Alaska Department of Environmental Conservation
Air Permits Program

TECHNICAL ANALYSIS REPORT

For the terms and conditions of
Minor Permit AQ0272MSS04

Issued to Hilcorp North Slope, LLC
For the Lisburne Production Center (LPC)

Preliminary – October 22, 2025

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1. INTRODUCTION

This Technical Analysis Report (TAR) provides the Alaska Department of Environmental Conservation's (Department's) basis for issuing Minor Permit AQ0272MSS04 to Hilcorp North Slope, LLC (Hilcorp) for the Lisburne Production Center (LPC) Power Export Project (PXP). The permit application is classified under 18 AAC 50.508(6) to revise terms or conditions in Construction Permit AQ0272CPT01 Revision 1 and Minor Permit AQ0272MSS03.

2. STATIONARY SOURCE DESCRIPTION

The Lisburne Production Center (LPC) is an existing stationary source owned by ConocoPhillips Alaska, Inc., ExxonMobil Alaska Production Inc., and Chevron USA Inc. LPC processes fluids received from crude oil reservoirs located on the North Slope. These reservoirs include but are not limited to the following: Lisburne, Point McIntyre, Niakuk, West Beach State, and North Prudhoe Bay State. The processed fluids are then separated into oil, gas, and water.

The emissions unit (EU) inventory consists of turbines, heaters, reciprocating engines, fire pumps, and flares. Hilcorp currently operates the stationary source under shielded Operating Permit AQ0272TVP02 Revision 3 and the terms & conditions associated with administrative amendment Operating Permit AQ0272TVP02 Revision 4 due to the pending Title V permit renewal.

3. PERMIT HISTORY RELEVANT TO PROJECT

Construction Permit AQ0272CPT01 (0073-AC061) established a fuel consumption limit of 3,272 MMscf/yr per rolling 12-month period for the Solar Mars GSC T-12000 turbines (EU IDs 6 through 9) to avoid Prevention of Significant Deterioration (PSD) classification for NO_X.

4. APPLICATION DESCRIPTION

Hilcorp submitted its minor permit application on July 2, 2024 for the LPC PXP. This project involves installing and upgrading components within the LPC facility. The project will entail installing a 25 MWe electrical transformer and the operation of two Solar Mars 90-13000S SoLoNOx combustion turbines (EU IDs 6A and 7A) to allow an additional 10 MWe to be exported to the Greater Prudhoe Bay Unit (GPBU) power grid and secondarily to allow LPC to import power if the internal power generated is insufficient to meet the internal demand.

The 25 MWe electrical transformer will be connected to the power grid, with one of the two SoLoNOx turbines (EU IDs 6A and 7A) installed as part of the PXP, and the other for the Rich Gas Compressor Project (RGCP) authorized under Minor Permit AQ0272MSS03. The existing 15 MWe electrical transformer will still be connected to the grid, but only one transformer can be used at a time. The Solar Mars SoLoNOx combustion turbines must remain above 50% load in order to validate the assumptions used to determine the projected actual emissions (PAE) presented in this application. Specifically, the application requests the following:

1. Operate the Solar Mars 90-13000S SoLoNOx units (EU IDs 6A and 7A) to ensure that PSD major modification is not triggered for NO_X.
2. Revise the 3,272 MMscf/yr fuel consumption limit in Condition 7.1a of Construction Permit AQ0272CPT01 Revision 1 to an equivalent NO_X emissions limit of 745 TPY that was originally proposed by the Department in preliminary permit AQ0272CPT01.

5. CLASSIFICATION FINDINGS

The Department finds that:

1. Minor Permit AQ0272MSS04 is classified under 18 AAC 50.508(6) to revise or rescind terms and conditions of a Title I permit.

6. APPLICATION REVIEW FINDINGS

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

1. The minor permit application for the Lisburne Production Center (LPC) contains the elements listed in 18 AAC 50.040.
2. Hilcorp asserts that operating two SoLoNOx combustion turbines (EU IDs 6A and 7A) in load sharing with the existing conventional combustion turbines (EU IDs 8 and 9) will support installation of a 25 MWe electric transformer to increase LPC's power exporting capabilities by an additional 10 MWe without changing the NO_X Best Available Control Technology (BACT) limit of 745 TPY on EU IDs 6A, 7A, 8, and 9.
3. The replacement of the 3,272 MMscf/yr fuel consumption limit with an equivalent NO_X emissions limit of 745 TPY on EU IDs 6A, 7A, 8, and 9 will cause slight increases in potential emissions of VOC, PM_{10}, $PM_{2.5}$, and HAPs (increase of 0.175 TPY).
4. The RGCP is contemporaneous with the PXP and is not included in the baseline actual emissions (BAE), only the PAE. Therefore, combined Steps 1 and 2 of the PSD applicability analysis results in a significant emissions increase before netting. See Table B.
5. In determining the amount of excludable emissions in the PSD applicability analysis in Table C, Hilcorp asserts the excludable amount is the level of emissions from the existing Solar Mars GSC T-12000 turbines if the demand is high enough to generate up to full capacity of the LPC (26.1 MWe) without any increases associated with the RGCP and PXP, in accordance with 40 C.F.R. 52.21(b)(41)(ii)(C). This amount is the "could have accommodated emissions" (CAE). The CAE is subtracted by the BAE to get the excludable emissions (noted as Demand Growth), and the resulting number is subtracted from the Total Steps 1 and 2 Project Increase to derive the net change in emissions. See Table C.
6. The application (Attachment B, Table 2) states the CAE (rounded to two significant figures) for NO_X, CO, VOC, $PM_{10/2.5}$, and SO_2 is 701.44, 6.74, 2.94, 9.25, and 17.41 TPY, respectively. The Department used these values , except for NO_X (701.40 TPY) and $PM_{10/2.5}$ (9.26 TPY) after verifying the numbers in the amended Attachment B, Table 2 received by Hilcorp on August 8, 2025.
7. The net change in emissions, as determined in Table C with excludable emissions, is less than the significant emissions rate (SER) thresholds in 40 C.F.R. 52.21(b)(23)(i). Therefore, the PXP is not considered a PSD major modification.
8. The PTE of NO_X, CO, and SO_2 remain unchanged because EU IDs 6A, 7A, 8, and 9 are constrained by existing PSD and BACT limits from Construction Permit AQ0272CPT01 Revision 1.

