

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
AIR PERMITS PROGRAM

TECHNICAL ANALYSIS REPORT
For Air Quality Control Construction Permit AQ0323MSS01

Naknek Electric Association Inc.
Naknek Power Plant

REVISION OF STACK HEIGHTS

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ABBREVIATIONS/ACRONYMS

AAAQS.....	Alaska Ambient Air Quality Standards
AAC.....	Alaska Administrative Code
ACMP.....	Alaska Coastal Management Plan
AQIA.....	Air Quality Impact Analysis
COBC.....	Compliance Order by Consent
Department.....	Alaska Department of Environmental Conservation
EPA.....	United States Environmental Protection Agency
NEA.....	Naknek Electric Association
ORL.....	Owner Requested Limit
PSD.....	Prevention of Significant Deterioration
PTE.....	Potential to Emit
TAR.....	Technical Analysis Report

Units and Measures

ft.....	feet
gal/hr.....	gallons per hour
gal/day.....	gallons per day
gal/yr.....	gallons per year
hr.....	hours
hr/yr.....	hours per year
lb/gal.....	pounds of fuel per gal
lb/hr.....	pounds per hour
kW.....	kilowatts (electric)
lb.....	pounds
tpy.....	tons per year

Pollutants

CO.....	Carbon Monoxide
NO _x	Oxides of Nitrogen
NO ₂	Nitrogen Dioxide
PM.....	particulate Matter
PM-10.....	Particulate Matter with an aerodynamic diameter less than 10 microns
SO ₂	Sulfur Dioxide
VOC.....	Volatile Organic Compound

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1. Introduction

This Technical Analysis Report (TAR) provides the Alaska Department of Environmental Conservation's (Department's) basis for issuing an air quality control Minor Permit AQ0323MSS01 to Naknek Electric Association Inc. (NEA) for the Naknek Power Plant. The permit revises Construction Permit AQ0323CPT01, Revision 1, under 18 AAC 50.508(6). The Department proposes to incorporate Minor Permit AQ0323MSS01 into NEA's Title V Permit AQ0323TVP02, Revision 1 by administrative amendment under 18 AAC 50.542(e) and 18 AAC 50.326(c)(2).

1.1 Stationary Source Description

Naknek Power Plant is an existing rural electric utility in Naknek, Alaska that provides electricity to the communities of Naknek, South Naknek and King Salmon. It is classified as a major stationary source under the Prevention of Significant Deterioration (PSD) program. The plant houses ten diesel generator sets which NEA is currently operating under Construction Permit AQ0323CPT01, Revision 1; Operating Permit AQ0323TVP02, Revision 1; and Compliance Order by Consent (COBC) 2009-0927-50-8095.

1.2 Permit History

The Department issued Construction Permit AQ0323CPT01 on December 11, 2008 to rectify NEA's unauthorized installation of three emission units (Units 5a, 6a, and 7a) in 2005 and 2006. The installation was classified as a PSD-significant modification for oxides of nitrogen (NO_x), carbon monoxide (CO), and sulfur dioxide (SO₂).

Construction Permit AQ0323CPT01 Revision 1 required NEA to increase the stack heights for Units 1 through 10 to the heights NEA used in their ambient demonstration. The permit granted NEA 210 days from permit issuance to make the change.

NEA requested an informal review on December 26, 2008 wherein they asked for a 5-year period to phase-in the stack changes. The Department decided on March 12, 2009 that a 5-year period was excessive, but that extending the deadline to November 30, 2009 was warranted. The Department incorporated this finding as Revision 1 to Construction Permit AQ0323CPT01 on March 31, 2009. On April 13, 2009, NEA submitted a request for formal review, wherein they once again asked for a 5-year phase-in period for the stack changes. The Commissioner decided on June 15, 2009 to uphold the November 30, 2009 deadline.

NEA subsequently determined that smaller stack extensions would be adequate for demonstrating compliance with the applicable air quality standards and maximum allowable increases (increments), if made in conjunction with select operating restrictions. However, since there was inadequate time to revise the construction permit prior to the November 30, 2009 deadline, NEA entered into a Compliance Order by Consent (COBC 2009-0927-50-8095). Under the COBC, NEA committed to installing the shorter stack extensions by November 30th 2009 and to restricting operations as proposed.

NEA submitted their revised ambient demonstration and proposed operational restrictions in their October 2009 application for Minor Permit AQ0323MSS01. NEA completed the revised stack extensions by the November 30, 2009 deadline.

1.3 Application Description

The primary focus of NEA's permit application regards their desire to reduce the stack height requirements in Condition 4 of Construction Permit AQ0323CPT01, Revision 1 to the heights shown in Table 1. NEA provided a revised ambient air quality analysis (AQIA) to support their request. The reduced stack heights necessitated fuel sulfur and hourly operating limits to demonstrate compliance with the Alaska ambient air quality standards (AAAQS) and increments. NEA also asked the Department to change the pound per hour (lb/hr) emission factors for oxides of nitrogen (NO_x) in the owner requested limit (ORL) section of their construction permit to pound per gallon (lb/gal) emission factors. They also asked the Department to incorporate Minor Permit AQ0323MSS01 into their Title V permit by administrative amendment.

NEA itemized the desired Title I permit changes as nine specific requests. Each request included proposed permit language. NEA requested the following revisions and additions:

1. Revise stack height requirements in condition 4 of Permit AQ0323CPT01
2. Revise condition numbering
3. Limit fuel sulfur content to protect ambient air quality
4. Limit operation hours to protect ambient air quality
5. Revise fuel sulfur content monitoring, recording, and reporting
6. Update assessable emissions
7. Revise monitoring requirements of condition 18 of Permit AQ0323CPT01
8. Remove unnecessary ORLs
9. Delete monitoring in Conditions 21.3 and 22.3 of Permit AQ0323CPT01

In the original application, NEA proposed to burn fuel with a sulfur content not exceeding 0.33 percent by weight. They also proposed daily fuel limits when burning fuel with a sulfur content that exceeded 0.20 percent by weight. In a July 13, 2010 email to the Department, Jeanette Brena of Entrix, the consultant for NEA, reduced the requested fuel sulfur limit to 0.20 percent by weight. Ms. Brena stated NEA no longer burns fuel that contains more than 0.20 percent by weight of sulfur. This revision eliminated the need for daily fuel limits.

