Alaska Department of Environmental Conservation
Air Permits Program

TECHNICAL ANALYSIS REPORT
For the terms and conditions of
Minor Permit No. AQ1854MSS01

Issued to Hilcorp North Slope, LLC
For Omega Pad

Preliminary – August 1, 2024

Prepared by Joshua Klina
ADEC AQ/APP (Juneau)

Reviewed by Grace M. Germain
ADEC AQ/APP (Anchorage)

1. INTRODUCTION

This Technical Analysis Report (TAR) provides the Alaska Department of Environmental Conservation's (Department's) basis for issuing Minor Permit No. AQ1854MSS01 to Hilcorp North Slope, LLC (Hilcorp) for Omega Pad. The permit application is classified under 18 AAC 50.502(c)(1) for a new stationary source that has the potential to emit greater than 40 tons per year (TPY) of oxides of nitrogen (NO_x), 40 TPY of sulfur dioxide (SO_2), 10 TPY of particulate matter less than or equal to a nominal 2.5 microns in diameter ($PM_{2.5}$), and 15 TPY of particulate matter less than or equal to a nominal 10 microns in diameter (PM_{10}).

2. APPLICATION DESCRIPTION

Omega Pad is a proposed project for the construction of a new stationary source. Hilcorp proposes to construct a new drilling and production pad within the Western Operating Area of the Prudhoe Bay oil field, approximately 7.8 miles west-southwest of Hilcorp's Gathering Center #2 (GC-2). Omega Pad is expected to provide access to approximately 3,500 acres of undeveloped oil reserves.

The Omega Pad project will include the construction of a production pad, drilling of new wells, construction of a processing facility, and tie-ins to existing production transport pipelines and gas lift pipelines, electrical infrastructure, and other facilities. The proposed emissions unit (EU) inventory consists of four hot oil heaters, one or two standby generator engines[8], and five storage tanks.

Hilcorp submitted their application on December 21, 2023.

3. CLASSIFICATION FINDINGS

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

1. Minor Permit No. AQ1854MSS01 is classified under 18 AAC 50.502(c)(1) for a new stationary source that has the potential to emit greater than 40 TPY of NO_x, 40 TPY of SO_2, 10 TPY of $PM_{2.5}$, and 15 TPY of PM_{10}.

4. APPLICATION REVIEW FINDINGS

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

1. Hilcorp's minor permit application for Omega Pad contains the elements listed in 18 AAC 50.540.
2. Omega Pad will become a Title V source under 18 AAC 50.326 when emissions units authorized by this minor permit become fully operational because potential NO_x and CO emissions will each exceed the 100-TPY Title V major source threshold.
3. Hilcorp's modeling analysis complies with the ambient demonstration requirements of 18 AAC 50.540(c)(2).
4. To protect the annually averaged NO_2; 1-hour, 3-hour, 24-hour, and annually averaged SO_2; 24-hour and annually averaged $PM_{2.5}$; and 24-hour PM_{10} Alaska ambient air quality

[8] Hilcorp's application materials indicate that Hilcorp has yet to identify the actual engine or engines that will be installed as EU ID 5, standby engine(s). EU ID 5 will either be one ultra-low sulfur diesel (ULSD)-fired engine that will have a maximum capacity of 1,490 (bhp) or two ULSD-fired engines that will have a maximum rated capacity of 779 bhp, each.

standards (AAAQS), the Permittee is required to comply with the following requirements:

- Construct and maintain the exhaust stacks of EU IDs 1 – 5 according to the stack configuration requirements in Condition 10.1. For further discussion, see Section 3.7.2.2 of the modeling review in Appendix B.
- Construct and maintain the exhaust stacks of EU IDs 1 – 4 according to the stack height requirements in Condition 10.2. For further discussion, see Section 3.7.2.1 of the modeling review in Appendix B.
- Limit the hydrogen sulfur (H_2S) content of fuel gas combusted in EU IDs 1 – 4 to no more than 250 parts per million by volume (ppmv) as required in Condition 11.1. For further discussion, see Section 3.7.1.1 of the modeling review in Appendix B.
- Limit the sulfur content of diesel fuel combusted in EU ID 5 to no more than 0.0015 percent sulfur by weight as required in Condition 11.2. For further discussion, see Section 3.7.1.1 of the modeling review in Appendix B.

5. The Department added Condition 3 to require tracking of nonroad engines (NREs), including NREs identified as construction phase units, to ensure that any NRE brought onto the stationary source will maintain its NRE status, as defined in 40 C.F.R. 1068.30. The Department deems this requirement is necessary because the stationary source's NO_x and CO PTEs of 212.25 TPY and 216.48 TPY, respectively, are close to the PSD major classification threshold of 250 TPY. No NREs have been identified in Hilcorp's current application materials for the Omega Pad project. In a response to one of the Department's information requests, Hilcorp stated they have not identified the exact construction equipment inventory that will be used for the project. However, Hilcorp stated that "based on typical construction activities for other Alaska North Slope facilities, Hilcorp anticipates that construction emissions will originate predominantly from fuel-fired highway engines, small nonroad engines, and small portable heaters." As such, it is possible that Hilcorp will bring NRE(s) onto the stationary source as part of its construction equipment inventory. NREs brought onto the stationary source can be regulatorily significant depending on the cumulative capacity of those units and whether those units maintain their statuses as NREs. The tracking requirements in Condition 3 make it possible to track major NREs brought onto the stationary source, to verify that they maintain their statuses as NREs, and to determine their impacts on the stationary source's classification.

5. EMISSIONS SUMMARY AND PERMIT APPLICABILITY

Table 3 shows the emissions summary and permit applicability with assessable emissions from the stationary source. Emission factors and detailed calculations are provided in Appendix A.

A summary of the potential to emit (PTE) and assessable PTE, as determined by the Department, is shown in Table 3 below.

Table 3 – Emissions Summary and Permit Applicability, tons per year (TPY)

Parameter	NO_x	CO	VOC	$PM_{2.5}$	PM_{10}	PM	SO_2
New Stationary Source PTE	212.25	216.48	14.11	15.63	15.63	15.63	84.00

Parameter	NO_x	CO	VOC	$PM_{2.5}$	PM_{10}	PM	SO_2
18 AAC 50.502(c)(1) Permit Thresholds	40	N/A	N/A	10	15	N/A	40
502(c)(1) Applicable?	Y	N/A	N/A	Y	Y	N/A	Y
PSD Major Threshold	250	250	250	250	250	N/A	250
PSD Major Required	N	N	N	N	N	N/A	N
Title V Permit Thresholds	100	100	100	100			100
Title V Permit Required?	Y	Y	N	N			N
Assessable Emissions	212.25	216.48	14.11	15.63[a]			84.00
Total Assessable [a], [b]	542.47						

Notes:

[a] – PM emissions include PM_{10} and $PM_{2.5}$ emissions. Therefore, PM_{10} and $PM_{2.5}$ are not counted in total assessable emissions.

