ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Air Permits Program

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION
for
Fort Wainwright
US Army Garrison and Doyon Utilities

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Abbreviations/Acronyms

AAC ....Alaska Administrative Code
AAAQS ....Alaska Ambient Air Quality Standards
Department ....Alaska Department of Environmental Conservation
BACT ....Best Available Control Technology
CFB……………………Circulating Fluidized Bed
CFR. ....Code of Federal Regulations
Cyclones………………Mechanical Separators
DFP……………………Diesel Particulate Filter
DLN..............................Dry Low NOx
DOC…………………...Diesel Oxidation Catalyst
EPA ....Environmental Protection Agency
ESP……………………Electrostatic Precipitator
EU.................................Emission Unit
FITR…………………...Fuel Injection Timing Retard
GCPs…………………..Good Combustion Practices
HAP ....Hazardous Air Pollutant
ITR……………………Ignition Timing Retard
LEA……………………Low Excess Air
LNB……………………Low NOx Burners
MR&Rs ....Monitoring, Recording, and Reporting
NESHAPS ....National Emission Standards for Hazardous Air Pollutants
NSCR…………………Non-Selective Catalytic Reduction
NSPS ....New Source Performance Standards
ORL ....Owner Requested Limit
PSD................................Prevention of Significant Deterioration
PTE................................Potential to Emit
RICE, ICE ....Reciprocating Internal Combustion Engine, Internal Combustion Engine
SCR ....Selective Catalytic Reduction
SIP ....Alaska State Implementation Plan
SNCR…………………Selective Non-Catalytic Reduction
ULSD ....Ultra Low Sulfur Diesel

Units and Measures

gal/hr..............................gallons per hour
g/kWh ....grams per kilowatt hour
g/hp-hr ....grams per horsepower hour
hr/day.............................hours per day
hr/yr ....hours per year
hp...................................horsepower
lb/hr ....pounds per hour
lb/MMBtu ....pounds per million British thermal units
lb/1000 gal ....pounds per 1,000 gallons
kW ....kilowatts
MMBtu/hr ....million British thermal units per hour
MMscf/hr ....million standard cubic feet per hour
ppmv ....parts per million by volume
tpy..................................tons per year

Pollutants

CO ....Carbon Monoxide
HAP ....Hazardous Air Pollutant
NOx ....Oxides of Nitrogen
SO_2 ....Sulfur Dioxide
PM-2.5 ....Particulate Matter with an aerodynamic diameter not exceeding 2.5 microns
PM-10 ....Particulate Matter with an aerodynamic diameter not exceeding 10 microns

1. INTRODUCTION

Fort Wainwright is a military installation located within and adjacent to the city of Fairbanks, Alaska, in the Tanana River Valley. The EUs located within the military installation at Fort Wainwright are either owned and operated by a private utility company, Doyon Utilities, LLC. (DU), or by U.S. Army Garrison Fort Wainwright (FWA). The two entities, DU and FWA, comprise a single stationary source operating under two permits.

In a letter dated April 24, 2015, the Alaska Department of Environmental Conservation (Department) requested the stationary sources expected to be major stationary sources in the particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers (PM-2.5) serious nonattainment area perform a voluntary Best Available Control Technology (BACT) review in support of the state agency's required SIP submittal once the nonattainment area is re-classified as a Serious PM-2.5 nonattainment area. The designation of the area as "Serious" with regard to nonattainment of the 2006 24-hour PM-2.5 ambient air quality standards was published in Federal Register Vol. 82, No. 89, May 10, 2017, pages 21703-21706, with an effective date of June 9, 2017.[1]

This report addresses the significant EUs listed in the DU permit AQ1121TVP02, Revision 2 and the FWA permit AQ0236TVP03, Revision 2. This report provides the Department's review of the BACT analysis for PM-2.5 and BACT analyses provided for oxides of nitrogen (NOx) and sulfur dioxide (SO_2) emissions, which are precursor pollutants that can form PM-2.5 in the atmosphere post combustion.

The following sections review Fort Wainwright's BACT analysis for technical accuracy and adherence to accepted engineering cost estimation practices.

2. BACT EVALUATION

A BACT analysis is an evaluation of all technically available control technologies for equipment emitting the triggered pollutants and a process for selecting the best option based on feasibility, economics, energy, and other impacts. 40 CFR 52.21(b)(12) defines BACT as a site-specific determination on a case-by-case basis. The Department's goal is to identify BACT for the permanent emission units (EUs) at Fort Wainwright that emit NOx, PM-2.5, and SO_2, establish emission limits which represent BACT, and assess the level of monitoring, recordkeeping, and reporting (MR&R) necessary to ensure Fort Wainwright applies BACT for the EUs. The Department based the BACT review on the five-step top-down approach set forth in Federal Register Volume 61, Number 142, July 23, 1996 (Environmental Protection Agency). Table A and Table B present the EUs subject to BACT review.

[1] [1] Federal Register, Vol. 82, No. 89, Wednesday May 10, 2017 (https://dec.alaska.gov/air/anpms/comm/docs/2017-09391-CFR.pdf)

Table A: Privatized Emission Units Subject to BACT Review

EU ID[1]	Description of EU	Rating/Size		Location
1	Coal-Fired Boiler 3	230	MMBtu/hr	Central Heating and Power Plant (CHPP)
2	Coal-Fired Boiler 4	230	MMBtu/hr	CHPP
3	Coal-Fired Boiler 5	230	MMBtu/hr	CHPP
4	Coal-Fired Boiler 6	230	MMBtu/hr	CHPP
5	Coal-Fired Boiler 7	230	MMBtu/hr	CHPP
6	Coal-Fired Boiler 8	230	MMBtu/hr	CHPP
7a	South Coal Handling Dust Collector DC-01	13,150	acfm	CHPP
7b	South Underbunker Dust Collector DC-02	884	acfm	CHPP
7c	North Coal Handling Dust Collector NDC-1	9,250	acfm	CHPP
8	Backup Generator Engine	2,937	hp	CHPP
9	Emergency Generator Engine	353	hp	Building 1032
10	Emergency Generator Engine	762	hp	Building 1060
11	Emergency Generator Engine	762	hp	Building 1060
12	Emergency Generator Engine	82	hp	Building 1193
13	Emergency Generator Engine	587	hp	Building 1555
14	Emergency Generator Engine	320	hp	Building 1563
15	Emergency Generator Engine	1,059	hp	Building 2117
16	Emergency Generator Engine	212	hp	Building 2117
17	Emergency Generator Engine	176	hp	Building 2088
18	Emergency Generator Engine	212	hp	Building 2296
19	Emergency Generator Engine	71	hp	Building 3004
20	Emergency Generator Engine	35	hp	Building 3028
21	Emergency Generator Engine	95	hp	Building 3407
22	Emergency Generator Engine	35	hp	Building 3565
23	Emergency Generator Engine	155	hp	Building 3587
24	Emergency Generator Engine	50	hp	Building 3703
25	Emergency Generator Engine	18	hp	Building 5108
26	Emergency Generator	68	hp	Building 1620
27	Emergency Generator	274	hp	Building 1054
28	Emergency Generator	274	hp	Building 4390
29	Emergency Pump Engine	75	hp	Building 1056
30	Emergency Pump Engine	75	hp	Building 3403
31	Emergency Pump Engine	75	hp	Building 3724
32	Emergency Pump Engine	75	hp	Building 4162
33	Emergency Pump Engine	75	hp	Building 1002
34	Emergency Pump Engine	220	hp	Building 3405
35	Emergency Pump Engine	55	hp	Building 4023
36	Emergency Pump Engine	220	hp	Building 3563
51a	DC-1 Fly Ash Dust Collector	3,620	acfm	CHPP
51b	DC-2 Bottom Ash Dust Collector	3,620	acfm	CHPP
52	Coal Storage Pile	N/A		CHPP

Table B: Fort Wainwright Army Emission Units Subject to BACT Review

EU ID[1]	Description of EU	Rating/Size	Location
8	Backup Diesel-Fired Boiler 1	19 MMBtu/hr	Basset Hospital
9	Backup Diesel-Fired Boiler 2	19 MMBtu/hr	Basset Hospital
10	Backup Diesel-Fired Boiler 3	19 MMBtu/hr	Basset Hospital
11	Backup Diesel-Electric Generator 1	900 kW	Basset Hospital
12	Backup Diesel-Electric Generator 2	900 kW	Basset Hospital
13	Backup Diesel-Electric Generator 3	900 kW	Basset Hospital
22	VOC Extraction and Combustion	N/A	
23	Fort Wainwright Landfill	1.97 million cubic meters	
24	Aerospace Activities	N/A	
26	Emergency Generator	324 hp	Building 2132
27	Emergency Generator	67 hp	Building 1580
28	Emergency Generator	398 hp	Building 3406
29	Emergency Generator	47 hp	Building 3567
30	Fire Pump	275 hp	Building 2089
31	Fire Pump #1	235 hp	Building 1572
32	Fire Pump #2	235 hp	Building 1572
33	Fire Pump #3	235 hp	Building 1572
34	Fire Pump #4	235 hp	Building 1572
35	Fire Pump #1	240 hp	Building 2080
36	Fire Pump #2	240 hp	Building 2080
37	Fire Pump	105 kW	Building 3498
38	Fire Pump #1	120 hp	Building 5009
39	Fire Pump #2	120 hp	Building 5009
40	Waste Oil-Fired Boiler	2.6 MMBtu/hr	Building 5007
???	Distillate Fired Boilers (23)	Varies	Varies
???	Waste Oil-Fired Boiler	2.5 gal/hr	Building 3476
???	Waste Oil-Fired Boiler	2.5 gal/hr	Building 3476

Five-Step BACT Determinations

The following sections explain the steps used to determine BACT for NOx, PM-2.5, and SO_2 for the applicable equipment.

Step 1 Identify All Potentially Available Control Technologies

The Department identifies all available control technologies for the EU and the pollutant under consideration. This includes technologies used throughout the world or emission reductions through the application of available control techniques, changes in process design, and/or operational limitations. To assist in identifying available controls, the Department reviews available controls listed on the Reasonably Available Control Technology (RACT), BACT, and Lowest Achievable Emission Rate (LAER) Clearinghouse (RBLC). The RBLC is an EPA database where permitting agencies nationwide post imposed BACT for PSD sources. In addition to the RBLC search, the Department used several search engines to look for emerging and tried technologies used to control NOx, PM-2.5, and SO_2 emissions from equipment similar to those listed in Table A and Table B.

Step 2 Eliminate Technically Infeasible Control Technologies:
The Department evaluates the technical feasibility of each control option based on source specific factors in relation to each EU subject to BACT. Based on sound documentation and demonstration, the Department eliminates control technologies deemed technically infeasible due to physical, chemical, and engineering difficulties.

Step 3 Rank the Remaining Control Technologies by Control Effectiveness
The Department ranks the remaining control technologies in order of control effectiveness with the most effective at the top.

Step 4 Evaluate the Most Effective Controls and Document the Results as Necessary
The Department reviews the detailed information in the BACT analysis about the control efficiency, emission rate, emission reduction, cost, environmental, and energy impacts for each option to decide the final level of control. The analysis must present an objective evaluation of both the beneficial and adverse energy, environmental, and economic impacts. A proposal to use the most effective option does not need to provide the detailed information for the less effective options. If cost is not an issue, a cost analysis is not required. Cost effectiveness for a control option is defined as the total net annualized cost of control divided by the tons of pollutant removed per year. Annualized cost includes annualized equipment purchase, erection, electrical, piping, insulation, painting, site preparation, buildings, supervision, transportation, operation, maintenance, replacement parts, overhead, raw materials, utilities, engineering, start-up costs, financing costs, and other contingencies related to the control option. Sections 3, 4, and 5, present the Department's BACT determinations for NOx, PM-2.5, and SO_2.

Step 5 Select BACT
The Department selects the most effective control option not eliminated in Step 4 as BACT for the pollutant and EU under review and lists the final BACT requirements determined for each EU in this step. A project may achieve emission reductions through the application of available technologies, changes in process design, and/or operational limitations. The Department reviewed Fort Wainwright's BACT analysis and made BACT determinations for NOx, PM-2.5, and SO_2 for Fort Wainwright. These BACT determinations are based on the information submitted by Fort Wainwright in their analysis, information from vendors, suppliers, sub-contractors, RBLC, and an exhaustive internet search.

3. BACT DETERMINATION FOR NOx

The NOx controls proposed in this section are not planned to be implemented. The optional precursor demonstration (as allowed under 40 C.F.R. 51.1006) for the precursor gas NOx for point sources illustrates that NOx controls are not needed. DEC is planning to submit with the Serious SIP a final precursor demonstration as justification not to require NOx controls. Please see the precursor demonstration for NOx posted at http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip-development. The PM2.5 NAAQS Final SIP Requirements Rule states if the state determines through a precursor demonstration that controls for a precursor gas are not needed for attaining the standard, then the controls identified as BACT/BACM or Most Stringent Measure for the precursor gas are not required to be implemented.[2] Final approval of the precursor demonstration is at the time of the Serious SIP approval.

Fort Wainwright has six existing 230 million British Thermal Units (MMBtu)/hr spreader-stoker type boilers that burn coal to produce steam for stationary source-wide heating and power. It also contains small and large emergency engines, fire pumps, and generators, diesel-fired boilers, and material handling equipment subject to BACT. The Department reviewed the control technologies Fort Wainwright identified in their analysis and made a NOx BACT finding for the EUs listed in Tables A and B.

The Department based its NOx assessment on BACT determinations found in the RBLC, internet research, and BACT analyses submitted to the Department by Golden Valley Electric Association (GVEA) for the North Pole Power Plant and Zehnder Facility, Aurora Energy, LLC (Aurora) for the Chena Power Plant, U.S. Army Corps of Engineers (US Army) for Fort Wainwright, and the University of Alaska Fairbanks (UAF) for the Fairbanks Campus Power Plant.

3.1 NOx BACT for the Industrial Coal-Fired Boilers

Possible NOx emission control technologies for coal-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 11.110, Coal Combustion in Industrial Size Boilers and Furnaces. The search results for coal-fired boilers are summarized in Table 3-1.

Table 3-1. RBLC Summary of NOx Control for Industrial Coal-Fired Boilers

Control Technology	Number of Determinations	Emission Limits (lb/MMBtu)
Selective Catalytic Reduction	9	0.05 – 0.08
Selective Non-Catalytic Reduction	18	0.07 – 0.36
Low NOx Burners	18	0.07 – 0.3
Overfire Air	8	0.07 – 0.3
Good Combustion Practices	2	0.1 – 0.6

RBLC Review
A review of similar units in the RBLC indicates selective catalytic reduction, selective non-

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

catalytic reduction, low NOx burners, overfire air, and good combustion practices are the principle NOx control technologies installed on industrial coal-fired boilers. The lowest NOx emission rate in the RBLC is 0.05 lb/MMBtu.

Step 1- Identification of NOx Control Technologies for the Industrial Coal-Fired Boilers
From research, the Department identified the following technologies as available for control of NOx emissions from industrial coal-fired boilers:

(a) Selective Catalytic Reduction (SCR)[3]
SCR is a post-combustion gas treatment technique for reducing nitric oxide (NO) and nitrogen dioxide (NO_2) in the boiler exhaust stream to molecular nitrogen (N_2), water, and oxygen (O_2). In the SCR process, aqueous or anhydrous ammonia (NH_3) is injected into the flue gas upstream of a catalyst bed. The catalyst lowers the activation energy of the NOx decomposition reaction. NOx and NH_3 combine at the catalyst surface forming an ammonium salt intermediate, which subsequently decomposes to produce elemental N_2 and water. Depending on the overall NH_3-to-NOx ratio, removal efficiencies are generally 70 to 90 percent. Challenges associated with using SCR on industrial boilers include a narrow window of acceptable inlet and exhaust temperatures (500°F to 800°F), emission of NH_3 into the atmosphere (NH_3 slip) caused by non-stoichiometric reduction reaction, and disposal of depleted catalysts. The Department considers SCR a technically feasible control technology for the industrial coal-fired boilers.

(b) Selective Non-Catalytic Reduction (SNCR)[4]
SNCR involves the non-catalytic decomposition of NOx in the flue gas to N_2 and water using reducing agents such as urea or NH_3. The process utilizes a gas phase homogeneous reaction between NOx and the reducing agent within a specific temperature window. The reducing agent must be injected into the flue gas at a location in the unit that provides the optimum reaction temperature and residence time. The NH_3 process (trade name-Thermal DeNOx) requires a reaction temperature window of 1,600°F to 2,200°F. In the urea process (trade name–NO_xOUT), the optimum temperature ranges between 1,600°F and 2,100°F. Expected NOx removal efficiencies are typically between 40 to 62 percent, according to the RBLC, or between 30 and 50 percent reduction, according to the EPA fact sheet (EPA-452/F-03-031). The Department considers SNCR a technically feasible control technology for the industrial coal-fired boilers.

(c) Non-Selective Catalytic Reduction (NSCR)
NSCR simultaneously reduces NOx and oxidizes CO and hydrocarbons in the exhaust gas to N_2, carbon dioxide (CO_2), and water. The catalyst, usually a noble metal, causes the reducing gases in the exhaust stream (hydrogen, methane, and CO) to reduce both NO and NO_2 to N_2 at a temperature between 800°F and 1,200°F, below the expected temperature of the coal-fired boiler flue gas. NSCR requires a low excess O_2 concentration in the exhaust gas stream to be effective because the O_2 must be depleted

[3] https://www3.epa.gov/ttncatc1/dir1/fscr.pdf
[4] https://www3.epa.gov/ttncatc1/dir1/fsncr.pdf

before the reduction chemistry can proceed. NSCR is only effective with rich-burn gas-fired units that operate at all times with an air/fuel ratio controller at or close to stoichiometric conditions. Coal-fired boilers operate under conditions far more fuel-lean than required to support NSCR. The Department's research did not identify NSCR as a control technology used to control NOx emissions from large coal-fired boilers installed at any facility after 2005. The Department does not consider NSCR a technically feasible control technology for the industrial coal-fired boilers.

(d) Low NOx Burners (LNBs)
Using LNBs can reduce formation of NOx through careful control of the fuel-air mixture during combustion. Control techniques used in LNBs includes staged air, and staged fuel, as well as other methods that effectively lower the flame temperature. Experience suggests that significant reduction in NOx emissions can be realized using LNBs. The U.S. EPA reports that LNBs have achieved reduction up to 80%, but actual reduction depends on the type of fuel and varies considerably from one installation to another. Typical reductions range from 40% - 60% but under certain conditions, higher reductions are possible. Air staging, or two-stage combustion, is generally described as the introduction of overfire air into the boiler or furnace. Overfire air is the injection of air above the main combustion zone. As indicated by EPA's AP-42, LNBs are applicable to tangential and wall-fired boilers of various sizes but are not applicable to other boiler types such as cyclone furnaces or stokers. The Department does not consider LNBs a technically feasible control technology for the existing stoker type coal-fired boilers.

(e) Circulating Fluidized Bed (CFB)
In a fluidized bed combustor, fuel is introduced to a bed of either sorbent (limestone) or inert material (usually sand) that is fluidized by an upward flow of air. This upward air flow allows for better mixing of the gas and solids to create a better heat transfer and chemical reactions. Combustion takes place in the bed at a lower temperature than other boiler types which lowers the formation of thermally generated NOx. For the purposes of this report, a control technology does not include passive control measures that act to prevent pollutants from forming such as inherent process design features or characteristics. The Department does not consider CFB a technically feasible control technology to retrofit the existing coal-fired boilers.

(f) Low Excess Air (LEA)
Boiler operation with low excess air is considered an integral part of good combustion practices because this process can maximize the boiler efficiency while controlling the formation of NOx. Boilers operated with five to seven percent excess air typically have peak NOx formation from both peak combustion temperatures and chemical reactions. At both lower and higher excess air concentrations the formation of NOx is reduced. At higher levels of excess air, an increase in the formation of CO occurs. CO can increase exponentially at very high levels of excess air and the combustion efficiency is greatly reduced. As a result, the preference is to reduce excess air such that both NOx and CO generation is minimized and the boiler efficiency is optimized. Only one RLBC entry identified low excess air technology as a NOx control alternative for a mass-feed stoker designed boiler. Boilers are regularly designed to operate with low excess air as described

in the previous LNB discussion. The Department considers LEA a technically feasible control technology for the industrial coal-fired boilers.

(g) Good Combustion Practices (GCPs)
GCPs typically include the following elements:

1. Sufficient residence time to complete combustion;
2. Providing and maintaining proper air/fuel ratio;
3. High temperatures and low oxygen levels in the primary combustion zone; and
4. High enough overall excess oxygen levels to complete combustion and maximize thermal efficiency.

Combustion efficiency is dependent on the gas residence time, the combustion temperature, and the amount of mixing in the combustion zone. GCPs are accomplished primarily through combustion chamber design as it relates to residence time, combustion temperature, air-to-fuel mixing, and excess oxygen levels. The Department considers GCPs a technically feasible control technology for the industrial coal-fired boilers.

(h) Fuel Switching
This evaluation considers retrofit of existing coal-fired boilers. It is assumed that use of another type of coal would not reduce NOx emissions. Therefore, the Department does not consider the use of an alternate fuel to be a technically feasible control technology for the industrial coal-fired boilers.

(i) Steam / Water Injection
Steam/water injection into the combustion zone reduces the firing temperature in the combustion chamber and has been traditionally associated with reducing NOx emissions from gas combustion turbines but not coal-fired boilers. In addition, steam/water has several disadvantages, including increases in carbon monoxide and un-burned hydrocarbon emissions and increased fuel consumption. Further, the Department found that steam or water injection is not listed in the EPA RBLC for use in any coal-fired boilers and it would be less efficient at controlling NOx emissions than SCR. Therefore, the Department does not consider steam or water injection to be a technically feasible control option for the existing coal-fired boilers.

(j) Reburn
Reburn is a combustion hardware modification in which the NOx produced in the main combustion zone is reduced in a second combustion zone downstream. This technique involves withholding up to 40 percent (at full load) of the heat input to the main combustion zone and introducing that heat input above the top row of burners to create a reburn zone. Reburn fuel (natural gas, oil, or pulverized coal) is injected with either air or flue gas to create a fuel-rich zone that reduces the NOx created in the main combustion zone to nitrogen and water vapor. The fuel-rich combustion gases from the reburn zone are completely combusted by injecting overfire air above the reburn zone. Reburn may be applicable to many boiler types firing coal as the primary fuel, including tangential, wall-fired, and cyclone boilers. However, the application and effectiveness are site-specific because each boiler is originally designed to achieve specific steam conditions and

capacity which may be altered due to reburn. Commercial experience is limited; however, this limited experience does indicate NOx reduction of 50 to 60 percent from uncontrolled levels may be achieved. Reburn combustion control would require significant changes to the design of the existing boilers. Therefore, the Department does not consider reburn to be a technically feasible control technology to retrofit the existing industrial coal-fired boilers.

Step 2 - Eliminate Technically Infeasible NOx Control Technologies for the Coal-Fired Boilers
As explained in Step 1 of Section 3.1, the Department does not consider non-selective catalytic reduction, low NOx burners, circulating fluidized beds, fuel switching, steam/water injection, or reburn as technically feasible technologies to control NO_x emissions from existing industrial coal-fired boilers.

Step 3 - Rank the Remaining NOx Control Technologies for Industrial Coal-Fired Boilers
The following control technologies have been identified and ranked by efficiency for the control of NOx emissions from the coal-fired industrial boilers:

(a) Selective Catalytic Reduction (70% - 90% Control)
(b) Selective Non-Catalytic Reduction (30% - 50% Control)
(g) Good Combustion Practices (Less than 40% Control)
(f) Low Excess Air (10% - 20% Control)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright provided an economic analysis for the installation of selective catalytic reduction and selective non-catalytic reduction. A summary of the analysis is shown below:

Table 3-2. Fort Wainwright Economic Analysis for Technically Feasible NOx Controls

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton)
SCR	177	88	$13,860,931	$2,222,777	$25,166
SNCR	105	52	$5,598,476	$936,162	$17,852
Capital Recovery Factor = 0.1424 (7% interest rate for a 10 year equipment life)					

Fort Wainwright contends that the economic analysis indicates the level of NOx reduction does not justify the use of selective catalytic reduction or selective non-catalytic reduction for the coal-fired boilers based on the excessive cost per ton of NOx removed per year.

Fort Wainwright proposes the following as BACT for NOx emissions from the coal-fired boilers:

(a) NOx emissions from the operation of the coal-fired boilers will be controlled with good combustion practices and injection of overfire air with oxygen trim systems.

(b) NOx emissions from the coal-fired boilers will not exceed 0.46 lb/MMBtu over a 3-hour averaging period.

(c) Initial compliance with the proposed NOx emission limit will be demonstrated by conducting a performance test to obtain an emission rate.

Department Evaluation of BACT for NOx Emissions from the Industrial Coal-Fired Boilers

The Department revised the cost analyses provided by Fort Wainwright for the installation of SCR and SNCR using the cost estimating procedures identified in EPA's May 2016 Air Pollution Control Cost Estimation Spreadsheet for Selective Catalytic Reduction,[5] and Selective Non-Catalytic Reduction,[6] using the unrestricted potential to emit from the six coal-fired boilers combined, a baseline emission rate of 0.58 lb NOx/MMBtu,[7] a retrofit factor of 1.5 for a difficult retrofit, a NOx removal efficiency of 90% and 50% for SCR and SNCR respectively, an interest rate of 5.5% (current bank prime interest rate), and a 20 year equipment life. A summary of the analysis is shown below:

Table 3-3. Department Economic Analysis for Technically Feasible NOx Controls

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
SCR	1,447	1,302	$59,328,700	$6,816,393	$5,234
SNCR	1,447	723	$9,247,363	$1,628,874	$2,251
Capital Recovery Factor = 0.0837 (5.5% interest rate for a 20 year equipment life)					

The Department's economic analysis indicates the level of NOx reduction justifies the use of selective catalytic reduction or selective non-catalytic reduction as BACT for the coal-fired boilers located in the Serious PM-2.5 nonattainment area.

Step 5 - Selection of NOx BACT for the Industrial Coal-Fired Boilers

The Department's finding is that selective catalytic reduction and selective non-catalytic reduction are both economically and technically feasible control technologies for NOx. Since selective catalytic reduction has a higher control efficiency, it is selected as BACT to control NOx emissions from the industrial coal-fired boilers.

The Department's finding is that BACT for NOx emissions from the coal-fired boilers is as follows:

(a) NOx emissions from DU EUs 1 through 6 shall be controlled by operating and maintaining SCR at all times the units are in operation;

(b) NOx emissions from DU EUs 1 through 6 shall not exceed 0.060 lb/MMBtu averaged over a 3-hour period; and

(c) Initial compliance with the proposed NOx emission limit will be demonstrated by conducting a performance test to obtain an emission rate.

[5] https://www3.epa.gov/ttn/ecas/docs/scr_cost_manual_spreadsheet_2016_vf.xlsm

[6] https://www3.epa.gov/ttn/ecas/docs/sncr_cost_manual_spreadsheet_2016_vf.xlsm

[7] Emission factor from AP-42 Table 1.1-3 for spreader stoker sub-bituminous coal (8.8 lb NOx/ton) and converted to lb/MMBtu using heat value for Usibelli Coal of 7,560 Btu/lb, http://www.usibelli.com/coal/data-sheet.

Table 3-4 lists the proposed NOx BACT determination for this facility along with those for other coal-fired boilers in the Serious PM-2.5 nonattainment area.

Table 3-4. Comparison of NOx BACT for Coal-Fired Boilers at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	6 Coal-Fired Boilers	1,380 MMBtu/hr	0.06 lb/MMBtu[8]	Selective Catalytic Reduction
UAF	Dual Fuel-Fired Boiler	295.6 MMBtu/hr	0.02 lb/MMBtu[9]	Selective Catalytic Reduction
Chena	4 Coal-Fired Boilers	497 MMBtu/hr	0.05 lb/MMBtu[10]	Selective Catalytic Reduction

3.2 NOx BACT for the Diesel-Fired Boilers

Possible NOx emission control technologies for diesel-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13.220, Commercial/Institutional Size Boilers (<100 MMBtu/hr). The search results for diesel-fired boilers are summarized in Table 3-5.

Table 3-5. RBLC Summary of NOx Control for Diesel-Fired Boilers

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Low-NOx Burner	8	0.023 - 0.14
Good Combustion Practices	1	0.01
No Control Specified	2	0.070 - 0.12

RBLC Review

A review of similar units in the RBLC indicates low-NOx burners and good combustion practices are the principle NOx control technologies installed on diesel-fired boilers. The lowest NOx emission rate listed in the RBLC is 0.01 lb/MMBtu.

Step 1 - Identification of NOx Control Technologies for the Diesel-Fired Boilers

From research, the Department identified the following technologies as available for control of NOx emissions from diesel-fired boilers:

(a) Low NOx Burners (LNBs)
The theory of LNBs was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. The Department considers LNB a technically feasible control technology for the diesel-fired boilers.

(b) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. The Department considers limited operation a technically feasible control technology for the diesel-fired boilers.

[8] Calculated using a 90% NOx control efficiency for SCR with uncontrolled emission factor from AP-42 Table 1.1-3 for spreader stoker sub-bituminous coal (8.8 lb NOx/ton) and converted to lb/MMBtu using heat value for Usibelli Coal of 7,560 Btu/lb, http://www.usibelli.com/coal/data-sheet.

[9] Calculated using a 90% NOx control efficiency for SCR with uncontrolled emission rate from 40 C.F.R. 60.44b(l)(1) [NSPS Subpart Db].

[10] Calculated using a 90% NOx control efficiency for SCR with uncontrolled emission rate from most recent NOx source test, which occurred on Oct 27, 2018.

(c) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. The Department considers GCPs a technically feasible control technology for the diesel-fired boilers.

(d) Flue Gas Recirculation (FGR)
Flue gas recirculation involves extracting a portion of the flue gas from the economizer section or air heater outlet and readmitting it to the furnace through the furnace hopper, the burner windbox, or both. This method reduces the concentration of oxygen in the combustion zone and may reduce NOx by as much as 40 to 50 percent in some boilers. Chapter 1.3-7 from AP-42 indicates that FGR can require extensive modifications to the burner and windbox and can result in possible flame instability at high FGR rates. The Department does not consider FGR a technically feasible control technology for the diesel-fired boilers.

