ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Air Permits Program

TECHNICAL ANALYSIS REPORT

for

Air Quality Control Minor Permit AQ0014MSS02

City and Borough of Sitka
Jarvis Street Power Plant

Installation of Turbine

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Table of Contents

Abbreviations/Acronyms

AAC .....Alaska Administrative Code
ADEC.....Alaska Department of Environmental Conservation
CBS .....City and Borough of Sitka
CFR. .....Code of Federal Regulations
EU .....Emissions Unit
MR&R.....Monitoring, Recordkeeping and Reporting
N/A.....Not Applicable
ORL.....Owner requested limit(s)
PSD .....Prevention of Significant Deterioration
PTE .....Potential to Emit
TAR.....Technical Analysis Report

Units and Measures

bhp.....brake horsepower
Btu/gal.....British thermal units per gallon
gal/hr .....gallons per hour
gr./dscf .....grains per standard cubic feet per minute
lb .....pounds
lb/hr.....pounds per hour
lb/MWh.....pounds per megawatt-hour
kW.....kilowatts
MMBtu/hr .....million British Thermal Units per hour
MW .....megawatts
ppmw.....parts per million by weight
scfm.....standard cubic feet per minute
tpy .....tons per year
wt% .....weight percent

Pollutants

CH_4.....Methane
CO .....Carbon Monoxide
CO_2.....Carbon Dioxide
CO_2e.....Carbon Dioxide Equivalent
GHG.....Greenhouse Gas
N_2O .....Nitrous Oxide
NOx.....Oxides of Nitrogen
PM-10 .....Particulate Matter with an aerodynamic diameter less than 10 microns
SO_2 .....Sulfur Dioxide
VOC .....Volatile Organic Compound

1.0 Introduction

This Technical Analysis Report (TAR) provides the basis for the Alaska Department of Environmental Conservation's (Department's) decision to issue Air Quality Control Minor Permit AQ0014MSS02 to the City and Borough of Sitka (CBS) for their Jarvis Street Diesel Plant. The minor permit is classified under 18 AAC 50.508(6) for revising an existing Title I permit and 18 AAC 50.508(5) to establish a new owner requested limit (ORL).

1.1 Stationary Source Description

The Jarvis Street Diesel Plant is an electric utility managed by CBS and is classified under Standard Industrial Classification code 4911 and North American Industrial Classification System code 221112 (Fossil Fuel Electric Power Generation). The plant provides standby, maintenance, and emergency generation capacity to residential, commercial, and public customers in Sitka, Alaska. The Jarvis Street Diesel Plant supplements community power needs as a backup to hydroelectric power generated at two local lakes.

Emissions units (EUs) operating at the Jarvis Street Diesel Plant include four diesel generators. The stationary source contains several fuel storage tanks that are not subject to federal regulation. The primary fuel combusted at the stationary source is No. 2 diesel with sulfur content not exceeding 0.0036 percent by weight (wt%).

1.2 Permit History

The Department issued a Pre-Approved Emission Limit (PAEL) Permit AQ0014PL201 on September 24, 1997 to avoid a Title V permitting. The Department issued an ORL Permit AQ0014ORL01 on March 27, 2010 to replace the PAEL and limit the annual NOx emissions to 99.9 tons and avoid Title V permitting. The Department issued Minor Permit AQ0014MSS01 on April 20, 2012 to limit the annual NOx emissions to 249.9 tons and avoid Prevention of Significant Deterioration (PSD) classification. Jarvis Street Diesel Plant currently operates under Permit AQ0014MSS01.

1.3 Application Description

The community is experiencing increased demand because of a community-wide shift to electric heating. The plant is anticipating an increase in demand through 2015 during an expansion of the Blue Lake Hydroelectric Project. CBS intends to meet this demand by adding a turbine to the existing four diesel generators.

