



Williams Ohio Valley Midstream LLC
Park Place Corporate Center 2
2000 Commerce Drive
Pittsburgh, PA 15275
(412) 787-7300
(412) 787-6002 fax

August 21, 2015
(Via Federal Express)

Beverly McKeone
New Source Review Program Manager
Division of Air Quality
West Virginia Department of Environmental Protection
601 57th Street SE
Charleston, WV 25304-2345

**Subject: Application for 45CSR13 NSR Modification Permit
Williams Ohio Valley Midstream LLC
WGGG COMPRESSOR STATION
Wetzel County, West Virginia**

Dear Ms. McKeone,

Williams Ohio Valley Midstream LLC (OVM) is submitting an Application for 45CSR13 New Source Review (NSR) Modification Permit for the existing Wetzel Gas Gathering System (WGGG) Compressor Station, located on the southwest side of Buffalo Run Road, approximately 3.7 miles south of Jacksonburg, in Wetzel County, West Virginia.

The requested 45CSR13 NSR Modification Permit will supersede and replace General Permit G35-A087, issued 02/22/13. This application for 45CSR13 NSR Modification Permit has been prepared and submitted to provide for the following proposed changes at the subject facility:

- Reduce the 40 MMscfd Dehydrator 01 Off-Gas Control Efficiency from 95% to:
 - Dehydrator-Flash Tank (DFT-01/5E) \geq 50% Recycle of Off-Gas; and
 - Dehydrator-Regenerator/Still Vent (DSV-01/6E) \geq 95% Control of Off-Gas.

Furthermore, several emissions estimating protocols improvements were implemented as follows:

- Updated Compressor Engine (CE-01/1E and CE-02/2E) estimating protocols.
- Added Compressor Rod Packing and Engine Crankcase (RPC/3E) emission estimates.
- Added Start/Stop/Maintenance (Blowdown) (SSM/4E) emission estimates.
- Updated the Reboiler 01 (RBV/7E) estimating protocols.
- Updated the Produced Water Storage Tank (T-01/8E) estimating protocols.
- Added Produced Water Truck-Load-Out (TLO/9E) emission estimates.
- Added Piping and Equipment Fugitive (FUG-G/1F and FUG-W/2F) emission estimates.
- Utilized site-specific, representative, extended gas analysis.

The Facility-Wide Emissions and the Unit-Specific VOC Emissions are summarized on the following page:

FACILITY-WIDE EMISSIONS SUMMARY (Tons per Year)

Criteria Pollutants	Potential Emissions (Including Fugitives)			
	Current	Increase	Proposed	Title V
Nitrogen Oxides (NOX)	13.69	0.07	13.76	100
Carbon Monoxide (CO)	5.71	0.28	5.99	100
*Point - Volatile Organic Compounds (VOC)	24.65	61.74	86.39	100
Fugitive - Volatile Organic Compounds (VOC)	---	6.39	6.39	---
Total - Volatile Organic Compounds (VOC)	24.65	68.13	92.78	---
Sulfur Dioxide (SO2)	0.06	1.1E-03	0.06	100
Particulate Matter (PM10/2.5)	0.90	0.13	1.03	100
Hazardous Air Pollutants (HAP)	Potential Emissions (Including Fugitives)			
	Current	Increase	Proposed	Title V
Benzene	0.09	0.26	0.35	10
Ethylbenzene	0.05	0.28	0.33	10
Formaldehyde (HCHO)	2.62	0.09	2.71	10
n-Hexane	0.29	1.14	1.43	10
Methanol (MeOH)	---	0.16	0.16	10
Toluene	0.19	0.47	0.66	10
2,2,4-Trimethylpentane (i-Octane, TMP)	---	0.19	0.19	10
Xylenes	0.29	0.78	1.07	10
Other HAP (Acetaldehyde, MeCl, etc.)	---	0.93	0.93	10
Total HAP	3.53	4.31	7.84	25
Greenhouse Gases (GHG)	Potential Emissions (Including Fugitives)			
	Current	Increase	Proposed	Title V
Carbon Dioxide (CO ₂)	8,647	5,284	13,931	---
Methane (CH ₄)	295	180	476	---
Nitrous Oxide (N ₂ O)	0.02	0.01	0.03	---
CO ₂ Equivalent (CO ₂ e)	16,033	9,796	25,829	---

***Bold** values indicate that the emissions exceed the 45CSR13 Modification Permit Threshold (6 lb/hr AND 10 tpy).

UNIT SPECIFIC - VOC EMISSIONS SUMMARY (Tons per Year)

Unit ID	Description	Current	Increase	Proposed	Comment
CE-01/1E	1,380 bhp Engine	6.68	2.77	9.45	New Protocol
CE-02/2E	1,380 bhp Engine	6.68	2.77	9.45	New Protocol
RPC/3E	Rod Packing/Crankcase	**	3.44	3.44	New Protocol
SSM/4E	Start/Stop/Maintenance	**	10.03	10.03	New Protocol
***DFT-01/5E	Dehydrator Flash Tank	10.60	42.45	53.05	Modified Unit
DSV-01/6E	Dehydrator Still Vent	0.63	0.07	0.70	New Protocol
RBV-01/7E	Dehydrator Reboiler	0.02	0.00	0.02	New Protocol
T-01/8E	Produced Water Tank	0.04	0.07	0.11	New Protocol
TLO/09	Truck Load-Out	**	0.12	0.12	New Protocol
FUG-G/1F	Fugitives - Gas	**	2.55	2.55	New Protocol
FUG-W/2F	Fugitives - Water/Oil	**	3.84	3.84	New Protocol
TOTAL VOC (TPY)		24.65	68.13	92.78	

**The G35-A Application did not include RPC, SSM, TLO, FUG-G, and FUG-W emissions.

*****Bold** values indicate that the emission increase is due to modifications to the equipment and/or operations.

Beverly McKeone
WVDEP – Division of Air Quality
August 21, 2015
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The facility continues to qualify as a Minor Source under Non-Attainment New Source Review (NNSR), Prevention of Significant Deterioration (PSD), and Title V Operating Permits. The facility is also an Area Source for Hazardous Air Pollutants (HAP) under the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations.

If you have any questions concerning this submittal or need additional information, please contact me at (412) 787-4259 or Danell.Zawaski@Williams.com.

Sincerely,



R. Danell Zawaski, P.E.
Environmental Specialist

Enclosures:

Application for NSR Modification Permit
Attachments A through S
Check for Application Fee

**APPLICATION FOR
45CSR13 NEW SOURCE REVIEW (NSR)
MODIFICATION PERMIT**

For the:

Williams Ohio Valley Midstream LLC
WGGG COMPRESSOR STATION
Wetzel County, West Virginia

Submitted to:



**WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY**

Submitted by:



Williams Ohio Valley Midstream LLC
Park Place Corporate Center 2
2000 Commerce Drive
Pittsburgh, PA 15275

Prepared by:



EcoLogic Environmental Consultants, LLC
864 Windsor Court
Santa Barbara, CA 93111

August 2015

**APPLICATION FOR
45CSR13 NEW SOURCE REVIEW (NSR)
MODIFICATION PERMIT**

Williams Ohio Valley Midstream LLC
WGGG COMPRESSOR STATION
Wetzel County, West Virginia

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APPLICATION FEE

**APPLICATION FOR
45CSR13 NEW SOURCE REVIEW (NSR)
MODIFICATION PERMIT**

- **SECTION I. General**
 - **SECTION II. Additional Attachments and Supporting Documents**
 - **SECTION III. Certification of Information**
-



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

**APPLICATION FOR NSR PERMIT
 AND
 TITLE V PERMIT REVISION
 (OPTIONAL)**

PLEASE CHECK ALL THAT APPLY TO NSR (45CSR13) (IF KNOWN):

- CONSTRUCTION MODIFICATION RELOCATION
 CLASS I ADMINISTRATIVE UPDATE TEMPORARY
 CLASS II ADMINISTRATIVE UPDATE AFTER-THE-FACT

PLEASE CHECK TYPE OF 45CSR30 (TITLE V) REVISION (IF ANY):

- ADMINISTRATIVE AMENDMENT MINOR MODIFICATION
 SIGNIFICANT MODIFICATION NOT APPLICABLE

IF ANY BOX ABOVE IS CHECKED, INCLUDE TITLE V REVISION INFORMATION AS ATTACHMENT S TO THIS APPLICATION

FOR TITLE V FACILITIES ONLY: Please refer to "Title V Revision Guidance" in order to determine your Title V Revision options (Appendix A, "Title V Permit Revision Flowchart") and ability to operate with the changes requested in this Permit Application.

Section I. General

1. Name of applicant (as registered with the WV Secretary of State's Office): WILLIAMS OHIO VALLEY MIDSTREAM LLC (OVM)		2. Federal Employer ID No. (FEIN): 27 - 0856707	
3. Name of facility (if different from above): WGGS COMPRESSOR STATION		4. The applicant is the: <input type="checkbox"/> OWNER <input type="checkbox"/> OPERATOR <input checked="" type="checkbox"/> BOTH	
5A. Applicant's mailing address: PARK PLACE CORPORATE CENTER 2 2000 COMMERCE DRIVE PITTSBURGH, PA 15275		5B. Facility's present physical address: SOUTHWEST SIDE OF BUFFALO RUN ROAD ~2.7 MILES SOUTH OF JACKSONBURG WETZEL COUNTY, WV	
6. West Virginia Business Registration. Is the applicant a resident of the State of West Virginia? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO – If YES, provide a copy of the Certificate of Incorporation/Organization/Limited Partnership (one page) including any name change amendments or other Business Registration Certificate as Attachment A . – If NO, provide a copy of the Certificate of Authority/Authority of L.L.C./Registration (one page) including any name change amendments or other Business Certificate as Attachment A .			
7. If applicant is a subsidiary corporation, please provide the name of parent corporation: THE WILLIAMS COMPANIES, INC.			
8. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO – If YES, please explain: APPLICANT LEASES THE PROPERTY – If NO, you are not eligible for a permit for this source.			
9. Type of plant or facility (stationary source) to be constructed, modified, relocated, administratively updated or temporarily permitted (e.g., coal preparation plant, primary crusher, etc.): 1389 - OIL AND GAS FIELD SERVICES, N.E.C.		10. North American Industry Classification System (NAICS) code for the facility: 213112 - SUPPORT ACTIVITIES FOR OIL AND GAS OPERATIONS	
11A. DAQ Plant ID No. (existing facilities): 103-00053		11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (existing facilities): GENERAL PERMIT G35-A087 – ISSUED 02/22/13	
12A. Directions to the facility: – For Modifications, Administrative Updates or Temporary permits at an existing facility, please provide directions to the <i>present location</i> of the facility from the nearest state road; – For Construction or Relocation permits , please provide directions to the <i>proposed new site location</i> from the nearest state road. Include a MAP as Attachment B . FROM WV-20/SHORTLINE HWY IN JACKSONBURG: A. HEAD WEST ON MAIN STREET ~ 0.1 MILES; B. TURN LEFT ONTO BUFALO RUN ROAD ~ 3.7 MILES; C. ENTRANCE TO SITE IS ON THE RIGHT.			
All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.			

12.B. New site address (if applicable): SEE ABOVE	12C. Nearest city or town: JACKSONBURG	12D. County: WETZEL
12.E. UTM Northing (KM): 4,371.06 KM NORTHING	12F. UTM Easting (KM): 531.51 KM EASTING	12G. UTM Zone: 17S
13. Briefly describe the proposed change(s) at the facility: THIS APPLICATION IS PREPARED AND SUBMITTED TO: <ul style="list-style-type: none"> • REDUCE THE 40 MMSCFD DEHYDRATOR 01 OFF-GAS CONTROL EFFICIENCY FROM 95% TO: <ul style="list-style-type: none"> - DEHYDRATOR FLASH TANK (DFT-01/5E) ≥ 50% RECYCLE OF OFFGAS; AND - DEHYDRATOR REGNERATOR/STILL VENT (DSV-01/6E) ≥ 95% CONTROL EFFICIENCY OF OFF-GAS. • IMPROVE AND UPDATE SEVERAL EMISSIONS ESTIMATING PROTOCOLS. 		
14A. Provide the date of anticipated installation or change: IMMEDIATELY UPON PERMIT ISSUANCE – If this is an After-The-Fact permit application, provide the date upon which the proposed change did happen: NA	14B. Date of anticipated Start-Up if a permit is granted: NA	
14C. Provide a Schedule of the planned Installation of/Change to and Start-Up of each of the units proposed in this permit application as Attachment C (if more than one unit is involved).		
15. Provide maximum projected Operating Schedule of activity/activities outlined in this application: Hours Per Day: 24 Days Per Week: 7 Weeks Per Year: 52		
16. Is demolition or physical renovation at an existing facility involved? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
17. Risk Management Plans. If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see www.epa.gov/ceppo), submit your Risk Management Plan (RMP) to U.S. EPA Region III.		
18. Regulatory Discussion. List all Federal and State air pollution control regulations that you believe are applicable to the proposed process (<i>if known</i>). A list of possible applicable requirements is also included in Attachment S of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance (<i>if known</i>). Provide this information as Attachment D .		

Section II. Additional attachments and supporting documents.

19. Include a check payable to WVDEP – Division of Air Quality with the appropriate application fee (per 45CSR22 and 45CSR13).
20. Include a Table of Contents as the first page of your application package.
21. Provide a Plot Plan , e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as Attachment E (Refer to Plot Plan Guidance). – Indicate the location of the nearest occupied structure (e.g. church, school, business, residence).
22. Provide a Detailed Process Flow Diagram(s) showing each proposed or modified emissions unit, emission point and control device as Attachment F .
23. Provide a Process Description as Attachment G . – Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).
24. Provide Material Safety Data Sheets (MSDS) for all materials processed, used or produced as Attachment H . – For chemical processes, provide a MSDS for each compound emitted to the air.
25. Fill out the Emission Units Table and provide it as Attachment I .
26. Fill out the Emission Points Data Summary Sheet (Table 1 and Table 2) and provide it as Attachment J .
27. Fill out the Fugitive Emissions Data Summary Sheet and provide it as Attachment K .
<i>All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.</i>

28. Check all applicable Emissions Unit Data Sheets listed below:

<input checked="" type="checkbox"/> Bulk Liquid Transfer (TLO/9E)	<input type="checkbox"/> Haul Road Emissions	<input type="checkbox"/> Quarry
<input type="checkbox"/> Chemical Processes	<input type="checkbox"/> Hot Mix Asphalt Plant	<input type="checkbox"/> Solid Materials Sizing, Handling and Storage Facilities
<input type="checkbox"/> Concrete Batch Plant	<input type="checkbox"/> Incinerator	<input checked="" type="checkbox"/> Storage Tanks (T-01/8E)
<input type="checkbox"/> Grey Iron and Steel Foundry	<input type="checkbox"/> Indirect Heat Exchanger	

General Emission Unit, specify:

- NATURAL GAS COMPRESSOR/GENERATOR ENGINE DATA SHEET (CE-01/1E AND CE-01/2E)
- COMPRESSOR ROD PACKING/ENGINE CRANKCASE EMISSIONS (RPC/3E)
- START/STOP/MAINTENANCE (BLOWDOWN) (SSM/4E)
- NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET (RFT-01/5E, RSV-01/6E, RBV-01/7E)
- FUGITIVE LEAK SOURCES (FUG-G/1F AND FUG-W/2F)

Fill out and provide the Emissions Unit Data Sheet(s) as **Attachment L**.

29. Check all applicable Air Pollution Control Device Sheets listed below:

<input type="checkbox"/> Absorption Systems	<input type="checkbox"/> Baghouse	<input type="checkbox"/> Flare
<input type="checkbox"/> Adsorption Systems	<input type="checkbox"/> Condenser	<input type="checkbox"/> Mechanical Collector
<input type="checkbox"/> Afterburner	<input type="checkbox"/> Electrostatic Precipitator	<input type="checkbox"/> Wet Collecting System

Other Collectors, specify: **OXIDATION CATALYST (01-OXCAT AND 02-OXCAT)
BTEX SKID (01-BTEX)**

Fill out and provide the Air Pollution Control Device Sheet(s) as **Attachment M**.

30. Provide all Supporting Emissions Calculations as Attachment N, or attach the calculations directly to the forms listed in Items 28 through 31.

31. Monitoring, Recordkeeping, Reporting and Testing Plans. Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as **Attachment O**.

➤ Please be aware that all permits must be practically enforceable whether or not the applicant chooses to propose such measures. Additionally, the DAQ may not be able to accept all measures proposed by the applicant. If none of these plans are proposed by the applicant, DAQ will develop such plans and include them in the permit.

32. Public Notice. At the time that the application is submitted, place a Class I Legal Advertisement in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and *Example Legal Advertisement* for details). Please submit the Affidavit of Publication as **Attachment P** immediately upon receipt.

33. Business Confidentiality Claims. Does this application include confidential information (per 45CSR31)?

YES NO

➤ **If YES**, identify each segment of information on each page that is submitted as confidential and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's "Precautionary Notice – Claims of Confidentiality" guidance found in the *General Instructions* as **Attachment Q**.

Section III. Certification of Information

34. Authority/Delegation of Authority. Only required when someone other than the responsible official signs the application. Check applicable Authority Form below: **NA**

<input type="checkbox"/> Authority of Corporation or Other Business Entity	<input type="checkbox"/> Authority of Partnership
<input type="checkbox"/> Authority of Governmental Agency	<input type="checkbox"/> Authority of Limited Partnership

Submit completed and signed Authority Form as Attachment R.

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

35A. Certification of Information. To certify this permit application, a Responsible Official (45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

Certification of Truth, Accuracy, and Completeness

I, the undersigned **Responsible Official** / **Authorized Representative**, hereby certify that all information contained in this application and any supporting documents appended hereto, is true, accurate, and complete based on information and belief after reasonable inquiry I further agree to assume responsibility for the construction, modification and/or relocation and operation of the stationary source described herein in accordance with this application and any amendments thereto, as well as the Department of Environmental Protection, Division of Air Quality permit issued in accordance with this application, along with all applicable rules and regulations of the West Virginia Division of Air Quality and W.Va. Code § 22-5-1 et seq. (State Air Pollution Control Act). If the business or agency changes its Responsible Official or Authorized Representative, the Director of the Division of Air Quality will be notified in writing within 30 days of the official change.

Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

SIGNATURE: Don Wicburg (Please use blue ink) DATE: 9/20/2015 (Please use blue ink)

35B. Printed name of signee: DON WICBURG	35C. Title: VICE PRESIDENT AND GENERAL MANAGER	
35D. E-mail: DON.WICBURG@WILLIAMS.COM	36E. Phone: (304) 843-3158	36F. FAX: (304) 843-3131
36A. Printed name of contact person: R. DANELL ZAWASKI, P.E.	36B. Title: ENVIRONMENTAL SPECIALIST	
36C. E-mail: DANELL.ZAWASKI@WILLIAMS.COM	36D. Phone: (412) 787-4259	36E. FAX: (412) 787-6002

PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:

<input checked="" type="checkbox"/> Attachment A: Business Certificate	<input checked="" type="checkbox"/> Attachment K: Fugitive Emissions Data Summary Sheet
<input checked="" type="checkbox"/> Attachment B: Map(s)	<input checked="" type="checkbox"/> Attachment L: Emissions Unit Data Sheet(s)
<input checked="" type="checkbox"/> Attachment C: Installation and Start Up Schedule	<input checked="" type="checkbox"/> Attachment M: Air Pollution Control Device Sheet(s)
<input checked="" type="checkbox"/> Attachment D: Regulatory Discussion	<input checked="" type="checkbox"/> Attachment N: Supporting Emissions Calculations
<input checked="" type="checkbox"/> Attachment E: Plot Plan	<input checked="" type="checkbox"/> Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans
<input checked="" type="checkbox"/> Attachment F: Detailed Process Flow Diagram(s)	<input checked="" type="checkbox"/> Attachment P: Public Notice
<input checked="" type="checkbox"/> Attachment G: Process Description	<input type="checkbox"/> Attachment Q: Business Confidential Claims) (NA)
<input checked="" type="checkbox"/> Attachment H: Material Safety Data Sheets (MSDS)	<input type="checkbox"/> Attachment R: Authority Forms) (NA)
<input checked="" type="checkbox"/> Attachment I: Emission Units Table	<input type="checkbox"/> Attachment S: Title V Permit Revision Information) (NA)
<input checked="" type="checkbox"/> Attachment J: Emission Points Data Summary Sheet	<input checked="" type="checkbox"/> Application Fee

Please mail an original and three (3) copies of the complete permit application with the signature(s) to the DAQ, Permitting Section, at the address listed on the first page of this application. Please DO NOT fax permit applications.

FOR AGENCY USE ONLY – IF THIS IS A TITLE V SOURCE:

Forward 1 copy of the application to the Title V Permitting Group and

For Title V Administrative Amendments:

NSR permit writer should notify Title V permit writer of draft permit

For Title V Minor Modifications:

Title V permit writer should send appropriate notification to EPA and affected states within 5 days of receipt,

NSR permit writer should notify Title V permit writer of draft permit.

For Title V Significant Modifications processed in parallel with NSR Permit revision:

NSR permit writer should notify a Title V permit writer of draft permit,

Public notice should reference both 45CSR13 and Title V permits,

EPA has 45 day review period of a draft permit.

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

ATTACHMENT A

Business Certificate

“6. **West Virginia Business Registration.** Provide a copy of the Certificate of Authority/Authority of L.L.C./Registration (one page) including any name change amendments or other Business Certificate as Attachment A.”

- **Certificate of Amendment to the Certificate of Authority**
 - From: CAIMAN EASTERN MIDSTREAM, LLC
 - To: WILLIAMS OHIO VALLEY MIDSTREAM LLC
 - Date: May 15, 2012

 - **Certificate of Authority of a Foreign Limited Liability Company**
 - To: CAIMAN EASTERN MIDSTREAM, LLC
 - Date: September 11, 2009
-

State of West Virginia



Certificate

*I, Natalie E. Tennant, Secretary of State of the
State of West Virginia, hereby certify that*

the attached true and exact copy of the Articles of Amendment to the Articles of Organization of

CAIMAN EASTERN MIDSTREAM, LLC

are filed in my office, signed and verified, as required by the provisions of West Virginia Code §31B-2-204 and conform to law. Therefore, I issue this

CERTIFICATE OF AMENDMENT TO THE CERTIFICATE OF AUTHORITY

changing the name of the limited liability company to

WILLIAMS OHIO VALLEY MIDSTREAM LLC



*Given under my hand and the
Great Seal of the State of
West Virginia on this day of
May 15, 2012*

Natalie E. Tennant

Secretary of State

State of West Virginia



Certificate

I, Natalie E. Tennant, Secretary of State of the State of West Virginia, hereby certify that

CAIMAN EASTERN MIDSTREAM, LLC

Control Number: 99GIS

a limited liability company, organized under the laws of the State of Texas has filed its "Application for Certificate of Authority" in my office according to the provisions of West Virginia Code §31B-10-1002. I hereby declare the organization to be registered as a foreign limited liability company from its effective date of September 11, 2009, until a certificate of cancellation is filed with our office.

Therefore, I hereby issue this

CERTIFICATE OF AUTHORITY OF A FOREIGN LIMITED LIABILITY COMPANY

to the limited liability company authorizing it to transact business in West Virginia

*Given under my hand and the
Great Seal of the State of
West Virginia on this day of
September 11, 2009*



Natalie E. Tennant

Secretary of State

ATTACHMENT B

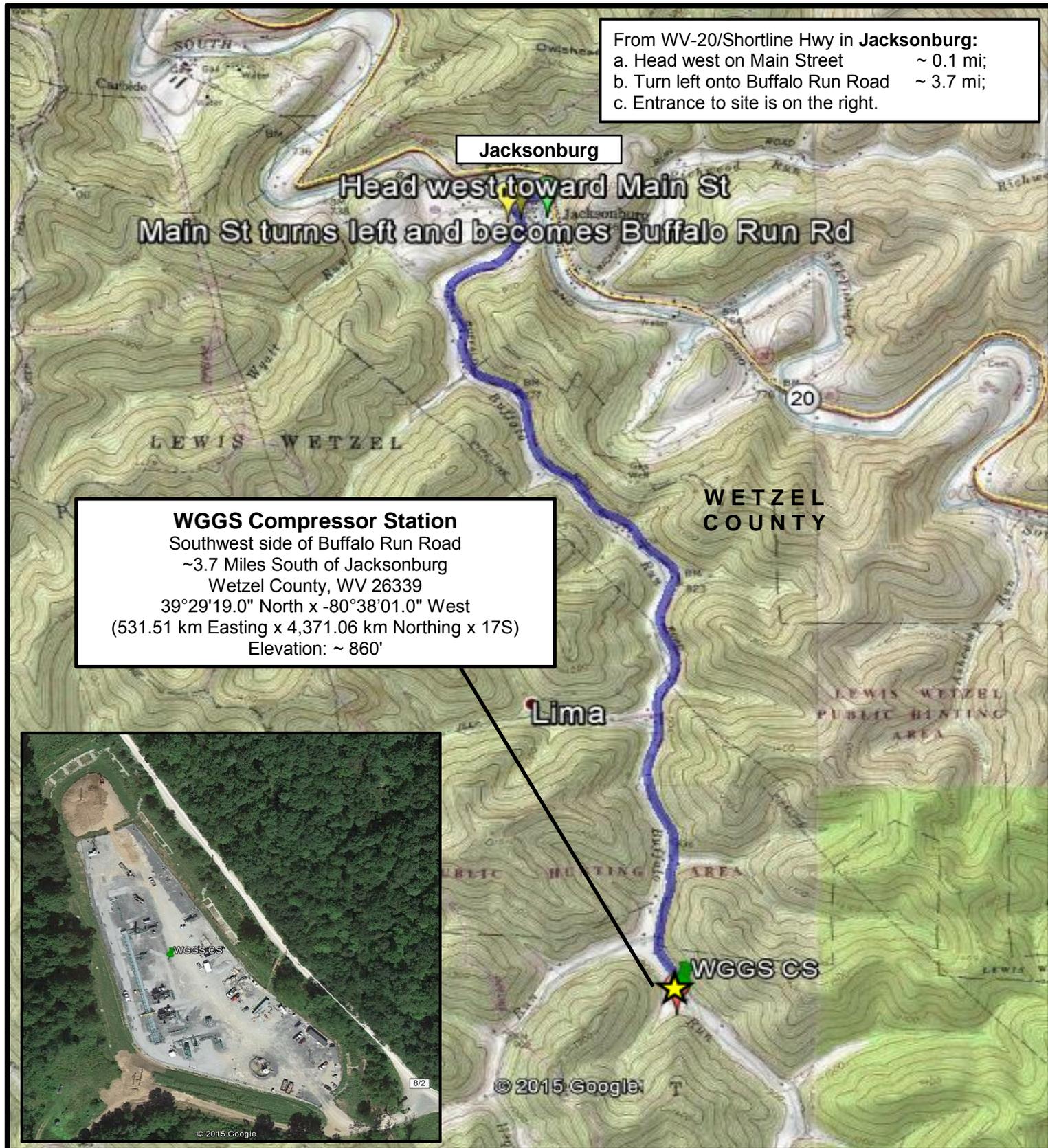
Map(s)

“12A. For **Modifications, Administrative Updates** or **Temporary** permits at an existing facility, please provide directions to the present location of the facility from the nearest state road. Include a MAP as Attachment B.”

- **Address:**
Southwest side of Buffalo Run Road
~3.7 Miles South of Jacksonburg
Wetzel County, WV 26339
 - **Latitude and Longitude:**
39°29'19.00" North x -80°38'01.00" West
(39.4886° North x -80.6336° West)
 - **UTM:**
531.51 km Easting x 4,371.06 km Northing x Zone 17S
 - **Elevation:**
~860'
 - **Directions:**
From WV-20/Shortline Hwy in **Jacksonburg:**
 - a. Head west on Main Street ~ 0.1 mi;
 - b. Turn left onto Buffalo Run Road ~ 3.7 mi;
 - c. Entrance to site is on the right.
 - **USGS:**
7.5" Topographic – Center Point - WV – 2014
-

Williams Ohio Valley Midstream LLC
WGG S COMPRESSOR STATION
Application for 45CSR NSR Modification Permit
Attachment B - Map(s)

Location/Topographic Map



ATTACHMENT C

Installation and Start-Up Schedule

“14C. Provide a **Schedule** of the planned **Installation** of/**Change** to and **Start-Up** of each of the units proposed in this permit application as Attachment C.”

This application for 45CSR13 NSR Modification Permit has been prepared and submitted to provide for the following proposed changes at the subject facility:

- Reduce the 40 MMscfd Dehydrator 01 Off-Gas Control Efficiency from 95% to:
 - Dehydrator-Flash Tank (DFT-01/5E) \geq 50% Recycle of Off-Gas; and
 - Dehydrator-Regenerator/Still Vent (DSV-01/6E) \geq 95% Control of Off-Gas.

Modifications will be implemented immediately upon permit issuance.

Williams Ohio Valley Midstream LLC

WGGS COMPRESSOR STATION

Application for 45CSR13 New Source Review (NSR) Modification Permit

ATTACHMENT D

Regulatory Discussion

“18. **Regulatory Discussion.** List all Federal and State air pollution control regulations that you believe are applicable to the proposed process (if known). Discuss applicability and proposed demonstration(s) of compliance (if known). Provide this information as Attachment D.”

- **Regulatory Discussion**
 - A. Applicability of New Source Review (NSR) Regulations
 - B. Applicability of Federal Regulations
 - C. Applicability of Source Aggregation
 - D. Applicability of State Regulations
-

Williams Ohio Valley Midstream LLC
WGGS COMPRESSOR STATION
Application for 45CSR13 NSR Modification Permit

Attachment D
REGULATORY DISCUSSION

A. Applicability of New Source Review (NSR) Regulations

The following New Source Review (NSR) regulations are potentially applicable to natural gas production facilities. Applicability to the Williams Ohio Valley Midstream LLC WGGS Compressor Station (“subject facility”) has been determined as follows:

1. Prevention of Significant Deterioration (PSD) [Not Applicable]

This rule does not apply. The subject facility is a “PSD Minor Source” for each regulated pollutant, as follows:

- NOx: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy
- CO: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy
- VOC: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy
- SO₂: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy
- PM_{10/2.5}: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy

2. Non-Attainment New Source Review (NNSR) [Not Applicable]

This rule does not apply. The subject facility location is designated as either “Maintenance” or “Attainment/Unclassified” for all criteria pollutants.

3. Major Source of Hazardous Air Pollutants (HAPs) [Not Applicable]

This rule does not apply. The subject facility qualifies as a “HAP Area Source” as follows:

- Each HAP: HAP Area Source with Controlled Individual HAP PTE < 10 tpy
- Total HAPs: HAP Area Source with Controlled Total of All HAPs PTE < 25 tpy

4. Title V Operating Permit (TVOP) [Not Applicable]

This rule does not apply. The subject facility qualifies as a “Title V Minor Source” as follows:

- NOx: Title V Natural Minor Source with Pre-Controlled PTE < 100 tpy
- CO: Title V Natural Minor Source with Pre-Controlled PTE < 100 tpy
- VOC: Title V Synthetic Minor Source with Controlled PTE < 100 tpy
- SO₂: Title V Natural Minor Source with Pre-Controlled PTE < 100 tpy
- PM_{10/2.5}: Title V Natural Minor Source with Pre-Controlled PTE < 100 tpy
- Each HAP: Title V Synthetic Minor Source with Controlled PTE < 10 tpy
- Total HAPs: Title V Synthetic Minor Source with Controlled PTE < 25 tpy

B. Applicability of Federal Regulations

The following federal regulations are potentially applicable to natural gas production facilities. Applicability to the subject facility has been determined as follows:

1. **NSPS A, General Provisions**

40CFR§60.1-§60.19

[Applicable]

This rule does apply to all sources subject to an NSPS (unless a specific provision is excluded within the source NSPS). Requirements include monitoring, recordkeeping and reporting.

2. **NSPS Dc, Steam Generating Units**

40CFR§60.40c-§60.48c

[Not Applicable]

This rule does not apply because there is no steam generating unit at the subject facility with a maximum design heat input capacity ≥ 10 MMBtu/hr and ≤ 100 MMBtu/hr (§60.40c(a)).

3. **NSPS Kb, Volatile Organic Liquid Storage Vessels**

40CFR§60.110b-§60.117b

[Not Applicable]

This rule does not apply because there is no tank used to store volatile organic liquids (VOL) with a design capacity ≥ 75 m³ (19,815 gal, 471.8 bbl) (§60.110b(a)).

4. **NSPS GG, Stationary Gas Turbines**

40CFR§60.330-§60.335

[Not Applicable]

This rule does not apply because there is no stationary gas turbine at the subject facility (§60.330).

5. **NSPS KKK, Leaks from Natural Gas Processing Plants**

40CFR§60.630-§60.636

[Not Applicable]

This rule does not apply because the subject facility is not a natural gas processing plant (§60.630(b)).

6. **NSPS LLL, Onshore Natural Gas Processing: SO₂ Emissions**

40CFR§60.640-§60.648

[Not Applicable]

This rule does not apply because there is no gas sweetening operation at the subject facility (§60.640(a)).

7. **NSPS IIII, Compression Ignition Reciprocating Internal Combustion Engines**

40CFR§60.4200-§60.4219

[Not Applicable]

This rule does not apply because there is no stationary compression ignition engine at the subject facility (§60.4200(a)).

8. NSPS JJJJ, Stationary Spark Ignition (SI) Internal Combustion Engines (ICE)

40CFR§60.4230-§60.4248

[Applicable]

This rule does apply to the 1,380 bhp Caterpillar G3516B compressor engines (CE-01/1E and CE-02/2E) because the maximum engine power is greater than 500 HP and each engine was manufactured on or after 07/01/07 (§60.4230(a)(4)(i)).

Requirements include NO_x, CO and VOC emission limits (§60.4233(e-f)); operating limits (§60.4243); performance testing (§60.4244); and notification and recordkeeping (§60.4245).

9. NSPS KKKK, Stationary Combustion Turbines

40CFR§60.4300-§60.4420

[Not Applicable]

This rule does not apply because there is no stationary combustion turbine at the (§60.4300).

10. NSPS OOOO, Crude Oil and Natural Gas Production

40CFR§60.5360-§60.5430

[Applicable]

This rule does apply to each reciprocating compressor driven by the CAT G3516B engines because the subject facility is located within the natural gas production segment and each compressor commenced construction after 08/23/11 (§60.5360 and §60.5365(c)).

Requirements include replacing rod packing systems on a specified schedule (§60.5385(a)) and monitoring, recordkeeping and reporting (§60.5410(c), §60.5415(c), §60.5420(b)).

This rule does not apply to the produced water storage vessel (tank) because the tank does not have the potential to emit VOC ≥ 6 tpy (§60.5420).

This rule does not apply to the group of all equipment, except compressors, within a process unit (§60.5365(f)).

This rule does not apply to the pneumatic controllers because their bleed rate is < 6 scfh, located between the wellhead and point of custody transfer, and not located at a natural gas processing plant (§60.5365(d)(i)).

11. NESHAP A, General Provisions

40CFR§63.1-§63.16

[Applicable]

This rule does apply to the 40.0 MMscfd Dehydrator 01 (DFT-01/5E and DSV-01/6E) because it is subject to NESHAP Subpart HH. Requirements include notification and recordkeeping.

12. NESHAP HH, Oil and Natural Gas Production Facilities

40CFR§63.760-§63.779

[Applicable]

This rule does apply to the 40.0 MMscfd Dehydrator 01 (DFT-01/5E and DSV-01/6E). However, because the TEG dehydrator has a benzene PTE < 0.9 megagrams per year (< 1.0 tpy), it is exempt from all requirements except to maintain records of actual annual average benzene emissions to demonstrate continuing exemption status (§63.764(e)(1)).

This rule does not apply to storage vessels (tanks), compressors, or ancillary equipment because the subject facility is an area source of HAP emissions (§63.760(b)(2)). In no case does this rule apply to engines or turbines.

13. NESHAP HHH, Natural Gas Transmission and Storage Facilities

40CFR§63.1270-§63.1289

[Not Applicable]

This rule does not apply because the subject facility is not a natural gas transmission or storage subject facility transporting or storing natural gas prior to local distribution (§63.1270(a)).

14. NESHAP YYYY, Stationary Combustion Turbines

40CFR§63.6080-§63.6175

[Not Applicable]

This rule does not apply because there is no stationary gas turbine at the subject facility (§63.6080).

15. NESHAP ZZZZ, Stationary Reciprocating Internal Combustion Engines (RICE)

40CFR§63.6580-§63.6675

[Applicable]

This rule does apply to the 1,380 bhp Caterpillar G3516B compressor engines (CE-01/1E and CE-02/2E); however, because they are “new”; i.e., commenced construction or reconstruction on or after 06/12/06 (§63.6590(a)(2)(iii)), the only requirement is compliance with 40CFR§60.4230-§60.4248 (NSPS JJJJ) for Spark Ignition Internal Combustion Engines.

