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Trinity Consultants

VIA E-MAIL: david.read@dep.state.fl.us

February 2, 2016

Mr. David Read
Permitting Section Administrator
Florida Department of Environmental Protection
Office of Permitting and Compliance
2600 Blair Stone Road, M.S. 5500
Tallahassee, Florida 32399-2400

RE: Sabal Trail Pipeline M&R Station – Suwannee County, Florida

Dear Mr. Read:

Trinity Consultants (Trinity) has prepared this air construction permit application on behalf of Sabal Trail Transmission, LLC (Sabal Trail) for a meter and regulation (M&R) stations located in Suwannee County in Florida. Sabal Trail is a joint venture between affiliates of Spectra Energy Partners, LP and NextEra Energy, Inc.

APPLICATION OVERVIEW

Sabal Trail is proposing to construct an interstate natural gas pipeline that will originate in Tallapoosa County, Alabama, transport natural gas through Georgia, and terminate at an interconnection with Florida Southeast Connection's proposed project in Osceola County, Florida. Sabal Trail has previously submitted air construction permit applications and received permits for the proposed compressor stations in Florida. The purpose of this application is to request an air construction permit for the proposed M&R station in Suwannee County, Florida. The purpose of this M&R station is to:

1. Accurately and continuously measure the natural gas delivered at the pipeline interconnect with Florida Gas Transmission's existing mainline natural gas pipeline, and
2. Regulate the pressure of the natural gas delivery to ensure both the Sabal Trail system and existing Florida Gas Transmission system are maintained within their specified pressure ranges.

OVERALL BENEFITS OF THE PIPELINE

The proposed M& R station is an above-ground facility that is part of the Sabal Trail pipeline support system. The pipeline will have an end product capable of transporting over 1 billion Dth/d of natural gas and will provide dedicated natural gas transportation services for local distribution, industrial users, and natural gas-fired power generation needs starting in May 2017. This in turn, will provide the Southeast region with a unique opportunity to secure a cost effective, domestically produced, environmentally friendly source of energy to support its current demand, as well as its future growth, for clean burning natural gas.

The proposed M&R station will not include any compressor units and will not assist in pressurizing pipeline gas. The proposed station is a small site on or adjacent to the existing right-of-way for Florida Gas Transmission. It will only consist of piping equipment and other de minimis equipment and activities that are categorically exempt from permitting.

The Sabal Trail Pipeline will provide multiple tangible benefits to Florida and the Southeast region. Sabal Trail Pipeline will:

- Meet an existing and growing natural gas fuel supply need of electric generators and other natural gas users in Florida and the Southeast, including Alabama and Georgia;
- Add a third independent natural gas transmission pipeline into Florida with access to multiple upstream supply sources from Transcontinental Gas Pipeline Company's existing Compressor Station 85;
- Add reliability to the natural gas transmission grid in the Southeast; and
- Provide deliveries to a new Central Florida Hub that will interconnect with the two existing natural gas transmission pipelines currently serving central and southern Florida.

Fishkind & Associates, an independent economic consultant, estimates that the construction of the Sabal Trail pipeline will add a much needed boost to state and local economies. There will be an estimated 11,000 direct jobs created in the region, along with 3,500 indirect and induced jobs, leading to additional wages of almost $500 million during construction. Hundreds of permanent jobs will result from the project. Additionally, the project will generate over $1.5 billion in life-cycle tax benefits to counties and local governments in Alabama, Georgia, and Florida.

PROPOSED FACILITY DESCRIPTION

The proposed Suwannee M&R Station will be located at the southeast portion of Suwannee county near the intersection of FL 247 S and FL 49 S. Currently, the site is relatively isolated, with no current development within 1,000 feet of the proposed location for the M&R station. As described above, the M&R station will include piping equipment and other de minimis units and activities that are exempt from permitting. Furthermore,

- The facility is not in a non-attainment zone for any pollutants.
- The facility will not generate dust, fumes, gases, mist, odorous matter, vapors or combination thereof, such as to cause a nuisance to nearby property.
- This M&R station has already been included in a detailed environmental impact study prepared by the Federal Energy Regulatory Commission (FERC) that demonstrated that this M&R station will not cause harm to the environment and public health is not adversely affected by this project.
- No compressor units are being installed at this location; therefore, minimizing the environmental impacts from this proposed project. Table 1 below shows the insignificant impacts from the proposed M&R station. These emission estimates assume conservative, worst-case emissions from the proposed Suwannee M&R station emission units and activities.

Table 1. Station-Wide Annual Potential Emissions

Pollutant (tpy)	Project Emissions Potential	Major Source Threshold (tpy)	De Minimis (Permit Exemption) Thresholds[1] (tpy)	Is the Facility a Minor Source?	Are Pollutant Emissions Under Permitting Exemption Thresholds?
CO_2e	4,464	100,000	--	Yes	N/A
NO_X	0.001	100	25	Yes	Yes
CO	0.01	100	25	Yes	Yes
$PM_{10}/PM_{2.5}$	0.0001	100	10	Yes	Yes
SO_2	6.44E-06	100	25	Yes	Yes
VOC	14.98	100	10	Yes	No
Total HAPs	1.52	25	2.5	Yes	No

As seen in the table above, the M&R station will be considered a minor source. In addition, upon comparing the emissions to the generic facility-wide permit exemption thresholds[1], the emissions of most pollutants are under these exemptions, providing further confidence that the proposed project will not cause harm to public health or the environment. However, since some emissions are slightly over the permitting exemption thresholds, Sabal Trail is submitting a construction permit application with detailed conservative emissions estimates, a regulatory applicability section, and a description of the emission units and activities to facilitate a thorough review by the Florida Department of Environmental Protection (DEP). The review will allow DEP to ensure that the impacts from the proposed M&R station conform to the requirements of the state implementation plan (SIP), as well as Environmental Protection Agency (EPA) requirements developed under the Clean Air Act (CAA) to protect public health.

Additional requirements and assurances are afforded through the permitting process, even for a true minor site such as the M&R proposed:

- The issuance of a permit will subject the facility operations to additional monitoring, recordkeeping and reporting requirements as deemed necessary by DEP;
- As a permitted source, the DEP will ensure compliance through inspections and compliance enforcement; and
- DEP will have site-specific data from the permitted source that can contribute to accurate future policy and regulatory decisions made by the state.

[1] In accordance with Rule 62-210.300(3)(b)2.a., F.A.C.

Additional information on the proposed project is included in the attached application report and appendices. If you have any questions or comments about the information presented in this letter, please do not hesitate to call me at (407) 982-2891.

Sincerely,

TRINITY CONSULTANTS

Michael Ballenger, P.E.
Manager of Consulting Services – Florida

cc: Bobby Van Borssum, Spectra Energy

Attachments

AIR CONSTRUCTION PERMIT APPLICATION

Sabal Trail Transmission, LLC > Suwannee M&R Station

Sabal Trail
TRANSMISSION

Air Construction Permit Application

Sabal Trail Transmission, LLC
5400 Westheimer Court
Houston, TX 77056

Prepared by:

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Orlando, FL 32814

February 2016

Trinity Consultants

Environmental solutions delivered uncommonly well

TABLE OF CONTENTS

1 INTRODUCTION

1.1 SABAL TRAIL PIPELINE OVERVIEW

Sabal Trail Transmission, LLC (Sabal Trail), a joint venture between affiliates of Spectra Energy Partners, LP and NextEra Energy, Inc., is proposing to construct an interstate natural gas pipeline that will originate in Tallapoosa County, Alabama, transport natural gas through Georgia, and terminate at an interconnection with Florida Southeast Connection's proposed project in Osceola County, Florida. The Sabal Trail pipeline will have an initial capacity of 830,000 dekatherms per day (Dth/d) with an in-service date beginning May 1, 2017. The Sabal Trail Project capacity will increase to approximately 1,075,000 Dth/d by 2021.

The proposed pipeline corridor traverses thirteen (13) counties in Florida, including Hamilton, Madison, Suwannee, Gilchrist, Alachua, Levy, Marion, Citrus, Sumter, Lake, Orange, Polk, and Osceola Counties. Appendix A shows the proposed path of the new Sabal Trail transmission pipeline in Florida.

The pipeline will include aboveground facilities comprised of meter stations and compressor stations along the main pipeline route. The stations will be strategically located along the route to maintain line pressure and ensure natural gas continues to move at sufficient volumes for reliable service at delivery points. Sabal Trail has already submitted air construction permit applications and received permits for the proposed compressor stations in Florida. This application includes information on the proposed meter and regulation (M&R) station located in Suwannee County, Florida (Suwannee M&R Station) with construction to commence as soon as required permits are issued.

1.2 PROPOSED SUWANNEE M&R STATION

Sabal Trail is proposing to build a new natural gas M&R station in Suwannee County, Florida. The Universal Transverse Mercator (UTM) coordinates of the facility are 321.35 kilometers (km) east and 3,323.74 km north (UTM Zone 17, NAD83), with the general location as identified in the area map in Appendix A.

The Suwannee M&R Station will include one (1) natural gas heater, one (1) emergency generator, piping components, storage tanks, and loading operations. The proposed facility may operate up to 8,760 hours per year.

1.3 AIR PERMITTING OVERVIEW

The proposed Suwannee M&R Station involves the installation of one (1) new natural gas heater. There are no other combustion sources at the station. The heater is not subject to 40 CFR 60 Subpart Dc, *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units* based on the size of the heater *(40 CFR 60.40c(a))*. A review of major new source review (NSR) applicability of the proposed Suwannee M&R Station indicates that it will not trigger Prevention of Significant Deterioration (PSD) permitting for any pollutants. Furthermore, the facility is a minor source under the Title V Operating Program and an area source for hazardous air pollutants (HAPs).

Sabal Trail is submitting the enclosed Air Construction Permit application to the Florida Department of Environmental Protection (DEP) pursuant to Rule 62-210.300(1)(a) of the Florida Administrative Code (F.A.C.) which requires that unless otherwise exempt by rule [Rule 62-210.300(3)(a) or (b), F.A.C., or Rule 62-4.040 F.A.C.], a permittee shall not initiate any construction, reconstruction, or modification at the facility without obtaining prior authorization from DEP. The heater meets the categorical exemption in Rule 62-

210.300(3)(a)34., F.A.C. that applies to fossil fuel steam generators, hot water generators, and other external combustion heating units with a heat input capacity less than 100 MMBtu/hr. The emergency generator meets the categorical exemption in Rule 62-210.300(3)(a)35., F.A.C. that applies to Stationary Reciprocating Internal Combustion engines. This permit application is being submitted as the facility-wide VOC emissions are greater than 10 tpy. Therefore, the facility does not qualify for a generic facility-wide exemption in accordance with 62-210.300(3)(b)2., F.A.C.

1.4 APPLICATION FORMS

The permit application forms [DEP Form No. 62-210.900(3)] required by Rule 62-4.050, F.A.C., were completed electronically using the Electronic Permit Submittal and Processing (EPSAP) system Non-Title V Form. The Sabal Trail authorized representative and the professional engineer (P.E.) certifications are being provided electronically via EPSAP.

1.5 APPLICATION CONTENTS

This permit application is organized as follows:

- Section 2 contains a detailed description of the proposed Suwannee M&R Station processes;
- Section 3 contains emissions calculations methodology and results;
- Section 4 contains a regulatory applicability analysis;
- Appendix A contains an area map, and the transmission pipeline in Florida;
- Appendix B contains detailed emission calculations; and
- Appendix C contains generator specification sheet.

1.6 CONSTRUCTION SCHEDULE

Sabal Trail is expecting to begin construction of the proposed Suwannee M&R Station as soon as the permits/approvals are obtained in 2016. Sabal Trail anticipates that construction will be completed by June 2021.

1.7 PERMIT APPLICATION FEE

As per Rule 62-4.050(4)(a)4., F.A.C., where new or existing multiple emissions units located at the same facility are substantially similar in nature, the applicant may submit a single application and required permit fee for construction or operation of the emissions units at the facility. For a construction permit, the application fee is determined as the fee that applies for a single emissions unit with total potential emissions of all of the substantially similar emissions units at the facility.

Per 62-4.050(4)(a)(2)d., F.A.C. for an emission unit, such as the gas releases and piping components, having potential emissions of 5 or more tons per year (tpy), but less than 25 tpy, of any single pollutant is $1,000. Therefore, the total enclosed construction permit application fee is $1,000. The heater meets the categorical exemption in Rule 62-210.300(3)(a)34., F.A.C; therefore, a fee for the heater does not apply. The emergency generator meets the categorical exemption in Rule 62-210.300(3)(a)35., F.A.C; therefore, a fee for the emergency generator does not apply.

The following table presents a description of the applicable fees for air construction permits for emissions units not requiring prevention of significant deterioration (PSD) or nonattainment area (NAA) preconstruction review according to Rule 62-4.050(4)(a)2., F.A.C.:

Table 1-1. Applicable Fees for Air Construction Permits

Rule	Description	Applicable Fee
62-4.050(4)(a)2.a.	Construction permit for an emissions unit having potential emissions of 100 or more tons per year of any single pollutant	$5,000
62-4.050(4)(a)2.b.	Construction permit for an emissions unit having potential emissions of 50 or more tons per year, but less than 100 tons per year, of any single pollutant	$4,500
62-4.050(4)(a)2.c.	Construction permit for an emissions unit having potential emissions of 25 or more tons per year, but less than 50 tons per year, of any single pollutant	$2,000
62-4.050(4)(a)2.d.	Construction permit for an emissions unit having potential emissions of 5 or more tons per year, but less than 25 tons per year, of any single pollutant	$1,000
62-4.050(4)(a)2.e.	Construction permit for an emissions unit having potential emissions of less than 5 tons per year of each pollutant	$250

The following table presents a summary of how the air construction permit fees described in Table 1-1 are applicable to the emission units identified in the Suwannee M&R Station.

Table 1-2. Suwannee M&R Station Air Construction Permit Applicable Fees

Emission Unit	Description	Potential to Emit	Applicable Fee
SUWA – GR; SUWA - PC	Gas Releases; Piping Components	Construction permit for an emissions unit having potential emissions of 5 or more tons per year, but less than 25 tons per year, of any single pollutant	$1,000

The total enclosed construction permit application fee is $1,000.

2 PROCESS DESCRIPTION

From its source at a wellhead, natural gas goes through a series of production, transmission and distribution processes en-route to its final user at home or a business. Sabal Trail is proposing, as part of the transmission segment, to construct a new natural gas M&R station in Suwannee County, Florida (Suwannee M&R Station). The purpose of the station is to achieve seamless transfer between different transmission lines. The Suwannee M&R Station will operate up to 8,760 hours per year (continuous operation).

2.1 FACILITY DESCRIPTION

The proposed Suwannee M&R Station will include the following emission units and activities:

- One new Bruest 0.0025 MMBtu/hr heat input natural gas fired heater or equivalent;
- One new Kohler 18 kW natural gas fired emergency generator or equivalent;
- One new 1,000 gallon pipeline liquids storage tank; and
- Miscellaneous support equipment.

The Suwannee M&R Station will NOT include production, natural gas liquids fractionation, nor glycol dehydration equipment as part of its operation.

2.1.1 Natural Gas Fired Fuel Gas Heater

Sabal Trail is proposing to install one Bruest (or equivalent) natural gas-fired heater at the Suwannee M&R Station. Heater No. 1 (SUWA HIG-01) has a rated heat input capacity of 0.0025 MMBtu/hr, based on the high heating value (HHV) of the natural gas. Based on the DEP rules, the proposed natural gas-fired process heater meets the categorical exemption in Rule 62-210.300(3)(a)34., F.A.C.

2.1.2 Natural Gas Fired Emergency Generator

Sabal Trail is proposing to install one Kohler (or equivalent) natural gas-fired emergency generator at the Suwannee M&R Station. The emergency generator has a rated capacity of 18 kW. Based on the DEP rules, the proposed natural gas-fired emergency generator meets the categorical exemption in Rule 62-210.300(3)(a)35., F.A.C.

2.1.3 Emissions from Condensate Storage Tank

Although natural gas in pipelines is considered a dry gas, it is not uncommon for a small amount of water and hydrocarbons to condense out of the gas stream while in transit. The 1,000 gallon pipeline liquid storage tank at Sabal Trail will be used to store condensate collected at the M&R station. Removing the condensate is a necessary activity to ensure that the natural gas in the pipeline remains as dry as possible. The tank will have negligible working and breathing losses, as well as minor losses from flashing. Greenhouse gas (GHG) emissions from the condensate storage tank are negligible. Condensate from the storage tank will be shipped off site via tanker trucks for disposal. The storage tank is exempt from permitting under the provisions of Rule 62-210.300(3)(b)1., F.A.C. - Generic Emission Unit or Activity Exemption.

2.1.4 Miscellaneous Support Equipment

Ancillary equipment will be used to support the natural gas transmission at the Suwannee M&R Station. Typical sources of emissions from natural gas M&R station support equipment include fugitive leaks from piping components (valves, flanges, connectors, and open-ended lines), as well as gas release events. In addition, there will be emissions from truck loading operations. There may also be other exempt activities, such as maintenance painting, welding, parts washing, etc. These activities will yield negligible emissions and will meet the Generic Emission Unit or Activity Exemption per Rule 62-210.300(3)(b)1., F.A.C. and/or the categorical exemptions under Rule 62-210.300(3)(a), F.A.C.

2.1.4.1 Fugitive Emission Sources from Piping Components

Emissions from piping components will occur as a result of the proposed project. While the design is not yet final, component counts were estimated based on data from similar sized M&R stations. Components will include flanges, connectors, valves, open-ended lines, compressor seals, pump seals, etc. While the majority of the piping components are in gas service, since the purpose of the M&R station is to support natural gas transmission, there will also be some components in light liquid service to handle natural gas condensate.

2.1.4.2 Emissions from Gas Releases

The proposed project will result in gas releases at the M&R station due to periodic blowdown at the station. Gas releases refer to the intentional and unintentional venting of gas for maintenance, routine operations, or during emergency conditions. The majority of emissions from gas release events are associated with reduced pressure demand events, or maintenance activities.

2.1.4.3 Emissions from Truck Loading

The proposed project will result in gas releases during the loading of volatile organic liquids into tanker trucks. These activities are exempt from permitting under the provisions of Rule 62-210.300(3)(b)1., F.A.C. - Generic Emission Unit or Activity Exemption.

3 POTENTIAL EMISSIONS QUANTIFICATION

This section provides a summary of the calculation methodology used to estimate potential emissions for the natural gas heater, the natural gas emergency generator, piping components, gas releases, storage tank, and truck loadings. Appendix B provides the detailed emission calculations for the project.

3.1 NATURAL GAS HEATER EMISSIONS

Sabal Trail is proposing to install one (1) new natural gas fired heater. The heater has a maximum heat input of 0.0025 MMBtu/hr. The following table provides information on the emission factors used to calculate emissions from the heater.

Table 3-1. Bruest Heater Emission Factors

Pollutant	Emission Factor from Source	Source
NO_X	60 ppmvd at 3% O_2	Vendor specified emission rate
CO	1,560 ppmvd at 3% O_2	Vendor specified emission rate
TOC	470 ppmvd at 3% O_2	Vendor specified emission rate
VOC	470 ppmvd TOC at 3% O_2 191.76 lb/MMscf	TOC: vendor specified emission rate Table 1.4-3 of AP-42
CH_4	470 ppmvd TOC at 3% O_2 80.19 lb/MMscf	TOC: vendor specified emission rate Table 1.4-2 of AP-42
$PM_{10}/PM_{2.5}$	7.60 lb/MMscf	Table 1.4-2 of AP-42
SO_2	0.60 lb/MMscf	Table 1.4-2 of AP-42
CO_2	53.02 kg/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-1
N_2O	0.0001 kg/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-2
Total HAPs	470 ppmvd TOC at 3% O_2 Multiple HAP factors	TOC: vendor specified emission rate Table 1.4-3 of AP-42

In order to calculate hourly emissions, the emission factors provided in the table above are converted to units of lb/MMscf. These converted factors are multiplied by each heater's hourly fuel consumption in scf/hr to obtain hourly emissions. Fuel consumption is calculated from the heat output of the heater assuming a thermal efficiency of 70% and a natural gas heating value of 1,020 Btu/scf. Annual potential emissions are calculated based on average hourly fuel consumption. Maximum hourly potential emissions are calculated based on maximum hourly fuel consumption, assuming an overload capability of 105%. The following sections summarize the methods used to obtain lb/MMscf emission factors for each pollutant emitted from the new heater.

3.1.1 Heater Emissions Factors – NO_X, CO, and TOC

NO_X, CO, and TOC emitted by the heater are calculated based on vendor-specified emission rates and vendor-specified fuel consumption for the heater. NO_X, CO, and TOC factors are derived as follows:

Equation 3-1:

$$NO_x, CO, TOC\ EF = ppmvd, 3\%\ O_2 \times \frac{lb/MMBtu}{ppmvd, 3\%\ O_2} \times 1,020\frac{MMBtu}{MMscf} = \frac{lb}{MMscf}$$

3.1.2 Heater Emissions Factors – VOC, CH_4, and HAPs

VOC, CH_4, and HAP emissions are calculated using the TOC emission rate and AP-42 emission factors. Standard emission factors for TOC, VOC, CH_4, and HAP from natural gas fired heaters are provided in Chapter 1.4 of AP-42. Table 1.4-2 (version dated July 1998) provides a CH_4 emission factor for natural gas-fired external combustion sources. The TOC and VOC factors used in the calculations differ slightly from the factors provided in Table 1.4-2. Instead, TOC and VOC factors are calculated as the sum of the factors for all speciated organic compounds listed in AP-42 Table 1.4-3 which are TOCs and VOCs, respectively. These calculated values differently slightly from AP-42 Table 1.4-2. Table 1.4-3 of AP-42 (version dated July 2000) provides emission factors for the HAPs emitted from natural gas fired external combustion units.

Ratios of VOC, CH_4, and HAP to UHC from the AP-42 factors are applied to the UHC factor derived from vendor information to obtain emission factors for VOC, CH_4, and HAP. For normal operation, the uncontrolled VOC, CH_4, and HAP factors are derived as follows:

Equation 3-2:

$$VOC, CH_4, HAP\ EF = \frac{lb\ TOC}{MMscf} \times \frac{\left(\frac{lb\ pollutant}{MMBtu} \times 1{,}020\ \frac{MMBtu}{MMscf}\right)}{\left(0.011\frac{lb\ UHC}{MMBtu} \times 1{,}020\ \frac{MMBtu}{MMscf}\right)} = \frac{lb}{MMscf}$$

3.1.3 Heater Emissions Factors – PM_{10}, $PM_{2.5}$, and SO_2

PM_{10} and $PM_{2.5}$ emissions emitted by the heater are calculated based on the emission factors listed in Table 1.4-2 of AP-42 (version dated July 1998) for natural gas fired external combustion sources. The total PM emission factor of 7.6 lb/MMscf, which includes filterable and condensable particulate, is used. It is assumed that all particulate emitted from natural gas combustion is less than 2.5 microns in diameters, such that PM equals PM_{10} and $PM_{2.5}$. The SO_2 emission factor of 0.6 lb/MMscf from Table 3.2-2 of AP-42 is used directly.

3.1.4 Heater Emissions Factors – CO_2, N_2O, and CO_2e

CO_2 and N_2O emissions emitted by the heater are calculated based on the emission factors listed in 40 CFR 98, Subpart C, Tables C-1 and C-2. Equation 3-3 and Equation 3-4 show how factors in lb/MMscf are derived for these pollutants. GHGs emitted from the heater include CO_2, CH_4, and N_2O. CO_2e emissions are calculated using the GWPs provided in Table 3-2.

Equation 3-3:

$$[CO_2]\ EF = \left[53.02\frac{kg}{MMBtu}\right] \times \left[2.2046\frac{lb}{kg}\right] \times \left[1{,}026\frac{Btu}{scf}\right] = \left[119{,}927\frac{lb\ CO_2}{MMscf}\right]$$

Equation 3-4:

$$[N_2O]\ EF = \left[0.0001\frac{kg}{MMBtu}\right] \times \left[2.2046\frac{lb}{kg}\right] \times \left[1{,}026\frac{Btu}{scf}\right] = \left[0.23\frac{lb\ N_2O}{MMscf}\right]$$

Total GHG emissions in terms of CO_2 equivalents (CO_2e) are equal to the sum of all individual GHGs emitted by the turbines, accounting for the respective global warming potential (GWP) of each GHG. The GWPs used to calculate CO_2e emissions for each pollutant emitted by the project are contained in the following table.

Table 3-2. Applicable Global Warming Potentials

Pollutant*	GWP**
CO_2	1
CH_4	25
N_2O	298

*Only those GHGs for which quantifiable emissions increases are expected due to this project are listed.

** GWPs are based on a 100-year time horizon, as identified in Table A-1 to 40 CFR Part 98, Subpart A as amended on November 29, 2013, and effective January 1, 2014, to incorporate revised GWPs as published in the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report (AR4). *See* 78 Fed Reg 71903-71981.

As such, the CO_2e factor is derived as follows:

Equation 3-5:

$$[CO_2e\,]EF = \left[\frac{lb\ CO_2}{MMscf} \times 1\ GWP\right] + \left[\frac{lb\ CH_4}{MMscf} \times 25\ GWP\right] + \left[\frac{lb\ N_2O}{MMscf} \times 298\ GWP\right] = \left[\frac{lb\ CO_2e}{MMscf}\right]$$

3.2 NATURAL GAS EMERGENCY GENERATOR EMISSIONS

As discussed in Section 2.1.2, the natural gas fired emergency generator will be categorically exempt. The rated capacity of the emergency generator is 18 kW (See Appendix C for generator specification sheet). Therefore, the emissions from the operation of the emergency generator are anticipated to be negligible, and have not been quantified in this application.

3.3 EMISSIONS FROM CONDENSATE STORAGE TANK

Although stabilized condensate has no flashing losses, flashing losses do occur when the pressure of a liquid is decreased or the temperature is increased. At the Suwannee M&R Station, flashing losses occur at the pipeline liquids storage tank and include VOCs, GHGs, and HAPs. Total flashing losses are calculated based on a flash gas rate and a representative flash gas density. The flash gas rate is calculated based on a liquids input rate and a flash factor.[1] Emissions of individual VOCs, GHGs, and HAPs are calculated from total flashing losses using a representative pipeline liquids compositions.

