

Technical Analysis Report
For the terms and conditions of
Minor Permit AQ0215MSS05

Issued to:
City of Unalaska

For the:
Dutch Harbor Power Plant

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ADEC/Air Permits Program

Preliminary - April 10, 2020

1. INTRODUCTION

This Technical Analysis Report (TAR) provides the Alaska Department of Environmental Conservation's (Department's) basis for issuing Minor Permit AQ0215MSS05 to the City of Unalaska (the City) for the Dutch Harbor Power Plant (DHPP). The City submitted an application under 18 AAC 50.508(5) to establish a new owner requested limit and under 18 AAC 50.508(6) to revise terms and conditions previously established in a Title I permit. The permit is also classified under 18 AAC 50.502(c)(2)(B) for the installation of a new emission unit with a rated capacity exceeding 10 million British thermal units per hour in a sulfur dioxide special protection area. Minor Permit AQ0215MSS05 rescinds Minor Permit AQ0215MSS04 and revises Minor Permit AQ0215MSS03.

2. STATIONARY SOURCE DESCRIPTION

The Dutch Harbor Power Plant is an existing stationary source located at the south-east shore of Amaknak Island, a neighborhood connected by bridge to Unalaska Island. The area is not linked to a regional power grid. DHPP is the sole power provider to about 550 residential and commercial customers in the Unalaska and Dutch Harbor area. DHPP consists of several fuel storage tanks and several diesel-electric generators varying in both size and installation date.

Federal prevention of significant deterioration (PSD) and Alaska Air Quality Control Regulations designate the area as Class II for purposes of PSD increment compliance. The location is also within an area designated as special protection for sulfur dioxide (SO₂) under 18 AAC 50.025(c)(1). The nearest Class I areas are the Bering Sea National Wildlife Refuge located 500 miles north, and the Simeonof National Wildlife Refuge located 257 miles northeast of DHPP. DHPP is classified as a PSD major source because it has the potential to emit (PTE) at least 250 tpy of NO_x. This permit reauthorizes the installation of EU ID 16 and authorizes the restarting of EU IDs 7 and 8. The City currently operates the DHPP under Operating Permit AQ0215TVP04.

3. APPLICATION DESCRIPTION

The City submitted an application for Minor Permit AQ0215MSS05 on January 6, 2020 to rescind Minor Permit AQ0215MSS04 and to withdraw the application for Construction Permit AQ0215CPT05. Minor Permit AQ0215MSS04 authorized the initial installation of EU ID 16, and to avoid PSD review, it required that EU IDs 7 and 8 be removed from service. The application for Minor Permit AQ0215MSS05 requested a new minor permit to authorize the installation of EU ID 16 without requiring the removal of EU IDs 7 and 8. Minor Permit AQ0215MSS04 also included a PSD avoidance limit for EU ID 16 of 94.41 lb/hr NO_x, which was based on the manufacturer's not-to-exceed emission rate. The application for AQ0215MSS05 included a new owner requested limit (ORL) to restrict the combined actual NO_x emissions from EU IDs 7 and 16 to no more than 161.7 tons per year as a surrogate for PTE. This limit was derived from baseline actual NO_x emissions of 121.8 tpy from EU ID 7 (between January 2009 and December 2010) with a new allocation of 39.9 tpy of NO_x for EU ID 16. The application also included a new ORL to restrict the power production of EU ID 16 to no greater than 3,740 kW during any given hour.

The authorization of EU ID 16 in Minor Permit AQ0215MSS05 allows the City to continue to avoid PSD review and is consistent with the requirements in 40 CFR 52.21(r)(4) and 18 AAC 50.544(i)(1)(B).

The application requested the following changes to existing ORLs in Minor Permit AQ0215MSS03.

- Remove the combined power production limit on EU IDs 7, 8, 13, 14, and 15 of 105,803 megawatt hours (MWh) per 12-month period in Condition 22.3 of Minor Permit AQ0215MSS03. This operational limit was used to demonstrate compliance with the PSD avoidance limits for SO₂ and VOC emissions. In order to demonstrate compliance with the SO₂ and VOC emissions limits, replace the monitoring, recordkeeping and reporting (MR&R) of MWh produced per 12-month period with MR&R of actual SO₂ and VOC emissions as a surrogate for PTE.
- Revise the MR&R in Condition 23 of Minor Permit AQ0215MSS03, which contains outdated PM₁₀ emission factors (EFs), to base the PM₁₀ calculations on updated EFs in units of lb/MMBtu or g/kW-hr from AP-42, vendor data, and accepted source test results.

As required under 18 AAC 50.540(c)(2)(C), the application included an ambient air quality analysis to demonstrate that the project, as restricted according to Appendix B, will not cause or contribute to a violation of the SO₂ Alaska Ambient Air Quality Standards (AAAQS).

4. CLASSIFICATION FINDINGS

The Department finds that this project is classified under 18 AAC 50.508(5), 18 AAC 50.508(6), and 18 AAC 50.502(c)(2)(B).

5. APPLICATION REVIEW FINDINGS

Based on the review of the application for AQ0215MSS05, the Department finds that:

1. The City's minor permit application for the Dutch Harbor Power Plant contains the elements listed in 18 AAC 50.540.
2. The PSD applicability analysis submitted on January 6, 2020 included only Step 1 of the two-step analysis and relied upon an EPA Memorandum dated March 13, 2018 which allows the use of emissions reductions in Step 1. The Department had requested the use of both steps of the two-step process, as codified under 40 CFR 52.21. The City submitted an application addendum that correctly provided a two-step PSD analysis, including contemporaneous emissions increases, on February 27, 2020.
3. In order to avoid PSD review for the installation of EU ID 16, Minor Permit AQ0215MSS04 required the decommissioning of EU IDs 7 and 8. With the recession of AQ0215MSS04, EU IDs 7 and 8 become existing EUs and EU ID 16 becomes a new EU for permit applicability under Minor Permit AQ0215MSS05.
4. The reauthorization of EU ID 16 will be consistent with 18 AAC 50.544(i)(1) and 40 CFR 52.21(r)(4).