16. NESHAP DDDDD, Industrial, Commercial, and Institutional Boilers and Process Heaters – Major Sources

40CFR§63.7480 – §63.7575

[Not Applicable]

This rule does not apply because the subject facility is not a major source of HAP (§63.7485).

17. NESHAP JJJJJJ, Industrial, Commercial, and Institutional Boilers and Process Heaters – Area Sources

40CFR§63.11193 – §63.11237

[Not Applicable]

This rule does not apply because gas-fired boilers are not subject to the requirements of this subpart (§63.11195(e)). Specifically, “boiler” is defined as an enclosed device using controlled flame combustion in which water is heated to recover thermal energy in the

form of steam and/or hot water.

18. Chemical Accident Prevention Provisions

40CFR§68.1-§68.220

[Not Applicable]

This rule does not apply because the subject facility does not store more than a threshold quantity of a regulated substance in a process (§68.115).

19. Compliance Assurance Monitoring (CAM)

40CFR§64.1-§64.10

[Not Applicable]

This rule does not apply because the subject facility is not major source that is required to obtain a part 70 or 71 (Title V) permit.

20. Mandatory Greenhouse Gases (GHG) Reporting

40CFR§98.1-§98.9

[Not Applicable]

This rule does not apply. The subject facility is not subject to a listed source category and the aggregate maximum heat input capacity is < 30 MMBtu/hr from all stationary fuel combustion sources combined (§98.2(a)).

C. Applicability of Source Aggregation

For New Source Review (NSR) and Title V permitting, the three-part regulatory criteria to determine whether emissions from two or more facilities should be aggregated and treated as a single source is whether the activities:

- i) Belong to the same industrial grouping; and
- ii) Are located on one or more contiguous or adjacent properties; and
- iii) Are under control of the same person (or persons under common control).

i) Same Industrial Grouping

The subject facility shares the same two-digit major SIC code of 13 as the upstream gas production wells and other Williams' facilities.

ii) Contiguous or Adjacent

The determination of whether two or more facilities are "contiguous" or "adjacent" is made on a case-by-case basis. This determination is proximity based, and it is important to focus on this criterion and whether two contiguous or adjacent facilities, considered as a single source, meet the common sense notion of a plant. The functional interrelationship of the two or more facilities is not a relevant inquiry in determining whether the facilities are "contiguous" or "adjacent."

Neither West Virginia nor federal regulations define the terms "contiguous" or "adjacent." It is clear, however, that the determination of whether two or more facilities are "contiguous" or "adjacent" is based on the plain meaning of the terms "adjacent" and "contiguous", which consider the physical distance between the facilities. The term contiguous is defined in the dictionary as being in actual contact; touching along a boundary or at a point. The term

adjacent” is defined in the dictionary as not distant, nearby, having a common endpoint or border.

The closest Williams-owned facility to the subject facility is the Dewhurst Dehydration Station, which is located approximately 1.1 miles to the South-Southeast. These two facilities do not meet the common sense definition of being “contiguous” with or “adjacent”.

The subject facility compresses and dehydrates gas produced from an upstream production well located in northern West Virginia. The subject facility is located on a parcel that is directly adjacent to a pre-existing upstream production wellpad operated by Trans Energy and Republic Energy.

The location of the subject facility was chosen because of suitable characteristics for construction and operation, such as the availability of a reasonably flat grade and accessibility for large trucks and equipment. Williams’ business model is to construct scalable capacity that contemplates additional production from multiple operators and the initial configuration is merely a foundation for additional opportunities in the area. The subject facility does not need to be located in the immediate vicinity of the upstream wells in order to operate properly. Had suitable land been available elsewhere, the subject facility could have been located farther from the upstream wells and could theoretically be moved farther from the wells without affecting operations. Therefore, despite the fact that the subject facility is located in close proximity to one or many upstream production sources, aggregation of the subject facility with upstream wells does not meet the common sense notion of a plant.

iii) Common Control

Williams OVM operates under its parent company The Williams Companies, Inc. (Williams) and is the sole operator of the subject facility. The closest Williams-operated facility to the subject facility is the Dewhurst Dehydration Station, located approximately 1.1 miles south-southeast. The Dewhurst Dehydration Station is not “contiguous” with or “adjacent” to the subject facility.

The production wells, including the Trans Energy wellpad, that send natural gas to the subject facility are owned and operated by other companies, which are unaffiliated with Williams. Williams has no ownership stake in the Trans Energy wellpad or in any production well or production company that may send natural gas to the subject facility.

Furthermore, neither Williams OVM, nor Williams, exercise operational control over any equipment owned or operated by any natural gas producer upstream of the subject facility. All employees at the subject facility are under the exclusive direction of Williams and are not under the control of any other entity. Similarly, Williams has no authority over employees of the production wells. These companies operate wholly independent of one another. No employees are expected to shuttle back and forth between the subject facility and any production well.

At this time, contracts are in place for the subject facility to process natural gas produced from multiple upstream production wells located throughout the region. As future commercial

opportunities are identified, the subject facility will potentially receive gas from other producers. Williams will not have ownership or control of any future wellhead facilities. The producers are, and will be responsible for, any decisions to produce or shut-in wellhead facilities and have no control over the equipment installed, owned, and operated by Williams. Similarly, Williams cannot control the installation or operation of any equipment located at a well site that may be considered an air contamination source.

For the reason above, it is clear that Williams does not have common control of any production wells, including the Trans Energy well.

Summary

The subject facility and the upstream production wells should not be aggregated and treated as a single source of emissions because the subject facility is not under common control with any of the upstream wells. Additionally, the subject facility and the upstream production wells, considered together, do not meet the common sense notion of a plant because the subject facility is expected to service multiple production wells and because the location of the facility was selected for reasons unrelated to the location of the production wells. Accordingly, the subject facility should not be aggregated with the upstream wells in determining major source or PSD status

D. Applicability of State Regulations

The following State regulations are potentially applicable to natural gas production facilities. Applicability to the facility has been determined as follows:

1. Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers

45CSR2

[Applicable]

This rule does apply, however, because the dehydrator reboiler (RBV-01/7E) has a maximum design heat input (MDHI) rating < 10 MMBtu/hr, the only requirement is to limit visible emissions to < 10% opacity during normal operations (§45-02-3.1). The reboiler combusts only natural gas which inherently conforms to the visible emission standards.

2. Prevent and Control the Discharge of Air Pollutants into the Open Air which Causes or Contributes to an Objectionable Odor or Odors

45CSR4

[Applicable]

This rule does apply and states that an objectionable odor is an odor that is deemed objectionable when in the opinion of a duly authorized representative of the Air Pollution Control Commission (Division of Air Quality), based upon their investigations and complaints, such odor is objectionable. No odors have been deemed objectionable.

3. Control of Air Pollution from Combustion of Refuse

45CSR6

[Not Applicable]

This rule does not apply because there is no refuse combustion performed at the subject facility.

- 4. Prevent and Control Air Pollution from the Emission of Sulfur Oxides**
45CSR10 [Not Applicable]
- This rule does not apply because each “fuel burning unit” at the subject facility has a Maximum Design Heat Input (MDHI) rating < 10 MMBtu/hr.
- 5. Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation**
45CSR13 [Applicable]
- This rule does apply. Williams OVM is applying for a 45CSR13 New Source Review Modification Permit and has published the required Class I legal advertisement notifying the public of this application to modify the existing permit; and paid the appropriate application fee.
- 6. Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants**
45CSR14 [Not Applicable]
- The rule does not apply because the subject facility is not a major source of air pollutants.
- 7. Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60**
45CSR16 [Applicable]
- The rule does apply to this source by reference to §40CFR60 Subparts JJJJ and OOOO. Williams OVM is subject to the notification, testing, monitoring, recordkeeping and reporting requirements of these Subparts.
- 8. Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contribute to Nonattainment**
45CSR19 [Not Applicable]
- This rule does not apply because the subject facility is a minor (or “deferred”) source of all regulated pollutants.
- 9. Regulation of Volatile Organic Compounds (VOC)**
45CSR21 [Not Applicable]
- This rule does not apply because the subject facility is not located in Putnam County, Kanawha County, Cabell County, Wayne County, or Wood County
- 10. Air Quality Management Fees Program**
45CSR22 [Applicable]
- This rule does apply. It establishes a program to collect fees for certificates to operate and for permits to construct, modify or relocate sources of air pollution.

11. Prevent and Control Emissions of Toxic Air Pollutants

45CSR27

[Not Applicable]

This rule does not apply because equipment used in the production and distribution of petroleum products is exempt, provided that the product contains no more than 5% benzene by weight (§45-22-2.4).

12. Air Pollution Emissions Banking and Trading

45CSR28

[Not Applicable]

This rule does not apply. The subject facility does not choose to participate in the voluntarily statewide air pollutant emissions trading program.

13. Emission Statements for VOC and NOX

45CSR29

[Not Applicable]

This rule does not apply because subject facility is not located in Putnam, Kanawha, Cabell, Wayne, Wood, or Greenbrier Counties (§45-29-1).

14. Requirements for Operating Permits

45CSR30

[Not Applicable]

This rule does not apply because the subject facility is a minor (or non-major or “deferred”) source of all regulated pollutants.

Pursuant to the authority granted in West Virginia 45CSR§30-3.2 and 45CSR§30A-3.1, the DAQ is extending the deferral, which was set to expire December 15, 2000, of non-major sources subject to West Virginia 45CSR30 (Title V Program) from the obligation to submit an operating permit application.

15. Emission Standards for Hazardous Air Pollutants (HAP)

45CSR34

[Applicable]

This rule does apply by reference to §40CFR63, Subparts HH and ZZZZ. Williams OVM is subject to the recordkeeping, monitoring, and testing required of these Subparts.

ATTACHMENT E

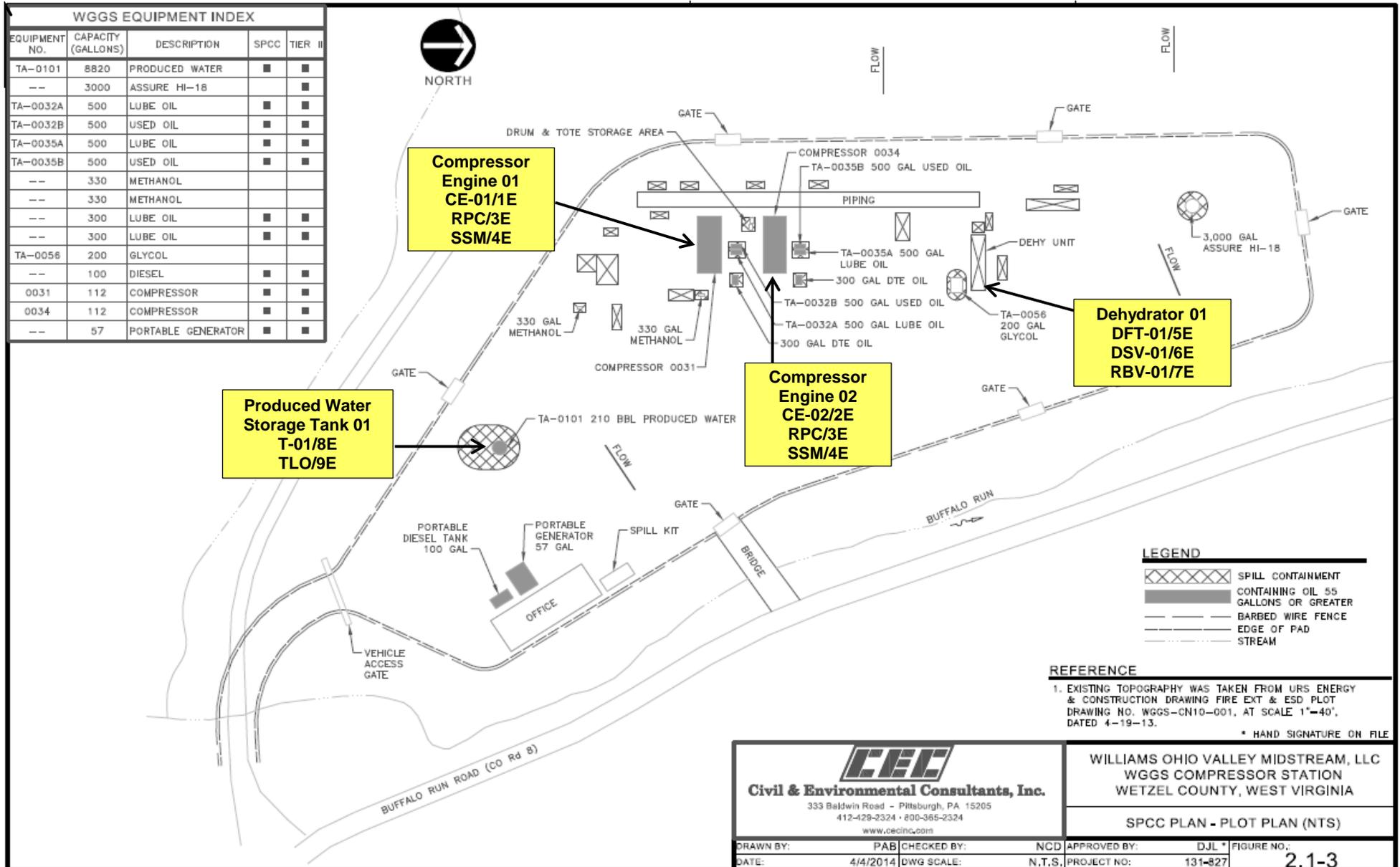
Plot Plan

“21. Provide a **Plot Plan**, e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as Attachment E.”

- **Plot Plan**
-

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Attachment E - Plot Plan(s)

Plot Plan



ATTACHMENT F

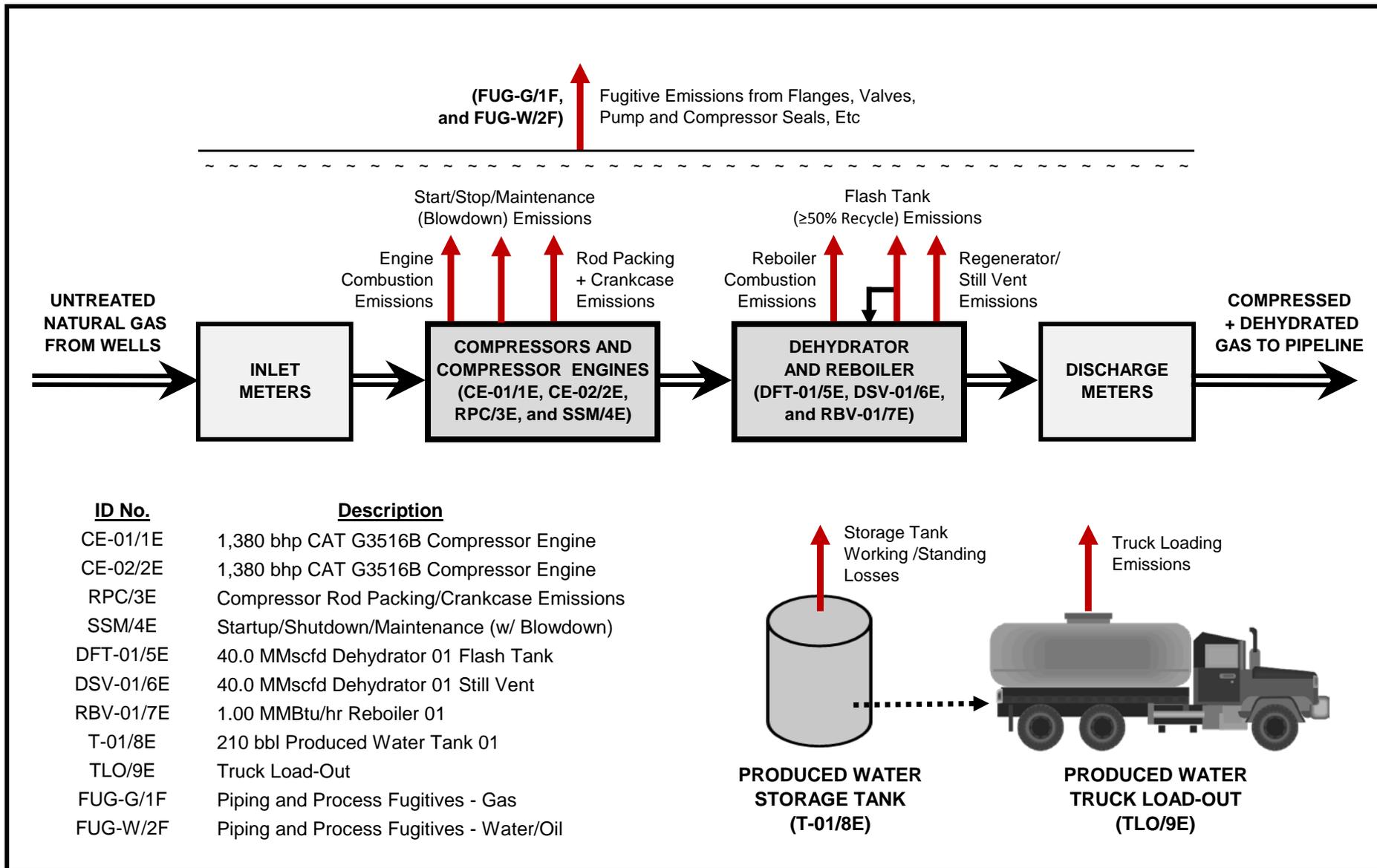
Detailed Process Flow Diagram

“22. Provide a **Detailed Process Flow Diagram(s)** showing each proposed or modified emissions unit, emission point and control device as Attachment F.”

- **Process Flow Diagram (PFD)**
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Williams Ohio Valley Midstream LLC
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 Attachment F - Detailed Process Flow Diagram

Process Flow Diagram (PFD)



ATTACHMENT G

Process Description

“23. Provide a **Process Description** as Attachment G. Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable). “

- **Process Description**

- A. Project Overview
 - B. Compressor Engine
 - C. Compressor Rod Packing and Crankcase Emissions
 - D. Startup/Shutdown/Maintenance (Blowdown)
 - E. Triethylene Glycol (TEG) Dehydrator – Flash Tank and Still Vent Dehydrator
 - F. Triethylene Glycol (TEG) Dehydrator – Reboiler
 - G. Storage Tanks
 - H. Truck Load-Out
 - I. Piping and Equipment Fugitive Emissions
-

Williams Ohio Valley Midstream LLC
WGGS COMPRESSOR STATION
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Attachment G
PROCESS DESCRIPTION

A. Project Overview

Williams Ohio Valley Midstream LLC owns and operates the existing Wetzel Gas Gathering System (WGGS) Compressor Station located on the southwest side of Buffalo Run Road, approximately 3.7 miles South of Jacksonburg, in Wetzel County (See Appendix B – Site Location Maps). The facility receives natural gas from local production wells then compresses and dehydrates the gas for delivery to a gathering pipeline.

