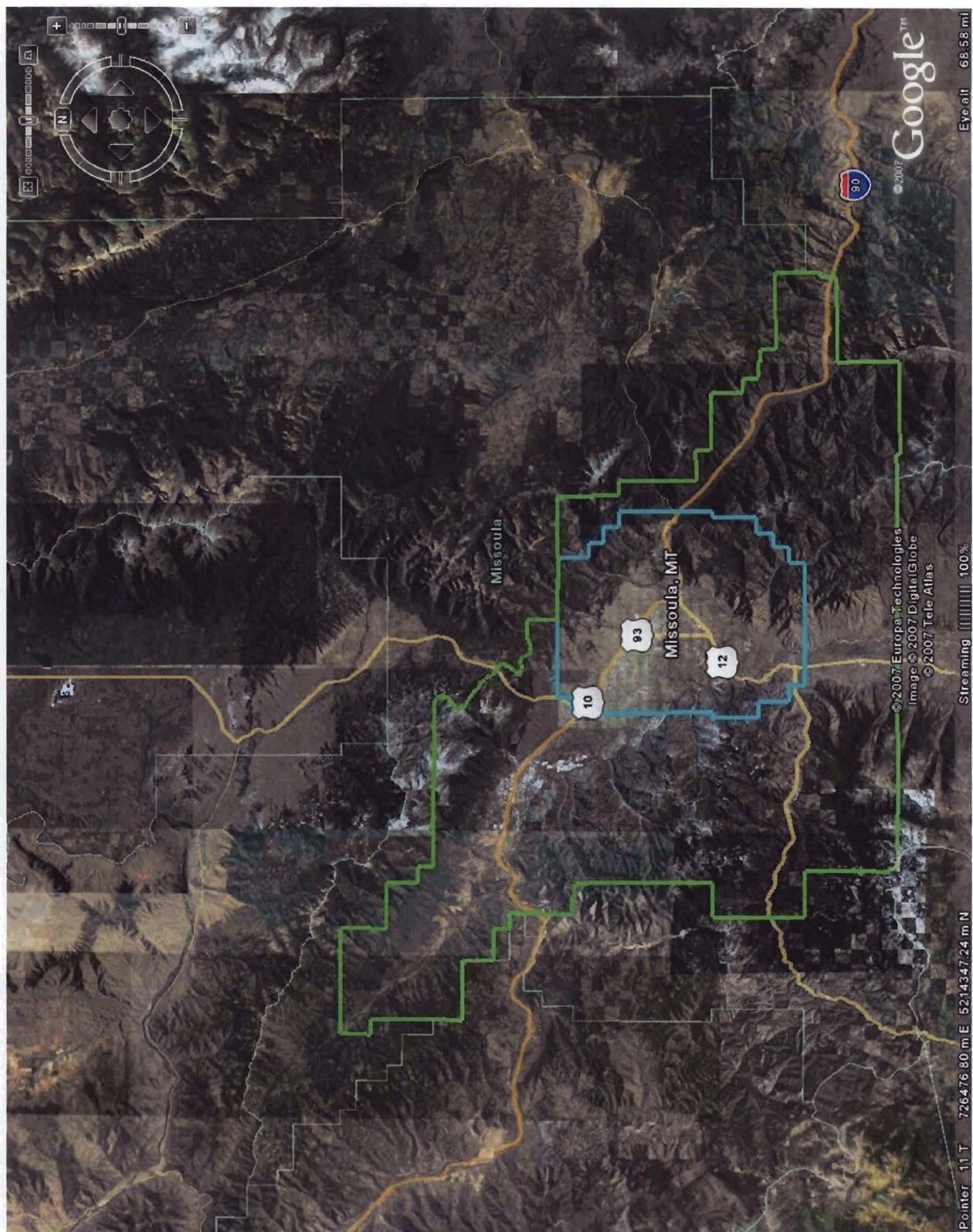


Figure 7. Map showing the Air Stagnation Zone (blue) in relation to the Missoula Valley and the proposed PM_{2.5} non-attainment area.

Table 8. Major Industrial Point Sources in Missoula County

	2004					2005					2006				
Industrial Source	CO	NO2	SO2	VOC	PM2.5	CO	NO2	SO2	VOC	PM2.5	CO	NO2	SO2	VOC	PM2.5
Smurfit-Stone	3442.3607	1601.6784	177.3555	308.9958	165.7821	1483.2640	817.9545	83.8650	115.7406	185.4931	1611.7894	851.1171	63.3837	123.9257	148.3664
Roseburg	87.7845	495.2933	7.5353	19.0705	N/A	84.7720	473.9499	7.1546	19.4271	N/A	72.5662	354.4402	5.5281	17.4160	N/A
Stimson	301.6556	210.5861	11.2643	119.2923	109.3383	233.9958	163.4846	8.7488	88.5205	128.4837	268.9678	187.9650	10.0602	99.6269	119.0587
Hexion	0.5985	2.8500	0.0171	7.0314	N/A	0.4515	2.1500	0.0129	7.1057	N/A	0.3885	1.8500	0.0111	5.6290	N/A
ConocoPhillips	20.0800	8.0300	N/A	67.9430	N/A	19.7500	7.9000	N/A	63.1110	N/A	19.9100	7.9600	N/A	65.1155	N/A
Allied Waste	3.4133	4.7036	2.5142	1.7066	1.4277	3.4727	4.7856	2.5579	1.7364	1.4526	3.4830	4.7997	2.5655	1.7415	1.4569
Pyramid	21.5762	3.9913	0.4979	50.1777	27.8460	20.7369	3.3837	0.4568	46.2246	26.4573	20.8119	3.2205	0.4501	45.4397	25.8798
Total	3877.4688	2327.1327	199.1843	574.2173	304.3941	1846.4429	1473.6083	102.7960	341.8659	341.8867	1997.9168	1411.3525	81.9987	358.8943	294.7618
Percent of Total w/in proposed boundary	99.44%	99.83%	99.75%	91.26%	90.85%	98.88%	99.77%	99.56%	86.48%	92.26%	98.96%	99.77%	99.45%	87.34%	91.22%

2. Air quality in potentially included versus excluded areas.

While there is a lack of monitoring data for many areas of the county, results from permanent and temporary monitoring sites, when used in concert with the other factors, help define which areas should be included in the non-attainment area.

Monitoring data collected in 2000-2001 shows that the community of Frenchtown to the west of the Missoula urban area has very similar $PM_{2.5}$ values to Missoula (Table 4), and therefore must be included in the non-attainment boundary. The community of Huson, even further west, is a much smaller community but is located in the same valley. Therefore $PM_{2.5}$ values are likely to be similar there as well.

The Health Department also conducted $PM_{2.5}$ sampling in Milltown, east of the urban area, from 2002 to 2004 (Tables 5 and 6). $PM_{2.5}$ levels collected from that site were slightly lower than those found in Missoula. This result follows given that the sampled portion of the county to the east is located topographically upgradient of the urban area.

The Department has not conducted sampling in the Lolo area, south of the Missoula urban area toward Ravalli County. This community is also located topographically upgradient from the urban area, in the Bitterroot River valley. Based on the size of the community, its lack of industrial sources, and its upgradient location, air quality is likely better in Lolo than in the Missoula urban area.

To the north, the Department is conducting monitoring in Seeley Lake. While a limited amount of data has been collected to date, making a robust analysis of $PM_{2.5}$ levels in Seeley Lake difficult, the available data shows that no correlation exists between levels of $PM_{2.5}$ in Missoula and the levels collected from Seeley Lake.

Based on topography and limited sources of winter time $PM_{2.5}$, the northwestern portion of the Nine Mile area (to the extreme northwest of Frenchtown) should be excluded from the non-attainment area. The proposed boundary encompasses the majority of private lands located in the Nine-Mile valley to the northwest of Frenchtown. To the east areas encompassing both Milltown and points beyond Turah will need to be included in any non-attainment area based on 2002-2004 monitoring data (Tables 5 and 6), and are both within the proposed non-attainment area.

It is reasonable to assume that $PM_{2.5}$ concentrations and $PM_{2.5}$ emissions in areas outside the proposed non-attainment area will be significantly lower due to minimal population numbers, generally higher elevations, steep topographical gradients limiting population growth over much of the excluded area, and a general lack of point or area $PM_{2.5}$ sources. Also, $PM_{2.5}$ levels over $35 \mu g/m^3$ mostly occur during winter time inversions when pollution is trapped near the valley floors (10-30 meters) resulting in lower $PM_{2.5}$ concentrations at higher elevations. According to the Montana Air Pollution Study (1980), wintertime inversions in the Missoula area range from 3 to 820 feet thick, and are based at 331 to 1640 feet above the valley floor. The proposed boundary includes areas that are below 4000 feet elevation, which includes areas from 600 to over 800 feet above the valley floor, thus encompassing areas likely to be impacted by these inversions, as well as areas with significant sources contributing the majority of

the PM_{2.5} emissions.

The data shown in Tables 3 & 4 was collected from March of 2000 to March of 2001 for a special study conducted by researchers from the University of Montana. The data show that the levels of PM_{2.5} collected from the Frenchtown area correlate strongly with PM_{2.5} levels collected from Missoula.

Table 3. Frenchtown¹ 24-Hour High PM_{2.5} Values from 2000-2001 CMB Study

2000: March-December		2001: January-March	
Date	µg/m ³	Date	µg/m ³
12/23	55.3	1/4	57.0
11/17	17.1	2/21	49.3
10/24	15.8	3/5	19.3

¹Frenchtown study samples collected every 12th Day. In Frenchtown there are no woodstove regulations, deicer is not used on the streets and many roads are unpaved.

Table 4. Missoula-Frenchtown High Daily PM_{2.5} Value Comparison

Date	Boyd Missoula µg/m ³	Park- Health Department µg/m ³	Frenchtown µg/m ³
12/23/00	48.4	53.1	55.3
1/4/01	42.3	42.9	57.0
2/21/01	37.0	No Data	49.3
3/5/01	20.6	11.4	19.3

The data shown in Tables 5 & 6 was collected from August of 2002 to September of 2004 for a special study by the Missoula City-County Health Department. The data show that the levels of PM_{2.5} collected from the Milltown area to the east of Missoula are not significantly correlated with PM_{2.5} levels collected from the Missoula Valley.

Table 5. Milltown 24-Hour High PM_{2.5} Values

2002: Aug.-December		2003		2004: January-Sept.	
Date	µg/m ³	Date	µg/m ³	Date	µg/m ³
11/16	25.8	8/10	29.0	1/16	49.1
10/26	21.7	8/25	27.1	1/19	42.9
11/25	19.8	1/24	26.6	1/13	37.1
11/7	19.5	12/2	25.4	1/10	24.4
12/22	18.4	11/8	22.9	1/7	22.5

Table 6. Missoula-Milltown High Daily PM_{2.5} Value Comparison

Date	Missoula Health Department µg/m ³	Milltown µg/m ³
1/24/03	41.6	26.6
11/8/03	32.9	22.9
12/2/03	27.1	25.4
8/25/03	24.9	27.1
8/10/03	24.7	29.0
1/16/04	62.3	49.1
1/10/04	55.4	24.4
1/19/04	46.8	42.9
1/13/04	No Data	37.1
2/15/04	30.8	13.2
1/7/04	29.8	22.5

The data shown in Table 7 was collected from 2005 to 2006 by the Missoula City-County Health Department. The Seeley Lake sampling site was recently moved, and sampling at this location is currently underway. The available data show that the levels of PM_{2.5} collected from the Seeley Lake area are not significantly correlated with PM_{2.5} levels collected from the Missoula Valley.

Table 7. Seeley Lake High PM_{2.5} Values

2005-Partial Year		2006	
Date	µg/m ³	Date	µg/m ³
12/15	25.1	12/7	39.4
12/21	24.1	1/5	38.3
11/18	24.1	1/2	32.1
11/30	22.9	2/4	24.9
12/27	21.4	1/19	22.2

3. Population density and degree of urbanization including commercial development in included versus excluded areas.

Missoula is the only city in Missoula County; none of the other population centers are incorporated, nor are they very large. The city of Missoula is situated in the middle of the proposed non-attainment boundary and covers 26 square miles. Over 63% of the population lives within the city with a density of almost 2400 persons per square mile. Surrounding the city is an urban area comprising an additional 26 square miles. Together the city and urban area house over 76% of the county's population.

Missoula County has several communities that are situated along the major travel corridors. Most of these centers are included in the proposed non-attainment area. The included communities include Frenchtown and Huson to the west; Lolo to the south; and Bonner/Milltown/West Riverside and Clinton to the east. Of these, Lolo is the largest

with a population of approximately 3400 people and a density of 356 persons per square mile. The Bonner/West Riverside area is the most densely populated at about 1091 persons per mile.

All told, the Missoula Office of Planning and Grants estimates that the proposed non-attainment boundary includes over 93% of the county's population.

Communities not included in the proposed non-attainment area are Evaro, which is on the Flathead Indian Reservation to the north of the urban area and those communities in the Blackfoot and Clearwater River drainages to the northeast. For the latter communities, Seeley Lake is the most populated at about 1450 persons.

Table 9. Total population and population density of the City of Missoula and unincorporated towns within Missoula County.

Area	Total Area in mi ²	Total Population	Persons per mi ²
Missoula County	2618.34	101,417*	39.0*
Missoula	23.91	64,081*	2397.1
Lolo	9.72	3388	356.2
Bonner/W. Riverside	1.66	1693	1091.6
Frenchtown	3.28	883	271.8
Seeley Lake	11.03	1436	131.8
Evaro	17.03	329	19.3

* 2006 US Census estimated population. All other data is from the 2000 U.S. Census.

Most commercial development is centered in the Missoula urban area. Smaller communities also have some small businesses and a few large industries. With the exception of the Seeley Lake area, all of the concentrated commercial development is included in the proposed non-attainment boundary.

Topography, access to services, existing transportation corridors, and availability of electrical service and potable water have played a significant role in how Missoula County has developed. The following series of maps (Figure 8) show that development has generally occurred in the Missoula urban area and along the river valleys.

