APPENDIX I:
AIR QUALITY IMPACTS ASSESSMENT

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Nobles Grade and Tamiami Prospects
Big Cypress National Preserve

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1. INTRODUCTION

Burnett Oil Co., Inc. (Burnett Oil) is proposing to construct Nobles Grade and Tamiami Prospects (Project) at the Big Cypress National Preserve, Collier County, Florida. The proposed Project day-to-day operations will entail separation of oil/water/gas, pumping and transfer, storage of oil and produced water, combustion of surplus gas, and loading of oil products in tank trucks. The produced gas will be used to generate power at the location by the natural gas generators. Surplus gas that is not used for facility power generation is controlled by an enclosed combustor. Emission sources will include the heater treaters, oil/water storage tanks, truck loading, engines (power generators), enclosed combustors, and fugitive emissions. Trinity Consultants, Inc. (Trinity) performed an air quality impact assessment to assess compliance with the National Ambient Air Quality Standards (NAAQS) for applicable pollutant and averaging periods. In addition, Trinity performed a visibility analysis to assess the visual impacts at the Big Cypress National Preserve and Everglades National Park (NP) due to the proposed project.

1.1 Executive Summary

Based on the project potential to emit (PTE) emissions, the proposed Project is a minor air emissions source. Refer to Appendix C for detailed emission calculations. Neither federal nor state air quality regulations require an air quality impacts analysis, as the emissions are below thresholds requiring detailed assessment to confirm protection of public health and welfare. To provide additional confirmation to the National Park Service (NPS), Trinity has performed an air quality impact assessment, following a similar methodology as if the Project were a major source of air emissions. Accordingly, Trinity conducted an air dispersion modeling analysis utilizing the EPA recommended screening model, AERSCREEN, for the following pollutants and the averaging periods to demonstrate compliance with the NAAQS:

- Carbon monoxide (CO): 1-hr and 8-hr Averaging Periods;
- Nitrogen dioxide (NO_2): 1-hr and Annual Averaging Periods;
- Fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller ($PM_{2.5}$): 24-hr and Annual Averaging Periods;
- Inhalable particles, with diameters that are generally 10 micrometers and smaller (PM_{10}): 24-hr Averaging Period; and
- Sulfur dioxide (SO_2): 1-hr Averaging Period.

Trinity modeled a worst-case scenario by including emissions from drilling phase during construction (i.e., emissions from the drilling rig engines), operational emissions from the Nobles Grade Prospect and its associated loading facility, and emissions from the Tamiami Prospect to assess the air quality impacts due to the proposed project. Accordingly, ***the proposed project will not cause or significantly contribute to an exceedance of a NAAQS for any applicable pollutant and its averaging periods***. The results of the air dispersion modeling analysis for the proposed project are provided in Table 1-1. The air dispersion modeling methodology and detailed discussions are provided in Section 2.

Table 1-1. Air Dispersion Modeling Analysis

Pollutant	Averaging Period	Modeled Concentration, $\mu g/m^3$	Background Concentration, $\mu g/m^3$	Total Concentration, $\mu g/m^3$	NAAQS, $\mu g/m^3$	Exceed NAAQS? (Yes/No)
CO	1-Hour	97.49	1,943.10	2,040.04	40,000	No
	8-Hour	87.74	1,371.60	1,458.84	10,000	No
NO_2	1-Hour	96.50	79.02	175.50	188	No
	Annual	9.65	14.92	24.57	100	No
$PM_{2.5}$	24-Hour	3.07	17.33	20.40	35	No
	Annual	0.51	6.53	7.04	12	No
PM_{10}	Annual	0.51	47	47.51	150	No
SO_2	1-Hour	0.21	2.62	2.83	196	No

In addition, the potential visibility impact of emissions from the proposed Project were evaluated using VISCREEN, a screening model approved by United States Environmental Protection Agency (EPA), for the Big Cypress National Preserve and Everglades National Park (Everglades NP). Based on the Level-2 VISCREEN Analysis, ***the maximum visual impacts due to the proposed project inside the Big Cypress National Preserve and the Everglades NP are less than the screening criteria***. The VISCREEN results and discussions are provided in Section 3.

1.2 Modeling Approach and AERSCREEN Background

The air quality impacts from the proposed Project were evaluated as discussed below:

- Operational Emissions from the Nobles Grade Prospect and its associated loading facility, operational emissions from the Tamiami Prospect, and emissions from the drilling rig engines during the construction phase are evaluated for NAAQS compliance. Refer to Section 2.
- In event that the existing pipeline infrastructure cannot be utilized for Tamiami Prospect, Burnett Oil will construct a loading facility as an alternative. Therefore, air quality impacts were assessed for this alternative project i.e., overall impacts from the proposed Project plus the Tamiami Loading Facility alternative. Refer to Section 3.

1.2.1 Project Impacts Assessment (Operational emissions from Nobles Grade Prospect and its loading facility, Tamiami Prospects, and emissions from the drilling rig engines)

Trinity evaluated the following emission scenarios to determine the worst-case impacts. After determining the worst-case scenario, Trinity conducted a conservative screening analysis model to demonstrate compliance with NAAQS. Note that the construction of the Tamiami and Nobles Grade Prospects will not occur simultaneously. Accordingly, Trinity assessed three potential scenarios as discussed below:

- Scenario 1: Under this scenario, operational emissions from the Nobles Grade and its associated loading facility plus the drilling rig engine emissions will occur simultaneously.
- Scenario 2: Under this scenario, operational emissions from the Tamiami Prospect plus the drilling rig engine emissions will occur simultaneously.
- Scenario 3: Under this scenario, operational emissions from Nobles Grade Pad and its associated loading facility and Tamiami Prospect plus the emissions from the drilling rig engines during the construction phase (operational emissions from the Project plus the drilling rig emissions during the construction phase).

Based on the above, the worst-case emissions (short-term and annual averaging periods) for the proposed Project will occur under Scenario 3. Therefore, Trinity modeled emissions from Scenario 3 to demonstrate compliance with NAAQS. By demonstrating compliance with NAAQS for Scenario 3, no additional modeling is required for Scenarios 1 and 2, as these scenarios will have a lower air quality impact than Scenario 3.

Trinity utilized the screening model AERSCREEN to demonstrate compliance with NAAQS. AERSCREEN produces estimates of "worst-case" 1-hour concentrations for a single source, without the need for hourly meteorological data. The AERSCREEN model produces concentration estimates that are equal to or greater than the estimates produced by AERMOD with a fully developed set of meteorological and terrain data.[1] Note that AERSCREEN will result in more conservative concentrations in comparison with a refined dispersion model such as AERMOD i.e., if the AERMOD model was prepared for this Project, the AERMOD-calculated concentrations will be lower than the concentrations predicted using AERSCREEN. Therefore, when the results obtained from AERSCREEN are in compliance with the NAAQS, the proposed Project will not cause significant deterioration to the Park's air quality and no further analysis is required.

Note that the AERSCREEN model is independent of the source location and is not pollutant specific. The AERSCREEN model does not require geo-reference co-ordinates to be entered into the model. The concentrations are primarily derived in the model based on the emission rates, stack parameters, and wind-speed. In the screening modeling, the necessary inputs such as near-by buildings (to account for downwash impact), source elevation (terrain), meteorology data (wind speed and ambient temperature) were included. Additionally, only one source can be modeled in AERSCREEN at a time. Therefore, Trinity modeled the NO_x emission rates for four sources (drilling rig engines, flares, generators, and heaters) in four different models and added all the resulting concentrations to calculate the overall impacts.

The AERSCREEN model will produce the worst-case 1-hr concentrations and utilizes scaling factors to calculate the 3-hr, 8-hr, 24-hr, and annual averaging periods. Based on the modeled concentrations for NO_x, Trinity utilized the ratio approach to calculate the concentrations for other pollutants and their respective averaging periods since the only variable for each pollutant is the emission rate and no change were required to the stack parameters, meteorology data, or surface characteristics (obtained using AERSURFACE). Refer to Section 2.4 for modeled results.

In summary, the screening model results in a conservative estimate and demonstrating compliance with NAAQS using the screening model is appropriate for this proposed Project and protective of the Park's air quality.

1.2.2 Tamiami Loading Facility Alternative

The air quality impacts from the Tamiami Loading Facility Alternative are discussed in Section 3. As discussed above, Trinity utilized the ratio approach to determine the impacts from the Tamiami Loading Facility Alternative since the screening model is independent of source location and is not pollutant specific. Refer to Section 3 for additional information.

1.3 Report Overview

This modeling report describes the methodology utilized in conducting the air dispersion modeling analysis for all applicable pollutants and their respective averaging periods and the visibility impacts analysis for the

[1] https://www.epa.gov/scram/air-quality-dispersion-modeling-screening-models

proposed project. The air dispersion modeling analysis was performed in accordance with the current U.S. EPA modeling guidelines and in consideration of the following guidance:[2]

- *Guideline on Air Quality Models* 40 CFR 51, Appendix W (EPA, Revised, January 17, 2017);
- *User's Guide for the AMS/EPA Regulatory Model – AERMOD,* (EPA, April 2018);
- *AERMOD Implementation Guide* (EPA, April 2018);
- *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard* (EPA, Memorandum from Mr. Tyler Fox, March 1, 2011);
- *Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard* (EPA, Memorandum from Mr. R. Chris Owen and Roger Brode, September 30, 2014); and
- *Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report* (Natural Resource Report, October 2020).

Sections 2 and 3 describes the air quality dispersion modeling methodology, inputs and results. Section 4 includes a brief discussion of the visibility impacts analysis. The aerial maps of the proposed Project are included in Appendix A. The drilling rig engine emission calculations are provided in Appendix B. Detailed emission calculations are provided in Appendix C. All modeling associated files are provided in Appendix D.

[2] Federal Register Vol. 70, No. 216, pp. 68,218 – 68,261. Codified at 40 CFR Part 51, Appendix W.

2. DISPERSION MODELING METHODOLOGY - PROPOSED PROJECT

This section describes the air dispersion modeling methodologies that have been used to demonstrate that emissions from the proposed project will not cause or significantly contribute to a violation of the NAAQS. Table 2-1 lists the applicable standards for 1-hour NO_2. Note that the table presents the numeric values of the NAAQS for simplicity. Each NAAQS is also based on a “form” of the standard (i.e., 3-year average of the 98^{th} percentile of the annual distribution of daily maximum 1-hour concentrations for 1-hour NO_2).

Table 2-1. Applicable Air Quality Standards

Pollutant	Averaging Period	Primary NAAQS ($\mu g/m^3$)
CO	1-Hour	40,000
	8-Hour	10,000
NO_2	1-Hour	188
	Annual	100
$PM_{2.5}$	24-Hour	35
	Annual	12
PM_{10}	Annual	150
SO_2	1-Hour	196

The sections below describe the screening modeling analysis utilized to demonstrate compliance with NAAQS for the proposed project.

2.1 Air Dispersion Model

The air dispersion modeling analysis was performed using AERSCREEN (Version 16216) for the proposed project. AERSCREEN is the recommended screening model based on American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD). The model produces estimates of "worst-case" 1-hour concentrations for a single source, without the need for hourly meteorological data. AERSCREEN is intended to produce concentration estimates that are equal to or greater than the estimates produced by AERMOD with a fully developed set of meteorological and terrain data.[3] Accordingly, Trinity evaluated a worst-case scenario to assess the air quality impacts from the proposed project using AERSCREEN as discussed in sections below.

Note that the AERSCREEN model is independent of the source location and is not pollutant specific. The AERSCREEN model does not require Universal Transverse Mercator (UTM) coordinates to be entered into the model. The concentrations are primarily derived in the model based on the emission rates, stack parameters, and wind-speed. In the screening modeling, the necessary inputs such as near-by buildings (to account for downwash impact), source elevation (terrain), meteorology data (wind speed and ambient temperature) were input into the model. Refer to Section 2.3.2 for additional information.

[3] https://www.epa.gov/scram/air-quality-dispersion-modeling-screening-models

2.2 Worst-Case Modeling Scenario

Trinity assessed the following operational and construction scenarios that may occur simultaneously to assess the cumulative air quality impacts from the proposed project:

- ***Scenario 1***: Operational emissions from Nobles Grade Pad and loading facility plus the emissions from the drilling rig engines associated with the Tamiami Pad;
- ***Scenario 2***: Operational emissions from Tamiami Pad plus the emissions from the drilling rig engines associated with the Nobles Grade Pad and loading facility; and
- ***Scenario 3***: Operational emissions from Nobles Grade Pad and loading facility and Tamiami Pad plus the emissions from the drilling rig engines during the construction phase. Note that the construction of the Nobles Grade and Tamiami will not occur simultaneously. However, the operation of the Nobles Grade and Tamiami prospects will occur simultaneously.

Based on the above, Scenario 3 results in worst-case emissions and Trinity assessed the air quality impacts from Scenario 3 to demonstrate compliance with NAAQS for the proposed project. For Scenario 3, Trinity assumed that the operational emissions from both the Tamiami and Nobles Grade Prospects are occurring along with the drilling rig emissions at the Tamiami Prospect because the minimum distance to the ambient air for Tamiami Prospect is approximately 1,200 ft, which will result in a worst-case impact assumption. Note that the minimum distance to the ambient air for the Nobles Grade Prospect is approximately 1,900 ft.

The worst-case short-term (lb/hr) and annual emissions (tpy) that occurs during the operational phase and the drilling emissions that occurs during construction phase are modeled to demonstrate compliance with NAAQS. The compliance demonstration is for life of the Project, as proposed. By demonstrating compliance with NAAQS for Scenario 3, no additional modeling is required for Scenarios 1 and 2, as these scenarios will have a lower air quality impact than Scenario 3. The following subsections describe the model setup for Scenario 3.

2.3 Model Inputs

This section describes the model inputs and background concentration utilized to assess the air quality impact.

2.3.1 Modeled Emission Rates and Stack Parameters

The modeled emission rates and stack parameters are provided in Tables 2-2 and 2-3, respectively. During the drilling phase, Burnett Oil will utilize a RAPAD Rig 33, or equivalent, which include three Tier 2 certified Caterpillar 3512 engines (1,475 hp each). Detailed emission calculations for the drilling rig engines are provided in Appendix B. Note that the load factor for *Diesel Light Commercial Generator Sets* (SCC 227000600) is based on EPA MOVES (NONROAD2008a model is incorporated into MOVES) and can be found in *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* technical guidance.[4] The load factor is not based on county or regional average and is based on the data from the Power System Research, Inc. (PSR) study, which is based on surveys of equipment users.[5] Additionally, Trinity believes this load factor is representative of total load and operation of this drilling rig, accounting for all three engines operating at once. Tables presenting the drilling rig emissions calculations are provided in Appendix B of this report.

[4] *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling,* July 2010, pg. no. A6 (Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10081RV.pdf).

[5] *Ibid.*

Table 2-2. Modeled Emission Rates

Emission Source	Phase	No. of Units	Emission Rates[3], lb/hr			
			NO_x	$PM_{10}/PM_{2.5}$	CO	SO_2
Drilling Rig Engine	Construction - Drilling[1]	3	17.54	0.63	10.95	0.02
Heater Treater	Operation - Tamiami and Nobles Grade Prospects[2]	4	0.296	0.02	0.25	0.001
Enclosed Combustor		3	3.430	-	15.63	0.002
Generator		6	0.186	0.29	1.93	0.02
		Totals	**21.452**	**0.94**	**28.76**	**0.04**

[1] Each drilling rig includes three Caterpillar 3512 engines. Therefore, modeled three engines assuming only one drilling rig operating at a time between Tamiami and Nobles grade prospects.

[2] Emission sources during operation from both the Tamiami and Nobles Grade Prospects are assumed to occur simultaneously.

[3] Total emissions from each source type for Tamiami and Nobles Grade Prospects, consistent with Operation Phase Emissions previously provided to NPS on January 5, 2021.

Note that the emission rates provided in Table 2-2 is the total emissions for each of the emission source for the proposed Project. For example, the NO_x emission rate (3.430 lb/hr) is the total NO_x emissions from all three enclosed combustors.

Tables listing the emissions sources and emission rates, as well as narrative discussion of the project sources, emissions controls, emission factor reference, emission calculation methodology, and detailed tables of the Project operations is provided in Appendix C to this report. Note that the primary pollutants modeled for the NAAQS evaluation are specific to NO_X, PM_{10}, $PM_{2.5}$, CO and SO_2. Emissions of additional pollutants that do not have direct modeled impacts, such as VOC and greenhouse gases, are described in Appendix C. Note that the Project will utilize vapor capture vapors and route the streams to either the on-site generators or to an enclosed combustor, consistent with EPA recommendations and as noted in regulatory requirements (e.g., New Source Performance Standards Subpart OOOO). The vapor capture system will be designed to capture all vapor from the tanks, with consideration for peak vapor flow intervals. The specific design requirements and compliance assurance considerations will be defined as the specific Project engineering progresses and through air permitting discussions with the Florida Department of Environmental Protection (FDEP).

Table 2-3. Modeled Stack Parameters

Emission Source	Stack Height, ft	Stack Velocity, ft/s	Exhaust Temperature, F	Stack Diameter, ft	Heat Release Rate[1], kcal/s
Drilling Rig Engine	17.41	205.38	945.9	0.67	N/A
Heater Treater	18.50	5.40	500.0	0.75	N/A
Enclosed Combustor	20.04	-	-	-	1,765
Generator	9.92	273	1,350.0	0.75	N/A

[1] Based on the below equation:

Heat Release Rate = Heat Input Rating (MMBtu/hr) x 10^6 Btu/MMBtu x 252.164 cal/BTU x 1 Hr/60 min x 1 min/60 sec
= 25.207 MMBtu/hr x 10^6 x 251.996 / 60 / 60 = 1,765 kcal/s

2.3.2 Other Model Inputs

This section describes the other model inputs utilized in the AERSCREEN such as buildings, receptors, and meteorology.

2.3.2.1 Building Downwash Effects

The emissions sources have been evaluated in terms of the equipment proximity to nearby structures. The purpose of this evaluation is to determine if stack discharges may become caught in the turbulent wakes generated by these structures. Therefore, during the drilling phase, Trinity included the drilling rig engine trailer as a downwash structure. In addition, during the operational phase, a near-by oil storage tank was included as a downwash structure.

2.3.2.2 Receptors

Based on the leasing boundary, Trinity determined the minimum distance to the ambient air to be 1,200 ft. Trinity conservatively assumed the same minimum distance to the ambient air (1,200 ft.) for all source type. Also, Trinity included discrete receptors from 50 meters to 10,000 meters in AERSCREEN.

2.3.2.3 Meteorology

Trinity obtained the minimum and maximum temperature from EPA AP-42, Chapter 7, Table 7.1-7 for Miami, FL. The minimum wind speed is obtained from Station ID 12839 (KMIA, Miami International Airport), which is approximately 40 miles from the Tamiami Prospect. Note that Trinity utilized the pre-processed AERMET meteorological dataset provided by Florida Department of Environmental Protection for Station ID 12839 (2015 - 2019) to obtain the windspeed. Additionally, Trinity determined the surface characteristics for the project area using AERSURFACE Version 20060 and the AERSURFACE output is provided in Appendix D.

2.3.3 Background Concentrations

The background concentrations determined for the project area are provided in Table 2-4.