Working and breathing losses occur at all tanks at the Suwannee M&R Station, including pipeline liquid tanks, lubricating oil tanks, and oil-water separators. Working and breathing losses include VOCs, GHGs, and HAPs and are calculated with EPA's TANKS 4.09d program using maximum potential throughputs for each tank. The results of these tanks runs are provided in Table F-2 in Appendix B.

3.4 MISCELLANEOUS SUPPORT EQUIPMENT

Fugitive emissions and gas releases at the Suwannee M&R Station will occur as a result of the proposed project. The methodologies used to calculate this potential increase are described in the following sections.

[1] The liquids input rate is determined based on operator experience with the incorporation of a safety factor, and the flash factor in standard cubic foot per barrel (scf/bbl) was determined in a laboratory analysis of a gas sample taken from Atlanta, Texas.

3.4.1 Emissions from Piping Components

Fugitive emissions from equipment leaks will occur during operation of the Suwannee M&R Station due to the installation of equipment and piping components. While the design is not yet final, component counts have been estimated based on preliminary engineering drawings. Note that the final design may change the component counts. Components will include flanges, connectors, valves, open-ended lines, compressor seals, pump seals, etc.

Potential emissions are calculated from the piping components using emission factors from EPA's Protocol for Equipment Leak Emission Estimates (EPA 453/R-95-017), Table 2-4 (November 1995) which provides leak emission factors for oil and gas production operations. Gas service factors are used for components in natural gas service, light oil service factors are used for components in pipeline liquids service (e.g. condensate). Since an emission factor is not provided for leaks from pump seals in heavy oil service in Table 2-4, the average SOCMI without ethylene emission factor for pumps in heavy oil service from Table 2-1 is used to estimate emissions. Annual emissions are conservatively calculated assuming that the components are in continuous gas/liquid/oil service as follows:

Equation 3-6:

$$\textbf{Total Gas Emissions} = \#\, \boldsymbol{of\ components} \times \frac{\frac{\boldsymbol{kg}}{\boldsymbol{hr}}}{\boldsymbol{component}} \times \frac{\mathbf{8{,}760}\ \boldsymbol{hrs}}{\boldsymbol{yr}} \times \frac{\mathbf{1{,}000}\ \boldsymbol{g}}{\boldsymbol{kg}} \times \frac{\boldsymbol{lb}}{\mathbf{453.6}\ \boldsymbol{g}} \times \frac{\mathbf{2{,}000}\ \boldsymbol{ton}}{\boldsymbol{lb}} = \frac{\boldsymbol{tons}}{\boldsymbol{yr}}$$

The equation above is used to calculate total fugitive gas emitted from the piping components at the Suwannee M&R Station. Emissions of individual VOCs, GHGs, and HAPs are calculated by multiplying the total fugitive gas emissions from piping components in gas, pipeline liquid, and oil service by the weight percent of each pollutant in gas, pipeline liquids, and oil. Gas, pipeline liquid, and oil compositions are engineering estimates based on data for another natural gas pipeline station, with scaling of VOC specifies to ensure a conservative representation.[2, 3]

3.4.2 Emissions from Gas Releases

Gas releases occur due to periodic blowdown/purge events at the station, as well as operation of pneumatic actuators. The majority of emissions from gas release events are associated with routine operations such as reduced pressure demand events, or maintenance activities. The potential volume of gas emitted was estimated in standard cubic feet per year based on the preliminary design data for the M&R station (piping volume/pressure, number of actuators, and inclusion of gas chromatograph), and an assumed maximum number of release events. Emissions of individual VOCs, GHGs, and HAPs are calculated by multiplying the total gas emissions from gas releases by the weight percent of each pollutant in the natural gas compressed at the facility.[4]

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[2] Oil is assumed to be 100 percent VOC and contain no GHGs or HAPs. Pipeline liquids composition is based on the composition of residual liquids following flashing, calculated based on a laboratory analysis of flashing from an operation in Atlanta, Texas in April 2009.

[3] Natural gas composition is conservatively estimated based on an extended gas analysis taken from a similar natural gas transmission station in operation in Thomaston, Texas in November 2005.

[4] Ibid.

3.4.3 Emissions from Truck Loading

Emissions occur during the loading of volatile organic liquids into tanker trucks and include VOCs, GHGs, and HAPs. Total loading losses are calculated based on calculation methods for submerged filling provided in AP-42 Section 5.2 (version dated July 2008). Emissions of individual VOCs, GHGs, and HAPs are calculated from total loading losses using representative pipeline liquids and lubricating oil compositions.

3.5 TOTAL PROJECT EMISSIONS

The following table presents project emission potential from all emission sources to be installed as a part of the proposed Suwannee M&R Station. Detailed emission calculations can be found in Appendix B of this application report.

Table 3-3. Station Wide Annual Potential Emissions[5]

Unit	EU ID	CO_{2e} (tpy)	NO_X (tpy)	CO (tpy)	$PM_{10}/PM_{2.5}$ (tpy)	SO_2 (tpy)	VOC (tpy)	Total HAPS (tpy)
Gas Heater 1	SUWA HIG-01	1.3	0.001	0.01	0.0001	6.44E-06	0.002	0.001
Piping Components	SUWA-PC	1,033	--	--	--	--	6.77	0.87
Gas Release	SUWA-GR	3,358	--	--	--	--	6.05	0.52
Tanks	SUWA-V01	69.5	--	--	--	--	2.09	0.13
Truck Loading	SUWA-TL-PL	2.8	--	--	--	--	0.05	0.003
Project Emission Potential		**4,464**	**0.001**	**0.01**	**0.0001**	**6.44E-06**	**14.98**	**1.52**

[5] Because of the limited operation and expected negligible emissions, the facility-wide totals do not include estimates from the categorically exempt 18 kW emergency generator.

4 REGULATORY APPLICABILITY ANALYSIS

The proposed Suwannee M&R Station is subject to certain air quality regulations. This section summarizes the air permitting requirements and key air quality regulations that apply to the station. Federal and state air regulations are addressed.

4.1 PERMITTING PROGRAMS

The proposed Suwannee M&R Station is potentially subject to various federal and state regulatory programs. Specifically, applicability of New Source Review (NSR), Title V of the 1990 Clean Air Act Amendments, New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP) and Florida State Implementation Plan (SIP) regulations are addressed. Federal permitting programs are discussed first, followed by Florida's permitting programs.

4.1.1 Federal Permitting Programs

Federal permitting programs comprise requirements for construction of new sources or modification of existing sources (New Source Review) and for operation of major sources of air pollutants (Title V Operating Permit Program).

4.1.1.1 New Source Review

The NSR permitting program generally requires that a stationary source obtain a permit and undertake other obligations prior to construction of any facility if the proposed project results in the potential to emit air pollution in excess of certain threshold levels. The federal NSR program is codified in 40 CFR 51-52. Florida Department of Environmental Protection has developed its own EPA-approved NSR program under Chapter 62-212, F.A.C.

Two distinct NSR permitting programs apply depending on whether the facility is located in an attainment or nonattainment area for a particular pollutant, known as Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review (NNSR), respectively. NNSR permitting applies to new construction or modifications that result in emission increases of a particular pollutant for which the area in which the facility is located is classified as "nonattainment". The PSD permitting program applies to projects with emissions increases of pollutants for which the area is classified as "attainment" or "unclassifiable".

The proposed facility will be located in Suwannee County, which has been classified as in attainment with the National Ambient Air Quality Standards (NAAQS) or unclassified for all regulated pollutants. Therefore, with respect to the NSR permitting program, only PSD requirements are considered to be potentially applicable to the proposed Suwannee M&R Station. Under PSD permitting rules, the major source threshold is 250 tpy unless the facility falls under one of the specifically delineated source categories ("List of 28") in Rule 62-210.200(174), F.A.C. as having a lower 100 tpy threshold. Natural gas M&R stations are not on the "List of 28" and the Suwannee M&R Station will not operate fossil-fuel fired boilers with more than 250 MMBtu/hr heat input (one of the 28 categories with a lower threshold). Therefore the PSD major source threshold for the Suwannee M&R Station is 250 tpy of any PSD pollutant. Note that since the facility is not on the List of 28 and does not have a source subject to a NSPS or NESHAP promulgated before August 7, 1980, only non-fugitive (point source) emissions are assessed against the 250 tpy major source threshold; fugitive emissions are excluded from the major source applicability determination.[6]

[6] Rule 62-210.200(174)(c), F.A.C.

Table 4-1 illustrates that none of the potential emissions of the traditional criteria pollutants for the Suwannee M&R Station will be greater than 250 tpy. Therefore, the proposed Suwannee M&R Station is not subject to PSD permitting.

Table 4-1. Potential Emissions and PSD Applicability

Pollutant	Facility Wide Potential to Emit[7] (tpy)	Major Source Threshold* (tpy)	PSD Permitting Applicability (Yes/No)
CO	0.01	250	No
NO_X	0.001	250	No
SO_2	6.44E-06	250	No
PM	0.0001	250	No
PM_{10}	0.0001	250	No
$PM_{2.5}$	0.0001	250	No
VOC	14.98	250	No
Lead	N/A	250	No
Mercury	N/A	250	No
H_2SO_4	N/A	250	No
*Threshold based on source not being on List of 28 and located in an attainment area.			

4.1.1.2 EPA's GHG Tailoring Rule

On June 3, 2010, EPA issued a final rule that "tailors" the applicability provisions of the PSD program to allow EPA and states to phase in permitting requirements for GHG emissions. This final rule is more commonly known as the "Tailoring Rule." The Tailoring Rule established PSD applicability for GHG emissions for a new stationary source to be 100,000 tpy, measured as CO_2e.

Table 3-3 provides potential GHG emissions, expressed as CO_2e, for the Suwannee M&R Station. Station-wide potential GHG emissions are calculated to be 4,464 tpy.

On June 23, 2014, the Supreme Court of the United States issued a decision with respect to GHG applicability to the PSD program as well as the Title V operating permit program. The decision stated that, "EPA exceeded its statutory authority when it interpreted the Clean Air Act to require PSD and Title V permitting for stationary sources based on their greenhouse gas emissions. Specifically, the Agency may not treat greenhouse gases as a pollutant for purposes of defining a 'major emitting facility' (or a 'modification' thereof) in the PSD context or a 'major source' in the Title V context." Util. Air Regulatory Grp. v. EPA, Case No. 12-1146, Slip Op. at 29 [June 23, 2014].

The decision goes on further to state that, "EPA may, however, continue to treat greenhouse gases as a 'pollutant subject to regulation under this chapter' for purposes of requiring BACT for 'anyway' sources." An "anyway" source is defined as a source that would be subject to PSD applicability "anyway" due to PSD applicability of another PSD pollutant (Id).

[7] Note that the total facility-wide PTE includes fugitive emissions. The facility wide PTE is under the major source threshold even upon incorporating fugitive emissions from the M&R station.

The Suwannee M&R Station is not considered an "anyway" source, because the predicted emissions of all other PSD pollutants are below their respective SERs. Therefore, based on the U.S. Supreme Court's decision, the Suwannee M&R Station, including its GHG emissions, is not subject to PSD applicability or BACT review.

4.1.2 Florida Permitting Programs

Florida's State Implementation Plan (SIP) provides requirements for state permitting of construction, modification, or operation of emissions sources in Rules 62-210 and 62-213, F.A.C. Florida's permitting rules also provide for permitting exemptions and deferrals for insignificant modifications. The proposed operation at the Suwannee M&R Station remain subject to SIP permitting rules and requirements for obtaining an operating permit subsequent to construction permitting. The Suwannee M&R Station is submitting this application for the proposed project which requires a construction permit per Rule 62-210.300(1), F.A.C.

4.2 AIR QUALITY REGULATIONS

The Suwannee M&R Station is potentially subject to federal and state regulations for air quality control. This section describes the applicability criteria and principal requirements of federal and state regulations that result in permit conditions for the Suwannee M&R Station.

4.2.1 New Source Performance Standards (NSPS)

Regulatory requirements for facilities subject to NSPS are incorporated by reference in Rule 62-204.800(8), F.A.C., and located in 40 CFR Part 60. NSPS require new, modified, or reconstructed sources to control emissions to the level achievable by the best-demonstrated technology as specified in the applicable provisions. Moreover, any source subject to an NSPS is also subject to the general provisions of NSPS Subpart A, unless specifically excluded.

4.2.1.1 40 CFR Part 60 Subpart A - General Provisions

All affected sources subject to source-specific NSPS are subject to the general provisions of NSPS Subpart A unless specifically excluded by the source-specific NSPS. Subpart A requires initial notification, performance testing, recordkeeping and monitoring, provides reference methods, and mandates general control device requirements for all other subparts as applicable.

4.2.1.2 40 CFR 60 Subpart Dc - Small Industrial-Commercial-Institutional Steam Generating Units

NSPS Subpart Dc applies to steam generating units with a heat input capacity greater than or equal to 10 MMBtu/hr and less than or equal to 100 MMBtu/hr that have been constructed, modified, or reconstructed after June 9, 1989. The heater at the proposed Suwannee M&R Station will have a maximum heat input capacity below 10 MMBtu/hr. Therefore, this unit is not subject to NSPS Subpart Dc.

4.2.1.3 40 CFR 60 Subpart Kb - Volatile Organic Liquid Storage Vessels

NSPS Subpart Kb, *Standards of Performance for Volatile Organic Liquid Storage Vessels*, regulates storage vessels with a capacity greater than 75 cubic meters (m^3) (19,813 gallons) that are used to store volatile organic liquids for which construction, reconstruction, or modification is commenced after July 23, 1984.

NSPS Subpart Kb has provisions in §60.110b(b) to exempt tanks based on size and the maximum true vapor pressure of the material stored. Specifically, NSPS Subpart Kb "does not apply to storage vessels with a capacity greater than or equal to 151 m [39,890 gallons] storing a liquid with a maximum true vapor pressure less than

3.5 kilopascals (kPa) or with capacity greater than or equal to 75 m [19,813 gallons] but less than 151 m [39,890 gallons] storing a liquid with a maximum true vapor pressure less than 15.0 kPa."

The proposed facility will include one above ground storage tank, with a capacity of 1,000 gallons. NSPS Subpart Kb will not apply to the tank based on the size threshold.

4.2.1.4 40 CFR 60 Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

NSPS Subpart JJJJ applies to owners and operators of stationary spark ignition internal combustion engines that commence construction after June 12, 2006, where the stationary engines are manufactured on or after January 1, 2009. However, this Subpart does not require emissions standards for very small emergency engines, with a maximum engine power less than or equal to 19 kW.[8] The engine at the proposed Suwannee M&R Station will be used as an emergency generator, and will have a maximum rated engine power of 18 kW (under 19kW). Therefore, this unit is not subject to emission standards under NSPS Subpart JJJJ. Furthermore, the emergency generator will comply with Subpart ZZZZ by complying with the requirements set forth in NSPS Subpart JJJJ per 40 CFR 63.6590(c)(1). Although the emergency generator will not be subject to any NSPS emissions standards, the facility will install a non-resettable hour meter on the emergency generator per 40 CFR 60.4237(c), and follow the operating restriction codified under 40 CFR 60.4243(d) as an emergency engine. Sabal Trail will comply with the requirements of this subpart.

4.2.1.5 40 CFR Part 60 Subpart OOOO - Natural Gas Production, Transmission and Distribution

NSPS Subpart OOOO establishes emission standards and compliance schedules for the control of VOC and SO_2 emissions from affected facilities that commence construction, modification or reconstruction after August 23, 2011. Affected facilities include certain units and operations located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment. "Custody transfer" is defined under 40 CFR 60.5430 as the transfer of natural gas after processing and/or treatment in the producing operations, or from storage vessels or automatic transfer facilities or other such equipment, including product loading racks, to pipelines or any other forms of transportation. "Natural gas transmission" is defined under 40 CFR 60.5430 as the pipelines used for long distance transport of natural gas (excluding processing). Specific equipment used in natural gas transmission includes the land, mains, valves, meters, boosters, regulators, storage vessels, dehydrators, compressors, and their driving units and appurtenances, and equipment used for transporting gas from a production plant, delivery point of purchased gas, gathering system, storage area, or other wholesale source of gas to one or more distribution area(s). Sabal Trail will gain custody of natural gas only after separate production operations, or at "the point of custody transfer." Sabal Trail and its operations, including the Suwannee M&R Station, will be located in the natural gas transmission segment.

Affected facilities include storage vessels located in the natural gas transmission and storage segment that have the potential for VOC emissions equal to or greater than 6 tpy per 40 CFR 60.5365(e). This requirement specifies that,

> *"The potential for VOC emissions must be calculated using a generally accepted model or calculation methodology, based on the maximum average daily throughput determined for a 30-day period of production prior to the applicable emission determination deadline specified in this section. The determination may take into account requirements under a legally and practically enforceable limit in an operating permit or other requirement established under a Federal, State, local or tribal authority."*

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[8] 40 CFR 60.4230(a)(4)(iv) includes emergency engines only if the maximum engine power is greater than 19 kW. If an engine with a maximum power less than or equal to 19 kW will meet the defined requirements of an emergency engine, no other requirements of Subpart JJJJ apply.

The Suwannee M&R Station will not operate any storage vessels which have the potential to emit 6 tpy or more of VOC. Therefore, NSPS Subpart OOOO does not apply to the Suwannee M&R Station.

Additionally, the amendments to NSPS OOOO proposed on August 18, 2015 (i.e., NSPS OOOOa) include requirements for fugitive emissions from compressor stations. In accordance with 40 CFR 60.5430a, a compressor station site is defined as, *"…any permanent combination of one or more compressors that move natural gas at increased pressure through gathering or transmission pipelines…* "

The Suwannee M&R station will not include any compressors, and will not be subject to the requirements for fugitive emissions proposed in NSPS OOOOa. There will be no storage vessels subject to the requirements of NSPS OOOOa for reasons consistent with the applicability determination provided in this section for NSPS OOOO (The Suwannee M&R Station will not operate any storage vessels which have the potential to emit 6 tpy or more of VOC.)

4.2.2 National Emission Standards for Hazardous Air Pollutants (NESHAP)

NESHAP are emission standards for HAP and are applicable to major and area sources of HAP. A HAP major source is defined as having potential emissions in excess of 25 tpy for total HAP and/or potential emissions in excess of 10 tpy for any individual HAP. An area source is a stationary source that is not a major source. Part 63 NESHAP allowable emission limits are established on the basis of a Maximum Achievable Control Technology (MACT) determination for a particular source category. NESHAP apply to sources in specifically regulated industrial source categories [CAA Section 112(d)] or on a case-by-case basis [Section 112(g)] for facilities not regulated as a specific industrial source type. The Suwannee M&R Station will be an area source of HAP emissions as total HAP PTE does not exceed 25 tpy and no single HAP will exceed 10 tpy.

4.2.2.1 40 CFR 63 Subpart A – General Provisions

NESHAP Subpart A, *General Provisions*, contains national emission standards for HAP defined in Section 112(b) of the Clean Air Act. All affected sources, which are subject to another NESHAP, are subject to the general provisions of NESHAP Subpart A, unless specifically excluded by the source-specific NESHAP. Regulatory requirements for facilities subject to Part 63 NESHAP are incorporated by reference in Rule 62-204.800(11), F.A.C.

4.2.2.2 40 CFR Part 63, Subpart HH - National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities

Per 63.760(a) and (b), Subpart HH applies to facilities that process, upgrade, or store hydrocarbon liquids. The natural gas production facility to which the rule applies ends at the point that the natural gas enters a facility in the natural gas transmission and storage category per 63.760(a)(3). The Suwannee M&R Station is considered a natural gas transmission facility; therefore, Subpart HH is not applicable.

4.2.2.3 40 CFR Part 63, Subpart HHH – National Emission Standards for Hazardous Air Pollutants from Natural Gas Transmission and Storage Facilities

Per 40 CFR 63.1270(a) and (b), Subpart HHH applies to glycol dehydration units at major sources of HAP. Since Suwannee M&R Station is not a major HAP source nor will it be constructing any glycol dehydration units as a part of the proposed project, this regulation is not applicable to the project.

4.2.2.4 40 CFR Par 63, Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

40 CFR 63 Subpart ZZZZ, also known as RICE MACT, establishes emissions limitations and operating limitations for HAP emissions from reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. The Suwannee M&R Station will be an area source of HAP, and will install a RICE at the site; therefore, the RICE MACT applies for this facility. In accordance with 40 CFR 63.6590(c)(1), a new stationary RICE at an area source may demonstrate compliance with this regulation by complying with 40 CFR 60 Subpart JJJJ; therefore, Sabal Trail will comply with 40 CFR 63 Subpart ZZZZ by complying with the requirements of 40 CFR 60 Subpart JJJJ.

4.2.2.5 40 CFR Par 63, Subpart DDDDD – Industrial, Commercial, and Institutional Boilers and Process Heaters Major Sources

40 CFR 63 Subpart DDDDD, also known as Boiler MACT, regulates HAP emissions from boilers and process heaters at facilities that are a major source of HAP. While the Suwannee M&R Station will install a fuel gas heater, the station will be an area source of HAP; therefore, major source Boiler MACT does not apply.

4.2.2.6 40 CFR Par 63, Subpart JJJJJJ - Industrial, Commercial, and Institutional Boilers and Process Heaters Area Sources

40 CFR 63 Subpart JJJJJJ regulates HAP emissions from boilers and process heaters at facilities that are an area source of HAP. However, in accordance with 40 CFR 63.11195(e), gas-fired boilers are not subject to this subpart. Therefore 40 CFR 63 Subpart JJJJJJ does not apply.

4.2.3 Risk Management Program

40 CFR §68, Chemical Accident Provisions, requires submittal of a Risk Management Plan if the facility stores a regulated material above the applicable concentration and threshold values. The Suwannee M&R Station design is for natural gas transmission and will not have the infrastructure to store any regulated material. Therefore, the facility is subject only to the General Duty Clause requirements and must review materials as purchased to verify if additional requirements must be met per Clean Air Act Section 112(r)(1).

4.2.4 State Regulation Applicability

Florida’s State Implementation Plan (SIP) provides requirements for state permitting of construction, modification, or operation of emissions sources as detailed in Section 4.1.2. The Suwannee M&R Station is subject to regulations contained in the Florida Administrative Code, Chapter 62 (Florida Air Rules). The Florida Air Rules fall under two main categories, those regulations that are generally applicable (e.g., permitting requirements), and those that have specific applicability (e.g., PM standards for manufacturing equipment). Generally applicable facility provisions (e.g., restrictions on open burning) are not included in this discussion.

4.2.4.1 Rule 62-296.320(1), F.A.C. – General VOC Emissions Standard

Rule 62-296.320(1), F.A.C., prohibits the storage and use of volatile organic compounds or organic solvents without applying known and existing vapor emission controls. The rule specifies that no person shall store, pump, handle, process, load, unload or use in any process or installation, volatile organic compounds or organic solvents without applying known and existing vapor emission control devices or systems. The Suwannee M&R Station will employ the general practices outlined in this regulation to minimize VOC emissions from general supporting operations.

4.2.4.2 Rule 62-296.320(4)(b)1, F.A.C. – General Visible Emissions Standard

The general visible emissions standard limits visible emissions (i.e., opacity) from all sources of air pollution to 20%, unless another standard provides a more stringent limit. The Suwannee M&R Station will comply with the opacity requirement for the proposed combustion units by firing only natural gas in the units.

4.2.4.3 Rule 62-296.500, F.A.C. - Reasonably Available Control Technology (RACT) - Volatile Organic Compounds (VOC) and Nitrogen Oxides (NO_X) Emitting Facilities

Rule 62-296.500, F.A.C., requires those facilities that are in designated ozone nonattainment areas or ozone air quality maintenance areas to comply with applicable reasonably available control technology (RACT) standards if VOC or NO_X are emitted. Suwannee County is not designated as an ozone air quality maintenance area. Therefore, the Suwannee M&R Station will not be subject to VOC RACT requirements under Rule 62-296.500, F.A.C.

4.2.4.4 Rule 62-297.310 F.A.C. – General Compliance Test Requirements

Per Rule 62-297.310(8)(b), F.A.C., an owner or operator of an emissions unit that is subject to any emission limiting standard shall conduct a compliance test that demonstrates compliance with the applicable emission limiting standard prior to obtaining an operating permit. However, there are no applicable emissions limiting standards applicable to the emissions units included in this permit application. Therefore a compliance test demonstration will not be applicable.

APPENDIX A: AREA MAP, AND TRANSMISSION PIPELINE IN FLORIDA

UTM Easting (m)

Coordinates reflect UTM Zone 17, NAD83.