This application for 45CSR13 NSR Modification Permit has been prepared and submitted to provide for the following proposed changes at the subject facility:

- Reduce the 40 MMscfd Dehydrator 01 Off-Gas Control Efficiency from 95% to:
 - Dehydrator-Flash Tank (DFT-01/5E) \geq 50% Recycle of Off-Gas; and
 - Dehydrator-Regenerator/Still Vent (DSV-01/6E) \geq 95% Control of Off-Gas.

B. Compressor Engines

Two (2) natural gas-fueled compressor engine are utilized at the facility. The lean-burn engines drive natural gas compressors to increase the pressure of the natural gas. Emissions result from the combustion of natural gas fuel.

C. Compressor Rod Packing and Crankcase Emissions

The compressor and engine operations result in emissions from the wear of mechanical joints, seals, and rotating surfaces over time.

D. Start/Stop/Maintenance (Blowdown)

During routine operation of the facility, the compressor engines will undergo periods of startup and shutdown. Often when an engine is shutdown, the natural gas contained within the compressor and associated piping is vented to atmosphere. Additionally, there will be other infrequent and (often) de-minimis emissions from various maintenance activities at the facility that are not necessarily associated with compressor blowdowns.

E. Dehydrator

One (1) dehydrator is utilized at the facility. The dehydrator is comprised of a contactor/absorber tower (no vented emissions), a flash tank, and a regenerator/still.

The dehydrator is used to remove water vapor from the inlet wet gas stream to meet pipeline specifications. In the dehydration process, the wet inlet gas stream flows through an absorber tower where the gas is contacted with lean glycol. The lean glycol absorbs the water in the gas stream and becomes rich glycol, laden with water and trace amounts of hydrocarbons.

The rich glycol is then sent to the flash tank where the pressure is reduced, thus liberating the lighter hydrocarbon, primarily methane, but also significant quantities of VOCs. A minimum of 50% of the flash tank offgas is recycled as fuel in the reboiler.

Following the flash tank, the rich glycol is then routed to the regenerator/still where it is boiled to drive off the water vapor and any remaining hydrocarbons. Once boiled, the glycol is returned to a lean state and used again in the process.

The off-gases from the regenerator/still are routed to a condenser (BTEX Skid) to remove the VOC prior to discharge to the environment. The manufacturer of the BTEX Skid shows a minimum of 95% VOC control efficiency.

F. Reboiler

A reboiler is utilized to supply heat for the regenerator/still. The reboiler is fueled by primarily by the flash tank off-gas, with supplemental natural gas as requisite.

G. Storage Tanks

There are tanks at the facility used to store various materials, including produced water, lube oil, fresh and spent TEG, etc. All of these tanks, except for the produced water storage tank, generate de-minimis (insignificant) emissions.

The produced water tank receives liquids from the dehydrator and inlet separator. Liquids removed through the dehydration process are cooled, condensed and sent to the 210 barrel atmospheric storage tank. The inlet separator removes produced fluids (primarily water) and these liquids are also sent to the 210 bbl atmospheric storage tank.

A ProMax simulation of a representative compressor station was completed to determine the presence of flash emissions from the storage tanks. The ProMax process simulation showed minimal tank flash emissions and these losses are included in the emission estimates.

H. Truck Load-Out

Loading of produced water into tanker trucks will produce small quantities of VOC emissions from the displacement of vapors inside the tanker trucks.

I. Piping and Equipment Fugitive Emissions

Piping and process equipment generate from leaks from different component types (connectors, valves, pumps, etc.) in gas-vapor service and water/oil service.

ATTACHMENT H
Material Safety Data Sheets (MSDS)
(And Representative Gas Analysis)

“24. Provide **Material Safety Data Sheets (MSDS)** for all materials processed, used or produced as Attachment H. For chemical processes, provide a MSDS for each compound emitted to the air.”

- **NATURAL GAS**
 - Inlet Gas - Certificate of Analysis
 - Extended Gas Analysis Summary

 - **MATERIAL SAFETY DATA SHEETS (MSDS):**
 - Natural Gas
 - Triethylene Glycol (TEG)
 - Produced Water/Condensate
-

Williams Ohio Valley Midstream LLC
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Attachment H - Gas Analysis

Inlet Natural Gas - Certificate of Analysis

Legacy Measurement Solutions
 Shreveport, LA
 318-226-7237

Good

Customer	: 2259 - WILLIAMS	Date Sampled	: 06/24/2014
Station ID	: 52223-50	Date Analyzed	: 07/03/2014
Cylinder ID	: w7081	Effective Date	: 07/01/2014
Producer	:	Cyl Pressure	: 935
Lease	: WGGG INTERCONNECT	Temp	: 96
Area	: 500 - OHIO VALLEY MID	Cylinder Type	: Spot
State	: WV	Sample By	: C

<u>COMPONENT</u>	<u>MOL%</u>	<u>GPM@14.73(PSIA)</u>	<u>WT%</u>
Oxygen	0.0000	0.000	0.000
Nitrogen	0.3945	0.000	0.601
Methane	87.9625	0.000	76.709
Carbon-Dioxide	0.1162	0.000	0.278
Ethane	8.2577	2.214	13.497
Propane	2.2945	0.634	5.500
Iso-Butane	0.2948	0.097	0.931
Normal-Butane	0.3939	0.124	1.245
Iso-Pentane	0.1087	0.040	0.426
Normal-Pentane	0.0685	0.025	0.269
2,2-Dimethylbutane	0.0055	0.002	0.026
2,3-Dimethylbutane/CycloC5	0.0062	0.002	0.029
2-methylpentane	0.0216	0.009	0.101
3-methylpentane	0.0137	0.006	0.064
Normal-Hexane	0.0182	0.008	0.085
2,2-Dimethylpentane	0.0005	0.000	0.003
Methylcyclopentane	0.0034	0.001	0.016
BENZENE	0.0000	0.000	0.000
3,3-Dimethylpentane	0.0000	0.000	0.000
CYCLOHEXANE	0.0023	0.001	0.011
2-Methylhexane	0.0084	0.004	0.046
2,3-Dimethylpentane	0.0016	0.001	0.009
3-Methylhexane	0.0062	0.003	0.034
1,t2-DMCYC5 / 2,2,4-TMC5	0.0000	0.000	0.000
1,t3-Dimethylcyclopentane	0.0000	0.000	0.000
N-Heptane	0.0057	0.003	0.031
METHYLCYCLOHEXANE	0.0045	0.002	0.024
2,5-Dimethylhexane	0.0000	0.000	0.000
2,3-Dimethylhexane	0.0000	0.000	0.000
TOLUENE	0.0012	0.000	0.006
2-Methylheptane	0.0017	0.001	0.011
4-Methylheptane	0.0013	0.001	0.008
3-Methylheptane	0.0014	0.001	0.009
1,t4-Dimethylcyclohexane	0.0000	0.000	0.000
N-OCTANE / 1,T2-DMCYC6	0.0018	0.001	0.011
1,t3-DMCYC6/1,C4-DMCYC6/1,C2,C3-TMCYC5	0.0000	0.000	0.000
2,4,4 TMC6	0.0000	0.000	0.000
2,6-Dimethylheptane / 1,C2-DMCYC6	0.0000	0.000	0.000
Ethylcyclohexane	0.0000	0.000	0.000
ETHYLBENZENE	0.0000	0.000	0.000
M-XYLENE	0.0013	0.001	0.008
P-XYLENE	0.0007	0.000	0.004
O-XYLENE	0.0000	0.000	0.000
NONANE	0.0010	0.001	0.007
N-DECANE	0.0005	0.000	0.004
N-UNDECANE	0.0000	0.000	0.000
TOTAL	100.0000	3.182	99.999

Williams Ohio Valley Midstream LLC
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Attachment H - Gas Analysis

Extended Gas Analysis Summary

Representative Gas Analysis - Sampled 06/27/14

Compound	CAS	Formula	Molecular Weight (MW)	Mole % (M% = V%)	Mole Fraction (M%/Sum-M%)	Weighted Sum (MW*MF)	Weight % (WS/Sum-WS)	lb/MMscf (WS/UGC#)
Water	109-86-4	H2O	18.02	---	---	---	---	---
Carbon Monoxide	630-08-0	CO	28.01	---	---	---	---	---
Nitrogen	7727-37-9	N2	28.01	0.3945	0.00394	0.1105	0.6006	291.21
Oxygen	7782-44-7	O2	32.00	---	---	---	---	---
Hydrogen Sulfide	2148-87-8	H2S	34.09	---	---	---	---	---
Carbon Dioxide	124-38-9	CO2	44.01	0.1162	0.00116	0.0511	0.2779	134.76
Methane*	75-82-8	CH4	16.04	87.9625	0.87961	14.1111	76.6962	37,185.08
Ethane*	74-84-0	C2H6	30.07	8.2577	0.08258	2.4830	13.4953	6,543.03
Propane**	74-98-6	C3H8	44.10	2.2945	0.02294	1.0118	5.4991	2,666.14
i-Butane**	75-28-5	C4H10	58.12	0.2948	0.00295	0.1713	0.9313	451.51
n-Butane**	106-97-8	C4H10	58.12	0.3939	0.003939	0.2289	1.2443	603.29
Cyclopentane**	287-92-3	C5H10	70.10	---	---	---	---	---
i-Pentane**	78-78-4	C5H12	72.15	0.1087	0.001087	0.0784	0.4262	206.66
n-Pentane**	109-66-0	C5H12	72.15	0.0685	0.000685	0.0494	0.2686	130.23
Cyclohexane**	110-82-7	C6H12	84.16	0.0057	0.000057	0.0048	0.0261	12.64
Other Hexanes**	110-54-3	C6H14	86.18	0.0470	0.000470	0.0405	0.2201	106.73
Methylcyclohexanes**	varies	C7H14	98.19	0.0045	0.000045	0.0044	0.0240	11.64
Heptanes**	varies	C7H16	100.20	0.0224	0.000224	0.0224	0.1220	59.15
C8+ Heavies**	varies	C8+	130.00 est	0.0077	0.000077	0.0100	0.0544	26.38
Benzene***	71-43-2	C6H6	78.11	0.0005	0.000005	0.0004	0.0021	1.03
Ethylbenzene***	100-41-4	C8H10	106.17	0.0005	0.000005	0.0005	0.0029	1.40
n-Hexane***	110-54-3	C6H14	86.18	0.0182	0.000182	0.0157	0.0852	41.33
Toluene***	108-88-3	C7H8	92.14	0.0012	0.000012	0.0011	0.0060	2.91
2,2,4-Trimethylpentane***	540-84-1	C8H18	114.23	0.0005	0.000005	0.0006	0.0031	1.51
Xylenes***	1330-20-7	C8H10	106.17	0.0025	0.000025	0.0027	0.0144	6.99

Total:	100.00	1.0000	18.40	100.00	48,484
THC:	99.49	0.9949	18.24	99.12	48,058
Total CH4:	87.96	0.8796	14.11	76.70	37,185
Total VOC:	3.27	0.0327	1.64	8.93	4,330
Total HAP:	0.02	0.0002	0.02	0.11	55

* = Hydrocarbon (HC) ** = also Volatile Organic Compound (EPA-VOC) *** = also Hazardous Air Pollutant (EPA-HAP)
 #UGC (Universal Gas Constant) = 379.482 scf/lb-mol @ 60 °F and 14.696 psia. Pound "X"/scf = M% of "X" * MW of "X" / UGC

To be conservative, the following "worst-case" values were assumed:

Compound	CAS	Formula	Representative Gas Analysis			Assumed "Worst-Case"		
			Mole %	Wgt %	lb/MMscf	Mole %	Wgt %	lb/MMscf
Nitrogen	7727-37-9	N2	0.3945	0.6006	291.2145	0.000	0.000	0.00
Carbon Dioxide	124-38-9	CO2	0.1162	0.2779	134.76	0.172	0.413	200.00
Methane*	75-82-8	CH4	87.9625	76.6962	37,185.08	100.000	100.000	42,275.00
Ethane*	74-98-6	C2H6	8.2577	13.4953	6,543.03	0.000	0.000	0.00
VOC**	Various	C3 thru C10+	3.2711	8.9299	4,329.55	3.929	10.725	5,200.00
Benzene***	71-43-2	C6H6	0.0005	0.0021	1.03	0.0024	0.010	5.00
Ethylbenzene***	100-41-4	C8H10	0.0005	0.0029	1.40	0.0018	0.010	5.00
n-Hexane***	110-54-3	C6H14	0.0182	0.0852	41.33	0.0220	0.103	50.00
Toluene***	108-88-3	C7H8	0.0012	0.0060	2.91	0.0021	0.010	5.00
2,2,4-Trimethylpentane***	540-84-1	C8H18	0.0005	0.0031	1.51	0.0017	0.010	5.00
Xylenes***	1330-20-7	C8H10	0.0025	0.0144	6.99	0.0036	0.021	10.00
Total HAP***	Various	C6 thru C8	0.0234	0.1138	55.17	0.0339	0.165	80.00



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Version: 1.0

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY

Product Identifier

Product Form: Mixture

Product Name: Wellhead Natural Gas

Synonyms: Wellhead Gas, Raw Gas, Methane, Residue Gas, Natural Gas Sweet, Marsh Gas, Fuel Gas, Petroleum Gas.

Intended Use of the Product

Use of the Substance/Mixture: Fuel.

Name, Address, and Telephone of the Responsible Party

Company

Williams, Inc.

One Williams Center

Tulsa, OK 74172, US

T 800-688-7507

enterpriseehs@williams.com

Emergency Telephone Number

Emergency number : 800-424-9300

SECTION 2: HAZARDS IDENTIFICATION

Classification of the Substance or Mixture

Classification (GHS-US)

Simple Asphy

Flam. Gas 1 H220

Compressed gas H280

Label Elements

GHS-US Labeling

Hazard Pictograms (GHS-US)



Signal Word (GHS-US)

: Danger

Hazard Statements (GHS-US)

: H220 - Extremely flammable gas
H280 - Contains gas under pressure; may explode if heated
May displace oxygen and cause rapid suffocation

Precautionary Statements (GHS-US)

: P210 - Keep away from heat, sparks, open flames, hot surfaces. - No smoking.
P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 - Eliminate all ignition sources if safe to do so.
P403 - Store in a well-ventilated place.
P410+P403 - Protect from sunlight. Store in a well-ventilated place.

Other Hazards

Other Hazards Not Contributing to the Classification: Contains hydrogen sulfide. Hydrogen sulfide is a highly flammable, explosive gas under certain conditions, is a toxic gas, and may be fatal. Gas can accumulate in the headspace of closed containers, use caution when opening sealed containers. Heating the product or containers can cause thermal decomposition of the product and release hydrogen sulfide. Exposure may aggravate those with pre existing eye, skin, or respiratory conditions.

Unknown Acute Toxicity (GHS-US) Not available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Mixture

Name	Product identifier	% (w/w)	Classification (GHS-US)
Methane	(CAS No) 74-82-8	> 75	Simple Asphy

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			Flam. Gas 1, H220 Liquefied gas, H280
Ethane	(CAS No) 74-84-0	< 20	Simple Asphy Flam. Gas 1, H220 Liquefied gas, H280
Propane	(CAS No) 74-98-6	< 10	Simple Asphy Flam. Gas 1, H220 Liquefied gas, H280
Carbon dioxide	(CAS No) 124-38-9	< 10	Simple Asphy Compressed gas, H280
Butane	(CAS No) 106-97-8	< 5	Simple Asphy Flam. Gas 1, H220 Liquefied gas, H280
Nitrogen	(CAS No) 7727-37-9	< 5	Simple Asphy Compressed gas, H280
Hydrogen sulfide	(CAS No) 7783-06-4	<= 0.0004	Flam. Gas 1, H220 Liquefied gas, H280 Acute Tox. 2 (Inhalation:gas), H330 Aquatic Acute 1, H400

Full text of H-phrases: see section 16

SECTION 4: FIRST AID MEASURES

Description of First Aid Measures

General: Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible). If frostbite or freezing occurs, immediately flush with plenty of lukewarm water to GENTLY warm the affected area. Do not use hot water. Do not rub affected area. Get immediate medical attention.

Inhalation: When symptoms occur: go into open air and ventilate suspected area. Remove to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER/doctor/physician if you feel unwell

Skin Contact: Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical attention if irritation persists. Thaw frosted parts with lukewarm water. Do not rub affected area.

Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention if irritation persists

Ingestion: Rinse mouth. Do NOT induce vomiting. Get immediate medical attention.

Most Important Symptoms and Effects Both Acute and Delayed

General: May cause frostbite on contact with the liquid. Butane is an asphyxiant. Lack of oxygen can be fatal

Inhalation: Gas can be toxic as a simple asphyxiant by displacing oxygen from the air. Asphyxia by lack of oxygen: risk of death. May cause drowsiness or dizziness

Skin Contact: Contact with the liquid may cause cold burns/frostbite

Eye Contact: This gas is non-irritating; but direct contact with liquefied/pressurized gas or frost particles may produce severe and possibly permanent eye damage from freeze burns

Ingestion: Ingestion is not considered a potential route of exposure. Non-irritating; but solid and liquid forms of this material and pressurized gas may cause freeze burns.

Chronic Symptoms: Contains a small amount of Hydrogen Sulfide, symptoms of overexposure are headaches, dizziness, nausea, coughing, respiratory irritation, eye irritation, skin irritation, pain in the nose, and loss of consciousness. Heating of the product may release higher amounts of Hydrogen Sulfide (H₂S).

Indication of Any Immediate Medical Attention and Special Treatment Needed

If exposed or concerned, get medical advice and attention.

SECTION 5: FIREFIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media: Foam, dry chemical, carbon dioxide, water spray, fog

Unsuitable Extinguishing Media: Do not use a heavy water stream. Use of heavy stream of water may spread fire

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Special Hazards Arising From the Substance or Mixture

Fire Hazard: Extremely flammable gas

Explosion Hazard: May form flammable/explosive vapor-air mixture. Heating may cause an explosion. Heat may build pressure, rupturing closed containers, spreading fire and increasing risk of burns and injuries.

Reactivity: Hazardous reactions will not occur under normal conditions.

Advice for Firefighters

Precautionary Measures Fire: Exercise caution when fighting any chemical fire

Firefighting Instructions: Leaking gas fire: Do not extinguish, unless leak can be stopped safely. In case of leaking gas fire, eliminate all ignition sources if safe to do so. Use water spray or fog for cooling exposed containers. In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.

