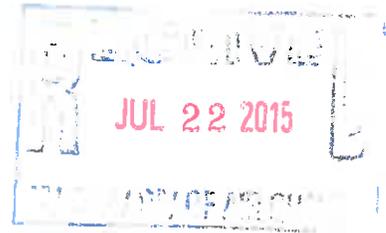




July 21, 2015

William F. Durham
Director
WVDEP, Division of Air Quality
601 – 57th Street
Charleston, West Virginia 25304



Re: Permit Determination Request – R13-3132A
Yoho Pad, (I.D. 103-00073) Gastar Exploration USA Inc.

Dear Mr. Durham Director,

Gastar Exploration Inc. would like to submit for your consideration the attached Permit Determination Application to reflect the diminished condensate production at the Yoho Pad. These changes in operation involve the removal of an enclosed combustor. Due to the permanent nature of these changes emission estimates have predicted emissions below permitting thresholds. Both storage vessels will continue to be utilized for brine water storage, but the condensate tank will be relabeled. .

If any additional information is needed, please contact me by telephone at (304) 545-8563 or by e-mail at jhanshaw@slrconsulting.com.

Sincerely,
SLR International Corporation

A handwritten signature in blue ink that reads "Jesse Hanshaw".

Jesse Hanshaw P.E.
Principal Engineer

cc Alicia Cook HSE Coordinator, Gastar Exploration



global environmental solutions

Yoho Well Pad

Plant ID No. 103-00074

New Martinsville, West Virginia

Permit Determination

SLR Ref: 116 01034 000xx

July 2015



global environmental solutions

Permit Determination

Yoho Well Pad, Plant ID No. 103-00074 New Martinsville, West Virginia

Prepared for:

Gastar Exploration USA, Inc.
1331 Lamar Street
Suite 650
Houston, Texas 77010

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 that reads "Lori Smith".

Lori Smith.
Senior Engineer

A handwritten signature in blue ink that reads "Jesse Hanshaw".

Jesse Hanshaw P.E.
Principal Engineer

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APPLICATION FOR PERMIT

Permit Determination

**Yoho Well Pad
New Martinsville, West Virginia**

Gastar Exploration USA, Inc.
1331 Lamar Street, Suite 650
Houston, Texas 77010



WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
601 57th Street, SE
Charleston, WV 25304
Phone: (304) 928-0475
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):

Gastar Exploration USA, Inc.

2. NAME OF FACILITY (IF DIFFERENT FROM ABOVE):

Yoho Well Pad

3. NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS) CODE:

211111

4A. MAILING ADDRESS: 1331 Lamar, Suite 650

Houston TX 77010

4B. PHYSICAL ADDRESS:

Off State Route 20, near New Martinsville

5A. DIRECTIONS TO FACILITY (PLEASE PROVIDE MAP AS ATTACHMENT A): From State Route 2 North, take a right onto State Route 7 at New Martinsville. Stay on State Route 7 until making a right onto State Route 20. Travel about 1.5 miles on State Route 20 and make a right onto Thomas Lane. The well pad is on the right of the road.

5B. NEAREST ROAD:
Thomas Lane off of State Rte 20

5C. NEAREST CITY OR TOWN:
New Martinsville

5D. COUNTY:
Wetzel

5E. UTM NORTHING (KM):
4,383.341

5F. UTM EASTING (KM):
514.882

5G. UTM ZONE:
17

6A. INDIVIDUAL TO CONTACT IF MORE INFORMATION IS REQUIRED:
Alicia Cook

6B. TITLE:
HSE Coordinator

6C. TELEPHONE:
304-622-4796

6D. FAX:
304-622-4824

6E. E-MAIL:
acook@gastar.com

7A. DAQ PLANT I.D. NO. (FOR AN EXISTING FACILITY ONLY):

103-00074

7B. PLEASE LIST ALL CURRENT 45CSR13, 45CSR14, 45CSR19 AND/OR TITLE V (45CSR30) PERMIT NUMBERS ASSOCIATED WITH THIS PROCESS (FOR AN EXISTING FACILITY ONLY):

R13-3132A

7C. IS THIS PDF BEING SUBMITTED AS THE RESULT OF AN ENFORCEMENT ACTION? IF YES, PLEASE LIST:

Yes. NOV received on June 29, 2015

8A. TYPE OF EMISSION SOURCE (CHECK ONE):

- NEW SOURCE ADMINISTRATIVE UPDATE
 MODIFICATION 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?

