Alaska Department of Environmental Conservation

Preliminary Draft

Possible Concepts and Potential Approaches

For development of the
Fairbanks North Star Borough Nonattainment Area
Serious State Implementation Plan

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This document provides a summary and context to the various technical preliminary draft documents that have been released. Several areas within the draft documents highlight where additional information is needed or work still needs to be done. A brief list is provided here. Areas within the documents that identify specifically where additional information would be useful will be in text boxes similar to the one below.

Basic list of information needs

- Heating oil supply data to cross-check splits of #1 and #2 oil use estimated from Fairbanks residential home heating surveys
- Technical feasibility of measures identified with the draft Best Available Control Measure (BACM) analysis
- Any information that will assist in the economic evaluation of the BACM analysis
- Answers to questions posed regarding potential Most Stringent Measures (MSM)

DEC is releasing preliminary drafts in order to be transparent in our process and to provide an opportunity for the public to provide additional data and information. The drafts do not represent final decisions. Based upon public input, control measures may be added or removed.

The Environmental Protection Agency (EPA) reclassified the Fairbanks North Star Borough (FNSB) fine particulate matter (PM2.5) nonattainment area from a Moderate to a Serious Area with an effective date of June 9, 2017. The reclassification by EPA triggered a requirement for DEC to update the area's SIP to include additional requirements that can implemented to improve air quality.

The draft documents and any additional information provided by the public will form the basis of the updated SIP. Some of the documents fulfill explicit EPA requirements for a Serious Area SIP while others are optional supporting materials. The public is encouraged to provide additional information to dec.air.comment@alaska.gov by May 9, 2018 that could assist in the finalization of the preliminary drafts. Final drafts will be released as part of the formal public review process when the full Serious SIP is released later in 2018.

1. Introduction

The Fairbanks North Star Borough (FNSB) has levels of fine particulate matter ($PM_{2.5}$) air pollution that are above the health based National Ambient Air Quality standard (NAAQS).

In November 2009, FNSB[1] was designated as a Moderate nonattainment area for the 2006 24-hour Fine Particulate ($PM_{2.5}$) NAAQS.[2] On April 28, 2017, EPA officially re-classified the Fairbanks from "Moderate" to "Serious" nonattainment for the 24-Hour $PM_{2.5}$ standard, effective June 9, 2017.[3] The reclassification triggered a requirement for the Alaska Department of Environmental Conservation (ADEC) to draft a Serious State Implementation Plan (SIP). ADEC is working cooperatively with the FNSB in support of local air quality efforts and the development of the SIP. The preliminary draft documents are foundational documents that will contribute to the Serious SIP, which will be subject to an additional formal public review in the future.

[1] EPA designation documents refer just to "Fairbanks" and not FNSB.
[2] https://www.gpo.gov/fdsys/pkg/FR-2009-11-13/pdf/E9-25711.pdf
[3] https://www.federalregister.gov/documents/2017/05/10/2017-09391/determinations-of-attainment-by-the-attainment-date-determinations-of-failure-to-attain-by-the

Key elements of the Serious SIP include:

- Updated Emission Inventories – a base year (2013), the mandated attainment date (2019) and the attainment year, if different (as late as 2024).
- Control Measure Analysis – an evaluation of all control measures implemented in other $PM_{2.5}$ nonattainment areas for direct $PM_{2.5}$ and its precursors determined to be significant.
- Implementation of the Best Available Control Measures and Technologies (BACM and BACT) that are determined to be technologically and economically feasible for the FNSB area.
- Attainment Demonstration – photochemical modeling which demonstrates the concentrations within the FNSB nonattainment area are equal to or less that the $PM_{2.5}$ NAAQS.

If it is impracticable to model attainment of the $PM_{2.5}$ standard by 2019, ADEC will have to request an extension of the attainment date. If this occurs, the necessary level of controls would rise from BACT to Most Stringent Measures (MSM). MSM would achieve the most stringent emissions reductions from among those control measures which are either included in any SIP for any other NAAQS, or that have been achieved in practice in any state and can feasibly be implemented in the nonattainment area.

Along with the FNSB, EPA also designated the following communities as Serious $PM_{2.5}$ nonattainment areas:

- Los Angeles County, California
- Provo, Utah
- Salt Lake City, Utah
- San Joaquin County, California

Insight into the challenges FNSB faces in defining a path to attainment can be seen in Table 1. Using information available from EPA's Green Book, Table 1 displays design values[4] supporting EPA's initial nonattainment designations in 2009 with the most recent design values[5] available. It shows differing levels of progress have been achieved by each community. Three communities have recorded declines while two communities have recorded increases. FNSB, which has the lowest population has the distinction of having a triple digit design value and the largest design value increase. While this is a result of the more recent design value using measurements from a different monitor (North Pole) than used in the initial designation (downtown Fairbanks), the difference between this value and the ambient standard is 71 $\mu g/m^3$, which means that 98th percentile concentrations (the form of the standard) need to be reduced by 67% to demonstrate attainment. Despite the magnitude of the challenge, **the current design value demonstrates progress; it is 15% lower than the 124 $\mu g/m^3$ design value recorded in the 2013-2015 period.** That reduction is part of a continuing trend with design values dropping from 139 $\mu g/m^3$ in 2014 to 124 $\mu g/m^3$ in 2015 and 106 $\mu g/m^3$ in 2016. Preliminary data for 2017 suggests that the North Pole design value will drop well below 100 $\mu g/m^3$. These reductions demonstrate the steady progress the community has achieved in reducing fine particulate emissions.