Step 2 - Eliminate Technically Infeasible NOx Control Technologies for the Diesel-Fired Boilers
As explained in Step 1 of Section 3.2, the Department does not consider flue gas recirculation as technically feasible technology for the diesel-fired boilers.

Step 3 - Rank the Remaining NOx Control Technologies for the Diesel-Fired Boilers
The following control technologies have been identified and ranked by efficiency for the control of NOx emissions from the diesel-fired boilers.

(b)	Limited Operation	(94% Control)
(a)	Low NOx Burners	(35% - 55% Control)
(c)	Good Combustion Practices	(Less than 40% Control)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for NOx emissions from the diesel-fired boilers:

(a) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation;

(b) Combined operating limit of 600 hours per year for FWA EUs 8, 9, and 10; and

(c) Limiting operation of the other 24 diesel-fired boilers to testing, maintenance, and emergency use with the exception of the waste fuel boilers.

Department Evaluation of BACT for NOx Emissions from the Diesel-Fired Boilers.

The Department reviewed Fort Wainwright's proposal and finds that the 27 diesel-fired boilers have a combined potential to emit (PTE) of less than three tons per year (tpy) for NOx based on non-emergency operation of 500 hours per year. At three tpy, the cost effectiveness in terms of dollars per ton for add-on pollution control for these units is economically infeasible.

Step 5 - Selection of NOx BACT for the Diesel-Fired Boilers
The Department's finding is that BACT for NOx emissions from the diesel-fired boilers is as follows:

(a) NOx emissions from the diesel-fired boilers shall not exceed 0.15 lb/MMBtu[11];
(b) Combined operating limit of 600 hours per year for FWA EUs 8, 9, and 10;
(c) Limit non-emergency operation of the 27 diesel fired boilers, with the exception of the waste-fuel boilers, to no more than 500 hours per year, for maintenance checks and readiness testing; and
(d) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation.

Table 3-6 lists the proposed NOx BACT determination for this facility along with those for other diesel-fired boilers rated at less than 100 MMBtu/hr in the Serious PM-2.5 nonattainment area.

Table 3-6. Comparison of NOx BACT for the Diesel-Fired Boilers at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	27 Diesel-Fired Boilers	< 100 MMBtu/hr	0.15 lb/MMBtu	Limited Operation Good Combustion Practices
UAF	3 Diesel-Fired Boilers	< 100 MMBtu/hr	0.15 lb/MMBtu	Limited Operation Good Combustion Practices
GVEA Zehnder	2 Diesel-Fired Boilers	< 100 MMBtu/hr	0.15 lb/MMBtu	Low NOx Burners

3.3 NOx BACT for the Large Diesel-Fired Engines, Fire Pumps, and Generators

Possible NOx emission control technologies for large engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 17.100 to 17.190, Large Internal Combustion Engines (>500 hp). The search results for large diesel-fired engines are summarized in Table 3-7.

Table 3-7. RBLC Summary of NOx Control for Large Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Selective Catalytic Reduction	3	0.5 - 0.7
Other Add-On Control	1	1.0
Federal Emission Standards	13	3.0 - 6.9
Good Combustion Practices	31	3.0 - 13.5
No Control Specified	60	2.8 - 14.1

RBLC Review
A review of similar units in the RBLC indicates selective catalytic reduction, good combustion practices, and compliance with the federal emission standards are the principle NOx control technologies installed on large diesel-fired engines. The lowest NOx emission rate listed in the RBLC is 0.5 g/hp-hr.

[11] Emission rate from AP-42 Table 1.3-1 for boilers smaller than 100 MMBtu/hr (20 lb/1,000 gallons of diesel) and converted to lb/MMBtu assuming 0.137 MMBtu/gal diesel (AP-42).

Step 1 - Identification of NOx Control Technology for the Large Diesel-Fired Engines
From research, the Department identified the following technologies as available for control of NOx emissions from diesel-fired engines rated at 500 hp or greater:

(a) Selective Catalytic Reduction
The theory of SCR was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. The Department considers SCR a technically feasible control technology for the large diesel-fired engines.

(b) Turbocharger and Aftercooler
Turbocharger technology involves the process of compressing intake air in a turbocharger upstream of the air/fuel injection. This process boosts the power output of the engine. The air compression increases the temperature of the intake air so an aftercooler is used to reduce the intake air temperature. Reducing the intake air temperature helps lower the peak flame temperature which reduces NOx formation in the combustion chamber. The Department considers turbocharger and aftercooler a technically feasible control technology for the large diesel-fired engines.

(c) Fuel Injection Timing Retard (FITR)
FITR reduces NOx emissions by the delay of the fuel injection in the engine from the time the compression chamber is at minimum volume to a time the compression chamber is expanding. Timing adjustments are relatively straightforward. The larger volume in the compression chamber produces a lower peak flame temperature. With the use of FITR the engine becomes less fuel efficient, particulate matter emissions increase, and there is a limit with respect to the degree the timing may be retarded because an excessive timing delay can cause the engine to misfire. The timing retard is generally limited to no more than three degrees. Diesel engines may also produce more black smoke due to a decrease in exhaust temperature and incomplete combustion. FITR can achieve up to 50 percent NOx reduction. Due to the increase in particulate matter emissions resulting from FITR, this technology will not be carried forward.

(d) Ignition Timing Retard (ITR)
ITR lowers NOx emissions by moving the ignition event to later in the power stroke, after the piston has begun to move downward. Because the combustion chamber volume is not at a minimum, the peak flame temperature is not as high, which lowers combustion temperature and produces less thermal NOx. Use of ITR can cause an increase in fuel usage, an increase in particulate matter emissions, and engine misfiring. ITR can achieve between 20 to 30 percent NOx reduction. Due to the increase in the particulate matter emissions resulting from ITR, this technology will not be carried forward.

(e) Federal Emission Standards
RBLC NOx determinations for federal emission standards require the engines meet the requirements of 40 C.F.R. 60 Subpart IIII, 40 C.F.R 63 Subpart ZZZZ, non-road engines (NREs), or EPA tier certifications. Subpart IIII applies to stationary compression ignition internal combustion engines that are manufactured or reconstructed after July 11, 2005.

The Department considers meeting the technology based New Source Performance Standards (NSPS) of Subpart IIII as a technically feasible control technology for the large diesel-fired engines.

(f) Limited Operation
FWA EUs 11, 12, and 13 currently operate under a combined annual limit of less than 600 hours per year to avoid classification as a Prevention of Significant Deterioration (PSD) major modification for NOx. Limiting the operation of emissions units reduces the potential to emit of those units. The Department considers limited operation a technically feasible control technology for the large diesel-fired engines.

(g) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. The Department considers GCPs a technically feasible control technology for the large diesel-fired engines.

Step 2 - Eliminate Technically Infeasible NOx Control Technologies for the Large Engines
As explained in Step 1 of Section 3.3, the Department does not consider fuel injection timing retard and ignition timing retard as technically feasible technologies to control NOx emissions from the large diesel-fired engines.

Step 3 - Rank the Remaining NOx Control Technologies for the Large Diesel-Fired Engines
The following control technologies have been identified and ranked by efficiency for the control of NOx emissions from the large diesel-fired engines.

(f)	Limited Operation	(94% Control)
(a)	Selective Catalytic Reduction	(90% Control)
(g)	Good Combustion Practices	(Less than 40% Control)
(b)	Turbocharger and Aftercooler	(6% – 12% Control)
(e)	Federal Emission Standards	(Baseline)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for NOx emissions from the large diesel-fired engines:

(a) Combined operating limit of 600 hours per year for FWA EUs 11, 12, and 13; and

(b) For engines manufactured after the applicability dates of 40 C.F.R. 60 Subpart IIII, BACT is selected as compliance with 40 C.F.R Part 60 Subpart IIII. For older engines, compliance with 40 C.F.R. 63 Subpart ZZZZ is proposed as BACT.

Department Evaluation of BACT for NOx Emissions from the Large Diesel-Fired Engines

The Department reviewed Fort Wainwright's proposal and finds that NOx emissions from the large diesel-fired engines can additionally be controlled by limiting the use of the units during non-emergency operation as well as complying with the applicable federal emission standards.

Step 5 - Selection of NOx BACT for the Large Diesel-Fired Engines
The Department's finding is that the BACT for NOx emissions from the large diesel-fired engines is as follows:

(a) Combined operating limit of 600 hours per year for FWA EUs 11, 12, and 13;

(b) Limit EU 8 to 500 hours per year;

(c) Limit non-emergency operation of DU EUs 8, 10, 11, 13, and 15 to no more than 100 hours per year each for maintenance checks and readiness testing;

(d) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation; and

(e) Comply with the numerical BACT emission limits listed in Table 3-8 for NOx.

Table 3-8 Proposed NOx BACT Limits for the Large Diesel-Fired Engines

Location	EU	Year	Description	Size	Status	BACT Limit	Proposed BACT
DU	8	2009	Generator Engine	2,937 hp	Certified Engine	4.8 g/hp-hr	Limited Operation for Non-Emergency Use (100 hours per year each) Good Combustion Practices
DU	10	2010	Generator Engine	762 hp	Certified Engine	4.8 g/hp-hr	
DU	11	2010	Generator Engine	762 hp	Certified Engine	4.8 g/hp-hr	
DU	13	2008	Generator Engine	587 hp	Certified Engine	3.0 g/hp-hr	
DU	15	2005	Generator Engine	1,059 hp	Manufacturer Information	5.75 g/hp-hr	
FWA	11	2003	Caterpillar 3512	1,206 hp	AP-42 Table 3.4-1	10.9 lb/hp-hr	Limit combined operation to 600 hours per year
FWA	12	2003	Caterpillar 3512	1,206 hp	AP-42 Table 3.4-1	10.9 lb/hp-hr	
FWA	13	2003	Caterpillar 3512	1,206 hp	AP-42 Table 3.4-1	10.9 lb/hp-hr	

Table 3-9 lists the proposed NOx BACT determination for this facility along with those for other diesel-fired engines rated at more than 500 hp located in the Serious PM-2.5 nonattainment area.

Table 3-9. Comparison of NOx BACT for Large Diesel-Fired Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	8 Large Diesel-Fired Engines	> 500 hp	3.0 – 10.9 g/hp-hr	Limited Operation Good Combustion Practices Federal Emission Standards
UAF	Large Diesel-Fired Engine	13,266 hp	1.3 g/hp-hr	Selective Catalytic Reduction Turbocharger and Aftercooler Good Combustion Practices Limited Operation
GVEA North Pole	Large Diesel-Fired Engine	600 hp	10.9 g/hp-hr	Turbocharger and Aftercooler Good Combustion Practices Limited Operation
GVEA Zehnder	2 Large Diesel-Fired Engines	11,000 hp (each)	3.7 g/hp-hr	Turbocharger and Aftercooler Good Combustion Practices Limited Operation

3.4 NOx BACT for the Small Emergency Engines, Fire Pumps, and Generators

Possible NOx emission control technologies for small engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17.210, Small Internal Combustion Engines (<500 hp). The search results for small diesel-fired engines are summarized in Table 3-10.

Table 3-10. RBLC Summary for NOx Control for Small Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Federal Emission Standards	5	2.2 – 4.8
Good Combustion Practices	25	2.0 – 9.5
Limited Operation	4	3.0
No Control Specified	25	2.6 – 5.6

RBLC Review
A review of similar units in the RBLC indicates limited operation, good combustion practices, and compliance with the federal emission standards are the principle NOx control technologies for small diesel-fired engines. The lowest NOx emission rate listed in the RBLC is 2.0 g/hp-hr.

Step 1 - Identification of NOx Control Technology for the Small Diesel-Fired Engines
From research, the Department identified the following technologies as available for control of NOx emissions from diesel-fired engines rated at less than 500 hp:

(a) Selective Catalytic Reduction
The theory of SCR was discussed in detail in the NOx BACT for the coal-fired boiler and will not be repeated here. The Department considers SCR a technically feasible control technology for the small diesel-fired engines.

(b) Turbocharger and Aftercooler
The theory of turbocharger and aftercooler was discussed in detail in the NOx BACT for the large diesel-fired engine and will not be repeated here. The Department considers a turbocharger and aftercooler a technically feasible control technology for the small diesel-fired engines.

(c) Ignition Timing Retard (ITR)
The theory of ITR was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. Due to the increase in particulate matter emissions resulting from ITR, this technology will not be carried forward.

(d) Federal Emission Standards
RBLC NOx determinations for federal emission standards require the engines meet the requirements of 40 C.F.R. 60 Subpart IIII, 40 C.F.R 63 Subpart ZZZZ, non-road engines (NREs), or EPA tier certifications. Subpart IIII applies to stationary compression ignition internal combustion engines that are manufactured or reconstructed after July 11, 2005. The Department considers meeting the technology based NSPS of Subpart IIII as a technically feasible control technology for the small diesel-fired engines.

(e) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. The Department considers limited operation as a technically feasible control technology for the small diesel-fired engines.

(f) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the large dual fired boiler and will not be repeated here. The Department considers GCPs a technically feasible control technology for the small diesel-fired engines.

Step 2 - Eliminate Technically Infeasible NOx Control Technologies for the Small Engines
As explained in Step 1 of Section 3.4, the Department does not consider ignition timing retard as a technically feasible technology to control NOx emissions from the small diesel-fired engines.

Step 3 - Rank the Remaining NOx Control Technologies for the Small Engines
The following control technologies have been identified and ranked by efficiency for the control of NOx emissions from the small diesel-fired engines.

(e)	Limited Operation	(94% Control)
(a)	Selective Catalytic Reduction	(90% Control)
(b)	Turbocharger and Aftercooler	(6% – 12% Control)
(f)	Good Combustion Practices	(Less than 40% Control)
(d)	Federal Emission Standards	(Baseline)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for NOx emissions from the small diesel-fired engines:

(a) Good Combustion Practices; and

(b) For engines manufactured after the applicability dates of 40 C.F.R. 60 Subpart IIII, BACT is selected as compliance with 40 C.F.R Part 60 Subpart IIII. For older engines, compliance with 40 C.F.R. 63 Subpart ZZZZ is proposed as BACT.

Department Evaluation of BACT for NOx Emissions from Small Diesel-Fired Engines

The Department reviewed Fort Wainwright’s proposal and found that in addition to maintaining good combustion practices and complying with federal emission standards, limiting operation of the small diesel-fired engines during non-emergency operation to no more than 100 hours per year each is BACT for NOx emissions.

Step 5 - Selection of NOx BACT for the Small Diesel-Fired Engines
The Department’s finding is that the BACT for NOx emissions from the small diesel-fired engines is as follows:

(a) Limit non-emergency operation of DU EUs 9, 12, 14, 16 through 28, 29a, 30, 31a, 32, 33, 34, 35, 36, and FWA EUs 26 through 39 to no more than 100 hours per year each for maintenance checks and readiness testing;

(b) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation; and

(c) Comply with the numerical BACT emission limits listed in Table 3-11 for NOx.

Table 3-11. Proposed NOx BACT Limits for the Small Diesel-Fired Engines

Location	EU	Year	Description	Size	Status	BACT Limit	Proposed BACT
DU	9	1988	Generator Engine	353 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	Limited Operation for Non-Emergency Use (100 hours per year each) Good Combustion Practices
DU	12	2002	Generator Engine	82 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	14	2008	Generator Engine	320 hp	Certified Engine	4.0 g/kW-hr	
DU	16	2005	Generator Engine	212 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	17	2007	Generator Engine	176 hp	Permit condition 23.1c	6.9 g/hp-hr	
DU	18	2005	Generator Engine	212 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	19	2007	Generator Engine	71 hp	Certified Engine	7.5 g/kW-hr	
DU	20	1976	Generator Engine	35 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	21	2001	Generator Engine	95 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	22	1989	Generator Engine	35 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	23	2003	Generator Engine	155 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	24	1993	Generator Engine	50 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	25	2011	Generator Engine	18 hp	Certified Engine	7.5 g/kW-hr	
DU	26	2003	Generator Engine	68 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	27	2010	Generator Engine	274 hp	Certified Engine	4.0 g/kW-hr	
DU	28	2010	Generator Engine	274 hp	Certified Engine	4.0 g/kW-hr	
DU	30	1952	Lift Pump Engine	75 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	32	1955	Lift Pump Engine	75 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	33	1994	Lift Pump Engine	75 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	34	1995	Well Pump Engine	220 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	35	2009	Well Pump Engine	55 hp	Certified Engine	4.7 g/kW-hr	
DU	36	1995	Well Pump Engine	220 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
DU	29a	2014	Lift Pump Engine	74 hp	Certified Engine	4.7 g/kW-hr	
DU	31a	2014	Lift Pump Engine	74 hp	Certified Engine	4.7 g/kW-hr	
FWA	26	2012	QSB7-G3 NR3	295 hp	Certified Engine	4.0 g/kW-hr	
FWA	27	2009	4024HF285B	67 hp	Certified Engine	4.7 g/kW-hr	
FWA	28	2007	CAT C9 GENSET	398 hp	Certified Engine	4.0 g/kW-hr	
FWA	29	ND	TM30UCM	47 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
FWA	30	2007	JW64-UF30	275 hp	Certified Engine	4.0 g/kW-hr	
FWA	31	1994	DDFP-04AT	235 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
FWA	32	1994	DDFP-04AT	235 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
FWA	33	1994	DDFP-04AT	235 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
FWA	34	1994	DDFP-04AT	235 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
FWA	35	1977	N-855-F	240 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
FWA	36	1977	N-855-F	240 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
FWA	37	2005	JU4H-UF40	94 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
FWA	38	1996	PDFP-06YT	120 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	
FWA	39	1996	PDFP-06YT	120 hp	AP-42, Table 3.3-1	0.031 lb/hp-hr	

Table 3-12 lists the proposed NOx BACT determination for this facility along with those for other diesel-fired engines rated at less than 500 hp located in the Serious PM-2.5 nonattainment area.

Table 3-12. Comparison of NOx BACT for Small Diesel Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	41 Small Diesel-Fired Engines	< 500 hp	0.007 – 0.031 lb/hp-hr	Limited Operation for Non-Emergency Use (100 hours per year each) Good Combustion Practices
UAF	Six Small Diesel-Fired Engines	< 500 hp	0.0007 – 0.031 lb/hp-hr	Turbocharger and Aftercooler Good Combustion Practices Limited Operation

4. BACT DETERMINATION FOR PM-2.5

The Department based its PM-2.5 assessment on BACT determinations found in the RBLC, internet research, and BACT analyses submitted to the Department by GVEA for the North Pole Power Plant and Zehnder Facility, Aurora for the Chena Power Plant, US Army for Fort Wainwright, and UAF for the Combined Heat and Power Plant.

4.1 PM-2.5 BACT for the Industrial Coal-Fired Boilers

Possible PM-2.5 emission control technologies for coal-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 11.110, Coal Combustion in Industrial Size Boilers and Furnaces. The search results for coal-fired boilers are summarized in Table 4-1.

Table 4-1. RBLC Summary of PM-2.5 Control for Industrial Coal-Fired Boilers

Control Technology	Number of Determinations	Emission Limits (lb/MMBtu)
Pulse Jet Fabric Filters	4	0.012 – 0.024
Electrostatic Precipitators	2	0.02 – 0.03

RBLC Review
A review of similar units in the RBLC indicates that fabric filters and electrostatic precipitators are the principle particulate matter control technologies installed on industrial coal-fired boilers. The lowest PM-2.5 emission rate listed in RBLC is 0.012 lb/MMBtu.

Step 1 - Identification of PM-2.5 Control Technologies for the Industrial Coal-Fired Boilers
From research, the Department identified the following technologies as available for control of PM-2.5 emissions from industrial coal-fired boilers:

(a) Fabric Filters
Fabric filters or baghouses are comprised of an array of filter bags contained in housing. Air passes through the filter media from the "dirty" to the "clean" side of the bag. These devices undergo periodic bag cleaning based on the build-up of filtered material on the bag as measured by pressure drop across the device. The cleaning cycle is set to allow

operation within a range of design pressure drop. Fabric filters are characterized by the type of cleaning cycle: mechanical-shaker,[12] pulse-jet,[13] and reverse-air.[14] Fabric filter systems have control efficiencies of 95% to 99.9%, and are generally specified to meet a discharge concentration of filterable particulate (e.g., 0.01 grains per dry standard cubic feet). The Department considers fabric filters a technically feasible control technology for the industrial coal-fired boilers.

(b) Wet and Dry Electrostatic Precipitators (ESP)
ESPs remove particles from a gas stream by electrically charging particles with a discharge electrode in the gas path and then collecting the charged particles on grounded plates. The inlet air is quenched with water on a wet ESP to saturate the gas stream and ensure a wetted surface on the collection plate. This wetted surface along with a period deluge of water is what cleans the collection plate surface. Wet ESPs typically control streams with inlet grain loading values of 0.5 – 5 gr/ft^3 and have control efficiencies between 90% and 99.9%.[15] Wet ESPs have the advantage of controlling some amount of condensable particulate matter. The collection plates in a dry ESP are periodically cleaned by a rapper or hammer that sends a shock wave that knocks the collected particulate off the plate. Dry ESPs typically control streams with inlet grain loading values of 0.5 – 5 gr/ft^3 and have control efficiencies between 99% and 99.9%.[16] The Department considers ESP a technically feasible control technology for the industrial coal-fired boilers.

(c) Wet Scrubbers
Wet scrubbers use a scrubbing solution to remove PM/PM_{10}/$PM_{2.5}$ from exhaust gas streams. The mechanism for particulate collection is impaction and interception by water droplets. Wet scrubbers are configured as counter-flow, cross-flow, or concurrent flow, but typically employ counter-flow where the scrubbing fluid is in the opposite direction as the gas flow. Wet scrubbers have control efficiencies of 50% - 99%.[17] One advantage of wet scrubbers is that they can be effective on condensable particulate matter. A disadvantage of wet scrubbers is that they consume water and produce water and sludge. For fine particulate control, a venturi scrubber can be used, but typical loadings for such a scrubber are 0.1-50 grains/scf. The Department considers the use of wet scrubbers a technically feasible control technology for the industrial coal-fired boilers.

(d) Mechanical Collectors (Cyclones)
Cyclones are used in industrial applications to remove particulate matter from exhaust flows and other industrial stream flows. Dirty air enters a cyclone tangentially and the

[12] https://www3.epa.gov/ttn/catc/dir1/ff-shaker.pdf
[13] https://www3.epa.gov/ttn/catc/dir1/ff-pulse.pdf
[14] https://www3.epa.gov/ttn/catc/dir1/ff-revar.pdf
[15] https://www3.epa.gov/ttn/catc/dir1/fwespwpi.pdf
https://www3.epa.gov/ttn/catc/dir1/fwespwpl.pdf
[16] https://www3.epa.gov/ttn/catc/dir1/fdespwpi.pdf
https://www3.epa.gov/ttn/catc/dir1/fdespwpl.pdf
[17] https://www3.epa.gov/ttn/catc/dir1/fcondnse.pdf
https://www3.epa.gov/ttn/catc/dir1/fiberbed.pdf
https://www3.epa.gov/ttn/catc/dir1/fventuri.pdf

centrifugal force moves the particulate matter against the cone wall. The air flows in a helical pattern from the top down to the narrow bottom before exiting the cyclone straight up the center and out the top. Large and dense particles in the stream flow are forced by inertia into the walls of the cyclone where the material then falls to the bottom of the cyclone and into a collection unit. Cleaned air then exits the cyclone either for further treatment or release to the atmosphere. The narrowness of the cyclone wall and the speed of the air flow determine the size of particulate matter that is removed from the stream flow. Cyclones are most efficient at removing large particulate matter (PM-10 or greater). Conventional cyclones are expected to achieve 0 to 40 percent PM-2.5 removal. High efficiency single cyclones are expected to achieve 20 to 70 percent PM-2.5 removal. The Department considers cyclones a technically feasible control technology for the industrial coal-fired boilers.

(e) Settling Chamber
Settling chambers appear only in the biomass fired boiler RBLC inventory for particulate control, not in the coal fired boiler RBLC inventory. This type of technology is a part of the group of air pollution control collectively referred to as "pre-cleaners” because the units are often used to reduce the inlet loading of particulate matter to downstream collection devices by removing the larger, abrasive particles. The collection efficiency of settling chambers is typically less than 10 percent for PM-10. The EPA fact sheet does not include a settling chamber collection efficiency for PM-2.5. The Department does not consider settling chambers a technically feasible control technology for the industrial coal-fired boilers.

(f) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the industrial coal-fired boilers and will not be repeated here. Proper management of the combustion process will result in a reduction of PM-2.5 emissions. The Department considers GCPs a technically feasible control technology for the industrial coal-fired boilers.

Step 2 - Eliminate Technically Infeasible PM-2.5 Control Technologies for the Coal-Fired Boilers
As explained in Step 1 of Section 4.1, the Department does not consider a settling chamber as a technically feasible technology to control particulate matter emissions from the industrial coal-fired boilers.

Step 3 - Rank the Remaining PM-2.5 Control Technologies for the Industrial Coal-Fired Boilers
The following control technologies have been identified and ranked by efficiency for the control of PM-2.5 from the industrial coal-fired boilers:

(a)	Fabric Filters	(99.9% Control)
(b)	Electrostatic Precipitator	(99.6% Control)
(c)	Wet Scrubber	(50% – 99% Control)
(d)	Cyclone	(20% – 70% Control)
(f)	Good Combustion Practices	(Less than 40% Control)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for PM-2.5 emissions from the coal-fired boilers:

(a) PM-2.5 emissions from the operation of the coal-fired boilers shall be controlled by installing, operating, and maintaining a full stream baghouse.

(b) PM-2.5 emissions from the coal-fired boilers shall not exceed 0.05 gr/dscf over a 3-hour averaging period.

(c) Initial compliance with the proposed PM-2.5 emission limit will be demonstrated by conducting a performance test to obtain an emission rate.

Step 5 - Selection of PM-2.5 BACT for the Industrial Coal-Fired Boilers
The Department's finding is that BACT for PM-2.5 emissions from the coal-fired boilers is as follows:

(a) PM-2.5 emissions from DU EUs 1 through 6 shall be controlled by operating and maintaining fabric filters (full stream baghouse) at all times the units are in operation;

(b) PM-2.5 emissions from DU EUs 1 through 6 shall not exceed 0.006 lb/MMBtu[18] averaged over a 3-hour period; and

(c) Initial compliance with the proposed PM-2.5 emission limit will be demonstrated by conducting a performance test to obtain an emission rate.

Table 4-2 lists the proposed PM-2.5 BACT determination for this facility along with those for other industrial coal-fired boilers in the Serious PM-2.5 nonattainment area.

Table 4-2. Comparison of PM-2.5 BACT for Coal-Fired Boilers at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	6 Coal-Fired Boilers	1380 MMBtu/hr	0.006 lb/MMBtu[18]	Full stream baghouse
UAF	Dual Fuel-Fired Boiler	295.6 MMBtu/hr	0.006 lb/MMBtu[18]	Fabric Filters

4.2 PM-2.5 BACT for the Diesel-Fired Boilers

Possible PM-2.5 emission control technologies for diesel-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13.220, Commercial/Institutional Size Boilers (<100 MMBtu/hr). The search results for diesel-fired boilers are summarized in Table 4-3.

Table 4-3. RBLC Summary of PM-2.5 Control for Diesel-Fired Boilers

Control Technology	Number of Determinations	Emission Limits
Good Combustion Practices	3	0.25 lb/gal
		0.1 tpy
		2.17 lb/hr

[18] Average soot blown run emission rate (rounded up) from worst coal-fired boiler tested at Fort Wainwright (Boiler No. 3) during most recent source test on April 19-22, 24, and 25, 2017.

RBLC Review
A review of similar units in the RBLC indicates good combustion practices are the principle PM-2.5 control technologies installed on diesel-fired boilers. The lowest PM-2.5 emission rate listed in the RBLC is 0.1 tpy.

Step 1 - Identification of PM-2.5 Control Technology for the Diesel-Fired Boilers
From research, the Department identified the following technologies as available for control of PM-2.5 emissions from diesel-fired boilers:

(a) Scrubbers
The theory behind scrubbers was discussed in detail in the PM-2.5 BACT for the industrial coal-fired boilers and will not be repeated here. The Department considers scrubbers as a technically feasible control technology for the diesel-fired boilers.

(b) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. The Department considers limited operation a technically feasible control technology for the diesel-fired boilers.

(c) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the industrial coal-fired boilers and will not be repeated here. Proper management of the combustion process will result in a reduction of PM-2.5 emissions. The Department considers GCPs a technically feasible control technology for the diesel-fired boilers.

Step 2 - Eliminate Technically Infeasible PM-2.5 Control Technologies for Diesel-Fired Boilers
All identified control devices are technically feasible for the diesel-fired boilers.

Step 3 - Rank the Remaining PM-2.5 Control Technologies for the Diesel-Fired Boilers
The following control technologies have been identified and ranked by efficiency for the control of PM-2.5 emissions from the diesel-fired boilers:

(a)	Scrubber	(50% - 99% Control)
(b)	Limited Operation	(94% Control)
(c)	Good Combustion Practices	(Less than 40% Control)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes good combustion practices as BACT for PM-2.5 emissions from the diesel-fired boilers.

Department Evaluation of BACT for PM-2.5 Emissions from Diesel-Fired Boilers

The Department reviewed Fort Wainwright's proposal and finds that the 27 diesel-fired boilers have a combined PTE of less than one tpy for PM-2.5 based on non-emergency operation of 500 hours per year. At one tpy, the cost effectiveness in terms of dollars per ton for add-on pollution control for these units is economically infeasible.