2. NEA Requests and Department Responses

NEA requested nine revisions to Construction Permit AQ0323CPT01 Revision 1. The following discussion gives details of the requested revisions and the Department's responses.

2.1 Request 1 and 2: Revision of Stack Heights to Protect Ambient Air Quality

NEA adequately demonstrated that the revised stack heights will *not* lead to modeled violations of the AAAQS or increments when operating their emission units within the requested constraints. The Department therefore granted NEA's request to reduce the required stack

heights to the levels shown in Table 1. The Department’s specific findings regarding NEA’s ambient demonstration is provided in Appendix B of this TAR.

Table 1: Current and Requested Stack Height Requirements

Unit ID	Model Number	Rating (kW)	Current Requirement (ft)	Requested Height (ft)
1	Caterpillar 3512	835	48	35.3
2	Caterpillar 3512	835	48	35.3
3	Caterpillar 3512	835	48	35.3
4	Caterpillar 3516B	1,322	48	35.3
5a	Caterpillar 3512B	1,050	50	34.3
6a	Caterpillar 3512B	1,050	50	34.3
7a	Caterpillar 3512B	1,050	50	34.3
8	White Superior 40SX16	1,000	48	36.6
9	Caterpillar3516B	1,135	48	38.2
10	Caterpillar 3516B	1,135	48	38.2

Condition 4 of Construction Permit AQ0323CPT01, Revision 1, contained a deadline for making the stack changes. The Department did not carry forward the deadline provision since NEA already made the changes under the COBC. The Department also did not use NEA’s requested wording and permit numbering system in Minor Permit AQ0323MSS01. The Department instead used a numbering system that maintained numerical flow throughout the minor permit.

2.2 Request 3 and 4: Fuel Sulfur and Hours Limits as New Conditions to Protect Ambient Air Quality

The Department added NEA’s requested fuel sulfur and hourly operating limits as new ambient air conditions in Minor Permit AQ0323MSS01. However, the Department used alternative wording in order to clarify the purpose for these conditions. The added conditions include monitoring and reporting requirements. The Department specified that hour meters must be accurate to within five percent or better - a common level of accuracy used in recent permits. NEA requested unlimited daily fuel combustion of fuel containing less than 0.20 percent sulfur by weight. The Department allowed unlimited fuel combustion in all units because the Department’s review of the AQIA confirmed that when burning fuel with sulfur content not exceeding 0.20 percent by weight, SO₂ emitted by the units do not lead to modeled violations of the AAAQS or increment.

2.3 Request 5: Revise Fuel Sulfur Content MR&R in Conditions 15 and 23

Condition 15 of Construction Permit AQ0323CPT01 Revision 1 reiterates the 500 parts per million sulfur compound emission limit contained in 18 AAC 50.055(c). It also established two methods by which NEA could demonstrate compliance with this emission limit. The primary method was to use fuel with a maximum sulfur content of 0.5 percent, by weight. NEA asked that they instead be allowed to demonstrate compliance by using fuel that meets the 0.2 percent by weight fuel sulfur limit required to protect the SO₂ AAAQS and increments. This change allows for consistent demonstration methods throughout the permit. The Department granted NEA’s request, but used different wording from what NEA suggested.

Condition 23 of Construction Permit AQ0323CPT01 Revision 1 established a sulfur dioxide Best Available Control Technology (BACT) limit for Unit IDs 5a, 6a and 7a. The limit restricted the

fuel sulfur content to 0.5 percent, by weight. NEA did not request a change to the BACT limit. However, they asked that the monitoring, recordkeeping and reporting requirements be revised so that they can demonstrate compliance with the 0.5 percent BACT limit by complying with the more stringent 0.2 percent ambient air limit. The Department granted NEA’s request, but used different wording from what NEA suggested.

2.4 Request 6: Update of Assessable Emissions

The new limits on annual operation hours and fuel sulfur content resulted in emission reductions. The Department therefore reduced the assessable emissions from 1,365 tpy to 1,252 tpy.

2.5 Request 7: Revise the Monitoring Requirements of Condition 18

NEA noted that Construction Permit AQ0323CPT01 Revision 1 changed the method for demonstrating compliance with a previously established NO_x ORL to avoid PSD review. Operating Permit AQ0323TVP01 required NEA to limit their annual power generation and annual fuel consumption, and to calculate their NO_x emissions using emission factors based on kilowatt-hours. Construction Permit AQ0323CPT01 Revision 1 consolidated and revised the monitoring requirements by requiring NEA to track operating hours (in lieu of fuel consumption and generated power). Construction Permit AQ0323CPT01 Revision 1 also required NEA to calculate their NO_x emissions from the hours of operation and unit-specific pound per hour (lb/hr) emission factors.

NEA requested the Department revert the monitoring requirement to fuel consumption, and to establish fuel-based emission factors for calculating the annual NO_x emissions. NEA provided the desired pound per gallon (lb/gal) emission factors in their permit application.

The Department has no preference as to whether emissions are based on an operating hour basis or on a fuel consumption basis, *as long as* the emission factors represent worst-case conditions (or are load-specific). The worst-case lb/hr NO_x emissions typically occur under full-load conditions. The worst-case lb/gal NO_x emission factors typically do not. The Department therefore reviewed NEA’s desired emission factors to ensure they represented the maximum emissions that could occur under the expected range of operation. The Department’s findings are provided in Table 2. The maximum emission rate for each unit is in bold font. Since these values match NEA’s requested values, the Department revised the NO_x ORL monitoring provision as requested by NEA.

Table 2: Fuel Based NO_x Emission Factors (lb/gal)

Percent of Rating	Units 1-3	Unit 4	Units 9 and 10	Unit 8
100	0.634	0.548	0.536	0.470
75	0.682	0.585	0.614	
50	0.696	0.590	0.641	
25	0.631	0.591	0.566	
10	0.585	0.583	0.499	

Table Notes:

$$(\text{lb}/1,000 \text{ gal}) = [(\text{lb}/\text{hr}) \div (\text{gal}/\text{hr})] \times 1,000$$

The Department selected the highest derived fuel-based emission factors

NEA requested that the Department make the revision retroactive to the previous 12-month period to avoid two types of calculations. The Department agrees that there is no need for duplicative reporting methods. Either approach would be acceptable, as long as there are adequate monitoring records to support the emission calculation. The Department therefore included a footnote in the permit granting NEA the option of applying the fuel-based method retroactively.