Table 2-4. 2017 - 2019 Background Concentration Data

Pollutant	Avg. Period	Station ID	Monitor Location	County, State	Distance from Project Area (miles)	Background Conc.[1] (μg/m³)	NAAQS (μg/m³)	Form of the NAAQS
CO	1-hr	12-086-4002	Miami	Miami-Dade, FL	~44	1,943	40,000	2nd high - highest of 3 years
	8-hr					1,372	10,000	
NO_2	1-hr	12-086-4002	Miami	Miami-Dade, FL	~44	79.02	188	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Annual					14.92	100	annual mean - highest of 3 years

Pollutant	Avg. Period	Station ID	Monitor Location	County, State	Distance from Project Area (miles)	Background Conc.[1] (μg/m³)	NAAQS (μg/m³)	Form of the NAAQS
$PM_{2.5}$	24-Hr	12-011-0034	Davie	Broward, FL	~39	17	35	98th percentile, averaged over 3 years
	Annual					6.5	12	annual mean - average of 3 years
PM_{10}	24-Hr	12-011-0034	Davie	Broward, FL	~39	47	150	2nd high - highest of 3 years
SO_2	1-hr	12-011-0034	Davie	Broward, FL	~39	3	196	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

[1] Based on the form of the NAAQS for the most recent 3-years (2017-2019) of data available on U.S. EPA's Airdata website (Note: 2020 Design values are not finalized by EPA). - https://www.epa.gov/outdoor-air-quality-data/monitor-values-report.

2.4 Model Results

AERSCREEN was utilized for each emission source type listed in Table 2-2 and the concentrations obtained for each of the source type were added to determine the impacts (i.e., total concentration) from the proposed project. The background concentration was added to the total concentration and compared against the NAAQS.

To determine the total concentrations for comparison to the NAAQS, Trinity performed the air dispersion modeling analysis in AERSCREEN based on the NO_X emission rates, by source type. For all other pollutants, Trinity ratioed the resulting predicted NO_X concentration by the ratio of the pollutant emissions rate to the modeled NO_X emission rates to determine their respective concentrations. In addition, for NO_2 1-hr and annual averaging period, Trinity utilized a Tier 2 approach to demonstrate compliance with NAAQS, i.e., applied an Ambient Ratio Method Version 2 (ARM2) by conservatively multiplying the modeled concentration with 0.9. Additionally, as discussed in Section 2.1, AERSCREEN estimates the "worst-case" hourly concentration and applies a scaling ratio for other averaging periods as discussed below:

- 3-hour: fixed ratio of 1.00;
- 8-hour: fixed ratio of 0.90;
- 24-hour: fixed ratio of 0.60; and
- Annual: fixed ratio of 0.10.

The above scaling ratios were utilized to estimate the concentrations for all averaging periods except for 1-hour averaging period. Tables 2-5 through 2-12 provide the air dispersion modeling results for all applicable pollutants and their respective averaging periods.

Table 2-5. Modeling Results for NO_2 - 1-Hour Averaging Period

Pollutant	Averaging Period	Phase	Emission Source	Modeled Concentration, µg/m³
NO_2	1-Hour	Drilling	Drilling Rig Engines	88.30
		Operations - Tamiami and Nobles Grade	Enclosed Combustors	4.88
			Heater Treaters	2.52
			Generators	0.80
Background Concentration, µg/m³				**79.02**
Total Concentration (Modeled Concentration + Background Concentration), µg/m³				**175.52**
NAAQS, µg/m³				**188**
Exceeds NAAQS? Yes/No				**No**

Table 2-6. Modeling Results for NO_2 - Annual Averaging Period

Pollutant	Averaging Period	Phase	Emission Source	Modeled Concentration, µg/m³
NO_2	Annual	Drilling	Drilling Rig Engines	8.83
		Operations - Tamiami and Nobles Grade	Enclosed Combustors	0.49
			Heater Treaters	0.25
			Generators	0.08
Background Concentration, µg/m³				**14.92**
Total Concentration (Modeled Concentration + Background Concentration), µg/m³				**24.57**
NAAQS, µg/m³				**100**
Exceeds NAAQS? Yes/No				**No**

Table 2-7. Modeling Results for $PM_{2.5}$ - 24-Hour Averaging Period

Pollutant	Averaging Period	Phase	Emission Source	Modeled Concentration, µg/m³
$PM_{2.5}$	24-Hour	Drilling	Drilling Rig Engines	2.10
		Operations - Tamiami and Nobles Grade	Enclosed Combustors	-
			Heater Treaters	0.13
			Generators	0.84
Background Concentration, µg/m³				**17.33**
Total Concentration (Modeled Concentration + Background Concentration), µg/m³				**20.40**
NAAQS, µg/m³				**35**
Exceeds NAAQS? Yes/No				**No**

Table 2-8. Modeling Results for $PM_{2.5}$ - Annual Averaging Period

Pollutant	Averaging Period	Phase	Emission Source	Modeled Concentration, $\mu g/m^3$
$PM_{2.5}$	Annual	Drilling	Drilling Rig Engines	0.35
		Operations - Tamiami and Nobles Grade	Enclosed Combustors	-
			Heater Treaters	0.02
			Generators	0.14
Background Concentration, $\mu g/m^3$				**6.53**
Total Concentration (Modeled Concentration + Background Concentration), $\mu g/m^3$				**7.04**
NAAQS, $\mu g/m^3$				**12**
Exceeds NAAQS? Yes/No				**No**

Table 2-9. Modeling Results for PM_{10} - Annual Averaging Period

Pollutant	Averaging Period	Phase	Emission Source	Modeled Concentration, $\mu g/m^3$
PM_{10}	24-Hour	Drilling	Drilling Rig Engines	2.10
		Operations - Tamiami and Nobles Grade	Enclosed Combustors	-
			Heater Treaters	0.13
			Generators	0.84
Background Concentration, $\mu g/m^3$				**47.0**
Total Concentration (Modeled Concentration + Background Concentration), $\mu g/m^{33}$				**50.07**
NAAQS, $\mu g/m^3$				**150**
Exceeds NAAQS? Yes/No				**No**

Table 2-10. Modeling Results for CO - 1-Hour Averaging Period

Pollutant	Averaging Period	Phase	Emission Source	Modeled Concentration, $\mu g/m^3$
CO	1-Hour	Drilling	Drilling Rig Engines	61.24
		Operations - Tamiami and Nobles Grade	Enclosed Combustors	24.71
			Heater Treaters	2.34
			Generators	9.20
Background Concentration, $\mu g/m^3$				**1,943.10**
Total Concentration (Modeled Concentration + Background Concentration), $\mu g/m^3$				**2,040.59**
NAAQS, $\mu g/m^3$				**40,000**
Exceeds NAAQS? Yes/No				**No**

Table 2-11. Modeling Results for CO - 8-Hour Averaging Period

Pollutant	Averaging Period	Phase	Emission Source	Modeled Concentration, μg/m³
CO	8-Hour	Drilling	Drilling Rig Engines	55.11
		Operations - Tamiami and Nobles Grade	Enclosed Combustors	22.24
			Heater Treaters	2.10
			Generators	8.28
Background Concentration, μg/m³				**1,371.60**
Total Concentration (Modeled Concentration + Background Concentration), μg/m³				**1,459.34**
NAAQS, μg/m³				**10,000**
Exceeds NAAQS? Yes/No				**No**

Table 2-12. Modeling Results for SO_2 - 1-Hour Averaging Period

Pollutant	Averaging Period	Phase	Emission Source	Modeled Concentration, μg/m³
SO_2	1-Hour	Drilling	Drilling Rig Engines	0.13
		Operations - Tamiami and Nobles Grade	Enclosed Combustors	0.003
			Heater Treaters	0.004
			Generators	0.08
Background Concentration, μg/m³				**2.62**
Total Concentration (Modeled Concentration + Background Concentration), μg/m³				**2.83**
NAAQS, μg/m³				**196**
Exceeds NAAQS? Yes/No				**No**

As shown in the above tables, the proposed Project demonstrates compliance with NAAQS for all applicable pollutants and their respective averaging periods with the worst-case impacts predicted by AERSCREEN. Accordingly, refined modeling (e.g., AERMOD) is not necessary to confirm the Project is protective of Park's air quality, as refined modeling will result in a lower modeled concentration. The modeling and all other associated input files are provided in Appendix D.

3. AIR QUALITY ANALYSIS FOR TAMIAMI LOADING FACILITY ALTERNATIVE

Burnett Oil is proposing to construct Nobles Grade and Tamiami Prospects (Project) at the Big Cypress National Preserve, Collier County, Florida. In the event that an existing pipeline cannot be utilized to ship the product from the Tamiami Prospect (preferred). Therefore, Burnett Oil is proposing to construct a loading facility at the Tamiami Prospect similar to the loading facility proposed at the Nobles Grade Prospect as a project alternative. Trinity estimated emissions from the proposed alternative loading facility at the Tamiami Prospect and included the alternative's potential air quality impacts in this evaluation of the proposed Project. Based on a quantitative analysis, discussed below, Trinity concludes that the proposed Project including the Tamiami Loading Facility alternative will not cause or significantly contribute to an exceedance of a NAAQS for any applicable pollutant and its averaging periods. This section provides the summary of the updated operational emissions from Tamiami Prospect to account for the proposed loading facility alternative and the potential air quality impacts due to the proposed Project.

3.1 Tamiami Loading Facility Alternative Air Emissions

The loading emissions at the Tamiami Prospect will be controlled by a low-pressure combustor (ECD-2). NO_x and CO emissions were calculated using emission factors from EPA's AP-42 Chapter 13, Table 13.5-1 (09/91), Emission Factors for Flare Operations, in pounds per million British thermal units (lb/MMBtu). VOC emissions were calculated using the mass flow rate modeled with ProMax® and a manufacturer rated destruction efficiency of 98%. SO_2 emissions were estimated assuming that the fuel gas has a total sulfur content of 0.2 gr/100 scf. Detailed emission calculations are provided in Appendix C. The facility-wide operational emissions for the Tamiami Prospect with the alternative loading facility added are provided in the following table.

Table 3-1. Proposed Facility-Wide Emissions - Tamiami Prospect

	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	H_2S (tpy)	HAPs (tpy)	CO_2e (tpy)
Tamiami Sources									
Oil Tanks (8)	-	-	-	-	-	-	-	-	-
Water Tanks (8)	-	-	-	-	-	-	-	-	-
Gunbarrel Separator	-	-	-	-	-	-	-	-	-
Heaters (2)	0.64	0.54	0.035	9.20E-04	0.049	0.049	-	-	767.14
Generators (3)	0.40	4.22	0.59	0.036	0.65	0.65	-	4.36	7,569
Combustor (1)	7.34	33.47	19.63	0.0025	-	-	-	-	12,642
Loading Facility	***0.31***	***1.42***	***4.08***	***0.003***	***-***	***-***	***-***	***-***	***294.91***
Unpaved Haul Roads	-	-	-	-	0.74	0.074	-	-	-
Fugitive Components	-	-	11.20	-	-	-	-	-	-
Tamiami Total	**8.70**	**39.65**	**36.00**	**0.043**	**1.44**	**0.77**	**-**	**4.36**	**21,274**

3.2 Air Quality Impact Assessment

Based on the previously performed air dispersion modeling analysis (refer to Section 2 of this report), Trinity quantitatively assessed the air quality impacts due to the proposed loading facility alternative at the Tamiami Prospect utilizing a ratio of emissions rates to AERSCREEN-predicted modeled concentrations. Note that the previously performed air dispersion modeling analysis was based on the emissions from the drilling activities, operational emissions from the Tamiami Prospect, operational emissions from the Nobles Grade Prospect, and emissions from Nobles Grade Loading Facility. Based on this modeling analysis (refer to Section 2 of this report), the air quality impacts for the proposed Project in addition to the loading facility alternative at the Tamiami Prospect are provided in tables below.

Table 3-2. Air Quality Impacts from the Proposed Tamiami Loading Facility - NO_2 1-hr Averaging Period

Source	Pollutant	Averaging Period	Modeled Rate[1] (lb/hr)	Project Concentration[1] (mg/m^3)	Alternative Emissions Rate[2] (lb/hr)	Alternative Predicted Concentration[3] (mg/m^3)
Combustor	NO_2	1-hr	3.43	4.88	0.07	0.10

[1] Based on the modeling results provided in Table 2-5 of this report. Included combustor NO_2 emissions from Tamiami and Nobles Grade Prospects and emissions from the Nobles Grade Loading Facility.
[2] Emissions from the Proposed Loading Facility at the Tamiami Prospect.
[3] Predicted Concentration, $\mu g/m^3$ = Previously Modeled Concentration, $\mu g/m^3$ / Previously Modeled Rate, lb/hr x Proposed Emission Rate (lb/hr).

Based on the quantitative ratio analysis provided in the previous table, Burnett Oil assessed the air quality impacts due to the proposed Project and the results are provided in Table 3-3. PM_{10} and $PM_{2.5}$ emissions are negligible from the low-pressure combustor (ECD-2) at the alternative loading facility for the Tamiami Prospect. Therefore, the air dispersion modeling analysis provided in Section 2 remains valid for PM_{10} and $PM_{2.5}$.

Table 3-3. Air Quality Impacts from the Proposed Project

Pollutant	Averaging Period	Project Modeled Concentration[1] (mg/m^3)	Predicted Concentration w/ Alternative[2] (mg/m^3)	NAAQS (mg/m^3)	Exceeds NAAQS? (Yes/No)
NO_2	1-hr	175.52	175.62	188	No
	Annual	24.57	24.58	100	No
CO	1-hr	2,040.59	2,041.62	40,000	No
	8-hr	1,459.34	1,459.80	10,000	No
SO_2	1-hr	2.83	2.84	196	No

[1] Based on the modeling analysis presented in Section 2. Total modeled concentration (drilling emissions, simultaneous operation of Tamiami and Nobles Grade Prospects, and Nobles Grade Loading Facility) plus the background concentration.
[2] Predicted concentration is based on the Previously Modeled Concentration and the predicted impacts from the proposed loading facility at the Tamiami Prospect.

As shown in Table 3-3, ***the proposed Project will not cause or significantly contribute to an exceedance of a NAAQS for any applicable pollutant and its averaging periods including the Tamiami Loading Facility alternative***. Additionally, the construction emissions related to the proposed loading facility is infrequent and would be significantly lower when compared to the overall Project. The expected emissions from the proposed facility at the Tamiami Prospect would be less than approximately 3 tons for all criteria pollutants based on a conservative estimate of assuming 5% of the total construction emissions from the Project may occur for the proposed loading facility at the Tamiami Prospect. Therefore,

Trinity believes that the proposed Project will not cause any significant air quality impacts surrounding the Project area.

4. VISIBILITY IMPACT ANALYSIS

This section describes the methodology utilized to assess the visibility impacts from the proposed project. Trinity assessed the visibility impacts at the noise receptor sites provided by NPS and the Everglades NP Class I area due to the Nobles Grade and Tamiami Prospects.

4.1 Visibility Analysis

Near-field visibility analysis is typically required for any sensitive receptors (state/national parks, local airports, etc.) that may be located within the proposed project's significant impact area (SIA). The analysis is generally conducted in the U.S. EPA approved model called VISCREEN. The VISCREEN model has been developed to assess the potential visual air quality impacts of isolated sources that are located less than 50 kilometers (km) from areas of interest.

VISCREEN calculates the potential visual impact of a single point source plume of specified emissions under assumed transport and dispersion conditions. Emissions from the Nobles Grade and Tamiami Prospects do not originate from a single point source but from numerous point sources located throughout the Project area. These scattered emissions are inherently much more dilute, and disperse more quickly, than if the same emissions were vented from a single stack. However, VISCREEN requires that each project emission sources must be grouped together for modeling as if they were emitted from a single stack. As a result, VISCREEN presents very conservative results for predicting worst-case visibility impacts from the proposed project. Accordingly, Trinity assessed the visibility impacts at the Everglades NP and noise receptor locations within the Big Cypress National Preserve.

4.1.1 Visibility Analysis - Everglades NP

The Everglades NP Class I Area receptors were obtained from NPS.[6] Based on the review of the Everglades NP receptors and the location of the project area, the closest distance from Tamiami and Nobles Grade Prospect to the Everglades NP is approximately 29 kilometers (km) and 39.5 km, respectively. Accordingly, Trinity performed the visibility analysis for the worst-case scenario i.e., assuming emissions from drilling rig engines, operational emissions from Tamiami Prospect, and operational emissions from Nobles Grade Prospect) are occurring simultaneously at the Tamiami Prospect because it is closer to the Everglades NP compared to the Nobles Grade Prospect. If the visual impact is not adverse or significant for this conservative representation of all emissions from the Tamiami Prospect at the Everglades NP, it will also demonstrate compliance for the Nobles Grade Prospect. Therefore, no separate VISCREEN model was necessary for Nobles Grade Prospect.

The following parameters were utilized in VISCREEN for the visibility impacts analysis for the Everglades NP:

Distance between the emissions source and the observer:
Trinity utilized the closest distance between the well pad at the Tamiami Prospect and the receptor location at the Everglades NP (28.39 km).

Distance between the emissions source and the closest Class I area boundary:
Trinity utilized the closest distance between the well pad at the Tamiami Prospect and the receptor location at the Everglades NP (28.39 km).

[6] https://irma.nps.gov/DataStore/Reference/Profile/2249830

Distance between the emissions source and the most distant Class I area boundary:
Trinity utilized the distance from the well pad at the Tamiami Prospect to the most distant receptor location at the Everglades NP (125.40 km).

The maximum predicted worst-case visual impacts inside the Everglades NP exceeded the screening criteria based on the Level 1 Analysis using the default VISCREEN parameters. Therefore, Trinity performed a Level 2 Analysis using the actual worst-case meteorological conditions. For the Level 2 Analysis, Trinity utilized the average five-year wind speed data (3.849 m/s) obtained from the pre-processed meteorological data (2015-2019) provided by the Florida Department of Environmental Protection[7] for Station ID 12839 (KMIA, Miami International Airport), which is approximately 40 miles from the project area and assumed a worst-case stability class (F). Additionally, Trinity utilized an average annual background visual range of 169 km obtained from Table 10 of the Federal Land Managers' Air Quality Related Values Work Group.[8] For emission rates, Trinity utilized the total NO_X emissions (21.44 lb/hr) and $PM_{2.5}$ emissions as soot (0.94 lb/hr), from the proposed project (i.e., drilling rig emissions during construction phase + Operational emissions from Tamiami Prospect + Operational emissions from Nobles Grade Prospect) in the VISCREEN model as shown in Table 2-2. For all other input parameters such as ozone concentration and particulate density, Trinity utilized the default VISCREEN parameters. The results for the Level 2 analysis are provided in the table below. Based on the Level 2 VISCREEN Analysis, the maximum visual impacts due to the proposed project inside the Everglades NP are less than the screening criteria.

Table 4-1. Level 2 Screening Results of Tamiami Project at Everglades NP

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	155	50.5	14	2	0.283	0.05	-0.005
SKY	140	155	50.5	14	2	0.164	0.05	-0.005
TERRAIN	10	166	125.4	3	2	0.167	0.05	0.002
TERRAIN	140	166	125.4	3	2	0.076	0.05	0.002

4.1.2 Visibility Analysis - Big Cypress National Preserve

Trinity assessed the visibility impacts at the noise receptor locations provided in Table 4-2 to address the visibility impacts inside the Big Cypress National Preserve due to the proposed project. In addition to the noise receptor locations, National Park Service requested to evaluate the Oasis Visitor Center for visibility impacts. Accordingly, Trinity assessed the visibility impacts based on the worst-case emissions scenario discussed in Section 4.1.1 above.

[7] https://floridadep.gov/air/air-business-planning/content/aermet-datasets-map.
[8] https://www.fws.gov/guidance/sites/default/files/documents/FLAG%20Air%20Quality%20Phase%201%20report.pdf

Table 4-2. Receptor Locations Evaluated for Visibility Impacts

Location	Latitude	Longitude	Prospect	Distance from Project Location, km
FNST @ Nobles Grade	26.139018°	-81.071629°	Nobles Grade	~4.10
Ivy Camp	26.128368°	-81.060330°		~5.30
Oak Hill Camp	26.084608°	-81.036231°		~9.61
Approximate - Stump Camp Trail	26.087335°	-81.123648°		~5.69
FNST @ Tamiami	25.973565°	-80.974652°	Tamiami	~9.50
10-mile Camp	25.964333°	-80.986304°		~10.8
WOST nest site	25.967126°	-80.849850°		~3.48
Private Camp	25.973899°	-80.884865°		~1.03
Big Cypress Oasis Visitor Center	25.857475°	-81.033469°		~20.65

Trinity performed the Level 2 analysis using the actual worst-case meteorological conditions consistent with the analysis performed for the Everglades NP. Trinity assumed that each of the receptor locations as a "*surrogate*" Class I Area and modeled them in VISCREEN to assess the impacts within these receptor locations. Therefore, for each of the receptor locations, Trinity utilized the distance from the project location for the following input parameters:

- Distance between the emissions source and the observer (for example, 4.10 km for FNST @ Nobles Grade);
- Distance between the emissions source and the closest Class I area boundary (for example, 4.10 km for FNST @ Nobles Grade); and
- Distance between the emissions source and the most distant Class I area boundary (for example, 4.10 km for FNST @ Nobles Grade).