[4] A design value is calculated as the three-year average of 98th percentile 24-hour $PM_{2.5}$ concentrations. For example the 2016 design value averages 24-hour 98th percentile concentrations from 2014, 2015, and 2016.

[5] A design value is a statistic that describes the air quality status of a given location relative to the level of the National Ambient Air Quality Standards (NAAQS). Compliance with the 24-hour $PM_{2.5}$ NAAQS is determined using three years of air monitoring data. The design value is an average of the 98th percentile 24-hr average $PM_{2.5}$ concentrations over three years.

Table 1
Serious $PM_{2.5}$ Nonattainment Metrics*

Area Name	24-hour Design Value at Time of Designation (2006-2008)	Design Value as of 7/14/17 (2014-2016)	Population (2010)
Fairbanks, AK	41	106^	87,456
Los Angeles – South Coast Air Basin, CA	49	43	15,716,242
Provo, UT	44	29	517,537
Salt Lake City, UT	48	42	1,665,137
San Joaquin Valley, CA	70	72	3,842,165

* https://www3.epa.gov/airquality/greenbook/rdtc.html
^ The design value at the time of designation was based upon monitoring in Fairbanks. The 2016 design value was based upon monitoring in North Pole.

Information presented in the Reasonable Available Control Measure (RACM) analysis for the Moderate $PM_{2.5}$ SIP[6] documented that home heating expenses in FNSB are two to three times higher than seen in any other community with wood burning controls. Unlike many communities, FNSB has limited access to natural gas and the dominant source of residential heating is fuel oil, which has had volatile prices swings in recent years. The high cost of fuel causes many residents to look for alternatives, notably wood and to a lesser extent coal, which have emission factors that are orders of magnitude above fuel oil. Data on average heating degree days[7] recorded for winter months in the Serious $PM_{2.5}$ nonattainment areas is displayed below in Figure 1. The FNSB values are more than double those seen in the other areas. A broader comparison of heating requirements is displayed in the second figure. It shows that FNSB heating needs far exceed those recorded in other lower-48 cold weather communities. The high cost of heating is the principal challenge to improving air quality in FNSB.

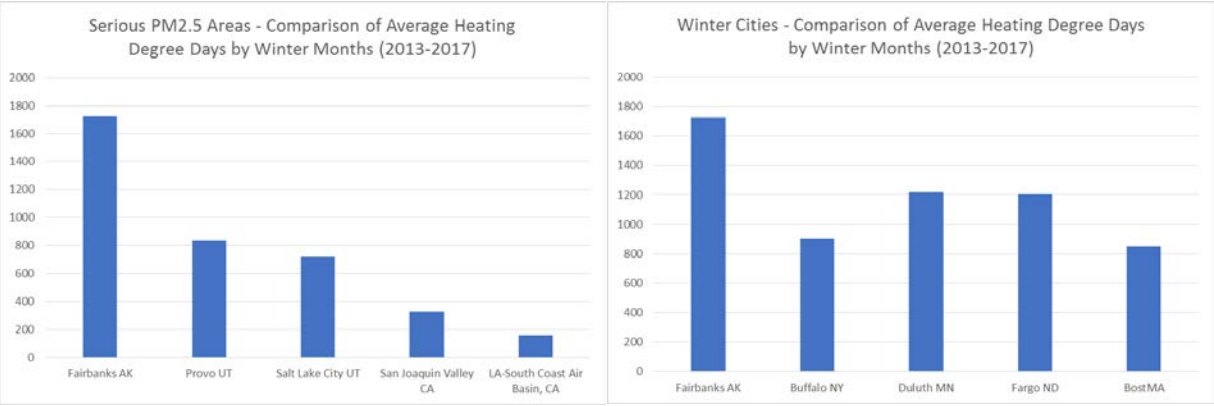

Figure 1: Heating degree day comparison. (Source: http://www.weatherdatadepot.com)

[6] https://dec.alaska.gov/air/anpms/comm/docs/fbxSIPpm2-5/appendix_iii.d.5.07-draft_11-13-14.pdf

[7] Heating Degree Days (HDDs) are a common metric used to compare space heating loads or demand across locations or by month/season within a specific area, and represent the number of degrees that a day's average temperature is below a base or reference temperature, typically 65°F.

The remainder of this document is organized to present the preliminary draft information and how that information forms the key elements needed to prepare this SIP. They are presented in the order in which they are employed.