2.6 Request 8: Deletion of Condition 19 and 20 of Permit AQ0323CPT01

Conditions 19 and 20 limit Unit IDs 1, 2, 3, 4, 8, 9, and 10 to 150 tpy CO and 82 tpy SO₂ respectively. These were ORLs to avoid PSD review during a previous permit action. NEA requested the deletion of Condition 19 and 20 because the new restrictions on operation hours and fuel sulfur content reduce the potential emissions of these units to 121 tpy of CO and 60 tpy SO₂, which are less than the respective ORLs.

The Department agrees that the new restrictions will limit the potential CO and SO₂ emissions to levels below the previously established ORLs. However, restrictions are still needed to comply with the ORLs. The unrestricted CO and SO₂ emissions for these units are provided below in Table 3 and Table 4. The unrestricted CO emissions for the listed units are 194 tpy, which exceeds the 150 tpy ORL. The unrestricted SO₂ emissions for the listed units are 99 tpy, which likewise exceeds the 82 tpy ORL. Department is therefore maintaining the CO and SO₂ ORLs, but is allowing NEA to demonstrate compliance with these limits by complying with the ambient-air related hourly operational limit and fuel sulfur limit, respectively.

Table 3: CO Emission Rates and Emissions for Operating Each Unit 8,760 hr/yr

Unit	lb CO/hr	TPY CO
1, 2, 3	3.07	40.34
4	16.73	73.28
8	7.37	32.15
9, 10	5.50	48.18
All Units	---	193.95

Table Notes:

Caterpillar provided the emission rates (as given in Attachment B of application)

Tons pollutant emitted per year = (lb pollutant emitted per hour) × (hours operated per year) ÷ 2000

Table 4: Hypothetical SO₂ Emissions for Operating Each Unit 8,760 hr/yr

Unit	Max gal/hr	Gal/yr	Tons Fuel	Fuel with 0.2% S		Fuel with 0.33% S	
				Tons S in Fuel	TPY SO ₂	Tons S in Fuel	TPY SO ₂
1, 2, 3	58.4	1,534,752	5,410	10.82	21.64	17.86	35.72
4	89.6	784,896	2,767	5.53	11.06	9.13	18.27
8	68.5	600,060	2,115	4.23	8.46	6.98	13.97
9, 10	75.5	1,322,760	4,663	9.33	18.66	15.39	30.78
All Units	---			29.91	59.82	49.36	98.74

Table Notes:

Density of fuel is assumed to be 7.05 lb/gal

2.7 Request 9: Deletion of Condition 21.3 and 22.3 of Permit AQ0323CPT01

Conditions 21 and 22 of Construction Permit AQ0323CPT01 Revision 1, imposed NO_x and CO Best Available Control Technology (BACT) limits on Units 5a, 6a and 7a. The conditions also required NEA to demonstrate compliance with the limits through an initial source test. NEA conducted the test in January 2010. Sub-conditions 21.3 and 22.3 imposed subsequent source tests within 5 years of the initial demonstrations. NEA stated subsequent source test requirements are beyond the scope of a Title I permit, and should only be imposed through a Title V permit. They therefore asked the Department to delete sub-conditions 21.3 and 22.3 from the construction permit.

The Department agrees with NEA's position and deleted Sub-conditions 21.3 and 22.3 from the permit. The Department originally imposed these requirements in order to fulfill NEA's request to incorporate the construction permit provisions into their Title V permit as an administrative revision. In order to do this, the permit had to include the necessary elements of the operating permit provisions in 40 CFR 71.6. Since the Title V permit now contains the subsequent source testing requirements, the Department can now delete these conditions from the Title I permit.

3. Emissions Summary and Permit Applicability

The revisions NEA requested lead to decreases in emissions due to the newly imposed operational and fuel sulfur limits.

3.1 Emissions of NO_x

NEA requested 6,000 hours of operation for each of Units 1, 2, and 3 and 1,500 hours of operation for Unit 4. This implies NEA expects the permit to allow all other emission units to operate 8,760 hours a year each. NEA requested to maintain NO_x emission caps established in Construction Permit AQ0323CPT01. The NO_x emission cap in Permit AQ0323CPT01 consists of two parts:

- (a) A 578 tpy ORL for Units 1 through 4 and Units 8 through 10 in Condition 18; and
- (b) A 24.9 lb/hr BACT limit for Units 5a, 6a, and 7a in Condition 21, which is equivalent to 327 tpy.

As NEA requested, the Department limited hours of operation for Units 1 through 4 and maintained the cap on NO_x emissions from Units 1 through 4 and Units 8 through 10 at 578 tpy. This gives NEA flexibility to increase or decrease operating hours of Units 8, 9, and 10 depending on how many hours NEA actually operates Units 1 through 4. NEA did not request a revision to the 24.9 lb/hr BACT limit in Condition 21.

3.2 Gallons of Fuel Burned

NEA initially proposed daily fuel consumption limits as a function of fuel sulfur content, but revised the application to limit fuel sulfur content to 0.20 percent by weight. NEA's AQIA and Department's review showed the units can burn up to their maximum capacities when burning fuel with sulfur content not exceeding 0.20 percent by weight.

3.3 Minor Permit Applicability

NEA must obtain a minor permit to revise or rescind the terms and conditions of a construction permit, per 18 AAC 50.508(6). NEA’s request does not trigger any other permit classifications.

The potential CO, PM-10, VOC, and SO₂ emissions decrease because of the decreased operating hours and use of fuel with a lower sulfur content. The NO_x emissions cap does not change. The project therefore does *not* trigger the minor permit classifications under

18 AAC 50.502(c)(3)(A). This change in emissions is illustrated in the following two tables.

Table 5 presents the potential emissions under Minor Permit AQ0323MSS01. Table 6 presents the previous potential emissions under Construction Permit AQ0323CPT01 Revision 1.