CBS submitted the minor permit application on April 8, 2013 and supplemented the application with an ORL for fuel use on June 19, 2013. The specific requests for the application:

- Authorize the installation and operation of a 16,045 kilowatts (kW) Solar Turbine;
- Include the turbine NOx emissions in the existing source-wide 249.9 tons per year (tpy) nitrogen oxides (NOx) limit and revise the associated monitoring, recordkeeping, and reporting (MR&R) requirements;
- Limit source-wide fuel consumption to 8.8 million gallons a year;

2.0 Emissions and Permit Applicability

The stationary source is an existing source, avoiding classification as a Prevention of Significant Deterioration (PSD) major source.

PSD Applicability for GHG
The potential-to-emit (PTE) of greenhouse gas (GHG) emissions before modification is17,562 tpy of carbon dioxide equivalent (CO_2e). The applicant is requesting a 8.8 million gallons a year fuel consumption ORL to limit source-wide GHG emissions to less than 100,000 tpy CO_2e.
PSD Applicability for Criteria Pollutants
The applicant has requested to retain the existing 249.9 tpy NOx ORL to avoid classification as a PSD major for NOx in this minor permit.

Minor Permit Applicability
The applicant is requesting to retain the NOx ORL at 249.9 tpy for new and existing emission units. Table 1 presents the PTE and permit applicability for the project under 18 AAC 50.502(c)(3)(A). As shown in Table 1, the project does not trigger minor permit requirements.

Table 1: Potential Emissions (tpy), Change in Emissions, and Permit Applicability

Description	NOx	CO	PM-10	SO_2	VOC	Source
Existing PTE	249.98	57.29	6.55	0.40	10.74	Table A-1 of this TAR
New PTE	249.98	57.29	7.23	2.09	21.61	Table A-1 of this TAR
Increase in PTE	0.0	0.0	0.68	1.69	10.87	
Increase Threshold	10	N/A	10	10	N/A	18 AAC 50.502(c)(3)(A)
Modeling Triggered?	No	N/A	No	No	N/A	

Table 2 presents assessable emissions for the stationary source.

Table 2: Assessable Emissions (tpy)

Description	NOx	CO	PM-10	SO_2	VOC	Total
New PTE	249.98	57.29	7.23	2.23	21.67	
Assessable Emissions	250	57	0	0	22	329

2.1 Department Findings

The Department reviewed the application and made the following finding:

- Minor Permit AQ0014MSS02 is classified under 18 AAC 50.508(6) because CBS is requesting revisions to terms and conditions of an existing permit.
- Minor Permit AQ0014MSS02 is classified under 18 AAC 50.508(5) because CBS is requesting an 8.8 million gallons a year fuel consumption limit to avoid classification as a PSD major source for GHG.

3.0 Permit Requirements

This section of the TAR provides a technical and regulatory basis for the requirements in Minor Permit AQ0014MSS02, classified under 18 AAC 50.508(6) and 18 AAC 50.508(5).

3.1 General Requirement for all Minor Permits

As required by 18 AAC 50.544(a), all minor permits issued under 18 AAC 50.542 must identify the stationary source, the project, the Permittee, contact information, the requirement to pay fees, ORLs that apply to the source, and the applicable standard permit conditions in 18 AAC 50.345.

a. The permit cover page identifies the stationary source, project, Permittee, and contact information.

b. The requirement to pay fees is included in Section 2 of the permit.

c. The ORLs are included in Section 4 of Minor Permit AQ0014MSS02 and are described in Section 3.3 of this TAR.

d. The standard permit conditions are in Section 7 of the permit.

3.2 Requirements for a Minor Permit Classified under 18 AAC 50.508(6)

As required by 18 AAC 50.544(i), the minor permit contains terms and conditions necessary to ensure that USAF will construct and operate the stationary source in accordance with 18 AAC 50.