Accordingly, the maximum visual impacts due to the proposed project inside the Big Cypress National Preserve are less than the screening criteria. The results for the Level 2 analysis are provided in Tables 4-3 through 4-11.

Table 4-3. Level 2 Screening Results of Nobles Grade at FNST

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	84	4.1	84	3.02	0.432	0.06	-0.005
SKY	140	84	4.1	84	2.00	0.279	0.06	-0.005
TERRAIN	10	84	4.1	84	2.00	0.271	0.06	0.000
TERRAIN	140	84	4.1	84	2.00	0.083	0.06	0.000

Table 4-4. Level 2 Screening Results of Nobles Grade at Ivy Camp

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	84	5.3	84	2.68	0.377	0.05	-0.005
SKY	140	84	5.3	84	2.00	0.243	0.05	-0.005
TERRAIN	10	84	5.3	84	2.00	0.217	0.05	0.000
TERRAIN	140	84	5.3	84	2.00	0.071	0.05	0.000

Table 4-5. Level 2 Screening Results of Nobles Grade at Oak Hill Camp

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	84	9.6	84	2.00	0.278	0.05	-0.003
SKY	140	84	9.6	84	2.00	0.179	0.05	-0.003
TERRAIN	10	84	9.6	84	2.00	0.138	0.05	0.000
TERRAIN	140	84	9.6	84	2.00	0.054	0.05	0.000

Table 4-6. Level 2 Screening Results of Nobles Grade at Stump Camp Trail

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	84	5.7	84	2.59	0.363	0.05	-0.004
SKY	140	84	5.7	84	2.00	0.234	0.05	-0.004
TERRAIN	10	84	5.7	84	2.00	0.205	0.05	0.000
TERRAIN	140	84	5.7	84	2.00	0.069	0.05	0.000

Table 4-7. Level 2 Screening Results of Tamiami at FNST

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	84	9.5	84	2.01	0.280	0.05	-0.003
SKY	140	84	9.5	84	2.00	0.180	0.05	-0.004
TERRAIN	10	84	9.5	84	2.00	0.139	0.05	0.000
TERRAIN	140	84	9.5	84	2.00	0.054	0.05	0.000

Table 4-8. Level 2 Screening Results of Tamiami at 10-mile Camp

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	84	10.8	84	2.00	0.262	0.05	-0.003
SKY	140	84	10.8	84	2.00	0.169	0.05	-0.003
TERRAIN	10	84	10.8	84	2.00	0.127	0.05	0.000
TERRAIN	140	84	10.8	84	2.00	0.051	0.05	0.000

Table 4-9. Level 2 Screening Results of Tamiami at WOST Nest site

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	84	3.5	84	3.25	0.472	0.06	-0.006
SKY	140	84	3.5	84	2.00	0.305	0.06	-0.006
TERRAIN	10	84	3.5	84	2.00	0.315	0.06	0.000
TERRAIN	140	84	3.5	84	2.00	0.094	0.06	0.000

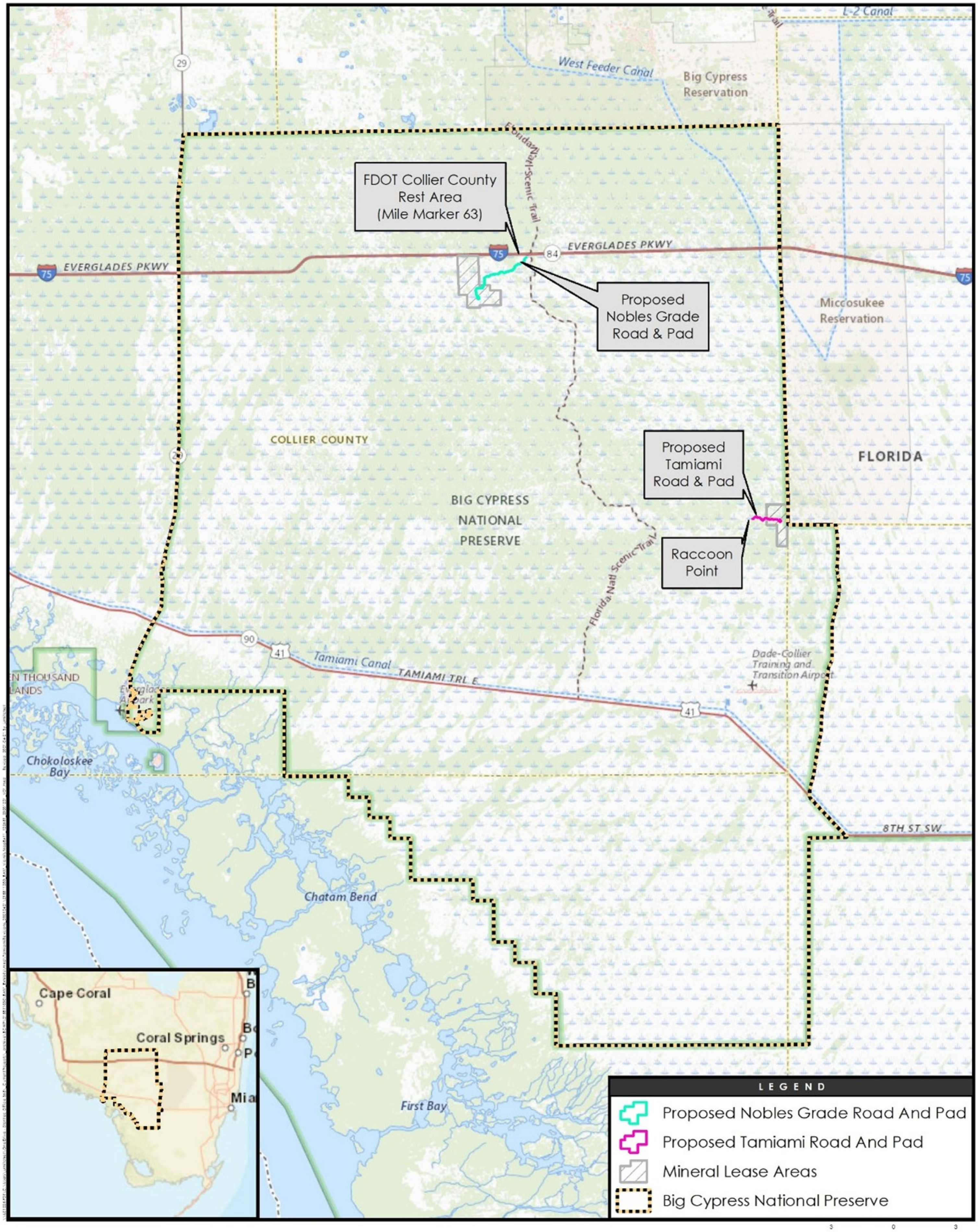
Table 4-10. Level 2 Screening Results of Tamiami at Private Camp

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	84	1.0	84	5.22	0.982	0.10	-0.012
SKY	140	84	1.0	84	2.63	0.634	0.10	-0.012
TERRAIN	10	84	1.0	84	2.00	1.162	0.10	0.001
TERRAIN	140	84	1.0	84	2.00	0.309	0.10	0.001

Table 4-11. Level 2 Screening Results of Tamiami at Oasis Visitor Center

Maximum Visual Impacts INSIDE Class I Area								
Background	Theta (°)	Azi (°)	Distance (km)	Alpha (°)	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	84	20.7	84	2.00	0.189	0.05	-0.002
SKY	140	84	20.7	84	2.00	0.121	0.05	-0.002
TERRAIN	10	84	20.7	84	2.00	0.084	0.05	0.000
TERRAIN	140	84	20.7	84	2.00	0.040	0.05	0.000

APPENDIX A. AERIAL MAP



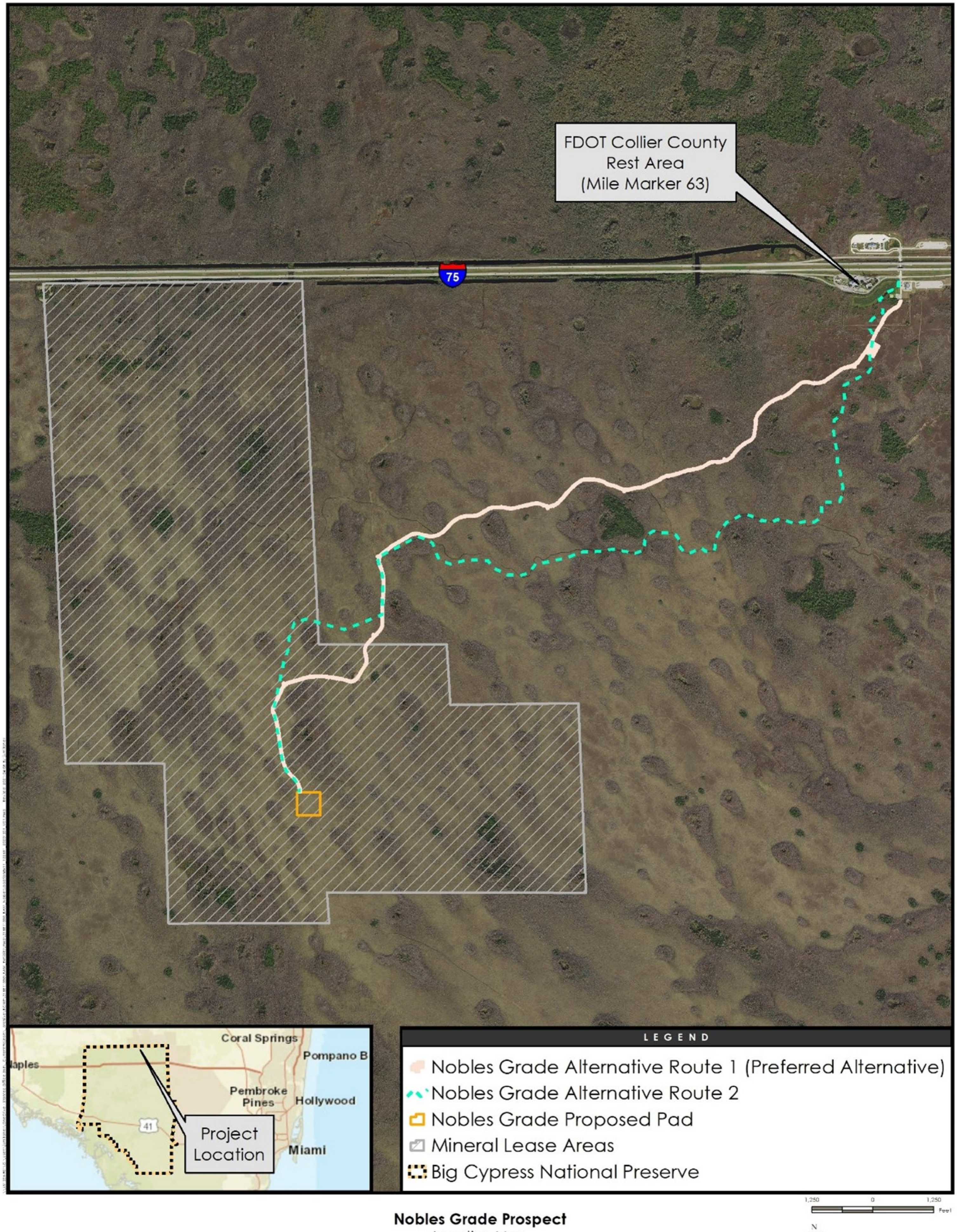
Nobles Grade & Tamiami Prospects

Big Cypress National Preserve Vicinity Map

April 2021

Notes:
1. Coordinate System: NAD 1983 StatePlane Florida East FIPS 0901 Feet
2. Source data: Stantec Staff
3. Imagery: Esri USGS Topo (Main Data Frame) Esri Streets (Inset)

Prepared by: JM 04/01/21
Technical Review by: JW 04/01/21
Independent Review by: BW 04/01/21



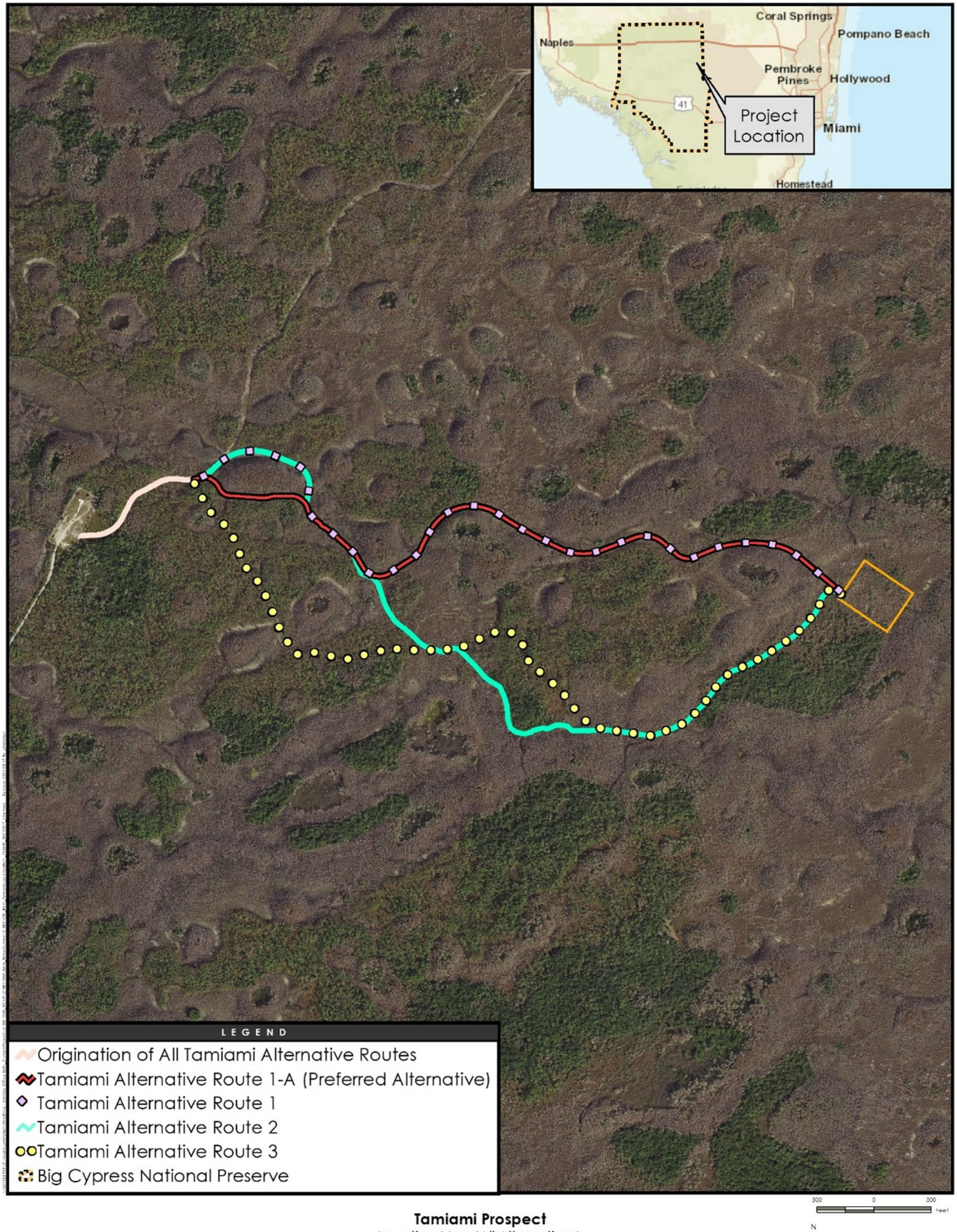
Nobles Grade Prospect

Location Map

April 2021

Notes:
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Source data: Stantec Staff
3. Imagery: 2020 Collier County Imagery (Main Data Frame) Esri Streets (Inset)

Prepared by: JM 04/01/21
Technical Review by: JW 04/01/21
Independent Review by: BW 04/01/21



Tamiami Prospect

Location Map (All Alternatives)

May 2021

Notes:
1. Coordinate System: NAD 1983 StatePlane Florida East FIPS 0901 Feet
2. Source data: Stantec Staff
3. Imagery: 2020 Collier County Imagery (Main Data Frame) Esri Streets (Inset)

Prepared by: JM 05/04/21
Technical Review by: JW 05/04/21
Independent Review by: BW 05/04/21

APPENDIX B. DRILLING RIG ENGINE EMISSIONS

Burnett Oil, Inc.
Potential Emissions from the Drilling Rig Engines

Input Data

Drilling Rig Engine	Caterpillar 3512
Default HHV of Distillate Fuel Oil No.2, MMBtu/gal	0.138
Number of Units	3
Power Rating, kW	1,099.91
Power Rating[1], hp	1,475.00
Load Factor[2], %	43%
Fuel consumption[3], gal/hr	45.4
Tier 2 Engine Size	Large
Expected hours of operation	8,760

[1] Data provided by Burnett Oil.
[2] Per EPA MOVES3 for SCC 2270006005 (Generators).
[3] Per Caterpillar 3512 specification sheet.

Fuel Gas External Combustion Greenhouse Gas Emission Factors

Units	CO_2[1]	CH_4[2]	N_2O[2]
kg/MMBtu	73.96	3.0E-03	6.0E-04
Global Warming Potential (GWP) [3]	1	25	298
lb/MMBtu	163	6.6E-03	1.3E-03

[1] CO_2 emission factor from 40 CFR 98 Subpart C Table C-1 for Distillate Fuel Oil No. 2, November 29, 2013.
[2] CH_4 and N_2O emission factors from 40 CFR 98 Subpart C, Table C-2 for Petroleum (all fuel types), November 29, 2013.
[3] CO_2e is calculated as follows: $CO_2e = CO_2 * GWP_{CO2} + CH_4 * GWP_{CH4} + N_2O * GWP_{N2O}$

Emission Calculations

Pollutant	Emission Factors[1]		Emission Factor Basis	Per Engine		Total Emissions (3 Engines)	
				Potential Hourly Emissions (lb/hr)	Potential Annual Emissions (tpy)	Potential Hourly Emissions (lb/hr)	Potential Annual Emissions (tpy)
PM	0.20	g/KW-hr	Tier 2 Standard Requirement[2]	0.209	0.91	0.63	2.74
PM_{10}	0.20	g/KW-hr	Tier 2 Standard Requirement[2]	0.209	0.91	0.63	2.74
$PM_{2.5}$	0.20	g/KW-hr	Tier 2 Standard Requirement[2]	0.209	0.91	0.63	2.74
SO_2	0.00001	lb/hp-hr	AP-42, Section 3.4 (15 ppm sulfur)	0.008	0.034	0.02	0.10
NO_X	5.608	g/KW-hr	Tier 2 Standard Requirement[2]	5.847	25.61	17.54	76.83
VOC	0.79	g/KW-hr	Tier 2 Standard Requirement[2]	0.826	3.62	2.48	10.86
CO	3.5	g/KW-hr	Tier 2 Standard Requirement[2]	3.649	16.0	10.95	47.95
CO_2[4]	23	lb/gal	EPA - 40 CFR 98 Table C-1	439	1,924	1,318	5,772
CH_4	9.11E-04	lb/gal	EPA - 40 CFR 98 Table C-2	0.018	0.078	0.05	0.23
N_2O	1.82E-04	lb/gal	EPA - 40 CFR 98 Table C-2	0.004	0.016	0.01	0.05
CO_2e[6]	23	lb/gal	calculated	441	1,931	1,322	5,792

[1] Large engines are considered greater than 560 kW for Tier 2 emission factor basis. GHG emission factors are the same for all engine sizes.
[2] Tier 2 standard are promulgated by 40 CFR 89.112 Table 1.
[3] Tier 2 standard apply to NMHC + NO_X. NO_X contribution is estimated based on the ratio of NO_X to NO_X + HC provided in Tier 1 stand 0.876 Tier 1 NOX/(NOX+HC)

APPENDIX C. OPERATIONAL EMISSION CALCULATIONS

1. OPERATION PHASE EMISSIONS

Burnett has calculated potential air emissions for the following emission sources associated with the operation phase of the project.

