Attachment 1

State of Alaska
Area Designations For the
24-Hour Fine Particle National Ambient Air Quality Standard

The table below identifies the boroughs in Alaska that EPA intends to designate as not attaining the 2006 24-hour fine particle (PM2.5) standard.[1] A borough or as appropriate a part of it will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the borough is determined to be contributing to the violation of the standard.

Area	**Alaska's Recommended Nonattainment Area**	**EPA's Intended Nonattainment Area**
City of Fairbanks	Part of Fairbanks North Star Borough (FNSB)	Expanded part of Fairbanks North Star Borough (FNSB)
Mendenhall Valley, Juneau	Part of Juneau Borough	Expanded part of Juneau Borough

EPA intends to designate the remaining boroughs in the state as "attainment/unclassifiable."

EPA Technical Analysis for Fairbanks

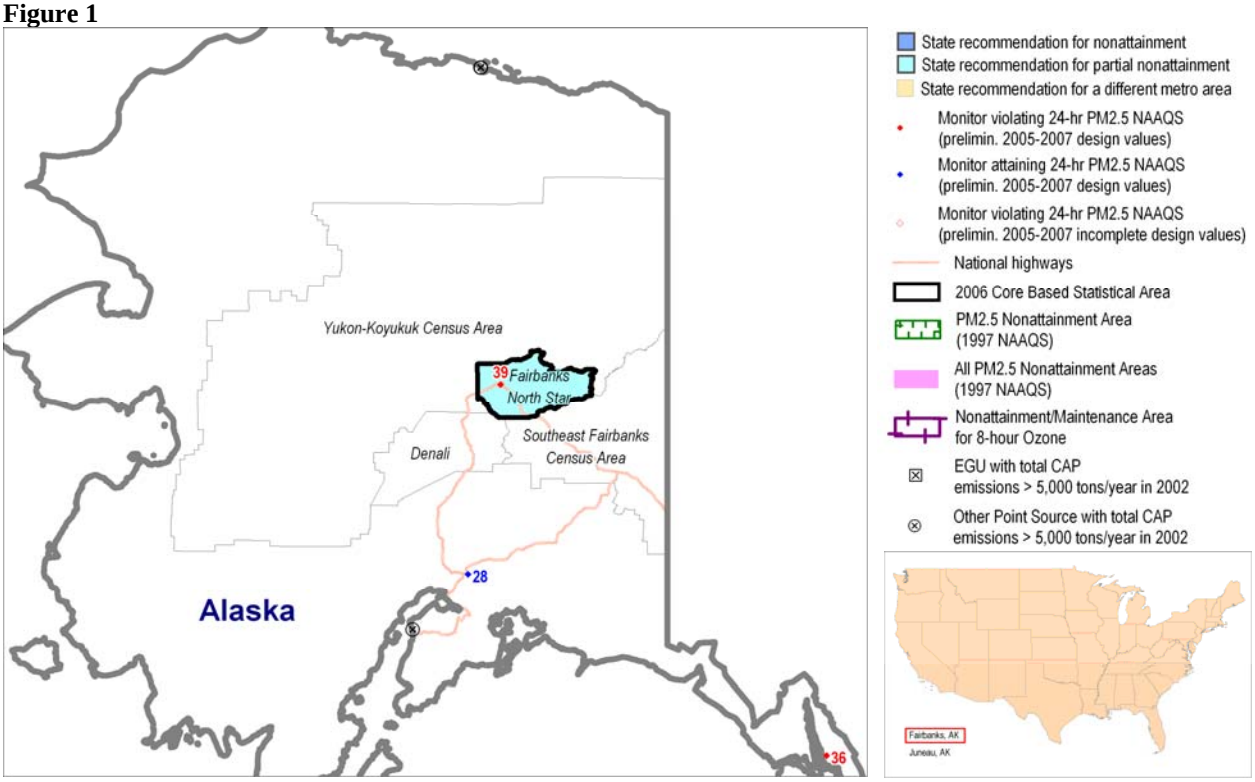
Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for Fairbanks identifies the boroughs with monitors that violate the 24-hour PM2.5 standard and evaluates the boroughs that potentially contribute to fine particle concentrations in the area. EPA has evaluated these boroughs based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

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

Figure 1 is a map of the boroughs in the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and boroughs recommended as nonattainment by the State.

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

Figure 1



In a letter submitted to EPA on December 18, 2007, the Governor of the State of Alaska and the Alaska Department of Environmental Conservation (ADEC) recommended that City of Fairbanks and areas surrounding it, within the Fairbanks North Star Borough, be designated as nonattainment for the 2006 24-hour $PM_{2.5}$ NAAQS. These data are from FRM and FEM monitors within the City of Fairbanks.

Air quality monitoring data on the composition of fine particle mass are available from the Positive Matrix Factorization[2] performed by the State of Alaska. Analysis of these data indicates that the days with the highest fine particle concentrations occur in the winter, and the average chemical composition of the highest days appears to be:

- secondary aerosol related (sulfate and nitrate),
- wood burning related emissions,
- an unidentified zinc-related source, and
- mobile emissions

Based on EPA's 9-factor analysis described below, EPA believes that an expanded part of Fairbanks North Star Borough should be designated nonattainment for the 24-hour $PM_{2.5}$ air quality standard based on air quality data from 2005-2007. These boroughs are listed in the table below.

Fairbanks Nonattainment Area	**State-Recommended Nonattainment Boroughs**	**EPA-Recommended Nonattainment Boroughs**
Alaska	Part of FNSB	Expanded part of FNSB

The State of Alaska recommended designating a portion of FNSB as nonattainment. EPA has taken this request under consideration, but finds that the information provided to date does not adequately support the State's recommended partial borough designation. Accordingly, a larger portion of FNSB is included in EPA's intended designation. EPA will consider any additional information provided by the State in making final decisions on the designations.

[2] A. Reff et al, "Receptor Modeling of Ambient Particulate Matter Data Using Positive Matrix Factorization: Review of Existing Methods," Journal of the Air and Waste Management Association, 57:146-154, February 2007.

The following is a summary of the 9-factor analysis for the EPA Region 10 portion of the Fairbanks Nonattainment area.

Proposed geographic boundaries for the Fairbanks $PM_{2.5}$ Nonattainment Area

Alaska's Recommendation

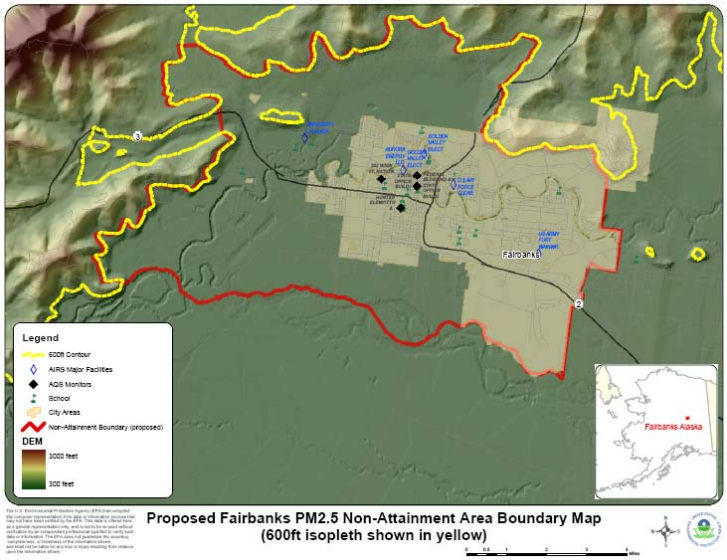


Figure 2: State of Alaska's Recommendation

Based on the 9 factors, ADEC, in consultation with the Fairbanks North Star Borough, submitted a boundary recommendation for the $PM_{2.5}$ nonattainment area in Fairbanks. The proposed boundary is depicted in the Digital Elevation Map above (outlined in red). ADEC submitted supplemental information and recommended that as data are collected over the next several years, this boundary could be further refined.

The State of Alaska proposed a nonattainment area that would be bounded on the south by the Tanana River. The western and northern boundary would be at the 600 foot elevation on the surrounding hills and ridges. The eastern boundary would also extend along at the 600 foot elevation level to the eastern edge of the Fairbanks city boundary (also the Fort Wainwright military reservation boundary). The eastern boundary would then continue south along the city boundary to the Tanana River. Figure 1 shows a map of the boundary proposed by Alaska.

The state's submission of emissions data, including identification of emission sources and the magnitude of emissions, seems to be inconclusive and incomplete. For example, there seem to several AIRS major sources to the south and east of the state's proposed boundary. The PMF analysis points to a significant sulfate contribution on the filter but the proposed boundaries do not adequately capture all sources of SO_2 in the region that could potentially contribute to formation of secondary SO_4 aerosols. The State also has not substantiated the exclusion of the City of North Pole, and sources located within, from the NAA boundary. The state's review of the complex meteorology and topography and chemical mechanisms that may be active during episodes that cause high $PM_{2.5}$ buildup and exceedances is inadequate to completely explain the nature of the events, the sources and pollution formation mechanisms that may contribute to exceedances of the 24-hour $PM_{2.5}$ NAAQS. The State's submission, taken as a whole, does not support the boundary proposed by the State.

EPA's Modifications

EPA has reviewed available sources of information and finds several industrial sources to the east and south of the City of Fairbanks, within the FNSB. These sources could potentially contribute to $PM_{2.5}$ levels in the City of Fairbanks monitor. Further, preliminary data from a monitoring study[3] completed in the winter of 2007 indicate that

[3] Evaluation and possible modification of the Community Multiscale Air Quality (CMAQ) Model to simulate PM2.5 in Fairbanks, Alaska, where high concentrations of PM2.5 are observed under cold, dark, and stable conditions

high $PM_{2.5}$ readings are an area-wide phenomenon rather than a localized one. EPA performed an analysis of weather during episodes of high $PM_{2.5}$ values and preliminarily found that many pollutant formation mechanisms and complex meteorology contribute to the complexity of sources, conversion mechanisms and airflow characteristics in this area. EPA's own analysis reveals that the complexity of the area and existence of sources in the Fairbanks North Star Borough beyond the State's proposed boundary warrants an extension of the nonattainment area boundary.

EPA's intent is to establish a boundary that will adequately capture emission sources that are contributing to violations of the $PM_{2.5}$ standards in Fairbanks, AK. As local residential heating and related emissions are thought to be key contributors to elevated $PM_{2.5}$ levels and because there are major sources to the North of the City of Fairbanks, EPA's proposed boundary includes these sources and all residential areas around the City of Fairbanks. To the east, west, and south, the boundary includes sources of air pollution along the Alaska Pipeline and various military lands. A map showing EPA's proposed nonattainment area is shown below.

