



February 26, 2015

Bev McKeone  
NSR Permitting Supervisor  
WVDEP, Division of Air Quality  
601 – 57<sup>th</sup> Street, SE  
Charleston, West Virginia 25304



**Re:** Permit Determination  
Cabot 50 Well Pad, Bancroft, West Virginia

Dear Ms. McKeone:

SLR International Corporation (SLR) has prepared the attached Permit Determination on behalf of Cabot Oil & Gas's (Cabot) Cabot 50 well pad located near Bancroft, West Virginia.

Cabot has plans to operate one nonconventional well at the Cabot 50 well pad, which will also operate one gas processing unit and one tank to contain produced water. As a result of this facility wide review the potential to emit was found to be below 6 lb/hr and 10 tpy or 144 lb/day of any criteria pollutant or 2 lb/hr or 5 tpy of aggregate HAPs. The highest criteria pollutant, which is VOCs, is estimated to be 0.72 lb/hr, which allows the source to stay below the stationary source threshold of 6 lb/hr. Likewise, HAP emissions were well below the 2 and 5 thresholds.

If any additional information is needed, please don't hesitate contacting me by telephone at (304) 545-8563 or by e-mail at [jhanshaw@slrconsulting.com](mailto:jhanshaw@slrconsulting.com).

Sincerely,  
**SLR International Corporation**



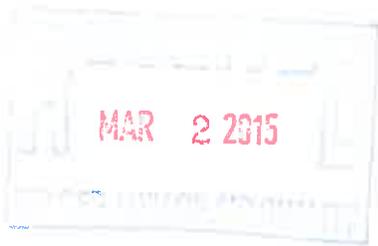
Jesse Hanshaw, P.E.  
Principal Engineer

JH:lev

Attachment: Permit Determination  
cc Randy Spencer, Cabot Oil & Gas



global environmental solutions



**Cranberry Pipeline Corporation**

**Cabot 50 Well Pad**

**Bancroft, West Virginia**

**Permit Determination**

**February 2015**



## Cabot 50 Permit Determination

Prepared for:

**Cranberry Pipeline Corporation**  
**c/o Cabot Oil & Gas Corporation**  
900 Lee Street East  
Suite 1500  
Charleston, WV 25301

This document has been prepared by SLR International Corporation. The material and data in this permit application were prepared under the supervision and direction of the undersigned.

A handwritten signature in blue ink, appearing to read "Ethan Saturday".

---

Ethan Saturday, E.I.  
Staff Engineer

A handwritten signature in blue ink, appearing to read "Jesse Hanshaw".

---

Jesse Hanshaw, P.E.  
Principal Engineer

## CONTENTS

---

PERMIT DETERMINATION FORM

ATTACHMENT A	.....	MAP
ATTACHMENT B	.....	PROCESS FLOW DIAGRAM
ATTACHMENT C	.....	PROCESS DESCRIPTION
ATTACHMENT D	.....	MSDS
ATTACHMENT E	.....	CALCULATIONS

# **PERMIT DETERMINATION FORM**

## **Permit Determination**

**Cabot 50 Well Pad, New Facility  
Bancroft, West Virginia**

Cranberry Pipeline Corporation  
c/o Cabot Oil & Gas Corporation  
900 Lee Street East  
Suite 1500  
Charleston, WV 25301

February 2015



WEST VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
DIVISION OF AIR QUALITY  
601 57<sup>th</sup> Street, SE  
Charleston, WV 25304  
Phone: (304) 926-0475  
www.dep.wv.gov/daq

**PERMIT DETERMINATION FORM  
(PDF)**

FOR AGENCY USE ONLY: PLANT I.D. # \_\_\_\_\_  
PDF # \_\_\_\_\_ PERMIT WRITER: \_\_\_\_\_

1. NAME OF APPLICANT (AS REGISTERED WITH THE WV SECRETARY OF STATE'S OFFICE): Cranberry Pipeline Corporation		
2. NAME OF FACILITY (IF DIFFERENT FROM ABOVE): Cabot 50 Well Pad		3. NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS) CODE: 211111
4A. MAILING ADDRESS: 900 Lee Street East Suite 1500 Charleston, WV 25301		4B. PHYSICAL ADDRESS: Off Guano Creek Road Bancroft, WV (See Coordinates)
5A. DIRECTIONS TO FACILITY (PLEASE PROVIDE MAP AS ATTACHMENT A): From Bancroft, go north on WV Hwy 62 for 0.5 miles. Turn right on Guano Creek Road, after 2 miles stay left at top of hill, continue another 0.4 miles and stay left at fork, continue another 0.4 miles to well pad.		
5B. NEAREST ROAD: Guano Creek Road	5C. NEAREST CITY OR TOWN: Bancroft	5D. COUNTY: Putnam
5E. UTM NORTHING (KM): 4265.45786	5F. UTM EASTING (KM): 427.18912	5G. UTM ZONE: 17N
6A. INDIVIDUAL TO CONTACT IF MORE INFORMATION IS REQUIRED: Jesse Hanshaw		6B. TITLE: Application Consultant Principal Engineer
6C. TELEPHONE: (304) 545-8563	6D. FAX: (681) 205 8969	6E. E-MAIL: jhanshaw@slrconsulting.com
7A. DAQ PLANT I.D. NO. (FOR AN EXISTING FACILITY ONLY): NA	7B. PLEASE LIST ALL CURRENT 45CSR13, 45CSR14, 45CSR19 AND/OR TITLE V (45CSR30) PERMIT NUMBERS ASSOCIATED WITH THIS PROCESS (FOR AN EXISTING FACILITY ONLY): NA	
7C. IS THIS PDF BEING SUBMITTED AS THE RESULT OF AN ENFORCEMENT ACTION? IF YES, PLEASE LIST: NO		
8A. TYPE OF EMISSION SOURCE (CHECK ONE): <input checked="" type="checkbox"/> NEW SOURCE <input type="checkbox"/> ADMINISTRATIVE UPDATE <input type="checkbox"/> MODIFICATION <input type="checkbox"/> OTHER (PLEASE EXPLAIN IN 11B)		8B. IF ADMINISTRATIVE UPDATE, DOES DAQ HAVE THE APPLICANT'S CONSENT TO UPDATE THE EXISTING PERMIT WITH THE INFORMATION CONTAINED HEREIN? <input type="checkbox"/> YES <input type="checkbox"/> NO
9. IS DEMOLITION OR PHYSICAL RENOVATION AT AN EXISTING FACILITY INVOLVED? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
10A. DATE OF ANTICIPATED INSTALLATION OR CHANGE: 03/13/2015		10B. DATE OF ANTICIPATED START-UP: 03/13/2015
11A. PLEASE PROVIDE A DETAILED PROCESS FLOW DIAGRAM SHOWING EACH PROPOSED OR MODIFIED PROCESS EMISSION POINT AS ATTACHMENT B.		
11B. PLEASE PROVIDE A DETAILED PROCESS DESCRIPTION AS ATTACHMENT C.		
12. PLEASE PROVIDE MATERIAL SAFETY DATA SHEETS (MSDS) FOR ALL MATERIALS PROCESSED, USED OR PRODUCED AS ATTACHMENT D. FOR CHEMICAL PROCESSES, PLEASE PROVIDE A MSDS FOR EACH COMPOUND EMITTED TO AIR.		

**13A. REGULATED AIR POLLUTANT EMISSIONS:**

⇒ **FOR A NEW FACILITY**, PLEASE PROVIDE PLANT WIDE EMISSIONS BASED ON THE POTENTIAL TO EMIT (PTE) FOR THE FOLLOWING AIR POLLUTANTS INCLUDING ALL PROCESSES.