Legend

- COMPRESSOR STATION LOCATIONS
- MILE POSTS
- PROPOSED 36" PIPELINE
- PROPOSED 24" CITRUS COUNTY PIPELINE
- PROPOSED 36" HUNTERS CREEK PIPELINE
- COUNTIES
- STATES

NO.	REVISION - DESCRIPTION	BY	DATE	CHK'D	APP'D
0	ISSUED FOR PERMITTING	GIE	11/20/2014	FSR	DRS

RESOURCE REPORT 1 - FIGURE 1.1-1

Sabal Trail TRANSMISSION

SABAL TRAIL PROJECT
PROPOSED PIPELINE
FIGURE 1.1-1
SABAL TRAIL PROJECT
LOCATION MAP
ALABAMA, GEORGIA & FLORIDA

DWG NO: 1657-PL-DG-70075-001 | SHT: 1 of 1 | REV: 0

Date: 11/5/2014 Time: 2:41:56 PM User: joeyj
H:_GIS\Data\1657\Deliverables\FERC_Final\Figures\RR1\1.1-1 Sabal Trail Project Location Map\MXD\REV 0\1657-PL-DG-70075-001.mxd

APPENDIX B: EMISSIONS CALCULATIONS

TABLE A-1
Potential to Emit
Basis
Project Increase

Emission Source				Material/Capacity		Operational Limits												Data
ID	FIN	EPN	Description			Short-Term -- Material Flow			Short-Term -- Capacity			Annual Material Flow			Annual Utilization			Sources
SUWA-PC	SUWA-PC-NG	SUWA-PC-NG	Piping Components	Natural Gas		Valves: 633; Connectors: 0; Flanges: 3,237; Open-Ended Lines: 239; Pump Seals: 0; Other (blowdown valves, relief valves, and compressor seals): 38												TABLE B-1
	SUWA-PC-PL	SUWA-PC-PL	Piping Components	Pipeline Liquids		Valves: 126; Connectors: 630; Flanges: 0; Open-Ended Lines: 28; Pump Seals: 0; Other (blowdown valves, relief valves, and compressor seals): 3												TABLE B-2
SUWA-GR	SUWA-GR-ST	SUWA-GR-ST	Gas Release Events	Natural Gas		Natural Gas	962,856	scfh				Natural Gas	5,312,094	scf/yr	Runtime	N/A		TABLE C-1
	SUWA-GR-PL	SUWA-GR-PL	Gas Release Events	Natural Gas														
SUWA-HIG-01	SUWA-HIG-01	SUWA-HIG-01	Heating Device	0.00175	MMBTU/hr (output)	Natural Gas	2.45	scfh	Heat Input	0.0025	MMBTU/hr	Natural Gas	21,471	scf/yr	Runtime	8,760	hrs/yr	TABLE D-1a
SUWA-V-01	SUWA-V-01	SUWA-V-01	Storage Tank	1,000	gal	Pipeline Liquids Storage Tank	1,000	gal/hr				Pipeline Liquids Storage Tank	12,000	gal/yr	Runtime	N/A		TABLE F-2
SUWA-TL-PL	SUWA-TL-PL	SUWA-TL-PL	Truck Loading Area	1,000	gph	Pipeline Liquids Storage Tank	1,000	gal/hr				Pipeline Liquids Storage Tank	12,000	gal/yr	Runtime	N/A		TABLE F-3

TABLE A-1
Potential to Emit
Emissions
Project Increase

Emission Source				Material/Capacity	Potential to Emit (tpy)												Data
ID	FIN	EPN	Description		CO_{2-e}	NO_X	CO	$PM_{10/2.5}$	SO_2	VOC (Total)	HAP (Total)	Benzene	Ethylbenzene	Hexane (n-)	Toluene	Xylenes	Sources
SUWA-PC	SUWA-PC-NG	SUWA-PC-NG	Piping Components	Natural Gas	1,033.22					1.8634	0.1589	0.0227	0.0091	0.0369	0.0284	0.0618	TABLE B-1
	SUWA-PC-PL	SUWA-PC-PL	Piping Components	Pipeline Liquids	0.0472					4.9080	0.7147	0.0708	0.0234	0.0832	0.2207	0.3153	TABLE B-2
SUWA-GR	SUWA-GR-ST	SUWA-GR-ST	Gas Release Events	Natural Gas	3,357.45					6.0552	0.5164	0.0739	0.0295	0.1199	0.0923	0.2008	TABLE C-1
	SUWA-GR-PL	SUWA-GR-PL	Gas Release Events	Natural Gas													
SUWA-HIG-01	SUWA-HIG-01	SUWA-HIG-01	Heating Device	0.0018 MMBTU/hr (output)	1.3097	0.0008	0.0126	0.0001	6.4412E-06	0.0021	0.0007	7.8601E-07		0.0007	1.2726E-06		TABLE D-1a
SUWA-V-01	SUWA-V-01	SUWA-V-01	Storage Tank	Flash	37.4640					1.5031	0.0899	0.0183	0.0010	0.0647	0.0225	0.0134	TABLE E-4
				Storage	32.0778					0.5942	0.0370	0.0090	0.0003	0.0172	0.0081	0.0024	TABLE F-2
SUWA-TL-PL	SUWA-TL-PL	SUWA-TL-PL	Truck Loading Area	1000 gph	2.8641					0.0531	0.0033	0.0008	0.0000	0.0015	0.0007	0.0002	TABLE F-3
				TOTAL	4,464.43	0.0008	0.0126	0.0001	0.0000	14.9790	1.5209	0.1955	0.0633	0.3240	0.3728	0.5940	

TABLE B-1
Piping Components
Hourly and Annual Emission Estimates - Project

Source			SUWA-PC-NG			
Service			Gas			
			Natural Gas			
Minimum hours when component purged with inert gas			0 hrs/yr			
Component	Valves	Count	633 components			
		Emission Factor	4.50E-03 kg/hr/component			
	Connectors	Count	0 components			
		Emission Factor	2.00E-04 kg/hr/component			
	Flanges	Count	3,237 components			
		Emission Factor	3.90E-04 kg/hr/component			
	Open-Ended Lines	Count	239 components			
		Emission Factor	2.00E-03 kg/hr/component			
	Pump Seals	Count	0 components			
		Emission Factor	2.40E-03 kg/hr/component			
	Other	Count	38 components	**Emissions**		
		Emission Factor	8.80E-03 kg/hr/component	**Avg. Hourly**	**Max. Annual**	**Max. Hourly**
Speciation	$CO_{2\text{-}e}$		2173.36% by weight	235.8942 lb/hr	1,033.2165 tpy	283.0730 lb/hr
	CO_2		3.29% by weight	0.3571 lb/hr	1.5642 tpy	0.4286 lb/hr
	TOC (Total)		95.60% by weight	10.3767 lb/hr	45.4498 tpy	12.4520 lb/hr
	Methane		86.80% by weight	9.4215 lb/hr	41.2661 tpy	11.3058 lb/hr
	Ethane		4.88% by weight	0.5298 lb/hr	2.3203 tpy	0.6357 lb/hr
	VOC (Total)		3.92% by weight	0.4254 lb/hr	1.8634 tpy	0.5105 lb/hr
	VOC (non-HAP)		3.59% by weight	0.3892 lb/hr	1.7045 tpy	0.4670 lb/hr
	HAP (Total)		0.33% by weight	0.0363 lb/hr	0.1589 tpy	0.0435 lb/hr
	Benzene		0.05% by weight	5.19E-03 lb/hr	2.27E-02 tpy	6.23E-03 lb/hr
	Ethylbenzene		0.02% by weight	2.07E-03 lb/hr	9.09E-03 tpy	2.49E-03 lb/hr
	Hexane (n-)		0.08% by weight	8.42E-03 lb/hr	3.69E-02 tpy	1.01E-02 lb/hr
	Methanol					
	Naphthalene					
	Toluene		0.06% by weight	6.48E-03 lb/hr	2.84E-02 tpy	7.78E-03 lb/hr
	Trimethylpentane (2,2,4-)		0.00% by weight	0.00E+00 lb/hr	0.00E+00 tpy	0.00E+00 lb/hr
	Xylenes		0.13% by weight	1.41E-02 lb/hr	6.18E-02 tpy	1.69E-02 lb/hr

NOTES

1. Emission factors obtained from Table 2-4 (Oil & Gas Production Operations) of Protocol for Equipment Leak Emission Estimates (EPA 453/R-95-017). The emission factor for pumps in heavy oil service is obtained from Table 2-1.
2. Piping component counts based on design drawings (IFB).
3. The component type "Other" includes blowdown valves, relief valves, and compressor seals.
4. Weight percents based on gas analysis used to estimate gas release annual emissions (TABLE C-1).
5. Maximum hourly emissions are based on 120% of the hourly emissions estimated in an effort to be conservative.

TABLE B-2
Piping Components
Hourly and Annual Emission Estimates - Project

Source			SUWA-PC-PL			
Service			Light Oil			
			Pipeline Liquids			
Minimum hours when component purged with inert gas			0 hrs/yr			
Component	Valves	Count	126 components			
		Emission Factor	2.50E-03 kg/hr/component			
	Connectors	Count	630 components			
		Emission Factor	2.10E-04 kg/hr/component			
	Flanges	Count	0 components			
		Emission Factor	1.10E-04 kg/hr/component			
	Open-Ended Lines	Count	28 components			
		Emission Factor	1.40E-03 kg/hr/component			
	Pump Seals	Count	0 components			
		Emission Factor	1.30E-02 kg/hr/component			
	Other	Count	3 components	**Emissions**		
		Emission Factor	7.50E-03 kg/hr/component	**Avg. Hourly**	**Max. Annual**	**Max. Hourly**
Speciation	CO_{2-e}		0.96% by weight	0.0108 lb/hr	0.0472 tpy	0.0129 lb/hr
	CO_2		0.01% by weight	0.0001 lb/hr	0.0006 tpy	0.0002 lb/hr
	TOC (Total)		99.99% by weight	1.1220 lb/hr	4.9143 tpy	1.3464 lb/hr
	Methane		0.04% by weight	0.0004 lb/hr	0.0019 tpy	0.0005 lb/hr
	Ethane		0.09% by weight	0.0010 lb/hr	0.0044 tpy	0.0012 lb/hr
	VOC (Total)		99.86% by weight	1.1206 lb/hr	4.9080 tpy	1.3447 lb/hr
	VOC (non-HAP)					
	HAP (Total)		14.54% by weight	0.1632 lb/hr	0.7147 tpy	0.1958 lb/hr
	Benzene		1.44% by weight	1.62E-02 lb/hr	7.08E-02 tpy	1.94E-02 lb/hr
	Ethylbenzene		0.48% by weight	5.34E-03 lb/hr	2.34E-02 tpy	6.41E-03 lb/hr
	Hexane (n-)		1.69% by weight	1.90E-02 lb/hr	8.32E-02 tpy	2.28E-02 lb/hr
	Methanol					
	Naphthalene					
	Toluene		4.49% by weight	5.04E-02 lb/hr	2.21E-01 tpy	6.05E-02 lb/hr
	Trimethylpentane (2,2,4-)		0.03% by weight	2.90E-04 lb/hr	1.27E-03 tpy	3.48E-04 lb/hr
	Xylenes		6.42% by weight	7.20E-02 lb/hr	3.15E-01 tpy	8.64E-02 lb/hr

NOTES

1. Emission factors obtained from Table 2-4 (Oil & Gas Production Operations) of Protocol for Equipment Leak Emission Estimates (EPA 453/R-95-017).
The emission factor for pumps in heavy oil service is obtained from Table 2-1.
2. Piping component counts based on design drawings (IFB).
3. The component type "Other" includes blowdown valves, relief valves, and compressor seals.
4. Weight percents based on composition estimate (TABLE F-1).
5. Maximum hourly emissions are based on 120% of the hourly emissions estimated in an effort to be conservative.

TABLE C-1
Gas Releases -Project
Hourly and Annual Emission Estimates

Category	Station/Pipeline Operations					
Source	SUWA-GR-ST			SUWA-GR-PL		
	Avg. Hourly	Max. Annual	Max. Hourly	Avg. Hourly	Max. Annual	Max. Hourly
Gas Release	0 scfh	0 scf/yr	0 scfh	606 scfh	5,312,094 scf/yr	962,856 scfh
	0 lb/hr	0 lb/yr	0 lb/hr	35 lb/hr	308,964 lb/yr	56,002 lb/hr
NO_X						
CO						
SO_2						
$PM_{10/2.5}$						
$CO_{2\text{-e}}$	0.0000 lb/hr	0.0000 tpy	0.0000 lb/hr	766.5416 lb/hr	3,357.4523 tpy	1,127,125.0264 lb/hr
CO_2	0.0000 lb/hr	0.0000 tpy	0.0000 lb/hr	1.1605 lb/hr	5.0830 tpy	1,842.6566 lb/hr
N_2O						
TOC (Total)	0.0000 lb/hr	0.0000 tpy	0.0000 lb/hr	33.7192 lb/hr	147.6899 tpy	53,539.7811 lb/hr
Methane	0.0000 lb/hr	0.0000 tpy	0.0000 lb/hr	30.6152 lb/hr	134.0948 tpy	45,011.2948 lb/hr
Ethane	0.0000 lb/hr	0.0000 tpy	0.0000 lb/hr	1.7215 lb/hr	7.5400 tpy	2,530.9323 lb/hr
VOC (Total)	0.0000 lb/hr	0.0000 tpy	0.0000 lb/hr	1.3825 lb/hr	6.0552 tpy	5,997.5541 lb/hr
VOC (non-HAP)	0.0000 lb/hr	0.0000 tpy	0.0000 lb/hr	1.2646 lb/hr	5.5388 tpy	5,486.0985 lb/hr
HAP (Total)	0.0000 lb/hr	0.0000 tpy	0.0000 lb/hr	0.1179 lb/hr	0.5164 tpy	511.4555 lb/hr
Acetaldehyde						
Acrolein						
Benzene	0.00E+00 lb/hr	0.00E+00 tpy	0.00E+00 lb/hr	1.69E-02 lb/hr	7.39E-02 tpy	7.32E+01 lb/hr
Biphenyl						
Butadiene (1,3-)						
Carbon Tetrachloride						
Chlorobenzene						
Chloroform						
Dichloropropene (1,3-)						
Ethylbenzene	0.00E+00 lb/hr	0.00E+00 tpy	0.00E+00 lb/hr	6.74E-03 lb/hr	2.95E-02 tpy	2.93E+01 lb/hr
Ethylene Dibromide						
Formaldehyde						
Hexane (n-)	0.00E+00 lb/hr	0.00E+00 tpy	0.00E+00 lb/hr	2.74E-02 lb/hr	1.20E-01 tpy	1.19E+02 lb/hr
Methanol						
Methylene Chloride						
Methylnaphthalene (2-)						
Naphthalene						
PAH						
Phenol						
Propylene Oxide						
Styrene						
Tetrachloroethane (1,1,2,2-)						
Toluene	0.00E+00 lb/hr	0.00E+00 tpy	0.00E+00 lb/hr	2.11E-02 lb/hr	9.23E-02 tpy	9.14E+01 lb/hr
Trichloroethane (1,1,2-)						
Trimethylpentane (2,2,4-)	0.00E+00 lb/hr	0.00E+00 tpy	0.00E+00 lb/hr	0.00E+00 lb/hr	0.00E+00 tpy	0.00E+00 lb/hr
Vinyl Chloride						
Xylenes	0.00E+00 lb/hr	0.00E+00 tpy	0.00E+00 lb/hr	4.59E-02 lb/hr	2.01E-01 tpy	1.99E+02 lb/hr

NOTES

1. Data extracted from TABLE C-2.
2. Gas density is 110% of the value extracted from physical property estimation spreadsheet, based on an extended gas analysis at a site in Texas.

Density (TABLE C-7):	0.0460 lb/scf	Safety Factor:	126%			

3. As it will be assumed that this gas is representative, the following is used to scaled the extended analysis based on GC data for Thomaston, TX.

			Average	Maximum	VOC Specie Scaling:	
VOC (TABLE C-7):	0.00283 lb/scf	VOC (GC Data):	0.00180 lb/scf	0.00493 lb/scf	average	64%
	6.14% wt%		3.92% wt%	10.71% wt%	maximum	174%
Methane (TABLE C-7):	84.70% wt%		86.80% wt%	80.37% wt%		
Ethane (TABLE C-7):	4.76% wt%		4.88% wt%	4.52% wt%		

TABLE C-2
Summary of Gas Release Volumes - Project

Category	Event Information					Gas Release		
	Description		Gas Release	Frequency		Release	Hourly	Annual
	Type	ID	(scf/event)	(hr^{-1})	(yr^{-1})	Point	(scf/hr)	(scf/yr)
Blowdown	Pipeline	M&R	958,055	1	5	M&R	958,055	4,790,275
Purge	Pipeline	M&R	9,959	1	5	M&R	9,959	49,796
Actuation	Pipeline	Bi-directional skid	14	4	365	DSV330E	56	5,125
Actuation	Pipeline	Bi-directional skid	14	4	365	DSV301B	56	5,125
Actuation	Pipeline	Bi-directional skid	14	4	365	DSV311B	56	5,125
Actuation	Pipeline	Bi-directional skid	14	4	365	DSV311A	56	5,125
Actuation	Pipeline	Bi-directional skid	14	4	365	DSV301A	56	5,125
Actuation	Pipeline	Bi-directional skid	14	4	365	TBD	56	5,125
Actuation	Pipeline	Filter/Separator	8	4	365	FV301A	32	2,897
Actuation	Pipeline	Filter/Separator	8	4	365	FV301B	32	2,897
Actuation	Pipeline	Filter/Separator	8	4	365	FV302A	32	2,897
Actuation	Pipeline	Filter/Separator	8	4	365	FV302B	32	2,897
Actuation	Pipeline	Meter skid	1	4	365	FV120A	4	387
Actuation	Pipeline	Meter skid	2	4	365	FV120B	8	741
Actuation	Pipeline	Meter skid	2	4	365	FV120C	8	741
Actuation	Pipeline	Meter skid	2	4	365	FV120D	8	741
Actuation	Pipeline	Control Valve skid (SK-07)	2	4	365	PCV122B	10	874
Actuation	Pipeline	Control Valve skid (SK-07)	2	4	365	FCV122B	10	874
Actuation	Pipeline	Control Valve skid (SK-07)	2	4	365	PCV122A	10	874
Actuation	Pipeline	Control Valve skid (SK-07)	2	4	365	FCV122A	10	874
Actuation	Pipeline	Control Valve skid (SK-07)	175	4	365	FV123A	698	63,722
Actuation	Pipeline	Control Valve skid (SK-07)	175	4	365	FV123B	698	63,722
Actuation	Pipeline	Control Valve skid (SK-08)	2	4	365	PCV122D	10	874
Actuation	Pipeline	Control Valve skid (SK-08)	2	4	365	FCV122D	10	874
Actuation	Pipeline	Control Valve skid (SK-08)	2	4	365	PCV122C	10	874
Actuation	Pipeline	Control Valve skid (SK-08)	2	4	365	FCV122C	10	874
Actuation	Pipeline	Control Valve skid (SK-08)	175	4	365	FV123C	698	63,722
Actuation	Pipeline	Control Valve skid (SK-08)	175	4	365	FV123D	698	63,722
Actuation	Pipeline	Control Valve skid (SK-09)	2	4	365	PCV122E	10	874
Actuation	Pipeline	Control Valve skid (SK-09)	2	4	365	FCV122E	10	874
Actuation	Pipeline	Control Valve skid (SK-09)	2	4	365	PCV122F	10	874
Actuation	Pipeline	Control Valve skid (SK-09)	2	4	365	FCV122F	10	874
Actuation	Pipeline	Control Valve skid (SK-09)	175	4	365	FV123E	698	63,722
Actuation	Pipeline	Control Valve skid (SK-09)	175	4	365	FV123F	698	63,722
Vent	Pipeline	Gas Chromatograph Building	1	4	35,040	GC Building	4	34,261
Station Operations							0	0
Pipeline Operations							962,856	5,312,094

NOTES

1. Data extracted from TABLE C-3, TABLE C-4,TABLE C-5, and TABLE C-6.
2. For pipeline and station yard blowdowns and purges it is assumed that only a blowdown or purge can take place at any segment of pipeline in any 1-hour period.

Pipeline	Blowdown	(light orange)
	Purge	(orange)

TABLE C-3
Blowdown - Project

Piping Description						Initial Conditions			Final Conditions			Event[2]		Gas Release Data		
Location Description			Diameter (in)		Length	Volume	Press.	Temp.	Press.	Temp.	Volume[1]	Frequency		Hourly	Annual	Release
General	Location		nom.	act.	(ft)	(ft^3)	(psig)	(°F)	(psig)	(°F)	(scf)	(hr^{-1})	(yr^{-1})	(scf/hr)	(scf/yr)	Point
Pipeline	M&R	M&R	1	0.96	5.99	0	1,456	120	0	68	4	1	5	4	18	Pipeline - M&R
Pipeline	M&R	M&R	2	1.94	588.44	12	1,456	120	0	68	1,422	1	5	1,422	7,112	
Pipeline	M&R	M&R	3	2.90	14.00	1	1,456	120	0	68	76	1	5	76	379	
Pipeline	M&R	M&R	8	7.63	29.92	9	1,456	120	0	68	1,118	1	5	1,118	5,591	
Pipeline	M&R	M&R	10	9.75	30.49	16	1,456	120	0	68	1,864	1	5	1,864	9,318	
Pipeline	M&R	M&R	12	11.75	84.77	64	1,456	120	0	68	7,524	1	5	7,524	37,620	
Pipeline	M&R	M&R	16	15.00	80.63	99	1,456	120	0	68	11,663	1	5	11,663	58,315	
Pipeline	M&R	M&R	20	19.00	48.08	95	1,456	120	0	68	11,160	1	5	11,160	55,799	
Pipeline	M&R	M&R	24	23.00	96.60	279	1,456	120	0	68	32,853	1	5	32,853	164,266	
Pipeline	M&R	M&R	30	29.00	1,080.52	4,956	1,456	120	0	68	584,215	1	5	584,215	2,921,073	
Pipeline	M&R	M&R	36	35.00	315.16	2,106	1,456	120	0	68	248,203	1	5	248,203	1,241,015	
Pipeline	F/S Area	48" F/S				246	1,456	120	0	68	28,977	1	5	28,977	144,885	
Pipeline	F/S Area	48" F/S				246	1,456	120	0	68	28,977	1	5	28,977	144,885	
Pipeline - M&R		TOTAL			2,374.60	8,127.79	1,456	120			958,055	1	5	958,054.94	4,790,274.69	

NOTES

1. Final volume calculated using ideal gas law $[(PV/ZT)_i = (PV/ZT)_f]$. $V_f = V_i (P_i/P_f) (T_f/T_i) (Z_f/Z_i)$, where Z is estimated using the following equation: $Z = 0.9994 - 0.0002P + 3E\text{-}08P^2$.
2. The frequency of events is based on operator experience as to what would reasonably constitute a worst-case scenario.
3. Blowdown of the affected Launcher/Receiver barrel is included with the blowdown of the piping in the Launcher/Receiver Area.
4. For conservatism assumed all lines are blown down simultaneously.
5. Blowdown emissions are from new FGT Suwannee M&R station.

TABLE C-4
Purge and Drain - Project

Piping Description		Purge Valve Data					Gas Stream Data										Miscellaneous Factors[3,4,5]					Purge Data[6,7]		Event[8]			Gas Release Data		
General	Location	ID	Type	Throat Cross-Section			Upstream Data				Critical Flow Data[1,2]						Discharge Coefficient	Adjustment Factors				Fractional Amount Valve Opened	Gas Flow Rate	Frequency		Duration	Hourly	Annual	Release Point
				Diameter		Area	Pressure		Temp.		Absolute Press.		Absolute Temp.			Velocity													
				nom.	act.	**A**	P_o		T_o		Ratio	P_c	Ratio	T_c		v_c	C_d	Valve Type	Pressure	Temp.	Expansion								
				(in)	(in)	(ft^2)	(psig)	(psia)	(°F)	(°R)	R_{cp} $R_{ct}^{(k/(k-1))}$ (n.d.)	P_oR_{cp} (psia)	R_{ct} 2/(k+1) (n.d.)	(T_o R_{ct}) (°F)	(°R)	(ft/sec)	(n.d.)	F_{vt} (n.d.)	F_P (P_c/P_{STP}) (n.d.)	F_T (T_{STP}/T_c) (n.d.)	F_Z (Z_{STP}/Z_c) (n.d.)	f_{open} (n.d.)	(scf/sec)	(hr^{-1})	(yr^{-1})	(sec)	(scf/hr)	(scf/yr)	
Pipeline	M&R	M&R	Plug	2.0	1.939	0.0205	12	26.7	120	580	0.5439	14.52	0.8658	42.16	502.16	1,358.36	0.98	0.40	0.9858	1.0514	1.0000	100%	11	1	5	880	9,959	49,796	M&R

NOTES

1. The ratio of specific heats for natural gas is assumed to be: 1.31 (n.d.).
2. Critical velocity is estimated using the following equation: $(k\ gT_cR/M)^{0.5}$. Where,
   g = acceleration due to gravity = 32.174 ft/sec^2
   R = universal gas constant = 1,545 (ft lb)/(lb-mol °R)
   M = molecular weight of gas = 17.7224 lb/lb-mol {TABLE C-7}
3. Discharge coefficient.
4. Valve type adjustment factor.
5. Expansion adjustment factor is estimated using the following equation: $Z = 0.9994 - 0.0002P + 3E\text{-}08P^2$.
6. The fractional amount that the valve is opened is based on operator experience as to what would reasonably constitute a worst-case scenario.
7. The purge gas flow rate is estimated using the following equation: $C_d\ A\ v_c\ F_p\ F_t\ Y\ f_{open}\ F_{vt}$.
8. The frequency and duration of events is based on operator experience as to what would reasonably constitute a worst-case scenario.
9. Gas releases from Low Point Drains are not included if there were no modifications to these drains/valves.