Step 5 - Selection of PM-2.5 BACT for the Diesel-Fired Boilers

The Department's finding is that BACT for PM-2.5 emissions from the diesel-fired boilers is as follows:

(a) PM-2.5 emissions from the diesel-fired boilers shall not exceed 0.012 lb/MMBtu[19] averaged over a 3-hour period, with the exception of the waste fuel boilers which must comply with the State particulate matter emissions standard of 0.05 grains per dry standard cubic foot under 18 AAC 50.055(b)(1);

(b) Combined operating limit of 600 hours per year for FWA EUs 8, 9, and 10;

(c) Limit non-emergency operation of the 27 diesel fired boilers, with the exception of the waste-fuel boilers, to no more than 500 hours per year, for maintenance checks and readiness testing; and

(d) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation.

Table 4-4 lists the proposed PM-2.5 BACT determination for this facility along with those for other diesel-fired boilers rated at less than 100 MMBtu/hr in the Serious PM-2.5 nonattainment area.

Table 4-4. Comparison of PM-2.5 BACT for the Diesel-Fired Boilers at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	27 Diesel-Fired Boilers	< 100 MMBtu/hr	0.012 lb/MMBtu[19]	Good Combustion Practices
UAF	3 Diesel-Fired Boilers	< 100 MMBtu/hr	0.012 lb/MMBtu[19]	Limited Operation Good Combustion Practices
Zehnder	2 Diesel-Fired Boilers	< 100 MMBtu/hr	0.012 lb/MMBtu[19]	Good Combustion Practices

4.3 PM-2.5 BACT for the Large Diesel-Fired Engines, Fire Pumps, and Generators

Possible PM-2.5 emission control technologies for large engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 17.100-17.190, Large Internal Combustion Engines (>500 hp). The search results for large diesel-fired engines are summarized in Table 4-5.

Table 4-5. RBLC Summary of PM-2.5 Control for Large Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Federal Emission Standards	12	0.03 – 0.02
Good Combustion Practices	28	0.03 – 0.24
Limited Operation	11	0.04 – 0.17
Low Sulfur Fuel	14	0.15 – 0.17
No Control Specified	14	0.02 – 0.15

RBLC Review

A review of similar units in the RBLC indicates that good combustion practices, compliance with the federal emission standards, low ash/sulfur diesel, and limited operation are the principle

[19] Emission factor from AP-42 Table's 1.3-2 (total condensable particulate matter from No. 2 oil, 1.3 lb/1,000 gal) and 1.3-6 (PM-2.5 size-specific factor from distillate oil, 0.25 lb/1,000 gal) converted to lb/MMBtu.

PM-2.5 control technologies installed on large diesel-fired engines. The lowest PM-2.5 emission rate in the RBLC is 0.02 g/hp-hr.

Step 1 - Identification of PM-2.5 Control Technology for the Large Diesel-Fired Engines
From research, the Department identified the following technologies as available for control of PM-2.5 emissions from diesel-fired engines rated at 500 hp or greater:

(a) Diesel Particulate Filter (DPF)
DPFs are a control technology that are designed to physically filter particulate matter from the exhaust stream. Several designs exist which require cleaning and replacement of the filter media after soot has become caked onto the filter media. Regenerative filter designs are also available that burn the soot on a regular basis to regenerate the filter media. The Department considers DPF a technically feasible control technology for the large diesel-fired engines.

(b) Diesel Oxidation Catalyst (DOC)
DOC can reportedly reduce PM-2.5 emissions by 30% and PM emissions by 50%. A DOC is a form of "bolt on" technology that uses a chemical process to reduce pollutants in the diesel exhaust into decreased concentrations. They replace mufflers on vehicles, and require no modifications. More specifically, this is a honeycomb type structure that has a large area coated with an active catalyst layer. As CO and other gaseous hydrocarbon particles travel along the catalyst, they are oxidized thus reducing pollution. The Department considers DOC a technically feasible control technology for the large diesel-fired engines.

(c) Positive Crankcase Ventilation
Positive crankcase ventilation is the process of re-introducing the combustion air into the cylinder chamber for a second chance at combustion after the air has seeped into and collected in the crankcase during the downward stroke of the piston cycle. This process allows any unburned fuel to be subject to a second combustion opportunity. Any combustion products act as a heat sink during the second pass through the piston, which will lower the temperature of combustion and reduce the thermal NOx formation. The Department considers positive crankcase ventilation a technically feasible control technology for the large diesel-fired engines.

(d) Low Sulfur Fuel
Low sulfur fuel has been known to reduce particulate matter emissions. The Department considers low sulfur fuel as a feasible control technology for the large diesel-fired engines.

(e) Low Ash Diesel
Residual fuels and crude oil are known to contain ash forming components, while refined fuels are low ash. Fuels containing ash can cause excessive wear to equipment and foul engine components. The Department considers low ash diesel a technically feasible control technology for the large diesel-fired engines.

(f) Federal Emission Standards
RBLC PM-2.5 determinations for federal emission standards require the engines meet the requirements of 40 C.F.R. 60 NSPS Subpart IIII, 40 C.F.R 63 Subpart ZZZZ, non-road engines (NREs), or EPA tier certifications. NSPS Subpart IIII applies to stationary compression ignition internal combustion engines that are manufactured or reconstructed after July 11, 2005. The Department considers NSPS Subpart IIII a technically feasible control technology for the large diesel-fired engines.

(g) Limited Operation
FWA EUs 11, 12, and 13 currently operate under a combined annual limit of less than 600 hours per year to avoid classification as a PSD major modification for NOx. Limiting the operation of emissions units reduces the potential to emit of those units. The Department considers limited operation a technically feasible control technology for the large diesel-fired engines.

(h) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. Proper management of the combustion process will result in a reduction of PM-2.5 emissions. The Department considers GCPs a technically feasible control technology for the large diesel-fired engine.

Step 2 - Eliminate Technically Infeasible PM-2.5 Control Technologies for the Large Engines
All control technologies identified are technically feasible to control particulate emissions from the large diesel-fired engines.

Step 3 - Rank the Remaining PM-2.5 Control Technologies for the Large Diesel-Fired Engines
The following control technologies have been identified and ranked by efficiency for the control of PM-2.5 emissions from the large diesel-fired engines:

(g)	Limited Operation	(94% Control)
(a)	Diesel Particulate Filters	(85% Control)
(h)	Good Combustion Practices	(Less than 40% Control)
(b)	Diesel Oxidation Catalyst	(30% Control)
(e)	Low Ash Diesel	(25% Control)
(c)	Positive Crankcase Ventilation	(10% Control)
(f)	Federal Emission Standards	(Baseline)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for PM-2.5 emissions from the large diesel-fired engines:

(a) Combined operating limit of 600 hours per year for FWA EUs 11, 12, and 13;

(b) For engines manufactured after the applicability dates of 40 C.F.R. 60 Subpart IIII, BACT is selected as compliance with 40 C.F.R Part 60 Subpart IIII. For older engines, compliance with 40 C.F.R. 63 Subpart ZZZZ is proposed as BACT; and

(c) Combust only ULSD.

Department Evaluation of BACT for PM-2.5 Emissions from the Large Diesel-Fired Engines

The Department reviewed Fort Wainwright's proposal finds that PM-2.5 emissions from the large diesel-fired engines can be controlled by limiting the use of the units during non-emergency operation as well as complying with the applicable federal emission standards.

Step 5 - Selection of PM-2.5 BACT for the Large Diesel-Fired Engines

The Department's finding is that the BACT for PM-2.5 emissions from the large diesel-fired engines is as follows:

(a) Combined operating limit of 600 hours per year for FWA EUs 11, 12, and 13;

(b) Limit EU 8 to 500 hours of operation per year;

(c) Limit non-emergency operation of DU EUs 8, 10, 11, 13, and 15 to no more than 100 hours each per year for maintenance checks and readiness testing;

(d) Combust only ULSD;

(e) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation; and

(f) Comply with the numerical BACT emission limits listed in Table 4-6 for PM-2.5.

Table 4-6. Proposed PM-2.5 BACT Limits for Large Diesel-Fired Engines

Location	EU	Year	Description	Size	Status	BACT Limit	Proposed BACT
DU	8	2009	Generator Engine	2,937 hp	Certified Engine	0.15 g/hp-hr	40 CFR 60 Subpart IIII
DU	10	2010	Generator Engine	762 hp	Certified Engine	0.15 g/hp-hr	40 CFR 60 Subpart IIII
DU	11	2010	Generator Engine	762 hp	Certified Engine	0.15 g/hp-hr	40 CFR 60 Subpart IIII
DU	13	2008	Generator Engine	587 hp	Certified Engine	0.15 g/hp-hr	40 CFR 60 Subpart IIII
DU	15	2005	Generator Engine	1,059 hp	AP-42 Table 3.4-1	0.32 g/hp-hr	Good Combustion Practices
FWA	11	2003	Caterpillar 3512	1,206 hp	AP-42 Table 3.4-1	0.32 g/hp-hr	Limit combined operation to 600 hours per 12-month rolling period.
FWA	12	2003	Caterpillar 3512	1,206 hp	AP-42 Table 3.4-1	0.32 g/hp-hr	
FWA	13	2003	Caterpillar 3512	1,206 hp	AP-42 Table 3.4-1	0.32 g/hp-hr	

Table 4-7 lists the proposed PM-2.5 BACT determination for this facility along with those for other diesel-fired engines rated at more than 500 hp located in the Serious PM-2.5 nonattainment area.

Table 4-7. Comparison of PM-2.5 BACT for Large Diesel Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
UAF	Large Diesel-Fired Engine	13,266 hp	0.32 g/hp-hr	Positive Crankcase Ventilation Limited Operation
Fort Wainwright	8 Large Diesel-Fired Engines	> 500 hp	0.15 – 0.32 g/hp-hr	Limited Operation Ultra-Low Sulfur Diesel Federal Emission Standards
GVEA North Pole	Large Diesel-Fired Engine	600 hp	0.32 g/hp-hr	Positive Crankcase Ventilation Good Combustion Practices

Facility	Process Description	Capacity	Limitation	Control Method
GVEA Zehnder	2 Large Diesel-Fired Engines	11,000 hp (each)	0.32 g/hp-hr	Limited Operation Good Combustion Practices

4.4 PM-2.5 BACT for the Small Emergency Engines, Fire Pumps, and Generators

Possible PM-2.5 emission control technologies for small engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17.210, Small Internal Combustion Engines (<500 hp). The search results for diesel-fired engines are summarized in Table 4-8.

Table 4-8. RBLC Summary for PM-2.5 Control for Small Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Federal Emission Standards	3	0.15
Good Combustion Practices	19	0.15 – 0.4
Limited Operation	7	0.15 – 0.17
Low Sulfur Fuel	7	0.15 – 0.3
No Control Specified	14	0.02 – 0.09

RBLC Review
A review of similar units in the RBLC indicates low ash/sulfur diesel, compliance with federal emission standards, limited operation, and good combustion practices are the principle PM-2.5 control technologies installed on small diesel-fired engines. The lowest PM-2.5 emission rate listed in the RBLC is 0.02 g/hp-hr.

Step 1 - Identification of PM-2.5 Control Technology for the Small Diesel-Fired Engines
From research, the Department identified the following technologies as available for control of PM-2.5 emissions from diesel-fired engines rated at less than 500 hp:

(a) Diesel Particulate Filter
The theory behind DPF was discussed in detail in the PM-2.5 BACT for the large diesel-fired engines and will not be repeated here. The Department considers DPF a technically feasible control technology for the small diesel-fired engines.

(b) Diesel Oxidation Catalyst
The theory behind DOC was discussed in detail in the PM-2.5 BACT for the large diesel-fired engines and will not be repeated here. The Department considers DOC a technically feasible control technology for the small diesel-fired engines.

(c) Low Ash Diesel
Residual fuels and crude oil are known to contain ash forming components, while refined fuels are low ash. Fuels containing ash can cause excessive wear to equipment and foul engine components. The Department considers low ash diesel a technically feasible control technology for the small diesel-fired engine.

(d) Federal Emission Standards

The theory behind federal emission standards was discussed in detail in the PM-2.5 BACT for the large diesel-fired engines and will not be repeated here. The Department considers federal emission standards a technically feasible control technology for the small diesel-fired engines.

(e) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. The Department considers limited operation a technically feasible control technology for the small diesel-fired engines.

(f) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. Proper management of the combustion process will result in a reduction of PM-2.5 emissions. The Department considers GCPs a technically feasible control technology for the small diesel-fired engines.

Step 2 - Eliminate Technically Infeasible PM-2.5 Control Technologies for the Small Engines
All identified control technologies are technically feasible for the small diesel-fired engines.

Step 3 - Rank the Remaining PM-2.5 Control Technologies for the Small Diesel-Fired Engines
The following control technologies have been identified and ranked by efficiency for the control of PM-2.5 emissions from the small diesel-fired engines:

(e)	Limited Operation	(94% Control)
(a)	Diesel Particulate Filters	(60% - 90% Control)
(b)	Diesel Oxidation Catalyst	(40% Control)
(f)	Good Combustion Practices	(Less than 40% Control)
(c)	Low Ash/Sulfur Diesel	(25% Control)
(d)	Federal Emission Standards	(Baseline)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for PM-2.5 emissions from the small diesel-fired engines:

(a) Good Combustion Practices;

(b) For engines manufactured after the applicability dates of 40 C.F.R. 60 Subpart IIII, BACT is proposed as compliance with 40 C.F.R Part 60 Subpart IIII. For older engines, compliance with the 40 C.F.R. 63 Subpart ZZZZ is proposed as BACT; and

(c) Combust only ULSD.

Department Evaluation of BACT for PM-2.5 Emissions from Small Diesel-Fired Engines

The Department reviewed Fort Wainwright's proposal and found that in addition to maintaining good combustion practices, complying with federal requirements, and combusting only ULSD: limiting operation of the small diesel-fired engines during non-emergency operation to no more than 100 hours per year each is BACT for PM-2.5.

Step 5 - Selection of PM-2.5 BACT for the Small Diesel-Fired Engines

The Department's finding is that BACT for PM-2.5 emissions from the small diesel-fired engines is as follows:

(a) Combust only ULSD;

(b) Limit non-emergency operation of DU EUs 9, 12, 14, 16 through 28, 29a, 30, 31a, 32, 33, 34, 35, 36, and FWA EUs 26 through 39 to no more than 100 hours per year each for maintenance checks and readiness testing;

(c) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation; and

(d) Comply with the numerical BACT emission limits listed in Table 4-9 for PM-2.5.

Table 4-9. Proposed PM-2.5 BACT Limits for Small Diesel-Fired Engines

Location	EU	Year	Description	Size	Status	BACT Limit	Proposed BACT
DU	9	1988	Generator Engine	353 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	Limited Operation for Non-Emergency Use (100 hours per year each) Good Combustion Practices Combust ULSD
DU	12	2002	Generator Engine	82 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	14	2008	Generator Engine	320 hp	Certified Engine	0.2 g/kW-hr	
DU	16	2005	Generator Engine	212 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	17	2007	Generator Engine	176 hp	Permit condition 23.1c	0.40 g/hp-hr	
DU	18	2005	Generator Engine	212 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	19	2007	Generator Engine	71 hp	Certified Engine	0.4 g/kW-hr	
DU	20	1976	Generator Engine	35 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	21	2001	Generator Engine	95 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	22	1989	Generator Engine	35 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	23	2003	Generator Engine	155 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	24	1993	Generator Engine	50 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	25	2011	Generator Engine	18 hp	Certified Engine	0.4 g/kW-hr	
DU	26	2003	Generator Engine	68 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	27	2010	Generator Engine	274 hp	Certified Engine	0.2 g/kW-hr	
DU	28	2010	Generator Engine	274 hp	Certified Engine	0.2 g/kW-hr	
DU	30	1952	Lift Pump Engine	75 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	32	1955	Lift Pump Engine	75 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	33	1994	Lift Pump Engine	75 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	34	1995	Well Pump Engine	220 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	35	2009	Well Pump Engine	55 hp	Certified Engine	0.3 g/hp-hr	
DU	36	1995	Well Pump Engine	220 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
DU	29a	2014	Lift Pump Engine	74 hp	Certified Engine	0.03 g/kW-hr	
DU	31a	2014	Lift Pump Engine	74 hp	Certified Engine	0.03 g/kW-hr	
FWA	26	2012	QSB7-G3 NR3	295 hp	Certified Engine	0.02 g/kW-hr	
FWA	27	2009	4024HF285B	67 hp	Certified Engine	0.3 g/kW-hr	
FWA	28	2007	CAT C9 GENSET	398 hp	Certified Engine	0.2 g/kW-hr	
FWA	29	ND	TM30UCM	47 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
FWA	30	2007	JW64-UF30	275 hp	Certified Engine	0.2 g/kW-hr	
FWA	31	1994	DDFP-04AT	235 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
FWA	32	1994	DDFP-04AT	235 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
FWA	33	1994	DDFP-04AT	235 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	

Location	EU	Year	Description	Size	Status	BACT Limit	Proposed BACT
FWA	34	1994	DDFP-04AT	235 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
FWA	35	1977	N-855-F	240 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
FWA	36	1977	N-855-F	240 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
FWA	37	2005	JU4H-UF40	94 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
FWA	38	1996	PDFP-06YT	120 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	
FWA	39	1996	PDFP-06YT	120 hp	AP-42, Table 3.3-1	2.20 E-3 lb/hp-hr	

Table 4-10 lists the proposed PM-2.5 BACT determination for this facility along with those for other diesel-fired engines rated at less than 500 hp located in the Serious PM-2.5 nonattainment area.

Table 4-10. Comparison of PM-2.5 BACT for Small Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	41 Small Diesel-Fired Engines	< 500 hp	0.015 – 1.0 g/hp-hr	Good Combustion Practices Limited Operation
UAF	One Small Diesel-Fired Engine	< 500 hp	0.015 – 1.0 g/hp-hr	Good Combustion Practices Limited Operation

4.5 PM-2.5 BACT for the Material Handling

Possible PM-2.5 emission control technologies for material handling were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 99.100 - 190, Fugitive Dust Sources. The search results for material handling units are summarized in Table 4-11.

Table 4-11. RBLC Summary for PM-2.5 Control for Material Handling

Control Technology	Number of Determinations	Emission Limits
Fabric Filter / Baghouse	10	0.005 gr./dscf
Electrostatic Precipitator	3	0.032 lb/MMBtu
Wet Suppressants / Watering	3	29.9 tpy
Enclosures / Minimizing Drop Height	4	0.93 lb/hr

RBLC Review

A review of similar units in the RBLC indicates good operational practices, enclosures, fabric filters, and minimizing drop heights are the principle PM-2.5 control technologies for material handling operations.

Step 1 - Identification of PM-2.5 Control Technology for the Material Handling

From research, the Department identified the following technologies as available for PM-2.5 control of materials handling:

(a) Fabric Filters
The theory behind fabric filters was discussed in detail in the PM-2.5 BACT for the industrial coal-fired boilers and will not be repeated here. The Department considers fabric filters a technically feasible control technology for material handling.

(b) Enclosure
Enclosure structures shelter material from wind entrainment and are used to control particulate emissions. Enclosures can either fully or partially enclose the source and control efficiency is dependent on the level of enclosure.

(c) Wet and Dry Electrostatic Precipitators
The theory behind ESPs was discussed in detail in the PM-2.5 BACT for the industrial coal-fired boilers and will not be repeated here. The Department considers ESPs a technically feasible control technology for material handling.

(d) Wet Scrubbers
The theory behind wet scrubbers was discussed in detail in the PM-2.5 BACT for the industrial coal-fired boilers and will not be repeated here. The Department considers wet scrubbers a technically feasible control technology for material handling.

(e) Mechanical Collectors (Cyclones)
The theory behind cyclones was discussed in detail in the PM-2.5 BACT for the industrial coal-fired boilers and will not be repeated here. The Department considers cyclones a technically feasible control technology for material handling.

(f) Suppressants
The use of dust suppression to control particulate matter can be effective for stockpiles and transfer points exposed to the open air. Applying water or a chemical suppressant can bind the materials together into larger particles which reduces the ability to become entrained in the air either from wind or material handling activities. The Department considers the use of suppressants a technically feasible control technology for all of the material handling units.

(g) Wind Screens
A wind screen is similar to a solid fence which is used to lower wind velocities near stockpiles and material handling sites. As wind speeds increase, so do the fugitive emissions from the stockpiles, conveyors, and transfer points. The use of wind screens is appropriate for materials not already located in enclosures. Due to all of the material handling units being operated in enclosures the Department does not consider wind screens a technically feasible control technology for the material handling units.

(h) Vents/Closed System Vents/Negative Pressure Vents
Vents can control fugitive emissions by collecting fugitive emissions from enclosed loading, unloading, and transfer points and then venting emissions to the atmosphere or back into other equipment such as a storage silo. Other vent control designs include enclosing emission units and operating under a negative pressure. The Department considers vents to be a technically feasible control technology for the material handling units.

Step 2 - Eliminate Technically Infeasible PM-2.5 Controls for the Material Handling

All of the identified control technologies are technically feasible for material handling.

Step 3 - Rank the Remaining PM-2.5 Control Technologies for the Material Handling
The following control technologies have been identified and ranked for control of particulates from the material handling equipment.

(a)	Fabric Filters	(50 - 99% Control)
(b)	Enclosures	(50 - 99% Control)
(d)	Wet Scrubber	(50% - 99% Control)
(c)	Electrostatic Precipitator	(>90% Control)
(e)	Cyclone	(20% -70% Control)
(f)	Suppressants	(less than 90% Control)
(h)	Vents	(less than 90% Control)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for PM-2.5 emissions from material handling based on a combination of manufacturing design and loading techniques:

(a) PM-2.5 emissions from the South Coal Handling Dust Collector (EU 7a) shall not exceed 0.0025 gr/dscf and shall be controlled by enclosed emission points and by following manufacturer's recommendations for operations and maintenance.

(b) PM-2.5 emissions from the South Underbunker, Fly Ash, and Bottom Ash Dust Collectors (EUs 7b, 7c, 51a, and 51b) shall not exceed 0.02 gr/dscf and shall be controlled by enclosed emission points and by following manufacturer's recommendations for operations and maintenance.

(c) PM-2.5 emissions from the North Coal Handling Dust Collector (EU 7c) shall not exceed 0.02 gr/dscf and shall be limited to no more than 200 hours per year.

(d) Initial compliance with the PM-2.5 emission limits, except the emission limit for EU 52, will be demonstrated by conducting a performance test to obtain an emission rate.

(e) PM-2.5 emissions from the Emergency Coal Storage Pile and Operations (EU 52) shall not exceed 1.42 tpy and shall be controlled with chemical stabilizers, wind fencing, covered haul vehicles, watering, and wind awareness. These procedures are identified in the September 2003 Fort Wainwright Dust Control Plan, prepared by the United States Army Center for Health Promotion and Preventive Medicine Alaskan Field Office in Conjunction with Oak Ridge Institute for Science and Education.

Step 5 - Selection of PM-2.5 BACT for the Material Handling Equipment
The Department's finding is that BACT for PM-2.5 emissions from the material handling equipment is as follows:

(a) PM-2.5 emissions from the material handling equipment EUs 7a – 7c, 51a, and 51b shall be controlled by operating and maintaining fabric filters at all times the units are in operation;

(b) Comply with the numerical BACT emission limits listed in Table 4-12 for PM-2.5;

(c) PM-2.5 emissions from DU EU 52 shall not exceed 1.42 tpy. Continuous compliance with the PM-2.5 emissions limit shall be demonstrated by complying with the fugitive dust control plan identified in the applicable operating permit issued to the source in accordance with 18 AAC 50 and AS 46.14; and

(d) Initial compliance with the PM-2.5 emission rates for the material handling units, except EU 52, shall be demonstrated with a performance test to obtain an emission rate.

Table 4-12. PM-2.5 BACT Control Technologies Proposed for Material Handling

EU ID	Description	Current Control	BACT Limit	Proposed BACT Control
7a	South Coal Handling Dust Collector	Partial Enclosure and Dust Collection	0.0025 gr/dscf	Enclosed emission points and follow manufacturer recommendations for operations and maintenance
7b	South Underbunker Dust Collector	Partial Enclosure and Dust Collection	0.02 gr/dscf	Enclosed emission points and follow manufacturer recommendations for operations and maintenance
7c	North Coal Handling Dust Collector	Partial Enclosure and Dust Collection	0.02 gr/dscf	Limited Operation – This source serves as backup to EU 7a and operates less than 200 hours each year
52	Emergency Coal Storage Pile and Operations	Follow Fugitive Dust Control Plan	Dust Control Plan[20]	Chemical Stabilizers, Wind Fencing, Covered Haul Vehicles, Watering, and Wind Awareness
51a	Fly Ash Dust Collector	Partial Enclosure and Dust Collection	0.02 gr/dscf	Enclosed emission points and follow manufacturer recommendations for operations and maintenance
51b	Bottom Ash Dust Collector	Partial Enclosure and Dust Collection	0.02 gr/dscf	Enclosed emission points and follow manufacturer recommendations for operations and maintenance

5. BACT DETERMINATION FOR SO_2

The Department based its SO_2 assessment on BACT determinations found in the RBLC, internet research, and BACT analyses submitted to the Department by GVEA for the North Pole Power Plant and Zehnder Facility, Aurora for the Chena Power Plant, US Army for Fort Wainwright, and UAF for the Combined Heat and Power Plant.

5.1 SO_2 BACT for the Industrial Coal-Fired Boilers

Possible SO_2 emission control technologies for coal-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 11.110, Coal Combustion in Industrial Size Boilers and Furnaces. The search results for the coal-fired boilers are summarized in Table 5-1.

Table 5-1. RBLC Summary of SO_2 Control for Industrial Coal-Fired Boilers

Control Technology	Number of Determinations	Emission Limits (lb/MMBtu)
Flue Gas Desulfurization / Scrubber / Spray Dryer	10	0.06 – 0.12
Limestone Injection	10	0.055 – 0.114
Low Sulfur Coal	4	0.06 – 1.2

[20] If technological or economic limitations in the application of a measurement methodology to a particular emission unit would make an emission limit infeasible, a design, equipment, work practice, operational standard or combination of thereof, may be prescribed.

RBLC Review
A review of similar units in the RBLC indicates flue gas desulfurization, limestone injection, and low sulfur coal are the principle SO_2 control technologies installed on industrial coal-fired boilers. The lowest SO_2 emission rate in the RBLC is 0.055 lb/MMBtu.

Step 1- Identification of SO_2 Control Technology for the Coal-Fired Boilers
From research, the Department identified the following technologies as available for SO_2 control of industrial coal-fired boilers:

(a) Wet Scrubbers
Post combustion flue gas desulfurization techniques can remove SO_2 formed during combustion by using an alkaline reagent to absorb SO_2 in the flue gas. Flue gasses can be treated using wet, dry, or semi-dry desulfurization processes. In the wet scrubbing system, flue gas is contacted with a solution or slurry of alkaline material in a vessel providing a relatively long residence time. The SO_2 in the flue reacts with the alkali solution or slurry by adsorption and/or absorption mechanisms to form liquid-phase salts. These salts are dried to about one percent free moisture by the heat in the flue gas. These solids are entrained in the flue gas and carried from the dryer to a PM collection device, such as a baghouse.

The lime and limestone wet scrubbing process uses a slurry of calcium oxide or limestone to absorb SO_2 in a wet scrubber. Control efficiencies in excess of 91 percent for lime and 94 percent for limestone over extended periods are possible. Sodium scrubbing processes generally employ a wet scrubbing solution of sodium hydroxide or sodium carbonate to absorb SO_2 from the flue gas. Sodium scrubbers are generally limited to smaller sources because of high reagent costs and can have SO_2 removal efficiencies of up to 96.2 percent. The double or dual alkali system uses a clear sodium alkali solution for SO_2 removal followed by a regeneration step using lime or limestone to recover the sodium alkali and produce a calcium sulfite and sulfate sludge. SO_2 removal efficiencies of 90 to 96 percent are possible. The Department considers flue gas desulfurization with a wet scrubber a technically feasible control technology for the industrial coal-fired boilers.

(b) Spray Dry Absorbers (SDA)
In SDA systems, an aqueous sorbent slurry with a higher sorbent ratio than that of a wet scrubber is injected into the hot flue gases. As the slurry mixes with the flue gas, the water is evaporated and the process forms a dry waste which is collected in a baghouse or electrostatic precipitator. The Department considers flue gas desulfurization with an SDA system a technically feasible control technology for the industrial coal-fired boilers.

(c) Dry Sorbent Injection (DSI)
Dry sorbent injection systems (spray dry scrubbers) pneumatically inject a powdered sorbent directly into the furnace, the economizer, or the downstream ductwork depending on the temperature and the type of sorbent utilized. The dry waste is removed using a baghouse or electrostatic precipitator. Spray drying technology is less complex mechanically, and no more complex chemically, than wet scrubbing systems. The main

advantages of the spray dryer is that this technology avoids two problems associated with wet scrubbing, corrosion and liquid waste treatment. Spray dry scrubbers are mostly used for small to medium capacity boilers and are preferable for retrofits. The Department considers flue gas desulfurization with a dry scrubber a technically feasible control technology for the industrial coal-fired boilers.

(d) Low Sulfur Coal
Fort Wainwright purchases coal from the Usibelli Coal Mine located in Healy, Alaska. This coal mine is located 115 miles south of Fairbanks. The coal mined at Usibelli is sub-bituminous coal and has a relatively low sulfur content with guarantees of less than 0.4 percent by weight. Usibelli Coal Data Sheets indicate a range of 0.08 to 0.28 percent Gross As Received (GAR) percent Sulfur (%S). According to the U.S. Geological Survey, coal with less than one percent sulfur is classified as low sulfur coal. The Department considers the use of low sulfur coal a feasible control technology for the industrial coal-fired boilers.

(e) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the industrial coal-fired boilers and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2 emissions. The Department considers GCPs a technically feasible control technology for the industrial coal-fired boilers.

Step 2 - Eliminate Technically Infeasible SO_2 Control Technologies for Coal-Fired Boilers
All identified control devices are technically feasible for the industrial coal-fired boilers.