[b] HAP emissions are a subset of either VOC or PM_{10} emissions and are excluded from the assessable emissions total to avoid double counting. The total cumulative HAP PTE is 3.9 TPY, including the highest single HAP (n-Hexane) PTE at 3.6 TPY.

6. PERMIT ADMINISTRATION

Hilcorp may proceed with construction of the stationary source upon the issuance of this minor permit. The stationary source has the potential to emit more than 100 TPY of one or more criteria pollutants. Therefore, the stationary source is required to obtain a Title V operating permit. A timely Title V application for the stationary source is due no later than 12 months after the stationary source commences operation or reaches the 100-TPY threshold. The Department is interpreting 'commences operation' as 'starting to operate any of the emissions units listed in Table 1 of Minor Permit No. AQ1854MSS01. The Department based its decision on a reasonable interpretation for 40 C.F.R. 71.5(a)(1)(ii).

7. PERMIT CONDITIONS

The bases for the standard and general conditions imposed in Minor Permit No. AQ1854MSS01 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 a replacement EU.

Condition 2 is a general requirement for good air pollution control practices and maintenance of EUs operated at the stationary source. Maintaining and operating equipment in good working order is fundamental to preventing unnecessary or excess emissions. Standard conditions for monitoring compliance with emission standards are based on the assumption that good maintenance is performed. Without appropriate maintenance, equipment can deteriorate more quickly than with appropriate maintenance. The Permittee

is required to keep maintenance records to show that proper maintenance procedures were followed, and to make the records available to the Department.

Condition 3 requires tracking of NREs brought onto the stationary source, to verify that they maintain their statuses as NREs according to 40 C.F.R. 1068.30, and to determine their impacts on the stationary source's classification. Hilcorp has not identified a construction units inventory in their application materials for this stationary source. However, in a response to one of the Department's information requests, Hilcorp stated that "based on typical construction activities for other Alaska North Slope facilities, Hilcorp anticipates that construction emissions will originate predominantly from fuel-fired highway engines, small nonroad engines, and small portable heaters." As such, it is possible that Hilcorp will include NREs as part of the construction units inventory for this project. The stationary source's NO_x and CO PTEs of 212.25 TPY and 216.48 TPY, respectively, are close to the PSD major classification threshold of 250 TPY. As such, NREs brought onto the stationary source can be regulatorily significant depending on the cumulative capacity of those units and whether those units maintain their statuses as NREs.

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 No. AQ1854MSS01. However, the Department modified the condition 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.

Condition 6.3 applies only to permitted new stationary sources that have not yet commenced construction or operations or existing stationary sources that are inactive but are keeping their operating permits current. As indicated by this condition, if the stationary source has not commenced construction or operation on or before March 31, the Permittee is required to submit a transmittal letter certified by the responsible official under 18 AAC 50.205 indicating that the assessable emissions for the source are zero for the previous fiscal year and provide estimates for when construction or operation will commence.

Section 3: State Emission Standards

Condition 7, Visible Emissions

Visible emissions, excluding condensed water vapor, from an industrial process or fuel-burning equipment may not reduce visibility through the effluent by more than 20 percent averaged over six consecutive minutes, under 18 AAC 50.055(a)(1).

Permits classified under 18 AAC 50.502(c) must include terms and conditions requiring performance tests for emission limits under 18 AAC 50.050-18 AAC 50.090. Therefore, the Department is requiring an initial compliance demonstration (Method 9 observation) for EU ID 5 (diesel-fired engine) within 60 days of its startup. The Department has also included recordkeeping and reporting requirements for EU ID 5 to assure compliance with the visible emissions standard.

The Department will not be requiring performance testing for the fuel gas-fired heaters (EU IDs 1 – 4) because fuel gas-fired equipment generally complies with the visible emissions standard while they only combust fuel gas. Therefore, in place of requiring performance testing, the Department is requiring the Permittee to certify in each operating report required under Condition 17 that only fuel gas is combusted in each of EU IDs 1 – 4. Combusting any fuel other than fuel gas in any of EU IDs 1 – 4 shall be reported under excess emissions and permit deviation reporting requirements. This is consistent with the language in the Department's Standard Permit Condition (SPC) VIII (Visible Emissions and Particulate Matter Monitoring Plan for Gas Fuel-Burning Equipment).

Ongoing visible emissions monitoring for EU IDs 1 – 5 will be included in the Operating Permit.

Condition 8, Particulate Matter (PM)

Particulate matter emitted from an industrial process or fuel-burning equipment may not exceed 0.05 grains per cubic foot of exhaust gas (gr/dscf), averaged over three hours, under 18 AAC 50.055(b).

Experience has shown there is a correlation between opacity and particulate matter. Twenty percent visible emissions would normally comply with the 0.05 gr/dscf. As such, compliance with the opacity limits is included as a surrogate method of assuring compliance with the PM standards.

Ongoing PM monitoring for EU IDs 1 – 5 will be included in the Operating Permit.

Condition 9, Sulfur Compound Emissions

Sulfur compound emissions from an industrial process or fuel burning equipment may not exceed 500 ppm averaged over a period of three hours, under 18 AAC 50.055(c).

Permits classified under 18 AAC 50.502(c) must include terms and conditions requiring performance tests for emission limits under 18 AAC 50.050 – 090.

Calculations show that fuel oil with a sulfur content less than 0.74 percent by weight will comply with the state sulfur standard. Therefore, diesel fuel grades with a maximum sulfur content of 0.0015 percent by weight, such as ultra-low sulfur diesel (ULSD), will meet the state sulfur standard. Per Condition 11.2, the Permittee can only combust liquid fuel that meets the specifications of ULSD in EU ID 5.

Calculations show that fuel gas with a hydrogen sulfide (H_2S) content less than 4,000 parts per million by volume (ppmv) will comply with the state sulfur standard. Therefore, fuel gas with a maximum H_2S content of 250 ppmv will meet the state sulfur standard. Per Condition 11.1, the Permittee can only combust fuel gas with a maximum H_2S content of 250 ppmv in EU IDs 1 – 4.

The Permittee will demonstrate compliance with the state sulfur standard by complying with the more stringent sulfur limits and associated MR&R requirements found under Condition 11.

Section 4: Ambient Air Quality Protection Requirements

Conditions 10 - 11, Ambient Air Quality Protection Requirements

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 annually averaged NO_2; 1-hour, 3-hour, 24-hour, and annually averaged SO_2; 24-hour and annually averaged $PM_{2.5}$; and 24-hour PM_{10} AAAQS for the reasons described in the modeling review found in Appendix B of this TAR.