Protection During Firefighting: Do not enter fire area without proper protective equipment, including respiratory protection.

Hazardous Combustion Products: Carbon oxides (CO, CO₂). Hydrocarbon, sulfur dioxide (SO₂), and Hydrogen sulfide (H₂S) fatal and irritating gases

Other information: Do not allow run-off from fire fighting to enter drains or water courses

Reference to Other Sections

Refer to section 9 for flammability properties.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

General Measures: Use special care to avoid static electric charges. Eliminate every possible source of ignition. Keep away from heat/sparks/open flames/hot surfaces - No smoking. Avoid breathing (dust, vapor, mist, gas). Use only outdoors or in a well-ventilated area. Ruptured cylinders may rocket. Do not allow product to spread into the environment

For Non-Emergency Personnel

Protective Equipment: Use appropriate personal protection equipment (PPE).

Emergency Procedures: Evacuate unnecessary personnel.

For Emergency Personnel

Protective Equipment: Equip cleanup crew with proper protection.

Emergency Procedures: Ventilate area.

Environmental Precautions

Prevent entry to sewers and public waters. Avoid release to the environment

Methods and Material for Containment and Cleaning Up

For Containment: Notify authorities if liquid enters sewers or public waters. Use only non-sparking tools

Methods for Cleaning Up: Clear up spills immediately and dispose of waste safely. Isolate area until gas has dispersed. Use water spray to disperse vapors. For water based spills contact appropriate authorities and abide by local regulations for hydrocarbon spills into waterways. Contact competent authorities after a spill

Reference to Other Sections

See heading 8, Exposure Controls and Personal Protection.

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling

Additional Hazards When Processed: Handle empty containers with care because residual vapors are flammable. Extremely flammable gas. Do not pressurize, cut, or weld containers. Do not puncture or incinerate container. Liquid gas can cause frost-type burns. If stored under heat for extended periods or significantly agitated, this material might evolve or release hydrogen sulfide, a toxic, flammable gas, which can raise and widen this material's actual flammability limits and significantly lower its auto-ignition temperature. Hydrogen sulfide can be fatal.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety procedures. Wash hands and other exposed areas with mild soap and water before eating, drinking, or smoking and again when leaving work. Do not eat, drink or smoke when using this product

Technical Measures: Proper grounding procedures to avoid static electricity should be followed. Comply with applicable regulations.

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Storage Conditions: Store in a dry, cool and well-ventilated place. Keep container closed when not in use. Keep in fireproof place. Store in a well-ventilated place. Keep container tightly closed. Keep/Store away from extremely high or low temperatures, ignition sources, direct sunlight, incompatible materials. Store in original container.

Incompatible Materials: strong acids, Strong bases, Strong oxidizers, chlorine, Halogenated compounds

Conditions for Safe Storage, Including Any Incompatibilities Not available

Specific End Use(s)

Fuel.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

Hydrogen sulfide (7783-06-4)		
USA ACGIH	ACGIH TWA (ppm)	1 ppm
USA ACGIH	ACGIH STEL (ppm)	5 ppm
USA OSHA	OSHA PEL (Ceiling) (ppm)	20 ppm
USA NIOSH	NIOSH REL (ceiling) (mg/m ³)	15 mg/m ³
USA NIOSH	NIOSH REL (ceiling) (ppm)	10 ppm
USA IDLH	US IDLH (ppm)	100 ppm
Alberta	OEL Ceiling (mg/m ³)	21 mg/m ³
Alberta	OEL Ceiling (ppm)	15 ppm
Alberta	OEL TWA (mg/m ³)	14 mg/m ³
Alberta	OEL TWA (ppm)	10 ppm
British Columbia	OEL Ceiling (ppm)	10 ppm
Manitoba	OEL STEL (ppm)	5 ppm
Manitoba	OEL TWA (ppm)	1 ppm
New Brunswick	OEL STEL (mg/m ³)	21 mg/m ³
New Brunswick	OEL STEL (ppm)	15 ppm
New Brunswick	OEL TWA (mg/m ³)	14 mg/m ³
New Brunswick	OEL TWA (ppm)	10 ppm
Newfoundland & Labrador	OEL STEL (ppm)	5 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1 ppm
Nova Scotia	OEL STEL (ppm)	5 ppm
Nova Scotia	OEL TWA (ppm)	1 ppm
Nunavut	OEL Ceiling (mg/m ³)	28 mg/m ³
Nunavut	OEL Ceiling (ppm)	20 ppm
Nunavut	OEL STEL (mg/m ³)	21 mg/m ³
Nunavut	OEL STEL (ppm)	15 ppm
Nunavut	OEL TWA (mg/m ³)	14 mg/m ³
Nunavut	OEL TWA (ppm)	10 ppm
Northwest Territories	OEL Ceiling (mg/m ³)	28 mg/m ³
Northwest Territories	OEL Ceiling (ppm)	20 ppm
Northwest Territories	OEL STEL (mg/m ³)	21 mg/m ³
Northwest Territories	OEL STEL (ppm)	15 ppm
Northwest Territories	OEL TWA (mg/m ³)	14 mg/m ³
Northwest Territories	OEL TWA (ppm)	10 ppm
Ontario	OEL STEL (ppm)	15 ppm
Ontario	OEL TWA (ppm)	10 ppm
Prince Edward Island	OEL STEL (ppm)	5 ppm
Prince Edward Island	OEL TWA (ppm)	1 ppm
Québec	VECD (mg/m ³)	21 mg/m ³
Québec	VECD (ppm)	15 ppm

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Québec	VEMP (mg/m ³)	14 mg/m ³
Québec	VEMP (ppm)	10 ppm
Saskatchewan	OEL STEL (ppm)	15 ppm
Saskatchewan	OEL TWA (ppm)	10 ppm
Yukon	OEL STEL (mg/m ³)	27 mg/m ³
Yukon	OEL STEL (ppm)	15 ppm
Yukon	OEL TWA (mg/m ³)	15 mg/m ³
Yukon	OEL TWA (ppm)	10 ppm

Propane (74-98-6)

USA ACGIH	ACGIH TWA (ppm)	1000 ppm
USA OSHA	OSHA PEL (TWA) (mg/m ³)	1800 mg/m ³
USA OSHA	OSHA PEL (TWA) (ppm)	1000 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	1800 mg/m ³
USA NIOSH	NIOSH REL (TWA) (ppm)	1000 ppm
USA IDLH	US IDLH (ppm)	2100 ppm (10% LEL)
Alberta	OEL TWA (ppm)	1000 ppm
British Columbia	OEL TWA (ppm)	1000 ppm
Manitoba	OEL TWA (ppm)	1000 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1000 ppm
Nova Scotia	OEL TWA (ppm)	1000 ppm
Ontario	OEL TWA (ppm)	1000 ppm
Prince Edward Island	OEL TWA (ppm)	1000 ppm
Québec	VEMP (mg/m ³)	1800 mg/m ³
Québec	VEMP (ppm)	1000 ppm
Saskatchewan	OEL STEL (ppm)	1250 ppm
Saskatchewan	OEL TWA (ppm)	1000 ppm

Butane (106-97-8)

USA ACGIH	ACGIH TWA (ppm)	1000 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	1900 mg/m ³
USA NIOSH	NIOSH REL (TWA) (ppm)	800 ppm
Alberta	OEL TWA (ppm)	1000 ppm
British Columbia	OEL STEL (ppm)	750 ppm
British Columbia	OEL TWA (ppm)	600 ppm
Manitoba	OEL TWA (ppm)	1000 ppm
New Brunswick	OEL TWA (mg/m ³)	1900 mg/m ³
New Brunswick	OEL TWA (ppm)	800 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1000 ppm
Nova Scotia	OEL TWA (ppm)	1000 ppm
Nunavut	OEL STEL (mg/m ³)	2576 mg/m ³
Nunavut	OEL STEL (ppm)	1000 ppm
Nunavut	OEL TWA (mg/m ³)	1901 mg/m ³
Nunavut	OEL TWA (ppm)	800 ppm
Northwest Territories	OEL STEL (mg/m ³)	2576 mg/m ³
Northwest Territories	OEL STEL (ppm)	1000 ppm
Northwest Territories	OEL TWA (mg/m ³)	1901 mg/m ³
Northwest Territories	OEL TWA (ppm)	800 ppm
Ontario	OEL TWA (ppm)	800 ppm
Prince Edward Island	OEL TWA (ppm)	1000 ppm
Québec	VEMP (mg/m ³)	1900 mg/m ³

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Québec	VEMP (ppm)	800 ppm
Saskatchewan	OEL STEL (ppm)	1250 ppm
Saskatchewan	OEL TWA (ppm)	1000 ppm
Yukon	OEL STEL (mg/m ³)	1600 mg/m ³
Yukon	OEL STEL (ppm)	750 ppm
Yukon	OEL TWA (mg/m ³)	1400 mg/m ³
Yukon	OEL TWA (ppm)	600 ppm
Carbon dioxide (124-38-9)		
USA ACGIH	ACGIH TWA (ppm)	5000 ppm
USA ACGIH	ACGIH STEL (ppm)	30000 ppm
USA OSHA	OSHA PEL (TWA) (mg/m ³)	9000 mg/m ³
USA OSHA	OSHA PEL (TWA) (ppm)	5000 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	9000 mg/m ³
USA NIOSH	NIOSH REL (TWA) (ppm)	5000 ppm
USA NIOSH	NIOSH REL (STEL) (mg/m ³)	54000 mg/m ³
USA NIOSH	NIOSH REL (STEL) (ppm)	30000 ppm
USA IDLH	US IDLH (ppm)	40000 ppm
Alberta	OEL STEL (mg/m ³)	54000 mg/m ³
Alberta	OEL STEL (ppm)	30000 ppm
Alberta	OEL TWA (mg/m ³)	9000 mg/m ³
Alberta	OEL TWA (ppm)	5000 ppm
British Columbia	OEL STEL (ppm)	15000 ppm
British Columbia	OEL TWA (ppm)	5000 ppm
Manitoba	OEL STEL (ppm)	30000 ppm
Manitoba	OEL TWA (ppm)	5000 ppm
New Brunswick	OEL STEL (mg/m ³)	54000 mg/m ³
New Brunswick	OEL STEL (ppm)	30000 ppm
New Brunswick	OEL TWA (mg/m ³)	9000 mg/m ³
New Brunswick	OEL TWA (ppm)	5000 ppm
Newfoundland & Labrador	OEL STEL (ppm)	30000 ppm
Newfoundland & Labrador	OEL TWA (ppm)	5000 ppm
Nova Scotia	OEL STEL (ppm)	30000 ppm
Nova Scotia	OEL TWA (ppm)	5000 ppm
Nunavut	OEL STEL (mg/m ³)	27000 mg/m ³
Nunavut	OEL STEL (ppm)	15000 ppm
Nunavut	OEL TWA (mg/m ³)	9000 mg/m ³
Nunavut	OEL TWA (ppm)	5000 ppm
Northwest Territories	OEL STEL (mg/m ³)	27000 mg/m ³
Northwest Territories	OEL STEL (ppm)	15000 ppm
Northwest Territories	OEL TWA (mg/m ³)	9000 mg/m ³
Northwest Territories	OEL TWA (ppm)	5000 ppm
Ontario	OEL STEL (ppm)	30000 ppm
Ontario	OEL TWA (ppm)	5000 ppm
Prince Edward Island	OEL STEL (ppm)	30000 ppm
Prince Edward Island	OEL TWA (ppm)	5000 ppm
Québec	VECD (mg/m ³)	54000 mg/m ³
Québec	VECD (ppm)	30000 ppm
Québec	VEMP (mg/m ³)	9000 mg/m ³
Québec	VEMP (ppm)	5000 ppm
Saskatchewan	OEL STEL (ppm)	30000 ppm

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Saskatchewan	OEL TWA (ppm)	5000 ppm
Yukon	OEL STEL (mg/m ³)	27000 mg/m ³
Yukon	OEL STEL (ppm)	15000 ppm
Yukon	OEL TWA (mg/m ³)	9000 mg/m ³
Yukon	OEL TWA (ppm)	5000 ppm
Nitrogen (7727-37-9)		
Methane (74-82-8)		
USA ACGIH	ACGIH TWA (ppm)	1000 ppm
British Columbia	OEL TWA (ppm)	1000 ppm
Manitoba	OEL TWA (ppm)	1000 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1000 ppm
Nova Scotia	OEL TWA (ppm)	1000 ppm
Ontario	OEL TWA (ppm)	1000 ppm
Prince Edward Island	OEL TWA (ppm)	1000 ppm
Saskatchewan	OEL STEL (ppm)	1250 ppm
Saskatchewan	OEL TWA (ppm)	1000 ppm
Ethane (74-84-0)		
USA ACGIH	ACGIH TWA (ppm)	1000 ppm
Alberta	OEL TWA (ppm)	1000 ppm
British Columbia	OEL TWA (ppm)	1000 ppm
Manitoba	OEL TWA (ppm)	1000 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1000 ppm
Nova Scotia	OEL TWA (ppm)	1000 ppm
Ontario	OEL TWA (ppm)	1000 ppm
Prince Edward Island	OEL TWA (ppm)	1000 ppm
Saskatchewan	OEL STEL (ppm)	1250 ppm
Saskatchewan	OEL TWA (ppm)	1000 ppm

Exposure Controls

Appropriate Engineering Controls: Gas detectors should be used when flammable gases/vapours may be released. Ensure adequate ventilation, especially in confined areas. Proper grounding procedures to avoid static electricity should be followed. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Use explosion-proof equipment

Personal Protective Equipment: Protective goggles. Protective clothing. Respiratory protection of the dependent type. Insulated gloves



Materials for Protective Clothing: Chemically resistant materials and fabrics. Wear fire/flammable resistant/retardant clothing

Hand Protection: Wear chemically resistant protective gloves. Insulated gloves

Eye Protection: Chemical goggles or face shield.

Skin and Body Protection: Not available

Respiratory Protection: Use a NIOSH-approved self-contained breathing apparatus whenever exposure may exceed established Occupational Exposure Limits.

Thermal Hazard Protection: Wear suitable protective clothing.

Other Information: When using, do not eat, drink or smoke.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Information on Basic Physical and Chemical Properties

Physical State : Gas

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Appearance	: Clear, Colorless gas
Odor	: Contains Ethyl Mercaptan for leak detection, which has a skunk-like odor, odorless.
Odor Threshold	: Not available
pH	: Not available
Relative Evaporation Rate (butylacetate=1)	: Not available
Melting Point	: Not available
Freezing Point	: Not available
Boiling Point	: -157 °C (-250.6°F)
Flash Point	: -187 °C (-304.6°F)
Auto-ignition Temperature	: > 288 °C (>550.4°F)
Decomposition Temperature	: Not available
Flammability (solid, gas)	: Extremely flammable gas
Lower Flammable Limit	: 3 %
Upper Flammable Limit	: 17 %
Vapor Pressure	: 40 mm Hg @25°C (77°F)
Relative Vapor Density at 20 °C	: 0.6
Relative Density	: Not available
Specific Gravity	: Not available
Solubility	: Not available
Log Pow	: Not available
Log Kow	: Not available
Viscosity, Kinematic	: Not available
Viscosity, Dynamic	: Not available
Explosion Data – Sensitivity to Mechanical Impact	: Not available
Explosion Data – Sensitivity to Static Discharge	: Not available

SECTION 10: STABILITY AND REACTIVITY

Reactivity: Hazardous reactions will not occur under normal conditions.

Chemical Stability: Extremely flammable gas. Stable at standard temperature and pressure.

Possibility of Hazardous Reactions: Hazardous polymerization will not occur.

Conditions to Avoid: Direct sunlight. Extremely high or low temperatures. Open flame. Overheating. Heat. Sparks. Incompatible materials. Avoid ignition sources

Incompatible Materials: Strong acids. Strong bases. Strong oxidizers. Halogenated compounds. Chlorine

Hazardous Decomposition Products: Carbon oxides (CO, CO₂). hydrocarbons. Sulfur dioxide and hydrogen sulfide are fatal and irritating gases.

SECTION 11: TOXICOLOGICAL INFORMATION

Information on Toxicological Effects - Product

Acute Toxicity : Not classified

LD50 and LC50 Data Not available

Skin Corrosion/Irritation: Not classified

Serious Eye Damage/Irritation: Not classified

Respiratory or Skin Sensitization: Not classified

Germ Cell Mutagenicity: Not classified

Teratogenicity: Not available

Carcinogenicity: Not classified

Specific Target Organ Toxicity (Repeated Exposure): Not classified

Reproductive Toxicity: Not classified

Specific Target Organ Toxicity (Single Exposure): Not classified

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Aspiration Hazard: Not classified

Symptoms/Injuries After Inhalation: Gas can be toxic as a simple asphyxiant by displacing oxygen from the air. Asphyxia by lack of oxygen: risk of death. May cause drowsiness or dizziness.

Symptoms/Injuries After Skin Contact: Contact with the liquid may cause cold burns/frostbite.

Symptoms/Injuries After Eye Contact: This gas is non-irritating; but direct contact with liquefied/pressurized gas or frost particles may produce severe and possibly permanent eye damage from freeze burns.

Symptoms/Injuries After Ingestion: Ingestion is not considered a potential route of exposure. Non-irritating; but solid and liquid forms of this material and pressurized gas may cause freeze burns.

Information on Toxicological Effects - Ingredient(s)

LD50 and LC50 Data

Hydrogen sulfide (7783-06-4)	
LC50 Inhalation Rat (mg/l)	0.99 mg/l (Exposure time: 1 h)
ATE (gases)	100.000 ppmV/4h
Propane (74-98-6)	
LC50 Inhalation Rat (mg/l)	658 mg/l (Exposure time: 4 h)
Butane (106-97-8)	
LC50 Inhalation Rat (mg/l)	658 mg/l (Exposure time: 4 h)
Ethane (74-84-0)	
LC50 Inhalation Rat (mg/l)	658 mg/l (Exposure time: 4 h)

SECTION 12: ECOLOGICAL INFORMATION

Toxicity

Wellhead Natural Gas (CAS Mixture)	
LC50 Fish 1	0.002 mg/l (Exposure time: 96 h - Species: Coregonus clupeaformis)
Hydrogen sulfide (7783-06-4)	
LC50 Fish 1	0.0448 mg/l (Exposure time: 96 h - Species: Lepomis macrochirus [flow-through])
EC50 Daphnia 1	0.022 mg/l (Exposure time: 96 h - Species: Gammarus pseudolimnaeus)
LC 50 Fish 2	0.016 mg/l (Exposure time: 96 h - Species: Pimephales promelas [flow-through])

Persistence and Degradability

Wellhead Natural Gas	
Persistence and Degradability	Not established.