5. The ORL restricting the combined NO_x emissions from EU IDs 7 and 16 to no more than 161.7 tons per year allows DHPP to continue to avoid PSD review for EU ID 16. The Permittee will demonstrate compliance by tracking and reporting actual NO_x emissions.
6. The request to limit the power production of EU ID 16 is not a stand-alone ORL under 18 AAC 50.508(5) because it is not necessary to avoid a permit classification under AS 46.14.130. However, the operational restriction on EU ID 16 is necessary to ensure compliance with the owner requested NO_x limit by ensuring that the NO_x emission factor is accurate.
7. The NO_x EF used to calculate PTE for EU ID 16 is from a September 2015 source test. The EF corresponds to a load of 3,760 kWe. Therefore the Department will impose a power production limit on EU ID 16 of no greater than 3,760 kWe during any given hour rather than the 3,740 kW load requested in the application.
8. The City intends to operate EU ID 16 at approximately 80-85 percent of its maximum load (below 3,760 kWe) but to calculate PTE, they used manufacturer provided emission factors for CO and VOC corresponding to a load of 4,416 kWe and a PM₁₀ source test emission factor corresponding to a load of 3,760 kWe. These emission factors under estimate the PTE.
9. Emissions calculations comparing existing PTE of the affected EUs to future PTE of the affected EUs (including ORLs) demonstrates that the Permittee is also avoiding minor permitting under 18 AAC 50.502(c)(3) and (c)(4).

6. EMISSIONS SUMMARY AND PERMIT APPLICABILITY

PSD Applicability Analysis

PSD applicability analysis is a two-step process. The first step determines if the emissions increases for the project reach or exceed the significant emissions thresholds listed in 40 CFR 52.21(21)(b)(23)(i). The second step evaluates the net emissions increases during the five-year contemporaneous period. The project must undergo PSD review if the project results in both a significant emissions increase and a significant net emissions increase. The contemporaneous period for this project is the five years prior to the installation of EU ID 16 under Minor Permit AQ0215MSS04 because under 18 AAC 50.544(i)(1) and 40 CFR 52.21(r)(4), the PSD analysis must be conducted as if Minor Permit AQ0215MSS04 was never issued.

Table 5 and Table 6 show the PSD applicability for the installation of EU ID 16. Emission factors and calculation assumptions are provided in Appendix A. The PSD applicability analysis was conducted in two steps. The first step involved calculating the total emissions increase from the addition of EU ID 16.

Step 1: The baseline actual emissions (BAE) for EU ID 16 (assumed to be a new EU for this analysis) would be zero so the change in emissions is therefore equal to the PTE. In this case, the NO_x PTE is the ORL of 161.7 tpy and the other pollutant emissions are the PTE while operating up to the NO_x ORL. As indicated in Table 5, the Step 1 emissions increases were significant for NO_x, and indirect PM_{2.5} and ozone because of NO_x.

Table 5 – PSD Permit Applicability Step 1, Tons per Year (tpy)

Pollutant	BAE	PTE of New EU	Change in Emissions	PSD Significance Level	Significant Emissions Increase?
NO _x	0	161.7	161.7	40	Yes
CO	0	14.1	14.1	100	No
PM	0	6.1	6.1	25	No
PM ₁₀	0	6.1	6.1	15	No
PM _{2.5}	0	6.1	6.1	10 (or 40 tpy SO ₂ or NO _x)	Yes (indirect)
Ozone	0	NA	NA	(40 tpy VOC or NO _x)	Yes
VOC	0	13.2	13.2	40	No
SO ₂	0	0.75	0.75	40	No
CO _{2e}	0	12,257	12,257	75,000	No

Notes:

- Step 1 PSD permit applicability conducted in accordance with 40 CFR 52.21(a)(2)(iv)(d).
- BAE – baseline actual emissions
- PTE – potential to emit
- PSD significant emission levels are from 40 CFR 52.21(b)(23)(i)
- PM_{2.5} emissions are assumed equal to PM₁₀ emissions.
- For fuel burning equipment, PM emissions are assumed equal to PM₁₀ emissions.

Step 2: This step involves calculating the net emissions increases, as described in 40 CFR 52.21(b)(3), and includes contemporaneous emissions increases and decreases. In 2011, the stationary source went through PSD review for NO_x and PM_{2.5} for the installation of EU ID 15. Therefore, the NO_x and PM_{2.5} emissions increases from EU ID 15 are not creditable for the current project per 40 CFR 52.21(b)(3)(iii)(a). PM₁₀ emission increases for EU ID 15 did not go through PSD review and are considered creditable. However, because the PM₁₀ emissions increase in Step 1 did not meet the significant emissions threshold, it is not necessary to evaluate PM₁₀ emissions in Step 2. As stated previously, PSD review is only required if the project results in both a significant emissions increase and a significant net emissions increase for a particular pollutant.

The creditable emissions decreases are from the baseline actual emissions of EU ID 7. The two year average BAE for EU ID 7 was 121.8 tons of NO_x. For purposes of the applicability analysis, the Permittee has assigned full use of the ORL emissions cap to EU ID 16. This will make the projected actual emissions (PAE) for EU ID 7 zero and the total NO_x BAE of 121.8 tpy a creditable decrease. Table 6 shows Step 2 of the PSD permit applicability analysis for NO_x. As a result of the creditable emissions decreases for EU ID 7 and the combined NO_x ORL of 161.7 tpy for EU IDs 7 and 16, the net emissions increase for NO_x is less than the PSD significant level of 40 tpy and the Permittee is not required to go through PSD review for this project. Because the net emissions increase of NO_x is not significant, PM_{2.5} and Ozone are no longer subject to PSD review, as was indicated in Step 1.