The Fairbanks NAA extends to the Western border of FNSB and captures topographic features of 1500 to 200 feet, drops South to the Southern border of FNSB with topographic features of over 1000 feet, East to capture sources along the Alaska pipeline and to the eastern border of the military reservation and topography of 2000 to 3000 feet, and North to the coordinates of MTRS FF 000022NN 000088EE Sec 3300 and West to MTRS FF 000022NN 000055W Sec 3300. The northern boundary captures sources along the Alaska pipeline and the topographic features of over 2000 ft. This proposed boundary captures the key topographical features, and sources and populations within those topographical features that could contribute to violations at the $PM_{2.5}$ monitor in the City of Fairbanks

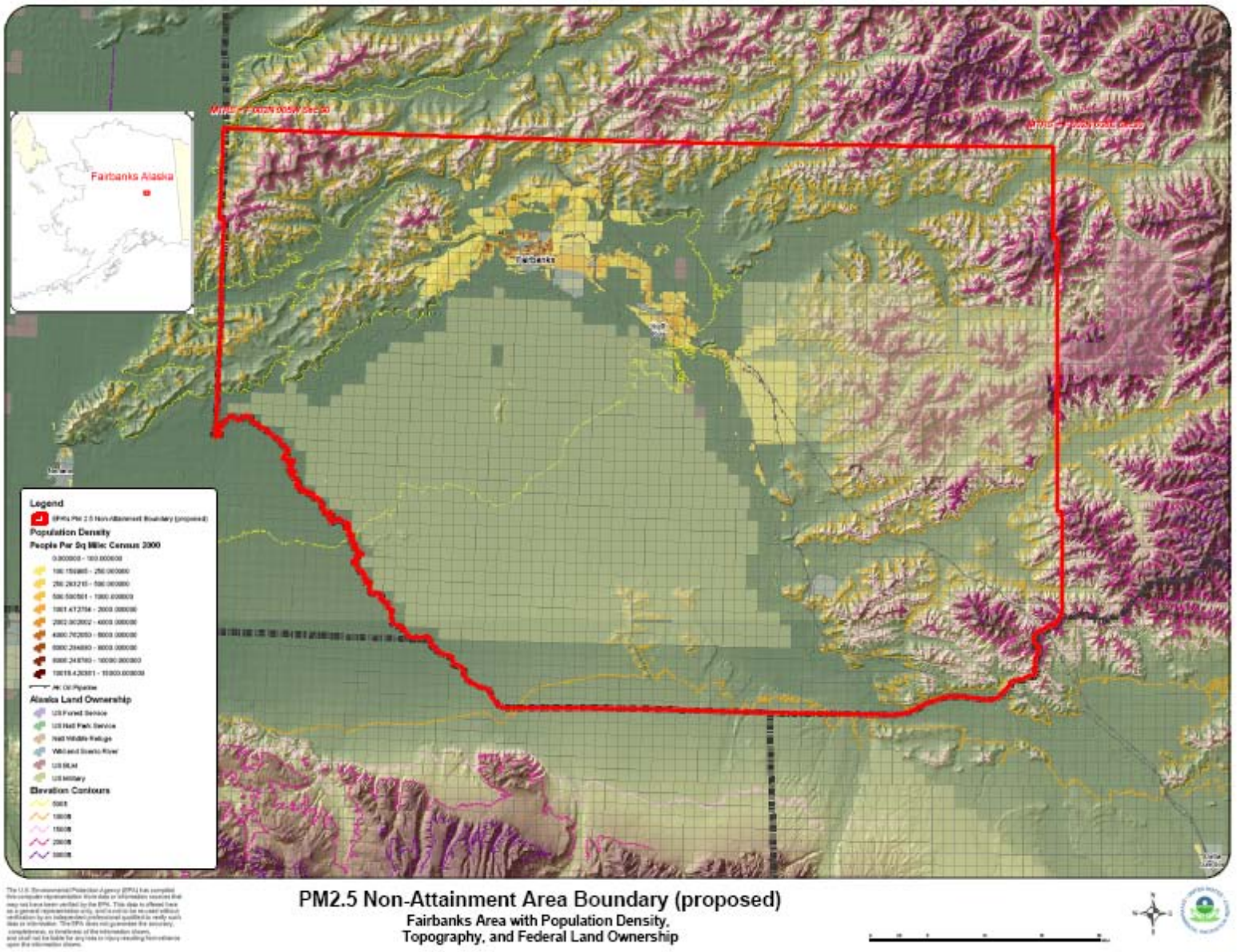
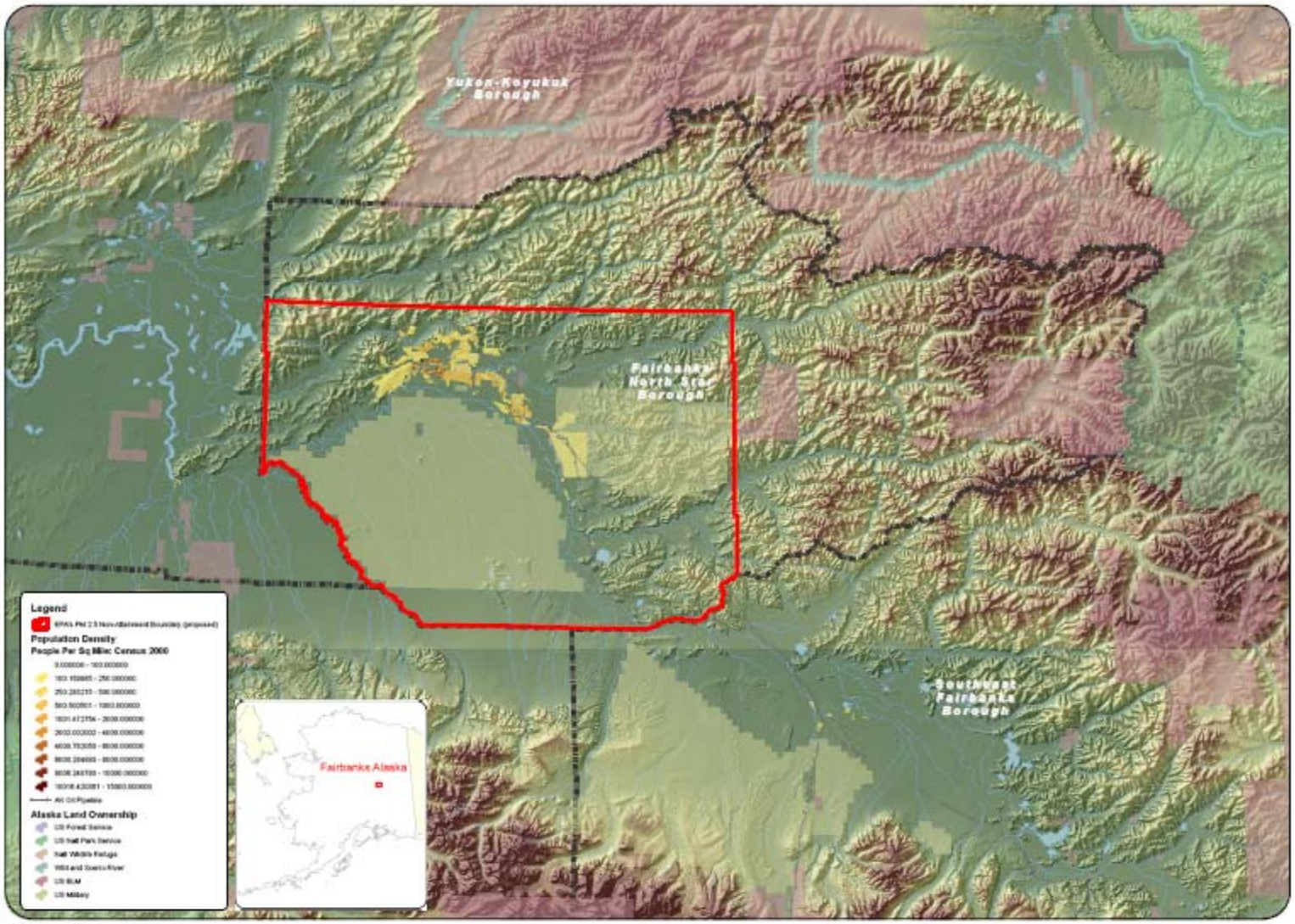

Fairbanks Alaska
Legend
Population Density
People Per Sq Mile: Census 2000
Alaska Land Ownership
Elevation Contours
PM2.5 Non-Attainment Area Boundary (proposed)
Fairbanks Area with Population Density,
Topography, and Federal Land Ownership

Figure 3



PM2.5 Non-Attainment Area Boundary (proposed)
Fairbanks North Star Borough
with Population Density, Federal Land Ownership & Topopgraphy

Figure 3

Factor 1: Emissions data

For this factor, EPA evaluated borough level emission data for the following $PM_{2.5}$ components and precursor pollutants: "$PM_{2.5}$ emissions total," "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 and NO_x, are part of "$PM_{2.5}$ emissions total," they are not shown on the template or data spreadsheet as separate items). "$PM_{2.5}$ emissions carbon" represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and "$PM_{2.5}$ emissions other" represents other inorganic particles (crustal). Emissions of SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (ammonia) are also potential $PM_{2.5}$ precursors and are included for consideration. Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1[4].

EPA also considered the Contributing Emissions Score (CES) for each borough. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of boroughs in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors. A summary of the CES is included in attachment 2[5]. EPA did not consider the CES for areas in Alaska due to unavailability of meteorological data to complete the analysis.

Table 1 shows estimated emissions of $PM_{2.5}$ and $PM_{2.5}$ precursors (given in tons per year) for potentially contributing boroughs in the Fairbanks area from the NEI database. It is evident from the emissions estimates that the direct and secondary precursor emissions are an order of magnitude higher in Fairbanks North Star, than in the surrounding boroughs. In conjunction with other factors, the much higher emissions in this area suggest that most of the emission sources contributing to exceedances at the Fairbanks monitor are likely located within that area. Furthermore, there are two major populated areas within the borough within close vicinity of the monitor, the city of Fairbanks and the city of North Pole. Additional analysis is needed to identify the locations and types of emission sources within Fairbanks North Star Borough.

Table 1. Component Emissions.

Borough	State	Designated for NAA by State	PM2.5 emissions - total (tpy)	PM2.5 emissions - carbon (tpy)	PM2.5 emissions - other (tpy)	SO_2 emissions (tpy)	NO_x emissions (tpy	VOC emissions (tpy	NH_3 emissions (tpy)
Fairbanks North Star	AK	Portions of the City of FNSB.	2872	777	2096	5712	8630	4144	62
Yukon-Kayakuk	AK	No	471	135	337	287	1952	935	7
Denali	AK	No	127	30	96	167	325	318	2
Southeast Fairbanks	AK	No	366	74	293	73	494	614	9

Emissions Analysis for the City of Fairbanks

The State of Alaska's Department of Environmental Conservation (ADEC) submitted a positive matrix factorization (PMF) analysis of $PM_{2.5}$ speciation data. These data were collected at a site in downtown Fairbanks.

Positive matrix factorization (PMF)[6] is a recent development in the class of data analysis techniques called factor analysis, in which the fundamental problem is to resolve the identities and contributions of components in an unknown mixture. PMF has been used extensively for source apportionment of ambient particulate matter (PM), to

[4] See http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html.
[5] A more detailed description can be found at http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C]
[6] A. Reff et al, "Receptor Modeling of Ambient Particulate Matter Data Using Positive Matrix Factorization: Review of Existing Methods," Journal of the Air and Waste Management Association, 57:146-154, February 2007.

resolve the mixture of sources that contributes to PM samples. PMF is especially applicable to working with environmental data because it incorporates the variable uncertainties often associated with measurements of environmental samples, and forces all of the values in the solution profiles and contributions to be nonnegative, which is more realistic than solutions from previously used methods like principal components analysis.

Based on ADEC's preliminary analysis, the principal sources of PM appear to be:

- secondary aerosol-related (sulfate and nitrate),
- wood burning related emissions,
- an unidentified zinc-related source, and
- mobile emissions.

Sulfate from sulfur-bearing sources appears to be much more important than nitrate (see figures below). The presumed principal source seems to be the combustion of sulfur-bearing fuel for space heating, which results in sulfur dioxide emissions. Additionally, there are at least 5 major industrial sources in the City of Fairbanks with significant emissions potential for direct and secondary precursors of $PM_{2.5}$ based on information from the EPA AIRS/AFS database. A small fraction (less than five percent) of the combustion-generated sulfur oxides emitted from fuel burning sources may also be directly emitted as sulfate. The contribution for motor vehicle emissions seems less conclusive and points to the need for a more detailed analysis.

Sources of wood burning emissions in Fairbanks include residential wood stoves and other appliances, and external wood boilers. Survey data and other evidence suggest that wood burning may have increased in recent years. External wood boilers are a relatively new and substantially uncontrolled $PM_{2.5}$ source that has the potential to cause high localized concentrations of $PM_{2.5}$ and may be a significant air pollution nuisance as well as a potential health threat at smaller scales. There are a variety of methods for measuring $PM_{2.5}$ emissions from wood burning, including new methods that have a degree of selectivity for wood smoke.