Bioaccumulative Potential

Wellhead Natural Gas	
Bioaccumulative Potential	Not established.
Hydrogen sulfide (7783-06-4)	
BCF fish 1	(no bioaccumulation expected)
Log Pow	0.45 (at 25 °C)
Propane (74-98-6)	
Log Pow	2.3
Butane (106-97-8)	
Log Pow	2.89
Carbon dioxide (124-38-9)	
BCF fish 1	(no bioaccumulation)
Log Pow	0.83
Ethane (74-84-0)	
Log Pow	<= 2.8

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Mobility in Soil Not available

Other Adverse Effects

Other adverse effects: Can cause frost damage to vegetation. Has photochemical ozone creation potential.

Other Information: Avoid release to the environment.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal Recommendations: Dispose of waste material in accordance with all local, regional, national, provincial, territorial and international regulations.

Additional Information: Handle empty containers with care because residual vapors are flammable. Empty gas cylinders should be returned to the vendor for recycling or refilling.

SECTION 14: TRANSPORT INFORMATION

In Accordance With ICAO/IATA/DOT/TDG

UN Number

UN-No.(DOT): 1971

DOT NA no.: UN1971

UN Proper Shipping Name

DOT Proper Shipping Name : Natural gas, compressed
(with high methane content)

Hazard Labels (DOT) : 2.1 - Flammable gases



DOT Packaging Exceptions (49 CFR 173.xxx) : 306

DOT Packaging Non Bulk (49 CFR 173.xxx) : 302

DOT Packaging Bulk (49 CFR 173.xxx) : 302

Additional Information

Emergency Response Guide (ERG) Number : 115

Transport by sea

DOT Vessel Stowage Location : E - The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length, but is prohibited from carriage on passenger vessels in which the limiting number of passengers is exceeded.

DOT Vessel Stowage Other : 40 - Stow "clear of living quarters"

Air transport

DOT Quantity Limitations Passenger Aircraft/Rail (49 CFR 173.27) : Forbidden

DOT Quantity Limitations Cargo Aircraft Only (49 CFR 175.75) : 150 kg

SECTION 15: REGULATORY INFORMATION

US Federal Regulations

Wellhead Natural Gas	
SARA Section 311/312 Hazard Classes	Fire hazard Immediate (acute) health hazard Sudden release of pressure hazard
Hydrogen sulfide (7783-06-4)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on SARA Section 302 (Specific toxic chemical listings) Listed on SARA Section 313 (Specific toxic chemical listings)	
SARA Section 302 Threshold Planning Quantity (TPQ)	500
SARA Section 313 - Emission Reporting	1.0 %

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Propane (74-98-6)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

Butane (106-97-8)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

Carbon dioxide (124-38-9)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

Nitrogen (7727-37-9)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

Methane (74-82-8)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

Ethane (74-84-0)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

US State Regulations

Hydrogen sulfide (7783-06-4)

U.S. - California - SCAQMD - Toxic Air Contaminants - Non-Cancer Acute
 U.S. - California - SCAQMD - Toxic Air Contaminants - Non-Cancer Chronic
 U.S. - California - Toxic Air Contaminant List (AB 1807, AB 2728)
 U.S. - Colorado - Hazardous Wastes - Discarded Chemical Products, Off-Specification Species, Container and Spill Residues
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)
 U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities
 U.S. - Delaware - Accidental Release Prevention Regulations - Toxic Endpoints
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities
 U.S. - Hawaii - Occupational Exposure Limits - STELs
 U.S. - Hawaii - Occupational Exposure Limits - TWAs
 U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations
 U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Emission Levels (ELs)
 U.S. - Idaho - Occupational Exposure Limits - Acceptable Maximum Peak Above the Ceiling Concentration for an 8-Hour Shift
 U.S. - Idaho - Occupational Exposure Limits - Ceilings
 U.S. - Idaho - Occupational Exposure Limits - TWAs
 U.S. - Louisiana - Reportable Quantity List for Pollutants
 U.S. - Maine - Air Pollutants - Hazardous Air Pollutants
 U.S. - Massachusetts - Allowable Ambient Limits (AALs)
 U.S. - Massachusetts - Allowable Threshold Concentrations (ATCs)
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Right To Know List
 U.S. - Massachusetts - Threshold Effects Exposure Limits (TEELs)
 U.S. - Michigan - Occupational Exposure Limits - STELs
 U.S. - Michigan - Occupational Exposure Limits - TWAs
 U.S. - Michigan - Polluting Materials List
 U.S. - Michigan - Process Safety Management Highly Hazardous Chemicals
 U.S. - Minnesota - Chemicals of High Concern
 U.S. - Minnesota - Hazardous Substance List
 U.S. - Minnesota - Permissible Exposure Limits - STELs
 U.S. - Minnesota - Permissible Exposure Limits - TWAs

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U.S. - Montana - Ambient Air Quality Standards
 U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - 24-Hour
 U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - Annual
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances
 U.S. - New Jersey - Environmental Hazardous Substances List
 U.S. - New Jersey - Right to Know Hazardous Substance List
 U.S. - New Jersey - Special Health Hazards Substances List
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)
 U.S. - New Mexico - Air Quality - Ambient Air Quality Standards
 U.S. - New York - Occupational Exposure Limits - TWAs
 U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances
 U.S. - North Carolina - Control of Toxic Air Pollutants
 U.S. - North Dakota - Ambient Air Quality Standards - Maximum Permissible Concentrations
 U.S. - North Dakota - Hazardous Wastes - Discarded Chemical Products, Off-Specification Species, Container and Spill Residues
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities
 U.S. - Ohio - Extremely Hazardous Substances - Threshold Quantities
 U.S. - Oregon - Permissible Exposure Limits - Ceilings
 U.S. - Oregon - Permissible Exposure Limits - STELs
 U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List
 U.S. - Pennsylvania - RTK (Right to Know) List
 U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - 1-Hour
 U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - 24-Hour
 U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - Annual
 U.S. - South Carolina - Toxic Air Pollutants - Maximum Allowable Concentrations
 U.S. - South Carolina - Toxic Air Pollutants - Pollutant Categories
 U.S. - Tennessee - Occupational Exposure Limits - STELs
 U.S. - Tennessee - Occupational Exposure Limits - TWAs
 U.S. - Texas - Drinking Water Standards - Secondary Constituent Levels (SCLs)
 U.S. - Texas - Effects Screening Levels - Long Term
 U.S. - Texas - Effects Screening Levels - Short Term
 U.S. - Vermont - Hazardous Waste - Hazardous Constituents
 U.S. - Vermont - Permissible Exposure Limits - STELs
 U.S. - Vermont - Permissible Exposure Limits - TWAs
 U.S. - Virginia - Water Quality Standards - Chronic Freshwater Aquatic Life
 U.S. - Virginia - Water Quality Standards - Chronic Saltwater Aquatic Life
 U.S. - Washington - Dangerous Waste - Dangerous Waste Constituents List
 U.S. - Washington - Dangerous Waste - Discarded Chemical Products List
 U.S. - Washington - Permissible Exposure Limits - STELs
 U.S. - Washington - Permissible Exposure Limits - TWAs
 U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 25 Feet to Less Than 40 Feet
 U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 40 Feet to Less Than 75 Feet
 U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 75 Feet or Greater
 U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights Less Than 25 Feet
 U.S. - Wyoming - Process Safety Management - Highly Hazardous Chemicals
 U.S. - Alaska - Water Quality Standards - Chronic Aquatic Life Criteria for Fresh Water
 U.S. - Alaska - Water Quality Standards - Chronic Aquatic Life Criteria for Marine Water

Propane (74-98-6)

U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)
 U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities

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U.S. - Hawaii - Occupational Exposure Limits - TWAs
 U.S. - Idaho - Occupational Exposure Limits - TWAs
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Right To Know List
 U.S. - Michigan - Occupational Exposure Limits - TWAs
 U.S. - Minnesota - Hazardous Substance List
 U.S. - Minnesota - Permissible Exposure Limits - TWAs
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances
 U.S. - New Jersey - Environmental Hazardous Substances List
 U.S. - New Jersey - Right to Know Hazardous Substance List
 U.S. - New Jersey - Special Health Hazards Substances List
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)
 U.S. - New York - Occupational Exposure Limits - TWAs
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities
 U.S. - Oregon - Permissible Exposure Limits - TWAs
 U.S. - Pennsylvania - RTK (Right to Know) List
 U.S. - Tennessee - Occupational Exposure Limits - TWAs
 U.S. - Texas - Effects Screening Levels - Long Term
 U.S. - Texas - Effects Screening Levels - Short Term
 U.S. - Vermont - Permissible Exposure Limits - TWAs
 U.S. - Washington - Permissible Exposure Limits - STELs
 U.S. - Washington - Permissible Exposure Limits - TWAs

Butane (106-97-8)

U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)
 U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities
 U.S. - Hawaii - Occupational Exposure Limits - TWAs
 U.S. - Maine - Chemicals of High Concern
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Right To Know List
 U.S. - Michigan - Occupational Exposure Limits - TWAs
 U.S. - Minnesota - Chemicals of High Concern
 U.S. - Minnesota - Hazardous Substance List
 U.S. - Minnesota - Permissible Exposure Limits - TWAs
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances
 U.S. - New Jersey - Environmental Hazardous Substances List
 U.S. - New Jersey - Right to Know Hazardous Substance List
 U.S. - New Jersey - Special Health Hazards Substances List
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities
 U.S. - Oregon - Permissible Exposure Limits - TWAs
 U.S. - Pennsylvania - RTK (Right to Know) List

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U.S. - Tennessee - Occupational Exposure Limits - TWAs
 U.S. - Texas - Effects Screening Levels - Long Term
 U.S. - Texas - Effects Screening Levels - Short Term
 U.S. - Vermont - Permissible Exposure Limits - TWAs
 U.S. - Washington - Permissible Exposure Limits - STELS
 U.S. - Washington - Permissible Exposure Limits - TWAs

Carbon dioxide (124-38-9)

U.S. - Hawaii - Occupational Exposure Limits - STELS
 U.S. - Hawaii - Occupational Exposure Limits - TWAs
 U.S. - Idaho - Occupational Exposure Limits - TWAs
 U.S. - Maine - Air Pollutants - Greenhouse Gases (GHG)
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity
 U.S. - Massachusetts - Right To Know List
 U.S. - Massachusetts - Volatile Organic Compounds Exempt From Requirements
 U.S. - Michigan - Occupational Exposure Limits - STELS
 U.S. - Michigan - Occupational Exposure Limits - TWAs
 U.S. - Minnesota - Hazardous Substance List
 U.S. - Minnesota - Permissible Exposure Limits - STELS
 U.S. - Minnesota - Permissible Exposure Limits - TWAs
 U.S. - New Jersey - Right to Know Hazardous Substance List
 U.S. - New York - Occupational Exposure Limits - TWAs
 U.S. - Oregon - Permissible Exposure Limits - TWAs
 U.S. - Pennsylvania - RTK (Right to Know) List
 U.S. - Tennessee - Occupational Exposure Limits - STELS
 U.S. - Tennessee - Occupational Exposure Limits - TWAs
 U.S. - Texas - Effects Screening Levels - Long Term
 U.S. - Texas - Effects Screening Levels - Short Term
 U.S. - Vermont - Permissible Exposure Limits - STELS
 U.S. - Vermont - Permissible Exposure Limits - TWAs
 U.S. - Washington - Permissible Exposure Limits - STELS
 U.S. - Washington - Permissible Exposure Limits - TWAs

Nitrogen (7727-37-9)

U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity
 U.S. - Massachusetts - Right To Know List
 U.S. - Minnesota - Hazardous Substance List
 U.S. - New Jersey - Right to Know Hazardous Substance List
 U.S. - Pennsylvania - RTK (Right to Know) List
 U.S. - Washington - Permissible Exposure Limits - Simple Asphyxiants

Methane (74-82-8)

U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities
 U.S. - Delaware - Volatile Organic Compounds Exempt from Requirements
 U.S. - Maine - Air Pollutants - Greenhouse Gases (GHG)
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Right To Know List
 U.S. - Massachusetts - Volatile Organic Compounds Exempt From Requirements

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U.S. - Minnesota - Hazardous Substance List
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances
 U.S. - New Jersey - Environmental Hazardous Substances List
 U.S. - New Jersey - Excluded Volatile Organic Compounds
 U.S. - New Jersey - Right to Know Hazardous Substance List
 U.S. - New Jersey - Special Health Hazards Substances List
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities
 U.S. - Oregon - Permissible Exposure Limits - TWAs
 U.S. - Pennsylvania - RTK (Right to Know) List
 U.S. - Texas - Effects Screening Levels - Long Term
 U.S. - Texas - Effects Screening Levels - Short Term
 U.S. - Washington - Permissible Exposure Limits - Simple Asphyxiants

Ethane (74-84-0)

U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)
 U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities
 U.S. - Delaware - Volatile Organic Compounds Exempt from Requirements
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2
 U.S. - Massachusetts - Right To Know List
 U.S. - Massachusetts - Volatile Organic Compounds Exempt From Requirements
 U.S. - Minnesota - Hazardous Substance List
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances
 U.S. - New Jersey - Environmental Hazardous Substances List
 U.S. - New Jersey - Excluded Volatile Organic Compounds
 U.S. - New Jersey - Right to Know Hazardous Substance List
 U.S. - New Jersey - Special Health Hazards Substances List
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities
 U.S. - Oregon - Permissible Exposure Limits - TWAs
 U.S. - Pennsylvania - RTK (Right to Know) List
 U.S. - Texas - Effects Screening Levels - Long Term
 U.S. - Texas - Effects Screening Levels - Short Term
 U.S. - Washington - Permissible Exposure Limits - Simple Asphyxiants

Canadian Regulations

Wellhead Natural Gas

WHMIS Classification	Class B Division 1 - Flammable Gas Class A - Compressed Gas
----------------------	--



Hydrogen sulfide (7783-06-4)

Listed on the Canadian DSL (Domestic Substances List) inventory.
 Listed on the Canadian Ingredient Disclosure List

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WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class D Division 2 Subdivision B - Toxic material causing other toxic effects
----------------------	---

Propane (74-98-6)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas
----------------------	--

Butane (106-97-8)

Listed on the Canadian DSL (Domestic Substances List) inventory.

Listed on the Canadian Ingredient Disclosure List

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas
----------------------	--

Carbon dioxide (124-38-9)

Listed on the Canadian DSL (Domestic Substances List) inventory.

Listed on the Canadian Ingredient Disclosure List

WHMIS Classification	Class A - Compressed Gas
----------------------	--------------------------

Nitrogen (7727-37-9)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class A - Compressed Gas
----------------------	--------------------------

Methane (74-82-8)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas
----------------------	--

Ethane (74-84-0)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas
----------------------	--

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by CPR.

SECTION 16: OTHER INFORMATION

Revision date : 10/02/2013

Other Information : This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200

GHS Full Text Phrases:

Acute Tox. 2 (Inhalation:gas)	Acute toxicity (inhalation:gas) Category 2
Aquatic Acute 1	Hazardous to the aquatic environment - Acute Hazard Category 1
Compressed gas	Gases under pressure Compressed gas
Flam. Gas 1	Flammable gases Category 1
Liquefied gas	Gases under pressure Liquefied gas
Simple Asphy	Simple Asphyxiant
H220	Extremely flammable gas
H280	Contains gas under pressure; may explode if heated
H330	Fatal if inhaled
H400	Very toxic to aquatic life

Party Responsible for the Preparation of This Document

Wellhead Natural Gas

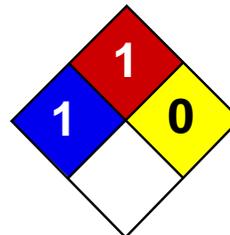
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Williams, Inc.
One Williams Center
Tulsa, OK 74172, US
800-688-7507

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product

North America GHS US 2012 & WHMIS



Health	1
Fire	1
Reactivity	0
Personal Protection	J

Material Safety Data Sheet

Triethylene glycol MSDS

Section 1: Chemical Product and Company Identification

Product Name: Triethylene glycol

Catalog Codes: SLT2644

CAS#: 112-27-6

RTECS: YE4550000

TSCA: TSCA 8(b) inventory: Triethylene glycol

CI#: Not available.

Synonym: 2,2'-[1,2-Ethanediy]bis(oxy)]bisethanol

Chemical Formula: C₆H₁₄O₄

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Triethylene glycol	112-27-6	100

Toxicological Data on Ingredients: Triethylene glycol: ORAL (LD50): Acute: 17000 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of eye contact (irritant), of ingestion. Slightly hazardous in case of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:

Very hazardous in case of eye contact (irritant). Slightly hazardous in case of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, the nervous system. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact: No known effect on skin contact, rinse with water for a few minutes.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 371°C (699.8°F)

Flash Points: CLOSED CUP: 177°C (350.6°F). OPEN CUP: 165.5°C (329.9°F).

Flammable Limits: LOWER: 0.9% UPPER: 9.2%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Avoid contact with eyes. If ingested, seek medical advice immediately and show the container or the label.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Splash goggles. Lab coat.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Hygroscopic liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 150.18 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 285°C (545°F)

Melting Point: -5°C (23°F)

Critical Temperature: Not available.

Specific Gravity: 1.1274 (Water = 1)

Vapor Pressure: Not available.

Vapor Density: 5.17 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 17000 mg/kg [Rat].

Chronic Effects on Humans: The substance is toxic to kidneys, the nervous system.