Table 6 – PSD Permit Applicability Step 2, (tpy)

Pollutant	Step 1 Emissions	Step 2a	Step 2b	Net Emissions Increase	PSD Significance Level	Significant Net Emissions Increase?
NOx	161.7	-121.8	NA	39.9	40	No

Notes:

- Step 2 PSD permit applicability conducted in accordance with 40 CFR 52.21(b)(3).
- Step 2a includes creditable emissions decreases.
- Step 2b includes creditable emissions increases.
- PSD significant emission levels are from 40 CFR 52.21(b)(23)(i).
- PM_{2.5} emissions are assumed equal to PM₁₀ emissions.

The City utilized emission factors from AP-42, vendor data, and source test results. The Department make several corrections to the emissions estimates presented in the January 6, 2020 minor permit application. The City used several manufacturer provided not-to exceed (NTE) values, listed in terms of engine power (brake kilowatt or bkW) but multiplied them by the generator power (kilowatt electric or kWe). The Department adjusted all manufacturer NTE values using an assumed engine efficiency of 96 percent. This came from the manufacturer data by dividing generator power by engine power (e.g. $4416/4600 = 0.96$).

The permit includes a load limit for EU ID 16 of 3,760 kWe which is approximately 85 percent of the maximum rated load. The City used manufacturer NTE values at 100 percent load for CO and VOC emission factors, which are not accurate if the unit is operating below 85 percent load. The City used source test results for the PM₁₀ emission factor. If EU 16 is operating below 3,760 kWe then the source test result at 3,760 kWe is not a valid PM₁₀ emission factor.

The Department revised the CO, PM₁₀, and VOC emission factors for EU ID 16 using manufacturer NTE values at 75 percent load and adjusted for engine efficiency. As indicated in the application, one reason for this permit was to avoid being forced to operate EU ID 16 at low, inefficient loads. The NTE values at 75 percent load are reasonably conservative because the Permittee will be operating EU ID 16 at between 80 and 85 percent load for overall thermal and cost efficiency. The Department also adjusted the CO and VOC emission factors for EU ID 15 for engine efficiency.

The Department also revised the fuel usage rates for EU IDs 15 and 16 using manufacturer provided values and converted to gallons per hour using an assumed liquid fuel density of 7.0 pounds per gallon.

Table 7 shows the minor permit applicability of the project. The analysis is limited to potential emissions for EU IDs 7 and 16 because they were the only EUs affected by this project. The emissions reflect the ORLs to avoid PSD review. EFs and detailed calculations are provided in Appendix A.

Table 7 – Minor Permit Applicability Analysis

	Emissions (tpy)				
	NO _x	CO	SO ₂	PM ₁₀ / PM _{2.5}	VOC
PTE of EU IDs 7 & 16 after modification	161.7	15.1	0.75	6.1/6.1	13.2
PTE of EU ID 7 before modification	201.5	39.9	0.5	2.7/2.7	3.9
Change in PTE for project	-39.8	-24.8	0.25	3.4/3.4	9.3
18 AAC 50.502(c)(3) thresholds	10	NA	NA	10/10	NA
50.502(c)(3) applicable?	No	No	No	No	No
18 AAC 50.502(c)(4) thresholds	NA	NA	40	NA	NA
50.502(c)(4) applicable?	No	No	No	No	No

Notes:

The 18 AAC 50.502(c)(4) threshold applies to SO₂ because the stationary source PTE is less than the 50.502(c)(3) threshold for SO₂.

PM_{2.5} emissions are conservatively assumed equal to PM₁₀ emissions.

NA is not applicable

Assessable emissions for the stationary source total 1,475 tpy, as shown in Table 8 and include any pollutant greater than or equal to 10 tpy. Appendix A presents the emissions summary. The PTE in Table 8 represents a compilation of different operating scenarios. Individual pollutants were maximized while remaining below the established limits for PM₁₀ and NO_x. Maximum CO occurs with high utilization of EU IDs 7 and 8. Maximum NO_x occurs with high utilization of EU IDs 13 and 14

Table 8 – Assessable Emissions (tpy)

	NO _x	CO	SO ₂	PM	VOC
Stationary Source PTE	1,258.6	135.47	4.6	30.5	50.3
Assessable Emissions	1,259	135	0	31	50
Total Assessable	1,475				

Notes:

PM emissions are assumed equal to PM₁₀ emissions.

Assessable emissions include any pollutant greater than or equal to 10 tpy.

7. REVISIONS TO PERMIT CONDITIONS

Table 9 lists the requirements carried over from Minor Permit AQ0215MSS03 into Minor Permit AQ0215MSS05 and conditions that have been added.

Table 9 – Comparison of AQ0215MSS03 to AQ0215MSS05 Conditions¹

Permit AQ0215MSS03 Condition	Description of Requirement	Permit AQ0215MSS05 Condition	How Condition was Revised
1	Emission Unit Inventory	Section 1	The EU Inventory Table is no longer part of Condition 1. The EU inventory in this permit includes all EUs at the stationary source because they have applicable requirements in this permit.
3.1	Assessable PTE	4.1	The assessable PTE of the stationary source was changed from 1,685 tpy to 1,475 tpy as a result of the project and new ORL limiting emissions from EU IDs 7 and 16.
NA	Ambient Air Quality Protection Requirements	6	These are the ambient air quality protection requirements necessary for the installation of EU ID 16. They are from Appendix B.
22.3	ORL to avoid PSD review for VOC and SO ₂	8	The tpy limits for VOC and SO ₂ remain unchanged. The previous ORL restricted the total power production of EU IDs 7, 8, & 13–15 to no more than 105,803 MWh per 12-month period. This operational limit was used to demonstrate compliance with the PSD avoidance limits for SO ₂ and VOC emissions and the Permittee was required to track total MWh. The new ORL requires that the Permittee track actual VOC and SO ₂ emissions using specific equations and emission factors (EFs) to demonstrate compliance with the PSD avoidance limits. EFs may be updated without a permit revision following Department acceptance of a recent source test.
23	ORL to avoid PSD review for PM ₁₀	10	The tpy limit for PM ₁₀ remains unchanged and applies to EU IDs 7, 8, & 13–15. The EFs in Table 3 have changed. The EFs in Table 3 are the same EFs used to calculate PM ₁₀ PTE. Condition 10.2 allows the EFs to be updated without a permit revision following Department acceptance of a recent source test.
NA	ORLs to avoid PSD review for NO _x	11 and 12	A new NO _x limit of 161.7 tpy applied to EU IDs 7 and 16 will allow the Permittee more operational flexibility and to continue to avoid PSD review for EU ID 16. The load limit of 3,760 kWe on EU ID 16 is necessary to ensure compliance with the owner requested NO _x limit by ensuring that the NO _x emission factor is accurate.