Step 3 - Rank the Remaining SO_2 Control Technologies for Industrial Coal-Fired Boilers
The following control technologies have been identified and ranked by efficiency for control of SO_2 emissions from the industrial coal-fired boilers:

(a)	Wet Scrubbers	(99% Control)
(b)	Spray Dry Absorbers	(90% Control)
(c)	Dry Sorbent Injection (Duct Sorbent Injection)	(50 – 80% Control)
(d)	Low Sulfur Coal	(30% Control)
(e)	Good Combustion Practices	(Less than 40% Control)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright provided an economic analysis of the installation of wet and dry scrubber systems. A summary of the analysis is shown below:

Table 5-2. Fort Wainwright Economic Analysis for Technically Feasible SO_2 Controls

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton)
Wet Scrubber	1,767	1,749	???	???	6,900 - 13,800

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton)
Spray-Dry Scrubber	1,767	1,590	???	???	5,200 - 6,200
Dry Sorbent Injection[21]	1,767	1,414	6,191,696	6,384,196	4,516 - 5,968
Capital Recovery Factor = 0.1424 (7% interest rate for a 10 year equipment life)					

Fort Wainwright contends that the economic analysis indicates the level of SO_2 reduction does not justify the use of wet scrubbers, semi-dry scrubbers, or dry scrubber systems (dry-sorbent injection) for the coal-fired boilers based on the excessive cost per ton of SO_2 removed per year.

Fort Wainwright proposes the following as BACT for SO_2 emissions from the coal-fired boilers:

(a) SO_2 emissions from the operation of the coal-fired boilers will be controlled by limited operation, good combustion practices, and low sulfur fuel at all times the boilers are in operation.

(b) SO_2 emissions from the coal-fired boilers will be controlled by burning low sulfur coal at all times the boilers are in operation.

(c) SO_2 emissions from the coal-fired boilers will not exceed 0.49 lb/MMBtu.

(d) SO_2 emissions from the coal-fired boilers will be controlled by limiting the allowable coal combustion to no more than 300,000 tons per year.

(e) Initial compliance with the proposed SO_2 emission limit will be demonstrated by conducting a performance test to obtain an emission rate.

Department Evaluation of BACT for SO_2 Emissions from the Industrial Coal-Fired Boilers

The Department revised the cost analysis provided for the installation of wet scrubbers, semi-dry scrubbers (spray dry absorbers), and dry scrubbers (dry sorbent injection) using a potential to emit of 1,168 tpy for the six coal-fired boilers combined (calculated using the existing permit limit of 336,000 tons of coal per year combined), a baseline emission rate of 0.46 lb SO_2/MMBtu,[22] a retrofit factor of 1.5 for difficult retrofits, a SO_2 removal efficiency of 99%, 90% and 80% for wet scrubbers, spray dry absorbers and dry sorbent injection respectively, an interest rate of 5.5% (current bank prime interest rate), and a 15 year equipment life. A summary of the analysis is shown below:

Table 5-3. Department Economic Analysis for Technically Feasible SO_2 Controls

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton)
Wet Scrubber	1,168	1,157	138,118,131	23,913,899	20,673
Spray Dry Absorbers	1,168	1,052	125,929,192	22,305,559	21,211

[21] Calculated using Amerair Industries Proposal for 80% removal of SO_2 emissions.

[22] Calculated assuming a 0.2% sulfur content by weight (typical gross as received) and a higher heating value of 7,560 Btu/lb for Healy coal (average of gross as received range) http://www.usibelli.com/coal/data-sheet, and AP-42 Table 1.1-3 emission factors for spreader stoker boilers combusting sub-bituminous coal.

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton)
Dry Sorbent Injection	1,168	935	15,279,601	9,655,624	10,329
Capital Recovery Factor = 0.0996 (5.5% interest rate for a 15 year equipment life)					

The Department's economic analysis indicates the level of SO_2 reduction justifies the use of dry sorbent injection as BACT for the coal-fired boilers located in the Serious PM-2.5 nonattainment area.

Step 5 - Selection of SO_2 BACT for the Industrial Coal-Fired Boilers
The Department's finding is that BACT for SO_2 emissions from the coal-fired boilers is as follows:

(a) SO_2 emissions from DU EUs 1 through 6 shall be controlled by operating and maintaining dry sorbent injection at all times the units are in operation;

(b) SO_2 emissions from DU EUs 1 through 6 shall not exceed 0.10 lb/MMBtu[23] averaged over a 3-hour period;

(c) Limit the combined coal combustion in DU EUs 1 through 6 to no more than 336,000 tons per year.

(d) Initial compliance with the SO_2 emission rate for the coal-fired boilers will be demonstrated by conducting a performance test to obtain an emission rate.

Table 5-4 lists the proposed SO_2 BACT determination for this facility along with those for other coal-fired boilers in the Serious PM-2.5 nonattainment area.

Table 5-4. Comparison of SO_2 BACT for Coal-Fired Boilers at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	6 Coal-Fired Boilers	1380 MMBtu/hr (combined)	0.10 lb/MMBtu[23]	Dry Sorbent Injection Limited Operation Low Sulfur Coal
UAF	Dual Fuel-Fired Boiler	295.6 MMBtu/hr	0.10 lb/MMBtu	Dry Sorbent Injection Limestone Injection Low Sulfur Coal
Chena	4 Coal-Fired Boilers	497 MMBtu/hr (combined)	0.10 lb/MMBtu	Dry Sorbent Injection Low Sulfur Coal

[23] BACT limit selected after evaluating existing emission limits in the RBLC database for coal-fired boilers, taking into account previous source test data from coal-fired boilers in Alaska and actual emissions data from other sources employing similar types of controls, using site specific vendor quotes provided by Amerair Industries, and in-line with EPA's pollution control Fact Sheets while keeping in mind that BACT limits must be achievable at all times.

5.2 SO_2 BACT for the Diesel-Fired Boilers

Possible SO_2 emission control technologies for diesel-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13.220, Commercial/Institutional Size Boilers (<100 MMBtu/hr). The search results for diesel-fired boilers are summarized in Table 5-5.

Table 5-5. RBLC Summary of SO_2 Control for Diesel-Fired Boilers

Control Technology	Number of Determinations	Emission Limits (lb/MMBtu)
Low Sulfur Fuel	5	0.0036 – 0.0094
Good Combustion Practices	4	0.0005
No Control Specified	5	0.0005

RBLC Review
A review of similar units in the RBLC indicates that good combustion practices and combustion of low sulfur fuel are the principle SO_2 control technologies installed on diesel-fired boilers. The lowest SO_2 emission rate listed in the RBLC is 0.0005 lb/MMBtu.

Step 1 - Identification of SO_2 Control Technology for the Diesel-Fired Boilers
From research, the Department identified the following technologies as available for control of SO_2 emissions from diesel-fired boilers:

(a) Ultra-Low Sulfur Diesel
ULSD has a fuel sulfur content of 0.0015 percent sulfur by weight or less. Using ULSD would reduce SO_2 emissions because the diesel-fired boilers are combusting standard diesel that has a sulfur content of up to 0.5 percent sulfur by weight. Switching to ULSD could control 99 percent of SO_2 emissions from the diesel-fired boilers. The Department considers ULSD a technically feasible control technology for the diesel-fired boilers.

(b) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. The Department considers limited operation a technically feasible control technology for the diesel-fired boilers.

(c) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2 emissions. The Department considers GCPs a technically feasible control technology for the diesel-fired boilers.

Step 2 - Eliminate Technically Infeasible SO_2 Control Technologies for the Diesel-Fired Boilers
All identified control technologies are technically feasible for the diesel-fired boilers.

Step 3 - Rank the Remaining SO_2 Control Technologies for the Diesel-Fired Boilers
The following control technologies have been identified and ranked by efficiency for the control of SO_2 emissions from the diesel-fired boilers:

(a) Ultra Low Sulfur Diesel (99% Control)
(b) Limited Operation (94% Control)
(c) Good Combustion Practices (Less than 40% Control)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for SO_2 emissions from the diesel-fired boilers:

(a) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation;

(b) Combined operating limit of 600 hours per year for FWA EUs 8, 9, and 10; and

(c) Combust only ULSD.

Department Evaluation of BACT for SO_2 Emissions from Diesel-Fired Boilers

The Department reviewed Fort Wainwright's proposal and finds that the 27 diesel fired boilers have a combined PTE of less than ten tpy for SO_2 based on non-emergency operation of 500 hours per year. At ten tpy, the cost effectiveness in terms of dollars per ton for add-on pollution control for these units is economically infeasible.

Step 5 - Selection of SO_2 BACT for the Diesel-Fired Boilers

The Department's finding is that BACT for SO_2 emissions from the diesel-fired boilers is as follows:

(a) SO_2 emissions from the diesel-fired boilers shall be controlled by only combusting ULSD, with the exception of the waste fuel boilers;

(b) Combined operating limit of 600 hours per year for FWA EUs 8, 9, and 10;

(c) Limit non-emergency operation of the 27 diesel fired boilers, with the exception of the waste-fuel boilers, to no more than 500 hours per year, for maintenance checks and readiness testing; and

(d) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation.

Table 5-6 lists the proposed SO_2 BACT determination for this facility along with those for other diesel-fired boilers rated at less than 100 MMBtu/hr in the Serious PM-2.5 nonattainment area.

Table 5-6. Comparison of SO_2 BACT for the Diesel-Fired Boilers at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	Diesel-Fired Boilers	< 100 MMBtu/hr	15 ppmw S in fuel	Limited Operation Good Combustion Practices Ultra-Low Sulfur Diesel
	Waste Fuel-Fired Boilers		0.5 % S by weight	Good Combustion Practices
UAF	3 Diesel-Fired Boilers	< 100 MMBtu/hr	15 ppmw S in fuel	Good Combustion Practices Ultra-Low Sulfur Diesel

Facility	Process Description	Capacity	Limitation	Control Method
GVEA Zehnder	2 Diesel-Fired Boilers	< 100 MMBtu/hr	15 ppmw S in fuel	Good Combustion Practices Ultra-Low Sulfur Diesel

5.3 SO_2 BACT for the Large Diesel-Fired Engines, Fire Pumps, and Generators

Possible SO_2 emission control technologies for large engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 17.100 to 17.190, Large Internal Combustion Engines (>500 hp). The search results for large diesel-fired engines are summarized in Table 5-7.

Table 5-7. RBLC Summary for SO_2 Control for Large Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Low Sulfur Diesel	27	0.005 – 0.02
Federal Emission Standards	6	0.001 – 0.005
Limited Operation	6	0.005 – 0.006
Good Combustion Practices	3	None Specified
No Control Specified	11	0.005 – 0.008

RBLC Review

A review of similar units in the RBLC indicates combustion of low sulfur fuel, limited operation, good combustion practices, and compliance with the federal emission standards are the principle SO_2 control technologies installed on large diesel-fired engines. The lowest SO_2 emission rate listed in the RBLC is 0.001 g/hp-hr.

Step 1 - Identification of SO_2 Control Technology for the Large Diesel-Fired Engines

From research, the Department identified the following technologies as available for control of SO_2 emissions from diesel-fired engines rated at 500 hp or greater:

(a) Ultra-Low Sulfur Diesel
The theory of ULSD was discussed in detail in the SO_2 BACT for the diesel-fired boilers and will not be repeated here. The Department considers ULSD a technically feasible control technology for the large diesel-fired engines.

(b) Federal Emission Standards
The theory of federal emission standards was discussed in detail in the NOx BACT for the large diesel-fired engines and will not be repeated here. The Department considers meeting the technology based NSPS of Subpart IIII as a technically feasible control technology for the large diesel-fired engines.

(c) Limited Operation
FWA EUs 11, 12, and 13 currently operate under a combined annual limit of less than 600 hours per year to avoid classification as a PSD major modification for NOx. Limiting the operation of emission units reduces the potential to emit for those units. The Department considers limited operation a technically feasible control technology for the large diesel-fired engines.

(d) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2 emissions. The Department considers GCPs a technically feasible control technology for the large diesel-fired engines.

Step 2 - Eliminate Technically Infeasible SO_2 Control Technologies for the Large Engines
All identified control technologies are technically feasible for the large diesel-fired engines.

Step 3 - Rank the Remaining SO_2 Control Technologies for the Large Diesel-Fired Engines
The following control technologies have been identified and ranked by efficiency for the control of SO_2 emissions from the large diesel-fired engines.

(a)	Ultra Low Sulfur Diesel	(99% Control)
(c)	Limited Operation	(94% Control)
(d)	Good Combustion Practices	(Less than 40% Control)
(b)	Federal Emission Standards	(Baseline)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for SO_2 emissions from the large diesel-fired engines:

(a) Combined operating limit of 600 hours per year for FWA EUs 11, 12, and 13; and

(b) SO_2 emissions from the operation of the large diesel-fired engines shall be controlled with combustion of ultra-low sulfur diesel.

Department Evaluation of BACT for SO_2 Emissions from the Large Diesel-Fired Engines

The Department reviewed Fort Wainwright's proposal and finds that SO_2 emissions from the large diesel-fired engines can additionally be controlled by limiting the use of the units during non-emergency operation.

Step 5 - Selection of SO_2 BACT for the Large Diesel-Fired Engines
The Department's finding is that BACT for SO_2 emissions from the large diesel-fired engines is as follows:

(a) SO_2 emissions from DU EUs 8, 10, 11, 13, and 15 and FWA EUs 11, 12, and 13 shall be controlled by only combusting ULSD;

(b) Limit EU 8 to 500 hours per year;

(c) Combined operating limit of 600 hours per year for FWA EUs 11, 12, and 13;

(d) Limit non-emergency operation of DU EUs 8, 10, 11, 13, and 15 to no more than 100 hours per year, for maintenance checks and readiness testing; and

(e) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation.

Table 5-8 lists the proposed SO_2 BACT determination for this facility along with those for other diesel-fired engines rated at more than 500 hp located in the Serious PM-2.5 nonattainment area.

Table 5-8. Comparison of SO_2 BACT for Large Diesel-Fired Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	8 Large Diesel-Fired Engines	> 500 hp	15 ppmw S in fuel	Limited Operation Good Combustion Practices Ultra-Low Sulfur Diesel
UAF	Large Diesel-Fired Engine	13,266 hp	15 ppmw S in fuel	Limited Operation Good Combustion Practices Ultra-Low Sulfur Diesel
GVEA North Pole	Large Diesel-Fired Engine	600 hp	500 ppmw S in fuel	Good Combustion Practices Ultra-Low Sulfur Diesel
GVEA Zehnder	2 Large Diesel-Fired Engines	11,000 hp	15 ppmw S in fuel	Good Combustion Practices Ultra-Low Sulfur Diesel

5.4 SO_2 BACT for the Small Emergency Engines, Fire Pumps, and Generators

Possible SO_2 emission control technologies for small engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17.210, Small Internal Combustion Engines (<500 hp). The search results for small diesel-fired engines are summarized in Table 5-9.

Table 5-9. RBLC Summary for SO_2 Control for Small Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Low Sulfur Diesel	6	0.005 – 0.02
No Control Specified	3	0.005

RBLC Review
A review of similar units in the RBLC indicates combustion of low sulfur fuel is the principle SO_2 control technology for small diesel-fired engines. The lowest SO_2 emission rate listed in the RBLC is 0.005 g/hp-hr.

Step 1 - Identification of SO_2 Control Technology for the Small Diesel-Fired Engines
From research, the Department identified the following technologies as available for control of SO_2 emissions from diesel-fired engines rated at less than 500 hp:

(a) Ultra-Low Sulfur Diesel
The theory of ULSD was discussed in detail in the SO_2 BACT for the small diesel-fired boilers and will not be repeated here. The Department considers ULSD a technically feasible control technology for the small diesel-fired engines.

(b) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. The

Department considers limited operation a technically feasible control technology for the small diesel-fired engines.

(c) Good Combustion Practices
The theory of GCPs was discussed in detail in the NOx BACT for the coal-fired boilers and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2 emissions. The Department considers GCPs a technically feasible control technology for the small diesel-fired engines.

Step 2 - Eliminate Technically Infeasible SO_2 Control Technologies for the Small Engines
All identified control technologies are technically feasible for the small diesel-fired engines.

Step 3 - Rank the Remaining SO_2 Control Technologies for the Small Diesel-Fired Engines
The following control technologies have been identified and ranked by efficiency for the control of SO_2 emissions from the small diesel-fired engines.

(a) Ultra Low Sulfur Diesel (99% Control)
(b) Limited Operation (94% Control)
(c) Good Combustion Practices (Less than 40% Control)

Step 4 - Evaluate the Most Effective Controls

Fort Wainwright BACT Proposal

Fort Wainwright proposes the following as BACT for SO_2 emissions from the small diesel-fired engines:

(a) Good Combustion Practices;
(b) Combust only ULSD.

Department Evaluation of BACT for SO_2 Emissions from Small Diesel-Fired Engines

The Department reviewed Fort Wainwright’s proposal and found that in addition to maintaining good combustion practices and combusting only ULSD, limiting operation of the small diesel-fired engines during non-emergency operation to no more than 100 hours per year each is BACT for SO_2.

Step 5 - Selection of SO_2 BACT for the Small Diesel-Fired Engines
The Department’s finding is that BACT for SO_2 emissions from the small diesel-fired engines is as follows:

(a) Limit non-emergency operation of DU EUs 9, 12, 14, 16 through 28, 29a, 30, 31a, 32, 33, 34, 35, 36, and FWA EUs 26 through 39 to no more than 100 hours per year each for maintenance checks and readiness testing;

(b) Combust only ULSD; and

(c) Maintain good combustion practices by following the manufacturer’s maintenance procedures at all times of operation.

Table 5-10 lists the proposed SO_2 BACT determination for this facility along with those for other diesel-fired engines rated at less than 500 hp located in the Serious PM-2.5 nonattainment area.

Table 5-10. Comparison of SO_2 BACT for Small Diesel-Fired Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	41 Small Diesel-Fired Engines	< 500 hp	15 ppmw S in fuel	Limited Operation Ultra-Low Sulfur Diesel Good Combustion Practices
UAF	One Small Diesel-Fired Engine	< 500 hp	15 ppmw S in fuel	Limited Operation Ultra-Low Sulfur Diesel

6. BACT DETERMINATION SUMMARY

Table 6-1. Proposed NOx BACT Limits

EU ID	Description	Capacity	Proposed BACT Limit	Proposed BACT Control
DU 1	Six Coal Fired Boiler 3	230 MMBtu/hr	0.06 lb/MMBtu	Selective Catalytic Reduction
DU 2	Six Coal Fired Boiler 4	230 MMBtu/hr	0.06 lb/MMBtu	
DU 3	Six Coal Fired Boiler 5	230 MMBtu/hr	0.06 lb/MMBtu	
DU 4	Six Coal Fired Boiler 6	230 MMBtu/hr	0.06 lb/MMBtu	
DU 5	Six Coal Fired Boiler 7	230 MMBtu/hr	0.06 lb/MMBtu	
DU 6	Six Coal Fired Boiler 8	230 MMBtu/hr	0.06 lb/MMBtu	
FWA 8	Backup Diesel-Fired Boiler 1	19 MMBtu/hr	0.15 lb/MMBtu	Good Combustion Practices Limited Operation (600 hours/year combined)
FWA 9	Backup Diesel-Fired Boiler 2	19 MMBtu/hr	0.15 lb/ MMBtu	
FWA 10	Backup Diesel-Fired Boiler 3	19 MMBtu/hr	0.15 lb/ MMBtu	
N/A	Diesel-Fired Boilers (24)	Varies	0.15 lb/ MMBtu	Good Combustion Practices Limited Operation (500 hours/year each, for non-emergency operation)
DU 8	Generator Engine	2,937 hp	4.8 g/hp-hr	Good Combustion Practices Limited Operation (100 hours/year each, for non-emergency operation)
DU 10	Generator Engine	762 hp	4.8 g/hp-hr	
DU 11	Generator Engine	762 hp	4.8 g/hp-hr	
DU 13	Generator Engine	587 hp	3.0 g/hp-hr	
DU 15	Generator Engine	1,059 hp	5.75 g/hp-hr	
FWA 11	Caterpillar 3512	1,206 hp	10.9 g/hp-hr	Good Combustion Practices Limited Operation (600 hours/year combined)
FWA 12	Caterpillar 3512	1,206 hp	10.9 g/hp-hr	
FWA 13	Caterpillar 3512	1,206 hp	10.9 g/hp-hr	
DU 9	Generator Engine	353 hp	0.031 lb/hp-hr	Good Combustion Practices Limited Operation (100 hours/year each, for non-emergency operation)
DU 12	Generator Engine	82 hp	0.031 lb/hp-hr	
DU 14	Generator Engine	320 hp	4.0 g/kW-hr	
DU 16	Generator Engine	212 hp	0.031 lb/hp-hr	
DU 17	Generator Engine	176 hp	6.9 lb/hp-hr	
DU 18	Generator Engine	212 hp	0.031 lb/hp-hr	
DU 19	Generator Engine	71 hp	7.5 g/kW-hr	
DU 20	Generator Engine	35 hp	0.031 lb/hp-hr	

EU ID	Description	Capacity	Proposed BACT Limit	Proposed BACT Control
DU 21	Generator Engine	95 hp	0.031 lb/hp-hr	Good Combustion Practices Limited Operation (100 hours/year each, for non-emergency operation)
DU 22	Generator Engine	35 hp	0.031 lb/hp-hr	
DU 23	Generator Engine	155 hp	0.031 lb/hp-hr	
DU 24	Generator Engine	50 hp	0.031 lb/hp-hr	
DU 25	Generator Engine	18 hp	7.5 g/kW-hr	
DU 26	Generator Engine	68 hp	0.031 lb/hp-hr	
DU 27	Generator Engine	274 hp	4.0 g/kW-hr	
DU 28	Generator Engine	274 hp	4.0 g/kW-hr	
DU 30	Lift Pump Engine	75 hp	0.031 lb/hp-hr	
DU 32	Lift Pump Engine	75 hp	0.031 lb/hp-hr	
DU 33	Lift Pump Engine	75 hp	0.031 lb/hp-hr	
DU 34	Well Pump Engine	220 hp	0.031 lb/hp-hr	
DU 35	Well Pump Engine	55 hp	4.7 g/hp-hr	
DU 36	Well Pump Engine	220 hp	0.031 lb/hp-hr	
DU 29a	Lift Pump Engine	74 hp	4.7 g/kW-hr	
DU 31a	Lift Pump Engine	74 hp	4.7 g/kW-hr	
FWA 26	QSB7-G3 NR3	295 hp	4.0 g/kW-hr	
FWA 27	4024HF285B	67 hp	4.7 g/kW-hr	
FWA 28	CAT C9 GENSET	398 hp	4.0 g/kW-hr	
FWA 29	TM30UCM	47 hp	0.031 lb/hp-hr	
FWA 30	JW64-UF30	275 hp	4.0 g/kW-hr	
FWA 31	DDFP-04AT	235 hp	0.031 lb/hp-hr	
FWA 32	DDFP-04AT	235 hp	0.031 lb/hp-hr	
FWA 33	DDFP-04AT	235 hp	0.031 lb/hp-hr	
FWA 34	DDFP-04AT	235 hp	0.031 lb/hp-hr	
FWA 35	N-855-F	240 hp	0.031 lb/hp-hr	
FWA 36	N-855-F	240 hp	0.031 lb/hp-hr	
FWA 37	JU4H-UF40	94 hp	0.031 lb/hp-hr	
FWA 38	PDFP-06YT	120 hp	0.031 lb/hp-hr	
FWA 39	PDFP-06YT	120 hp	0.031 lb/hp-hr	

Table 6-2. Proposed PM-2.5 BACT Limits

EU ID	Description	Capacity	Proposed BACT Limit	Proposed BACT Control
DU 1	Six Coal Fired Boiler 3	230 MMBtu/hr	0.006 lb/MMBtu	Full stream baghouse
DU 2	Six Coal Fired Boiler 4	230 MMBtu/hr	0.006 lb/MMBtu	
DU 3	Six Coal Fired Boiler 5	230 MMBtu/hr	0.006 lb/MMBtu	
DU 4	Six Coal Fired Boiler 6	230 MMBtu/hr	0.006 lb/MMBtu	
DU 5	Six Coal Fired Boiler 7	230 MMBtu/hr	0.006 lb/MMBtu	
DU 6	Six Coal Fired Boiler 8	230 MMBtu/hr	0.006 lb/MMBtu	
FWA 8	Backup Diesel-Fired Boiler 1	19 MMBtu/hr	0.012 lb/MMBtu	Good Combustion Practices Limited Operation (600 hours/year combined) Combust ULSD
FWA 9	Backup Diesel-Fired Boiler 2	19 MMBtu/hr	0.012 lb/MMBtu	
FWA 10	Backup Diesel-Fired Boiler 3	19 MMBtu/hr	0.012 lb/MMBtu	
N/A	Diesel-Fired Boilers	Varies	0.012 lb/MMBtu	Good Combustion Practices Limited Operation (500 hours/year each, for non-emergency operation) Combust ULSD
DU 8	Generator Engine	2,937 hp	0.15 g/hp-hr	40 CFR 60 Subpart IIII Combust ULSD Good Combustion Practices Limited Operation (100 hours/year each, for non-emergency operation)
DU 10	Generator Engine	762 hp	0.15 g/hp-hr	
DU 11	Generator Engine	762 hp	0.15 g/hp-hr	
DU 13	Generator Engine	587 hp	0.15 g/hp-hr	
DU 15	Generator Engine	1,059 hp	0.32 g/hp-hr	Limited Operation (100 hours/year, for non-emergency operation) Good Combustion Practices Combust ULSD
FWA 11	Caterpillar 3512	1,206 hp	0.32 g/hp-hr	Limit Operation (600 hours/year combined) Combust ULSD Good Combustion Practices
FWA 12	Caterpillar 3512	1,206 hp	0.32 g/hp-hr	
FWA 13	Caterpillar 3512	1,206 hp	0.32 g/hp-hr	

EU ID	Description	Capacity	Proposed BACT Limit	Proposed BACT Control
DU 9	Generator Engine	353 hp	2.20 E-3 lb/hp-hr	Limited Operation (100 hours/year each, for non-emergency operation) Good Combustion Practices Combust ULSD
DU 12	Generator Engine	82 hp	2.20 E-3 lb/hp-hr	
DU 14	Generator Engine	320 hp	0.2 g/kW-hr	
DU 16	Generator Engine	212 hp	2.20 E-3 lb/hp-hr	
DU 17	Generator Engine	176 hp	0.40 g/hp-hr	
DU 18	Generator Engine	212 hp	2.20 E-3 lb/hp-hr	
DU 19	Generator Engine	71 hp	0.4 g/kW-hr	
DU 20	Generator Engine	35 hp	2.20 E-3 lb/hp-hr	
DU 21	Generator Engine	95 hp	2.20 E-3 lb/hp-hr	
DU 22	Generator Engine	35 hp	2.20 E-3 lb/hp-hr	
DU 23	Generator Engine	155 hp	2.20 E-3 lb/hp-hr	
DU 24	Generator Engine	50 hp	2.20 E-3 lb/hp-hr	
DU 25	Generator Engine	18 hp	0.4 g/kW-hr	
DU 26	Generator Engine	68 hp	2.20 E-3 lb/hp-hr	
DU 27	Generator Engine	274 hp	0.2 g/kW-hr	
DU 28	Generator Engine	274 hp	0.2 g/kW-hr	
DU 30	Lift Pump Engine	75 hp	2.20 E-3 lb/hp-hr	
DU 32	Lift Pump Engine	75 hp	2.20 E-3 lb/hp-hr	
DU 33	Lift Pump Engine	75 hp	2.20 E-3 lb/hp-hr	
DU 34	Well Pump Engine	220 hp	2.20 E-3 lb/hp-hr	
DU 35	Well Pump Engine	55 hp	0.3 g/hp-hr	
DU 36	Well Pump Engine	220 hp	2.20 E-3 lb/hp-hr	
DU 29a	Lift Pump Engine	74 hp	0.03 g/kW-hr	
DU 31a	Lift Pump Engine	74 hp	0.03 g/kW-hr	
FWA 26	QSB7-G3 NR3	295 hp	0.02 g/kW-hr	
FWA 27	4024HF285B	67 hp	0.3 g/kW-hr	
FWA 28	CAT C9 GENSET	398 hp	0.2 g/kW-hr	
FWA 29	TM30UCM	47 hp	2.20 E-3 lb/hp-hr	
FWA 30	JW64-UF30	275 hp	0.2 g/kW-hr	
FWA 31	DDFP-04AT	235 hp	2.20 E-3 lb/hp-hr	
FWA 32	DDFP-04AT	235 hp	2.20 E-3 lb/hp-hr	

EU ID	Description	Capacity	Proposed BACT Limit	Proposed BACT Control
FWA 33	DDFP-04AT	235 hp	2.20 E-3 lb/hp-hr	Limited Operation (100 hours/year each, for non-emergency operation) Good Combustion Practices Combust ULSD
FWA 34	DDFP-04AT	235 hp	2.20 E-3 lb/hp-hr	
FWA 35	N-855-F	240 hp	2.20 E-3 lb/hp-hr	
FWA 36	N-855-F	240 hp	2.20 E-3 lb/hp-hr	
FWA 37	JU4H-UF40	94 hp	2.20 E-3 lb/hp-hr	
FWA 38	PDFP-06YT	120 hp	2.20 E-3 lb/hp-hr	
FWA 39	PDFP-06YT	120 hp	2.20 E-3 lb/hp-hr	

Table 6-3. Proposed PM-2.5 BACT Limits for Material Handling Equipment

EU ID	Description	Proposed BACT Limit	Proposed BACT Control
7a	South Coal Handling Dust Collector	0.0025 gr/dscf	Enclosed emission points and follow manufacturer recommendations for operations and maintenance
7b	South Underbunker Dust Collector	0.02 gr/dscf	Enclosed emission points and follow manufacturer recommendations for operations and maintenance
7c	North Coal Handling Dust Collector	0.02 gr/dscf	Limited Operation – This source serves as backup to EU 7a and operates less than 200 hours each year
52	Emergency Coal Storage Pile and Operations	Varies	Chemical Stabilizers, Wind Fencing, Covered Haul Vehicles, Watering, and Wind Awareness
51a	Fly Ash Dust Collector	0.02 gr/dscf	Enclosed emission points and follow manufacturer recommendations for operations and maintenance
51b	Bottom Ash Dust Collector	0.02 gr/dscf	Enclosed emission points and follow manufacturer recommendations for operations and maintenance