Figure 4: $PM_{2.5}$ Mass vs. Sulfate Mass

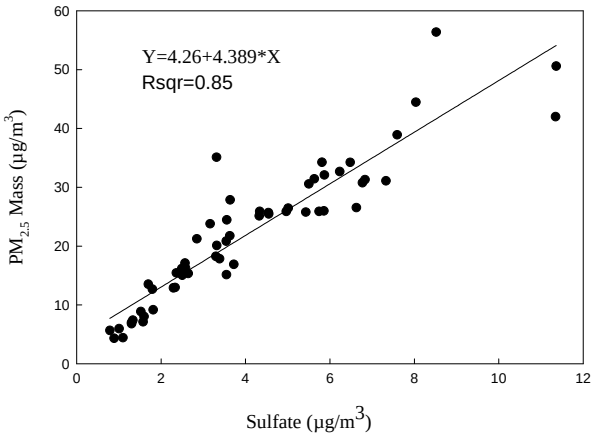
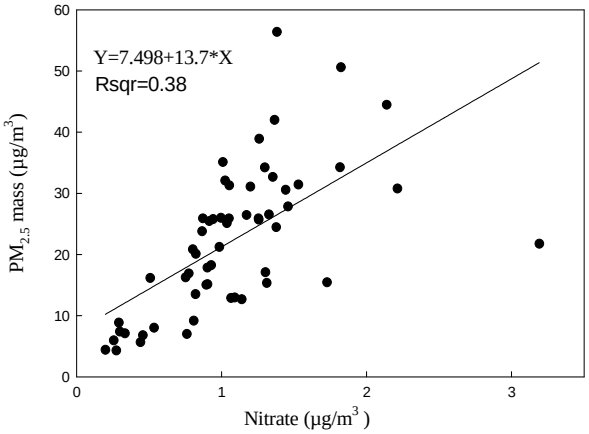


Figure 5: $PM_{2.5}$ Mass vs. Nitrate Mass



Approximately 15 miles Southeast of Fairbanks is the City of North Pole, Alaska, with a 2006 population of over 1800 residents. It is the largest populated center located near Fairbanks. Emissions in North Pole are presumed to be from sources similar to those in Fairbanks, with some home heating using sulfur-bearing fuel, residential wood combustion, and at least one major point source in the area. However, neither EPA nor the State of Alaska has any quantification of the sources in North Pole other than the point sources.

Plant Name	**Carbon Monoxide, TPY**	**Particulate Matter, TPY**	**SO_2 TPY**	**NO_X TPY**
Golden Valley Electric Association	258	204	4079	3749

Based on emission data for the Cities of Fairbanks and North Pole, it seems likely that exceedances are caused by sources in Fairbanks and North Pole. Further analysis of topography and meteorology under exceedance conditions will have to be examined to understand the level of contribution from sources in the City of North Pole to the violating monitor.

EPA has identified other point sources and population centers outside the State's proposed boundary that may potentially contribute to exceedances of the standard at the Fairbanks $PM_{2.5}$ monitor. These sources are mainly to the south and east of the City of Fairbanks. Such sources include point sources with direct emissions of PM2.5 and components that could form $PM_{2.5}$, and homes that use heating fuel such as wood and oil. A boundary that captures all potential sources that could contribute to PM2.5 violations will have to consider these sources within FNSB.

Factor 2: Air quality data

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

The 24-hour $PM_{2.5}$ design values for the $PM_{2.5}$ monitors in Fairbanks, AK are shown in Table 2. The monitor shows the 24-hour $PM_{2.5}$ standard being violated based on both the 2004-2006 and the preliminary 2005-2007 monitoring data. Therefore, the City of Fairbanks is a candidate for being designated nonattainment. This factor, combined with the emissions analysis indicates that sources within the City of Fairbanks are contributors to the $PM_{2.5}$ exceedances in the Fairbanks North Star Borough. The City of North Pole does not have a $PM_{2.5}$ monitor within the city boundaries. Therefore, this factor does not provide evidence to exclude or include the City of North Pole as a contributor to the violating monitor in Fairbanks. Of the surrounding boroughs, none have an FRM or FEM for $PM_{2.5}$.

Table 2:

Borough	State Recommended Nonattainment?	24-hr Design Values 04-06 (µg/m^3)	24-hr Design Values 2005-07 (Preliminary) (µg/m^3)
Fairbanks, AK	Yes	43	39

[Note: Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr PM2.5 NAAQS for designation purposes.]

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

Table 3 shows the 2006 population for each Borough in the area being evaluated, as well as the population density for each Borough in that area. Population data give an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour $PM_{2.5}$ standards.

From the tables and the population density maps, it is evident that the analysis needs to focus on the Fairbanks North Star Borough. The population and population densities indicate that the majority of the population of this area resides within Fairbanks North Star Borough and more specifically in and around the Cities of Fairbanks and North Pole. This supports the inference that violations in the area are the result of contributions from emissions and activity in this area. Therefore, any reasonable boundary that attempts to captures emission sources that could contribute to the violations at the Fairbanks PM2.5 monitor should include the Cities of Fairbanks and North Pole and populated areas around those cities, at a minimum.

Table 3: Population

Borough	State Recommended Nonattainment?	2006 Population	2006 Population Density (pop/sq mile)
Fairbanks North Star	Yes (portion)	94803	10
City of Fairbanks	Yes (portion)	31142	973
City of North Pole	No	1828	446
Yukon-Kayakuk	No	5844	0
Denali	No	1846	0.1
Southeast Fairbanks	No	6773	0.2

Sources: http://www.census.gov/popest/boroughs/CO-EST2006-03.html for 2006 populations; http://www.census.gov/population/censusdata/90den_stco.txt for size.

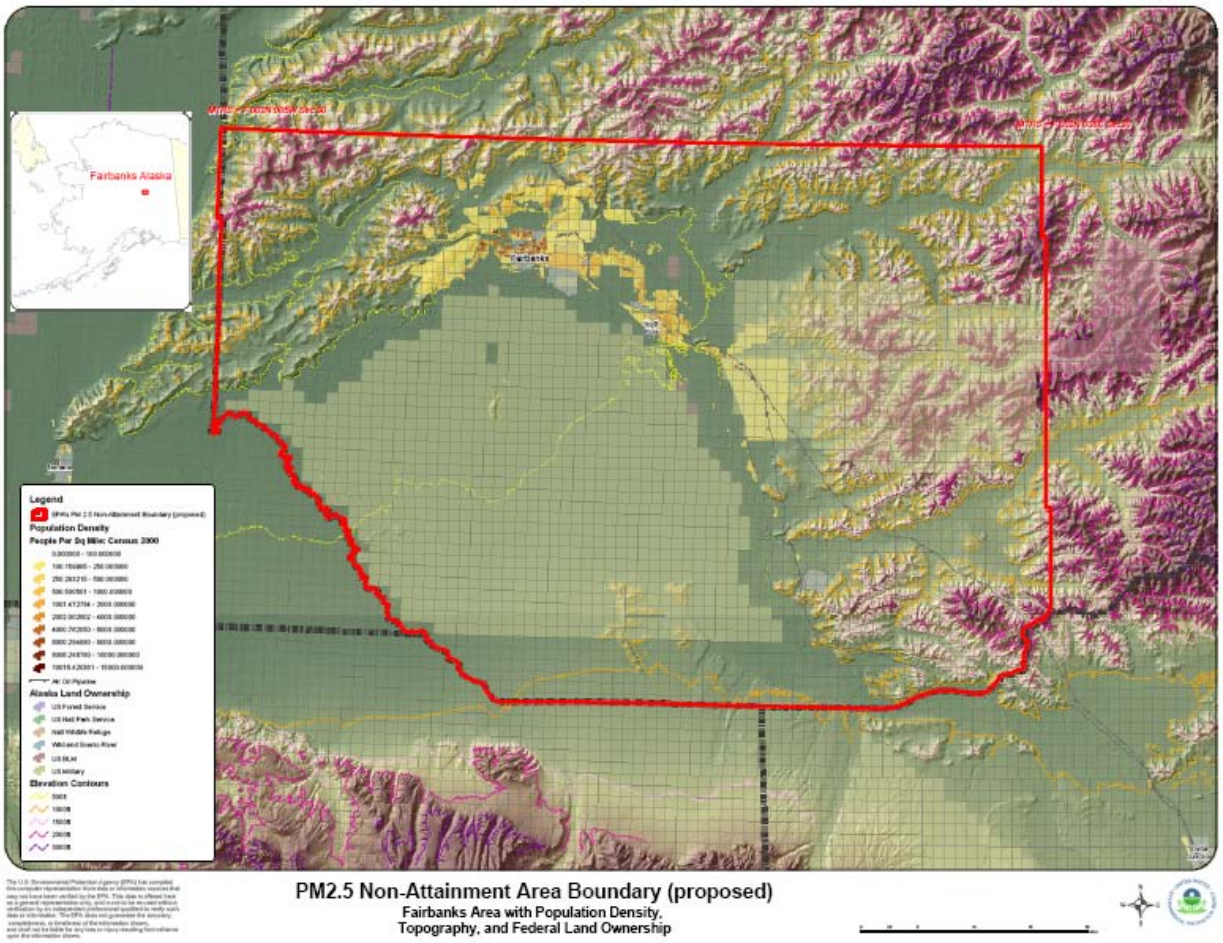


Figure 6: Population density for the EPA proposed PM2.5 NAA for FNSB

Factor 4: Traffic and commuting patterns

This factor, combined with Factor 5, growth rates and patterns, considers the number of commuters in each Borough who drive to another Borough, as well as the total Vehicle Miles Travelled (VMT) for each Borough. A Borough with numerous commuters would generally indicate that it is an integral part of an urban area and a possible contributor to the $PM_{2.5}$ levels in the violating county or borough.

It is evident from the data in Table 4 that very few commuters commute to and from Fairbanks North Star Borough. In addition, other factors indicate that surrounding boroughs are not contributing emissions to the Fairbanks North Star Borough. The listing of boroughs on Table 5 reflects a ranking based on the number of people commuting to other boroughs.

Table 4:

Borough	State Recommended Non-attainment?	2005 VMT (Millions)	Commuting from Fairbanks to borough (#)	Commuting from Fairbanks to other boroughs (%)	Commuting from other boroughs to Fairbanks (#)	Commuting from other boroughs to Fairbanks (%)
Fairbanks North Star	Yes (partial)	321	39563	100	39563	100
Yukon-Koyukuk	No	66	32	0	55	0
Denali	No	20	159	0.5	77	0
Southeast Fairbanks	No	71	53	0	74	0

Source: EPA TTN 2005_vmt_borough_level-1.xls

[Note: The 2005 VMT data used for table 5 and 6 of the 9-factor analysis has been derived using methodology similar to that described in "Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf
The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.]

However, as there are populated areas within FNSB, outside the State's recommended boundary, traffic in those areas could cause commute based emissions that could contribute to the violations on the Fairbanks monitor and therefore justify inclusion in the nonattainment area.

Factor 5: Growth rates and patterns

This factor considers population growth for 2000-2005 and growth in vehicle miles traveled for 1996-2005 for boroughs in Alaska, as well as patterns of population and VMT growth. A borough with rapid population or VMT growth is likely to be contributing to fine particle concentrations in the area.

Table 5 and 5a below shows population, population growth, VMT and VMT growth for boroughs that in Alaska. Boroughs are listed in descending order based on VMT growth between [1996 and 2005].

This factor looks at the extent, pattern and rate of growth of population and VMT within the Fairbanks Metropolitan Area Transportation System (FMATS) Planning Area, which includes the City of Fairbanks and the City of North Pole, from 2000 to 2006. A borough with rapid population or VMT growth is generally an integral part of an urban area and could be an appropriate area for implementing mobile-source and other emission-control strategies, thus warranting inclusion in the nonattainment area.

Since 1985, population levels in the Fairbanks area have remained relatively stable. Increase in military activity due to the addition of a light infantry division to Fort Wainwright acted to offset a reduction in state and local governmental spending due to declining oil revenues. These factors resulted in a 1990 Borough population of 77,720. According to the Census,[i] the Borough population experienced little change between 1990 and 2000, with an overall growth rate of 0.6% per year. During that same time period, the Census data indicate that the population within the cities of Fairbanks and North Pole also declined slightly by about 0.16% per year. From 2000 to 2006, the population increased by 0.7% (combined) and this trend is not expected to change very much with population forecasts for the 2006-2015 period estimated to be in the range of about 1% each year.