¹ This table does not include all standard and general conditions.

8. PERMIT CONDITIONS

The bases for the conditions imposed in Minor Permit AQ0215MSS05 are described below.

Cover Page

18 AAC 50.544(a)(1) requires the Department to identify the stationary source, Permittee, and contact information.

Emissions Unit Inventory

The EUs authorized and/or restricted by this permit are listed in Section 1. Unless noted elsewhere in this permit, the information in Section 1 is for identification purposes only. Condition 1 is a general requirement to comply with AS 46.14 and 18 AAC 50 when installing a replacement EU. Condition 2 is required under 18 AAC 50.544(c)(3) for permit classifications of 18 AAC 50.502(c).

Section 2: Emission Fees

18 AAC 50.544(a)(2) requires the Department to include a requirement to pay fees in accordance with 18 AAC 50.400 – 18 AAC 50.499 in each minor permit issued under 18 AAC 50.542. The Department used the Standard Permit Condition I language for Minor Permit AQ0215MSS05.

Section 3: Ambient Air Quality Protection

18 AAC 50.544(a)(3) and 18 AAC 50.544(a)(6) require the Department to include conditions to protect air quality, when warranted. The Department determined that conditions are warranted to protect the 1-hour, 3-hour, 24-hour and annual SO₂ AAAQS for the reasons described in Appendix B of this TAR. MR&R requirements for EU ID 16 are included in Operating Permit AQ0215TVP04 Revision 1, which is undergoing an integrated review with this minor permit in accordance with 18 AAC 50.326(c)(1).

The ambient requirements for EU IDs 7 and 8 that appear in the conclusion section of Appendix B are identical to the ambient requirements for EU ID 7 and 8 in Minor Permit AQ0215MSS03 and appear in the same format that is in Operating Permit AQ0215TVP04. The Department does not believe it is necessary to include the same ambient requirements in this minor permit.

Section 4: Owner Requested Limits

18 AAC 50.544(h) describes the requirements for a permit classified under 18 AAC 50.508(5). This permit describes the ORLs, including specific testing, monitoring, recordkeeping, and reporting requirements; it lists all equipment covered by the ORL; and describes the classification that the limit allows the applicant to avoid.

Conditions 8 and 10 revise the MR&R for ORLs that were established in previous Title I permits for PSD avoidance. The ton per year limits for SO₂, VOC, and PM₁₀ remain unchanged. The Permittee is now required to calculate and report actual emissions using emission factors provided in the permit. The Permittee may also use more recent emission factors from a Department accepted source test without revising the permit. The PM₁₀ EFs in Table 3 are the same EFs used to calculate stationary source PTE. The Department is allowing the Permittee to use 0.394 g/kW-hr (from a source test that was not reviewed by

the Department) for EU ID 15 because it is more conservative than the manufacturer provided NTE value at 75 percent load.

Conditions 11 and 12 establish new PSD avoidance ORLs for NO_x. Condition 11 restricts the combined NO_x emissions from EU IDs 7 and 16 to no more than 161.7 tons per year. This limit was derived from baseline actual NO_x emissions of 121.8 tpy from EU ID 7 (between January 2009 and December 2010) with a new allocation of 39.9 tpy of NO_x for EU ID 16. Condition 12 includes a new ORL to restrict the power production of EU ID 16 to no greater than 3,740 kW during any given hour. It is not a not a stand-alone ORL under 18 AAC 50.508(5) because it is not necessary to avoid a permit classification under AS 46.14.130. However, the operational restriction on EU ID 16 is necessary to ensure compliance with the owner requested NO_x limit by ensuring that the NO_x emission factor is accurate. Together, these limits allow the authorization of EU ID 16 while still avoiding a PSD major modification.

Section 5: Standard Permit Conditions

18 AAC 50.544(a)(5) requires each minor permit issued under 18 AAC 50.542 to contain the standard permit conditions in 18 AAC 50.345, as applicable. 18 AAC 50.345(a) clarifies that subparts (c)(1) and (2), and (d) through (o), may be applicable for a minor permit.

The Department included the necessary minor permit-related standard conditions of 18 AAC 50.345 in Minor Permit AQ0215MSS05. The Department incorporated these standard conditions as follows:

- 18 AAC 50.345(c)(1) and (2) are incorporated as Condition 13 of Section 5 (Standard Permit Conditions);
- 18 AAC 50.345(d) through (g) are incorporated as Conditions 14 through 17, respectively, of Section 5 (Standard Permit Conditions);

9. PERMIT ADMINISTRATION

Minor Permit AQ0215MSS05 revises Title I provisions. The Department intends to issue a significant revision to Operating Permit AQ0215TVP04 using the integrated review procedures described in 18 AAC 50.326(c)(1) after the EPA 45 day review period.