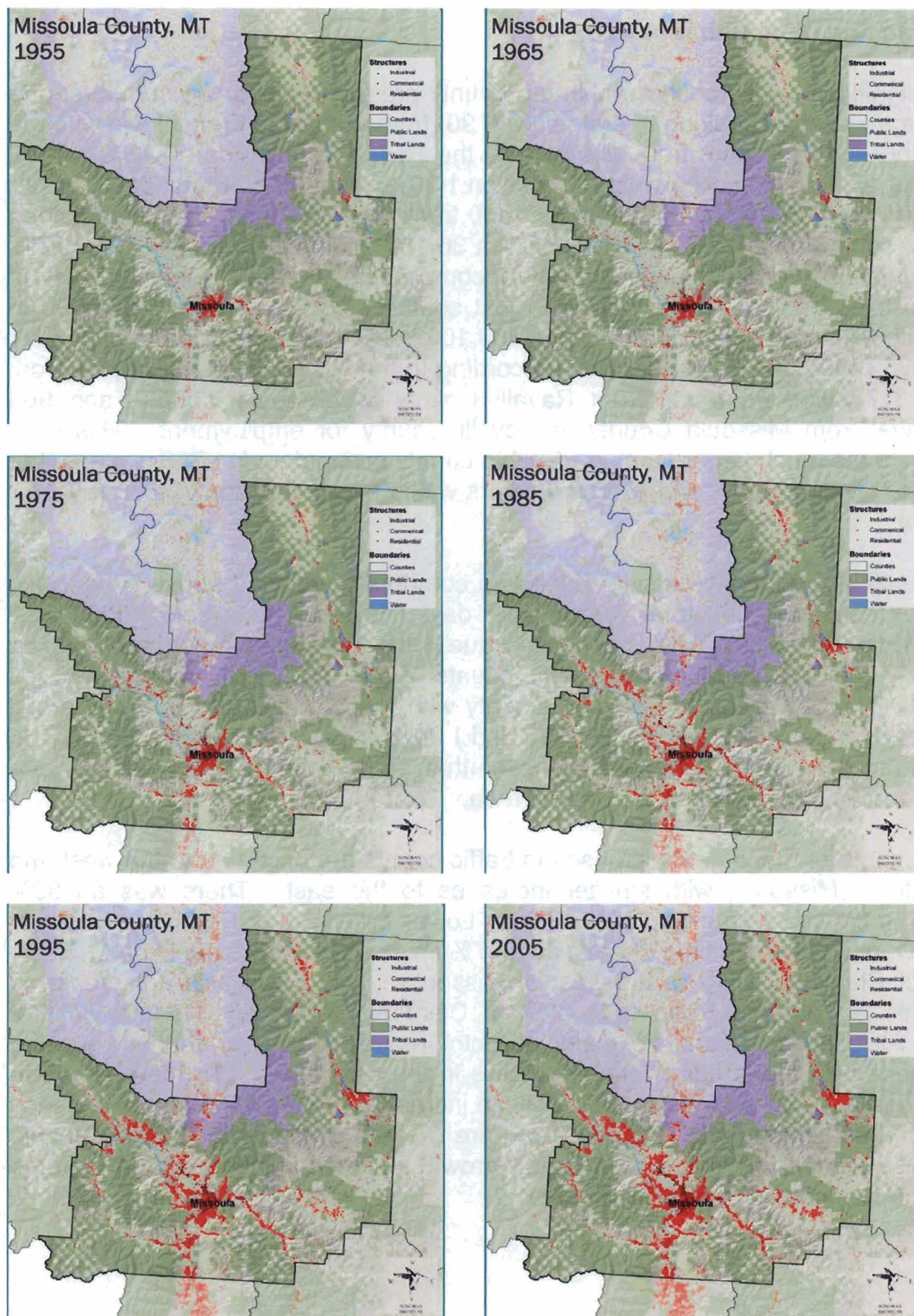


Figure 8. Maps showing the growth patterns of Missoula County from 1955-2005. Red areas indicate areas of growth (Industrial, Commercial, and Residential). Courtesy Sonoran Institute.

4. Traffic and commuting pattern.

The most significant traffic counts within the county are found along two corridors; one running roughly east-west along Interstate 90 (I 90) from Bonner to Frenchtown with the other running north to south from Missoula to the Ravalli county line (MDOT). Total traffic counts along the east to west corridor on I 90 exceed 30,600 total vehicles per day (totaling over 486,000 VMT), and over 4500 trucks daily. Total traffic counts along the north to south corridor are even higher with 36,184 total vehicles daily. Total VMT within the Missoula urban planning area (encompassing an area from just east of Frenchtown to Bonner, and from Evaro to just south of Lolo) was over 1,638,000 in 2000. Within Missoula city limits, VMT was 869,100 in 2000 and expected to grow over 40% by 2025 (2004 LRTP). In addition, according to the US Census Journey to Work database, 3178 workers travel from Ravalli County to Missoula County, and 900 workers travel from Missoula County to Ravalli County for employment. This is in comparison to the much larger number of within-county commuters (11,766 workers that travel within Ravalli County, and 47,159 workers within Missoula County) that travel for employment.

Few areas within the county outside of the two corridors mentioned above have traffic counts in excess of 10,000 total vehicles per day, and most have below 5000 total vehicles per day (Figure 9). This is especially true in the more remote northern portions of the county, which experience total traffic counts of only 1100 to 1700 total vehicles per day (MDOT). All areas of Missoula County with traffic counts above 10,000 total vehicles per day, including the Highway 93 and I 90 corridors are within the proposed non-attainment area. Most areas with fewer than 2000 total vehicles per day are excluded from the proposed non-attainment area.

In addition, some of the largest increases in traffic counts are occurring to the west and to the south of Missoula, with smaller increases to the east. There was an 89% increase in traffic counts during 2004-2006 on Lower Miller Creek Road, just south of Missoula. During the same time, there was a 37% increase in traffic counts on S. 7th W, 300' east of Clements Road to the west of Missoula. There was a 20% increase in traffic counts on Spurgin Road 300' east of Clements Road, also to the west of Missoula. All of these roads are major collector roads, serving to connect growing neighborhoods with the larger arterial roadways in the urban area. To the east, there was an 8% increase on W. Riverside Dr. These increases are likely due to the increase in growth and settlement in these areas, and are likely to continue for the foreseeable future. These areas experiencing rapid traffic growth and the neighborhoods they serve fall within the proposed non-attainment area.



Figure 9. Map of Missoula County showing traffic counts on major highways throughout the county. Upper numbers refer to car counts, lower numbers refer to truck counts. (MT DOT)

5. Expected growth (including extent, pattern and rate of growth).

The unique topography, access to services, as well as availability of electric service and potable water within the Missoula area plays a significant role in determining the location of future development. As a result, most growth in the county is expected in the urban area (Figure 10), in and around Lolo to the south, and toward Frenchtown to the west. The Missoula County Office of Planning and Grants is currently in the process of mapping any additional areas of expected growth.

Growth trends can be demonstrated in several different ways. The first is by the number of acres subdivided between 1996-2004, with over 5300 acres being subdivided within the Missoula urban area, and over 2300 acres subdivided to the west, within the Frenchtown-Huson area. By comparison, the area with the next largest number of acres subdivided is the Seeley-Swan area to the north east of Missoula, with only 1400 acres subdivided during the same time. The second way this trend is demonstrated is by the number of individual lots subdivided within the county. Within the Missoula urban area, over 4900 lots were subdivided from 1996 to 2004. By comparison, the next highest number of subdivided lots was within the Lolo area, with 407 lots subdivided during the same time.

Missoula also attracts many new residents each year, given the proximity to many recreational areas within minutes of the city. The Missoula city population is expected to grow at a rate of 1.3% per year (2004 LRTP). With this increase in population and

development will likely be an increase in the number of vehicles and VMT, as well as an increase in the number of homes in the area. This growth in either population or services is not expected in the more remote areas of the county; as a result these areas should not be included in the non-attainment boundary.

Much of the land not included in the non-attainment area, with the exception of land in the Blackfoot and Clearwater drainages is under public ownership, is often very steep and is not likely to be developed either into residential or commercial uses.

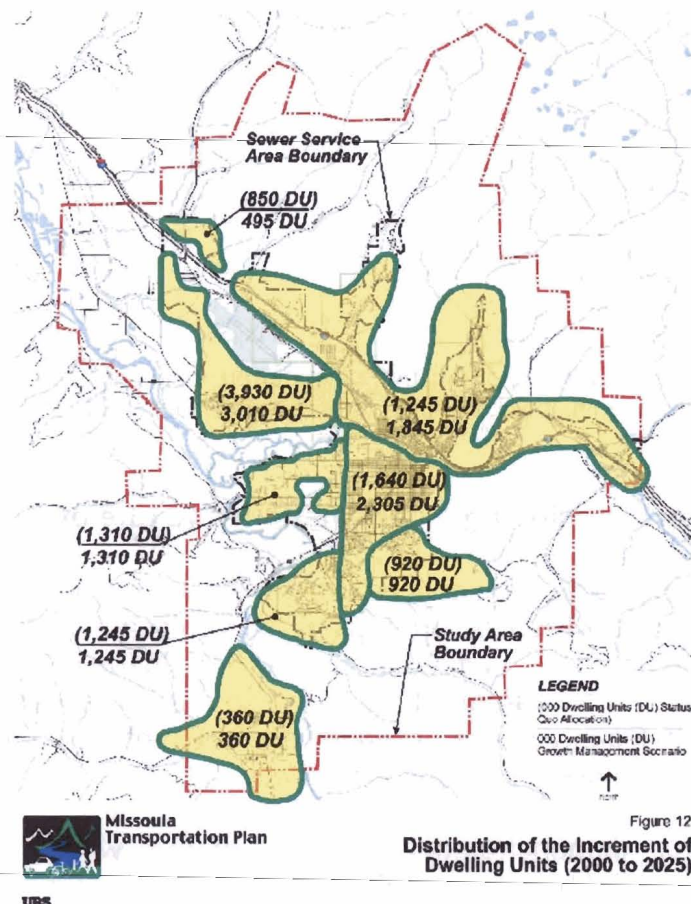


Figure 10. Expected increases in dwelling units and locations within Missoula County, showing areas of expected growth.

6. Meteorology (weather/transport patterns).

The average annual temperature of the Missoula area is 7.1°C (44.8°F), and the average annual precipitation is 35.1cm (13.8 inches) (National Weather Service).

The Missoula Valley is located west of the Continental Divide, has steep slopes limiting lateral dispersion, and is subject to intense and long lasting stagnation periods with strong persistent temperature inversions in the lower atmosphere. These stagnation

periods are the root cause of the high PM_{2.5} ambient levels that have resulted in the non-attainment status of the Missoula Valley.

With the exception of summer forest fire impacts, all of the highest measured PM_{2.5} levels occur during the winter months when these inversions are the strongest and most persistent. The problematic winter inversions are surface based during the night and elevated during the day. The inversions are typically very strong (+ 3 °C/100m or more) for the lowest 200 meters of the atmosphere during the nighttime hours into the early morning. During the late morning and afternoon, the atmosphere near the surface becomes somewhat adiabatic or at least isothermal for the lower 200-300 meters allowing some vertical mixing, but an elevated inversion remains in place trapping the pollutants in the valley over a period of several days, allowing the particulate levels to steadily rise until a synoptic event flushes the air out of the valley. During the nighttime hours when the surface-based inversion is at its strongest, vertical mixing is almost nonexistent.

Smoke and other pollutants from area sources such as cars and woodstoves are trapped in a very shallow (10-30 meters) layer near the surface. This produces the characteristic "spike" of high PM_{2.5} concentrations during the nighttime hours and during the morning commute.

With the vertical mixing issue, lateral dispersion is also severely limited during this period with many hours of "calm" wind speeds recorded at the surface. Winds aloft are totally decoupled from the surface by the stable inversion layer and there is almost no net transport of air out of the valley. Under these conditions, even "regional scale" pollutants like PM_{2.5} with high residence times aloft become local issues with steep lateral concentration gradients as pollution stays very near the emission sources. Diurnal drainage flows are the only sources of air movement under these conditions and they do little to provide any net transport. The bottoms of the valley is relatively flat and, once minor flows reach the valley floor from the side canyons, downslope gravity winds are minimal.

Three big differences between the Bitterroot and Missoula Valleys are their size, shape and orientation. The Bitterroot is long, narrow, and oriented north/south. The Missoula valley is more bowl shaped with five drainages converging before exiting out to the northwest. The minor amounts of drainage flows reaching the Missoula Valley from the Bitterroot under inversion conditions are very shallow and skirt the west edge of Missoula Valley in the low terrain before heading out past Frenchtown through the Clark Fork River Canyon. This physical separation of air from the Bitterroot Valley from the city of Missoula is why the CMB results from the two areas are so dissimilar.

Such a transport scenario is demonstrated by the available air monitoring data for the area, showing increased concentrations of PM_{2.5} to the west of Missoula (Table 4), with lower concentrations found to the east (Table 6). Thus, it is highly unlikely that pollution generated within the Missoula urban area would impact the Seeley Lake or Swan Valley areas to the north east. This supports the idea that a non-attainment boundary should focus on the city of Missoula and the immediate urban area, rather than the more remote parts of the county such as Condon or Seeley Lake.

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

Missoula is a city located in the Rocky Mountains of western Montana. The Missoula urban area, located at the confluence of several mountain valleys, contains over 76,431 people and is the largest urban area in the United States surrounded by the Rocky Mountains. In addition, the Missoula urban area is host to three rivers, including the Bitterroot, Clark Fork, and Blackfoot. Frenchtown lies to the northwest of Missoula, and the Bonner/West Riverside areas lie to the east (Figure 11).

The unique topography surrounding the Missoula area supports the creation of a non-attainment area that encompasses the Missoula urban area, while excluding the higher elevations and more remote parts of the county. The topography of Missoula County is one of the most significant factors influencing the air quality within the region. The surrounding mountains rise several thousand feet above the valley floor and act to confine the pollutants generated within Missoula to the city and the immediate area. Moreover, the surrounding mountains promote the formation of inversions in the winter (when the majority of $PM_{2.5}$ exceedances occur), which act to trap pollution to the valley floor both within and around the Missoula area. As noted above, the mountains surrounding Missoula prevent the transport of pollution generated within the Missoula urban area to other outlying areas of the county.

Due to the lack of current development and limited potential for future development, there is a lack of $PM_{2.5}$ sources (either point or area) from areas that are at higher elevations or within the more remote portions of the county. As such, any non-attainment area boundary need not include these steep slopes or remote areas.

8. Jurisdictional boundaries (e.g., counties, air districts, Reservations, etc.).

Given the nature of $PM_{2.5}$ as a regional, rather than a localized pollutant, the Missoula County non-attainment area likely will, and should, extend southward from the Missoula urban area to the Missoula-Ravalli county line. While it is likely that the geographical area found in non-attainment of the 24hr $PM_{2.5}$ standard will cover regions of both Missoula and Ravalli counties, any such non-attainment area should be divided at the boundary line between the two counties. This would effectively encompass the necessary region of non-attainment by creating two separate but adjacent non-attainment areas. The proposed Missoula County non-attainment area is contiguous with the proposed Ravalli County non-attainment area.