9. Hilcorp used source test data for both sets of the Solar Mars GSC T-12000 Combustion Turbines to calculate BAE for NO_X and CO emissions.
10. Hilcorp used source test data for the Solar Mars GSC T-12000 Combustion Turbines to calculate PAE for NO_X and CO emissions.
11. Hilcorp used the vendor performance data for the Solar Mars 90-13000S SoLoNOx Combustion Turbines to calculate PAE for NO_X and CO based on the assumption that the SoLoNOx turbines are operated above 50% load at all times during normal operation.
12. The 40 C.F.R. 52.21(r)(6) requirements are included as Conditions 7 through 9 for all four turbines in Table 1 since 50% SER threshold for CO is exceeded as a result of the project. These requirements will sunset after 10 calendar years from the date the transformer is installed and ready to operate.
13. Considering that BAE was originally calculated using source test data (see EFs from Table A-1 of the application), Condition 7.2 requires CO emissions for the Solar Mars 90-1300S SoLoNOx turbines installed in 2025 (EU IDs 6A and 7A) to be calculated in accordance with Condition 7.1 using the exhaust gas concentration vendor data or if available, either Department-approved source test data or representative source test data. Condition 7.3 requires CO emissions for the Solar Mars GSC T-12000 turbines installed in 1986 (EU IDs 8 and 9) to be calculated from all representative source test data.
14. The Department added Condition 5, rescinding Condition 9, 11, and 12 from Minor Permit AQ0272MSS03 that was in place to verify the assumptions used for the PAE in the RGCP and to avoid triggering additional MR&R requirements under 40 C.F.R. 52.21(r)(6) for CO. These conditions will be rescinded once the new 25 MWe transformer is installed and ready to operate.
15. The Department will issue an administrative amendment (Operating Permit AQ0272TVP02 Revision 5) to incorporate Minor Permit AQ0272MSS04 by reference, in accordance with 18 AAC 50.542(e).
16. Hilcorp's ambient demonstration complies with the requirements of 18 AAC 50.540(k)(3). See modeling review in Appendix B.

7. EMISSIONS SUMMARY AND PERMIT APPLICABILITY

Table A through Table C show the permit applicability analysis for the PXP. The upgrade of EU IDs 6 and 7 with a SoLoNOx combustion turbine (EU IDs 6A and 7A) does not affect the emissions from other emissions units, therefore this section only addresses the changes in emissions from modification of EU IDs 6 and 7. Table D shows the assessable emissions for the stationary source's operational modifications allowed under this minor permit.

7.1. Minor Permit Applicability under 18 AAC 50.502(c)(3)(A)

Table A shows the minor permit applicability under 18 AAC 50.502(c)(3)(A) for the proposed LPC PXP with and without a SoLoNOx upgrade on EU IDs 6 and 7 to a Solar Mars 90-13000S SoLoNOx (EU IDs 6A and 7A). The PTE for NSR pollutants in Table A is based on the mass emission limit of 745 TPY of NO_X and previous BACT and PSD review avoidance limits that include (but are not limited to) EU IDs 6A, 7A, 8, or 9. The changes in LPC's PTE with the replacement of the fuel consumption limit of 3,272 MMscf/yr on EU IDs 6A, 7A, 8, and 9 are highlighted below.

Table A – Minor Permit Applicability and PTE[1] (TPY)

Description	PTE[1], TPY					
	NO_X[2]	CO[3]	VOC[6,7]	$PM_{2.5}$[4]	PM_{10}[4]	SO_2[5]
PTE BEFORE MODIFICATION	745	366	3.59	11.27	11.27	157
PTE AFTER MODIFICATION (No SoLoNOx)	745	366	4.60	14.45	14.45	157
PTE AFTER MODIFICATION (Two SoLoNOx turbines (EU IDs 6A and 7A))	745	366	4.60	14.45	14.45	157
Change in PTE	**0**	**0**	**+1.01**	**+3.18**	**+3.18**	**0**
18 AAC 50.502(c)(3) Permit Thresholds[2]	10	N/A	N/A	10	10	10
Permit Under 502(c)(3)(A) required?	**No**	**N/A**	**N/A**	**No**	**No**	**No**

Notes:

1. Existing PTE for the stationary source is from the most current stationary source's emissions calculations spreadsheets submitted with the application.
2. NO_X PTE is based on the existing combined NO_X combined BACT limit of 745 TPY for EU IDs 6A, 7A, 8, and 9.
3. CO PTE is based on the existing combined PSD avoidance limit for CO of 366 TPY for EU IDs 4 through 9.
4. $PM_{2.5}$ and PM_{10} emissions are part of PM. PTE values are for EU IDs 6A, 7A, 8, and 9, conservatively estimated based on emission factor (EF) of 0.0066 lb/MMBtu fuel input for PM in AP-42 Table 3.1-2a, and a net (lower heat) fuel gas heat content of 928 Btu/scf.
5. SO_2 PTEs are based on existing combined SO_2 BACT limit for EU IDs 1 through 9.
6. VOC PTEs are for EU IDs 6A, 7A, 8, and 9, estimated based on EF of 0.0021 lb/MMBtu fuel input for VOC in AP-42 Table 3.1-2a, and net (lower heat) fuel gas heat content of 928 Btu/scf.
7. Increase in HAP PTE of 0.175 TPY considered part of VOC PTE to avoid double counting.

7.2. PSD Permit Applicability under 18 AAC 50.306, 40 C.F.R. 52.21(b)(23)(i), and §52.21(b)(3)(i)

Prevention of Significant Deterioration (PSD) applicability is a two-step process. The first step determines if the emission increases for the project reach or exceed the significant emissions thresholds listed in 40 C.F.R. 52.21(b)(23)(i). The second step evaluates the net emissions increase during the five-year contemporaneous period. The project will require a PSD review if the project results in a significant emissions increase and a significant net emissions increase (including excludable emissions, per 40 C.F.R. 52.21(b)(41)(ii)(C)). Steps 1 and 2 of PSD applicability process is combined and assumes both a significant emissions and net emissions increase.

Table B shows the PSD permit applicability for the proposed LPC, with and without a SoLoNOx upgrade. As shown in the table, the emissions increase resulting from the project would cause a significant emissions and net increase in NO_X and inconsequential increases to the other regulated new source review (NSR) pollutants, CO, SO_2, PM, PM_{10}, and $PM_{2.5}$. However, Table C shows the amount of excludable emissions to net out of PSD review.

Table B – PSD Permit Applicability – Steps 1 and 2[1]

Emissions/Thresholds (TPY)	NO_X	CO	VOC	PM	PM_{10}	$PM_{2.5}$	SO_2
Steps 1 and 2 - Project Emissions Increase (NO SoLoNOx)							

Emissions/Thresholds (TPY)	NO_X	CO	VOC	PM	PM_{10}	$PM_{2.5}$	SO_2
BAE[2] – EU IDs 6 – 9	**269.43**	**7.99**	**1.38**	**4.34**	**4.34**	**4.34**	**8.17**
PAE[3] – EU IDs 8 and 9 in operation	547.24	2.78	2.08	6.54	6.54	6.54	12.31
PAE[4] – WITHOUT SoLoNOx in operation, EU IDs 6A and 7A	547.24	2.78	2.08	6.54	6.54	6.54	12.31
PAE Total	**1094.48**	**5.56**	**4.16**	**13.08**	**13.08**	**13.08**	**24.62**
Total Steps 1 and 2 Project Increase (PAE – BAE)	**825.05**	**-2.43**	**2.78**	**8.74**	**8.74**	**8.74**	**16.45**
PSD Significant Emissions Increase Threshold[6]	40	100	40	25	15	10 (direct)	40
PSD Permit Required?	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**
Steps 1 and 2 - Project Emissions Increase (WITH SoLoNOx)							
BAE[2] – EU IDs 6 – 9	**269.43**	**7.99**	**1.38**	**4.34**	**4.34**	**4.34**	**8.17**
PAE[3] – EU IDs 8 and 9 in operation	547.24	2.78	2.08	6.54	6.54	6.54	12.31
PAE[7] – WITH SoLoNOx in operation, EU IDs 6A and 7A	127.70	102.73	3.54	6.81	6.81	6.81	12.81
PAE Total[5]	**674.94**	**105.51**	**5.62**	**13.35**	**13.35**	**13.35**	**25.13**
Total Steps 1 and 2 Project Increase (PAE – BAE)	**405.51**	**97.52**	**4.24**	**9.01**	**9.01**	**9.01**	**16.96**
PSD Significant Emissions Increase Threshold[6]	40	100	40	25	15	10 (direct)	40
PSD Permit Required?	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**

