5.3 Nonattainment Area Boundary and Design Day Episode Selection

After EPA lowered the 24-hour ambient $PM_{2.5}$ standard from 65 micrometers per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ in December 2006, States were required to examine monitoring data collected within their communities and make designation recommendations based on the new standard by December 2007. After an examination of monitoring data collected at the State office building in downtown Fairbanks from 1999–2006, DEC recommended that Fairbanks be designated nonattainment for the revised $PM_{2.5}$ standard. Based on this recommendation, EPA initiated a process to define the size of the $PM_{2.5}$ nonattainment area within Fairbanks. Since monitoring data were collected at only one location, this process did not have much insight into how concentrations varied throughout the Borough. This resulted in EPA initially suggesting that a large portion of the Borough be designated nonattainment (to be conservative). In response, the State and Borough assembled an extensive set of data describing population density; terrain; meteorology; available air quality data, including limited measurements from Fort Wainwright and Eielson Air Force bases; available emission inventory estimates, etc. This information ultimately led to the selection of a much smaller final $PM_{2.5}$ nonattainment boundary for Fairbanks. The $PM_{2.5}$ boundary is different than the previously defined carbon monoxide (CO) boundary specified for Fairbanks. The boundary is important because it defines the area that is subject to regulatory controls needed to produce reductions in ambient concentrations needed to attain the standard.

Figure 5.3-1 shows a map of the nonattainment area boundary. The EPA rulemaking establishing the $PM_{2.5}$ nonattainment area[1] included the following townships and ranges within the Fairbanks North Star Borough:

- MTRS F001N001—All Sections;
- MTRS F001N001E—Sections 2–11, 14–23, 26–34;
- MTRS F001N002—Sections 1–5, 8–17, 20–29, 32–36;
- MTRS F001S001E—Sections 1, 3–30, 32–36;
- MTRS F001S001W—Sections 1–30;
- MTRS F001S002E—Sections 6–8, 17–20, 29–36;
- MTRS F001S002W—Sections 1–5, 8–17, 20–29, 32–33;
- MTRS F001S003E—Sections 31–32;
- MTRS F002N001E—Sections 31–35;
- MTRS F002N001—Sections 28, 31–36;
- MTRS F002N002—Sections 32–33, 36;
- MTRS F002S001E—Sections 1–2;
- MTRS F002S002E—Sections 1–17, 21–24; and
- MTRS F002S003E—Sections 5–8, 18.

[1] Federal Register, Vol. 74, No. 218, Friday, November 13, 2009, pages 58688-58781.