The creation of two separate but adjoining non-attainment areas would allow each county to implement the most effective and applicable strategies to reduce $PM_{2.5}$ pollution for each individual county. This is especially important given the different source contributions of $PM_{2.5}$ in each county (see figures 4 & 12), as well as the specific regulatory and political realities each county currently faces.

The different source contributions of $PM_{2.5}$ in each county necessitates that steps to correct the violations differ as well. This would best be accomplished by each county individually, in that each county has the best understanding of the history of not only the air pollution within its boundaries, but possesses the best understanding of the political landscape within the county as well.

Missoula has a long history of addressing violations of the National Ambient Air Quality Standards for carbon monoxide (CO) and PM_{10} and bringing the community into compliance. Consequently, Missoula has developed a strong air pollution program with extensive regulations (Missoula City-County Air Pollution Control Program, Revised 11-17-00) to reduce these pollutants. For example, in the mid 1980's, when it became clear that the increased use of woodstoves was a significant source of PM_{10} , it became illegal to install fireplaces or high particulate emitting wood stoves inside the Missoula Air Stagnation Zone. To further control woodstove emissions, it became illegal in 1994 to install any cordwood burning woodstove in the Air Stagnation Zone. In addition, high particulate emitting woodstoves are required to be removed from the property at the time the property changes ownership. The 2006-2007 chemical mass balance study shows that residential wood burning, while reduced from historic levels, continues to account for around 55% of winter time $PM_{2.5}$ levels. Currently Missoula is a maintenance area for carbon monoxide (CO) and a non-attainment area for the 24hr PM_{10} standard, but due to control measures that have been implemented, Missoula has not violated either standard since the early 1990's. It is of note that the non-attainment boundaries for both of these pollutants center on the city of Missoula, and do not include the more remote parts of the county.

In contrast, Ravalli County does not have an air pollution control program operating within the county, nor is the county currently out of attainment for any national air quality standard. Because Missoula and Ravalli counties have an extremely different air quality history and perspective, the strategies and starting points to address the new $PM_{2.5}$ 24hr standard will be different. However, while the forces at work within each county

may be different in myriad ways, there are likely causes of $PM_{2.5}$ pollution that are not only common to both counties, but are shared by both as well, such as transportation. It will thus be necessary for both counties to collaborate on measures aimed at controlling mobile sources of particulate pollution which travel between both counties. It is likely that the Montana DEQ will need to assume an active role to help facilitate collaboration between the two counties.

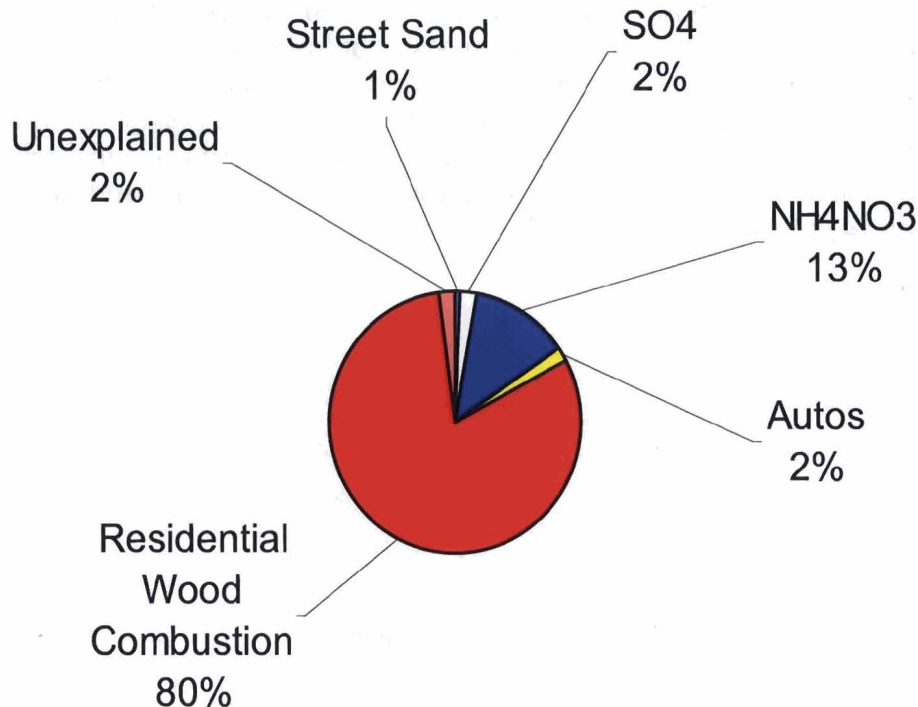


Figure 12. Graph showing draft results of the chemical mass balance (CMB) study conducted in Hamilton during the winter of 2006-2007 showing the relative contributions from several sources to total $PM_{2.5}$ pollution.

9. Level of control of emission sources.

As noted above, Missoula County has a long history of air pollution control measures, necessitated by the quality of the air within the Missoula urban area, with exceedances for air quality standards beginning in 1969. The Missoula City-County Air Pollution Control program encompasses the entire geographic area of Missoula County including the Missoula urban area. Current areas of increased controls for PM_{10} and CO fall within the boundaries of the proposed $PM_{2.5}$ non-attainment area. These areas were created to control the sources of PM_{10} and CO, and focus on the Missoula Air Stagnation Zone rather than the outlying areas of the county where there are few sources of PM_{10} or CO. In addition, over 90% of the Missoula County population (Missoula County Office of Planning and Grants), and all major industrial point sources

except for Pyramid Lumber (see #1 above) are within the proposed non-attainment area boundary.

The regulations and specific provisions of the program are adopted by the Missoula City-County Air Pollution Control Board, Board of Commissioners of Missoula County and the Missoula City Council. The air pollution control program is administered, implemented, and enforced by the Missoula City-County Air Pollution Control Board.

The current program is designed to control emissions from re-entrained road dust, open burning, residential wood burning, vehicle exhaust, incinerators, petroleum storage and other industrial sources. Although the program focuses on controlling particulate emissions, specific provisions of the program also control emissions of other pollutants including: sulfur dioxide, carbon monoxide, fluorides, volatile organic hydrocarbons, nitrogen dioxide, hazardous air pollutants, and odors. These regulations and programs have resulted in a marked improvement in Missoula's air quality. In fact, as noted above in #8, Missoula has not violated the carbon monoxide (CO) standard since 1992, and has not violated the PM₁₀ standard since 1989.

END OF DOCUMENT

ATTACHMENT III

RAVALLI COUNTY NINE FACTOR ANALYSIS

Nine Factor Analysis Defining the PM_{2.5} NAAQS Nonattainment Area Boundary for Ravalli County, Montana

Montana Department of Environmental Quality, Winter 2007

Background

The Montana Department of Environmental Quality (DEQ) has determined that a violation of a federal National Ambient Air Quality Standard (NAAQS) has occurred in Ravalli County, Montana. This determination is based on an analysis of ambient PM_{2.5} (particulate matter less than or equal to 2.5 microns in diameter) monitoring data collected during 2004 through 2006 at two monitoring sites in Hamilton: the Ravalli County Courthouse [AIRS #30-081-0001] and the Sheriff's Lot [AIRS #30-081-0007]. The combined data from these two sites violated the 24-hour PM_{2.5} NAAQS of 35 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Using the 'Nine Factors' listed in the U.S. Environmental Protection Agency's (EPA) April 1, 2003 guidance memo¹, DEQ evaluated the geographic extent of the proposed PM_{2.5} nonattainment area (NAA) for Ravalli County. EPA's nine factors are:

1. Emissions in areas potentially included versus excluded from the nonattainment area;
2. Air quality in potentially included versus excluded areas;
3. Population density and degree of urbanization including commercial development in included versus excluded areas;
4. Traffic and commuting patterns;
5. Expected growth (including extent, pattern and rate of growth);
6. Meteorology (weather/transport patterns);
7. Geography/topography (mountain ranges or other air basin boundaries);
8. Jurisdictional boundaries (e.g. counties, air districts, Reservations, etc.); and
9. Level of control of emission sources.

Each one of the 'Nine Factor' analyses is explained in the following sections. All information is based upon the most recent, best available data. Where applicable, data representing the counties adjacent to Ravalli County is also included for comparison purposes. An adjacent county, Missoula, is emphasized since air quality monitoring there also revealed a violation of the 24-hour PM_{2.5} NAAQS.

The dominant source of particulate matter in Ravalli County on an annual basis is from area sources since few industrial point sources exist in the county. The primary area sources are residential wood burning, re-entrained crustal material from unpaved roads, and motor vehicle exhaust.

¹ Jeffrey Holmstead. EPA. April 1, 2003. "Designations for the Fine Particle National Ambient Air Quality Standards".

Based on the results of DEQ's Nine Factor Analysis, the Governor of the State of Montana recommends that EPA designate all of Ravalli County as a PM_{2.5} nonattainment area. Similarly, based on the Nine Factor Analysis prepared by the Missoula City-County Health Department (MCCHD), the Governor recommends that EPA designate a large portion of Missoula County as a PM_{2.5} NAA. A portion of the proposed Ravalli County PM_{2.5} NAA boundary (the northern edge) is contiguous to the proposed Missoula PM_{2.5} NAA boundary in order to provide some uniform regulatory control measures while observing the necessary administrative separation.

The proposed Ravalli County PM_{2.5} nonattainment area is the entire county. The legal description is as follows: Beginning at the intersection of the boundary line between Montana and Idaho with the line dividing townships ten (10) and eleven (11) north, range twenty-two (22) west, and running thence in a general southerly direction following said boundary line to an intersection of the summit of the Bitter Root mountains with the continental divide, said intersection being six (6) miles, more or less, northwest of the crossing of the Dehalonega pass; thence running in a general northeasterly direction along the top of the continental divide to an intersection with the summit of the divide between Bitter Root river and Rock creek; thence following the summit of said divide in a northerly direction to its intersection with the north line of township ten (10) north, range eighteen (18) west; thence following the line between township ten (10) north and eleven (11) north, west to the point of beginning.²

The DEQ describes geographic planning areas using the Montana State Plane Coordinate System (SPCS), zone 2500, North American Datum 1983 (NAD83), using approximately 25 kilometers (km) by 25 km (625 km²) sized grids, which are roughly 241 mi². These planning areas are used for air pollution control programs including, but not limited to, nonattainment planning areas. The SPCS coordinate system is easily defined, readily mapped, and recognized federally and globally for describing geographic points and areas.³

Factor 1: Emissions and Air Quality in Adjacent Areas (Including Adjacent Consolidated Metropolitan Statistical Areas (CMSAs) and Metropolitan Statistical Areas (MSAs))

Ravalli County is located in southwestern Montana and extends nearly 100 miles from the Missoula border to Lost Trail Pass at the Idaho border. U.S. Highway 93 is the major north-south highway running through the county. Ravalli County contains the "Bitterroot Valley" which is bounded by the Sapphire Mountains to the east and the Bitterroot Mountains to the west. Figure 1 shows the relationship of Ravalli County to the five adjacent counties in Montana (Beaverhead, Granite, and Missoula) and Idaho (Idaho and Lemhi).

² Montana State Legislature. ONLINE:

(http://leg.mt.gov/content/mtcode_const/sup_mat_annon/description_of_county_boundaries.pdf).

³ DEQ. Montana Clean Air Act Section 107(d) Planning Areas Map. Available Upon Request.

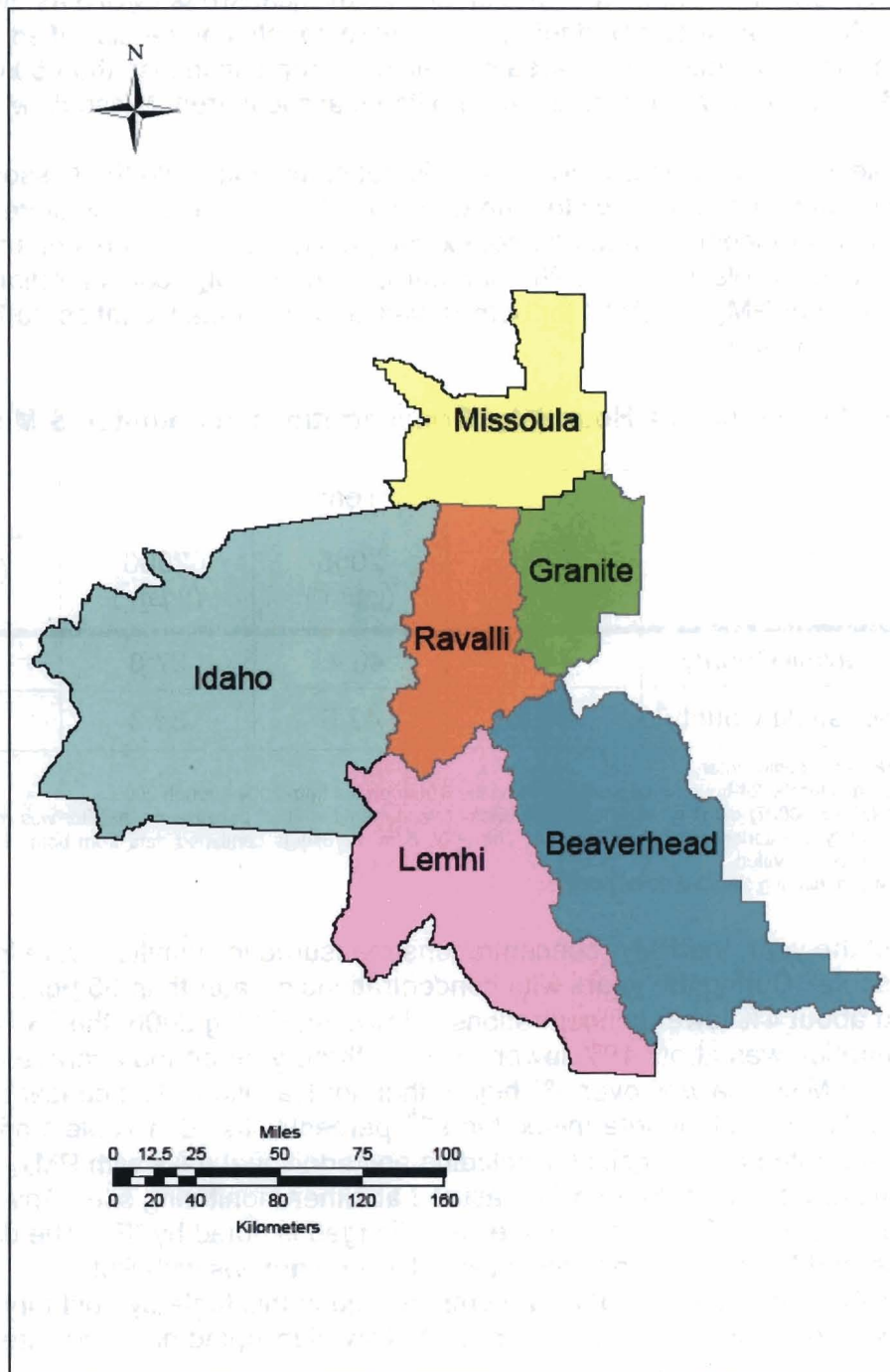


Figure 1. Ravalli and Adjacent Counties in Montana & Idaho.