1.1 Operation Phase Emissions Summary

A summary of the proposed emissions is shown in the table below.

Table 1-1. Operation Phase Emissions Summary

	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	H_2S (tpy)	HAPs (tpy)	CO_2e (tpy)
Tamiami Sources									
Oil Tanks (8)	-	-	-	-	-	-	-	-	-
Water Tanks (8)	-	-	-	-	-	-	-	-	-
Gunbarrel Separator (1)	-	-	-	-	-	-	-	-	-
Heaters (2)	0.64	0.54	0.035	9.20E-04	0.049	0.049	-	-	767.14
Generators (3)	0.40	4.22	0.59	0.036	0.65	0.65	-	4.36	7,569.41
Combustor (1)	7.34	33.47	19.63	0.0025	-	-	-	-	12,642.30
Loading Facility	0.31	1.42	4.08	0.003	-	-	-	-	294.91
Unpaved Haul Roads	-	-	-	-	0.74	0.074	-	-	-
Fugitive Components	-	-	11.20	-	-	-	-	-	-
Tamiami Total	**8.70**	**39.65**	**36.00**	**0.043**	**1.44**	**0.77**	**-**	**4.36**	**21,273.76**
Nobles Grade Sources									
Oil Tanks (12)	-	-	-	-	-	-	-	-	-
Water Tanks (12)	-	-	-	-	-	-	-	-	-
Gunbarrel Separator (1)	-	-	-	-	-	-	-	-	-
Oil Loading	0.31	1.42	4.08	0.0025			-	-	294.91
Heaters (2)	0.64	0.54	0.035	9.20E-04	0.049	0.049	-	-	767.14
Generators (3)	0.40	4.22	0.59	0.036	0.65	0.65	-	4.36	7,569.41
Combustor (1)	7.37	33.58	19.72	0.0025	-	-	-	-	12,686.01
Unpaved Haul Roads	-	-	-	-	0.74	0.074	-	-	-
Fugitive Components	-	-	11.20	-	-	-	-	-	-
Nobles Grade Total	**8.73**	**39.77**	**35.63**	**0.042**	**1.44**	**0.77**	**-**	**4.36**	**21,317.47**

1.2 Detailed Emissions Calculations

Potential emissions were calculated for the operation phase sources by using the following calculation methodologies. Emissions calculations are attached in Attachment 1.

1.2.1 Natural Gas Heaters

Heated separators are heated by a total of four (4) 0.75 MMBtu/hr natural gas-fired heaters at these facilities. Emissions of NO_X, CO, VOC, and PM were based on the emission factors reported in EPA's AP-42 Chapter 1, Tables 1.4-1, 1.4-2, and 1.4-3 (07/98). SO_2 emissions were estimated assuming that the fuel gas has a total sulfur content of 0.2 gr/100 scf.

The natural gas specific emission factor from 40 CFR 98 Subpart C, Tables C-1 and C-2, *Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel* and *Default CH_4 and N_2O Emission Factors for Various Types of Fuel,* were used to estimate CO_2, CH_4, and N_2O emissions, in kilograms per MMBtu (kg/MMBtu). The carbon dioxide equivalent (CO_2e) emission rate was calculated based on the CO_2, CH_4, and N_2O emission rates, weighted according to their global warming potentials (GWP) of 1, 25, and 298, respectively.

To calculate emissions for heat rate based emission factors (lb/MMBtu or kg/MMBtu), a natural gas higher heating value (HHV) of 1,020 British thermal units per standard cubic foot (Btu/scf).

1.2.2 Natural Gas Generators

These production facilities will operate with a total of six (6) natural gas-fired generators. Burnett currently predicts that the generators will be Mesa Solutions units rated at 350 kW. The generators will be powered by field gas that is produced at these facilities. If any excess gas is not needed to power the generators, gas will be sent to the combustors.

Emissions from NO_X, CO, and VOC were based on the emission factor reported in manufacturer specifications. Filterable and condensable PM and HAP emission were estimated using emission factors from EPA's AP-42 Chapter 3, Table 3.2-2 (07/00), *Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines*, in pounds per million British thermal units (lb/MMBtu). SO_2 emissions were estimated assuming that the fuel gas has a total sulfur content of 0.2 gr/100 scf.

The natural gas specific emission factor from 40 CFR 98 Subpart C, Tables C-1 and C-2, *Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel* and *Default CH_4 and N_2O Emission Factors for Various Types of Fuel,* were used to estimate CO_2, CH_4, and N_2O emissions, in kilograms per MMBtu (kg/MMBtu). The carbon dioxide equivalent (CO_2e) emission rate was calculated based on the CO_2, CH_4, and N_2O emission rates, weighted according to their global warming potentials (GWP) of 1, 25, and 298, respectively.

To calculate emissions for heat rate based emission factors (lb/MMBtu or kg/MMBtu), a natural gas higher heating value (HHV) of 1,020 British thermal units per standard cubic foot (Btu/scf)[1] and the manufacturer rated brake-specific fuel consumption rate of 8,467 scf Btu/hp-hr were used.

1.2.3 Gunbarrel Separators

The Tamiami and Nobles Grade facilities will stabilize and separate produced water with a 1000 bbl gunbarrel separator (one per site).

BR&E ProMax^{TM} software was utilized to estimate potential annual emissions from working, breathing and flash consistent with the methodology of U.S. EPA's AP-42 Chapter 7.1. The ProMax simulation was built assuming oil and produced water production rates of 1,825 and 1,999 bbl/day at each site, respectively, and using the dimension and usage assumptions reported in Table 1-2.

[1] Per footnote b of AP-42, Table 3.2-2.

Table 1-2. Gunbarrel Separator Assumptions

Tank Dimensions L (ft)	Tank Dimensions Dia. (ft)	Filling Rate (bbl/d)	Material Category	Tank Color	Orientation
16	21.5	2015.9	Light Organics	Dark Green	Vertical

The ProMax simulation estimates the composition and properties of the liquid based on the parameterized process equipment at the facility. A printout of ProMax process flow diagram is attached in Attachment 2.

1.2.4 Storage Tanks

The Tamiami and Nobles Grade facilities will store crude oil and produced water in a number of storage tanks. Current design specifications for the project predict that the following storage tanks will be located at each platform:

- ► **Tamiami**
  - Eight (8) 500 bbl oil storage tanks
  - Eight (8) 500 bbl produced water tanks
- ► **Nobles Grade**
  - Twelve (12) 500 bbl oil storage tanks
  - Twelve (12) 500 bbl produced water tanks

BR&E ProMax™ software was utilized to estimate potential annual emissions from working, breathing and flash consistent with the methodology of U.S. EPA's AP-42 Chapter 7.1. The ProMax simulation was built assuming oil and produced water production rates of 1,825 and 1,999 bbl/day at each site, respectively, and using the dimension and usage assumptions reported in Table 1-3.

Table 1-3. Storage Tank Assumptions

Tank	Tank Dimensions L (ft)	Tank Dimensions Dia. (ft)	Filling Rate (bbl/d)	Material Category	Tank Color	Orientation
Nobles Grade						
Produced Water Tanks	16	15.5	174.4	Light Organics	Dark Green	Vertical
Oil Storage Tanks	16	15.5	160.75	Heavy Crude	Dark Green	Vertical
Tamiami						
Produced Water Tanks	16	15.5	261.6	Light Organics	Dark Green	Vertical
Oil Storage Tanks	16	15.5	241.1	Heavy Crude	Dark Green	Vertical

All tanks were assumed to operate continuously with fixed roofs. The ProMax simulation estimates the composition and properties of the liquid based on the parameterized process equipment at the facility. A printout of ProMax process flow diagram is attached in Attachment 2.

1.2.5 Oil Loading

VOC emissions from the truck loading of crude oil at the Nobles Grade loading site were calculated with BR&E ProMax, which estimates emissions using Equation 1 of U.S. EPA's AP-42, Section 5.2 (07/08).[2]

The application of Equation 1 is described below.

$$L_L = 12.46 \left(\frac{SPM}{T}\right)$$

Where:
L = total loading loss (lb/10^3 gal)
S = a saturation factor (0.5 for Submerged loading of a clean cargo tank, see AP-42 Table 5.2-1)
P = true vapor pressure of liquid loaded (psia)
M = molecular weight of vapors (lb/lb-mole)
T = temperature of bulk liquid loaded (°R)

To represent loading emissions, the following assumptions were used:

- A maximum loading rate of 360 bbl/hr (the volume of two typical haul trucks)
- A conservative annual load rate of 1,576,800 bbl/yr.
- The truck loading will be "Submerged loading of a clean cargo tank" (S is assumed to be 0.5 per AP-42 Table 5.2-1)
- The properties (P, M, and T) and composition of the liquid loaded were estimated based on the applicable process streams in ProMax.

The loading rack will be controlled by a low pressure combustor. Controlled emissions from oil loading are based on a destruction efficiency of VOCs of 98%. NO_X and CO emissions from the combustor were calculated using emission factors from EPA's AP-42 Chapter 13, Table 13.5-1 (09/91), *Emission Factors for Flare Operations*, in pounds per million British thermal units (lb/MMBtu). SO_2 emissions were estimated assuming that the pilot fuel gas has a total sulfur content of 0.2 gr/100 scf.

Note that oil product from the Tamiami location will not be loaded into trucks at the site, but will be delivered to the existing Maverick pipeline.

1.2.6 Enclosed Combustion Device

Enclosed combustion devices (one (1) per site, two (2) total) will be used to combust excess field gas produced at 2-phase separators, gunbarrel separators, oil and produced water storage tanks that is not needed to power the generators installed onsite. This is conservatively represented in these calculations as all of the gas produced at the facility. NO_X and CO emissions were calculated using emission factors from EPA's AP-42 Chapter 13, Table 13.5-1 (09/91), *Emission Factors for Flare Operations*, in lb/MMBtu. VOC emissions were calculated using the mass flow rate modeled with ProMax and a manufacturer rated destruction efficiency of 99.5%. SO_2 emissions were estimated assuming that the fuel gas has a total sulfur content of 0.2 gr/100 scf. Additionally, emissions from the Tamiami Loading facility will be controlled by a low pressure combustor (ECD-2).

[2] U.S. EPA, AP-42 Section 5.2 Transportation and Marketing of Petroleum Liquids, 6/08.

1.2.7 Unpaved Haul Roads

Haul trucks are used to transport crude oil from these facilities on unpaved roads. Emissions were calculated in accordance with EPA's AP-42 Chapter 13.2.2, Equations 1a and 2.

The application of theses equations is described below.

Equation 1a, which is used to quantify hourly emissions, states that,

$$E = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

Where:
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
k, a, and b = constants referenced from Table 13.2.2-2

Equation 2, which is used to calculated annual emissions, states that,

$$E_{Ext} = E\left(\frac{365\text{-}P}{365}\right)$$

Where:
EExt = annual size-specific emission factor extrapolated for natural mitigation (lb/VMT)
E = emission factor from Equation 1a (lb/VMT)
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation

The quantity of vehicle miles traveled per hour is calculated based on the volume of a haul truck (180 bbl) and the projected oil production rate (1,825 bbl/day). The mean vehicle weight is calculated assuming that an empty truck is 16 tons. The loaded truck weight is calculated based on the density of oil produced at the site as modeled by ProMax. The round-trip haul road length is conservatively assumed to be 0.25 miles.

1.2.8 Fugitive Emissions

Fugitive emissions were calculated in accordance with Table 2-4 of *EPA Protocol for Equipment Leak Emission Estimates (1995)*. Gas, Light Oil, and Heavy Oil service component counts were estimated based on the equipment that is expected to be installed at each facility and is reported in the fugitive emission calculations attached in Attachment 1. Oil and gas compositions were estimated based on modeled compositions from ProMax.

ATTACHMENT 1. DETAILED OPERATION PHASE EMISSIONS

Gunbarrel Separators

Gunbarrel Input Information			
Unit(s):	GB-1		
Description:	1000 bbl Gunbarrel Separators		
Number of Separators:	1		
Oil Throughput	2,000	bbl/day	
Produced Water Throughput	2,000	bbl/day	

Uncontrolled Gunbarrel Emissions[1]

Component	W&B Emissions		Total Emissions		Total Per GB	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Water	1.11E+00	4.84E+00	1.11E+00	4.84E+00	1.11E+00	4.84E+00
Hydrogen Sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon Dioxide	2.28E-02	9.97E-02	2.28E-02	9.97E-02	2.28E-02	9.97E-02
Nitrogen	2.16E-05	9.46E-05	2.16E-05	9.46E-05	2.16E-05	9.46E-05
Methane	4.59E-03	2.01E-02	4.59E-03	2.01E-02	4.59E-03	2.01E-02
Ethane	6.91E-03	3.03E-02	6.91E-03	3.03E-02	6.91E-03	3.03E-02
Propane	2.10E-03	9.21E-03	2.10E-03	9.21E-03	2.10E-03	9.21E-03
Isobutane	5.64E-05	2.47E-04	5.64E-05	2.47E-04	5.64E-05	2.47E-04
n-Butane	1.91E-04	8.36E-04	1.91E-04	8.36E-04	1.91E-04	8.36E-04
Isopentane	1.04E-05	4.57E-05	1.04E-05	4.57E-05	1.04E-05	4.57E-05
n-Pentane	2.49E-06	1.09E-05	2.49E-06	1.09E-05	2.49E-06	1.09E-05
n-Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
iC6	1.32E-06	5.79E-06	1.32E-06	5.79E-06	1.32E-06	5.79E-06
Heptane	1.56E-08	6.85E-08	1.56E-08	6.85E-08	1.56E-08	6.85E-08
Octane	4.57E-10	2.00E-09	4.57E-10	2.00E-09	4.57E-10	2.00E-09
Nonane	1.88E-11	8.22E-11	1.88E-11	8.22E-11	1.88E-11	8.22E-11
Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,2,4-Trimethylpentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Decanes Plus	1.73E-17	7.56E-17	1.73E-17	7.56E-17	1.73E-17	7.56E-17
VOC	**0.0024**	**0.010**	**0.0024**	**0.010**	**0.0024**	**0.010**
Total HAP	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
CO_2e[2]	**1.38E-01**	**6.03E-01**	**1.38E-01**	**6.03E-01**	**1.38E-01**	**6.03E-01**

[1] Vapors are sent to generators as fuel gas (controlled emissions represented by GEN-1 to GEN-3). Surplus vapors are sent to the enclosed combustor (controlled emissions represented by ECD-1).

[2] tons/yr CO2e = ton/yr * GWP; GWPs referece from 40 CFR 98 Table A-1

Oil Storage Tanks

Oil Tank Input Information			
Unit(s):	TK-1 through TK-8		
Description:	500 bbl Crude Oil Storage Tanks		
Number of Tanks:	8		
Total Oil Throughput:	2,000	bpd	
Oil Throughput Per Tank:	250	bpd	

Uncontrolled Oil Tank Emissions [1]								
Component	Flash Emissions		W&B Emissions		Total Emissions		Total Per Tank	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Water	2.55E+00	1.12E+01	6.46E-04	2.83E-03	2.55E+00	1.12E+01	3.19E-01	1.40E+00
Hydrogen Sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon Dioxide	1.07E+00	4.69E+00	1.05E-01	4.60E-01	1.18E+00	5.15E+00	1.47E-01	6.44E-01
Nitrogen	5.20E-02	2.28E-01	4.26E-04	1.87E-03	5.25E-02	2.30E-01	6.56E-03	2.87E-02
Methane	7.12E+00	3.12E+01	2.28E-01	1.00E+00	7.35E+00	3.22E+01	9.19E-01	4.03E+00
Ethane	2.69E+01	1.18E+02	4.29E+00	1.88E+01	3.12E+01	1.37E+02	3.90E+00	1.71E+01
Propane	1.12E+02	4.91E+02	1.78E+01	7.81E+01	1.30E+02	5.69E+02	1.62E+01	7.11E+01
Isobutane	2.82E+01	1.24E+02	3.90E+00	1.71E+01	3.21E+01	1.41E+02	4.01E+00	1.76E+01
n-Butane	6.92E+01	3.03E+02	9.16E+00	4.01E+01	7.84E+01	3.43E+02	9.80E+00	4.29E+01
Isopentane	2.49E+01	1.09E+02	3.13E+00	1.37E+01	2.80E+01	1.23E+02	3.50E+00	1.53E+01
n-Pentane	2.57E+01	1.12E+02	3.17E+00	1.39E+01	2.88E+01	1.26E+02	3.61E+00	1.58E+01
n-Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
iC6	2.50E+01	1.10E+02	2.95E+00	1.29E+01	2.80E+01	1.23E+02	3.50E+00	1.53E+01
Heptane	9.91E+00	4.34E+01	1.04E+00	4.54E+00	1.09E+01	4.79E+01	1.37E+00	5.99E+00
Octane	4.10E+00	1.80E+01	3.90E-01	1.71E+00	4.49E+00	1.97E+01	5.61E-01	2.46E+00
Nonane	1.48E+00	6.47E+00	1.04E-01	4.54E-01	1.58E+00	6.92E+00	1.98E-01	8.65E-01
Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,2,4-Trimethylpentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Decanes Plus	2.59E-03	1.13E-02	1.51E-04	6.62E-04	2.74E-03	1.20E-02	3.43E-04	1.50E-03
VOC	**300.48**	**1316.08**	**41.68**	**182.54**	**342.15**	**1498.62**	**42.77**	**187.33**
Total HAP	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
CO_2e[2]	**1.79E+02**	**7.85E+02**	**5.82E+00**	**2.55E+01**	**1.85E+02**	**8.10E+02**	**2.31E+01**	**1.01E+02**

[1] Vapors are sent to generators as fuel gas (controlled emissions represented by GEN-1 to GEN-3). Surplus vapors are sent to the enclosed combustor (controlled emissions represented by ECD-1).