⇒ **FOR AN EXISTING FACILITY**, PLEASE PROVIDE THE PROPOSED CHANGE IN EMISSIONS BASED ON THE PTE OF ALL PROCESS CHANGES FOR THE FOLLOWING AIR POLLUTANTS.

PTE FOR A GIVEN POLLUTANT IS TYPICALLY BEFORE AIR POLLUTION CONTROL DEVICES AND IS COLLECTED BASED ON THE MAXIMUM DESIGN CAPACITY OF PROCESS EQUIPMENT.

POLLUTANT	HOURLY PTE (LB/HR)	YEARLY PTE (TON/YR) (HOURLY PTE MULTIPLIED BY 8760 HR/YR) DIVIDED BY 2000 LB/TON
PM	0.02	0.07
PM <sub>10</sub>	0.02	0.07
VOCs	3.19	13.97
CO	0.17	0.73
NO <sub>x</sub>	0.20	0.86
SO <sub>2</sub>	0.01	0.01
Pb	-	-
HAPs (AGGREGATE AMOUNT)	0.01	0.02
TAPs (INDIVIDUALLY)*	-	-
OTHER (INDIVIDUALLY)*	-	-

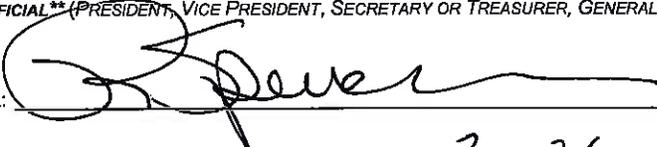
\* ATTACH ADDITIONAL PAGES AS NEEDED

**13B. PLEASE PROVIDE ALL SUPPORTING CALCULATIONS AS ATTACHMENT E.**

CALCULATE AN HOURLY AND YEARLY PTE OF EACH PROCESS EMISSION POINT (SHOWN IN YOUR DETAILED PROCESS FLOW DIAGRAM) FOR ALL AIR POLLUTANTS LISTED ABOVE INCLUDING INDIVIDUAL HAP'S (LISTED IN SECTION 112[b] OF THE 1990 CAAA), TAP'S (LISTED IN 45CSR27), AND OTHER AIR POLLUTANTS (E.G. POLLUTANTS LISTED IN TABLE 45-13A OF 45CSR13, MINERAL ACIDS PER 45CSR7, ETC.).

**14. CERTIFICATION OF DATA**

I, RANDY SPENCER (TYPE NAME) ATTEST THAT ALL THE REPRESENTATIONS CONTAINED IN THIS APPLICATION, OR APPENDED HERETO, ARE TRUE, ACCURATE, AND COMPLETE TO THE BEST OF MY KNOWLEDGE BASED ON INFORMATION AND BELIEF AFTER REASONABLE INQUIRY, AND THAT I AM A **RESPONSIBLE OFFICIAL**\*\* (PRESIDENT, VICE PRESIDENT, SECRETARY OR TREASURER, GENERAL PARTNER OR SOLE PROPRIETOR) OF THE APPLICANT.

SIGNATURE OF RESPONSIBLE OFFICIAL: 

TITLE: EH&S MANAGER

DATE: 2, 26, 15

\*\* THE DEFINITION OF THE PHRASE 'RESPONSIBLE OFFICIAL' CAN BE FOUND AT 45CSR13, SECTION 2.23.

**NOTE:** PLEASE CHECK ENCLOSED ATTACHMENTS

ATTACHMENT A     ATTACHMENT B     ATTACHMENT C     ATTACHMENT D     ATTACHMENT E

RECORDS ON ALL CHANGES ARE REQUIRED TO BE KEPT AND MAINTAINED ON-SITE FOR TWO (2) YEARS.

THE PERMIT DETERMINATION FORM WITH THE INSTRUCTIONS CAN BE FOUND ON DAO'S PERMITTING SECTION WEB SITE

[www.dep.wv.gov/daq](http://www.dep.wv.gov/daq)

# **ATTACHMENT A**

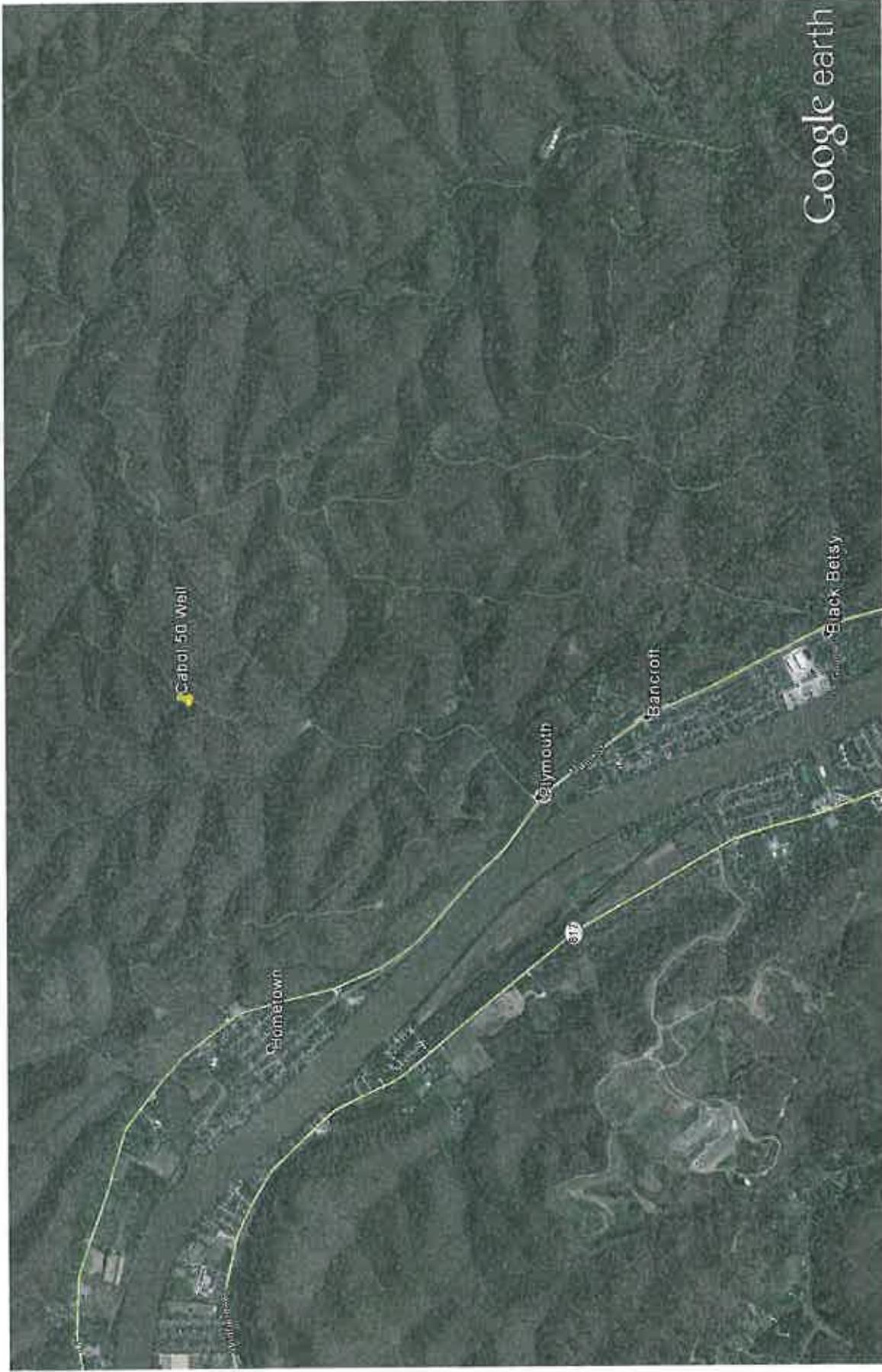
## **MAP**

### **Permit Determination**

**Cabot 50 Well Pad, New Facility  
Bancroft, West Virginia**

Cranberry Pipeline Corporation  
c/o Cabot Oil & Gas Corporation  
900 Lee Street East  
Suite 1500  
Charleston, WV 25301