- Section 2 presents the preliminary draft emissions inventory, which provides the initial insight into the relative magnitude of source contributions and discusses the significance of these source contributions.
- Section 3 presents preliminary findings for precursor pollutant significance. $PM_{2.5}$ precursor pollutants include sulfur dioxide, nitrogen oxides, ammonia, and volatile organic compounds, which as a result of complex chemical reactions can form particles in the atmosphere.
- Section 4 presents findings for source specific Best Available Control Technology (BACT) analysis.
- Section 5 presents preliminary findings for the Best Available Control Measure (BACM) analysis.
- Section 6 discusses the implications of these preliminary findings in section 2-5 for attainment.

Each discussion also identifies the work that remains to be completed and within the draft preliminary documents identifies additional information that may be needed.

2. Preliminary Emission Inventory

Title I of the Clean Air Act Amendments of 1990 (CAA) contains provisions requiring development of emission inventories for designated areas that fail to meet the National Ambient Air Quality Standards (NAAQS). The emission inventory is a collection of emission estimates separately compiled for each potential source of air pollutants within the nonattainment area and surrounding regions and then integrated into a combined framework. Stated simply, the inventory is a foundational element of the SIP and used to identify the key sources of emissions and contributions from all sources in the area and serves as a basis for determining how to best reduce pollutant emissions in order to attain the NAAQS.

For the FNSB Serious $PM_{2.5}$ SIP, a complex set of emission inventories must be prepared to satisfy CAA and EPA regulatory requirements. Table 2 summarizes the minimum set of inventories that must be developed and submitted to satisfy the Serious Area SIP requirements. (If FNSB is not projected to attain the $PM_{2.5}$ NAAQS by the 2019 target date for Serious $PM_{2.5}$ areas, a broader set of inventories must be developed out as far as 2024 to identify when attainment is expected. This broader set of required inventories is discussed in detail in the Emission Inventory document.) Table 2 refers to two classes of inventories:

1. Planning – inventories of total source emissions across the defined nonattainment area; and
2. Modeling – inventories that spatially locate sources within a dense three-dimension grid that includes and extends beyond the nonattainment area.

Table 2
Summary of Applicable Inventories for Serious Area $PM_{2.5}$ SIP

Class	Type	Geographic Area[8]	Calendar Year	Regulatory Requirements	Status
Planning	Base Year	Nonattainment Area	2013	CAA 172(c)(3)	Preliminary Draft
	Projected, with controls	Nonattainment Area	2019	CAA 172(c)(3)	Under Construction

[8] The modeling domain covers an area larger than the nonattainment area. This larger modeling domain is necessary in air quality modeling to capture upwind sources, reduce the influence of boundary conditions, and capture the influence of recirculated pollution from within the nonattainment area.

Modeling	Baseline	Modeling Domain	2013	CAA 189(b)(1)	Preliminary Draft
	Projected, with controls	Modeling Domain	2019	CAA 189(b)(1)	Under Construction

Planning inventories are used to fulfill regulatory planning and reporting requirements that must be tracked for the nonattainment area. Modeling inventories are used in conjunction with an air quality model that simulates how emissions are dispersed and transported throughout the atmosphere and chemically react to form $PM_{2.5}$ from other "precursor" pollutants. The inventories include emissions of directly-emitted $PM_{2.5}$ as well as potential precursor pollutants: sulfur dioxide (SO_2), oxides of nitrogen (NOx), volatile organic compounds (VOC), and ammonia (NH_3).

ADEC and EPA jointly determined that the baseline year for the Serious SIP is 2013. The joint agency determination of the baseline year considered calendar years within the five-year period (2011-2015) upon which the Serious Area "design value" will be based. Factors evaluated included:

1) The representativeness/meteorological severity of each candidate year;
2) The availability of data from periodic inventory reporting requirements such as three-year National Emission Inventory (NEI) reporting; and
3) Whether the year was centered within, or at one end of the 2011-2015 period (a centered year better accounts for effects of any trends within the period).

Emission estimates based on locally-collected source activity data in that year were used to establish this baseline inventory. Table 3 presents the preliminary 2013 baseline planning inventory for the nonattainment area, expressed as average day emissions within the wintertime nonattainment season. Emissions of direct $PM_{2.5}$ are highlighted in the first column. Precursors pollutant emissions are also shown. As seen in Table 3, it appears the largest share of direct $PM_{2.5}$ (63% of total $PM_{2.5}$) comes from space heating, with wood-burning being the dominant fuel type producing $PM_{2.5}$ emissions. For NOx and SO_2, point sources (large industrial facilities) are the largest contributor, producing 64% and 67% of total emissions for those pollutants, respectively. (The majority of VOC and NH_3 precursors emissions also come from space heating). Note that even though the emissions from some precursor pollutants exceed the emissions of direct $PM_{2.5}$, not all of the precursor will convert to $PM_{2.5}$ in the atmosphere.