Table 5. Population growth in the City of Fairbanks and North Pole from 2000 – 2006

City	Population April 2000	Population July 2006	Percent Population Change
Fairbanks	30224	31142	3
North Pole	1570	1828	16

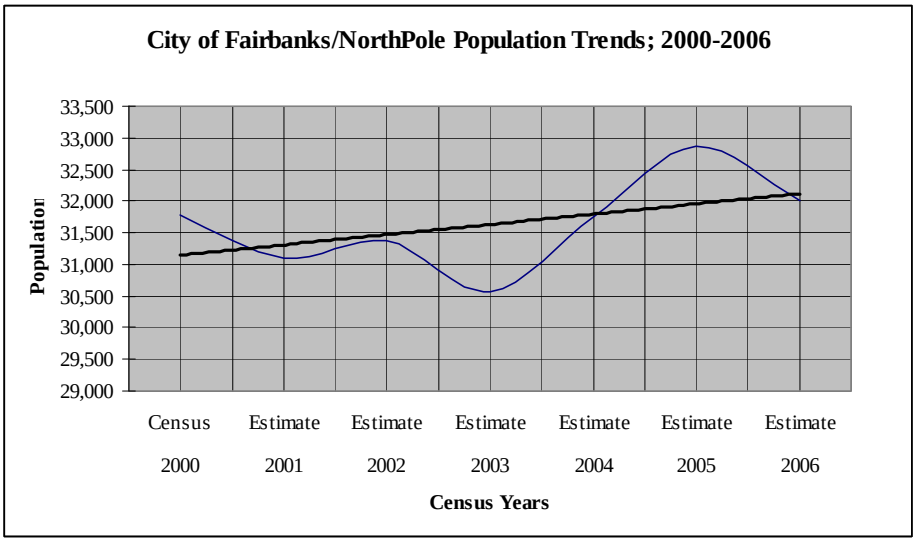


Figure 7: Source: http://www.census.gov/popest/cities/tables/SUB-EST2006-04-02.xls

Growth in Vehicle Travel

VMT estimates and projections are taken from the Fairbanks Metroploitan Area Transportion System (FMATS) Long Range Transportion Plan (LRTP). This estimate includes the City of Northpole but is a sound basis to understand the growth in vehicle travel in the area.

Despite the slight reduction in population recorded from 1990 to 2000, Fairbanks and North Pole experienced a modest increase in travel (1.1% per year)during these periods. From 2002-2004 VMT growth was reported as 1.2 % per year and this is expected to continue to 2015 at a growth rate of approximately 1.4%. With a relatively stable population and slow growth in VMT, the FMATS transportation network has relatively low levels of congestion and excess transportation capacity. FMATS routinely considers and implements projects that will assist in reducing congestion such as signalization improvements at intersections. The Fairbanks North Star Borough also has a transit system that provides a good level of service for a relatively spread out community.

Table 5 a. VMT growth in the City of Fairbanks and North Pole from 2000 – 2015

2000 VMT (millions)	2006 VMT (millions)	Percent change	2010	Percent Change	2015	Percent Change
272	315	16	335	6	361	8

Altough the VMT growth rates are small in magnitude, Postive Matix Factorization and emissions inventory studies point to the need for further analysis of the contribution of mobile sources to the $PM_{2.5}$ levels during high concentration episodes.

There is slow growth rate in the Fairbanks Metropolitan area. The growth rate as projected is not expected to be a major influence in the extent of the nonattainment area boundary.

FACTORS 6 and 7: Meteorology (weather/transport patterns) and Geography/Topography

For Fairbanks, Alaska, as in many areas in the Northwest, these two factors combine together to create unique effects that cause violations in highly localized areas within a county or in a micro-air shed as in a mountain-valley. To understand how the interactions of terrain and meteorology affect the cause and nature of violations in such areas, it is beneficial to examine these two factors together.

For this factor, EPA considered data from National Weather Service instruments in the area. Wind direction and wind speed data for 2004-2006 were analyzed, with an emphasis on "high $PM_{2.5}$ days" for each of two seasons (an October-April "cold" season and a May-September "warm" season). These high days are defined as days where any

FRM or FEM air quality monitors had 24-hour $PM_{2.5}$ concentrations above 95% on a frequency distribution curve of $PM_{2.5}$ 24-hour values.

For each air quality monitoring site, EPA developed a "pollution rose" to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. The figure identifies 24-hour $PM_{2.5}$ values by color; days exceeding 35 $\mu g/m^3$ are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

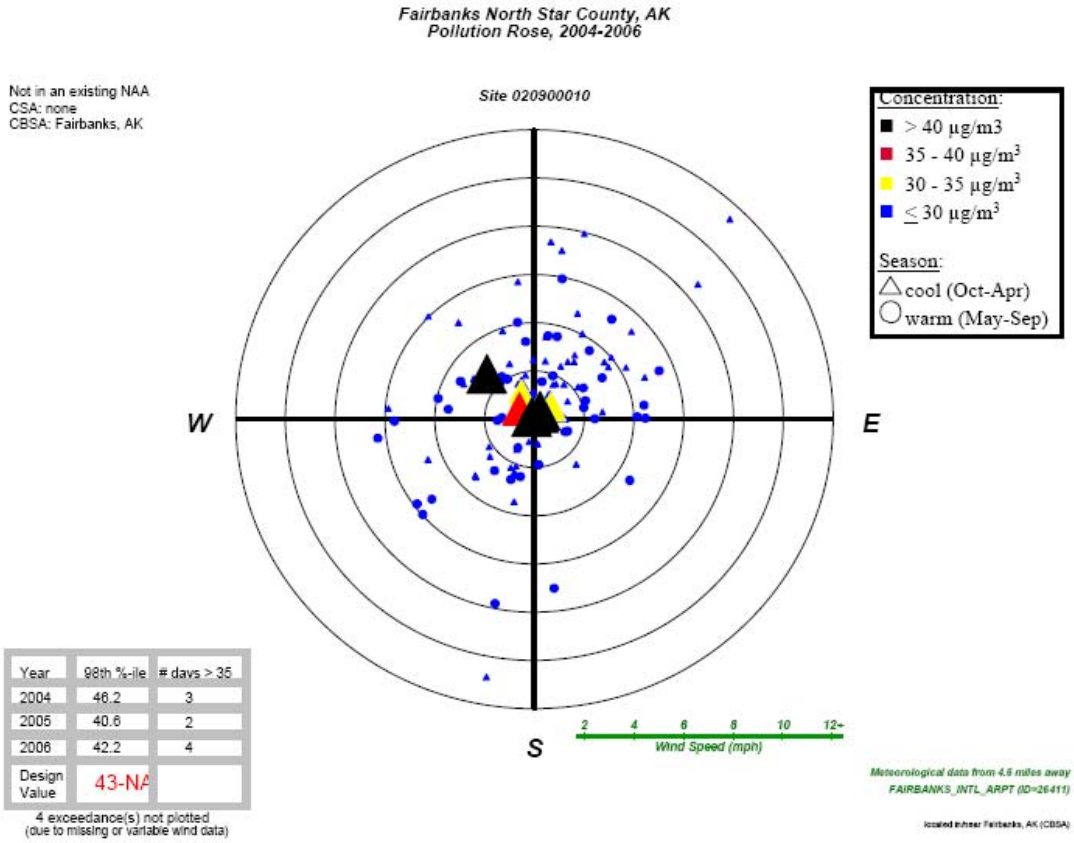


Figure 8: Fairbanks Pollution Rose

As shown in the pollution rose in Figure 2, the average prevailing surface wind direction for high $PM_{2.5}$ days in the City of Fairbanks is from the Northwest for one event and calm from many of the other high days. The pollution roses show that 24-hour $PM_{2.5}$ concentrations are influenced by emissions from any direction at various times, but these data also suggest that emissions from some directions relative to the violation are more likely to contribute to the violation than emissions from other directions.

Note: the meteorology factor is also considered in each county's Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high $PM_{2.5}$ days.

As in many areas in the West, Fairbanks exhibits a confluence of factors which include locally available sources of pollution, topography, and meteorology which complement each other to provide the necessary ingredients for the contribution and buildup of pollutants concentrations that violate the NAAQS.

> Available Sources of Pollution: The PMF study submitted by ADEC shows that secondary aerosol, primarily sulfate and nitrate makes up about 40-55% of the monthly average mass concentrations on $PM_{2.5}$,

with the highest percentage in January (the coldest month with an average temperature of about -10 °F. The remaining mass is attributed to wood burning, an unknown source of Zinc and other smaller source categories of sea salt and motor vehicles. For cold winter days, with severe inversions, the use of wood and sulfur bearing distillate fuels for heating is expected to be generally high. These are presumably the principal sources of SO_2 emissions. The usage of these fuels and subsequently the emissions will be especially high for severely cold winter days in December, January, and February. There are also local industrial sources within the City of Fairbanks and the City of North Pole that are classified as major sources in the EPA AIRS/AFS database that contribute direct PM and precursor gases that can contribute to secondary aerosol formations (CO, PM, SO_2 and NO_x). A preliminary reporting also indicates that there are major stationary sources to the North, South, and East of the City of Fairbanks.

Topography: At 440 ft ASL, the City of Fairbanks lies on the winding Chena River near its confluence with the Tanana River, which occurs just south of town. The city is surrounded by ridges on the northeast, north, and west, which rise to about 600 feet ASL; further ridges beyond the first ring of ridges reach 2500 feet ASL. The low elevation of the city center with respect to the surrounding ridges causes air pollution build up within the "bowl" during stagnation episodes. The Chatinika, Chena, and Salcha River drainages define the area surrounded by rolling hills to the north, east and west of the urban centers. The Tanana River Valley flats border the city to the south and southeast.

The nearby city of North Pole lies about 15 miles to the southeast of Fairbanks on the valley floor in a less topographically confined region, with the closest hills lying to the east at a greater distance from the North Pole city center than the hills surrounding downtown Fairbanks . The terrain from Fairbanks to North Pole exhibits a gentle rise from 440 ft in Fairbanks to about 480 ft in North Pole.

Additional Analysis:

Preliminary data analysis suggested that the exceedances in Fairbanks were characterized by very low temperatures and inversions that were extremely severe. To understand this further, EPA conducted further analysis of the severity of inversions, the diurnal variation of the mixing heights, and wind speeds and direction, and effect of these on air masses in and around the City of Fairbanks. Below is a summary of the analysis.

Mean annual wind direction frequency distribution (%) for non-calm observations.

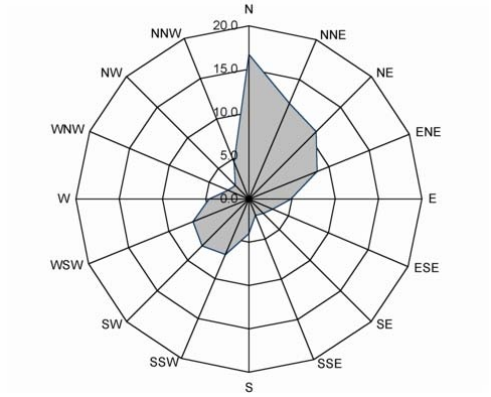


Figure 9: Annual percentage of calm and non-calm observations
Analyses are based on hourly observations for the period 1971 – 2000)
(Source: http://climate.gi.alaska.edu/Climate/Wind/Direction/Fairbanks/FAI.html)

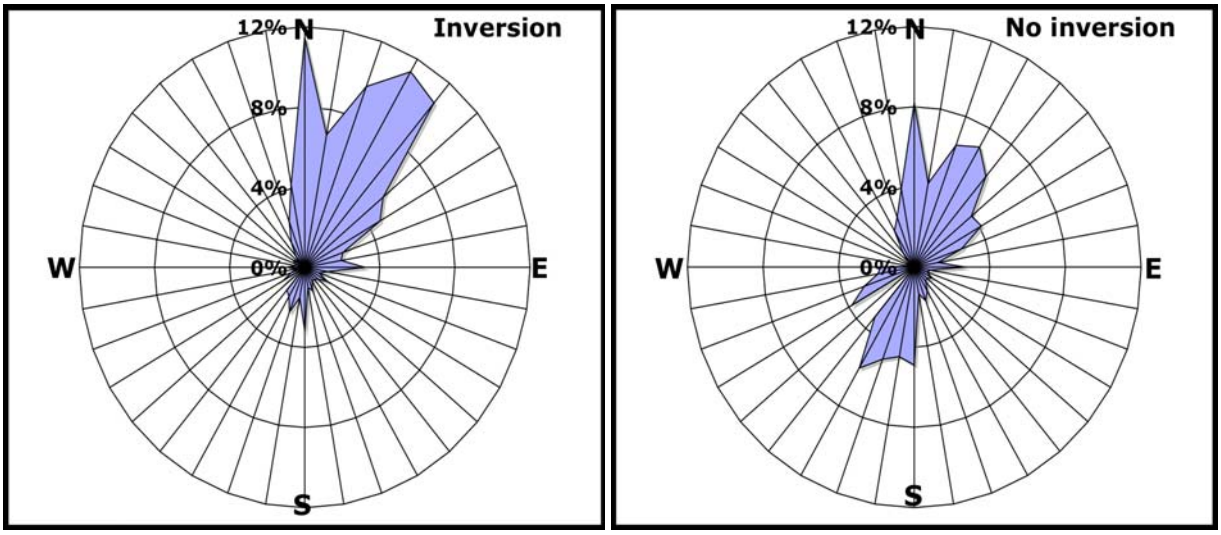


Figure 10: Frequency distribution of surface winds for surface inversion and no surface inversion cases for Fairbanks (Source: http://ams.confex.com/ams/pdfpapers/84504.pdf)

Meteorology: Fairbanks winters are dominated by a pattern of cold, stable air that shows little movement that supports the buildup of available air pollutants. Temperatures typically range between -20° and +20° F, with several periods of - 40° F each winter. Occasionally, temperatures can extend colder temperatures (e.g. -66° F). A combination of high albedo and the low solar elevation that occurs in northern latitudes during the winter months creates little heating of the ground and weak vertical mixing between the surface and elevated layers. Fairbanks frequently experiences ground-based inversions of considerable strength (40° F/100m) topped by weaker inversion zones such that the layer of inverted lapse rates range as high as 1-2 kilometers. This condition together with local emissions of $PM_{2.5}$ and its precursors (especially sulfur dioxide) can cause episodes of elevated $PM_{2.5}$ concentrations.