Ravalli County does not contain any metropolitan statistical areas (MSA) as defined by the Office of Management and Budget and the entire county can be classified as “rural” based on the EPA’s definition of an area containing a population less than 50,000.^{4,5} In contrast, Missoula County contains a metropolitan statistical area, Missoula MSA.⁶

The DEQ believes the Ravalli County airshed is not continuous with the Missoula County airshed during stagnant wintertime wind conditions. Specifically, under these conditions, these adjacent airsheds do not exchange significant amounts of air pollution between counties. Table 1 lists the 98th percentile 24-hour PM_{2.5} concentrations that violated the 24-hour PM_{2.5} NAAQS for both Ravalli and Missoula Counties during the 2004 - 2006 time period.

Table 1. 98th Percentile 24-Hour PM_{2.5} Concentrations in Hamilton & Missoula.

City - County	Year			Average ² (µg/m ³)
	2004 (µg/m ³) ¹	2005 (µg/m ³)	2006 (µg/m ³)	
Hamilton - Ravalli County ³	44.7	40.7 ³	27.8	37.7
Missoula - Missoula County ⁴	46.8	42.5	34.3	41.2

¹ µg/m³ = micrograms per cubic meter.

² The final site averages for the 24-hour period were based on the 3 year period from 2004 through 2006.

³ The current site (30-081-0007) didn't meet data completeness requirements in 2005 because the monitor was moved from the original Ravalli County monitoring site (30-081-0001). The 2005 data represents combined data from both of these sites to estimate the 98th percentile value.

⁴ The Missoula PM_{2.5} monitoring site ID is 30-081-0007.

Regardless of the year, the PM_{2.5} concentrations measured in Hamilton were lower than in those Missoula. During the years with concentrations greater than 35 µg/m³, Hamilton had about 4% lower concentrations. However, during 2006, the 98th percentile PM_{2.5} concentration was about 19% lower. For the three-year period average, the concentration in Missoula was over 9% higher than for Hamilton. The concentrations and corresponding days that determined the 98th percentile listed in Table 1 are given in Table 2 and are noted by asterisks (*) including any additional days with PM_{2.5} concentrations greater than 20 µg/m³ measured at either monitoring site. Any concentration that was affected by wildfires and flagged is noted by “F”. The dates that both Hamilton and Missoula monitoring sites collected samples with PM_{2.5} concentrations greater than 35 µg/m³ are emphasized in this table by bold font in addition to the corresponding concentrations. Yellow highlighted days indicate PM_{2.5}

⁴ 65 FR 249. Office of Management and Budget. Standards for Defining Metropolitan and Micropolitan Statistical Areas; Notice. December 27, 2000. ONLINE: (<http://www.census.gov/population/www/estimates/00-32997.pdf>).

⁵ 69 FR 110. EPA. Rural Business Investment Program. June 8, 2004. ONLINE: (<http://www.epa.gov/fedrgstr/EPA-IMPACT/2004/June/Day-08/i12731.htm>).

⁶ U.S. Census Bureau. Current Lists of Metropolitan and Micropolitan Statistical Areas and Definitions. ONLINE: (<http://www.census.gov/population/www/estimates/metrodef.html>).

concentrations were dissimilar between the two sites.

Table 2. Dates and PM_{2.5} Concentrations $\geq 20 \mu\text{g}/\text{m}^3$ in Hamilton & Missoula, 2004 – 2006.

Date	PM _{2.5} Concentration ($\mu\text{g}/\text{m}^3$)		Date	PM _{2.5} Concentration ($\mu\text{g}/\text{m}^3$)	
	Hamilton	Missoula		Hamilton	Missoula
1/1/2004	44.7 ^{*2}	28.0	1/19/2005	1.7	62.5 [*]
1/7/2004	30.0	29.8	1/25/2005	19.5	27.1
1/10/2004	64.0 [*]	55.4 [*]	1/28/2005	15.1	25.8
1/13/2004	38.6	ND ³	8/8/2005	21.8F ⁴	30.8F
1/16/2004	45.5 [*]	62.3 [*]	8/29/2005	ND	24.9F
1/19/2004	41.7	46.8 [*]	11/18/2005	21.0	29.4
1/22/2004	12.2	28.0	11/21/2005	ND	21.2
2/15/2004	7.7	30.8	11/30/2005	3.2	20.2
2/18/2004	12.0	20.8	12/9/2005	ND	42.5 [*]
10/27/2004	ND	28.3	12/12/2005	52.8 [*]	54.0 [*]
11/5/2004	16.9	31.7	12/18/2005	21.3	ND
11/11/2004	22.0	14.8	12/24/2005	5.2	21.8
11/17/2004	15.7	22.8	2/13/2006	ND	24.4
11/23/2004	10.0	22.1	3/6/2006	21.5	19.4
12/14/2004	19.9	23.5	8/30/2006	ND	34.3 ^{*F}
12/17/2004	15.4	36.6	11/28/2006	ND	43.2 [*]
12/26/2004	19.7	25.2	12/4/2006	ND	21.5
12/29/2004	ND	28.0	12/7/2006	30.5 [*]	26.2
1/4/2005	27.7	19.2	12/10/2006	ND	36.2 [*]
1/7/2005	29.4	10.0	12/19/2006	27.8 [*]	17.1
1/10/2005	40.7 [*]	20.6	12/22/2006	ND	30.2
1/16/2005	37.3	30.8			

¹ $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter.

² "*" denotes the values that were used in the 98th percentile compliance calculation.

³ "ND" = no data collected.

⁴ "F" denotes the value was influenced by wildfire, but not eligible for exclusion by EPA.

Over 40% of the days in Table 2 when PM_{2.5} concentrations were greater than 35 $\mu\text{g}/\text{m}^3$, the fine particulate concentrations were grossly dissimilar between the two sites when ignoring the influence of wildfires. Almost 35% of the remaining dates, the Missoula PM_{2.5} monitor recorded higher concentrations in comparison to about 24% when Hamilton recorded higher PM_{2.5} concentrations.

As displayed in Table 2, Ravalli County recorded six days greater than 35 $\mu\text{g}/\text{m}^3$ over the three years, whereas Missoula County recorded nine days greater than this concentration. Therefore, there were nine total days with PM_{2.5} concentrations greater than 35 $\mu\text{g}/\text{m}^3$ measured at both monitoring sites. Three days out of nine (33%) were common for both sites: 1/10/04, 1/16/04, and 12/12/05. On 1/10/04 and 12/12/05, the

concentrations were within about 2% of each other. On 1/16/04, the PM_{2.5} concentration measured in Missoula was about 37% higher than in Hamilton.

Table 3 illustrates the compliance calculation for the annual PM_{2.5} standard of 15.0 µg/m³ for both Ravalli and Missoula. Note that the annual means in this table are arithmetic means and not calculated using the required technique as described in 40 CFR Part 50 Appendix N. As seen from Table 3, neither county came close to violating the annual PM_{2.5} standard.

Table 3. Arithmetic PM_{2.5} Annual Mean Compliance Calculation.

City - County	Year			Average ² (µg/m ³)
	2004 (µg/m ³) ¹	2005 (µg/m ³)	2006 (µg/m ³)	
Hamilton - Ravalli	8.53	8.94 ³	8.34	8.60
Missoula - Missoula ⁴	10.7	11.09	9.50	10.43

¹ µg/m³ = micrograms per cubic meter.

² The final site averages for the annual standard were based on the 3 year period from 2004 through 2006.

³ The current site (30-081-0007) didn't meet data completeness requirements in 2005 because the monitor was moved from the original Ravalli County monitoring site (30-081-0001). The 2005 data represents combined data from both of these sites to estimate the annual average value.

⁴ The Missoula PM_{2.5} monitoring site ID is 30-081-0007.

The concentrations of PM_{2.5} in the ambient air also include secondary fine particles. Secondary particulates form as a result of the interaction of precursor emissions of ammonia (NH₃), nitrous oxides (NO_x), sulfur dioxide (SO₂), and volatile organic carbons (VOC or VOCs). Therefore, for Factor 1, DEQ reviewed the annual emissions in tons per year (tpy) from these secondary fine particulates in addition to the crustal PM_{2.5} for Ravalli and adjacent counties based on the 2001 National Emission Inventory (NEI) as shown in Table 4. The primary and filterable PM_{2.5} emissions were combined to characterize the crustal PM_{2.5} emissions. Table 4 also displays the proportion of the annual emissions from the surrounding counties relative to the Ravalli County emissions.

The emissions in Table 4 represented four general source categories: point, area, onroad mobile, and nonroad mobile. Onroad mobile emissions occurred on both paved and unpaved roads. The nonroad sources included 2- and 4- stroke and diesel engines, construction equipment, aircraft, and locomotives. Area sources included residential wood combustion (wood stoves, etc.), residential fossil fuel combustion, and agriculture (including field burning). It should be noted that these emissions should be evaluated proportionally since DEQ did not submit state-specific data for the 2001 NEI. The state of Idaho did submit area source data, but only some point source data.

Table 4. Estimated Emissions of SO₂, NO_x, VOC, NH₃, and PM_{2.5} in 2001 in Ravalli and Adjacent Counties.¹

County - State	State + County FIPS ²	SO ₂ (tpy) ³	Percent of Ravalli (%)	NO _x (tpy)	Percent of Ravalli (%)	VOC (tpy)	Percent of Ravalli (%)	NH ₃ (tpy)	Percent of Ravalli (%)	Crustal PM _{2.5} (tpy)	Percent of Ravalli (%)	Total (tpy)	Percent of Ravalli (%)
Ravalli - MT	03-081	157	NA ⁴	2,147	NA	2,518	NA	1,072	NA	5,327	NA	11,221	NA
Beaverhead - MT	30-001	228	145.2	1,877	87.4	2,147	85.3	3,560	332.1	3,663	68.8	11,475	102.3
Granite - MT	30-039	166	105.7	2,038	94.9	802	31.9	710	66.2	1,506	28.3	5,222	46.5
Missoula - MT	30-063	824	524.8	11,209	522.1	7,191	285.6	515	48.0	7,532	141.4	27,271	243.0
Idaho - ID	16-049	1,441	917.8	6,267	291.9	15,473	614.5	2,455	229.0	26,472	496.9	52,108	464.4
Lemhi - ID	16-059	749	477.1	3,188	148.5	7,686	305.2	1,947	181.6	12,350	231.8	25,920	231.0

¹ EPA. Criteria Pollutant Emissions Summary Files, 2001. File: sccsummarymade09192005.txt. ONLINE:

(ftp://ftp.epa.gov/pub/EmissionInventory/nei_criteria_summaries/2001criteria_summaryfiles/).

² The five character state and county codes are assigned by the Federal Identification Program System (FIPS).

³ tpy = tons per year.

⁴ NA = Not Applicable.

For the 2001 NEI, only Granite County had less total emissions than Ravalli County. About 50% of the 2001 NEI estimated Ravalli County emissions were crustal and the other fraction was composed of the precursor emissions for secondary particulate formation. The very high Idaho County PM_{2.5} emissions were due to wildfire activities. In comparison to Missoula County, the Ravalli County emissions were about 40%. Table 5 lists the source contributions by pollutant for each county as determined by the 2001 NEI.

Table 5. Percent Source Contributions to SO₂, NO_x, VOC, NH₃, and PM_{2.5} Emissions in Ravalli & Surrounding Counties.¹

Pollutant	Source Type	Percentage Source Contribution by County (%)					
		Ravalli - MT	Beaverhead - MT	Granite - MT	Missoula - MT	Idaho - ID	Lemhi - ID
SO ₂	Point	0.0	0.4	0.0	21.8	0.2	0.0
	Area	59.3	70.7	34.3	35.8	95.3	97.2
	Onroad Mobile	31.8	10.5	5.4	10.6	1.2	0.9
	Nonroad Mobile	8.9	18.4	60.3	31.8	3.3	1.9
NO _x	Point	0.0	1.3	0.0	26.8	0.1	0.0
	Area	20.4	32.6	10.9	18.2	84.7	89.9
	Onroad Mobile	73.1	46.2	15.7	23.6	8.8	6.6
	Nonroad Mobile	6.5	19.9	73.4	31.5	6.4	3.5
VOC	Point	0.0	0.0	0.0	14.6	0.4	0.0
	Area	58.9	74.4	67.6	51.4	95.3	91.7
	Onroad Mobile	33.0	17.4	17.3	24.2	1.9	1.5
	Nonroad Mobile	8.1	8.2	15.1	9.8	2.4	6.8
NH ₃	Point	0.0	0.0	0.0	0.2	0.0	0.0
	Area	95.9	99.4	98.8	83.9	99.4	99.6
	Onroad Mobile	4.0	0.6	1.1	15.7	0.6	0.3
	Nonroad Mobile	0.1	0.0	0.1	0.2	0.0	0.1
Crustal PM _{2.5}	Point ²	0.0	0.6	0.0	22.8	0.5	0.0
	Area ²	99.0	97.8	96.6	74.8	99.3	99.9
	Onroad Mobile ³	0.7	0.5	0.5	0.7	0.0	0.0
	Nonroad Mobile ³	0.3	1.1	2.9	1.7	0.2	0.1

¹ NEI = National Emission Inventory; EPA. Criteria Pollutant Emissions Summary Files. 2001. File: tier3summarymade09082005.txt. ONLINE:

(ftp://ftp.epa.gov/pub/EmissionInventory/nei_criteria_summaries/2001criteria_summaryfiles/).

² Crustal PM_{2.5} point and area included both the primary and filterable PM_{2.5}.

³ Crustal PM_{2.5} onroad and nonroad mobile were primary PM_{2.5} only.

Most of the annual PM_{2.5} emissions in Ravalli County were from area sources, primarily re-entrained road from unpaved roads followed by onroad mobile sources. Over 70% of the Ravalli County NO_x emissions were from onroad mobiles sources. Cattle husbandry was almost 84% of the ammonia emissions and almost 40% of the VOCs emissions were from wildfires, which cannot be considered when determining the NAA boundary. In 2001, the Ravalli County had no significant point sources; PM_{2.5} emissions from the current three point sources are discussed in Factor 9.

