INTERNAL PERMITTING DOCUMENT TRACKING MANIFEST

Company Name **E. Marcellus Asset Company, LLC**

Permitting Action Number R13-3076A Total Days 247 DAQ Days 5

Permitting Action:

- ○ Permit Determination
- ○ General Permit
- ○ Administrative Update
- ○ Temporary
- ○ Relocation
- ○ Construction
- ○ Modification
- ○ PSD (Rule 14)
- ○ NNSR (Rule 19)

Documents Attached:

- ✓ Engineering Evaluation/Memo
- ✓ Draft Permit
- ✓ Notice
- ○ Denial
- ○ Final Permit/General Permit Registration
- ○ Completed Database Sheet
- ○ Withdrawal
- ○ Letter
- ○ Other *(specify)*_____

Date	From	To	Action Requested
7/6/2016	David Keatley	Bev McKeone	Review Draft Permit and Engineering Evaluation and Go To Notice.
7/7	Bev	David	Su comments - Add on Go to Notice
7/8	David	Sandy	Go To Notice

NOTE: Retain a copy of this manifest for your records when transmitting your document(s).

west virginia department of environmental protection

Division of Air Quality
601 57th Street SE
Charleston, WV 25304
Phone (304) 926-0475 • FAX: (304) 926-0479

Earl Ray Tomblin, Governor
Randy C. Huffman, Cabinet Secretary
www.dep.wv.gov

ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-3076A
Plant ID No.:	033-00200
Applicant:	E. Marcellus Asset Company, LLC
Facility Name:	Tichenal Station
Location:	Harrison County
NAICS Code:	486210
Application Type:	Modification
Received Date:	November 2, 2015
Engineer Assigned:	David Keatley
Fee Amount:	$2,000
Date Fees Received:	November 2, 2015
Complete Date:	July 1, 2016
Due Date:	September 9, 2016
Applicant Ad Date:	November 2, 2015
Newspaper:	*The Exponent Telegram*
UTM's:	Easting: 547.619 km Northing: 4,337.377 km Zone: 17
Description:	Permit R13-3076A will supersede and replace R13-3076. Permit five (5) 1,380-bhp engines and remove five (5) 1,680-bhp engines from the permit which were never installed. Updated emissions for TEG dehydration units.

DESCRIPTION OF PROCESS

This facility compresses and dehydrates natural gas. Natural gas enters the facility via pipeline and first goes to the inlet separator where liquids fall out of the natural gas stream and flow to the produced water tanks (T01, T02, T08, and T09). The natural gas stream which leaves the inlet separator goes to nine (9) compressors to raise the pressure of the natural gas stream. Drains from the compressors go to the produced water tanks. The compressors are powered by nine compressor engines. Five (5) of the compressor engines (CE-1 through CE-5) are natural gas fired four-stroke rich-burn 1,380-bhp Waukesha L5794GSI. Four (4) of the compressor engines (CE-6 through CE-9) are natural gas fired rich-burn four-stroke 1,680 bhp Waukesha L7044GSI. Engines (CE-1 through

CE-5) are equipped with a non-selective catalyst reduction (NSCR) device. Engine (CE-6 though CE-9) are equipped with Maxim three-way catalyst which reduces the following pollutants by the following percentages: nitrogen oxides, 96.5%; carbon monoxide (CO) 95%, volatile organic compounds (VOCs), 90%; and formaldehyde, 98%. The compressed natural gas stream flows to two (2) triethylene glycol (TEG) dehydration units to reduce the water content of the natural gas stream. Lean TEG will flow countercurrent to the natural gas stream in the contactors to remove water and other constituents. The rich TEG will then be sent to the flash tank where vapors flash and are controlled by the flame zone of the reboiler (98% control efficiency). The liquids from the flash tank then go to the regenerator to remove the water from the rich TEG. The vapors from the regenerator are piped to a condenser to remove most of the water vapor and then piped to the flash zone of the reboiler when the reboiler is not operating the vapors are sent to a Jatco igniter which has a catalyst for a 98% minimum control efficiency. The two (2) 1.5-mmBtu/hr reboilers (RBV-1 and RBV-2) combusts vapors from the flash tank and condenser and warms the regenerator to evaporate water with other pollutants from the rich TEG stream.

SITE INSPECTION

Karl Dettinger from DAQ's Compliance and Enforcment section performed a site visit on March 2, 2015. The facility was deemed in compliance at that time.

From the I-79 Jane Lew exit. Travel west on CR 7 to US 19. Turn right onto US 19 N and travel to the New Bethel United Methodist Church and Cemetary. Proceed approximately 1,000 feet to a fork in the road. Bear left onto Isaac's Creek Road. (CR 38). Travel on CR 38 for approximately 2.8 miles to CR 38/3 (Hurst Hollow Rd.). Turn left onto CR 38/3 for approximately 0.35 miles the facility is on the right.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Table 1: Estimated Maximum Controlled Modified PTE

Source ID	Emission Source	Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (tpy)
CE-1 through CE-5	Compressor Engine Waukesha L5794GSI 1,380 bhp (Emissions per Unit)	Nitrogen Oxides	1.52	6.66
		Carbon Monoxide	1.83	8.00
		Volatile Organic Compounds	0.30	1.33
		Sulfur Dioxide	0.01	0.03
		Total Particulate Matter	0.23	1.00
		PM_{10}	0.23	1.00
		Formaldehyde	0.12	0.53
		Acetaldehyde	0.04	0.15
		Acrolein	0.04	0.14
		Benzene	0.02	0.09
		Toluene	0.01	0.30
		CO_2e	1,511	6,618

45CSR22 - *Air Quality Management Fee Program*

This facility is a minor source, not subject to 45CSR30, and the NSPS are Title V exempt. This facility is required to keep their Certificate to Operate current. E. Marcellus paid a $1,000 construction application fee and $1,000 NSPS fee. Since this facility has a total reciprocating engine capacity of greater than 1,000 hp (15,120 hp) this facility is subject to 8D with an annual fee of $500.

40CFR63 Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines)

Subpart ZZZZ establishes national emission limitations and operating limitations for HAPs emitted from stationary RICE located at major and area sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations. This facility is subject to the area source requirements and has non-emergency spark ignition engines.

Engine CE-1 throught CE-5 are "New Stationary RICE" sources at an area source of HAPs and are affected source because construction will commenced after June 12, 2006 [63.6590(a)(2)(iii)] due to the manufacture's dates of the engines.

Stationary RICE subject to Regulations under 40 CFR Part 60 must meet the requirements of those subparts that apply (40 CFR 60 Subpart JJJJ, for spark ignition engines) if the engine is a new stationary RICE located at an area source (§63.6590(c)(1)). No additional requirements apply for these engines under this subpart.

40CFR60 Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (SI ICE))

Engines (CE-2, CE-4, and CE-5) are subject to 40CFR60 Subpart JJJJ because construction was after June 12, 2006, the engines were manufactured after July 1, 2007, and are greater than 500 hp.
[40CFR60.4230(4)(i)]

40CFR60.4248 Table 1 provides the allowable emission standards for stationary spark ignition internal combustion engines. Engines (CE-2, CE-4 and CE-5) are non-emergency hp≥500 manufacturer date after July 1, 2007 the allowable emission standards in g/hp-hr are: 2.0, NO_x; 4.0, CO; and 1.0, VOC. The engines will also have operating limits, performance tests, notification requirements, and recordkeeping requirements.

The following rules and regulations do not apply to the facility:

40CFR60 Subpart OOOO (Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution)

EPA issued it new source performance standards (NSPS) and air toxics rules for the oil and gas sector on April 17, 2012. 40CFR60 Subpart OOOO establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO_2) emissions from affected facilities that commence construction, modification or reconstruction after August 23, 2011. The following affected sources which commence construction, modification or reconstruction after August 23, 2011 are subject to the applicable provisions of this subpart:

a. Each reciprocating compressor affected facility, which is a single reciprocating compressor located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment. For the purposes of this subpart, your reciprocating compressor is considered to have commenced construction on the date the compressor is installed (excluding relocation) at the facility. A reciprocating compressor located at a well site, or an adjacent well site and servicing more than one well site, is not an affected facility under this subpart.

There will be five (5) reciprocating compressor associated with CE-1 through CE-5 at this facility. The compressors associated with CE-1 through CE-5 were constructed before the effective date of this regulation and therefore this regulation is not applicable.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The majority of non-criteria regulated pollutants fall under the definition of Hazardous Air Pollutant (HAP)s which, with some revision since, were 188 compounds identified under Section 112(b) of the Clean Air Act (CAA) as pollutants or groups of pollutants that EPA knows or suspects may cause cancer or other serious human health effects. HAPs are those pollutants that are specifically identified in section 112(b) of the Clean Air Act. To be listed as a HAP, EPA must find that the chemical in question may present a threat to human health and cause adverse environmental effects. As can be seen in Table 4 this facility is an area source of HAPs (potential to emit (PTE) less than 10 tons per year of any pollutant on the HAP list, or less 25 tons per year for all HAPs)

The following table lists each HAP's carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)):

Table 4: IRIS HAP Carcinogenic Risk

HAPs	Type	Known/Suspected Carcinogen	Classification
Formaldehyde	HAP/TAP	Yes	Category B - Probable Human Carcinogen

All HAPs have other non-carcinogenic chronic and acute effects. These adverse health effects may be associated with a wide range of ambient concentrations and exposure times and are influenced by source-specific characteristics such as emission rates and local meteorological conditions. Health impacts are also dependent on multiple factors that affect variability in humans such as genetics, age, health status (e.g., the presence of pre-existing disease) and lifestyle. As stated previously, *there are no federal or state ambient air quality standards for these specific chemicals*. For a complete discussion of the known health effects of each compound refer to the IRIS database located at ***www.epa.gov/iris***.

AIR QUALITY IMPACT ANALYSIS

Based on the annual emissions rates this facility will not be a major source as defined by 45CSR14, so no air quality impact analysis was performed.

CHANGES TO PERMIT R13-3076

Permit five (5) 1,380-bhp engines and remove five (5) 1,680-bhp engines from the permit which were never installed. Reboilers (RBV-1 and RBV-2) in the previous application were listed as 0.2 mmBtu/hr, however the units are actually 1.5 mmBtu/hr units. For the TEG dehydration units (RSV-1 and RSV-2) a more recent extended gas analysis was used with a higher pressure 1,150 psig, TEG flowrate was increased to 15 gpm, stripping gas was used in the analysis, and a 20% factor was used for variation in the gas composition.

RECOMMENDATION TO DIRECTOR

The information provided in this facility's permit application indicates that compliance with all state and federal air quality requirements will be achieved. It is recommended that E. Marcellus Asset Company, LLC should be granted a 45CSR13 Modification permit for Tichenal Station.

David Keatley
Permit Writer - NSR Permitting

July 7, 2016

Date

West Virginia Department of Environmental Protection

Earl Ray Tomblin
Governor

Division of Air Quality

Randy C. Huffman
Cabinet Secretary

Permit to Modify

R13-3076A

This permit is issued in accordance with the West Virginia Air Pollution Control Act (West Virginia Code §§22-5-1 et seq.) and 45 C.S.R. 13 – Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Temporary Permits, General Permits and Procedures for Evaluation. The permittee identified at the above-referenced facility is authorized to construct the stationary sources of air pollutants identified herein in accordance with all terms and conditions of this permit.

Issued to:

E. Marcellus Asset Company, LLC
Tichenal Station
033-00200

William F. Durham
Director

Issued: Draft

This permit will supersede and replace Permit R13-3076.

Facility Location:	near Tichenal, Harrison County, West Virginia
Mailing Address:	801 Cherry Street Suite 3400, Unit 20 Fort Worth, Texas 76102
Facility Description:	Natural Gas Compression Station
NAICS Codes:	486210
UTM Coordinates:	543.491 km Easting • 4,337.325 km Northing • Zone 17
Permit Type:	Modification
Description of Change:	Permit five (5) 1,380-bhp engines and remove five (5) 1,680-bhp engines from the permit which were never installed. Updated emissions for TEG dehydration units.

Any person whose interest may be affected, including, but not necessarily limited to, the applicant and any person who participated in the public comment process, by a permit issued, modified or denied by the Secretary may appeal such action of the Secretary to the Air Quality Board pursuant to article one [§§22B-1-1 et seq.], Chapter 22B of the Code of West Virginia. West Virginia Code §§22-5-14.

The source is not subject to 45CSR30.

Table of Contents

1.0. Emission Units

Emission Unit ID	Emission Point ID	Emission Unit Description	Year Installed	Design Capacity	Control Device
CE-1	1E	Compressor Engine Waukesha L5794GSI	2013	1,380 bhp	NSCR
CE-2	2E	Compressor Engine Waukesha L5794GSI	2011	1,380 bhp	NSCR
CE-3	3E	Compressor Engine Waukesha L5794GSI	2015	1,380 bhp	NSCR
CE-4	4E	Compressor Engine Waukesha L5794GSI	2015	1,380 bhp	NSCR
CE-5	5E	Compressor Engine Waukesha L5794GSI	2011	1,380 bhp	NSCR
CE-6	CE-6	Compressor Engine Waukesha L7044GSI	2012	1,680 bhp	NSCR
CE-7	CE-7	Compressor Engine Waukesha L7044GSI	2012	1,680 bhp	NSCR
CE-8	CE-8	Compressor Engine Waukesha L7044GSI	2012	1,680 bhp	NSCR
CE-9	CE-9	Compressor Engine Waukesha L7044GSI	2012	1,680 bhp	NSCR
RSV-1	RSV-1	TEG Dehydrator Still Vent	2011	64 mmscf/day	Condenser/RBV-1
RBV-1	RBV-1	TEG Dehydrator Reboiler	2011	1.5 mmBtu/hr	None
RSV-2	RSV-2	TEG Dehydrator Still Vent	2012	60 mmscf/day	Condenser/RBV-1
RBV-2	RBV-2	TEG Dehydrator Reboiler	2012	1.5 mmBtu/hr	None
LR-1	LR-1	Truck Loading	2011	1,533,000 gallons/year	None
T01-T02	T01-T02	Produced Water Tanks	2007	300 BBL	None
T08-T09	T08-T09	Produced Water Tanks	2007	300 BBL	None
T03	T03	Used Oil	2007	1,000 gallons	None
T04	T04	TEG	2007	1,000 gallons	None
T05	T05	Lube Oil	2007	1,000 gallons	None
T06	T06	Lube Oil	2007	1,000 gallons	None
T07	T07	Dehy Drains	2007	285 gallons	None

2.0. General Conditions

2.1. Definitions

2.1.1. All references to the "West Virginia Air Pollution Control Act" or the "Air Pollution Control Act" mean those provisions contained in W.Va. Code §§ 22-5-1 to 22-5-18.

2.1.2. The "Clean Air Act" means those provisions contained in 42 U.S.C. §§ 7401 to 7671q, and regulations promulgated thereunder.

2.1.3. "Secretary" means the Secretary of the Department of Environmental Protection or such other person to whom the Secretary has delegated authority or duties pursuant to W.Va. Code §§ 22-1-6 or 22-1-8 (45CSR§30-2.12.). The Director of the Division of Air Quality is the Secretary's designated representative for the purposes of this permit.

2.2. Acronyms

BBL or bbl	Barrel	**NO_x**	Nitrogen Oxides
CAAA	Clean Air Act Amendments	**NSPS**	New Source Performance Standards
CBI	Confidential Business Information	**PM**	Particulate Matter
CEM	Continuous Emission Monitor	**$PM_{2.5}$**	Particulate Matter less than 2.5 µm in diameter
CES	Certified Emission Statement	**PM_{10}**	Particulate Matter less than 10µm in diameter
C.F.R. *or* CFR	Code of Federal Regulations	**Ppb**	Pounds per Batch
CO	Carbon Monoxide	**Pph**	Pounds per Hour
C.S.R. *or* CSR	Codes of State Rules	**Ppm**	Parts per Million
DAQ	Division of Air Quality	**Ppmv or ppmv**	Parts per Million by Volume
DEP	Department of Environmental Protection	**PSD**	Prevention of Significant Deterioration
dscm	Dry Standard Cubic Meter	**Psi**	Pounds per Square Inch
FOIA	Freedom of Information Act	**SIC**	Standard Industrial Classification
HAP	Hazardous Air Pollutant	**SIP**	State Implementation Plan
HON	Hazardous Organic NESHAP	**SO_2**	Sulfur Dioxide
HP	Horsepower	**TAP**	Toxic Air Pollutant
lbs/hr	Pounds per Hour	**TPY**	Tons per Year
LDAR	Leak Detection and Repair	**TRS**	Total Reduced Sulfur
M	Thousand	**TSP**	Total Suspended Particulate
MACT	Maximum Achievable Control Technology	**USEPA**	United States Environmental Protection Agency
MDHI	Maximum Design Heat Input	**UTM**	Universal Transverse Mercator
MM	Million	**VEE**	Visual Emissions Evaluation
MMBtu/hr *or* mmbtu/hr	Million British Thermal Units per Hour	**VOC**	Volatile Organic Compounds
MMCF/hr *or* mmcf/hr	Million Cubic Feet per Hour	**VOL**	Volatile Organic Liquids
NA	Not Applicable		
NAAQS	National Ambient Air Quality Standards		
NESHAPS	National Emissions Standards for Hazardous Air Pollutants		

2.3. Authority

This permit is issued in accordance with West Virginia air pollution control law W.Va. Code §§ 22-5-1. et seq. and the following Legislative Rules promulgated thereunder:

2.3.1. 45CSR13 – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Temporary Permits, General Permits and Procedures for Evaluation*;

2.4. Term and Renewal

2.4.1. This Permit shall remain valid, continuous and in effect unless it is revised, suspended, revoked or otherwise changed under an applicable provision of 45CSR13 or any other applicable legislative rule;

2.5. Duty to Comply

2.5.1. The permitted facility shall be constructed and operated in accordance with the plans and specifications filed in Permit Application R13-3076 and any modifications, administrative updates, or amendments thereto. The Secretary may suspend or revoke a permit if the plans and specifications upon which the approval was based are not adhered to; **[45CSR§§13-5.11 and -10.3.]**

2.5.2. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the West Virginia Code and the Clean Air Act and is grounds for enforcement action by the Secretary or USEPA;

2.5.3. Violations of any of the conditions contained in this permit, or incorporated herein by reference, may subject the permittee to civil and/or criminal penalties for each violation and further action or remedies as provided by West Virginia Code 22-5-6 and 22-5-7;

2.5.4. Approval of this permit does not relieve the permittee herein of the responsibility to apply for and obtain all other permits, licenses, and/or approvals from other agencies; i.e., local, state, and federal, which may have jurisdiction over the construction and/or operation of the source(s) and/or facility herein permitted.

2.6. Duty to Provide Information

The permittee shall furnish to the Secretary within a reasonable time any information the Secretary may request in writing to determine whether cause exists for administratively updating, modifying, revoking, or terminating the permit or to determine compliance with the permit. Upon request, the permittee shall also furnish to the Secretary copies of records to be kept by the permittee. For information claimed to be confidential, the permittee shall furnish such records to the Secretary along with a claim of confidentiality in accordance with 45CSR31. If confidential information is to be sent to USEPA, the permittee shall directly provide such information to USEPA along with a claim of confidentiality in accordance with 40 C.F.R. Part 2.

2.7. Duty to Supplement and Correct Information

Upon becoming aware of a failure to submit any relevant facts or a submittal of incorrect information in any permit application, the permittee shall promptly submit to the Secretary such supplemental facts or corrected information.

2.8. Administrative Update

The permittee may request an administrative update to this permit as defined in and according to the procedures specified in 45CSR13.
[45CSR§13-4.]

2.9. Permit Modification

The permittee may request a minor modification to this permit as defined in and according to the procedures specified in 45CSR13.
[45CSR§13-5.4.]

2.10 Major Permit Modification

The permittee may request a major modification as defined in and according to the procedures specified in 45CSR14 or 45CSR19, as appropriate.
[45CSR§13-5.1]

2.11. Inspection and Entry

The permittee shall allow any authorized representative of the Secretary, upon the presentation of credentials and other documents as may be required by law, to perform the following:

a. At all reasonable times (including all times in which the facility is in operation) enter upon the permittee's premises where a source is located or emissions related activity is conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times (including all times in which the facility is in operation) any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under the permit;

d. Sample or monitor at reasonable times substances or parameters to determine compliance with the permit or applicable requirements or ascertain the amounts and types of air pollutants discharged.

2.12. Emergency

2.12.1. An "emergency" means any situation arising from sudden and reasonable unforeseeable events beyond the control of the source, including acts of God, which situation requires immediate corrective action to restore normal operation, and that causes the source to exceed a technology-based emission limitation under the permit, due to unavoidable increases in emissions attributable to the emergency. An emergency shall not include noncompliance to

the extent caused by improperly designed equipment, lack of preventative maintenance, careless or improper operation, or operator error.

2.12.2. Effect of any emergency. An emergency constitutes an affirmative defense to an action brought for noncompliance with such technology-based emission limitations if the conditions of Section 2.12.3 are met.

2.12.3. The affirmative defense of emergency shall be demonstrated through properly signed, contemporaneous operating logs, or other relevant evidence that:

a. An emergency occurred and that the permittee can identify the cause(s) of the emergency;

b. The permitted facility was at the time being properly operated;

c. During the period of the emergency the permittee took all reasonable steps to minimize levels of emissions that exceeded the emission standards, or other requirements in the permit; and

d. The permittee submitted notice of the emergency to the Secretary within one (1) working day of the time when emission limitations were exceeded due to the emergency and made a request for variance, and as applicable rules provide. This notice must contain a detailed description of the emergency, any steps taken to mitigate emissions, and corrective actions taken.

2.12.4. In any enforcement proceeding, the permittee seeking to establish the occurrence of an emergency has the burden of proof.

2.12.5 The provisions of this section are in addition to any emergency or upset provision contained in any applicable requirement.

2.13. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a permittee in an enforcement action that it should have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. However, nothing in this paragraph shall be construed as precluding consideration of a need to halt or reduce activity as a mitigating factor in determining penalties for noncompliance if the health, safety, or environmental impacts of halting or reducing operations would be more serious than the impacts of continued operations.

2.14. Suspension of Activities

In the event the permittee should deem it necessary to suspend, for a period in excess of sixty (60) consecutive calendar days, the operations authorized by this permit, the permittee shall notify the Secretary, in writing, within two (2) calendar weeks of the passing of the sixtieth (60) day of the suspension period.

2.15. Property Rights

This permit does not convey any property rights of any sort or any exclusive privilege.

2.16. Severability

The provisions of this permit are severable and should any provision(s) be declared by a court of competent jurisdiction to be invalid or unenforceable, all other provisions shall remain in full force and effect.

2.17. Transferability

This permit is transferable in accordance with the requirements outlined in Section 10.1 of 45CSR13.
[45CSR§13-10.1.]

2.18. Notification Requirements

The permittee shall notify the Secretary, in writing, no later than thirty (30) calendar days after the actual startup of the operations authorized under this permit.

2.19. Credible Evidence

Nothing in this permit shall alter or affect the ability of any person to establish compliance with, or a violation of, any applicable requirement through the use of credible evidence to the extent authorized by law. Nothing in this permit shall be construed to waive any defense otherwise available to the permittee including, but not limited to, any challenge to the credible evidence rule in the context of any future proceeding.

3.0. Facility-Wide Requirements

3.1. Limitations and Standards

3.1.1. **Open burning.** The open burning of refuse by any person, firm, corporation, association or public agency is prohibited except as noted in 45CSR§6-3.1.
[45CSR§6-3.1.]

3.1.2. **Open burning exemptions.** The exemptions listed in 45CSR§6-3.1 are subject to the following stipulation: Upon notification by the Secretary, no person shall cause, suffer, allow or permit any form of open burning during existing or predicted periods of atmospheric stagnation. Notification shall be made by such means as the Secretary may deem necessary and feasible.
[45CSR§6-3.2.]

3.1.3. **Asbestos.** The permittee is responsible for thoroughly inspecting the facility, or part of the facility, prior to commencement of demolition or renovation for the presence of asbestos and complying with 40 C.F.R. § 61.145, 40 C.F.R. § 61.148, and 40 C.F.R. § 61.150. The permittee, owner, or operator must notify the Secretary at least ten (10) working days prior to the commencement of any asbestos removal on the forms prescribed by the Secretary if the permittee is subject to the notification requirements of 40 C.F.R. § 61.145(b)(3)(i). The USEPA, the Division of Waste Management, and the Bureau for Public Health - Environmental Health require a copy of this notice to be sent to them.
[40CFR§61.145(b) and 45CSR§34]

3.1.4. **Odor.** No person shall cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor at any location occupied by the public.
[45CSR§4-3.1] *[State Enforceable Only]*

3.1.5. **Permanent shutdown.** A source which has not operated at least 500 hours in one 12-month period within the previous five (5) year time period may be considered permanently shutdown, unless such source can provide to the Secretary, with reasonable specificity, information to the contrary. All permits may be modified or revoked and/or reapplication or application for new permits may be required for any source determined to be permanently shutdown.
[45CSR§13-10.5.]

3.1.6. **Standby plan for reducing emissions.** When requested by the Secretary, the permittee shall prepare standby plans for reducing the emissions of air pollutants in accordance with the objectives set forth in Tables I, II, and III of 45CSR11.
[45CSR§11-5.2.]

3.2. Monitoring Requirements

[Reserved]

3.3. Testing Requirements

3.3.1. **Stack testing.** As per provisions set forth in this permit or as otherwise required by the Secretary, in accordance with the West Virginia Code, underlying regulations, permits and orders, the permittee shall conduct test(s) to determine compliance with the emission

limitations set forth in this permit and/or established or set forth in underlying documents. The Secretary, or his duly authorized representative, may at his option witness or conduct such test(s). Should the Secretary exercise his option to conduct such test(s), the operator shall provide all necessary sampling connections and sampling ports to be located in such manner as the Secretary may require, power for test equipment and the required safety equipment, such as scaffolding, railings and ladders, to comply with generally accepted good safety practices. Such tests shall be conducted in accordance with the methods and procedures set forth in this permit or as otherwise approved or specified by the Secretary in accordance with the following:

a. The Secretary may on a source-specific basis approve or specify additional testing or alternative testing to the test methods specified in the permit for demonstrating compliance with 40 C.F.R. Parts 60, 61, and 63 in accordance with the Secretary's delegated authority and any established equivalency determination methods which are applicable. If a testing method is specified or approved which effectively replaces a test method specified in the permit, the permit may be revised in accordance with 45CSR§13-4. or 45CSR§13-5.4 as applicable.

b. The Secretary may on a source-specific basis approve or specify additional testing or alternative testing to the test methods specified in the permit for demonstrating compliance with applicable requirements which do not involve federal delegation. In specifying or approving such alternative testing to the test methods, the Secretary, to the extent possible, shall utilize the same equivalency criteria as would be used in approving such changes under Section 3.3.1.a. of this permit. If a testing method is specified or approved which effectively replaces a test method specified in the permit, the permit may be revised in accordance with 45CSR§13-4. or 45CSR§13-5.4 as applicable.

c. All periodic tests to determine mass emission limits from or air pollutant concentrations in discharge stacks and such other tests as specified in this permit shall be conducted in accordance with an approved test protocol. Unless previously approved, such protocols shall be submitted to the Secretary in writing at least thirty (30) days prior to any testing and shall contain the information set forth by the Secretary. In addition, the permittee shall notify the Secretary at least fifteen (15) days prior to any testing so the Secretary may have the opportunity to observe such tests. This notification shall include the actual date and time during which the test will be conducted and, if appropriate, verification that the tests will fully conform to a referenced protocol previously approved by the Secretary.

d. The permittee shall submit a report of the results of the stack test within sixty (60) days of completion of the test. The test report shall provide the information necessary to document the objectives of the test and to determine whether proper procedures were used to accomplish these objectives. The report shall include the following: the certification described in paragraph 3.5.1.; a statement of compliance status, also signed by a responsible official; and, a summary of conditions which form the basis for the compliance status evaluation. The summary of conditions shall include the following:

    1. The permit or rule evaluated, with the citation number and language;
    2. The result of the test for each permit or rule condition; and,
    3. A statement of compliance or noncompliance with each permit or rule condition.