Table 3
Preliminary 2013 Baseline Winter Season Nonattainment Area Emissions (tons/day) by Source Sector

	Nonattainment Area Winter Season Emissions (tons/day)				
Source Sector	**$PM_{2.5}$**	**NOx**	**SO_2**	**VOC**	**NH_3**
Point Sources	1.25	10.58	7.44	0.21	0.051
Area Sources, Space Heating, All	2.62	2.32	3.62	9.56	0.137
Area, Space Heat, Wood	2.46	0.39	0.08	9.35	0.092
Area, Space Heat, Oil	0.06	1.72	3.42	0.10	0.003
Area, Space Heat, Coal	0.09	0.05	0.10	0.11	0.013
Area, Space Heat, Other	0.01	0.16	0.02	0.01	0.028
Area Sources, Other	0.05	0.00	0.00	0.33	0.000
On-Road Mobile Sources	0.26	3.63	0.04	4.41	0.055

Non-Road Mobile Sources	0.03	0.03	0.00	1.32	0.000
TOTALS	**4.20**	**16.56**	**11.10**	**15.82**	**0.244**

The fact that space heating (specifically wood burning) is the dominant $PM_{2.5}$ emission source category is not surprising in the harsh arctic winter climate of FNSB, which results in extremely high heating energy demand per square foot experienced in no other location in the lower-48.

This extreme heating energy demand is complicated by the fact that the other primary space heating fuel, heating oil, has exhibited significant historical price variations that have been exacerbated by FNSB's remote interior Alaska location and the lack of a widespread and affordable natural gas delivery infrastructure. (Natural gas is a very clean heating fuel, but its availability within the nonattainment area is limited.) Year-to-year local survey data have been collected during these heating oil price swings that indicate FNSB residents tend to switch to greater use of wood when heating oil prices are high because wood is cheaper, especially for residents that cut their own wood.

Moreover, most but not all dwellings appear to have multiple heating devices/fuels, typically a central heating oil furnace and a woodstove. Depending on household income, occupants of these dwellings have more or less willingness and ability to switch between oil and wood given historical oil price volatility. In addition, a small fraction of nonattainment area households (5%) have a wood device as their sole heating source based on analysis of data from the 2011-2015 Fairbanks Home Heating surveys.[9] Requiring a cessation of wood-burning for space heat in these households is problematic during the harsh winter conditions.

To date, ADEC has completed preparation of a draft preliminary 2013 baseline inventory, which is being released, and is in the process of gathering information in order to project source activity and emissions through 2019 (and potentially out to 2024) based on socio-economic forecasts of population, employment and housing within this period. Key issues associated with these forecasts include:

- *Eielson Air Force Base Growth* – Starting in 2018 and ramping up through 2021, Eielson Air Force Base (located just outside the nonattainment area) will exhibit significant growth in military and civilian personnel associated with a deployment of a new squadron of F-35 fighter jets. Although military aircraft operating in the area are minor contributors to PM2.5 and precursor emissions, the influx of personnel associated with the F-35 deployment that live or travel within the nonattainment area will likely represent a marked uptick in growth across the area.

- *Future Heating Oil Prices and Impacts on Wood Use* – Fairbanks heating oil prices peaked around the 2013 calendar year baseline inventory. The projection of emissions from 2013 baseline levels will need to account for historically measured shifts between wood and heating oil use as heating oil prices have risen and dropped in the past. The projected baseline inventory in 2019 (and potentially later years) will use U.S. Energy Information Administration (EIA) forecasted heating oil prices (scaled to FNSB) to reflect the expected future mix of wood vs. heating oil use for space heating. (Given the uncertainty in energy price forecasts, worst/best case price scenarios will also be developed and used to develop separate projected inventories to bound the effects of the heating oil price forecasts.)

Analysis is also underway to determine if attainment can be reached by 2019, which is the current attainment date, by strengthening existing controls or adopting and implementing new control measures prior to that date.

[9] As described in the Emission Inventory document, over 3,500 nonattainment area households were sampled across the annual Fairbanks Home Heating surveys from 2011-2015. Data were collected on the heating devices and annual and wintertime fuel usage within each home and analyzed to estimate the fraction of homes with wood as their sole heating source.

The Fairbanks and North Pole portions of the nonattainment area appear to be under different timelines for being able to come into attainment, with Fairbanks likely to attain much sooner than North Pole. Thus, DEC is evaluating the implications of splitting the current nonattainment area into separate planning areas for SIP purposes, which would trigger the need for separate planning inventories for each.

One element of the emission inventory that affects calculated SO_2 emissions for space heating is the estimated split between #1 and #2 heating oil used in oil devices for space heating. The preliminary draft baseline inventory estimated the residential split based on respondent data from 2011-2015 FNSB home heating surveys. Local supplier data on #1 and #2 use within the nonattainment area, separately for residential and non-residential use, would be a useful cross-check of this estimate.