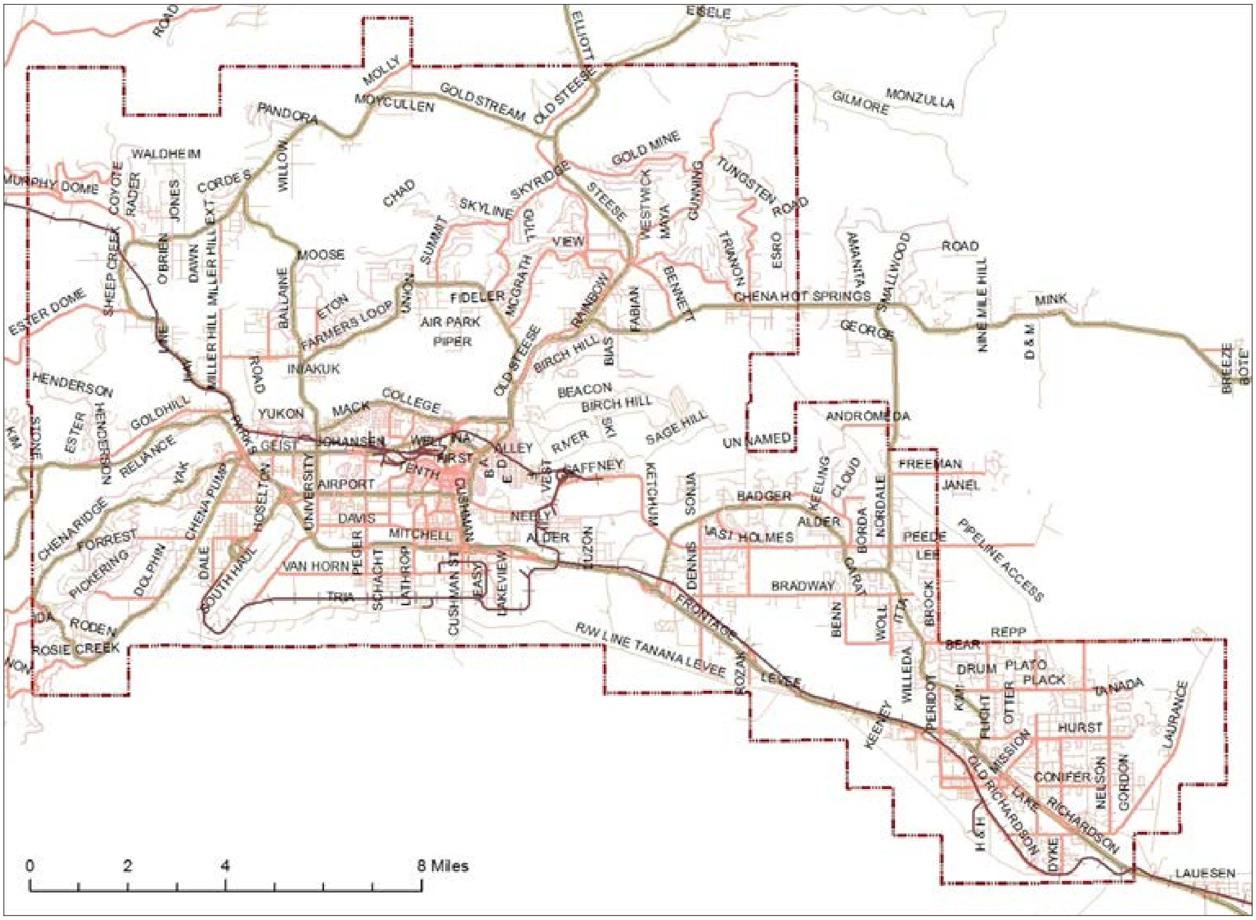

Figure 5.3-1. Fairbanks $PM_{2.5}$ Nonattainment Boundary

Eielson was excluded from the nonattainment area because monitoring data from the base showed that $PM_{2.5}$ concentrations were dramatically lower than those collected in downtown Fairbanks and meteorological data showed that upper air wind flows, which move the plume from the Central Heat and Power Plant, were rarely in the direction of the nonattainment area when concentrations were above the standard. Conversely, no measurements were available to document concentrations within the Ester and Goldstream Valleys. Since these areas are growing and have similar meteorology to the downtown area, where elevated concentrations have been recorded, they were included within the nonattainment boundary. Because preliminary measurements collected by the Borough at the Transportation Center on Peger Rd. and in North Pole indicated that these areas experienced elevated $PM_{2.5}$ concentrations, they were also included within the nonattainment boundary.

A detailed rationale of the Nonattainment Boundary selection can be found in Appendix III.D.5.3.

5.3.1. Summary of Design Day/Episode Selection for the Fairbanks $PM_{2.5}$ NonAttainment Area

Sections 108 and 109 of the Clean Air Act (CAA) require EPA to regularly review and update the NAAQS. As previously discussed, in 2006 EPA strengthened the 24-hour fine particle standard from the 1997 level of 65 μg/m^3 to 35 μg/m^3, and retained the annual fine particle standard at 15 μg/m^3. In 2012, EPA retained the 24-hour $PM_{2.5}$ standard, but strengthened the annual standard to12 μg/m^3. Elements of the NAAQS include the indicator, averaging period, level, and form of the standard. The indicator specifies the pollutant and whether it is primary or secondary; the averaging period specifies whether it is 24-hour, annual, etc.; the level specifies the concentration that provides protection for public health; and the form specifies the metrics used to assess compliance with the level of the standard (e.g., average annual, 98th percentile, etc.).

The 24-hour $PM_{2.5}$ standard is calculated using a three-year average of annual 98th percentile values. The "design value" is calculated from a three-year period of data EPA defines as the reference for assessing progress towards attainment. EPA specified 2008 as the base year for areas designated as nonattainment for the 2006 24-hour $PM_{2.5}$ standard. The design value for the base year was calculated from 98th percentile values for 2006, 2007, and 2008. A description of that calculation is presented in Appendix III.D.5.8. The base year 2008 design value calculated for Fairbanks is 40.7 μg/m^3. The design value is updated with each new year of monitoring data (i.e., it changes year to year).

In order to assess the impact of air quality controls, it is necessary to first model the baseline conditions that lead to concentrations that are representative of the Fairbanks design day. Since 2008 was selected as the base year for planning, the Borough, ADEC, and EPA evaluated the monitoring and meteorological data from that year to find episodes that could be used to represent typical conditions in Fairbanks when concentrations exceed the standard at "design day" levels. The agencies reviewed the monitored concentrations, meteorological conditions, and the results of a principal component analysis of their relationship to find episodes that met the criteria listed below.