Appendix A: Emissions Summary (tpy)

EU ID	Description	Hours/Max Operation	NO _x		CO		SO ₂		PM ₁₀		VOC	
			EF	PTE	EF	PTE	EF	PTE	EF	PTE	EF	PTE
7	Genset #8	0 h	17.7 g/kW-hr (vendor)	0.0	0.85 lb/MMBtu	0.0	0.01 wt% S	0.0	0.573 lb/MMBtu	0.0	0.082 lb/MMBtu	0.0
8	Genset #9	7,600 h	8.7 g/kW-hr (vendor)	89.6	0.85 lb/MMBtu	38.9	0.01 wt% S	0.46	0.573 lb/MMBtu	2.6	0.082 lb/MMBtu	3.75
13	Genset #10	5,000 h	13.6 g/kW-hr (BACT)	390.2	11.3 lb/hr (BACT)	28.3	0.01 wt% S	1.1	0.2 g/kW-hr (filterable from vendor plus AP-42 condensable)	5.7	0.082 lb/MMBtu	8.94
14	Genset #11	5,000 h	13.6 g/kW-hr (BACT)	390.2	11.3 lb/hr (BACT)	28.3	0.01 wt% S	1.1	0.2 g/kW-hr (filterable from vendor plus AP-42 condensable)	5.7	0.082 lb/MMBtu	8.94
15	Genset #13	4,310 h	9.8 g/kW-hr (BACT)	205.4	0.48 g/kW-hr (vendor @ 100% load)	10.0	0.01 wt% S	0.86	0.394 g/kW-hr (2012 source test)	8.3	0.64 g/kW-hr (vendor)	13.3
16	Genset #12	4422 h	8.83 g/kW-hr (2015 source test)	161.69	0.77 g/kW-hr (vendor @ 75% load)	14.1	0.01 wt% S	0.75	0.333 g/kW-hr (vendor @ 75% load)	6.1	0.72 g/kW-hr (vendor @ 75% load)	13.2
17	Genset #15	100 h	5.75 g/kW-hr (BACT)	0.2	4.4 g/kW-hr (NSPS Subpart III)	0.1	0.01 wt% S	0.0	1.7 lb/kgal	0.0	3.27 g/kW-hr (vendor)	0.1
NA	Smart ash burner	(280 tpy of solid waste)	2 lb/ton	0.3	20 lb/ton	2.8	2.5 lb/ton	0.35	15 lb/ton	2.1	15 lb/ton	2.1
Total				1,237.6		122.5		4.6		30.5		50.3
EUs 7, 8, 13–15 & 17								3.5		22.29		35.9
EUs 7 & 16				161.69								
Alternate Operating Scenario PTE				1,258.6		135.5						

Notes:

Emission factors are from AP-42 unless noted otherwise. EFs from NSPS Subpart III are not-to-exceed (NTE) values (standard × 1.25)
 For EU IDs 13 & 14, PM₁₀ EF includes manufacturer provided filterable PM₁₀ and AP-42 Table 3.4-2 condensable PM in lb/MMBtu (used conversion of 293.07 kWh/MMBtu)
 For EU ID 15, CO and VOC EFs are manufacturer NTE values at 100 percent load, provided in g/bkW-hr and adjusted for 96 percent engine efficiency
 For EU ID 16, NO_x EF is from source test at 3,760 kWe; CO, PM₁₀, and VOC EFs are manufacturer NTE values at 75 percent load, provided in g/bkW-hr and adjusted for engine efficiency
 Maximum CO occurs with maximum utilization of EU IDs 7 and 8. Maximum NO_x occurs with high utilization of EU IDs 13 and 14.

APPENDIX B: MODELING REPORT

Alaska Department of Environmental Conservation
Air Permit Program

review of
City of Unalaska's Ambient Demonstration
for the
Revision of Minor Permit AQ0215MSS03

Minor Permit AQ0215MSS05

Prepared by: James Renovatio
Reviewed by: Patrick Dunn
Date: 27 March, 2020

1. INTRODUCTION

This report summarizes the Alaska Department of Environmental Conservation's (Department's) findings regarding the ambient demonstration submitted by the City of Unalaska (City) for the revision to Minor Permit AQ0215MSS03 project (Project) at the Dutch Harbor Power Plant (DHPP) stationary source. The City submitted this analysis in support of their 6 January, 2020 application for Minor Permit AQ0215MSS05. The City adequately demonstrated that operating the Project emissions units (EUs) within the restrictions listed in this report will not cause or contribute to a violation of the annually averaged, 24-hour, three-hour, or one-hour sulfur dioxide Alaska Ambient Air Quality Standards (AAAQS) provided in 18 AAC 50.010.

2. BACKGROUND

The following sub-sections provide additional background on the proposed project and application materials.

2.1. Stationary Source Information

The DHPP is an existing prevention of significant deterioration (PSD) major stationary source with a potential to emit (PTE) at least 250 tons-per-year (tpy) of oxides of nitrogen (NO_x). It is located in southwest Alaska near the southeast shore of Amaknak Island, a neighborhood connected by bridge to Unalaska. The stationary source is specifically located at 53.88° N by 166.52° W and is situated within an area designated as special protection for SO₂ under 18 AAC 50.025(c)(1).

The DHPP consists of multiple liquid fuel storage tank and diesel-electric generator EUs of varying capacities/ratings and age. The City operates the DHPP stationary source under Construction Permit AQ0215CPT02 Revision 1 and Operating Permit AQ0215TVP04 Revision 1.

2.2. Project Description

The Project authorizes the installation of liquid fuel-fired engine-generator EU ID 16, restart of liquid fuel-fired engine-generator EU IDs 7 and 8, and imposition of owner requested limits (ORLs) on operations to avoid the permitting requirements for a PSD modification; see the Technical Analysis Report (TAR) for Minor Permit AQ0215MSS05 for additional detail.

2.3. Project Classification

The City's application is classified under 18 AAC 50.502(c)(2)(B) for the construction of an EU with a rated capacity in excess of 10 million British thermal units-per-hour (MMBtu/hr) in a SO₂ special protection area. In accordance with the application information requirements of 18 AAC 50.540(c)(2)(C), applicants must provide an ambient analysis with regard to the SO₂ AAAQS. The City fulfilled this requirement by submitting an SO₂ AAAQS analysis with their application.

The City's application is also classified under 18 AAC 50.508(5) since they are asking the Department to establish ORLs to avoid additional permit classifications. There are no ambient air demonstration requirements associated with an 18 AAC 50.508(5) permit classification.