Table 5: Summary of Potential Emissions under Minor Permit AQ0323MSS01 (tpy)

Emission Unit	NO _x	CO	PM-10	VOC	SO ₂	All Pollutants
5a-7a	327	116	3	4	27	477
1 – 4; 8 – 10	578	121	12	20	44	775
Total	905	236	15	25	71	1252

Table Notes:

Table 8 is derived from Table A-2 and Table A-3 of Appendix A of this TAR

Table 6: Summary of Potential Emissions under Construction Permit AQ0323CPT01

Emission Unit	NO _x	CO	PM-10	VOC	SO ₂	All Pollutants
5a-7a	327	116	3	4	67	517
1 – 4; 8 – 10	578	150	14	25	52	819
Total	905	266	17	29	149	1366

3.4 Assessable Emissions

Assessable emissions are the sum of pollutants emitted above 10 tpy. Since this project will lead to a decrease in emissions, the Department reduced the total assessable emissions. The revised value of 1,252 tpy reflects the total potential emissions, as shown in Table 5.

3.5 Department Findings

The Department finds that:

1. The Naknek Power Plant is classified as a major stationary source under 40 CFR 52.21(b)(1)(i)(a).
2. Revising the existing Title I permit conditions described in the application required a minor permit under 18 AAC 50.508(6).
3. As NEA requested, the Department can incorporate this minor permit into Title V Permit AQ0323TVP02, Rev 1 by administrative amendment under 18 AAC 50.542(e) and 18 AAC 50.326(c)(2) because the procedures used to issue this permit satisfy applicable requirements of 18 AAC 50.542, 18 AAC 50.326, and 18 AAC 50.544.
4. Applications classified under 18 AAC 50.508(6) must include the effect of revising the permit terms and conditions per 18 AAC 50.540(k)(3). Since NEA requested revisions to the terms and conditions established under a PSD review to protect the AAAQS and increments, they had to show the effect of these revisions on their previous ambient air

quality analysis. NEA’s revised analysis adequately fulfills the PSD ambient demonstration requirements listed in 40 CFR 52.21(k), (l), (m) and (o). The revised stack heights will not cause or contribute to a violation of the NO₂, CO and SO₂ AAAQS listed in 18 AAC 50.010, or the NO_x and SO₂ maximum allowable increases (increments) in 18 AAC 50.020, when the emission units are operated within NEA’s requested limits.

5. The Naknek Power Plant is located in the Bristol Bay Borough in the Southwest coastal district coastal zone. The Department determined during the processing of Permit-to-Operate 9525-AA007 and Construction Permit AQ0323CPT01 that the power plant satisfied Alaska Coastal Management Project (ACMP) requirements. Moreover, this is a minor permit that revises Construction Permit AQ0323CPT01 Revision 1 under 18 AAC 50.508(6). This classification is not on the ACMP list, and therefore, does not require further ACMP review.
6. The permit requires a 30 day public notice and an opportunity to hold a public hearing under 18 AAC 50.542(d)(1)(D) in accordance with 40 CFR 51.166(q)(2)(v). If a public hearing is requested, the Department will provide a 30 day notice prior to the hearing.
7. Because NEA has a TV permit, this permit need not contain a periodic affirmation that the permit still accurately describes the stationary source required under 18 AAC 50.544(d).

4. Permit Requirements

The Department issued this minor permit under 18 AAC 50.508(6), and 18 AAC 50.542. The following sections describe the permit requirements and content.

4.1 Requirements for All Minor Permits

As required by 18 AAC 50.544(a), a minor permit 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. The permit identifies the stationary source, project, Permittee, and contact information. The permit contains standard sections of a Title I permit. Standard sections include:

- (a) emission unit inventory that describes the characteristics of the emission units;
- (b) emission fees that describe fee requirements and assessable emissions;
- (c) general certification and information required of source;
- (d) generic standard conditions needed to make the permit enforceable;
- (e) applicable source test (if any) and monitoring requirements; and
- (f) documentation that lists major events during the development of the permit.

4.2 Requirements for Minor Permits Issued under 18 AAC 50.542

As required in 18 AAC 50.544(a), this permit:

- (a) identifies the stationary source and Permittee;
- (b) describes the project;
- (c) provides contact information;
- (d) requires Permittee to pay fees in accordance with 18 AAC 50.400-18 AAC 50.499;
- (e) requires compliance with ambient standards established under 18 AAC 50.201;
- (f) includes requirements of ORL under 18 ACC 50.225; and

(g) includes applicable standard permit conditions in 18 AAC 50.345.

4.3 Requirements for a Minor Permit issued under 18 AAC 50.508(6)

Minor Permit AQ0323MSS01 revises Construction Permit AQ0323CPT01 Revision 1. Per 18 AAC 50.544(i)(1), Minor Permit AQ0323MSS01 contains the conditions necessary to ensure that NEA operates their stationary source as described in their permit application.

4.4 Air Quality Impact Analysis under 18 AAC 50.540(k)(3)

The main purpose of NEA's permit application is to reduce the required stack heights. To achieve that, NEA requested limits on fuel sulfur content and annual operation hours. NEA submitted a revised AQIA to support their request. Appendix B of this TAR describes the Department's review of the AQIA.

5. Permit Administration

Minor Permit AQ0323MSS01 is classified under 18 AAC 50.508(6) because NEA asked the Department to revise conditions of Construction Permit AQ0323CPT01. NEA has requested the Department to incorporate Minor Permit AQ0323MSS01 provisions into Title V Operating Permit AQ0323TVP02, Rev 1 as an administrative revision. The Department intends to oblige NEA's request after EPA's 45 day review.

6. SO₂ Emissions Rate and Fuel Consumption

Table A-1 presents operating hours and hour emission rates of the other criteria pollutants.

Table A-1: Operating Hours and Pounds of Pollutants Emitted per Hour

Emission Unit	Hours per Year	NO _x	CO	PM-10	VOC
1	ORL 6,000 or less	37.04	3.07	0.31	0.71
2	ORL 6,000 or less	37.04	3.07	0.31	0.71
3	ORL 6,000 or less	37.04	3.07	0.31	0.71
4	ORL 1,500 or less	49.04	16.73	0.20	0.42
5a	8,760 unlimited	24.90	8.80	0.19	0.33
6a	8,760 unlimited	24.90	8.80	0.19	0.33
7a	8,760 unlimited	24.90	8.80	0.19	0.33
8	8,760 or less	32.17	7.37	0.94	0.95
9	8,760 or less	40.51	5.50	0.60	1.10
10	8,760 or less	40.51	5.50	0.60	1.10

Table Notes:

Operating hours of Units 1 – 4 are ORLs. Operating hours for Units 8 – 10 will vary depending on the actual operating hours the applicant did operate Units 1 – 4. Units 8 – 10 are backups.