YES NO

9. IS DEMOLITION OR PHYSICAL RENOVATION AT AN EXISTING FACILITY INVOLVED? YES NO

10A. DATE OF ANTICIPATED INSTALLATION OR CHANGE:

N/a

10B. DATE OF ANTICIPATED START-UP:

N/a

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	0.006	0.020
PM ₁₀	0.084	0.370
VOCs	0.031	0.130
CO	0.100	0.270
NO _x	0.070	0.320
SO ₂	0.000	0.002
Pb	N/a	N/a
HAPs (AGGREGATE AMOUNT)	0.000	0.010
TAPs (INDIVIDUALLY)*	N/a	N/a
OTHER (INDIVIDUALLY)*	N/a	N/a

* ATTACH ADDITIONAL PAGES AS NEEDED

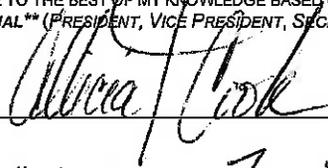
13B. PLEASE PROVIDE ALL SUPPORTING CALCULATIONS AS ATTACHMENT E.

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, **Alicia Cook** (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: HSE Coordinator Date: 7, 21, 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 DAQ'S PERMITTING SECTION WEB SITE

www.dep.wv.gov/daq

ATTACHMENT A

AREA MAP

Permit Determination

**Yoho Well Pad
New Martinsville, West Virginia**

Gastar Exploration USA, Inc.
1331 Lamar Street, Suite 650
Houston, Texas 77010



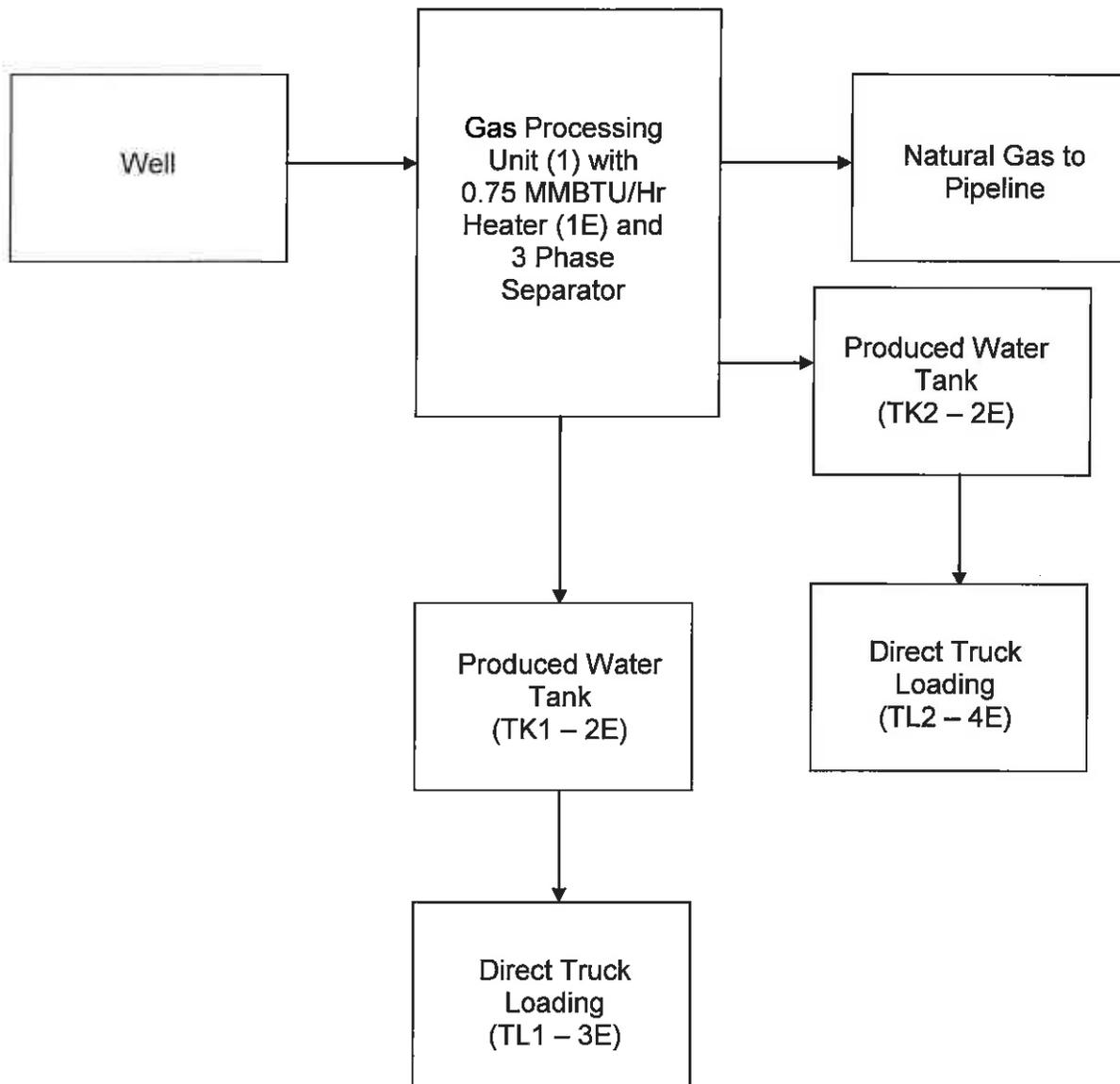
ATTACHMENT B

PROCESS FLOW DIAGRAM

Permit Determination

Yoho Well Pad
New Martinsville, West Virginia

Gastar Exploration USA, Inc.
1331 Lamar Street, Suite 650
Houston, Texas 77010



ATTACHMENT C

PROCESS DESCRIPTION

Permit Determination

**Yoho Well Pad
New Martinsville, West Virginia**

Gastar Exploration USA, Inc.
1331 Lamar Street, Suite 650
Houston, Texas 77010

Process Description

Background Information

Gastar Exploration USA, Inc. (Gastar) drilled the Yoho Well Pad in 2009 and it was shut in. The well was placed into production in late 2013. The well was approved to produce natural gas, condensate and produced water.

In early 2014, the West Virginia Department of Environmental Protection approved a Class I Administrative Update for the Yoho Well Pad. The approval granted Gastar's plans to remove the existing two (2) temporary 500bbl condensate and produced water tanks and replace them with two (2) 210bbl tanks. Due to the permanent nature of the storage vessels, fugitive emissions are minimized due to the use of Enardo 660 thief hatches set at 12 oz with viton gaskets and Enardo 8" 2008 emergency vents – set at 12 oz with viton gaskets.

Proposed

Based upon production and testing records, no condensate has been produced at the Yoho Well Pad since 2013. With the lack of condensate production and the approval of this Permit Determination, Gastar proposes to remove the vapor combustor (1C). Currently, the well produces relatively small amounts of natural gas and produced water. Therefore, if the combustor is removed, the site will consist of a gas processing unit containing a 0.75 MMBtu/hr heater and two produced water tanks, 210bbl/each.