The permit carries forward permit conditions from Minor Permit AQ0014MSS01 in this permit. These include the requirement to:

- burn diesel fuel that contains no more than 0.0036 percent by weight (wt%) of sulfur, which is equivalent to 36 parts per million by weight (ppmw) of sulfur. The applicant requested this fuel sulfur limit in Permit AQ0014MSS01 to avoid minor permitting under 18 AAC 50.502(c)(1).
- source test EU 4 if source-wide NOx emissions exceed 200 tons during any 12 consecutive months period; and
- source test each of EU 1 through 3 if source-wide NOx emissions exceed 200 tons during any 12 consecutive months period and any of EUs 1 through 3 burns more than 50,000 gallons of fuel during any 12 consecutive months period.

The permit authorizes the installation and operating of a turbine (EU 5), and includes NOx emissions from EU 5 in the source-wide 249.9 tpy NOx ORL.

To verify the vendor-provided NOx emission rates, the permit requires conducting a NOx source test on the new EU at four evenly spaced representative loads that span the operating range including the maximum and minimum loads. The Department specified a winter source test to capture the worst possible NOx emission rates. The lowest recorded temperature in Sitka since 1971 is 0°F[1]. Therefore, it is prudent to base the emission rates on the rates the vendor provided for 0°F.

[1] http://www.weather.com/weather/wxclimatology/monthly/USAK0224, June 24, 2013.

The Department allowed 180 days for testing the new turbine to coordinate the testing with 40 CFR 60, Subpart KKKK requirements. The Department is also requiring periodic testing once every five years for periodic verification of the vendor guaranteed NOx emission factor of 0.037 lb NOx/gallon.

a. State Visible Emission Standards for New Turbine (EU 5)
EU 5 is a fuel-burning equipment subject to the state standard in 18 AAC 50.055(a)(1). Minor Permit AQ0014MSS02 contains terms and conditions that require CBS to perform a Method 9 test on EU 5 to demonstrate initial compliance with the state standards.

b. State Particulate Matter (PM) Emission Standards for EU 5
EU 5 is a fuel-burning equipment subject to the state standard of 0.05 grains per standard cubic foot (gr./dscf) of exhaust gas in 18 AAC 50.055(b)(1). The Department used exhaust emission characteristics in the vendor specifications to show that the EU will comply with the state PM emission standards. As shown in Table A-2, the estimated grain loading of EU will not exceed 0.0023 grains per dry standard cubic foot. The applicant used Equation 19-1, Reference Method 19, 40 CFR 60 to estimate the grain loading as 0.0026 gr./dscf. Therefore, the permit does not require a source to demonstrate compliance with the PM standard. For initial compliance with the PM standard, the permit requires CBS to comply with the initial Method 9 VE test described under the VE standard.

c. Sulfur Compounds Emission Standards for EU 5
EU 5 is a fuel-burning equipment subject to the state standard for sulfur compound emissions of 500 ppm SO_2, averaged over three hours in 18 AAC 50.055(c). EU 5 will burn liquid fuel that contains no more than 36 ppmw of sulfur. The sulfur compounds in the exhaust of an EU burning such a fuel cannot exceed 500 parts per million (ppm) of SO_2, averaged over three hours. Section 3 of Minor Permit AQ0014MSS02 contains terms and conditions that ensure the sulfur content of the liquid fuel does not exceed 36 ppmw.

3.3 Requirements for a Minor Permit issued under 18 AAC 50.508(5)

This permit is establishing a new ORL of 8.8 million gallons a year to avoid PSD for GHG emissions. A source wide annual fuel use limit of 8.8 million gallons will limit the GHG emissions to less than 100,000 tons of CO_2e.

As required by 18 AAC 50.544(h), the minor permit includes terms and conditions that describe:

- the ORLs, including monitoring, recordkeeping, and reporting requirements;
- lists all equipment covered by the ORLs; and
- each permit classification under AS 46.14.130 the ORLs allow the owner to avoid.