[WV Code § 22-5-4(a)(14-15) and 45CSR13]

3.4. Recordkeeping Requirements

3.4.1. **Retention of records.** The permittee shall maintain records of all information (including monitoring data, support information, reports, and notifications) required by this permit recorded in a form suitable and readily available for expeditious inspection and review. Support information includes all calibration and maintenance records and all original strip-chart recordings for continuous monitoring instrumentation. The files shall be maintained for at least five (5) years following the date of each occurrence, measurement, maintenance, corrective action, report, or record. Said records shall be maintained on site or in a readily accessible off-site location maintained by the permittee for a period of five (5) years. Said records shall be readily available to the Director of the Division of Air Quality or his/her duly authorized representative for expeditious inspection and review. Any records submitted to the agency pursuant to a requirement of this permit or upon request by the Director shall be certified by a responsible official. Where appropriate, the permittee may maintain records electronically (on a computer, on computer floppy disks, CDs, DVDs, or magnetic tape disks), on microfilm, or on microfiche.

3.4.2. **Odors.** For the purposes of 45CSR4, the permittee shall maintain a record of all odor complaints received, any investigation performed in response to such a complaint, and any responsive action(s) taken.
[45CSR§4. *State Enforceable Only.*]

3.5. Reporting Requirements

3.5.1. **Responsible official.** Any application form, report, or compliance certification required by this permit to be submitted to the DAQ and/or USEPA shall contain a certification by the responsible official that states that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

3.5.2. **Confidential information.** A permittee may request confidential treatment for the submission of reporting required by this permit pursuant to the limitations and procedures of W.Va. Code § 22-5-10 and 45CSR31.

3.5.3. **Correspondence.** All notices, requests, demands, submissions and other communications required or permitted to be made to the Secretary of DEP and/or USEPA shall be made in writing and shall be deemed to have been duly given when delivered by hand, or mailed first class with postage prepaid to the address(es) set forth below or to such other person or address as the Secretary of the Department of Environmental Protection may designate:

If to the DAQ:
Director
WVDEP
Division of Air Quality
601 57th Street
Charleston, WV 25304-2345

If to the US EPA:
Associate Director
Office of Enforcement and Compliance Assistance (3AP20)
U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

3.5.4. Operating Fee

3.5.4.1. In accordance with 45CSR22 – Air Quality Management Fee Program, the permittee shall not operate nor cause to operate the permitted facility or other associated facilities on the same or contiguous sites comprising the plant without first obtaining and having in current effect a Certificate to Operate (CTO). Such Certificate to Operate (CTO) shall be renewed annually, shall be maintained on the premises for which the certificate has been issued, and shall be made immediately available for inspection by the Secretary or his/her duly authorized representative.

3.5.5. **Emission inventory.** At such time(s) as the Secretary may designate, the permittee herein shall prepare and submit an emission inventory for the previous year, addressing the emissions from the facility and/or process(es) authorized herein, in accordance with the emission inventory submittal requirements of the Division of Air Quality. After the initial submittal, the Secretary may, based upon the type and quantity of the pollutants emitted, establish a frequency other than on an annual basis.

4.0. Source-Specific Requirements

4.1. Limitations and Standards

4.1.1. **Record of Monitoring.** The permittee shall keep records of monitoring information that include the following:

a. The date, place as defined in this permit, and time of sampling or measurements;
b. The date(s) analyses were performed;
c. The company or entity that performed the analyses;
d. The analytical techniques or methods used;
e. The results of the analyses; and
f. The operating conditions existing at the time of sampling or measurement.

4.1.2. **Minor Source of Hazardous Air Pollutants (HAP).** HAP emissions from the facility shall be less than 10 tons/year of any single HAP and 25 tons/year of any combination of HAPs. Compliance with this Section shall ensure that the facility is a minor HAP source.

4.1.3. **Operation and Maintenance of Air Pollution Control Equipment.** The permittee shall, to the extent practicable, install, maintain, and operate the control devices listed in Section 1.1 and associated monitoring equipment in a manner consistent with safety and good air pollution control practices for minimizing emissions, or comply with any more stringent limits set forth in this permit or as set forth by any State rule, Federal regulation, or alternative control plan approved by the Secretary.
[45CSR§13-5.11.]

4.1.4. **Record of Malfunctions of Air Pollution Control Equipment.** For the control devices listed in Section 1.1, the permittee shall maintain records of the occurrence and duration of any malfunction or operational shutdown of the air pollution control equipment during which excess emissions occur. For each such case, the following information shall be recorded:

a. The equipment involved.
b. Steps taken to minimize emissions during the event.
c. The duration of the event.
d. The estimated increase in emissions during the event.

For each such case associated with an equipment malfunction, the additional information shall also be recorded:

e. The cause of the malfunction.
f. Steps taken to correct the malfunction.
g. Any changes or modifications to equipment or procedures that would help prevent future recurrences of the malfunction.

5.0. Source-Specific Requirements (Compressor Engines, CE-1 through CE-9)

5.1. Limitations and Standards

5.1.1. Maximum Power Limit. Each emission unit CE-1 through CE-5 shall not have a brake horsepower which exceeds 1,380 bhp.

5.1.2. Maximum emissions from each of the 1,380 bhp natural gas fired reciprocating engines, Waukesha L5794GSI (CE-1 through CE-5) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Nitrogen Oxides	1.52	6.66
Carbon Monoxide	1.83	8.00
Volatile Organic Compounds	0.30	1.33

5.1.3. Maximum Power Limit. Each emission unit CE-6 through CE-9 shall not have a brake horsepower which exceeds 1,680 bhp.

5.1.4. Maximum emissions from each of the 1,680 bhp natural gas fired reciprocating engines, Waukesha L7044GSI (CE-6 through CE-9) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Nitrogen Oxides	1.85	8.11
Carbon Monoxide	2.22	9.73
Volatile Organic Compounds	0.37	1.62

5.1.5. a. Rich-burn natural gas compressor engines (CE-1 through CE-9) equipped with non-selective catalytic reduction (NSCR) air pollution control devices shall be fitted with a closed-loop, automatic air/fuel ration controller to ensure emissions of regulated pollutants do not exceed the potential to emit for any engine/NSCR combination under varying load. The closed-loop, automatic air/fuel ration controller shall control a fuel metering valve to deliver additional fuel when required to ensure a fuel-rich mixture and a resultant exhaust oxygen content of less than or equal to 0.5%. The automatic air/fuel ratio controller shall also incorporate dual-point exhaust gas temperature and oxygen sensors which provide temperature and exhaust oxygen content differential feedback. Such controls shall ensure proposer and efficient operation of the engine and NSCR air pollution control device.

b. The automatic air/fuel ratio controller or closed-loop automatic feedback controller shall provide a warning or indication to the operator and/or be interlocked with the engine ignition system to cease engine operation in case of a masking, poisoning, or over-rich air/fuel ratio situation which results in performance degradation or failure of the catalyst element; and

c. No person shall knowingly:

1. Remove or render inoperative any air pollution or auxiliary air pollution control device installed subject to the requirements of this permit.
2. Install any part or component when the principal effect of the part or component is to bypass, defeat, or render inoperative any air pollution control device or auxillary air pollution control device installed subject to the requirements of this permit; or
3. Cause or allow engine exhaust gases to bypass any catalytic reduction device.

5.1.6. Requirements for Use of Catalytic Reduction Devices

a. For natural gas compressor engines (CE-1 through CE-9), the permittee shall monitor the temperature to the inlet of the catalyst and in accordance with manufacturer's specifications, a high temperature alarm shall shut off the engine before thermal deactivation of the catalyst

occurs. If the engine shuts off due to high temperature, the permittee shall also check for thermal deactivation of the catalyst before normal operations are resumed.

b. Upon request by the Director, testing shall be conducted using a portable analyzer in accordance with a protocol approved by the Director. Such controls shall ensure proper and efficient operation of the engine and air pollution control devices.

5.2. Monitoring Requirements

5.2.1. Catalytic Oxidizer Control Devices

a. The permittee shall regularly inspect, properly maintain and/or replace catalytic reduction devices and auxiliary air pollution control devices to ensure functional and effective operation of the engine's physical and operational design. The permittee shall ensure proper operation, maintenance and performance of catalytic reduction devices and auxiliary air pollution control devices by:

1. Maintaining proper operation of the automatic air/fuel ratio controller or automatic feedback controller.
2. Following a written operating and maintenance plan.

5.3. Recordkeeping Requirements

5.3.1. Any occurrence these engines shut down due to high temperature shall be recorded. Said records shall be maintained on site or in a readily accessible off-site location maintained by the permittee for a period of five (5) years. Said records shall be readily available to the Director of the Division of Air Quality or his/her duly authorized representative for expeditious inspection and review. Any records submitted to the agency pursuant to a requirement of this permit or upon request by the Director shall be certified by a responsible official.

6.0. Source-Specific Requirements (Reboilers, RBV-1 and RBV-2)

6.1. Limitations and Standards

6.1.1. Maximum Design Heat Input. The maximum design heat input for each Reboiler (RBV-1 and RBV-2) shall not exceed 1.5 MMBTU/hr.

6.1.2. Maximum emissions from each 1.5 MMBTU/hr Reboiler (RBV-1 and RBV-2) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Nitrogen Oxides	0.16	0.67
Carbon Monoxide	0.13	0.56

6.1.3. No person shall cause, suffer, allow or permit emission of smoke and/or particulate matter into the open air from any fuel burning unit which is greater than ten (10) percent opacity based on a six minute block average.
[45CSR§2-3.1.]

6.2. Monitoring Requirements

6.2.1. At such reasonable times as the Secretary may designate, the permittee shall conduct Method 9 emission observations for the purpose of demonstrating compliance with Section 6.1.3. Method 9 shall be conducted in accordance with 40 CFR 60 Appendix A.

6.3. Testing Requirements

6.3.1. Compliance with the visible emission requirements of section 6.1.3. shall be determined in accordance with 40 CFR Part 60, Appendix A, Method 9 or by using measurements from continuous opacity monitoring systems approved by the Director. The Director may require the installation, calibration, maintenance and operation of continuous opacity monitoring systems and may establish policies for the evaluation of continuous opacity monitoring results and the determination of compliance with the visible emission requirements of section 6.1.3. Continuous opacity monitors shall not be required on fuel burning units which employ wet scrubbing systems for emission control.
[45CSR§2-3.2.]

6.4. Recordkeeping Requirements

6.4.2. The permittee shall maintain records of all monitoring data required by Section 6.2.1. documenting the date and time of each visible emission check, the emission point or equipment/source identification number, the name or means of identification of the observer, the results of the check(s), whether the visible emissions are normal for the process, and, if applicable, all corrective measures taken or planned. The permittee shall also record the general weather conditions (i.e. sunny, approximately 80°F, 6 - 10 mph NE wind) during the visual emission check(s). Should a visible emission observation be required to be performed per the requirements specified in Method 9, the data records of each observation shall be maintained per the requirements of Method 9.

6.5. Reporting Requirements

6.5.1. Any deviation(s) from the allowable visible emission requirement for any emission source discovered during observations using 40CFR Part 60, Appendix A, Method 9 or 22 shall be reported in writing to the Director of the Division of Air Quality as soon as practicable, but in any case within ten (10) calendar days of the occurrence and shall include at least the following information: the results of the visible determination of opacity of emissions, the cause or suspected cause of the violation(s), and any corrective measures taken or planned.

7.0. Source-Specific Requirements (TEG Dehydration Units, RSV-1 and RSV-2)

7.1. Limitations and Standards

7.1.1. Maximum Throughput Limitations. The maximum wet natural gas throughput to the glycol dehydration unit/still column RSV-1 shall not exceed 64.0 million standard cubic feet per day (MMscf/day). The maximum wet natural gas throughput to the glycol dehydration unit/still column RSV-2 shall not exceed 60.0 million standard cubic feet per day (MMscf/day). Compliance with the Maximum Throughput Limitations shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the monthly throughput at any given time during the previous twelve consecutive calendar months.

7.1.2. Maximum emissions from the glycol dehydration unit/still column (RSV-1) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Volatile Organic Compounds	0.40	1.76

7.1.3. Maximum emissions from the glycol dehydration unit/still column (RSV-1) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Volatile Organic Compounds	0.41	1.77

7.1.4. For purposes of determining potential HAP emissions at production-related facilities, the methods specified in 40 CFR 63, Subpart HH (i.e. excluding compressor engines from HAP PTE) shall be used.

7.1.5. Any source that determines it is not a major source but has actual emissions of 5 tons per year or more of a single HAP, or 12.5 tons per year or more of a combination of HAP (i.e., 50 percent of the major source thresholds), shall update its major source determination within 1 year of the prior determination or October 15, 2012, whichever is later, and each year thereafter, using gas composition data measured during the preceding 12 months.
[40CFR§63.760(c)]

7.1.6. The permittee is exempt from the requirements of 40CFR§63.760(b)(2) if the criteria below is met, except that the records of the determination of these criteria must be maintained as required in 40CFR§63.774(d)(1).

a. The actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere are less than 0.90 megagram per year (1 ton/yr), as determined by the procedures specified in §63.772(b)(2) of this subpart.

[40CFR§63.764(e)]

7.1.7. All vapors from the flash tanks will be sent to the respective reboilers (RBV-1 and RBV-2) to be used as fuel.

7.1.8. All vapors from the TEG dehydrators regenerators (RSV-1 and RSV-2) will be sent to respective condensers when the the respective TEG dehydration unit is in operation.

7.1.9. The vapors from the regenerator from each TEG dehydration unit (RSV-1 and RSV-2) will be controlled with a minimum efficiency of 98%.

7.1.10. All vapors from condensers (RSV-1 and RSV-2) will be sent to the respective reboilers (RBV-1 and RBV-2) to be used as fuel when the respective reboiler is in operation.

7.1.11. When the respective TEG dehydration units are in operation and reboilers (RBV-1 and RBV-2) are not in operation the vapors from the respective condensers are sent to the respective Jatco igniter.

7.2. Monitoring Requirements

7.2.1. The permittee shall monitor the throughput of wet natural gas process stream which flows through the contactor of the TEG dehydration unit on a monthly basis.

7.2.2. In order to demonstrate compliance with the area source status, claimed within sections 7.1.2 and 7.1.3, as well as the benzene exemption provided under section 7.1.7, the following parameters shall be measured at least once monthly, with the exception of wet gas composition, in order to define annual average values or, if monitoring is not practical, some parameters may be assigned default values as listed below.

a. Natural Gas Flowrate
   i. Number of days operated per year
   ii. Monthly throughput (MMscf/month)
   iii. Annual daily average (MMscf/day), and
   iv. Maximum design capacity (MMscf/day)
b. Absorber temperature and pressure
c. Lean glycol circulation rate
d. Glycol pump type and maximum design capacity (gpm)
e. Flash tank temperature and pressure, if applicable
f. Stripping Gas flow rate, if applicable
g. Wet gas composition (upstream of the absorber – dehydration column) sampled in accordance with GPA method 2166 and analyzed consistent with GPA extended method 2286 as well as the procedures presented in the GRI-GLYCalc™ Technical Reference User Manual and Handbook V4
h. Wet gas water content (lbs H_2O/MMscf)
i. Dry gas water content (lbs H_2O/MMscf) at a point directly after exiting the dehydration column and before any additional separation points

The following operating parameter(s) may be assigned default values when using GRI-GLYCalc:

a. Dry gas water content can be assumed to be equivalent to pipeline quality at 7 lb H_2O / MMscf
b. Wet gas water content can be assumed to be saturated
c. Lean glycol water content if not directly measured may use the default value of 1.5 % water as established by GRI
d. Lean glycol circulation rate may be estimated using the TEG recirculation ratio of 3 gal TEG / lb H_2O removed.

Note: If you are measuring and using actual wet or dry gas water content, then you should also measure the glycol recirculation rate rather than using the default TEG recirculation ratio. **[45CSR§13-5.11, §63.772(b)(2)(i)]**

7.2.3. The nickel alloy catalyst shall be visually inspected monthly.

7.3. Testing Requirements

7.3.1. The permittee shall determine the composition of the wet natural gas by sampling in accordance with GPA Method 2166 and analyzing according to extended GPA Method 2286 analysis as specified in the GRI-GLYCalc™ V4 Technical Reference User Manual and Handbook. As specified in the handbook, the permittee shall sample the wet gas stream at a location prior to the glycol dehydration contactor column, but after any type of separation device, in accordance with GPA method 2166. The permittee may utilize other equivalent methods provided they are approved in advance by DAQ as part of a testing protocol. If alternative methods are proposed, a test protocol shall be submitted for approval no later than 60 days before the scheduled test date. The initial compliance test must be conducted within 180 days of permit issuance or within 180 days of startup of the glycol dehydration unit, whichever is later.

Note: The DAQ defines a representative wet gas sample to be one that is characteristic of the average gas composition dehydrated throughout a calendar year. If an isolated sample is not indicative of the annual average composition, the permittee may opt to produce a weighted average based on throughput between multiple sampling events, which can be used to define a more representative average annual gas composition profile.
[45CSR§13-5.11]

7.3.2. The following testing and compliance provisions of Part 63 Subpart HH National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities are applicable to the facility:

§ 63.772 Test methods, compliance procedures, and compliance demonstrations.

(b) Determination of glycol dehydration unit flowrate, benzene emissions, or BTEX emissions. The procedures of this paragraph shall be used by an owner or operator to determine glycol dehydration unit natural gas flowrate, benzene emissions, or BTEX emissions.

(2) The determination of actual average benzene emissions or BTEX emissions from a glycol dehydration unit shall be made using the procedures of paragraph (b)(2)(i) of this requirement. Emissions shall be determined either uncontrolled, or with federally enforceable controls in place.

(i) The owner or operator shall determine actual average benzene emissions using the model GRI-GLYCalc™ , Version 3.0 or higher, and the procedures presented in the associated GRI-GLYCalc™ Technical Reference Manual. Inputs to the model shall be representative of actual operating conditions of the glycol dehydration unit and may be determined using the procedures documented in Gas Research Institute (GRI) report entitled "Atmospheric Rich/Lean Method for Determining Glycol Dehydrator Emissions " (GRI-95/0368.1).
[§63.772(b)(2)(i)]

7.4. Recordkeeping Requirements

7.4.1. The permittee shall maintain a record of the wet natural gas throughput through the TEG dehydration contactor to demonstrate compliance with section 7.1.1 of this permit. Said records shall be maintained for a period of five (5) years on site or in a readily accessible off-site location maintained by the permittee. Said records shall be readily available to the Director of the Division of Air Quality or his/her duly authorized representative for expeditious inspection and review. Any records submitted to the agency pursuant to a requirement of this permit or upon request by the Director shall be certified by a responsible official.

7.4.2. For the purpose of documenting compliance with the emission limitations, HAP major source thresholds, as well as the benzene exemption, the permittee shall maintain records of all monitoring data, wet gas sampling, and annual GRI-GLYCalc™ emission estimates. Said records shall be maintained for a period of five (5) years on site or in a readily accessible off-site location maintained by the permittee. Said records shall be readily available to the Director of the Division of Air Quality or his/her duly authorized representative for expeditious inspection and review. Any records submitted to the agency pursuant to a requirement of this permit or upon request by the Director shall be certified by a responsible official. **[45CSR§13-5.11]**

7.4.3. For the monthly inspection required in 7.2.3. of the nickel alloy catalyst at a minimum it shall be noted that the catalyst is physically there and not fouled.

7.5. Reporting Requirements

7.5.1. The permittee shall submit an emission summary for the glycol dehydration unit, which incorporates the wet gas testing results required by 7.3.1. These reports shall include an actual annual average emission estimate for the calendar year of the sample, modeled using GRI-GLYCalc™ , Version 3.0 or higher software, which incorporates site specific parameters measured in accordance with 7.2.2. The permittee shall also supply all supporting documentation where site-specific operating parameters are tabulated to define the annual average values. The report shall incorporate a copy of the laboratory analysis obtained from the wet gas testing as well as a description of how and where the sample was taken. The report shall include a reference to all sampling and analytical methods utilized. Additionally, the permittee shall also define the glycol unit's maximum potential to emit (PTE) using the TEG pump's design capacity for recirculation rate input as well as the maximum design throughput of the contactor column or 1.2 times the highest documented annual average rate for any of the 5 years prior to October 15, 2012. If this calculated PTE exceeds 50% of major source thresholds then annual sampling shall be implemented in accordance with 40 CFR§63.760(c). The permittee shall also identify where the compressor station is located with respect to a custody transfer point, which is referenced within 40 C.F.R 63, subpart HH as the point where the gas enters into a natural gas transmission and/or storage pipeline. This report shall be signed by a responsible official upon submittal. The permittee shall submit a written report of the results of testing required in 7.3.1 of this permit before the close of business on the 90th day following the completion of such testing to the Director. **[45CSR§13-5.11]**

8.0. Source-Specific Requirements (40CFR60 Subpart JJJJ Requirements; CE-2 and CE-4 through CE-9)

8.1. Limitations and Standards

8.1.1. The provisions of this subpart are applicable to owners, and operators of stationary spark ignition (SI) internal combustion engines (ICE) as specified below. For the purposes of this subpart, the date that construction commences is the date the engine is ordered by the owner or operator.

a. Owners and operators of stationary SI ICE that commence construction after June 12, 2006, where the stationary SI ICE are manufactured:

1. On or after July 1, 2007, for engines with a maximum engine power greater than or equal to 500 HP

[40CFR§60.4230(a)]

8.1.2. If you are an owner or operator of an area source subject to this subpart, you are exempt from the obligation to obtain a permit under 40 CFR part 70 or 40 CFR part 71, provided you are not required to obtain a permit under 40 CFR 70.3(a) or 40 CFR 71.3(a) for a reason other than your status as an area source under this subpart. Notwithstanding the previous sentence, you must continue to comply with the provisions of this subpart as applicable. [40CFR§60.4230(c)]

8.1.3. Stationary SI ICE may be eligible for exemption from the requirements of this subpart as described in 40 CFR part 1068, subpart C (or the exemptions described in 40 CFR parts 90 and 1048, for engines that would need to be certified to standards in those parts), except that owners and operators, as well as manufacturers, may be eligible to request an exemption for national security. [40CFR§60.4230(e)]

8.2. Emission Standards for Owners and Operators

8.2.1. Owners and operators of stationary SI ICE with a maximum engine power greater than or equal to 75 KW (100 HP) (except gasoline and rich burn engines that use LPG) must comply with the emission standards in Table 1 to this subpart for their stationary SI ICE. For owners and operators of stationary SI ICE with a maximum engine power greater than or equal to 100 HP (except gasoline and rich burn engines that use LPG) manufactured prior to January 1, 2011 that were certified to the certification emission standards in 40 CFR part 1048 applicable to engines that are not severe duty engines, if such stationary SI ICE was certified to a carbon monoxide (CO) standard above the standard in Table 1 to this subpart, then the owners and operators may meet the CO certification (not field testing) standard for which the engine was certified. [40CFR§60.4233(e)]

8.2.2. Owners and operators of stationary SI ICE that are required to meet standards that reference 40 CFR 1048.101 must, if testing their engines in use, meet the standards in that section applicable to field testing, except as indicated in paragraph (e) of this section. [40CFR§60.4233(h)]

8.2.3. Owners and operators of stationary SI ICE must operate and maintain stationary SI ICE that achieve the emission standards as required in §60.4233 over the entire life of the engine. [40CFR§60.4234]

8.3. Other Requirements for Owners and Operators

8.3.1. After July 1, 2010, owners and operators may not install stationary SI ICE with a maximum engine power of less than 500 HP that do not meet the applicable requirements in §60.4233. [40CFR§60.4236(a)]

8.3.2. The requirements of this section do not apply to owners and operators of stationary SI ICE that have been modified or reconstructed, and they do not apply to engines that were removed from one existing location and reinstalled at a new location. [40CFR§60.4236(e)]

8.4. Compliance Requirements for Owners and Operators

8.4.1. If you are an owner or operator of a stationary SI internal combustion engine and must comply with the emission standards specified in §60.4233(d) or (e), you must demonstrate compliance according to one of the methods specified in paragraphs (b)(1) and (2) of this section.

a. Purchasing an engine certified according to procedures specified in this subpart, for the same model year and demonstrating compliance according to one of the methods specified in paragraph (a) of this section.

b. Purchasing a non-certified engine and demonstrating compliance with the emission standards specified in §60.4233(d) or (e) and according to the requirements specified in §60.4244, as applicable, and according to paragraphs (b)(2)(i) and (ii) of this section.

1. If you are an owner or operator of a stationary SI internal combustion engine greater than 25 HP and less than or equal to 500 HP, you must keep a maintenance plan and records of conducted maintenance and must, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, you must conduct an initial performance test to demonstrate compliance.
2. If you are an owner or operator of a stationary SI internal combustion engine greater than 500 HP, you must keep a maintenance plan and records of conducted maintenance and must, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, you must conduct an initial performance test and conduct subsequent performance testing every 8,760 hours or 3 years, whichever comes first, thereafter to demonstrate compliance.

[40CFR§60.4243(b)]

8.4.2. Owners and operators of stationary SI natural gas fired engines may operate their engines using propane for a maximum of 100 hours per year as an alternative fuel solely during emergency operations, but must keep records of such use. If propane is used for more than 100 hours per year in an engine that is not certified to the emission standards when using propane, the owners and operators are required to conduct a performance test to demonstrate compliance with the emission standards of §60.4233. [40CFR§60.4243(e)]

8.4.3. If you are an owner or operator of a stationary SI internal combustion engine that is less than or equal to 500 HP and you purchase a non-certified engine or you do not operate and maintain your certified stationary SI internal combustion engine and control device according to the manufacturer's written emission-related instructions, you are required to perform initial performance testing as indicated in this section, but you are not required to conduct subsequent performance testing unless the stationary engine is rebuilt or undergoes major repair or maintenance. A rebuilt stationary SI ICE means an engine that has been rebuilt as that term is defined in 40 CFR 94.11(a). [40CFR§60.4243(f)]

8.4.4. It is expected that air-to-fuel ratio controllers will be used with the operation of three-way catalysts/non-selective catalytic reduction. The AFR controller must be maintained and operated appropriately in order to ensure proper operation of the engine and control device to minimize emissions at all times. [40CFR§60.4243(g)]

C_{imeas}= Concentration of compound i measured by EPA Method 320, ppmv as carbon.

$$C_{Peq} = 0.6098 \times C_{imeas} \quad \text{(Eq. 6)}$$

Where:
C_{Peq}= Concentration of compound i in mg of propane equivalent per DSCM.