The City's application is also classified under 18 AAC 50.508(6) due to their request to revise terms or conditions previously established in a permit issued under the Title I provisions of the Clean Air Act. Applicants subject to this provision must include the effects of revising those terms or conditions on the underlying ambient demonstration, per 18 AAC 50.540(k)(3)(C).¹ The City requested revisions to select conditions in Minor Permit AQ0215MSS03 and the rescission of Minor Permit AQ0215MSS04. The subject revisions do not impact the underlying ambient demonstration and, therefore, do not necessitate an evaluation of associated impacts.

2.4. Modeling Protocol Submittal

The Department does not typically require a modeling protocol to be submitted with minor permit applications.² However, a protocol is helpful to ensure that the modeling tools, procedures, input data, and assumptions that are used by an applicant are consistent with both State and Federal guidance.

The City did not submit a modeling protocol for the Project. However, their consultant, HMH Consulting, LLC (HMH), discussed several key aspects with the Department prior to conducting the ambient analysis.

2.5. Application Submittal

The City submitted an application for a minor permit with an ambient analysis on 6 January, 2020. They provided an addendum to their application, germane to a revised PSD analysis, via email on 27 February, 2020. HMH prepared the application, analysis, and addendum on their behalf.

3. SOURCE IMPACT ANALYSIS

The City used computer analysis (modeling) to predict the ambient SO₂ air quality impacts. The Department's findings regarding the City's analysis are discussed below.

3.1. Approach

The City compared their Project impacts to the significant impact levels (SILs) listed in Table 5 of 18 AAC 50.215(d). Impacts less than the SIL are considered negligible. For those pollutants and averaging periods with significant impacts, a cumulative impact analysis is warranted. The City's modeled Project impacts for all averaging periods of SO₂ were less than their respective SILs. Therefore, no cumulative analysis is required.

¹ 18 AAC 50.540(k)(3)(C) only requires applicants to update the previously modeled pollutants and averaging periods. It does not require applicants to conduct an ambient analysis for newly developed air quality standards.

² The Department may request an applicant submit a modeling protocol in accordance with 18 AAC 50.540(c)(2).

3.2. Model Selection

There are a number of air dispersion models available to applicants and regulators. The U.S. Environmental Protection Agency (EPA) lists these models in their *Guideline on Air Quality Models* (Guideline), which the Department has adopted by reference in 18 AAC 50.040(f). The City used EPA's AERMOD Modeling System (AERMOD) for their ambient analysis. AERMOD is an appropriate modeling system for this permit application. The AERMOD Modeling System consists of three major components: AERMAP, used to process terrain data and develop elevations for the receptor grid and EUs; AERMET, used to process the meteorological data; and the AERMOD dispersion model, used to estimate the ambient pollutant concentrations.

The City used the current version of AERMAP, version 18081, in their ambient analysis. They used AERMET and AERMOD versions 18081. EPA updated AERMOD and AERMET on 10 July, 2019. The latest versions are now AERMOD and AERMET versions 19191. The Department, therefore, reviewed EPA's Model Change Bulletin for these updates and determined that the associated revisions entail optional features, non-pertinent algorithms, and other changes that would be unlikely to significantly alter estimated model results. Therefore, none of the changes warrant an updated modeling analysis.

3.3. Meteorological Data

AERMOD requires hourly meteorological data to estimate plume dispersion. A *minimum* of one-year of site-specific data, or five years of representative National Weather Service (NWS) data should be used per Section 8.3 of the Guideline. When modeling with site-specific data, the Guideline states that up to five years should be used, when available, to account for year-to-year variation in meteorological conditions.

The City used five years of NWS data, spanning 1 January, 2013 through 31 December, 2017, from the National Climatic Data Center (NCDC) in Unalaska. They used contemporaneous upper-air data from the NOAA/ESRL Radiosone Database for Cold Bay. The City used these data in previous application submissions, which continue to adequately represent the plume transport conditions at the Dutch Harbor Power Plant stationary source for the current application period.

3.3.1. Surface Characteristics

AERMET requires the area surrounding the meteorological tower to be characterized with regard to the following three surface characteristics: noon-time albedo, Bowen ratio, and surface roughness length. EPA has provided additional guidance regarding the selection and processing of values for these surface characteristics in their *AERMOD Implementation Guide*.

The City derived domain-specific values for albedo and Bowen ratio by observing the land use classification for each square kilometer (km) in a 10 km by 10 km grid. These land use classifications were observed in comport with the National Land Cover Data from the U.S. Geological Survey (USGS). The City assigned individual values by month in order to adjust the surface characteristics by season. They weighted the

individual monthly values according to Department guidance in order to derive composite monthly values for the 10 km by 10 km domain. The Department finds the City’s approach and results in comport with the aforementioned guidance and acceptable for the Project. The resultant composite values for albedo and Bowen ratio are illustrated Table 1.

The surface roughness length is evaluated within a circular area of one km radius about the meteorological tower. The City segregated this circular area into six equal 60-degree sectors to determine a surface roughness length by sector. Each sector contains one or more of the NLCD-derived land use classifications. The City weighted the surface roughness length associated with each classification according to Department guidance in order to derive a composite value for each sector. They did this for each month in order to accommodate the seasonal variance in the surface roughness length. The Department finds the City’s approach and results in comport with the aforementioned guidance and acceptable for the Project. The resultant composite values for surface roughness are illustrated Table 1.

Table 1. Approved AERMET surface parameters for AQ0215MSS05

Surface Parameter		Winter	Spring	Summer	Fall
Albedo		0.34	0.34	0.15	0.15
Bowen Ratio		0.25	0.30	0.34	0.39
Surface Roughness Length (m)					
Sector	Range				
1	30° - 90°	0.006	0.043	0.074	0.012
2	90° - 150°	0.0057	0.0106	0.0118	0.0091
3	150° - 210°	0.0038	0.0042	0.0044	0.0039
4	210° - 270°	0.001	0.001	0.001	0.001
5	270° - 330 °	0.001	0.001	0.001	0.001
6	330° - 30°	0.0066	0.041	0.0703	0.0117

Table Notes

Season are defined as follows: spring, April and May; summer, June through August; fall, September through October; winter, November through March.