Other Toxic Effects on Humans:

Very hazardous in case of ingestion. Slightly hazardous in case of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Triethylene glycol TSCA 8(b) inventory: Triethylene glycol

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC): R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Not applicable. Lab coat. Not applicable. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:31 PM

Last Updated: 05/21/2013 12:00 PM

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SECTION 1 – MATERIAL IDENTIFICATION AND USE**Material Name:** PRODUCED WATER (SWEET - FROM CRUDE OIL OR DEEP GAS PRODUCTION)**Use:** Process stream, waste**WHMIS Classification:** Class B, Div. 2; Class D, Div. 2, Sub-Div. A and B**NFPA:** Fire: 3 Reactivity: 0 Health: 2**TDG:** UN: 1267 Class: 3 Packing Group: II**Shipping Name:** PETROLEUM CRUDE OIL**Manufacturer/Supplier:** ENCANA CORPORATION#1800, 855 - 2nd Street S.W., P.O. BOX 2850

CALGARY, ALBERTA, T2P 2S5

Emergency Telephone: (403) 645-3333**Chemical Family:** Water with C5+ aliphatic and aromatic hydrocarbons.**SECTION 2 – HAZARDOUS INGREDIENTS OF MATERIAL**

Hazardous Ingredients	Approximate Concentrations (%)	C.A.S. Nos.	LD50/LC50 (Incl. Species & Route)	Exposure Limits
Sodium chloride	5-20	7647-14-05	N.Av.	N.Av.
n-Hexane	0.1-1	110-54-3	LD50, rat, oral, 28.7 g/kg	50 ppm (OEL, TLV)
Benzene	0.1-1	71-43-2	LD50, rat, oral, 930 mg/kg LC50, rat, 4 hr, 13200 ppm	0.5 ppm (OEL) 0.5 ppm (TLV)

OEL = 8 hr. Alberta Occupational Exposure Limit; TLV = Threshold Limit Value (8 hrs)

SECTION 3 – PHYSICAL DATA FOR MATERIAL**Physical State:** Liquid**Specific Gravity:** 1.0 - 1.1 @ 20 degrees C**Vapour Density (air=1):** 2.5-3.0**Percent Volatiles, by volume:** 100**pH:** N.Av.**Coefficient of Water/Oil Distribution:** >100 / 1**Odour & Appearance:** colorless/straw coloured liquid, hydrocarbon odour

(N.A.V. = not available N.App. = not applicable)

Vapour Pressure (mmHg): 20 @ 20 deg. C.**Odour Threshold (ppm):** N.Av.**Evaporation Rate:** N.Av.**Boiling Pt. (deg.C):** 50 to 100**Freezing Pt. (deg.C):** -10 to 0 (est.)**SECTION 4 – FIRE AND EXPLOSION****Flammability:** Yes **Conditions:** Bulk of material is water, and will not ignite. However, sufficient hydrocarbon vapour may be present to cause flash fire at normal temperatures*.**Means of Extinction:** Foam, CO2, dry chemical. Explosive accumulations can build up in areas of poor ventilation*.**Special Procedures:** Use water spray to cool fire-exposed containers, and to disperse vapors if spill has not ignited. If safe to do so, cut off supply and allow flame to burn out*.**Flash Point (deg.C) & Method:** <-40 (TCC) (hydrocarbons)***Upper Explosive Limit (% by vol.):** 8***Lower Explosive Limit (% by vol.):** 1***Auto Ignition Temp. (deg.C):** 260***Hazardous Combustion Products:** Carbon monoxide, carbon dioxide***Sensitivity to Impact:** No**Sensitivity to Static Discharge:** Yes, may ignite***TDG Flammability Classification:** Class 3*

*Assuming hydrocarbon content is high enough to ignite. Hydrocarbons may derive from the original produced water or contamination through transportation in a tank that had previously contained crude oil.

SECTION 5 – REACTIVITY DATA

Chemical Stability: Yes **Conditions:** Heat

Incompatibility: Yes **Substances:** Oxidizing agents (e.g. chlorine, compressed oxygen)

Reactivity: Yes **Conditions:** Heat, strong sunlight

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide

SECTION 6 – TOXICOLOGICAL PROPERTIES OF PRODUCT

Routes of Entry:

Skin Absorption: Yes

Skin Contact: Yes (liquid)

Eye Contact: Yes

Inhalation: Acute: Yes

Chronic: Yes

Ingestion: Yes

Effects of Acute Exposure: Vapour may cause irritation of eyes, nose and throat, dizziness and drowsiness. Contact with skin may cause irritation and possibly dermatitis. Hydrocarbons absorbed through intact skin. Contact of liquid with eyes may cause severe irritation.

Effects of Chronic Exposure: Due to presence of benzene and n-hexane, long term exposure may increase the risk of anaemia, leukaemia and nervous system damage.

Sensitization to Product: N.Av.

Exposure Limits of Product: 0.5 ppm (8 hr Alberta OEL for benzene)

Irritancy: Yes

Synergistic Materials: None reported

Carcinogenicity: Yes **Reproductive Effects:** Possibly **Teratogenicity:** Possibly **Mutagenicity:** Possibly

SECTION 7 – PREVENTIVE MEASURES

Personal Protective Equipment: Use positive pressure self-contained breathing apparatus, supplied air breathing apparatus, or cartridge respirator approved for organic vapours where concentrations may exceed exposure limits.

Gloves: Viton (nitrile adequate for short exposure to liquid)

Respiratory: SCBA, SABA or cartridge respirator approved for organic vapours.

Eye: Chemical splash goggles

Footwear: As per safety policy. **Clothing:** As per fire protection policy.

Engineering Controls: Use only in well ventilated areas. Mechanical ventilation required in confined areas. Equipment must be explosion proof.

Leaks & Spills: Stop leak if safe to do so. Use personal protective equipment. Use water spray to cool containers.

Remove all ignition sources. Provide explosion-proof clearing ventilation, if possible. Prevent from entering confined spaces, or from contaminating land and water courses. Dyke and pump into containers for recycling or disposal. Notify appropriate regulatory authorities.

Waste Disposal: Contact appropriate regulatory authorities for disposal requirements.

Handling Procedures & Equipment: Avoid contact with liquid. Avoid inhalation. Bond and ground all transfers.

Avoid sparking conditions.

Storage Requirements: Store in a cool, dry, well ventilated area away from heat, strong sunlight, and ignition sources.

Special Shipping Information: N.Av.

SECTION 8 – FIRST AID MEASURES

Skin: Flush skin with water, removing contaminated clothing. Get medical attention if irritation persists or large areas of contact.

Eye: Immediately flush with large amounts of luke warm water for 15 minutes, lifting upper and lower lids at intervals. Get medical attention if irritation persists.

Inhalation: Ensure own safety. Remove victim to fresh air. Give oxygen, artificial respiration, or CPR if needed. Get immediate medical attention.

Ingestion: Give 2-3 glasses of milk or water to drink. DO NOT INDUCE VOMITING. Keep warm and at rest. Get immediate medical attention.

SECTION 9 – PREPARATION DATE OF MSDS

Prepared By: Encana Environment, Health and Safety (EHS)

Phone Number: (403) 645-2000 Preparation Date: July 1, 2011 Expiry Date: July 1, 2014

ATTACHMENT I
Emission Units Table

“25. Fill out the **Emission Units Table** and provide it as Attachment I.”

- **Emissions Unit Table**
-

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment I**EMISSION UNITS TABLE**

(Include 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-01	1E	Compressor Engine 01 CAT G3516B (4SLB)	2013	1,380 bhp	Existing	01-OXCAT
CE-02	2E	Compressor Engine 02 CAT G3516B (4SLB)	2013	1,380 bhp	Existing	02-OXCAT
RPC	3E	Reciprocating Compressor Rod Packing and Engine Crankcase	2013	2,760 bhp	Existing	na
SSM	4E	Start/Stop/Maintenance (Blowdown)	2013	2,760 bhp	Existing	na
DFT-01	5E	Dehydrator 01 Flash Tank (≥ 50% Recycle)	2013 / tbd	40.0 MMscfd	Modified	na
DSV-01	6E	Dehydrator 01 Regenerator/Still Vent	2013	40.0 MMscfd	Existing	01-BTEX
RBV-01	7E	Reboiler Vent	2013	1.00 MMBtu/hr	Existing	na
T-01	8E	Storage Tank Produced Water	2013	210 bbl	Existing	na
TLO	9E	Truck Load-Out Produced Water	2013	3,578 bbl/yr	Existing	na
FUG-G	1F	Piping and Equipment Fugitives (Gas)	2013	1,737 Fittings	Existing	na
FUG-W	2F	Piping and Equipment Fugitives (Water/Oil)	2013	873 Fittings	Existing	na

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, etc.⁴ For Control Devices use the following numbering system: 1C, 2C, 3C, ... or other appropriate designation.

ATTACHMENT J

Emission Points Data Summary Sheet

“26. Fill out the **Emission Points Data Summary Sheet** (Table 1 and Table 2) and provide it as Attachment J.”

- **Table 1 – Emissions Data**
 - **Table 2 – Release Parameter Data**
-

Williams Ohio Valley Midstream LLC
WGGS COMPRESSOR STATION
 Application for 45CSR13 NSR Modification Permit
Attachment J - Emission Points Data Summary Sheet

Compressor Engine 01 (CE-01/1E)

Table 1: Emissions Data

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type ¹	Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan)		Air Pollution Control Device (Must match Emission Units Table & Plot Plan)		Vent Time for Emission Unit (Chemical processes only)		All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used ⁶	Emission Concentration ⁷ (ppmv or mg/m ³)
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
CE-01/1E CE-02/2E (Each)	Upward Vertical	1,380 bhp CAT G3516B (4SLB@1,400 rpm) (Compressor Engine 01 and 02, each w/ OxCat) (CE-01/1E and CE-02/2E)		01-OxCat 02-OxCat	OxCat	C	8760 (Each)	NOX	1.52	6.66	1.52	6.66	Gas	Vendor	
								CO	9.19	40.24	0.64	2.82	Gas	Vendor	
		VOC	4.11					17.99	2.16	9.45	Gas	Vendor			
		SO2	0.01					0.03	0.01	0.03	Gas	AP-42			
		PM10/2.5	0.11					0.50	0.11	0.50	Solid/Gas	AP-42			
		Benzene	5.0E-03					0.02	3.2E-03	0.01	Gas	AP-42			
		Ethylbenzene	4.5E-04					2.0E-03	2.9E-04	1.3E-03	Gas	AP-42			
		HCHO	1.25					5.46	0.30	1.31	Gas	Vendor			
		n-Hexane	0.01					0.06	0.01	0.04	Gas	AP-42			
		Methanol	0.03					0.12	0.02	0.08	Gas	AP-42			
		Toluene	4.6E-03					0.02	3.0E-03	0.01	Gas	AP-42			
		2,2,4-TMP	2.8E-03					0.01	1.8E-03	0.01	Gas	AP-42			
		Xylenes	2.1E-03					0.01	1.4E-03	0.01	Gas	AP-42			
		Other HAP	0.16					0.72	0.11	0.47	Gas	AP-42			
		Total HAP	1.47					6.43	0.44	1.94	Gas	Sum			
		CO2	1,518					6,649	1,518	6,649	Gas	Vendor			
		CH4	8.06					35.31	8.06	35.31	Gas	Vendor			
N2O	2.5E-03	0.01	2.5E-03	0.01	Gas	AP-42									
CO2e	1,720	7,536	1,720	7,536	Gas	Wgt Sum									

Continued ...

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment J - Emission Points Data Summary Sheet

Rod Packing/Crankcase Leaks (RPC/2E)

Table 1: Emissions Data

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type ¹	Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan)		Air Pollution Control Device (Must match Emission Units Table & Plot Plan)		Vent Time for Emission Unit (Chemical processes only)		All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used ⁶	Emission Concentration ⁷ (ppmv or mg/m ³)
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
RPC/3E	na	RPC/3E	RPC/3E	na	na	C	8,760	NOX	---	---	---	---	Gas	---	
								CO	---	---	---	---	Gas	---	
								VOC	0.79	3.44	0.79	3.44	Gas	Vendor	
								SO2	---	---	---	---	Gas	---	
								PM10/2.5	---	---	---	---	Solid/Gas	---	
								Benzene	2.5E-03	0.01	2.5E-03	0.01	Gas	Vendor	
								Ethylbenzene	2.5E-03	0.01	2.5E-03	0.01	Gas	Vendor	
								HCHO	0.02	0.09	0.02	0.09	Gas	Vendor	
								n-Hexane	2.5E-03	0.01	2.5E-03	0.01	Gas	Vendor	
								Methanol	---	---	---	---	Gas	---	
								Toluene	2.5E-03	0.01	2.5E-03	0.01	Gas	Vendor	
								2,2,4-TMP	2.5E-03	0.01	2.5E-03	0.01	Gas	Vendor	
								Xylenes	2.5E-03	0.01	2.5E-03	0.01	Gas	Vendor	
								Other HAP	---	---	---	---	Gas	---	
								Total HAP	0.04	0.16	0.04	0.16	Gas	Sum	
								CO2	25	111	25	111	Gas	Vendor	
								CH4	5.97	26.14	5.97	26.14	Gas	Vendor	
								N2O	---	---	---	---	Gas	---	
CO2e	175	765	175	765	Gas	Wgt Sum									

Continued ...

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment J - Emission Points Data Summary Sheet

Start/Stop/Maintenance (w/ Blowdown) (SSM/3E)

Table 1: Emissions Data															
Emission Point ID No. <i>(Must match Emission Units Table & Plot Plan)</i>	Emission Point Type ¹	Emission Unit Vented Through This Point <i>(Must match Emission Units Table & Plot Plan)</i>		Air Pollution Control Device <i>(Must match Emission Units Table & Plot Plan)</i>		Vent Time for Emission Unit <i>(Chemical processes only)</i>		All Regulated Pollutants - Chemical Name/CAS ³ <i>(Speciate VOCs & HAPS)</i>	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase <i>(At exit conditions, Solid, Liquid or Gas/Vapor)</i>	Est. Method Used ⁶	Emission Concentration ⁷ <i>(ppmv or mg/m³)</i>
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
SSM/4E	na	SSM/4E	SSM/4E	na	na	I	na	NOX	---	---	---	---	Gas	---	
								CO	---	---	---	---	Gas	---	
								VOC	---	10.03	---	10.03	Gas	Vendor	
								SO2	---	---	---	---	Gas	---	
								PM10/2.5	---	---	---	---	Solid/Gas	---	
								Benzene	---	0.01	---	0.01	Gas	Vendor	
								Ethylbenzene	---	0.01	---	0.01	Gas	Vendor	
								HCHO	---	---	---	---	Gas	---	
								n-Hexane	---	0.10	---	0.10	Gas	Vendor	
								Methanol	---	---	---	---	Gas	---	
								Toluene	---	0.01	---	0.01	Gas	Vendor	
								2,2,4-TMP	---	0.01	---	0.01	Gas	Vendor	
								Xylenes	---	0.01	---	0.01	Gas	Vendor	
								Other HAP	---	---	---	---	Gas	---	
								Total HAP	---	0.15	---	0.15	Gas	Sum	
								CO2	---	0.39	---	0.39	Gas	MB	
								CH4	---	81.57	---	81.57	Gas	MB	
N2O	---	---	---	---	Gas	---									
CO2e	---	2,040	---	2,040	Gas	Wgt Sum									

Continued ...

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment J - Emission Points Data Summary Sheet

Dehydrator 01 - Flash-Tank (DSV-01/5E)

Table 1: Emissions Data

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type ¹	Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan)		Air Pollution Control Device (Must match Emission Units Table & Plot Plan)		Vent Time for Emission Unit (Chemical processes only)		All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used ⁶	Emission Concentration ⁷ (ppmv or mg/m ³)
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
DFT-01/5E	Upward Vertical	40 MMscfd Dehydrator 01 (Flash Tank w/ >50% Recycle) (DFT-01/5E)		na	na	C	8,760	NOX	---	---	---	---	Gas	---	
								CO	---	---	---	---	Gas	---	
		VOC	12.11					53.05	12.11	53.05	Gas	GLYCalc			
		SO2	---					---	---	---	Gas	---			
		PM10/2.5	---					---	---	---	Solid/Gas	---			
		Benzene	0.03					0.14	0.03	0.14	Gas	GLYCalc			
		Ethylbenzene	0.03					0.15	0.03	0.15	Gas	GLYCalc			
		HCHO	---					---	---	---	Gas	GLYCalc			
		n-Hexane	0.18					0.81	0.18	0.81	Gas	GLYCalc			
		Methanol	---					---	---	---	Gas	---			
		Toluene	0.11					0.39	0.11	0.39	Gas	GLYCalc			
		2,2,4-TMP	0.01					0.02	0.01	0.02	Gas	GLYCalc			
		Xylenes	0.17					0.73	0.17	0.73	Gas	GLYCalc			
		Other HAP	---					---	---	---	Gas	---			
		Total HAP	0.53					2.24	0.53	2.24	Gas	Sum			
		CO2	1.09					4.79	1.09	4.79	Gas	GLYCalc			
		CH4	62.27					272.73	62.27	272.73	Gas	GLYCalc			
N2O	---	---	---	---	Gas	---									
CO2e	1,558	6,823	1,558	6,823	Gas	Wgt Sum									

Continued ...

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment J - Emission Points Data Summary Sheet

Dehydrator 01 - Regenerator/Still Vent (DSV-01/6E)

Table 1: Emissions Data

Emission Point ID No. <i>(Must match Emission Units Table & Plot Plan)</i>	Emission Point Type ¹	Emission Unit Vented Through This Point <i>(Must match Emission Units Table & Plot Plan)</i>		Air Pollution Control Device <i>(Must match Emission Units Table & Plot Plan)</i>		Vent Time for Emission Unit <i>(Chemical processes only)</i>		All Regulated Pollutants - Chemical Name/CAS ³ <i>(Speciate VOCs & HAPS)</i>	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase <i>(At exit conditions, Solid, Liquid or Gas/Vapor)</i>	Est. Method Used ⁶	Emission Concentration ⁷ <i>(ppmv or mg/m³)</i>	
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr				
DSV-01/6E	Upward Vertical	40 MMscfd Dehydrator 01 (Regenerator/Still Vent w/ BTEX Skid) (DSV-01/6E)						8,760	NOX	---	---	---	---	Gas	---	
		CO	---	---	---	---	Gas		---							
		VOC	9.59	42.02	0.16	0.70	Gas		GLYCalc							
		SO2	---	---	---	---	Gas		---							
		PM10/2.5	---	---	---	---	Solid/Gas		---							
		Benzene	0.27	1.17	0.01	0.03	Gas		GLYCalc							
		Ethylbenzene	0.71	3.11	0.01	0.03	Gas		GLYCalc							
		HCHO	---	---	---	---	Gas		GLYCalc							
		n-Hexane	0.07	0.29	0.00	0.01	Gas		GLYCalc							
		Methanol	---	---	---	---	Gas		---							
		Toluene	1.13	4.93	0.02	0.09	Gas		GLYCalc							
		2,2,4-TMP	0.00	0.01	0.00	0.00	Gas		GLYCalc							
		Xylenes	4.78	20.91	0.04	0.18	Gas		GLYCalc							
		Other HAP	---	---	---	---	Gas		---							
		Total HAP	6.94	30.42	0.08	0.34	Gas		Sum							
		CO2	0.07	0.31	0.07	0.31	Gas		GLYCalc							
		CH4	0.85	3.73	0.04	0.19	Gas		GLYCalc							
		N2O	---	---	---	---	Gas		---							
CO2e	21	94	1	5	Gas	Wgt Sum										

Continued ...