Due to the experimental nature of this well, vertical single stage producing from the Marcellus, the Yoho Well Pad has reported a relatively quick decline in production. Further, since there has been no condensate production since it first came online in late 2013 this facility's potential to emit had been substantially reduced. As a result, this Permit Determination demonstrates via direct measurements that the Yoho Pad's emissions have dropped below the permit triggers.

ATTACHMENT D

MATERIAL SAFETY DATA SHEETS (MSDS)

Permit Determination

Yoho Well Pad
New Martinsville, West Virginia

Gastar Exploration USA, Inc.
1331 Lamar Street, Suite 650
Houston, Texas 77010

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 H₂S 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

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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

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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

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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

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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

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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 H₂S 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

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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, Liquified
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

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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

SUPPORTING CALCULATIONS

Permit Determination

Yoho Well Pad
New Martinsville, West Virginia

Gastar Exploration USA, Inc.
1331 Lamar Street, Suite 650
Houston, Texas 77010

**Table 1. Annual Potential To Emit (PTE)
Gastar Exploration - Yoho Pad**

Source	PTE without Fugitive Emissions									
	PM	PM10	PM2.5	SO2	NOx	CO	VOC	HAPs	CO2e *	
Line Heaters + GPUs Tanks	0.024	0.367	0.367	0.0019	0.32	0.27	0.02	0.00609	384.16	
Total Emissions (ton/yr)	0.02	0.37	0.37	0.002	0.32	0.27	0.13	0.01	384.16	
Total Emissions (lb/day)	0.13	2.01	2.01	0.01	2	1	0.73	0.03	2105	
Total Emissions (lb/hr)	0.006	0.084	0.084	0.000	0.07	0.1	0.031	0.00	88	

*CO2e total is in Metric Tons/Yr.