Section 5: General Recordkeeping, Reporting, and Certification Requirements

Condition 12, Recordkeeping Requirements

The condition restates the regulatory requirements for recordkeeping, and supplements the recordkeeping defined for specific conditions in the permit. The records being kept provide evidence of compliance with this requirement.

Condition 13, 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 14, Submittals

Condition 14 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.

Condition 15, Information Requests

AS 46.14.020(b) allows the Department to obtain a wide variety of emissions, design and operational information from the owner and operator of a stationary source. This statutory provision is reiterated as a standard permit condition in 18 AAC 50.345(i). The Department used the standard language in Minor Permit No. AQ1854MSS01.

Condition 16 and Section 9, Excess Emission and Permit Deviation Reports and Notification Form

This condition reiterates the notification requirements in 18 AAC 50.235(a)(2) and 18 AAC 50.240 regarding unavoidable emergencies, malfunctions, and excess emissions. Also, the Permittee is required to notify the Department when emissions or operations deviate from the requirements of the permit. The Department used the language in SPCs III and IV, except as follows:

The Department has modified Condition 16.3 and the Notification Form in Section 9 to reflect the electronic submittal requirements in 18 AAC 50.270 using the Department's online form to submit notification of excess emissions and permit deviations beginning September 7, 2023. The electronic notification form is found at the Division of Air Quality's Air Online Services (AOS) system webpage http://dec.alaska.gov/applications/air/airtoolsweb using the Permittee Portal option.

Submittal through other methods may be allowed only upon written Department approval. Beyond as noted, the Department has determined that the standard conditions adequately meet the requirements of 40 C.F.R. 71.6(a)(3).

Condition 17, Operating Reports

The Department mostly used the SPC VII language for the operating report condition. However, the Department modified or eliminated the Title V-specific aspects in order to make the language applicable for a minor permit.

Condition 18, Title V Major Source Application Submittal Date

For a stationary source that directly emits, or has the potential to emit, 100 TPY or more of any air pollutant subject to regulation, the Permittee shall file a complete application to obtain the part 70 Title V Operating Permit within 12 months after commencing operation or exceeding the 100 TPY threshold as required by 40 C.F.R. 70.5.

Condition 19, Air Pollution Prohibited

18 AAC 50.110 prohibits any emission which is injurious to human health or welfare, animal or plant life, or property, or which would unreasonably interfere with the enjoyment of life or property. Condition 19 reiterates this prohibition as a permit condition. The Department used the SPC II language for Minor Permit No. AQ1854MSS01.

Condition 20, Emission Inventory Reporting

This condition requires the Permittee to submit emissions data to the state, so the state is able to satisfy the federal requirement to submit emission inventory data from point sources to the EPA as required under 40 C.F.R. 51.15 and 51.321. The federal emission inventory requirement applies to sources defined as point sources in 40 C.F.R. 51.50. Under 18 AAC 50.275, the state also requires reporting of emissions triennially for stationary sources with an air quality permit, regardless of permit classification. This includes sources that do not meet the federal emission thresholds in Table 1 to Appendix A of 40 C.F.R. 51 Subpart A. The state must report emissions data as described in 40 C.F.R. 51.15 and the data elements in Tables 2a and 2b to Appendix A of 40 C.F.R. 51 Subpart A to EPA.

The Department modified the language in SPC XV for the permit condition by lowering the thresholds that require reporting to include all stationary sources regardless of permit classification (excluding ORLs and PAELs) to capture the new requirements found in 18 AAC 50.275, effective September 7, 2022.

As of the issue date of this permit, Omega Pad is required to report triennially, as described in Condition 20.

Condition 21, Consistency of Reporting Methodologies

Condition 21, is from 18 AAC 50.275(a) and requires all stationary sources, regardless of permit classification (with the exception of owner requested limits (ORLs) issued under 18 AAC 50.225 and preapproved emission limits (PAELs)) issued under 18 AAC 50.230), to report actual emissions to the state so that the state can meet its obligation under 40 C.F.R. 51. Condition 21.1 is from 18 AAC 50.275(b) and requires consistency on the stationary sources' actual emissions reports submitted for NEI and the state's assessable emissions.

The regulation was added to 18 AAC 50 on September 7, 2022, to include all stationary sources required to report actual emissions for the purpose of federal emissions inventory and to avoid inconsistencies in actual emissions reports submitted. When reporting actual emissions under Condition 20 or assessable emissions under Condition 5.2, consistent emission factors and calculation methods shall be used for all reporting requirements for the stationary source.

Section 6: Standard Permit Conditions

Conditions 22 – 27, 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 all of the minor permit-related standard conditions of 18 AAC 50.345 in Minor Permit No. AQ1854MSS01. The Department incorporated these standard conditions as follows:

- 18 AAC 50.345(c)(1) and (2) is incorporated as Condition 22 of Section 6 (Standard Permit Conditions);
- 18 AAC 50.345(d) through (h) is incorporated as Conditions 23 through 27, respectively, of Section 6 (Standard Permit Conditions);
- As previously discussed, 18 AAC 50.345(i) is incorporated as Condition 15 and 18 AAC 50.345(j) is incorporated as Condition 12 of Section 5 (Recordkeeping, Reporting, and Certification Requirements); and

APPENDIX A: Emissions Calculations

Table A-1 presents details of the EUs, their characteristics, and emissions. Potential emissions are estimated using maximum annual operation for all fuel burning equipment as defined in 18 AAC 50.990(39) subject to any operating limits.

Table A-1 – Emissions Summary, in Tons Per Year (TPY)