Table 6-4. Proposed SO_2 BACT Limits

EU ID	Description	Capacity	Proposed BACT Limit	Proposed BACT Control
DU 1	Six Coal Fired Boiler 3	230 MMBtu/hr	0.10 lb/MMBtu	Dry Sorbent Injection Limited Operation (336,000 tons/year combined) Low Sulfur Coal
DU 2	Six Coal Fired Boiler 4	230 MMBtu/hr	0.10 lb/MMBtu	
DU 3	Six Coal Fired Boiler 5	230 MMBtu/hr	0.10 lb/MMBtu	
DU 4	Six Coal Fired Boiler 6	230 MMBtu/hr	0.10 lb/MMBtu	
DU 5	Six Coal Fired Boiler 7	230 MMBtu/hr	0.10 lb/MMBtu	
DU 6	Six Coal Fired Boiler 8	230 MMBtu/hr	0.10 lb/MMBtu	
FWA 8	Backup Diesel-Fired Boiler 1	19 MMBtu/hr	15 ppmv S in fuel	Good Combustion Practices Limited Operation (600 hours/year combined) Combust ULSD
FWA 9	Backup Diesel-Fired Boiler 2	19 MMBtu/hr	15 ppmv S in fuel	
FWA 10	Backup Diesel-Fired Boiler 3	19 MMBtu/hr	15 ppmv S in fuel	
N/A	Diesel-Fired Boilers	Varies	15 ppmv S in fuel	Limited Operation (500 hours/year each, for non-emergency operation) Good Combustion Practices Combust ULSD
DU 8	Generator Engine	2,937 hp	15 ppmv S in fuel	Limited Operation (100 hours/year each, for non-emergency operation) Good Combustion Practices Combust ULSD
DU 10	Generator Engine	762 hp	15 ppmv S in fuel	
DU 11	Generator Engine	762 hp	15 ppmv S in fuel	
DU 13	Generator Engine	587 hp	15 ppmv S in fuel	
DU 15	Generator Engine	1,059 hp	15 ppmv S in fuel	
FWA 11	Caterpillar 3512	1,206 hp	15 ppmv S in fuel	Limit Operation (600 hours/year combined) Combust ULSD Good Combustion Practices
FWA 12	Caterpillar 3512	1,206 hp	15 ppmv S in fuel	
FWA 13	Caterpillar 3512	1,206 hp	15 ppmv S in fuel	
DU 9	Generator Engine	353 hp	15 ppmv S in fuel	Limited Operation (100 hours/year each, for non-emergency operation) Good Combustion Practices Combust ULSD
DU 12	Generator Engine	82 hp	15 ppmv S in fuel	
DU 14	Generator Engine	320 hp	15 ppmv S in fuel	
DU 16	Generator Engine	212 hp	15 ppmv S in fuel	
DU 17	Generator Engine	176 hp	15 ppmv S in fuel	
DU 18	Generator Engine	212 hp	15 ppmv S in fuel	
DU 19	Generator Engine	71 hp	15 ppmv S in fuel	

EU ID	Description	Capacity	Proposed BACT Limit	Proposed BACT Control
DU 20	Generator Engine	35 hp	15 ppmv S in fuel	Limited Operation (100 hours/year each, for non-emergency operation) Good Combustion Practices Combust ULSD
DU 21	Generator Engine	95 hp	15 ppmv S in fuel	
DU 22	Generator Engine	35 hp	15 ppmv S in fuel	
DU 23	Generator Engine	155 hp	15 ppmv S in fuel	
DU 24	Generator Engine	50 hp	15 ppmv S in fuel	
DU 25	Generator Engine	18 hp	15 ppmv S in fuel	
DU 26	Generator Engine	68 hp	15 ppmv S in fuel	
DU 27	Generator Engine	274 hp	15 ppmv S in fuel	
DU 28	Generator Engine	274 hp	15 ppmv S in fuel	
DU 30	Lift Pump Engine	75 hp	15 ppmv S in fuel	
DU 32	Lift Pump Engine	75 hp	15 ppmv S in fuel	
DU 33	Lift Pump Engine	75 hp	15 ppmv S in fuel	
DU 34	Well Pump Engine	220 hp	15 ppmv S in fuel	
DU 35	Well Pump Engine	55 hp	15 ppmv S in fuel	
DU 36	Well Pump Engine	220 hp	15 ppmv S in fuel	
DU 29a	Lift Pump Engine	74 hp	15 ppmv S in fuel	
DU 31a	Lift Pump Engine	74 hp	15 ppmv S in fuel	
FWA 26	QSB7-G3 NR3	295 hp	15 ppmv S in fuel	
FWA 27	4024HF285B	67 hp	15 ppmv S in fuel	
FWA 28	CAT C9 GENSET	398 hp	15 ppmv S in fuel	
FWA 29	TM30UCM	47 hp	15 ppmv S in fuel	
FWA 30	JW64-UF30	275 hp	15 ppmv S in fuel	
FWA 31	DDFP-04AT	235 hp	15 ppmv S in fuel	
FWA 32	DDFP-04AT	235 hp	15 ppmv S in fuel	
FWA 33	DDFP-04AT	235 hp	15 ppmv S in fuel	
FWA 34	DDFP-04AT	235 hp	15 ppmv S in fuel	
FWA 35	N-855-F	240 hp	15 ppmv S in fuel	
FWA 36	N-855-F	240 hp	15 ppmv S in fuel	
FWA 37	JU4H-UF40	94 hp	15 ppmv S in fuel	
FWA 38	PDFP-06YT	120 hp	15 ppmv S in fuel	
FWA 39	PDFP-06YT	120 hp	15 ppmv S in fuel	

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Environmental Conservation

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October 20, 2017

Rich Morris
Directorate of Public Works-Environmental Division
U.S. Army Fort Wainwright
Attn. Richard Morris-Building 3023
1046 Marks Rd
Fort Wainwright, AK 99703

Subject: Request for additional information for the Best Available Control Technology Technical Memorandum for Fort Wainwright by December 22, 2017

Dear Mr. Morris:

A portion of the Fairbanks North Star Borough (FNSB) has been in nonattainment with the 24-hour National Ambient Air Quality Standard for fine particulate matter ($PM_{2.5}$) since 2009. In a letter dated April 24, 2015, I requested that Fort Wainwright and other affected stationary sources voluntarily provide the Alaska Department of Environmental Conservation (ADEC) with a Best Available Control Technology (BACT) analysis in advance of the nonattainment area being reclassified to a Serious Area. On May 10, 2017, the US Environmental Protection Agency (EPA) published their determination that the FNSB $PM_{2.5}$ nonattainment area would be reclassified from a Moderate Area to a Serious Area effective June 9, 2017.[1]

Once the nonattainment area was reclassified to Serious, it triggered the need for Best Available Control Measure (BACM)/BACT analyses. A BACM analysis requires that ADEC review potential control measure options for the various sectors that contribute to the $PM_{2.5}$ air pollution in the nonattainment area. A BACT analysis must be conducted for applicable stationary sources such as Ft. Wainwright. BACM and BACT are required to be evaluated regardless of the level of contribution by the source to the problem or its impact on the areas ability to attain.[2] The BACT analysis is a required component of a Serious State Implementation Plan (SIP).[3] ADEC sent an

[1] Federal Register, Vol. 82, No. 89, Wednesday May 10, 2017 (https://dec.alaska.gov/air/anpms/comm/docs/2017-09391-CFR.pdf)

[2] https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf, Clean Air Act 189 (b)(1)(B) and 189 (e) and CFR 51.1010(4)(i) require the implementation of BACT for point sources and precursors emissions and BACM for area sources.

[3] https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf, Clean Air Act 189 (b)(1)(B) and 189 (e) require the implementation of BACT for point sources and precursors emissions and BACM for area sources

to Mr. Eric Dick at Fort Wainwright on May 11, 2017 notifying him of the reclassification to Serious and included a request for the BACT analysis to be completed by August 8, 2017. The BACT analysis from Fort Wainwright, which included emission units found in Operating Permits AQ1121TVP02 Revision 2 and AQ0236TVP03 Revision 2, was submitted by email to the Department on July 13, 2017.

ADEC reviewed the BACT analysis provided for Fort Wainwright and is requesting additional information to assist it in making a legally and practicably enforceable BACT determination for the source. ADEC requests a response by December 22, 2017. If ADEC does not receive a response to this information request by this date, ADEC will make a preliminary BACT determination based upon the information originally provided. However, ADEC does not have the in depth knowledge of your facility's infrastructure and without additional information may select a more stringent BACT for your facility in order to be approvable by EPA. It is ADEC's intent to release the preliminary BACT determinations for public comment along with any precursor demonstrations and BACM analysis before the required public comment process for the Serious SIP. In order to provide this additional comment opportunity, ADEC must adhere to a strict schedule. Your assistance in providing the necessary information in a timely manner is greatly appreciated.

After ADEC makes a final BACT determination for Fort Wainwright, it must include the determination in the Alaska's Serious SIP that then ultimately requires approval by EPA.[4] In addition, the BACT implementation 'clock' was also triggered by the EPA reclassification of the area to Serious on June 9, 2017. Therefore, the control measures that are included in the final BACT determination will be required to be fully implemented prior to June 9, 2021 - 4 years after reclassification.[5]

As indicated in a meeting on September 21, 2017 between ADEC Air Quality staff and the stationary sources affected by the BACT requirements, ADEC will also be using the information submitted or developed to support the BACT determinations for Most Stringent Measure (MSM) consideration. MSMs will be a required element of the state implementation plan if the State applies for an extension of the attainment date from EPA. Therefore, the information you submit will be used for both analyses.

ADEC appreciates the cooperation that we've received from Fort Wainwright. ADEC staff would like to continue periodic meetings to keep track of timelines and progress. If you have any questions related to this request, please feel free to contact us. Deanna Huff (email: Deanna.huff@alaska.gov) and Cindy Heil (email: Cindy.heil@alaska.gov) are the primary contacts for this effort within the Division of Air Quality.

Sincerely,

Denise Koch, Director
Division of Air Quality

[4] https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partD-subpart4-sec7513a
[5] 40. CFR 51.1010(4)

Enclosures:

October 20, 2017	Request for Additional Information for Fort Wainwright BACT Analysis;
May 11, 2017	Serious SIP BACT due date email
April 24, 2015	Voluntary BACT Analysis for Fort Wainwright (Privatized Emission Units) to Eric Dick, Environmental Manager US Army Fort Wainwright
April 24, 2015	Voluntary BACT Analysis for Fort Wainwright (Privatized Emission Units) to Kathleen Hook, Environmental Program Manager, Doyon Utilities, LLC

cc: Larry Hartig, ADEC/ Commissioner's Office
Alice Edwards, ADEC/ Commissioner's Office
Cindy Heil, ADEC/Air Quality
Deanna Huff, ADEC/ Air Quality
Jim Plosay, ADEC/ Air Quality
Aaron Simpson, ADEC/Air Quality
Eric Dick/U.S. Army (Fort Wainwright)
Tim Hamlin, EPA Region 10
Zach Hedgpeth, EPA Region 10

ADEC Request for Additional Information
Fort Wainwright – Doyon Utilities
BACT Analysis Review
HydroGeoLogic, Inc. Report, June 2017

October 20, 2017

Please address the following comments by providing the additional information identified by December 22, 2017. Following the receipt of the information the Alaska Department of Environmental Conservation (ADEC) intends to make its preliminary Best Available Control Technology (BACT) determination and release that determination for public comment. In order to provide this additional comment opportunity, ADEC must adhere to a strict schedule. Your assistance in providing the necessary information in a timely manner is greatly appreciated. Additional requests for information may result from comments received during the public comment period or based upon the new information provided in response to this information request.

This document does not represent a final BACT determination by ADEC. Please contact Aaron Simpson at aaron.simpson@alaska.gov with any questions regarding ADEC's comments.

Draft Comments

1. Equipment Life – Page 4-2 of the analysis states "The BACT analysis for all control technologies assumes a 10-year useful life." ADEC identified that the EPA Air Pollution Control Cost Manual[1] (cost manual) uses a hypothetical example that assumes the control equipment has a useful life of ten years. However the cost analysis must use a reasonable estimate of the actual life of the control equipment for each control technology. As indicated in the proposed rule for Texas and Oklahoma Federal Implementation Plan for Regional Haze and Interstate Transport of Pollution Affecting Visibility – EPA-R06-OAR-2014-0754; Federal Register, Vol. 79, No. 241, 74818 [2] EPA indicated that:

   > "In determining the cost of scrubbers in our prior Oklahoma FIP, we used a lifetime of 30 years. In so doing, we noted that scrubber vendors indicate that the lifetime of a scrubber is equal to the lifetime of the boiler, which might easily be over 60 years. We also noted that many scrubbers that were installed between 1975 and 1986 are still in operation today (e.g., Coyote Station, H.L. Spurlock Unit 2, East Bend Unit 2, Laramie River Unit 3, Cholla 5, Basin Electric, Mitchell Unit 33, and all of the units in Table 30 that currently have scrubbers). Further, we noted that standard cost estimating handbooks and published papers report 30 years as a typical life for a scrubber and that many utilities routinely specify 30+ year lifetimes in requests for proposal and to evaluate proposals."

   In order to use an equipment life that is shorter than 30 years evidence must be provided to support the claim that "DU [Central Heat and Power Plant] is nearing the end of the useful design life cycle." This evidence could include information regarding the actual age of currently

[1] U.S. EPA OAQPS Air Pollution Control Cost Manual, 6th Edition [EPA/452/B-02-001]

[2] https://www.regulations.gov/document?D=EPA-R06-OAR-2014-0754-0001

operating control equipment, or design documents for associated process equipment such as boilers.

2. DSI Cost Analysis – The cost manual does not currently include a chapter covering dry sorbent injection (DSI). However, as part of their Regional Haze FIP for Texas, EPA Region 6 developed cost estimates for DSI as applied to a large number of coal fired utility boilers. See the Technical Support Documents for the Cost of Controls Calculations for the Texas Regional Haze Federal Implementation Plan (Cost TSD) for additional information. The Cost TSD and associated spreadsheets are located at: https://www.regulations.gov/document?D=EPA-R06-OAR-2014-0754-0008. Please update the cost analysis for DSI and provide technical justifications for all assumptions used in the analysis submitted as part of the BACT analysis (i.e., direct and indirect contingency costs, startup costs, initial performance test costs, electricity rate, and reagent costs). Additionally, see Comments 7, 11, and 12 for additional information related to retrofit costs, baseline emissions, and factor of safety.

3. SNCR Cost Analysis – The EPA has recently updated the cost manual chapter pertaining to SNCR, and developed a cost spreadsheet to be used for evaluation of this technology for cost effectiveness. The cost analysis submitted as part of this BACT analysis[3] uses the EPA cost spreadsheet. Please update the cost analysis using the unrestricted potential to emit for each of the emissions units or propose operational limits (i.e., 300,000 tons of coal per year). Additionally, see Comments 7, 11, and 12 for additional information related to retrofit costs, baseline emissions, and factor of safety.

4. SCR Cost Analysis – The EPA has recently updated the cost manual chapter pertaining to SCR, and developed a cost spreadsheet to be used for evaluation of this technology for cost effectiveness. The cost analysis submitted as part of this BACT analysis[4] uses the EPA cost spreadsheet. Please update the cost analysis using the unrestricted potential to emit for each of the emissions units or propose operational limits. Additionally, see Comments 7, 11, and 12 for additional information related to retrofit costs, baseline emissions, and factor of safety.

5. BACT limits – BACT limits by definition, are numerical emission limits. However regulation allows a design, equipment, or work/operational practices if technological or economic limitations make a measurement methodology infeasible. Provide numerical emission limits (and averaging periods) for each proposed BACT selection, or justify why a measurement methodology is technically infeasible and provide the proposed design equipment, or work/operational practices for pollutant for each emission unit included in the analysis. Startup, Shutdown, and Malfunction (SSM) must be addressed in the BACT analysis. Measures to minimize the occurrence of these periods, or to minimize emissions during these periods are control options. Combinations of steady-state control options and SSM control options can be combined to create distinct control strategies. In no event shall application of BACT result in emissions of any pollutant which would exceed the emissions allowed by an applicable standard under 40 C.F.R. parts 60 (NSPS) and 61 (NESHAP).

6. Good Combustion Practices –For each emission unit type (coal boilers, distillate boilers, engines, and material handling) for which good combustion practices was proposed as BACT, describe what constitutes good combustion practices. Include any work or operational practices that will be implemented and describe how continuous compliance with good combustion practices will be achieved.

[3] "sncr_cost_manual_spreadsheet_2016_vf Ft Wainwright.xlsm"
[4] "scr_cost_manual_spreadsheet_2016_vf Ft Wainwright.xlsm"

7. Retrofit Costs – EPA's Control Cost Manual indicates that study-level cost estimates (± 30 percent) should not include a retrofit factor greater than 30 percent, so detailed cost estimates (± 5 percent) is required for higher factors. High retrofit cost factors (50 percent or more) may be justified in unusual circumstances (e.g., long and unique ductwork and piping, site preparation, tight fits, helicopter or crane installation, additional engineering, and asbestos abatement). Provide detailed cost analyses and justification for difficult retrofit (1.6 – 1.9 times the capital costs) considerations used in the BACT analysis.

8. Provide an economic analysis for low-NOx burners (LNBs) and flue gas recirculation (FGR) for one of the diesel-fired boilers, not proposed as limited operation (FWA EUs 8 – 10). Identify all small boilers with emission unit identification numbers. Provide in the analysis: the control efficiency associated with LNBs and FGR, Captured Emissions (tons per year), Emissions Reduction (tons per year), Capital Costs (2017 dollars), Operating Costs (dollars per year), Annualized Costs (dollars per year), and Cost Effectiveness (dollars per ton) using EPA's cost manual.

9. Identify the control efficiencies proposed for limited operation of the small diesel-fired boilers (FWA EUs 8 – 10). If limited operation is not selected for the 24 other small boilers (list EU ID numbers), identify the energy, environmental, economic impacts and other costs used to remove limited operation from the analysis. Include numerical NOx emission limits, work, or operational practices that will be implemented for the small boilers and describe how continuous compliance with the BACT limits will be achieved.

10. Identify control efficiencies for limited operation and installation of turbochargers and aftercoolers for diesel-fired engines to be used to rank the technically feasible control technologies. If the proposed control efficiencies of limited operation or installation of turbochargers and aftercoolers is greater than that of SCR, rank the control technologies to remove SCR from the top-down BACT analysis. If SCR is ranked as a higher control efficiency for reduction of NOx, provide justification as to why SCR can be removed from the analysis. If the engines only operate infrequently, as indicated in the analysis, provide a justification for why limited operation cannot be proposed as an enforceable limit, or provide an economic analysis that indicates that the cost effectiveness of installing SCR or turbochargers and aftercoolers would have an adverse economic impact. Identify how many hours the units would have to operate for SCR to become economically feasible for these units.

11. Include the baseline emissions for all emission units included in the analysis. Typically, the baseline emission rate represents a realistic scenario of upper bound uncontrolled emissions for the emissions unit (unrestricted potential to emit not actual emissions). NSPS and NESHAP requirements are not considered in calculating the baseline emissions. The baseline is usually the legal limit that would exist, but for the BACT determination. Baseline takes into account the effect of equipment that is part of the design of the unit (e.g., water injection and LNBs) because they are considered integral components to the unit's design. If the uncontrolled emission rate is 'soft,' run the cost effectiveness calculations using two or three different baselines.

12. If warranted, include a factor of safety when setting BACT emission limitations. The safety factor is a legitimate method of deriving a specific emission limitation that may not be exceeded. These limits do not have to reflect the highest possible control efficiencies, but rather, should allow the Permittee to achieve compliance with the numerical emission limit on a consistent basis.

13. Please propose numerical emission limits for the diesel-fired engines DU EUs 8 through 28, 30, 32 through 36, 29a, and 31a and FWA EUs 11, 12, 13, and 26 – 39. Provide the source of the emission factor (e.g., vendor data, AP-42 emission factor, EPA Tier Certified Engine, or NSPS Subpart IIII). Please identify what constitutes "good housekeeping practices" for DU EU 15 and describe how continuous compliance with these practices is BACT for the unit.

14. Include scrubbers and limited operation in the review of PM-2.5 control technologies for diesel-fired boilers. Rank the control technologies by efficiency (specify % control). Select the best performing control technology as BACT or provide specific energy, environmental, and economic impacts and other costs justification for why each better performing control technology was not selected instead of good combustion practices. Provide a numerical PM-2.5 emission limit for the diesel-fired boilers or identify the work or operational practices that will be utilized to ensure compliance with proposed limits.

15. Include positive crankcase ventilation (closed crank ventilation system) and limited operation in the review of PM-2.5 control technologies for engines. Rank the control technologies (include low ash fuel) by efficiency (specify % control). Select the best performing control technology as BACT or provide specific energy, environmental, and economic impacts and other costs justification for why each better performing control technology was not selected instead of combustion of ULSD (low ash fuel). Revise the economic analysis for PM-2.5 emission controls for engines to reflect a calculation based on the units' potential to emit, not 500 hours per year (i.e., 8,760 hours per year or enforceable permit limits). Provide numerical PM-2.5 emission limits for the engines or identify the work or operational practices that will be utilized as BACT for the diesel-fired engines.

16. Provide an analysis of why enclosures are not technically feasible for the coal pile storage. Covering a stockpile is a proven control method used in pulverized mineral processing operations. Additionally, provide an analysis of why wetting agents and watering for dust suppression is not considered technically feasible during the summer months (i.e., when the ambient temperature is above freezing). Provide a numerical PM-2.5 emission limit for the Emergency Coal Storage Pile and Operations or identify the work or operational practices that will be utilized as BACT for the material handling operations.

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Environmental Conservation

DIVISION OF AIR QUALITY
Director's Office

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Return Receipt Requested

April 24, 2015

Eric Dick, Environmental Manager
U.S. Army Fort Wainwright
ATTN: IMFW-PWE (E. Dick)
1060 Gaffney Road, # 4500
Fort Wainwright, AK 99703-4500

Subject: Voluntary BACT Analysis for Fort Wainwright (Privatized Emission Units)

Dear Mr. Dick:

Portions of the Fairbanks North Star Borough are in nonattainment with the 24-hour National Ambient Air Quality Standard for Fine Particulate Matter (PM 2.5). The Alaska Department of Environmental Conservation (ADEC) expects that the Environmental Protection Agency (EPA) will change the nonattainment designation from a Moderate Area to a Serious Area in June 2016. Once EPA designates the area as Serious, an 18-month clock begins for submittal of an implementation plan that includes best available control technologies (BACT) analysis and determination for stationary sources with over 70 tons per year (TPY) potential to emit (PTE) for PM2.5 or its precursors.

ADEC has neither the funding nor the in depth knowledge of your facility's infrastructure to determine the most appropriate BACT for your facility. Without the information or resources necessary to conduct detailed cost analysis and produce supporting documentation, ADEC may select a more stringent BACT for your facility in order to be approvable by EPA. In addition, 18 months is likely not adequate to complete a thorough BACT analysis.

Therefore, ADEC requests that your facility voluntarily begin the BACT analysis. We request that you submit an initial BACT analysis to ADEC by December 2015 and the final BACT analysis by March 2016 to ADEC. ADEC is required to make a BACT determination for every eligible facility within the designated PM2.5 nonattainment area and final BACT determinations are ultimately reviewed by EPA and subject to federal approval as part of the federally required PM2.5 implementation plan.

<u>Background</u>

EPA required that ADEC submit a State Implementation Plan (SIP) because portions of the Fairbanks North Star Borough (FSNB) are in nonattainment with the health based 24-hour National Ambient Air Quality Standard for PM2.5. ADEC submitted an initial, Moderate Area PM2.5 SIP for FNSB to EPA on December 31, 2014.

Unfortunately, this Moderate Area SIP was developed as an impracticable SIP because modeling was unable to demonstrate that attainment with the health standard was possible by December 30, 2015. Preliminary air monitoring results also indicate that FNSB will not demonstrate attainment in 2015. Attainment is calculated on a rolling three year average of the highest 98th percentile concentration at each monitor. When those monitoring results become final in May 2016 and an official three year design value is calculated, the FNSB non-attainment area will remain over the 24-hr PM 2.5 standard of 35 $\mu g/m^3$. The final determination of this design value will result in the FNSB non-attainment area being reclassified from a Moderate Area to a Serious Area[1] (40 CRF Parts 50, 51 and 93). This reclassification will happen by operation of law as outlined in Clean Air Act Sections 188 and 189. It is anticipated that the formal designation to Serious Area will occur in June 2016.

A Serious Area designation will result in several new, more stringent requirements, one of which is that all source categories in the nonattainment area that meet the BACT threshold of 70 TPY PTE for $PM_{2.5}$ and its precursor pollutants (NOx, SO2, VOC, NH3) must be analyzed for Best Available Control Measures (BACM). As part of BACM, a Best Available Control Technologies (BACT) analysis will be required. The Serious Area BACT trigger requires the same approach as a PSD/NSR BACT project. A Serious non-attainment area BACT limit is set using a top-down analysis on a case-by-case basis taking into account energy, environmental and economic impacts, and costs. The analysis must include all emission units at the source.

The timelines for completion of the BACT analysis, subsequent BACT determination, and the submittal of the Serious Area SIP are outlined in the preamble of the Particulate Matter 10 (PM10) rule and reconfirmed in the newly proposed $PM_{2.5}$ Implementation Rule[2]. Both rules require a completed SIP 18 months after designation to Serious. This 18 month time period does not allow enough time to thoroughly evaluate BACT, update the emission inventory, complete the modeling and allow for development and processing for a Serious Area SIP.

ADEC believes that it is best for facilities to complete the BACT analysis for their own facilities. ADEC does not have the funding to develop the analysis nor the in depth knowledge of each sources' infrastructure. ADEC would therefore base the cost analysis on the installation of control equipment without being able to factor in all the costs associated with retrofitting existing equipment. Without the detailed cost analysis and supporting documentation to support less stringent BACT options, it is doubtful that the BACT portions of the Serious SIP will be approvable without using the most stringent measures.

By requesting an early BACT analysis for facilities before the official Serious Area designation, it will help ADEC meet the following timelines and ultimately submit a Serious Area SIP to EPA by the

[1] 40 CFR Parts 50,51 and 93 http://www.epa.gov/airquality/particlepollution/actions.html

[2] http://www.epa.gov/airquality/particlepollution/actions.html

required due date. Early analysis also has the potential to increase flexibility for each Stationary Source under the rules.

- Serious Area SIP inventory development starts: January, 2015
- BACT kick off meeting: March 5, 2015
- Submit initial BACT results to ADEC: December, 2015
- Submit complete/final BACT analysis to ADEC: March, 2016
- Serious Area SIP modeling by ADEC starts: March, 2016
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- Serious Area SIP draft: December, 2016
- Serious Area SIP public notice period: February, 2017
- Serious Area SIP submitted by ADEC to EPA: December, 2017

Meeting the BACT analysis requirements is a major component of a Serious SIP. This is a challenging issue. It is important that ADEC accurately reflect the contributions of industrial sources to the air pollution problem and the potential improvements available within this emission sector along with the other emission sources in the community.

ADEC staff would like to continue periodic meetings to keep track of timelines and progress. If you have any questions related to this request, please feel free to contact us. Deanna Huff (email: Deanna.huff@alaska.gov) and Cindy Heil (email: Cindy.heil@alaska.gov) are the primary contacts for this effort within the Division of Air Quality.

Sincerely,

Denise Koch, Director
Division of Air Quality

cc: Larry Hartig, ADEC/ Commissioner's Office
Alice Edwards, ADEC/ Commissioner's Office
John Kuterbach, ADEC/ Air Quality
Cindy Heil, ADEC/Air Quality
Deanna Huff, ADEC/ Air Quality
Kathleen Hook/ Doyon Utilities, LLC

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April 24, 2015

Kathleen Hook
Environmental Program Manager
Doyon Utilities, LLC
PO Box 74040
Fairbanks, AK 99707

Subject: Voluntary BACT Analysis for Fort Wainwright (Privatized Emission Units)

Dear Ms. Hook:

Portions of the Fairbanks North Star Borough are in nonattainment with the 24-hour National Ambient Air Quality Standard for Fine Particulate Matter (PM 2.5). The Alaska Department of Environmental Conservation (ADEC) expects that the Environmental Protection Agency (EPA) will change the nonattainment designation from a Moderate Area to a Serious Area in June 2016. Once EPA designates the area as Serious, an 18-month clock begins for submittal of an implementation plan that includes best available control technologies (BACT) analysis and determination for stationary sources with over 70 tons per year (TPY) potential to emit (PTE) for PM2.5 or its precursors.

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ADEC staff would like to continue periodic meetings to keep track of timelines and progress. If you have any questions related to this request, please feel free to contact us. Deanna Huff (email: Deanna.huff@alaska.gov) and Cindy Heil (email: Cindy.heil@alaska.gov) are the primary contacts for this effort within the Division of Air Quality.