Table 2a. GPU Heater Rates and VOC/HAP Emissions
Gastar Exploration - Yoho Pad

Pollutant	Emission Factor	Emissions (tons/year)
Criteria Pollutants		
PM/PM10/PM2.5	7.6 lb/MMcf (1)	0.02
SO ₂	0.6 lb/MMcf (1)	0.00
NOx	100 lb/MMcf (2)	0.32
CO	84 lb/MMcf (2)	0.27
VOC	5.5 lb/MMcf (1)	0.02
Hazardous Air Pollutants		
Arsenic	2.0E-04 lb/MMcf (3)	0.000
Benzene	2.1E-03 lb/MMcf (4)	0.000
Beryllium	1.2E-05 lb/MMcf (3)	0.000
Cadmium	1.1E-03 lb/MMcf (3)	0.000
Chromium	1.4E-03 lb/MMcf (3)	0.000
Cobalt	8.4E-05 lb/MMcf (3)	0.000
Dichlorobenzene	1.2E-03 lb/MMcf (4)	0.000
Formaldehyde	7.5E-02 lb/MMcf (4)	0.000
Hexane	1.8E+00 lb/MMcf (4)	0.006
Lead	5.0E-04 lb/MMcf (3)	0.000
Manganese	3.8E-04 lb/MMcf (3)	0.000
Mercury	2.6E-04 lb/MMcf (3)	0.000
Naphthalene	6.1E-04 lb/MMcf (4)	0.000
Nickel	2.1E-03 lb/MMcf (3)	0.000
PAH/POM	1.3E-03 lb/MMcf (4)	0.000
Selenium	2.4E-05 lb/MMcf (3)	0.000
Toluene	3.4E-03 lb/MMcf (4)	0.000
Total HAP	1.9E+00 lb/MMCF	0.006
Greenhouse Gas Emissions		
CO ₂	116.89 lb/MMBtu (5)	383.981
CH ₄	2.2E-03 lb/MMBtu (5)	0.007
N ₂ O	0.0 lb/MMBtu (5)	0.000
CO ₂ e ^(b)		384.162

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 Heaters= 1
 Fuel Use (MMBtu/hr) = 0.75
 Hours of Operation (hr/yr)= 8760
 MMBtu/MMcf= 1020
 PTE Fuel Use (MMcf/yr) = 6.4

(b) CO₂ equivalent = [(CO₂ emissions)*(GWP_{CO2})]+[(CH₄ emissions)*(GWP_{CH4})]+[(N₂O emissions)*(GWP_{N2O})]
 Global Warming Potential (GWP)

CO ₂	1	(6)
CH ₄	25	(6)
N ₂ 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

Table 3. Tank Emissions
Gastar Exploration - Yoho Pad

Emission Unit	Tank Contents	Control Devices	Tank Throughput (hbls/day)	Flashing EF (lbs/bbls)	Flashing Emissions (lbs/day)	Working /Breathing Emissions (lbs/day)	VOC Emissions (lb/day)	VOC Emissions (lb/hr)	VOC Emissions (tons/yr)
ST01	Produced Water	None	1.10	0.280	0.31 (1)	0.01	0.32	0.01	0.06
ST02	Produced Water	None	1.10	0.280	0.31 (1)	0.01	0.32	0.01	0.06
						Total	0.64	0.03	0.12

Note: These tanks are filled by sand trap separators

Calculations:

(a) Flashing Emissions

$$\text{PTE emissions (lbs/day)} = [\text{Tank Throughput (bbls/day)}] \times [\text{Flashing GOR/GWR (lbs/bbls)}]$$

(b) Working and Breathing Emissions

$$\text{PTE emissions (lbs/day)} = [\text{Tank 4.0 Emissions (lbs/year)}] / [(\text{days/year})]$$

Notes:

(1) Flashing GWR emission factor from FESCO Flash Liberation measurements sampled on 3-11-14 at the Yoho Well Pad. Working and Breathing losses from EPA Tank 4.09 model estimates using #2 fuel oil contents as worst case

ATTACHMENT F

AUTHORITY OF CORPORATION (ATTACHMENT R)