Notes:

1. Steps 1 and 2 PSD Permit applicability conducted in accordance with 40 C.F.R. 52.21(a)(2)(iv)(A) and 40 C.F.R. 52.21(b)(3)(i).
2. Per 40 C.F.R. 52.21(b)(48)(ii), the BAE for the proposed project includes combined emissions from existing EU IDs 6, 7, 8, and 9 based on the average rate, in tons per year (TPY), at which the emissions units actually emitted the pollutant during any consecutive 24-month period (May 2020 to April 2022) selected by Hilcorp.
3. Per 40 C.F.R. 52.21(b)(41)(ii)(A), the PAE are based on the historical operational date for the existing EUs, expected business activity, and highest projections of business activity. These projections include continued operation at historical loads in addition to the 3,900 kWe required for the Rich Gas Compressor that supports the RGCP and 14 to 25 MWe electrical export depending on the season through the electrical transformer that supports the PXP with four of the LPC power plant turbines operating. Since this part of the PAE is specific to the turbines that are not being upgraded (EU IDs 8 and 9), the PAE is the same with or without SoLoNOx.
4. For simplicity, the PAE for the upgraded SoLoNOx combustion turbines (EU IDs 6A and 7A) without SoLoNOx are set equal to the emissions from the two conventional turbines (EU IDs 8 and 9). Since the PAE from conventional combustion turbines (EU IDs 8 and 9) are combined with the emissions from the upgraded turbines (EU IDs 6A and 7A) without SoLoNOx, this represents emissions from the operation of four conventional turbines generating more power than the projected LPC power demand comprising of both the RGCP and PXP and is conservatively representative of the "without SoLoNOx" PAE.
5. The PAE total reflects continued operation of the LPC Power Plant at historical loads in addition to the 3,900 kWe required for the Rich Gas Compressor that supports the RGCP and the 14 to 25 MWe electrical export depending on the season through the electrical transformer that supports the PXP. To add to the conservatism, load sharing involving the upgraded SoLoNOx combustion turbines occurred during intake temperatures that maximize upgraded combined turbine emissions (coldest temperatures).

6. PSD significant emissions increase thresholds are listed in 40 C.F.R. 52.21(b)(23)(i).
7. Per 40 C.F.R. 52.21(b)(41)(ii)(D), the PAE with SoLoNOx are based on the historical operational data for the existing EUs, expected business activity, and highest projections of business activity. These projections include continued operation at historical loads in addition to the 3,900 kWe required for the Rich Gas Compressor that supports the RGCP and the 14 to 25 MWe electrical export depending on season through the electrical transformer that supports the PXP. Totals in this row represent emissions from the upgraded SoLoNOx turbines (EU IDs 6A and 7A) operating in load sharing with EU IDs 8 and 9.

Table C shows the "could have accommodated" (CAE) emissions from the LPC and the net emissions increase as a result of the project, with and without SoLoNOx on EU IDs 6A and 7A. Per 40 C.F.R. 52.21(b)(41)(ii)(C), in determining the PAE before beginning actual construction, "shall exclude, that portion of the unit's emissions following the project that an existing unit could have accommodated during the consecutive 24-month period used to establish the baseline actual emissions under paragraph (b)(48) of this section and that are also unrelated to the particular project, including any increased utilization due to product demand growth". This amount is the emissions from the existing turbines (EU IDs 6 through 9, prior to Minor Permits AQ0272MSS03 and AQ0272MSS04) if the demand is high enough to generate up to LPC's full capacity of 26.1 MWe. After netting CAE to get the excludable emissions (EE) from the existing turbines, PSD review is not required.

Table C – PSD Applicability – Excludable Emissions[1]

Emissions/Thresholds (TPY)	NO_X	CO	VOC	PM	PM_{10}	$PM_{2.5}$	SO_2
Total Combined Steps 1 and 2 Project Increase WITHOUT SoLoNOx (PAE – BAE)	**825.05**	**-2.43**	**2.78**	**8.74**	**8.74**	**8.74**	**16.05**
Total Combined Steps 1 and 2 Project Increase WITH SoLoNOx (PAE – BAE)	**405.51**	**97.52**	**4.24**	**9.01**	**9.01**	**9.01**	**16.96**
BAE – EU IDs 6 - 9	**269.43**	**7.99**	**1.38**	**4.34**	**4.34**	**4.34**	**8.17**
Could Have Accommodated (CAE)	701.40	6.74	2.94	9.26	9.26	9.26	17.41
Excludable Emissions [EE] (CAE – BAE)[1]	431.97	-1.25	1.56	4.92	4.92	4.92	9.24
Total Combined Steps 1 and 2 Project Increase WITHOUT SoLoNOx (Total Combined Steps 1 and 2 – EE)	**393.08**	**-1.18**	**1.22**	**3.82**	**3.82**	**3.82**	**6.81**
Total Combined Steps 1 and 2 Project Increase WITH SoLoNOx (Total Combined Steps 1 and 2 Project Increase – EE)	**-26.46**	**98.77**	**2.68**	**4.09**	**4.09**	**4.09**	**7.72**
PSD Net Significant Emissions Increase Threshold (with excludable emissions)[2]	40	100	40	25	15	10 (direct)	40
PSD Permit Required? (NO SoLoNOx)	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**
PSD Permit Required? (WITH SoLoNOx)	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Notes:

1. Excludable emissions defined in accordance with 40 C.F.R. 52.21(b)(41)(ii)(C). The excludable amount is the level of emissions that could be accommodated by the four existing Solar Mars T-12000 turbines during

the baseline period, without any increases caused by changes associated with the projects included in the PAE (i.e, RGCP and PXP).

2. Significant net emissions increase thresholds are listed in 40 C.F.R. 52.21(b)(23)(i).

Table D below shows a summary of the stationary source's PTE and the assessable PTE. The PTE due to the project is listed below.

Table D – Stationary Source's PTE and Assessable Emissions Summary

Parameter	PTE (TPY)						
	NO_X	CO	VOC	$PM_{2.5}$[1]	PM_{10}[1]	PM[1]	SO_2
PTE	2,249.14	734.99	77.90	60.70	60.70	60.70	273.32
Assessable Emissions	2,249.14	734.99	77.90	60.70	60.70	60.70	273.32
Total Assessable Emissions	3,396.06						

Notes:

1. $PM_{2.5}$ emissions are part of and conservatively assumed equal to PM_{10} emissions. PM_{10} and $PM_{2.5}$ emissions are part of Total PM emissions. Therefore, $PM_{2.5}$ and PM_{10} are not counted in total assessable emissions to avoid double counting.

8. REVISIONS TO PERMIT CONDITIONS

Table E below list changes to the requirements carried over from Construction Permit AQ0272CPT01 Revision 1 into Minor Permit AQ0272MSS04.