Sincerely,

Denise Koch, Director
Division of Air Quality

cc: Larry Hartig, ADEC/ Commissioner's Office
Alice Edwards, ADEC/ Commissioner's Office
John Kuterbach, ADEC/ Air Quality
Cindy Heil, ADEC/Air Quality
Deanna Huff, ADEC/ Air Quality
Eric Dick/U.S. Army (Fort Wainwright)

THE STATE of ALASKA
GOVERNOR BILL WALKER

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September 13, 2018

Rich Morris
Directorate of Public Works-Environmental Division
U.S. Army Fort Wainwright
Attn. Richard Morris-Building 3023
1046 Marks Rd
Fort Wainwright, AK 99703

Subject: Request for additional information for the Best Available Control Technology Technical Memorandum for Fort Wainwright by November 1, 2018

Dear Mr. Morris:

A portion of the Fairbanks North Star Borough (FNSB) has been in nonattainment with the 24-hour National Ambient Air Quality Standard for fine particulate matter ($PM_{2.5}$) since 2009. In a letter dated April 24, 2015, I requested that Fort Wainwright and other affected stationary sources voluntarily provide the Alaska Department of Environmental Conservation (ADEC) with a Best Available Control Technology (BACT) analysis in advance of the nonattainment area being reclassified to a Serious Area. On May 10, 2017, the US Environmental Protection Agency (EPA) published their determination that the FNSB $PM_{2.5}$ nonattainment area would be reclassified from a Moderate Area to a Serious Area effective June 9, 2017.[1]

Once the nonattainment area was reclassified to Serious, it triggered the need for Best Available Control Measure (BACM)/BACT analyses. A BACM analysis requires that ADEC review potential control measure options for the various sectors that contribute to the $PM_{2.5}$ air pollution in the nonattainment area. A BACT analysis must be conducted for applicable stationary sources such as Ft. Wainwright. BACM and BACT are required to be evaluated regardless of the level of contribution by the source to the problem or its impact on the areas ability to attain.[2] The BACT analysis is a required component of a Serious State Implementation Plan (SIP).[3] ADEC sent an email

[1] Federal Register, Vol. 82, No. 89, Wednesday May 10, 2017 (https://dec.alaska.gov/air/anpms/comm/docs/2017-09391-CFR.pdf)

[2] https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf, Clean Air Act 189 (b)(1)(B) and 189 (e) and CFR 51.1010(4)(i) require the implementation of BACT for point sources and precursors emissions and BACM for area sources.

[3] https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf, Clean Air Act 189 (b)(1)(B) and 189 (e) require the implementation of BACT for point sources and precursors emissions and BACM for area sources

to Mr. Eric Dick at Fort Wainwright on May 11, 2017 notifying him of the non-attainment area reclassification to Serious and included a request for the BACT analysis to be completed by August 8, 2017. The BACT analysis from Fort Wainwright, which included emission units found in Operating Permits AQ1121TVP02 Revision 2 and AQ0236TVP03 Revision 2, was submitted by email to the Department on July 13, 2017.

On March 22, 2018, ADEC released a preliminary draft of the BACT determination for Fort Wainwright for public discussion on its website at: http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip-development. As indicated in the release, this document is a work in progress. ADEC received additional information from Doyon Utilities and EPA on the preliminary draft BACT determination and expects to make changes to the determination based upon this input. Therefore, ADEC is requesting additional information from Fort Wainwright to assist it in making a legally and practicably enforceable BACT determination for the source.

Specifically, ADEC requests that Fort Wainwright review the cost effectiveness spreadsheet provided as a part of the preliminary SO_2 BACT determination which was originally developed by Sargent & Lundy (S&L) in 2010. The spreadsheet includes a link to the S&L white paper that provides a basis for the cost effectiveness calculations and indicates that the model is intended to calculate estimated total project cost (total capital cost of installation), as well as direct and indirect annual operating costs. These calculations are largely based on the estimated usage of sorbent and the gross generating capacity of the plant. Please use this spreadsheet to calculate the cost effectiveness of SO_2 removal in dollars per ton and identify all assumptions and technical justifications used in the analysis.

If ADEC does not receive a response to this information request by November 1, 2018, ADEC will make a preliminary BACT determination based upon the information originally provided. However, ADEC does not have the in depth knowledge of your facility's infrastructure and without additional information, may select a more stringent BACT for your facility in order to be approvable by EPA. It is ADEC's intent to release the preliminary BACT determinations for public review along with any precursor demonstrations and BACM analyses before the required public comment process for the Serious SIP. In order to provide this additional comment opportunity, ADEC must adhere to a strict schedule. Your assistance in providing the necessary information in a timely manner is greatly appreciated.

After ADEC makes a final BACT determination for Fort Wainwright, it must include the determination in Alaska's Serious SIP that then ultimately requires approval by EPA.[4] In addition, the BACT implementation 'clock' was also triggered by the EPA reclassification of the area to Serious on June 9, 2017. Therefore, the control measures that are included in the final BACT determination will be required to be fully implemented prior to June 9, 2021 - 4 years after reclassification.[5]

As indicated in a meeting on September 21, 2017 between ADEC Air Quality staff and the stationary sources affected by the BACT requirements, ADEC will also be using the information submitted or developed to support the BACT determinations for Most Stringent Measure (MSM)

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[4] https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partD-subpart4-sec7513a

[5] 40. CFR 51.1010(4)

consideration. MSMs will be a required element of the state implementation plan if the State applies for an extension of the attainment date from EPA. Therefore, the information you submit will be used for both analyses.

ADEC appreciates the cooperation that we've received from Fort Wainwright. ADEC staff would like to continue periodic meetings to keep track of timelines and progress. If you have any questions related to this request, please feel free to contact us. Deanna Huff (email: Deanna.huff@alaska.gov) and Cindy Heil (email: Cindy.heil@alaska.gov) are the primary contacts for this effort within the Division of Air Quality.

Sincerely,

BY DK

Denise Koch, Director
Division of Air Quality

Enclosures:

September 10, 2018	ADEC Request for Additional Information for Fort Wainwright BACT Analysis
May 23, 2018	Doyon Utilities Comments Addressing the Preliminary Best Available Control Technology Determination for Fort Wainwright US Army Garrison and Doyon Utilities
May 21, 2018	EPA Comments on ADEC Preliminary Draft Serious SIP Development Materials for the Fairbanks Serious PM-2.5 nonattainment Area
October 20, 2017	Request for Additional Information for Fort Wainwright BACT Analysis;
May 11, 2017	Serious SIP BACT due date email
April 24, 2015	Voluntary BACT Analysis for Fort Wainwright (Privatized Emission Units) to Eric Dick, Environmental Manager US Army Fort Wainwright
April 24, 2015	Voluntary BACT Analysis for Fort Wainwright (Privatized Emission Units) to Kathleen Hook, Environmental Program Manager, Doyon Utilities, LLC

cc: Larry Hartig, ADEC/Commissioner's Office
Alice Edwards, ADEC/Commissioner's Office
Cindy Heil, ADEC/Air Quality
Deanna Huff, ADEC/Air Quality
Jim Plosay, ADEC/Air Quality
Aaron Simpson, ADEC/Air Quality
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Tim Hamlin, EPA Region 10
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Dan Brown, EPA Region 10

ADEC Request for Additional Information
Fort Wainwright – Doyon Utilities
BACT Analysis Review
HydroGeoLogic, Inc. Report, June 2017

September 10, 2018

Please address the following comments by providing the additional information identified by November 1, 2018. Following the receipt of the information the Alaska Department of Environmental Conservation (ADEC) intends to make its preliminary Best Available Control Technology (BACT) determination and release that determination for public comment. In order to provide this additional comment opportunity, ADEC must adhere to a strict schedule. Your assistance in providing the necessary information in a timely manner is greatly appreciated. Additional requests for information may result from comments received during the public comment period or based upon the new information provided in response to this information request.

This document does not represent a final BACT determination by ADEC. Please contact Aaron Simpson at aaron.simpson@alaska.gov with any questions regarding ADEC's comments.

Draft Comments

1. Equipment Life – Page 4-2 of the analysis states "The BACT analysis for all control technologies assumes a 10-year useful life." ADEC identified that the EPA Air Pollution Control Cost Manual[1] (cost manual) uses a hypothetical example that assumes the control equipment has a useful life of ten years. However the cost analysis must use a reasonable estimate of the actual life of the control equipment for each control technology. As indicated in the proposed rule for Texas and Oklahoma Federal Implementation Plan for Regional Haze and Interstate Transport of Pollution Affecting Visibility – EPA-R06-OAR-2014-0754; Federal Register, Vol. 79, No. 241, 74818 [2] EPA indicated that:

   > "In determining the cost of scrubbers in our prior Oklahoma FIP, we used a lifetime of 30 years. In so doing, we noted that scrubber vendors indicate that the lifetime of a scrubber is equal to the lifetime of the boiler, which might easily be over 60 years. We also noted that many scrubbers that were installed between 1975 and 1986 are still in operation today (e.g., Coyote Station, H.L. Spurlock Unit 2, East Bend Unit 2, Laramie River Unit 3, Cholla 5, Basin Electric, Mitchell Unit 33, and all of the units in Table 30 that currently have scrubbers). Further, we noted that standard cost estimating handbooks and published papers report 30 years as a typical life for a scrubber and that many utilities routinely specify 30+ year lifetimes in requests for proposal and to evaluate proposals."

   In order to use an equipment life that is shorter than 30 years evidence must be provided to support the claim that "DU [Central Heat and Power Plant] is nearing the end of the useful design life cycle." This evidence could include information regarding the actual age of currently

[1] U.S. EPA OAQPS Air Pollution Control Cost Manual, 6th Edition [EPA/452/B-02-001]
[2] https://www.regulations.gov/document?D=EPA-R06-OAR-2014-0754-0001

operating control equipment, or design documents for associated process equipment such as boilers.

2. SNCR Cost Analysis – The EPA has recently updated the cost manual chapter pertaining to SNCR, and developed a cost spreadsheet to be used for evaluation of this technology for cost effectiveness. The cost analysis submitted as part of this BACT analysis[3] uses the EPA cost spreadsheet. Please update the cost analysis using the unrestricted potential to emit for each of the emissions units or propose operational limits (i.e., 300,000 tons of coal per year), and provide technical justifications for all assumptions used in the analysis submitted as part of the BACT analysis (i.e., direct and indirect contingency costs, startup costs, initial performance test costs, electricity rate, and reagent costs). Additionally, see Comments 7, 10, and 11 for additional information related to retrofit costs, baseline emissions, and factor of safety.

3. SCR Cost Analysis – The EPA has recently updated the cost manual chapter pertaining to SCR, and developed a cost spreadsheet to be used for evaluation of this technology for cost effectiveness. The cost analysis submitted as part of this BACT analysis[4] uses the EPA cost spreadsheet. Please update the cost analysis using the unrestricted potential to emit for each of the emissions units or propose operational limits, and provide technical justifications for all assumptions used in the analysis submitted as part of the BACT analysis (i.e., direct and indirect contingency costs, startup costs, initial performance test costs, electricity rate, and reagent costs). Additionally, see Comments 7, 10, and 11 for additional information related to retrofit costs, baseline emissions, and factor of safety.

4. BACT limits – BACT limits by definition, are numerical emission limits. However regulation allows a design, equipment, or work/operational practices if technological or economic limitations make a measurement methodology infeasible. Provide numerical emission limits (and averaging periods) for each proposed BACT selection, or justify why a measurement methodology is technically infeasible and provide the proposed design equipment, or work/operational practices for each pollutant and emission unit included in the analysis. Startup, Shutdown, and Malfunction (SSM) must be addressed in the BACT analysis. Measures to minimize the occurrence of these periods, or to minimize emissions during these periods are control options. Combinations of steady-state control options and SSM control options can be combined to create distinct control strategies. In no event shall application of BACT result in emissions of any pollutant which would exceed the emissions allowed by an applicable standard under 40 C.F.R. parts 60 (NSPS) and 61 (NESHAP).

   In comments from Doyon Utilities on May 23, 2018, they correctly identify that PM emissions from fuel-fired EUs are greater than actual PM-2.5 emissions from the same EU. They also requested clarification for the rationale for selecting a PM-2.5 emission rate of 0.05 grain/dscf. This value was provided in the June 2017 BACT Technical Memorandum from the U.S. Army Corp of Engineers. Therefore, please provide a basis for the 0.05 grain/dscf numerical BACT emissions limit for PM-2.5 emissions from the industrial coal fired boilers.

5. Good Combustion Practices – For each emission unit type (coal boilers, distillate boilers, engines, and material handling) for which good combustion practices was proposed as BACT, describe what constitutes good combustion practices. Include any work or operational practices that will be implemented and describe how continuous compliance with good combustion practices will be achieved.

[3] "sncr_cost_manual_spreadsheet_2016_vf Ft Wainwright.xlsm"
[4] "scr_cost_manual_spreadsheet_2016_vf Ft Wainwright.xlsm"

6. Site-Specific Quotes Needed – The cost analyses must be based on emission unit-specific quotes for capital equipment purchase and installation costs at Fort Wainwright. This retrofit project must be considered in order to obtain reliable study/budget level (+/- 30%) cost estimates which are appropriate to use as the basis for decision making in determining BACT.

7. Retrofit Costs – EPA's Control Cost Manual indicates that study-level cost estimates (± 30 percent) should not include a retrofit factor greater than 30 percent, so detailed cost estimates (± 5 percent) are required for higher factors. High retrofit cost factors (50 percent or more) may be justified in unusual circumstances (e.g., long and unique ductwork and piping, site preparation, tight fits, helicopter or crane installation, additional engineering, and asbestos abatement). Provide detailed cost analyses and technical justification for difficult retrofit (1.6 – 1.9 times the capital costs) considerations used in the BACT analysis.

8. Condensable Particulate Matter – Although the existing control technology on the coal fired boilers may be evaluated as to whether it meets the requirement for BACT for particulate matter, baghouses primarily reduce emissions of filterable particulate matter rather than condensable PM. Given that all condensable PM emitted by the coal fired boilers would be classified as PM-2.5, the BACT analyses must include consideration of control options for these emissions. Where control technologies evaluated for control of other pollutants may provide a collateral benefit in reducing emissions of PM-2.5, this should be evaluated as well.

9. Interest Rate – All cost analyses must use the current bank prime interest rate. This can be found online at https://www.federalreserve.gov/releases/h15/ (go to bank prime rate in the table). Please revise the cost analyses as appropriate.

10. Baseline Emissions - Include the baseline emissions for each emission unit included in the analysis. Typically, the baseline emission rate represents a realistic scenario of upper bound uncontrolled emissions for the emissions unit (unrestricted potential to emit not actual emissions). NSPS and NESHAP requirements are not considered in calculating the baseline emissions. The baseline is usually the legal limit that would exist, but for the BACT determination. Baseline takes into account the effect of equipment that is part of the design of the unit (e.g., water injection and LNBs) because they are considered integral components to the unit's design. If the uncontrolled emission rate is 'soft,' run the cost effectiveness calculations using two or three different baselines.

11. Factor of Safety - If warranted, include a factor of safety when setting BACT emission limitations. The safety factor is a legitimate method of deriving a specific emission limitation that may not be exceeded. These limits do not have to reflect the highest possible control efficiencies, but rather, should allow the Permittee to achieve compliance with the numerical emission limit on a consistent basis.

12. Provide an economic analysis for low-NOx burners (LNBs) and flue gas recirculation (FGR) for one of the diesel-fired boilers, not proposed as limited operation (FWA EUs 8 – 10). Identify all small boilers with emission unit identification numbers. Provide technical justification for all assumptions used in the analysis submitted as part of the BACT analysis (i.e., direct and indirect contingency costs, startup costs, initial performance test costs, electricity rate, and reagent costs). Provide in the analysis: the control efficiency associated with LNBs and FGR, captured emissions (tons per year), emissions reduction (tons per year), capital costs (2017 dollars), operating costs (dollars per year), annualized costs (dollars per year), and cost effectiveness (dollars per ton) using EPA's cost manual.

13. Identify the control efficiencies proposed for limited operation of the small diesel-fired boilers (FWA EUs 8 – 10). If limited operation is not selected for the 24 other small boilers (list EU

numbers), identify the energy, environmental, economic impacts and other costs used to remove limited operation from the analysis. Include numerical NOx emission limits, work, or operational practices that will be implemented for the small boilers and describe how continuous compliance with the BACT limits will be achieved.

14. Identify control efficiencies for limited operation and installation of turbochargers and aftercoolers for diesel-fired engines to be used to rank the technically feasible control technologies. If the proposed control efficiencies of limited operation or installation of turbochargers and aftercoolers is greater than that of SCR, rank the control technologies to remove SCR from the top-down BACT analysis. If SCR is ranked as a higher control efficiency for reduction of NOx, provide justification as to why SCR can be removed from the analysis. If the engines only operate infrequently, as indicated in the analysis, provide a justification for why limited operation cannot be proposed as an enforceable limit, or provide an economic analysis that indicates that the cost effectiveness of installing SCR or turbochargers and aftercoolers would have an adverse economic impact. Please provide technical justifications for all assumptions used in the analysis submitted as part of the BACT analysis (i.e., direct and indirect contingency costs, startup costs, initial performance test costs, electricity rate, and reagent costs). Identify how many hours the units would have to operate for SCR to become economically feasible for these units.

15. Please propose numerical emission limits for the diesel-fired engines DU EUs 8 through 28, 30, 32 through 36, 29a, and 31a and FWA EUs 11, 12, 13, and 26 – 39. Provide the source of the emission factor (e.g., vendor data, AP-42 emission factor, EPA Tier Certified Engine, or NSPS Subpart IIII). Please identify what constitutes "good housekeeping practices" for DU EU 15 and describe how continuous compliance with these practices is BACT for the unit.

16. Include scrubbers and limited operation in the review of PM-2.5 control technologies for diesel-fired boilers. Rank the control technologies by efficiency (specify % control). Select the best performing control technology as BACT or provide specific energy, environmental, and economic impacts and other costs justification for why each better performing control technology was not selected instead of good combustion practices. Please provide technical justifications for all assumptions used in the analysis submitted as part of the BACT analysis (i.e., direct and indirect contingency costs, startup costs, initial performance test costs, electricity rate, and reagent costs). Provide a numerical PM-2.5 emission limit for the diesel-fired boilers or identify the work or operational practices that will be utilized to ensure compliance with proposed limits.

17. Include positive crankcase ventilation (closed crank ventilation system) and limited operation in the review of PM-2.5 control technologies for engines. Rank the control technologies (include low ash fuel) by efficiency (specify % control). Select the best performing control technology as BACT or provide specific energy, environmental, and economic impacts and other costs justification for why each better performing control technology was not selected instead of combustion of ULSD (low ash fuel). Revise the economic analysis for PM-2.5 emission controls for engines to reflect a calculation based on the units' potential to emit, not 500 hours per year (i.e., 8,760 hours per year or enforceable permit limits). Provide numerical PM-2.5 emission limits for the engines or identify the work or operational practices that will be utilized as BACT for the diesel-fired engines. Provide technical justifications for all assumptions used in the analysis submitted as part of the BACT analysis (i.e., direct and indirect contingency costs, startup costs, initial performance test costs, electricity rate, and reagent costs).

18. Provide an analysis of why enclosures are not technically feasible for the coal pile storage. Covering a stockpile is a proven control method used in pulverized mineral processing

operations. Additionally, provide an analysis of why wetting agents and watering for dust suppression are not considered technically feasible during the summer months (i.e., when the ambient temperature is above freezing). Provide a numerical PM-2.5 emission limit for the Emergency Coal Storage Pile and Operations or identify the work or operational practices that will be utilized as BACT for the material handling operations.

19. Department research has indicated that a switch to low ash and low sulfur fuels in large and small diesel engines can reduce emissions of particulate matter. Please provide an analysis of the expected control efficiency reduction over the federal emissions standards (baseline) expected to be achieved by switching to a low ash or low sulfur fuel.

20. Please provide manufacturer information for DU EU 9 identifying the PM-2.5 emission factor that will be used in setting the numerical BACT limits for that unit.

21. Provide an economic analysis for circulating dry scrubber (CDS) SO_2 technology for the coal fired boilers (EUs 1-6). Provide in the analysis: the control efficiency associated with CDS, captured emissions (tons per year), emissions reduction (tons per year), capital costs (2017 dollars), operating costs (dollars per year), annualized costs (dollars per year), and cost effectiveness (dollars per ton) using EPA's cost manual. Please provide technical justifications for all assumptions used in the analysis submitted as part of the BACT analysis (i.e., direct and indirect contingency costs, startup costs, initial performance test costs, electricity rate, and reagent costs).

22. Review the cost effectiveness spreadsheet provided as a part of the preliminary SO_2 BACT determination which was originally developed by Sargent & Lundy (S&L) in 2010. The spreadsheet includes a link to the S&L white paper that provides a basis for the cost effectiveness calculations and indicates that the model is intended to calculate estimated total project cost (total capital cost of installation), as well as direct and indirect annual operating costs. These calculations are largely based on the estimated usage of sorbent and the gross generating capacity of the plant. Please use this spreadsheet to calculate the cost effectiveness of SO_2 removal in dollars per ton and identify all assumptions and technical justifications used in the analysis. In this analysis use a bottom-up cost estimating approach based on actual plant conditions. These conditions would include SO_2 emission rates based on current PTE, permit constraints (where applicable and enforceable), available space, ambient conditions, and local factors such as construction logistics, labor wage rates, and local sorbent costs.

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May 23, 2018

Mr. Aaron Simpson
Alaska Department of Environmental Conservation
Division of Air Quality
P.O Box 111800
Juneau AK 99811-1800

Re: Comments Addressing the Preliminary Best Available Control Technology Determination for Fort Wainwright US Army Garrison and Doyon Utilities

Dear Mr. Simpson:

Doyon Utilities, LLC (DU) is providing the enclosed comments addressing the preliminary Best Available Control Technology (BACT) assessment that the Alaska Department of Environmental Conservation (ADEC) has prepared for the Fort Wainwright US Army Garrison and Doyon Utilities. DU has limited this review and comment effort to those emissions units that are operated by DU and that are included in Title V Permit AQ1121TVP02, Revision 2. DU has not provided comments addressing emissions units that are operated by the US Army Garrison.

DU appreciates this opportunity to provide comments addressing the preliminary BACT documents. DU understands that the preliminary BACT documents are a work in progress. DU also understands that ADEC hopes to receive additional information from the public as a result of the release of the preliminary draft BACT documents and that ADEC expects to make changes to the documents based upon this input.

The attached comments identify a number of concerns of varying degree of seriousness. The items discussed in the comments that are of most concern to DU are:

- The preliminary BACT analysis for sulfur dioxide (SO_2) emissions from the Central Heat and Power Plant (CHPP) boilers (Emissions Units (EUs) 1 through 6) identifies dry sorbent injection (DSI) as the preferred SO_2 emission control technology. The analysis that supports this determination is based on unsupported assumptions, use of a cost model that may not be appropriate for these boilers, and inconsistent SO_2 emission calculations. The analysis is also lacking site-specific engineering data. As a result, the analysis appears not to be defensible.
- The preliminary BACT analysis for SO_2 emissions from the CHPP boilers assumes a more stringent coal combustion limit and coal sulfur content than currently required, but does

not assess these options through the five-step BACT process or determine whether these assumptions are even valid.

- The preliminary $PM_{2.5}$ BACT analysis and draft BACT determinations for the material handling emissions units (EUs 7a, 7b, 7c, 51a, 51b, and 52) are confusing and unclear.
- The required methods to demonstrate compliance with the preliminary BACT limits are in many cases unclear or unspecified.
- Many of the preliminary $PM_{2.5}$ BACT emission limits are provided without supporting rationale, may not be appropriate as $PM_{2.5}$ emission limits, and/or may not be achievable.

Please contact Kathleen Hook at 907-455-1540 or khook@doyonutilities.com if you have any questions or would like to further discuss any specific comments.

Best Regards,

Shayne Coiley
Senior Vice President
Doyon Utilities, LLC

cc: Jim Plosay, ADEC
Kathleen Hook, DU
Courtney Kimball, SLR

Enclosure: Comments Addressing the Preliminary Best Available Control Technology Determination for Fort Wainwright US Army Garrison and Doyon Utilities Dated March 22, 2018

CO 18-061

Comments Addressing the Preliminary Best Available Control Technology Determination for Fort Wainwright US Army Garrison and Doyon Utilities Dated March 22, 2018

General Comments

1. Inadequate technical information is provided in the Preliminary Best Available Control Technology Determination (Preliminary Determination). This lack of information generally includes, but is not limited to, the following areas.
   - Little or no engineering data or rationale is provided to support the Alaska Department of Environmental Conservation (ADEC) preliminary determinations addressing whether an emission control technology is or is not technically feasible.
   - Little or no engineering data, cost data, or rationale is provided to support the preliminary determinations addressing whether an emission control technology is or is not Best Available Control Technology (BACT).
   - The methodology used to determine emissions reductions is typically not quantified.

   This lack of data and rationale is inconsistent with past ADEC insistence that the stationary sources provide a substantial level of detail and specific engineering data to support the BACT analyses that the stationary sources submitted to ADEC.

2. The Preliminary Determination tables that provide a comparison of emissions unit capacities and BACT emission limits for affected stationary sources (University of Alaska Fairbanks, Fort Wainwright, Golden Valley Electric Association (GVEA) North Pole Plant, and GVEA Zehnder Plant) generally have inconsistent units of measurement within each table. As a result, these tables have limited usefulness without further analysis being prepared.

3. In many cases, the Preliminary Determination does not identify the methods that must be used to verify compliance with the preliminary BACT limits. The methods to be used for verifying compliance should be identified so that the Permittees can determine whether the methods that ADEC intends to require are appropriate and whether the methods will be overly cumbersome and/or expensive.

Section 3. BACT Determination for Nitrogen Oxides (NO_X)

In Section 3 of the Preliminary Determination, ADEC states that "the NO_X controls proposed in this section are not planned to be implemented." Instead, ADEC is planning to submit a final precursor demonstration to the U.S. Environmental Protection Agency (EPA) "as justification not to require NO_X controls." As a result, Doyon Utilities (DU) has not reviewed this section of the Preliminary Determination and is not providing comments because:

- ADEC does not plan to implement the proposed NO_X BACT determinations, and
- Focusing on those sections of the Preliminary Determination that ADEC intends to implement is a better use of the short amount of time that was made available for this review.

DU will review any future NO_X BACT proposals and will provide comments if EPA does not approve the ADEC final precursor demonstration and the implementation of NO_X BACT emissions controls becomes mandatory.

Section 4. BACT Determination for Fine Fraction Respirable Particulate Matter ($PM_{2.5}$)

The ADEC preliminary $PM_{2.5}$ BACT analysis includes errors, assumptions, and inconsistencies that are of varying degree of concern. Each instance of concern is discussed below in no particular order of seriousness.

4. Section 4: The term "full steam baghouse" appears several times in the Preliminary Determination. The correct term is "full stream baghouse."

5. Section 4.1 (Industrial Coal-fired Boilers), Steps 4(b) and 5(b): The Preliminary Determination establishes a $PM_{2.5}$ emission limit of 0.05 grains per dry standard cubic foot (gr/dscf) for the coal-fired boilers, Emissions Units (EUs) 1 through 6. No basis for the selection of this $PM_{2.5}$ emission rate is provided, but the selected emission rate value is consistent with the particulate matter (PM) emission rate for industrial processes and fuel burning equipment established in 18 Alaska Administrative Code (AAC) 50.055(b)(1). This PM emission limit is commonly called the SIP PM emission limit. The appropriateness of using the SIP PM emission limit to establish a $PM_{2.5}$ emission limit is unclear because:
   - PM includes all filterable particulate matter regardless of size while $PM_{2.5}$ includes only filterable particulate matter with an nominal aerodynamic diameter of 2.5 microns, and
   - $PM_{2.5}$ includes all condensable matter while PM does not include any condensable matter.

   In many, but not all cases, actual PM emissions from a fuel-fired emissions unit are greater than the actual $PM_{2.5}$ emissions from that same emissions unit. If the assumption is being made that $PM_{2.5}$ emissions from EUs 1 through 6 are less than or equal to PM emissions, this assumption should be supported with existing source test results to confirm that compliance with the preliminary limit can be met. If this assumption is not being made, ADEC should explain more fully the rationale for selecting a $PM_{2.5}$ emission rate of 0.05 gr/dscf as the $PM_{2.5}$ BACT emission limit for EUs 1 through 6.

6. Section 4.1 (Industrial Coal-fired Boilers), Table 4-2: This table provides the total plant capacity for the listed stationary sources instead of individual boiler capacity. The preliminary $PM_{2.5}$ BACT emission limits are not presented in consistent units of measurement or are not provided in the table. As a result, the table is not useful for the intended comparative purpose.

7. Section 4.3 (Large Diesel-fired Engines), Step 1(f): This section cites "RBLC NO_X determinations." The correct reference is "RBLC information for $PM_{2.5}$ determinations."

8. Section 4.3 (Large Diesel-fired Engines), Steps 1 through 5: The ADEC rationale for the preliminary BACT determination of combusting ultra-low sulfur diesel (ULSD) is inconsistent for the following reasons.

- In Step 1(d), the use of low sulfur fuel is listed as an available and feasible emission control technology.
- Step 2 eliminates low sulfur fuel as technically infeasible which is inconsistent with the statement in Step 1 and incorrect. The use of low sulfur fuel is technically feasible, but the contribution of this technology toward reducing $PM_{2.5}$ emissions cannot be quantified.
- Step 3 does not address the use of ULSD.
- Step 5 requires the use of ULSD, with no supporting rationale or cost analysis. This determination is also inconsistent with the incorrect Step 2 conclusion that low sulfur fuel is not technically feasible.

Please make the appropriate corrections to Section 4.3. DU understands that the requirement to combust ULSD will likely remain unchanged for the large diesel-fired engines. Specifically, the preliminary sulfur dioxide (SO_2) BACT decision also requires the use of ULSD, so correcting this inconsistency in Section 4.3 will not eliminate the requirement to combust ULSD in the large diesel-fired engines. The combustion of ULSD is required in the large diesel-fired engines that are subject to 40 Code of Federal Regulations (CFR) 60 Subpart IIII.

9. Section 4.3 (Large Diesel-fired Engines), Step 4 and 5: A cost analysis is not provided to support the preliminary $PM_{2.5}$ BACT determinations identified in Step 5. Because each BACT determination must be based on technical and economic feasibility, the rationale for these preliminary determinations is incomplete, making the validity of the preliminary determinations questionable. Please provide the required economic feasibility analysis.

10. Section 4.3 (Large Diesel-fired Engines), Step 5(b): The Preliminary Determination is unclear with respect to whether the 500 hours per year operating limit in non-emergency situations is applicable to EUs 8, 10, 11, 13, and 15 individually or cumulatively. If the operating limit is cumulative, the limit is inconsistent with Title V Permit AQ1121TVP02 which allows EU 8 to be converted to a non-emergency engine with a limit of 500 hours per year. If the limit applies to each individual engine, the requirement is inconsistent with applicable requirements under 40 CFR 63 Subpart ZZZZ (or Subpart IIII, if applicable), which allows 100 hours per year of non-emergency operation but does not restrict those non-emergency operations to maintenance checks and readiness testing.