Permit Determination

**Yoho Well Pad
New Martinsville, West Virginia**

Gastar Exploration USA, Inc.
1331 Lamar Street, Suite 650
Houston, Texas 77010

**Attachment R
AUTHORITY OF CORPORATION
OR OTHER BUSINESS ENTITY (DOMESTIC OR FOREIGN)**

TO: The West Virginia Department of Environmental Protection,
Division of Air Quality

DATE: September 12, 2013

ATTN: Director

Corporation's / other business entity's Federal Employer I.D. Number 2180224

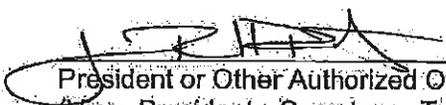
The undersigned hereby files with the West Virginia Department of Environmental Protection, Division of Air Quality, a permit application and hereby certifies that the said name is a trade name which is used in the conduct of an incorporated business or other business entity.

Further, the corporation or the business entity certifies as follows:

(1) Alicia L. Cook (is/are) the authorized representative(s) and in that capacity may represent the interest of the corporation or the business entity and may obligate and legally bind the corporation or the business entity.

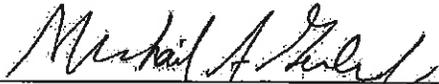
(2) The corporation or the business entity is authorized to do business in the State of West Virginia.

(3) If the corporation or the business entity changes its authorized representative(s), the corporation or the business entity shall notify the Director of the West Virginia Department of Environmental Protection, Division of Air Quality, immediately upon such change.



President or Other Authorized Officer
(Vice President, Secretary, Treasurer or other
official in charge of a principal business function of
the corporation or the business entity)

(If not the President, then the corporation or the business entity must submit certified minutes or bylaws stating legal authority of other authorized officer to bind the corporation or the business entity).



Secretary

Gastar Exploration, Ltd.

Name of Corporation or business entity

Revision 03/2007

March 25, 2014

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

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

Sample: Gastar - Yoho Station
Gas Liberated from Separator Water
From 209 psig & 93 °F to 0 psig & 70 °F

Date Sampled: 03/11/14

Job Number: 42239.001

CHROMATOGRAPH EXTENDED ANALYSIS - SUMMATION REPORT - GPA 2286

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	< 0.001	
Nitrogen	3.807	
Carbon Dioxide	1.524	
Methane	33.928	
Ethane	23.565	6.266
Propane	16.219	4.443
isobutane	2.877	0.936
n-Butane	7.434	2.330
2-2 Dimethylpropane	0.059	0.022
isopentane	2.431	0.884
n-Pentane	3.057	1.102
Hexanes	3.006	1.231
Heptanes Plus	<u>2.093</u>	<u>0.910</u>
Totals	100.000	18.125

Computed Real Characteristics Of Heptanes Plus:

Specific Gravity -----	3.483	(Air=1)
Molecular Weight -----	99.70	
Gross Heating Value -----	5292	BTU/CF

Computed Real Characteristics Of Total Sample:

Specific Gravity -----	1.261	(Air=1)
Compressibility (Z) -----	0.9884	
Molecular Weight -----	36.09	
Gross Heating Value		
Dry Basis -----	1997	BTU/CF
Saturated Basis -----	1963	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: 14.650 PSI & 60 Deg F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: MR
Processor: AL
Cylinder ID: WF# 3 S

David Dannhaus 361-661-7015

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

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	< 0.001		< 0.001
Nitrogen	3.807		2.955
Carbon Dioxide	1.524		1.858
Methane	33.928		15.083
Ethane	23.565	6.266	19.634
Propane	16.219	4.443	19.817
Isobutane	2.877	0.936	4.633
n-Butane	7.434	2.330	11.972
2,2 Dimethylpropane	0.059	0.022	0.118
Isopentane	2.431	0.884	4.860
n-Pentane	3.057	1.102	6.111
2,2 Dimethylbutane	0.075	0.031	0.179
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.149	0.061	0.356
2 Methylpentane	0.874	0.361	2.087
3 Methylpentane	0.515	0.209	1.230
n-Hexane	1.393	0.570	3.326
Methylcyclopentane	0.111	0.038	0.259
Benzene	0.014	0.004	0.030
Cyclohexane	0.138	0.047	0.322
2-Methylhexane	0.285	0.132	0.791
3-Methylhexane	0.277	0.125	0.769
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.263	0.114	0.723
n-Heptane	0.421	0.193	1.169
Methylcyclohexane	0.214	0.086	0.582
Toluene	0.026	0.009	0.066
Other C8's	0.248	0.115	0.757
n-Octane	0.057	0.029	0.180
Ethylbenzene	0.000	0.000	0.000
M & P Xylenes	0.007	0.003	0.021
O-Xylene	0.000	0.000	0.000
Other C9's	0.027	0.014	0.094
n-Nonane	0.005	0.003	0.018
Other C10's	0.000	0.000	0.000
n-Decane	0.000	0.000	0.000
Undecanes (11)	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>
Totals	100.000	18.125	100.000