[40CFR§60.4244(g)]

8.6. Notification, Reports, and Records for Owners and Operators

8.6.1. Owners or operators of stationary SI ICE must meet the following notification, reporting and recordkeeping requirements.

a. Owners and operators of all stationary SI ICE must keep records of the information in paragraphs (a)(1) through (4) of this section.

1. All notifications submitted to comply with this subpart and all documentation supporting any notification.
2. Maintenance conducted on the engine.
3. If the stationary SI internal combustion engine is a certified engine, documentation from the manufacturer that the engine is certified to meet the emission standards and information as required in 40 CFR parts 90 and 1048.
4. If the stationary SI internal combustion engine is not a certified engine or is a certified engine operating in a non-certified manner and subject to §60.4243(a)(2), documentation that the engine meets the emission standards.

[40CFR§60.4245(a)]

b. For all stationary SI emergency ICE greater than or equal to 500 HP manufactured on or after July 1, 2010, that do not meet the standards applicable to non-emergency engines, the owner or operator of must keep records of the hours of operation of the engine that is recorded through the non-resettable hour meter. For all stationary SI emergency ICE greater than or equal to 130 HP and less than 500 HP manufactured on or after July 1, 2011 that do not meet the standards applicable to non-emergency engines, the owner or operator of must keep records of the hours of operation of the engine that is recorded through the non-resettable hour meter. For all stationary SI emergency ICE greater than 25 HP and less than 130 HP manufactured on or after July 1, 2008, that do not meet the standards applicable to non-emergency engines, the owner or operator of must keep records of the hours of operation of the engine that is recorded through the non-resettable hour meter. The owner or operator must document how many hours are spent for emergency operation, including what classified the operation as emergency and how many hours are spent for non-emergency operation. [40CFR§60.4245(b)]

c. Owners and operators of stationary SI ICE greater than or equal to 500 HP that have not been certified by an engine manufacturer to meet the emission standards in §60.4231 must submit an initial notification as required in §60.7(a)(1). The notification must include the information in paragraphs (c)(1) through (5) of this section.

1. Name and address of the owner or operator;
2. The address of the affected source;
3. Engine information including make, model, engine family, serial number, model year, maximum engine power, and engine displacement;
4. Emission control equipment; and

5. Fuel used.
[40CFR§60.4245(c)]

d. Owners and operators of stationary SI ICE that are subject to performance testing must submit a copy of each performance test as conducted in §60.4244 within 60 days after the test has been completed. [40CFR§60.4245(d)]

CERTIFICATION OF DATA ACCURACY

I, the undersigned, hereby certify that, based on information and belief formed after reasonable inquiry, all information contained in the attached _____, representing the period beginning _____ and ending _____, and any supporting documents appended hereto, is true, accurate, and complete.

Signature[1] (please use blue ink) _____ Responsible Official or Authorized Representative _____ Date

Name & Title (please print or type) _____ Name _____ Title

Telephone No. _____ Fax No. _____

[1] This form shall be signed by a "Responsible Official." "Responsible Official" means one of the following:

a. For a corporation: The president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit and either:

(i) the facilities employ more than 250 persons or have a gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), or

(ii) the delegation of authority to such representative is approved in advance by the Director;

b. For a partnership or sole proprietorship: a general partner or the proprietor, respectively;

c. For a municipality, State, Federal, or other public entity: either a principal executive officer or ranking elected official. For the purposes of this part, a principal executive officer of a Federal agency includes the chief executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., a Regional Administrator of U.S. EPA); or

d. The designated representative delegated with such authority and approved in advance by the Director.

AIR QUALITY PERMIT NOTICE

Notice of Intent to Approve

On November 2, 2015, E. Marcellus Asset Company, LLC applied to the WV Department of Environmental Protection, Division of Air Quality (DAQ) for a permit to Modify a natural gas compression station named Tichenal Station located near Tichenal, Harrison County, WV at latitude 39.1841 N and longitude 80.4964 W. A preliminary evaluation has determined that all State and Federal air quality requirements will be met by the proposed facility. The DAQ is providing notice to the public of its preliminary determination to issue the permit as R13-3076A.

The following potential increase in emissions will be authorized by this permit action: Oxides of Nitrogen, 36.70 TPY; Volatile Organic Compounds, 67.50 TPY; Formaldehyde, 5.11 TPY; Total HAPs 12.74, TPY; and Carbon Dioxide Equivalent, 2,904 TPY.

Written comments or requests for a public meeting must be received by the DAQ before 5:00 p.m. on (Day of Week, Month, Day, Year). A public meeting may be held if the Director of the DAQ determines that significant public interest has been expressed, in writing, or when the Director deems it appropriate.

The purpose of the DAQ's permitting process is to make a preliminary determination if the proposed Construction will meet all state and federal air quality requirements. The purpose of the public review process is to accept public comments on air quality issues relevant to this determination. Only written comments received at the address noted below within the specified time frame, or comments presented orally at a scheduled public meeting, will be considered prior to final action on the permit. All such comments will become part of the public record.

David Keatley
WV Department of Environmental Protection
Division of Air Quality
601 57th Street, SE
Charleston, WV 25304
Telephone: 304/926-0499, ext. 1224
FAX: 304/926-0478

Additional information, including copies of the draft permit, application and all other supporting materials relevant to the permit decision may be obtained by contacting the engineer listed above. The draft permit and engineering evaluation can be downloaded at:

www.dep.wv.gov/daq/Pages/NSRPermitsforReview.aspx

Keatley, David J

From: Keatley, David J
Sent: Wednesday, July 06, 2016 1:06 PM
To: Humes, Chris
Cc: McKeone, Beverly D; Stovall, Jeffrey; 'Coleman, Jessica'
Subject: WV DAQ NSR Permit Application Complete for E. Marcellus Asset Company, LLC; Tichenal Station

RE: Application Status: Complete
E. Marcellus Asset Company, LLC, Tichenal Station
Permit Application R13-3076A
Plant ID No. 033-00200

Mr. Humes:

Your application for a Modification Permit for a Natural Gas Compressor Station was received by this Division on November 2, 2015 and assigned to the writer for review. Upon review of said application, it has been determined that the application is complete and, therefore, the statutory review period commenced on July 1, 2016.

In the case of this application, the agency believes it will take approximately 90 days to make a final permit determination.

This determination of completeness shall not relieve the permit applicant of the requirement to subsequently submit, in a timely manner, any additional or corrected information deemed necessary for a final permit determination.

Should you have any questions, please contact David Keatley at (304) 926-0499 ext. 1224 or reply to this email.

David Keatley, Ph.D., PE
West Virginia Department of Environmental Protection
Division of Air Quality, NSR Air Pollution Permit Engineer
Phone: (304) 926-0475 ext. 1224

Keatley, David J

From: Coleman, Jessica <Jessica.Coleman@crestwoodlp.com>
Sent: Wednesday, July 06, 2016 2:57 PM
To: Keatley, David J
Cc: Petri, Emily
Subject: RE: WV DAQ NSR Permit Application Complete for E. Marcellus Asset Company, LLC; Tichenal Station
Attachments: 20160706_Crestwood_Tichenal_R13 Mod_Increases.pdf

David,

Attached are the proposed emission increases for the Tichenal R13 modification. Let me know if you need anything else.

Regards,

Jessica Coleman
Air Quality Specialist

Crestwood Midstream Partners LP
1200 Summit Avenue, Suite 320, Fort Worth, TX 76102
P: 817-339-5406 | C: 817-201-5222
F: 817-339-5401
Jessica.Coleman@crestwoodlp.com
www.crestwoodlp.com

From: Keatley, David J [mailto:David.J.Keatley@wv.gov]
Sent: Wednesday, July 06, 2016 12:06 PM
To: Humes, Chris
Cc: McKeone, Beverly D; Stovall, Jeffrey; Coleman, Jessica
Subject: WV DAQ NSR Permit Application Complete for E. Marcellus Asset Company, LLC; Tichenal Station

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E. Marcellus Asset Company, LLC, Tichenal Station
Permit Application R13-3076A
Plant ID No. 033-00200

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Should you have any questions, please contact David Keatley at (304) 926-0499 ext. 1224 or reply to this email.

David Keatley, Ph.D., PE
West Virginia Department of Environmental Protection
Division of Air Quality, NSR Air Pollution Permit Engineer
Phone: (304) 926-0475 ext. 1224

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 1c. Proposed Emission Increases

Pollutants	Estimated Site-Wide Emissions		
	Current R13-3076 (tpy)	Proposed Emissions (tpy)	Emissions Increase (tpy)
VOC	9.55	77.05	67.50
NO_x	30.25	66.95	36.70
CO	88.00	79.91	-8.09
Formaldehyde (HCHO)	0.15	5.26	5.11
Total HAPs	0.81	13.55	12.74
SO_2	0.33	0.31	-0.02
PM_{10}	10.64	10.18	-0.46
$PM_{2.5}$	10.64	10.18	-0.46
GHG (CO_2e)	80,900	83,804	2,904

Notes:

1. PM_{10} and $PM_{2.5}$ emissions are filterable + condensable.
2. VOC as shown above is NMNEHC + HCHO.
3. Emissions from all sources at the facility (including venting and fugitives) are included above

Keatley, David J

From: Coleman, Jessica <Jessica.Coleman@crestwoodlp.com>
Sent: Friday, July 01, 2016 10:41 AM
To: Keatley, David J
Cc: McKeone, Beverly D; Stovall, Jeffrey
Subject: FW: E. Marcellus Tichenal Compressor Station - R13-3076A - Dehydrator Emissions
Attachments: JATCO Emissions Testing & Summary of Results - Air Cooled Elim..pdf

David,

After looking at this in more detail myself, I thought some clarification might help. The test results do not show pre- and post-control emissions. Their purpose was to show the VOC emissions when the reboiler is off are similar to when the reboiler is on, to support an overall average 98% control efficiency. One can presume the "ON" column for each test is where you will see the maximum control efficiency of at least 98%; this column shows those post-control emissions. Comparing that to the "OFF" column for each test, you can see that the VOC emissions when the reboiler is OFF are very similar to and sometimes less than when the reboiler is on. This is further explained in the Jatco System Operation Guarantee where it states: "It is also a note that general operation of standard glycol reboiler dehydration, when the burner is on is when you achieve the flash/flux around the fire tube and when it shuts off the V.O.C output from the still column diminishes rapidly."

I hope that helps.

Jessica Coleman
Air Quality Specialist

Crestwood Midstream Partners LP
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F: 817-339-5401
Jessica.Coleman@crestwoodlp.com
www.crestwoodlp.com

Crestwood

Please note our new address

From: Coleman, Jessica
Sent: Friday, July 01, 2016 9:01 AM
To: Keatley, David J
Cc: Humes, Chris; Hansen, Ben; Stovall, Jeffrey; Petri, Emily; McKeone, Beverly D
Subject: RE: E. Marcellus Tichenal Compressor Station - R13-3076A - Dehydrator Emissions

Mr. Keatley,

Attached is the requested test data. Feel free to call me if you have further questions.

Jessica Coleman
Air Quality Specialist

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Sent: Friday, July 01, 2016 8:37 AM
To: Coleman, Jessica
Cc: Humes, Chris; Hansen, Ben; Stovall, Jeffrey; Petri, Emily; McKeone, Beverly D
Subject: RE: E. Marcellus Tichenal Compressor Station - R13-3076A - Dehydrator Emissions

Ms. Coleman,

Please provide the actual stack testing data VOC concentrations for reboiler on and reboiler off. The first JATCO sheet seems to have an error, the first sentence, should be post-condensed rather than pre-condensed?

David Keatley, Ph.D., PE
West Virginia Department of Environmental Protection
Division of Air Quality, NSR Air Pollution Permit Engineer
Phone: (304) 926-0475 ext. 1224

From: Coleman, Jessica [mailto:Jessica.Coleman@crestwoodlp.com]
Sent: Wednesday, June 29, 2016 4:49 PM
To: Keatley, David J <David.J.Keatley@wv.gov>
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Subject: RE: E. Marcellus Tichenal Compressor Station - R13-3076A - Dehydrator Emissions

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Thank you for your review of our updated dehydrator emissions. As discussed on the phone this morning, we thoroughly reviewed the ProMax inputs and calculations related to the still vent/condenser outlet emissions. There was an error in the Octanes emissions for both dehydrators. We have made that correction and attached revised emissions calculations for RSV-1 and RSV-2.

Additionally, please find attached the Jatco emissions guarantee for 98% control efficiency when routing still column vapors to the main reboiler burner and utilizing the Jatco igniter (aka, glow plug).

Please feel free to call me if you have further questions.

Regards,

Jessica Coleman
Air Quality Specialist

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We typically do not allow 98% control efficiency of still vent vapors going through a condenser. We understand this may be a special situation where 98% control efficiency may be achieved, however a manufacturer specification would be needed stating that 98% control efficiency is to be expected. We encourage E. Marcellus Asset Company to review their ProMax for errors, in particular the magnitude of uncontrolled VOCs is not typical for TEG dehydrator with 60 mmscfd. Comparing emissions from GRI-GLYCalc and ProMax may help decide if numbers from ProMax are reasonable.

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West Virginia Department of Environmental Protection
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Phone: (304) 926-0475 ext. 1224

From: Coleman, Jessica [mailto:Jessica.Coleman@crestwoodlp.com]
Sent: Monday, June 27, 2016 3:39 PM
To: Keatley, David J <David.J.Keatley@wv.gov>
Cc: Humes, Chris <Chris.Humes@crestwoodlp.com>; Hansen, Ben <ben.hansen@crestwoodlp.com>; Stovall, Jeffrey <Jeff.Stovall@crestwoodlp.com>; Petri, Emily <Emily.Petri@crestwoodlp.com>
Subject: E. Marcellus Tichenal Compressor Station - R13-3076A - Dehydrator Emissions

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Good afternoon. Crestwood, on behalf of E. Marcellus Asset Company, is submitting the attached updated emission calculations from two glycol dehydrators for the permit application R13-3076A at the Tichenal Compressor Station. As

requested on May 17, 2016, the control efficiency of the flash tank vapors routed to the reboiler has been updated to 50%.

Additionally, emissions from the two glycol dehydrators (RSV-1, RSV-2) have been refined and updated based on ProMax simulations. Each dehydrator was modeled in ProMax with its respective maximum gas flow rate, contact tower temperature and pressure, glycol pump rate, and flash tank temperature and pressure. The BTEX condenser outlet vapors (labeled as "BTEX Vapor") and uncontrolled flash tank vapor (labeled "Flash Gas") are provided as ProMax outputs. Subsequent control of these two streams by the reboiler is not modeled by ProMax. Therefore, the reboiler control is accounted for in the attached emission calculations. The BTEX condenser vapors are routed to the reboiler with nickel alloy catalyst (aka, "glow plug"), resulting in a 98% control efficiency of the BTEX vapor. The flash gas also is routed to the reboiler with a 50% control efficiency of the flash tank vapors. The ProMax inputs, results, and process flow diagram are included in the attachment to this email.

Please let me know if you have questions or need additional information.

Regards,

Jessica Coleman
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Attachments: JATCO Emissions Testing & Summary of Results - Air Cooled Elim..pdf

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Air Quality Specialist

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TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

April 11, 1996

Mr. Todd Wiggins
JATCO, Inc.
244 Northwest 111th Street
Oklahoma City, Oklahoma 73114

Dear Mr. Wiggins:

Thank you for your letter of March 25, 1996. I believe the following will provide what you need.

Our review indicates your "BTEX Eliminator" equipment may meet TNRCC emissions control requirements in a variety of oil and gas exploration and production applications if the user complies with all steps outlined in the enclosed letter. Other applications may be presented at any time for review.

You may also refer prospective clients to Mr. Duncan Stewart (512-239-1906; fax 239-1330; e-mail "dstewart@smtpgate.tnrcc.state.tx.us") to discuss permitting/exemption requirements for oil and gas exploration and production facilities in general, and dehydrator emissions control in particular.

Thank you for you interest in Clean Air.

Sincerely

Tammy Villarreal

Tammy Villarreal
Manager, Chemical Section
New Source Review Division

TV/DS/ds

Texas Natural Resource Conservation Commission

INTEROFFICE MEMORANDUM

To: Interested Parties Date: May 31, 1996

From: Tammy Villarreal

Subject: Control Requirements for Glycol Dehydration Units

Reference: TNRCC Letter, subject as above, dated March 4, 1994, signed by Tammy Villarreal

Many glycol dehydration vent condenser systems are being designed with one or more features which ensure the uncondensed vent stream fraction is always combusted before it reaches the atmosphere. Operators with such units now ask exactly what requirements of the referenced letter apply to their claim of standard exemption or standard permit. The simple answer is none.

The March 4, 1994 letter applies to dehydrators whose FINAL vent control is a condenser. Systems which direct the uncondensed fraction to the firebox or an afterburner have final control beyond the condenser. We typically recognize a destruction and removal efficiency of 98% for properly designed combustion units such as a dehydrator firebox or flare. The two percent uncombusted VOC amount should be determined based on the estimated vent load. The estimated vent load may be computed using any of the conservative software programs accepted by the TNRCC Office of Air Quality or through a rich-lean analysis conducted according to the protocol prepared by the Gas Research Institute.

No condenser efficiency test is required when the dehydrator still vents are combusted in the final control step.

MARK S. COLEMAN
Executive Director

FRANK KEATING
Governor

State of Oklahoma
DEPARTMENT OF ENVIRONMENTAL QUALITY

August 22, 1995

Mr. Tom Wiggins
President
Jatco Environmental
244 NW 111th
Okla. City, OK 73114

RE: Condenser Unit for Dehydrator Emission Control

Dear Mr. Wiggins:

While the Oklahoma Department of Environmental Quality cannot specifically recommend your product over another brand, we do feel that condensers are a viable method of treating the emission stream from a dehydrator. Along with the resale of collected liquids, another factor we consider a plus is the virtually total destruction in the reboiler tube of any hydrocarbons that don't condense.

If we can be of further assistance, please call 271-1683, x-116.

Sincerely,
Richard Kienlen
Richard Kienlen
Environmental Engineer
Permits Support Group
AIR QUALITY DIVISION

Summary of Results

Aquila Gas Pipeline Company owns and operates the Schultz Compressor Station located near Giddings, Texas. Within the Schultz Compressor Station is one glycol Reboiler equipped with a Jatco BTEX Eliminator. The unit was tested to determine the pattern and quantity of emissions released into the atmosphere. The tests were conducted on May 24, 1996 by Cubix Corporation of Austin, Texas.

Three one-hour test runs were performed on the glycol Reboiler while the unit was operating at normal conditions in which the burner cycled on and off. Table 2 represents the summary of results for the tests performed on the glycol Reboiler. The summary table contains three different emission rates for each test run:

1. While the burner was firing (on).
2. While the burner was not firing (off).
3. A one hour average that included both burner on and off conditions.

Maximum emission rates based on the highest concentrations and flow rates encountered during the tests are also presented in Table 2.

It should be noted that total hydrocarbons (THC) were measured continuously via Method 25a and by GC sample injections using Method 18. The continuous measurement tends to average the concentrations while the GC sample injections indicate the instantaneous concentrations at the specific moment in time. Spikes that may occur over very small time periods will be included in the average hydrocarbon concentrations by the continuous THC analyzer buy may be picked up by the GC if the spike occurs during an injection period. This may explain the discrepancies between the tow THC (and total VOC) concentrations listed in the table. VOC concentrations were determined by only taking the non-methane/nonethane fraction of the sample into account.

Measured concentrations and exhaust volumetric flow rates were used to calculate mass emission rates. Examples of the calculations for determination of emission rates can be found in Appendix B. All field data sheets used in accumulation of data can be found in Appendix A. Appendix A also contains a table which summarizes the stack gas flow rates, moisture contents, and molecular weights.

Table 2
Summary of Results: Test Runs 1 and 2

Aquila Gas Pipeline
Schultz Compressor Stations near Giddings, TX
Technicians: SLB, JRW
Sources: Glycol Reboiler Unit

Test Run Number-Burner Status	1-OFF	1-ON	Overall Average 1-BOTH	2-OFF	2-ON	Overall Average 2-BOTH
Date	5-24-96	5-24-96	5-24-96	5-24-96	5-24-96	5-24-96
Start Time (24 hr)	9:23	9:23	9:23	10:53	10:53	10:53
Stop Time (24 hr)	10:23	10:23	10:23	11:53	11:53	11:53
Ambient Conditions						
Atmospheric Pressure (in. Hg)	29.50	29.50	29.50	29.50	29.50	29.50
Temperature (°F wet)	74	74	74	74	74	74
Temperature (°F dry)	80	80	80	87	87	87
Humidity (lb/lb of air)	0.017	0.017	0.017	0.015	0.015	0.015
Flow Rate Data						
Exhaust Flow (DSCFH)	2953	4873	3747	3366	5622	4701
Measured stack Concentrations						
Methane (ppmv)	14.0	9.5	12.1	23.0	176.0	110.1
Ethane (ppmv)	4.5	<0.5	<2.8	<0.5	96.0	<54.6
Propane (ppmv)	4.6	<0.5	<2.9	<0.5	1.6	<1.2
Butane (ppmv)	3.3	<0.5	<2.1	<0.5	<0.5	<0.5
Pentane(ppmv)	9.6	3.2	7.0	<0.5	<0.5	<0.5
Hexane (ppmv)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzene(ppmv)	<0.5	<0.5	<0.5	<0.5	3.4	<2.2
Toluene (ppmv)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene (ppmv)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
O-xylene (ppmv)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
P-xylene (ppmv)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total VOC By GC/FID (ppmv as propane)	23.5	5.0	15.8	33.0	38.5	36.7
Total Hydocarbons by GC/FID (ppmv as propane)	31.0	8.4	21.7	41.0	169.5	114.5
Total VOC By Continuous FID (ppmv as propane)*	7.0	6.8	7.0	7.8	3.0	5.2
Total Hydrocarbons by Cont. FID (ppmv as propane)	9.2	11.6	10.2	9.7	13.3	11.7
OC (%)	18.10	5.40	12.84	19.06	6.37	12.08
CO2 (%)	1.80	10.40	5.35	1.45	9.72	6.00
Emission Rates (GC/FID)						
Methane (1b/hr)	0.0017	0.0019	0.0019	0.0032	0.0411	0.0215
Ethane (1b/hr)	0.0010	<0.0002	<0.0008	<0.0001	0.0420	<0.0200
Propane (1b/hr)	0.0016	<0.0003	<0.0012	<0.0002	0.0011	<0.0006
Butane (1b/hr)	0.0014	<0.0004	<0.0012	<0.0002	<0.0004	<0.0003
Pentane (1b/hr)	0.0053	0.0029	0.0049	<0.0003	<0.0005	<0.0004
Hexane (1b/hr)	<0.0003	<0.0005	<0.0004	<0.0004	<0.0006	<0.0005
Benzene(1b/hr)	<0.0003	<0.0005	<0.0004	<0.0003	0.039	<0.0021
Toluene(1b/hr)	<0.0004	<0.0006	<0.0004	<0.0004	<0.0007	<0.0006
Ethylbenzene (1b/hr)	<0.0004	<0.0007	<0.0005	<0.0005	<0.0008	<0.0007
O-xylene (1b/hr)	<0.0004	<0.0007	<0.0005	<0.0005	<0.0008	<0.0007
p-xylene(1b/hr)	<0.0004	<0.0007	<0.0005	<0.0005	<0.0008	<0.0007
Total VOC (1b/hr) by Continuous FID	0.0024	0.038	0.0030	0.0030	0.0019	0.0028
Total THC (1lb/hr) by Continuous FID	0.0031	0.0065	0.0044	0.0037	0.0086	0.0063

***Total Hydrocarbons by Continuous FID determined by Subtracting non-VOC (Methane + Ethane) fraction measured by GC/FID**

Tested by Cubix Corporation, Austin, Texas

Table 2
Summary of Results: Test Runs 3

Aquila Gas Pipeline
Schultz Compressor Stations near Giddings, TX
Technicians: SLB, JRW
Sources: Glycol Reboiler Unit

Test Run Number-Burner Status	3-OFF	3-ON	Overall Average 3-BOTH	Maximum Emissions 1 thru 3
Date	5-24-96	5-24-96	5-24-96	5-24-96
Start Time (24 hr)	12:18	12:18	12:18	9:23
Stop Time (24 hr)	13:18	13:18	13:18	13:18
Ambient Conditions				
Atmospheric Pressure (in. Hg)	29.50	29.50	29.50	
Temperature (°F wet)	77	77	77	
Temperature (°F dry)	90	90	90	
Humidity (lb/lb of air)	0.017	0.017	0.017	
Flow Rate Data				
Exhaust Flow (DSCFH)	3439	5449	4524	5622
Measured stack Concentrations				
Methane (ppmv)	13.0	48.5	32.2	324.4
Ethane (ppmv)	<0.5	30.5	<16.7	191.9
Propane (ppmv)	3.8	35.6	21.0	64.2
Butane (ppmv)	3.1	41.2	23.7	73.4
Pentane(ppmv)	4.0	27.4	16.6	44.9
Hexane (ppmv)	<0.5	12.3	<6.9	17.8
Benzene(ppmv)	3.0	43.9	25.1	60.5
Toluene (ppmv)	<0.5	15.8	<8.8	17.2
Ethylbenzene (ppmv)	<0.5	<0.5	<0.5	<0.5
O-xylene (ppmv)	<0.5	<0.5	<0.5	<0.5
P-xylene (ppmv)	<0.5	<0.5	<0.5	<0.5
Total VOC By GC/FID (ppmv as propane)	18.1	419	234.6	654.8
Total Hydocarbons by GC/FID (ppmv as propane)	22.9	458	257.9	723.0
Total VOC By Continuous FID (ppmv as propane)*	53.9	25.9	38.8	481.9
Total Hydrocarbons by Cont. FID (ppmv as propane)	68.1	28.3	46.1	532.0
OC (%)	19.72	5.78	12.33	20.37
CO2 (%)	1.11	10.16	5.91	13.66
Emission Rates (GC/FID)				
Methane (1b/hr)	0.0019	0.0110	0.0060	0.0758
Ethane (1b/hr)	<0.0001	0.0129	<0.0059	0.0840
Propane (1b/hr)	0.0015	0.0222	0.0108	0.0412
Butane (1b/hr)	0.0015	0.0326	0.0156	0.0600
Pentane (1b/hr)	0.0025	0.0279	0.0141	0.0472
Hexane (1b/hr)	<0.0004	0.0146	<0.0068	0.0218
Benzene(1b/hr)	0.0021	0.0485	0.0230	0.0690
Toluene(1b/hr)	<0.0004	0.0206	<0.0095	0.0231
Ethylbenzene (1b/hr)	<0.0005	<0.0008	<0.0006	<0.0008
O-xylene (1b/hr)	<0.0005	<0.0008	<0.0006	<0.0008
p-xylene(1b/hr)	<0.0005	<0.0008	<0.0006	<0.0008
Total VOC (1b/hr) by Continuous FID	0.0212	0.0161	0.0200	0.3095
Total THC (1lb/hr) by Continuous FID	0.0267	0.0176	0.0238	0.3417

***Total Hydrocarbons by Continuous FID determined by Subtracting non-VOC (Methane + Ethane) fraction measured by GC/FID**