Another large source of PM_{2.5} emissions in Ravalli County occurs during the spring through fall seasons from wildland fires and prescribed burning activities in the surrounding timber and rangelands. Long distance transport of fire activities in Idaho also impact Ravalli County. Emissions from prescribed burning are currently addressed under the Montana/Idaho State Airshed Group. Emissions from wildfires are also addressed through the Exceptional Events Rule whereby states may flag monitoring data that was adversely influenced by exceptional events, e.g., smoke from wildfires. If EPA concurs with the flagged data, then that data is not considered in compliance decisions, i.e., nonattainment determinations.

Due to the topographical features and meteorology described later, DEQ believes by proposing the entire county as the PM_{2.5} NAA, one captures all of the sources that did or will cause or contribute to exceedances of the 24-hour PM_{2.5} NAAQS in Ravalli County.

Factor 2: Air Quality in Potentially Included Versus Excluded Areas

During the 2004 - 2006 time period, federal reference method (FRM) PM_{2.5} data was collected in only two of the six counties (Ravalli and Missoula). However, other data sources are available to compare the emission sources in Ravalli and Missoula Counties.

A PM_{2.5} chemical mass balance (CMB) study was conducted in Hamilton from November 7, 2006 through February 27, 2007.⁷ The objective was to identify the PM_{2.5} sources in the Bitterroot Valley airshed during the four winter months (November through February) when the highest PM_{2.5} concentrations occur. The CMB study was designed to only collect samples once every six days, but unfortunately, only 11 of the proposed 19 samples were collected due to sampling errors. Therefore, additional samples will be collected during the 2007 - 2008 winter season.

The PM_{2.5} concentrations of the 11 CMB samples averaged 11.6 µg/m³ with the highest concentration of 30.5 µg/m³ being measured on December 7, 2006. Based on the results of the CMB model runs, on the average, emissions from residential wood combustion (RWC) accounted for 84% (83.6%) of the PM_{2.5} mass, with only 2% explained by automobile emissions. Ammonium nitrate, a secondary particle, averaged 13%. On the highest PM_{2.5} concentration day during the CMB study, RWC and ammonium nitrate averaged approximately 84% and 17%, respectively, of the explained PM_{2.5} mass. The area emissions of ammonia (from cattle) and NO_x (from motor vehicles) estimated by the 2000 NEI probably contributed to the ammonium nitrate identified by this CMB study.

Simultaneously with the Hamilton CMB study another CMB study was conducted in

⁷ Ward, Tony J. August 1, 2007. The Hamilton, Montana PM_{2.5} Source Apportionment Research Study. Center for Environmental Health Sciences. The University of Montana – Missoula. Skaggs Building 17B. Missoula MT 59812.

Missoula.⁸ Again, the objective was to identify the emission sources and estimate their contributions to the ambient PM_{2.5} concentrations measured in the Missoula Valley during the four winter months of November, December, January and February. Just like most of western Montana, including the Bitterroot Valley, this is the period when the highest PM_{2.5} concentrations occur, except for those years with bad wildfires during the summer months. In the Missoula CMB study, 26 samples were successfully collected and analyzed.

The PM_{2.5} concentrations of the 26 Missoula CMB samples averaged 15.4 µg/m³ with the highest concentration of 43.2 µg/m³ being measured on November 28, 2006. Unfortunately for comparison purposes, a corresponding Hamilton CMB sample was not collected the same day. Based on the results of the CMB model runs, on the average, emissions from RWC accounted for 56% (55.5%) of the PM_{2.5} mass, with only 1% explained by automobile emissions. Ammonium nitrate, a secondary particle, averaged 19%. On the highest PM_{2.5} concentration day during the Missoula CMB study, RWC and ammonium nitrate contributed approximately 60% and 10%, respectively of the explained PM_{2.5} mass. On December 7, 2006, the day that measured the highest PM_{2.5} concentration during the Hamilton CMB study, an error occurred in the data at the Missoula CMB site.

Four emission source profiles were common to both CMB studies: automobiles, ammonium nitrate, RWC and street sand. The Hamilton study used one other source profile, secondary sulfate, and about 2% of the average PM_{2.5} concentration was attributed to that emission source profile. It is important to note that secondary sulfate particles are not directly emitted by sources, but form in the atmosphere. The Missoula CMB study identified three different emission sources that were relatively significant contributing sources to the ambient PM_{2.5} concentrations in Missoula. These three sources were NOT identified in the Hamilton CMB study. These three sources and their relative contributions were:

- Diesel (~ 5%)
- Kraft recovery boiler (~ 7%), and
- Hog fuel boilers (~ 12%).

Relative to Hamilton, the diesel contribution is explained by the differences in motor vehicle populations (long haul heavy duty truck traffic on Interstate 90) and the presence of a main railroad line (with switching yard) in the Missoula Valley. A major point source in the Missoula Valley, Smurfit-Stone Container Corporation, uses both types of boilers that were identified in the CMB study. The diesel and the boiler emission source profiles were NOT identified in the Hamilton CMB analyses. This fact indicates there is very little or no exchange of air between the Missoula and Bitterroot Valleys during the wintertime when the highest PM_{2.5} concentrations are traditionally monitored.

⁸ Ward, Tony J. September 1, 2007. The Missoula, Montana PM_{2.5} Source Apportionment Research Study. Center for Environmental Health Sciences. The University of Montana – Missoula. Skaggs Building 17B. Missoula MT 59812.

Factor 3: Population Density and Degree of Urbanization Including Commercial Development In Included Versus Excluded Areas

According to the 2000 U.S. Census, Ravalli County had a total area of 2,394.21 square miles (mi²) or 6,201.00 square kilometers (km²). The total 2000 population was 36,070 residing in 14,289 occupied households (15,496 total housing units or 92% occupancy) within 10,182 families. Using this information for 2000, the population density is estimated to be approximately 15.1/mi² (5.8/km²) with an average housing density of approximately 6.5/mi² (2.5/km²).⁹ However, only about 25% of the land in Ravalli County is privately-owned, therefore the population and average housing densities was actually about 60/mi² and 26/mi², respectively, in the year 2000. The 2000 U.S. Census data relating to population, number of housing units, number of occupied housing units, and percentage of occupancy for the seven communities in Ravalli County is provided in Table 6.

Table 6. Ravalli Community, Population & Housing Unit Occupancy Data, 2000.¹

Community	Population	Number of Housing Units	Number of Occupied Housing Units	Percent Housing Occupancy (%)
Corvallis CDP ²	443	198	185	93.4
Darby Town ³	710	2,316	279	88.3
Florence CDP	901	336	323	96.1
Hamilton City ^{4,5}	3,705	1,915	1,772	92.5
Pinesdale Town	742	149	139	93.2
Stevensville Town	1,553	711	652	91.7
Victor CDP	859	375	351	93.6

¹ U.S. Census Bureau Quickfacts Report. 2000. Table DP-1. Profile of General Demographic Characteristics: 2000. ONLINE: (<http://quickfacts.census.gov/cgi-bin/qfd/demolink?30>).

² CDP = Census Designated Place(s); a geographic unincorporated place; a statistical definition assigned by the Office of Management and Budget (OMB) and used by the U.S. Census Bureau.

³ Town = a type of geographic incorporated place with local government; a statistical definition assigned by the Office of Management and Budget (OMB) and used by the U.S. Census Bureau.

⁴ City = a type of geographic incorporated place with local government; a statistical definition assigned by the Office of Management and Budget (OMB) and used by the U.S. Census Bureau.

⁵ County seat.

The total 2000 population of these seven communities was 8,913 or about 25% of the

⁹ Census and Economic Information Center. Montana Department of Commerce. Demographic & Economic Information for Ravalli County. ONLINE: (http://www.ourfactsyourfuture.org/admin/uploadedPublications/1598_Ravalli_CF06_Web.pdf).

Ravalli County total. Currently, there are only four incorporated towns in Ravalli County: Darby, Hamilton, Pinesdale, and Stevensville. Together in 2000, these four communities contained about 19% of the Ravalli County population. Another six communities are located in Ravalli County, but were not listed in Table 6 since 2000 U.S. Census data were unavailable: Alta, Connor, Grantsdale, Lost Trail Camp, Sula, and Woodside. All communities are included in the proposed PM_{2.5} Ravalli County nonattainment area.

Table 7 provides the land area, estimated 2004 through 2006 populations, and 2006 population densities for Ravalli and adjacent counties. Most of these counties had very low population densities (~2 people/mi²) except for Ravalli and Missoula Counties. In those two counties the population densities are significantly higher (~ 8.5 times higher), and the Missoula County population density was two times higher than Ravalli County. Approximately 75% of the land in Ravalli County is public, mostly U.S. Forest Service, with only about 25% privately owned (Figure 2). Thus, the potential for commercial and residential development is relatively limited in Ravalli County.

Table 7. Land Area and Population for Ravalli & Adjacent Counties.

County - State	Land Area (mi ²) ¹	2004 Population	2005 Population	2006 Population	2006 Density (persons/mi ²)
Ravalli - MT ^{2, 3}	2,394.21	39,417	39,822	40,582	~ 17 (16.95)
Beaverhead - MT ^{2, 3}	5,542.31	8,832	8,778	8,743	< 2 (1.58)
Granite - MT ^{2, 3}	1,727.44	2,893	2,932	2,909	< 2 (1.68)
Missoula - MT ^{2, 3}	2,597.97	99,031	100,033	101,417	~ 39 (39.04)
Idaho - ID ^{4, 5}	8,484.88	15,637	15,659	15,762	< 2 (1.86)
Lemhi - ID ^{4, 5}	4,564.16	7,827	7,868	7,930	< 2 (1.74)

¹ mi² = square mile.

² Census and Economic Information Center. Montana Department of Commerce. 2000 U.S. Census. CENSUS 2000 PUBLIC LAW 94-171 REDISTRICTING DATA – PLACE. ONLINE: (<http://ceic.mt.gov/C2000/PL2000/PLcountyarea.pdf>).

Census and Economic Information Center. Montana Department of Commerce. Components of Change and Total Population. Table 1. Annual Estimates of the Population, 2000-2006. ONLINE: (<http://ceic.mt.gov/Demog/estimate/pop/County/CO-EST2006-01-30.htm>).

⁴ U.S. Census Bureau. 2000 U.S. Census. State and County QuickFacts. ONLINE: (<http://quickfacts.census.gov/qfd/states/16000.html>).

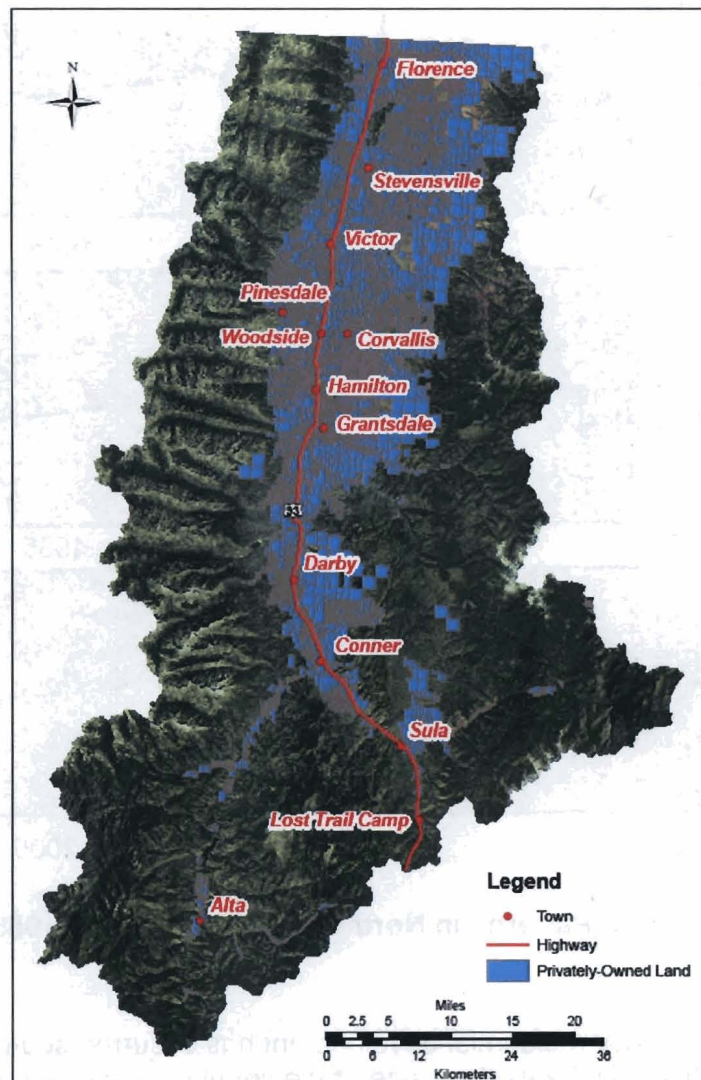


Figure 2. Privately Owned Land in Ravalli County.

The Missoula City-County Health Department provided the maps that are displayed in Figure 3. Although the entire Ravalli County was not included, the northern-most area adjacent to Missoula County is displayed. The red areas primarily indicate residences.