Caterpillar, the vendor, provided the hourly emission rates

Table A-2 and Table A-3 present annual emissions. Table A-4 presents SO₂ PTE.

Table A-2: Annual Emissions (Tons per year)

Emission Unit	NO _x	CO	PM-10	VOC	Comments
1	111.12	9.21	0.93	2.13	Actual emissions may be less depending on hours operated
2	111.12	9.21	0.93	2.13	
3	111.12	9.21	0.93	2.13	
4	36.81	12.55	0.15	0.32	
5a, 6a, and 7a	327.3	115.50	2.49	4.35	Maximum possible emissions
8	207.9	32.28	4.12	4.14	Actual missions depend on hours operated
9		24.09	2.63	4.82	
10		24.09	2.63	4.82	
5a – 7a	327	116	2	4	Maximum possible emissions
1 – 4, 8 - 10	578	121	12	20	NO _x is capped
All Units	905	236	15	25	

Table A-3: Expected Fuel Consumptions Rates and SO₂ Emissions

Units	Rated Gal/hr	ORL Total Gal/yr	Total Tons Fuel/yr	SO ₂ (tpy)
1, 2, and 3	58.4	1,051,200	3,705	14.8
4	89.6	134,400	475	1.9
5a, 6a, and 7a	72.1	1,894,788	6,679	26.7
8	68.5	600,060	2,115	8.5
9 and 10	75.5	1,322,760	4,663	18.7
All Units		5,003,208	17,637	70.6

Table Notes:

Rated gal/hr is vendor's data

Fuel sulfur content assumed as 0.20 percent by weight.

Table A-4: Unlimited Fuel Consumptions Rates and SO₂ PTE

Units	Rated Gal/hr (Vendor's Data)	Unlimited Gal/day	Total Gal/day	SO₂ PTE (tpy)
1, 2, and 3	58.4	1,401.6 each	4,204.8	21.6
4	89.6	2,150.4	2,150.4	11.1
5a, 6a, 7a	72.1	1,730.4 each	5,191.2	26.7
8	68.5	1,644.0	1,644.0	8.5
9 and 10	75.5	1,812.0 each	3,624	18.7
All Units			16,814.4	86.6

7. Memorandum on Modeling

MEMORANDUM

State of Alaska
Department of Environmental Conservation
Division of Air and Water Quality

TO: File

DATE: May 10, 2010

THRU: Alan Schuler, P.E.
Environmental Engineer
Air Permits Program

FILE NO.: AQ0323MSS01 – Modeling

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SUBJECT: Review of
Naknek Electric Association's
Power Plant

This memorandum summarizes the Department's findings regarding the ambient assessment submitted by Naknek Electric Association (NEA) for the Naknek Power Plant. NEA provided the assessment as part of their October 2009 minor permit application (AQ0323MSS01) to revise the minimum stack height requirements established in Construction Permit AQ0323CPT01. As described in this memorandum, NEA's revised analysis adequately fulfills the showing requirements of 18 AAC 50.540(k)(3). The revised analysis shows that operating the Naknek Power Plant sources within the requested constraints will not cause or contribute to a violation of the Alaska Ambient Air Quality Standards (AAAQS) provided in 18 AAC 50.010, the maximum allowable increases (increments) listed in 18 AAC 50.020. NEA has also fulfilled the pre-construction monitoring analysis required under 40 CFR 52.21(k) and the additional impact analysis required under 40 CFR 52.21(o).

The Department previously approved a multi-pollutant ambient demonstration submitted by NEA in support of Construction Permit AQ0323CPT01. The Department's original findings are documented in the December 6, 2007 memorandum, *Review of the Naknek Ambient Assessments*. This memorandum only addresses those items that have changed subsequent to the original analysis, or that otherwise warrant discussion.

BACKGROUND

The Naknek Power Plant is an existing stationary source. NEA presently operates the power plant under Air Quality Control Construction Permit AQ0323CPT01, Rev. 1 and Title V permit AQ0323TVP02. The power plant is classified under 18 AAC 50.306 as a Prevention of Significant Deterioration (PSD) major stationary source.

The Department issued Construction Permit AQ0323CPT01 on December 11, 2008 to authorize a PSD major modification. The construction permit requires NEA to increase the existing stack heights for all ten diesel-electric generators by November 1, 2009, in order to comply with the AAAQS and increments. While the construction permit imposed the stack heights used by NEA in their ambient demonstration, NEA has since concluded that the cost to make those stack modifications is unobtainable. They therefore submitted a minor permit application under 18 AAC 50.508(6) to reduce the stack height requirements.

NEA was unable to submit their minor permit application in sufficient time for the Department to issue a decision prior to the November 1, 2009 deadline. The Department therefore allowed NEA to proceed with the requested stack modification under Compliance Order by Consent 2005-0504-37-4520. This approach allowed for quicker air quality improvements (due to the proposed increase in stack heights) than what would have occurred if NEA had to wait until after the Department processed their minor permit application. However, the requested changes were at NEA's risk – i.e., the Department could still require additional stack changes if the proposed stack heights are inadequate for protecting the AAAQS/increment.

NEA's request is not subject to PSD review because the proposed changes do not increase emissions. However, applicants subject to 18 AAC 50.508(6) must show the effect of revising or revoking the permit term or condition per 18 AAC 50.540(k)(3). Because NEA requested a revision of ambient air terms and conditions established under the PSD program, they must update the ambient air portions of the PSD permit application, i.e, they must provide:

- A revised "Source Impact Analysis" (an AAAQS and increment demonstration) for the PSD-triggered pollutants – per 40 CFR 52.21(k);
- A revised "Air Quality Analysis" (preconstruction monitoring data) for the PSD-triggered pollutants – per 40 CFR 52.21(m); and
- A revised "Additional Impact Analysis" – per 40 CFR 52.21(o).