TABLE C-5
Pneumatic - Project

Description				Pneumatic Device				Power Gas					Event			Gas Release Data		
Location Description		Dia.	ID	Vendor	Description		Detail	Pressure		Gas per 90° Stroke		Flow	Frequency		Duration	Hourly	Annual	Release
General	Location	(in.)			Major	Minor		(psig)	(psia)	(scf/psia)	(scf)	(scfm)	(hr^{-1})	(yr^{-1})	(sec)	(scf/hr)	(scf/yr)	Point
Pipeline	Bi-directional skid	30	DSV330E	Shafer	Actuator	14.5x14	14.5x14	150	164.70	0.0852	14		4	365	25	56	5,125	DSV330E
Pipeline	Bi-directional skid	30	DSV301	Shafer	Actuator	14.5x14	14.5x14	150	164.70	0.0852	14		4	365	25	56	5,125	DSV301B
Pipeline	Bi-directional skid	30	DSV311	Shafer	Actuator	14.5x14	14.5x14	150	164.70	0.0852	14		4	365	25	56	5,125	DSV311B
Pipeline	Bi-directional skid	30	DSV311	Shafer	Actuator	14.5x14	14.5x14	150	164.70	0.0852	14		4	365	25	56	5,125	DSV311A
Pipeline	Bi-directional skid	30	DSV301	Shafer	Actuator	14.5x14	14.5x14	150	164.70	0.0852	14		4	365	25	56	5,125	DSV301A
Pipeline	Bi-directional skid	30	TBD	Shafer	Actuator	14.5x14	14.5x14	150	164.70	0.0852	14		4	365	25	56	5,125	TBD
Pipeline	Filter/Separator	24	FV301A	Shafer	Actuator	18x4.5	18x4.5	150	164.70	0.0482	8		4	365	18	32	2,897	FV301A
Pipeline	Filter/Separator	24	FV301B	Shafer	Actuator	18x4.5	18x4.5	150	164.70	0.0482	8		4	365	18	32	2,897	FV301B
Pipeline	Filter/Separator	24	FV302A	Shafer	Actuator	18x4.5	18x4.5	150	164.70	0.0482	8		4	365	18	32	2,897	FV302A
Pipeline	Filter/Separator	24	FV302B	Shafer	Actuator	18x4.5	18x4.5	150	164.70	0.0482	8		4	365	18	32	2,897	FV302B
Pipeline	Meter skid	8	FV120A	Shafer	Actuator	5x3	5x3	150	164.70	0.0064	1		4	365	5	4	387	FV120A
Pipeline	Meter skid	12	FV120B	Shafer	Actuator	9x7	9x7	150	164.70	0.0123	2		4	365	11	8	741	FV120B
Pipeline	Meter skid	12	FV120C	Shafer	Actuator	9x7	9x7	150	164.70	0.0123	2		4	365	11	8	741	FV120C
Pipeline	Meter skid	12	FV120D	Shafer	Actuator	9x7	9x7	150	164.70	0.0123	2		4	365	11	8	741	FV120D
Pipeline	Control Valve skid (SK-07)	12	PCV122B	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	PCV122B
Pipeline	Control Valve skid (SK-07)	12	FCV122B	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	FCV122B
Pipeline	Control Valve skid (SK-07)	8	[illegible]CV122 A	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	PCV122A
Pipeline	Control Valve skid (SK-07)	8	[illegible]CV122 A	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	FCV122A
Pipeline	Control Valve skid (SK-07)	10	FV123A	Bettis	Actuator	G8040	G8040	150	164.70	1.0600	175		4	365		698	63,722	FV123A
Pipeline	Control Valve skid (SK-07)	16	FV123B	Bettis	Actuator	G8040	G8040	150	164.70	1.0600	175		4	365		698	63,722	FV123B
Pipeline	Control Valve skid (SK-08)	12	[illegible]CV122 D	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	PCV122D
Pipeline	Control Valve skid (SK-08)	12	[illegible]CV122 D	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	FCV122D
Pipeline	Control Valve skid (SK-08)	12	[illegible]CV122 C	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	PCV122C
Pipeline	Control Valve skid (SK-08)	12	FCV122C	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	FCV122C
Pipeline	Control Valve skid (SK-08)	16	FV123C	Bettis	Actuator	G8040	G8040	150	164.70	1.0600	175		4	365		698	63,722	FV123C
Pipeline	Control Valve skid (SK-08)	16	FV123D	Bettis	Actuator	G8040	G8040	150	164.70	1.0600	175		4	365		698	63,722	FV123D
Pipeline	Control Valve skid (SK-09)	16	PCV122E	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	PCV122E
Pipeline	Control Valve skid (SK-09)	16	FCV122E	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	FCV122E
Pipeline	Control Valve skid (SK-09)	16	PCV122F	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	PCV122F
Pipeline	Control Valve skid (SK-09)	16	FCV122F	Becker	Actuator		QTCV-T1DB	150	164.70	0.0145	2		4	365		10	874	FCV122F
Pipeline	Control Valve skid (SK-09)	20	FV123E	Bettis	Actuator	G8040	G8040	150	164.70	1.0600	175		4	365		698	63,722	FV123E
Pipeline	Control Valve skid (SK-09)	20	FV123F	Bettis	Actuator	G8040	G8040	150	164.70	1.0600	175		4	365		698	63,722	FV123F

NOTES

1. Vendor literature to support the estimation of gas consumption and event duration. A 90° stroke is sufficient to open or close a valve.
2. For regulators that are the spring and diaphragm type, gas venting would only occur if spring tears diaphragm.
3. The frequency of events is based on a conservative overestimation.
4. Assuming that valves with 20" and 24" diameters have typical Shafer model number 18x4.5 operator

TABLE C-6
Gas Chromatograph - Project

Description			Chromatog	Initial Conditions			Final Conditions			Event		Gas Release Data		
Location Description			Vendor	Volume	Press.	Temp.	Press.	Temp.	Volume	Frequency		Hourly	Annual	Release
General	Location	ID		(ft3)	(psig)	(°F)	(psig)	(°F)	(scf)	(hr^{-1})	(yr^{-1})	(scf/hr)	(scf/yr)	Point
Pipeline	Gas Chromatograph Building	TBD	ABB	0.0092	1,200	50	0	68	1	4	35,040	4	34,261	GC Building

NOTES

1. Gas Chromatograph emissions are based on vendor provided total vent volume (includes purge and sample release).

TABLE C-7
Natural Gas
Physical Property Estimations

Component				Molecular Weight M_i $(lb/lb\text{-}mol)_i$	Vapor Density ρ_i $(lb/scf)_i$	Stream		
Name (i)	Formula	Type	HAP			Mole Fraction f_{n-i} $(lb\text{-}mol_i/lb\text{-}mol_T)$	Weight Fraction f_{m-i} $(f_{n-i}M_i)/\sum(f_{n-i}M_i)$ (lb_i/lb_T)	Volume Fraction f_{v-i} $f_{m-i}(\rho_i/\rho_T)$ (scf_i/scf_T)
Nitrogen	N2			28.013	0.0727	0.700%	1.106%	0.700%
Carbon Dioxide	CO2	GHG		44.010	0.1143	1.325%	3.290%	1.325%
Methane	C01H04	GHG		16.042	0.0417	93.569%	84.699%	93.569%
Ethane	C02H06			30.069	0.0781	2.807%	4.763%	2.807%
Propane	C03H08	VOC		44.096	0.1145	0.669%	1.665%	0.669%
Butane (i-)	C04H10	VOC		58.122	0.1509	0.143%	0.469%	0.143%
Butane (n-)	C04H10	VOC		58.122	0.1509	0.186%	0.610%	0.186%
Pentane (i-)	C05H12	VOC		72.149	0.1873	0.078%	0.318%	0.078%
Pentane (n-)	C05H12	VOC		72.149	0.1873	0.060%	0.244%	0.060%
Dimethylbutane (2,2-)	C06H14	VOC		86.175	0.2238	0.004%	0.019%	0.004%
Dimethylbutane (2,3-)	C06H14	VOC		86.175	0.2238	0.003%	0.015%	0.003%
Cyclopentane	C05H10	VOC		70.133	0.1821	0.004%	0.016%	0.004%
Methylpentane (2-)	C06H14	VOC		86.175	0.2238	0.022%	0.107%	0.022%
Methylpentane (3-)	C06H14	VOC		86.175	0.2238	0.013%	0.063%	0.013%
Hexane (n-)	C06H14	VOC	X	86.175	0.2238	0.025%	0.122%	0.025%
Dimethylpentane (2,2-)	C07H16	VOC		100.202	0.2602	0.001%	0.006%	0.001%
Methylcyclopentane	C06H12	VOC		84.159	0.2185	0.007%	0.033%	0.007%
Dimethylpentane (2,4-)	C07H16	VOC		100.202	0.2602	0.002%	0.011%	0.002%
Benzene	C06H06	VOC	X	78.112	0.2028	0.017%	0.075%	0.017%
Cyclohexane	C06H12	VOC		84.159	0.2185	0.008%	0.038%	0.008%
Methylhexane (2-)	C07H16	VOC		100.202	0.2602	0.010%	0.057%	0.010%
Dimethylpentane (2,3-)	C07H16	VOC		100.202	0.2602	0.003%	0.017%	0.003%
Methylhexane (3-)	C07H16	VOC		100.202	0.2602	0.010%	0.057%	0.010%
Dimethylcyclopentane (1,c-3-)	C07H14	VOC		98.186	0.2549	0.001%	0.006%	0.001%
Ethylpentane (3-)	C07H16	VOC		100.202	0.2602	0.000%	0.000%	0.000%
Dimethylcyclopentane (1,t-2-)	C07H14	VOC		98.186	0.2549	0.001%	0.006%	0.001%
Trimethylpentane (2,2,4-)	C08H18	VOC	X	114.229	0.2966	0.000%	0.000%	0.000%
Heptane (n-)	C07H16	VOC		100.202	0.2602	0.018%	0.102%	0.018%
Methylcyclohexane	C07H14	VOC		98.186	0.2549	0.013%	0.072%	0.013%
Trimethylcyclopentane (1,1,3-)	C08H16	VOC		112.213	0.2914	0.001%	0.006%	0.001%
Dimethylhexane (2,2-)	C08H18	VOC		114.229	0.2966	0.000%	0.000%	0.000%
Dimethylcyclohexane (1,c-2-)	C08H16	VOC		112.213	0.2914	0.002%	0.013%	0.002%
Dimethylhexane (2,5-)	C08H18	VOC		114.229	0.2966	0.003%	0.019%	0.003%
Dimethylhexane (2,4-)	C08H18	VOC		114.229	0.2966	0.000%	0.000%	0.000%
Ethylcyclopentane	C07H14	VOC		98.186	0.2549	0.001%	0.006%	0.001%
Toluene	C07H08	VOC	X	92.138	0.2392	0.018%	0.094%	0.018%
Trimethylcyclopentane (1,1,2-)	C08H16	VOC		112.213	0.2914	0.018%	0.114%	0.018%
Methylheptane (2-)	C08H18	VOC		114.229	0.2966	0.012%	0.077%	0.012%
Methylheptane (3-)	C08H18	VOC		114.229	0.2966	0.003%	0.019%	0.003%
Dimethylcyclohexane (1,c-3-)	C08H16	VOC		112.213	0.2914	0.001%	0.006%	0.001%
Trimethylcyclopentane (1,c-2,t-4-)	C08H16	VOC		112.213	0.2914	0.001%	0.006%	0.001%
Octane (n-)	C08H18	VOC		114.229	0.2966	0.033%	0.213%	0.033%
Dimethylcyclohexane (1,t-2-)	C08H16	VOC		112.213	0.2914	0.002%	0.013%	0.002%
Unknown C9 Aromatic	C09H12	VOC		120.192	0.3121	0.003%	0.020%	0.003%
Dimethylcyclohexane (1,t-3-)	C08H16	VOC		112.213	0.2914	0.003%	0.019%	0.003%
Dimethylcyclohexane (1,c-4-)	C08H16	VOC		112.213	0.2914	0.003%	0.019%	0.003%
Trimethylcyclopentane (1,c-2,c-3-)	C08H16	VOC		112.213	0.2914	0.003%	0.019%	0.003%
Dimethylheptane (2,2-)	C09H20	VOC		128.255	0.3330	0.010%	0.072%	0.010%
Dimethylheptane (2,4-)	C09H20	VOC		128.255	0.3330	0.001%	0.007%	0.001%
Ethylcyclopentane (1-methyl-c-3-)	C08H16	VOC		112.213	0.2914	0.002%	0.013%	0.002%

TABLE C-7
Natural Gas
Physical Property Estimations

Component				Molecular Weight M_i $(lb/lb\text{-}mol)_i$	Vapor Density ρ_i $(lb/scf)_i$	Stream		
Name (i)	Formula	Type	HAP			Mole Fraction f_{n-i} $(lb\text{-}mol_i/lb\text{-}mol_T)$	Weight Fraction f_{m-i} $(f_{n-i}M_i)/\Sigma(f_{n-i}M_i)$ (lb_i/lb_T)	Volume Fraction f_{v-i} $f_{m-i}(\rho_i/\rho_T)$ (scf_i/scf_T)
Ethylcyclohexane	C08H16	VOC		112.213	0.2914	0.002%	0.013%	0.002%
Dimethylheptane (2,5-)	C09H20	VOC		128.255	0.3330	0.000%	0.000%	0.000%
Dimethylheptane (3,5-)	C09H20	VOC		128.255	0.3330	0.000%	0.000%	0.000%
Ethylbenzene	C08H10	VOC	X	106.165	0.2757	0.005%	0.030%	0.005%
Trimethylheptane (2,3,4-)	C10H22	VOC		142.282	0.3694	0.000%	0.000%	0.000%
Trimethylcyclohexane (1,t-2,t-4-)	C09H18	VOC		126.239	0.3278	0.013%	0.093%	0.013%
Dimethylheptane (2,3-)	C09H20	VOC		128.255	0.3330	0.004%	0.029%	0.004%
Xylene (m-)	C08H10	VOC	X	106.165	0.2757	0.014%	0.084%	0.014%
Xylene (p-)	C08H10	VOC	X	106.165	0.2757	0.014%	0.084%	0.014%
Dimethylheptane (3,4-)	C09H20	VOC		128.255	0.3330	0.000%	0.000%	0.000%
Methyloctane (3-)	C09H20	VOC		128.255	0.3330	0.016%	0.116%	0.016%
Trimethylcyclohexane (1,t-2,c-3-)	C09H18	VOC		126.239	0.3278	0.001%	0.007%	0.001%
Xylene (o-)	C08H10	VOC	X	106.165	0.2757	0.006%	0.036%	0.006%
Trimethylcyclohexane (1,1,2-)	C09H18	VOC		126.239	0.3278	0.001%	0.007%	0.001%
Trimethylcyclohexane (1,t-2,c-4-)	C09H18	VOC		126.239	0.3278	0.003%	0.021%	0.003%
Trimethylcyclohexane (1,c-2,c-4-)	C09H18	VOC		126.239	0.3278	0.001%	0.007%	0.001%
Nonane (n-)	C09H20	VOC		128.255	0.3330	0.049%	0.355%	0.049%
Unknown C9 Naphthene	C09H18	VOC		126.239	0.3278	0.001%	0.007%	0.001%
Trimethylheptane (2,5,5-)	C10H22	VOC		142.282	0.3694	0.001%	0.008%	0.001%
Unknown C9 Paraffin	C09H20	VOC		128.255	0.3330	0.004%	0.029%	0.004%
Trimethylcyclohexane (1,c-2,t-3-)	C09H18	VOC		126.239	0.3278	0.006%	0.043%	0.006%
Trimethylcyclohexane (1,c-2,c-3-)	C09H18	VOC		126.239	0.3278	0.001%	0.007%	0.001%
Propylbenzene (i-)	C09H12	VOC		120.192	0.3121	0.010%	0.068%	0.010%
Propylcyclopentane (i-)	C08H16	VOC		112.213	0.2914	0.001%	0.006%	0.001%
Propylcyclopentane (n-)	C08H16	VOC		112.213	0.2914	0.001%	0.006%	0.001%
Unknown C10 Naphthene	C10H20	VOC		140.266	0.3642	0.001%	0.008%	0.001%
Unknown C10 Paraffin	C10H22	VOC		142.282	0.3694	0.002%	0.016%	0.002%
Propylbenzene (n-)	C09H12	VOC		120.192	0.3121	0.006%	0.041%	0.006%
Methylnonane (2-)	C10H22	VOC		142.282	0.3694	0.005%	0.040%	0.005%
Methylnonane (3-)	C10H22	VOC		142.282	0.3694	0.003%	0.024%	0.003%
Trimethylbenzene (1,2,4-)	C09H12	VOC		120.192	0.3121	0.003%	0.020%	0.003%
Butylbenzene (t-)	C10H14	VOC		134.218	0.3485	0.001%	0.008%	0.001%
Decane (n-)	C10H22	VOC		142.282	0.3694	0.006%	0.048%	0.006%
Natural Gas				17.722	0.0460	100.000%	100.000%	100.000%
TOC (Total)				17.293	0.0449	97.975%	95.603%	97.975%
VOC (Total)				68.065	0.1767	1.599%	6.141%	1.599%
HAP (Total)				93.750	0.2434	0.099%	0.524%	0.099%
Xylenes				106.165	0.2757	0.034%	0.204%	0.034%

NOTES

1. Vapor density is estimated using the ideal gas law (PV = nRT = (m/M)RT OR ρ = RPT/M), where R = 10.73164 (psia ft^3)/(lb-mol °R).
2. Standard conditions 68 °F
14.696 psia
3. Mole percentages are based on analysis by SPL of samples taken at 10:00 AM on November 3, 2005 at Meter Station (MS) JO-11S.
MS JO-11S is a TET facility that is located in Joquin, TX. MS JO-11S handles gas with a higher VOC content as it's closer to producers.

TABLE D-1a
Heaters
Natural Gas Combustion
Maximum Emission Estimates

Station ID	SUWA_HIG-01				
Agency ID	HIG-01				
Make	Bruest				
Model	SR-8				
Burner	N/A				
Fuel	Natural Gas				
Fuel Higher Heating Value (HHV)	1,020 BTU/scf			1,020 BTU/scf	
Heat Output at HHV	0.0018 MMBTU/hr			0.0018 MMBTU/hr	
Thermal Efficiency	70%			70%	
Operating Hours	8,760 hrs/yr				
Fuel Consumption	2.45 scfh			2.57 scfh	
	0.021 MMscf/yr				
Heat Input at HHV	0.0025 MMBTU/hr			0.0026 MMBTU/hr	
	22 MMBTU/yr	Avg. Hourly	Max. Annual		Max. Hourly
NO_X	73.82 lb/MMscf	0.0002 lb/hr	0.0008 tpy	73.8239 lb/MMscf	0.0002 lb/hr
CO	1,169.14 lb/MMscf	0.0029 lb/hr	0.0126 tpy	1,169.1403 lb/MMscf	0.0030 lb/hr
SO_2	0.60 lb/MMscf	0.0000 lb/hr	0.0000 tpy	0.6000 lb/MMscf	0.0000 lb/hr
$PM_{10/2.5}$	7.60 lb/MMscf	0.0000 lb/hr	0.0001 tpy	7.6000 lb/MMscf	0.0000 lb/hr
$CO_{2\text{-e}}$	121,999.15 lb/MMscf	0.2990 lb/hr	1.3097 tpy	121,999.15 lb/MMscf	0.3140 lb/hr
CO_2	119,926.98 lb/MMscf	0.2939 lb/hr	1.2875 tpy	119,926.98 lb/MMscf	0.3086 lb/hr
N_2O	0.23 lb/MMscf	0.0000 lb/hr	0.0000 tpy	0.23 lb/MMscf	0.0000 lb/hr
TOC (Total)	383.52 lb/MMscf	0.0009 lb/hr	0.0041 tpy	383.52 lb/MMscf	0.0010 lb/hr
Methane	80.19 lb/MMscf	0.0002 lb/hr	0.0009 tpy	80.19 lb/MMscf	0.0002 lb/hr
Ethane	108.08 lb/MMscf	0.0003 lb/hr	0.0012 tpy	108.08 lb/MMscf	0.0003 lb/hr
VOC (Total)	191.76 lb/MMscf	0.0005 lb/hr	0.0021 tpy	191.76 lb/MMscf	0.0005 lb/hr
HAP (Total)	65.82 lb/MMscf	0.0002 lb/hr	0.0007 tpy	65.82 lb/MMscf	0.0002 lb/hr
Acetaldehyde					
Acrolein					
Benzene	7.32E-02 lb/MMscf	1.79E-07 lb/hr	7.86E-07 tpy	7.32E-02 lb/MMscf	1.88E-07 lb/hr
Butadiene (1,3-)					
Carbon Tetrachloride					
Chlorobenzene					
Chloroethane					
Chloroform					
Dichloroethane (1,2-)					
Dichloropropane (1,2-)					
Dichloropropene (1,3-)					
Ethylbenzene					
Ethylene Dibromide					
Formaldehyde	2.61E+00 lb/MMscf	6.41E-06 lb/hr	2.81E-05 tpy	2.61E+00 lb/MMscf	6.73E-06 lb/hr
Hexane (n-)	6.28E+01 lb/MMscf	1.54E-04 lb/hr	6.74E-04 tpy	6.28E+01 lb/MMscf	1.62E-04 lb/hr
Methanol					
Methylene Chloride					
Methylnaphthalene (2-)	8.37E-04 lb/MMscf	2.05E-09 lb/hr	8.98E-09 tpy	8.37E-04 lb/MMscf	2.15E-09 lb/hr
Naphthalene	2.13E-02 lb/MMscf	5.21E-08 lb/hr	2.28E-07 tpy	2.13E-02 lb/MMscf	5.47E-08 lb/hr
PAH	3.08E-03 lb/MMscf	7.54E-09 lb/hr	3.30E-08 tpy	3.08E-03 lb/MMscf	7.91E-09 lb/hr
Phenol					
Propylene Oxide					
Styrene					
Tetrachloroethane (1,1,2,2-)					
Toluene	1.19E-01 lb/MMscf	2.91E-07 lb/hr	1.27E-06 tpy	1.19E-01 lb/MMscf	3.05E-07 lb/hr
Trichloroethane (1,1,2-)					
Trimethylpentane (2,2,4-)					
Vinyl Chloride					
Xylenes					

NOTES

1. Fuel higher heating value selected to correspond to AP-42 emissions factors.
2. Manufacturer provided data on rated capacity and fuel consumption (model SR-8 = model 1800).
3. Maximum output is assumed to be 105% of rated capacity.
4. Manufacturer provided NOx; CO; and HC emission test results (60 ppmvd at 3% O2; 1,560 ppmvd at 3% O2; and 470 ppmvd at 3% O2, respectively).

Based on data in the North American Combustion Handbook published by North American, Mfg., Co., the NO_X, CO and HC emission conversion factors are: 0.001206 (lb/MMBTU)/ppmvd at 3% O2; 0.000735(lb/MMBTU)/ppmvd at 3% O2; and 0.000400 (lb/MMBTU)/ppmvd at 3% O2, respectively.

5. CO2 emission factor based on 40 CFR 98, Subpart C, Table C-2 (1,026 BTU/scf; 53.02 kg/MMBTU ==> 119,926.98 lb/MMscf).
6. N2O emission factor based on 40 CFR 98, Subpart C, Table C-2 (1,026 BTU/scf; 0.0001 kg/MMBTU ==> 0.23 lb/MMscf).
7. Remaining emission factors were extracted from Section 1 of AP-42 (date 7/98): Tables 1.4-1, 1.4-2, 1.4-3, and 1.4-4.

Methane, Ethane, VOC, HAP, and Speciate VOC AP-42 emission factors were scaled based on the vendor data for HC: $EF_{Scaled} = (EF_{AP42})(EF_{HC}/EF_{THC\text{-}AP42})$

TABLE E-1
Flash Analysis
Summary of Laboratory Analysis

	FEED Pressurized Liquid	VAPOR Flash Gas	LIQUID Residual Liquid
Pressure	575.000 psig	0.034 psig	0.034 psig
	589.696 psia	14.730 psia	14.730 psia
Temperature	72 °F	60 °F	60 °F
API Gravity at 60°F	73.960 n.d.	788.526 n.d.	61.227 n.d.
Specific Gravity at 60°F	0.6887 n.d. (water)	0.1538 n.d. (water)	0.7342 n.d. (water)
	3.3880 n.d. (air)	0.9301 n.d. (air)	4.4320 n.d. (air)
Molecular Weight	98.125 lb/lb-mol	26.938 lb/lb-mol	128.362 lb/lb-mol
Density at 60°F and 14.730 psia	5.747 lb/gal	1.283 lb/gal	6.126 lb/gal
	0.2593 lb/ft^3	0.0712 lb/ft^3	0.3392 lb/ft^3
	22.1622 ft^3/gal	18.0282 ft^3/gal	18.0610 ft^3/gal
	930.8120 ft^3/bbl	757.1853 ft^3/bbl	758.5600 ft^3/bbl
	378.4123 ft^3/lb-mol	378.4123 ft^3/lb-mol	378.4123 ft^3/lb-mol
	17.0747 gal/lb-mol	20.9900 gal/lb-mol	20.9520 gal/lb-mol
	2.4598 lb-mol/bbl	2.0010 lb-mol/bbl	2.0046 lb-mol/bbl
Density at 68°F and 14.696 psia	947.3299 scf/bbl	770.6220 scf/bbl	772.0211 scf/bbl
	385.1275 scf/lb-mol	385.1275 scf/lb-mol	385.1275 scf/lb-mol
	2.4598 lb-mol/bbl	2.0010 lb-mol/bbl	2.0046 lb-mol/bbl
Vapor to Liquid Mole Ratio (V/L)	0.4249 n.d. (lb-mol_{VAPOR}/lb-mol_{LIQUID})		
Mole Balance	1.0000 bbl	0.3666 bbl	0.8612 bbl
	2.4598 lb-mol	0.7335 lb-mol	1.7263 lb-mol
	947.3299 scf	282.4903 scf	664.8396 scf
Flash Factor (FF)	328.0318 scf_{VAPOR}/bbl_{LIQUID}		

NOTES

1. Sample Data:	Location:	Atlanta, TX	
	Date:	04/15/09	
	Time:	Not Recorded	
2. Reference Conditions:		SPL	Standard
	T =	60 °F	68 °F
	P =	14.730 psia	14.696 psia
	Water	8.344 lb/gal	8.338 lb/gal
	Air	0.0765 lb/ft^3	0.0752 lb/ft^3