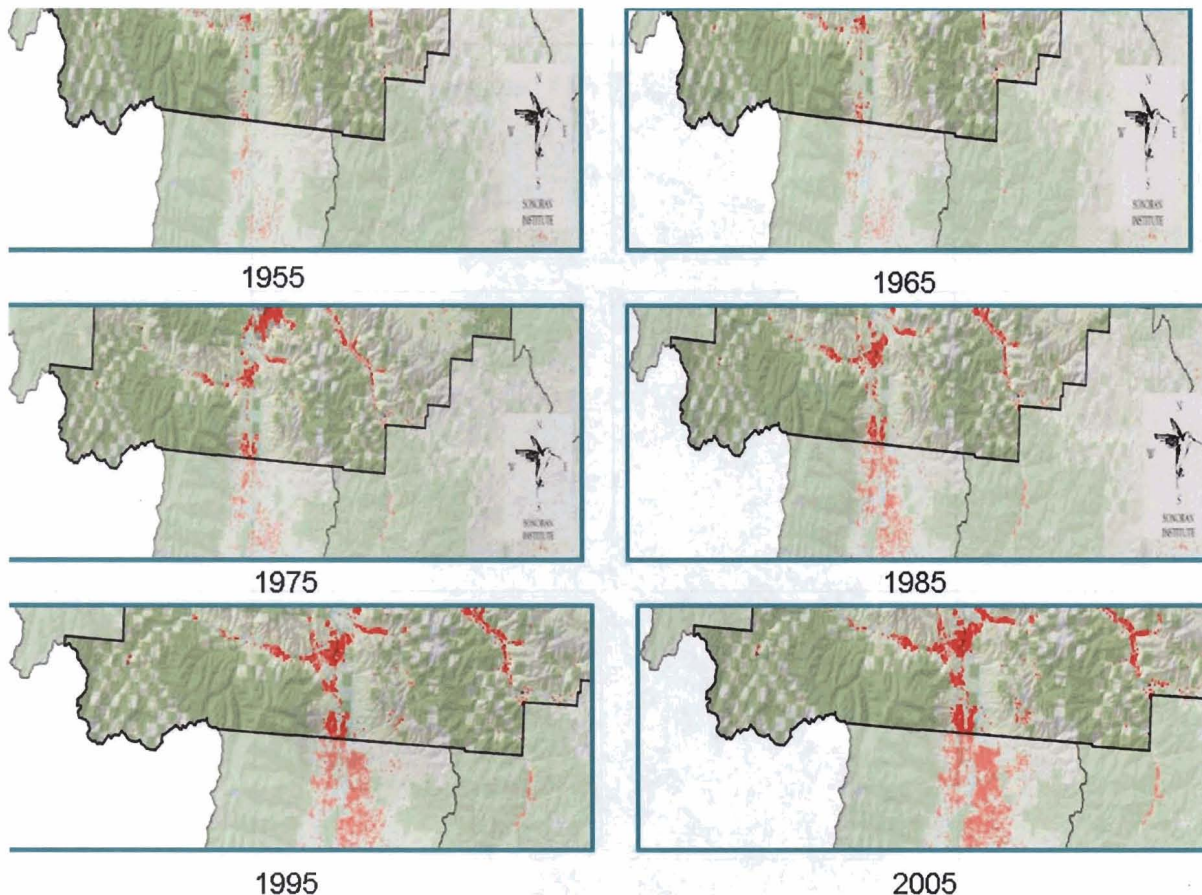


Figure 3. Growth Patterns in Northern Ravalli County, 1955 - 2005.¹

¹ Courtesy: Sonoran Institute.

As seen in Figure 3, heavy residential development has occurred south of Missoula into Ravalli County, particularly the eastern side of the county. Some land looks open for growth, but Ravalli County is still in the process of developing the zoning regulations (<http://www.ravallcounty.mt.gov/planning/Zoning.htm>).

Historically, the economy of Ravalli County relied predominantly on agriculture and timber. Logging operations supplied lumber to support area mining activities. However, the current Ravalli County economy primarily stems from retail trade. Other significant sectors include:

- Health Care and Social Assistance,
- Educational Services, Manufacturing, and
- Accommodation & Food Services (related to tourism).

However, the sectors that have seen the most growth in recent years are related to wholesale trade. They include Arts, Entertainment and Recreation, Mining, and

Construction, all of which have shown double-digit growth from 2004 to 2005.¹⁰

The new business growth in Ravalli County indicates commercial and industrial development. Table 8 lists the number of business establishments, number of employees, and sales receipts for Ravalli County in 1992, 1997, and 2002.

Table 8. Business Growth in Ravalli County: 1992, 1997, and 2002.¹

Business Characteristic	1992	1997	2002	1992 – 1997 Annual Percent Increase (%)	1992 – 2002 Annual Percent Increase (%)
Number of Establishments	504	624	843	4.8	6.7
Number of Employees	3,400	4,433	5,685	6.1	6.7
Sales Receipts (\$Million)	320	525	625	9.5	9.5

¹ U.S. Census Bureau. 1992. ONLINE: (<http://www.census.gov/epcd/www/92profiles/county/30081.TXT>).

² U.S. Census Bureau. 1997. ONLINE: (<http://www.census.gov/epcd/ec97/mt/MT081.HTM>).

³ U.S. Census Bureau. 2002. ONLINE: (<http://www.census.gov/econ/census02/data/mt/MT081.HTM>).

Over the ten year period from 1992 to 2002, Ravalli County had about a 7% annual increase in both number of establishments and employees, and 10% increase in million dollar sales receipts. However, as discussed earlier, most of these businesses were tourist-related with some construction and manufacturing. Based on the analysis for this factor, commercial development was and will probably continue to be limited due to unavailable land.

Factor 4: Traffic and Commuting Patterns

Ravalli County serves as a 'bedroom' community to the more urban northern Missoula area since Hamilton, the largest town in Ravalli County, is less than 50 miles away. Motor vehicle traffic movement north and south along U.S. Highway 93 is significant since alternative forms of transportation such as public transportation (bus service) is limited and light rail is nonexistent. Vehicle exhaust, and tire and brake wear are all

¹⁰ Census and Economic Information Center. Montana Department of Commerce. Research & Analysis Bureau. Demographics & Economic Information for Ravalli County. ONLINE: (http://www.ourfactsyourfuture.org/admin/uploadedPublications/1598_Ravalli_CF06_Web.pdf).

sources of PM_{2.5}; therefore, the commuting pattern of the Ravalli County residents is important to characterize.

The most recent ten years of data from the Montana Department of Transportation's (MDT) Automatic Traffic Recorders (ATR) on U.S. Highway 93 between Ravalli and Missoula Counties was analyzed. There were two ATR sites in Ravalli County:

- A-47 (north of Stevensville, which is closer to Missoula) and
- A-56 (north of Hamilton).

No ATR sites exist on U.S. Highway 93 between Missoula and the Ravalli County line. Table 9 lists the annual average daily traffic (AADT) for these sites for 1997 through 2006. It should be noted that the AADTs were adjusted by MDT for the time of year and day of the week.

Table 9. Annual Average Daily Traffic Growth on U.S. Highway 93, Ravalli County, 1997 – 2006.

Traffic Counter Code & Location	Year of AADT ¹										Annual Percent VMT Change (%) ²
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
A-47, north of Stevensville	7,973	8,8336	8,873	8,989	9,322	9,625	9,907	N/A ³	N/A	9,477	1.94
A-56, north of Hamilton	9,795	10,211	10,605	10,605	10,741	11,078	11,183	11,333	11,243	11,352	1.65

¹ AADT = annual average daily traffic; MDT. Statistics and Data. Montana's Automatic Traffic Recorders 2006. ONLINE: (<http://www.mdt.mt.gov/publications/docs/datastats/atr/atrbook06.pdf>).

² Annual VMT change = $(\text{EXP}((\text{LN}(D12/D11))/(\text{C12}-\text{C11}))) - 1$ (Cyra Cain, DEQ, personal communication, Al Vander Wey, Montana Department of Transportation, 2005).

³ N/A = Not Available.

In 2006, the ATR site closest to Missoula County (A-47) had lower AADT by about 17% than site A-56 which is further south in Ravalli County. However, the annual VMT growth was slightly higher at the more northern site (A-47) in Ravalli County. Taken together, the average VMT percent change for the two ATR sites in Ravalli County was approximately 1.80%. MDT's rural traffic flow map for Ravalli County with 2005 AADT data is shown in Figure 4. The map shows

slightly different traffic values than the recorders, but the traffic pattern is similar. The 2005 AADT map also shows data for traffic flow south of Hamilton. The numbers over the routes indicate total AADT with the truck AADT numbers listed underneath.



The AADT on U.S. Highway 93 between Hamilton and Connor (at the junction of US 93 and S-473) decreased significantly to approximately a third of the volume north of Hamilton. Continuing south to the Idaho border, the AADT decreased by approximately 75%.

Figure 4. Rural Traffic Patterns in Ravalli County, 2005.¹

¹ MDT. Montana Maps. 2005 Rural Traffic Flow Map. ONLINE: (http://www.mdt.mt.gov/travinfo/docs/2005_traffic_flow_map.pdf).

Another indicator of traffic patterns is the 'commuting to work characteristics' obtained from the 2000 U.S. Census. The U.S. Census Bureau classifies workers as 18 years and older. Table 10 gives the 2000 U.S. Census data pertaining to number of workers and their commuting patterns in Ravalli and adjacent counties.

Table 10. Commuting Patterns in Ravalli and Adjacent Counties.¹

County - State	Total Number of Workers	Number Working in Home County	Number Commuting to Ravalli County	Percent Commuting to Ravalli County (%)	Percent of Ravalli Workers Commuting to Other Counties (%)
Ravalli - MT	15,362	11,766	NA ²	NA	NA
Beaverhead - MT	4,403	4,126	5	0.1	< 0.0
Granite - MT	1,261	929	3	0.2	0.0
Missoula - MT	49,448	47,159	900	1.8	20.6
Idaho - ID	5,788	4,870	0	0.0	0.0
Lemhi - ID	3,097	2,999	0	0.0	0.0

¹ U.S. Census Bureau. County-to-County Worker Flow Files. 2000. ONLINE: (<http://www.census.gov/population/www/cen2000/commuting.html>).

Approximately 77% of the Ravalli County workers were employed in their home county while 21% (3,178) commuted to Missoula County. The remaining Ravalli County workers worked outside the area of interest. The Ravalli workers commuting to Missoula accounted for approximately 71% (6,356) of the 8,989 AADT in 2000 (Table 9). This projection is based on two assumptions:

- The 3,178 Ravalli County commuters did not carpool and
- They worked a traditional schedule (5 days/week and 50 weeks/year)

Essentially, the workers in the other adjacent counties did not commute to Ravalli County to work.

Factor 5: Growth Rates And Patterns

Ravalli County is projected to have the greatest population growth rate compared to the other adjacent counties, followed by Missoula County. The other adjacent counties are projected to have very low population growth rates. Table 11 shows the projected populations for Ravalli and adjacent counties from 2000 through 2030 in 5-year increments.

Table 11: Projected Populations for Ravalli & Adjacent Counties, 2000-2030, in 5-Year Increments.

County - State	U.S. Census	Estimated Census Data						2000 – 2030 Annual Percent Increase
	2000	2005	2010	2015	2020	2025	2030	
Ravalli - MT ¹	36,070	39,940	44,710	50,100	55,500	60,960	66,670	2.83
Beaverhead - MT ¹	9,202	8,773	8,920	9,260	9,630	10,070	10,570	0.50
Granite - MT ¹	2,830	2,965	3,160	3,250	3,360	3,510	3,670	0.99
Missoula - MT ¹	95,802	100,086	107,190	115,080	123,310	132,010	141,370	1.59
Idaho - ID ²	15,470	15,800	15,480	15,780	15,960	16,030	15,980	0.11
Lemhi - ID ²	7,750	7,940	8,430	9,060	9,660	10,200	10,720	1.28

¹ Census and Economic Center. Montana Department of Commerce. Montana Population Projections, Total Population. Source: NPA Data Services Inc. ONLINE: (http://ceic.mt.gov/Demog/project/NPAallcounties_1106_web.pdf).

² Alan Porter. Department of Labor. State of Idaho. Population Projections. October 3, 2007.

From 1970 to 2000, Ravalli County was one of the five fastest growing counties in Montana. The 1990s witnessed the largest population increases in Ravalli County and statewide. In the decade between 1990 and 2000, Ravalli County's population jumped by 44.2%, from 25,010 to 36,940. Montana's increased statewide from 799,065 to 902,195, a respectable 12.9% increase.

According to the Montana Department of Commerce's Census and Information Center (CEIC), from 1970 to 2000, Ravalli County experienced 178% increase in population in unincorporated areas compared to a 74% population increase in incorporated areas.¹¹ Interestingly, from 2000 through 2005, the percentages have changed and a higher proportion of the population is moving into incorporated areas (19%) compared to unincorporated ones (9%).¹²

Hamilton was the biggest town (population 2,499) at the start of that 1970 to 2000 period and it was still the largest with 4,443 people in 2000. Stevensville started that period with 829 people and ended with 1,553. Darby began with 538 and ended with 710. The first U.S. Census data for Pinesdale was collected in 1990 with a population of 670 being recorded. By 2000, Pinesdale's population had grown to 832 people.

Factor 6: Meteorology

The Missoula and Bitterroot Valleys have much in common, but some significant and important differences exist as well. Both valleys are located west of the Continental Divide, both have steep slopes limiting lateral dispersion, and both are subject to intense and long lasting stagnation periods with strong persistent temperature inversions in the lower atmosphere. These stagnation periods are the root cause of the high PM_{2.5} ambient levels that have been monitored in both areas.

Except for wildfire episodes during some summers, the highest PM_{2.5} concentrations were measured during the winter months when these temperature inversions are the strongest and most persistent. The problematic winter inversions are surface based during the night and elevated during the day. The inversions are typically very strong (+ 3 °C/100 meters or more) for the lowest 200 meters of the atmosphere during the nighttime hours into the early morning. During the late morning and afternoon, the atmosphere near the surface becomes somewhat adiabatic or at least isothermal for the lower 200-300 meters allowing some vertical mixing, but an elevated inversion remains in place trapping the pollutants in the valley over a period of several days, allowing the particulate levels to steadily rise until a synoptic event flushes the air out of the valley. During the nighttime hours when the surface-based inversion is the strongest, vertical mixing is almost nonexistent.

Smoke and other pollutants from area sources such as cars and woodstoves are trapped in a very shallow (10 - 30 meters) layer near the surface. This produces the characteristic "spike" of high hourly PM_{2.5} concentrations during the nighttime hours and during the morning commute.

¹¹ Census and Economic Information Center. INCORPORATED VERSUS UNINCORPORATED AREAS PERCENT CHANGE 1970 – 2000. ONLINE:

(http://www.ceic.mt.gov/graphics/Data_Maps/IncVsUninc1970-2000.pdf).

¹² Census and Economic Information Center. What the Numbers Say. ONLINE:

(http://www.ceic.mt.gov/Publications/Newsletter_Fall_Winter_06_07_Final.pdf).

Because of the vertical mixing issue, lateral dispersion is also severely limited during this period with many hours of “calm” wind speeds recorded at the surface. Winds aloft are totally decoupled from the surface by the stable inversion layer and there is almost no net transport of air out of either valley. Under these conditions, even “regional scale” pollutants like PM_{2.5} with high residence times aloft become local issues with steep lateral concentration gradients as pollution stays very near the emission sources. Diurnal drainage flows are the only sources of air movement under these conditions and they do little to provide any net transport. The bottoms of both valleys are relatively flat and, once minor flows reach the valley floors from the side canyons, downslope gravity winds are minimal.