- Days with 24-hour concentrations near 41 μg/m^3 (the design day is the average of the modeling episode dates ambient monitored by FRM and/or BAM).
- Days with speciation measurements available to provide insight into the chemical composition of recorded mass and an assessment of model performance.
- Meteorological conditions that represent typical inversion scenarios for days exceeding the standard—these are steady-state conditions where high concentrations ebb and flow and there is no appreciable change in meteorology.
- Meteorological conditions that represent a period when an approaching high-pressure system causes a rapid increase in concentrations.

- Episodes having multiple days above the standard and in the vicinity of the design day to provide better statistical confidence from modeling analyses.

- A sufficient "lead-in" period of 3-4 days prior to a higher concentration event to allow an air quality model to come to equilibrium and then follow natural fluctuations in pollutants.

Ultimately the agencies selected the two periods described below for use in the planning process.

1. *January 23 – February 10, 2008*. This episode would provide insight into conditions for near design day concentrations as well as more severe conditions producing substantially higher concentrations (i.e., those associated with an advancing high-pressure system). This is a period with colder temperatures. A summary of the concentrations and temperatures recorded for each day as well as the availability of speciation data is presented in Table 5.3-1.

2. *November 2 -17, 2008*. This episode reflects the stable conditions with the ebb and flow in concentrations; it has a corrected BAM value of 41.1 and an FRM value on the preceding day of 40.4. It occurs under relatively warmer temperatures, with lower space heating emissions and lower ventilation rates. A summary of the concentrations and temperatures recorded for each day, as well as the availability of speciation data, is presented in Table 5.3-2.

These multi-day episodes meet the above criteria and allow for analysis of days leading up to high concentrations, design day conditions, and days that exceed design day conditions. These episodes provide a reasonable baseline for analyzing controls to see what impact they have on reducing emissions to levels below the standard, while also allowing the Borough to assess how those controls may impact days with concentrations that exceed the 41 $\mu g/m^3$ design value.

Table 5.3-1
Summary of Fairbanks $PM_{2.5}$ Concentrations* and Daily Temperatures During January/February 2008 Design Episode

Date	24-hour Concentrations (µg/m³)			Daily Temperatures (ºF)		
	FRM	BAM	Speciation Data Available	Max	Min	Average
01/23/08		5.9		23	-11	6
01/24/08		27.2		-4	-30	-17
01/25/08	17.5	22.2	Yes	0	-31	-15
01/26/08		46.8		-25	-44	-34
01/27/08		35.8		-12	-43	-27
01/28/08	19.6	22.2	Yes	-6	-24	-15
01/29/08		42.0		-20	-31	-25
01/30/08		55.1		-15	-28	-21
01/31/08	No Data	19.9	Yes	-6	-15	-10
02/01/08		24.0		-5	-14	-9
02/02/08		13.2		-8	-30	-19
02/03/08	23.5	24.8	Yes	-19	-40	-29
02/04/08		51.7		-29	-44	-36
02/05/08		68.2		-29	-46	-37
02/06/08	No Data	71.0	Yes	-30	-47	-38
02/07/08		61.1		-29	-47	-38
02/08/08		73.4		-24	-46	-35
02/09/08	40.5	45.7	Yes	-15	-44	-29
02/10/08		32.7		-12	-48	-30

* FRMs are operated once every three days; BAMs collect hourly values, which are used to calculate 24-hour averages.

Table 5.3-2
Summary of Fairbanks $PM_{2.5}$ Concentrations* and Daily Temperatures During November 2008 Design Episode

Date	24-hour Concentrations ($\mu g/m^3$)			Daily Temperatures (ºF)		
	FRM	BAM	Speciation Data Available	Max	Min	Average
11/02/08	15.5	15.6		8	-6	1
11/03/08		6.6		12	2	7
11/04/08		9.7		14	-2	6
11/05/08	40.4	38.8		7	-10	-1
11/06/08		41.1		8	-11	-1
11/07/08		26.8		1	-17	-8
11/08/08	37.0	35.6	Yes	2	-12	-5
11/09/08		41.1		1	-15	-7
11/10/08		23.4		16	-5	6
11/11/08	27.4	23.7	Yes	17	-1	8
11/12/08		11.9		14	3	9
11/13/08		20.4		15	-9	3
11/14/08	50.7	51.1	Yes	3	-11	-4
11/15/08		29.4		14	-2	6
11/16/08		48.4		8	-13	-2
11/17/08	20.0	18.9		16	3	10

* FRMs are operated once every three days; BAMs collect hourly values, which are used to calculate 24-hour averages.