3. V + L = F => F = (1 + V/L)L {Overall Mole Balance}.

TABLE E-2
Flash Analysis
Extrapolation of Specie Mole Percentages

Component						Liquid Dump Flash Data				
						Input			Output	
						Liquid	**Scaled**	***Calculated***	**Vapor**	**Liquid**
Name (i)	GC Postition	SPL Class	Formula	Type	HAP	z_i ($mol_{i\text{-}F}/mol_F$)		z_i ($mol_{i\text{-}F}/mol_F$)	y_i ($mol_{i\text{-}V}/mol_V$)	x_i ($mol_{i\text{-}L}/mol_L$)
Nitrogen	1		N2			0.034%	0.034%	0.030%	0.101%	0.000%
Carbon Dioxide	3		CO2	GHG		0.968%	0.968%	0.970%	3.163%	0.038%
Methane	2		C01H04	GHG		20.922%	20.922%	20.921%	69.445%	0.303%
Ethane	4		C02H06			3.391%	3.391%	3.390%	10.467%	0.383%
Propane	5		C03H08	VOC		2.183%	2.183%	2.180%	5.339%	0.838%
Butane (i-)	6		C04H10	VOC		1.232%	1.232%	1.230%	2.126%	0.849%
Butane (n-)	7		C04H10	VOC		1.721%	1.721%	1.720%	2.495%	1.391%
Pentane (i-)	8		C05H12	VOC		2.354%	2.354%	2.350%	1.895%	2.543%
Pentane (n-)	9		C05H12	VOC		1.622%	1.622%	1.620%	1.056%	1.859%
Dimethylbutane (2,2-)	10	Hexanes	C06H14	VOC		0.174%	0.174%	0.174%	0.050%	0.227%
Dimethylbutane (2,3-)	11	Hexanes	C06H14	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Cyclopentane	12	Hexanes	C05H10	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Methylpentane (2-)	13	Hexanes	C06H14	VOC		1.218%	1.218%	1.218%	0.352%	1.586%
Methylpentane (3-)	14	Hexanes	C06H14	VOC		0.912%	0.912%	0.912%	0.264%	1.187%
Hexane (n-)	15	Hexanes	C06H14	VOC	X	1.937%	1.937%	1.937%	0.561%	2.522%
Dimethylpentane (2,2-)	16	Heptanes	C07H16	VOC		0.311%	0.311%	0.311%	0.032%	0.430%
Methylcyclopentane	17	Heptanes	C06H12	VOC		1.134%	1.134%	1.134%	0.116%	1.566%
Dimethylpentane (2,4-)	18	Heptanes	C07H16	VOC		0.128%	0.128%	0.128%	0.013%	0.177%
Trimethylbutane (2,2,3-)	19	Heptanes	C07H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Benzene	20	Heptanes	C06H06	VOC	X	1.713%	1.713%	1.713%	0.175%	2.366%
Dimethylpentane (3,3-)	21	Heptanes	C07H16	VOC		0.221%	0.221%	0.221%	0.023%	0.305%
Cyclohexane	22	Heptanes	C06H12	VOC		1.106%	1.106%	1.106%	0.113%	1.528%
Methylhexane (2-)	23	Heptanes	C07H16	VOC		2.292%	2.292%	2.292%	0.235%	3.166%
Dimethylpentane (2,3-)	24	Heptanes	C07H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Dimethylcyclopentane (1,1-)	25	Heptanes	C07H14	VOC		0.603%	0.603%	0.603%	0.062%	0.833%
Methylhexane (3-)	26	Heptanes	C07H16	VOC		2.379%	2.379%	2.379%	0.244%	3.286%
Dimethylcyclopentane (1,t-3-)	27	Heptanes	C07H14	VOC		0.163%	0.163%	0.163%	0.017%	0.225%
Dimethylcyclopentane (1,c-3-)	28	Heptanes	C07H14	VOC		0.266%	0.266%	0.266%	0.027%	0.367%
Ethylpentane (3-)	29	Heptanes	C07H16	VOC		0.029%	0.029%	0.029%	0.003%	0.040%
Dimethylcyclopentane (1,t-2-)	30	Heptanes	C07H14	VOC		0.222%	0.222%	0.222%	0.023%	0.307%
Trimethylpentane (2,2,4-)	31	Heptanes	C08H18	VOC	X	0.021%	0.021%	0.021%	0.002%	0.029%
Heptane (n-)	32	Heptanes	C07H16	VOC		3.742%	3.742%	3.742%	0.383%	5.169%
Methylcyclohexane	33	Octanes	C07H14	VOC		3.301%	3.301%	3.301%	0.136%	4.646%
Trimethylcyclopentane (1,1,3-)	34	Octanes	C08H16	VOC		0.225%	0.225%	0.225%	0.009%	0.317%
Dimethylhexane (2,2-)	35	Octanes	C08H18	VOC		0.095%	0.095%	0.095%	0.004%	0.134%
Dimethylcyclopentane (1,c-2-)	36	Octanes	C07H14	VOC		0.848%	0.848%	0.848%	0.035%	1.193%
Dimethylhexane (2,5-)	37	Octanes	C08H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Dimethylhexane (2,4-)	38	Octanes	C08H18	VOC		0.143%	0.143%	0.143%	0.006%	0.201%
Ethylcyclopentane	39	Octanes	C07H14	VOC		0.464%	0.464%	0.464%	0.019%	0.653%
Trimethylpentane (2,2,3-)	40	Octanes	C08H18	VOC		0.028%	0.028%	0.028%	0.001%	0.039%
Trimethylcyclopentane (1,t-2,c-4-)	41	Octanes	C08H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Dimethylhexane (3,3-)	42	Octanes	C08H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Trimethylcyclopentane (1,t-2,c-3-)	43	Octanes	C08H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Trimethylpentane (2,3,4-)	44	Octanes	C08H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Dimethylhexane (2,3-)	45	Octanes	C08H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Toluene	46	Octanes	C07H08	VOC	X	4.444%	4.444%	4.444%	0.183%	6.255%
Trimethylcyclopentane (1,1,2-)	47	Octanes	C08H16	VOC		0.371%	0.371%	0.371%	0.015%	0.522%
Dimethylhexane (3,4-)	48	Octanes	C08H18	VOC		3.505%	3.505%	3.505%	0.144%	4.933%
Methylheptane (2-)	49	Octanes	C08H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Methylheptane (4-)	50	Octanes	C08H18	VOC		2.896%	2.896%	2.896%	0.119%	4.076%
Dimethylhexane (3,4-)	51	Octanes	C08H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Methylheptane (3-)	52	Octanes	C08H18	VOC		0.416%	0.416%	0.416%	0.017%	0.585%
Ethylhexane (3-)	53	Octanes	C08H18	VOC		0.111%	0.111%	0.111%	0.005%	0.156%
Trimethylcyclopentane (1,c-2,t-4-)	54	Octanes	C08H16	VOC		0.028%	0.028%	0.028%	0.001%	0.039%
Dimethylcyclohexane (1,c-3-)	55	Octanes	C08H16	VOC		0.170%	0.170%	0.170%	0.007%	0.239%
Trimethylcyclopentane (1,c-2,t-3-)	56	Octanes	C08H16	VOC		0.170%	0.170%	0.170%	0.007%	0.239%
Dimethylcyclohexane (1,t-4-)	57	Octanes	C08H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Trimethylhexane (2,2,5-)	58	Octanes	C09H20	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Dimethylcyclohexane (1,1-)	59	Octanes	C08H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-3-)	60	Octanes	C08H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Ethylcyclopentane (1-methyl-c-3-)	61	Octanes	C08H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-2-)	62	Octanes	C08H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Trimethylhexane (2,2,4-)	63	Octanes	C09H20	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-1-)	64	Octanes	C08H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Cycloheptane	65	Octanes	C07H14	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Octane (n-)	66	Octanes	C08H18	VOC		4.372%	4.372%	4.372%	0.180%	6.153%
Trimethylhexane (2,4,4-)	67	Nonanes	C09H20	VOC		0.190%	0.190%	0.190%	0.003%	0.269%
Tetramethylpentane (2,2,4,4-)	68	Nonanes	C09H20	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Dimethylcyclohexane (1,t-3-)	69	Nonanes	C08H16	VOC		0.053%	0.053%	0.053%	0.001%	0.075%
Dimethylcyclohexane (1,c-4-)	70	Nonanes	C08H16	VOC		0.053%	0.053%	0.053%	0.001%	0.075%
Trimethylcyclopentane (1,c-2,c-3-)	71	Nonanes	C08H16	VOC		0.053%	0.053%	0.053%	0.001%	0.075%
Propylcyclopentane (i-)	72	Nonanes	C08H16	VOC		0.348%	0.348%	0.348%	0.006%	0.493%
Trimethylhexane (2,3,5-)	73	Nonanes	C09H20	VOC		0.006%	0.006%	0.006%	0.000%	0.009%
Dimethylheptane (2,2-)	74	Nonanes	C09H20	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Dimethylheptane (2,4-)	75	Nonanes	C09H20	VOC		0.158%	0.158%	0.158%	0.003%	0.224%
Methylcyclopentane (1-ethyl-c-2-)	76	Nonanes	C08H16	VOC		0.181%	0.181%	0.181%	0.003%	0.257%
Trimethylhexane (2,2,3-)	77	Nonanes	C09H20	VOC		0.000%	0.000%	0.000%	0.000%	0.000%

TABLE E-2
Flash Analysis
Extrapolation of Specie Mole Percentages

Component						Liquid Dump Flash Data				
						Input			Output	
						Liquid	**Scaled**	***Calculated***	**Vapor**	**Liquid**
Name (i)	GC Postition	SPL Class	Formula	Type	HAP	z_i ($mol_{i\text{-}F}/mol_F$)		z_i ($mol_{i\text{-}F}/mol_F$)	y_i ($mol_{i\text{-}V}/mol_V$)	x_i ($mol_{i\text{-}L}/mol_L$)
Dimethylcyclohexane (1,c-2-)	78	Nonanes	C08H16	VOC		0.510%	0.510%	0.510%	0.009%	0.723%
Dimethylheptane (2,6-)	79	Nonanes	C09H20	VOC		0.112%	0.112%	0.112%	0.002%	0.159%
Propylcyclopentane (n-)	80	Nonanes	C08H16	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Trimethylcyclohexane (1,c-3,c-5-)	81	Nonanes	C09H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Ethylcyclohexane	82	Nonanes	C08H16	VOC		1.365%	1.365%	1.365%	0.023%	1.935%
Dimethylheptane (2,5-)	83	Nonanes	C09H20	VOC		0.067%	0.067%	0.067%	0.001%	0.095%
Dimethylheptane (3,5-)	84	Nonanes	C09H20	VOC		0.067%	0.067%	0.067%	0.001%	0.095%
Trimethylcyclohexane (1,1,3-)	85	Nonanes	C09H18	VOC		0.077%	0.077%	0.077%	0.001%	0.109%
Trimethylhexane (2,3,3-)	86	Nonanes	C09H20	VOC		0.038%	0.038%	0.038%	0.001%	0.054%
Dimethylheptane (3,3-)	87	Nonanes	C09H20	VOC		0.038%	0.038%	0.038%	0.001%	0.054%
Trimethylcyclohexane (1,1,4-)	88	Nonanes	C09H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Tetramethylpentane (2,2,3,3-)	89	Nonanes	C09H20	VOC		0.261%	0.261%	0.261%	0.004%	0.370%
Ethylbenzene	90	Nonanes	C08H10	VOC	X	0.406%	0.406%	0.406%	0.007%	0.576%
Trimethylhexane (2,3,4-)	91	Nonanes	C09H20	VOC		0.007%	0.007%	0.007%	0.000%	0.010%
Trimethylcyclohexane (1,t-2,t-4-)	92	Nonanes	C09H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Dimethylheptane (2,3-)	93	Nonanes	C09H20	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Trimethylcyclohexane (1,c-3,t-5-)	94	Nonanes	C09H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Xylene (m-)	95	Nonanes	C08H10	VOC	X	2.462%	2.462%	2.462%	0.042%	3.490%
Xylene (p-)	96	Nonanes	C08H10	VOC	X	2.462%	2.462%	2.462%	0.042%	3.490%
Dimethylheptane (3,4-)	97	Nonanes	C09H20	VOC		0.092%	0.092%	0.092%	0.002%	0.130%
Methyloctane (2-)	98	Nonanes	C09H20	VOC		0.782%	0.782%	0.782%	0.013%	1.109%
Methyloctane (4-)	99	Nonanes	C09H20	VOC		0.782%	0.782%	0.782%	0.013%	1.109%
Dimethylheptane (3,4-)	100	Nonanes	C09H20	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Methyloctane (3-)	101	Nonanes	C09H20	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Butylcyclopentane (i-)	102	Nonanes	C09H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Trimethylcyclohexane (1,t-2,c-3-)	103	Nonanes	C09H18	VOC		0.231%	0.231%	0.231%	0.004%	0.327%
Trimethylcyclohexane (1,t-2,c-4-)	104	Nonanes	C09H18	VOC		0.231%	0.231%	0.231%	0.004%	0.327%
Xylene (o-)	105	Nonanes	C08H10	VOC	X	0.547%	0.547%	0.547%	0.009%	0.775%
Trimethylcyclohexane (1,1,2-)	106	Nonanes	C09H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Trimethylcyclohexane (1,c-2,t-4-)	107	Nonanes	C09H18	VOC		0.200%	0.200%	0.200%	0.003%	0.284%
Trimethylcyclohexane (1,c-2,c-4-)	108	Nonanes	C09H18	VOC		0.000%	0.000%	0.000%	0.000%	0.000%
Nonane (n-)	109	Nonanes	C09H20	VOC		2.884%	2.884%	2.884%	0.050%	4.088%
Unknowns	110	Decanes+	C10+	VOC		10.753%	10.753%	10.753%	0.079%	15.288%
TOTAL						100.001%	100.000%	99.984%	100.001%	99.976%
TOC (Total)						98.999%	98.998%	98.984%	96.737%	99.938%
VOC (Total)						74.686%	74.685%	74.673%	16.825%	99.252%
Hexanes						4.241%	4.240%	4.241%	1.227%	5.521%
Heptanes						14.330%	14.310%	14.330%	1.468%	19.795%
Octanes						21.587%	21.610%	21.587%	0.888%	30.382%
Nonanes						14.663%	14.660%	14.663%	0.252%	20.786%
Decanes+						10.753%	10.770%	10.753%	0.079%	15.288%
HAP (Total)						13.992%	13.992%	13.992%	1.022%	19.503%
Xylenes						1.209%	1.209%	1.209%	0.021%	1.714%

NOTES

1. Sample Data: Location: Atlanta, TX; Date: 04/15/09; Time: Not Recorded

Dimethyloctane (2,3-)

2. $v_i + l_i = f_i$; $y_i = v_i/V$; $x_i = l_i/L$; $z_i = f_i/F$ => $y_iV + x_iL = z_iF$ => $y_i(V/L)L + x_iL = z_i(1 + V/L)L$ => $z_i = [y_i(V/L) + x_i]/[1 + (V/L)]$ {Mole Balance}.

3. V/L = 0.4249 1 + V/L = 1.4249

4. z_i is refined to the same number if significant digits as y_i and x_i using the component mole balance and laboratory results for V/L.

5. z_i is scale using the hydrocarbon (e.g., hexanes+) z_i percentage in the flash analysis results, with the exception of HAP species.

6. $[y_i ; x_i]$ mole percent for species of hydrocarbons is estimated using scaled lab mole percent results for z_i and $[y ; x]_{HC}$ for the hydrocarbon.

(assumes v_i/l_i is same for all hydrocarbon species)

$(v/l)_{hexanes}$ = 0.2219
$y_{hexanes}$ = 1.227% $x_{hexanes}$ = 5.520% $z_{hexanes}$ = 4.240%
$y_i = z_i(y/z)_{hexanes}$ = 0.2894 z_i
$x_i = z_i(x/z)_{hexanes}$ = 1.3019 z_i

$(v/l)_{heptanes}$ = 0.0740
$y_{heptanes}$ = 1.466% $x_{heptanes}$ = 19.767% $z_{heptanes}$ = 14.310%
$y_i = z_i(y/z)_{heptanes}$ = 0.1024 z_i
$x_i = z_i(x/z)_{heptanes}$ = 1.3814 z_i

$(v/l)_{octanes}$ = 0.0292
$y_{octanes}$ = 0.889% $x_{octanes}$ = 30.414% $z_{octanes}$ = 21.610%
$y_i = z_i(y/z)_{octanes}$ = 0.0411 z_i
$x_i = z_i(x/z)_{octanes}$ = 1.4074 z_i

$(v/l)_{nonanes}$ = 0.0121
$y_{nonanes}$ = 0.252% $x_{nonanes}$ = 20.782% $z_{nonanes}$ = 14.660%
$y_i = z_i(y/z)_{nonanes}$ = 0.0172 z_i
$x_i = z_i(x/z)_{nonanes}$ = 1.4176 z_i

$(v/l)_{decanes+}$ = 0.0051
$y_{decanes+}$ = 0.079% $x_{decanes+}$ = 15.313% $z_{decanes+}$ = 10.770%
$y_i = z_i(y/z)_{decanes+}$ = 0.0073 z_i
$x_i = z_i(x/z)_{decanes+}$ = 1.4218 z_i

TABLE E-3a
Flash Analysis
Estimation of Specie Weight Percentages
Pressurized Liquid

Component			Molecular Weight $(lb/mol)_i$	Density $(lb/scf)_i$	Mole Percent (mol_i/mol_T)	Weight Percent (lb_i/lb_T)
Name (i)	Type	HAP				
Nitrogen			28.013	0.0727	0.030%	0.009%
Carbon Dioxide	GHG		44.010	0.1143	0.970%	0.435%
Methane	GHG		16.042	0.0417	20.924%	3.421%
Ethane			30.069	0.0781	3.391%	1.039%
Propane	VOC		44.096	0.1145	2.181%	0.980%
Butane (i-)	VOC		58.122	0.1509	1.230%	0.729%
Butane (n-)	VOC		58.122	0.1509	1.720%	1.019%
Pentane (i-)	VOC		72.149	0.1873	2.350%	1.728%
Pentane (n-)	VOC		72.149	0.1873	1.620%	1.191%
Dimethylbutane (2,2-)	VOC		86.175	0.2238	0.174%	0.153%
Dimethylbutane (2,3-)	VOC		86.175	0.2238	0.000%	0.000%
Cyclopentane	VOC		70.133	0.1821	0.000%	0.000%
Methylpentane (2-)	VOC		86.175	0.2238	1.218%	1.070%
Methylpentane (3-)	VOC		86.175	0.2238	0.912%	0.801%
Hexane (n-)	VOC	X	86.175	0.2238	1.937%	1.701%
Dimethylpentane (2,2-)	VOC		100.202	0.2602	0.311%	0.318%
Methylcyclopentane	VOC		84.159	0.2185	1.134%	0.973%
Dimethylpentane (2,4-)	VOC		100.202	0.2602	0.128%	0.131%
Trimethylbutane (2,2,3-)	VOC		100.202	0.2602	0.000%	0.000%
Benzene	VOC	X	78.112	0.2028	1.713%	1.364%
Dimethylpentane (3,3-)	VOC		100.202	0.2602	0.221%	0.226%
Cyclohexane	VOC		84.159	0.2185	1.106%	0.949%
Methylhexane (2-)	VOC		100.202	0.2602	2.292%	2.341%
Dimethylpentane (2,3-)	VOC		100.202	0.2602	0.000%	0.000%
Dimethylcyclopentane (1,1-)	VOC		98.186	0.2549	0.603%	0.603%
Methylhexane (3-)	VOC		100.202	0.2602	2.379%	2.430%
Dimethylcyclopentane (1,t-3-)	VOC		98.186	0.2549	0.163%	0.163%
Dimethylcyclopentane (1,c-3-)	VOC		98.186	0.2549	0.266%	0.266%
Ethylpentane (3-)	VOC		100.202	0.2602	0.029%	0.030%
Dimethylcyclopentane (1,t-2-)	VOC		98.186	0.2549	0.222%	0.222%
Trimethylpentane (2,2,4-)	VOC	X	114.229	0.2966	0.021%	0.024%
Heptane (n-)	VOC		100.202	0.2602	3.743%	3.822%
Methylcyclohexane	VOC		98.186	0.2549	3.302%	3.304%
Trimethylcyclopentane (1,1,3-)	VOC		112.213	0.2914	0.225%	0.257%
Dimethylhexane (2,2-)	VOC		114.229	0.2966	0.095%	0.111%
Dimethylcyclopentane (1,c-2-)	VOC		98.186	0.2549	0.848%	0.849%
Dimethylhexane (2,5-)	VOC		114.229	0.2966	0.000%	0.000%
Dimethylhexane (2,4-)	VOC		114.229	0.2966	0.143%	0.166%
Ethylcyclopentane	VOC		98.186	0.2549	0.464%	0.464%
Trimethylpentane (2,2,3-)	VOC		114.229	0.2966	0.028%	0.033%
Trimethylcyclopentane (1,t-2,c-4-)	VOC		112.213	0.2914	0.000%	0.000%
Dimethylhexane (3,3-)	VOC		114.229	0.2966	0.000%	0.000%
Trimethylcyclopentane (1,t-2,c-3-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylpentane (2,3,4-)	VOC		114.229	0.2966	0.000%	0.000%

TABLE E-3a
Flash Analysis
Estimation of Specie Weight Percentages
Pressurized Liquid

Component Name (i)	Type	HAP	Molecular Weight $(lb/mol)_i$	Density $(lb/scf)_i$	Mole Percent (mol_i/mol_T)	Weight Percent (lb_i/lb_T)
Dimethylhexane (2,3-)	VOC		114.229	0.2966	0.000%	0.000%
Toluene	VOC	X	92.138	0.2392	4.445%	4.174%
Trimethylcyclopentane (1,1,2-)	VOC		112.213	0.2914	0.371%	0.424%
Dimethylhexane (3,4-)	VOC		114.229	0.2966	3.506%	4.081%
Methylheptane (2-)	VOC		114.229	0.2966	0.000%	0.000%
Methylheptane (4-)	VOC		114.229	0.2966	2.896%	3.372%
Dimethylhexane (3,4-)	VOC		114.229	0.2966	0.000%	0.000%
Methylheptane (3-)	VOC		114.229	0.2966	0.416%	0.484%
Ethylhexane (3-)	VOC		114.229	0.2966	0.111%	0.129%
Trimethylcyclopentane (1,c-2,t-4-)	VOC		112.213	0.2914	0.028%	0.032%
Dimethylcyclohexane (1,c-3-)	VOC		112.213	0.2914	0.170%	0.194%
Trimethylcyclopentane (1,c-2,t-3-)	VOC		112.213	0.2914	0.170%	0.194%
Dimethylcyclohexane (1,t-4-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylhexane (2,2,5-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylcyclohexane (1,1-)	VOC		112.213	0.2914	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-3-)	VOC		112.213	0.2914	0.000%	0.000%
Ethylcyclopentane (1-methyl-c-3-)	VOC		112.213	0.2914	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-2-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylhexane (2,2,4-)	VOC		128.255	0.3330	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-1-)	VOC		112.213	0.2914	0.000%	0.000%
Cycloheptane	VOC		98.186	0.2549	0.000%	0.000%
Octane (n-)	VOC		114.229	0.2966	4.373%	5.090%
Trimethylhexane (2,4,4-)	VOC		128.255	0.3330	0.190%	0.248%
Tetramethylpentane (2,2,4,4-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylcyclohexane (1,t-3-)	VOC		112.213	0.2914	0.053%	0.061%
Dimethylcyclohexane (1,c-4-)	VOC		112.213	0.2914	0.053%	0.061%
Trimethylcyclopentane (1,c-2,c-3-)	VOC		112.213	0.2914	0.053%	0.061%
Propylcyclopentane (i-)	VOC		112.213	0.2914	0.348%	0.398%
Trimethylhexane (2,3,5-)	VOC		128.255	0.3330	0.006%	0.008%
Dimethylheptane (2,2-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylheptane (2,4-)	VOC		128.255	0.3330	0.158%	0.207%
Methylcyclopentane (1-ethyl-c-2-)	VOC		112.213	0.2914	0.181%	0.207%
Trimethylhexane (2,2,3-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylcyclohexane (1,c-2-)	VOC		112.213	0.2914	0.510%	0.583%
Dimethylheptane (2,6-)	VOC		128.255	0.3330	0.112%	0.146%
Propylcyclopentane (n-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylcyclohexane (1,c-3,c-5-)	VOC		126.239	0.3278	0.000%	0.000%
Ethylcyclohexane	VOC		112.213	0.2914	1.365%	1.561%
Dimethylheptane (2,5-)	VOC		128.255	0.3330	0.067%	0.088%
Dimethylheptane (3,5-)	VOC		128.255	0.3330	0.067%	0.088%
Trimethylcyclohexane (1,1,3-)	VOC		126.239	0.3278	0.077%	0.099%
Trimethylhexane (2,3,3-)	VOC		128.255	0.3330	0.038%	0.050%
Dimethylheptane (3,3-)	VOC		128.255	0.3330	0.038%	0.050%
Trimethylcyclohexane (1,1,4-)	VOC		126.239	0.3278	0.000%	0.000%

TABLE E-3a
Flash Analysis
Estimation of Specie Weight Percentages
Pressurized Liquid

Component			Molecular Weight $(lb/mol)_i$	Density $(lb/scf)_i$	Mole Percent (mol_i/mol_T)	Weight Percent (lb_i/lb_T)
Name (i)	Type	HAP				
Tetramethylpentane (2,2,3,3-)	VOC		128.255	0.3330	0.261%	0.341%
Ethylbenzene	VOC	X	106.165	0.2757	0.406%	0.439%
Trimethylhexane (2,3,4-)	VOC		128.255	0.3330	0.007%	0.009%
Trimethylcyclohexane (1,t-2,t-4-)	VOC		126.239	0.3278	0.000%	0.000%
Dimethylheptane (2,3-)	VOC		128.255	0.3330	0.000%	0.000%
Trimethylcyclohexane (1,c-3,t-5-)	VOC		126.239	0.3278	0.000%	0.000%
Xylene (m-)	VOC	X	106.165	0.2757	2.462%	2.664%
Xylene (p-)	VOC	X	106.165	0.2757	2.462%	2.664%
Dimethylheptane (3,4-)	VOC		128.255	0.3330	0.092%	0.120%
Methyloctane (2-)	VOC		128.255	0.3330	0.782%	1.022%
Methyloctane (4-)	VOC		128.255	0.3330	0.782%	1.022%
Dimethylheptane (3,4-)	VOC		128.255	0.3330	0.000%	0.000%
Methyloctane (3-)	VOC		128.255	0.3330	0.000%	0.000%
Butylcyclopentane (i-)	VOC		126.239	0.3278	0.000%	0.000%
Trimethylcyclohexane (1,t-2,c-3-)	VOC		126.239	0.3278	0.231%	0.297%
Trimethylcyclohexane (1,t-2,c-4-)	VOC		126.239	0.3278	0.231%	0.297%
Xylene (o-)	VOC	X	106.165	0.2757	0.547%	0.592%
Trimethylcyclohexane (1,1,2-)	VOC		126.239	0.3278	0.000%	0.000%
Trimethylcyclohexane (1,c-2,t-4-)	VOC		126.239	0.3278	0.200%	0.257%
Trimethylcyclohexane (1,c-2,c-4-)	VOC		126.239	0.3278	0.000%	0.000%
Nonane (n-)	VOC		128.255	0.3330	2.884%	3.770%
Unknowns	VOC		**283.704**	0.7366	10.755%	31.094%
Pressurized Liquid			98.125	0.2548	100.000%	100.000%
TOC (Total)			98.677	0.2562	99.000%	99.556%
VOC (Total)			124.943	0.3244	74.685%	95.096%
HAP (Total)			92.449	0.2400	7.356%	6.931%
Xylenes			106.165	0.2757	5.472%	5.920%

NOTES

1. Normalized mole percentages from TABLE E-2 to make total 100.000%.
2. Determined molecular weight of unknowns via iteration to match TABLE E-1.