A closer analysis of winter inversions has been done by Hartmann, et al. at the Alaska Geophysical Institute (http://ams.confex.com/ams/pdfpapers/84504.pdf) shows that during winter inversion conditions the winds are from the North and Northeast, with no significant return flow components. A no-inversion wind rose shows a small return flow from the SSW-SW direction. This directionality suggests a flow from the direction of the Denali Range and warmer air which descends the leeside of the range (adiabatic heating), which perhaps contributes to a warming at the surface and a weaker surface inversion. An annual wind rose also shows that surface winds are predominantly from the N-ENE, but follows the no-inversion wind rose with a small return flow from the S-WSW direction.

A climatological analysis conducted by EPA using climate data from the Fairbanks International Airport support the above studies. In the study, EPA initially analyzed the relationship between temperature and $PM_{2.5}$ concentrations.

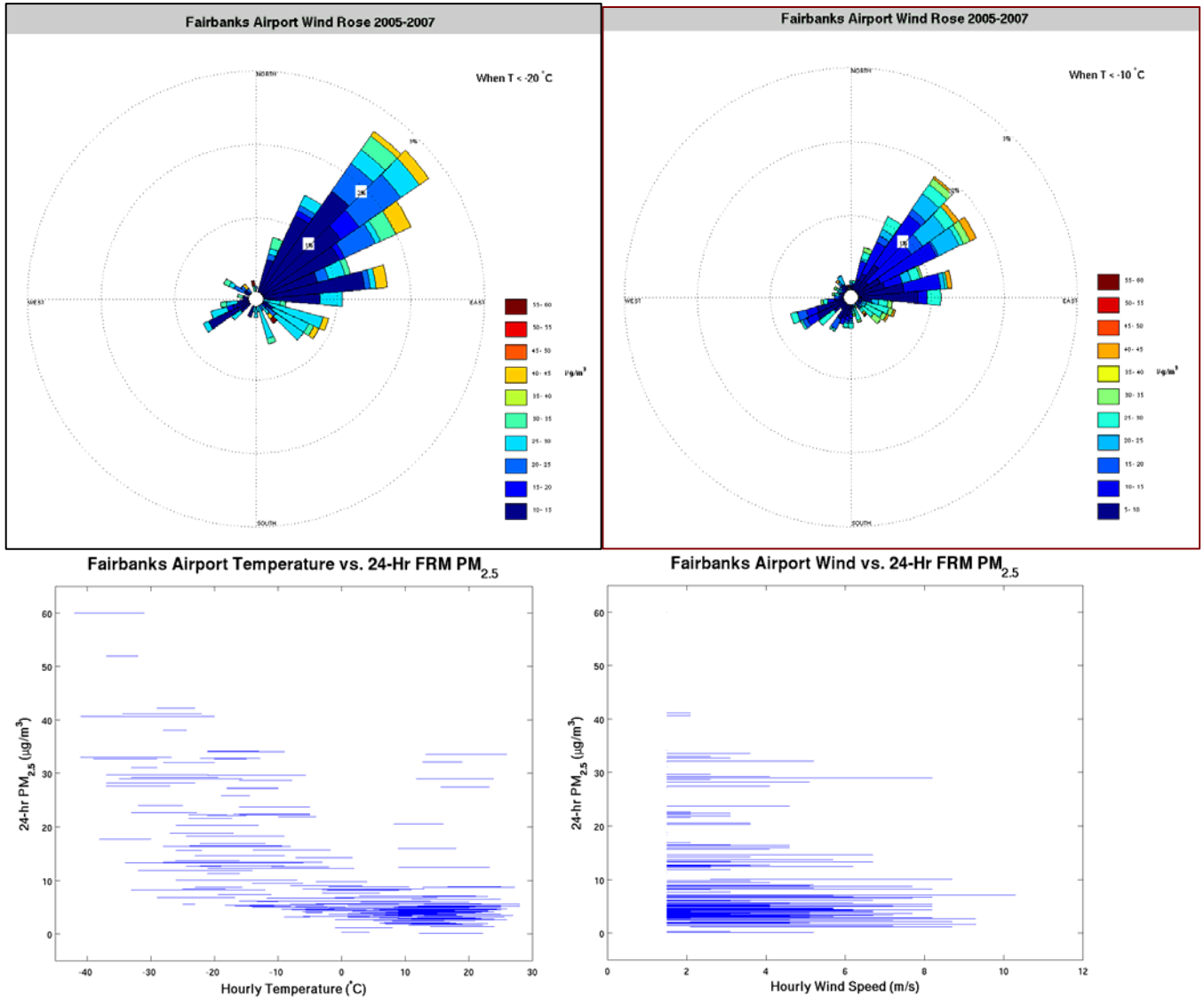


Figure 11: Temperature and pollution rose plots form Fairbanks, 2005-2007.

As shown in the plot of hourly temperature versus $PM_{2.5}$ concentrations, the concentrations show an inverse relationship with temperature. Further there seem to be no exceedances of the $PM_{2.5}$ standard for temperatures above -20 °C. An analysis of concentrations against wind speed also shows an inverse relationship, with high values of $PM_{2.5}$ (above 30 μgm^{-3}) occurring at low wind speeds or calm conditions.

Based on this information, EPA constructed concentrations roses for days when the temperatures were below -20 °C and -10 °C, as all exceedances of the $PM_{2.5}$ standard occurred during these temperature regimes. The more significant plot, for days with temperatures lower than -20 °C, the wind direction is primarily from the NE with small components from the SW and SE. Both the wind speed and direction support a katabatic flow from the ridges to the North of town and to the NE of the airport. On these days, it is presumable that the extreme temperatures with snow on the ground sets up very strong surface inversions with accompanying stable air and limited mixing in the layer near the surface. Under these conditions, it is foreseeable that additional fuel is required for residential heating in and around the city of Fairbanks. If there are residential areas on the ridges above the City, heating from these residences could also contribute to the emissions, which potentially drain down the ridges into town.

Under these low temperatures and mixing regimes with very stable conditions, most of the organics may already be in the aerosol phase and there may be enough liquid water content in the air mass to enable all modes of wet deposition – aqueous phase solution, acting as condensation nuclei, and scavenging due to larger droplets, all of which is measured as $PM_{2.5}$ in the filters.

Consideration of Meteorological Factors to assess contribution for sources in North Pole, AK: According to the state climatologist at the University of Alaska at Fairbanks, the topography of the Fairbanks area with a broad and flat river valley to the south and hills to the north give rise nearly to a katabatic or gravity driven flow during the winter. At this time of year winds are light and Fairbanks is frequently cut off from the free atmosphere with the predominant low-level temperature inversion. An interesting exception to this is for areas south of Fairbanks in the path of the so-called 'Tanana Jet' in which the wind is funneled by the highlands surrounding the Tanana River valley, primarily around the Delta Junction area. This flow does not affect the Fairbanks - North Pole area.

The Tanana Valley Jet (TVJ) is a winter season wind phenomenon that commonly occurs in this area, with particular impact on the community of Delta Junction. The TVJ is a cold katabatic wind blowing down the Tanana Valley from southeast to northwest. The pressure gradient force down the valley is the primary driver of the TVJ. The area covered by the TVJ then extends westward down the valley until the wind dissipates over the Tanana Flats south of Fairbanks and Nanana. The TVJ can sometimes wonder out of the boundary of this zone to affect Eielson AFB and Nanana, and but it never impacts Fairbanks.

The availability of primary sources of emissions and gaseous precursors, temperature and wind regimes conducive to reactivity, and a stable air mass, which keeps pollutants in the area provide conditions that create elevated levels of $PM_{2.5}$ in the valley. However, the analysis also reveals that there is interplay of complex mechanisms that contribute to the elevated $PM_{2.5}$ levels. Preliminary data from a saturation monitoring study indicates that the $PM_{2.5}$ readings in the vicinity of the City of Fairbanks could be more of a regional nature than a localized one and further analysis is needed to decipher the exact nature of the sources and mechanisms involved in these processes.

This analysis indicates the state's recommended boundary is not adequate to fully capture the sources, the emissions of directly and secondarily formed PM2.5 and the mode by which they are transported in the area. EPA's expansion of the boundary reflects the complexity in these factors, as explained in this analysis and in Factor 1.

Factor 8: Jurisdictional boundaries (e.g., existing PM and ozone areas)

In evaluating the jurisdictional boundary factor, consideration should be given to existing boundaries and organizations that may facilitate air quality planning and the implementation of control measures to attain the

standard. Areas designated as nonattainment (e.g. for $PM_{2.5}$ or 8-hour ozone standard) represent important boundaries for state air quality planning.

The analysis of jurisdictional boundaries considered the planning and organizational structure of the FNSB and ADEC to determine if the implementation of controls in a nonattainment area can be carried out in a cohesive manner.

Figure 12: City Boundaries within the Fairbanks North Star Borough

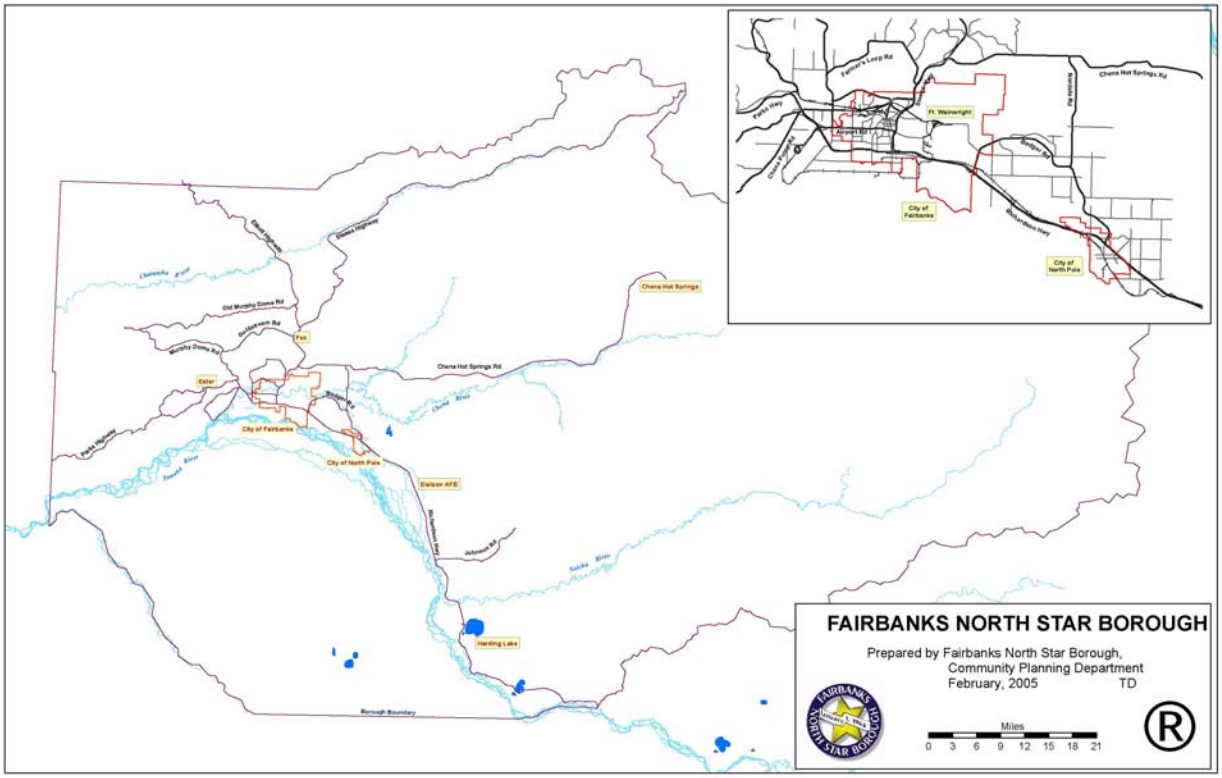
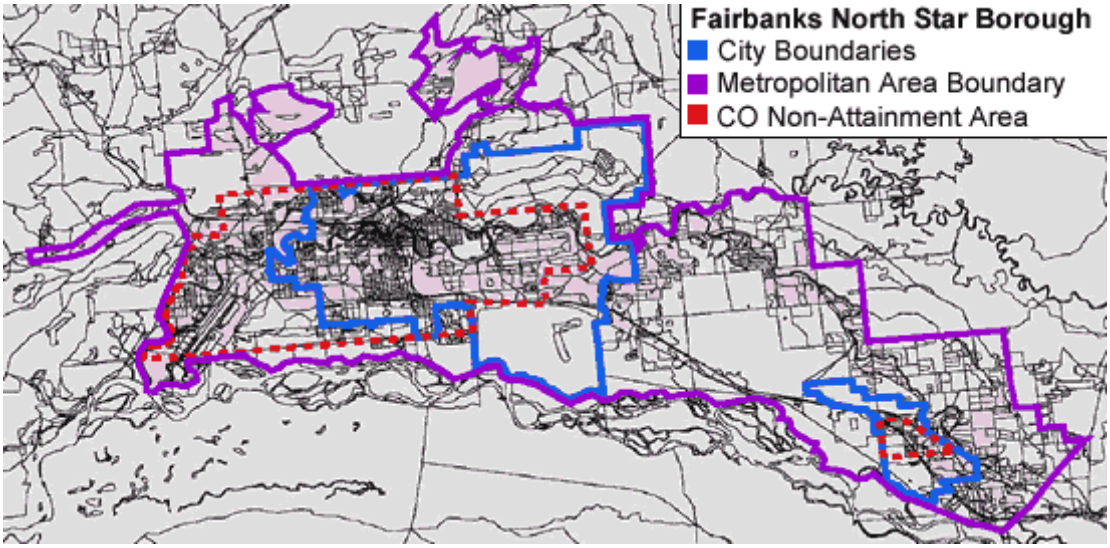