NEA does not need to provide a Class I impact analysis under 40 CFR 52.21(p) since this was not required in the original PSD application. The PSD-triggered pollutants that NEA must include in their revised ambient air assessments are: nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and carbon monoxide (CO).

APPROACH

NEA used AERMOD version 07026 in their revised ambient air demonstration. AERMOD version 07026 was the latest version available when NEA modeled this project.

EPA released AERMOD version 09292 on October 23, 2009. This new version of AERMOD includes an updated algorithm for predicting NO₂ impacts and potentially predicts greater impacts than the 07026 version. Because NEA's modeled NO₂ impacts are close to the AAAQS (95.7 µg/m³, including background), the Department ran a NO₂ sensitivity analysis using AERMOD version 09292. The resulting analysis showed little variation from the maximum impact predicted using version 07026. NEA's predicted impact (excluding background) using version 07026 was 77.1 µg/m³; the Department's was 77.2 µg/m³ using version 09292. Therefore, the 07026 version of AERMOD is acceptable for this application.

AECOM conducted the ambient analysis on behalf of NEA. The Department has previously approved NEA's approach, including the use of the Plume Volume Molar Ratio Method (PVMRM) algorithm.

Because NEA plans to replace provisions of a PSD permit, the modeling analysis was more comprehensive in approach. Below is a summary of NEA's approach:

- Conduct dispersion modeling to determine maximum model predicted impacts for the PSD triggered pollutants (NO₂, SO₂, CO).

- Compare the predicted impacts to the Class II Significant Impact Levels (SILs) and define the Significant Impact Areas (SIAs) for all criteria pollutants that exceed the SILs.
- Compare the predicted impacts to the pre-construction monitoring thresholds to determine whether pre-construction monitoring is required.
- Determine off-site sources to include in the AAAQS and PSD increment modeling based on the SIAs and source size.
- Conduct cumulative dispersion modeling for all NEA emission units and applicable off-site emission units (if any) to determine the total impact for comparison to AAAQS and PSD increments.

Facility Layout

NEA identified the 10 emissions units, one multi-tiered building, and 6 storage tanks as part of the facility layout. The location of the buildings and emission sources were based upon AutoCAD drawings developed by the applicant. The survey control point is located at the Northeast corner of the property with the site survey provided in UTM NAD83 in units of meters. This is the same coordinate system used to identify the receptors. The site location was verified by referencing its position on a USGS topographic map.

Meteorological Data

AERMOD requires hourly meteorological data to estimate plume dispersion. NEA used the same data set as used in their previous analysis, which consisted of five years (1988-1992) of National Weather Service (NWS) data from King Salmon, AK and concurrent upper air data from King Salmon. NEA reprocessed the data sets using AERMET version 06341, which is the current EPA release.

AERMET requires site-specific values (representative of the meteorological site) for the following three surface characteristics: noon-time albedo, bowen ratio, and surface roughness length. NEA updated their approach for processing the surface characteristics per current EPA and Department guidance. They also used EPA's 2008 AERSURFACE User's Guide to determine the parameters for each land-use classification. The resulting AERMET surface parameters are reasonable.

EPA allows the high second-high (h2h) modeled concentration to be compared to short-term air quality standards if at least one year of temporally representative site-specific, or five years of representative off-site data, are used. When these criteria are not met, then the highest estimate is to be used. Since NEA used five years of data, the Department allowed NEA to compare the h2h estimate to the short-term SO₂ standards.

Ambient Air Boundary

As in their previous modeling approach, NEA used the facility fence line as their ambient air boundary.

Emission Rates and Stack Parameters

NEA's basic parameters for each emission unit remain unchanged since their original PSD application. These parameters, such as exhaust temperatures and exit velocities, can be found in the vendor data supplied with that application. The CO emission rates also remain unchanged from the previous modeling analysis.

Stack Heights

The Department imposed a minimum stack height for each emission unit in Construction Permit AQ0323CPT01. NEA requested that the minimum stack heights be reduced to the levels shown in **Table 1**. NEA used the requested stack heights in the revised modeling analysis. In both cases, the stack height refers to the release height above the grade.

Table 1: Modeled Stack Heights

Emission Unit	Stack Height in AQ0323CPT01 (m)	Revised Stack Height (m)
1	14.63	10.75
2	14.63	10.75
3	14.63	10.75
4	14.63	10.75
5a	15.24	10.45
6a	15.24	10.45
7a	15.24	10.45
8	14.63	11.15
9	14.63	11.65
10	14.63	11.65

NO_x Emission Rates

NEA’s construction permit has an ORL for NO_x emissions to limit emissions from Units 1 – 4 and 8 – 10 to 578 tons per year. The construction permit modeling conservatively modeled Units 1 – 10 running at 8,760 hours per year resulting at a run time higher than the ORL. For this modeling, NEA applied the NO_x ORL to the emission units to emulate a more accurate emission setting. NEA performed a sensitivity analysis on the emission units subject to the ORL to rank each emission unit from highest to lowest impact by assuming a 1 g/s emission rate for each unit. The ORL was then subsequently allocated to the higher emission units until the total emissions equaled 578 tons per year. Additionally, NEA applied an hourly limit to the higher impacting engines to keep those units from being modeled with an undesirably large percentage of the 578 tpy ORL. NEA requests that Unit 4 run only 1,500 hours per year and Units 1 – 3 at 6,000 hours per year per unit. This gives the final emission rates used in the overall modeling shown below in **Table 2**. The Department concurs with this approach.

Table 2: NO_x Sensitivity Test

EU ID – Ranked Highest to Lowest	Maximum Impact from All Years (µg/m ³) ¹	Max Hourly NO _x Emission Rates (lb/hr)	Proposed ORL (hr/yr)	Total NO _x Emission Rates with ORLs (tpy)	Total Modeled NO _x Emission Rates with Cap Applied (tpy)	Modeled Annual NO _x Emission Rates (g/s)
4	27.73	49.04	1,500	36.78	36.78	1.06
3	27.27	37.04	6,000	111.12	111.12	3.20
2	22.54	37.04	6,000	111.12	111.12	3.20
1	19.59	37.04	6,000	111.12	111.12	3.20
8	15.63	32.17	8,760	140.90	140.90	4.05
9	15.15	40.51	8,760	177.43	66.96	1.93
10	12.06	40.51	8,760	177.43	0.00	0.00
Total				865.9	578.0	

¹ Assumes 1 g/s at 8,760 hrs/year. Used to rank emission units based on impact.