3.4. Coordinate System

Air quality models need to know the relative location of the EUs, structures (if applicable), and receptors, in order to properly estimate ambient pollutant concentrations. Therefore, applicants must use a consistent coordinate system in their analysis. The City used Zone 3 of the Universal Transverse Mercator (UTM) system for their modeling domain.

3.5. Terrain

Terrain features can influence the dispersion of exhaust plumes from EUs and the resulting ambient air concentrations of the pollutants being emitted. Digitized terrain elevation data is, therefore, generally included in a modeling analysis. AERMOD’s terrain preprocessor, AERMAP, uses terrain data to obtain the base elevations for the modeled EUs, buildings, and receptors; and to calculate a “hill height scale” for each receptor.

The City used National Elevation Dataset (NED) files for their terrain analysis. They processed these data in comport with the North American Datum of 1983 (NAD 83). NED is the current terrain elevation dataset provided by the Unites States Geological Survey.

3.6. EU Inventory

The City included EU IDs 7 and 8 in their modeled inventory.³ The Department notes that the EU inventory germane to the Project at-hand is inclusive to EU IDs 7 and 16 and not the aforementioned units. The City, however, elected to rely upon a previous demonstration⁴ that included estimated impacts from EU IDs 7 and 8 as a surrogate; the details of this approach are discussed in the following subsections. All modeled EUs were characterized as point sources.

3.6.1. Excluded EUs

The City excluded non-Project EUs from their modeled inventory. The exclusion of units not relevant to a Stage 1 SIL analysis is appropriate. The Department notes that they also excluded EU ID 16 from their modeled inventory in favor of EU ID 8, though the former unit remains central to the Project at-hand and the latter is not. In explaining this approach, the City asserts that the Stage 1 results from their previous demonstration, upon which the current demonstration is based and that includes emissions from EUs 7 and 8, offers a conservative framework for the ambient analysis prepared in support of the current Project. Their basis for the City's position appears to be predicated upon several points:

- a modeled operational assumption of 8,760 hours-per-year (hr/yr) for EU IDs 7 and 8; and
- a 'scaling' of model-estimated concentrations by a factor of two, i.e. doubling the resultant output.

The Department notes that the City's approach is imbued with significant uncertainty. While the use of conservative operational assumptions and wholesale scaling of model-estimated output has merit, *ceteris paribus*, it does not capture the myriad of potential factors that may drive model outputs. Illustratively, the City's assumptions are insufficient to quantify the potential difference in atmospheric transport and impacts between EU IDs 8 and 16, the latter boasting a rating nearly four times that of the former. Heterogeneous release parameters and spatial differences between the subject units further complicate advancing reliable conclusions; this is especially salient in areas of complex terrain. The Department additionally observes that the City's modeled EUs, all engine-generator units, appear to use modeled emission rates calculated from the generator rating rather than that of the prime mover combusting liquid fuels; this and the question of assumed load also appear to be relevant noting manufacturer data indicating a maximum or not-to-exceed load regime greater than those employed in the model assumptions.

³ The City's modeling files established source categories for other units. However, the only two possessing non-zero emission rates were EU IDs 7 and 8.

⁴ Submitted in support of the City's withdrawn 2019 application for PSD Construction Permit AQ0215CPT05.

The Department, nevertheless, evaluated the potential impact of the City's surrogate modeling approach by performing its own abbreviated sensitivity analysis for EU ID 16. The results of this partial analysis suggest a relatively large margin of compliance remains with the SIL for all averaging periods subject to review. Therefore, the Department finds the City's modeled EU inventory appropriate for the current project, but anticipates a more case-specific approach with future submissions to avoid potential delays in permit processing.

3.7. EU Release Parameters

The assumed emission rates and characterization of how the emissions enter the atmosphere will significantly influence an applicant's modeled results. Therefore, applicants must provide the stack height, diameter, location, and base elevation, in addition to the pollutant emission rates, exhaust plume exit velocity, and exhaust temperature for each exhaust stack.

3.7.1. Emission Rates

The Department generally found the City's modeled emission rates to be consistent with the emissions information provided throughout their application. The exceptions, or items that otherwise warrant additional discussion, are discussed below.

3.7.2.1 Sulfur Compound Emissions

SO₂ emissions are directly related to the sulfur content of the fuel being fired. The City's ambient demonstration is based on units firing a liquid fuel with a sulfur content of 100 parts-per-million by weight (ppmw). Therefore, the Department is including this assumption as a permit condition to protect the one-hour, three-hour, 24-hour, and annually-averaged SO₂ AAAQS.

3.7.2.2 Operational Limits

The City's application requested operational limits on EU ID 7 to avoid one or more permit classifications. Their ambient demonstration, however, is based on a maximum short-term emissions scenario for the two modeled units. This emissions scenario, which provides for unlimited operation of the modeled units, does not yield estimated results that threaten the AAAQS. Therefore, the Department is not including these ORLs as a permit condition to protect the one-hour, three-hour, 24-hour, and annually-averaged SO₂ AAAQS.

3.7.2. Point Source Parameters

In addition to the previously discussed emission rates, applicants must provide the stack height, diameter, location, base elevation, exhaust plume exit velocity, and exhaust temperature for each EU characterized as a point source.

The Department generally found the modeled stack parameters to be consistent with the vendor information or expectations for similarly sized EUs. The exceptions, or items that otherwise warrant additional discussion, are discussed below.

3.7.2.1 Stack Heights

The Department generally found the modeled stack heights to be consistent with those of similarly sized EUs. It notes, however, that the City’s surrogate modeled-unit approach within a SIL demonstration creates significant uncertainty.

Therefore, the Department is including the stack height assumptions, listed in Table 2, as a permit condition to protect the one-hour, three-hour, 24-hour, and annually-averaged SO₂ AAAQS.