February 2015



Google earth



© www.histofortmap.as.com

Google earth

feet  
km



**ATTACHMENT B**

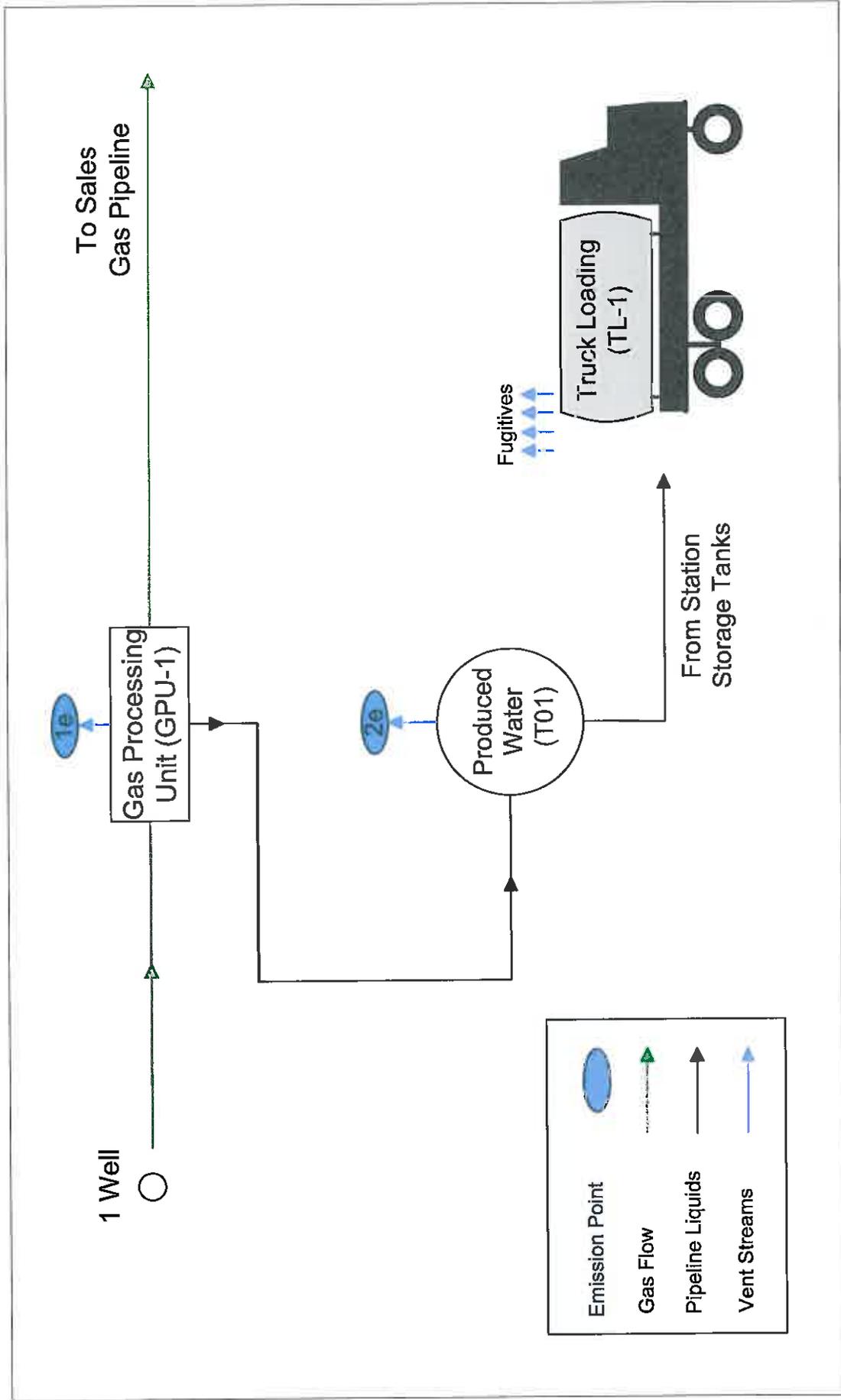
**PROCESS FLOW DIAGRAM**

**Permit Determination**

**Cabot 50 Well Pad, New Facility  
Bancroft, West Virginia**

Cranberry Pipeline Corporation  
c/o Cabot Oil & Gas Corporation  
900 Lee Street East  
Suite 1500  
Charleston, WV 25301

February 2015



**Process Flow Diagram**  
**Cranberry Pipeline Corporation**  
**Cabot 50**  
**Bancroft, West Virginia**

**ATTACHMENT C**

**PROCESS DESCRIPTION**

**Permit Determination**

**Cabot 50 Well Pad, New Facility  
Bancroft, West Virginia**

Cranberry Pipeline Corporation  
c/o Cabot Oil & Gas Corporation  
900 Lee Street East  
Suite 1500  
Charleston, WV 25301

February 2015

## PROCESS DESCRIPTION

---

This is a permit determination for Cranberry Pipeline Corporation's Cabot 50 well pad facility.

### **DESCRIPTION OF PROCESS**

The Cabot 50 well site consists of one well which is expected to produce around 4 MMscf/day, one 2 mmBtu/hr gas processing unit (GPU-1), and one 250 barrel above ground storage tank (T1) for produced water storage. The well is not expected to produce condensate and the maximum produced water production rate is estimated not to exceed 360 bbl/d. Although it is expected that this maximum daily volume of liquid will quickly diminish, this worst case daily throughput was used to estimate the entire year's production.

In addition to the maximum liquid production rate other emission inputs were also maximized to produce worst case emission estimates. For example, the flash gas emissions were estimated using pressurized liquid sampling from a like source which operated at a higher separator pressure of 540 psig. The Cabot 50 site plans to operate its GPU separation process at closer to 300 psig. Additionally, working and breathing losses were estimated assuming a worst case organic layer on top of the produced water having a Reid vapor pressure of 6 psig.

Even with these conservative assumptions the Cabot 50 site remains below the Rule 13 permitting triggers of 6 lb/hr and 10 tpy of any criteria pollutant such as VOC. The site was also evaluated for hazardous air pollutant emissions and found to only have trace quantities due to products of natural gas combustion within the GPU heater. The initial well characterization showed gas compositions equivalent to pipeline quality natural. Therefore, the HAP emissions are also estimated to be below the permitting triggers of 2 lb/hr or 5 tpy of aggregate HAP potential.

# **ATTACHMENT D**

## **MSDS**

### **Permit Determination**

**Cabot 50 Well Pad, New Facility  
Bancroft, West Virginia**

Cranberry Pipeline Corporation  
c/o Cabot Oil & Gas Corporation  
900 Lee Street East  
Suite 1500  
Charleston, WV 25301

February 2015

**UNOCAL MATERIAL SAFETY DATA SHEET**

Product Name: Processed Natural Gas  
Product Code: None

Page 1 of 8

**1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

Product Name: Processed Natural Gas  
Product Code: None  
Synonyms: Dry Gas  
Generic Name: Natural Gas  
Chemical Family: Paraffin hydrocarbon

Responsible Party: Unocal Corporation  
Union Oil Company of California  
14141 Southwest Freeway  
Sugar Land, Texas  
77478

For further information contact MSDS Coordinator  
8am - 4pm Central Time, Mon - Fri: 281-287-5310

**EMERGENCY OVERVIEW**

**24 Hour Emergency Telephone Numbers:**

For Chemical Emergencies:  
Spill, Leak, Fire or Accident  
Call CHEMTREC  
North America: (800) 424-9300  
Others: (703) 527-3887 (collect)

For Health Emergencies:  
California Poison  
Control System  
(800) 356-3129

**Health Hazards:** Use with adequate ventilation.

**Physical Hazards:** Flammable gas. Can cause flash fire. Gas displaces oxygen available for breathing. Keep away from heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment). Do not enter storage areas or confined space unless adequately ventilated.