[2] tons/yr CO2e = ton/yr * GWP; GWPs referece from 40 CFR 98 Table A-1

Produced Water Storage Tanks

Produced Water Tank Input Information		
Unit(s):	TK-9 through TK-16	
Description:	500 bbl Produced Water Storage Tanks	
Number of Tanks:	8	
Total Water Throughput:	2,000	bpd
Water Throughput Per Tank:	250	bpd

Uncontrolled Total Emissions From Produced Water Tank[1]								
Component	Flash Emissions		W&B Emissions		Total Emissions		Total Per Tank	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Water	6.60E-02	2.89E-01	1.51E+00	6.63E+00	1.58E+00	6.92E+00	1.97E-01	8.65E-01
Hydrogen Sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon Dioxide	4.37E-02	1.91E-01	3.20E-02	1.40E-01	7.57E-02	3.32E-01	9.46E-03	4.15E-02
Nitrogen	3.34E-03	1.46E-02	3.07E-05	1.34E-04	3.37E-03	1.48E-02	4.21E-04	1.84E-03
Methane	2.55E-01	1.12E+00	6.50E-03	2.85E-02	2.61E-01	1.14E+00	3.26E-02	1.43E-01
Ethane	2.78E-01	1.22E+00	9.80E-03	4.29E-02	2.88E-01	1.26E+00	3.60E-02	1.58E-01
Propane	4.43E-01	1.94E+00	2.95E-03	1.29E-02	4.46E-01	1.96E+00	5.58E-02	2.44E-01
Isobutane	5.50E-02	2.41E-01	7.96E-05	3.49E-04	5.51E-02	2.41E-01	6.88E-03	3.02E-02
n-Butane	1.66E-01	7.28E-01	2.67E-04	1.17E-03	1.67E-01	7.29E-01	2.08E-02	9.12E-02
Isopentane	3.63E-02	1.59E-01	1.47E-05	6.42E-05	3.63E-02	1.59E-01	4.54E-03	1.99E-02
n-Pentane	2.16E-02	9.48E-02	3.48E-06	1.53E-05	2.16E-02	9.48E-02	2.71E-03	1.19E-02
n-Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
iC6	2.23E-02	9.76E-02	1.85E-06	8.11E-06	2.23E-02	9.76E-02	2.79E-03	1.22E-02
Heptane	3.17E-03	1.39E-02	2.19E-08	9.58E-08	3.17E-03	1.39E-02	3.96E-04	1.74E-03
Octane	6.13E-04	2.68E-03	6.35E-10	2.78E-09	6.13E-04	2.68E-03	7.66E-05	3.36E-04
Nonane	1.42E-04	6.24E-04	2.64E-11	1.15E-10	1.42E-04	6.24E-04	1.78E-05	7.79E-05
Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,2,4-Trimethylpentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Decanes Plus	6.33E-07	2.77E-06	2.38E-17	1.04E-16	6.33E-07	2.77E-06	7.91E-08	3.47E-07
VOC	**0.749**	**3.28**	**0.0033**	**0.015**	**0.75**	**3.29**	**0.094**	**0.41**
Total HAP	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
CO_2e[2]	**6.41E+00**	**2.81E+01**	**1.95E-01**	**8.52E-01**	**6.61E+00**	**2.89E+01**	**8.26E-01**	**3.62E+00**

[1] Vapors are sent to generators as fuel gas (controlled emissions represented by GEN-1 to GEN-3). Surplus vapors are sent to the enclosed combustor (controlled emissions represented by ECD-1).

[2] tons/yr CO2e = ton/yr * GWP; GWPs referece from 40 CFR 98 Table A-1

Burnett Oil Company, Inc. - Tamiami

Enclosed Combustion Device

Emission Unit: ECD-1
Source Description: Controls 2-phase separator, gunbarrel, oil tanks, oil loading, and produced water tanks.

VOC Heat Input and Flow Rate Calculation Per Unit

Parameters	Value	Unit	Notes
Number of ECDs	1	-	
Process VOC Emissions	3926.34	tpy	2-phase separator, gunbarrel, oil tanks, and produced water tanks
Process H_2S Emissions	0.00E+00	tpy	2-phase separator, gunbarrel, oil tanks, and produced water tanks
Process HAP Emissions	0.00E+00	tpy	2-phase separator, gunbarrel, oil tanks, and produced water tanks
Steady-State Heating Value	1919.43	Btu/scf	Heating value of combined streams
Steady-State Flow Rate	12788.78	scf/hr	Total flow from combined streams
Steady-State Heating Rate	24.55	MMBtu/hr	Calculated based on heating value and steady-state flow
Steady-State Flow Rate	0%		Long-term safety factor (No safety factor applied)
	12788.8	scf/hr	Flow with safety factor
	1919.4	Btu/scf	Heating value with safety factor
	112.03	MMscf/yr	Annual flow with safety factor
Steady-State Heating Rate	0%		Short-term safety factor (No safety factor applied)
	24.55	MMBtu/hr	Calculated based on heating value and steady-state flow
Flare Pilot	100	scf/hr	Engineering Estimate
	0%		Safety factor
	100	scf/hr	Pilot flow with safety factor (No safety factor applied)
	1.00E-04	MMscf/hr	
Pilot Gas Heating Value	1020	Btu/scf	Default heating value
Pilot Heating Rate	0.102	MMBtu/hr	
	0.88	MMscf/yr	
Heating Rate + Pilot	24.65	MMBtu/hr	

Emission Rates								
	NO_X	CO	VOC[1]	SO_2[2]	H_2S[2]	HAPs	Units	Notes
Emission Factors	0.0680	0.3100					lb/MMBtu	AP-42 Table 13.5-2
				0.0003			lb S/hr	Based on 2 gr S/100 scf
Pilot Emissions	0.007	0.03		5.71E-04			lb/hr	Calculated using TNRCC EFs
	0.03	0.14		0.0025			tpy	
Steady-State Emissions	1.67	7.61					lb/hr	Calculated using TNRCC EFs
			4.48	0.00	0.00	0.00	lb/hr	99.5% DRE
	7.31	33.33	19.63	0.00	0.00	0.00	tpy	
Total Steady-State & Pilot Emissions	***1.68***	***7.64***	***4.48***	***5.71E-04***	***0.00***	***0.00***	***lb/hr***	
	7.34	***33.47***	***19.63***	***0.0025***	***0.00***	***0.00***	***tpy***	

1 Efficiency of VOC, H_2S, and HAP combustion is: 99.5%
2 Assume that 100% of combusted H_2S is converted to SO_2. To convert, molar mass ratio of SO_2 (64 g/mol) to H_2S (34 g/mol) is used.
Fuel sulfur content is assumed to be 2 gr/100 scf.
"-" Indicates emissions of this pollutant are not expected.

Greenhouse Gas Emissions						
	CO_2	N_2O	CH_4	CO_2e	Units	Notes
Emission Factors	53.06	0.0001	0.001		kg/MMBtu	40 CFR 98 Tables C-1 and C-2
	1	298	25		GWP	40 CFR 98 Table A-1
Total Steady-State & Pilot Emissions	***2883.39***	***0.0054***	***0.054***	***2886.37***	lb/hr	
	12629.26	***0.024***	***0.24***		tons/yr[3]	
	12629.26	***7.09***	***5.95***	***12642.30***	tons/yr CO_2e[4]	

[3]GHG ton/yr = EF (kg/MMBtu) *Fuel consumption (MMBtu/hr) * 1tonne/1000kg * Hours of operation (hr/yr) * 1.1023 ton/tonne
[4]tons/yr CO2e = ton/yr * GWP

Burnett Oil Company, Inc. - Tamiami

Low Pressure Combustion Device

Emission Unit: ECD-2

Source Description: Controls truck loading emissions.

VOC Heat Input and Flow Rate Calculation Per Unit

Parameters	Value	Unit	Notes
Number of ECDs	1	-	
Process VOC Emissions	204.13	tpy	truck loading emissions
Process H_2S Emissions	0.00E+00	tpy	truck loading emissions
Process HAP Emissions	0.00E+00	tpy	truck loading emissions
Oil Vapor Heating Value	2604.08	Btu/scf	Heating value of oil vapor
Loading Vapor Flow Rate	363.27	scf/hr	Total short-term flow from oil loadout
Loading Vapor Heating Rate	0.95	MMBtu/hr	Calculated based on heating value and short-term flow
Annual Loading	1.59	MMscf/yr	Annual vapor flow
	0.47	MMBtu/hr	Calculated based on heating value and annual flow average
Flare Pilot	100	scf/hr	Engineering Estimate
	0%		Safety factor
	100	scf/hr	Pilot flow with safety factor (No safety factor applied)
	1.00E-04	MMscf/hr	
Pilot Gas Heating Value	1020	Btu/scf	Default heating value
Pilot Heating Rate	0.102	MMBtu/hr	
	0.88	MMscf/yr	
Heating Rate + Pilot	1.05	MMBtu/hr	

Emission Rates

	NO_X	CO	VOC[1]	SO_2[2]	H_2S[2]	HAPs	Units	Notes
Emission Factors	0.0680	0.3100					lb/MMBtu	AP-42 Table 13.5-2
				0.0003			lb S/hr	Based on 2 gr S/100 scf
Pilot Emissions	0.007	0.03		5.71E-04			lb/hr	Calculated using TNRCC EFs
	0.03	0.14		0.0025			tpy	
Controlled Loading Emissions	0.06	0.29					lb/hr	Calculated using TNRCC EFs
			0.93	0.00	0.00	0.00	lb/hr	98% DRE
	0.28	1.28	4.08	0.00	0.00	0.00	tpy	
Total Controlled Loading & Pilot Emissions	***0.07***	***0.32***	***0.93***	***5.71E-04***	***0.00***	***0.00***	***lb/hr***	
	0.31	***1.42***	***4.08***	***0.0025***	***0.00***	***0.00***	***tpy***	

[1] Efficiency of VOC, H_2S, and HAP combustion is: 98%

[2] Assume that 100% of combusted H_2S is converted to SO_2. To convert, molar mass ratio of SO_2 (64 g/mol) to H_2S (34 g/mol) is used.

Fuel sulfur content is assumed to be 2 gr/100 scf.

"-" Indicates emissions of this pollutant are not expected.

Greenhouse Gas Emissions

	CO_2	N_2O	CH_4	CO_2e	Units	Notes
Emission Factors	53.06	0.0001	0.001		kg/MMBtu	40 CFR 98 Tables C-1 and C-2
	1	298	25		GWP	40 CFR 98 Table A-1
Total Steady-State & Pilot Emissions	***122.59***	***0.0002***	***0.0023***	***122.72***	lb/hr	
	294.60	***0.001***	***0.01***		tons/yr[3]	
	294.60	***0.17***	***0.14***	***294.91***	tons/yr CO_2e[4]	

[3] GHG ton/yr = EF (kg/MMBtu) *Fuel consumption (MMBtu/hr) * 1tonne/1000kg * Hours of operation (hr/yr) * 1.1023 ton/tonne

[4] tons/yr CO2e = ton/yr * GWP

Burnett Oil Company, Inc. - Tamiami

Generator

Unit:	GEN-1 to GEN-3
Make/Model:	Mesa Solutions 350 kW Mobile Generator
Controls:	None
Type:	4 SLB

Engine Data			
Horsepower	581	hp	Catalyst Data
RPM	1800	rpm	Catalyst Data
Fuel heat value	1,020	Btu/scf	Default
Heating rate	4.92	MMBtu/hr	Calculated
	8467.23	Btu/hp-hr	Catalyst Data
Fuel consumption	0.0048	MMscf/hr	Calculated
	42.2	MMscf/yr	Calculated
Operating hours	8760	hrs/year	Facilty Design

Uncontrolled Emissions														
NO_x	CO	VOC[1]	SO_2[2]	PM[3]	HCHO	Acetaldehyde	Acrolein	Benzene	E-Benzene	Toluene	Xylene	Total HAP	Notes	
0.024	0.25	0.035											g/hp-hr	Manufacturer Specs
				0.0384	0.0528	0.00836	0.00514	0.00044	0.0000397	0.000408	1.84E-04		lb/MMBtu	AP-42 Table 3.2-3
			0.002										gr/scf	
0.031	**0.32**	**0.04**	**0.0028**	**0.049**	**0.26**	**0.041**	**0.025**	**0.0022**	**1.95E-04**	**0.0020**	**9.05E-04**	**0.33**	**lb/hr**	
0.13	**1.41**	**0.20**	**0.012**	**0.22**	**1.14**	**0.18**	**0.11**	**0.0095**	**8.55E-04**	**0.0088**	**0.0040**	**1.45**	**tpy**	

Controlled Emissions														
NO_x	CO	VOC[1]	SO_2[2]	PM[3]	HCHO	Acetaldehyde	Acrolein	Benzene	E-Benzene	Toluene	Xylene	Total HAP	Notes	
0.024	0.25	0.035											g/hp-hr	Manufacturer Specs
0.0%	0.0%												%	Control Efficiency
				0.0384	0.0528	0.00836	0.00514	0.00044	0.0000397	0.000408	0.000184		lb/MMBtu	AP-42 Table 3.2-3
			0.002										gr/scf	
0.031	**0.32**	**0.04**	**0.0028**	**0.049**	**0.26**	**0.041**	**0.025**	**0.0022**	**1.95E-04**	**0.0020**	**9.05E-04**	**0.33**	**lb/hr**	
0.13	**1.41**	**0.20**	**0.012**	**0.22**	**1.14**	**0.18**	**0.11**	**0.0095**	**8.55E-04**	**0.0088**	**0.0040**	**1.45**	**tpy**	

Notes

[1] VOC emissions do note include aldehydes pursuant to NSPS JJJJ definition of VOCs.
[2] calculated
[3] It is assumed that TSP = PM_{10} = $PM_{2.5}$, PM emissions are dervied from AP-42 emissions factors and converted to g/hp-hr using engine specifications.
[4] Total HAPs were calculated using AP-42 emissions factors for a 4-Stroke Lean Burn Engine.

Greenhouse Gas Emissions						
	CO_2	N_2O	CH_4	CO_2e	Units	Notes
Emission Factors	53.06	0.0001	0.001		kg/MMBtu	40 CFR 98 Tables C-1 and C-2
	1	298	25		GWP	40 CFR 98 Table A-1
Total Steady-State & Pilot Emissions	***575.46***	***0.0011***	***0.011***	***576.06***	lb/hr	
	2520.53	***0.0048***	***0.048***		tons/yr[3]	
	2520.53	***1.42***	***1.19***	***2523.14***	tons/yr CO_2e[4]	

[3]GHG ton/yr = EF (kg/MMBtu) *Fuel consumption (MMBtu/hr) * 1tonne/1000kg * Hours of operation (hr/yr) * 1.1023 ton/tonne
[4]tons/yr CO2e = ton/yr * GWP

Heated Separator

Heater Input Information			
Unit(s):	H-1 and H-2		
Description:	750 Mbtu/hr heaters		
Heat input:	0.75	MMBtu/hr	Estimated heat input
Fuel heat value:	1,020	Btu/scf	Estimated heating value
Fuel sulfur content:	0.2	gr/100scf	Estimated for sweet field gas
Operating hours:	8760	hours/year	
Fuel Usage:	735.3	scf/hr	

Emission Calculations per Unit

	NO_x	CO	VOC	SO_2[1]	PM[2]	CO_2	CH_4	N_2O	CO_2e[3]	Unit	Notes
Emission Factors	100	84	5.5		7.6					lb/MMscf	AP-42 Table 1.4-1 & 2
	100.0	84.0	5.5		7.6					lb/MMscf	Adjusted EF, per footnote a in Tables 1.4-1 and 1.4-2
						53.0	0.0010	0.00010		kg/MMBtu	Table C-1 and C-2 of 40 CFR 98 Subpart C
						116.6	0.0022	0.00022		lb/MMBtu	
Emissions	0.074	0.062	0.0040		0.0056	87.48	0.0017	0.0002		lb/hr[4]	
										tons/year[5]	
Total Emissions	0.074	0.062	0.0040	1.05E-04	0.0056	87.48	0.0017	0.00017	87.57	lb/hr	
	0.32	0.27	0.018	4.60E-04	0.024	383.18	0.0072	0.00072	383.57	tons/year	

[1] SO_2 lb/hr = Sulfur (gr/100scf) * 1lb/7000gr * Rating (MMBtu/hr)*10^6 (Btu/MMBtu) / Heat value (Btu/scf)* 64/32

[2] Assumes TSP = PM_{10} = $PM_{2.5}$

[3] Global Warming Potentials (GWP) are from Table A-1 of the EPA GHG MRR under 40 CFR Part 98.

CH_4 GWP = 25

N_2O GWP = 298

[4] lb/hr emissions calculated using the following methods:

NO_x, CO, VOC and PM lb/hr = EF (lb/MMscf) * Rating (MMBtu/hr) / Heat value (Btu/scf)

GHGs = EF(lb/MMBtu) * Rating *(MMBtu/hr)

[5] For all non-HAP calculations, tons/year = lb/hr * Operating hours * 1ton/2000lb

Unpaved Haul Road Emissions

Haul Input Information	
Unit(s):	HAUL
Description:	Unpaved haul road emissions

Input Data		
Empty vehicle weight[1]	16	tons
Load weight[2]	25.1	tons
Loaded vehicle[3]	41.1	tons
Mean vehicle weight[4]	28.57	tons
Oil Throughput	2000	bbl/day
Loadout volume	730000	bbl/yr
Vehicle size	180	bbl
Vehicle frequency[5]	12	vehicles/day
Round-trip distance	0.25	mile/trip
Truck Size:	7560	Nominal
Filling Time:	0.75	Nominal
Oil Loadout Spots	1	Assumed
Trip frequency[6]	1.3	trips/hour
Trip frequency[7]	4056	trips/yr
Surface silt content[8]	4.8	%
Annual wet days[9]	70	days/yr
Vehicle miles traveled[10]	0.33	mile/hr
Vehicle miles traveled	1014.0	miles/yr

Emission Factors and Constants		
Parameter	**PM_{10}**	**$PM_{2.5}$**
k, lb/VMT[11]	1.5	0.15
a, lb/VMT[11]	0.90	0.90
b, lb/VMT[11]	0.45	0.45
Hourly EF, lb/VMT[12]	1.81	0.18
Annual EF, lb/VMT[13]	1.47	0.15

Emission Calculations for Particulate Matter		
PM_{10}	**$PM_{2.5}$**	
0.60	0.060	lb/hr[14]
0.74	0.07	ton/yr[15]

1 Empty vehicle weight includes driver and occupants and full fuel load.
2 Cargo, transported materials, etc. (Density (lb/gal) *7560 gal truck/ 2000lb/ton)
3 Loaded vehicle weight = Empty + Load Size
4 Mean Vehicle weight = (Loaded Weight + Empty Weight) / 2
5 Vehicles per day = Loadout volume / Truck size
6 Trips per hour = Total loadout spots / Loading time
7 Trips per year = Total throughput (bbl/yr) / Truck size (bbl)
8 AP-42 Table 13.2.2-1
9 Conservative assumption rainy days per Figure 13.2.2-1.
10 VMT/hr = Vehicle Miles Traveled per hour= Trips per hour * Segment Length
11 Table 13.2.2-2, Industrial Roads
12 AP-42 13.2.2, Equation 1a
13 AP-42 13.2.2, Equation 2
14 lb/hr = Hourly EF (lb/VMT) * VMT (mile/hr)
15 ton/yr = Annual EF (lb/VMT) * VMT (mile/hr) * Hours of operation (hr/yr)

Fugitive Emissions

Emission unit: FUG

Facility-wide Fugitive Emissions Per Piece of Equipment								
Subcomponent		**Emission Factor[1] (lb/hr/comp)**	**Control Efficiency**	**VOC Content[2] (wt%)**	**H_2S Content[2] (wt%)**	**Benzene Content[2] (wt%)**	**HAP Content[2] (wt%)**	**Subcomponent Counts[3]**
Valves	Gas	9.92E-03	0.0%	71.02%	0.0000%	0.0000%	0.00%	105
	Light Oil	5.51E-03	0.0%	51.91%	0.000%	0.00%	0.00%	263
	Heavy Oil	1.85E-05	0.0%	51.91%	0.000%	0.00%	0.00%	25
Flanges	Gas	8.60E-04	0.0%	71.02%	0.0000%	0.00%	0.00%	213
	Light Oil	2.43E-04	0.0%	51.91%	0.000%	0.00%	0.00%	528
	Heavy Oil	8.60E-07	0.0%	51.91%	0.000%	0.00%	0.00%	50
Connectors	Gas	4.41E-04	0.0%	71.02%	0.0000%	0.00%	0.00%	347
	Light Oil	4.63E-04	0.0%	51.91%	0.000%	0.00%	0.00%	424
	Heavy Oil	1.65E-05	0.0%	51.91%	0.000%	0.00%	0.00%	0
Pumps	Light Oil	2.87E-02	0.0%	51.91%	0.000%	0.00%	0.00%	15
	Heavy Oil	2.87E-02	0.0%	51.91%	0.000%	0.00%	0.00%	0
Other	Gas	1.94E-02	0.0%	71.02%	0.0000%	0.00%	0.00%	38
	Light Oil	1.65E-02	0.0%	51.91%	0.000%	0.00%	0.00%	2
	Heavy Oil	7.06E-05	0.0%	51.91%	0.000%	0.00%	0.00%	0
				Hourly VOC Emission Rate (lb/hr)[4]				2.66
				Annual VOC Emission Rate (tpy)[5]				11.67
				Hourly H_2S Emission Rate (lb/hr)[4]				0.00E+00
				Annual H_2S Emission Rate (tpy)[5]				0.00E+00
				Hourly Benzene Emission Rate (lb/hr)[4]				0.00E+00
				Annual Benzene Emission Rate (tpy)[5]				0.00E+00
				Hourly HAP Emission Rate (lb/hr)[4]				0.00E+00
				Annual HAP Emission Rate (tpy)[5]				0.00E+00

[1] Emission factors from Table 2-4 of EPA Protocol for Equipment Leak Emission Estimates, 1995.