Table E – Comparison of Construction Permit AQ0272CPT01 Revision 1 to Minor Permit AQ0272MSS04 Conditions[1]

Permit AQ0272CPT01 Revision 1 Condition No.	Description of Requirement	Permit AQ0272MSS04 Condition No.	How Condition was Revised
7.1b	NO_X limit to avoid classification as a PSD Major Modification	6	Replaced fuel consumption limit of 3,272 MMscf per rolling 12-month period with an equivalent NO_X mass emissions limit of 745 TPY.

Notes:

1. This table does not contain all of the standard permit conditions.

9. PERMIT ADMINISTRATION

Minor Permit AQ0272MSS04 contradicts some conditions in the Title V permit issued to LPC. Therefore, the Department will incorporate by reference the applicable requirements of Minor Permit AQ0272MSS04 into the current shielded Title V Operating Permit AQ0272TVP02 Revision 3 by administrative amendment, in accordance with 18 AAC 50.542(e). Hilcorp may not operate under Minor Permit AQ0272MSS04 until the Department issues Title V Operating Permit AQ0272TVP02 Revision 5.

10. PERMIT CONDITIONS

The bases for the standard and general conditions imposed in Minor Permit AQ0272MSS04 are described below.

Cover Page

18 AAC 50.544(a)(1) requires the Department to identify the stationary source, Permittee, and contact information. The Department provided this information on the cover page of the permit.

Section 1: Emissions Unit Inventory

The EUs authorized and/or restricted by this permit are listed in Table 1 of the permit. Unless otherwise noted in the permit, the information in Table 1 is for identification purposes only. Condition 1 is a general requirement to comply with AS 46.14 and 18 AAC 50 when installing an upgraded EU.

Section 2: Fee Requirements

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 (SPC) I language for Minor Permit AQ0272MSS04. The Department modified Condition 2 by removing the requirement to only pay for emissions of each air pollutant in quantities of 10 tons per year or greater, to be consistent with the updates to the emission fees in 18 AAC 50.410(a) that went into effect September 7, 2022. The Department is in the process of incorporating these updates into SPC I.

Section 3: Revisions to Previous Permit Actions

Condition 4 authorizes the recession of Condition 7.1b (in its entirely) of Construction Permit AQ0272CPT01 Revision 1 and replaces it with Condition 6 (equivalent mass NO_X emissions limit of 745 TPY) to avoid PSD major modification.

Condition 5 authorizes the recession of Condition 9, 11, and 12 of Minor Permit AQ0272MSS03 that was in place to validate PAE assumptions for the RGCP once the installation of the 25 MWe transformer is completed.

Section 4: CO Emissions MR&R Requirements

Conditions 7 through 9, 40 C.F.R. 52.21(r)(6) Requirements.

The provisions of 40 C.F.R. 52.21(r)(6) apply with respect to any regulated NSR pollutant emitted from projects for existing emissions units at a major stationary source in circumstances where there is a reasonable possibility that a project that is not part of a major modification may result in a significant emissions increase of that pollutant. The requirements include additional monitoring, recordkeeping, and reporting during the 10-year contemporaneous period after startup of the project (i.e, when the transformer is installed and ready to operate).

Condition 7 requires monitoring of the CO emissions from the four turbines in addition to calculating the net change in CO emissions each calendar year, which determines if the project is a major modification under 40 C.F.R. 52.21(b)(2)(i).

Conditions 8 and 9 include specific recordkeeping and reporting requirements. Condition 9.3 requires the Permittee to submit a PSD permit application if the net change in emissions calculated in accordance with Condition 7.4a for the preceding year reaches or exceeds 100 TPY (including -1.25 TPY of excludable emissions).

Conditions 7 through 9 sunset after 10 calendar years from the date the transformer is installed and ready to operate.

Section 5: General Recordkeeping, Reporting, and Certification Requirements

Condition 10, Certification

18 AAC 50.205 requires the Permittee to certify any permit application, report, affirmation, or compliance certification submitted to the Department. The Department used the language in Standard Permit Condition (SPC) XVII. This requirement is reiterated as a standard permit condition in 18 AAC 50.345(j).

Condition 11, Submittals

Condition 11 clarifies where the Permittee should send their reports, certifications, and other submittals required by the permit. The Department used the language in SPC XVII. The Department included this condition from a practical perspective rather than a regulatory obligation.

Section 6: Standard Permit Conditions

Conditions 12 – 17, 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 minor permit-related standard conditions of 18 AAC 50.345 in Minor Permit AQ0272MSS04. The Department incorporated these standard conditions as follows:

- 18 AAC 50.345(c)(1) and (2) is incorporated as Condition 12 of Section 6 (Standard Permit Conditions); and
- 18 AAC 50.345(d) through (h) is incorporated as Conditions 13 through 17, respectively, of Section 6 (Standard Permit Conditions).

APPENDIX A: BAE and PAE for the LPC Power Export Project

Tables A-1 and A-2 present details of the calculations basis for baseline actual emissions and projected emissions as provided in the minor permit application.

Table A-1 – BAE Summary, in Tons Per Year (TPY)[1]

EU IDs	Description	NO_X[2,7]	CO[3,7]	SO_2[4]	VOC[5]	$PM_{10}/PM_{2.5}$[5,6]
6 through 9	Solar Mars GSC T-12000	269.43	7.99	8.17	1.38	4.34

Notes:

1. BAE for existing equipment were calculated using EFs generated from source tests and hourly operational data from the LPC data acquisition system organized into twenty-six 5 degree (approx.) intake temperature bins for a 24-month period between May 2020 to April 2022.
2. NO_X BAE at each temperature bin was calculated using the NO_X volume concentration (in parts per million by volume on a dry basis (ppmvd)) at site conditions (15% O_2), the emission factor at site conditions (EINOx in lb/MMBtu) multiplied by input heat consumption on a lower heating value (LHV in Btu/scf) basis to get emission factor (EF in lb/hr), and the hours of operation of the turbine. NO_X @ 15% O_2 ISO concentration is derived from provided air fuel ratio (AFR) correlation curve (best fit representing 97.5% confidence interval). NO_X was corrected to site conditions using the equation from 40 C.F.R. 60.335(b)(1). The emissions generated during operation in each of the temperature bins were calculated knowing the percentage of time operating in each bin and the average horsepower generated using 2 years of operational data. The emissions from each of the temperature bins were then summed together to get the total annual average emissions over the 2-year baseline period.
3. CO BAE at each temperature bin was calculated using the CO volume concentration (ppmv) at site conditions (15% O_2), the emission factor at site concentrations (EICO in lb/MMBtu), multiplied by input heat consumption on a LHV (Btu/scf) basis to get EF (lb/hr), and the hours of operation of the turbine. CO exhaust gas concentration is derived from provided AFR correlation curve (best fit representing 97.5% confidence interval). The emissions generated during operation in each of the temperature bins were calculated as described in Note 2 and summed together to get the total annual average emissions over the 2-year baseline period.
4. SO_2 BAE at each temperature bin was calculated using mass balance, the monthly average H_2S concentration (75 ppmv), the hourly average fuel consumption for the LPC power plant, and total aggregate hours operated by all turbines. The emissions generated during operation in each of the temperature bins were calculated as described in Note 2 and summed together to get the total annual average emissions over the 2-year baseline period.
5. VOC BAE and $PM_{10}/PM_{2.5}$ BAE at each temperature bin were determined from EPA AP-42 EFs (Table 3.1-2a, April 2000), the hourly average fuel consumption of the LPC power plant, and total aggregated hours operated by all turbines. The emissions generated during operation in each of the temperature bins were calculated as described in Note 2 and then summed together to get the total annual average emissions over the 2-year baseline period.
6. PM emissions performance is assumed to be the same regardless of control or combustion technology, and all PM is less than PM_{10} and all PM_{10} is less than $PM_{2.5}$.
7. LHV is assumed to be 921 Btu/scf. The calculated volume of dry combustion productions per unit of heat content at stoichiometric conditions based on LPC fuel composition and LHV (F_d) is assumed to be 9,708 dscf/MMBtu, as determined by EPA Method 19, Equation 19-13.