< Physical Form: Gas  
< Appearance: Colorless  
< Odor: Odorless in the absence of H<sub>2</sub>S or mercaptans

NFPA HAZARD CLASS: Health: 1 (Slight)  
Flammability: 4 (Extreme)  
Reactivity: 0 (Least)

Issue Date: 03/18/03  
Revised Sections: 1, 3

Status: Final Revised

## UNOCAL

Product Name: Processed Natural Gas  
 Product Code: None

Page 2 of 8

## 2. COMPOSITION/INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	% Weight	EXPOSURE GUIDELINE		
		Limits	Agency	Type
Methane CAS# 74-82-8	98	1000 ppm	MSHA	TWA
Carbon Dioxide CAS# 124-38-9	0-5	5000 ppm	ACGIH	TWA
		30000 ppm	ACGIH	STEL
		5000 ppm	OSHA	TWA
		5000 ppm	MSHA	TWA
		5000 ppm	Cal.OSHA	TWA
30000 ppm	Cal.OSHA	STEL		
Nitrogen CAS# 7727-37-9	0-5	1000 ppm	MSHA	TWA
Ethane CAS# 74-84-0	1	1000 ppm	MSHA	TWA

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

## 3. HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS:

**Eye:** Not expected to be an eye irritant.

**Skin:** Skin contact is unlikely. Skin absorption is unlikely.

**Inhalation (Breathing):** Asphyxiant. High concentrations in confined spaces may limit oxygen available for breathing.

**Ingestion (Swallowing):** This material is a gas under normal atmospheric conditions and ingestion is unlikely.

**Signs and Symptoms:** Light hydrocarbon gases are simple asphyxiants which, at high enough concentrations, can reduce the amount of oxygen available for breathing. Symptoms of overexposure can include shortness of breath, drowsiness, headaches, confusion,

Issue Date: 03/18/03  
 Revised Sections: 1, 3

Status: Final Revised

UNOCAL

Product Name: Processed Natural Gas  
Product Code: None

Page 3 of 8

decreased coordination, visual disturbances and vomiting, and are reversible if exposure is stopped. Continued exposure can lead to hypoxia (inadequate oxygen), cyanosis (bluish discoloration of the skin), numbness of the extremities, unconsciousness and death. High concentrations of carbon dioxide can increase heart rate and blood pressure.

**Cancer:** No data available.

**Target Organs:** No data available.

**Developmental:** Limited data - See Other Comments, below.

**Other Comments:** High concentrations may reduce the amount of oxygen available for breathing, especially in confined spaces. Hypoxia (inadequate oxygen) and respiratory acidosis (increased carbon dioxide in blood), during pregnancy may have adverse effects on the developing fetus. Exposure during pregnancy to high concentrations of carbon monoxide, which is produced during the combustion of hydrocarbon gases, can also cause harm to the developing fetus.

**Pre-Existing Medical Conditions:** None known.

#### 4. FIRST AID MEASURES

**Eye:** If irritation or redness develops, move victim away from exposure and into fresh air. Flush eyes with clean water. If symptoms persist, seek medical attention.

**Skin:** First aid is not normally required. However, it is good practice to wash any chemical from the skin.

**Inhalation (Breathing):** If respiratory symptoms develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention. If victim is not breathing, immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

**Ingestion (Swallowing):** This material is a gas under normal atmospheric conditions and ingestion is unlikely.

Issue Date: 03/18/03  
Revised Sections: 1, 3

Status: Final Revised

UNOCAL

Product Name: Processed Natural Gas  
Product Code: None

Page 4 of 8

**5. FIRE FIGHTING MEASURES**

**Flammable Properties:** Flash Point: Not applicable (gas)  
OSHA Flammability Class: Flammable gas  
LEL / UEL: No data  
Autoignition Temperature: 800-1000°F

**Unusual Fire & Explosion Hazards:** This material is flammable and may be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, or mechanical/electrical equipment). Vapors may travel considerable distances to a source of ignition where they can ignite, flashback, or explode. May create vapor/air explosion hazard indoors, outdoors, or in sewers. If container is not properly cooled, it can rupture in the heat of a fire. Closed containers exposed to extreme heat can rupture due to pressure buildup.

**Extinguishing Media:** Dry chemical or carbon dioxide is recommended. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

**Fire Fighting Instructions:** For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self-contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8). Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. If this cannot be done, allow fire to burn. Move undamaged containers from immediate hazard area if it can be done with minimal risk. Stay away from ends of container. Water spray may be useful in minimizing or dispersing vapors. Cool equipment exposed to fire with water, if it can be done with minimal risk.

**6. ACCIDENTAL RELEASE MEASURES**

Flammable. Keep all sources of ignition and hot metal surfaces away from spill/release. The use of explosion-proof equipment is recommended. Stay upwind and away from spill/release. Notify persons down wind of spill/release, isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with

Issue Date: 03/18/03  
Revised Sections: 1, 3

Status: Final Revised

UNOCAL

Product Name: Processed Natural Gas  
Product Code: None

Page 5 of 8

minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8). Notify fire authorities and appropriate federal, state, and local agencies. Water spray may be useful in minimizing or dispersing vapors (see Section 5).

**7. HANDLING AND STORAGE**

**Handling:** The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Section 2 and 8). Use good personal hygiene practice.

**Storage:** Keep container(s) tightly closed. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Post area "No Smoking or Open Flame." Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred.

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

**Engineering controls:** If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits (see Section 2), additional ventilation or exhaust systems may be required. Where explosive mixtures may be present, electrical systems safe for such locations must be used (see appropriate electrical codes).

**Personal Protective Equipment (PPE):**

**Respiratory:** Wear a positive pressure air supplied respirator in oxygen deficient environments (oxygen content <19.5%). A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

**Skin:** Not required based on the hazards of the material. However, it is considered good practice to wear gloves when handling chemicals.

Issue Date: 03/18/03  
Revised Sections: 1, 3

Status: Final Revised

UNOCAL

Product Name: Processed Natural Gas  
Product Code: None

Page 6 of 8

**Eye/Face:** While contact with this material is not expected to cause irritation, the use of approved eye protection to safeguard against potential eye contact is considered good practice.

**Other Protective Equipment:** A source of clean water should be available in the work area for flushing eyes and skin. Impervious clothing should be worn as needed. Self-contained respirators should be available for non-routine and emergency situations.

**9. PHYSICAL AND CHEMICAL PROPERTIES**

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm).

Flash Point: Not applicable (gas)  
Flammable/Explosive Limits (%): No data  
Autoignition Temperature: 800-1000°F  
Appearance: Colorless  
Physical State: Gas  
Odor: Odorless in the absence of H<sub>2</sub>S or mercaptans  
Vapor Pressure (mm Hg): No data  
Vapor Density (air=1): <1  
Boiling Point: -259°F  
Freezing/Melting Point: No data  
Solubility in Water: Slight  
Specific Gravity: 0.30+ (Air=1)  
Percent Volatile: 100 vol.%  
Evaporation Rate (nBuAc=1): N/A (Gas)

**10. STABILITY AND REACTIVITY**

**Chemical Stability:** Stable under normal conditions of storage and handling.

**Conditions To Avoid:** Avoid all possible sources of ignition (see Sections 5 & 7).

**Incompatible Materials:** Avoid contact with strong oxidizing agents.

**Hazardous Decomposition Products:** Combustion can yield carbon dioxide and carbon monoxide.

Issue Date: 03/18/03  
Revised Sections: 1, 3

Status: Final Revised

UNOCAL

Product Name: Processed Natural Gas  
Product Code: None

Page 7 of 8

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

No definitive information available on carcinogenicity, mutagenicity, target organs or developmental toxicity.