Figure 13: Planning Boundaries in the vicinity of the City of Fairbanks



The proposed boundary submitted by the state of Alaska intersects several planning boundaries as shown in the figures above. In this instance, the area potentially contributing to the violation of the $PM_{2.5}$ NAAQS appear to be larger than those for CO, and larger than the city or metropolitan area boundaries.

Factor 9: Level of control of emission sources

This factor considers emission controls currently implemented for major sources in the Fairbanks area. The emission estimates on Table 1 (under Factor 1) include any control strategies implemented by the states in the Fairbanks before 2005 that may influence emissions of any component of $PM_{2.5}$ emissions (i.e., total carbon, SO_2, NO_x, and crustal $PM_{2.5}$).

There are a few large point sources in the Fairbanks North Star Borough that are controlled under the State of Alaska's permitting program. These sources do have the potential to emit significant amounts of direct $PM_{2.5}$ and other components of $PM_{2.5}$ emissions but do operate with controls required by the state permitting program.

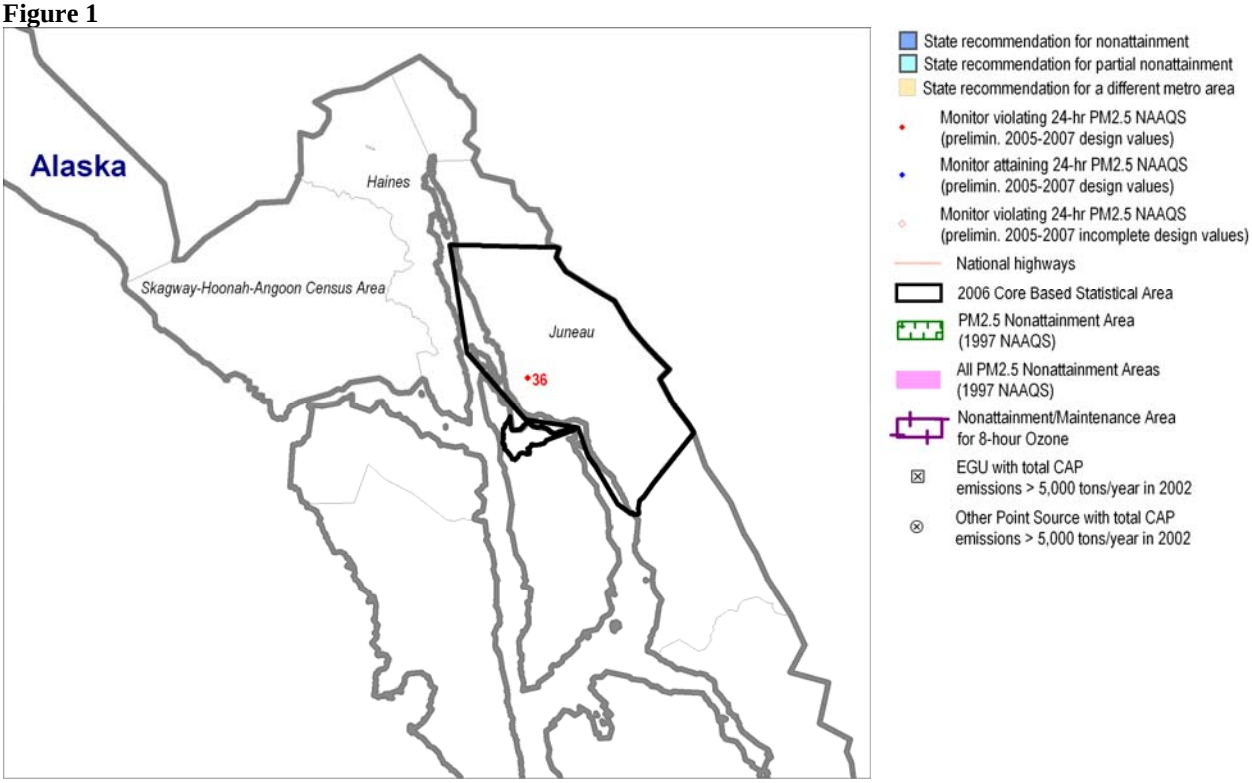
EPA Technical Analysis for Juneau, Alaska Nonattainment Area

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for Fairbanks identifies the boroughs with monitors that violate the 24-hour PM2.5 standard and evaluates the boroughs that potentially contribute to fine particle concentrations in the area. EPA has evaluated these boroughs based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

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

Figure 1 is a map of the boroughs in the area and other relevant information, such as the locations and design values of air quality monitors, the metropolitan area boundary, and boroughs recommended as nonattainment by the State.

Figure 1



Note that Juneau CBSA is defined as smaller than the borough.

On April 17, 2008, EPA informed the a designee of the Governor of Alaska that preliminary data from the Mendenhall Valley monitor indicated the area being in violation of the 24 hour $PM_{2.5}$ standard and invited the designee to make recommendations for designations and a boundary. In a letter dated June 2, 2008, a designee of the Governor of Alaska informed EPA that Mendenhall Valley in Juneau is potentially in violation of the 2006 24-hr $PM_{2.5}$ standards based on preliminary 2005-2007 design values. These data are from FRM or FEM monitors in Mendenhall Valley, Juneau.

The air quality monitor at Mendenhall Valley in Juneau, Alaska, was found to be in violation of 2006 24-hr $PM_{2.5}$ standards based on 2005-2007 data, which was certified in July 2008. As the state of Alaska had limited time to prepare a detailed 9 factor analysis for this area, the state submitted the previous PM_{10} boundary as a recommended starting point as they proceeded to refine their boundary recommendation..

Based on EPA's 9-factor analysis described below, EPA believes that an expanded part of Juneau Borough should be designated nonattainment for the 24-hour $PM_{2.5}$ air-quality standards as part of the Juneau, Alaska nonattainment area, based upon currently available information. The boroughs are listed in the table below.

Juneau Nonattainment Area	**State-Recommended Nonattainment Area**	**EPA-Recommended Nonattainment Area**
Alaska	Previous PM_{10} Nonattainment area boundary for Juneau	Expanded part of Juneau Borough

EPA has taken Alaska's recommendation under consideration and finds that the information provided to date does not adequately support the State's partial borough designation. EPA's review of the information indicates that an area that is more expansive that the previous PM_{10} nonattainment area may be a more appropriate boundary for the nonattainment area for the 24-hour $PM_{2.5}$ NAAQS. Accordingly, a larger portion of Juneau is included in EPA's intended designation. EPA will consider any additional information provided by the State in making final designation determinations."

Proposed geographic boundaries for the Juneau $PM_{2.5}$ Nonattainment Area

Review of submittal by State of Alaska

The State of Alaska submitted the PM_{10} nonattainment area boundary for Juneau as the boundary recommendation for the $PM_{2.5}$ non-attainment area in Juneau. The proposed boundary, depicted in the Digital Elevation Map below (outline in red), captures the air shed most likely to be in nonattainment of the 24-hour $PM_{2.5}$ NAAQS based on existing monitoring data and knowledge of sources in that area. The State recommended that as data are submitted, this boundary could be further refined.

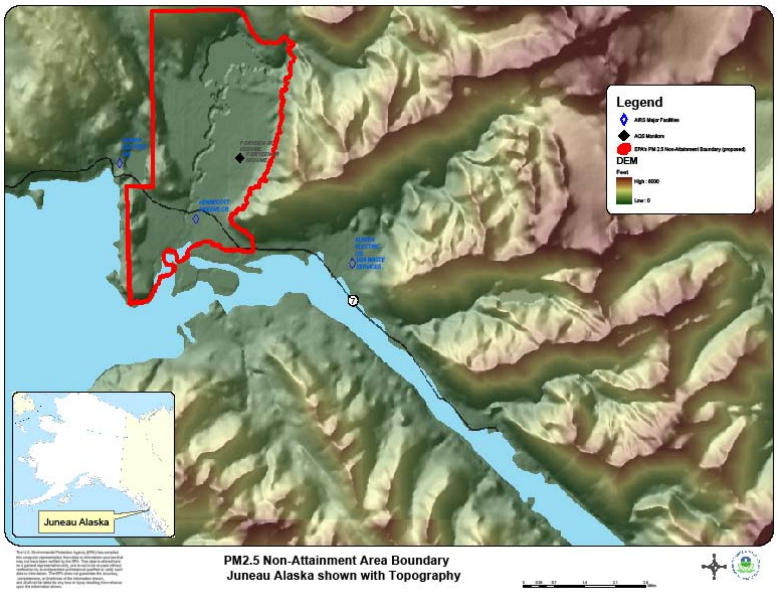


Figure 2: State's Proposed NAA Boundary

EPA's Modifications

After reviewing the state's submissions of emissions data, EPA has concluded that the State's submission, taken as a whole, does not support the boundary proposed by the State.

EPA has reviewed available information and has identified several industrial sources outside and around the area of Juneau Borough, as well as populated areas to the Southeast of the City of Juneau. The nature of the contributions from these sources and populated areas is not clear without additional information as to the types of sources that exist. Specifically, EPA will look for point and area sources in the Juneau area that could potentially contribute to the violations in the Juneau monitor and the type of meteorology that accompanies exceedances. This includes, but is not limited to, wind speed and direction for high $PM_{2.5}$ days, evidence of transport from other areas within the borough and other unique conditions that may influence the formation and transport of pollutants that could impact the Mendenhall Valley monitor.

After review of available information, EPA proposes changes to the boundary to adequately capture all sources of emissions that could potentially be contributing to violations of the 24-hour $PM_{2.5}$ standards in Juneau, AK. A map showing EPA's proposed boundary is shown below. Any further information submitted by the state will be taken into consideration and reviewed to determine if further modification of the nonattainment area boundary is needed.