3. Preliminary Modeling and Precursor Analysis Results

Attainment is demonstrated or modeled within the SIP using a mathematical air quality model that simulates how pollutants emitted from various locations within and beyond the nonattainment area are dispersed and transported and how they chemically react within the atmosphere to form $PM_{2.5}$. For the FNSB SIP, attainment modeling is conducted with the EPA-approved Community Multiscale Air Quality (CMAQ) model, an Eulerian 3-dimensional transport photochemical model over a modeling domain of 202 × 202 horizontal grid cells, each 1.33 km square. There are also 38 vertical layers in the 3-dimensional domain, with finer spacing in the ground/near ground layers. Through the modeling inventories, emissions are allocated into each grid cell (horizontally and vertically) based on known source locations. Using input meteorology (also 3-dimensionally represented), the CMAQ model then simulates the movement, build-up and formation of ambient $PM_{2.5}$ for each hour of the day over two historical wintertime modeling episodes when measured concentrations in the nonattainment are exceeding the $PM_{2.5}$ standard for an extended period of days.

Preliminary CMAQ modeling runs have been performed using the preliminary 2013 baseline emissions inventory to evaluate and validate the model's performance in representing historically measured concentrations at ambient monitors within the nonattainment area. This involves comparisons of both predicted vs. measured $PM_{2.5}$ in those grid cells where the monitors are located as well as comparisons of individual species of primary vs. secondary (i.e., directly-emitted vs. atmospherically-formed) $PM_{2.5}$. This latter comparison is a key part of validating the model's performance since it ensures the model adequately reflects the mix of sources that contribute both direct $PM_{2.5}$ emissions as well as emissions of gaseous precursor pollutants (SO_2, NOx, VOC and NH_3) that react in the atmosphere to form ambient $PM_{2.5}$.

A separate series of CMAQ runs (again using the 2013 baseline inventory) have also been conducted to evaluate the significance of the precursor pollutants to determine whether emission controls must also be considered for these precursors and not just directly-emitted $PM_{2.5}$. In accordance with EPA guidance, this precursor modeling analysis consists of a combination of concentration-based and emissions sensitivity modeling, where the baseline inventory is scaled by different levels to evaluate the model's response to changes in the levels of input emissions of direct $PM_{2.5}$ and each precursor. These precursor sensitivity runs are performed for both the stationary point source sector individually and for the entire or "comprehensive" set of all inventoried emission sources to inform the Best Available Control Technology (BACT) and Best Available Control Measure (BACM) evaluations, respectively as to which specific precursors are significant and warrant evaluation of emission controls.

Table 4 summarizes the preliminary findings of the precursor significant modeling analysis pollutant controls to

be evaluated under BACT and BACM. Even though the emissions for some precursors exceed the emissions of direct $PM_{2.5}$ not all of the precursor will convert to $PM_{2.5}$. One other consideration is that the $PM_{2.5}$ and precursor gases emitted by point sources may not contribute to ground level concentrations due to the height of the plume and the strong inversions present in the winter.

Table 4
Preliminary Precursor Significance Evaluation Summary

Precursor Pollutant	Modeling Assessment
Volatile Organic Compounds (VOCs)	Not significant for either point sources or comprehensively
Oxides of Nitrogen (NOx)	Not significant for either point sources or comprehensively
Ammonia (NH_3)	Not significant for either point sources or comprehensively
Sulfur Dioxide (SO_2)	Significant for both point sources and comprehensively

4. Preliminary BACT Findings

Once EPA re-classified the FNSB $PM_{2.5}$ nonattainment area to Serious, it triggered the requirement for stationary sources with over 70 tons per year (TPY) potential to emit (PTE) for $PM_{2.5}$ or its precursors to conduct a Best Available Control Technology (BACT) analysis.

Based on the ADEC preliminary evaluations, Table 5 shows which pollutants are being evaluated for new point source control measures under BACT, based on preliminary evaluations conducted to date.

Table 5
Preliminary Precursor Significance Evaluation Summary

Pollutant	New Control Measure Preliminary Decision	Basis for Preliminary Decision
PM2.5 - direct	No new control measures - currently controlled	Draft BACT Analysis
VOCs Volatile Organic Compounds	No new control measures	Draft Precursor Determination
NOx Nitrous Oxides	No new control measures	Draft Precursor Determination
NH3 Ammonia	No new control measures	No applicable control measures or technologies
SO2 Sulfur Dioxide	Yes, new control measures	Draft BACT Analysis/Draft Precursor Determination

The sulfate portion of $PM_{2.5}$ is the second or third largest contributor to concentrations in the nonattainment area - SO_2 emissions convert to ammonium sulfate in the atmosphere. The NOx emissions convert to ammonium nitrate in the atmosphere and both ammonium nitrate and sulfate are components of $PM_{2.5}$. ADEC is considering implementing SO_2 controls for point sources. ADEC is not considering controls for NOx and VOC gases from major point sources, because they were deemed to be insignificant contributors to the $PM_{2.5}$ exceedances (see Table 4) and currently installed direct $PM_{2.5}$ controls are considered BACT according to the Draft BACT Analysis.