12. DISPOSAL CONSIDERATIONS

This material, if discarded as produced, would be a RCRA "characteristic" hazardous waste due to the characteristic(s) of ignitability (D001). If the material is spilled to soil or water, characteristic testing of the contaminated materials is recommended. Further, this material is subject to the land disposal restriction in 40 CFR 268.40 and may require treatment prior to disposal to meet specific standards. Consult state and local regulations to determine whether they are more stringent than the federal requirements.

Container contents should be completely used and containers should be emptied prior to discard. Container rinsate could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. Larger empty containers, such as drums, should be returned to the distributor or to a drum reconditioner. To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name / Technical Name: Hydrocarbon Gas, Liquefied  
N.O.S. (Methane)  
Hazard Class or Division: 2.1  
ID #: UN1965

14. REGULATORY INFORMATION

This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:

--None--

**Warning:** This material contains the following chemicals which are known to the State of California to cause cancer, birth defects or

Issue Date: 03/18/03  
Revised Sections: 1, 3

Status: Final Revised

UNOCAL

Product Name: Processed Natural Gas  
Product Code: None

Page 8 of 8

other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

--None Known--

This material has not been identified as a carcinogen by NTP, IARC, or OSHA.

EPA (CERCLA) Reportable Quantity: --None--

**15. DOCUMENTARY INFORMATION**

Issue Date: 03/18/03  
Previous Issue Date: 11/29/99  
Product Code: None  
Previous Product Code: None

**16. DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES**

The information in this document is believed to be correct as of the date issued. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THIS INFORMATION, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. This information and product are furnished on the condition that the person receiving them shall make his own determination as to the suitability of the product for his particular purpose and on the condition that he assume the risk of his use thereof.

Issue Date: 03/18/03  
Revised Sections: 1, 3

Status: Final Revised

# **ATTACHMENT E**

# **CALCULATIONS**

## **Permit Determination**

**Cabot 50 Well Pad, New Facility  
Bancroft, West Virginia**

Cranberry Pipeline Corporation  
c/o Cabot Oil & Gas Corporation  
900 Lee Street East  
Suite 1500  
Charleston, WV 25301

February 2015

**Table 1: Annual Potential To Emit (PTE)  
Cranberry Pipeline Corporation - Cabot 50**

**Criteria PTE**

Source	PM	PM10	PM2.5	SO2	NOx	CO	VOC	CO2e
Tanks (ton/yr)	-	-	-	-	-	-	3.987	-
Truck Loading (ton/yr)	-	-	-	-	-	-	0.139	-
GPU Heaters	0.065	0.065	0.065	0.005	0.859	0.721	0.047	1025.007
Fugitives	-	-	-	-	-	-	0.002	8.113
<b>Total Emissions (ton/yr)</b>	<b>0.065</b>	<b>0.065</b>	<b>0.065</b>	<b>0.005</b>	<b>0.859</b>	<b>0.721</b>	<b>4.175</b>	<b>1033.120</b>
<b>Total Emissions (lb/hr)</b>	<b>0.015</b>	<b>0.015</b>	<b>0.015</b>	<b>0.001</b>	<b>0.196</b>	<b>0.165</b>	<b>0.953</b>	<b>235.872</b>

**HAP PTE**

Source	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane	Formaldehyde	Total HAPs Listed (tpy)
Tanks (ton/yr)	-	-	-	-	-	-	0.000
Truck Loading (ton/yr)	-	-	-	-	-	-	0.000
GPU Heaters	0.000	0.000	-	-	0.015	0.001	0.016
<b>Total Emissions (ton/yr)</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.014</b>	<b>0.001</b>	<b>0.016</b>
<b>Total Emissions (lb/hr)</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.003</b>	<b>0.000</b>	<b>0.004</b>

**Table 2. Tank Emissions  
Cranberry Pipeline Corporation - Cabot 50**

Emission Unit	Tank Contents	Tank Throughput (bbls/day)	Flashing EF <sup>1</sup> (lbs/bbls)	Flashing Emissions (lbs/day) <sup>(a)</sup>	Working and Breathing Emissions (lbs/day) <sup>(b)</sup>	VOC Emissions (lb/hr)	VOC Emissions (tons/yr)
T01	Produced Water	360.0	0.001	0.36	21.49	0.9103	3.9872
<b>Total</b>						<b>0.9103</b>	<b>3.9872</b>

**Calculations:**

(a) Flashing Emissions

PTE emissions (lbs/day) = [Tank Throughput (bbls/day)] x [Flashing EF (lbs/bbls)]

(b) Working and Breathing Emissions (2)

PTE emissions (lbs/day) = [EPA Tank 4.09 Emissions (lbs/year)] / [ (days/year)]

**Notes:**

(1) Flashing EF from Pressurized Liq (produced water @ 540 psig) Flash Gas Liberation of Separator Water at Zick No. 7H

(2) Model output from EPA Tank 4.09 (See supporting documentation attached)

**Table 3. Gas Processing Unit (GPU) Rates and Emissions  
Cranberry Pipeline Corporation - Cabot 50**

Pollutant	Emission Factor		Emissions (lbs/hr)	Emissions (tons/yr)
<b>Criteria Pollutants</b>				
PM/PM10/PM2.5	7.6 lb/MMcf	(1)	1.49E-2	6.53E-2
SO <sub>2</sub>	0.6 lb/MMcf	(1)	1.18E-3	5.15E-3
NO <sub>x</sub>	100 lb/MMcf	(2)	1.96E-1	8.59E-1
CO	84 lb/MMcf	(2)	1.65E-1	7.21E-1
VOC	5.5 lb/MMcf	(1)	1.08E-2	4.72E-2
<b>Hazardous Air Pollutants</b>				
Arsenic	2.0E-04 lb/MMcf	(3)	3.92E-7	1.72E-6
Benzene	2.1E-03 lb/MMcf	(4)	4.12E-6	1.80E-5
Beryllium	1.2E-05 lb/MMcf	(3)	2.35E-8	1.03E-7
Cadmium	1.1E-03 lb/MMcf	(3)	2.16E-6	9.45E-6
Chromium	1.4E-03 lb/MMcf	(3)	2.75E-6	1.20E-5
Cobalt	8.4E-05 lb/MMcf	(3)	1.65E-7	7.21E-7
Dichlorobenzene	1.2E-03 lb/MMcf	(4)	2.35E-6	1.03E-5
Formaldehyde	7.5E-02 lb/MMcf	(4)	1.47E-4	6.44E-4
Hexane	1.8E+00 lb/MMcf	(4)	3.53E-3	1.55E-2
Lead	5.0E-04 lb/MMcf	(3)	9.80E-7	4.29E-6
Manganese	3.8E-04 lb/MMcf	(3)	7.45E-7	3.26E-6
Mercury	2.6E-04 lb/MMcf	(3)	5.10E-7	2.23E-6
Naphthalene	6.1E-04 lb/MMcf	(4)	1.20E-6	5.24E-6
Nickel	2.1E-03 lb/MMcf	(3)	4.12E-6	1.80E-5
PAH/POM	1.3E-03 lb/MMcf	(4)	2.53E-6	1.11E-5
Selenium	2.4E-05 lb/MMcf	(3)	4.71E-8	2.06E-7
Toluene	3.4E-03 lb/MMcf	(4)	6.67E-6	2.92E-5
<b>Total HAP</b>	<b>1.9E+00 lb/MMCF</b>		<b>3.71E-3</b>	<b>1.62E-2</b>
<b>Greenhouse Gas Emissions</b>				
CO <sub>2</sub>	116.89 lb/MMBtu	(5)	2.34E+2	1.02E+3
CH <sub>4</sub>	2.2E-03 lb/MMBtu	(5)	4.41E-3	1.93E-2
N <sub>2</sub> O	0.0 lb/MMBtu	(5)	4.41E-4	1.93E-3
CO <sub>2</sub> e <sup>(b)</sup>	-	-	234.020	1,025.007