EU ID	Unit Description	Maximum Rating or Capacity	Operating Limits	NO_x		CO		VOC		$PM_{2.5}$ / PM_{10}/PM		SO_2
				EF	PTE (TPY)	EF	PTE (TPY)	EF	PTE (TPY)	EF	PTE (TPY)	PTE (TPY)
1	Hot Oil Heater	115 MMBtu/hr	8,760 hr/yr	0.10 lb/MMBtu[2]	50.37	84 lb/MMscf	41.85	5.5 lb/MMscf	2.74	7.6 lb/MMscf	3.79	20.98[7]
2	Hot Oil Heater	115 MMBtu/hr	8,760 hr/yr	0.10 lb/MMBtu[2]	50.37	84 lb/MMscf	41.85	5.5 lb/MMscf	2.74	7.6 lb/MMscf	3.79	20.98[7]
3	Hot Oil Heater	115 MMBtu/hr	8,760 hr/yr	0.10 lb/MMBtu[2]	50.37	84 lb/MMscf	41.85	5.5 lb/MMscf	2.74	7.6 lb/MMscf	3.79	20.98[7]
4	Hot Oil Heater	115 MMBtu/hr	8,760 hr/yr	0.10 lb/MMBtu[2]	50.37	84 lb/MMscf	41.85	5.5 lb/MMscf	2.74	7.6 lb/MMscf	3.79	20.98[7]
5	Standby Engine(s)[1]	1,490 bhp	8,760 hr/yr	0.67 g/kW-hr[3]	10.78[5]	3.5 g/kW-hr[3]	46.94[6]	0.19 g/kW-hr[3]	3.06[5]	0.03 g/kW-hr[3]	0.48[5]	7.0E-02[8]
		2 x 779 bhp		0.51 lb/hr[4]	4.47	3.5 g/kW-hr[3]	49.08[6]	0.04 lb/hr[4]	0.35	0.04 lb/hr[4]	0.35	6.7E-02[8]
6	Emulsion Breaker Tank	2,300 gallons	8,760 hr/yr	N/A	0.00	N/A	0.00	AP-42, Section 7.1.	0.02	N/A	0.00	0.00
7	Anti Foam Tank	2,300 gallons	8,760 hr/yr	N/A	0.00	N/A	0.00	AP-42, Section 7.1.	0.02	N/A	0.00	0.00
8	Pad Buster Tank	2,300 gallons	8,760 hr/yr	N/A	0.00	N/A	0.00	AP-42, Section 7.1.	0.02	N/A	0.00	0.00
9	Corrosion Inhibitor Tank	14,000 gallons	8,760 hr/yr	N/A	0.00	N/A	0.00	AP-42, Section 7.1.	0.03	N/A	0.00	0.00
10	ULSD Tank	5,000 gallons	8,760 hr/yr	N/A	0.00	N/A	0.00	AP-42, Section 7.1.	1.6E-04	N/A	0.00	0.00
Total Potential to Emit					**212.25**		**216.48**		**14.11**		**15.63**	**84.0[9]**

Notes:

1. As of issuance of this permit, Hilcorp has yet to identify the actual engine or engines that will be installed as EU ID 5. EU ID 5 consists of two possible scenarios: either one Cummins QST30-G17 engine (1,490 bhp) or two Caterpillar C18 engines (779 bhp, each). The total potential emissions include the worst-case scenario emissions from EU ID 5 (i.e., the potential emissions from both scenarios were calculated for each pollutant, but only the highest of the two calculated potential emissions were included in the total potential to emit).

2. Reference is emission standard for nitrogen oxides (expressed as NO_2) from 40 C.F.R. 60, NSPS Subpart Db.
3. Reference is emission standards for Tier 4 engines from Table 1 of 40 C.F.R. 1039.
4. Reference is vendor data for Caterpillar C18 engine.
5. A Not-to-Exceed (NTE) factor of 1.5 was used for emissions calculations for Tier 4 engine per 40 C.F.R. 1039.101(e).
6. A NTE factor of 1.25 was used for emissions calculations for Tier 4 per 40 C.F.R. 1039.101(e).
7. A fuel gas hydrogen sulfide (H_2S) concentration of 250 ppmv is assumed to be the worst-case scenario.
8. Ultra-low sulfur diesel (i.e., maximum sulfur content of 0.0015 percent sulfur by weight) is assumed to be the worst-case scenario.
9. The SO_2 emissions were calculated through a mass balance calculation based on sulfur contents of combusted fuels.

APPENDIX B: Modeling Report

Alaska Department of Environmental Conservation
Air Permit Program

Review of
Hilcorp North Slope, LLC's (Hilcorp's)
Ambient Demonstration
for Omega Pad

Minor Permit No. AQ1854MSS01

Prepared by: Joshua Klina
June 6, 2024

\\Decjn-svrfile\decjn-svrfile\Groups\AQ\PERMITS\AIRFACS\Hilcorp Alaska LLC\Omega Pad (1854)\Preliminary\Preliminary Minor Permit Modeling Report for Omega Pad.docx

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 proposed new stationary source, Omega Pad. Hilcorp submitted this analysis in support of their December 18, 2023 minor permit application (AQ1854MSS01). Hilcorp demonstrated that operating Omega Pad emissions units (EUs) within the restrictions listed in this report will not cause or contribute to a violation of the annual average nitrogen dioxide (NO_2); 1-hour, 3-hour, 24-hour, and annual average sulfur dioxide (SO_2); 24-hour and annual average particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$); and 24-hour average particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}) Alaska Ambient Air Quality Standards (AAAQS) established in 18 AAC 50.010.

2. PROJECT BACKGROUND

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

2.1. Project Location

Hilcorp is proposing to establish a new stationary source on the Alaskan North Slope. Hilcorp's application materials indicate the new stationary source, Omega Pad, will be located at 70.352586 °N, 149.360722 °W. This location is situated within the Western Operating Area of the Prudhoe Bay Unit (PBU). Omega Pad's location will be approximately 7.8 miles west-southwest of Hilcorp's Gathering Center #2 (GC-2). Additionally, Omega Pad will not be contiguous or adjacent with any other well pads in the area.

2.2. Project Description

Hilcorp's application for Minor Permit No. AQ1854MSS01 proposes to expand oil resource development within the Prudhoe Bay Unit (PBU) by constructing a new drilling and production pad, Omega Pad, which is expected to provide access to approximately 3,500 acres of undeveloped oil reserves. The Omega Pad project will involve the construction of a production pad, drilling of new wells, construction of a processing facility, and tie-ins to existing production transport pipelines and gas lift pipelines, electrical infrastructure, and other facilities.

As part of the Omega Pad project, Hilcorp's application proposes the installation of emissions units (EUs) with regulatorily significant ratings and emissions potentials. These proposed EUs include four hot oil heaters, one or two standby generator engines[1], and five storage tanks. Further details on these proposed EUs are provided in Section 3.6 (EU Inventory). Hilcorp's application materials have identified the proposed project under the standard industrial classification (SIC), 1311, for crude petroleum and natural gas

[1] Hilcorp's application materials indicates that Hilcorp has yet to identify the actual engine or engines that will be installed as EU ID 5, standby engine(s). This EU will either be one ULSD-fired engine with a maximum rated capacity of 1,490 bhp or two ULSD-fired engines with a maximum rated capacity of 779 bhp, each.

operations. The proposed EU inventory at the source is generally consistent with that of its industrial classification.

2.3. Project Classification

Hilcorp's minor permit application is classified under 18 AAC 50.502(c)(1) for construction of a new stationary source with a potential to emit greater than the applicable thresholds for oxides of nitrogen (NO_x), SO_2, $PM_{2.5}$, and PM_{10}. In accordance with the application information requirements of 18 AAC 50.540(c)(2)(A), applicants must provide an AAAQS analysis for each triggered pollutant. Hilcorp fulfilled this requirement by submitting an AAAQS analysis for the annual average NO_2; 1-hour, 3-hour, 24-hour, and annual average SO_2; 24-hour and annual average $PM_{2.5}$; and 24-hour PM_{10} AAAQS with their minor permit application.