[2] Weight percent of gas and liquid components are referenced from flash gas and liquid streams from a ProMax simulation for this facility.

[3] Subcomponent counts for each subcomponent are based on estimated average component counts for each piece of equipment.

[4] Hourly Emissions [lb/hr] = Emissions Factor [lb/hr/component] * Weight Content of Chemical Component [%] * Subcomponent Count.

[5] Annual Emissions [ton/yr] = Hourly Emissions [lb/hr] * 8760 [hr/yr] * 1/2000 [ton/lb].

Gunbarrel Separators

Gunbarrel Input Information			
Unit(s):	GB-1		
Description:	1000 bbl Gunbarrel Separators		
Number of Separators:	1		
Oil Throughput	2,000	bbl/day	
Produced Water Throughput	2,000	bbl/day	

Uncontrolled Gunbarrel Emissions[1]						
Component	W&B Emissions		Total Emissions		Total Per GB	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Water	1.11E+00	4.84E+00	1.11E+00	4.84E+00	1.11E+00	4.84E+00
Hydrogen Sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon Dioxide	2.28E-02	9.97E-02	2.28E-02	9.97E-02	2.28E-02	9.97E-02
Nitrogen	2.16E-05	9.46E-05	2.16E-05	9.46E-05	2.16E-05	9.46E-05
Methane	4.59E-03	2.01E-02	4.59E-03	2.01E-02	4.59E-03	2.01E-02
Ethane	6.91E-03	3.03E-02	6.91E-03	3.03E-02	6.91E-03	3.03E-02
Propane	2.10E-03	9.21E-03	2.10E-03	9.21E-03	2.10E-03	9.21E-03
Isobutane	5.64E-05	2.47E-04	5.64E-05	2.47E-04	5.64E-05	2.47E-04
n-Butane	1.91E-04	8.36E-04	1.91E-04	8.36E-04	1.91E-04	8.36E-04
Isopentane	1.04E-05	4.57E-05	1.04E-05	4.57E-05	1.04E-05	4.57E-05
n-Pentane	2.49E-06	1.09E-05	2.49E-06	1.09E-05	2.49E-06	1.09E-05
n-Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
iC6	1.32E-06	5.79E-06	1.32E-06	5.79E-06	1.32E-06	5.79E-06
Heptane	1.56E-08	6.85E-08	1.56E-08	6.85E-08	1.56E-08	6.85E-08
Octane	4.57E-10	2.00E-09	4.57E-10	2.00E-09	4.57E-10	2.00E-09
Nonane	1.88E-11	8.22E-11	1.88E-11	8.22E-11	1.88E-11	8.22E-11
Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,2,4-Trimethylpentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Decanes Plus	1.73E-17	7.56E-17	1.73E-17	7.56E-17	1.73E-17	7.56E-17
VOC	**0.0024**	**0.010**	**0.0024**	**0.010**	**0.0024**	**0.010**
Total HAP	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
CO_2e[2]	**1.38E-01**	**6.03E-01**	**1.38E-01**	**6.03E-01**	**1.38E-01**	**6.03E-01**

[1] Vapors are sent to generators as fuel gas (controlled emissions represented by GEN-1 to GEN-3). Surplus vapors are sent to the enclosed combustor (controlled emissions represented by ECD-1).

[2] tons/yr CO2e = ton/yr * GWP; GWPs referece from 40 CFR 98 Table A-1

Oil Storage Tanks

Oil Tank Input Information			
Unit(s):	TK-1 through TK-12		
Description:	500 bbl Crude Oil Storage Tanks		
Number of Tanks:	12		
Total Oil Throughput:	2,000	bpd	
Oil Throughput Per Tank:	167	bpd	

Uncontrolled Oil Tank Emissions [1]								
Component	Flash Emissions		W&B Emissions		Total Emissions		Total Per Tank	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Water	2.55E+00	1.12E+01	7.06E-04	3.09E-03	2.55E+00	1.12E+01	2.13E-01	9.32E-01
Hydrogen Sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon Dioxide	1.07E+00	4.69E+00	1.08E-01	4.74E-01	1.18E+00	5.17E+00	9.83E-02	4.31E-01
Nitrogen	5.20E-02	2.28E-01	4.66E-04	2.04E-03	5.25E-02	2.30E-01	4.38E-03	1.92E-02
Methane	7.12E+00	3.12E+01	2.50E-01	1.09E+00	7.37E+00	3.23E+01	6.15E-01	2.69E+00
Ethane	2.69E+01	1.18E+02	4.69E+00	2.05E+01	3.16E+01	1.38E+02	2.63E+00	1.15E+01
Propane	1.12E+02	4.91E+02	1.95E+01	8.54E+01	1.31E+02	5.76E+02	1.10E+01	4.80E+01
Isobutane	2.82E+01	1.24E+02	4.26E+00	1.87E+01	3.25E+01	1.42E+02	2.71E+00	1.19E+01
n-Butane	6.92E+01	3.03E+02	1.00E+01	4.38E+01	7.92E+01	3.47E+02	6.60E+00	2.89E+01
Isopentane	2.49E+01	1.09E+02	3.42E+00	1.50E+01	2.83E+01	1.24E+02	2.36E+00	1.03E+01
n-Pentane	2.57E+01	1.12E+02	3.47E+00	1.52E+01	2.91E+01	1.28E+02	2.43E+00	1.06E+01
n-Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
iC6	2.50E+01	1.10E+02	3.22E+00	1.41E+01	2.82E+01	1.24E+02	2.35E+00	1.03E+01
Heptane	9.91E+00	4.34E+01	1.13E+00	4.97E+00	1.10E+01	4.84E+01	9.20E-01	4.03E+00
Octane	4.10E+00	1.80E+01	4.26E-01	1.87E+00	4.53E+00	1.98E+01	3.77E-01	1.65E+00
Nonane	1.48E+00	6.47E+00	1.13E-01	4.96E-01	1.59E+00	6.97E+00	1.33E-01	5.80E-01
Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,2,4-Trimethylpentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Decanes Plus	2.59E-03	1.13E-02	1.65E-04	7.23E-04	2.75E-03	1.21E-02	2.30E-04	1.01E-03
VOC	**300.48**	**1316.08**	**45.56**	**199.56**	**346.04**	**1515.64**	**28.84**	**126.30**
Total HAP	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
CO_2e[2]	**1.79E+02**	**7.85E+02**	**6.35E+00**	**2.78E+01**	**1.86E+02**	**8.13E+02**	**1.55E+01**	**6.77E+01**

[1] Vapors are sent to generators as fuel gas (controlled emissions represented by GEN-1 to GEN-3). Surplus vapors are sent to the enclosed combustor (controlled emissions represented by ECD-1).

[2] tons/yr CO2e = ton/yr * GWP; GWPs referece from 40 CFR 98 Table A-1

Produced Water Storage Tanks

Produced Water Tank Input Information		
Unit(s):	TK-13 through TK-24	
Description:	500 bbl Produced Water Storage Tanks	
Number of Tanks:	12	
Total Water Throughput:	2,000	bpd
Water Throughput Per Tank:	167	bpd

Uncontrolled Total Emissions From Produced Water Tank[1]								
Component	Flash Emissions		W&B Emissions		Total Emissions		Total Per Tank	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Water	6.60E-02	2.89E-01	1.57E+00	6.87E+00	1.64E+00	7.16E+00	1.36E-01	5.97E-01
Hydrogen Sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon Dioxide	4.37E-02	1.91E-01	3.32E-02	1.45E-01	7.69E-02	3.37E-01	6.41E-03	2.81E-02
Nitrogen	3.34E-03	1.46E-02	3.18E-05	1.39E-04	3.37E-03	1.48E-02	2.81E-04	1.23E-03
Methane	2.55E-01	1.12E+00	6.74E-03	2.95E-02	2.61E-01	1.14E+00	2.18E-02	9.54E-02
Ethane	2.78E-01	1.22E+00	1.02E-02	4.45E-02	2.88E-01	1.26E+00	2.40E-02	1.05E-01
Propane	4.43E-01	1.94E+00	3.06E-03	1.34E-02	4.46E-01	1.96E+00	3.72E-02	1.63E-01
Isobutane	5.50E-02	2.41E-01	8.25E-05	3.61E-04	5.51E-02	2.41E-01	4.59E-03	2.01E-02
n-Butane	1.66E-01	7.28E-01	2.77E-04	1.21E-03	1.67E-01	7.29E-01	1.39E-02	6.08E-02
Isopentane	3.63E-02	1.59E-01	1.52E-05	6.65E-05	3.63E-02	1.59E-01	3.03E-03	1.33E-02
n-Pentane	2.16E-02	9.48E-02	3.61E-06	1.58E-05	2.16E-02	9.48E-02	1.80E-03	7.90E-03
n-Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
iC6	2.23E-02	9.76E-02	1.92E-06	8.41E-06	2.23E-02	9.76E-02	1.86E-03	8.14E-03
Heptane	3.17E-03	1.39E-02	2.27E-08	9.93E-08	3.17E-03	1.39E-02	2.64E-04	1.16E-03
Octane	6.13E-04	2.68E-03	6.58E-10	2.88E-09	6.13E-04	2.68E-03	5.11E-05	2.24E-04
Nonane	1.42E-04	6.24E-04	2.73E-11	1.20E-10	1.42E-04	6.24E-04	1.19E-05	5.20E-05
Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,2,4-Trimethylpentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Decanes Plus	6.33E-07	2.77E-06	2.47E-17	1.08E-16	6.33E-07	2.77E-06	5.28E-08	2.31E-07
VOC	**0.749**	**3.28**	**0.0034**	**0.015**	**0.75**	**3.29**	**0.063**	**0.27**
Total HAP	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
CO_2e[2]	**6.41E+00**	**2.81E+01**	**2.02E-01**	**8.84E-01**	**6.61E+00**	**2.90E+01**	**5.51E-01**	**2.41E+00**

[1] Vapors are sent to generators as fuel gas (controlled emissions represented by GEN-1 to GEN-3). Surplus vapors are sent to the enclosed combustor (controlled emissions represented by ECD-1).

[2] tons/yr CO2e = ton/yr * GWP; GWPs referece from 40 CFR 98 Table A-1

Burnett Oil Company, Inc. - Nobles Grade

Enclosed Combustion Device

Emission Unit: ECD-1
Source Description: Controls 2-phase separator, gunbarrel, oil tanks, and produced water tanks.

VOC Heat Input and Flow Rate Calculation Per Unit

Parameters	Value	Unit	Notes
Number of ECDs	1	-	
Process VOC Emissions	3943.37	tpy	2-phase separator, gunbarrel, oil tanks, and produced water tanks
Process H_2S Emissions	0.00E+00	tpy	2-phase separator, gunbarrel, oil tanks, and produced water tanks
Process HAP Emissions	0.00E+00	tpy	2-phase separator, gunbarrel, oil tanks, and produced water tanks
Steady-State Heating Value	1921.01	Btu/scf	Heating value of combined streams
Steady-State Flow Rate	12822.63	scf/hr	Total flow from combined streams
Steady-State Heating Rate	24.63	MMBtu/hr	Calculated based on heating value and steady-state flow
Steady-State Flow Rate	0%		Long-term safety factor (No safety factor applied)
	12822.6	scf/hr	Flow with safety factor
	1921.0	Btu/scf	Heating value with safety factor
	112.33	MMscf/yr	Annual flow with safety factor
Steady-State Heating Rate	0%		Short-term safety factor (No safety factor applied)
	24.63	MMBtu/hr	Calculated based on heating value and steady-state flow
Flare Pilot	100	scf/hr	Engineering Estimate
	0%		Safety factor
	100	scf/hr	Pilot flow with safety factor (No safety factor applied)
	1.00E-04	MMscf/hr	
Pilot Gas Heating Value	1020	Btu/scf	Default heating value
Pilot Heating Rate	0.102	MMBtu/hr	
	0.88	MMscf/yr	
Heating Rate + Pilot	24.73	MMBtu/hr	

Emission Rates								
	NO_X	CO	VOC[1]	SO_2[2]	H_2S[2]	HAPs	Units	Notes
Emission Factors	0.0680	0.3100					lb/MMBtu	AP-42 Table 13.5-2
				0.0003			lb S/hr	Based on 2 gr S/100 scf
Pilot Emissions	0.007	0.03		5.71E-04			lb/hr	Calculated using TNRCC EFs
	0.03	0.14		0.0025			tpy	
Steady-State Emissions	1.68	7.64					lb/hr	Calculated using TNRCC EFs
			4.50	0.00	0.00	0.00	lb/hr	99.5% DRE
	7.34	33.45	19.72	0.00	0.00	0.00	tpy	
Total Steady-State, & Pilot Emissions	***1.68***	***7.67***	***4.50***	***5.71E-04***	***0.00***	***0.00***	***lb/hr***	
	7.37	***33.58***	***19.72***	***0.0025***	***0.00***	***0.00***	***tpy***	

[1] Efficiency of VOC, H_2S, and HAP combustion is: 99.5%

[2] Assume that 100% of combusted H_2S is converted to SO_2. To convert, molar mass ratio of SO_2 (64 g/mol) to H_2S (34 g/mol) is used.
Fuel sulfur content is assumed to be 2 gr/100 scf.

"-" Indicates emissions of this pollutant are not expected.

Greenhouse Gas Emissions						
	CO_2	N_2O	CH_4	CO_2e	Units	Notes
Emission Factors	53.06	0.0001	0.001		kg/MMBtu	40 CFR 98 Tables C-1 and C-2
	1	298	25		GWP	40 CFR 98 Table A-1
Total Steady-State & Pilot Emissions	***2893.36***	***0.0055***	***0.055***	***2896.35***	lb/hr	
	12672.92	***0.024***	***0.24***		tons/yr[3]	
	12672.92	***7.12***	***5.97***	***12686.01***	tons/yr CO_2e[4]	

[3] GHG ton/yr = EF (kg/MMBtu) *Fuel consumption (MMBtu/hr) * 1tonne/1000kg * Hours of operation (hr/yr) * 1.1023 ton/tonne

[4] tons/yr CO2e = ton/yr * GWP

Oil Loading

Oil Loading Uncontrolled Emissions		
Pollutant	**lb/hr**	**tons/yr**
VOC	43.15	204.13
H_2S	0.00E+00	0.00E+00
n-Hexane	0.00E+00	0.00E+00
Benzene	0.00E+00	0.00E+00
Toluene	0.00E+00	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00
Xylenes	0.00E+00	0.00E+00
2,2,4-TMP	0.00E+00	0.00E+00
Total HAP	0.00E+00	0.00E+00
CO_2e[1]	6.02E+00	2.85E+01

[1] tons/yr CO2e = ton/yr * GWP; GWPs referece from 40 CFR 98 Table A-1.

Burnett Oil Company, Inc. - Nobles Grade

Low Pressure Combustion Device

Emission Unit: ECD-2
Source Description: Controls truck loading emissions.

VOC Heat Input and Flow Rate Calculation Per Unit

Parameters	Value	Unit	Notes
Number of ECDs	1	-	
Process VOC Emissions	204.13	tpy	truck loading emissions
Process H_2S Emissions	0.00E+00	tpy	truck loading emissions
Process HAP Emissions	0.00E+00	tpy	truck loading emissions
Oil Vapor Heating Value	2604.47	Btu/scf	Heating value of oil vapor
Loading Vapor Flow Rate	363.21	scf/hr	Total short-term flow from oil loadout
Loading Vapor Heating Rate	0.95	MMBtu/hr	Calculated based on heating value and short-term flow
Annual Loading	1.59	MMscf/yr	Annual vapor flow
	0.47	MMBtu/hr	Calculated based on heating value and annual flow average
Flare Pilot	100	scf/hr	Engineering Estimate
	0%		Safety factor
	100	scf/hr	Pilot flow with safety factor (No safety factor applied)
	1.00E-04	MMscf/hr	
Pilot Gas Heating Value	1020	Btu/scf	Default heating value
Pilot Heating Rate	0.102	MMBtu/hr	
	0.88	MMscf/yr	
Heating Rate + Pilot	1.05	MMBtu/hr	

Emission Rates								
	NO_X	CO	VOC[1]	SO_2[2]	H_2S[2]	HAPs	Units	Notes
Emission Factors	0.0680	0.3100					lb/MMBtu	AP-42 Table 13.5-2
				0.0003			lb S/hr	Based on 2 gr S/100 scf
Pilot Emissions	0.007	0.03		5.71E-04			lb/hr	Calculated using TNRCC EFs
	0.03	0.14		0.0025			tpy	
Controlled Loading Emissions	0.06	0.29					lb/hr	Calculated using TNRCC EFs
			0.93	0.00	0.00	0.00	lb/hr	98% DRE
	0.28	1.28	4.08	0.00	0.00	0.00	tpy	
Total Controlled Loading & Pilot Emissions	***0.07***	***0.32***	***0.93***	***5.71E-04***	***0.00***	***0.00***	***lb/hr***	
	0.31	***1.42***	***4.08***	***0.0025***	***0.00***	***0.00***	***tpy***	

[1] Efficiency of VOC, H_2S, and HAP combustion is: 98%

[2] Assume that 100% of combusted H_2S is converted to SO_2. To convert, molar mass ratio of SO_2 (64 g/mol) to H_2S (34 g/mol) is used.
Fuel sulfur content is assumed to be 2 gr/100 scf.

"-" Indicates emissions of this pollutant are not expected.