The three big differences between the Bitterroot and Missoula Valleys are:

- SIZE
- SHAPE
- ORIENTATION

The Bitterroot is long, narrow, and oriented north/south. The Missoula valley is more bowl-shaped with five drainages converging before exiting out to the northwest. The minor amounts of drainage flows reaching the Missoula Valley from the Bitterroot under inversion conditions are very shallow and skirt the west edge of Missoula Valley in the low terrain before heading out past Frenchtown through the Clark Fork River Canyon. This physical separation of air from the Bitterroot Valley from the city of Missoula is why the CMB results from the two areas are so dissimilar. Specific weather analysis was evaluated and presented below.

Since the highest PM_{2.5} concentrations consistently occur during the winter months, this factor analysis focused on the months January, February, and December. Table 12 lists the minimum, maximum, and average ambient air temperatures by month and county for each year 2004 through 2006. The codes representing the sites in this table and other tables in this section are either WBAN (Weather-Bureau-Army-Navy) or COOP (Cooperative). The 5-digit WBAM acronym is used at National Climatic Data Center for digital data storage and general station identification purposes. The Philipsburg Ranger Station ID is a WIMS (Weather Information Management System) code. Further analysis of the specific meteorological conditions that occur during high PM_{2.5} concentration events is investigated later in this section.

Table 12: Wintertime Ambient Air Temperatures in Ravalli & Adjacent Counties, 2004 – 2006.

County – State (Site, ID)	Year	Ambient Air Temperature (°F) ¹								
		Minimum			Maximum			Average		
		January	February	December	January	February	December	January	February	December
Ravalli - MT (Stevensville, 247894) ²	2004	14.2	22.4	20.8	29.6	42.9	38.8	23.1	31.0	31.1
	2005	13.4	17.0	12.6	35.5	46.1	30.0	29.1	29.4	24.2
	2006	27.5	22.1	19.9	44.1	41.9	34.2	35.0	31.2	24.1
Beaverhead - MT (Dillon Airport, 24138) ³	2004	11.4	16.9	17.8	30.1	36.4	39.0	20.8	26.7	28.4
	2005	12.6	17.2	11.6	33.9	44.3	29.3	23.3	30.8	20.5
	2006	19.7	13.4	14.4	37.3	36.2	36.1	28.5	24.8	25.3
Granite - MT (Philipsburg Ranger Station, 243002) ²	2004	13.4	15.0	19.9	31.1	34.3	37.1	23.8	23.9	29.1
	2005	14.7	15.1	12.2	34.4	42.0	30.7	26.0	27.6	23.8
	2006	25.5	13.1	14.3	38.9	34.7	32.5	31.2	23.4	23.6
Missoula - MT (Missoula International Airport, 24153) ³	2004	14.8	21.9	22.9	27.0	36.8	36.5	20.9	29.4	29.7
	2005	14.5	20.2	12.6	29.5	41.5	26.5	22.0	30.9	19.6
	2006	27.7	18.8	18.9	40.3	36.9	32.7	34.0	27.9	25.8
Idaho - ID (Grangeville, 24139) ³	2004	24.1	25.4	26.0	35.4	39.3	40.5	30.0	32.6	33.4
	2005	24.5	24.4	21.0	39.2	44.3	35.0	32.1	34.5	28.3
	2006	30.1	22.7	22.3	42.6	39.6	37.5	36.6	31.4	30.2

¹ °F = degrees Fahrenheit.

² Western Regional Climate Center. Monthly Summary. ONLINE: (<http://www.raws.dri.edu/cgi-bin/rawMAIN.pl?mtMSTE>).

³ National Climatic Data Center. Monthly Summary. ONLINE: (<http://www.ncdc.noaa.gov/oa/ncdc.html>).

⁴ Incomplete data set, seven missing days.

Most of the average ambient air temperatures recorded in Ravalli County (Stevensville Ranger Station) during the winter months in 2004 through 2006 were higher than the corresponding temperatures measured at the Missoula International Airport in Missoula County. The one exception was the January average minimum air temperatures. In this case, the Stevensville Ranger Station temperatures were consistently lower than at the airport in Missoula. The ranger station and the airport elevations are 3,365 feet (~1,026 meters) and 3,192 feet (~973 meters), respectively, a difference of 173 feet (~53 meters). One would expect ambient air temperatures to decrease with increasing elevation. These data may indicate that the Missoula valley is experiencing atmospheric inversion layer conditions in which colder air is being trapped by warmer upper air conditions. The graphic representations of the each wintertime month (January, February, and December) minimum, average, and maximum ambient air temperatures by county for the years 2004 through 2006 are shown in Figure 5.

Figure 5. Minimum, Maximum and Average Winter Ambient Air Temperatures in Ravalli & Adjacent Counties, 2004 – 2006.

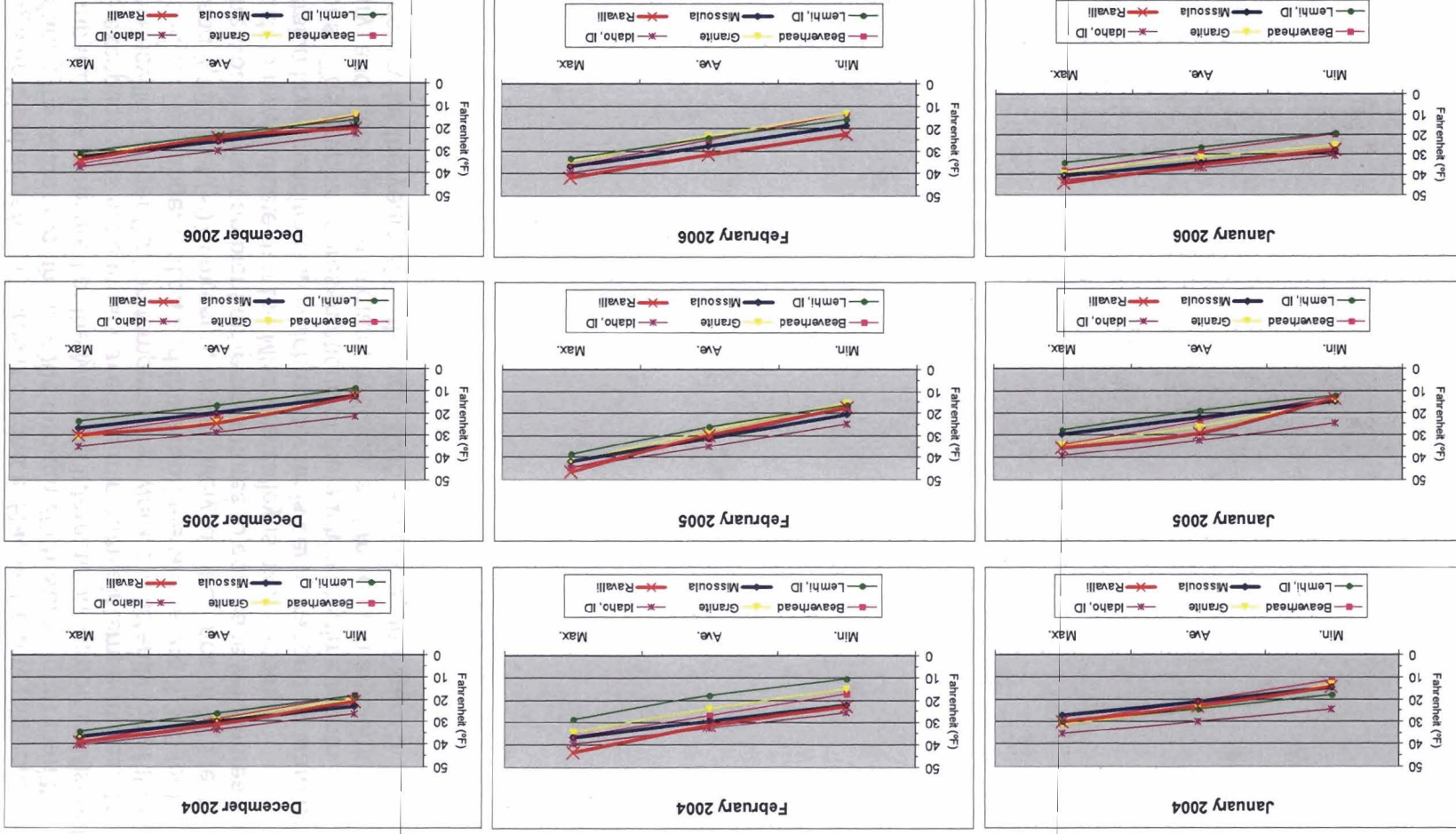


Table 13 provides the average prevailing wind directions and speeds for the combined winter months by county. The dominant wind directions for Ravalli County were from the south (25%) followed by southeast (16%), north (16%), and northeast (15%), respectively. Salmon (the seat of Lemhi County) is the closest substantial town south of Ravalli County, and Salmon is approximately 30 miles south of the Montana/Idaho border. For the Missoula Valley, the dominant wind directions were from the northwest, west, and southeast, respectively, and none of those directions toward Ravalli County. For the other adjacent Montana counties, the dominant wind direction was from the south. This analysis indicates that PM_{2.5} emissions within the adjacent counties do not significantly contribute to the high PM_{2.5} levels in Ravalli County.

Table 13. Prevailing Wintertime Wind Directions and Speeds for Ravalli & Adjacent Counties, 2004 – 2006.

County - State(Site, ID)	Wind Direction (%)								Average Wind Speed (mph) ¹
	N	NE	E	SE	S	SW	W	NW	
Ravalli - MT (Stevensville, 247894) ²	15.9	15.0	11.9	16.0	25.2	9.3	2.1	4.6	2.5 ³
Beaverhead - MT (Dillon Airport, 24138) ⁴	0.4	5.6	3.0	2.2	46.4	42.0	0.4	0.0	9.0
Granite - MT (Phillisburg Ranger Station, 243002) ²	4.7	7.4	9.3	19.5	51.0	5.4	2.3	0.4	3.7
Missoula - MT (Missoula International Airport, 24153) ⁴	8.1	2.2	11.4	19.9	7.8	4.8	21.4	24.4	3.7
Idaho - ID (Grangeville, 24139) ^{4, 5}	1.2	8.0	13.2	13.2	12.7	36.8	13.3	1.6	7.6
Lemhi - ID (Salmon County Airport, 24196) ⁴	75.4	2.0	2.8	7.0	5.5	3.8	1.9	1.6	3.2

¹ mph = miles per hour.

² RAWWS USA Climate Archive. ONLINE: (<http://www.rawws.dri.edu/>).

³ December 2006 data were unavailable.

⁴ National Climatic Data Center. Monthly Summary. ONLINE: (<http://www.ncdc.noaa.gov/oa/ncdc.html>).

⁵ Data were only available for December 2005, and January and February 2006.

For the final meteorological analysis, the air temperature data from days in Ravalli County with PM_{2.5} concentrations ≥ 35

$\mu\text{g}/\text{m}^3$ were evaluated. In addition, the air temperature data from the three corresponding high $\text{PM}_{2.5}$ concentration days in Missoula was also evaluated. Table 14 lists the corresponding minimum, maximum, and average ambient air temperatures for the days of interest.

Table 14. Air Temperature Data on High $\text{PM}_{2.5}$ Concentration Dates in Ravalli & Missoula Counties, 2004 – 2006.

County (Site, ID)	Date	Ambient Air Temperature ($^{\circ}\text{F}$) ¹		
		Minimum	Maximum	Average
Ravalli (Stevensville, 247894) ²	1/01/04	7	20	15
	1/10/04	11	28	18
	1/16/04	14	38	23
	1/10/05	11	25	17
	1/16/05	4	20	13
	12/12/05	2	20	10
Missoula (Missoula International Airport, 24153) ³	1/10/04	11	26	19
	1/16/04	13	30	22
	12/12/05	23	42	33

¹ $^{\circ}\text{F}$ = degrees Fahrenheit.

² RAWs USA Climate Archive. ONLINE: (<http://www.raws.dri.edu/>).

³ National Climatic Data Center. Monthly Summary. ONLINE: (<http://www.ncdc.noaa.gov/oa/ncdc.html>).

Of the three dates with high $\text{PM}_{2.5}$ concentrations in common to both counties, two days (1/10 and 1/16/04) exhibited similar ambient temperatures in contrast to the third day (12/12/05) which recorded relatively different temperatures. For the six, high $\text{PM}_{2.5}$ concentrations days in Ravalli County during 2004 - 2006, Table 15 characterizes the wind data (direction, average speed, and percentage of calms) measured by the Stevensville monitor. The wind data recorded in Missoula on their three high $\text{PM}_{2.5}$ concentration days in common with Ravalli County is also included in this table. Those three days in common were also emphasized in bold text under the Ravalli County section in Table 15.

Table 15. Wind Data on High PM_{2.5} Concentration Days in Ravalli & Missoula Counties, 2004 – 2005.

County (Site, ID)	Date	Percent of Time in Given Wind Direction (%)								Average Speed (mph)	Percent Calm (%)
		N	NE	E	SE	S	SW	W	NW		
Ravalli (Stevensville, 247894) ¹	1/01/04	8.4	0.0	4.2	12.5	20.8	25.0	12.5	16.6	1.1	42
	1/10/04	12.5	20.8	37.5	12.5	12.5	0.0	4.2	0.0	1.4	8
	1/16/04	4.2	12.5	12.5	25.0	25.0	4.2	8.3	8.3	1.2	29
	1/10/05	12.5	20.8	4.2	16.7	12.5	20.8	8.3	4.2	0.7	50
	1/16/05	36.3	13.6	13.6	4.6	13.6	4.6	4.6	9.1	0.9	46
	12/12/05	16.7	12.5	8.3	8.3	29.2	8.3	12.5	4.2	1.0	29
	OVERALL	15.1	13.4	13.4	13.3	18.9	10.5	8.4	7.0	1.1	34
Missoula (Missoula International Airport, 24153) ²	1/10/04	59.3	0.0	11.0	18.7	3.3	0.0	1.1	6.6	1.7	58
	1/16/04	0.0	0.0	0.0	0.0	0.0	< 1.0	0.0	0.0	0.1	99
	12/12/05	59.3	0.0	11.0	18.7	3.3	0.0	1.1	6.6	1.2	75
	OVERALL	59.3	0.0	11.0	18.7	3.3	0.0	1.1	6.6	1.0	77

¹ RAWs USA Climate Archive. ONLINE: (<http://www.raws.dri.edu/>).

² National Climatic Data Center. Monthly Summary. ONLINE: (<http://www.ncdc.noaa.gov/oa/ncdc.html>).

Generally, days with high PM_{2.5} concentrations have extremely low wind speeds accompanied with a high percentage of calm winds. This situation is especially common in the Missoula Valley. In the Bitterroot Valley, winds swirl about with no dominant direction. Under these conditions, it's highly unlikely for emissions to exchange between either county. It's highly probable that both counties experience the same atmospheric conditions, e.g. high pressure, which produce strong temperature inversions and result in high ambient PM_{2.5} concentrations.