EPA's proposed boundary for Juneau captures the key topographical features, and sources and populations within those topographical features that could contribute to violations at the $PM_{2.5}$ monitor in the City of Juneau. The Juneau NAA extends on the Northwest to:

Township 39 South, Range 64 east, Section 36 North (northwest corner of section), then south to Township 40 South, Range 64 East, Section 36 (southwest corner of section), east to
Township 41 South, Range 66 East, Section 66 (northwest corner of section), south to
Township 42 South, Range 66 East, Section 66 (southwest corner of section), east to
Township 42 South, Range 68 East, Section 66 (southeast corner of section), north to
Township 40 South, Range 67 East, Section 16 (northeast corner of section), west to
Township 40 South, Range 66 East, Section 15 (northwest corner of section), north to
Township 39 South, Range 66 East, Section 33 (northeast corner of section), west to complete the boundary.

This area covers populated areas around highway 7 and major point sources around the City of Juneau. Topographically to the north, northeast, and east this boundary intersects with the 3000 and 4000 ft contours. To the

South the boundary extends past a topographical barrier of 3000 ft almost to the Stephen passage, and to the west the boundary extends over the Young Bay and the Favorite Channel, which are large water bodies directly connected to the Northern Pacific Ocean.

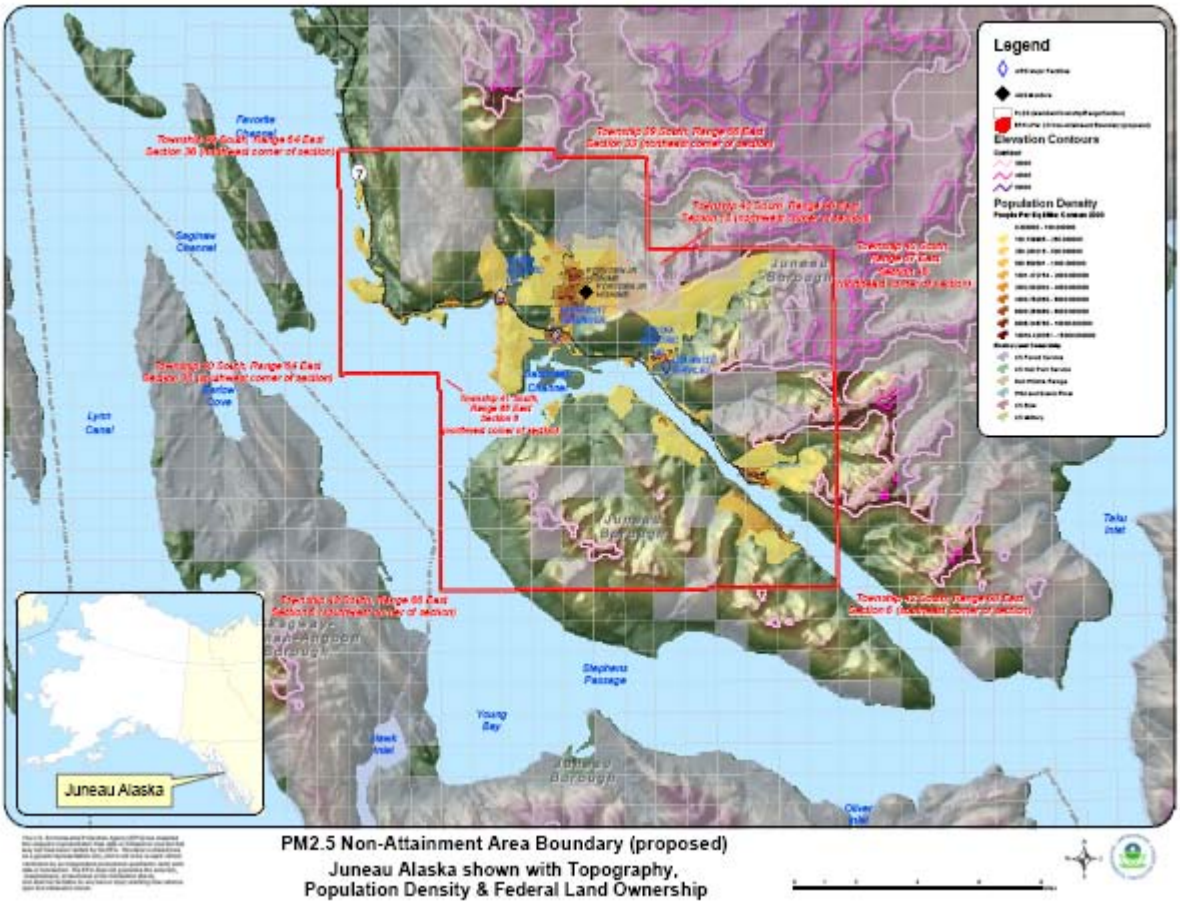


Figure 3

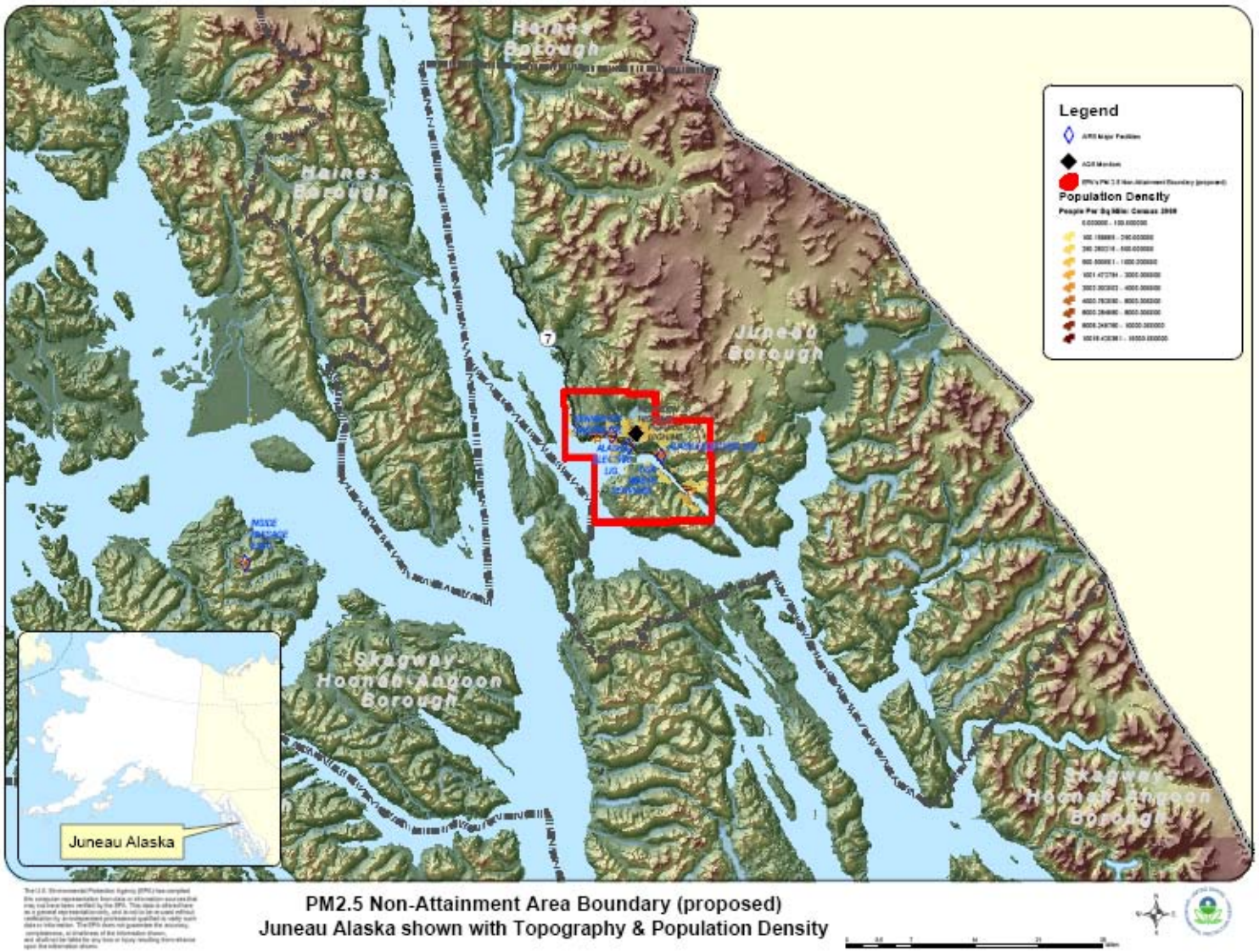

Legend
Population Density
Haines Borough
Juneau Borough
Skagway Hoonah-Angoon Borough
Juneau Alaska
PM2.5 Non-Attainment Area Boundary (proposed)
Juneau Alaska shown with Topography & Population Density

Figure 3 a

Factor 1: Emissions data

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

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1[7].

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors[8]. A summary of the CES is included in attachment 2. EPA did not consider the CES for areas in Alaska due to unavailability of meteorological data to complete the analysis.

Table 1 shows emissions of $PM_{2.5}$ and precursor pollutants components (given in tons per year) for violating and potentially contributing counties in the Juneau. Counties that are part of the Juneau nonattainment area for the 1997 $PM_{2.5}$ NAAQS are shown in boldface.

Boroughs adjacent to Juneau are the Haines Borough to the northwest, west, and the Skagway-Hoonah-Angoon (SHA) Census Area, to the south and southwest. Juneau shares its eastern border with the Canadian province of British Columbia to the northeast and east

Table 1. $PM_{2.5}$ Related Emissions

County	State Recommended Nonattainment?	$PM_{2.5}$ emissions total (tpy)	$PM_{2.5}$ emissions carbon (tpy)	$PM_{2.5}$ emissions other (tpy)	SO_2 (tpy)	NOx (tpy)	VOCs (tpy)	NH_3 (tpy)
Juneau	Yes, Partial	306	99	207	413	1278	1979	25
Haines	No	157	26	131	22	106	290	3
SHA	No	208	46	162	46	178	515	4

From the borough levels emissions, Juneau has higher total $PM_{2.5}$ emissions and a higher proportion of carbon based PM2.5. Emissions from Juneau are also higher than the surrounding boroughs for pollutants that have the potential to act as $PM_{2.5}$ precursors, such as SO_2 and NO_x. Further analysis is required to understand if emissions from adjacent counties may contribute to the $PM_{2.5}$ violations in the Mendenhall Valley monitor in Juneau.

Factor 2: Air quality data

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

The 24-hour $PM_{2.5}$ design values for counties in the Juneau area are shown in Table 2. There are no FRM, FEM or alternative monitors in any of the adjacent counties.

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

Table 2. Air Quality Data

County	State Recommended Nonattainment?	24-hr PM2.5 Design Values, 2004-2006 ($\mu g/m^3$)	24-hr PM2.5 Design Values, 2005-2007 ($\mu g/m^3$)
Juneau	Yes	32	36
Haines		No data available	No data available
SHA		No data available	No data available

[Note: Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr PM2.5 NAAQS for designation purposes.]

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

Table 3 shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour $PM_{2.5}$ standards.

As can be seen in the Table and the associated population density and topography maps below, Juneau Borough is very sparsely populated and the surrounding counties are even more so. Population based emissions are likely to be very limited from areas of Juneau Borough other than the cities of Juneau and Douglas. The State of Alaska has not submitted any information that indicates above average commercial growth or major new or planed expansions of industrial facilities in the area. Although, SHA has emissions comparable to Juneau, the population density for SHA is very low. This supports exclusion of other counties from the proposed NAA boundary.