Pollutant control technologies were evaluated for the five power plants in Fairbanks and North Pole using EPA's five-step top-down approach detailed in the Final $PM_{2.5}$ Rule.[10] However, in making any final control measure decisions, it will be important to look at the collective impacts to the communities as well as air quality. It is also important to identify community characteristics that may be outside the norm when comparing pollutant control technologies used in other parts of the country.

At this time, ADEC is considering only requiring one control measure per major stationary source to meet BACT and MSM for SO_2. The most feasible measure that has the least economic impact, most likely to be implemented in a timely fashion and provide direct emission benefits are shown in Table 6.

Table 6
Preliminary BACT Controls by Point Source Facility

Facility	Emission Unit Description	ADEC Preliminary BACT/MSM Determination
Aurora	Four Coal-Fired Boilers	Dry Sorbent Injection
Fort Wainwright	Six Coal-Fired Boilers	Dry Sorbent Injection
GVEA North Pole	2 Diesel-Fired Turbines	Ultra-Low Sulfur Diesel
GVEA Zehnder	2 Diesel-Fired Turbines	Ultra-Low Sulfur Diesel
UAF	Coal & Biomass Boiler	Dry Sorbent Injection

BACT analysis of preliminary cost for the initial selection of source control measures is summarized below in Table 7 from information found within the BACT Determination for each facility.

Table 7
Preliminary BACT Cost Analysis Summary

Facility	ADEC Preliminary BACT Determination	Efficiency	Cost Estimates at this time (Capital Costs)
Aurora	Dry Sorbent Injection	80%	$12,332,076
Fort Wainwright	Dry Sorbent Injection	80%	$10,186,401
GVEA North Pole	Ultra-Low Sulfur Diesel	99.7%	$30,425,130
GVEA Zehnder	Ultra-Low Sulfur Diesel	99.7%	
UAF	Dry Sorbent Injection	75%	$4,394,193
Community Burden			$53,756,800

In Table 8, the capital costs for all other technologically feasible control options are listed with associated costs. As mentioned, DEC believes that the most feasible measure for each point source that has the least economic impact, most likely to be implemented and provide direct emission benefits are those listed in Table 6.

The following control measures in Table 8 are NOT being considered at this time for either BACT or MSM, even if they have increased efficiency, due to the economic burden on the community.

Table 8

[10] https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf

Preliminary additional MSM controls for Point Source Facilities that are NOT proposed to be implemented.

Facility	ADEC Preliminary BACT/MSM Determination	Efficiency (SO_2 Control)	Cost Estimates at this time (Capital Costs)
Aurora	Spray Dry Absorber	90%	$60,270,115
Fort Wainwright	Spray Dry Absorber	90%	$83,952,795
UAF	Spray Dry Absorber	90%	$18,992,799
Community Burden			$103,005,979

Facility	ADEC Preliminary BACT/MSM Determination	Efficiency (SO_2 Control)	Cost Estimates at this time (Capital Costs)
Aurora	Wet Scrubber	99%	$65,957,875
Fort Wainwright	Wet Scrubber	99%	$92,078,754
UAF	Wet Scrubber	99%	$20,641,103
Community Burden			$160,100,732

The preliminary decision to limit control to a single option for each facility will have an economic impact to individuals and the community. Please see the Draft BACT Determination for additional information on the cost estimates presented above.

5. Preliminary BACM Findings

The process for selecting Best Available Control Measures (BACM) is defined in a series of steps detailed in the Final $PM_{2.5}$ Rule.[11] The status of each step is presented in Table 9 below. It shows that work on the first three steps are within the Preliminary Draft document and that Steps 4 and 5, along with the overall findings are currently under construction. Step 1, a summary of the preliminary baseline inventory findings, was presented earlier. Step 2 examined rules, regulations and $PM_{2.5}$ SIP commitments from 29 separate nonattainment areas and identified, 71 control measures that were potentially more stringent than those currently in place for FNSB (Ordinance No. 2018-04, adopted February 8, 2018). The preliminary technological feasibility of implementing each of those measures was examined in Step 3. A careful analysis of the regulations mandating the 71 control measures with current FNSB regulations determined that 45 measures provide no additional emission benefits. These measures were rejected for a variety of reasons, including: they affect less sources (e.g., fireplaces were exempted, whereas they are not in Fairbanks), the measure was implemented as a nuisance control, not an air quality control, the air quality Alert threshold is less stringent, etc. Twelve measures were determined to have marginal/unquantifiable benefits and technologically infeasible. A total of fourteen (14) measures appear to be technologically feasible and will need to be further examined for economic feasibility in Step 4. They are listed in Table 10.