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. Hilcorp did not submit a modeling protocol for the Omega Pad project.

2.5. Application Submittal

The Department received Hilcorp's permit application and ambient demonstration on December 18, 2023. Hilcorp provided supplemental information via emails dated February 21, 2024, and June 6, 2024, in response to separate information requests sent by the Department. Boreal Environmental Services prepared the application and ambient analysis on their behalf.

3. SOURCE IMPACT ANALYSIS

Hilcorp used computer analysis (modeling) to predict the NO_2, $PM_{2.5}$, PM_{10}, and SO_2 ambient air quality impacts from the emissions that would be generated from operation of their proposed new stationary source, Omega Pad. The Department's findings regarding Hilcorp's analysis are discussed below.

3.1. Approach

Hilcorp performed a cumulative ambient air quality impact analysis for the following pollutants and averaging periods: annual average NO_2; 1-hour, 3-hour, 24-hour, and annual average SO_2; 24-hour and annual average $PM_{2.5}$; and 24-hour PM_{10}.

Hilcorp's application materials indicate that construction activities (e.g., operation of temporary construction EUs) are not expected to overlap with the operation of the stationary source (e.g., operation of permanent EUs). Their application materials further indicate they expect construction activities to occur over a short duration and to generate emissions that will be negligible in comparison to emissions generated from the operation of the stationary

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

source. However, no further details were provided regarding anticipated construction activities in Hilcorp's initial application materials.

Consequently, the Department sent an information request, dated February 2, 2024, asking Hilcorp to provide additional characterization of the expected construction activities. Hilcorp's response, dated February 21, 2024, included an approximate timeline for their expected construction activities. Hilcorp indicated they are anticipating construction to commence in the first quarter of 2026 with the installation of vertical support members. This is expected to be followed by facility construction in the second quarter of 2026 and installation of pipelines in the first quarter of 2027. Hilcorp anticipates operations to commence in the fourth quarter of 2027 or the first quarter of 2028. In that same response, Hilcorp stated they have not identified the exact construction equipment inventory that will be used for the project. However, they anticipate that construction emissions will originate predominantly from fuel-fired highway engines, small nonroad engines, and small portable heaters. Hilcorp did not provide an estimate for the size of their expected construction EUs inventory.

Based on their assumptions, Hilcorp predicated their analysis on the operation of the stationary source, Omega Pad, without the impacts of concurrent construction activities. For this specific source, the Department agrees with Hilcorp's approach in its ambient demonstration.

3.2. Model Selection

There are several 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.

AERMOD 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 of which are version 23132. They assumed flat terrain within the modeled domain rather than running AERMAP, which is common practice for new source review modeling on the Alaskan 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 data, the Guideline states that up to five years should be used, when available, to account for year-to-year variation in meteorological conditions.

Hilcorp used five years of publicly available hourly surface meteorological data collected at the Prudhoe Bay A-Pad (A-Pad) station during calendar years 2014, 2015, 2016, 2019, and

2020.[3] Hilcorp also used concurrent twice-daily upper air meteorological data collected by the National Weather Service (NWS) at Utqiagvik, Alaska. Hilcorp's application materials indicate that the Department, in the past, reviewed the surface meteorological data collected during 2014, 2015, 2016, 2019, and 2020 at the A-Pad station and determined that these data meet the requirements in 40 C.F.R. 51, Appendix W (the Guideline). Hilcorp's application materials also assert that the surface meteorological data collected at the A-Pad station and the upper air meteorological data collected at Utqiagvik, Alaska are representative of meteorological conditions at the proposed Omega Pad location based on the proximity to the proposed location, the relatively consistent meteorological conditions across the Alaskan North Slope coastal plain, and the recent dates of collection for the meteorological data.

The Department could not identify any records indicating that it had reviewed and determined that Hilcorp's use of meteorological data recorded at the A-Pad and Utqiagvik, Alaska in their ambient modeling demonstration for the Omega Pad project meets the requirements in the Guideline. However, the Department did identify records indicating that it, in the past, reviewed the surface meteorological data collected at the A-Pad during 2014, 2015, 2016, 2019, and 2020 and determined that these data meet the quality assurance requirements of the Prevention of Significant Deterioration (PSD) program.

The Department sent an information request, dated February 2, 2024, asking Hilcorp to justify their use of the A-Pad meteorological data for the Omega Pad project. In response, Hilcorp elaborated on their reasons for selecting the A-Pad meteorological data. Hilcorp stated they believe that the A-Pad meteorological data adequately represents meteorological conditions at Omega Pad "because of the proximity of Omega Pad to the PBU A-Pad and because of the similar terrain features that surround the two locations. Omega Pad is located approximately 15 miles to the west of the PBU A-Pad monitoring site. Omega Pad and the PBU A-Pad are located on the coastal plain of the Alaska North Slope and the area surrounding Omega Pad and PBU A-Pad is relatively flat with no significant elevated terrain features. Additionally, Omega Pad and the PBU A-Pad are located approximately 15 miles inland from the Beaufort Sea. As a result, the surrounding geographic features have a similar influence on ambient air temperatures and winds at Omega Pad and PBU A-Pad. Furthermore, Omega Pad and PBU A-Pad experience similar seasonal and diurnal changes to incoming solar radiation because Omega Pad and the PBU A-Pad are both located approximately 70 degrees latitude."

The Department evaluated Hilcorp's use of meteorological data collected at the A-Pad station and Utqiagvik, Alaska, and found that these data are sufficient to represent atmospheric transport conditions at Omega Pad at the time of review. While this data is sufficient for Hilcorp's ambient demonstration for the Omega Pad project, it should be noted that the Department is unable to find any record of communication prior to this review between Hilcorp and itself concerning the use of these data for the Omega Pad project. The Department encourages applicants to discuss the proposed use of off-site meteorological data with the Department prior to submission of an application to avoid potential delays in the review and/or issuance of a permit decision.

[3] Note that data collected at the PBU A-Pad during 2017 and 2018 are unavailable and have not been submitted to the Department for PSD-data quality assurance review.

The Department notes that Hilcorp processed the A-Pad's and Utqiagvik's meteorological data using the most current version of AERMET, version 23132.

3.3.1. Surface Characteristics

AERMET requires the area surrounding the meteorological tower to be characterized by 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*.

Hilcorp characterized the area surrounding the proposed location of Omega Pad using surface parameters previously approved by the Department for tundra.[4] These surface parameters are appropriate for the proposed stationary source because it will be located in the Alaskan North Slope. The approved surface parameters are summarized below in Table 1.