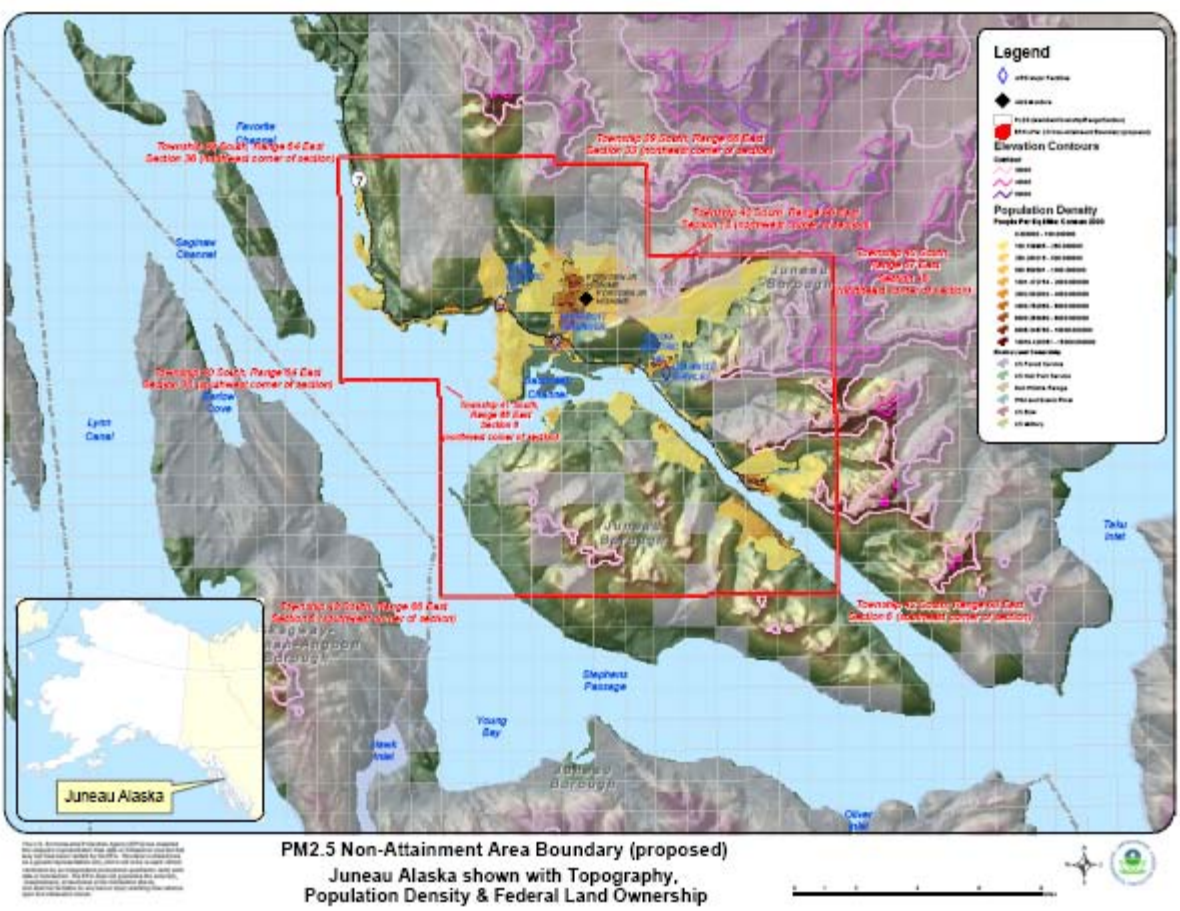


Figure 4: EPA proposed boundary for Juneau showing population densities

Table 3. Population

County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Juneau	Yes	30881	11
Haines	No	2243	1
SHA	No	3137	0

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Juneau area, the percent of total commuters in each county who commute to other counties within this area, as well as the total Vehicle Miles Traveled (VMT) for each county in thousands of miles (see Table 4). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area.

Table 4. Traffic and Commuting Patterns

County	State Recommended Non-attainment?	2005 VMT (1000s mi)	Number Commuting to any violating counties	Percent Commuting to any violating counties	Number Commuting into statistical area	Percent Commuting into statistical area
Juneau	Yes	207	16000	99	16000	99
Haines	No	24	20	2	20	2
SHA	No	34	60	4	60	4

The listing of counties on Table 5 reflects a ranking based on the number of people commuting to other counties. The counties that are in the nonattainment area for the 1997 $PM_{2.5}$ NAAQS are shown in boldface.

Most of the commuters in this region seem to stay within the Juneau Borough. Traffic levels in Juneau Borough are an order of magnitude larger than the surrounding boroughs and are likely generating emissions that may contribute to violations of the standard in the Mendenhall Valley monitor in Juneau. All the preceding factors indicate that the surrounding boroughs are not contributors to the $PM_{2.5}$ violations in the Juneau monitor but that a larger part of the Juneau Borough than what the state has suggested may be appropriate.

(Note: The 2005 VMT data used for table 5 and 6 of the 9-factor analysis has been derived using methodology similar to that described in "Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf
The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.)

Factor 5: Growth rates and patterns

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

Table 5 below shows population, population growth, VMT and VMT growth for counties that are included in the Juneau Area. Counties are listed in descending order based on VMT growth between 1996 and 2005.

Table 5. Population and VMT Values and Percent Change.

Location	Population (2005)	Population Density (2005)	Population % change (2000 - 2005)	2005 VMT (1000s mi)	VMT % change (1996 to 2005)
Juneau	30881	11	1	207	62
Haines	2243	1	(7)	24	10
SHA	3137	0	(9)	34	(1)

Population growth in Juneau Borough has been stable in the 5 years from 2000 to 2005 but population has actually decreased in the surrounding boroughs. Interestingly enough vehicle miles travelled has increased by 62% from 1996 to 2005. This could be due to higher car ownership rates and/or higher rates of driving based on improved roads or based on changing nature of employment. It can be expected that vehicular emissions of direct $PM_{2.5}$ and NO_x may be higher than it was a few years ago.

Factor 6: Meteorology (weather/transport patterns)

For this factor, EPA considered data from National Weather Service instruments in the area. Wind direction and wind speed data for 2004-2006 were analyzed, with an emphasis on "high $PM_{2.5}$ days" for each of two seasons (an October-April "cold" season and a May-September "warm" season). These high days are defined as days where any FRM or FEM air quality monitors had 24-hour $PM_{2.5}$ concentrations above 95% on a frequency distribution curve of $PM_{2.5}$ 24-hour values.

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

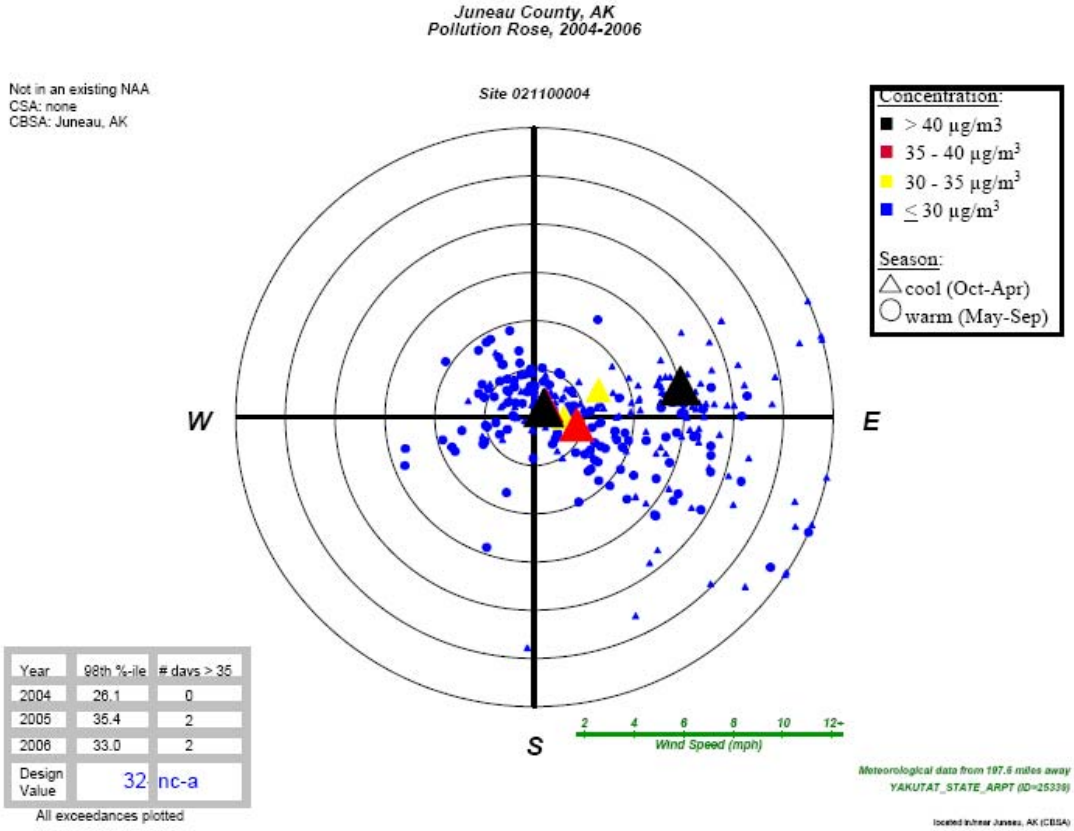


Figure 5: Pollution Rose from the Yakutat State Airport.

This pollution rose is constructed with wind speed and direction from an airport which it almost 200miles away. In places like Juneau, complex terrain and its interplay with meteorology make this data not representative of conditions in Juneau. EPA will work with the State during the public comment period to obtain data for this factor and explain how meteorology plays a factor in high PM2.5 days in Juneau.

Note: the meteorology factor is also considered in each county's Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high $PM_{2.5}$ days.

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

The geography/topography analysis looks at physical features of the land that might have an effect on the air shed and, therefore, on the distribution of $PM_{2.5}$ over the Juneau and Mendenhall Valley.

The City of Juneau lies on the Gastineau Channel and at about sea-level. This area covers populated areas around highway 7 and major point sources around the City of Juneau. Topographically to the north, northeast, and east hills rise to about 3000 and 4000 ft. To the South the city is bounded by the Gastineau Channel and there is a island with a topographical barrier of 3000 ft extending almost to the Stephen passage. To the west of the city also are some smaller topographical features which slope over the Favorite Channel, which is large water bodies directly connected to the Northern Pacific Ocean.

Factor 8: Jurisdictional boundaries (e.g., existing PM and ozone areas)

In evaluating the jurisdictional boundary factor, consideration should be given to existing boundaries and organizations that may facilitate air quality planning and the implementation of control measures to attain the standard. Areas designated as nonattainment (e.g for PM2.5 or 8-hour ozone standard) represent important boundaries for state air quality planning.

Juneau is a PM_{10} nonattainment area with boundaries as shown below. As mentioned in the summary the State submitted the PM_{10} boundary as the recommended boundary for the 2006 $PM_{2.5}$ nonattainment area. However, due to the above discussed factors, EPA feels that the PM_{10} boundary does not include all the sources that could potentially contribute to the violations in the Mendenhall Valley monitor in Juneau.

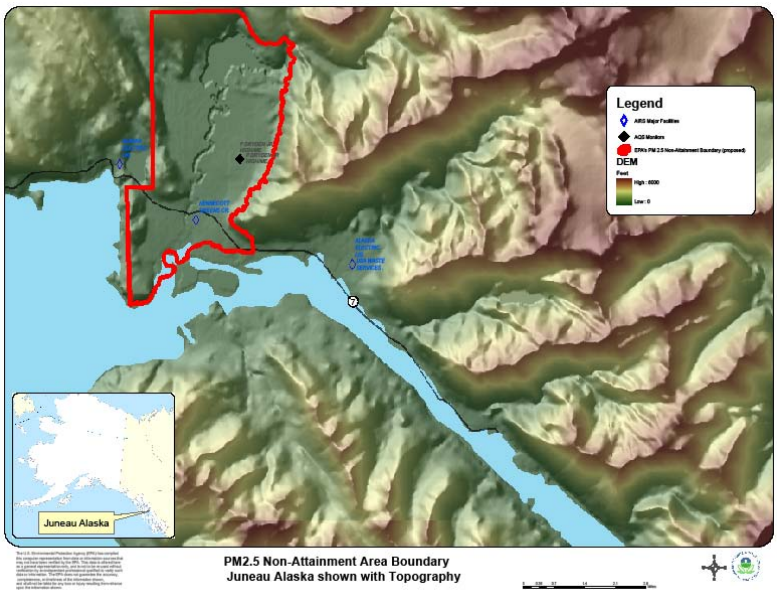


Figure 6. Map of Juneau depicting the previous PM_{10} nonattainment area

Factor 9: Level of control of emission sources

This factor considers emission controls currently implemented for major sources in the Juneau NAA.

The emission estimates on Table 1 (under Factor 1) include any control strategies implemented by the states in the Juneau before 2005 that may influence emissions of any component of $PM_{2.5}$ emissions (i.e., total carbon, SO_2, NOx, and crustal $PM_{2.5}$).

The area is maintaining the 24 hour PM10 standard and controls instituted based on the State Implementation Plan are in effect in this area.

Attachment 2
Description of the Contributing Emissions Score

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

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

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

[A more detailed description of the CES can be found at
http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C.]
Attachment 2

Description of the Contributing Emissions Score[9]

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

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

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

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

[i]. Census data supplied by the Alaska Department of Transportation and Public Facilities (ADOT&PF).