Greenhouse Gas Emissions						
	CO_2	N_2O	CH_4	CO_2e	Units	Notes
Emission Factors	53.06	0.0001	0.001		kg/MMBtu	40 CFR 98 Tables C-1 and C-2
	1	298	25		GWP	40 CFR 98 Table A-1
Total Steady-State & Pilot Emissions	***122.59***	***0.0002***	***0.0023***	***122.72***	lb/hr	
	294.60	***0.001***	***0.01***		tons/yr[3]	
	294.60	***0.17***	***0.14***	***294.91***	tons/yr CO_2e[4]	

[3] GHG ton/yr = EF (kg/MMBtu) *Fuel consumption (MMBtu/hr) * 1tonne/1000kg * Hours of operation (hr/yr) * 1.1023 ton/tonne

[4] tons/yr CO2e = ton/yr * GWP

Burnett Oil Company, Inc. - Nobles Grade

Generator

Unit: GEN-1 to GEN-3
Make/Model: Mesa Solutions 350 kW Mobile Generator
Controls: None
Type: 4 SLB

Engine Data			
Horsepower	581	hp	Catalyst Data
RPM	1800	rpm	Catalyst Data
Fuel heat value	1,020	Btu/scf	Default
Heating rate	4.92	MMBtu/hr	Calculated
	8467.23	Btu/hp-hr	Catalyst Data
Fuel consumption	0.0048	MMscf/hr	Calculated
	42.2	MMscf/yr	Calculated
Operating hours	8760	hrs/year	Facilty Design

Uncontrolled Emissions

NO_x	CO	VOC[1]	SO_2[2]	PM[3]	HCHO	Acetaldehyde	Acrolein	Benzene	E-Benzene	Toluene	Xylene	Total HAP	Notes	
0.024	0.25	0.035											g/hp-hr	Manufacturer Specs
				0.0384	0.0528	0.00836	0.00514	0.00044	0.0000397	0.000408	1.84E-04		lb/MMBtu	AP-42 Table 3.2-3
			0.002										gr/scf	
0.031	**0.32**	**0.04**	**0.0028**	**0.049**	**0.26**	**0.041**	**0.025**	**0.0022**	**1.95E-04**	**0.0020**	**9.05E-04**	**0.33**	**lb/hr**	
0.13	**1.41**	**0.20**	**0.012**	**0.22**	**1.14**	**0.18**	**0.11**	**0.0095**	**8.55E-04**	**0.0088**	**0.0040**	**1.45**	**tpy**	

Controlled Emissions

NO_x	CO	VOC[1]	SO_2[2]	PM[3]	HCHO	Acetaldehyde	Acrolein	Benzene	E-Benzene	Toluene	Xylene	Total HAP	Notes	
0.024	0.25	0.035											g/hp-hr	Manufacturer Specs
0.0%	0.0%												%	Control Efficiency
				0.0384	0.0528	0.00836	0.00514	0.00044	0.0000397	0.000408	0.000184		lb/MMBtu	AP-42 Table 3.2-3
			0.002										gr/scf	
0.031	**0.32**	**0.04**	**0.0028**	**0.049**	**0.26**	**0.041**	**0.025**	**0.0022**	**1.95E-04**	**0.0020**	**9.05E-04**	**0.33**	**lb/hr**	
0.13	**1.41**	**0.20**	**0.012**	**0.22**	**1.14**	**0.18**	**0.11**	**0.0095**	**8.55E-04**	**0.0088**	**0.0040**	**1.45**	**tpy**	

Notes

[1] VOC emissions do note include aldehydes pursuant to NSPS JJJJ definition of VOCs.
[2] calculated
[3] It is assumed that TSP = PM_{10} = $PM_{2.5}$, PM emissions are dervied from AP-42 emissions factors and converted to g/hp-hr using engine specifications.
[4] Total HAPs were calculated using AP-42 emissions factors for a 4-Stroke Lean Burn Engine.

Greenhouse Gas Emissions

	CO_2	N_2O	CH_4	CO_2e	Units	Notes
Emission Factors	53.06	0.0001	0.001		kg/MMBtu	40 CFR 98 Tables C-1 and C-2
	1	298	25		GWP	40 CFR 98 Table A-1
Total Steady-State & Pilot Emissions	***575.46***	***0.0011***	***0.011***	***576.06***	lb/hr	
	2520.53	***0.0048***	***0.048***		tons/yr[3]	
	2520.53	***1.42***	***1.19***	***2523.14***	tons/yr CO_2e[4]	

[3]GHG ton/yr = EF (kg/MMBtu) *Fuel consumption (MMBtu/hr) * 1tonne/1000kg * Hours of operation (hr/yr) * 1.1023 ton/tonne
[4]tons/yr CO2e = ton/yr * GWP

Heated Separator

Heater Input Information			
Unit(s):	H-1 and H-2		
Description:	750 Mbtu/hr heaters		
Heat input:	0.75	MMBtu/hr	Estimated heat input
Fuel heat value:	1,020	Btu/scf	Estimated heating value
Fuel sulfur content:	0.2	gr/100scf	Estimated for sweet field gas
Operating hours:	8760	hours/year	
Fuel Usage:	735.3	scf/hr	

Emission Calculations per Unit

	NO_x	CO	VOC	SO_2[1]	PM[2]	Total HAPs[3]	CO_2	CH_4	N_2O	CO_2e[4]	Unit	Notes
Emission Factors	100	84	5.5		7.6						lb/MMscf	AP-42 Table 1.4-1 & 2
	100.0	84.0	5.5		7.6						lb/MMscf	Adjusted EF, per footnote a in Tables 1.4-1 and 1.4-2
							53.0	0.0010	0.00010		kg/MMBtu	Table C-1 and C-2 of 40 CFR 98 Subpart C
							116.6	0.0022	0.00022		lb/MMBtu	
Emissions	0.074	0.062	0.0040		0.0056		87.48	0.0017	0.0002		lb/hr[5]	
											tons/year[6]	
Total Emissions	0.074	0.062	0.0040	1.05E-04	0.0056	0.0072	87.48	0.0017	0.00017	87.57	lb/hr	
	0.32	0.27	0.018	4.60E-04	0.024	0.031	383.18	0.0072	0.00072	383.57	tons/year	

[1] SO_2 lb/hr = Sulfur (gr/100scf) * 1lb/7000gr * Rating (MMBtu/hr)*10^6 (Btu/MMBtu) / Heat value (Btu/scf) * 64/32

[2] Assumes TSP = PM_{10} = $PM_{2.5}$

[3] HAP annual emission rate calculated using GRI-HAPCalc 3.01

[4] Global Warming Potentials (GWP) are from Table A-1 of the EPA GHG MRR under 40 CFR Part 98.

CH_4 GWP = 25

N_2O GWP = 298

[5] lb/hr emissions calculated using the following methods:

NO_x, CO, VOC and PM lb/hr = EF (lb/MMscf) * Rating (MMBtu/hr) / Heat value (Btu/scf)

GHGs = EF(lb/MMBtu) * Rating *(MMBtu/hr)

[6] For all non-HAP calculations, tons/year = lb/hr * Operating hours * 1ton/2000lb

Unpaved Haul Road Emissions

Haul Input Information	
Unit(s):	HAUL
Description:	Unpaved haul road emissions

Input Data		
Empty vehicle weight[1]	16	tons
Load weight[2]	25.1	tons
Loaded vehicle[3]	41.1	tons
Mean vehicle weight[4]	28.57	tons
Oil Throughput	2000	bbl/day
Loadout volume	730000	bbl/yr
Vehicle size	180	bbl
Vehicle frequency[5]	12	vehicles/day
Round-trip distance	0.25	mile/trip
Truck Size:	7560	Nominal
Filling Time:	0.75	Nominal
Oil Loadout Spots	1	Assumed
Trip frequency[6]	1.3	trips/hour
Trip frequency[7]	4056	trips/yr
Surface silt content[8]	4.8	%
Annual wet days[9]	70	days/yr
Vehicle miles traveled[10]	0.33	mile/hr
Vehicle miles traveled	1014.0	miles/yr

Emission Factors and Constants		
Parameter	**PM_{10}**	**$PM_{2.5}$**
k, lb/VMT[11]	1.5	0.15
a, lb/VMT[11]	0.90	0.90
b, lb/VMT[11]	0.45	0.45
Hourly EF, lb/VMT[12]	1.81	0.18
Annual EF, lb/VMT[13]	1.47	0.15

Emission Calculations for Particulate Matter		
PM_{10}	**$PM_{2.5}$**	
0.60	0.060	lb/hr[14]
0.74	0.07	ton/yr[15]

[1] Empty vehicle weight includes driver and occupants and full fuel load.
[2] Cargo, transported materials, etc. (Density (lb/gal) *7560 gal truck/ 2000lb/ton)
[3] Loaded vehicle weight = Empty + Load Size
[4] Mean Vehicle weight = (Loaded Weight + Empty Weight) / 2
[5] Vehicles per day = Loadout volume / Truck size
[6] Trips per hour = Total loadout spots / Loading time
[7] Trips per year = Total throughput (bbl/yr) / Truck size (bbl)
[8] AP-42 Table 13.2.2-1
[9] Per NMED Guidance
[10] VMT/hr = Vehicle Miles Traveled per hour= Trips per hour * Segment Length
[11] Table 13.2.2-2, Industrial Roads
[12] AP-42 13.2.2, Equation 1a
[13] AP-42 13.2.2, Equation 2
[14] lb/hr = Hourly EF (lb/VMT) * VMT (mile/hr)
[15] ton/yr = Annual EF (lb/VMT) * VMT (mile/hr) * Hours of operation (hr/yr)

Fugitive Emissions

Emission unit: FUG

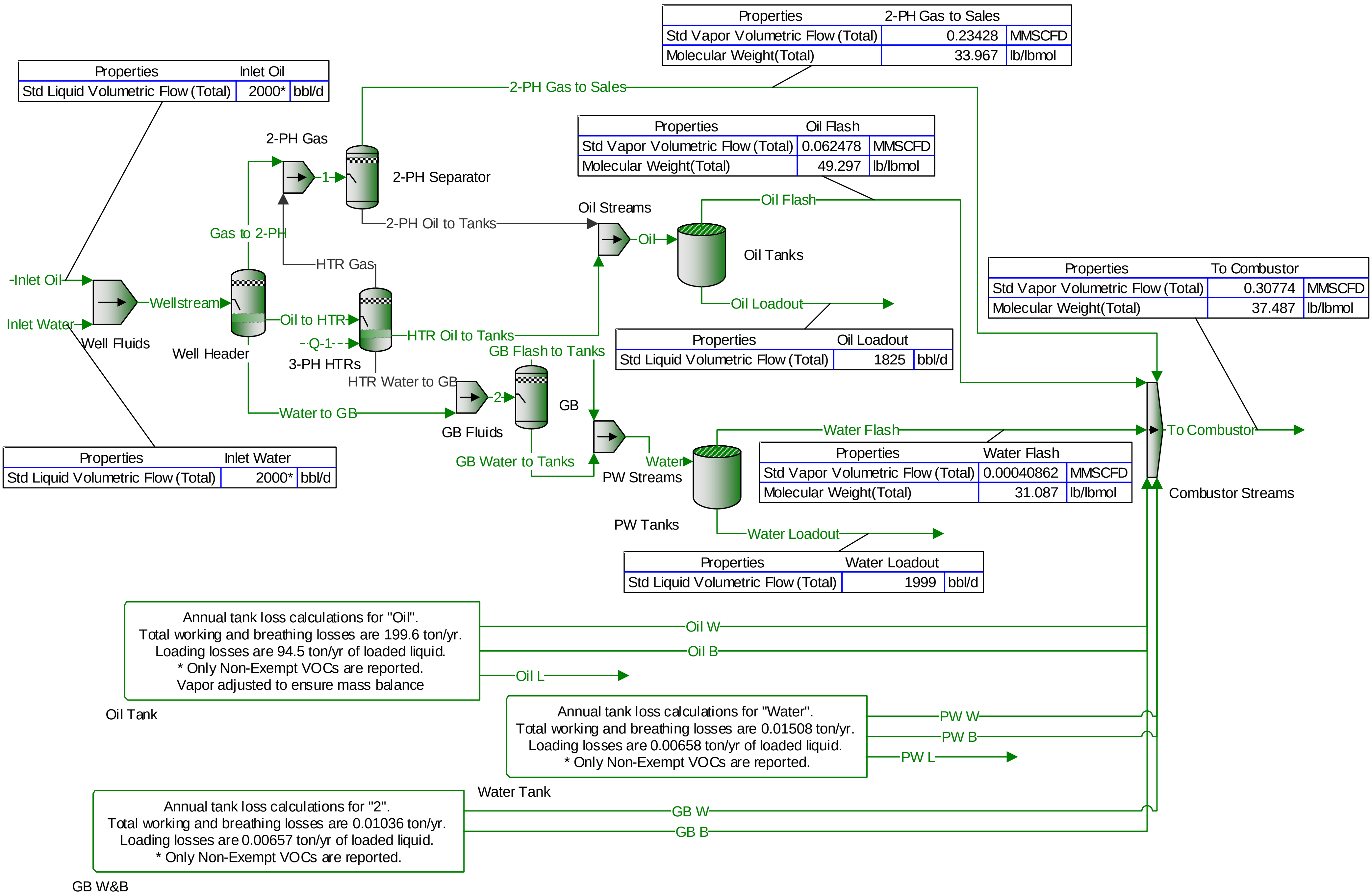
Facility-wide Fugitive Emissions Per Piece of Equipment								
Subcomponent		Emission Factor[1] (lb/hr/comp)	Control Efficiency	VOC Content[2] (wt%)	H_2S Content[2] (wt%)	Benzene Content[2] (wt%)	HAP Content[2] (wt%)	Subcomponent Counts[3]
Valves	Gas	9.92E-03	0.0%	71.08%	0.0000%	0.0000%	0.00%	90
	Light Oil	5.51E-03	0.0%	51.91%	0.000%	0.00%	0.00%	293
	Heavy Oil	1.85E-05	0.0%	51.91%	0.000%	0.00%	0.00%	25
Flanges	Gas	8.60E-04	0.0%	71.08%	0.0000%	0.00%	0.00%	183
	Light Oil	2.43E-04	0.0%	51.91%	0.000%	0.00%	0.00%	588
	Heavy Oil	8.60E-07	0.0%	51.91%	0.000%	0.00%	0.00%	50
Connectors	Gas	4.41E-04	0.0%	71.08%	0.0000%	0.00%	0.00%	314
	Light Oil	4.63E-04	0.0%	51.91%	0.000%	0.00%	0.00%	507
	Heavy Oil	1.65E-05	0.0%	51.91%	0.000%	0.00%	0.00%	0
Pumps	Light Oil	2.87E-02	0.0%	51.91%	0.000%	0.00%	0.00%	12
	Heavy Oil	2.87E-02	0.0%	51.91%	0.000%	0.00%	0.00%	0
Other	Gas	1.94E-02	0.0%	71.08%	0.0000%	0.00%	0.00%	35
	Light Oil	1.65E-02	0.0%	51.91%	0.000%	0.00%	0.00%	2
	Heavy Oil	7.06E-05	0.0%	51.91%	0.000%	0.00%	0.00%	0
				Hourly VOC Emission Rate (lb/hr)[4]				2.56
				Annual VOC Emission Rate (tpy)[5]				11.20
				Hourly H_2S Emission Rate (lb/hr)[4]				0.00E+00
				Annual H_2S Emission Rate (tpy)[5]				0.00E+00
				Hourly Benzene Emission Rate (lb/hr)[4]				0.00E+00
				Annual Benzene Emission Rate (tpy)[5]				0.00E+00
				Hourly HAP Emission Rate (lb/hr)[4]				0.00E+00
				Annual HAP Emission Rate (tpy)[5]				0.00E+00

[1] Emission factors from Table 2-4 of EPA Protocol for Equipment Leak Emission Estimates, 1995.
[2] Weight percent of gas and liquid components are referenced from flash gas and liquid streams from a ProMax simulation for this facility.
[3] Subcomponent counts for each subcomponent are based on estimated average component counts for each piece of equipment.
[4] Hourly Emissions [lb/hr] = Emissions Factor [lb/hr/component] * Weight Content of Chemical Component [%] * Subcomponent Count.
[5] Annual Emissions [ton/yr] = Hourly Emissions [lb/hr] * 8760 [hr/yr] * 1/2000 [ton/lb].

ATTACHMENT 2. SUPPORTING DOCUMENTATION

Burnett Oil Company, Inc.

Nobles Grade Tank Battery



Properties	Inlet Oil	
Std Liquid Volumetric Flow (Total)	2000*	bbl/d

Properties	Inlet Water	
Std Liquid Volumetric Flow (Total)	2000*	bbl/d

Properties	2-PH Gas to Sales	
Std Vapor Volumetric Flow (Total)	0.23428	MMSCFD
Molecular Weight(Total)	33.967	lb/lbmol

Properties	Oil Flash	
Std Vapor Volumetric Flow (Total)	0.062478	MMSCFD
Molecular Weight(Total)	49.297	lb/lbmol

Properties	Oil Loadout	
Std Liquid Volumetric Flow (Total)	1825	bbl/d

Properties	To Combustor	
Std Vapor Volumetric Flow (Total)	0.30774	MMSCFD
Molecular Weight(Total)	37.487	lb/lbmol

Properties	Water Flash	
Std Vapor Volumetric Flow (Total)	0.00040862	MMSCFD
Molecular Weight(Total)	31.087	lb/lbmol

Properties	Water Loadout	
Std Liquid Volumetric Flow (Total)	1999	bbl/d

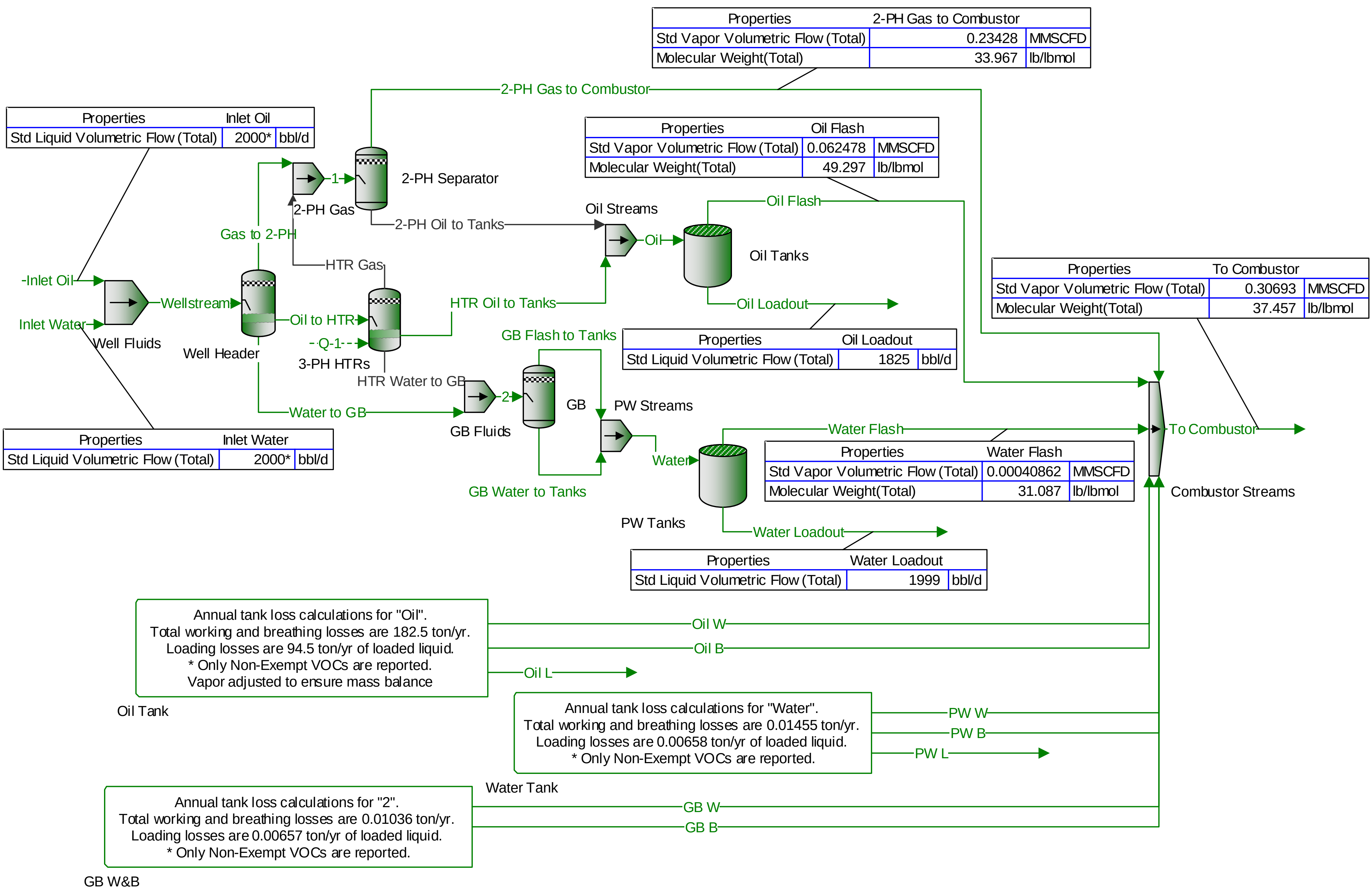
Annual tank loss calculations for "Oil".
Total working and breathing losses are 199.6 ton/yr.
Loading losses are 94.5 ton/yr of loaded liquid.
* Only Non-Exempt VOCs are reported.
Vapor adjusted to ensure mass balance

Annual tank loss calculations for "Water".
Total working and breathing losses are 0.01508 ton/yr.
Loading losses are 0.00658 ton/yr of loaded liquid.
* Only Non-Exempt VOCs are reported.