Table A-2 – PAE Summary, in TPY[1,10]

EU IDs	Description	NO_X[8]	CO[8]	SO_2	VOC	$PM_{10}/PM_{2.5}$[7]
8 and 9	Solar Mars GSC T-12000[2]	547.24	2.78	12.31	2.08	6.54
6A and 7A	Solar Mars 90-13000S SoLoNOx	127.70[3,6]	102.73[3,6]	12.82[4]	3.54[5,6]	6.81[5]
Total		674.94	105.51	25.13	5.62	13.35

Threshold to Trigger 40 C.F.R. 52.21(r)(6) (with excludable emissions)[9, 11]		56.74	
Threshold to Trigger PSD Review (with excludable emissions)[9,12]		106.74	

Notes:

1. The PAE is the scenario with the SoLoNOx turbine sharing the load demand with the other SoLoNOx turbine and the two remaining GSC T-12000 turbines to account for the increased LPC power demand after the connection of the 25 MWe electric transformer to the LPC internal power bus.
2. PAE for the unmodified GSC T-12000 turbines were calculated using the projected performance data from Table B-1 in Appendix B of the application and the same methodologies used to calculate BAE for each of the criteria pollutants.
3. NO_X and CO PAE at each temperature bin were determined using the same equations that were used to determine the emission factor at site concentrations (lb/MMBtu), multiplied by the vendor input heat consumption on a LHV (Btu/scf) basis to get EF (lb/hr), and the hours of operation of the turbine. The emissions from operation in each of the temperature bins were then summed together to get the total emissions during a worst-case future year.
4. SO_2 PAE at each temperature bin was determined using projected fuel consumption and mass balance (assumes same value, 75 ppmv, used for BAE). The emissions from operation in each of the temperature bins were then summed together to get the total emissions during a worst-case future year.
5. VOC and $PM_{10}/PM_{2.5}$ PAE at each temperature bin were determined using the projected fuel consumption and EPA AP-42 emission factors (Table 3.1-2a, April 2000). The emissions from operation in each of the temperature bins were then summed together to get the total emissions during a worst-case future year.
6. NO_X and CO emissions performance at 15% O_2 were provided by the vendor because AFR and source test data correlations are not available for the turbines. The emissions provided are valid only if the turbines operate above 50% load during normal operations.
7. PM emissions performance is assumed to be the same regardless of control or combustion technology, and all PM is less than PM_{10} and all PM_{10} is less than $PM_{2.5}$.
8. LHV is assumed to be 921 Btu/scf. LHV (F_d) is assumed to be 9,708 dscf/MMBtu, as determined from EPA Method 19, Equation 19-13.
9. N/A for NO_X, since excludable emissions are used to net out of PSD review. See Table C.
10. PAE assumes worst-case scenario of EU IDs 6A and 7A operating at the same time with EU IDs 8 and 9.
11. Threshold for 40 C.F.R. 52.21(r)(6) requirements was determined from half of the CO SER (50 TPY). The number is derived from 7.99 TPY (BAE) + 50 TPY (half of CO SER) - 1.25 (excludable CO emissions) = 56.74 TPY.
12. Threshold for PSD review was determined from CO SER of 100 TPY. The number is derived from 100 TPY of CO (net change) + 7.99 TPY (BAE) - 1.25 (excludable CO emissions) = 106.74 TPY (CO emissions)

APPENDIX B: Modeling Report

Alaska Department of Environmental Conservation
Air Permits Program

Review of

Hilcorp North Slope, LLC's
Ambient Demonstration
for the
Power Export Project
at the
Lisburne Production Center

Minor Permit AQ0272MSS04

Prepared by: James Julian Renovatio
Prepared on: October 22, 2025

1. INTRODUCTION

This report summarizes the Alaska Department of Environmental Conservation's (Department's) findings regarding the ambient demonstration submitted by Hilcorp North Slope, LLC (Hilcorp) for the Power Export Project (PXP). Hilcorp submitted this analysis in support of their 2 July, 2024 minor permit application (AQ0272MSS04). Hilcorp demonstrated that operating the Lisburne Production Center (LPC) emissions units (EUs) within the restrictions listed in this report will not cause or contribute to a violation of the:

- annual nitrogen dioxide (NO_2);
- annual and 24-hour particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10});
- eight- and one-hour carbon monoxide (CO); or
- annual, 24-hour, and three-hour sulfur dioxide (SO_2)

Alaska Ambient Air Quality Standards (AAAQS) established in 18 AAC 50.010. Additionally, Hilcorp demonstrated that the PXP will not cause or contribute to a violation of the:

- annual NO_2;
- annual and 24-hour PM_{10}; or
- annual, 24-hour, and three-hour SO_2

maximum allowable increases (increments) described in 18 AAC 50.020.

2. PROJECT BACKGROUND

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

2.1. Project/Source Location

The LPC is an existing stationary source situated on the Alaskan North Slope coastal plain, approximately two kilometers (km) inland from the Beaufort Sea. Application materials indicate the source is located at 70°17'6.3" N, 148°25'54.3" W. This location is within the census-designated community of Prudhoe Bay.

2.2. Project/Source Description

Hilcorp's LPC PXP proposes the modification of permitting for an existing stationary source. Salient regulatory aspects of the project include the upgrade of an existing power generation turbine to one with emissions controls and a revision to the form of terms and conditions of monitoring, recordkeeping, and reporting (MR&R) associated with prevention of significant deterioration (PSD) avoidance for oxides of nitrogen (NO_X).

The EU inventory at the LPC consists of both liquid fuel- and fuel gas-fired equipment at the production pad and associated drill sites. It includes various turbines[1], reciprocating internal combustion engines, heaters/boilers, high- and low-pressure flares, liquid hydrocarbon storage tanks, and various emergency or limited-use equipment.

[1] The EU inventory provided in the current Title V permit for the stationary source includes power generation, compression, refrigeration, and gas injection turbines.

The LPC is a prevention of significant deterioration (PSD) major stationary source. Hilcorp presently operates the source under Title V Operating Permit[2] AQ0272TVP02 Revision 3 and administrative amendment Revision 4.