SO₂ Emission Rates

SO₂ emissions are directly related to the amount of sulfur in the fuel. In their PSD application, NEA assumed a 0.50 percent, by weight, fuel sulfur content. They reduced the maximum fuel sulfur content to 0.33 percent in their minor permit application. This reduction is needed to help offset the increased impacts associated with the shorter stack heights. The Department is therefore imposing a 0.33 percent fuel sulfur limit to protect the SO₂ AAAQS and increments.

NEA also found that additional restrictions are needed to protect the 24-hour SO₂ AAAQS and increment. While NEA did not discuss the restrictions in terms of a daily SO₂ emission rate, NEA essentially limited the source-wide SO₂ emissions to a nominal level of 480 pounds per day. NEA requested this source-wide limit by requesting daily fuel consumption limits when burning fuel that contains more than 0.20 percent sulfur. NEA’s specific request (and modeling approach) incorporated a tiered approach based on the fuel sulfur content for establishing the daily fuel limits. NEA’s requested limits (per unit) and the resulting source-wide SO₂ emissions are shown below in **Table 3**.

Table 3: Tiered Fuel Consumption Limits Based on Fuel Sulfur Content

S (wt%)	Fuel Limit Per Unit (gal/day)	Source-Wide SO ₂ Emissions (lb/day)
0.33 ≥ S > 0.30	1,000	468
0.30 ≥ S > 0.25	1,100	468
0.25 ≥ S > 0.20	1,350	480
0.20 ≥ S	No Limit	478

NEA used the hour per year and gallon per day restrictions for determining the annual average SO₂ emission rates. Therefore, the hour per year restrictions are needed to protect the annual average SO₂ AAAQS/increment as well as the annual average NO₂ AAAQS/increment; and the gallon per day restrictions are needed to protect the annual average SO₂ AAAQS/increment as well as the 24-hour SO₂ AAAQS/increment.

Increment Emissions

NEA modeled the NO₂ and SO₂ increment using the same method as in their previous modeling analysis.

Downwash

NEA reran BPIP for the new stack heights in order to determine the revised building profile dimensions. NEA used the current BPIP program (BPIP-Prime version 04274).

Receptor Grid

NEA used the same receptor grid spacing as the previous model with only minor changes. NEA removed the 500m spacing far-field grid that extended from the 1 km border out to 5 km in each cardinal direction. The previous modeling analysis showed that the major impact occurred at the fence line and the Department concluded that the far-field grid was not necessary.

The Department approved NEA to use two sets of data to verify the terrain elevations. NEA used both terrain elevation and hill scale heights derived from the National Elevations Data (NED) set inputted into AERMAP and site-specific survey data. Based on a comparison between the datasets, NEA discovered that the two data source had a 3 meter offset. NEA increased the surveyed base elevation for each source by 3 meters to be consistent with the AERMAP receptor elevations.

Pre-Construction Monitoring

In addition to demonstrating compliance with the AAAQS and increments, NEA also had to update their pre-construction monitoring demonstration conducted under 40 CFR 52.21(m)(1) of the PSD program. This provision requires PSD applicants to submit ambient air monitoring data, unless the existing concentration or the project impact is less than the monitoring threshold provided in 40 CFR 52.21(i)95). The requirement only pertains to the pollutants subject to PSD review.

In NEA's PSD application, NEA demonstrated that project impacts were less than the pre-construction monitoring thresholds for NO₂ and CO, but not for SO₂. For the reasons described in the Department's December 6, 2007 memorandum, the Department accepted NEA's use the ambient SO₂ data collected by the Nome Joint Utility System (NJUS) as a worst-case surrogate of the maximum ambient SO₂ concentration in Naknek.

NEA provided a revised pre-construction monitoring demonstration with their minor permit application. The findings and conclusions regarding the revised demonstration is provided in the "Results and Discussion" section of this memorandum.

Background Concentrations

NEA used the same background concentrations as used in their PSD application.

RESULTS AND DISCUSSION

Pre-Construction Monitoring

Table 4 below shows the project impacts as compared to the pre-construction monitoring thresholds for NO₂, CO, and SO₂. As shown in the table, the project exceeds the pre-construction monitoring thresholds for NO₂ only. SO₂ and CO do not exceed the pre-construction monitoring thresholds.

Table 4: Pre-Construction Impacts

Pollutant	Sulfur Content (%wt)	Averaging Time	Project Impact (µg/m ³)	Pre-Construction Monitoring Threshold (µg/m ³)	Exceed Pre-Construction?
NO ₂	N/A	Annual	27.6	14	Yes
CO	N/A	8-Hour	34	575	No
SO ₂	0.20	24-Hour	3.3	13	No
	0.25		3.3		
	0.30		2.9		
	0.33		2.9		

NEA discussed the NO₂ project impact results with the Department during an August 21, 2009 teleconference. It was decided that NEA may use the same approach as previously used to address the pre-construction monitoring issue for SO₂ – i.e., rely on the ambient data collected by NJUS as a worst-case surrogate of the maximum ambient NO₂ concentration in Naknek. NJUS collected this data near their Snake River power plant between August 2002 and September 2004.

As with the SO₂ data, the NJUS NO₂ data does not meet the PSD quality assurance requirements. There are too many uncertainties to confirm the specific values of the data set. *However*, there was sufficient information to justify the approximate range of the values. The maximum NO₂ concentrations are also very small – less than 10% of the annual average AAAQS. The Department is therefore accepting the NJUS NO₂ data as adequate for meeting the pre-construction monitoring requirements in NEA’s permit application for the following reasons:

- 1) NEA cannot fully comply with the pre-construction monitoring requirements since they are already operating the subject emission units; and
- 2) The NJUS data shows that the AAAQS is not threatened or exceeded, which satisfies the intent of the pre-construction monitoring requirement.