Annual tank loss calculations for "2".
Total working and breathing losses are 0.01036 ton/yr.
Loading losses are 0.00657 ton/yr of loaded liquid.
* Only Non-Exempt VOCs are reported.

Burnett Oil Company, Inc.

Tamiami Tank Battery



Properties	2-PH Gas to Combustor	
Std Vapor Volumetric Flow (Total)	0.23428	MMSCFD
Molecular Weight(Total)	33.967	lb/lbmol

Properties	Inlet Oil	
Std Liquid Volumetric Flow (Total)	2000*	bbl/d

Properties	Oil Flash	
Std Vapor Volumetric Flow (Total)	0.062478	MMSCFD
Molecular Weight(Total)	49.297	lb/lbmol

Properties	To Combustor	
Std Vapor Volumetric Flow (Total)	0.30693	MMSCFD
Molecular Weight(Total)	37.457	lb/lbmol

Properties	Oil Loadout	
Std Liquid Volumetric Flow (Total)	1825	bbl/d

Properties	Inlet Water	
Std Liquid Volumetric Flow (Total)	2000*	bbl/d

Properties	Water Flash	
Std Vapor Volumetric Flow (Total)	0.00040862	MMSCFD
Molecular Weight(Total)	31.087	lb/lbmol

Properties	Water Loadout	
Std Liquid Volumetric Flow (Total)	1999	bbl/d

Annual tank loss calculations for "Oil".
Total working and breathing losses are 182.5 ton/yr.
Loading losses are 94.5 ton/yr of loaded liquid.
* Only Non-Exempt VOCs are reported.
Vapor adjusted to ensure mass balance

Annual tank loss calculations for "Water".
Total working and breathing losses are 0.01455 ton/yr.
Loading losses are 0.00658 ton/yr of loaded liquid.
* Only Non-Exempt VOCs are reported.

Annual tank loss calculations for "2".
Total working and breathing losses are 0.01036 ton/yr.
Loading losses are 0.00657 ton/yr of loaded liquid.
* Only Non-Exempt VOCs are reported.

RM

Reservoir Fluid Study

for

EXXON COMPANY, U.S.A.

CLCC No. 27-3
Racoon Point

RFL 850224

File RFL 850224

Well CLCC No. 27-3

PRESSURE-VOLUME RELATIONS AT 175 °F.
(Constant Composition Expansion)

Pressure, PSIG	Relative Volume(1)	Y Function(2)
5000	0.9712	
4000	0.9771	
3000	0.9829	
2000	0.9889	
1000	0.9957	
800	0.9971	
700	0.9978	
600	0.9986	
500	0.9993	
417	1.0000	
415	1.0019	
412	1.0048	
400	1.0170	
382	1.0372	2.372
359	1.0669	2.319
332	1.1088	2.251
300	1.1713	2.168
269	1.2498	2.086
237	1.3586	1.992
210	1.4814	1.911
182	1.6551	1.821
158	1.8659	1.729
128	2.2483	1.619
97	2.9253	1.484
71	3.9714	1.354

(1) Relative Volume: V/Vsat is barrels at indicated pressure per barrel at saturation pressure.

(2) Y Function = $\frac{(Psat-P)}{(Pabs)(V/Vsat-1)}$

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION[a]

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO_x[b]		CO	
	Emission Factor (lb/10^6 scf)	Emission Factor Rating	Emission Factor (lb/10^6 scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS)[c]	280	A	84	B
Uncontrolled (Post-NSPS)[c]	190	A	84	B
Controlled - Low NO_x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO_x burners	50	D	84	B
Controlled - Low NO_x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from lb/10^6 scf to kg/10^6 m^3, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from 1b/10^6 scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] Expressed as NO_2. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO_X emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO_X emission factor.

[c] NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_X burner)	0.64	E
PM (Total)[c]	7.6	D
PM (Condensable)[c]	5.7	D
PM (Filterable)[c]	1.9	B
SO_2[d]	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. $CO_2[lb/10^6 scf] = (3.67) (CON) (C)(D)$, where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, $4.2x10^4$ $lb/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM_{10}, $PM_{2.5}$ or PM_1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to SO_2.
Assumes sulfur content is natural gas of 2,000 $grains/10^6$ scf. The SO_2 emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO_2 emission factor by the ratio of the site-specific sulfur content ($grains/10^6$ scf) to 2,000 $grains/10^6$ scf.

Since flares do not lend themselves to conventional emission testing techniques, only a few attempts have been made to characterize flare emissions. Recent EPA tests using propylene as flare gas indicated that efficiencies of 98 percent can be achieved when burning an offgas with at least 11,200 kJ/m^3 (300 Btu/ft^3). The tests conducted on steam-assisted flares at velocities as low as 39.6 meters per minute (m/min) (130 ft/min) to 1140 m/min (3750 ft/min), and on air-assisted flares at velocities of 180 m/min (617 ft/min) to 3960 m/min (13,087 ft/min) indicated that variations in incoming gas flow rates have no effect on the combustion efficiency. Flare gases with less than 16,770 kJ/m^3 (450 Btu/ft^3) do not smoke.

Table 13.5-1 presents flare emission factors, and Table 13.5-2 presents emission composition data obtained from the EPA tests.[1] Crude propylene was used as flare gas during the tests. Methane was a major fraction of hydrocarbons in the flare emissions, and acetylene was the dominant intermediate hydrocarbon species. Many other reports on flares indicate that acetylene is always formed as a stable intermediate product. The acetylene formed in the combustion reactions may react further with hydrocarbon radicals to form polyacetylenes followed by polycyclic hydrocarbons.[2]

In flaring waste gases containing no nitrogen compounds, NO is formed either by the fixation of atmospheric nitrogen (N) with oxygen (O) or by the reaction between the hydrocarbon radicals present in the combustion products and atmospheric nitrogen, by way of the intermediate stages, HCN, CN, and OCN.[2] Sulfur compounds contained in a flare gas stream are converted to SO_2 when burned. The amount of SO_2 emitted depends directly on the quantity of sulfur in the flared gases.

Table 13.5-1 (English Units). EMISSION FACTORS FOR FLARE OPERATIONS[a]

EMISSION FACTOR RATING: B

Component	Emission Factor ($lb/10^6$ Btu)
Total hydrocarbons[b]	0.14
Carbon monoxide	0.37
Nitrogen oxides	0.068
Soot[c]	0 - 274

[a] Reference 1. Based on tests using crude propylene containing 80% propylene and 20% propane.
[b] Measured as methane equivalent.
[c] Soot in concentration values: nonsmoking flares, 0 micrograms per liter (µg/L); lightly smoking flares, 40 µg/L; average smoking flares, 177 µg/L; and heavily smoking flares, 274 µg/L.

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES[a]
(SCC 2-02-002-53)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	2.21 E+00	A
NO_x[c] <90% Load	2.27 E+00	C
CO[c] 90 - 105% Load	3.72 E+00	A
CO[c] <90% Load	3.51 E+00	C
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	3.58 E-01	C
Methane[g]	2.30 E-01	C
VOC[h]	2.96 E-02	C
PM10 (filterable)[i,j]	9.50 E-03	E
PM2.5 (filterable)[j]	9.50 E-03	E
PM Condensable[k]	9.91 E-03	E
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[l]	2.53 E-05	C
1,1,2-Trichloroethane[l]	<1.53 E-05	E
1,1-Dichloroethane	<1.13 E-05	E
1,2-Dichloroethane	<1.13 E-05	E
1,2-Dichloropropane	<1.30 E-05	E
1,3-Butadiene[l]	6.63 E-04	D
1,3-Dichloropropene[l]	<1.27 E-05	E
Acetaldehyde[l,m]	2.79 E-03	C
Acrolein[l,m]	2.63 E-03	C
Benzene[l]	1.58 E-03	B
Butyr/isobutyraldehyde	4.86 E-05	D
Carbon Tetrachloride[l]	<1.77 E-05	E

The following empirical expressions may be used to estimate the quantity in pounds (lb) of size-specific particulate emissions from an unpaved road, per vehicle mile traveled (VMT):

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation:

$$E = k\ (s/12)^a (W/3)^b \tag{1a}$$

and, for vehicles traveling on publicly accessible roads, dominated by light duty vehicles, emissions may be estimated from the following:

$$E = \frac{k\ (s/12)^a (S/30)^d}{(M/0.5)^c} - C \tag{1b}$$

where k, a, b, c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

The source characteristics s, W and M are referred to as correction parameters for adjusting the emission estimates to local conditions. The metric conversion from lb/VMT to grams (g) per vehicle kilometer traveled (VKT) is as follows:

1 lb/VMT = 281.9 g/VKT

The constants for Equations 1a and 1b based on the stated aerodynamic particle sizes are shown in Tables 13.2.2-2 and 13.2.2-4. The PM-2.5 particle size multipliers (k-factors) are taken from Reference 27.

Table 13.2.2-2. CONSTANTS FOR EQUATIONS 1a AND 1b

Constant	Industrial Roads (Equation 1a)			Public Roads (Equation 1b)		
	PM-2.5	PM-10	PM-30*	PM-2.5	PM-10	PM-30*
k (lb/VMT)	0.15	1.5	4.9	0.18	1.8	6.0
a	0.9	0.9	0.7	1	1	1
b	0.45	0.45	0.45	-	-	-
c	-	-	-	0.2	0.2	0.3
d	-	-	-	0.5	0.5	0.3
Quality Rating	B	B	B	B	B	B

*Assumed equivalent to total suspended particulate matter (TSP)
"-" = not used in the emission factor equation

Table 13.2.2-2 also contains the quality ratings for the various size-specific versions of Equation 1a and 1b. The equation retains the assigned quality rating, if applied within the ranges of source conditions, shown in Table 13.2.2-3, that were tested in developing the equation:

Table 13.2.2-3. RANGE OF SOURCE CONDITIONS USED IN DEVELOPING EQUATION 1a AND 1b

Emission Factor	Surface Silt Content, %	Mean Vehicle Weight		Mean Vehicle Speed		Mean No. of Wheels	Surface Moisture Content, %
		Mg	ton	km/hr	mph		
Industrial Roads (Equation 1a)	1.8-25.2	1.8-260	2-290	8-69	5-43	4-17[a]	0.03-13
Public Roads (Equation 1b)	1.8-35	1.4-2.7	1.5-3	16-88	10-55	4-4.8	0.03-13

[a] See discussion in text.

As noted earlier, the models presented as Equations 1a and 1b were developed from tests of traffic on unpaved surfaces. Unpaved roads have a hard, generally nonporous surface that usually dries quickly after a rainfall or watering, because of traffic-enhanced natural evaporation. (Factors influencing how fast a road dries are discussed in Section 13.2.2.3, below.) The quality ratings given above pertain to the mid-range of the measured source conditions for the equation. A higher mean vehicle weight and a higher than normal traffic rate may be justified when performing a worst-case analysis of emissions from unpaved roads.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [23]. The emission factor also varies with aerodynamic size range average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual average emissions are inversely proportional to the number of days with measurable (more than 0.254 mm [0.01 inch]) precipitation:

$$E_{ext} = E\ [(365 - P)/365] \tag{2}$$

where:

E_{ext} = annual size-specific emission factor extrapolated for natural mitigation, lb/VMT

E = emission factor from Equation 1a or 1b

P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation (see below)

Figure 13.2.2-1 gives the geographical distribution for the mean annual number of "wet" days for the United States.

Equation 2 provides an estimate that accounts for precipitation on an annual average basis for the purpose of inventorying emissions. It should be noted that Equation 2 does not account for differences in the temporal distributions of the rain events, the quantity of rain during any event, or the potential for the rain to evaporate from the road surface. In the event that a finer temporal and spatial resolution is desired for inventories of public unpaved roads, estimates can be based on a more complex set of assumptions. These assumptions include:

1. The moisture content of the road surface material is increased in proportion to the quantity of water added;
2. The moisture content of the road surface material is reduced in proportion to the Class A pan evaporation rate;
3. The moisture content of the road surface material is reduced in proportion to the traffic volume; and
4. The moisture content of the road surface material varies between the extremes observed in the area. The CHIEF Web site (http://www.epa.gov/ttn/chief/ap42/ch13/related/c13s02-2.html) has a file which contains a spreadsheet program for calculating emission factors which are temporally and spatially resolved. Information required for use of the spreadsheet program includes monthly Class A pan evaporation values, hourly meteorological data for precipitation, humidity and snow cover, vehicle traffic information, and road surface material information.

It is emphasized that <u>the simple assumption underlying Equation 2 and the more complex set of assumptions underlying the use of the procedure which produces a finer temporal and spatial resolution</u> have not been verified in any rigorous manner. For this reason, the quality ratings for either approach should be downgraded one letter from the rating that would be applied to Equation 1.

13.2.2.3 Controls[18-22]

A wide variety of options exist to control emissions from unpaved roads. Options fall into the following three groupings:

1. <u>Vehicle restrictions</u> that limit the speed, weight or number of vehicles on the road;

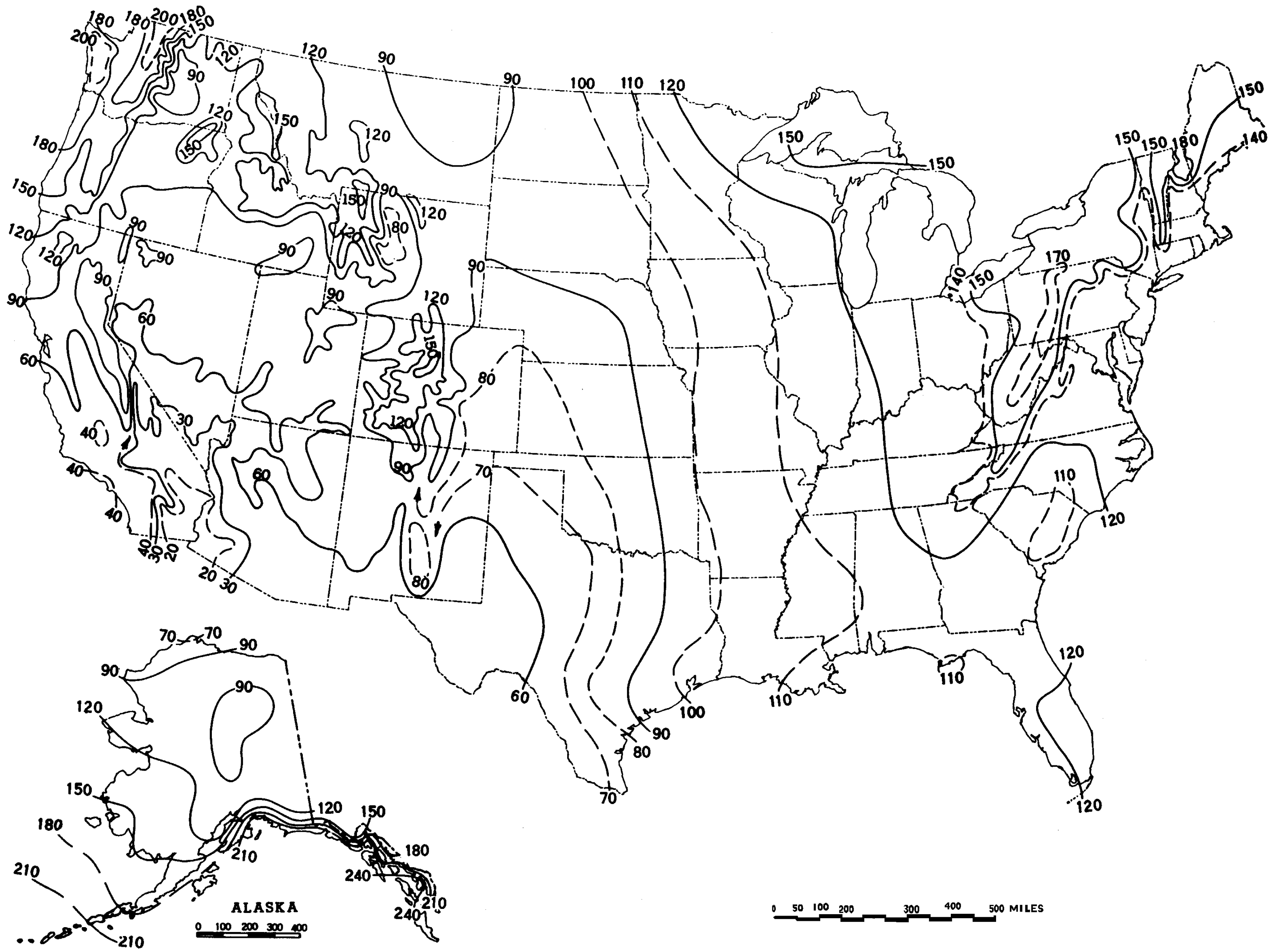


Figure 13.2.2-1. Mean number of days with 0.01 inch or more of precipitation in United States.

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-453/R-95-017
November 1995

Air

EPA

Protocol for Equipment Leak Emission Estimates

TABLE 2-4. OIL AND GAS PRODUCTION OPERATIONS AVERAGE EMISSION FACTORS (kg/hr/source)

Equipment Type	Service[a]	Emission Factor (kg/hr/source)[b]
Valves	Gas	4.5E-03
	Heavy Oil	8.4E-06
	Light Oil	2.5E-03
	Water/Oil	9.8E-05
Pump seals	Gas	2.4E-03
	Heavy Oil	NA
	Light Oil	1.3E-02
	Water/Oil	2.4E-05
Others[c]	Gas	8.8E-03
	Heavy Oil	3.2E-05
	Light Oil	7.5E-03
	Water/Oil	1.4E-02
Connectors	Gas	2.0E-04
	Heavy Oil	7.5E-06
	Light Oil	2.1E-04
	Water/Oil	1.1E-04
Flanges	Gas	3.9E-04
	Heavy Oil	3.9E-07
	Light Oil	1.1E-04
	Water/Oil	2.9E-06
Open-ended lines	Gas	2.0E-03
	Heavy Oil	1.4E-04
	Light Oil	1.4E-03
	Water/Oil	2.5E-04

[a]Water/Oil emission factors apply to water streams in oil service with a water content greater than 50%, from the point of origin to the point where the water content reaches 99%. For water streams with a water content greater than 99%, the emission rate is considered negligible.

[b]These factors are for total organic compound emission rates (including non-VOC's such as methane and ethane) and apply to light crude, heavy crude, gas plant, gas production, and off shore facilities. "NA" indicates that not enough data were available to develop the indicated emission factor.

[c]The "other" equipment type was derived from compressors, diaphrams, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves, and vents. This "other" equipment type should be applied for any equipment type other than connectors, flanges, open-ended lines, pumps, or valves.

APPENDIX D. MODELING INPUT FILES

The modeling input files will be provided in a downloaded link and it will contain the folders listed in the table below.

Folder/File Names	Sub-folders	Content Description
AERSCREEN	Drilling Rig Engines	AERSCREN input files for each of the modeled source.
	Flares_OPS	
	Generators_OPS	
	Heaters	
VISCREEN	Viscreen _ BICY_10 Mile Camp_Tamiami	VISCREEN input and output files for each of the modeled locations.
	Viscreen _ BICY_FNST_Ivycamp_NG	
	Viscreen _ BICY_FNST_NG	
	Viscreen _ BICY_FNST_Tamiami	
	Viscreen _ BICY_Oak Hill Camp_NG	
	Viscreen _ BICY_Oasis Visitor Center_Tamiami	
	Viscreen _ BICY_Private Camp_Tamiami	
	Viscreen _ BICY_Stump Camp Trail	
	Viscreen _ BICY_WOST Nest Site_Tamiami	
	Viscreen _ EGNP_Tamiami	
Burnett Oil Noise Receptor Locations 2021-0511_(FINAL).kmz	-	Source locations.