2.3. Project Classification

Hilcorp's application is classified under 18 AAC 50.508(6) for their request to revise or rescind terms or conditions of a permit issued under the Title I provisions of the Clean Air Act. Applicants subject to this classification must include the effects of revising or rescinding the terms or conditions on the underlying ambient demonstration[3] in accordance with the requirements of 18 AAC 50.540(k)(3)(C).[4]

Hilcorp proposed the upgrade of an existing power generation turbine to include SoLoNOx emissions controls and a revision to the form of associated fuel consumption MR&R. These proposed revisions impact the limits of Condition 7.1 in Air Quality Control Construction Permit AQ0272CPT01 Revision 1, which were initially established to protect the ambient air quality standards and increments. Hilcorp met the showing requirements by submitting an ambient demonstration of the estimated annual NO_2; annual and 24-hour PM_{10}; eight- and one-hour CO; and annual, 24-hour, and three-hour SO_2 AAAQS, in addition to the annual NO_2; annual and 24-hour PM_{10}; and annual, 24-hour, and three-hour SO_2 increment impacts with their application.

2.4. Modeling Protocol Submittal

The Department does not typically require a modeling protocol to be submitted[5] with applications for minor permits. 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.

Hilcorp did not submit a modeling protocol for the LPC PXP. Application materials indicate they employed an approach that 'relies heavily' upon the underlying demonstration, provided in support of Air Quality Control Construction Permit AQ0272CPT01, to develop their current ambient demonstration.

2.5. Application Submittal

Hilcorp submitted an application for a minor permit with an ambient analysis on 2 July, 2024. Their consultant, SLR International Corporation (SLR), prepared the application and ambient analysis on their behalf.

[2] The current Title V Operating Permit has expired, but remains active under shield. The Applicant previously submitted an application for renewal, which the Department is processing contemporaneously with their application for Air Quality Control Minor Permit AQ0272MSS04.

[3] This demonstration was initially prepared by BP Exploration Alaska, Inc. in support of permitting at the stationary source occurring in the late 1990s. It was subsequently revised and submitted by the then Applicant in support of Air Quality Control Construction Permit AQ0272CPT01, issued in February of 2001.

[4] 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. The Permittee associated with the underlying ambient demonstration conducted their analysis prior to the Department's adoption of the one-hour SO_2 AAAQS. Therefore, Hilcorp was not required to provide this aspect of analysis with their application for a minor permit.

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

3. SOURCE IMPACT ANALYSIS

Hilcorp used computer analysis (modeling) to predict the ambient NO_2, PM_{10}, CO, and SO_2 air quality impacts. The Department's findings regarding their analysis are discussed below.

3.1. Approach

An applicant may use a multi-step approach in performing an ambient demonstration. In this approach, project impacts are first compared 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.

Hilcorp's application materials indicate that the change in project emissions from the pollutants and averaging periods subject to review are not likely to cause an increase in impacts above the respective SILs. They, nevertheless, performed a cumulative impact analysis with a stated purpose of providing a basis for future analyses. This analysis was developed using the underlying demonstration[6] as a basis. It was revised to reflect changes to various sources, modeling techniques, and other key aspects of importance that have occurred during the period of time that has elapsed since its submission. Hilcorp's analysis observes one operational scenario[7] that entails the contemporaneous operation of all EUs with loads and emission rates "*…consistent with or higher than those used to develop source potential to emit*". The Department finds that assuming the contemporaneous operation of all EUs at their maximum emission rates is a generally conservative approach where a single modeled scenario is appropriate.

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). Hilcorp 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. Hilcorp used the current versions of AERMOD and AERMET, both version 23132, at the time of their application. They assumed flat terrain within the modeled domain rather than running AERMAP, which is common practice for new source review modeling on the North Slope coastal plain.

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 is required, per Section 8.4 of the Guideline. When modeling with site-specific

[6] The underlying demonstration from the late 1990s, as revised for submission in 2000, was originally prepared using the Industrial Source Complex Short Term Version 3 (ISCST3) model.

[7] Application materials describe this scenario as relying upon the exclusive firing of fuel gas in the dual-fuel turbines, which are currently authorized to fire gaseous fuel only. The underlying demonstration included multiple scenarios to account for the firing of different fuels in the dual fuel turbines.

data, the Guideline recommends that up to five years should be used, when available, to account for year-to-year variation in meteorological conditions.

Hilcorp used two years of site-specific surface data collected during calendar years 2019 and 2020 at the Prudhoe Bay A-Pad monitoring station. They used concurrent upper air data collected by the NWS at Utqiagvik. Section 3.0 of Hilcorp's ambient demonstration, provided as Attachment C to their 2 July, 2024 application, includes a basis for the selection and use of these data and an evaluation of their current representativeness in terms of the discussions and recommendations for meteorological input advanced under Section 8.4 of the Guideline. The Department finds that the case-specific use of these data is adequate to support the ambient demonstration for Air Quality Control Minor Permit AQ0272MSS04. It notes that Hilcorp re-processed their meteorological data using the most current version of AERMET, 23132.

3.4. Coordinate System

Air quality models need to know the relative location of the EUs, structures, and receptors in order to properly estimate ambient pollutant concentrations. Therefore, applicants must use a consistent coordinate system in their analysis. Hilcorp used the Universal Transverse Mercator (UTM) system, Zone 6.

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, unless the entire modeling domain is over water or the terrain features are so slight that a flat terrain assumption can be made. 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.

Hilcorp did not include terrain data in their modeling analysis. Their application indicates the project is situated within the North Slope coastal plain, which may be assumed flat for the purposes of modeling. This is an appropriate assumption for the current demonstration at the LPC stationary source.

3.6. EU Inventory

Hilcorp modeled all of the LPC PXP EUs in their ambient demonstration except as subsequently noted. The modeled LPC EUs were characterized as point sources.

3.6.1. Excluded EUs

Hilcorp's modeled EU inventory included only those units modeled in the underlying ambient demonstration. They did not model an unspecified capacity of transient and/or non-road engine EUs associated with the LPC PXP. These units are generally described in Section 1.2 of their 2 July, 2024 application as supporting project construction activities to be performed in late 2025. Hilcorp's application indicates that they do not anticipate a large inventory of non-road engines citing the scope of proposed work.

The Department typically requires information regarding the ratings, proposed use(s), and characterization of an Applicant's non-road engine inventory in order to reliably estimate the spatial and temporal contributions of their ambient impacts. The impacts of

principal concern in Hilcorp's ambient demonstration include the maximum allowable increases for annually averaged NO_2 and SO_2, model-estimated as consuming 76- and 91-percent of their respective increment thresholds. The Department notes that Hilcorp's ambient demonstration is imbued with elements of conservatism with regard to these pollutants and averaging periods. Therefore, impacts from these unmodeled non-road engine EUs are anticipated to be adequately represented through ambient background data for Air Quality Control Minor Permit AQ0272MSS04.

3.6.2. Increment Analysis

The LPC stationary source is located within a Class II area of the Northern Alaska Intrastate Air Quality Control Region. The minor source baseline dates for the pollutants subject to review are

- 8 February, 1988 for NO_2;
- 13 November, 1978 for PM_{10}; and
- 1 June, 1979 for SO_2.

The major source baseline dates for the aforementioned pollutants are

- 8 February, 1988 for NO_2;
- 6 January, 1975 for PM_{10}; and
- 6 January, 1975 for SO_2.