Table 1. Approved AERMET Surface Parameters for the Omega Pad

Surface Parameter	Winter Value	Summer Value
Albedo	0.8	0.18
Bowen Ratio	1.5	0.80
Surface Roughness Length (m)	0.004	0.02

Table Note:
Summer is defined as June through September, and winter is defined as October through May, for purposes of processing the Omega Pad data with AERMET.

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 modeling analysis. Hilcorp's model references 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 stationary source will be located within the Alaskan North Slope coastal plain, which may be assumed flat for the purposes of modeling. This is an appropriate assumption for the current ambient demonstration for Omega Pad.

[4] The Department has reported the approved surface parameters for tundra in numerous North Slope modeling reviews as well as Section 2.6.4.2 of the Department's *Modeling Procedures Review Manual.*

3.6. EU Inventory

Hilcorp modeled the EUs listed in Table 2. These EUs were characterized as point sources. Hilcorp assumed all the modeled EUs would operate concurrently and that each of them would operate continuously at maximum capacity for all 8,760 hours of the year.

Table 2. Modeled EU Inventory

EU ID	Stack ID	Description	Cumulative Rating
1	HEATER01	Hot Oil Heater 1	115 MMBtu/hr
2	HEATER02	Hot Oil Heater 2	115 MMBtu/hr
3	HEATER03	Hot Oil Heater 3	115 MMBtu/hr
4	HEATER04	Hot Oil Heater 4	115 MMBtu/hr
5	ENGINE01	Standby Engine 1	1,490 bhp
	ENGINE02	Standby Engine 2	1,490 bhp

3.6.1. Excluded EUs

Hilcorp excluded the following EUs from their modeling analysis:

- the Emulsion Breaker Tank (EU ID 6);
- the Anti Foam Tank (EU ID 7);
- the Pad Buster Tank (EU ID 8);
- the Corrosion Inhibitor Tank (EU ID 9); and
- the ULSD Tank (EU ID 10).

EU IDs 6 – 10 are not fuel-burning equipment. Instead, they are storage tanks that will hold petroleum fuels and other industrial liquids. Their only emissions will be volatile organic compounds (VOCs), which are not included in this ambient demonstration.

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 Hilcorp'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.

3.7.1.1. Sulfur Compound Emissions

SO_2 emissions are directly related to the sulfur content of the fuel. The sulfur content of liquid fuel is in the form of elemental sulfur, while the sulfur content of fuel gas is in the form of hydrogen sulfide (H_2S). Hilcorp's proposed Omega Pad EU inventory consists of both liquid- and fuel gas-fired equipment.

Hilcorp assumed their fuel gas-fired EUs (EU IDs 1-4) would only combust fuel gas with a maximum H_2S content of 250 parts per million by volume (ppmv). The Department is, therefore, including a limit on the sulfur content of fuel gas fired in EU IDs 1-4 at the stationary source as an enforceable permit condition to protect the annually averaged, 24-hour, three-hour, and one-hour SO_2 AAAQS.

In their ambient demonstration, Hilcorp assumed that EU ID 5 would only combust ultra-low sulfur diesel (ULSD), a fuel with a maximum sulfur content of 0.0015 percent sulfur by weight. The Department, therefore, is including a limit on the sulfur content of diesel combusted in EU ID 5 at the stationary source and MR&R requirements associated with that limit to protect the annually averaged, 24-hour, three-hour, and one-hour SO_2 AAAQS.

3.7.1.2. Operational Limits

As stated under Section 3.6, Hilcorp assumed that the modeled Omega Pad stationary source EUs would operate continuously throughout the year at maximum capacity. Hilcorp did not request or assume any operational limits.

3.7.1.3. Weighted Standards as Emission Factors

Hilcorp's modeling analysis relies upon the EPA's emission standards for Tier 4 engines, found in Table 1 of 40 C.F.R. 1039.101[5], to characterize the NO_x and PM emissions from EU ID 5. The Department notes that these standards were developed using the weighted emissions from various class-specific equipment and do not represent a unit-specific maximum, or not-to-exceed factor typically suitable for use in characterizing an EUs maximum emissions potential. Guidance[6] exists to mitigate the uncertainty associated with using these standards in estimating unit-specific emissions. Succinctly, the use of a case-specific multiplication factor (not-to-exceed (NTE) factor) to address the NTE standard[7] is recommended.

Hilcorp's application materials indicate that they observed the recommended approach and utilized the Tier 4 emission factors with the appropriate NTE factors to characterize the emissions from EU ID 5. Because Hilcorp's modeling analysis relies on this characterization of EU ID 5 and its emissions, the Department is including enforceable conditions that require the Permittee to verify through vendor or manufacturer certifications or guarantees that EU ID 5 will meet the assumed EPA Tier rating, Tier 4 Final. The Department is including these requirements to protect the annually averaged NO_2; 24-hour and annually averaged $PM_{2.5}$; and 24-hour PM_{10} 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.

[5] Table 1 of 40 C.F.R. 1039.101 is also known as *Tier 4 Exhaust Emission Standards After the 2014 Model Year*.
[6] In comport with 40 C.F.R. 1039.101.
[7] NTE Standard = Emission Standard (e.g., Tier 4 emission standards from Table 1 of 40 C.F.R. 1039.101) x NTE Factor

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

3.7.2.1. Stack Heights

The modeled stack heights of EU IDs 1 – 5 warrant additional discussion because they are not typical for EUs of similar functions and sizes.

EU IDs 1 – 4 (the hot oil heaters) were each modeled with a stack height of 15.2 meters. This modeled stack height is taller than what might be expected for heaters of similar sizes. Additionally, taller exhaust stacks generally correspond to greater enhanced dispersion of emissions, and consequently lesser modeled impacts. The Department, therefore, is imposing stack height requirements to ensure that the built stacks reflect the stacks that were modeled.

Hilcorp has yet to identify the actual engine or engines that will be installed as EU ID 5. Hilcorp's application materials indicate that EU ID 5 will either be one ULSD-fired engine that will have a maximum rated capacity of 1,490 brake-horsepower (bhp) or two ULSD-fired engines that will have maximum rated capacities of 779 bhp, each. In lieu of conducting separate modeling analyses for the two possible scenarios, a single conservative modeling scenario based on the installation and operation of two ULSD-fired engines with a maximum capacity of 1,490 bhp, each, was conducted. The engines were modeled with exhaust parameters that correspond to an engine rated at 779 bhp, i.e., stack heights that are shorter than expected for similarly sized EUs. These exhaust parameters correspond to less enhanced dispersion of emissions, and consequently greater modeled impacts, thus resulting in a more conservative analysis. Hilcorp's analysis demonstrated that even with stack heights of 2.1 meters for the engines modeled as EU ID 5, the stationary source would not cause or contribute to a violation of AAAQS. It is likely that no appreciable effect on the ambient air quality would be garnered by imposing a minimum stack height of 2.1 meters for EU ID 5. Therefore, the Department is not imposing minimum stack height requirements for EU ID 5.