MW = 98.125 lb/lb-mol

TABLE E-3b
Flash Analysis
Estimation of Specie Weight Percentages
Flash Gas

Component			Molecular	Density	Mole	Weight
Name (i)	Type	HAP	Weight (lb/mol)$_i$	(lb/scf)$_i$	Percent (mol$_i$/mol$_T$)	Percent (lb$_i$/lb$_T$)
Nitrogen			28.013	0.0727	0.101%	0.105%
Carbon Dioxide	GHG		44.010	0.1143	3.163%	5.167%
Methane	GHG		16.042	0.0417	69.444%	41.356%
Ethane			30.069	0.0781	10.467%	11.683%
Propane	VOC		44.096	0.1145	5.339%	8.739%
Butane (i-)	VOC		58.122	0.1509	2.126%	4.587%
Butane (n-)	VOC		58.122	0.1509	2.495%	5.383%
Pentane (i-)	VOC		72.149	0.1873	1.895%	5.075%
Pentane (n-)	VOC		72.149	0.1873	1.056%	2.828%
Dimethylbutane (2,2-)	VOC		86.175	0.2238	0.050%	0.161%
Dimethylbutane (2,3-)	VOC		86.175	0.2238	0.000%	0.000%
Cyclopentane	VOC		70.133	0.1821	0.000%	0.000%
Methylpentane (2-)	VOC		86.175	0.2238	0.352%	1.128%
Methylpentane (3-)	VOC		86.175	0.2238	0.264%	0.844%
Hexane (n-)	VOC	X	86.175	0.2238	0.561%	1.793%
Dimethylpentane (2,2-)	VOC		100.202	0.2602	0.032%	0.119%
Methylcyclopentane	VOC		84.159	0.2185	0.116%	0.363%
Dimethylpentane (2,4-)	VOC		100.202	0.2602	0.013%	0.049%
Trimethylbutane (2,2,3-)	VOC		100.202	0.2602	0.000%	0.000%
Benzene	VOC	X	78.112	0.2028	0.175%	0.509%
Dimethylpentane (3,3-)	VOC		100.202	0.2602	0.023%	0.084%
Cyclohexane	VOC		84.159	0.2185	0.113%	0.354%
Methylhexane (2-)	VOC		100.202	0.2602	0.235%	0.873%
Dimethylpentane (2,3-)	VOC		100.202	0.2602	0.000%	0.000%
Dimethylcyclopentane (1,1-)	VOC		98.186	0.2549	0.062%	0.225%
Methylhexane (3-)	VOC		100.202	0.2602	0.244%	0.907%
Dimethylcyclopentane (1,t-3-)	VOC		98.186	0.2549	0.017%	0.061%
Dimethylcyclopentane (1,c-3-)	VOC		98.186	0.2549	0.027%	0.099%
Ethylpentane (3-)	VOC		100.202	0.2602	0.003%	0.011%
Dimethylcyclopentane (1,t-2-)	VOC		98.186	0.2549	0.023%	0.083%
Trimethylpentane (2,2,4-)	VOC	X	114.229	0.2966	0.002%	0.009%
Heptane (n-)	VOC		100.202	0.2602	0.383%	1.426%
Methylcyclohexane	VOC		98.186	0.2549	0.136%	0.495%
Trimethylcyclopentane (1,1,3-)	VOC		112.213	0.2914	0.009%	0.039%
Dimethylhexane (2,2-)	VOC		114.229	0.2966	0.004%	0.017%
Dimethylcyclopentane (1,c-2-)	VOC		98.186	0.2549	0.035%	0.127%
Dimethylhexane (2,5-)	VOC		114.229	0.2966	0.000%	0.000%
Dimethylhexane (2,4-)	VOC		114.229	0.2966	0.006%	0.025%
Ethylcyclopentane	VOC		98.186	0.2549	0.019%	0.070%
Trimethylpentane (2,2,3-)	VOC		114.229	0.2966	0.001%	0.005%
Trimethylcyclopentane (1,t-2,c-4-)	VOC		112.213	0.2914	0.000%	0.000%
Dimethylhexane (3,3-)	VOC		114.229	0.2966	0.000%	0.000%
Trimethylcyclopentane (1,t-2,c-3-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylpentane (2,3,4-)	VOC		114.229	0.2966	0.000%	0.000%

TABLE E-3b
Flash Analysis
Estimation of Specie Weight Percentages
Flash Gas

Component			Molecular	Density	Mole	Weight
Name (i)	Type	HAP	Weight $(lb/mol)_i$	$(lb/scf)_i$	Percent (mol_i/mol_T)	Percent (lb_i/lb_T)
Dimethylhexane (2,3-)	VOC		114.229	0.2966	0.000%	0.000%
Toluene	VOC	X	92.138	0.2392	0.183%	0.625%
Trimethylcyclopentane (1,1,2-)	VOC		112.213	0.2914	0.015%	0.064%
Dimethylhexane (3,4-)	VOC		114.229	0.2966	0.144%	0.611%
Methylheptane (2-)	VOC		114.229	0.2966	0.000%	0.000%
Methylheptane (4-)	VOC		114.229	0.2966	0.119%	0.505%
Dimethylhexane (3,4-)	VOC		114.229	0.2966	0.000%	0.000%
Methylheptane (3-)	VOC		114.229	0.2966	0.017%	0.073%
Ethylhexane (3-)	VOC		114.229	0.2966	0.005%	0.019%
Trimethylcyclopentane (1,c-2,t-4-)	VOC		112.213	0.2914	0.001%	0.005%
Dimethylcyclohexane (1,c-3-)	VOC		112.213	0.2914	0.007%	0.029%
Trimethylcyclopentane (1,c-2,t-3-)	VOC		112.213	0.2914	0.007%	0.029%
Dimethylcyclohexane (1,t-4-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylhexane (2,2,5-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylcyclohexane (1,1-)	VOC		112.213	0.2914	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-3-)	VOC		112.213	0.2914	0.000%	0.000%
Ethylcyclopentane (1-methyl-c-3-)	VOC		112.213	0.2914	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-2-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylhexane (2,2,4-)	VOC		128.255	0.3330	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-1-)	VOC		112.213	0.2914	0.000%	0.000%
Cycloheptane	VOC		98.186	0.2549	0.000%	0.000%
Octane (n-)	VOC		114.229	0.2966	0.180%	0.763%
Trimethylhexane (2,4,4-)	VOC		128.255	0.3330	0.003%	0.016%
Tetramethylpentane (2,2,4,4-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylcyclohexane (1,t-3-)	VOC		112.213	0.2914	0.001%	0.004%
Dimethylcyclohexane (1,c-4-)	VOC		112.213	0.2914	0.001%	0.004%
Trimethylcyclopentane (1,c-2,c-3-)	VOC		112.213	0.2914	0.001%	0.004%
Propylcyclopentane (i-)	VOC		112.213	0.2914	0.006%	0.025%
Trimethylhexane (2,3,5-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylheptane (2,2-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylheptane (2,4-)	VOC		128.255	0.3330	0.003%	0.013%
Methylcyclopentane (1-ethyl-c-2-)	VOC		112.213	0.2914	0.003%	0.013%
Trimethylhexane (2,2,3-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylcyclohexane (1,c-2-)	VOC		112.213	0.2914	0.009%	0.037%
Dimethylheptane (2,6-)	VOC		128.255	0.3330	0.002%	0.009%
Propylcyclopentane (n-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylcyclohexane (1,c-3,c-5-)	VOC		126.239	0.3278	0.000%	0.000%
Ethylcyclohexane	VOC		112.213	0.2914	0.023%	0.098%
Dimethylheptane (2,5-)	VOC		128.255	0.3330	0.001%	0.005%
Dimethylheptane (3,5-)	VOC		128.255	0.3330	0.001%	0.005%
Trimethylcyclohexane (1,1,3-)	VOC		126.239	0.3278	0.001%	0.006%
Trimethylhexane (2,3,3-)	VOC		128.255	0.3330	0.001%	0.003%
Dimethylheptane (3,3-)	VOC		128.255	0.3330	0.001%	0.003%
Trimethylcyclohexane (1,1,4-)	VOC		126.239	0.3278	0.000%	0.000%

TABLE E-3b
Flash Analysis
Estimation of Specie Weight Percentages
Flash Gas

Component			Molecular Weight $(lb/mol)_i$	Density $(lb/scf)_i$	Mole Percent (mol_i/mol_T)	Weight Percent (lb_i/lb_T)
Name (i)	Type	HAP				
Tetramethylpentane (2,2,3,3-)	VOC		128.255	0.3330	0.004%	0.021%
Ethylbenzene	VOC	X	106.165	0.2757	0.007%	0.028%
Trimethylhexane (2,3,4-)	VOC		128.255	0.3330	0.000%	0.001%
Trimethylcyclohexane (1,t-2,t-4-)	VOC		126.239	0.3278	0.000%	0.000%
Dimethylheptane (2,3-)	VOC		128.255	0.3330	0.000%	0.000%
Trimethylcyclohexane (1,c-3,t-5-)	VOC		126.239	0.3278	0.000%	0.000%
Xylene (m-)	VOC	X	106.165	0.2757	0.042%	0.167%
Xylene (p-)	VOC	X	106.165	0.2757	0.042%	0.167%
Dimethylheptane (3,4-)	VOC		128.255	0.3330	0.002%	0.008%
Methyloctane (2-)	VOC		128.255	0.3330	0.013%	0.064%
Methyloctane (4-)	VOC		128.255	0.3330	0.013%	0.064%
Dimethylheptane (3,4-)	VOC		128.255	0.3330	0.000%	0.000%
Methyloctane (3-)	VOC		128.255	0.3330	0.000%	0.000%
Butylcyclopentane (i-)	VOC		126.239	0.3278	0.000%	0.000%
Trimethylcyclohexane (1,t-2,c-3-)	VOC		126.239	0.3278	0.004%	0.019%
Trimethylcyclohexane (1,t-2,c-4-)	VOC		126.239	0.3278	0.004%	0.019%
Xylene (o-)	VOC	X	106.165	0.2757	0.009%	0.037%
Trimethylcyclohexane (1,1,2-)	VOC		126.239	0.3278	0.000%	0.000%
Trimethylcyclohexane (1,c-2,t-4-)	VOC		126.239	0.3278	0.003%	0.016%
Trimethylcyclohexane (1,c-2,c-4-)	VOC		126.239	0.3278	0.000%	0.000%
Nonane (n-)	VOC		128.255	0.3330	0.050%	0.236%
Unknowns	VOC		**473.700**	1.2300	0.079%	1.387%
Flash Gas			26.938	0.0699	100.000%	100.000%
TOC (Total)			26.379	0.0685	96.736%	94.728%
VOC (Total)			66.745	0.1733	16.825%	41.688%
HAP (Total)			88.115	0.2288	0.762%	2.492%
Xylenes			106.165	0.2757	0.094%	0.371%

NOTES

1. Normalized mole percentages from TABLE E-2 to make total 100.000%.
2. Determined molecular weight of unknowns via iteration to match TABLE E-1, unless value negative.

MW = 26.938 lb/lb-mol

TABLE E-3c
Flash Analysis
Estimation of Specie Weight Percentages
Residual Liquid

Component Name (i)	Type	HAP	Molecular Weight $(lb/mol)_i$	Density $(lb/scf)_i$	Mole Percent (mol_i/mol_T)	Weight Percent (lb_i/lb_T)
Nitrogen			28.013	0.0727	0.000%	0.000%
Carbon Dioxide	GHG		44.010	0.1143	0.038%	0.013%
Methane	GHG		16.042	0.0417	0.303%	0.038%
Ethane			30.069	0.0781	0.383%	0.090%
Propane	VOC		44.096	0.1145	0.838%	0.288%
Butane (i-)	VOC		58.122	0.1509	0.849%	0.385%
Butane (n-)	VOC		58.122	0.1509	1.391%	0.630%
Pentane (i-)	VOC		72.149	0.1873	2.544%	1.430%
Pentane (n-)	VOC		72.149	0.1873	1.859%	1.045%
Dimethylbutane (2,2-)	VOC		86.175	0.2238	0.227%	0.152%
Dimethylbutane (2,3-)	VOC		86.175	0.2238	0.000%	0.000%
Cyclopentane	VOC		70.133	0.1821	0.000%	0.000%
Methylpentane (2-)	VOC		86.175	0.2238	1.586%	1.065%
Methylpentane (3-)	VOC		86.175	0.2238	1.188%	0.797%
Hexane (n-)	VOC	X	86.175	0.2238	2.522%	1.693%
Dimethylpentane (2,2-)	VOC		100.202	0.2602	0.430%	0.335%
Methylcyclopentane	VOC		84.159	0.2185	1.567%	1.027%
Dimethylpentane (2,4-)	VOC		100.202	0.2602	0.177%	0.138%
Trimethylbutane (2,2,3-)	VOC		100.202	0.2602	0.000%	0.000%
Benzene	VOC	X	78.112	0.2028	2.367%	1.440%
Dimethylpentane (3,3-)	VOC		100.202	0.2602	0.305%	0.238%
Cyclohexane	VOC		84.159	0.2185	1.528%	1.002%
Methylhexane (2-)	VOC		100.202	0.2602	3.167%	2.472%
Dimethylpentane (2,3-)	VOC		100.202	0.2602	0.000%	0.000%
Dimethylcyclopentane (1,1-)	VOC		98.186	0.2549	0.833%	0.637%
Methylhexane (3-)	VOC		100.202	0.2602	3.287%	2.566%
Dimethylcyclopentane (1,t-3-)	VOC		98.186	0.2549	0.225%	0.172%
Dimethylcyclopentane (1,c-3-)	VOC		98.186	0.2549	0.368%	0.281%
Ethylpentane (3-)	VOC		100.202	0.2602	0.040%	0.031%
Dimethylcyclopentane (1,t-2-)	VOC		98.186	0.2549	0.307%	0.235%
Trimethylpentane (2,2,4-)	VOC	X	114.229	0.2966	0.029%	0.026%
Heptane (n-)	VOC		100.202	0.2602	5.170%	4.036%
Methylcyclohexane	VOC		98.186	0.2549	4.647%	3.555%
Trimethylcyclopentane (1,1,3-)	VOC		112.213	0.2914	0.317%	0.277%
Dimethylhexane (2,2-)	VOC		114.229	0.2966	0.134%	0.119%
Dimethylcyclopentane (1,c-2-)	VOC		98.186	0.2549	1.194%	0.913%
Dimethylhexane (2,5-)	VOC		114.229	0.2966	0.000%	0.000%
Dimethylhexane (2,4-)	VOC		114.229	0.2966	0.201%	0.179%
Ethylcyclopentane	VOC		98.186	0.2549	0.653%	0.500%
Trimethylpentane (2,2,3-)	VOC		114.229	0.2966	0.039%	0.035%
Trimethylcyclopentane (1,t-2,c-4-)	VOC		112.213	0.2914	0.000%	0.000%
Dimethylhexane (3,3-)	VOC		114.229	0.2966	0.000%	0.000%
Trimethylcyclopentane (1,t-2,c-3-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylpentane (2,3,4-)	VOC		114.229	0.2966	0.000%	0.000%

TABLE E-3c
Flash Analysis
Estimation of Specie Weight Percentages
Residual Liquid

Component			Molecular	Density	Mole	Weight
Name (i)	Type	HAP	Weight $(lb/mol)_i$	$(lb/scf)_i$	Percent (mol_i/mol_T)	Percent (lb_i/lb_T)
Dimethylhexane (2,3-)	VOC		114.229	0.2966	0.000%	0.000%
Toluene	VOC	X	92.138	0.2392	6.256%	4.491%
Trimethylcyclopentane (1,1,2-)	VOC		112.213	0.2914	0.522%	0.457%
Dimethylhexane (3,4-)	VOC		114.229	0.2966	4.934%	4.391%
Methylheptane (2-)	VOC		114.229	0.2966	0.000%	0.000%
Methylheptane (4-)	VOC		114.229	0.2966	4.077%	3.628%
Dimethylhexane (3,4-)	VOC		114.229	0.2966	0.000%	0.000%
Methylheptane (3-)	VOC		114.229	0.2966	0.586%	0.521%
Ethylhexane (3-)	VOC		114.229	0.2966	0.156%	0.139%
Trimethylcyclopentane (1,c-2,t-4-)	VOC		112.213	0.2914	0.039%	0.034%
Dimethylcyclohexane (1,c-3-)	VOC		112.213	0.2914	0.239%	0.209%
Trimethylcyclopentane (1,c-2,t-3-)	VOC		112.213	0.2914	0.239%	0.209%
Dimethylcyclohexane (1,t-4-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylhexane (2,2,5-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylcyclohexane (1,1-)	VOC		112.213	0.2914	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-3-)	VOC		112.213	0.2914	0.000%	0.000%
Ethylcyclopentane (1-methyl-c-3-)	VOC		112.213	0.2914	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-2-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylhexane (2,2,4-)	VOC		128.255	0.3330	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-1-)	VOC		112.213	0.2914	0.000%	0.000%
Cycloheptane	VOC		98.186	0.2549	0.000%	0.000%
Octane (n-)	VOC		114.229	0.2966	6.155%	5.477%
Trimethylhexane (2,4,4-)	VOC		128.255	0.3330	0.269%	0.269%
Tetramethylpentane (2,2,4,4-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylcyclohexane (1,t-3-)	VOC		112.213	0.2914	0.075%	0.066%
Dimethylcyclohexane (1,c-4-)	VOC		112.213	0.2914	0.075%	0.066%
Trimethylcyclopentane (1,c-2,c-3-)	VOC		112.213	0.2914	0.075%	0.066%
Propylcyclopentane (i-)	VOC		112.213	0.2914	0.493%	0.431%
Trimethylhexane (2,3,5-)	VOC		128.255	0.3330	0.009%	0.009%
Dimethylheptane (2,2-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylheptane (2,4-)	VOC		128.255	0.3330	0.224%	0.224%
Methylcyclopentane (1-ethyl-c-2-)	VOC		112.213	0.2914	0.257%	0.224%
Trimethylhexane (2,2,3-)	VOC		128.255	0.3330	0.000%	0.000%
Dimethylcyclohexane (1,c-2-)	VOC		112.213	0.2914	0.723%	0.632%
Dimethylheptane (2,6-)	VOC		128.255	0.3330	0.159%	0.159%
Propylcyclopentane (n-)	VOC		112.213	0.2914	0.000%	0.000%
Trimethylcyclohexane (1,c-3,c-5-)	VOC		126.239	0.3278	0.000%	0.000%
Ethylcyclohexane	VOC		112.213	0.2914	1.935%	1.692%
Dimethylheptane (2,5-)	VOC		128.255	0.3330	0.095%	0.095%
Dimethylheptane (3,5-)	VOC		128.255	0.3330	0.095%	0.095%
Trimethylcyclohexane (1,1,3-)	VOC		126.239	0.3278	0.109%	0.107%
Trimethylhexane (2,3,3-)	VOC		128.255	0.3330	0.054%	0.054%
Dimethylheptane (3,3-)	VOC		128.255	0.3330	0.054%	0.054%
Trimethylcyclohexane (1,1,4-)	VOC		126.239	0.3278	0.000%	0.000%

TABLE E-3c
Flash Analysis
Estimation of Specie Weight Percentages
Residual Liquid

Component			Molecular	Density	Mole	Weight
Name (i)	Type	HAP	Weight $(lb/mol)_i$	$(lb/scf)_i$	Percent (mol_i/mol_T)	Percent (lb_i/lb_T)
Tetramethylpentane (2,2,3,3-)	VOC		128.255	0.3330	0.370%	0.370%
Ethylbenzene	VOC	X	106.165	0.2757	0.576%	0.476%
Trimethylhexane (2,3,4-)	VOC		128.255	0.3330	0.010%	0.010%
Trimethylcyclohexane (1,t-2,t-4-)	VOC		126.239	0.3278	0.000%	0.000%
Dimethylheptane (2,3-)	VOC		128.255	0.3330	0.000%	0.000%
Trimethylcyclohexane (1,c-3,t-5-)	VOC		126.239	0.3278	0.000%	0.000%
Xylene (m-)	VOC	X	106.165	0.2757	3.491%	2.887%
Xylene (p-)	VOC	X	106.165	0.2757	3.491%	2.887%
Dimethylheptane (3,4-)	VOC		128.255	0.3330	0.130%	0.130%
Methyloctane (2-)	VOC		128.255	0.3330	1.109%	1.108%
Methyloctane (4-)	VOC		128.255	0.3330	1.109%	1.108%
Dimethylheptane (3,4-)	VOC		128.255	0.3330	0.000%	0.000%
Methyloctane (3-)	VOC		128.255	0.3330	0.000%	0.000%
Butylcyclopentane (i-)	VOC		126.239	0.3278	0.000%	0.000%
Trimethylcyclohexane (1,t-2,c-3-)	VOC		126.239	0.3278	0.328%	0.322%
Trimethylcyclohexane (1,t-2,c-4-)	VOC		126.239	0.3278	0.328%	0.322%
Xylene (o-)	VOC	X	106.165	0.2757	0.776%	0.641%
Trimethylcyclohexane (1,1,2-)	VOC		126.239	0.3278	0.000%	0.000%
Trimethylcyclohexane (1,c-2,t-4-)	VOC		126.239	0.3278	0.284%	0.279%
Trimethylcyclohexane (1,c-2,c-4-)	VOC		126.239	0.3278	0.000%	0.000%
Nonane (n-)	VOC		128.255	0.3330	4.089%	4.086%
Unknowns	VOC		**283.170**	0.7353	15.292%	33.734%
Residual Liquid			128.362	0.3333	100.000%	100.000%
TOC (Total)			128.394	0.3334	99.962%	99.987%
VOC (Total)			129.116	0.3353	99.276%	99.859%
HAP (Total)			92.587	0.2404	10.159%	7.327%
Xylenes			106.165	0.2757	7.757%	6.416%

NOTES

1. Normalized mole percentages from TABLE E-2 to make total 100.000%.
2. Determined molecular weight of unknowns via iteration to match TABLE E-1.

MW = 128.362 lb/lb-mol

TABLE E-4
Flash Analysis
Maximum Hourly and Annual Emission Estimates

Station ID	V-01				
Service	Pipeline Liquids				
Liquids Holding Capacity	1,000 gal			1,000 gal	
Liquids Input Rate	12,000 gal/yr			1,000 gal/hr	
Flash Gas Density	0.0769 lb/scf			0.0769 lb/scf	
Flash Factor	328.03 scf/bbl			328.03 scf/bbl	
Flash Gas Rate	93,723 scf/yr			7,810 scfh	
Flash Losses	7,211 lb/yr	Average	Maximum	601 lb/hr	Maximum
Flash Gas	100.00% by weight	0.8232 lb/hr	3.6055 tpy	100.00% by weight	600.9213 lb/hr
$CO_{2\text{-}e}$	1039.07% by weight	8.5534 lb/hr	37.4640 tpy	1039.07% by weight	6,244.0081 lb/hr
CO_2	5.17% by weight	0.0425 lb/hr	0.1863 tpy	5.17% by weight	31.0522 lb/hr
TOC (Total)	94.73% by weight	0.7798 lb/hr	3.4154 tpy	94.73% by weight	569.2380 lb/hr
Methane	41.36% by weight	0.3404 lb/hr	1.4911 tpy	41.36% by weight	248.5182 lb/hr
Ethane	11.68% by weight	0.0962 lb/hr	0.4212 tpy	11.68% by weight	70.2082 lb/hr
VOC (Total)	41.69% by weight	0.3432 lb/hr	1.5031 tpy	41.69% by weight	250.5115 lb/hr
VOC (non-HAP)	39.20% by weight	0.3227 lb/hr	1.4132 tpy	9.19% by weight	55.2321 lb/hr
HAP (Total)	2.49% by weight	0.0205 lb/hr	0.0899 tpy	2.49% by weight	14.9762 lb/hr
Benzene	0.5089% by weight	0.0042 lb/hr	0.0183 tpy	0.5089% by weight	3.0579 lb/hr
Ethylbenzene	0.0275% by weight	0.0002 lb/hr	0.0010 tpy	0.0275% by weight	0.1653 lb/hr
Hexane (n-)	1.7932% by weight	0.0148 lb/hr	0.0647 tpy	1.7932% by weight	10.7758 lb/hr
Methanol					
Naphthalene					
Toluene	0.6253% by weight	0.0051 lb/hr	0.0225 tpy	0.6253% by weight	3.7576 lb/hr
Trimethylpentane (2,2,4-)	0.0091% by weight	0.0001 lb/hr	0.0003 tpy	0.0091% by weight	0.0548 lb/hr
Xylenes	0.3706% by weight	0.0031 lb/hr	0.0134 tpy	0.3706% by weight	2.2272 lb/hr

NOTES

1. Separator Characteristics:
   - Orientation: Vertical Fixed Roof Tank
   - Height/Length: 5.00 ft
   - Diameter: 6.50 ft
   - Capacity (physical): 1,241 gal
   - Capacity (liquid): 1,000 gal
2. Liquid input rates:
   - a. maximum hourly based on operator experience; 1,000 gal
   - b. maximum annual based on operating experience and safety factor; and 12,000 gal
   - c. average hourly is just the maximum annual divided by 8,760 hrs/yr.
3. Flash gas density is 110% of the value extracted from TABLE E-3b.
   Density (TABLE E-3b): 0.0699 lb/scf   Safety Factor: 110%
4. Flash factor extracted from TABLE E-1.
5. Speciated emissions vapor weight percentages extracted from TABLE E-3b.