The permit requires MR&R for fuel consumption in all EUs at the stationary source to verify compliance with the fuel consumption ORL. The permit requires MR&R for the hourly operating

The application states that lowest temperature ever at Sitka is -4° F, recorded in 1917, and temperatures were recorded below 0° F twice in Sitka's meteorological history.

load of the turbine because the vendor guaranteed the emission rates for operation at 65 percent load or higher. Section 4 of the permit contains these requirements.

3.4 Federal Emission Standard

The permit does not contain federal standards for EU 5 because an operating permit is being developed concurrently with this minor permit. The operating permit will contain the applicable federal standards for EU 5.

4.0 Permit Administration

An operating permit has not yet been issued to the source. Therefore, the source can operate under Minor Permit AQ0014MSS02 upon issuance.

CBS submitted an application for an operating permit in February 2013. The Department is in the processing the operating permit and has included the conditions of Minor Permit AQ0014MSS02 into the public notice draft operating permit.

Appendix A

Table A-1: Operating Hours. Emission Factors and PTE

EUs in Use	Rating	Gal/hr	Hr/yr	Input	NOx		CO		PM-10		VOC		SO_2	CO_2e
				MMBtu/yr	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	tpy	tpy
1	2,880 bhp	154	7,233	152,602	69.12		15.84		1.21		1.848			
2	3,856 bhp	192	5,402	142,094	92.54		21.21		1.51		2.474			98,650
3	3,856 bhp	192	5,402	142,094	92.54	249.98	21.21	57.29	1.51	7.23	2.474	21.61	2.23	
4	6,785 bhp	318	4,933	214,620	101.35		8.55		2.65		4.353			
5 (> 0°F)	15,434 kW	1,120	7,857	1,205,578	41.03		9.61		1.84		5.50			

Table Notes on Emission Factors (EF):
EUs 1, 2, and 3: EFs for NOx, CO, and VOC are from Table 3.4-1 of AP-42; PM EF of 0.0573 lb/MMBtu is from AP-42, Table 3.4-2. The lb/hphr EFs in Table 3.4-1 are multiplied by the rated capacities to obtain the lb/hr EFs.
EU 4: EFs for NOx, CO, and PM are vendor provided; VOC EF is from Table 3.4-1 in AP-42
The maximum rating for EU 5 is 16,045 kW when operating at sub-zero temperatures. The characteristics in the table are for operation at 0 deg F.
EU 5 (0 deg F): Vendor provided EFs. The vendor-provided NOx emission factors are lower than the NSPS standard of 74 ppmv.
PM EF for EU 5 is 0.012 lb/MMBtu, from AP-42, Table 3.1-2a
Gal/hr for EUs 1-4: Estimated from the rating of the equipment and 137,000 Btu/gal obtained from AP-42, Appendix A.
SO_2 Emissions calculated by mass balance. Emissions are twice the amount of sulfur in the fuel assuming 36 ppmw of sulfur. Density of the fuel 7.05 lb/gal
CO_2e EF = (CO_2 EF + (21 * CH_4 EF) + (310 * N_2O EF)) = 163.65 lb/MMBtu
GHG EF in kg/MMBtu come from 40 CFR 98, Table C-1 and Table C-2 – CO_2: 73.96; CH_4: 0.003; N_2O: 0.0006

Table A-2: Turbine Characteristics at 0°F

kW	MMBtu/hr	Gal/hr	scfm	lb NOx/hr	lb NOx/gal	lb PM/hr	gr PM/dscf
15,434	153.44	1,120	93,553	41.03	0.03663	1.84	0.00229

Table Notes:
The lb NOx/hr emission rates are based on vendor data. The vendor guarantees the rates for operation at or above 65% load.
lb NOx/gal = (lb NOx/hr) ÷ (Gal/hr)
PM hourly rates are based on 0.012 lb PM/MMBtu from AP-42, Table 3.1-2a.
The exhaust rates provided by the vendor The temperature at Sitka has not fallen below 0°F since 1971.