**Calculations:**

(a) Annual emissions (tons/yr) = [Annual Usage (MMBtu/yr or MMCF/yr)]x [Number of Identical Heaters]x [Emission Factor (lb/MMBtu or lb/MMCF)] / [2,000 lb/ton]

Number of GPUs 1  
 Fuel Use (MMBtu/hr) = 2  
 Hours of Operation (hr/yr) = 8760  
 PTE Fuel Use (MMcf/yr) = 17.2 (7)

(b) CO<sub>2</sub> equivalent = [(CO<sub>2</sub> emissions)\*(GWP<sub>CO2</sub>)]+[(CH<sub>4</sub> emissions)\*(GWP<sub>CH4</sub>)]+[(N<sub>2</sub>O emissions)\*(GWP<sub>N2O</sub>)]  
 Global Warming Potential (GWP)

CO <sub>2</sub>	1	(6)
CH <sub>4</sub>	25	(6)
N <sub>2</sub> O	298	(6)

**Notes:**

- (1) AP-42, Chapter 1.4, Table 1.4-2. Emission Factors For Criteria Pollutants and Greenhouse Gases From Natural Gas Combustion, July 1998.
- (2) AP-42, Chapter 1.4, Table 1.4-1. Emission Factors For Nitrogen Oxides (Nox) and Carbon Monoxide(CO) From Natural Gas Combustion, July 1998.
- (3) AP-42, Chapter 1.4, Table 1.4-4. Emission Factors For Metals From Natural Gas Combustion, July 1998.
- (4) AP-42, Chapter 1.4, Table 1.4-3. Emission Factors for Speciated Organic Compounds from Natural Gas Combustion, July 1998.
- (5) Emission factors are from 40 CFR 98, Subpart C, Table C-1 and C-2.
- (6) Global Warming Potentials obtained from 40 CFR 98, Subpart A, Table A-1.
- (7) MMBtu to MMcf conversion factor is 1020. AP-42, Chapter 1.4.

**Table 4. Truck Loading VOC Emissions  
Cranberry Pipeline Corporation - Cabot 50**

Contents	Volume Transferred	Loading Loss <sup>(a)</sup> (lb VOC/1000gal)	PTE VOC Emissions (lb/hr)	PTE VOC Emissions <sup>(b)</sup> (tons/yr)
Water	5,518,800 gal/yr	0.050	0.032	0.139
<b>Total</b>			<b>0.032</b>	<b>0.139</b>

**Calculations:**

(a) Loading Loss (lbs/1000 gal) =  $12.46 \times [\text{Saturation Factor}] \times [\text{True Vapor Pressure of Liquid Loaded (psia)}] \times [\text{Molecular Weight of Vapors (lbs/lb-mole)}] / [\text{Temperature of Bulk Liquid Loaded (°R)}]$

(b) Annual Emissions(tons/yr) =  $[\text{Loading Loss (lb VOC/ 1000 gal)}] \times [\text{Volume Transferred(gal/yr)}] / 1000 / 2000$

Water

Saturation factor= 1.40 (1)

Pvap (psia)= 0.012 (2)

Molecular Weight (lb/lb-mol)= 130.0 (2)

Bulk Liquid Temperature (F)= 80.0

**Notes:**

(1) AP-42 Section 5.2 (splash fill)

(2) AP-42 Section 7.1, Table 7.1-2 (#2 fuel oil)

**Table 5. Fugitive Leak Emissions  
Cranberry Pipeline Corporation - Cabot 50**

Fugitive emissions from valves and fittings are calculated using the major equipment default component count approach from 40 CFR Part 98 because site-specific component counts have not been collected.

Pollutant	Emission Factor Total Gas Losses	Annual emission losses <sup>(a)</sup> (tons/yr)
Valves	1.30E-05 kg/hr/source (1)	0.0100
Pressure Relief Valves	1.20E-04 kg/hr/source (1)	0.0081
Connector	1.20E-04 kg/hr/source (1)	0.3012
Open-ended Lines	1.20E-04 kg/hr/source (1)	0.0203
<b>Total</b>	-	<b>0.3396</b>

**Calculations:**

(a) Annual emission losses (tons/yr) = [Emission Factor (kg/hr/source)] x [Number of Sources] x [Hours of Operation per Year] x [0.001102 tons/ kg]

(b) Leak detection survey conducted on 12-29-2012 revealed no leaks at the facility.

Number of Components in Gas Service

Valves=	80	(2)
Pressure Relief Valves=	7	(2)
Connectors=	260	(2)
Open-ended lines	18	(2)

Maximum Hour of Operation = 8,760

Compound	Fraction <sup>(3)</sup>	Potential Annual Emissions (tons/yr) <sup>(b)</sup>
C6 +	0.00022	0.0001
Nitrogen	0.01138	0.0039
Methane	0.95532	0.3244
CO2	0.00601	0.0020
Ethane	0.02203	0.0075
Propane	0.0035	0.0012
i Butane	0.00039	0.0001
n Butane	0.0008	0.0003
i Pentane	0.0002	0.0001
n Pentane	0.00015	0.0001
<b>Total VOC Emissions</b>		<b>0.0018</b>
<b>Total CO2e<sup>(c)</sup></b>		<b>8.11</b>

(b) Potential Annual Emissions (tons/yr) = Annual Emission Losses (TPY) X (compound Weight fraction)

(c) CO<sub>2</sub> equivalent = [(CO<sub>2</sub> emissions) x (GWP<sub>CO2</sub>)] + [(CH<sub>4</sub> emissions) x (GWP<sub>CH4</sub>)] + [(N<sub>2</sub>O emissions) x (GWP<sub>N2O</sub>)]  
Global Warming Potential (GWP)

CO <sub>2</sub>	1	(4)
CH <sub>4</sub>	25	(4)
N <sub>2</sub> O	298	(4)

**Notes:**

(1) Emission factors from *Protocol for Equipment Leak Emission Estimates* Table 2-3 Marketing Terminal Average Emission Factors

(2) *Default Average Component Counts for Major Onshore Natural Gas Production Equipment* from 40 CFR 98, Subpart

(3) Representative Gas Analysis Results from the Dangle Facility

(4) Global Warming Potentials obtained from 40 CFR 98, Subpart A, Table A-1

**TANKS 4.0.9d**  
**Emissions Report - Detail Format**  
**Tank Identification and Physical Characteristics**

**Identification**

User Identification: Cabot\_Cabot 50\_T01  
City: Charleston  
State: West Virginia  
Company: Cabot Oil & Gas Corporation  
Type of Tank: Vertical Fixed Roof Tank  
Description: 250 BBL Produced Water Tank

**Tank Dimensions**

Shell Height (ft): 18.00  
Diameter (ft): 10.00  
Liquid Height (ft) : 18.00  
Avg. Liquid Height (ft): 4.50  
Volume (gallons): 10,500.00  
Turnovers: 525.60  
Net Throughput(gal/yr): 5,518,800.00  
Is Tank Heated (y/n): N

**Paint Characteristics**

Shell Color/Shade: Red/Primer  
Shell Condition: Good  
Roof Color/Shade: Red/Primer  
Roof Condition: Good