[11] https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf

Table 9
Status of Preliminary Draft BACM Analysis

Element	Status
Step 1: Develop a Comprehensive Inventory of Sources and Source Categories of Directly Emitted and PM2.5 and PM2.5 Precursors	Preliminary Draft BACM Analysis
Step 2: Identify Potential Control Measures	Preliminary Draft BACM Analysis
Step 3: Determine Whether an Available Control Measure or Technology is Technologically Feasible	Preliminary Draft BACM Analysis
Step 4: Determine Whether an Available Control Technology or Measure is Economically Feasible	**Under Construction**
Step 5. Determine the Earliest Date by Which a Control Measure or Technology can be Implemented in Whole or in Part	**Under Construction**
BACM Findings	**Under Construction**

Overall, these preliminary findings show that 57 of the candidate control measures are technologically infeasible meaning they offer no potential emissions benefit. This seems to indicate that the current FNSB controls are equal to or more stringent than most of those found in other $PM_{2.5}$ control program across the U.S. (i.e., FNSB has a very extensive control program). However, this preliminary finding is dependent on existing FNBS ordinances remaining as is. Recognizing that wood burning is the dominant source of directly emitted $PM_{2.5}$, the technologically feasible measures, beyond what is already implemented, appear to offer limited benefit as they impact relatively small source categories: new construction, rental units, coal, etc. The only measure that has been identified within the preliminary draft that addresses a significant source is ultra-low sulfur (ULS) heating oil which impacts ~ 70% of the homes in the nonattainment area. This initial BACM measure is used in many areas within the Northeastern U.S. Please see http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip-development "Residential Fuel Expenditure Assessment of a Transition to Ultra-Low Sulfur Heating Oil for the Fairbanks PM-2.5 Serious Nonattainment Area" for the preliminary cost evaluation for this potential measure.

Table 10
Preliminary List of Measures Determined to be More Stringent than Existing Controls

Number	Measure Title
Measure 3	Require Building or Other Permit – More Limited Devices Allowed
Measure 8	Prohibit Installation of Solid Fuel Heating Device in New Construction
Measure 9	Limit the Density of Solid Fuel Heating Devices in New Construction
Measure 10	Install EPA-Certified Device Whenever a Fireplace or Chimney in Remodeled
Measure 22	Require Registration of All Devices
Measure 24	Require Permanent Installed Alternative Heating Method in Rental Units
Measure 29	Allow Only NOASH Households to Burn During Curtailment Periods
Measure 47	Inspection Warrants

Measure 48	Date Certain Removal of "Coal Only Heater"
Measure 51	Ultra-low Sulfur Heating Oil
Measure 52	Operation and Sale of Small "Pot Burners" Prohibited
Measure 53	No Use Sale or Exchange of Used Oil for Fuel, unless it Meets Constituent Property Limits
Measure R5	Ban New Installations – Hydronic Heaters
Measure R29	Increase Coverage of the District Heating System

The draft results of the Preliminary Precursor Demonstration found that NOx and VOCs are not significant and therefore controls for these pollutants do not need to be examined. This finding exempted motor vehicle Inspection and Maintenance (I/M) programs from a Step 3 analysis of technological feasibility for NOx and VOC benefits. Since EPA's motor vehicle emissions model MOVES, including the recently released version MOVES2014, does not provide a PM benefit for either light- or heavy-duty I/M programs, there is no basis for assessing benefits for either program, therefore the preliminary finding is that an I/M program is determined to be technologically infeasible.

Additional information regarding the technological feasibility of the control measures listed within the Preliminary draft BACM analysis or Table 10 will assist DEC in finalizing a list of measures to move forward to the development of the economic feasibility analysis. Economic information would also be helpful.

6. Preliminary Outlook for Attainment

Despite the progress achieved in recent years, FNSB requires huge reductions in emissions to achieve the 67% reduction in 98th percentile concentrations needed to demonstrate attainment. The preliminary baseline emission inventory shows that 60+ percent of directly emitted $PM_{2.5}$ comes from residential wood burning. The additional technologically feasible control measures identified in the BACM analysis appear to offer limited reductions in residential wood burning emissions. The remaining measures appear to offer limited short-term benefits that will increase over time.

The Precursor Demonstration found SO_2 to be significant and point source controls identified in the BACT analysis offer significant benefits. Similarly, mandating ULS heating oil offers the potential for significant reductions in residential SO_2 emissions. The problem with ULS heating oil is that it could carry a significant price premium, which if implemented may cause home owners to increase wood burning to offset a portion of their increased heating bill. Directly emitted $PM_{2.5}$ from wood burning is orders of magnitude higher than from ULS heating oil. Therefore, the net benefit between increased wood burning emissions and decreased SO_2 emissions (and converted sulfate) could be very sensitive to the elasticity used to calculate the fractional increase in wood burning. This issue is being analyzed and has not been resolved.