While the Department is accepting the NJUS NO₂ data for this application, the Department will not accept it in future applications. Applicants are to submit PSD applications prior to making the requested change, not after. Therefore, reason 1) above should no longer be a consideration in future submittals. Since true pre-construction data is expected in future PSD applications, these future data sets must *fully* comply with the PSD requirements.

Significant Impact Levels

The NO₂, CO, and SO₂ project impacts are shown below in **Table 5**. As shown in the table, SO₂ (at all fuel grades) and NO₂ exceed the SILs; CO does not. The maximum impacts all occur along the fence line. These results show that modeling cumulative impact analysis is required for SO₂ and NO₂ to ensure that these pollutants do not violate the ambient standards and increments. A cumulative impact analysis is not required for CO.

Table 5: SIL Concentrations Comparison

Pollutant	Averaging Time	Project Impact ($\mu\text{g}/\text{m}^3$)	Class II SIL ($\mu\text{g}/\text{m}^3$)	Exceed SIL?
NO ₂	Annual	27.6	1	Yes
CO	1-Hour	121	2000	No
	8-Hour	34	500	
Sulfur Content = 0.20%				
SO ₂	3-Hour	11.5	25	No
	24-Hour	3.3	5	
	Annual	23	1	Yes
Sulfur Content = 0.25%				
SO ₂	3-Hour	83	25	Yes
	24-Hour	3.3	5	No
	Annual	25	1	Yes
Sulfur Content = 0.30%				
SO ₂	3-Hour	189	25	Yes
	24-Hour	2.9	5	No
	Annual	27	1	Yes
Sulfur Content = 0.33%				
SO ₂	3-Hour	254	25	Yes
	24-Hour	2.9	5	No
	Annual	29	1	Yes

Maximum AAAQS Impacts

The maximum NO₂ and SO₂ AAAQS impacts are shown below in **Table 6**. Only the SO₂ values that exceeded the SILs were modeled for compliance with the standards and increments. The background concentrations, total impacts and AAAQS are also shown. As shown in **Table 6**, the total impacts are less than the respective AAAQS. Therefore, NEA has demonstrated compliance with the AAAQS.

Table 6: Maximum AAAQS Impacts

Pollutant	Averaging Time	Maximum Modeled Concentration ($\mu\text{g}/\text{m}^3$)	Bkgd Conc ($\mu\text{g}/\text{m}^3$)	TOTAL IMPACT: Max conc plus bkgd ($\mu\text{g}/\text{m}^3$)	Ambient Standard ($\mu\text{g}/\text{m}^3$)
NO ₂	Annual	77.1	18.6	95.7	100
Sulfur Content = 0.20%					
SO ₂	Annual	33.1	5	38.1	80
Sulfur Content = 0.25%					
SO ₂	3-Hour	594	44	638	1300
	Annual	35.4	5	40.4	80
Sulfur Content = 0.30%					
SO ₂	3-Hour	714	44	758	1300
	Annual	37.4	5	42.4	80
Sulfur Content = 0.33%					
SO ₂	3-Hour	786	44	830	1300
	Annual	38.9	5	43.9	80

Maximum Increment Impacts

The maximum increment impacts are provided in **Table 7**, along with the Class II increment standards. As shown in **Table 7**, the maximum impacts are less than the applicable Class II standard. Therefore, NEA has demonstrated compliance with the Class II increment standards.

Table 7: Maximum Increment Impacts

Pollutant	Avg. Period	Maximum Modeled Conc. ($\mu\text{g}/\text{m}^3$)	Class II Increment Standard ($\mu\text{g}/\text{m}^3$)
NO ₂	Annual	6.1	25
Sulfur Content = 0.20%			
SO ₂	Annual	9.0	20
Sulfur Content = 0.25%			
SO ₂	3-Hour	100	512
	Annual	11.2	20
Sulfur Content = 0.30%			
SO ₂	3-Hour	133	512
	Annual	14.0	20
Sulfur Content = 0.33%			
SO ₂	3-Hour	154	512
	Annual	15.0	20

It is important to note that since ambient concentrations vary with distance from each source, the maximum values shown represent the highest value that may occur somewhere in the local airshed. They do *not* represent the highest concentration that could occur at *all* locations in the area.

Vegetation Impacts

NEA revised their approach for assessing potential vegetation impacts under the Additional Impact Analysis required under 40 CFR 52.21(o). Rather than comparing their modeled impacts to EPA’s circa-1980 vegetation screening thresholds, NEA followed the Department’s current guidance of demonstrating compliance with the secondary ambient air quality standards for the PSD-triggered pollutants. NEA therefore complied with this requirement through the AAAQS demonstration discussed above.

CONCLUSION

The Department has reviewed NEA’s modeling analysis for the Naknek Power Plant and concluded the following:

1. NEA’s revised analysis fulfill the ambient demonstration requirements of 40 CFR 52.21(k), (l), (m) and (o).
2. The NO₂, SO₂, and CO emissions associated with NEA’s project will not cause or contribute to a violation of the ambient air quality standards provided in 18 AAC 50.010, the maximum allowable increases (increments) provided in 18 AAC 50.020 – as applicable.
3. NEA conducted their modeling analysis in a manner consistent with EPA’s *Guideline on Air Quality Models*.

The Department has incorporated NEA's requested stack changes in Minor Permit AQ0323MSS01, along with the requested operating limits used to ensure NEA complies with the ambient air quality standards and increments. These conditions are summarized below.

1. Maintain the following stack heights. Ensure the stacks are uncapped and oriented vertically:

Emission Unit	Minimum Stack Height Above Ground (m)
1	10.75
2	10.75
3	10.75
4	10.75
5a	10.45
6a	10.45
7a	10.45
8	11.15
9	11.65
10	11.65

2. Limit the operation of Units 1 – 4 as follows:

Emission Unit	Hour Limit (hrs/yr)
1	6,000
2	6,000
3	6,000
4	1,500

3. Limit the sulfur content of the fuel burned to no greater than 0.33 percent, by weight.
4. Limit the daily fuel consumption as shown below for the indicated fuel sulfur contents:

S (wt%)	Fuel Limit Per Unit (gal/day)
$0.33 \geq S > 0.30$	1,000
$0.30 \geq S > 0.25$	1,100
$0.25 \geq S > 0.20$	1,350
$0.20 \geq S$	No Limit