Tested by Cubix Corporation, Austin, Texas

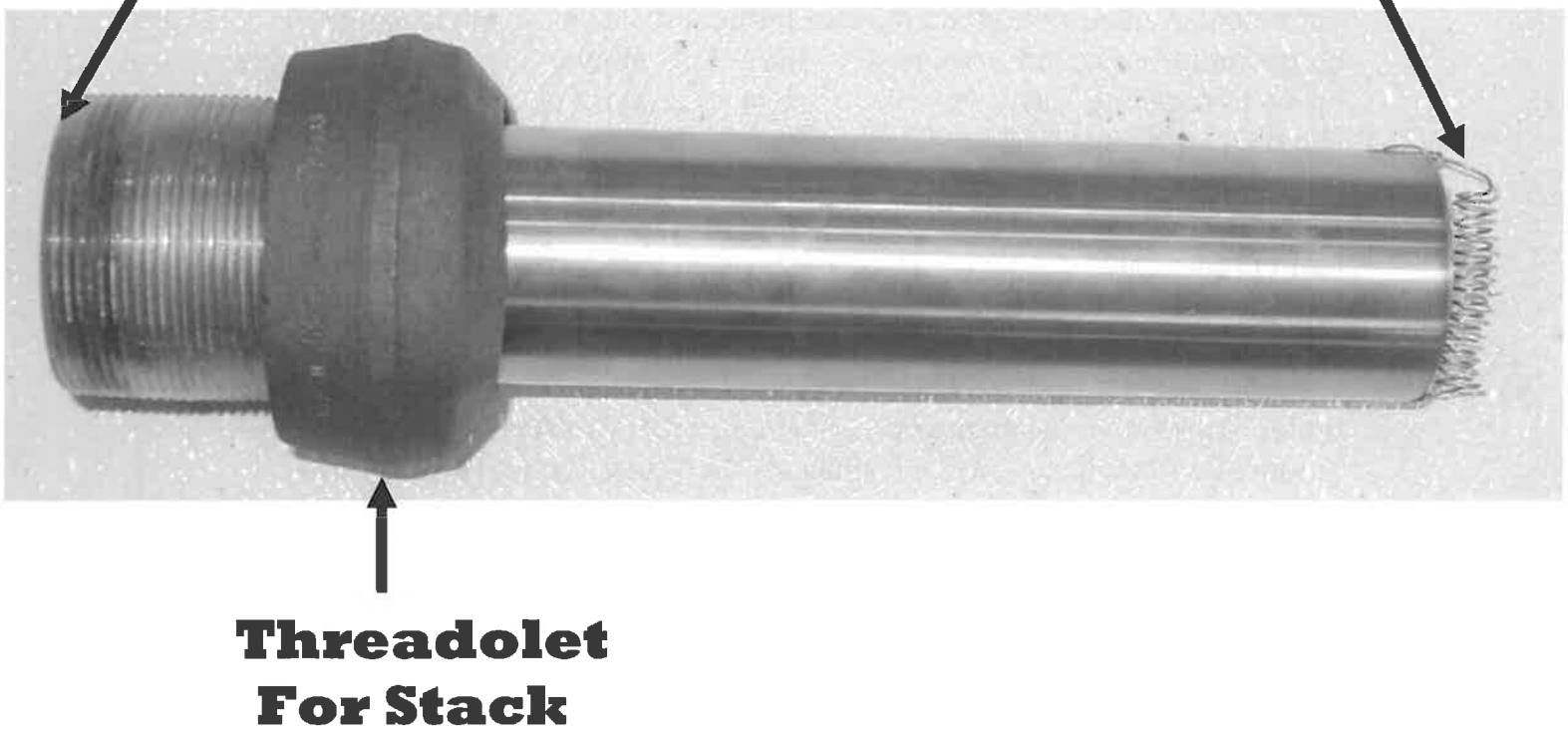
Velocity, Molecular Weight, Moisture Content, Flow Rate

Aquila Gas Pipeline Co.
Near Giddings, TX
Technicians: SLB, JRW
Sources: Glycol Reboiler Unit
BURNER STATUS
TEST RUN NUMBER

	OFF 1	ON 1	ON 2	OFF 2	OFF 3	ON 3
Date	5-24-96	5-24-96	5-24-96	5-24-96	5-24-96	5-24-96
Start Time (24 hrs)	09:25	09:33	11:08	11:33	12:39	13:15
Stop Time (24 hrs)	09:25	09:33	11:08	11:33	12:39	13:15
Stack Moisture & Molecular Wt.						
CO2 (%)	1.8	10.4	9.72	1.45	1.11	10.16
O2 (%)	18.10	5.40	6.37	19.06	19.72	5.78
Beginning Meter Reading (ft3)	194.33	194.33	194.33	194.33	216.75	216.75
Ending Meter Reading (ft3)	216.65	216.65	216.65	216.65	243.66	243.66
Beginning Impinger Wt (g)	2505.9	2505.9	2505.9	2505.9	2527.4	2527.4
Ending Impinger Wt. (g)	2527.4	2527.4	2527.4	2527.4	2562.0	2562.0
Dry Gas Meter Factor (Kd)	1.0094	1.0094	1.0094	1.0094	1.0094	1.0094
Dry Gas Meter Temperature (oF begin)	93	93	93	93	106	106
Dry Gas Meter Temperature (oF end)	106	106	106	106	106	106
Atmospheric Pressure (in Hg, abs.)	29.50	29.50	29.50	29.50	29.48	29.48
Stack gas Moisture (% volume)	4.61	4.61	4.61	4.61	6.14	6.14
Dry Gas Fraction	0.954	0.954	0.954	0.954	0.939	0.939
Stack Gas Molecular Wt. (lbs/lb-mole)	28.50	29.33	29.27	28.49	28.29	29.13
Velocity Pilot Tube Data						
VP #1	0.0020	0.0044	0.0060	0.0020	0.0021	0.0080
VP #2	0.0015	0.0066	0.0120	0.0016	0.0032	0.0114
VP #3	0.0017	0.0081	0.0100	0.0035	0.0028	0.0124
VP #4	0.0022	0.0120	0.0080	0.0028	0.0023	0.0074
Pilot Tube Factor	0.99	0.99	0.99	0.99	0.99	0.99
Sum of Square Root of Vertical	0.1715864	0.3471174	0.3764469	0.19679718	0.20326764	0.39359204
Compenent	4	4	4	4	4	4
Number of traverse Points	0.0428966	0.0867793	0.0941117	0.0491993	0.05081691	0.09839801
Average Square Root of VP's	240	562	445	249	246	564
Average Temperature (°F)	0.01	-0.005	0.01	-0.003	-0.015	-0.015
Static Pressure (in. H2O)	8	8	8	8	8	8
Stack Diameter (in.)	0.3490667	0.3490667	0.3490667	0.34906667	0.34906667	0.34906667
Stack Area (ft2)	199	479	489	229	237	546
Stack Velocity (ft/min)	69	167	171	80	83	190
Stack Flow, wet (ACFM)	**2953**	**4873**	**5622**	**3366**	**3439**	**5449**
Stack Flow, dry (SCFH)						

Testing by Cubix Corporation, Austin, Texas

The JATCO Igniter



The JATCO Igniter is a heterogeneous catalyst used to combust residual VOC's from the BTEX condenser when the Temperature Controller of the regenerator cycles the burner off. The residual VOC reactants are adsorbed on to the surface of the catalyst at the active sites. At this stage, both the residual VOC's from the condenser and the free oxygen in the stack reactant molecules might be adsorbed to the catalyst, or one might be attached and hit by the other one moving freely in the gas. This causes a molecular bond between the two gasses lowering the auto-ignition temperature of the residual VOC's from the condenser. Then the gas molecules are desorbed to leave the active site available for a new set of molecules to attach and react. The average low auto-ignition temperature of the JATCO Igniter is 300°. (This temperature may vary due to stream composition.)

JATCO, INC.

ENVIRONMENTAL
PROTECTION
EQUIPMENT

System Operation Guarantee
JATCO BTEX "ELIMINATOR"

The system operation of the JATCO BTEX "Eliminator" is able to achieve stack test results in excess of 98% destruction efficiency by routing the pre-condensed still column vapors to the main burner and inducing this low pressure V.O.C.'s into the primary air inlet of the original burner using our patented Jatco compound injector burner assembly. When re-boiler temperature is reached, a valve stops the V.O.C. flow to the main burner and opens to route the V.O.C.'s to the exhaust stack, through the igniter (to be installed with unit). The igniter consists of a stainless steel nipple with a nickel alloy wire coil. As the main burner is on its firing cycle, the exhaust gases keep this coil red hot by cumulating heat in the fire tube. After the main burner shuts off, and V.O.C.'s are routed to the exhaust stack, the coil will ignite or flash the vapor for a period until there is free air oxygen dilution. The actual stack testing will show burner/on burner/off cycles and concentrations. It is also a note that general operation of standard glycol re-boiler dehydration, when the burner is on is when you achieve the flash/flux around the fire tube and when it shuts off the V.O.C output from the still column diminishes rapidly.

JATCO Environmental Inc. stands behind all of the testing performed on our units and will purchase any unit back that does not perform to these standards.

244 N.W. 111th • Oklahoma City, OK. 73114 • Office (405) 755-4100 • Fax (405 755-4101

Keatley, David J

From: Coleman, Jessica <Jessica.Coleman@crestwoodlp.com>
Sent: Monday, May 16, 2016 2:59 PM
To: Keatley, David J
Cc: McKeone, Beverly D; Stovall, Jeffrey; Humes, Chris
Subject: RE: WV DAQ Permit Application Incomplete
Attachments: 20160512 - CRESTWOOD- 5794GSI EMISSION QAC4-67O-14.pdf; 20160512 - CRESTWOOD-7044GSI-EMISSION QAC4-670-14.pdf; 20160516 - Crestwood_Tichenal_Att I_Em Units Table_v2.0.pdf

Mr. Keatley,

Good afternoon. Please find below responses to your requests received on May 11. Feel free to call me if you have questions or require additional information.

1. The VOC guarantee on the catalyst manufacturer spec sheet was incorrectly labeled "NMHC". The catalyst vendor applies their guaranteed control efficiency to the engine outlet emissions as provided in the engine manufacturer spec sheet. After further review, it was noted that the engine outlet emissions were provided as NMEHC (nonmethane-ethane hydrocarbon). Therefore, the "VOC" values shown in the catalyst spec sheets represent NMEHC. The catalyst vendor has accordingly updated the attached spec sheets.

2. Attached to this email is a revised Attachment I to reflect the requested changes in your email. We have also updated the "Type and Date of Change" for other emission units for which we are seeking updates to permit limits and/or representations. Provided below is additional detail on the requested permit changes.
   a. Compressor Engines (CE-1 through CE-9) – Emission limits requested in previous permit applications were equal to the lowest minimum achievable emissions as guaranteed by the catalyst vendor. E. Marcellus is now requesting slightly higher emission limits to allow for greater compliance margin, while still meeting all applicable State and Federal requirements.
   b. TEG Dehydrator Reboilers (RBV-1, RBV-2) – Although no equipment changes were made, reboiler ratings were incorrectly represented in previous permit applications. E. Marcellus is now updating the ratings from 0.2 to 1.5 MMBtu/hr.
   c. TEG Dehydrator Still Vents (RSV-1, RSV-2) – GLYCalc runs were updated with a more recent extended wet gas analysis, assuming half the detection limit for any BTEX constituents that were sampled at less than the detection limit. Contact tower pressures were increased from 950 psig to 1150 psig. TEG flowrate was increased from 7.0 gpm to 15.0 gpm; two 7.5-gpm pumps are used simultaneously for a total 15.0 gpm. Stripping gas was included in the GLYCalc runs, even though stripping gas is used only as needed. The claimed control efficiency of routing the flash tank vapors to the reboiler was slightly decreased from 98% to 95%. The condenser/combustion combined control parameters for the regenerator overheads were updated. E. Marcellus is also requested to add the customary 20% safety factor (i.e., compliance margin) above GLYCalc outputs, to allow for the inherently variable dehydration process.
   d. Produced Water Tanks (T-01, T-02, T-08, T-09) – Permit No. R13-3076 contains no requirements for atmospheric storage tanks. However, the October 2015 permit application updated physical data (i.e., capacity, dimensions, and throughput) and emissions for these sources. Emissions from produced water storage tanks remain minimal at a total of 0.14 tpy VOC from all four tanks.
   e. Tank Truck Loading (LR-1) – Permit No. R13-3076 contains no requirements for truck loading. However, the October 2015 permit application updated the throughput and calculation methodology for this emission source. Emissions from produced water truck loading remain minimal at 0.08 tpy.

Best Regards,

Jessica Coleman
Air Quality Specialist

Crestwood Midstream Partners LP
1200 Summit Avenue, Suite 320, Fort Worth, TX 76102
P: 817-339-5406 | C: 817-201-5222
F: 817-339-5401
Jessica.Coleman@crestwoodlp.com
www.crestwoodlp.com

Please note our new address

From: Keatley, David J [mailto:David.J.Keatley@wv.gov]
Sent: Wednesday, May 11, 2016 1:03 PM
To: Coleman, Jessica
Cc: McKeone, Beverly D; Stovall, Jeffrey; Humes, Chris
Subject: WV DAQ Permit Application Incomplete for Company Name and Location

RE: Application Status: Notice of Deficiency
E. Marcellus Asset Company, LLC
Permit Application No. R13-3076A
Plant ID No. 033-00200

Ms. Coleman:

Your application for a Modification permit for a Natural Gas Compressor Station was received by this Division on November 2, 2015 and assigned to the writer for review. Upon further review of said application, it has been determined that the application as submitted is incomplete based on the following items:

1. To estimate the VOCs for Waukesha L579GSI engine the catalyst manufacturer should supply the emission factor for NMNEHC not the NMHC.

2. The emissions for RSV-1, RSV-2, and CE-6 through CE-9 in this application do not match what is currently permitted. If it is your intent is to modify the emissions from these emission units please correct the "Type and Date of Change" column in Attachment I from Existing to Modified to demonstrate this is the intent. In future applications please describe this in your Introduction. In your response to this email please state how you have modified the emissions from RSV-1, RSV-2, and CE-6 through CE-9 from the previous application. If you have modified emissions from other emission units not mentioned, please list which emissions you want to modify and explain how/why the emissions were modified for those units as well.

Please address the above deficiencies in writing within fifteen (15) days of the receipt of this email. Application review will not commence until the application has been deemed to be technically complete. Failure to respond to this request in a timely manner may result in the denial of the application.

Should you have any questions, please contact David Keatley at (304) 926-0499 ext. 1124 or reply to this email.

David Keatley, Ph.D., PE
West Virginia Department of Environmental Protection
Division of Air Quality, NSR Air Pollution Permit Engineer
Phone: (304) 926-0475 ext. 1224

Emission Control Application Data Sheet

MAXIM
10635 Brighton Lane
Stafford, Texas 77477
Phone: 832 554-0980
Fax: 832 554-0990

Customer: **CRESTWOOD** | Project: **5794GSI** | Date: **3/1/2016**

Customer Contact | IAC Contact: | Order/Quote #: **30116**

Engine Data:

Engine Model:	**Waukesha L5794GSI**		Speed:	**1200**	RPM
Fuel & Operating Type:	**Natural Gas Rich Burn**		Engine Power:	**1380** **1029**	Hp KW
Exhaust Flow Rate:	**6179** **10498** **9124**	acfm m^3/hr lbs/hr	Exhaust Temperature:	**1149** **621**	°F °C

Catalyst Data:

Number of Core layers:	**1**				
Model:	**QAC4-67-14**		Inlet Size:	**14**	in
Grade:	**Super Critical**		Outlet Size:	**14**	in
Body Diameter:	**40**	in	Body Length:	**122**	in
Estimated weight:	**1158** **525**	lbs Kg	Estimated Back Pressure:	**4.96** **12.4**	in of WC mbar
Core Part Number:	**3ECI-RO13-335-300-35-CH1019**	Qty (1) PE2-670	Speed through inlet:	**5983**	ft/min

Emission:

Min. Temp. at Core Face: **1112** °F **600** °C
Max. Temp. at Core Face: **1239** °F **671** °C

Catalyst Type: **3-Way**

	Pollutant					
	NOx	CO	NMEHC/VOC	H_2CO	ORGANIC PM10	
Engine Out / Pre Emission:	**13.7**	**9.3**	**0.33**	**0.05**	**0**	g/bhp-hr
	5889.39	**3997.91**	**141.86**	**21.49**	**0.00**	mg/Nm3
Post Emission:	**0.500**	**0.600**	**0.060**	**0.040**	**0.000**	g/bhp-hr

Acoustics:

Frequency Band (Hz):	31.5	63	125	250	500	1000	2000	4000	8000	
Raw Noise SPL (dB) at 3.28 ft.:	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	107 dBA
Estimated Attenuation (dB):	**12**	**25**	**38**	**35**	**25**	**21**	**21**	**20**	**20**	No Element
Plus:	**12**	**26**	**40**	**37**	**29**	**26**	**27**	**26**	**25**	One Element Layer
Silenced SPL (dB) at 3.28 ft.:	**88**	**74**	**60**	**63**	**71**	**74**	**73**	**74**	**75**	80.6 dBA

Warranty & Notes:

- **If Pre-Emission levels are not as noted above, contact IAC Acoustics for a re-quote.**
- To achieve Post Emissions levels detailed above, exhaust temperature and Pre-Emission data must be as specified.
- Maximum allowable exhaust temperature at core face is 1350°F.
- If applicable, the engine will require an air/fuel ratio controller to meet above emission levels. For Rich Burn engines λ must be 0.99 - 0.99.
- Catalyst cleaning/regeneration required, if initial backpressure increases by 2" WC.
- Engine operation to be stable and reproducible.
- QAC is not designed to withstand a backfire, therefore measures should be taken prior to QAC unit to alleviate backfire pressure.
- Maximum lubrication oil consumption rate to be less than 0.0015 lb/bhp/hr.
- Lube oil sulfate ash contents should not exceed 0.5%.
- Phosphorus and/or Zinc should not exceed 5 ppmv in the exhaust stream.
- A high temperature alarm/shutdown to be maintained at downstream of catalyst at 1300°F.
- Fuel not to contain heavy or transition metals such as Pb, Ar, Zn, Cu, Sn, Fe, Ba, Ni, Cr etc.
- Chlorinated or Silicone containing compounds in the exhaust not to exceed 1 ppmv.
- Sulfur compounds in the exhaust gas stream not to exceed 25 ppmv.
- Performance guarantee is voided should the catalyst become masked or de-activated by any contaminant in the exhaust stream.
- Engine to be maintained and operated in accordance within manufacturer's recommended practice.
- Under no condition will IAC Acoustics assume any contingent liabilities.
- Operating manual is available online at www.maximsilencers.com or contact a Maxim sales representative.
- Nomenclature: QAC4-292-8, 4 is grade (Super Critical), 29 is catalyst block size, 2 is no. of catalyst(s) and 8 is flange diameter.
- Organic PM10 are estimate only and not a guarantee because of the variability in fuels and additives which change PM10.
- IAC's standard one year warranty applies.

Rev level: 83

Revised May 16, 2016

Attachment I

Emission Units Table

(includes all emission units and air pollution control devices that will be part of this permit application review, regardless of permitting status)

Emission Unit ID[1]	Emission Point ID[2]	Emission Unit Description	Year Installed/ Modified	Design Capacity	Type[3] and Date of Change	Control Device[4]
CE-1	1E	Compressor Engine Waukesha L5794GSI	2013[9]	1,380 hp	Modification; 10/31/2015[5]	1C
CE-2	2E	Compressor Engine Waukesha L5794GSI	2011	1,380 hp	Modification; 10/31/2015[5]	2C
CE-3	3E	Compressor Engine Waukesha L5794GSI	2015[9]	1,380 hp	Modification; 10/31/2015[5]	3C
CE-4	4E	Compressor Engine Waukesha L5794GSI	2015[9]	1,380 hp	Modification; 10/31/2015[5]	4C
CE-5	5E	Compressor Engine Waukesha L5794GSI	2011	1,380 hp	Modification; 10/31/2015[5]	5C
CE-6	6E	Compressor Engine Waukesha L7044GSI	2012	1,680 hp	Modification; 10/31/2015[10]	6C
CE-7	7E	Compressor Engine Waukesha L7044GSI	2012	1,680 hp	Modification; 10/31/2015[10]	7C
CE-8	8E	Compressor Engine Waukesha L7044GSI	2012	1,680 hp	Modification; 10/31/2015[10]	8C
CE-9	9E	Compressor Engine Waukesha L7044GSI	2012	1,680 hp	Modification; 10/31/2015[10]	9C
CE-10	10E	Compressor Engine Waukesha L7044GSI	NA	1,680 hp	Removal[6]	10C
CE-11	11E	Compressor Engine Waukesha L7044GSI	NA	1,680 hp	Removal[6]	11C
CE-12	12E	Compressor Engine Waukesha L7044GSI	NA	1,680 hp	Removal[6]	12C
CE-13	13E	Compressor Engine Waukesha L7044GSI	NA	1,680 hp	Removal[6]	13C
CE-14	14E	Compressor Engine Waukesha L7044GSI	NA	1,680 hp	Removal[6]	14C
RBV-1	15E	TEG Dehydrator Reboiler	2011	1.5 MMBtu/hr[7]	Modification; 10/31/2015	None
RSV-1	16E	TEG Dehydrator Still Vent	2011	64 MMSCFD	Modification; 10/31/2015[10]	16C
RBV-2	17E	TEG Dehydrator Reboiler	2012	1.5 MMBtu/hr[7]	Modification; 10/31/2015	None
RSV-2	18E	TEG Dehydrator Still Vent	2012	60 MMSCFD	Modification; 10/31/2015[10]	18C
T-01	19E	Produced Water Tank	2011	300 bbl	Modification; 10/31/2015[10]	None

T-02	20E	Produced Water Tank	2011	300 bbl	Modification; 10/31/2015 [10]	None
T-03	21E	Used Oil Tank	2011	1,000 gallon	Existing, No change	None
T-04	22E	TEG Tank	2011	1,000 gallon	Existing, No change	None
T-05	23E	Lube Oil Tank	2011	1,000 gallon	Existing, No change	None
T-06	24E	Lube Oil Tank	2011	1,000 gallon	Existing, No change	None
T-07	25E	Dehy Drip Fluid Tank	2011	285 gallon	Existing, No change	None
T-08	26E	Produced Water Tank	2011	210 bbl [8]	Modification; 10/31/2015 [10]	None
T-09	27E	Produced Water Tank	2011	210 bbl [8]	Modification; 10/31/2015 [10]	None
LR-1	28E	Tank Truck Loading	2011	NA	Modification; 10/31/2015 [10]	None

[1] For Emission Units (or Sources) use the following numbering system:1S, 2S, 3S,... or other appropriate designation.
[2] For Emission Points use the following numbering system:1E, 2E, 3E, ... or other appropriate designation.
[3] New, modification, removal
[4] For Control Devices use the following numbering system: 1C, 2C, 3C,... or other appropriate designation.

[5] Note that these engines were planned to be removed with the installation of CE-10 through CE-14, but now E. Marcellus wishes to retain these assets. Only a change in emission limits is requested. No physical modification or change in the method of operation is requested.

[6] Note that these sources were permitted with the intent of replacing CE-1 through CE-5, but were never installed.

[7] The current R13 permit incorrectly lists the heat input of these units as 0.20 MMBtu/hr.

[8] The current R13 permit incorrectly lists the capacity of these tanks as 300 bbl.

[9] CE-1, CE-3, and CE-4 were replaced with like-in-kind engines in the installation years noted.

[10] Only a change in emission limits is requested. No physical modification or change in the method of operation is requested.

Keatley, David J

From: Coleman, Jessica <Jessica.Coleman@crestwoodlp.com>
Sent: Wednesday, March 02, 2016 11:17 AM
To: Keatley, David J
Cc: McKeone, Beverly D; Stovall, Jeffrey; Humes, Chris; Petri, Emily
Subject: RE: WV DAQ Permit Application Incomplete for E. Marcellus Asset Company, LLC; Tichenal Station
Attachments: 20160301 - CRESTWOOD- 5794GSI EMISSION QAC4-67O-14.pdf; 20160301 - CRESTWOOD-7044GSI-EMISSION QAC4-670-14.pdf

David,

Thank you for your review of the Tichenal air permit application. As we discussed yesterday, please find attached the updated catalyst spec sheets for CE-1 through CE-5 (Wauk 5794's) and CE-6 through CE-9 (Wauk 7044's). You will find that the g/bhp-hr (the basis of our proposed lb/hr and tpy limits) in the Attachment N emission calculations matches the guaranteed g/bhp-hr on the attached catalyst spec sheets.

Feel free to call me if you require additional information.

Regards,

Jessica Coleman
Air Quality Specialist

Crestwood Midstream Partners LP
801 Cherry St., Suite 3800, Unit 20, Fort Worth, TX 76102
P: 817-339-5406 | C: 817-201-5222
F: 817-339-5401
Jessica.Coleman@crestwoodlp.com
www.crestwoodlp.com

Crestwood

From: Keatley, David J [mailto:David.J.Keatley@wv.gov]
Sent: Wednesday, February 17, 2016 1:54 PM
To: Chris.Humes@creswoodlp.com
Cc: McKeone, Beverly D; Coleman, Jessica; Stovall, Jeffrey
Subject: WV DAQ Permit Application Incomplete for E. Marcellus Asset Company, LLC; Tichenal Station

RE: Application Status: Notice of Deficiency
E. Marcellus Asset Company, LLC; Tichenal Station
Permit Application No. R13-3076A
Plant ID No. 033-00200

Mr. Humes:

Your application for a Modification permit for a Natural Gas Compressor and Dehydration Station was received by this Division on November 2, 2015 and assigned to the writer for review. Upon further review of said application, it has been determined that the application in its current form is incomplete based on the following items:

1. The emission factors used to estimate emissions for engines CE-1 through CE-5 on page N-3 of the application do not match the post emission factors on the catalyst spec sheet. Please correct the corresponding pages in the application and resubmit those sheets.

Please address the above deficiencies in writing within fifteen (15) days of the receipt of this email. Application review will not commence until the application has been deemed to be technically complete. Failure to respond to this request in a timely manner may result in the denial of the application.

Should you have any questions, please contact David Keatley at (304) 926-0499 ext. 1224 or reply to this email.

David Keatley, Ph.D., PE
West Virginia Department of Environmental Protection
Division of Air Quality, NSR Air Pollution Permit Engineer
Phone: (304) 926-0475 ext. 1224

Emission Control Application Data Sheet

POWERTHERM Co., Inc.