**Roof Characteristics**

Type: Dome  
Height (ft): 0.00  
Radius (ft) (Dome Roof): 10.00

**Breather Vent Settings**

Vacuum Settings (psig): -0.03  
Pressure Settings (psig): 0.03

Meteorological Data used in Emissions Calculations: Charleston, West Virginia (Avg Atmospheric Pressure = 14.25 psia)

**TANKS 4.0.9d**  
**Emissions Report - Detail Format**  
**Liquid Contents of Storage Tank**

**Cabot\_Cabot 50\_T01 - Vertical Fixed Roof Tank**  
**Charleston, West Virginia**

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp (deg F)	Vapor Pressure (psia)			Vapor Mol. Weight	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
		Avg.	Min.	Max.		Avg.	Min.	Max.					
Gasoline (RVP 6)	All	68.21	54.54	77.87	59.32	3.3337	2.6165	4.2030	68.0000			92.00	Option 4: RVP=6, ASTM Slope=3

**TANKS 4.0.9d**  
**Emissions Report - Detail Format**  
**Detail Calculations (AP-42)**

**Cabot\_Cabot 50\_T01 - Vertical Fixed Roof Tank**  
**Charleston, West Virginia**

**Annual Emission Calculations**

Standing Losses (lb): 1,080.3713  
Vapor Space Volume (cu ft): 1,114.1583  
Vapor Density (lb/cu ft): 0.0408  
Vapor Space Expansion Factor: 0.2285  
Vented Vapor Saturation Factor: 0.2852

Tank Vapor Space Volume:  
Vapor Space Volume (cu ft): 1,114.1583  
Tank Diameter (ft): 10.0000  
Vapor Space Outage (ft): 14.1859  
Tank Shell Height (ft): 18.0000  
Average Liquid Height (ft): 4.5000

TANKS 4.0 Report

Roof Outage (ft): 0.8859

Roof Outage (Dome Roof)  
 Roof Outage (ft): 0.8859  
 Dome Radius (ft): 10.0000  
 Shell Radius (ft): 5.0000

Vapor Density  
 Vapor Density (lb/cu ft): 0.0408  
 Vapor Molecular Weight (lb/lb-mole): 68.0000  
 Vapor Pressure at Daily Average Liquid Surface Temperature (psia): 3.3337  
 Daily Avg. Liquid Surface Temp. (deg. R): 525.8785  
 Daily Average Ambient Temp. (deg. F): 54.9933  
 Ideal Gas Constant R (psia cuft / (lb-mol-deg R)): 10.731  
 Liquid Bulk Temperature (deg. R): 518.9933  
 Tank Paint Solar Absorptance (Shell): 0.8900  
 Tank Paint Solar Absorptance (Roof): 0.8900  
 Daily Total Solar Insulation Factor (Btu/sqft day): 1,250.5728

Vapor Space Expansion Factor  
 Vapor Space Expansion Factor: 0.2285  
 Daily Vapor Temperature Range (deg. R): 48.6683  
 Daily Vapor Pressure Range (psia): 1.5865  
 Breather Vent Press. Setting Range (psia): 0.0600  
 Vapor Pressure at Daily Average Liquid Surface Temperature (psia): 3.3337  
 Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia): 2.6185  
 Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia): 4.2030  
 Daily Avg. Liquid Surface Temp. (deg R): 525.8785  
 Daily Min. Liquid Surface Temp. (deg R): 514.2094  
 Daily Max. Liquid Surface Temp. (deg R): 537.5436  
 Daily Ambient Temp. Range (deg. R): 21.5333

Vented Vapor Saturation Factor  
 Vented Vapor Saturation Factor: 0.2852  
 Vapor Pressure at Daily Average Liquid Surface Temperature (psia): 3.3337  
 Vapor Space Outage (ft): 14.1859

Working Losses (lb): 6,782.6636  
 Vapor Molecular Weight (lb/lb-mole): 68.0000  
 Vapor Pressure at Daily Average Liquid Surface Temperature (psia): 3.3337  
 Annual Net Throughput (gal/yr.): 5,518,800.0000  
 Annual Turnovers: 525.6000  
 Turnover Factor: 0.2237  
 Maximum Liquid Volume (gal): 10,500.0000  
 Maximum Liquid Height (ft): 18.0000  
 Tank Diameter (ft): 10.0000  
 Working Loss Product Factor: 1.0000

Total Losses (lb): 7,843.0349

**TANKS 4.0.9d  
 Emissions Report - Detail Format  
 Individual Tank Emission Totals**

**Emissions Report for: Annual**

**Cabot\_Cabot 50\_T01 - Vertical Fixed Roof Tank  
 Charleston, West Virginia**

Components	Losses(lbs)		
	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 6)	6,762.66	1,080.37	7,843.03



**FESCO, Ltd.**  
**1100 Fesco Avenue - Alice, Texas 78332**

**For:** SLR International Corporation  
 900 Lee Street, Suite 500  
 Charleston, West Virginia 25301

**Date Sampled:** 11/19/13

**Date Analyzed:** 12/02/13

**Job Number:** J36876

**Sample:** Zick No. 7H

<b>FLASH LIBERATION OF SEPARATOR WATER</b>		
	<b>Separator</b>	<b>Stock Tank</b>
<b>Pressure, psig</b>	540	0
<b>Temperature, °F</b>	92	70
<b>Gas Water Ratio (1)</b>	-----	1.87
<b>Gas Specific Gravity (2)</b>	-----	0.572
<b>Separator Volume Factor (3)</b>	1.000	1.000

(1) - Scf of water saturated vapor per barrel of stock tank water

(2) - Air = 1.000

(3) - Separator volume / Stock tank volume

Analyst:           A. A.          

Piston No. : WF-130\*

**Base Conditions: 14.65 PSI & 60 °F**

**Certified: FESCO, Ltd. - Alice, Texas**

**David Dannhaus 361-661-7015**

**FESCO, Ltd.**  
**1100 Fesco Ave. - Alice, Texas 78332**

For: SLR International Corporation  
 900 Lee Street, Suite 500  
 Charleston, West Virginia 25301

Sample: Zick No. 7H  
 Gas Liberated from Separator Water  
 From 540 psig & 92 °F to 0 psig & 70 °F

Date Sampled: 11/19/13

Job Number: 36876.001

**CHROMATOGRAPH EXTENDED ANALYSIS - SUMMATION REPORT - GPA 2286**

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	< 0.001	
Nitrogen	0.261	
Carbon Dioxide	0.341	
Methane	97.589	
Ethane	1.664	0.449
Propane	0.026	0.007
Isobutane	0.002	0.001
n-Butane	0.001	0.000
2-2 Dimethylpropane	0.000	0.000
Isopentane	0.002	0.001
n-Pentane	0.001	0.000
Hexanes	0.009	0.004
Heptanes Plus	<u>0.104</u>	<u>0.051</u>
Totals	100.000	0.512

**Computed Real Characteristics Of Heptanes Plus:**

Specific Gravity ----- 4.237 (Air=1)  
 Molecular Weight ----- 122.47  
 Gross Heating Value ----- 6424 BTU/CF

**Computed Real Characteristics Of Total Sample:**

Specific Gravity ----- 0.572 (Air=1)  
 Compressibility (Z) ----- 0.9979  
 Molecular Weight ----- 16.53  
 Gross Heating Value  
   Dry Basis ----- 1036 BTU/CF  
   Saturated Basis ----- 1019 BTU/CF

\*Hydrogen Sulfide tested in laboratory by: Stained Tube Method (GPA 2377)

Results: <0.013 Gr/100 CF, <0.2 PPMV or <0.001 Mol %

Base Conditions: 14.850 PSI & 60 Deg F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: HB  
 Processor: ANB  
 Cylinder ID: WF# 1 S