The Department is imposing a minimum stack height of 15.2 meters for EU IDs 1 – 4 as a condition to protect ambient air quality.

3.7.2.2. Horizontal/Capped Stacks

Capped stacks or horizontal releases generally lead to higher impacts in the immediate near-field than what would occur from uncapped, vertical releases. The presence of non-vertical stacks or stacks with rain caps therefore requires special handling in an AERMOD analysis. EPA describes the proper approach for characterizing these types of stacks in their *AERMOD Implementation Guide*.[8] EPA has also developed an option in AERMOD that will automatically revise the stack

[8] *AERMOD Implementation Guide* (EPA-454/B-18-003); April 2018.

and exhaust parameters for any stack identified as horizontal (using the POINTHOR keyword) or capped (using the POINTCAP keyword).

Hilcorp used these options to characterize EU IDs 1 – 4 as having vertical capped releases and EU ID 5 as having horizontal uncapped releases. The Department will be including conditions allowing EU IDs 1 – 4 to have the option of using vertical capped releases and EU ID 5 the option of using horizontal uncapped releases.

3.8. Off-site Source Characterization

For a cumulative ambient air quality impact assessment, the potential emissions from the proposed project EU inventory and off-site stationary sources are modeled to compute a cumulative impact. In their application, Hilcorp indicated that Omega Pad will not be located near any sources that will cause a significant concentration gradient in the area around Omega Pad. Consequently, Hilcorp did not include any explicitly modeled off-site stationary sources in their cumulative impact analysis.

3.9. Pollutant Specific Considerations

The following pollutants warrant additional discussion.

3.9.1. Ambient NO_2 Modeling

The NO_x emissions created during combustion are partly nitric oxide (NO) and partly NO_2. After the combustion gas exits a stack, additional NO_2 is created as the exhaust mixes with atmospheric ozone.

Hilcorp used the Plume Volume Molar Ratio Method (PVMRM) to estimate their ambient NO_2 concentrations. The use of PVMRM is appropriate but warrants discussion.

3.9.1.1. In-Stack NO_2-to-NO_x Ratio

The assumed NO_2-to-NO_x in-stack ratio (ISR) is a variable that must be set for each NO_x-emitting EU. Source-specific data should be used to define this ratio when available.

Hilcorp used source test information consolidated by the Department[9] to develop assumed ISRs for their modeled EU inventory. The assumed ratio used to characterize the modeled project heaters (EU IDs 1 – 4) was 0.1. The modeled project engines (EU ID 5), which Hilcorp assumed will be certified to EPA Tier 4 standards[10] in their application, were modeled using a ratio of 0.3. These values are generally representative of the EUs being characterized.

[9] ADEC spreadsheet: NO_2-to-NO_x ratios per Source Tests Approved by the Alaska Department of Environmental Conservation, revised August 23, 2013. Available at: http://dec.alaska.gov/air/air-permit/dispersion-modeling/.

[10] See 40 C.F.R. 1039.101.

3.9.1.2. Ozone Data

PVMRM requires ambient ozone data to determine how much of the NO is converted to NO_2.

Hilcorp used five years of hourly ozone data collected at the A-Pad ambient air and meteorological monitoring station during calendar years 2014, 2015, 2016, 2019, and 2020. Hilcorp's application materials indicate that the data set had been reviewed and approved by the Department for prior ambient demonstrations prepared for Alaskan North Slope stationary sources (e.g., Minor Permit No. AQ1727MSS01). The Department's review of its own records indicates that Hilcorp's assertion is correct. However, the Department's previous approval for the use of these data for the ambient demonstration of other stationary sources is on a case-specific basis. The Department, therefore, evaluated Hilcorp's use of the A-Pad ozone data for the ambient demonstration of Omega Pad. Consequently, the Department found that Hilcorp's use of these data to estimate ambient NO_2 impacts from Omega Pad using PVMRM is appropriate.

3.9.2. $PM_{2.5}$

$PM_{2.5}$ is either directly emitted from a source or formed through chemical reactions in the atmosphere (secondary formation) from other pollutants (NO_x and SO_2).[11] AERMOD is an acceptable model for performing near-field analysis of the direct emissions, but EPA has not developed a near-field model that includes the necessary chemistry algorithms for estimating the secondary impacts. EPA instead recommends that applicants use "existing technical information" to assess the secondary impacts (a.k.a. a "Tier 1" analysis), or if warranted, a photochemical modeling analyses to assess the secondary impacts (a.k.a. a "Tier 2" analysis).[12] Tier 1 is the expected typical approach. Hilcorp's application materials did not include a discussion regarding their characterization of secondary $PM_{2.5}$ formation.

EPA noted in their May 2014 $PM_{2.5}$ modeling guidance that the maximum direct impacts and the maximum secondary impacts from a stationary source "*…are not likely well-correlated in time or space*", i.e., they will likely occur in different locations and at different times.[13] This difference occurs because secondary $PM_{2.5}$ formation is a complex photochemical reaction that requires a mix of precursor pollutants in sufficient quantities for significant formation to occur. As such, it is highly unlikely that there is sufficient time for the reaction to substantively occur within the immediate near-field, which is where the maximum direct impacts from the Omega Pad EUs occur.

Representative ambient monitoring data may be used to address the secondary formation that occurs from existing sources in an ambient standard demonstration. The background data that Hilcorp used in their $PM_{2.5}$ AAAQS analysis (see the *Off-Site Impacts* section of this report) meets this objective.

[11] The NO_x and SO_2 emissions are also referred to as "precursor emissions" in a $PM_{2.5}$ assessment.
[12] EPA's two-tiered approach for assessing secondary $PM_{2.5}$ formation is described in Section 5.4 of the Guideline.
[13] *Guidance for $PM_{2.5}$ Permit Modeling* (EPA-454/B-14-001); May 2014.

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 Hilcorp's characterization of the exhaust stacks and structures. The characterization matches the figures and photos provided in Hilcorp's 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 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*." [14] Applicants may, therefore, exclude areas that they own or lease from their ambient demonstration if the source "employs measures, which may include physical barriers, that are effective in precluding access to the land by the general public".[15] 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. Measures employed beyond physical barriers in precluding access to the land by the general public must be evaluated on a case-specific basis.

Hilcorp used the edges of Omega Pad to represent their ambient air boundary. This is a typical approach and is generally suitable for stationary sources at the Alaskan North Slope on a case-specific basis.

3.12. Receptor Grid

A dispersion model will calculate the concentration of the modeled pollutant at locations defined by the user. These locations are called receptors. Designated patterns of receptors are called receptor grids.

[14] 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).