Computed Real Characteristics Of Total Sample:

Specific Gravity	1.261	(Air=1)
Compressibility (Z)	0.9884	
Molecular Weight	36.09	
Gross Heating Value		
Dry Basis	1997	BTU/CF
Saturated Basis	1963	BTU/CF

March 25, 2014

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

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

Sample: Gastar - Yoho Station
Gas Liberated from Separator Water
From 209 psig & 83 °F to 0 psig & 70 °F

Date Sampled: 03/11/14

Job Number: 42239.011

CHROMATOGRAPH EXTENDED ANALYSIS - SUMMATION REPORT - GPA 2286

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	< 0.001	
Nitrogen	2.024	
Carbon Dioxide	1.130	
Methane	35.365	
Ethane	23.547	6.262
Propane	16.382	4.488
Isobutane	2.915	0.948
n-Butane	7.486	2.347
2-2 Dimethylpropane	0.071	0.027
Isopentane	2.464	0.896
n-Pentane	2.912	1.050
Hexanes	3.095	1.268
Heptanes Plus	<u>2.609</u>	<u>1.154</u>
Totals	100.000	18.438

Computed Real Characteristics Of Heptanes Plus:

Specific Gravity ----- 3.569 (Air=1)
Molecular Weight ----- 102.13
Gross Heating Value ----- 5401 BTU/CF

Computed Real Characteristics Of Total Sample:

Specific Gravity ----- 1.270 (Air=1)
Compressibility (Z) ----- 0.9878
Molecular Weight ----- 36.35
Gross Heating Value
Dry Basis ----- 2050 BTU/CF
Saturated Basis ----- 2015 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: 14.650 PSI & 60 Deg F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: MR
Processor: AL
Cylinder ID: WF# 10 S

David Dannhaus 361-661-7015

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

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	< 0.001		< 0.001
Nitrogen	2.024		1.560
Carbon Dioxide	1.130		1.368
Methane	35.365		15.608
Ethane	23.547	6.262	19.479
Propane	16.382	4.488	19.873
isobutane	2.915	0.948	4.661
n-Butane	7.486	2.347	11.970
2,2 Dimethylpropane	0.071	0.027	0.141
Isopentane	2.464	0.896	4.891
n-Pentane	2.912	1.050	5.780
2,2 Dimethylbutane	0.081	0.034	0.192
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.156	0.064	0.370
2 Methylpentane	0.910	0.376	2.157
3 Methylpentane	0.533	0.216	1.264
n-Hexane	1.415	0.579	3.355
Methylcyclopentane	0.114	0.039	0.264
Benzene	0.015	0.004	0.032
Cyclohexane	0.146	0.049	0.338
2-Methylhexane	0.301	0.139	0.830
3-Methylhexane	0.295	0.134	0.813
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.276	0.119	0.753
n-Heptane	0.482	0.221	1.329
Methylcyclohexane	0.253	0.101	0.683
Toluene	0.033	0.011	0.084
Other C8's	0.386	0.179	1.170
n-Octane	0.117	0.060	0.368
Ethylbenzene	0.002	0.001	0.006
M & P Xylenes	0.020	0.008	0.058
O-Xylene	0.002	0.001	0.006
Other C9's	0.111	0.056	0.386
n-Nonane	0.022	0.012	0.078
Other C10's	0.026	0.015	0.101
n-Decane	0.005	0.003	0.020
Undecanes (11)	<u>0.003</u>	<u>0.002</u>	<u>0.012</u>
Totals	100.000	18.438	100.000

Computed Real Characteristics Of Total Sample:

Specific Gravity -----	1.270	(Air=1)
Compressibility (Z) -----	0.9878	
Molecular Weight -----	36.35	
Gross Heating Value		
Dry Basis -----	2050	BTU/CF
Saturated Basis -----	2015	BTU/CF