David Dannhaus 361-661-7015

**CHROMATOGRAPH EXTENDED ANALYSIS  
TOTAL REPORT - GPA 2286**

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	< 0.001		< 0.001
Nitrogen	0.261		0.442
Carbon Dioxide	0.341		0.908
Methane	97.589		94.714
Ethane	1.664	0.449	3.027
Propane	0.026	0.007	0.069
Isobutane	0.002	0.001	0.007
n-Butane	0.001	0.000	0.004
2,2 Dimethylpropane	0.000	0.000	0.000
Isopentane	0.002	0.001	0.009
n-Pentane	0.001	0.000	0.004
2,2 Dimethylbutane	0.000	0.000	0.000
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.000	0.000	0.000
2 Methylpentane	0.000	0.000	0.000
3 Methylpentane	0.000	0.000	0.000
n-Hexane	0.009	0.004	0.047
Methylcyclopentane	0.000	0.000	0.000
Benzene	0.000	0.000	0.000
Cyclohexane	0.010	0.003	0.051
2-Methylhexane	0.000	0.000	0.000
3-Methylhexane	0.000	0.000	0.000
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.000	0.000	0.000
n-Heptane	0.007	0.003	0.042
Methylcyclohexane	0.014	0.006	0.083
Toluene	0.016	0.005	0.089
Other C8's	0.000	0.000	0.000
n-Octane	0.006	0.003	0.041
Ethylbenzene	0.000	0.000	0.000
M & P Xylenes	0.008	0.003	0.051
O-Xylene	0.000	0.000	0.000
Other C9's	0.000	0.000	0.000
n-Nonane	0.000	0.000	0.000
Other C10's	0.000	0.000	0.000
n-Decane	0.000	0.000	0.000
Undecanes (11)	<u>0.043</u>	<u>0.027</u>	<u>0.412</u>
Totals	100.000	0.512	100.000

**Computed Real Characteristics Of Total Sample:**

Specific Gravity -----	0.572	(Air=1)
Compressibility (Z) -----	0.9979	
Molecular Weight -----	16.53	
Gross Heating Value		
Dry Basis -----	1036	BTU/CF
Saturated Basis -----	1019	BTU/CF

## Emission Factor Calculation

Zick Well Pad Separator at 540psig and 92 F

Flash Gas Volume (scf/bbl)	Ideal Gas Volume (scf/mole)	Flash Gas MW (lb/lbmol)	Flash Gas wt fraction (VOC C3+/lb)	Emission Factor (lb VOC/bbl)
1.87	385	16.53	0.0091	0.000730626



Gas Analytical

Report Date: Jan 14, 2015 1:21p

Client:	Cabot Oil & Gas-Sissonville	Date Sampled:	Jan 14, 2015 12:30p
Site:	Unknown	Analysis Date:	Jan 14, 2015 3:00p
Field No:	9998	Collected By:	MIKE FERRELL
Meter:	S-008	Date Effective:	Jan 1, 2015 7:00a
Source Laboratory	Charleston, WV	Sample Pressure (PSI):	150.0
Lab File No:	A3826	Sample Temp (°F):	80
Sample Type:	Spot	Field H2O (PPM):	
Reviewed By:		Field H2S (PPM):	NT

Component	Mol %	Gal/MSCF
Methane	95.5589	
Ethane	2.1793	0.58
Propane	0.1926	0.05
I-Butane	0.0153	0.00
N-Butane	0.0282	0.01
I-Pentane	0.0103	0.00
N-Pentane	0.0048	0.00
Nitrogen	1.8286	
CO2	0.1442	
Hexanes+	0.0378	0.02
TOTAL	100.0000	0.67

Analytical Results at Base Conditions (Real)	
BTU/SCF (Dry):	1,016.6113 BTU/ft <sup>3</sup>
BTU/SCF (Saturated):	999.7954 BTU/ft <sup>3</sup>
PSIA:	14.73 PSI
Temperature (°F):	60.00 °F
Z Factor (Dry):	0.99794
Z Factor (Saturated):	0.99760

Analytical Results at Contract Conditions (Real)	
BTU/SCF (Dry):	1,016.6113 BTU/ft <sup>3</sup>
BTU/SCF (Saturated):	999.7954 BTU/ft <sup>3</sup>
PSIA:	14.7300 PSI
Temperature (°F):	60.0000 °F
Z Factor (Dry):	0.99794
Z Factor (Saturated):	0.99760

Calculated Specific Gravities	
Ideal Gravity:	0.5772      Real Gravity: 0.5782
Molecular Wt:	16.7174 lb/lbmol

Gross Heating Values are Based on:  
GPA 2145-09, 2186  
Compressibility is Calculated using AGA-8.

Source	Date	Notes

Station ID: GLASGOW  
 Device ID : 00000

Location:

Cabot 50

SYSTEM:  
 LEASE:  
 OPERATOR:

STATE:  
 PRODUCER:  
 BUYER:

Results Date/Time 01/14/2015 15:23  
 Stream Number 1  
 Manifold Temp 146.140 (deg F)  
 Oven Temp 140.023 (deg F)  
 Calculation Type AGA-8  
 Stream Application Rev 2103507-009  
 Metrology Control Number 2103313-001  
 Flash Software Part Number 2102411-035  
 Contract Pressure 14.730 (psia)  
 Contract Temp 60.000 (deg F)  
 Carrier Pressure(1) 33.400 (psig)  
 Carrier Pressure(2) 16.950 (psig)  
 Sample Pressure 12.394 (psig)

Comp	Response Factor	UnNorm	Norm	P Area	P Height	P Time	Liquids (USgal/MCF)	Ideal (Btu/SCF)	Rel. Den.
Propane	3.2326	0.2216	0.2203	632151	6908	50.17	0.0607	5.534	0.0033
Hydrogen Sulfide	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Isobutane	2.6614	0.0175	0.0174	55847	500	72.10	0.0057	0.565	0.0003
Butane	11.3678	0.0357	0.0354	117566	949	80.83	0.0112	1.156	0.0007
NeoPentane	0.4643	0.0016	0.0015	5864	40	104.85	0.0006	0.062	0.0000
IsoPentane	0.4303	0.0095	0.0094	36352	188	138.90	0.0034	0.377	0.0002
Pentane	2.0846	0.0078	0.0077	29948	136	162.03	0.0028	0.310	0.0002
Hexane+	0.1804	0.0187	0.0186	126006	1287	21.83	0.0000	0.000	0.0000
Nitrogen	4.6786	2.1594	2.1431	4993263	55396	45.03	0.0000	0.000	0.0207
Methane	1.3303	95.8089	95.0869	171241572	611660	54.60	0.0000	960.378	0.5267
CarbonDioxide	1.6780	0.1782	0.1769	393873	1777	97.43	0.0000	0.000	0.0027
Ethane	1.0685	2.3004	2.2830	7237469	16522	217.48	0.6117	40.403	0.0237
Hexane	0.0000	0.0000	0.0186	0	0	0.00	0.0077	0.884	0.0006
Heptane+	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Heptane	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Octane	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Nonane+	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Nonane	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Decane	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Undecane	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Dodecane	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Ethane-	0.0000	0.0000	0.0000	116130846	1151212	32.55	0.0000	0.000	0.0000
Propane +	0.0000	0.0000	0.0000	1365825	10960	30.50	0.0000	0.000	0.0000
Oxygen	0.0000	0.0000	0.0000	0	0	0.00	0.0000	0.000	0.0000
Total		100.7593	100.00				0.7037	1009.668	0.5802
Inferior Wobbe	1307.3525 (Btu/SCF)		Superior Wobbe	1331.3412 (Btu/SCF)					
Compressibility	0.9979		Density	0.0444 (lbm/ft3)					
Real Rel Density	0.5802		Ideal CV	1009.6684 (Btu/SCF)					
Inferior CV	996.4753 (Btu/SCF)		Superior CV	1014.0878 (Btu/SCF)					