MAXIM
10635 Brighton Lane
Stafford, Texas 77477
Phone: 832 554-0980
Fax: 832 554-0990

Customer: **CRESTWOOD** Project: **5794GSI** Date: **3/1/2016**

Customer Contact: IAC Contact: Order/Quote #: **30116**

Engine Data:

Engine Model:	**Waukesha L5794GSI**		Speed:	**1200**	RPM
Fuel & Operating Type:	**Natural Gas Rich Burn**		Engine Power:	**1380** **1029**	Hp KW
Exhaust Flow Rate:	**6179** **10498** **9124**	**acfm** **m^3/hr** **lbs/hr**	Exhaust Temperature:	**1149** **621**	°F °C

Catalyst Data:

Number of Core layers:	**1**				
Model:	**QAC4-67-14**		Inlet Size:	**14**	in
Grade:	**Super Critical**		Outlet Size:	**14**	in
Body Diameter:	**40**	in	Body Length:	**122**	in
Estimated weight:	**1158** **525**	lbs Kg	Estimated Back Pressure:	**4.96** **12.4**	in of WC mbar
Core Part Number:	**3ECI-RO13-335-300-35-CH1019**	Qty (1) PE2-670	Speed through inlet:	**5983**	ft/min

Emission:

Min. Temp. at Core Face: **1112** °F **600** °C
Max. Temp. at Core Face: **1239** °F **671** °C

Catalyst Type: **3-Way**

	Pollutant					
	NOx	CO	NMHC VOC	H_2CO	ORGANIC PM10	
Engine Out / Pre Emission:	**13.7**	**9.3**	**0.33**	**0.05**	**0**	g/bhp-hr
	5889.39	**3997.91**	**141.86**	**21.49**	**0.00**	mg/Nm3
Post Emission:	**0.500**	**0.600**	**0.060**	**0.040**	**0.000**	g/bhp-hr

Acoustics:

Frequency Band (Hz):	31.5	63	125	250	500	1000	2000	4000	8000	
Raw Noise SPL (dB) at 3.28 ft.:	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	107 dBA
Estimated Attenuation (dB):	**12**	**25**	**38**	**35**	**25**	**21**	**21**	**20**	**20**	No Element
Plus:	**12**	**26**	**40**	**37**	**29**	**26**	**27**	**26**	**25**	One Element Layer
Silenced SPL (dB) at 3.28 ft.:	**88**	**74**	**60**	**63**	**71**	**74**	**73**	**74**	**75**	80.6 dBA

Warranty & Notes:

- **If Pre-Emission levels are not as noted above, contact IAC Acoustics for a re-quote.**
- To achieve Post Emissions levels detailed above, exhaust temperature and Pre-Emission data must be as specified.
- Maximum allowable exhaust temperature at core face is 1350°F.
- If applicable, the engine will require an air/fuel ratio controller to meet above emission levels. For Rich Burn engines λ must be 0.96 - 0.99.
- Catalyst cleaning/regeneration required. If initial backpressure increases by 2" of WC.
- Engine operation to be stable and reproducible.
- QAC is not designed to withstand a backfire, therefore measures should be taken prior to QAC unit to alleviate backfire pressure.
- Maximum lubrication oil consumption rate to be less than 0.0015 lb/bhp/hr.
- Lube oil sulfate ash contents should not exceed 0.5%.
- Phosphorus and/or Zinc should not exceed 5 ppmv in the exhaust stream.
- A high temperature alarm/shutdown to be maintained at downstream of catalyst at 1300°F.
- Fuel not to contain heavy or transition metals such as Pb, Ar, Zn, Cu, Sn, Fe, Be, Ni, Cr etc.
- Chlorinated or Silicone containing compounds in the exhaust not to exceed 1 ppmv.
- Sulfur compounds in the exhaust gas stream not to exceed 25 ppmv.
- Performance guarantee is voided should the catalyst become masked or de-activated by any contaminant in the exhaust stream.
- Engine to be maintained and operated in accordance within manufacturer's recommended practice.
- Under no condition will IAC Acoustics assume any contingent liabilities.
- Operating manual is available online at www.maximsilencers.com or contact a Maxim sales representative.
- Nomenclature: QAC4-292-8, 4 is grade (Super Critical), 29 is catalyst block size, 2 is no. of catalyst(s) and 8 is flange diameter.
- Organic PM10 are estimate only and not a guarantee because of the variability in fuels and additives which change PM10.
- IAC's standard one year warranty applies.

Revlevel: 83

Emission Control Application Data Sheet

MAXIM
10635 Brighton Lane
Stafford, Texas 77477
Phone: 832 554-0980
Fax: 832 554-0990

Customer: **CRESTWOOD** | Project: **7044GSI** | Date: **3/1/2016**

Customer Contact | IAC Contact: | Order/Quote #: **30116**

Engine Data:

Engine Model:	**Waukesha L7044GSI**		Speed:	**1200**	RPM
Fuel & Operating Type:	**Natural Gas Rich Burn**		Engine Power:	**1680** **1253**	Hp KW
Exhaust Flow Rate:	**7808** **13266** **11305**	**acfm** **m^3/hr** **lbs/hr**	Exhaust Temperature:	**1181** **638**	°F °C

Catalyst Data:

Number of Core layers:	**1**				
Model:	**QAC4-67-14**		Inlet Size:	**14**	in
Grade:	**Super Critical**		Outlet Size:	**14**	in
Body Diameter:	**40**	in	Body Length:	**122**	in
Estimated weight:	**1158** **525**	lbs Kg	Estimated Back Pressure of the unit:	**7.28** **18.1**	in of WC mbar
Core Part Number:	**3ECI-WH13-335-300-35-CH1019**	Qty (1) PE2-670	Speed through inlet:	**7560**	ft/min
Cell Density	300	cpsi	Back Pressure across Element(s) only	**2.22** **5.5**	in of WC mbar

Emission:

Min. Temp. at Core Face: **1112** °F **600** °C
Max. Temp. at Core Face: **1271** °F **688** °C

Catalyst Type: **3-Way**

O_2 in Exhaust vol %
H_2O in Exhaust vol %

	Pollutant					
	NOx	CO	NMHC/VOC	CH_2O/CHCO	ORGANIC PM10	
Engine Out / Pre Emission:	**13.2**	**12**	**0.45**	**0.05**	**0**	g/bhp-hr
	5575.51	**5068.65**	**190.07**	**21.12**	**0.00**	mg/Nm3
Post Emission:	**0.500**	**0.600**	**0.060**	**0.040**	**0.000**	g/bhp-hr

Acoustics:

Frequency Band (Hz):	31.5	63	125	250	500	1000	2000	4000	8000	
Raw Noise SPL (dB) at 3.28 ft.:	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	107 dBA
Estimated Attenuation (dB):	**12**	**25**	**38**	**35**	**25**	**21**	**21**	**20**	**20**	No Element
Plus:	**12**	**26**	**40**	**37**	**29**	**26**	**27**	**26**	**25**	One Element Layer
Silenced SPL (dB) at 3.28 ft.:	**88**	**74**	**60**	**63**	**71**	**74**	**73**	**74**	**75**	80.6 dBA

Warranty & Notes:

- **If Pre-Emission levels are not as noted above, contact IAC Acoustics for a re-quote.**
- To achieve Post Emissions levels detailed above, exhaust temperature and Pre-Emission data must be as specified.
- Maximum allowable exhaust temperature at core face is 1350 °F.
- If applicable, the engine will require an air/fuel ratio controller to meet above emission levels. For Rich Burn engines λ must be 0.96 - 0.99.
- Catalyst cleaning/regeneration required, if initial backpressure increases by 2" of WC.
- Engine operation to be stable and reproducible.
- QAC is not designed to withstand a backfire, therefore measures should be taken prior to QAC unit to alleviate backfire pressure.
- Maximum lubrication oil consumption rate to be less than 0.0015 lb/bhp/hr.
- Lube oil sulfate ash contents should not exceed **0.5%.**
- Phosphorus and/or Zinc should not exceed 5 ppmv in the exhaust stream.
- A high temperature alarm/shutdown to be maintained at downstream of catalyst at 1300 °F.
- Fuel not to contain heavy or transition metals such as Pb, Ar, Zn, Cu, Sn, Fe, Ba, Ni, Cr etc.
- Chlorinated or Silicone containing compounds in the exhaust not to exceed 1 ppmv.
- Sulfur compounds in the exhaust gas stream not to exceed 25 ppmv.
- Performance guarantee is voided should the catalyst become masked or de-activated by any contaminant in the exhaust stream.
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- Operating manual is available online at www.maximsilencers.com or contact a Maxim sales representative.
- Nomenclature: QAC4-292-8, 4 is grade (Super Critical), 29 is catalyst block size, 2 is no. of catalyst(s) and 8 is flange diameter.
- Organic PM10 are estimate only and not a guarantee because of the variability in fuels and additives which change PM10.
- IAC's standard one year warranty applies.

Revision: 86

3/1/2016

Keatley, David J

From: Coleman, Jessica <Jessica.Coleman@crestwoodlp.com>
Sent: Thursday, December 03, 2015 4:28 PM
To: Keatley, David J
Subject: E. Marcellus - Tichenal - Engine spec sheets
Attachments: 20150817 - Tichenal - Wauk L5794GSI_EngCalc.pdf; 20150817 - Tichenal - Wauk L7044GSI EngCalc.pdf; 20150819 - Tichenal - Catalyst for L5794GSI - Permitting.pdf; 20150819 - Tichenal - Catalyst for L7044GSI - Permitting.pdf

David,

Attached are four documents related to the engines:

1. 20150817 - Tichenal - Wauk L5794GSI_EngCalc.pdf – Spec sheet for Waukesha L5794GSI engine.
2. 20150817 - Tichenal - Wauk L7044GSI EngCalc.pdf – Spec sheet for Waukesha L7044GSI engine.
3. 20150819 - Tichenal - Catalyst for L5794GSI - Permitting.pdf – Spec sheet for catalyst installed on Waukesha L5794 engines.
4. 20150819 - Tichenal - Catalyst for L7044GSI - Permitting.pdf – Spec sheet for catalyst installed on Waukesha L7044 engines.

Regards,

Jessica Coleman
Air Quality Specialist

Crestwood Midstream Partners LP
801 Cherry St., Suite 3800, Unit 20, Fort Worth, TX 76102
P: 817-339-5406 | C: 817-201-5222
F: 817-339-5430
Jessica.Coleman@crestwoodlp.com
www.crestwoodlp.com

VHP - L5794GSI

Gas Compression

ENGINE SPEED (rpm):	1200	NOx SELECTION (g/bhp-hr):	Customer Catalyst
DISPLACEMENT (in3):	5788	COOLING SYSTEM:	JW, IC + OC
COMPRESSION RATIO:	8.2:1	INTERCOOLER WATER INLET (°F):	130
IGNITION SYSTEM:	ESM	JACKET WATER OUTLET (°F):	180
EXHAUST MANIFOLD:	Water Cooled	JACKET WATER CAPACITY (gal):	107
COMBUSTION:	Rich Burn, Turbocharged	AUXILIARY WATER CAPACITY (gal):	11
ENGINE DRY WEIGHT (lbs):	24760	LUBE OIL CAPACITY (gal):	190
AIR/FUEL RATIO SETTING:	0.38% CO	MAX. EXHAUST BACKPRESSURE (in. H2O):	18
ENGINE SOUND LEVEL (dBA)	102	MAX. AIR INLET RESTRICTION (in. H2O):	15
		EXHAUST SOUND LEVEL (dBA)	111

SITE CONDITIONS:

FUEL:	Tichenal Inlet 24Jul2015	ALTITUDE (ft):	1100
FUEL PRESSURE RANGE (psig):	30 - 60	MAXIMUM INLET AIR TEMPERATURE (°F):	100
FUEL HHV (BTU/ft3):	1,100.3	FUEL WKI:	81.3
FUEL LHV (BTU/ft3):	994.6		

SITE SPECIFIC TECHNICAL DATA

POWER RATING	UNITS	MAX RATING AT 100 °F AIR TEMP	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE OF 100 °F		
			100%	75%	55%
CONTINUOUS ENGINE POWER	BHP	1380	1380	1035	763
OVERLOAD	% 2/24 hr	10	10	-	-
MECHANICAL EFFICIENCY (LHV)	%	33.1	33.1	31.9	29.7
CONTINUOUS POWER AT FLYWHEEL	BHP	1380	1380	1035	763
based on no auxiliary engine driven equipment					
FUEL CONSUMPTION					
FUEL CONSUMPTION (LHV)	BTU/BHP-hr	7692	7692	7994	8575
FUEL CONSUMPTION (HHV)	BTU/BHP-hr	8508	8508	8843	9485
FUEL FLOW *based on fuel analysis LHV*	SCFM	178	178	139	110
HEAT REJECTION					
JACKET WATER (JW)	BTU/hr x 1000	3111	3111	2560	2157
LUBE OIL (OC)	BTU/hr x 1000	473	473	425	402
INTERCOOLER (IC)	BTU/hr x 1000	180	180	115	56
EXHAUST	BTU/hr x 1000	2928	2928	2152	1616
RADIATION	BTU/hr x 1000	616	616	548	496
EMISSIONS (ENGINE OUT)					
NOx (NO + NO2)	g/bhp-hr	13.7	13.7	18.2	24.1
CO	g/bhp-hr	9.3	9.3	8.9	7.5
THC	g/bhp-hr	1.8	1.8	1.8	1.8
NMHC	g/bhp-hr	0.33	0.33	0.36	0.45
NM, NEHC	g/bhp-hr	0.08	0.08	0.09	0.11
CO2	g/bhp-hr	474	474	492	528
CO2e	g/bhp-hr	509	509	531	576
CH2O	g/bhp-hr	0.05	0.05	0.05	0.05
CH4	g/bhp-hr	1.42	1.42	1.56	1.93
AIR INTAKE / EXHAUST GAS					
INDUCTION AIR FLOW	SCFM	2009	2009	1576	1255
EXHAUST GAS MASS FLOW	lb/hr	9020	9020	7076	5635
EXHAUST GAS FLOW *at exhaust temp, 14.5 psia*	ACFM	6442	6442	4846	3724
EXHAUST TEMPERATURE	°F	1147	1147	1081	1027

HEAT EXCHANGER SIZING		
TOTAL JACKET WATER CIRCUIT (JW)	BTU/hr x 1000	3528
TOTAL AUXILIARY WATER CIRCUIT (IC + OC)	BTU/hr x 1000	741

COOLING SYSTEM WITH ENGINE MOUNTED WATER PUMPS		
JACKET WATER PUMP MIN. DESIGN FLOW	GPM	450
JACKET WATER PUMP MAX. EXTERNAL RESTRICTION	psig	16
AUX WATER PUMP MIN. DESIGN FLOW	GPM	79
AUX WATER PUMP MAX. EXTERNAL RESTRICTION	psig	44

All data provided per the condtions listed in the notes section on page three.
Data Generated by EngCalc Program Version 3.5 Dresser Inc.
8/17/2015 10:27 AM

VHP - L5794GSI

Gas Compression

FUEL COMPOSITION

HYDROCARBONS:		Mole or Volume %
Methane	CH4	89.523
Ethane	C2H6	8.299
Propane	C3H8	1.292
Iso-Butane	I-C4H10	0.151
Normal Butane	N-C4H10	0.164
Iso-Pentane	I-C5H12	0.044
Normal Pentane	N-C5H12	0.022
Hexane	C6H14	0.042
Heptane	C7H16	0
Ethene	C2H4	0
Propene	C3H6	0
	SUM HYDROCARBONS	99.537
NON-HYDROCARBONS:		
Nitrogen	N2	0.318
Oxygen	O2	0
Helium	He	0
Carbon Dioxide	CO2	0.145
Carbon Monoxide	CO	0
Hydrogen	H2	0
Water Vapor	H2O	0
	TOTAL FUEL	100

FUEL:	Tichenal Inlet 24Jul2015
FUEL PRESSURE RANGE (psig):	30 - 60
FUEL WKI:	81.3
FUEL SLHV (BTU/ft3):	977.32
FUEL SLHV (MJ/Nm3):	38.43
FUEL LHV (BTU/ft3):	994.63
FUEL LHV (MJ/Nm3):	39.11
FUEL HHV (BTU/ft3):	1100.25
FUEL HHV (MJ/Nm3):	43.27
FUEL DENSITY (SG):	0.62

Standard Conditions per ASTM D3588-91 [60°F and 14.696psia] and ISO 6976:1996-02-01[25, V(0;101.325)].
Based on the fuel composition, supply pressure and temperature, liquid hydrocarbons may be present in the fuel. No liquid hydrocarbons are allowed in the fuel. The fuel must not contain any liquid water.
Waukesha recommends both of the following:
1) Dew point of the fuel gas to be at least 20°F (11°C) below the measured temperature of the gas at the inlet of the engine fuel regulator.
2) A fuel filter separator to be used on all fuels except commercial quality natural gas.
Refer to the 'Fuel and Lubrication' section of 'Technical Data' or contact the Waukesha Application Engineering Department for additional information on fuels, or LHV and WKI* calculations.
* Trademark of General Electric Company

FUEL CONTAMINANTS

Total Sulfur Compounds	0	% volume
Total Halogen as Cloride	0	% volume
Total Ammonia	0	% volume
Siloxanes		
Tetramethyl silane	0	% volume
Trimethyl silanol	0	% volume
Hexamethyldisiloxane (L2)	0	% volume
Hexamethylcyclotrisiloxane (D3)	0	% volume
Octamethyltrisiloxane (L3)	0	% volume
Octamethylcyclotetrasiloxane (D4)	0	% volume
Decamethyltetrasiloxane (L4)	0	% volume
Decamethylcyclopentasiloxane (D5)	0	% volume
Dodecamethylpentasiloxane (L5)	0	% volume
Dodecamethylcyclohexasiloxane (D6)	0	% volume
Others	0	% volume

Total Sulfur Compounds	0 µg/BTU
Total Halogen as Cloride	0 µg/BTU
Total Ammonia	0 µg/BTU
Total Siloxanes (as Si)	0 µg/BTU

Calculated fuel contaminant analysis will depend on the entered fuel composition and selected engine model.

No water or hydrocarbon condensates are allowed in the engine. Requires liquids removal.

VHP - L5794GSI

Gas Compression

NOTES

1. All data is based on engines with standard configurations unless noted otherwise.
2. Power rating is adjusted for fuel, site altitude, and site air inlet temperature, in accordance with ISO 3046/1 with tolerance of ± 3%.
3. Fuel consumption is presented in accordance with ISO 3046/1 with a tolerance of -0 / +5% at maximum rating. Fuel flow calculation based on fuel LHV and fuel consumption with a tolerance of -0/+5 %. For sizing piping and fuel equipment, it is recommended to include the 5% tolerance.
4. Heat rejection tolerances are ± 30% for radiation, and ± 8% for jacket water, lube oil, intercooler, and exhaust energy.
5. Emission levels for engines with GE supplied 3-way catalyst are given at catalyst outlet flange. For all other engine models, emission levels are given at engine exhaust outlet flange prior to any after treatment. Values are based on a new engine operating at indicated site conditions, and adjusted to the specified timing and air/fuel ratio at rated load. Catalyst out emission levels represent emission levels the catalyst is sized to achieve. Manual adjustment may be necessary to achieve compliance as catalyst/engine age. Catalyst-out emission levels are valid for the duration of the engine warranty. Emissions are at an absolute humidity of 75 grains H2O/lb (10.71 g H2O/kg) of dry air. Emission levels may vary subject to instrumentation, measurement, ambient conditions, fuel quality, and engine variation. Engine may require adjustment on-site to meet emission values, which may affect engine performance and heat output. NOx, CO, THC, and NMHC emission levels are listed as a not to exceed limit, all other emission levels are estimated. CO2 emissions based on EPA Federal Register/Vol. 74, No. 209/Friday, October 30, 2009 Rules and Regulations 56398, 56399 (3) Tier 3 Calculation Methodology, Equation C-5.
6. Air flow is based on undried air with a tolerance of ± 7%.
7. Exhaust temperature given at engine exhaust outlet flange with a tolerance of ± 75°F (42°C).
8. Exhaust gas mass flow value is based on a "wet basis" with a tolerance of ± 7%.
9. Inlet air restrictions based on full rated engine load. Exhaust backpressure based on 158 PSI BMEP and 1200 RPM. Refer to the engine specification section of Waukesha's standard technical data for more information.
10. Cooling circuit capacity, lube oil capacity, and engine dry weight values are typical.
11. Fuel must conform to Waukesha's "Gaseous Fuel Specification" S7884-7 or most current version. Fuel may require treatment to meet current fuel specification.
12. Heat exchanger sizing values given as the maximum heat rejection of the circuit, with applied tolerances and an additional 5% reserve factor.
13. Fuel volume flow calculation in english units is based on 100% relative humidity of the fuel gas at standard conditions of 60°F and 14.696 psia (29.92 inches of mercury; 101.325 kPa).
14. Fuel volume flow calculation in metric units is based on 100% relative humidity of the fuel gas at a combustion temperature of 25°C and metering conditions of 0°C and 101.325 kPa (14.696 psia; 29.92 inches of mercury). This is expressed as [25, V(0;101.325)].
15. Engine sound data taken with the microphone at 1 m (3.3 ft) from the side of the engine at the approximate front-to-back centerline. Microphone height was at intake manifold level. Engine sound pressure data may be different at front, back and opposite side locations. Exhaust sound data taken with microphone 1 meter (3.3 ft) away and 1 meter (3.3 ft) to the side of the exhaust outlet.
16. Due to variation between test conditions and final site conditions, such as exhaust configuration and background sound level, sound pressure levels under site conditions may be different than those tabulated above.
17. Cooling system design flow is based on minimum allowable cooling system flow. Cooling system maximum external restriction is defined as the allowable restriction at the minimum cooling system flow.
18. Continuous Power Rating: The highest load and speed that can be applied 24 hours per day, seven days per week, 365 days per year except for normal maintenance at indicated ambient reference conditions and fuel. It is permissible to operate the engine at the indicated overload power, for two hours in every 24 hour period.
19. emPact emission compliance available for entire range of operable fuels; however, fuel system and/or O2 set point may need to be adjusted in order to maintain compliance.
20. In cold ambient temperatures, heating of the engine jacket water, lube oil and combustion air may be required. See Waukesha Technical Data.

SPECIAL REQUIREMENTS

VHP - L7044GSI

Gas Compression

ENGINE SPEED (rpm):	1200	NOx SELECTION (g/bhp-hr):	Customer Catalyst
DISPLACEMENT (in3):	7040	COOLING SYSTEM:	JW, IC + OC
COMPRESSION RATIO:	8:1	INTERCOOLER WATER INLET (°F):	130
IGNITION SYSTEM:	ESM	JACKET WATER OUTLET (°F):	180
EXHAUST MANIFOLD:	Water Cooled	JACKET WATER CAPACITY (gal):	100
COMBUSTION:	Rich Burn, Turbocharged	AUXILIARY WATER CAPACITY (gal):	11
ENGINE DRY WEIGHT (lbs):	24250	LUBE OIL CAPACITY (gal):	190
AIR/FUEL RATIO SETTING:	0.38% CO	MAX. EXHAUST BACKPRESSURE (in. H2O):	18
ENGINE SOUND LEVEL (dBA)	104	MAX. AIR INLET RESTRICTION (in. H2O):	15
		EXHAUST SOUND LEVEL (dBA)	111

SITE CONDITIONS:

FUEL:	Tichenal Inlet 24Jul2015	ALTITUDE (ft):	1100
FUEL PRESSURE RANGE (psig):	30 - 60	MAXIMUM INLET AIR TEMPERATURE (°F):	100
FUEL HHV (BTU/ft3):	1,100.3	FUEL WKI:	81.3
FUEL LHV (BTU/ft3):	994.6		

SITE SPECIFIC TECHNICAL DATA

		MAX RATING AT 100 °F AIR TEMP	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE OF 100 °F		
POWER RATING	**UNITS**		**100%**	**75%**	**59%**
CONTINUOUS ENGINE POWER	BHP	1680	1680	1260	843
OVERLOAD	% 2/24 hr	10	10	-	-
MECHANICAL EFFICIENCY (LHV)	%	31.6	31.6	30.7	28.2
CONTINUOUS POWER AT FLYWHEEL	BHP	1680	1680	1260	843
based on no auxiliary engine driven equipment					
FUEL CONSUMPTION					
FUEL CONSUMPTION (LHV)	BTU/BHP-hr	8070	8070	8305	9027
FUEL CONSUMPTION (HHV)	BTU/BHP-hr	8927	8927	9187	9985
FUEL FLOW *based on fuel analysis LHV*	SCFM	227	227	175	128
HEAT REJECTION					
JACKET WATER (JW)	BTU/hr x 1000	4042	4042	3263	2589
LUBE OIL (OC)	BTU/hr x 1000	571	571	526	465
INTERCOOLER (IC)	BTU/hr x 1000	264	264	176	96
EXHAUST	BTU/hr x 1000	3995	3995	2891	1933
RADIATION	BTU/hr x 1000	674	674	603	527
EMISSIONS (ENGINE OUT)					
NOx (NO + NO2)	g/bhp-hr	13.2	13.2	14.9	16.5
CO	g/bhp-hr	12.0	12.0	11.8	12.0
THC	g/bhp-hr	2.4	2.4	2.4	2.4
NMHC	g/bhp-hr	0.45	0.45	0.41	0.37
NM, NEHC	g/bhp-hr	0.11	0.11	0.10	0.09
CO2	g/bhp-hr	497	497	511	556
CO2e	g/bhp-hr	545	545	555	596
CH2O	g/bhp-hr	0.05	0.05	0.05	0.05
CH4	g/bhp-hr	1.92	1.92	1.76	1.61
AIR INTAKE / EXHAUST GAS					
INDUCTION AIR FLOW	SCFM	2483	2483	1916	1393
EXHAUST GAS MASS FLOW	lb/hr	11546	11545	8911	6477
EXHAUST GAS FLOW *at exhaust temp, 14.5 psia*	ACFM	8503	8502	6317	4376
EXHAUST TEMPERATURE	°F	1197	1197	1135	1060

HEAT EXCHANGER SIZING		
TOTAL JACKET WATER CIRCUIT (JW)	BTU/hr x 1000	4584
TOTAL AUXILIARY WATER CIRCUIT (IC + OC)	BTU/hr x 1000	946

COOLING SYSTEM WITH ENGINE MOUNTED WATER PUMPS		
JACKET WATER PUMP MIN. DESIGN FLOW	GPM	450
JACKET WATER PUMP MAX. EXTERNAL RESTRICTION	psig	16
AUX WATER PUMP MIN. DESIGN FLOW	GPM	79
AUX WATER PUMP MAX. EXTERNAL RESTRICTION	psig	44

All data provided per the condtions listed in the notes section on page three.
Data Generated by EngCalc Program Version 3.5 Dresser Inc.
8/17/2015 9:44 AM

VHP - L7044GSI

Gas Compression

FUEL COMPOSITION

HYDROCARBONS:		Mole or Volume %
Methane	CH4	89.523
Ethane	C2H6	8.299
Propane	C3H8	1.292
Iso-Butane	I-C4H10	0.151
Normal Butane	N-C4H10	0.164
Iso-Pentane	I-C5H12	0.044
Normal Pentane	N-C5H12	0.022
Hexane	C6H14	0.042
Heptane	C7H16	0
Ethene	C2H4	0
Propene	C3H6	0
	SUM HYDROCARBONS	99.537
NON-HYDROCARBONS:		
Nitrogen	N2	0.318
Oxygen	O2	0
Helium	He	0
Carbon Dioxide	CO2	0.145
Carbon Monoxide	CO	0
Hydrogen	H2	0
Water Vapor	H2O	0
	TOTAL FUEL	100

FUEL:	Tichenal Inlet 24Jul2015
FUEL PRESSURE RANGE (psig):	30 - 60
FUEL WKI:	81.3
FUEL SLHV (BTU/ft3):	977.32
FUEL SLHV (MJ/Nm3):	38.43
FUEL LHV (BTU/ft3):	994.63
FUEL LHV (MJ/Nm3):	39.11
FUEL HHV (BTU/ft3):	1100.25
FUEL HHV (MJ/Nm3):	43.27
FUEL DENSITY (SG):	0.62

Standard Conditions per ASTM D3588-91 [60°F and 14.696psia] and ISO 6976:1996-02-01[25, V(0;101.325)].
Based on the fuel composition, supply pressure and temperature, liquid hydrocarbons may be present in the fuel. No liquid hydrocarbons are allowed in the fuel. The fuel must not contain any liquid water.
Waukesha recommends both of the following:
1) Dew point of the fuel gas to be at least 20°F (11°C) below the measured temperature of the gas at the inlet of the engine fuel regulator.
2) A fuel filter separator to be used on all fuels except commercial quality natural gas.
Refer to the 'Fuel and Lubrication' section of 'Technical Data' or contact the Waukesha Application Engineering Department for additional information on fuels, or LHV and WKI* calculations.
* Trademark of General Electric Company

FUEL CONTAMINANTS

Total Sulfur Compounds	0	% volume	Total Sulfur Compounds	0 µg/BTU
Total Halogen as Cloride	0	% volume	Total Halogen as Cloride	0 µg/BTU
Total Ammonia	0	% volume	Total Ammonia	0 µg/BTU
Siloxanes			Total Siloxanes (as Si)	0 µg/BTU
Tetramethyl silane	0	% volume		
Trimethyl silanol	0	% volume		
Hexamethyldisiloxane (L2)	0	% volume	*Calculated fuel contaminant analysis will depend on the entered fuel composition and selected engine model.*	
Hexamethylcyclotrisiloxane (D3)	0	% volume		
Octamethyltrisiloxane (L3)	0	% volume		
Octamethylcyclotetrasiloxane (D4)	0	% volume		
Decamethyltetrasiloxane (L4)	0	% volume		
Decamethylcyclopentasiloxane (D5)	0	% volume		
Dodecamethylpentasiloxane (L5)	0	% volume		
Dodecamethylcyclohexasiloxane (D6)	0	% volume		
Others	0	% volume		

No water or hydrocarbon condensates are allowed in the engine. Requires liquids removal.