Hilcorp considered the LPC stationary source fuel-burning EUs as increment consuming in their increment analysis noting that most units were installed after the baseline dates. Their analysis did not include the EUs discussed under Section 3.6.1 of this report, off-site sources not included in the underlying increment demonstration, or impacts attributable to mobile and non-road activities.

Hilcorp conservatively assumed that the potential emissions of PM_{10} and SO_2 from the LPC EUs consume increment. They assumed the actual emissions of NO_X during calendar years 2022 and 2023 consume increment. Their application indicates that the latter approach remains protective of the NO_X increment noting that not all LPC EUs are increment consuming and the PXP will be increment expanding for this pollutant. A description of Hilcorp's characterization of off-site increment impacts is discussed under Section 3.13. The Department finds Hilcorp's increment analysis sufficient to characterize impacts with regard to the maximum allowable NO_2, PM_{10}, and SO_2 increases in the LPC PXP.

The Department encourages applicants to discuss the proposed selection and evaluation of an increment inventory with the Department prior to submission of an application.

3.7. EU Release Parameters

The assumed emission rates and characterization of how emissions enter the atmosphere will significantly influence 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 Hilcorp's modeled emission rates to be consistent with the emissions information provided throughout their application. The exceptions, or items that otherwise warrant additional information, are discussed below. A discussion regarding turbine emissions is provided in Section 3.7.2.1.

3.7.1.1. Sulfur Compound Emissions

SO_2 emissions are directly related to the sulfur content of the fuel(s) fired. The sulfur content of liquid fuels occurs as elemental sulfur; that of gaseous fuels occurs as hydrogen sulfide (H_2S).

The LPC stationary source consists of both liquid and gaseous fuel-fired EUs. Hilcorp's PXP entails proposed modifications to fuel gas-fired turbine EUs 6 through 9. They assumed a H_2S content of 168 parts-per-million by volume (ppmv) for the fuel fired in these turbines. This concentration reflects an upper limit required by the terms and conditions of a best available control technology (BACT) determination[8] associated with the Title V Operating Permit for this stationary source.

3.7.1.2. Short-term Emission Rates

The modeled emission rate should generally reflect the maximum emissions allowed during a given averaging period. Hilcorp used the maximum emissions by averaging period to develop the modeled emission rates for their PXP turbine EUs. Additional discussion is provided in Section 3.7.2.1. Therefore, the Department is not including any short-term operational restrictions to protect ambient air quality.

3.7.2. Point Source Parameters

In addition to the emission rates, applicants must provide the stack height, diameter, location, base elevation, exhaust plume exit velocity, and exhaust temperature for each EU that is 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. Information that warrants additional discussion is discussed below.

3.7.2.1. Load Analysis

The maximum ambient pollutant concentration does not always occur during the full-load operating conditions that typically produce the maximum emissions. The relatively poor dispersion that occurs with cooler exhaust temperatures and slower part-load exit velocities may produce the maximum ambient impacts. Turbine emissions also tend to greatly vary by fuel type, load, and inlet air temperature. Therefore, EPA recommends that a load analysis be conducted on the primary EUs to determine the worst-case conditions.

Hilcorp developed modeled emissions assumptions for the PXP EUs using data for Solar Mars 90 turbines. These data provide emissions information for NOx, PM_{10},

[8] Established in Permit to Operate No. 9473-AA025.

CO, and SO_2 by both load condition and ambient operating temperature. Hilcorp assumed the most conservative emissions rates by pollutant and averaging period across all load and temperature regimes provided by these data. This is a generally appropriate approach for the ambient demonstration supporting Air Quality Control Minor Permit AQ0272MSS04.

3.7.2.2. Horizontal/Capped Stacks

Capped stacks or those with horizontal atmospheric releases warrant additional discussion because they generally lead to higher impacts in the near-field than would occur from uncapped, vertical releases. Therefore, non-vertical stacks or those with rain caps require special handling in an AERMOD analysis. EPA describes the proper approach for characterizing these types of stacks in their *AERMOD Implementation Guide*.[9] EPA has also developed options in AERMOD that will automatically revise the stack and exhaust parameters for any point source releases identified as horizontal or capped by using the POINTHOR and POINTCAP keywords.

Hilcorp used EPA's POINTHOR model option to characterize flare EU IDs 33 through 38[10] as having a horizontal atmospheric release. They modeled all other EU stacks using uncapped, vertical releases. Enforceable terms and conditions requiring a vertical release for all the EUs at the LPC except for the flares that were included in Air Quality Control Construction Permit AQ0272CPT01 and have since been incorporated in the Title V Operating Permit for the stationary source.

3.8. Off-site Source Characterization

Hilcorp considered the impacts from nearby stationary sources in their cumulative analysis. A discussion of their approach for the selection of off-site sources to explicitly model is provided under Section 3.13. Hilcorp's characterization of the modeled off-site EUs is described below.

3.8.1. Off-site Emissions and Stack Parameters

Hilcorp assumed the emission rates and stack parameters from the underlying ISCST3 demonstration to characterize their off-site inventory in the LPC PXP. Application materials indicate that the SO_2 emission rate for select off-site units were doubled using the 'SEASON' model keyword to account for a general trend of souring gas in the region. A list of Hilcorp's modeled off-site sources is included in Table A-2 from the March of 2000 response to Department comments prepared by Arco Alaska Inc. for the Lisburne Production Center Modification project.

3.9. Pollutant Specific Considerations

The following pollutants warrant additional discussion.

3.9.1. Ambient NO_2 Modeling

The emissions of NO_X from combustion sources include both nitric oxide (NO) and NO_2 constituents. After combustion gases exit a stack, additional NO_2 can be formed

[9] *AERMOD Implementation Guide* (EPA-454/B-23-009); October 2023.
[10] Modeled with the 'F1' point source ID.

due to reactions within the atmosphere. Section 4.2.3.4 of the Guideline describes a three-tiered approach for estimating the ambient concentrations of NO_2 from this process, ranging from the simplest but very conservative assumption that all NO is converted to NO_2, to other more complex methods.

Hilcorp used the Tier 2 Ambient Ratio Method version 2 (ARM2) approach, where AERMOD applies an ambient NO_2-to-NO_X ratio to the one-hour modeled NO_X concentrations based on a formula empirically derived from ambient monitored NO_2-to-NO_X ratios. The ARM2 option includes default upper and lower limits on the ambient ratio applied to the modeled NO_X concentration of 0.9 and 0.5, respectively. Hilcorp used the default limits.

3.10. 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. Hilcorp used the current version of BPIPPRM, version 04274, to determine the building profiles needed by AERMOD.

Hilcorp included all of the modeled point sources in their downwash analysis. The Department used a proprietary 3-D visualization program to review their characterization of the exhaust stacks and structures. The characterization matches the figures provided in their permit application. Hilcorp appropriately accounted for downwash in their modeling analysis. BPIPPRM indicated that the modeled exhaust stacks are within the GEP stack height requirements.

3.11. Ambient Air Boundary

The AAAQS and increments only apply within location of *ambient air*, which has been defined by EPA as "…*that portion of the atmosphere, external to buildings, to which the general public has access*." [11] Applicants may, therefore, exclude areas that they own or lease from an ambient demonstration if they employ "…*measures, which may include physical barriers, that are effective in precluding access to the land by the general public.*" [12] 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.