[15] EPA has a revised policy on the exclusion of certain areas from the scope of "ambient air". This memo may be found in their NSR Policy and Guidance Database (see https://epa.gov/sites/default/files/2019-12/documents/revised_policy_on_exclusions_from_ambient_air.pdf).

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

- 25 m or less spacing along the ambient boundary;
- 25 m spacing within a 0.8 square kilometer (km^2) area centered over Omega Pad;
- 100 m spacing within a 6.2 km^2 area centered over Omega Pad; and
- 500 m spacing within a 68 km^2 area centered over Omega Pad.

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

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 approach for incorporating these impacts must be evaluated on a case-specific basis for each type of assessment and for each pollutant.

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. In summary, the off-site impacts must either be represented through 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*." Section 8.3.3(b) further states, "*…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 indicate that they do not anticipate any nearby sources to cause significant concentration gradients in the vicinity of the proposed Omega Pad stationary source. In their response to an information request, dated June 3, 2024, Hilcorp indicated that the closest permitted stationary source to Omega Pad is the Prudhoe Bay Unit (PBU) Z-Pad, located approximately 8.5 km to the southeast of Omega Pad. Hilcorp further indicated that an ambient demonstration in the PBU Z-Pad minor permit application showed that maximum project impacts are predicted to occur on or near the PBU Z-Pad ambient boundary (i.e., gravel pad edge).

However, Hilcorp did include background ambient air quality data in their cumulative impact analysis to represent the contribution of ambient air pollutant concentrations from non-modeled sources. The ambient air pollutant concentrations from the most recent ambient air data (monitoring year 2020) collected at the A-Pad monitoring station were used to represent the contribution of ambient air pollutant levels from non-modeled sources of NO_2 and SO_2. The most recent ambient air data (monitoring year 2020) collected at the PBU Central Compressor Plant (CCP) monitoring station were used to represent the contribution of non-modeled sources of $PM_{2.5}$ and PM_{10}. Hilcorp's application materials indicate the background ambient air data collected at the A-Pad and CCP stations have been reviewed by the Department and determined to be PSD-quality. The Department's records support Hilcorp's assertion that the Department has reviewed these data and determined them to be PSD-quality.

The Department sent an information request, dated February 2, 2024, asking Hilcorp to provide a narrative of why the ambient air data from the A-Pad and CCP stations are representative of ambient air conditions at Omega Pad. Hilcorp's response, dated February 21, 2024, stated "the Omega Pad is generally influenced by similar air pollutant emissions sources that influence ambient air pollutant levels at the PBU A-Pad and CCP monitoring sites. The PBU CCP monitoring site is located between the Central Compressor Plant and Central Gas Facility, which are two of the largest source of air pollutant emissions on the Alaska North Slope… The PBU A-Pad monitoring station is located at an active oil and gas production facility where routine drilling and well servicing activities, which include an array of mobile and portable fuel-fired equipment, occurs during the year. The PBU A-Pad is also located downwind of several other oil and gas production and processing facilities that include portable and stationary diesel-fired and fuel gas-fired equipment. As a result, the PBU A-Pad and CCP ambient air data provide a conservative representation of background ambient air pollutant levels at the Omega Pad."

The Department evaluated Hilcorp's use of ambient data collected at the A-Pad and the CCP stations and found that these data are sufficient to represent ambient concentrations of pollutants at Omega Pad at the time of review. Therefore, the Department has determined these data, on a case-specific basis, are appropriate for use in this cumulative impact analysis.

3.14. Modeled Design Concentrations

EPA generally allows applicants to use modeled concentrations that are consistent with the form of the standard as their modeled 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 3.

Table 3. Design Concentrations for Minor Permit No. AQ1854MSS01

Pollutant	Avg. Period	Allowed Value
NO_2	Annual	The maximum annual concentration from any year.
PM_{10}	24-hr	The maximum highest sixth-high (H6H) 24-hour average concentration of the five model years.
$PM_{2.5}$	24-hr	The maximum five-year average of the highest eighth-high (H8H) 24-hour average concentration of the five model years.
	Annual	The maximum annual concentration from any year.
SO_2	1-hr	The maximum five-year average of the highest fourth-high (H4H) daily maximum 1-hour average concentrations.
	3-hr	The maximum highest-second high concentration of the five model years.
	24-hr	The maximum highest-second high concentration of the five model years.
	Annual	The maximum annual concentration from any year.

4. RESULTS AND DISCUSSION

The maximum modeled NO_2, SO_2, $PM_{2.5}$, and PM_{10} impacts from Hilcorp's cumulative impact analysis are presented in Table 4. The background concentration, total impact, and respective

ambient standard are also presented for comparison. The total modeled impacts are less than the respective AAAQS. Therefore, Hilcorp has demonstrated compliance with the AAAQS.

Table 4. 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	38.8	5.7	44.5	100
SO_2	1-hour	97.0	17.0	114.0	196
	3-hour	101.3	0.0	101.3	1,300
	24-hour	64.7	0.0	64.7	365
	Annual	5.7	0.0	5.7	80
$PM_{2.5}$	24-hour	11.2	7.0	18.2	35
	Annual	2.0	1.4	3.4	12
PM_{10}	24-hour	16.3	20.0	36.3	150

5. CONCLUSION

The Department concludes the following based on its review of Hilcorp's modeling analysis:

1. The emissions from the proposed EUs will not cause or contribute to a violation of the annually averaged NO_2; 1-hour, 3-hour, 24-hour, and annually averaged SO_2; 24-hour and annually averaged $PM_{2.5}$, and 24-hour PM_{10} AAAQS listed in 18 AAC 50.010.
2. Hilcorp's modeling analysis complies with the ambient demonstration requirements of 18 AAC 50.540(c)(2).
3. Hilcorp conducted their modeling analysis in a manner consistent with the Guideline, as required under 18 AAC 50.215(b)(1).

The Department developed conditions in Minor Permit No. AQ1854MSS01 to ensure Hilcorp complies with the AAAQS. These conditions are summarized as follows:

- To protect the annually averaged NO_2; 1-hour, 3-hour, 24-hour, and annually averaged SO_2; 24-hour and annually averaged $PM_{2.5}$, and 24-hour PM_{10} AAAQS, the Permittee shall:
    - **Stack Heights.** Construct and maintain the exhaust stacks of EU IDs 1 – 4 with a stack height of at least 15.2 meters.
    - **EPA Tier 4 Standards.** The Permittee shall verify that EU ID 5 meets the EPA Tier 4 Final emission standards found in Table 1 of 40 C.F.R. 1039.101.
- To protect the 1-hour, 3-hour, 24-hour, and annual SO_2 AAAQS, the Permittee shall limit:
    - the sulfur content of the liquid fuel fired in EU ID 5 to 0.0015 percent sulfur by weight; and
    - the H_2S content of the fuel gas fired in EU IDs 1 – 4 to 250 ppmv.