NOTES

1. All data is based on engines with standard configurations unless noted otherwise.
2. Power rating is adjusted for fuel, site altitude, and site air inlet temperature, in accordance with ISO 3046/1 with tolerance of ± 3%.
3. Fuel consumption is presented in accordance with ISO 3046/1 with a tolerance of -0 / +5% at maximum rating. Fuel flow calculation based on fuel LHV and fuel consumption with a tolerance of -0/+5 %. For sizing piping and fuel equipment, it is recommended to include the 5% tolerance.
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6. Air flow is based on undried air with a tolerance of ± 7%.
7. Exhaust temperature given at engine exhaust outlet flange with a tolerance of ± 75°F (42°C).
8. Exhaust gas mass flow value is based on a "wet basis" with a tolerance of ± 7%.
9. Inlet air restrictions based on full rated engine load. Exhaust backpressure based on 158 PSI BMEP and 1200 RPM. Refer to the engine specification section of Waukesha's standard technical data for more information.
10. Cooling circuit capacity, lube oil capacity, and engine dry weight values are typical.
11. Fuel must conform to Waukesha's "Gaseous Fuel Specification" S7884-7 or most current version. Fuel may require treatment to meet current fuel specification.
12. Heat exchanger sizing values given as the maximum heat rejection of the circuit, with applied tolerances and an additional 5% reserve factor.
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14. Fuel volume flow calculation in metric units is based on 100% relative humidity of the fuel gas at a combustion temperature of 25°C and metering conditions of 0°C and 101.325 kPa (14.696 psia; 29.92 inches of mercury). This is expressed as [25, V(0;101.325)].
15. Engine sound data taken with the microphone at 1 m (3.3 ft) from the side of the engine at the approximate front-to-back centerline. Microphone height was at intake manifold level. Engine sound pressure data may be different at front, back and opposite side locations. Exhaust sound data taken with microphone 1 meter (3.3 ft) away and 1 meter (3.3 ft) to the side of the exhaust outlet.
16. Due to variation between test conditions and final site conditions, such as exhaust configuration and background sound level, sound pressure levels under site conditions may be different than those tabulated above.
17. Cooling system design flow is based on minimum allowable cooling system flow. Cooling system maximum external restriction is defined as the allowable restriction at the minimum cooling system flow.
18. Continuous Power Rating: The highest load and speed that can be applied 24 hours per day, seven days per week, 365 days per year except for normal maintenance at indicated ambient reference conditions and fuel. It is permissible to operate the engine at the indicated overload power, for two hours in every 24 hour period.
19. emPact emission compliance available for entire range of operable fuels; however, fuel system and/or O2 set point may need to be adjusted in order to maintain compliance.
20. In cold ambient temperatures, heating of the engine jacket water, lube oil and combustion air may be required. See Waukesha Technical Data.

SPECIAL REQUIREMENTS

iac acoustics

Emission Control Application Data Sheet

IAC Acoustics
10635 Brighton Lane
Stafford, Texas 77477
Phone: 832 554-0980
Fax: 832 554-0990

Customer: **CRESTWOOD** Project: **L5794 GSI** Date: **8/19/2015**

Customer Contact: IAC Contact: Order/Quote #: **0**

Engine Data:

Engine Model:	**Waukesha L5794GSI**		Speed:	**1200**	RPM
Fuel & Operating Type:	**Natural Gas Rich Burn**		Engine Power:	**1380**	Hp
				1029	KW
Exhaust Flow Rate:	**6179**	**acfm**	Exhaust Temperature:	**1149**	°F
	10498	**m^3/hr**		**621**	°C
	9124	**lbs/hr**			

Catalyst Data:

Number of Core layers:	**2**				
Model:	**QAC4-67-14**		Inlet Size:	**14**	in
Grade:	**Super Critical**		Outlet Size:	**14**	in
Body Diameter:	**40**	in	Body Length:	**122**	in
Estimated weight:	**1158**	lbs	Estimated Back Pressure of the unit:	**6.68**	in of WC
	525	Kg		**16.6**	mbar
Core Part Number:	**3ECI-WH13-335-300-35-CH1019**	Qty **2**	Speed through inlet:	**5983**	ft/min
Cell Density	300	cpsi	Back Pressure across Element(s) only	3.45	in of WC
				8.6	mbar

Emission:

Min. Temp. at Core Face: **1112** °F **600** °C
Max. Temp. at Core Face: **1239** °F **671** °C

Catalyst Type: **3-Way**

O_2 in Exhaust vol %
H_2O in Exhaust vol %

	Pollutant					
	NOx	CO	NMHC/VOC	CH_2O/CHCO	ORGANIC PM10	
Engine Out / Pre Emission:	**13.7**	**9.3**	**0.33**	**0.05**	**0**	g/bhp-hr
	5889.39	**3997.91**	**141.86**	**21.49**	**0.00**	mg/Nm3
Post Emission:	**0.411**	**0.558**	**0.053**	**0.037**	**0.000**	g/bhp-hr
	176.68	**239.87**	**22.70**	**15.69**	**0.00**	mg/Nm3
	97.0	***94.0***	***84.0***	***27.0***	***50.0***	% Reduction
	1.25	1.70	0.16	0.11		lb/hr
	5.48	7.44	0.70	0.49		tons/year operation **8760** hr/year
	84.8	115.2	10.9	7.5		ppmv
						ppmvd @ 15% O2

Acoustics:

Frequency Band (Hz):	31.5	63	125	250	500	1000	2000	4000	8000	
Raw Noise SPL (dB) at 3.28 ft.:	100	100	100	100	100	100	100	100	100	107 dBA
Estimated Attenuation (dB):	12	25	38	35	25	21	21	20	20	No Element
Plus:	12	26	41	38	32	30	31	30	29	Two Element Layers
Silenced SPL (dB) at 3.28 ft.:	88	74	59	62	68	70	69	70	71	76.6 dBA

Warranty & Notes:

- **If Pre-Emission levels are not as noted above, contact IAC Acoustics for a re-quote.**
- To achieve Post Emissions levels detailed above, exhaust temperature and Pre-Emission data must be as specified.
- Maximum allowable exhaust temperature at core face is 1350°F.
- If applicable, the engine will require an air/fuel ratio controller to meet above emission levels. For Rich Burn engines λ must be 0.96 - 0.99.
- Catalyst cleaning/regeneration required, if initial backpressure increases by 2" of WC.
- Engine operation to be stable and reproducible.
- QAC is not designed to withstand a backfire, therefore measures should be taken prior to QAC unit to alleviate backfire pressure.
- Maximum lubrication oil consumption rate to be less than 0.0015 lb/bhp/hr.
- Lube oil sulfate ash contents should not exceed 0.5%.
- Phosphorus and/or Zinc should not exceed 5 ppmv in the exhaust stream.
- A high temperature alarm/shutdown to be maintained at downstream of catalyst at 1300°F.
- Fuel not to contain heavy or transition metals such as Pb, Ar, Zn, Cu, Sn, Fe, Ba, Ni, Cr etc.
- Chlorinated or Silicone containing compounds in the exhaust not to exceed 1 ppmv.
- Sulfur compounds in the exhaust gas stream not to exceed 25 ppmv.
- Performance guarantee is voided should the catalyst become masked or de-activated by any contaminant in the exhaust stream.
- Engine to be maintained and operated in accordance within manufacturer's recommended practice.
- Under no condition will IAC Acoustics assume any contingent liabilities.
- Operating manual is available online at www.maximsilencers.com or contact a Maxim sales representative.
- Nomenclature: QAC4-292-8, 4 is grade (Super Critical), 29 is catalyst block size, 2 is no. of catalyst(s) and 8 is flange diameter.
- Organic PM10 are estimate only and not a guarantee because of the variability in fuels and additives which change PM10.
- IAC's standard one year warranty applies.

Rev level: 86

iac acoustics

Emission Control Application Data Sheet

IAC Acoustics
10635 Brighton Lane
Stafford, Texas 77477
Phone: 832 554-0980
Fax: 832 554-0990

Customer: **CRESTWOOD** Project: **L7044 GSI** Date: **8/19/2015**

Customer Contact: IAC Contact: Order/Quote #: **0**

Engine Data:

Engine Model:	**Waukesha L7044GSI**		Speed:	**1200**	RPM
Fuel & Operating Type:	**Natural Gas Rich Burn**		Engine Power:	**1680**	Hp
				1253	KW
Exhaust Flow Rate:	**7808**	**acfm**	Exhaust Temperature:	**1181**	°F
	13266	**m^3/hr**		**638**	°C
	11305	**lbs/hr**			

Catalyst Data:

Number of Core layers: **2**

Model:	**QAC4-67-14**		Inlet Size:	**14**	in
Grade:	**Super Critical**		Outlet Size:	**14**	in
Body Diameter:	**40**	in	Body Length:	**122**	in
Estimated weight:	**1158**	lbs	Estimated Back Pressure of the unit:	**9.48**	in of WC
	525	Kg		**23.6**	mbar
Core Part Number:	**3ECI-WH13-335-300-35-CH1019**	Qty **2**	Speed through inlet:	**7560**	ft/min
Cell Density	300	cpsi	Back Pressure across Element(s) only	4.42	in of WC
				11.0	mbar

Emission:

Min. Temp. at Core Face: **1112** °F **600** °C
Max. Temp. at Core Face: **1271** °F **688** °C

Catalyst Type: **3-Way**

O_2 in Exhaust vol %
H_2O in Exhaust vol %

	Pollutant					
	NOx	CO	NMHC/VOC	CH_2O/CHCO	ORGANIC PM10	
Engine Out / Pre Emission:	**13.2**	**12**	**0.45**	**0.05**	**0**	g/bhp-hr
	5575.51	**5068.65**	**190.07**	**21.12**	**0.00**	mg/Nm3
Post Emission:	**0.396**	**0.600**	**0.059**	**0.036**	**0.000**	g/bhp-hr
	167.27	**253.43**	**24.71**	**15.21**	**0.00**	mg/Nm3
	97.0	***95.0***	***87.0***	***28.0***	***50.0***	% Reduction
	1.47	2.22	0.22	0.13		lb/hr
	6.42	9.73	0.95	0.58		tons/year operation **8760** hr/year
	80.3	121.7	11.9	7.3		ppmv
						ppmvd @ 15% O2

Acoustics:

Frequency Band (Hz):	31.5	63	125	250	500	1000	2000	4000	8000	
Raw Noise SPL (dB) at 3.28 ft.:	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	107 dBA
Estimated Attenuation (dB):	**12**	**25**	**38**	**35**	**25**	**21**	**21**	**20**	**20**	No Element
Plus:	**12**	**26**	**41**	**38**	**32**	**30**	**31**	**30**	**29**	Two Element Layers
Silenced SPL (dB) at 3.28 ft.:	**88**	**74**	**59**	**62**	**68**	**70**	**69**	**70**	**71**	76.6 dBA

Warranty & Notes:

- **If Pre-Emission levels are not as noted above, contact IAC Acoustics for a re-quote.**
- To achieve Post Emissions levels detailed above, exhaust temperature and Pre-Emission data must be as specified.
- Maximum allowable exhaust temperature at core face is 1350°F.
- If applicable, the engine will require an air/fuel ratio controller to meet above emission levels. For Rich Burn engines λ must be 0.96 - 0.99.
- Catalyst cleaning/regeneration required, if initial backpressure increases by 2" of WC.
- Engine operation to be stable and reproducible.
- QAC is not designed to withstand a backfire, therefore measures should be taken prior to QAC unit to alleviate backfire pressure.
- Maximum lubrication oil consumption rate to be less than 0.0015 lb/bhp/hr.
- Lube oil sulfate ash contents should not exceed 0.5%.
- Phosphorus and/or Zinc should not exceed 5 ppmv in the exhaust stream.
- A high temperature alarm/shutdown to be maintained at downstream of catalyst at 1300°F.
- Fuel not to contain heavy or transition metals such as Pb, Ar, Zn, Cu, Sn, Fe, Ba, Ni, Cr etc.
- Chlorinated or Silicone containing compounds in the exhaust not to exceed 1 ppmv.
- Sulfur compounds in the exhaust gas stream not to exceed 25 ppmv.
- Performance guarantee is voided should the catalyst become masked or de-activated by any contaminant in the exhaust stream.
- Engine to be maintained and operated in accordance within manufacturer's recommended practice.
- Under no condition will IAC Acoustics assume any contingent liabilities.
- Operating manual is available online at www.maximsilencers.com or contact a Maxim sales representative.
- Nomenclature: QAC4-292-8, 4 is grade (Super Critical), 29 is catalyst block size, 2 is no. of catalyst(s) and 8 is flange diameter.
- Organic PM10 are estimate only and not a guarantee because of the variability in fuels and additives which change PM10.
- IAC's standard one year warranty applies.

Rev level: B6

Crestwood

801 Cherry Street
Suite 3800
Fort Worth, TX 76102

P: (817) 339.5400
F: (817) 339.5430
www.Crestwoodlp.com

November 30, 2015

Mr. David Keatley
WVDEP, Division of Air Quality
DAQ Permitting Section
601 57th Street SE
Charleston, WV 25304

Subject: Original Affidavit
E. Marcellus Asset Company, LLC – Tichenal Compressor Station
Plant ID No. 033-00200,
Application for Modification of Air Permit No. R13-3076

Dear Mr. Keatley:

Enclosed is the Original Affidavit for Class I Legal Advertisement for the above referenced application for your review.

Should you require any additional information, feel free to contact me at 817-339-5474 or Jeff.Stovall@crestwoodlp.com.

Sincerely,

Jeff Stovall

Jeff Stovall
Air Quality Manager
Crestwood Midstream Partners LP

Enclosures

PUBLISHER'S CERTIFICATE

I, Loretta Greathouse, Advertising Manager of THE EXPONENT TELEGRAM, a newspaper of general circulation published in the city of Clarksburg, County and state aforesaid, do hereby certify that the annexed:

AIR QUALITY PERMIT NOTICE

was published in THE EXPONENT-TELEGRAM 1 time(s) commencing on 11/05/2015 and ending on 11/05/2015 at the request of

CRESTWOOD MIDSTREAM PARTNERS.

Given under my hand this 11/10/15.

The publisher's fee for said publication is: $67.35.

Loretta Greathouse
Advertising Manager of The Exponent-Telegram

Subscribed to and sworn to before me this 11/10/15

Sarah Hurst
Notary Public in and for Harrison County, WV

My commission expires on

The 29th day of August 2017

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
SARAH E. HURST
Clarksburg Publishing Company
P.O. Box 2000
Clarksburg, WV 26302
My commission expires August 29, 2017

AIR QUALITY PERMIT NOTICE
Notice of Application

Notice is given that E. Marcellus Asset Company, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a Modification to R13 Permit No. R13-3076 for an existing Natural Gas Compressor Station located on 386 Hurst Hollow Road, Lost Creek, in Harrison County, West Virginia. The latitude and longitude coordinates are: 39.184078° N, -80.496442° W.

The applicant estimates the increased potential to discharge the following Regulated Air Pollutants will be:

Particulate Matter (PM) = 0 tpy
Particulate Matter Less Than 10 μm in diameter (PM10) = 0 tpy
Sulfur Dioxide (SO2) = 0 tpy
Volatile Organic Compounds (VOC) = 41.72 tpy
Carbon Monoxide (CO) = 0 tpy
Nitrogen Oxides (NOx) = 36.70 tpy
Hazardous Air Pollutants (HAPs) = 11.66 tpy
Benzene = 0.81 tpy
Ethylbenzene = 0.12 tpy
Formaldehyde = 5.11 tpy
n-Hexane = 0.08 tpy
Toluene = 0.20 tpy
Xylenes = 0.25 tpy
Greenhouse Gases (CO_2e) = 11,081 tpy

The facility is currently operating. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice.

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 1250, during normal business hours.
Dated this the 2nd day of November, 2015.

By: E. Marcellus Asset Company, LLC
Chris Humes
Vice President, Pipeline Operations
801 Cherry Street
Suite 3800, Unit 20
Fort Worth, TX 76102

Adkins, Sandra K

From:	Adkins, Sandra K
Sent:	Monday, November 02, 2015 3:37 PM
To:	'chris.humes@crestwoodlp.com'; 'jeff.stovall@crestwoodlp.com'
Cc:	McKeone, Beverly D; Keatley, David J
Subject:	WV Permit Application Status for E. Marcellus Asset Company, LLC; Tichenal Station

RE: Application Status
E. Marcellus Asset Company, LLC
Tichenal Station
Plant ID No. 033-00200
Application No. R13-3076A

Mr. Humes,

Your application for a modification permit for the Tichenal Station was received by this Division on November 2, 2015, and was assigned to David Keatley. The following item was not included in the initial application submittal:

Original affidavit for Class I legal advertisement not submitted.

This item is necessary for the assigned permit writer to continue the 30-day completeness review.

Within 30 days, you should receive a letter from David stating the status of the permit application and, if complete, given an estimated time frame for the agency's final action on the permit.

Any determination of completeness shall not relieve the permit applicant of the requirement to subsequently submit, in a timely manner, any additional or corrected information deemed necessary for a final permit decision.

Should you have any questions, please contact the assigned engineer, David Keatley, at 304-926-0499, extension 1224.

Thomas Heinsohn
Technical Support Rep.
512-466-0068
WPI – Powered by Solutions ™
www.wpi.com

From: Bauerle, Dan C [mailto:Dan.C.Bauerle@wv.gov]
Sent: Monday, June 18, 2012 7:04 AM
To: heinst@wpi.com
Subject: Request for Engine Specifications: 1970's? built Waukesha series 3711.....

Hello Mr. Heinsohn.

Would you be able to obtain engine specifications: bhp and NOx , emissions, built or shipped date, for these two older engines? That would be very much appreciated.
Engine serial nos. are 48521 and 48522. Any appropriate published Waukesha emissions data available? Can you tell from serial no. whether they're both 4-cycle rich burn engines or other?
Hp and emissions 735 and 1200 rpm? (Please let me know if additional (nameplate) info is needed in order to address my questions.)

Mr. Heinsohn, thank-you for considering this information request.

Regards,

Dan Bauerle
Engineer
West Virginia Dept. of Environmental Protection
Division of Air Quality (DAQ)
Compliance & Enforcement Section
601 57th Street, SE
Charleston, WV 25304
email: dan.c.bauerle@wv.gov
ph: (304) 926-0499 ext. 1078
fax: (304) 926-0479

AT-GL EMISSION LEVELS ‡

MODEL	CARBURETOR SETTING	GRAMS/BHP-HR				% OBSERVED DRY		MASS AFR (2)	VOLUME AFR (2)	EXCESS AIR RATIO
		NOx (1)	CO	NMHC (4)	THC	CO	O_2			
AT25GL	Standard	1.0	2.25	1.0	8.0	0.06	9.8	28.0:1	16.8:1	1.74
AT27GL	Standard	1.5	1.7	0.50	5.0	0.06	9.8	28.0:1	16.8:1	1.74
	Ultra Lean	1.25	1.5	0.40	3.5	0.05	11.2	32.0:1	19.2:1	2.00

‡ The AT-GL emission levels are based on 900 – 1000 rpm operation. For information at all other speeds contact Waukesha's Application Engineering Department.

VHP EMISSION LEVELS

MODEL	CARBURETOR SETTING	GRAMS/BHP-HR				% OBSERVED DRY		MASS AFR (2)	VOLUME AFR (2)	EXCESS AIR RATIO
		NOx (1)	CO	NMHC (4)	THC	CO	O_2			
G, GSI	Lowest Manifold (Best Power)	8.5	32.0	0.35	2.3	1.15	0.30	15.5:1	9.3:1	0.97
	Equal NOx & CO	12.0	12.0	0.35	2.3	0.45	0.30	15.9:1	9.6:1	0.99
	Catalytic Conv. Input (3-way(3))	13.0	9.0	0.30	2.0	0.38	0.30	15.95:1	9.6:1	0.99
	Standard (Best Economy)	22.0	1.5	0.25	1.5	0.02	1.35	17.0:1	10.2:1	1.06
F3514GSI F3524GSI L7044GSI	Equal NOx & CO	14.0	14.0	0.25	1.1	0.45	0.30	15.85:1	9.5:1	0.99
	Catalytic Conv. Input (3-way(3))	15.0	13.0	0.20	1.0	0.38	0.30	15.95:1	9.6:1	0.99
L5794GSI	Equal NOx & CO	13.5	13.5	0.45	3.0	0.45	0.30	15.85:1	9.5:1	0.99
	Catalytic Conv. Input (3-way(3))	14.5	11.0	0.45	2.9	0.38	0.30	15.95:1	9.6:1	0.99
GL	Standard	1.5	2.65	1.0	5.5	0.06	9.8	28.0:1	16.8:1	1.74
L5774LT#	Standard	2.6	2.0	0.60	4.0	0.04	8.0	24.7:1	14.8:1	1.54
L5794LT#	Standard	2.6	2.0	0.60	4.0	0.04	7.8	24.5:1	14.7:1	1.52

L5774LT and L5794LT emission levels are based on 1000 – 1200 rpm operation. For information at all other speeds contact Waukesha's Application Engineering Department.

NOTE: The above tables indicate emission levels that are valid for new engines for the duration of the standard warranty period and are attainable by an engine in good operating condition running on commercial quality natural gas of 900 BTU/ft^3 (35.38 MJ/m^3 [25, V(0; 101.325)]) SLHV, Waukesha Knock Index of 91 or higher, 93% methane content by volume, and at ISO standard conditions. Emissions are based on standard engine timing at 91 WKI® with an absolute humidity of 42 grains/lb. Refer to engine specific WKI® Power & Timing curves for standard timing. Unless otherwise noted these emission levels can be achieved across the continuous duty speed range and from 75% to 110% of the ISO Standard Power (continuous duty) rating. ***Contact your local Waukesha representative or Waukesha's Application Engineering Department for emission values which can be obtained on a case-by-case basis for specific ratings, fuels, and site conditions.***

Keatley, David J

From: Coleman, Jessica <Jessica.Coleman@crestwoodlp.com>
Sent: Monday, June 27, 2016 3:39 PM
To: Keatley, David J
Cc: Humes, Chris; Hansen, Ben; Stovall, Jeffrey; Petri, Emily
Subject: E. Marcellus Tichenal Compressor Station - R13-3076A - Dehydrator Emissions
Attachments: 20160627 - Tichenal - Dehy Emissions_Updated.pdf

Mr. Keatley,

Good afternoon. Crestwood, on behalf of E. Marcellus Asset Company, is submitting the attached updated emission calculations from two glycol dehydrators for the permit application R13-3076A at the Tichenal Compressor Station. As requested on May 17, 2016, the control efficiency of the flash tank vapors routed to the reboiler has been updated to 50%.

Additionally, emissions from the two glycol dehydrators (RSV-1, RSV-2) have been refined and updated based on ProMax simulations. Each dehydrator was modeled in ProMax with its respective maximum gas flow rate, contact tower temperature and pressure, glycol pump rate, and flash tank temperature and pressure. The BTEX condenser outlet vapors (labeled as "BTEX Vapor") and uncontrolled flash tank vapor (labeled "Flash Gas") are provided as ProMax outputs. Subsequent control of these two streams by the reboiler is not modeled by ProMax. Therefore, the reboiler control is accounted for in the attached emission calculations. The BTEX condenser vapors are routed to the reboiler with nickel alloy catalyst (aka, "glow plug"), resulting in a 98% control efficiency of the BTEX vapor. The flash gas also is routed to the reboiler with a 50% control efficiency of the flash tank vapors. The ProMax inputs, results, and process flow diagram are included in the attachment to this email.

Please let me know if you have questions or need additional information.

Regards,

Jessica Coleman
Air Quality Specialist

Crestwood Midstream Partners LP
1200 Summit Avenue, Suite 320, Fort Worth, TX 76102
P: 817-339-5406 | **C:** 817-201-5222
F: 817-339-5401
Jessica.Coleman@crestwoodlp.com
www.crestwoodlp.com

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 1a. Total Emissions from All Sources at the Facility *(Includes fugitive emissions)*

Pollutants	Estimated Site-Wide Emissions	
	lb/hr	tpy
VOC	20.68	90.95
NO_X	15.28	66.95
CO	18.24	79.91
Formaldehyde (HCHO)	1.20	5.26
Total HAPs	3.09	13.55
SO_2	0.07	0.31
PM_{10}	2.32	10.18
$PM_{2.5}$	2.32	10.18
GHG (CO_2e)	19,133	83,804
Others	---	---

Notes:
1. PM_{10} and $PM_{2.5}$ emissions are filterable + condensable.
2. VOC as shown above is NMNEHC + HCHO.
3. Emissions from all sources at the facility (including venting and fugitives) are included above

TABLE 1b. Total Emissions from All Sources at the Facility *(Not including fugitive emissions)*

Pollutants	Estimated Site-Wide Emissions		Title V Major Source Thresholds	PSD Major Source Thresholds
	lb/hr	tpy	tpy	tpy
VOC	15.05	65.90	100	250
NO_X	15.28	66.95	100	250
CO	18.24	79.91	100	250
Formaldehyde (HCHO)	1.20	5.26	10	---
Total HAPs	3.04	13.33	25	---
SO_2	0.07	0.31	100	250
PM_{10}	2.32	10.18	100	250
$PM_{2.5}$	2.32	10.18	100	250
GHG (CO_2e)	17,003	74,475	100,000	---
Others	---	---	---	---

Notes:
1. PM_{10} and $PM_{2.5}$ emissions are filterable + condensable.
2. VOC as shown above is NMNEHC + HCHO.
3. Emissions from all sources at the facility are included above
4. The Title V major source threshold for CO_{2e} is only applicable if the site is major for another pollutant.