11. Section 4.3 (Large Diesel-fired Engines), Table 4-6: This table cites manufacturer information for establishing the preliminary $PM_{2.5}$ BACT limit of 0.09 grams per horsepower-hour (g/hp-hr) for EU 15. The source of this manufacturer information is not provided in the Preliminary Determination and cannot otherwise be obtained to confirm this $PM_{2.5}$ emission rate is correct. An emission rate of 0.09 g/hp-hr is equivalent to 0.0002 pounds per horsepower-hour (lb/hp-hr). Potential emissions of $PM_{2.5}$ for EU 15 are currently calculated using an emission factor of 0.0007 lb/hp-hr per AP-42, Table 3.4-1. As a result, the preliminary BACT $PM_{2.5}$ limit of 0.09 g/hp-hr may not be appropriate or achievable for EU 15. Please provide the manufacturer information stating that a $PM_{2.5}$ emission rate of 0.09 g/hp-hr has been established for EU 15.

12. Section 4.4 (Small Emergency Engines), Step 5(a): The requirement to limit non-emergency operation of each of EUs 9, 12, 14, 16 through 28, 29a, 30, 31a, and 32 through 36 to 500 hours per year is

inconsistent with applicable requirements under 40 CFR 63 Subpart ZZZZ (or Subpart IIII, if applicable), which allows 100 hours per year of non-emergency operation but does not restrict those non-emergency operations to maintenance checks and readiness testing.

13. Section 4.4 (Small Diesel-fired Engines), Steps 1 through 5: The ADEC rationale for the preliminary BACT determination of combusting ultra-low sulfur diesel (ULSD) is inconsistent for the following reasons.
    - In Step 1(d), the use of low sulfur fuel is listed as an available and technically feasible emission control technology.
    - Step 2 eliminates low sulfur fuel as technically infeasible which is inconsistent with the statement in Step 1 and incorrect. The use of low sulfur fuel is technically feasible, but the contribution of this technology toward reducing $PM_{2.5}$ emissions cannot be quantified.
    - Step 3 does not address the use of ULSD.
    - Step 5 requires the use of ULSD, with no supporting rationale or cost analysis. This determination is also inconsistent with the incorrect Step 2 conclusion that low sulfur fuel is not technically feasible.

    Please make the appropriate corrections to Section 4.4. DU understands that the requirement to combust ULSD will likely remain unchanged for the small diesel-fired engines. Specifically, the preliminary sulfur dioxide (SO_2) BACT decision also requires the use of ULSD, so correcting this inconsistency in Section 4.4 will not eliminate the requirement to combust ULSD in the small diesel-fired engines.

14. Section 4.4 (Small Diesel-fired Engines), Steps 4 and 5: A cost analysis is not provided to support the preliminary $PM_{2.5}$ BACT determinations identified in Step 5. Because each BACT determination must be based on technical and economic feasibility, the rationale for these preliminary determinations is incomplete, making the validity of the preliminary determinations questionable. Please provide the required economic feasibility.

15. Section 4.4 (Small Diesel-fired Engines), Table 4-9: The proposed preliminary $PM_{2.5}$ BACT limit of 7.21 E-04 pounds per horsepower-hour (lb/hp-hr) is the PM_{10} emission factor for gasoline-fired engines from Table 3.3-1 of AP-42. Using this emission factor is not appropriate for diesel-fired engines or for $PM_{2.5}$.

16. Section 4.5 (Material Handling): This section addresses the material handling emissions units (EUs 7a through 7c, 51a, 51b, and 52) but does not make a distinction between the material handling emissions units that can be equipped with fabric filter controls (EUs 7a through 7c, 51a, and 51b) and the emissions unit that cannot be equipped with a baghouse (EU 52, the emergency coal storage pile) Because a coal storage pile is a very different type of emissions unit, the section is not clear with respect to the types of emission control technologies that might be used for each listed emissions unit. As a result, EU 52 should be addressed separately for clarity.

    As an example of this confusion, Step 1(g) indicates that wind screens are not considered technically feasible for material handling units, but Step 2 states that all identified control technologies are technically feasible. Wind screens may be an available and/or technically feasible control technology for a coal storage pile, but not necessarily for a dust collector. Conversely, fabric filters are identified as available and technically feasible in Step 1(a), but fabric filters are not an available control technology for coal storage piles.

17. Section 4.5 (Material Handling), Table 4-12: The proposed preliminary $PM_{2.5}$ BACT for EU 7c, the North Coal Handling Dust Collector, includes a 200 hours per year (hr/yr) operating limit. This emissions unit is a backup coal handling system that is used if the primary system coal handling system is not available. The Preliminary Determination does not explain the basis for this BACT operating limit. Pleased fully explain the rationale for imposing a BACT operating limit of 200 hr/yr on EU 7c.

18. Section 4.5 (Material Handling), Steps 4(e) and 5(c): The preliminary proposed $PM_{2.5}$ BACT emission limit of 0.48 tons per year (tpy) for EU 52 is 34 percent of the existing $PM_{2.5}$ potential to emit of 1.42 tpy. The Preliminary Determination does not provide the basis for the 0.48 tpy $PM_{2.5}$ BACT emission limit or explain the emission limit calculation methodology. Please fully explain the basis and rationale for imposing a $PM_{2.5}$ BACT emission limit of 0.48 tpy on EU 52.

19. Section 4.5 (Material Handling), Table 4-12: This table includes columns labeled "Current Controls" and "Current Emission Factors." The table does not provide preliminary proposed $PM_{2.5}$ BACT emission limits, which is inconsistent with the Table 4-12 title of "PM-2.5 BACT Control Technologies Proposed for Material Handling."

Section 5. BACT Determination for SO_2

The Preliminary Determination SO_2 BACT analysis includes errors, assumptions, and inconsistencies that are of varying degree of concern. These concerns are discussed below in no particular order of seriousness.

20. Section 5.1 (Industrial Coal-fired Boilers): In Table 5.3, the Preliminary Determination specifies SO_2 cost effectiveness for wet scrubbing and spray dry absorbers to be $10,788 per ton SO_2 removed and $11,136 per ton SO_2 removed, respectively. Although not explicitly stated, the Preliminary Determination implies that these two technologies are not economically feasible and so are not SO_2 BACT. While the economically feasibility analyses for these two control technologies likely underestimate actual costs, DU agrees that wet scrubbing and spray dry absorbers are not SO_2 BACT. As a result, comments addressing wet scrubbing or spray dry absorbers are not presented in this document.

    The preliminary proposed SO_2 BACT is dry sorbent injection (DSI) which the Preliminary Determination states has a cost effectiveness of $6,435 per ton SO_2 removed. This cost effectiveness determination is questionable and likely too low for the reasons provided below. Note that developing an accurate cost effectiveness for DSI would require a bottom-up cost estimate based on actual plant conditions.

- Cost Model Validity: The cost effectiveness spreadsheet provided by ADEC as a part of the preliminary SO_2 BACT determination was originally developed by Sargent & Lundy (S&L) in 2010. The spreadsheet includes a link to the S&L white paper that provides a basis for the calculations that are in Row 25 of the spreadsheet. The S&L white paper states that the model is intended to calculate estimated Total Project Cost (total capital cost of installation), as well as direct and indirect annual operating costs. These calculations are largely based on the estimated usage of sorbent (in this case Trona) on a tons per hour (tph) basis and the gross generating capacity of the plant. The white paper omits information that is necessary to ensure that the spreadsheet is properly applied to a specific situation, including:
    - Types of plants to which the model is applicable (utility power generation, combined heat and power (CHP), cogeneration, other);
    - Applicable number of boilers (single unit or multi-boiler installation);
    - Applicable size range;
    - Equipment included in the Total Purchased Cost (TPC) calculation;
    - On-site bulk storage capacity;
    - A basis for selecting a "Retrofit factor" other than "1.0"; and
    - Data and other information used to develop and support the equations used in the spreadsheet.

  Based on review of the cost effectiveness model and the supporting documentation, determining the validity of the results of the analysis is not possible. The concerns are rooted in three assumptions made by ADEC in preparing the cost model
    - ADEC assumed that the model is valid for a plant the size of Fort Wainwright.
        - The calculation for "Base Module" cost (Row 30 of the spreadsheet) is based on an equation that uses the predicted sorbent demand. The S&L white paper states that the equation was developed based on "Cost data for several DSI systems." No references or supporting information relating to these projects were provided. While the validity range for the equation was not identified, one piece of information that gives some indication of the applicable range. The equation has a discontinuity at 25 tph of sorbent flow. Given that the predicted total sorbent flow for all six coal-fired boilers at Fort Wainwright is 1.5 tph (based on the estimate in the Preliminary Determination), the Fort Wainwright boilers would be at the very bottom of the range of potential plant sizes. Without additional data to justify the cost calculation at very low sorbent injection rates, determining if the results of the equation are accurate is very difficult.
    - The Preliminary Determination assumes that multiple boilers can accurately be modeled as a lumped heat input in a single spreadsheet.
        - The S&L white paper does not identify the type or configuration of the plant on which the calculation was based. Data input fields included in the spreadsheet (unit size, gross heat rate) indicate that the analysis was developed based on a single power generation unit (single boiler, single steam turbine, no CHP or cogeneration).
        - Based on the inputs to the spreadsheet provided by ADEC, EUs 1 thorough 6 are being treated as a single, lumped heat input value. This approach is an oversimplification and will not accurately account for the equipment and utilities that will be necessary to independently operate six boilers. The actual installation will require six separate trains of sorbent processing and transport equipment. Each train contains a day bin, mills,

feeders, blowers, coolers, hoppers, piping, instrumentation, controls, electrical wiring and other supporting equipment. This need for separate systems complicates the design, increases overall footprint, and reduces the economy of scale that might be realized with a single larger unit. In theory, ADEC could possibly use the Retrofit Factor to account for this additional complexity, but without a method for determining the correct Retrofit Factor value, selecting any value other than "1.0" would be pure conjecture.

    - The sorbent feed rate currently calculated for EUs 1 through 6 is very small. Should the model be revised to calculate the cost effectiveness on a per unit basis, the feed rate would be roughly one sixth of the current value. This change would further amplify concerns about the accuracy of the TPC calculation.

  - ADEC assumed that the model is valid for a heat and power plant.
    - As discussed above, no information is available addressing the type of plant on which the S&L spreadsheet is based. The assumption is that the plant is a single power generation unit. A CHP plant differs significantly from a "traditional" power plant in that the steam produced in a CHP plant is not exclusively used to generate electricity. In an effort to make the spreadsheet work for this application, ADEC used "dummy" data in the "Unit Size (Gross)" and "Gross Heat Rate" fields so that the calculated "Heat Input" field showed the maximum heat input value for EUs 1 through 6 (1,380 million British thermal units per hour (MMBtu/hr)). This approach has unintended consequences relating to the accuracy of the direct annual costs. The fixed and variable operating and maintenance (O&M) costs are evaluated on a per kilowatt and a per megawatt basis respectively. Utilizing a "dummy" gross generation number to calculate annual costs may not produce an accurate result. Based on review, no method exists to accurately model the direct annual costs for an installation such as the Fort Wainwright EUs 1 through 6 by using the S&L spreadsheet.
    - The average maximum hourly heat input identified in Row 15 of the spreadsheet is incorrect. The value shown reflects the maximum hourly heat input for each of the boiler. The value does not account for the permitted annual coal consumption limit. If the coal consumption limit is considered, the maximum hourly heat input is reduced to 583 MMBtu/hr averaged over a year. A reduction in hourly heat input will have an impact on the overall cost effectiveness calculation, but given the concerns with the calculation itself, identifying the specific impacts is difficult.

- SO_2 Emission Rates: The preliminary BACT determination states that the SO_2 emission rate used in the spreadsheet to calculate the total annualized operating costs was based on 0.2 weight percent (wt. pct.) sulfur coal and AP-42 emission factors. This approach resulted in an emission rate of 0.46 pounds of SO_2 per MMBtu (lb SO_2/MMBtu) heat input. This value is significantly different than the effective emission rate for the plant based on the PTE established in Title V Permit AQ1121TVP02, Revision 2. The effective emission rate is calculated as follows:

  Permitted PTE: 1,764 tons of SO_2
  Permitted coal consumption limit: 336,000 tpy
  Assumed coal energy content: 7,600 British thermal units per pound (Btu/lb)

1,764 tons SO_2/yr * 1 year/336,000 tons coal * 1 lb coal/7,600 Btu * 10^6 Btu/MMBtu * 1 ton coal/2,000 lb coal * 2,000 lb SO_2/ton
= 0.691 lb SO_2/MMBtu

The difference between the ADEC-assumed emission rate and the effective emission rate leads to a significant error in the SO_2 cost effectiveness calculation. The ADEC spreadsheet divides the total annualized cost (determined by using the 0.46 lb/MMBtu SO_2 rate) by the SO_2 PTE (with an effective rate of 0.691 lb/MMBtu). The use of two different emission rates in this calculation results in an invalid comparison of two values that should not be compared to each other. For the result of the equation to be valid, the total annualized cost must be calculated using an SO_2 emission rate equal to the SO_2 PTE.

- Conclusion: Based on the review of the preliminary SO_2 BACT determination and the associated cost effectiveness calculation, no indication could be found that the Preliminary Determination calculation accurately reflects the actual operating conditions for EUs 1 through 6. As a result, no basis exists for determining if the installation of a DSI system is or is not economically feasible. Despite the inability to determine the accuracy of the calculations in the Preliminary Determination, those calculations likely underestimate the DSI cost effectiveness because the Preliminary Determination underestimates SO_2 emissions on a lb/MMBtu basis.

  If a more accurate cost effectiveness is to be determined, the cost effectiveness should be recalculated using a bottom-up cost estimating approach based on actual plant conditions. These conditions would include SO_2 emission rates based on current PTE, permit constraints (where applicable and enforceable), available space, ambient conditions, and local factors such as construction logistics, labor wage rates, and local sorbent costs.

21. Section 5.1 (Industrial Coal-fired Boilers), Step 5: The proposed coal combustion limit of 300,000 tpy and the assumption that the coal sulfur content is no greater than 0.2 weight percent are not evaluated through the five-step BACT process, or even identified as available control technologies in Step 1.
    - The current coal combustion limit for the six boilers is 336,000 tpy, per Condition 12.1 of AQ1121TVP02, Revision 2.
    - The current coal sulfur content is not limited beyond the State SIP SO_2 standard and the requirement to determine what the SO_2 emission concentrations would be prior to combusting coal with a sulfur content of greater than 0.4 weight percent. (Refer to Conditions 11 and 11.1 of AQ1121TVP02, Revision 2.)
    - If either of these requirements is to be imposed as a limit without a BACT analysis justifying the limit, the limit(s) should be used to calculate a revised baseline emission rate. The BACT analysis should then calculate any further emission reductions based on that revised baseline emission rate.

    DU does not agree that either the coal consumption limit of 300,000 tpy or the coal sulfur content assumption of less than or equal to 0.2 weight percent is appropriate. More investigation is needed to determine whether these assumptions are valid and feasible. At the least, the 0.2 weight percent coal sulfur limit should be assessed through the BACT analysis process. DU is not aware that Usibelli Coal Mine, the sole supplier of coal in Alaska, has even been contacted to advise whether the mine is capable of providing coal meeting that specification on a long-term basis. Step 1(d) of the Preliminary Determination acknowledges that the current contract guarantee is less than 0.4 weight percent sulfur, and that the coal typically ranges from 0.08 to 0.28 weight percent sulfur.

22. Section 5.4 (Small Emergency Engines), Step 5(a): The requirement to limit non-emergency operation of small emergency engines is inconsistent with applicable requirements under 40 CFR 63 Subpart ZZZZ (or Subpart IIII, if applicable), which allows 100 hours per year of non-emergency operation but does not restrict those non-emergency operations to maintenance checks and readiness testing.

23. Section 5.4 (Small Emergency Engines), Step 5(b): The determination that good combustion practices is BACT should be eliminated or a rationale should be provided for selecting good combustion practices in addition to the combustion of ULSD and limited operations. Per Table 5-10 of the Preliminary Determination, good combustion practices were not determined to be SO_2 BACT for small diesel-fired engines at other stationary sources. While DU follows good combustion practices as a standard practice, Step 3(c) indicates that good combustion practices are the least effective SO_2 emission control technology.

Attachment: EPA comments on ADEC Preliminary Draft Serious SIP Development materials for the Fairbanks serious $PM_{2.5}$ nonattainment area

General

The attached comments are intended to provide guidance on the preliminary drafts of SIP documents in development by ADEC. We expect that there will be further opportunities to review the more complete versions of the drafts and intend to provide more detailed comments at that point

1. Statutory Requirements - This preliminary draft does not address all statutory requirements laid out in Title I, Part D of the Clean Air Act or 40 C.F.R. Part 51, Subpart Z. The submitted Serious Area SIP will need to address all statutory and regulatory requirements as identified in Title I, Part D of the Clean Air Act, 40 C.F.R. Part 51, Subpart Z, the August 24, 2016 $PM_{2.5}$ SIP Requirements Rules (81 FR 58010, also referred to at the $PM_{2.5}$ Implementation Rule), and any associated guidance.

   In the preliminary drafts, notable missing elements included: Reasonable Further Progress, Quantitative Milestones, and Conformity. This is not an exhaustive list of required elements.

   The NNSR program is a required element for the serious area SIP. We understand ADEC recently adopted rule changes to address the nonattainment new source review element of the Serious SIP, and that ADEC plans to submit them to the EPA separately in October 2018. Thank you for your work on this important plan element.

2. Extension Request - This preliminary draft does not address the decision to request an attainment date extension and the associated impracticability demonstration. On September 15, 2017, ADEC sent a letter notifying the EPA that it intends to apply for an extension of the attainment date for the Fairbanks $PM_{2.5}$ Serious nonattainment area. The Serious Area SIP submitted to EPA will need to include both an extension request and an impracticability demonstration that meet the requirements of Clean Air Act section 188(e). In order to process an extension request, the EPA requests timely submittal of your Serious Area SIP to allow for sufficient time to review and take action prior to the current December 2019 attainment date, so as to allow, if approvable, the extension of the attainment date as requested/appropriate. For additional guidance, please refer to 81 FR 58096.

3. Split Request - We support the ADEC and the FNSB's decision to suspend their request to the EPA to split the nonattainment area. We support the effort to site a monitor in the Fairbanks area that is more representative of neighborhood conditions and thus more protective of community health. This would provide additional information on progress towards achieving clean air throughout the nonattainment area.

4. BACM (and BACT), and MSM - Best Available Control Measures (including Best Available Control Technologies) and Most Stringent Measures are evaluative processes inclusive of steps to identify, adopt, and implement control measures. Their definitions are found in 51.1000, 51.1010(a).

All source categories, point sources – area sources – on-road sources – non-road sources, need to be evaluated for BACM/BACT and MSM. De minimis or minimal contribution are not an allowable rationale for not evaluating or selecting a control measure or technology.

The process for identifying and adopting MSM is separate from, yet builds upon, the process of selecting BACM. Given that Alaska is intent on applying for an extension to the attainment date, Alaska must identify BACM and MSM for all source categories. These processes are described in 51.1010(a) and 51.1010(b) and in the $PM_{2.5}$ Implementation Rule preamble at 81 FR 58080 and 58096. We further discuss this process in the "BACM (and BACT), MSM" section that starts on page 3 below.

5. Resources and Implementation - The serious area $PM_{2.5}$ attainment plan will be best able to achieves its objectives when all components of the SIP, both the ADEC statewide and FNSB local measures, are sufficiently funded and fully implemented.

6. Use of Consultants- For the purpose of clarity, it will be important to identify that while contractors are providing support to ADEC, all analyses are the responsibility of the State.

Emissions Inventory

1. Extension Request Emission Inventories - Emissions inventories associated with the attainment date extension request will need to be developed and submitted. Table 1 of the Emissions Inventory document is one example where the submittal will need to include the additional emissions inventories, including RFP inventories, extension year inventories for planning and modeling, and attainment year planning and modeling inventories, associated with the attainment date extension request.

2. Modeling Requirements - Related to emissions inventory requirements, the serious area SIP will need to model and inventory 2023 and 2024, at minimum. We recommend starting at 2024 and modeling earlier and earlier until there is a year where attainment is not possible. That would satisfy the requirement that attainment be reached as soon as practicable.

3. Condensable Emissions - All emissions inventories and any associated planning, such as Reasonable Further Progress schedules, need to include condensable emissions as a separate column or line item, where available. Where condensable emissions are not available separately, provide condensable emissions as included (and noted as such) in the total number. The following are examples of where this would need to be incorporated in to the Emissions Inventory document:
    a. Page 20, paragraph 5 (or 2nd from the bottom).
    b. Page 34, Table 8. Include templates.

Precursor Demonstration

1. Ammonia Precursor Demonstration - The draft Concepts and Approaches document, Table 4 on page 9, states that a precursor demonstration was completed for ammonia and that the result was "Not significant for either point sources or comprehensively." The Precursor Demonstration chapter does not include an analysis for ammonia. Please include the precursor demonstration for ammonia in the Serious Plan or amend this table.

2. Sulfur Dioxide Precursor Description - The draft Concepts and Approaches document, Table 4 on page 9, states that sulfur dioxide was found to be significant. All precursors are presumptively considered significant by default and the precursor demonstration can only show that controls on a precursor are not required for attainment. Suggested language is, "No precursor demonstration possible."

BACM (and BACT), MSM

Overall

The EPA appreciates ADECs efforts to identify and evaluate BACM for eventual incorporation into the Serious Area SIP. The documents clearly display significant effort on the part of the state and are a good first step in the SIP development process. In particular, we are supportive of ADECs efforts to evaluate BACT for the major stationary sources in the nonattainment area, as control of these sources is required by the CAA and $PM_{2.5}$ SIP Requirements Rule.

1. BACM/BACT and MSM: Separate Analyses - The "Possible Concepts and Potential Approaches" document appears to conflate the terms BACM/BACT and MSM, as well as, the analyses for determining BACM/BACT and MSM. BACM and MSM have separate definitions in 40 CFR 51.1000. By extension, the processes for selecting BACM and MSM are laid out separately in the $PM_{2.5}$ SIP Requirements Rule (compare 40 CFR 51.1010(a) for BACM and 40 CFR 51.1010(b) for MSM). Accordingly, the serious area SIP submission will need to have both a BACM/BACT analysis and an MSM analysis. We believe that there is flexibility in how these analyses can be presented, so long as the submission clearly satisfies the requirements of both evaluations, methodologies, and findings.

2. Selection of Measures and Technologies - The CAA and the $PM_{2.5}$ SIP Requirements Rule requires that ***all*** available control measures and technologies that meet the BACM (including BACT) and MSM criteria need to be implemented. All source categories need to be evaluated including: point sources (including non-major sources), area sources, on-road sources, and non-road sources.

3. Technological Feasibility - All available control measures and technologies include those that have been implemented in nonattainment areas or attainment areas, or those potential measures and technologies that are available or new but not yet implemented. Similarly, Alaska may not automatically eliminate a particular control measure because other sources or nonattainment areas have not implemented the measure. The regulations do not have a quantitative limit on number of controls that should be implemented.

For technological feasibility, a state may consider factors including local circumstances, the condition and extent of needed infrastructure, or population size or workforce type and habits, which may prohibit certain potential control measures from being implementable. However, in the instance where a given control measure has been applied in another NAAQS nonattainment area, the state will need to provide a detailed justification for rejecting any potential BACM or MSM measure as technologically infeasible (81 FR 58085).

A Borough referendum prohibiting regulation of home heating would not be an acceptable consideration to render potential measures technologically infeasible. The State would be responsible for implementing the regulations in the case that the Borough was not able. We believe that the most efficient path to clean air in the Borough is through a local, community effort.

4. Economic Feasibility - The BACM (including BACT) and MSM analyses need to identify the basis for determining economic feasibility for both the BACM and MSM analyses. In general, the $PM_{2.5}$ SIP Requirements Rule requires the state apply more stringent criteria for determining the feasibility of potential MSM than that used to determine the feasibility of BACM and BACT, including consideration of higher cost/ton values as cost effective.

5. Timing - The evaluations will need to identify the time for selection, adoption, and implementation for all measures. BACT must be selected, adopted, and implemented no later than 4 years after reclassification (June 2021). MSM must be selected, adopted, and implemented no later than 1 year prior to the potentially extended attainment date (December 2023 at latest). The RFP section of the serious area plan will need to identify the BACM and MSM control measures, their time of implementation, and the time(s) of expected emissions reductions. Timing delays in selection, adoption, implementation are not considered for BACM and MSM.

   As mentioned in the comment above in the “General” comment section, there are three criteria distinguishing between BACM and MSM, not one.

BACM - General

1. BACM definition, evaluations - The definition of BACM at 40 CFR 51.1000 describes BACM as any measure “that generally can achieve greater permanent and enforceable emissions reductions in direct $PM_{2.5}$ and/or $PM_{2.5}$ plan precursors from sources in the area than can be achieved through the implementation of RACM on the same sources.” We believe that potential measures that are no more stringent than existing measures already implemented in FNSB, those that do not provide additional direct $PM_{2.5}$ and/or $PM_{2.5}$ precursors emissions reductions, do not meet the definition of BACM. These would need to be evaluated in the BACM and MSM analysis.

   For measures that are currently being implemented in Fairbanks that provide equivalent or more stringent control, we recommend identifying the ADEC or Borough implemented measure as part of the BACM control strategy. These implemented measures should be listed in their BACM findings at the end of the document. This comment applies to all of the measures that were screened out from consideration due to not being more stringent than the already implemented measure.

The analyses for a number of measures (e.g., Measure 30, Distribution of Curtailment Program information at time of woodstove sale) conclude that the emission reductions would be insignificant and difficult to quantify and, therefore, the measure is not technologically feasible. These measures may be technologically feasible. However, if existing measures constitute a higher level of control or if implementation of the measures is economically infeasible those would be valid conclusions if properly documented. De minimis or minimal contribution is not a valid rationale for not considering or selecting a control measure or technology.

The conclusion "not eligible for consideration as BACM" is not valid as all assessments for BACM and MSM are part of the evaluation. More appropriate conclusions could include that existing measures qualify as BACM or MSM, or are more stringent. Additional conclusions could include that evaluated measures were not technologically feasible, economically feasible, or could not practically be adopted and implemented prior to the required timeframe for BACM or MSM.

2. BACM and MSM, Ammonia - In the Approaches and Concepts document, Table 5 references that there are no applicable control measures or technologies for the $PM_{2.5}$ precursor ammonia. No information to substantiate this claim are found in the preliminary draft documents. Unless NH_3 is demonstrated to be insignificant for this area, the serious area plan will need to include an evaluation of NH_3 and potential controls for all source categories including points sources.

3. Backsliding Potential - When benchmarking the BACM and MSM analyses for stringency, ensure that the evaluation is based on the measures approved into the current Moderate SIP. This will relate primarily to the current ADEC/FNSB curtailment program but also other related rules. Many wood smoke control measures are interrelated, and changes to those measures may affect determinations on stringency of directly related and indirectly related measures. Examples of this can be found in multiple measures including, but not limited to Measures 5, 7, and 16.

4. Transportation Control Measures - The Approaches and Concepts document, on Page 13, states that the MOVES2014 model does not estimate a PM benefit as a result of an I/M program, and therefore the I/M is not technologically feasible. This is not a valid conclusion given that the Fairbanks area operated an I/M program to reduce carbon monoxide and the Utah Cache Valley nonattainment areas has an I/M program for VOC control. This measure will need to be evaluated. Referring to the 110(l) analysis for the Fairbanks CO I/M program may provide insight into how to quantify the emissions associated with an I/M program.

With regard to control measures related to on-road sources, we have received inquiries from the community regarding idling vehicles and further evaluation emission benefits would be responsive to citizen concern and may provide additional air quality benefit.

BACM - Specific Measures

- Measure 16, page 34-35. Date certain Removal of Uncertified Devices. The "date certain" removal of uncertified woodstoves in Tacoma, Washington appears more stringent than the current Moderate SIP approved Fairbanks ordinance in terms of the regulation and in practice. While the current ordinance appears to provide similar protection during stage 1 alerts, this is dependent on 100% compliance and the curtailment program remaining in its current form. Removal of uncertified stoves guarantees reductions in emissions in the airshed during both the curtailment periods and throughout the heating season. The information provided does not support the conclusion that the Fairbanks controls provides equivalent or more stringent control. Date certain removal of uncertified wood stoves needs to be considered for the area.

  Measures R4, R9, and R12, page 64, 68 and 71. These measures do not reference the Puget Sound Clean Air Agency (Section 13.07) requirement for removal of all uncertified stoves by September 30, 2015. This is equivalent to having all solid fuel burning appliances be certified and would be more stringent than the current SIP approved rules in Fairbanks. We believe that these measures need to be evaluated in the BACM and MSM analyses.

  Measure R4 and R9, page 64 and 68. All Wood Stoves Must be Certified. These measure should be evaluated.

- Measure 19-20 and 25, page 36-38 and 39. Renewal and Inspection Requirements. ADEC has not adequately demonstrated their conclusion that Fairbanks has a more stringent measure than Missoula and San Joaquin. We believe that the renewal requirements and inspection/maintenance requirements associated with the Missoula alert permits and San Joaquin registrations allows the local air agency an opportunity to verify on a regular basis that the device operates properly over times. Wood burning appliances require regular maintenance in order to achieve the certified emissions ratings. The FNSB Stage 1 waivers do not have an expiration and do not have an inspection and maintenance component making it less stringent.

- Measure 31, page 43. While the Borough has SIP approved dry wood requirements that prohibit the burning of wet wood and moisture disclosure requirements by sellers, we believe that a measure limiting the sale of wet wood during the winter months should be further analyzed for BACM (and MSM) consideration.

- Measures 33, 35, 36, 37, 43. Multiple Measures identify that recreational fires have been exempted from existing regulations. Small unregulated recreational fires, bonfires, fire pits, and warming fires have the potential to contribute emissions during a curtailment period. The FNSB and ADEC regulations should be re-evaluated for removing this exclusion.