Regardless of the outcome of the ULS heating oil analysis, additional reductions will be needed to demonstrate attainment beyond 2019. A variety of controls that were <u>not</u> identified in the BACM analysis (i.e., they have not been implemented in other $PM_{2.5}$ nonattainment areas) or rejected in the BACM analysis will need to be considered. They include:

- Most Stringent Measure (MSM) requirements will apply to both point and area sources. MSMs are required to be fully implemented 1-year prior to the attainment date. Preliminary estimates of the reductions needed to achieve attainment indicate that it may be impracticable to achieve the 2019 attainment date due in large part to the additional time needed to bring the North Pole Fire Station monitor into compliance. As part of the Serious SIP, the expected attainment year must be determined. As a result of the large reductions required at North Pole, it seems likely that this would require the

maximum allowed time out to December 2024. Under this scenario, MSMs would be required to be implemented by December 2023. ADEC is considering control measures that would satisfy both the BACT/BACM requirements and the Most Stringent Measurement (MSM) requirements. ADEC interprets the main difference between BACT/BACM and MSM as the time it takes to implement a control. To meet BACT/BACM, a control measure needs to be fully implemented four years after an area has been reclassified to Serious. For the FNSB nonattainment area, this is June 9, 2021.

- New measures not identified as candidates in the BACM analysis are expected to address activities that enhance burn ban compliance. Activities that promote awareness, outreach and enforcement (including staffing, measurement, penalties, etc.) will need to be examined, debated, selected and codified. Increased compliance with burn bans offers the largest potential reduction in directly emitted $PM_{2.5}$. Other measures may come from implementation activities employed by other programs with $PM_{2.5}$ concerns, such as Utah's use of infrared cameras to observe solid fuel heating device operation during nighttime operation. Other innovative data collection methods that have not been utilized (e.g., use of drones, etc.) may become available, Another source of control and candidate for MSM is expected to be the expanded availability of cleaner burning natural gas, which is not expected to be widely available until 2020.

- Measures determined to be technologically infeasible in the BACM analysis because they were not implemented in other communities' $PM_{2.5}$ attainment plans are also a source of controls that could be considered. They could include: development of regional kilns to dry wood, etc.

Measures determined to be technologically effective but not cost effective in the BACM analysis will also need to be considered and implemented as MSMs. Measures in this category are unknown at this time.

Changes in fuel pricing and fuel availability will offer FNSB homeowners with an array of opportunities to minimize their heating bill in future years. Information on homeowner preferences and interest in converting to natural gas once it becomes available is needed to aid forecasts about the mix of home heating fuels the community will be using.

ADEC is looking for information from the public that may assist in finalizing these preliminary documents. Information on the following concepts and questions would be particularly helpful to assist in the evaluation of MSMs.

1) Dry Wood Only sales by commercial wood sellers:
    a. What future year could a Dry Wood Only sales requirement be best implemented?
    b. How many years are needed to set up a supply if not kiln dried?
2) Development of a Regional Kiln or Wood Drying facility:
    a. What are the operating logistics of a regional wood drying program?
    b. Would individuals who cut their own wood be willing to have it dried, thus adding an additional step in their process?
3) Limitation on the type of wood fired heating devices that could be sold – for example, only those devices equipped with a catalytic device that has passed EPA certification.
    a. Possibly requiring catalytic device change out every three years – under current federal requirements a catalyst is only required to last up to three years.
    b. Registration of wood fired device by the vendor at the time it is sold.
4) Other ideas for MSMs related to reducing emissions from home heating or other sources.

ADEC has received feedback related to the compliance of control measures stating that the focus should be on those gross polluters or those specifically not burning correctly. Given the difficulty in determining bad burning practices or gross polluters due to large land plots and trees, guidance on the following options are being sought in order to meet requests of focused enforcement and compliance assurance.

5) Use of new technologies that may assist in allowing for more focused compliance and to assist in identifying problem areas. Some potential examples include:
    a. Use of infrared cameras to observe a heat signature for solid-fuel heating device operations during a Stage 2 restriction. Utah Department of Environmental Quality is currently using an infrared camera in their program to help determine compliance during periods of low light.
    b. Use of aerial technology, like a small camera-equipped drone operated within public space to identify smoke plumes in a nearby area for potential further investigation.
    c. Other innovative or new monitoring technologies?

    Use of new technologies may raise privacy or other concerns. Could the use of these technologies be found to be acceptable by a majority of the community? What concerns are raised and what privacy measures would be needed if such technologies are considered for use to initially identify poor burners or gross polluters in the community?
6) Expanding enforcement activities to the shoulder seasons (Sept/Oct) with lower opacity limits to identify improperly operated solid fuel devices prior to winter months.
7) Wood/solid fuel heating permit program - a program where wood burners may demonstrate that they burn dry wood, in an approved device, and operate their device in the appropriate manner. Many times commenters are stating they are responsible wood burners. A program that allows responsible wood burners to demonstrate their ability to and possibly allow them to burn during Stage 1 restrictions. How should such a program be funded?
8) Reduce the density of solid fuel burning appliances. The density of wood burners within a geographic area could be too many for some areas to support. Some type of program that permanently supports the introduction of alternatives to solid fuel burning during new construction, or resale, or some other option.
9) Other Ideas?