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 2. Atmospheric Emissions from Each Source at the Facility

Source Name	Source ID	Pollutants																	
		VOC		NO_X		CO		HCHO		Total HAPs		PM_{10}		$PM_{2.5}$		SO_2		GHG (CO_2e)	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
1,380 HP Compressor Engine	CE-1	0.30	1.33	1.52	6.66	1.83	8.00	0.12	0.53	0.26	1.15	0.23	1.00	0.23	1.00	0.01	0.03	1,511	6,618
1,380 HP Compressor Engine	CE-2	0.30	1.33	1.52	6.66	1.83	8.00	0.12	0.53	0.26	1.15	0.23	1.00	0.23	1.00	0.01	0.03	1,511	6,618
1,380 HP Compressor Engine	CE-3	0.30	1.33	1.52	6.66	1.83	8.00	0.12	0.53	0.26	1.15	0.23	1.00	0.23	1.00	0.01	0.03	1,511	6,618
1,380 HP Compressor Engine	CE-4	0.30	1.33	1.52	6.66	1.83	8.00	0.12	0.53	0.26	1.15	0.23	1.00	0.23	1.00	0.01	0.03	1,511	6,618
1,380 HP Compressor Engine	CE-5	0.30	1.33	1.52	6.66	1.83	8.00	0.12	0.53	0.26	1.15	0.23	1.00	0.23	1.00	0.01	0.03	1,511	6,618
1,680 HP Compressor Engine	CE-6	0.37	1.62	1.85	8.11	2.22	9.73	0.15	0.65	0.33	1.43	0.29	1.28	0.29	1.28	0.01	0.04	1,954	8,558
1,680 HP Compressor Engine	CE-7	0.37	1.62	1.85	8.11	2.22	9.73	0.15	0.65	0.33	1.43	0.29	1.28	0.29	1.28	0.01	0.04	1,954	8,558
1,680 HP Compressor Engine	CE-8	0.37	1.62	1.85	8.11	2.22	9.73	0.15	0.65	0.33	1.43	0.29	1.28	0.29	1.28	0.01	0.04	1,954	8,558
1,680 HP Compressor Engine	CE-9	0.37	1.62	1.85	8.11	2.22	9.73	0.15	0.65	0.33	1.43	0.29	1.28	0.29	1.28	0.01	0.04	1,954	8,558
Natural Gas-Fired TEG Dehy Reboiler	RBV-1	0.01	0.03	0.14	0.59	0.11	0.50	0.00	0.00	0.00	0.01	0.01	0.05	0.01	0.05	0.00	0.00	176	769
TEG Dehy Still	RSV-1	6.34	27.77	---	---	---	---	---	---	0.21	0.92	---	---	---	---	---	---	655	2,867
Natural Gas-Fired TEG Dehy Reboiler	RBV-2	0.01	0.03	0.14	0.59	0.11	0.50	0.00	0.00	0.00	0.01	0.01	0.05	0.01	0.05	0.00	0.00	176	769
TEG Dehy Still	RSV-2	5.61	24.56	---	---	---	---	---	---	0.21	0.90	---	---	---	---	---	---	619	2,709
Produced Water Tank	T01	0.02	0.07	---	---	---	---	---	---	0.00	0.01	---	---	---	---	---	---	2.3	10.1
Produced Water Tank	T02	0.02	0.07	---	---	---	---	---	---	0.00	0.01	---	---	---	---	---	---	2.3	10.1
Used Oil Tank	T03	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TEG Tank	T04	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
New Oil Tank	T05	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
New Oil Tank	T06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dehy Drip Tank	T07	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Produced Water Tank	T08	0.02	0.07	---	---	---	---	---	---	0.00	0.01	---	---	---	---	---	---	2.3	10.1
Produced Water Tank	T09	0.02	0.07	---	---	---	---	---	---	0.00	0.01	---	---	---	---	---	---	2.3	10.1
Produced Water Loading	---	0.02	0.08	---	---	---	---	---	---	0.00	0.00	---	---	---	---	---	---	---	---
Fugitives and Blowdowns	---	5.64	25.05	---	---	---	---	---	---	0.05	0.22	---	---	---	---	---	---	2,130	9,329
Total Facility		20.68	90.95	15.28	66.95	18.24	79.91	1.20	5.26	3.09	13.55	2.32	10.18	2.32	10.18	0.07	0.31	19,133	83,804

Notes:

1. PM_{10} and $PM_{2.5}$ emissions are filterable + condensable.
2. VOC as shown above (for compressor engines) is NMNEHC + HCHO.

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 6. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-1)

Dehydration Unit Information:

Source ID:	**RSV-1**	
Stack ID:	**RSV-1**	
Installation Date:	9/1/2011	
Projected Startup Date:	Existing	
Regenerator Control Type:	Condenser and Routed to Reboiler	
Control Efficiency:	98%	
Flash Tank Control Type:	Routed to Reboiler	
Control Efficiency:	50%	
Rated Dehy Throughput (MMscfd):	120	Maximum rate.
Glycol Circulation Rate (gpm):	15.0	Pump rating.
Max. Annual Hours of Operation (hr/yr):	8,760	Unrestricted operation.

Dehydration Unit Regenerator Vent Emissions Data:

Pollutant	Uncontrolled Emissions		Controlled Emissions		Emissions Estimation Method
	lbs/hr	tpy	lbs/hr	tpy	
VOC	31.93	139.84	6.34	27.77	PROMAX (See Next Table)
HAPs	4.47	19.59	0.21	0.92	PROMAX (See Next Table)
NO_X	---	---	---	---	PROMAX (See Next Table)
SO_2	---	---	---	---	PROMAX (See Next Table)
CO	---	---	---	---	PROMAX (See Next Table)
PM_{10}	---	---	---	---	PROMAX (See Next Table)
$PM_{2.5}$	---	---	---	---	PROMAX (See Next Table)
GHG (CO_2e)	1,080	4,730	655	2,867	PROMAX (See Next Table)
Other (Benzene)	0.37	1.61	0.01	0.05	PROMAX (See Next Table)

Notes:

1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Regenerator emissions include a 20% percent compliance margin above ProMax outputs.

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 6. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-1)

PROMAX Emissions Data - Regenerator Vent:

Component	Condenser Outlet Emissions			Controlled Emissions		
	lbs/hr	lbs/day	tpy	lbs/hr	lbs/day	tpy
Carbon Dioxide	0.456	10.94	2.00	33.688	808.52	147.56
Methane	1.797	43.13	7.87	0.036	0.86	0.16
Ethane	2.661	63.87	11.66	0.053	1.28	0.23
Propane	1.631	39.15	7.14	0.033	0.78	0.14
Isobutane	0.323	7.74	1.41	0.006	0.15	0.03
n-Butane	0.693	16.64	3.04	0.014	0.33	0.06
Isopentane	0.370	8.87	1.62	0.007	0.18	0.03
n-Pentane	0.337	8.10	1.48	0.007	0.16	0.03
n-Hexane	0.468	11.24	2.05	0.009	0.22	0.04
Cyclohexane	0.092	2.21	0.40	0.002	0.04	0.01
Other Hexanes	0.000	0.00	0.00	0.000	0.00	0.00
Heptanes	0.468	11.23	2.05	0.009	0.22	0.04
Methylcyclohexane	0.225	5.39	0.98	0.004	0.11	0.02
Benzene	0.301	7.21	1.32	0.006	0.14	0.03
Toluene	1.024	24.56	4.48	0.020	0.49	0.09
Ethylbenzene	0.721	17.31	3.16	0.014	0.35	0.06
Xylenes	1.005	24.12	4.40	0.020	0.48	0.09
C8 + Heavier Hydrocarbons	9.049	217.17	39.63	0.181	4.34	0.79
Triethylene Glycol	0.000	0.00	0.00	0.000	0.00	0.00
Total CO_2e	**45.38**	**1,089.06**	**198.75**	**34.59**	**830.08**	**151.49**
Total Hydrocarbon Emissions	**21.16**	**507.95**	**92.70**	**0.42**	**10.16**	**1.85**
Total VOC Emissions	**16.71**	**400.95**	**73.17**	**0.33**	**8.02**	**1.46**
Total HAP Emissions	**3.52**	**84.44**	**15.41**	**0.07**	**1.69**	**0.31**
Total BTEX Emissions	**3.05**	**73.21**	**13.36**	**0.06**	**1.46**	**0.27**

Notes:

1. Based on ProMax run at maximum design conditions of dry gas flowrate at 120 MMscfd, temperature at 120 °F, and pressure at 1145 psig. This unit operates two 450 gph pumps simultaneously. Regenerator overheads are routed to a condenser for control and then routed to the reboiler for a 98% control efficiency.
2. Controlled emissions of CO_2 include emissions created as combustion by-products from vent streams routed to the reboiler for control.
3. CO_2e is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25).

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 6. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-1)

PROMAX Emissions Data - Flash Tank:

Component	Flash Tank Outlet Emissions			Controlled Emissions		
	lbs/hr	lbs/day	tpy	lbs/hr	lbs/day	tpy
Carbon Dioxide	0.894	21.46	3.92	84.133	2019.20	368.50
Methane	34.145	819.49	149.56	17.073	409.74	74.78
Ethane	14.413	345.92	63.13	7.207	172.96	31.57
Propane	4.497	107.93	19.70	2.249	53.97	9.85
Isobutane	0.682	16.37	2.99	0.341	8.18	1.49
n-Butane	0.974	23.38	4.27	0.487	11.69	2.13
Isopentane	0.311	7.47	1.36	0.156	3.73	0.68
n-Pentane	0.232	5.57	1.02	0.116	2.79	0.51
n-Hexane	0.178	4.27	0.78	0.089	2.14	0.39
Cyclohexane	0.011	0.27	0.05	0.006	0.13	0.02
Other Hexanes	0.000	0.00	0.00	0.000	0.00	0.00
Heptanes	0.091	2.19	0.40	0.046	1.09	0.20
Methylcyclohexane	0.022	0.53	0.10	0.011	0.26	0.05
Benzene	0.006	0.15	0.03	0.003	0.08	0.01
Toluene	0.012	0.29	0.05	0.006	0.14	0.03
Ethylbenzene	0.006	0.14	0.03	0.003	0.07	0.01
Xylenes	0.006	0.14	0.02	0.003	0.07	0.01
C8 + Heavier Hydrocarbons	2.870	68.87	12.57	1.435	34.44	6.28
Triethylene Glycol	0.001	0.03	0.01	0.001	0.02	0.00
Total CO_2e	**854.53**	**20,508.63**	**3,742.82**	**510.95**	**12,262.79**	**2,237.96**
Total Hydrocarbon Emissions	**58.46**	**1403.01**	**256.05**	**29.23**	**701.50**	**128.02**
Total VOC Emissions	**9.90**	**237.60**	**43.36**	**4.95**	**118.80**	**21.68**
Total HAP Emissions	**0.21**	**4.99**	**0.91**	**0.10**	**2.49**	**0.46**
Total BTEX Emissions	**0.03**	**0.72**	**0.13**	**0.01**	**0.36**	**0.07**

Notes:

1. Based on ProMax run calculated conditions of temperature at 128 °F, and pressure at 45 psig. Flash gases are routed to the reboiler for use as fuel with a 50% control efficiency.
2. Controlled emissions of CO_2 include emissions created as combustion by-products from vent streams routed to the reboiler for control.
3. CO_2e is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25).

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 6. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-1)

Greenhouse Gas (GHG) Emissions - Controlled Vent Streams

Constituent	Condenser Vent Stream	Flash Tank Off Gas Stream	Source
	mol%	mol%	
CO_2, Y_{CO2}	2.5719	0.726	PROMAX Output Report
Methane, Y_j	27.8181	76.077	PROMAX Output Report
Ethane, Y_j	21.9795	17.133	PROMAX Output Report
Propane, Y_j	9.1862	3.645	PROMAX Output Report
Isobutane, Y_j	1.3781	0.419	PROMAX Output Report
n-Butane, Y_j	2.9626	0.599	PROMAX Output Report
Isopentane, Y_j	1.2728	0.154	PROMAX Output Report
n-Pentane, Y_j	1.1614	0.115	PROMAX Output Report
n-Hexane, Y_j	1.3492	1.349	PROMAX Output Report
Cyclohexane, Y_j	0.2723	0.005	PROMAX Output Report
Other Hexanes, Y_j	0.0000	0.000	PROMAX Output Report
Heptanes, Y_j	1.1601	0.033	PROMAX Output Report
Methylcyclohexane, Y_j	0.5681	0.008	PROMAX Output Report
2,2,4-Trimethylpentane, Y_j	0.0000	0.000	PROMAX Output Report
Benzene, Y_j	0.9554	0.003	PROMAX Output Report
Toluene, Y_j	2.7588	0.005	PROMAX Output Report
Ethylbenzene, Y_j	1.6873	0.002	PROMAX Output Report
Xylenes, Y_j	2.3508	0.002	PROMAX Output Report
C8 + Heavier Hydrocarbons, Y_j	0.8854	0.014	PROMAX Output Report
Triethylene Glycol, Y_j	0.0000	0.000	PROMAX Output Report
Flow Rate, V_s (scfh)	153	1,061	PROMAX Output Report
Control Efficiency (%)	98%	50%	---
Hours of Operation	8,760	8,760	Unrestricted Operation
Density of CO_2 (kg/ft^3 at 60F & 14.7 psia)	0.0526	0.0526	40 CFR Subpart 98 (Eq. W-36)
$E_{s,CO2}$ (combusted) - scf/hr	287	718	40 CFR Subpart 98 (Eq. W-39A)
Mass,CO_2 (combusted) - lb/hr	33.23	83.24	= E_aCO_2 (scf/hr) * Density of CO_2 (kg/scf) * 2.2 (lb/kg)
Mass,CO_2 (combusted) - tpy	145.56	364.59	= Mass, CO_2 (lb/hr) ÷ 2000 (lb/ton) * 8760 (hr/year)

Example Calculations:

GHG volumetric emissions from fuel combustion units using Equation W-39A from 40 CFR Subpart 98

$E_{s,CH4}$ = Annual CH_4 emissions from flare stack in cubic feet, at standard conditions.

$E_{s,CO2}$ = Contribution of annual CO_2 emissions from portable or stationary fuel combustion sources in standard cubic feet.

V_s = Volume of gas sent to combustion unit in standard cubic feet, during the year.

η = Fraction of gas combusted for portable and stationary equipment determined using engineering estimation. For internal combustion devices, a default of 0.995 can be used.

Y_j = Mole fraction of hydrocarbon constituents j (such as methane, ethane, propane, butane, and pentanes-plus) in gas sent to combustion unit.

R_j = Number of carbon atoms in the hydrocarbon constituent j for: 1 for methane, 2 for ethane, 3 for propane, 4 for butane, and 5 for pentanes-plus).

Y_{CO2} = Mole fraction of carbon dioxide constituent in gas sent to combustion unit.

$$E_{s,CO2} = (V_s * Y_{CO2}) + \eta * \sum_{j=1}^{5} V_s * Y_j * R_j \qquad \text{(Eq. W-39A)}$$

GHG mass emissions using Equation W-36 from 40 CFR Subpart 98

$Mass_i$ = GHG_i (either CH_4, CO_2, or N_2O) mass emissions in metric tons.

$E_{s,i}$ = GHG_i (either CH_4, CO_2, or N_2O) volumetric emissions at standard conditions, in cubic feet.

ρ_i = Density of GHG_i. Use 0.0526 kg/ft^3 for CO_2 and N_2O, and 0.0192 kg/ft^3 for CH_4 at 60 °F and 14.7 psia.

$$Mass_i = E_{s,i} * \rho_i * 10^{-3} \qquad \text{(Eq. W-36)}$$

Table 6. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-1)

Std Vapor Volumetric Flow BTEX Vapor = 0.00367 mmscf/day
1,338,169 scf/yr

Component	Molecular Weight lb/lb-mole	Condenser Outlet Emissions Vent Stream							
		Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	scf/yr	lb-mole/yr	lb/hr	tons/yr
Carbon Dioxide	44.010	2.57%	1.13	2.10%	-	34,416.46	90.72	0.456	1.996
Hydrogen Sulfide	34.082	0.00%	0.00	0.00%	-	0.00	0.00	0.000	0.000
Nitrogen	28.013	0.01%	0.00	0.00%	-	110.51	0.29	0.001	0.004
Methane	16.042	27.82%	4.46	8.29%	8.490%	372,253.12	981.21	1.797	7.870
Ethane	30.069	21.98%	6.61	12.27%	12.574%	294,122.48	775.27	2.661	11.656
Propane	44.096	9.19%	4.05	7.52%	7.707%	122,926.53	324.02	1.631	7.144
i-Butane	58.122	1.38%	0.80	1.49%	1.524%	18,440.84	48.61	0.323	1.413
n-Butane	58.122	2.96%	1.72	3.20%	3.276%	39,643.95	104.50	0.693	3.037
i-Pentane	72.149	1.27%	0.92	1.71%	1.747%	17,032.13	44.89	0.370	1.620
n-Pentane	72.149	1.16%	0.84	1.56%	1.594%	15,540.90	40.96	0.337	1.478
n-Hexane	86.175	1.35%	1.16	2.16%	2.212%	18,054.85	47.59	0.468	2.051
Cyclohexane	84.160	0.27%	0.23	0.43%	0.436%	3,643.63	9.60	0.092	0.404
Heptanes (as n-Heptane)	100.202	1.16%	1.16	2.16%	2.212%	15,524.47	40.92	0.468	2.050
Methylcyclohexane	98.186	0.57%	0.56	1.04%	1.061%	7,602.28	20.04	0.225	0.984
2,2,4-Trimethylpentane	114.230	0.00%	0.00	0.00%	0.000%	0.00	0.00	0.000	0.000
Benzene	78.114	0.96%	0.75	1.39%	1.420%	12,785.05	33.70	0.301	1.316
Toluene	92.141	2.76%	2.54	4.72%	4.836%	36,916.78	97.31	1.024	4.483
Ethylbenzene	106.167	1.69%	1.79	3.33%	3.408%	22,579.35	59.52	0.721	3.159
Xylenes	106.167	2.35%	2.50	4.63%	4.748%	31,458.34	82.92	1.005	4.402
Octanes (as n-Octane)	114.229	19.67%	22.47	41.73%	42.756%	263,269.38	693.95	9.049	39.634
Water	18.015	0.89%	0.16	0.30%	-	-	-	-	-
Triethylene Gycol	150.170	0.00%	0.00	0.00%	0.000%	0.00	0.00	0.000	0.000
TOTAL =		100.00%	53.86	100%	100%	1,326,321.04	3,496.02	21.62	94.70
		TOTAL HC	52.56	98%	100%	1,291,794.07	3,405.01	21.16	92.70
				TOTAL VOC =	78.94%	625,418.47	1,648.53	16.71	73.17
				TOTAL HAPs =	16.62%	121,794.37	321.04	3.52	15.41

Molar volume conversion @ 60 °F and 1 atm: 1 lb-mole = 379.4 scf

Annual Emissions (tpy) = Outlet Flow (scf/yr) x Mole % x Molecular Weight (lb/lb-mol) / 379.4 (scf/lb-mol) / 2,000 (lb/ton)

Hourly Emissions (lb/hr) = Annual Emissions (tpy) * 2,000 (lb/ton) / 8,760 (hr/yr)

Table 6. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-1)

Std Vapor Volumetric Flow Flash Gas = 0.02547 mmscf/day
9,298,152 scf/yr

Component	Molecular Weight lb/lb-mole	Flash Tank Outlet Emissions Vent Stream							
		Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	scf/yr	lb-mole/yr^3	lb/hr	tons/yr
Carbon Dioxide	44.010	0.73%	0.32	0.59%	-	67,523.19	177.98	0.894	3.917
Hydrogen Sulfide	34.082	0.00%	0.00	0.00%	-	0.00	0.00	0.000	0.000
Nitrogen	28.013	0.09%	0.02	0.12%	-	8,184.09	21.57	0.069	0.302
Methane	16.042	76.08%	12.20	57.46%	58.411%	7,073,772.43	18,645.60	34.145	149.556
Ethane	30.069	17.13%	5.15	24.25%	24.656%	1,593,037.47	4,199.05	14.413	63.131
Propane	44.096	3.65%	1.61	7.57%	7.693%	338,940.80	893.41	4.497	19.698
i-Butane	58.122	0.42%	0.24	1.15%	1.166%	38,989.21	102.77	0.682	2.987
n-Butane	58.122	0.60%	0.35	1.64%	1.667%	55,704.21	146.83	0.974	4.267
i-Pentane	72.149	0.15%	0.11	0.52%	0.532%	14,333.91	37.78	0.311	1.363
n-Pentane	72.149	0.12%	0.08	0.39%	0.397%	10,695.91	28.19	0.232	1.017
n-Hexane	86.175	0.07%	0.06	0.30%	0.304%	6,864.05	18.09	0.178	0.780
Cyclohexane	84.160	0.00%	0.00	0.02%	0.019%	444.10	1.17	0.011	0.049
Heptanes (as n-Heptane)	100.202	0.03%	0.03	0.15%	0.156%	3,022.28	7.97	0.091	0.399
Methylcyclohexane	98.186	0.01%	0.01	0.04%	0.038%	743.66	1.96	0.022	0.096
2,2,4-Trimethylpentane	114.230	0.00%	0.00	0.00%	0.000%	0.00	0.00	0.000	0.000
Benzene	78.114	0.00%	0.00	0.01%	0.011%	274.16	0.72	0.006	0.028
Toluene	92.141	0.00%	0.00	0.02%	0.021%	432.58	1.14	0.012	0.053
Ethylbenzene	106.167	0.00%	0.00	0.01%	0.010%	181.30	0.48	0.006	0.025
Xylenes	106.167	0.00%	0.00	0.01%	0.010%	177.05	0.47	0.006	0.025
Octanes (as n-Octane)	114.229	0.90%	1.03	4.83%	4.909%	83,490.20	220.07	2.870	12.569
Water	18.015	0.01%	0.00	0.01%	0.012%	1,312.56	3.46	0.007	0.031
Triethylene Gycol	150.170	0.00%	0.00	0.00%	0.002%	28.77	0.08	0.001	0.006
	TOTAL =	100.00%	21.24	99%	100%	9,298,151.92	24,508.79	59.43	260.30
		TOTAL HC	20.89	98%	100%	9,221,103.31	24,305.70	58.46	256.04
					TOTAL VOC =	16.93%	554,293.41	1,461.05	9.90	43.36
					TOTAL HAPs =	0.36%	7,929.13	20.90	0.21	0.91

Molar volume conversion @ 60 °F and 1 atm: 1 lb-mole = 379.4 scf
Annual Emissions (tpy) = Outlet Flow (scf/yr) x Mole % x Molecular Weight (lb/lb-mol) / 379.4 (scf/lb-mol) / 2,000 (lb/ton)
Hourly Emissions (lb/hr) = Annual Emissions (tpy) * 2,000 (lb/ton) / 8,760 (hr/yr)

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 7. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-2)

Dehydration Unit Information:

Source ID:	**RSV-2**	
Stack ID:	**RSV-2**	
Installation Date:	9/1/2011	
Projected Startup Date:	Existing	
Regenerator Control Type:	Condenser and Routed to Reboiler	
Control Efficiency:	98%	
Flash Tank Control Type:	Routed to Reboiler	
Control Efficiency:	50%	
Rated Dehy Throughput (MMscfd):	60	Maximum rate.
Glycol Circulation Rate (gpm):	15.0	Pump rating.
Max. Annual Hours of Operation (hr/yr):	8,760	Unrestricted operation.

Dehydration Unit Regenerator Vent Emissions Data:

Pollutant	Uncontrolled Emissions		Controlled Emissions		Emissions Estimation Method
	lbs/hr	tpy	lbs/hr	tpy	
VOC	30.39	133.11	5.61	24.56	PROMAX (See Next Table)
HAPs	4.45	19.51	0.21	0.90	PROMAX (See Next Table)
NO_X	---	---	---	---	PROMAX (See Next Table)
SO_2	---	---	---	---	PROMAX (See Next Table)
CO	---	---	---	---	PROMAX (See Next Table)
PM_{10}	---	---	---	---	PROMAX (See Next Table)
$PM_{2.5}$	---	---	---	---	PROMAX (See Next Table)
GHG (CO_2e)	1,023	4,480	619	2,709	PROMAX (See Next Table)
Other (Benzene)	0.37	1.64	0.01	0.05	PROMAX (See Next Table)

Notes:

1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Regenerator emissions include a 20% percent compliance margin above ProMax outputs.

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 7. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-2)

PROMAX Emissions Data - Regenerator Vent:

Pollutant	Condenser Outlet Emissions			Controlled Emissions		
	lbs/hr	lbs/day	tpy	lbs/hr	lbs/day	tpy
Carbon Dioxide	0.429	10.30	1.88	33.64	807.39	147.35
Methane	1.698	40.76	7.44	0.034	0.82	0.15
Ethane	2.632	63.17	11.53	0.053	1.26	0.23
Propane	1.644	39.45	7.20	0.033	0.79	0.14
Isobutane	0.335	8.05	1.47	0.007	0.16	0.03
n-Butane	0.704	16.91	3.09	0.014	0.34	0.06
Isopentane	0.384	9.21	1.68	0.008	0.18	0.03
n-Pentane	0.350	8.40	1.53	0.007	0.17	0.03
n-Hexane	0.498	11.94	2.18	0.010	0.24	0.04
Cyclohexane	0.095	2.28	0.42	0.002	0.05	0.01
Other Hexanes	0.000	0.00	0.00	0.000	0.00	0.00
Heptanes	0.506	12.15	2.22	0.010	0.24	0.04
Methylcyclohexane	0.235	5.64	1.03	0.005	0.11	0.02
Benzene	0.306	7.34	1.34	0.006	0.15	0.03
Toluene	1.030	24.71	4.51	0.021	0.49	0.09
Ethylbenzene	0.712	17.08	3.12	0.014	0.34	0.06
Xylenes	0.965	23.16	4.23	0.019	0.46	0.08
C8 + Heavier Hydrocarbons	8.883	213.20	38.91	0.178	4.26	0.78
Triethylene Glycol	0.000	0.00	0.00	0.000	0.00	0.00
Total CO_2e	**42.89**	**1,029.36**	**187.86**	**34.49**	**827.78**	**151.07**
Total Hydrocarbon Emissions	**20.98**	**503.43**	**91.88**	**0.42**	**10.07**	**1.84**
Total VOC Emissions	**16.65**	**399.50**	**72.91**	**0.33**	**7.99**	**1.46**
Total HAP Emissions	**3.51**	**84.23**	**15.37**	**0.07**	**1.68**	**0.31**
Total BTEX Emissions	**3.01**	**72.28**	**13.19**	**0.06**	**1.45**	**0.26**

Notes:

1. Based on ProMax run at maximum design conditions of dry gas flowrate at 60 MMscfd, temperature at 120 °F, and pressure at 1145 psig. This unit operates two 450 gph pumps simultaneously. Regenerator overheads are routed to a condenser for control and then routed to the reboiler for a 98% control efficiency.
2. Controlled emissions of CO_2 include emissions created as combustion by-products from vent streams routed to the reboiler for control.
3. CO_2e is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25).