Factor 7: Geography and Topography

Ravalli County is located on the western edge of Montana in a protected valley known locally as the 'Bitterroot Valley'. The Bitterroot Valley is orientated north-south between two mountain ranges: the Sapphires to the east and the Bitterroots to the west. The elevations range from 3,200 feet at the north end of the valley to 10,157 feet (ft) on Trapper Peak in the mountains at the south end of the valley. The elevations at the airports in Hamilton and Stevensville are 3,642 and 3,610 ft, respectively.¹³ The Bitterroot Valley is approximately 96 miles long and 20 miles wide at its mid-section, covering 2,394 square miles of land area. The Bitterroot River runs north from its source until it empties into the Clark Fork River in the Missoula Valley.

As seen in Figure 6, the topographic changes vary considerably between the northern and southern portions of the Bitterroot Valley. The isopleths in Figure 6 indicate elevations of 4,000, 5,000, and 7,000 feet. The northern end of the Bitterroot Valley is relatively flat and open, considerably wider than the southern portion with panoramic views overlooking agricultural land and towns. The southern end of the Bitterroot Valley narrows and is barely five miles wide where the Bitterroot River splits into the East and West Forks. The steep gradient of many hills prevents development since the Ravalli County subdivision regulations prohibits construction on any slopes 25% or greater (Cyra Cain, DEQ, personal communications, John Lavey, Ravalli County, October 1, 2007).

The topographic features surrounding Ravalli County make several of the nine factors insignificant for this proposed nonattainment area boundary analysis, especially those addressing adjacent population centers. For example, the entire Bitterroot Valley is outlined with mountains on either side. To the west lies the Bitterroot Mountain Range and the Selway-Bitterroot Wilderness Area. The west side of the valley is cut with numerous deeply-carved granite canyons, such as Blodgett Canyon. The nearest population center is the Lewiston-Orofino-Grangeville Idaho area located approximately 130 miles due west of Hamilton. To the south and east, the Sapphire Mountains and the Anaconda-Pintler Wilderness Area are also without significant population centers.

These topographic features and few surrounding population centers limit the predominant sources of particulate emissions to area sources within the Bitterroot Valley or those affecting the valley from adjacent forest lands in the form of smoke from outdoor burning or wildfires. As previously noted, particulate emissions from wildfires cannot be considered for determining nonattainment boundaries. However, for conservative purposes, DEQ included all of the forested lands in the public domain within the proposed Ravalli County PM_{2.5} nonattainment area.

¹³ AirNav.Com. Ravalli County and Stevensville airports. ONLINE: (<http://www.airnav.com/airport/6S5> and <http://www.airnav.com/airport/32S>).

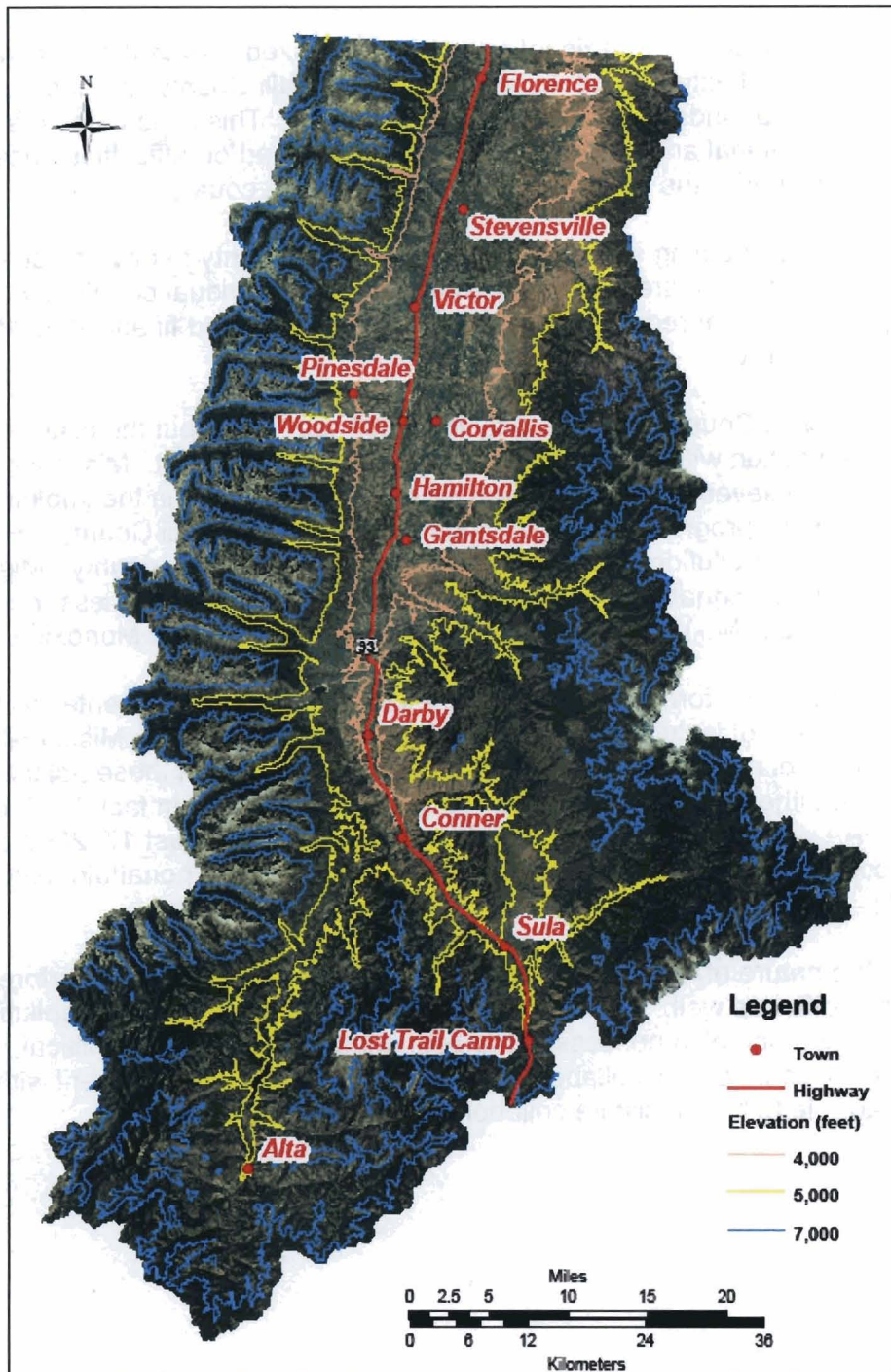


Figure 6. Map of Ravalli County Topography.

Factor 8: Jurisdictional Boundaries

Given the nature of PM_{2.5} as a regional rather than localized pollutant, the Ravalli County PM_{2.5} NAA will extend north to the Missoula-Ravalli County line and be contiguous with the boundary of the Missoula PM_{2.5} NAA. This action may create the potential for jurisdictional and enforcement opportunities and/or difficulties because these NAA remain under the separate jurisdictions of each county.

This necessity of maintaining separate NAA allows each county to develop strategies to reduce PM_{2.5} pollution that are most appropriate to each individual county and to implement processes that recognize the regulatory, political, and financial realities specific to each county.

Missoula and Ravalli Counties are not only physically separate, but the history of air pollution and regulation within each county is considerably different. Missoula has a long history of both severe air pollution and extensive experience in the implementation of a formal air quality program and regulations. In contrast, Ravalli County, to date, does not have an air pollution control program operating within the county. Missoula County is currently designated as nonattainment for particulate matter less than or equal to 10 microns (PM₁₀) and is in maintenance status for Carbon Monoxide (CO).

Notably, the current and former NAA boundaries for these pollutants center on the city of Missoula, and do not include the more remote parts of the county. Missoula County implemented control measures to reduce the emissions of both of these pollutants, and has not violated either of these standards since the early 1990s. In fact, the Missoula County CO NAA was officially redesignated to attainment on August 17, 2007 at 72 FR 46158. By contrast, Ravalli County has not been designated as nonattainment for any air pollutant.

Additionally, the nature of PM_{2.5} exceedances differs in each county. Therefore, control measures may differ as well. Each county understands the causes of air pollution within its own boundaries and also possesses the best understanding of the political landscape. Both counties will collaborate on control measure development with DEQ taking the lead role to help facilitate collaboration between counties.

Factor 9: Level of Existing Control of Emission Sources

No permitted major source with emissions exceeding 250 tons per year of any regulated pollutant is located within Ravalli County. However, three minor sources were permitted in the county during 2004-06: Bitterroot Pet Crematorium (AIRS #30-081-006), Rocky Mountain Laboratories (AIRS #30-081-005), and Specialty Surgical Products, Inc. (AIRS # 30-081-007). The acronym AIRS represents Aerometric Information Retrieval System. The Air Facility Subsystem (AFS) portion of the AIRS database is dedicated to tracking the information associated with permitted stationary sources of air pollution. These three facilities and associated emissions in tons per year for each year are given in Table 16. The listed air pollutants in this table are sulfur dioxide (SO₂), nitrogen dioxides (NO₂), volatile organic compounds (VOC), ammonia (NH₃), and PM₁₀. Since DEQ did not require reporting of fine particulates during the 2004 - 2006 time period, the particulate emissions in the AFS database were inventoried as PM₁₀, not PM_{2.5}.

Table 16. Estimated Actual Annual Emissions from DEQ-Permitted Minor Sources in Ravalli County for 2004-06.¹

Source	Pollutant (tons per year)																	
	2004						2005						2006					
	SO ₂	NO ₂	VOC	NH ₃	PM ₁₀	Total	SO ₂	NO ₂	VOC	NH ₃	PM ₁₀	Total	SO ₂	NO ₂	VOC	NH ₃	PM ₁₀	Total
Bitterroot Pet Crematorium	0.02	0.05	< 0.01		0.02	0.09	0.02	0.06	< 0.01		0.03	0.11	0.02	0.05	< 0.01		0.02	0.09
Rocky Mountain Labs	0.52	8.28	0.85	0.22	0.42	10.29	0.56	8.18	0.94	0.21	0.48	10.37	1.93	13.09	1.16	0.23	0.63	17.04
Specialty Surgical Products, Inc.			13.36			13.36			8.48			8.48			6.77			6.77

¹ DEQ. Emission Inventory Summary. DEQ Air Resources Management Bureau.

Combing all three minor industrial sources together, the total amount of emissions was less than 25 tons per year, regardless of the year. The DEQ believes these sources do not contribute a significant amount of PM_{2.5} emissions within the Bitterroot Valley airshed.

Figure 7 show the locations of the permitted industrial point sources, the local communities, the wilderness areas, and the U.S. Highway 93 in Ravalli County.

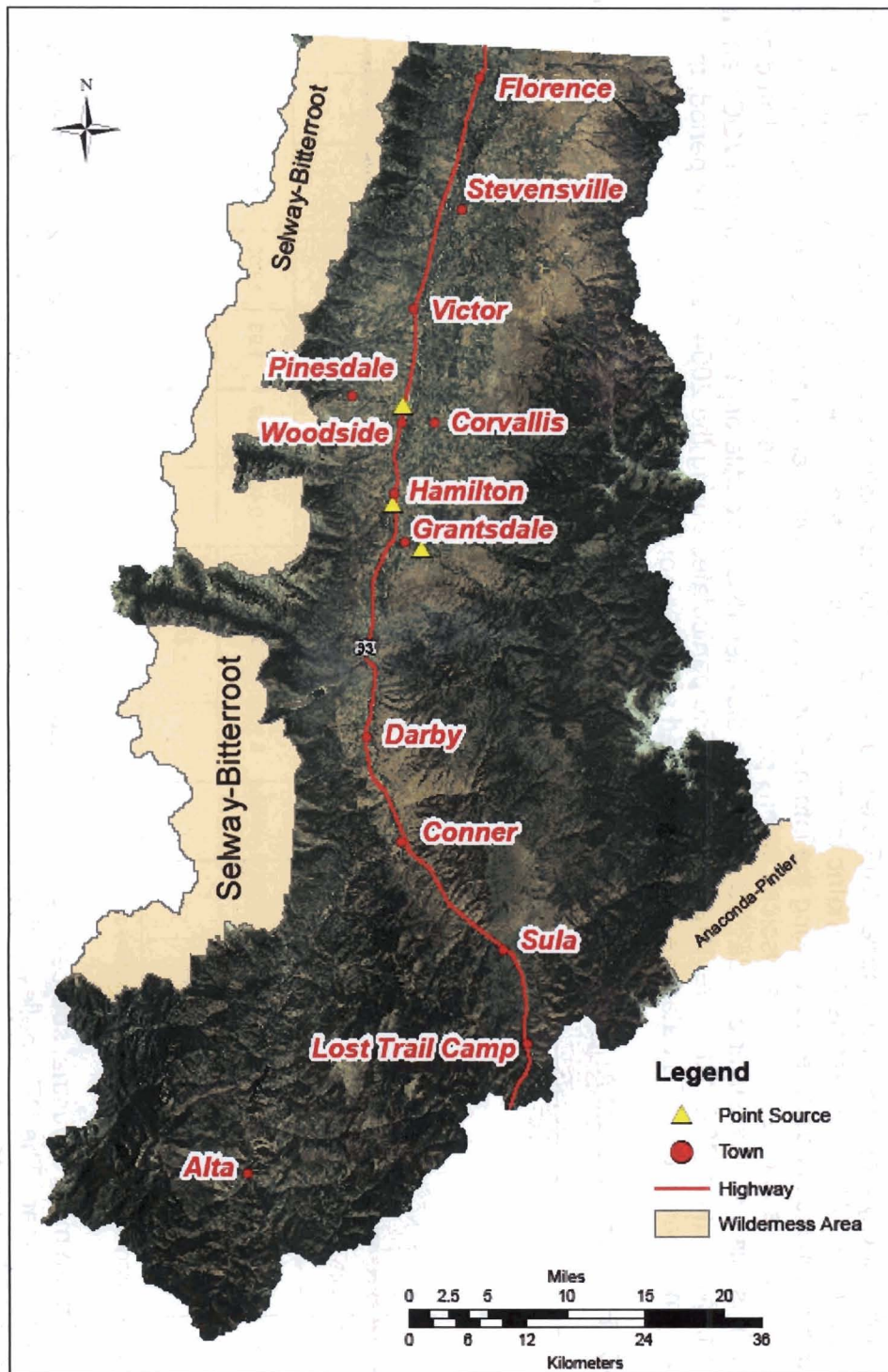


Figure 7. Industrial Point Sources and Wilderness Areas in Ravalli County.