- Measure 49, page 58. Ban on Coal Burning. We believe the regulations in Telluride are more stringent than in Fairbanks. Telluride prohibits coal burning all year whereas in Fairbanks an existing coal stove can burn when there is no curtailment which could contribute additional emissions to the airshed, especially during poor conditions when a curtailment may not have been called. We do not agree with the conclusion that the PM_{10} controls are ineligible for consideration for control of $PM_{2.5}$.

- Measure R20, page 76. Transportation Control Measures related to Vehicle Idling. We have received multiple inquiries regarding community interest in controlling emissions from idling vehicles. These types of control measures should be further evaluated in the BACM and MSM analyses.

- Measure 1, page 79-81. Surcharge on Solid Fuel Burning Appliances. For purposes of implementing an effective program to reduce $PM_{2.5}$ in the Borough we believe that a surcharge may be a helpful way to supplement limited funds. Implementation efforts within the nonattainment area could benefit from $24,000 of additional funding whether used for a code enforcer or other support of the wood smoke programs.

- Additional controls that should be further evaluated for BACM and MSM include:
  - Measure R1, page 63: Natural gas fired kiln or regional kiln.
  - Measure R12, page 71: Replace uncertified stoves in rental units.
  - Measure R17, page 75: Ban use of wood stoves
  - Measure R6, page 65: Remove Hydronic Heaters at Time of Home Sale & Date certain removal of Hydronic heaters. We suggest evaluating these measures at the state and local level.
  - Weatherization / heat retention programs should be evaluated. These should be evaluated for existing homes through energy audits and increasing insulation and energy efficiency. For new construction, building codes (Fairbanks Energy Code) should be evaluated with reference to the IECC Compliance Guide for Homes in Alaska http://insulationinstitute.org/wp-content/uploads/2015/12/AK_2009.pdf, and the DOE R-value recommendations, http://www.fairbanksalaska.us/wp-content/uploads/2011/07/ENERGY-CODE.pdf. (Note: More recent information may be available.)
  - Fuel oil boiler upgrades / operation & maintenance programs should be evaluated.

BACM - Ultra-Low Sulfur Fuel

1. Incomplete Analysis - The report findings provide analysis of the demand curve over a relatively short (12 month) time frame. This analysis appears to be based on a partial equilibrium model. This is a misleading time frame given the volatility of demand side fuel oil pricing. Also, in order to determine the equilibrium price, the analysis must also analyze

the supply curve. The report does not include information about the future supply side costs but needs to in order to make conclusions about the cost to the community of ultra-low sulfur heating oil.

2. Analysis of Increased Supply, Consumption - The report does not address future change in the market nor potential economies of scale to be achieved by an increase in ultra-low sulfur fuel consumption. Page 3 of the report identifies that, "the additional premium to purchase ULS over HS, decreased significantly since 2008-2010. It is likely that, this can be attributed to increased ULS capacity." We believe that the report should further explore the supply side costs.

3. Supply Cost Analysis - A supply side cost analysis is necessary to better understand the cost to the supplier to produce and provide ULS heating fuel. The BACM analysis must start with a transparent and detailed economic analysis of exclusively supplying ultra-low sulfur heating oil to the nonattainment area.

4. BACM Assessment - The current analysis does not provide information needed to assess BACM economic feasibility. The report should analyze the total cost to industry of delivering ultra-low sulfur heating oil to the entire community in terms of standard BACM metrics, $/ton.

BACT

General Comments

At this time, EPA is providing general comments based on review of the draft BACT analyses prepared by ADEC as well as addressing certain issues discussed in earlier BACT comments provided by EPA. Detailed comments regarding each individual analysis are not being provided at this time. While EPA appreciates the time and effort invested by ADEC staff in preparing the draft BACT analyses, the basic cost and technical feasibility information needed to form the basis for retrofit BACT analyses at the specific facilities has not been prepared. In other words, analyses which are adequate to guide decision making regarding control technology decisions for these rather complex retrofit projects cannot be prepared without site specific evaluation of capital control equipment purchase and installation costs, and site specific evaluation of retrofit considerations. EPA will conduct a thorough review of any future BACT or MSM analyses which are prepared based on adequate site specific information, and will provide detailed comments relative to each emission unit and pollutant at that time.

1. Level of Analysis – The analyses are presented as "preliminary BACT/MSM analyses" on the website, but the documents themselves are titled only as BACT analyses and the conclusions only reflect BACT. Additionally, the determinations may not be stringent enough to be considered BACT given that better performing SO_2 control technologies have not been adequately analyzed. These analyses cannot be considered to provide sufficient basis to support a selection of MSM.
2. Site-Specific Quotes Needed – The cost analyses, particularly for SO_2 control technologies, must be based on emission unit-specific quotes for capital equipment purchase and

installation costs at each facility. These are retrofit projects which must be considered individually in order to obtain reliable study/budget level (+/- 30%) cost estimates which are appropriate to use as the basis for decision making in determining BACT and potentially MSM. EPA believes that control decisions of this magnitude justify the relatively small expense of obtaining site-specific quotes.

3. SO_2 Control Technologies – The analyses must include evaluation of circulating dry scrubber (CDS) SO_2 control technology. This demonstrated technology can achieve SO_2 removal rates comparable to wet flue gas desulfurization (FGD) at lower capital and annual costs, and is more amenable to smaller units and retrofits. Modular units are available.
4. Control Equipment Lifetime – The analyses must use reasonable values for control equipment lifetime, according to the EPA control cost manual (EPA CCM). EPA believes that the following equipment lifetimes reflect reasonable assumptions for purposes of the cost analysis for each technology as stated in the EPA control cost manual and other EPA technical support documents. Use of shorter lifetimes for purposes of the cost analysis must include evidence to support the proposed shortened lifetime. One example where EPA agrees a shortened lifetime is appropriate would be where the subject emission unit has a federally enforceable shutdown date. Certain analyses submitted in the past have claimed shortened equipment lifetimes based on the harshness of the climate in Fairbanks. In order to use an equipment life that is shortened based on the harsh climate, evidence must be provided to support the claim. This evidence could include information regarding the actual age of currently operating control equipment, or design documents for associated process equipment such as boilers. Lacking adequate justification, all cost analyses must use the following values for control equipment lifetime:
   a. SCR, Wet FGD, DSI, CDS, SDA – 30 years
   b. SNCR – 20 years
5. Availability of Control Technologies – Technologically feasible control technologies may only be eliminated based on lack of availability if the analysis includes documented information from multiple control equipment vendors (who provide the technology in question) which confirms the technology cannot be available within the appropriate implementation timeline for the emission unit in question.
6. Assumptions and Supporting Documents – All documents cited in the analyses which form the basis for costs used and assumptions made in the analyses must be provided. Assumptions made in the analyses must be reasonable and appropriate for the control technologies included in the cost analysis.
7. Interest Rate – All cost analyses must use the current bank prime interest rate according to the revised EPA CCM. As of May 10, 2018, this rate is 4.75%. See https://www.federalreserve.gov/releases/h15/ (go to bank prime rate in the table).
8. Space Constraints – In order to establish a control technology as not technologically feasible due to space constraints or other retrofit considerations, detailed site specific information must be submitted in order to establish the basis for such a determination, including detailed drawings, site plans and other information to substantiate the claim.
9. Retrofit Factors – All factors that the facility believes complicate the retrofit installation of each technology should be described in detail, and detailed substantiating information must be submitted to allow reasonable determination of an appropriate retrofit factor or whether installation of a specific control technology is technologically infeasible. EPA Region 10

believes that installation factors which would complicate the retrofit installation of the control technology should be evaluated by a qualified control equipment vendor and be reflected in a site-specific capital equipment purchase and installation quote. Lacking site-specific cost information, all factors that the facility believes complicate the retrofit installation of each technology should be described in detail, and detailed substantiating information must be submitted to allow reasonable determination of an appropriate retrofit factor. One example of the many retrofit considerations that must be evaluated is the footprint required for each control technology. A vendor providing a wet scrubber will be able to estimate the physical space required for the technology, and evaluate the existing process equipment configuration and available space at each subject facility. The determination of whether a specific control technology is feasible and what the costs will be may be different at each facility based on this and other factors. Site-specific evaluation of these factors must be conducted in order to provide a reasonable basis for decision making.

10. Control Efficiency – Cost effectiveness calculations for each control technology must be based on a reasonable and demonstrated high end control efficiency achievable by the technology in question at other emission units, or as stated in writing by a control equipment vendor. If a lower pollutant removal efficiency is used as the basis for the analysis, detailed technical justification must be provided. For example, the ability of SCR to achieve over 90% NO_X reduction is well established, yet the ADEC draft analyses assume only 80% control. Use of this lower control efficiency requires robust technical justification.
11. Condensable Particulate Matter – Although the existing control technology on the coal fired boilers may be evaluated as to whether it meets the requirement for BACT for particulate matter, baghouses primarily reduce emissions of filterable particulate matter rather than condensable PM. Given that all condensable PM emitted by the coal fired boilers would be classified as $PM_{2.5}$, the BACT analyses must include consideration of control options for these emissions. Where control technologies evaluated for control of other pollutants may provide a collateral benefit in reducing emissions of $PM_{2.5}$, this should be evaluated as well.
12. Guidance Reference – The steps followed to perform the BACT analysis mentioned in section 2 are from draft NSR/PSD guidance. The correct reference should be 81 FR 58080, 8/24/2016. As a result of this, some of the steps outlined in the BACT analysis need to be updated.
13. Community Burden Estimate – The concepts and approaches document labels capital purchase and installation costs for air pollution control technology at the major source facilities as "community burden" (see Tables 7 and 8, pages 10-11). EPA believes it is important to properly label the cost numbers being used as capital purchase and installation costs, since presenting them as community burden appears to attribute the entire initial capital investment for the various control technologies to the community in a single year, and also ignores annual operation and maintenance costs. As described in the EPA CCM, the cost methodology used by EPA for determining the cost effectiveness of air pollution control technology amortizes the initial capital investment over the expected life of the control device, and includes expected annual operating and maintenance expenses. EPA believes presentation of this annualized cost over the life of the control technology more accurately represents the actual cost incurred and is consistent with how cost effectiveness is estimated in the context of a BACT analysis.
14. Conversion to Natural Gas – For any emission units capable of converting to natural gas combustion (with the requisite changes to the burners, etc), the MSM analysis in particular

should thoroughly evaluate the feasibility of this option. For example, GVEA has stated the combustion turbines at its North Pole Expansion Power Plant have the ability to burn natural gas, and the IGU has indicated the intent to expand the supply of natural gas to Fairbanks and North Pole.

APPENDIX:

Additional Comments and Suggestions

Possible Concepts and Potential Approaches

Throughout all SIP documents references to design values should include a footnote to the source of the information (e.g., "downloaded from AQS on XX/XX/XXX" or "downloaded from [state system] on XX/XX/XXXX") and how exceptional events were treated.

We suggest referencing the August 24, 2016 81 FR 58010 Fine Particulate Matter NAAQS: State Implementation Plan Requirements rule with one consistent term. We suggest the 2016 $PM_{2.5}$ Implementation Rule.

Page 4, Figure 1. The comparative degree days and heating related information is better suited for the sections evaluating BACM and economic feasibility. If intending on using this information to differentiate Fairbanks from other cold climates and/or nonattainment areas, depicting comparative home heating costs would be more supportive.

Page 4, Table 1. The design values in the table and in the discussion need to be updated for 2015-2017.

Page 6-7: The "Totals" row in Table 3 (non-attainment areas emissions by source sector) does not appear to be the sum of the individual source sector emissions.

Page 7: The statement about FNSB experiencing high heating energy demand per square foot needs to be referenced.

Page 7: The discussion of Eielson AFB growth needs a reference to the final EIS.

Page 9: Table 4's title should be changed to "Preliminary Precursor Demonstration Summary"

Page 9: Table 4 includes a column "Modeling Assessment". Not all precursors were assessed with modeling, and modeling is just one tool for the precursor demonstration. A suggestion for the column title is "Result of Precursor Demonstration."

Page 9: Table 5's title should be changed to "Preliminary BACT Summary." Table 5 also needs to update the title to reference "Precursor Demonstration" as the term "Precursor Significance Evaluation" is the incorrect terminology for this analysis.

Page 10: ADEC's proposal to only require one control measure per major stationary source to meet BACT and MSM for SO_2, is not consistent with the Act or rule. As discussed above, BACM and MSM have separate definitions in 40 CFR 51.1000. By extension, the processes for selecting BACM and MSM are laid out separately in the PM2.5 SIP Requirements Rule (compare 40 CFR 51.1010(a) for BACM and 40 CFR 51.1010(b) for MSM).

Page 10: Table 6 should identify the specific dry sorbent injection selected as BACT.

Page 11: Suggest changing “less sources” to “fewer sources.”

Page 13: The statement about an I/M program providing PM benefit needs to be clarified. Is this referring just to NOx and VOC precursor contribution to PM2.5, or also direct PM2.5 benefits?

Page 14: The statement “ADEC interprets the main difference between BACT/BACM and MSM as the time it takes to implement a control” is inaccurate. As discussed above, although the rule sets our different schedules for implementation of MSM and BACM, this is not the only major difference between those concepts. Notably, the rule contemplates a higher stringency for MSM as well as a higher cost/ton threshold for determining economic feasibility of the measure.

Technical Analysis Protocol

Page 2: The design values at the top of the page need to be updated to 2015-2017.

Page 2: Recommend removing the sentence “This site will be included in the Serious SIP’s attainment plan…” as the North Pole Elementary will be involved in the redesignation to attainment in the sense that all past and current monitoring data will be a part of an unmonitored area analysis to show that the entire area has attained the standard in addition to the regulatory monitor locations.

Page 2: Remove the discussion of the nonattainment area split.

Page 2: Paragraph 2, sentence 3 should refer to the unmonitored area analysis.

Page 2: The timeline described at the bottom of the page needs to be modified to reflect a current schedule. No projected year modeling was included in the preliminary draft documents. Control scenario modeling will likely not be completed in Q2 2018.

Page 3: We suggest a sentence overview of the unmonitored area analysis in Section 3.1.

Page 3: Section 3.2 needs to refer to the SPM data and how that will be used in the Serious Plan unmonitored area analysis. This section should discuss current DEC efforts to site a new monitor in Fairbanks.

Page 3: Section 3.4 needs to describe the CMAQ domain in addition to the WRF domain. A figure (map) would help.

Page 4: Section 3.5 needs a more developed discussion of the WRF assessment, including describing the criteria that were used to assess the state-of-the-art, what the current version is, and what version was used.

Page 4: Section 3.6 needs to reference all emission inventories in development, including potential attainment date extension years and RFP years.

Page 4: In Section 4.1, the statement about the Moderate SIP covering the relevant monitors for the Serious SIP is inaccurate. The statement needs to qualify whether it is referring to regulatory monitors or non-regulatory monitors. In addition, the North Pole Fire Station, NCore, and North Pole Elementary monitors were not included in the Moderate SIP.

Page 5: Table 4.1-1's title suggests that all SPM sites are listed, but only sites with regulatory monitors are listed. Please list all the SPM sites used in the unmonitored area analysis in a separate table and modify this title of Table 4.1-1 to reflect that it lists sites that are regulatory.

Page 5: North Pole Elementary was a regulatory site for a part of the baseline period and was NAAQS comparable. Table 4.1-1 needs to be updated.

Page 8: Table 4.2-1 should be updated to include 2011-2017 98^{th} percentiles. Table 4.2-2 should be updated to include 3-year design values for 2013-2017. For clarity, we recommend the 3-year design values include the full period in order to better distinguish from Table 4.2-1. For instance, "2013" would be "2011-2013".

Page 8: The statement starting, "a clear indication…" needs to be amended or removed. It is inaccurate. The prevalence of organic carbon does not indicate the dominance of wood burning, much less a clear indication. Many sources in Fairbanks emit organic carbon.

Page 8: The statement starting "The concentration share…" need to be amended or removed. Suggest removing "drastically". There is no scientific definition of a drastic change in percentages of $PM_{2.5}$ species, nor does the different 56% to 80% appear "drastic."

Page 9: The detailed description of the Simpson and Nattinger analysis does not reflect that SANDWICH process and it is preliminary data. It should be included within the body of the Serious Plan appendix on monitoring, but is out of place in a summary TAP.

Page 9: there are two different tables with the same table number (Table 4.3-1).

Page 10: Please clarify Table 4.4-1. This appears to be the design value calculation for the 5-year baseline design value, 2011-2015. If correct, then please label the 3-year design values according to the three years (e.g., "2011-2013"), clarify the table heading as being the "Five Year Baseline Design Value, 2011-2015 (µg/m3)", and clarify that the last column is the 5 Year Baseline Design Value associated with the table heading.

Page 11: At the end of section 5, please refer to the emission inventory chapter's meteorological discussion of the episodes.

Page 11: Section 6 needs to justify the extent, resolution, and vertical layer structure of the CMAQ domain (and the WRF domain) or refer to where that is included in the Moderate Plan.

Page 13: We suggest changing "PMNAA" to "NAA" to be consistent with the EI chapter.

Page 15, Section 8.1: There needs to be mention of how the F-35 deployment will be considered, with a reference to the final EIS.

Page 15-19: section 8.2-8.6 use the future tense for tasks that have been completed and are inconsistent with the schedule at the beginning of the TAP. Please adjust based on current status.

Page 20, section 9.2 states that “a BACT analysis is an evaluation of all technically available control technologies for equipment emitting the triggered pollutants and a process for selecting the best option based on feasibility, economics, energy, and other impacts.” This sentence should be revised to reflect that the technological feasibility assessment occurs after identification of all potential control measures for each source and source category.

Page 20, section 9.3 the second sentence should read: “BACM measures found to be economically infeasible for BACM *must* be analyzed for MSM.”

Page 21: Section 10.1 needs to be updated to reflect the current CMAQ version (5.2.1) and a discussion of why that model has not been used.

Page 21: Suggest sentence starting “There will be a gap…” be changed to “There is a gap in terms of assessing the performance at the North Pole Fire Station monitor for the Serious Plan because the State Office Building in Fairbanks was the only regulatory monitor at the time of the 2008 base case modeling episodes.”

Page 23: Please explain the solid and dashed lines in the soccer plot.

Page 23: Please be sure to include a full discussion of North Pole performance in this section. Even though we lack measurements, we can discuss the ratio of the modeling results at NPFS versus SOB versus that ratio from more recent monitoring data (2011-2015 baseline design value period).

Page 23: Please clarify what is meant by “Moderate Area SIP requirements.”

Page 24: The discussion of the 2013 base year discusses representative meteorological conditions without describing what the representative meteorological conditions are for high $PM_{2.5}$. Please reference the discussion of representative meteorological conditions that will be found elsewhere in the SIP.

Page 24: The discussion of the modeling years needs to be consistent and reflect the extension request past 2019. The attainment year cannot be earlier than 2019. Each extension year must be individually requested. For modeling efficiency, we recommend starting with 2024. If that year attains, then 2023 and so on until we have one year that attains and the year before that does not. This should give us the information about what is the earliest year for attainment.

Page 25: We suggest changing “modeling design value” to “design value for modeling”

Page 26: Please clarify the “SMAT” label in the tables. They may be the SANDWICH concentrations and the “5-yr DV” rows are the SMAT concentrations. Please clarify the units in the rows.

Emission Inventory

Clarification – In the EI document we would like to understand the functional difference between the base year, and baseline year

Please identify the methodology for generating ammonia and condensable PM emissions numbers.

Page 1: Please be consistent in "emission inventory" versus "emissions inventory".

Page 1: "CAA" to "Clean Air Act" for clarity

Page 3: It would be helpful to refer to 172(c)(3) in Section 1.2, bullet 1 as the planning and reporting requirements.

Page 5: Please include extension years and RFP years in Table 1's calendar years similar to what was done for Table 2. There should be one RFP projected inventory and QM beyond the extended attainment date. It would be helpful to include basic information about extension years and RFP years to better foreshadow Table 2.

Page 7: Please clarify the "winter season" inventory as the "seasonal" inventory that represents the daily average emissions across the baseline episodes.

Page 7, paragraph 1. Please include reference documentation for the following statement, "results in extremely high heating energy demand per square foot experienced in no other location in the lower-48."

Page 9: Please change "Violations" to "Exceedances." Exceedance is the term for concentrations over the standard. Violations is the term for dv over the standard.

Page 9: Add "No exceedances were recorded outside the months tabulated in Table 3 that were not otherwise flagged by Alaska DEC as Exceptional Events.", to the end of the last paragraph on the page.

Page 13: Please clarify the provenance of the BAM data (e.g., "downloaded from [state database or AQS] on XX/XX/XXXX). In particular, it is important to note if the data has been calibrated to the regulatory measurement (aka, corrected BAM).

Page 17-18. Sentence Unclear "For example, a planning inventory based on average daily emissions across the entire six-month nonattainment season will likely reflect a relatively lower fraction of wood use-based space heating emissions than one based on the modeling episode day average since wood use for space heating Fairbanks tends to occur as a secondary heating source on top of a "base" demand typically met by cleaner home heating oil when ambient temperatures get colder."

Page 19: Remove "Where appropriate,". All source sectors should be re-inventoried for 2013, even if the emissions for the sector ends up being the same as in 2008.

Page 19: Change “projected forward” to “re-inventoried”, or similar wording. Reserve “project” for when the emission inventory is estimating emissions in a future year.

Page 20: Please refer to EPA’s memo on the use of MOVES2014a for the plug in adjustment. As a reminder, this information is sufficient only for development of the emissions inventory, not for SIP credit.

Page 20: Please submit the technical appendix referenced on page 20. When that is submitted, we expect to provide additional comment. To allow for review, we request expedited submission.

Page 21: At bottom of page, “project” should be “re-inventoried” or something that refers to an inventory produced after the fact.

Page 22, paragraph 1, Space heating area sources. Please further explain how the combined survey data best represents 2013 emissions.

Page 23: Add information about how NH_3 was inventoried for this category.

Page 23, 2nd paragraph from bottom. Facilities need to provide direct PM and all precursors, whether directly submitted or calculated from emissions factors.

Page 23, last paragraph.

- Potential typo – we believe that 2018 should be 2013.
- Question – Does scaling emissions cause any point source to exceed its PTE?

Page 25, bullet 3, Laboratory – Measured Emissions Factors for Fairbanks Heating Devices. The statement “first and most comprehensive systematic” would be more credible if simplified.

Page 27: Clarify how data from the 2014 NEI was modified to reflect emissions in 2013. Were they assumed to be the same between the two years? Or adjusted based on population change, or some other information?

Page 33: Please include information on how the Speciate database was used to develop the modeling inventory (and perhaps elsewhere for the planning inventory, if appropriate).

Precursor Demonstration

Throughout the Serious Area SIP we recommend using the terminology, Precursor Demonstration, to be consistent with the $PM_{2.5}$ Implementation Rule.

General: The overview of the nitrate chemistry is complicated. We suggest you combine the two discussions into one and organize it with the following logic:

1. Describe the two chemical environments: (1) daytime and (2) nighttime.
2. Describe the information that supports that daytime chemistry is not relevant here.
3. Describe the information that supports that nighttime chemistry is limited by excess NO.

4. Describe what happens if the entire emission inventory was increasing by a factor of 3.6 to get appropriate concentrations in the North Pole area. How does ammonium nitrate change?
5. Describe how increasing the emission inventory and then reducing all source sectors by 75% results in less of a reduction in $P_{M2.5}$ than reducing all source sectors by 75% in the original emission inventory.
6. NOTE: We are willing to provide a rough draft of this organization, if provided the original word document.

Title page: remove "com"

Page 2: Recommend using Section 188-190 instead of 7513-7513b.

Page 2: Recommend moving the last three sentences of the first paragraph to the end of the second paragraph.

Page 2: Please add "threshold" after 1.3 in the third paragraph.

Page 2: Please explain concentration-based and sensitivity-based before using the terms.

Page 2: Please add a footnote whether the numbers in the Executive Summary are SANDWICHed or not.

Page 3: Please change "has decided" to "decided."

Page 3: Make sure the concentrations listed for ammonia include ammonium sulfate and ammonium nitrate.

Page 5-7: The figure captions say that concentrations are presented but the images themselves have percentages. Please use concentrations for this analysis.

Page 9: The first paragraph says that the point sources are not responsible for the majority of sulfate at the monitors. Please substantiate that claim, or modify it.

Page 13: Please explain the relevance of referring to the VOC emissions of home heating in this summary of VOCs.

Page 14: Recommend adding "… and adjusted to reflect speciated concentrations for a total PM2.5 equal to the five year 2011-2015 design value" to the sentence that starts "The speciated PM2.5 data [were] analyzed.

Page 14: Please include the results of the concentration based analysis, perhaps as a table.

Page 14: Clarify that the concentration used for NH_3 is the ammonium sulfate and ammonium nitrate. See the draft EPA Precursor Demonstration Guidance.

Page 17: Recommend removing "slightly" and removing the sentence referring to rounding to the nearest tenth of a microgram.

Page 17-18: To help understand what is going on with the bounding run versus the normal run, it would be helpful to have the RRFs for the Modeled 75% scenario.

BACM

Page 9 and throughout: For clarity, please refer to the implementation rule as "$PM_{2.5}$" not "PM".

Page 14, Table 3. It would be helpful to include filter speciation data.

Page 16, Table 4: Please identify the RACM measures that were technologically and economically feasible but could not be implemented in the RACM timeline or note there were none.

Page 20 and 25, Table 6 and 7: For the final Table identifying the control measures evaluated, it would be helpful to identify the following: measure, cost/ton, BACM determination, MSM determination, and any additional comments.

Page 24: 12 measures were eliminated because they were determined to offer marginal or unquantifiable benefit. However, a measure may offer marginal benefit but may also cost very little. If there is another explanation for why these measures were not considered that follows the BACM steps, please include that in the Serious Area Plan.

Page 28: Stage 1 alerts are referred to multiple times including in Measure 2 on page 28 and Measure 33, pg 47 and pg 48. Please clarify in these analyses whether the measure applies during all stages of alerts and the associated level of control with each stage.

Page 33: Measure 13 identified that no SIPs existed or EPA guidance/requirements for the measure and incorrectly used that rationale as the conclusion for not considering the measure.

Page 34: The discussion of Measure 15 does not clearly state how Alaska and the Borough ensure that devices are taken out at the point of sale. It also does not clearly state the process for ensuring a NOASH application doesn't involve a stove that should have been taken out at the point of sale. It also states that stoves between 2.5 g/hr and 7.5 g/hr can get a NOASH, whereas page 37 implies that a stove must be <2.5 g/hr to be eligible for a NOASH.

Page 47: Measure 33 in Klamath County and Feather River is more stringent than what exists in Fairbanks now. Fairbanks allows open burning without a permit when there is no stage restriction. Alaska DEC prohibits open burning between November 1 and March 31, but the air quality plan makes it clear that the state relies on the Borough to carry out the air quality program in Fairbanks. The fact that the local borough does not require a permit for open burning outside of curtailments makes this measure less stringent in Fairbanks than in other locations. In addition, Fairbanks does not curtail warming fires during a Stage 1.

Page 48: Measure 34 is less stringent in Fairbanks than in Klamath County. Uncertainty in weather forecasting means that Stage 1 alerts are not called correctly all the time, and not everyone is aware of when an alert is in effect. It is much simpler and less prone to error to prohibit burn barrels and outdoor burning devices entirely.

Page 57: Measure 46 review curtailment exemptions. The current Fairbanks curtailment exemption “These restrictions shall not apply during a power failure.” should be reviewed to clarified that it only applies to homes reliant on electricity for heating. As currently written, it appears overly broad.

Page 68: Measure R7, Ban Use of Hydronic Heaters, incorrectly identifies that no other SIPs implemented the measure as rational for not evaluating.

Page 72: Measure R15 is technologically feasible.

Page 78: It may help to make a section break or Section 2 label for “Analysis of Marginal / Unquantifiable Benefit BACM Measures

Page 81-83: The discussion of Measure 6 may need additional documentation. Anecdotal evidence is that damping is common in Fairbanks and is potentially a bigger source of pollution than not having a damper at very cold conditions. If installation by a certified technician addresses this issue, that should be documented.

Page 84: The quote, “did not know if the rule had worked well” needs a reference. It is also not clear of how relevant that is. It could be implemented well in Fairbanks and the fact that it may not have worked well in another location does not make it technologically infeasible for this location.

Page 85-86: While qualitative assessments are helpful to provide context, a quantitative assessment will be necessary to evaluate the measures as BACM and MSM.

Page 88: There are references to Fairbanks in the conclusion for Measure 17, but the analysis refers to AAC code.

Page 89: There appears to be missing text in the Background section related to Method 9.

Page 91: Measure 23 could consider the solution that the decals could be reflective and would be seen by vehicle headlights. Measure 23 could also consider that the decals are used by neighbors to determine who is or is not in compliance. This may be helpful as citizen compliance assistance efforts could supplement the Borough enforcement program.

Page 98-100: Measure 40 needs to include a discussion of all the areas listed on page 22. In addition, if a date certain measure or if Measure 29 were instituted, Measure 40 would essentially be achieved.

Page 114: Measure R5 describes a similar rule in Utah but lists “none” under implementing jurisdictions. Please make consistent.

ULS Heating Oil

Page vii and Page 16: Please check your information on the percentage of households who have a central oil fired furnace. Please consult ADEC's contractor for the emissions inventory and home heating surveys about (1) the percentage of homes that heat only with an oil furnace, and (2) home with a central oil burner and a wood stove. We have seen different numbers than presented here.

Page 13: Please check the labels for Fairbanks HS #2 and Fairbanks HS #1. They may be switched.

Page 14: The statement that there is "a clear explanation" may not be correct, or at minimum is an overstatement. The difference in price between HS#1 and ULSD has varied over time, and the report did not include an explanation for the variations.

Page 14: The third paragraph assumes that the capital costs of shipping ULS would be more than exists today. However, all heating oil is shipped, regardless of sulfur content, and there is no justification for the report for why shipping ULS would be higher than for HS. Additionally, it is possible that the shipping cost per unit could go down marginally if only one product is being supplied to Fairbanks and/or if the quantity supplied increases.

Page 21: The text and Table 7 present inconsistent information. For instance, the text says that the discounted net-present value of scenario 2 is $10,232 while the table says it is $5,768.56.