[11] The term "ambient air" is defined in 40 CFR 50.1. The Alaska Legislature has also adopted the definition by reference in AS 46.14.990(2).

[12] EPA has authored multiple guidance documents regarding ambient air issues which may be found in their Modeling Clearinghouse Information Storage and Retrieval System at http://cfpub.epa.gov/oarweb/MCHISRS/. This language originates from the December 2, 2019 Memorandum from EPA Administrator Andrew R. Wheeler to Regional Administrators: *Revised Policy on Exclusions from 'Ambient Air*.

Hilcorp used the edge of the LPC and aggregated well pads as their ambient air boundary. This is a typical approach and generally suitable North Slope stationary sources on a case-specific basis.

3.12. Receptor Grid

Hilcorp used a rectangular receptor grid of decreasing resolution centered about the stationary source. The receptor resolutions are:

- 25 meter (m) spacing along the ambient boundary;
- 25 m spacing from the ambient boundary to 500 m outward;
- 100 m spacing from the former resolution to 1.5 km outward; and
- 500 m spacing from the former resolution to 5 km outward.

Hilcorp's grid has sufficient resolution and coverage to determine the maximum impacts in the LPC PXP.

3.13. Off-Site Impacts

The air quality impact from natural and regional sources, along with long-range transport from far away sources, must be accounted for in a cumulative AAAQS demonstration. The increment consuming impact from nearby anthropogenic sources must likewise be accounted for in a cumulative increment demonstration. The approach for incorporating these impacts must be evaluated on a case-specific basis for each type of assessment and for each pollutant, as applicable.

Section 8.3 of the Guideline discusses how the off-site impacts could be incorporated for purposes of demonstrating compliance with an air quality standard. These impacts must be represented through either ambient monitoring data or through modeling. However, Section 8.3.3(b)(iii) notes, "*The number of nearby sources to be explicitly modeled in the air quality analysis is expected to be few except in unusual situations*." The language in this section further states that "*...sources that cause a significant concentration gradient in the vicinity of the* [applicant's source] *are not likely to be adequately characterized by the monitored data due to the high degree of variability of the source's impacts.*"

Hilcorp's application materials for the LPC PXP indicate that they modeled the same off-site sources and increment inventory that were included in the underlying demonstration. The assumed emission rates and release parameters for these sources are discussed under Section 3.8.1. These off-site sources are spatially proximate to the LPC stationary source, possess significant emissions potentials, and are appropriate for inclusion based on the recommendations of the Guideline. The Department notes that the model-estimated impacts from the off-site sources reported in the underlying ISCST3 modeling effort, as revised for submission in 2000, show ambient air impacts that are significantly below those attributable to the LPC stationary source. This trend appears to persist in the PXP, which may introduce elements of conservatism into model results. The Department, therefore, finds that Hilcorp's selection of modeled off-site sources remains appropriate for the LPC PXP. A list of the modeled off-site sources is included in Table A-2 from the March of 2000 response to Department comments prepared by Arco Alaska Inc. for the Lisburne Production Center Modification project.

Hilcorp also relied upon ambient pollutant data[13] from the Prudhoe Bay Unit A-Pad and Central Compressor Plant monitoring stations to represent impacts from non-modeled sources. The use of these background pollutant data, as proposed, may be considered appropriate on a case-specific basis.

3.14. Modeled Design Concentrations

EPA generally allows applicants to use modeled concentrations that are consistent with the form of the standard as their design concentration. Applicants must always compare their highest modeled concentrations to the deterministic annually average standards, increments, and SILs.

Hilcorp's assumed design concentrations are summarized in Table 1.

Table 1. Design concentrations

Pollutant	Avg. Period	Design Value
NO_2	Annual	The maximum annual concentration from any modeled year
PM_{10}	24-hour	The high fourth-high 24-hour concentration over one modeled year
CO	Eight-hour	The high second-high 24-hour concentration over the modeled years
	One-hour	The high second-high 24-hour concentration over the modeled years
SO_2	Annual	The maximum annual concentration from the modeled year
	24-hour	The 98th percentile 24-hour concentration over one modeled year
	Three-hour	The 98th percentile 24-hour concentration over one modeled year
	One-hour	The 99th percentile maximum daily one-hour concentration from the modeled years

4. RESULTS AND DISCUSSION

The maximum modeled annually averaged NO_2; annually averaged and 24-hour PM_{10}; eight and one-hour CO; and annually averaged, 24-hour, and three-hour SO_2 impacts from Hilcorp's cumulative analysis is provided in Table 2. The background concentrations, total impacts, and respective ambient standards are also provided for comparison. The total modeled impacts are less than the respective AAAQS. Therefore, Hilcorp has demonstrated compliance with the AAAQS.

[13] Application materials indicate that the Applicant relied upon: 2014-2016 data from A-Pad to characterize NO_2 impacts; 2013-2015 data from A-Pad to characterize SO_2 impacts; 2014-2016 data from CCP to characterize 24-hour PM_{10} impacts; 2010 data from CCP to characterize annual PM_{10} impacts; and 2014-2016 data from CCP to characterize CO impacts.

Table 2. Maximum impacts compared to the ambient standards

Pollutant	Avg. Period	Modeled Design Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	AAAQS ($\mu g/m^3$)
NO_2	Annual	45.19	6.20	51.4	100
SO_2	Three-hour	120.9	40.3	161.0	1,300
	24-hour	64.86	5.5	70.4	365
	Annual	18.13	1.20	19.3	80
PM_{10}	Annual	2.875	6.80	9.67	50
	24-hour	14.93	60.0	74.9	150
CO	One-hour	1,256	1,145	2,401	40,000
	Eight-hour	652.0	1,145	1,797	10,000

The maximum modeled annually averaged NO_2; annually averaged and 24-hour PM_{10}; and annually averaged, 24-hour, and three-hour SO_2 impacts from Hilcorp's increment demonstration is provided in Table 3. The respective Class II increments are also provided for comparison. The total modeled impacts are less than the respective Class II increments. Therefore, Hilcorp has demonstrated compliance with the maximum allowable increases.

Table 3. Maximum impacts compared to the increments

Pollutant	Avg. Period	Max. Modeled Concentration ($\mu g/m^3$)	AAAQS ($\mu g/m^3$)
NO_2	Annual	19.02	25
SO_2	Three-hour	121	512
	24-hour	64.9	91
	Annual	18.1	20
PM_{10}	24-hour	14.93	30
	Annual	2.875	17

5. CONCLUSION

The Department reviewed Hilcorp's modeling analysis and concludes the following:

1. Emissions from the proposed LPC PXP stationary source EUs will not cause or contribute to a violation of the annually averaged NO_2; annually averaged and 24-hour

PM_{10}; eight and one-hour CO; and annually averaged, 24-hour, and three-hour SO_2 AAAQS listed in 18 AAC 50.010.

2. Emissions from the proposed LPC PXP stationary source EUs will not cause or contribute to a violation of the annually averaged NO_2; annually averaged and 24-hour PM-10; and annually averaged, 24-hour, and three-hour SO_2 increments listed in 18 AAC 50.020.
3. Hilcorp's modeled analysis complies with the ambient demonstration requirements of 18 AAC 50.540(k)(3).
4. Hilcorp performed their modeled analysis in a manner consistent with the Guideline, as required under 18 AAC 50.215(b)(1).