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 7. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-2)

PROMAX Emissions Data - Flash Tank:

Pollutant	Flash Tank Outlet Emissions			Controlled Emissions		
	lbs/hr	lbs/day	tpy	lbs/hr	lbs/day	tpy
Carbon Dioxide	0.845	20.28	3.70	76.70	1840.90	335.96
Methane	32.344	776.25	141.67	16.172	388.13	70.83
Ethane	13.950	334.79	61.10	6.975	167.40	30.55
Propane	4.382	105.16	19.19	2.191	52.58	9.60
Isobutane	0.672	16.13	2.94	0.336	8.07	1.47
n-Butane	0.950	22.79	4.16	0.475	11.39	2.08
Isopentane	0.304	7.30	1.33	0.152	3.65	0.67
n-Pentane	0.227	5.44	0.99	0.113	2.72	0.50
n-Hexane	0.174	4.17	0.76	0.087	2.08	0.38
Cyclohexane	0.011	0.26	0.05	0.005	0.13	0.02
Other Hexanes	0.000	0.00	0.00	0.000	0.00	0.00
Heptanes	0.088	2.12	0.39	0.044	1.06	0.19
Methylcyclohexane	0.021	0.51	0.09	0.011	0.25	0.05
Benzene	0.006	0.15	0.03	0.003	0.07	0.01
Toluene	0.011	0.27	0.05	0.006	0.14	0.02
Ethylbenzene	0.005	0.13	0.02	0.003	0.07	0.01
Xylenes	0.005	0.13	0.02	0.003	0.06	0.01
C8 + Heavier Hydrocarbons	1.823	43.75	7.98	0.911	21.87	3.99
Triethylene Glycol	0.001	0.04	0.01	0.001	0.02	0.00
Total CO_2e	**809.44**	**19,426.65**	**3,545.36**	**481.00**	**11,544.09**	**2,106.80**
Total Hydrocarbon Emissions	**54.97**	**1319.38**	**240.79**	**27.49**	**659.69**	**120.39**
Total VOC Emissions	**8.68**	**208.33**	**38.02**	**4.34**	**104.17**	**19.01**
Total HAP Emissions	**0.20**	**4.85**	**0.88**	**0.10**	**2.42**	**0.44**
Total BTEX Emissions	**0.03**	**0.68**	**0.12**	**0.01**	**0.34**	**0.06**

Notes:

1. Based on ProMax run calculated conditions of temperature at 128 °F, and pressure at 45 psig. Flash gases are routed to the reboiler for use as fuel with a 50% control efficiency.
2. Controlled emissions of CO_2 include emissions created as combustion by-products from vent streams routed to the reboiler for control.
3. CO_2e is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25).

Company Name: E. Marcellus Asset Company
Facility Name: Tichenal Compressor Station
Project Description: R13 Modification Application

TABLE 7. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-2)

Greenhouse Gas (GHG) Emissions - Controlled Vent Streams

Constituent	Condenser Vent Stream mol%	Flash Tank Off Gas Stream mol%	Source
CO_2, Y_{CO2}	2.4674	0.723	PROMAX Output Report
Methane, Y_j	26.7808	75.908	PROMAX Output Report
Ethane, Y_j	22.1414	17.466	PROMAX Output Report
Propane, Y_j	9.4287	3.741	PROMAX Output Report
Isobutane, Y_j	1.4589	0.435	PROMAX Output Report
n-Butane, Y_j	3.0656	0.615	PROMAX Output Report
Isopentane, Y_j	1.3449	0.159	PROMAX Output Report
n-Pentane, Y_j	1.2277	0.118	PROMAX Output Report
n-Hexane, Y_j	1.4605	0.076	PROMAX Output Report
Cyclohexane, Y_j	0.2854	0.005	PROMAX Output Report
Other Hexanes, Y_j	0.0000	0.000	PROMAX Output Report
Heptanes, Y_j	1.2775	0.033	PROMAX Output Report
Methylcyclohexane, Y_j	0.6051	0.008	PROMAX Output Report
2,2,4-Trimethylpentane, Y_j	0.0000	0.000	PROMAX Output Report
Benzene, Y_j	0.9899	0.003	PROMAX Output Report
Toluene, Y_j	2.8265	0.005	PROMAX Output Report
Ethylbenzene, Y_j	1.6958	0.002	PROMAX Output Report
Xylenes, Y_j	2.2989	0.002	PROMAX Output Report
C8 + Heavier Hydrocarbons, Y_j	0.9658	0.014	PROMAX Output Report
Triethylene Glycol, Y_j	0.0000	0.000	PROMAX Output Report
Flow Rate, V_s (scfh)	150	1,008	PROMAX Output Report
Control Efficiency (%)	98%	50%	---
Hours of Operation	8,760	8,760	Unrestricted Operation
Density of CO_2 (kg/ft^3 at 60F & 14.7 psia)	0.0526	0.0526	40 CFR Subpart 98 (Eq. W-36)
$E_{s,CO2}$ (combusted) - scf/hr	286	654	40 CFR Subpart 98 (Eq. W-39A)
Mass,CO_2 (combusted) - lb/hr	33.21	75.86	= E_sCO_2 (scf/hr) * Density of CO_2 (kg/scf) * 2.2 (lb/kg)
Mass,CO_2 (combusted) - tpy	145.47	332.26	= Mass, CO_2 (lb/hr) ÷ 2000 (lb/ton) * 8760 (hr/year)

Example Calculations:

GHG volumetric emissions from fuel combustion units using Equation W-39A from 40 CFR 98

$E_{s,CH4}$ = Annual CH_4 emissions from flare stack in cubic feet, at standard conditions.

$E_{s,CO2}$ = Contribution of annual CO_2 emissions from portable or stationary fuel combustion sources in standard cubic feet.

V_s = Volume of gas sent to combustion unit in standard cubic feet, during the year.

η = Fraction of gas combusted for portable and stationary equipment determined using engineering estimation. For internal combustion devices, a default of 0.995 can be used.

Y_j = Mole fraction of hydrocarbon constituents j (such as methane, ethane, propane, butane, and pentanes-plus) in gas sent to combustion unit.

R_j = Number of carbon atoms in the hydrocarbon constituent j for: 1 for methane, 2 for ethane, 3 for propane, 4 for butane, and 5 for pentanes-plus).

Y_{CO2} = Mole fraction of carbon dioxide constituent in gas sent to combustion unit.

$$E_{s,CO2} = (V_s * Y_{CO2}) + \eta * \sum_{j=1}^{n} V_s * Y_j * R_j \qquad \text{(Eq. W-39A)}$$

GHG mass emissions using Equation W-36 from 40 CFR 98

$Mass_i$ = GHG_i (either CH_4, CO_2, or N_2O) mass emissions in metric tons.

$E_{s,i}$ = GHG_i (either CH_4, CO_2, or N_2O) volumetric emissions at standard conditions, in cubic feet.

ρ_i = Density of GHG_i. Use 0.0526 kg/ft^3 for CO_2 and N_2O, and 0.0192 kg/ft^3 for CH_4 at 60 °F and 14.7 psia.

$$Mass_i = E_{s,i} * \rho_i * 10^{-3} \qquad \text{(Eq. W-36)}$$

TABLE 7. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-2)

Std Vapor Volumetric Flow BTEX Vapor = 0.00360 mmscf/day
1,313,839 scf/yr

Component	Molecular Weight lb/lb-mole	Condenser Outlet Emissions Vent Stream							
		Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	scf/yr	lb-mole/yr	tons/yr	lb/hr
Carbon Dioxide	44.010	2.47%	1.09	2.00%	-	32,417.47	85.45	1.880	0.429
Hydrogen Sulfide	34.082	0.00%	0.00	0.00%	-	0.00	0.00	0.000	0.000
Nitrogen	28.013	0.01%	0.00	0.00%	-	100.47	0.26	0.004	0.001
Methane	16.042	26.78%	4.30	7.91%	8.097%	351,856.73	927.45	7.439	1.698
Ethane	30.069	22.14%	6.66	12.26%	12.548%	290,901.76	766.78	11.528	2.632
Propane	44.096	9.43%	4.16	7.65%	7.836%	123,878.40	326.53	7.199	1.644
i-Butane	58.122	1.46%	0.85	1.56%	1.598%	19,167.62	50.52	1.468	0.335
n-Butane	58.122	3.07%	1.78	3.28%	3.358%	40,276.62	106.16	3.085	0.704
i-Pentane	72.149	1.34%	0.97	1.79%	1.829%	17,670.14	46.58	1.680	0.384
n-Pentane	72.149	1.23%	0.89	1.63%	1.669%	16,129.91	42.52	1.534	0.350
n-Hexane	86.175	1.46%	1.26	2.32%	2.372%	19,189.22	50.58	2.179	0.498
Cyclohexane	84.160	0.29%	0.24	0.44%	0.453%	3,750.26	9.89	0.416	0.095
Heptanes (as n-Heptane)	100.202	1.28%	1.28	2.36%	2.413%	16,784.89	44.24	2.217	0.506
Methylcyclohexane	98.186	0.61%	0.59	1.09%	1.120%	7,949.79	20.95	1.029	0.235
2,2,4-Trimethylpentane	114.230	0.00%	0.00	0.00%	0.000%	0.00	0.00	0.000	0.000
Benzene	78.114	0.99%	0.77	1.42%	1.457%	13,005.32	34.28	1.339	0.306
Toluene	92.141	2.83%	2.60	4.79%	4.908%	37,135.02	97.88	4.510	1.030
Ethylbenzene	106.167	1.70%	1.80	3.31%	3.393%	22,279.72	58.73	3.117	0.712
Xylenes	106.167	2.30%	2.44	4.49%	4.600%	30,203.59	79.61	4.226	0.965
Octanes (as n-Octane)	114.229	19.67%	22.47	41.37%	42.350%	258,452.47	681.25	38.909	8.883
Water	18.015	0.97%	0.17	0.32%	-	-	-	-	-
Triethylene Gycol	150.170	0.00%	0.00	0.00%	0.000%	0.00	0.00	0.000	0.000
TOTAL =		100.00%	54.32	100%	100%	1,301,149.42	3,429.67	93.76	21.41
TOTAL HC			53.06	98%	100%	1,268,631.48	3,343.96	91.88	20.98
TOTAL VOC =					79.36%	625,872.99	1,649.72	72.91	16.65
TOTAL HAPs =					16.73%	121,812.88	321.08	15.37	3.51

Molar volume conversion @ 60 °F and 1 atm: 1 lb-mole = 379.4 scf

Annual Emissions (tpy) = Outlet Flow (scf/yr) x Mole % x Molecular Weight (lb/lb-mol) / 379.4 (scf/lb-mol) / 2,000 (lb/ton)

Hourly Emissions (lb/hr) = Annual Emissions (tpy) * 2,000 (lb/ton) / 8,760 (hr/yr)

TABLE 7. Natural Gas Dehydration Unit - Regenerator Vent Emissions Calculations (RSV-2)

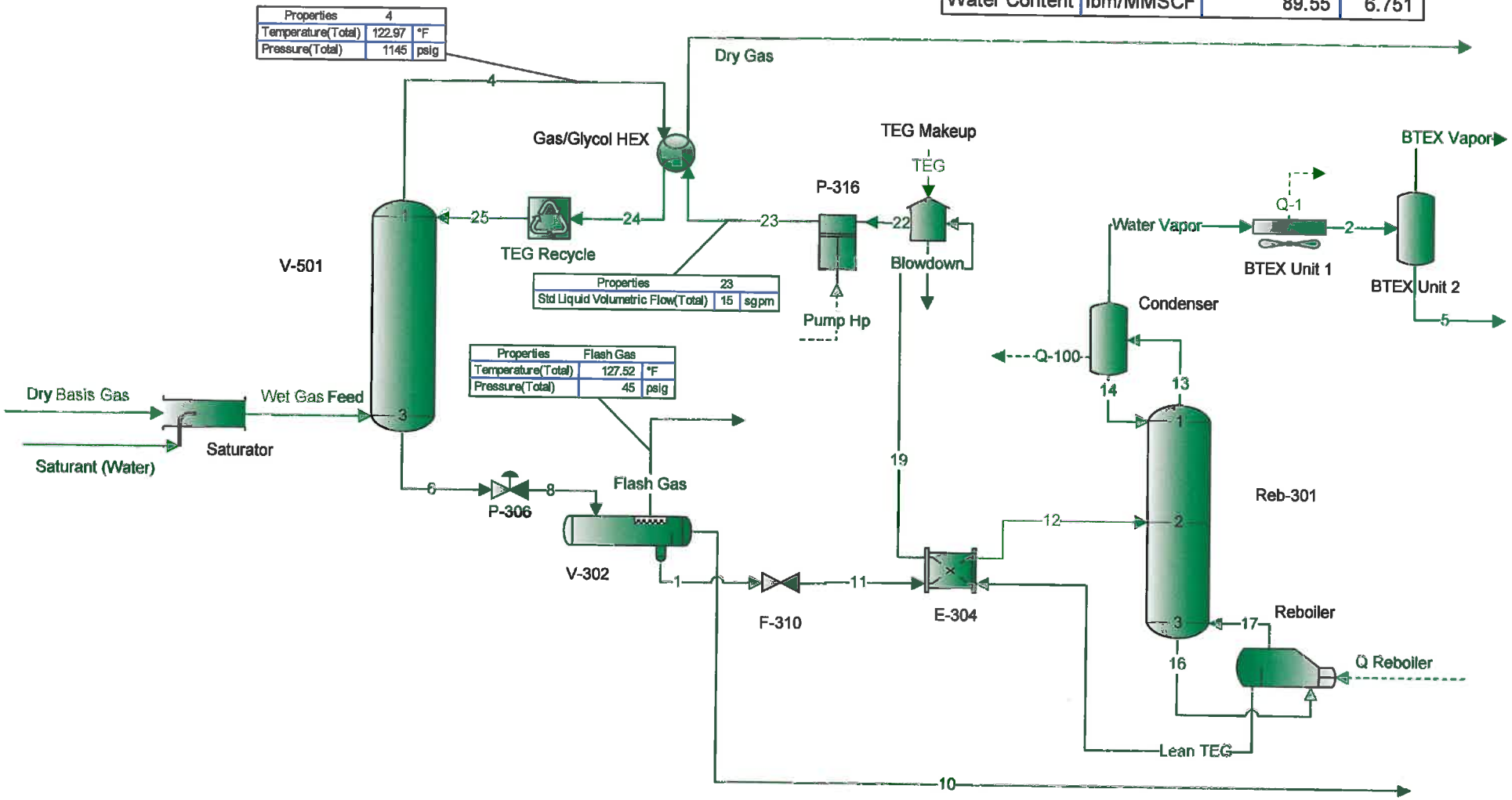
Std Vapor Volumetric Flow Flash Gas = 0.02418 mmscf/day
8,827,302 scf/yr

Component	Molecular Weight lb/lb-mole	Uncontrolled Emissions – Vent Stream							
		Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	scf/yr	lb-mole/yr^3	lb/hr	tons/yr
Carbon Dioxide	44.010	0.72%	0.32	1.51%	-	63,816.91	168.21	0.845	3.702
Hydrogen Sulfide	34.082	0.00%	0.00	0.00%	-	0.00	0.00	0.000	0.000
Nitrogen	28.013	0.09%	0.02	0.11%	-	7,600.88	20.03	0.064	0.281
Methane	16.042	75.91%	12.18	57.87%	58.836%	6,700,594.65	17,661.95	32.344	141.666
Ethane	30.069	17.47%	5.25	24.96%	25.376%	1,541,785.09	4,063.96	13.950	61.100
Propane	44.096	3.74%	1.65	7.84%	7.970%	330,220.47	870.42	4.382	19.191
i-Butane	58.122	0.44%	0.25	1.20%	1.223%	38,432.33	101.30	0.672	2.944
n-Butane	58.122	0.62%	0.36	1.70%	1.727%	54,294.97	143.11	0.950	4.159
i-Pentane	72.149	0.16%	0.11	0.54%	0.553%	14,013.21	36.94	0.304	1.332
n-Pentane	72.149	0.12%	0.09	0.41%	0.412%	10,439.42	27.52	0.227	0.993
n-Hexane	86.175	0.08%	0.07	0.31%	0.316%	6,694.57	17.65	0.174	0.760
Cyclohexane	84.160	0.00%	0.00	0.02%	0.020%	426.31	1.12	0.011	0.047
Heptanes (as n-Heptane)	100.202	0.03%	0.03	0.16%	0.161%	2,928.27	7.72	0.088	0.387
Methylcyclohexane	98.186	0.01%	0.01	0.04%	0.038%	714.17	1.88	0.021	0.092
2,2,4-Trimethylpentane	114.230	0.00%	0.00	0.00%	0.000%	0.00	0.00	0.000	0.000
Benzene	78.114	0.00%	0.00	0.01%	0.011%	261.42	0.69	0.006	0.027
Toluene	92.141	0.00%	0.00	0.02%	0.021%	411.48	1.08	0.011	0.050
Ethylbenzene	106.167	0.00%	0.00	0.01%	0.010%	171.90	0.45	0.005	0.024
Xylenes	106.167	0.00%	0.00	0.01%	0.010%	165.90	0.44	0.005	0.023
Octanes (as n-Octane)	114.229	0.60%	0.69	3.26%	3.316%	53,032.20	139.79	1.823	7.984
Water	18.015	0.01%	0.00	0.01%	-	-	-	-	-
Triethylene Gycol	150.170	0.00%	0.00	0.00%	0.003%	33.00	0.09	0.001	0.007
TOTAL =		100.00%	21.04	100%	100%	8,826,037.13	23,264.35	55.88	244.77
		TOTAL HC	20.70	98%	100%	8,754,586.34	23,076.02	54.97	240.78
				TOTAL VOC =	15.79%	512,206.60	1,350.11	8.68	38.01
				TOTAL HAPs =	0.37%	7,705.26	20.31	0.20	0.88

Molar volume conversion @ 60 °F and 1 atm: 1 lb-mole = 379.4 scf
Annual Emissions (tpy) = Outlet Flow (scf/yr) x Mole % x Molecular
Hourly Emissions (lb/hr) = Annual Emissions (tpy) * 2,000 (lb/ton) / 8,760 (hr/yr)

Tichenal Dehydration Unit

Names	Units	Wet Gas Feed	Dry Gas
Water Content	lbm/MMSCF	89.55	6.751



Names	Units	Q Reboiler	Q-100
Energy Rate	MBTU/h	859	41.48

ProMax - Raw Data - RSV-1 (120 mmscf/day)

		Inlet
Temperature	°F	120
Pressure	psia	1164.695949
Mole Fraction Vapor	%	100
Mole Fraction Light Liquid	%	0
Mole Fraction Heavy Liquid	%	0
Molecular Weight	lb/lbmol	17.91980271
Mass Density	lb/ft^3	3.787310402
Molar Flow	lbmol/h	13200.62253
Mass Flow	lb/h	236552.5514
Vapor Volumetric Flow	ft^3/h	62459.24584
Liquid Volumetric Flow	gpm	7787.126754
Std Vapor Volumetric Flow	MMSCFD	120.2263634
Std Liquid Volumetric Flow	sgpm	1496.415781
Compressibility		0.88587006
Specific Gravity		0.61872217
API Gravity		
Enthalpy	Btu/h	-437366934.7
Mass Enthalpy	Btu/lb	-1848.920808
Mass Cp	Btu/(lb*°F)	0.65606406
Ideal Gas CpCv Ratio		1.269611604
Dynamic Viscosity	cP	0.013621401
Kinematic Viscosity	cSt	0.224527757
Thermal Conductivity	Btu/(h*ft*°F)	0.024682834
Surface Tension	lbf/ft	
Net Ideal Gas Heating Value	Btu/ft^3	993.8107984
Net Liquid Heating Value	Btu/lb	21014.1114
Gross Ideal Gas Heating Value	Btu/ft^3	1100.251754
Gross Liquid Heating Value	Btu/lb	23268.19275

	mol %, wet
CO2	0.138
H2S	0.000
Nitrogen	0.336
Methane	88.977
Ethane	8.557
Propane	1.351
i-Butane	0.154
n-Butane	0.183
i-Pentane	0.044
n-Pentane	0.031
Cyclopentane	0.000
n-Hexane	0.020
Cyclohexane	0.001
n-Heptane	0.010
Methylcyclohexane	0.002
2,2,4-Trimethylpentane	0.000
Benzene	0.0005
Toluene	0.001
Ethylbenzene	0.0005
o-Xylene	0.0005
Water	0.188
Octane	0.005
Triethylene Glycol	0.000

ProMax - Results - RSV-1 (120 mmscf/day)

		Inlet	BTEX Vapor	Flash Gas
Temperature	°F	120.0	140.0	127.5
Pressure	psig	1164.7	14.7	59.7
Molecular Weight	lb/lbmol	17.9	35.8	20.4
Mass Density	lb/ft^3	3.8	0.1	0.2
Mass Flow	lb/h	236552.6	14.4	57.0
Std Vapor Volumetric Flow	MMSCFD	120.2	0.00367	0.02547
Specific Gravity		0.6	1.2	0.7
Net Ideal Gas Heating Value	Btu/ft^3	993.8	1603.7	1101.0
Gross Ideal Gas Heating Value	Btu/ft^3	1100.3	1744.9	1215.1
CO2	Mol%	0.1377	2.5719	0.7262
H2S	Mol%	0.0000	0.0000	0.0000
Nitrogen	Mol%	0.3364	0.0083	0.0880
Methane	Mol%	88.9772	27.8181	76.0772
Ethane	Mol%	8.5569	21.9795	17.1328
Propane	Mol%	1.3515	9.1862	3.6452
i-Butane	Mol%	0.1537	1.3781	0.4193
n-Butane	Mol%	0.1827	2.9626	0.5991
i-Pentane	Mol%	0.0439	1.2728	0.1542
n-Pentane	Mol%	0.0309	1.1614	0.1150
Cyclopentane	Mol%	0.0000	0.0000	0.0000
n-Hexane	Mol%	0.0205	1.3492	0.0738
Cyclohexane	Mol%	0.0010	0.2723	0.0048
n-Heptane	Mol%	0.0100	1.1601	0.0325
Methylcyclohexane	Mol%	0.0020	0.5681	0.0080
2,2,4-Trimethylpentane	Mol%	0.0000	0.0000	0.0000
Benzene	Mol%	0.0005	0.9554	0.0029
Toluene	Mol%	0.0010	2.7588	0.0047
Ethylbenzene	Mol%	0.0005	1.6873	0.0019
o-Xylene	Mol%	0.0005	2.3508	0.0019
Water	Mol%	0.1883	19.6738	0.8979
Octane	Mol%	0.0050	0.8854	0.0141
Triethylene Glycol	Mol%	0.0000	0.0000	0.0003

ProMax - Raw Data - RSV-2 (60 mmscf/day)

		Inlet
Temperature	°F	120
Pressure	psia	1164.695949
Mole Fraction Vapor	%	100
Mole Fraction Light Liquid	%	0
Mole Fraction Heavy Liquid	%	0
Molecular Weight	lb/lbmol	17.91980271
Mass Density	lb/ft^3	3.787310402
Molar Flow	lbmol/h	6600.311266
Mass Flow	lb/h	118276.2757
Vapor Volumetric Flow	ft^3/h	31229.62292
Liquid Volumetric Flow	gpm	3893.563377
Std Vapor Volumetric Flow	MMSCFD	60.1131817
Std Liquid Volumetric Flow	sgpm	748.2078906
Compressibility		0.88587006
Specific Gravity		0.61872217
API Gravity		
Enthalpy	Btu/h	-218683467.3
Mass Enthalpy	Btu/lb	-1848.920808
Mass Cp	Btu/(lb*°F)	0.65606406
Ideal Gas CpCv Ratio		1.269611604
Dynamic Viscosity	cP	0.013621401
Kinematic Viscosity	cSt	0.224527757
Thermal Conductivity	Btu/(h*ft*°F)	0.024682834
Surface Tension	lbf/ft	
Net Ideal Gas Heating Value	Btu/ft^3	993.8107984
Net Liquid Heating Value	Btu/lb	21014.1114
Gross Ideal Gas Heating Value	Btu/ft^3	1100.251754
Gross Liquid Heating Value	Btu/lb	23268.19275

	mol %, wet
CO2	0.138
H2S	0.000
Nitrogen	0.336
Methane	88.977
Ethane	8.557
Propane	1.351
i-Butane	0.154
n-Butane	0.183
i-Pentane	0.044
n-Pentane	0.031
Cyclopentane	0.000
n-Hexane	0.020
Cyclohexane	0.001
n-Heptane	0.010
Methylcyclohexane	0.002
2,2,4-Trimethylpentane	0.000
Benzene	0.0005
Toluene	0.001
Ethylbenzene	0.0005
o-Xylene	0.0005
Water	0.188
Octane	0.005
Triethylene Glycol	0.000

ProMax - Results - RSV-2 (60 mmscf/day)

		Inlet	BTEX Vapor	Flash Gas
Temperature	°F	120.0	140.0	128.0
Pressure	psig	1164.7	14.7	59.7
Molecular Weight	lb/lbmol	17.9	36.3	20.5
Mass Density	lb/ft^3	3.8	0.1	0.2
Mass Flow	lb/h	118276.3	14.4	54.4
Std Vapor Volumetric Flow	MMSCFD	60.1	0.00360	0.02418
Specific Gravity		0.6	1.3	0.7
Net Ideal Gas Heating Value	Btu/ft^3	993.8	1633.0	1108.5
Gross Ideal Gas Heating Value	Btu/ft^3	1100.3	1776.2	1223.0
CO2	Mol%	0.1377	2.4674	0.7229
H2S	Mol%	0.0000	0.0000	0.0000
Nitrogen	Mol%	0.3364	0.0076	0.0861
Methane	Mol%	88.9772	26.7808	75.9076
Ethane	Mol%	8.5569	22.1414	17.4661
Propane	Mol%	1.3515	9.4287	3.7409
i-Butane	Mol%	0.1537	1.4589	0.4354
n-Butane	Mol%	0.1827	3.0656	0.6151
i-Pentane	Mol%	0.0439	1.3449	0.1587
n-Pentane	Mol%	0.0309	1.2277	0.1183
Cyclopentane	Mol%	0.0000	0.0000	0.0000
n-Hexane	Mol%	0.0205	1.4605	0.0758
Cyclohexane	Mol%	0.0010	0.2854	0.0048
n-Heptane	Mol%	0.0100	1.2775	0.0332
Methylcyclohexane	Mol%	0.0020	0.6051	0.0081
2,2,4-Trimethylpentane	Mol%	0.0000	0.0000	0.0000
Benzene	Mol%	0.0005	0.9899	0.0030
Toluene	Mol%	0.0010	2.8265	0.0047
Ethylbenzene	Mol%	0.0005	1.6958	0.0019
o-Xylene	Mol%	0.0005	2.2989	0.0019
Water	Mol%	0.1883	19.6716	0.6008
Octane	Mol%	0.0050	0.9658	0.0143
Triethylene Glycol	Mol%	0.0000	0.0000	0.0004