Table 2. Minimum stack height requirements

EU	Model ID	Description	Min. Stack Height (m)
7	DHPPEU7	Caterpillar 3516	25.6
8	DHPPEU8	Caterpillar 3512B	25.6
16	DHPPEU16	Caterpillar C-280	25.4

Table Notes

The stack height for EU ID 16, while not modeled in the current Project, was to be included as an ambient condition in the City’s withdrawn 2019 application for PSD Construction Permit AQ0215CPT05.

3.7.2.2 Horizontal/Capped Stacks

The presence of non-vertical stacks or stacks with rain caps requires special handling in an AERMOD analysis. The City assumed their modeled stacks will all possess uncapped, vertical releases. The impacts from horizontal or capped stacks are typically greater than the impacts from stacks with vertical, uncapped discharges. Therefore, the Department is including the requirement to maintain vertical, uncapped stacks on EU IDs 7, 8, and 16 as a permit condition to protect the one-hour, three-hour, 24-hour, and annually-averaged SO₂ AAAQS.

3.8. Downwash

Downwash refers to the situation where local structures influence the plume from an exhaust stack. Downwash can occur when a stack height is less than a height derived by a procedure called “Good Engineering Practice” (GEP), which is defined in 18 AAC 50.990(42). It is a consideration when there are receptors relatively near the applicant’s structures and exhaust stacks. EPA developed the “Building Profile Input Program - PRIME” (BPIPPRM) program to determine which stacks could be influenced by nearby structures and to generate the cross-sectional profiles needed by AERMOD to determine the resulting downwash.

The City used the current version of BPIPPRM, version 04274, to determine the building profiles needed by AERMOD. They included all of the modeled point sources in their downwash analysis. The City appropriately accounted for downwash in their modeling analysis. BPIPPRM indicated that the modeled exhaust stacks are within the GEP stack height requirements.

3.9. Ambient Air Boundary

The AAAQS only apply in *ambient air* locations, which has been defined by EPA as, “...that portion of the atmosphere, external to buildings, to which the general public has

access."⁵ Applicants may, therefore, exclude areas that they own or lease from their ambient demonstration if public access is "precluded by a fence or other physical barrier."⁶ They conversely need to model that portion of their property/lease that has no such restriction, or where there is an easement or public right-of-way. Natural features, such as dense vegetation or topographical features, can provide adequate barriers to public access, although the adequacy of the given features must be evaluated on a case-specific basis.

The City used the property boundary at the DHPP, to which they control access, as their ambient air boundary. This is an appropriate boundary for the current application.

3.10. Receptor Grid

The City used a nested rectangular receptor grid of decreasing resolution with distance from the ambient boundary. The receptor resolutions are:

- 25 m from the ambient boundary to a distance of 1.2 km;
- 100 m from 1.2 km to 2 km;
- 250 m from 2 km to 3 km;
- 500 m from 3 km to 5 km; and
- 1 km from 5 km to 15 km.

The City's grid has sufficient resolution and coverage to determine the maximum impacts.

3.11. Design Concentrations

EPA generally allows applicants to use modeled concentrations that are consistent with the form of the standard. In all cases, applicants must compare the highest modeled concentration to the deterministic annual average standards, increments, and SILs.

The City used the highest modeled concentrations in comport with their Stage 1 SIL analysis. This approach is consistent with the forms of these ambient standards.

4. RESULTS AND DISCUSSION

The maximum SO₂ project impacts are presented in Table 3. The respective SIL are also presented for comparison. The estimated project impacts for all averaging periods subject to review all fall below the SIL and, therefore, demonstrate compliance with the AAAQS.

⁵ The term "ambient air" is defined in 40 CFR 50.1. The Alaska Legislature has also adopted the definition by reference in AS 46.14.90(2).

⁶ EPA has written a number of guidance documents regarding ambient air issues which may be found in their Modeling Clearinghouse Information Storage and Retrieval System (MCHISRS) or EPA Region 7's "Title V, NSR/PSD Policy and Guidance Database" (see <http://cfpub.epa.gov/oarweb/MCHISRS/> and <http://www.epa.gov/region07/air/search.htm>). The documents routinely use the phrase "fence or other physical barrier" when discussing an acceptable means for precluding public access at onshore locations. The phrase originated in a December 19, 1980 letter from EPA Administrator Douglas Costle to Senator Jennings Randolph.

Table 3. Maximum project impacts as compared to the SILs

Pollutant	Avg. Period	Max. Modeled Concentration ($\mu\text{g}/\text{m}^3$)	SIL ($\mu\text{g}/\text{m}^3$)
SO ₂	1-hour	2.86	8
	3-hour	2.50	25
	24-hour	1.72	5
	Annual	0.26	1

5. CONCLUSION

The Department reviewed the City's modeling analysis and concluded the following:

1. The emissions from the proposed EUs will not cause or contribute to a violation of the one-hour, three-hour, 24-hour, and annually-averaged SO₂ AAAQS listed in 18 AAC 50.010.
2. The City's modeling analysis fully complies with the ambient demonstration requirements of 18 AAC 50.540(c)(2) and 18 AAC 50.540(k)(3).
3. The City conducted their modeling analysis in a manner consistent with the Guideline, as required under 18 AAC 50.215(b)(1).

The Department developed conditions to protect ambient air quality in Minor Permit AQ0215MSS05 to ensure the City complies with the AAAQS. These conditions are *summarized* as follows:

To protect the one-hour, three-hour, 24-hour, and annually-averaged SO₂ AAAQS, the Permittee shall:

- limit the sulfur content liquid fuel fired in EU IDs 7, 8, and 16 to no greater than 100 ppmw;
- construct and maintain exhaust stacks on EU IDs 7 and 8 of a minimum 25.6 meters and on EU ID 16 of a minimum 25.4 meters; and
- maintain vertical, uncapped exhaust stacks on EU IDs 7, 8, and 16.