TABLE F-1
Volatile Organic Liquid Storage Tanks
Vapor Physical Property and Composition Estimates
Raoult's Law

Component Data													Liquid Data		Vapor Data	
Component			MW	Yaws Vapor Pressure Coefficients							VP Datum		mol%	wt%	y_i	$wt\%_i$
Name (i)	Type	HAP	$(lb/mol)_i$ **M_i**	A	B	C	D	E	T_{Min} (°F)	T_{Max} (°F)	**T** (°F)	P_i (psia)	(mol_i/mol_L) **f_{v-i}**	(lb_i/lb_L) **f_{m-i}**	(mol_i/mol_V)	(lb_i/lb_V)
Nitrogen			28.013	3.7362	2.6465E+02	-6.7880E+00	0.0000E+00	0.0000E+00	-345.75	-232.60	68.00		0.000%	0.000%	0.000%	0.000%
Carbon Dioxide	GHG		44.010	35.0169	-1.5119E+03	-1.1334E+01	9.3368E-03	1.7136E-09	-68.80	87.80	68.00	833.1743	0.038%	0.013%	1.087%	2.183%
Methane	GHG		16.042	14.6667	-5.7097E+02	-3.3373E+00	-2.1999E-09	1.3096E-05	-295.60	-115.60	68.00	7,889.8148	0.303%	0.038%	82.053%	60.088%
Ethane			30.069	20.6973	-1.1341E+03	-5.2514E+00	-9.8774E-11	6.7329E-06	-297.40	89.60	68.00	546.5426	0.383%	0.090%	7.185%	9.862%
Propane	VOC		44.096	21.4469	-1.4627E+03	-5.2610E+00	3.2820E-11	3.7349E-06	-306.40	206.60	68.00	121.5870	0.838%	0.288%	3.497%	7.039%
Butane (i-)	VOC		58.122	31.2541	-1.9532E+03	-8.8060E+00	8.9246E-11	5.7501E-06	-254.20	275.00	68.00	44.2751	0.849%	0.385%	1.290%	3.423%
Butane (n-)	VOC		58.122	27.0441	-1.9049E+03	-7.1805E+00	-6.6845E-11	4.2190E-06	-216.40	305.60	68.00	30.1688	1.391%	0.630%	1.440%	3.821%
Pentane (i-)	VOC		72.149	29.2963	-2.1762E+03	-7.8830E+00	-4.6512E-11	3.8997E-06	-256.00	368.60	68.00	11.1082	2.544%	1.430%	0.970%	3.193%
Pentane (n-)	VOC		72.149	33.3239	-2.4227E+03	-9.2354E+00	9.0199E-11	4.1050E-06	-202.00	386.60	68.00	8.1938	1.859%	1.045%	0.523%	1.722%
Dimethylbutane (2,2-)	VOC		86.175	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.227%	0.152%	0.039%	0.155%
Dimethylbutane (2,3-)	VOC		86.175	33.6319	-2.5524E+03	-9.3142E+00	1.4759E-10	3.9140E-06	-223.60	500.00	68.00	3.6998	0.000%	0.000%	0.000%	0.000%
Cyclopentane	VOC		70.133	29.1547	-2.3512E+03	-7.6965E+00	-1.6212E-10	3.1250E-06	-137.20	462.20	68.00	5.0181	0.000%	0.000%	0.000%	0.000%
Methylpentane (2-)	VOC		86.175	30.7477	-2.4888E+03	-8.2295E+00	-2.3723E-11	3.2402E-06	-243.40	437.00	68.00	3.3041	1.586%	1.065%	0.180%	0.707%
Methylpentane (3-)	VOC		86.175	35.2848	-2.6773E+03	-9.8546E+00	2.2352E-11	4.0277E-06	-261.40	447.80	68.00	2.9617	1.188%	0.797%	0.121%	0.475%
Hexane (n-)	VOC	X	86.175	69.7378	-3.6278E+03	-2.3927E+01	1.2810E-02	-1.6844E-16	-139.00	453.20	68.00	2.3626	2.522%	1.693%	0.204%	0.804%
Dimethylpentane (2,2-)	VOC		100.202	6.2875	-2.1682E+03	2.6936E+00	-1.5525E-02	1.0917E-05	-191.20	478.40	68.00	1.6191	0.430%	0.335%	0.024%	0.109%
Methylcyclopentane	VOC		84.159	32.4766	-2.6434E+03	-8.7933E+00	2.0749E-11	3.2158E-06	-223.60	500.00	68.00	2.1257	1.567%	1.027%	0.114%	0.439%
Dimethylpentane (2,4-)	VOC		100.202	35.9436	-2.8460E+03	-9.9938E+00	8.0693E-11	3.6419E-06	-182.20	476.60	68.00	1.5074	0.177%	0.138%	0.009%	0.042%
Trimethylbutane (2,2,3-)	VOC		100.202	32.3633	-2.6614E+03	-8.7743E+00	-7.6870E-10	3.2006E-06	-11.20	496.40	68.00	1.5789	0.000%	0.000%	0.000%	0.000%
Benzene	VOC	X	78.112	31.7718	-2.7254E+03	-8.4443E+00	-5.3534E-09	2.7187E-06	42.80	552.20	68.00	1.4495	2.367%	1.440%	0.118%	0.420%
Dimethylpentane (3,3-)	VOC		100.202	30.2570	-2.6313E+03	-7.9839E+00	4.6848E-13	2.7170E-06	-209.20	505.40	68.00	1.2681	0.305%	0.238%	0.013%	0.061%
Cyclohexane	VOC		84.159	48.5529	-3.0874E+03	-1.5521E+01	7.3830E-03	6.3563E-12	44.60	537.80	68.00	1.5112	1.528%	1.002%	0.079%	0.304%
Methylhexane (2-)	VOC		100.202	54.1075	-3.3785E+03	-1.7547E+01	8.2594E-03	-3.4967E-14	-180.40	494.60	68.00	0.9987	3.167%	2.472%	0.109%	0.496%
Dimethylpentane (2,3-)	VOC		100.202	39.7737	-2.9050E+03	-1.2012E+01	5.1334E-03	-2.3807E-14	-171.40	507.20	68.00	1.0467	0.000%	0.000%	0.000%	0.000%
Dimethylcyclopentane (1,1-)	VOC		98.186	58.1943	-3.4151E+03	-1.9294E+01	9.6704E-03	-2.4361E-15	-94.00	525.20	68.00	1.1616	0.833%	0.637%	0.033%	0.149%
Methylhexane (3-)	VOC		100.202	35.2535	-2.9310E+03	-9.6667E+00	-5.2026E-11	3.2107E-06	-182.20	503.60	68.00	0.9291	3.287%	2.566%	0.105%	0.479%
Dimethylcyclopentane (1,t-3-)	VOC		98.186	53.1912	-3.3121E+03	-1.7277E+01	8.3107E-03	5.0896E-14	-209.20	536.00	68.00	0.9791	0.225%	0.172%	0.008%	0.034%
Dimethylcyclopentane (1,c-3-)	VOC		98.186	35.4255	-2.7286E+03	-1.0444E+01	4.6608E-03	1.7565E-14	-209.20	532.40	68.00	1.0075	0.368%	0.281%	0.013%	0.057%
Ethylpentane (3-)	VOC		100.202	8.5463	-2.2979E+03	1.5503E+00	-1.2233E-02	8.2670E-06	-180.40	514.40	68.00	0.8755	0.040%	0.031%	0.001%	0.006%
Dimethylcyclopentane (1,t-2-)	VOC		98.186	36.8109	-2.9536E+03	-1.0275E+01	-4.6212E-12	3.6730E-06	-178.60	536.00	68.00	0.9713	0.307%	0.235%	0.010%	0.046%
Trimethylpentane (2,2,4-)	VOC	X	114.229	50.3422	-3.2789E+03	-1.6111E+01	7.4260E-03	-9.1804E-14	-160.60	519.80	68.00	0.7453	0.029%	0.026%	0.001%	0.004%
Heptane (n-)	VOC		100.202	65.0257	-3.8188E+03	-2.1684E+01	1.0387E-02	1.0206E-14	-130.00	512.60	68.00	0.6808	5.170%	4.036%	0.121%	0.552%
Methylcyclohexane	VOC		98.186	38.0955	-3.0738E+03	-1.0684E+01	-5.1766E-11	3.5282E-06	-194.80	570.20	68.00	0.6925	4.647%	3.555%	0.110%	0.495%
Trimethylcyclopentane (1,1,3-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.317%	0.277%	0.000%	0.001%
Dimethylhexane (2,2-)	VOC		114.229	38.7670	-3.1841E+03	-1.0857E+01	1.9275E-12	3.4797E-06	-185.80	530.60	68.00	0.5066	0.134%	0.119%	0.002%	0.012%
Dimethylcyclopentane (1,c-2-)	VOC		98.186	36.3623	-3.0025E+03	-1.0070E+01	-1.0435E-09	3.3726E-06	-65.20	557.60	68.00	0.7110	1.194%	0.913%	0.029%	0.131%
Dimethylhexane (2,5-)	VOC		114.229	40.0260	-3.2647E+03	-1.1282E+01	-6.5408E-10	3.6200E-06	-131.80	530.60	68.00	0.4490	0.000%	0.000%	0.000%	0.000%
Dimethylhexane (2,4-)	VOC		114.229	56.2877	-3.6225E+03	-1.8225E+01	8.1864E-03	8.7232E-12	30.20	537.80	68.00	0.4499	0.201%	0.179%	0.003%	0.016%
Ethylcyclopentane	VOC		98.186	36.3631	-3.0448E+03	-1.0038E+01	3.5007E-11	3.2347E-06	-216.40	566.60	68.00	0.5963	0.653%	0.500%	0.013%	0.060%
Trimethylpentane (2,2,3-)	VOC		114.229	35.9540	-3.0569E+03	-9.8896E+00	-7.2916E-11	3.1060E-06	-169.60	555.80	68.00	0.4788	0.039%	0.035%	0.001%	0.003%
Trimethylcyclopentane (1,t-2,c-4-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Dimethylhexane (3,3-)	VOC		114.229	38.0712	-3.1736E+03	-1.0617E+01	6.3090E-11	3.3817E-06	-194.80	552.20	68.00	0.4250	0.000%	0.000%	0.000%	0.000%
Trimethylcyclopentane (1,t-2,c-3-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%

TABLE F-1
Volatile Organic Liquid Storage Tanks
Vapor Physical Property and Composition Estimates
Raoult's Law

Component Data													**Liquid Data**		**Vapor Data**	
Component			MW	Yaws Vapor Pressure Coefficients							VP Datum		mol%	wt%	y_i	wt%$_i$
Name (i)	Type	HAP	(lb/mol)$_i$ **M_i**	A	B	C	D	E	T_{Min} (°F)	T_{Max} (°F)	**T** (°F)	P_i (psia)	(mol_i/mol_L) **f_{v-i}**	(lb_i/lb_L) **f_{m-i}**	(mol_i/mol_V)	(lb_i/lb_V)
Trimethylpentane (2,3,4-)	VOC		114.229	34.1565	-3.0232E+03	-9.2267E+00	2.7691E-11	2.7828E-06	-164.20	559.40	68.00	0.4029	0.000%	0.000%	0.000%	0.000%
Dimethylhexane (2,3-)	VOC		114.229	57.3778	-3.7143E+03	-1.8599E+01	8.2907E-03	-2.8441E-12	30.20	554.00	68.00	0.3451	0.000%	0.000%	0.000%	0.000%
Toluene	VOC	X	92.138	34.0775	-3.0379E+03	-9.1635E+00	1.0289E-11	2.7035E-06	-139.00	606.20	68.00	0.4219	6.256%	4.491%	0.091%	0.381%
Trimethylcyclopentane (1,1,2-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.522%	0.457%	0.000%	0.001%
Dimethylhexane (3,4-)	VOC		114.229	38.6119	-3.2685E+03	-1.0752E+01	3.6386E-09	3.2771E-06	30.20	564.80	68.00	0.3186	4.934%	4.391%	0.054%	0.281%
Methylheptane (2-)	VOC		114.229	37.6930	-3.2611E+03	-1.0391E+01	-1.0524E-12	3.0560E-06	-164.20	548.60	68.00	0.3028	0.000%	0.000%	0.000%	0.000%
Methylheptane (4-)	VOC		114.229	40.2080	-3.3661E+03	-1.1279E+01	-8.7855E-11	3.4055E-06	-185.80	552.20	68.00	0.3001	4.077%	3.628%	0.042%	0.219%
Dimethylhexane (3,4-)	VOC		114.229	38.6119	-3.2685E+03	-1.0752E+01	3.6386E-09	3.2771E-06	30.20	564.80	68.00	0.3186	0.000%	0.000%	0.000%	0.000%
Methylheptane (3-)	VOC		114.229	52.8828	-3.6231E+03	-1.6804E+01	7.1828E-03	7.4077E-14	-184.00	555.80	68.00	0.2869	0.586%	0.521%	0.006%	0.030%
Ethylhexane (3-)	VOC		114.229	40.2079	-3.3651E+03	-1.1285E+01	-5.4180E-09	3.4199E-06	30.20	557.60	68.00	0.2931	0.156%	0.139%	0.002%	0.008%
Trimethylcyclopentane (1,c-2,t-4-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.039%	0.034%	0.000%	0.000%
Dimethylcyclohexane (1,c-3-)	VOC		112.213	32.4775	-3.0067E+03	-8.5896E+00	7.0258E-11	2.1739E-06	-103.00	604.40	68.00	0.3176	0.239%	0.209%	0.003%	0.013%
Trimethylcyclopentane (1,c-2,t-3-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.239%	0.209%	0.000%	0.001%
Dimethylcyclohexane (1,t-4-)	VOC		112.213	32.5731	-2.9872E+03	-8.6494E+00	-2.1355E-09	2.2946E-06	-34.60	602.60	68.00	0.3364	0.000%	0.000%	0.000%	0.000%
Trimethylhexane (2,2,5-)	VOC		128.255	7.8816	-2.6422E+03	2.3902E+00	-1.5376E-02	9.7931E-06	-158.80	563.00	68.00	0.2426	0.000%	0.000%	0.000%	0.000%
Dimethylcyclohexane (1,1-)	VOC		112.213	33.1329	-3.0084E+03	-8.8498E+00	-4.3621E-10	2.3704E-06	-27.40	604.40	68.00	0.3361	0.000%	0.000%	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-3-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Ethylcyclopentane (1-methyl-c-3-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-2-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Trimethylhexane (2,2,4-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.000%	0.000%	0.000%	0.000%
Ethylcyclopentane (1-methyl-t-1-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Cycloheptane	VOC		98.186	54.0858	-3.6109E+03	-1.7331E+01	7.5272E-03	1.7553E-12	17.60	627.80	68.00	0.3185	0.000%	0.000%	0.000%	0.000%
Octane (n-)	VOC		114.229	29.0948	-3.0114E+03	-7.2653E+00	-2.2696E-11	1.4680E-06	-70.60	564.80	68.00	0.2040	6.155%	5.477%	0.043%	0.225%
Trimethylhexane (2,4,4-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.269%	0.269%	0.047%	0.275%
Tetramethylpentane (2,2,4,4-)	VOC		128.255	-3.8184	-2.2442E+03	7.0671E+00	-1.9644E-02	1.1435E-05	-86.80	568.40	68.00	0.2957	0.000%	0.000%	0.000%	0.000%
Dimethylcyclohexane (1,t-3-)	VOC		112.213	32.4384	-3.0550E+03	-8.5372E+00	2.2892E-10	2.0099E-06	-130.00	617.00	68.00	0.2590	0.075%	0.066%	0.001%	0.003%
Dimethylcyclohexane (1,c-4-)	VOC		112.213	31.9151	-3.0253E+03	-8.3613E+00	5.7055E-12	1.9673E-06	-124.60	617.00	68.00	0.2640	0.075%	0.066%	0.001%	0.003%
Trimethylcyclopentane (1,c-2,c-3-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.075%	0.066%	0.000%	0.000%
Propylcyclopentane (i-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.493%	0.431%	0.000%	0.001%
Trimethylhexane (2,3,5-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.009%	0.009%	0.001%	0.009%
Dimethylheptane (2,2-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.000%	0.000%	0.000%	0.000%
Dimethylheptane (2,4-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.224%	0.224%	0.039%	0.228%
Methylcyclopentane (1-ethyl-c-2-)	VOC		112.213	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.257%	0.224%	0.000%	0.001%
Trimethylhexane (2,2,3-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.000%	0.000%	0.000%	0.000%
Dimethylcyclohexane (1,c-2-)	VOC		112.213	32.1635	-3.0728E+03	-8.4344E+00	6.8943E-10	1.9558E-06	-58.00	631.40	68.00	0.2121	0.723%	0.632%	0.005%	0.027%
Dimethylheptane (2,6-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.159%	0.159%	0.028%	0.162%
Propylcyclopentane (n-)	VOC		112.213	33.9220	-3.2097E+03	-8.9914E+00	-3.2992E-11	2.0684E-06	-178.60	626.00	68.00	0.1793	0.000%	0.000%	0.000%	0.000%
Trimethylcyclohexane (1,c-3,c-5-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Ethylcyclohexane	VOC		112.213	32.7090	-3.1283E+03	-8.6023E+00	-3.9268E-11	1.9935E-06	-167.80	636.80	68.00	0.1870	1.935%	1.692%	0.012%	0.064%
Dimethylheptane (2,5-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.095%	0.095%	0.017%	0.097%
Dimethylheptane (3,5-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.095%	0.095%	0.017%	0.097%
Trimethylcyclohexane (1,1,3-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.109%	0.107%	0.000%	0.000%
Trimethylhexane (2,3,3-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.054%	0.054%	0.009%	0.055%

TABLE F-1
Volatile Organic Liquid Storage Tanks
Vapor Physical Property and Composition Estimates
Raoult's Law

Component Data													Liquid Data		Vapor Data	
Component			MW	Yaws Vapor Pressure Coefficients							VP Datum		mol%	wt%	y_i	$wt\%_i$
Name (i)	Type	HAP	$(lb/mol)_i$ $\mathbf{M_i}$	A	B	C	D	E	T_{Min} (°F)	T_{Max} (°F)	**T** (°F)	P_i (psia)	(mol_i/mol_L) $\mathbf{f_{v-i}}$	(lb_i/lb_L) $\mathbf{f_{m-i}}$	(mol_i/mol_V)	(lb_i/lb_V)
Dimethylheptane (3,3-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.054%	0.054%	0.009%	0.055%
Trimethylcyclohexane (1,1,4-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Tetramethylpentane (2,2,3,3-)	VOC		128.255	35.4216	-3.2760E+03	-9.5678E+00	9.0298E-10	2.4355E-06	14.00	640.40	68.00	0.1369	0.370%	0.370%	0.002%	0.010%
Ethylbenzene	VOC	X	106.165	36.1998	-3.3402E+03	-9.7970E+00	-1.1467E-11	2.5758E-06	-139.00	651.20	68.00	0.1388	0.576%	0.476%	0.003%	0.013%
Trimethylhexane (2,3,4-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.010%	0.010%	0.002%	0.010%
Trimethylcyclohexane (1,t-2,t-4-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Dimethylheptane (2,3-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.000%	0.000%	0.000%	0.000%
Trimethylcyclohexane (1,c-3,t-5-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Xylene (m-)	VOC	X	106.165	34.6803	-3.2981E+03	-9.2570E+00	-4.3563E-10	-2.4103E-06	-54.40	649.40	68.00	0.0468	3.491%	2.887%	0.006%	0.027%
Xylene (p-)	VOC	X	106.165	60.0531	-4.0159E+03	-1.9441E+01	8.2881E-03	-2.3647E-12	55.40	649.40	68.00	0.1277	3.491%	2.887%	0.015%	0.074%
Dimethylheptane (3,4-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.130%	0.130%	0.023%	0.133%
Methyloctane (2-)	VOC		128.255	6.0191	-2.8579E+03	3.4068E+00	-1.6572E-02	9.8047E-06	-112.00	597.20	68.00	0.0881	1.109%	1.108%	0.003%	0.020%
Methyloctane (4-)	VOC		128.255	11.2012	-2.9467E+03	1.2133E+00	-1.4423E-02	9.1770E-06	-171.40	599.00	68.00	0.0974	1.109%	1.108%	0.004%	0.022%
Dimethylheptane (3,4-)	VOC		128.255	33.1285	-2.4527E+03	-9.2016E+00	-4.7077E-10	4.1755E-06	-146.20	420.80	68.00	5.0720	0.000%	0.000%	0.000%	0.000%
Methyloctane (3-)	VOC		128.255	9.8147	-2.9609E+03	1.9061E+00	-1.5675E-02	9.7961E-06	-160.60	602.60	68.00	0.0889	0.000%	0.000%	0.000%	0.000%
Butylcyclopentane (i-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Trimethylcyclohexane (1,t-2,c-3-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.328%	0.322%	0.000%	0.001%
Trimethylcyclohexane (1,t-2,c-4-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.328%	0.322%	0.000%	0.001%
Xylene (o-)	VOC	X	106.165	37.2413	-3.4573E+03	-1.0126E+01	9.0676E-11	2.6123E-06	-13.00	674.60	68.00	0.0946	0.776%	0.641%	0.003%	0.012%
Trimethylcyclohexane (1,1,2-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Trimethylcyclohexane (1,c-2,t-4-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.284%	0.279%	0.000%	0.001%
Trimethylcyclohexane (1,c-2,c-4-)	VOC		126.239	11.0144	-2.9801E+03	2.7007E-01	-6.7946E-03	3.5409E-06	-63.40	734.00	68.00	0.0130	0.000%	0.000%	0.000%	0.000%
Nonane (n-)	VOC		128.255	8.8817	-2.8042E+03	1.5262E+00	-1.0464E-02	5.7972E-06	-63.40	613.40	68.00	0.0627	4.089%	4.086%	0.009%	0.051%
Unknowns	VOC		283.170	116.5157	-8.0140E+03	-3.8799E+01	1.3398E-02	-4.4444E-13	50.00	813.20	68.00	0.0000	15.292%	33.734%	0.000%	0.000%
Residual Liquid	Liquid	128.362 lb/lb-mol		Vapor	68.00 °F		29.1420 psia		21.907 lb/lb-mol				100.000%	100.000%	100.000%	100.000%
TOC (Total)		128.394 lb/lb-mol			68.00 °F		28.8362 psia		21.664 lb/lb-mol				99.962%	99.987%	98.913%	97.817%
VOC (Total)		129.116 lb/lb-mol			68.00 °F		2.8403 psia		63.095 lb/lb-mol				99.276%	99.859%	9.676%	27.868%
HAP (Total)		95.690 lb/lb-mol			68.00 °F		0.6569 psia		86.481 lb/lb-mol				19.507%	14.542%	0.440%	1.736%
Xylenes		106.165 lb/lb-mol			68.00 °F		0.0880 psia		106.165 lb/lb-mol				7.757%	6.416%	0.023%	0.114%

NOTES

1. Liquid composition of residual liquid based on SPL flash analysis (see TABLE E-3c).
2. Vapor pressure data for unknowns based on: Pentadecane (n-)

TABLE F-2
Volatile Organic Liquids Storage Tanks
Hourly and Annual Emission Estimates
Standing & Working Losses

Source		V-01				
Service		Pipeline Liquids Storage Tank				
Capacity		1,000 gal			1,000 gal	
Temperature of Stored Liquid		82.03 °F			100.13 °F	
Vapor Pressure		10.3406 psia			13.9305 psia	
Pumping Rate		150 gal/min			150 gal/min	
Throughput		12.00 turnover/yr				
		12,000 gal/yr			1,000 gal/hr	
Standing Losses					**July**	
					744 hrs/month	
					126.3757 lbs/month	
		1,005.2711 lb/yr			0.1699 lb/hr	
Working Losses		**1.53E-02** lb/gal			**1.69E-02** lb/gal	
		183.1770 lb/yr	Average	Maximum	16.8748 lb/hr	Maximum
Residual Liquid	Stand	358.84% by weight	0.4118 lb/hr	1.8036 tpy	358.84% by weight	0.6095 lb/hr
	Work		0.0750 lb/hr	0.3287 tpy		60.5534 lb/hr
	Total		0.4868 lb/hr	2.1323 tpy		61.1629 lb/hr
$CO_{2\text{-}e}$		5398.27% by weight	7.3237 lb/hr	32.0778 tpy	5398.27% by weight	920.1187 lb/hr
CO_2		7.83% by weight	0.0106 lb/hr	0.0465 tpy	7.83% by weight	1.3352 lb/hr
TOC (Total)		351.00% by weight	0.4762 lb/hr	2.0858 tpy	351.00% by weight	59.8277 lb/hr
Methane		215.62% by weight	0.2925 lb/hr	1.2813 tpy	215.62% by weight	36.7513 lb/hr
Ethane		35.39% by weight	0.0480 lb/hr	0.2103 tpy	35.39% by weight	6.0316 lb/hr
VOC (Total)		100.00% by weight	0.1357 lb/hr	0.5942 tpy	100.00% by weight	17.0447 lb/hr
VOC (non-HAP)		93.77% by weight	0.1272 lb/hr	0.5572 tpy	93.77% by weight	15.9830 lb/hr
HAP (Total)		6.23% by weight	0.0085 lb/hr	0.0370 tpy	6.23% by weight	1.0617 lb/hr
Benzene		1.5063% by weight	2.04E-03 lb/hr	8.95E-03 tpy	1.5063% by weight	2.57E-01 lb/hr
Ethylbenzene		0.0477% by weight	6.47E-05 lb/hr	2.83E-04 tpy	0.0477% by weight	8.13E-03 lb/hr
Hexane (n-)		2.8866% by weight	3.92E-03 lb/hr	1.72E-02 tpy	2.8866% by weight	4.92E-01 lb/hr
Methanol						
Naphthalene						
Toluene		1.3668% by weight	1.85E-03 lb/hr	8.12E-03 tpy	1.3668% by weight	2.33E-01 lb/hr
Trimethylpentane (2,2,4-)		0.0139% by weight	1.88E-05 lb/hr	8.25E-05 tpy	0.0139% by weight	2.37E-03 lb/hr
Xylenes		0.4073% by weight	5.53E-04 lb/hr	2.42E-03 tpy	0.4073% by weight	6.94E-02 lb/hr

NOTES

1. Tank Characteristics: TANKS 4.09d

Orientation	Vertical Fixed Roof Tank	Above Ground?	Yes
Height/Length	5.00 ft	Shell/Roof Color	Gray/Medium or less solar absorptance
Diameter	6.50 ft	Shell Condition	Good
Capacity (estimated)	1,241 gal	Vacuum Setting	-0.03 psig
Capacity (nominal)	1,000 gal	Pressure Setting	0.03 psig

2. Stored Liquid Characteristics:

Basis	USEPA TANKS 4.09d	MET Station:	Orlando, Florida
Material	Gasoline (RVP 13)	Selection based on VOC vapor pressure (see TABLE F-1).	
Liquid Molecular Weight	92.00 lb/lb-mol	Vapor Molecular Weight	62.00 lb/lb-mol

Monthly Data

	Days	Vapor Pressure avg	Vapor Pressure max	Liquid Surface Temperature avg	Liquid Surface Temperature max	TANKS Output standing	TANKS Output working	TANKS Flow
January	31	8.9388	10.4120	73.86	82.61	41.1379	13.1953	1,000
February	28	9.2561	11.0120	75.83	85.89	46.9796	13.6638	1,000
March	31	9.9586	12.1295	80.02	91.66	74.5275	14.7008	1,000
April	30	10.6168	13.2485	83.75	97.03	102.0958	15.6724	1,000
May	31	11.1671	13.9305	86.72	100.13	129.2926	16.4847	1,000
June	30	11.3652	13.8668	87.76	99.85	121.2258	16.7773	1,000
July	31	11.4313	13.8999	88.11	99.99	126.3757	16.8748	1,000
August	31	11.3124	13.6146	87.49	98.71	113.8763	16.6992	1,000
September	30	11.0179	13.0634	85.93	96.17	90.0517	16.2645	1,000
October	31	10.3598	12.1794	82.32	91.91	69.5367	15.2930	1,000
November	30	9.6193	11.2249	78.03	87.03	50.0174	14.1998	1,000
December	31	9.0444	10.4492	74.52	82.82	40.1540	13.3513	1,000
ALL	365	10.3406	13.9305	82.03	100.13	1,005.2711	183.1770	12,000

3. Emission Estimate Basis: USEPA TANKS 4.09d & TCEQ RG-166/01
4. Speciation of emissions is based on vapor weight percentages in TABLE F-1 normalized on VOC to assure methodology is conservative.
5. Included a conservative estimate of volume of liquids gathered at Hunters Creek M&R station, from maintenance activities.

TABLE F-3
Volatile Organic Liquids Loading (Tanker Trucks)
Hourly and Annual Emission Estimates

Source	SUWA-TL-PL				
Supply Vessel	V-01				
	Pipeline Liquids Storage Tank				
	1,000 gal			1,000 gal	
Tanker Truck Service	Dedicated Normal			Dedicated Normal	
Loading Method	Submerged			Submerged	
Saturation Factor	0.60 n.d.			0.60 n.d.	
Vapor Molecular Weight	62.00 lb/lb-mol			62.00 lb/lb-mol	
Bulk Liquid Temperature	82.03 °F			99.99 °F	
	542.03 R			559.99 R	
Vapor Pressure	10.3406 psia			13.9305 psia	
Loading Loss Factor	8.8427 lb/kgal			11.5304 lb/kgal	
Pumping Rate				150 gpm	
Throughput	12.00 turnover/yr				
	12,000 gal/yr			1,000 gal/hr	
Loading Losses	106.1128 lb/yr	Average	Maximum	11.5304 lb/hr	Maximum
Residual Liquid	358.84% by weight	0.0435 lb/hr	0.1904 tpy	358.84% by weight	41.3756 lb/hr
CO_{2-e}	5398.27% by weight	0.6539 lb/hr	2.8641 tpy	5398.27% by weight	622.4440 lb/hr
CO_2	7.83% by weight	0.0009 lb/hr	0.0042 tpy	7.83% by weight	0.9033 lb/hr
TOC (Total)	351.00% by weight	0.0425 lb/hr	0.1862 tpy	351.00% by weight	40.4724 lb/hr
Methane	215.62% by weight	0.0261 lb/hr	0.1144 tpy	215.62% by weight	24.8616 lb/hr
Ethane	35.39% by weight	0.0043 lb/hr	0.0188 tpy	35.39% by weight	4.0803 lb/hr
VOC (Total)	100.00% by weight	0.0121 lb/hr	0.0531 tpy	100.00% by weight	11.5304 lb/hr
VOC (non-HAP)	93.77% by weight	0.0114 lb/hr	0.0498 tpy	93.77% by weight	10.8122 lb/hr
HAP (Total)	6.23% by weight	0.0008 lb/hr	0.0033 tpy	6.23% by weight	0.7182 lb/hr
Benzene	1.5063% by weight	1.82E-04 lb/hr	7.99E-04 tpy	1.5063% by weight	1.74E-01 lb/hr
Ethylbenzene	0.0477% by weight	5.77E-06 lb/hr	2.53E-05 tpy	0.0477% by weight	5.50E-03 lb/hr
Hexane (n-)	2.8866% by weight	3.50E-04 lb/hr	1.53E-03 tpy	2.8866% by weight	3.33E-01 lb/hr
Methanol					
Naphthalene					
Toluene	1.3668% by weight	1.66E-04 lb/hr	7.25E-04 tpy	1.3668% by weight	1.58E-01 lb/hr
Trimethylpentane (2,2,4-)	0.0139% by weight	1.68E-06 lb/hr	7.37E-06 tpy	0.0139% by weight	1.60E-03 lb/hr
Xylenes	0.4073% by weight	4.93E-05 lb/hr	2.16E-04 tpy	0.4073% by weight	4.70E-02 lb/hr

NOTES

1. Emissions calculated using methods provided in USEPA, AP-42 Section 5.2 dated 6/2008. $L_L = 12.46[(S)M_VP/T]$
2. Physical property, throughput and speciation data based data from supply vessel emission calculation spreadsheet.
3. Included a conservative estimate of volume of liquids gathered at Hunters Creek M&R station, from maintenance activities.

APPENDIX C: GENERATOR SPECIFICATION SHEET

Models: 14/20RESA

KOHLER. Power Systems

Multi-Fuel
LPG/Natural Gas

The Kohler® Advantage

- **High Quality Power**
  Kohler home generators provide advanced voltage and frequency regulation along with ultra-low levels of harmonic distortion for excellent generator power quality to protect your valuable electronics.
- **Extraordinary Reliability**
  Kohler is known for extraordinary reliability and performance and backs that up with an industry-leading 5-year or 2000 hour limited warranty.
- **Powerful Performance**
  Exclusive Powerboost™ technology provides excellent starting power. The Kohler 14 kW generator can easily start and run a 5 ton air conditioner.*
- **Corrosion-Proof Enclosure**
  The bold new Kohler design is completely corrosion proof, even in harsh seaside environments, and is impact-resistant even at −34° C (−30° F).
- **Fast Response**
  Kohler's unique Fast-Response™ excitation system delivers excellent voltage response and short-circuit capability.

Standard Features

- **RDC2 Controller**
  - One digital controller manages both the generator set and transfer switch functions (with optional Model RXT).
  - Designed for today's most sophisticated electronics.
  - Electronic speed control responds quickly to varying demand.
  - Digital voltage regulation protects your sensitive electronics from harmonic distortion and unstable power quality.
- **Kohler Command PRO Engine Features**
  - Kohler Command PRO® OHV engine with hydraulic valve lifters for reliable performance without routine valve adjustment or lengthy break-in requirements.
  - Powerful, reliable air-cooled performance.
  - Simple field conversion between natural gas and LPG fuels while maintaining emission certification.
- **Designed for Easy Installation**
  - Polymer base eliminates the need for a concrete mounting pad, reducing installation time and cost.
  - Fuel and electrical connections through the enclosure wall eliminate the need for stub-ups through the bottom.
  - Load connection terminal block allows easy field wiring.
  - Designed for outdoor installation only.
- **Certifications**
  - Meets emission regulations for U.S. Environmental Protection Agency (EPA) with both natural gas and LPG. **Note:** CARB does not regulate emergency standby generators with outputs less than 50 HP.
  - UL 2200 listed (60 Hz model).
  - CSA certification available (60 Hz model).
  - GOST certified (Russia).
  - Accepted by the Massachusetts Board of Registration of Plumbers and Gas Fitters
- **Warranty**
  - 5-year/2000 hour limited warranty for on-grid (standby) applications in locations served by a reliable utility source.
  - 18 month/1000 hour limited warranty for off-grid (non-standby) applications (Model 14RESA only).

* Check the appliance manufacturer's specifications for actual power requirements. Consult a Kohler® Power Systems professional to calculate your exact residential power system requirements.

Generator Ratings

Model	Alternator	Voltage	Phase	Hz	Standby Ratings: Natural Gas kW/kVA	Natural Gas Amps	LPG kW/kVA	LPG Amps	Line Circuit Breaker Amps	Line Circuit Breaker Poles
14RESA	2F5	120 *	1	60	12/12	100	13/13	108	125	1
		110/220	1	60	12/12	54	14/14	63	100	2
		120/240 *	1	60	12/12	50	14/14	58	70	2
		115/230	1	50	10/10	43	11/11	47	70	2
		220†	1	50	10/10	45	11/11	50	50	1
		230	1	50	10/10	43	11/11	47	50	2
		240†	1	50	10/10	41	11/11	45	50	1
	2G5	120/208 *	3	60	12/15	41	13/16	45	50	3
		120/240 *	3	60	12/15	36	13/16	39	50	3
		220/380	3	60	12/15	22	13/16	24	32	4
		220/380‡	3	50	10/12	18	11/13	20	25	4
		230/400	3	50	10/12	18	11/13	19	25	4
		240/416‡	3	50	10/12	17	11/13	19	40	4
20RESA	2F7	120 *	1	60	18/18	150	20/20	166	175	1
		110/220	1	60	18/18	81	20/20	90	100	2
		120/240 *	1	60	18/18	75	20/20	83	100	2
		100/200	1	50	15/15	75	16/16	80	80	2
		115/230	1	50	15/15	65	16/16	69	100	2
		220†	1	50	15/15	68	16/16	72	80	1
		230	1	50	15/15	65	16/16	69	80	2
		240†	1	50	15/15	62	16/16	66	80	1
	2G7	120/208 *	3	60	17/21	58	17/21	58	80	3
		110/220	3	60	17/21	55	17/21	55	80	3
		127/220	3	60	17/21	55	17/21	55	80	4
		120/240 *	3	60	17/21	51	17/21	51	80	3
		220/380	3	60	17/21	32	17/21	32	40	4
		100/200	3	50	14/17	50	15/18	54	80	2
		220/380‡	3	50	14/17	26	15/18	28	32	4
		230/400	3	50	14/17	25	15/18	27	32	4
		240/416‡	3	50	14/17	24	15/18	26	50	2

* UL listed.

† 50 Hz models are factory-connected as 230 volts. Field-adjustable to 220 or 240 volts by an authorized service technician.

‡ 50 Hz models are factory-connected as 230/400 volts. Field-adjustable to 220/380 or 240/416 volts by an authorized service technician.

Note: The line circuit breaker is automatically selected based on the generator set model and voltage configuration.

RATINGS: Standby ratings apply to installations served by a reliable utility source. All single-phase units are rated at 1.0 power factor. The standby rating is applicable to variable loads with an average load factor of 80% for the duration of the power outage. No overload capacity is specified at this rating. Ratings are in accordance with ISO-3046/1, BS5514, AS2789, and DIN 6271. GENERAL GUIDELINES FOR DERATING: *ALTITUDE*: Derate 4% per 305 m (1000 ft.) elevation above 153 m (500 ft.). *TEMPERATURE*: Derate 2% per 5.5°C (10°F) temperature increase above 16°C (60°F). Availability is subject to change without notice. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever. Contact your local Kohler Co. generator distributor for availability.

Alternator Specifications

Alternator Specifications

Specifications	Alternator
Manufacturer	Kohler
Type	2-Pole, Rotating Field
Leads, quantity	
2F5, 2F7	4
2G5, 2G7	12
Voltage regulator	Digital
Insulation:	NEMA MG1-1.66
Material	Class H
Temperature rise	130°C Standby
Bearing: quantity, type	1, Sealed
Coupling	Direct
Amortisseur windings	Full
Voltage regulation, no-load to full-load RMS	±1.0%
One-step load acceptance	100% of Rating

Peak motor starting kVA:	(35% dip for voltages below)	
14RESA:		
240V, 1 ph	2F5 (4 lead)	33 (60 Hz)
220 V, 1 ph	2F5 (4 lead)	26 (50 Hz)
480 V or 240 V, 3 ph	2G5 (12 lead)	54 (60 Hz)
380 V or 220 V, 3 ph	2G5 (12 lead)	38 (50 Hz)
20RESA:		
240 V, 1 ph	2F7 (4 lead)	41 (60 Hz)
220 V, 1 ph	2F7 (4 lead)	28 (50 Hz)
480 or 240 V, 3 ph	2G7 (12 lead)	69 (60 Hz)
380 or 220 V, 3 ph	2G7 (12 lead)	55 (50 Hz)

Alternator Features

- Compliance with NEMA, IEEE, and ANSI standards for temperature rise.
- Self-ventilated and dripproof construction.
- Windings are vacuum-impregnated with epoxy varnish for dependability and long life
- Superior voltage waveform and minimum harmonic distortion from skewed alternator construction.
- Digital voltage regulator with ±1.0% no-load to full-load RMS regulation.
- Rotating-field alternator with static exciter for excellent load response.
- Total harmonic distortion (THD) from no load to full load with a linear load is less than 5%.

Application Data

Engine

Engine Specifications	14RESA	20RESA
Manufacturer	Kohler	
Engine: model, type	CH740 4-Cycle	CH1000 4-Cycle
Cylinder arrangement	V-2	
Displacement, cm^3 (cu. in.)	725 (44)	999 (61)
Bore and stroke, mm (in.)	83 x 67 (3.27 x 2.64)	90 x 78.5 (3.54 x 3.1)
Compression ratio	9:1	8.8:1
Main bearings: quantity, type	2, Parent Material	
Rated RPM		
60 Hz	3600	
50 Hz	3000	
Max. engine power at rated rpm, kW (HP)		
LPG, 60 Hz	17.6 (23.6)	23.0 (30.9)
LPG, 50 Hz	15.8 (21.2)	20.0 (26.8)
Natural gas, 60 Hz	15.3 (20.5)	20.2 (27.1)
Natural gas, 50 Hz	13.8 (18.5)	16.8 (22.5)
Cylinder head material	Aluminum	
Valve material	Steel/Stellite®	
Piston type and material	Aluminum Alloy	
Crankshaft material	Heat Treated, Ductile Iron	
Governor: type	Electronic	
Frequency regulation, no load to full load	Isochronous	
Frequency regulation, steady state	±0.5%	
Air cleaner type	Dry	

Engine Electrical

Engine Electrical System	14RESA	20RESA
Ignition system	Electronic, Capacitive Discharge	
Starter motor rated voltage (DC)	12	
Battery (purchased separately):		
Ground	Negative	
Volts (DC)	12	
Battery quantity	1	
Recommended cold cranking amps:		
(CCA) rating for −18°C (0°F)	500	
Group size	51	

Exhaust

Exhaust System	14RESA	20RESA
Exhaust temperature exiting the enclosure at rated kW, dry, °C (°F)	260 (500)	

Lubrication

Lubricating System	14RESA	20RESA
Type	Full Pressure	
Oil capacity (with filter), L (qt.)	1.8 (1.9)	1.9 (2.0)
Oil filter: quantity, type	1, Cartridge	
Oil cooler	Integral	

Fuel Pipe Size

Minimum Gas Pipe Size Recommendation, in. NPT

	14RESA		20RESA	
Pipe Length, m (ft.)	Natural Gas 193,000 Btu/hr.	LPG 203,000 Btu/hr.	Natural Gas 281,000 Btu/hr.	LPG 340,000 Btu/hr.
8 (25)	3/4	3/4	1	3/4
15 (50)	1	3/4	1	1
30 (100)	1	1	1 1/4	1
46 (150)	1 1/4	1	1 1/4	1 1/4
61 (200)	1 1/4	1	1 1/4	1 1/4

Fuel Requirements

Fuel System	14RESA	20RESA
Fuel types	Natural Gas or LPG	
Fuel supply inlet	1/2 NPT	
Fuel supply pressure, kPa (in. H_2O):		
Natural gas	1.2–2.7 (5-11)	
LP	1.7–2.7 (7-11)	

Fuel Composition Limits *	Nat. Gas	LPG
Methane, % by volume (minimum)	90 min.	—
Ethane, % by volume (maximum)	4.0 max.	—
Propane, % by volume	1.0 max.	85 min.
Propene, % by volume (maximum)	0.1 max.	5.0 max.
C_4 and higher, % by volume	0.3 max.	2.5 max.
Sulfur, ppm mass (maximum)	25 max.	
Lower heating value, MJ/m^3 (Btu/ft^3), (minimum)	33.2 (890)	84.2 (2260)

* Contact your local distributor for suitability and rating derates based on fuel compositions outside these limits.

Operation Requirements

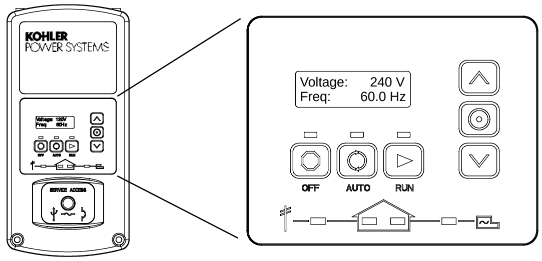
Fuel Consumption

Model	Fuel Type	% Load	Fuel Consumption, m^3/hr. (cfh) 60 Hz	50 Hz
14RESA	Natural Gas	100	5.4 (193)	4.9 (175)
		75	4.7 (163)	4.2 (148)
		50	3.5 (124)	3.1 (108)
		25	2.6 (93)	2.4 (84)
		Exercise	1.7 (60)	1.7 (60)
	LPG	100	2.3 (81)	2.1 (74)
		75	2.1 (75)	1.9 (68)
		50	1.8 (60)	1.5 (53)
		25	1.2 (45)	1.1 (40)
		Exercise	0.8 (30)	0.8 (30)
20RESA	Natural Gas	100	8.0 (281)	6.4 (225)
		75	6.9 (243)	5.4 (189)
		50	4.6 (161)	3.9 (139)
		25	3.6 (127)	2.9 (103)
		Exercise	2.0 (71)	2.0 (71)
	LPG	100	3.9 (136)	2.9 (102)
		75	3.1 (109)	2.4 (85)
		50	2.3 (82)	1.8 (63)
		25	1.7 (59)	1.3 (47)
		Exercise	1.0 (35)	1.0 (35)

Nominal fuel rating: Natural gas: 37 MJ/m^3 (1000 $Btu/ft.^3$)
LPG: 93 MJ/m^3 (2500 $Btu/ft.^3$)

LPG conversion factors: 8.58 $ft.^3$ = 1 lb.
0.535 m^3 = 1 kg
36.39 $ft.^3$ = 1 gal.

RDC2 Controller



The RDC2 controller provides integrated control for the generator set, Kohler® Model RXT transfer switch, programmable interface module (PIM), and load control module (LCM).

The RDC2 controller's 2-line LCD screen displays status messages and system settings that are clear and easy to read, even in direct sunlight or low light.

RDC2 Controller Features

- Membrane keypad:
  - OFF, AUTO, and RUN pushbuttons
  - Select and arrow buttons for access to system configuration and adjustment menus
- LED indicators for OFF, AUTO, and RUN modes
- LED indicators for utility power and generator set source availability and ATS position (Model RXT transfer switch required)
- LCD display:
  - Two lines x 16 characters per line
  - Backlit display with adjustable contrast for excellent visibility in all lighting conditions
- Scrolling system status display:
  - Generator set status
  - Voltage and frequency
  - Engine temperature
  - Oil pressure
  - Battery voltage
  - Engine runtime hours
- Date and time displays
- Smart engine cooldown senses engine temperature
- Digital isochronous governor to maintain steady-state speed at all loads
- Digital voltage regulation: ±1.0% RMS no-load to full-load
- Automatic start with programmed cranking cycle
- Programmable exerciser can be set to start automatically on any future day and time, and run every week or every two weeks
- Exercise modes:
  - Unloaded weekly exercise with complete system diagnostics
  - Unloaded full-speed exercise
  - Loaded full-speed exercise (Model RXT ATS required)
- Front-access mini USB connector for SiteTech™ or USB Utility connection
- Integral Ethernet connector for Kohler® OnCue® Plus
- Built-in 2.5 amp battery charger
- Remote two-wire start/stop capability for optional connection of Model RDT or RSB transfer switches

Additional RDC2 Controller Features

- Diagnostic messages:
  - Displays diagnostic messages for the engine, generator, Model RXT transfer switch, programmable interface module (PIM), and load control module (LCM)
  - Over 70 diagnostic messages can be displayed
- Maintenance reminders
- System settings:
  - System voltage, frequency, and phase
  - Voltage adjustment
  - Measurement system, English or metric
- ATS status (Model RXT ATS required):
  - Source availability
  - ATS position (normal/utility or emergency/generator)
  - Source voltage and frequency
- ATS control (Model RXT ATS required):
  - Source voltage and frequency settings
  - Engine start time delay
  - Transfer time delays
  - Voltage calibration
  - Fixed pickup and dropout settings
- Programmable Interface Module (PIM) status displays:
  - Input status (active/inactive)
  - Output status (active/inactive)
- Load control module (LCM) menus:
  - Load status
  - Test function

Generator Set Sound Data

Model 14RESA 8 point logarithmic average sound levels are 63 dB(A) during weekly engine exercise and 67 dB(A) during full-speed generator diagnostics and normal operation. For comparison to competitor ratings, the lowest sound levels are 58 dB(A) and 63 dB(A) respectively.*

Model 20RESA 8 point logarithmic average sound levels are 64 dB(A) during weekly engine exercise and 69 dB(A) during full-speed generator diagnostics and normal operation. For comparison to competitor ratings, the lowest point sound levels are 62 dB(A) and 67 dB(A) respectively.*

All sound levels are measured at 7 meters with no load.

* Lowest of 8 points measured around the generator. Sound levels at other points around generator may vary depending on installation parameters.

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For the nearest sales and service outlet in the
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KOHLERPower.com

Kohler Power Systems
Asia Pacific Headquarters
7 Jurong Pier Road
Singapore 619159
Phone (65) 6264-6422, Fax (65) 6264-6455

Generator Set Standard Features

- Battery cables
- EPA certified fuel system
- Corrosion-proof polymer sound enclosure
- Critical silencer
- Field-connection terminal block
- Fuel solenoid valve and secondary regulator
- Line circuit breaker
- Multi-fuel system, LPG/natural gas, field-convertible
- Oil drain extension with shutoff valve
- Premium 5-year limited warranty
- 18-month limited warranty for non-standby (off-grid) applications (14RESA only)
- RDC2 generator set/ATS controller
- Rodent-resistant construction
- Sound-deadening, flame-retardant foam per UL 94, class HF-1

Available Options

Approvals and Listings

- ❑ CSA approval

Communication Accessories

- ❑ OnCue® Plus Generator Management System
- ❑ OnCue® Plus Wireless Generator Management System

Concrete Mounting Pads

- ❑ Concrete mounting pad, 3 in. thick
- ❑ Concrete mounting pad, 4 in. thick (recommended for storm-prone areas)

Electrical System

- ❑ Battery
- ❑ Battery heater, 120VAC
- ❑ Battery heater, 240VAC
- ❑ Emergency stop kit
- ❑ Load control module (LCM) (provides 4 power relays and 2 HVAC relays)
- ❑ PowerSync® Automatic Paralleling Module (APM) (single phase only; parallels two 14RESA or two 20RESA generators)
- ❑ Programmable interface module (PIM) (provides 2 digital inputs and 6 relay outputs)

Available Options, Continued

Fuel System

- ❑ Braided stainless steel flexible fuel line

Literature

- ❑ General maintenance literature kit
- ❑ Overhaul literature kit
- ❑ Production literature kit

Maintenance

- ❑ Maintenance kit (includes air filter, oil, oil filter, and spark plugs)

Starting Aids

- ❑ Carburetor heater, 120 VAC
- ❑ Carburetor heater, 240 VAC

Carburetor heater is recommended for reliable starting at temperatures below 0°C (32°F)

- ❑ Fuel regulator heater pad 120VAC (20RESA)
- ❑ Fuel regulator heater pad 240VAC (20RESA)

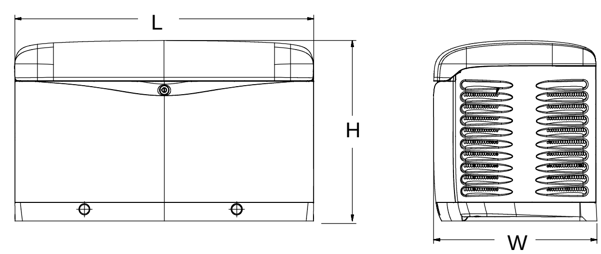
Fuel regulator heater is recommended for reliable starting at temperatures below −18°C (0°F).

Kohler® Automatic Transfer Switch

- ❑ Model RXT, see specification sheet G11-121
- ❑ Model RDT, see specification sheet G11-98
- ❑ Model RSB, see specification sheet G11-101
- ❑ Other Kohler® ATS

Generator Set Dimensions and Weights

Overall Size, L x W x H:		1216 x 665 x 733 mm (48 x 26.2 x 29 in.)
Shipping Weight:	14RESA	191 kg (420 lb.)
	20RESA	243 kg (535 lb.)



NOTE: Dimensions are provided for reference only and should not be used for planning installation. Contact your local distributor for more detailed information.

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