Williams Ohio Valley Midstream LLC
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Attachment J - Emission Points Data Summary Sheet

Dehydrator Reboiler 01 (RBV-01/5E)

Table 1: Emissions Data															
Emission Point ID No. <i>(Must match Emission Units Table & Plot Plan)</i>	Emission Point Type ¹	Emission Unit Vented Through This Point <i>(Must match Emission Units Table & Plot Plan)</i>		Air Pollution Control Device <i>(Must match Emission Units Table & Plot Plan)</i>		Vent Time for Emission Unit <i>(Chemical processes only)</i>		All Regulated Pollutants - Chemical Name/CAS ³ <i>(Speciate VOCs & HAPS)</i>	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase <i>(At exit conditions, Solid, Liquid or Gas/Vapor)</i>	Est. Method Used ⁶	Emission Concentration ⁷ <i>(ppmv or mg/m³)</i>
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
RBV-01/7E	Upward Vertical	RBV-01/7E	RBV-01/7E	na	na	C	8,760	NOX	0.10	0.43	0.10	0.43	Gas	AP-42	
								CO	0.08	0.36	0.08	0.36	Gas	AP-42	
								VOC	0.01	0.02	0.01	0.02	Gas	AP-42	
								SO2	5.9E-04	2.6E-03	5.9E-04	2.6E-03	Gas	AP-42	
								PM10/2.5	0.01	0.03	0.01	0.03	Solid/Gas	AP-42	
								Benzene	2.1E-06	9.0E-06	2.1E-06	9.0E-06	Gas	AP-42	
								Ethylbenzene	---	---	---	---	Gas	AP-42	
								HCHO	7.4E-05	3.2E-04	7.4E-05	3.2E-04	Gas	AP-42	
								n-Hexane	1.8E-03	0.01	1.8E-03	0.01	Gas	AP-42	
								Methanol	---	---	---	---	Gas	AP-42	
								Toluene	3.3E-06	1.5E-05	3.3E-06	1.5E-05	Gas	AP-42	
								2,2,4-TMP	---	---	---	---	Gas	AP-42	
								Xylenes	---	---	---	---	Gas	AP-42	
								Other HAP	1.9E-06	8.2E-06	1.9E-06	8.2E-06	Gas	AP-42	
								Total HAP	1.8E-03	0.01	1.8E-03	0.01	Gas	Sum	
								CO2	118	515	118	515	Gas	AP-42	
								CH4	2.3E-03	0.01	2.3E-03	0.01	Gas	AP-42	
								N2O	2.2E-03	0.01	2.2E-03	0.01	Gas	AP-42	
CO2e	118	518	118	518	Gas	Wgt Sum									

Continued ...

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment J - Emission Points Data Summary Sheet

Produced Water Storage Tank 01 (T-01/6E)

Table 1: Emissions Data

Emission Point ID No. <i>(Must match Emission Units Table & Plot Plan)</i>	Emission Point Type ¹	Emission Unit Vented Through This Point <i>(Must match Emission Units Table & Plot Plan)</i>		Air Pollution Control Device <i>(Must match Emission Units Table & Plot Plan)</i>		Vent Time for Emission Unit <i>(Chemical processes only)</i>		All Regulated Pollutants - Chemical Name/CAS ³ <i>(Speciate VOCs & HAPS)</i>	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase <i>(At exit conditions, Solid, Liquid or Gas/Vapor)</i>	Est. Method Used ⁶	Emission Concentration ⁷ <i>(ppmv or mg/m³)</i>	
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr				
T-01/8E	Upward Vertical	210 bbl Produced Water Storage Tank (T-01/8E)						8,760	NOX	---	---	---	---	Gas	---	
		CO	---	---	---	---	Gas		---							
		VOC	0.03	0.11	0.03	0.11	Gas		EPA							
		SO2	---	---	---	---	Gas		---							
		PM10/2.5	---	---	---	---	Solid/Gas		---							
		Benzene	7.5E-04	3.3E-03	7.5E-04	3.3E-03	Gas		EPA							
		Ethylbenzene	7.5E-04	3.3E-03	7.5E-04	3.3E-03	Gas		EPA							
		HCHO	---	---	---	---	Gas		---							
		n-Hexane	2.5E-03	0.01	2.5E-03	0.01	Gas		EPA							
		Methanol	---	---	---	---	Gas		---							
		Toluene	7.5E-04	3.3E-03	7.5E-04	3.3E-03	Gas		EPA							
		2,2,4-TMP	7.5E-04	3.3E-03	7.5E-04	3.3E-03	Gas		EPA							
		Xylenes	7.5E-04	3.3E-03	7.5E-04	3.3E-03	Gas		EPA							
		Other HAP	---	---	---	---	Gas		---							
		Total HAP	6.3E-03	0.03	6.3E-03	0.03	Gas		Sum							
		CO2	0.00	0.02	0.00	0.02	Gas		---							
		CH4	0.11	0.49	0.11	0.49	Gas		---							
N2O	---	---	---	---	Gas	---										
CO2e	2.80	12.27	2.80	12.27	Gas	---										

Continued ...

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment J - Emission Points Data Summary Sheet

Produced Water - Truck Load-Out (TLO/7E)

Table 1: Emissions Data															
Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type ¹	Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan)		Air Pollution Control Device (Must match Emission Units Table & Plot Plan)		Vent Time for Emission Unit (Chemical processes only)		All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used ⁶	Emission Concentration ⁷ (ppmv or mg/m ³)
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
TLO/9E	Upward Vertical	TLO/9E	TLO/9E	na	na	I	na	NOX	---	---	---	---	Gas	---	
								CO	---	---	---	---	Gas	---	
								VOC	---	0.12	---	0.12	Gas	AP-42	
								SO2	---	---	---	---	Gas	---	
								PM10/2.5	---	---	---	---	Solid/Gas	---	
								Benzene	---	6.0E-03	---	6.0E-03	Gas	AP-42	
								Ethylbenzene	---	6.0E-03	---	6.0E-03	Gas	AP-42	
								HCHO	---	---	---	---	Gas	---	
								n-Hexane	---	6.0E-03	---	6.0E-03	Gas	AP-42	
								Methanol	---	---	---	---	Gas	---	
								Toluene	---	6.0E-03	---	6.0E-03	Gas	AP-42	
								2,2,4-TMP	---	6.0E-03	---	6.0E-03	Gas	AP-42	
								Xylenes	---	6.0E-03	---	6.0E-03	Gas	AP-42	
								Other HAP	---	---	---	---	Gas	---	
								Total HAP	---	0.04	---	0.04	Gas	Sum	
								CO2	---	---	---	---	Gas	---	
								CH4	---	---	---	---	Gas	---	
N2O	---	---	---	---	Gas	---									
CO2e	---	---	---	---	Gas	---									

Continued ...

WGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment J - Emission Points Data Summary Sheet

FACILITY-WIDE SUMMARY

Table 1: Emissions Data - Continued

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type ¹	Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan)		Air Pollution Control Device (Must match Emission Units Table & Plot Plan)		Vent Time for Emission Unit (Chemical processes only)		All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used ⁶	Emission Concentration ⁷ (ppmv or mg/m ³)
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
na	na	na	na	na	na	na	na	NOX	3.14	13.76	3.14	13.76	Gas	Sum	
								CO	18.46	80.85	1.37	5.99	Gas	Sum	
								Point - VOC	30.74	144.78	17.41	86.39	Gas	Sum	
								Fugitive - VOC	1.46	6.39	1.46	6.39	Gas	Sum	
								Total - VOC	32.19	151.17	18.86	92.78	Gas	Sum	
								SO2	0.01	0.06	0.01	0.06	Gas	Sum	
								PM10/2.5	0.23	1.03	0.23	1.03	Gas	Sum	
								Benzene	0.34	1.49	0.08	0.35	Gas	Sum	
								Ethylbenzene	0.77	3.41	0.07	0.33	Solid/Gas	Sum	
								HCHO	2.52	11.02	0.62	2.71	Gas	Sum	
								n-Hexane	0.38	1.75	0.30	1.43	Gas	Sum	
								Methanol	0.06	0.25	0.04	0.16	Gas	Sum	
								Toluene	1.27	5.52	0.16	0.66	Gas	Sum	
								2,2,4-TMP	0.04	0.21	0.04	0.19	Gas	Sum	
								Xylenes	4.98	21.81	0.24	1.07	Gas	Sum	
								Other HAP	0.33	1.44	0.21	0.93	Gas	Sum	
								Total HAP	10.68	46.90	1.76	7.84	Gas	Sum	
								CO2	3,181	13,931	3,181	13,931	Gas	Sum	
CH4	91	479	90	476	Gas	Sum									
N2O	0.01	0.03	0.01	0.03	Gas	Sum									
CO2e	5,452	25,918	5,431	25,829	Gas	Sum									

**FACILITY-WIDE SUMMARY
(Including Fugitives (FUG-G/1F and FUG-W/2F))**

Continued ...

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Attachment J - Emission Points Data Summary Sheet

Table 1 Notes

Criteria Pollutants	
Pollutant	CAS
NO2	10102-44-0
CO	630-08-0
VOC	na
Propane	74-98-6
i-Butane	75-28-5
n-Butane	106-97-8
SO2	7446-09-5
PM10/2.5	na

Hazardous Air Pollutants (HAPs)	
Pollutant	CAS
Benzene	71-43-2
Ethylbenzene	100-41-4
Formadehyde	50-00-0
n-Hexane	110-54-3
Methanol	67-56-1
Toluene	108-88-3
2,2,4-TMP	540-84-1
Xylenes	1330-20-7
Other HAP	na
Total HAP	na

Greenhouse Gas (GHG) Pollutants	
Pollutant	CAS
CO2	124-38-9
CH4	74-82-8
N2O	10024-97-2
CO2e	na

Table 1: Notes

The EMISSION POINTS DATA SUMMARY SHEET provides a summation of emissions by emission unit. Note that uncaptured process emission unit emissions are not typically considered to be fugitive and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET. Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions). Please complete the FUGITIVE EMISSIONS DATA SUMMARY SHEET for fugitive emission activities.

- 1 Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.
- 2 Indicate by "C" if venting is continuous. Otherwise, specify the average short-term venting rate with units, for intermittent venting (ie., 15 min/hr). Indicate as many rates as needed to clarify frequency of venting (e.g., 5 min/day, 2 days/wk).
- 3 List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS2, VOCs, H2S, Inorganics, Lead, Organics, O3, NO, NO2, SO2, SO3, all applicable Greenhouse Gases (including CO2 and methane), etc. DO NOT LIST H2, H2O, N2, O2, and Noble Gases.
- 4 Give maximum potential emission rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).
- 5 Give maximum potential emission rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).
- 6 Indicate method used to determine emission rate as follows:
 MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).
- 7 Provide for all pollutant emissions. Typically, the units of parts per million by volume (ppmv) are used. If the emission is a mineral acid (sulfuric, nitric, hydrochloric or phosphoric) use units of milligram per dry cubic meter (mg/m3) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is SO2, use units of ppmv (See 45CSR10).

ATTACHMENT K
Fugitive Emissions Data Summary Sheet

“27. Fill out the **Fugitive Emissions Data Summary Sheet** and provide it as Attachment K.”

- **Application Forms Checklist**
 - **Fugitive Emissions Summary**
 - **Leak Source Data Sheet**
-

Williams Ohio Valley Midstream LLC
WGGG COMPRESSOR STATION
 Application for 45CSR13 NSR Modification Permit
Attachment K - Fugitive Emissions

FUGITIVE EMISSIONS DATA SUMMARY SHEET

The FUGITIVE EMISSIONS SUMMARY SHEET provides a summation of fugitive emissions. Fugitive emissions are those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. Note that uncaptured process emissions are not considered to be fugitive, and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET.

Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions).

APPLICATION FORMS CHECKLIST - FUGITIVE EMISSIONS
1.) Will there be haul road activities? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If Yes, then complete the HAUL ROAD EMISSIONS UNIT DATA SHEET.
2.) Will there be Storage Piles? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If Yes, then complete Table 1 of the NONMETALLIC MINERALS PROCESSING EMISSIONS UNIT DATA SHEET.
3.) Will there be Liquid Loading/Unloading Operations? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No --- Truck Load-Out (TLO/9E) is included in Point Source Emissions --- <input type="checkbox"/> If Yes, then complete the BULK LIQUID TRANSFER OPERATIONS EMISSIONS UNIT DATA SHEET.
4.) Will there be emissions of air pollutants from Wastewater Treatment Evaporation? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If Yes, then complete the GENERAL EMISSIONS UNIT DATA SHEET.
5.) Will there be Equipment Leaks (e.g. leaks from pumps, compressors, in-line process valves, pressure relief devices, open-ended valves, sampling connections, flanges, agitators, cooling towers, etc.)? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If Yes, then complete the LEAK SOURCE DATA SHEET section of the CHEMICAL PROCESSES EMISSIONS UNIT DATA SHEET.
6.) Will there be General Clean-up VOC Operations? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If Yes, then complete the GENERAL EMISSIONS UNIT DATA SHEET.
7.) Will there be any other activities that generate fugitive emissions? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If Yes, then complete the GENERAL EMISSIONS UNIT DATA SHEET or the most appropriate form.
If you answered "NO" to all of the items above, it is not necessary to complete the following table, "Fugitive Emissions Summary."

Williams Ohio Valley Midstream LLC
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Attachment K - Fugitive Emissions

FUGITIVE EMISSIONS DATA SUMMARY SHEET - Continued

The FUGITIVE EMISSIONS SUMMARY SHEET provides a summation of fugitive emissions. Fugitive emissions are those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. Note that uncaptured process emissions are not considered to be fugitive, and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET.
 Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions.

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants Chemical Name/CAS ¹	Maximum Potential Pre-Controlled Emissions ²		Maximum Potential Controlled Emissions ³		Est. Method Used ⁴
		lb/hr	ton/yr	lb/hr	ton/yr	
Paved Haul Roads	na	---	---	---	---	---
Unpaved Haul Roads	na	---	---	---	---	---
Storage Pile Emissions	na	---	---	---	---	---
Loading/Unloading Operations	--- Truck Load-Out (TLO/9E) is included in Point Source Emissions ---					
Wastewater Treatment	na	---	---	---	---	---
Equipment Leaks (FUG-G and FUG-L (10E) (Total)	VOC	1.46	6.39	1.46	6.39	AP-42
	Benzene	0.03	0.12	0.03	0.12	AP-42
	Ethylbenzene	0.03	0.12	0.03	0.12	AP-42
	Formaldehyde (HCHO)	---	---	---	---	---
	n-Hexane	0.09	0.41	0.09	0.41	AP-42
	Methanol (MeOH)	---	---	---	---	---
	Toluene	0.03	0.12	0.03	0.12	AP-42
	2,2,4-TMP (i-Octane)	0.03	0.12	0.03	0.12	AP-42
	Xylenes	0.03	0.12	0.03	0.12	AP-42
	Other HAP	---	---	---	---	---
	Total HAP	0.23	1.00	0.23	1.00	Sum
	CO2	0.02	0.10	0.02	0.10	MB
	CH4	5.43	23.79	5.43	23.79	MB
	N2O	---	---	---	---	---
	CO2e	136	595	136	595	Wgt Sum
General Clean-up VOC Emissions	na	---	---	---	---	---
Other	na	---	---	---	---	---

¹ List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS₂, VOCs, H₂S, Inorganics, Lead, Organics, O₃, NO, NO₂, SO₂, SO₃, all applicable Greenhouse Gases, etc. DO NOT LIST H₂, H₂O, N₂, O₂, and Noble Gases.

² Give rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in min (e.g. 5 lb VOC/20 min batch).

³ Give rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in min (e.g. 5 lb VOC/20 min batch).

⁴ Indicate method used to determine emission rate as follows:

MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

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Attachment K - Fugitive Emissions

DESCRIPTION OF FUGITIVE EMISSIONS

Source Category	Pollutant	Number of Source Components ¹	Number of Components Monitored by Frequency ²	Average Time to Repair (Days) ³	Estimated Annual Emission Rate (lb/yr) ⁴
Pumps ⁵	Light Liquid VOC ^{6,7}				
	Heavy Liquid VOC ⁸				
	Non-VOC ⁹				
Valves ¹⁰	Gas VOC				
	Light Liquid VOC				
	Heavy Liquid VOC				
	Non-VOC				
Safety Relief Valves ¹¹	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
Open Ended Lines ¹²	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
Sampling Connections ¹³	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
Compressors	Gas VOC				
	Non-VOC				
Flanges / Connectors	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
Other*	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
				TOTAL (lb/yr)	12,783
				TOTAL (tpy)	6.39

This Facility is NOT Subject to Leak Detection and Repair (LDAR) Regulations.

Please Reference the Fugitive Emissions Summary Data Sheet .

*Other components include compressor seals, relief valves, diaphragms, drains, meters, etc.

Attachment K
DESCRIPTION OF FUGITIVE EMISSIONS - Continued

Notes for Leak Source Data Sheet

1. For VOC sources include components on streams and equipment that contain greater than 10% VOC, including feed streams, reaction/separation facilities, and product/by-product delivery lines. Do not include certain leakless equipment as defined below by category.
2. By monitoring frequency, give the number of sources routinely monitored for leaks, using a portable detection device that measures concentration in visual or soap-bubble leak detection ppm. Do not include monitoring by methods. "M/Q(M)/Q/SA/A/0" means the time period between inspections as follows:
Monthly/Quarterly, with Monthly follow-up of repaired leakers/Quarterly/Semi-annual/Annually/other (specify time period)
- If source category is not monitored, a single zero in the space will suffice. For example, if 50 gas-service valves are monitored quarterly, with monthly follow-up of those repaired, 75 are monitored semi-annually, and 50 are checked bimonthly (alternate months), with non checked at any other frequency, you would put in the category valves, gas service: 0/50/0/75/0/50 (bimonthly).
3. Give the average number of days, after a leak is discovered, that an attempt will be made to repair the leak.
4. Note the method used: MB - material balance; EPA - emission factors established by EPA (cite document used);
EE - engineering estimate; 0 - other method, such as in-house emission factor (specify).
5. Do not include in the equipment count seal-less pumps (canned motor or diaphragm) or those with enclosed venting to a control device. (Emissions from vented equipment should be included in the estimates given in the Emission Points Data Sheet.)
6. Volatile organic compounds (VOC) means the term as defined in 40 CFR. 51.100 (s).
7. A light liquid is defined as a fluid with vapor pressure equal to or greater than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if 20% w/w or more of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20°C, then the fluid is defined as a light liquid.
8. A heavy liquid is defined as a fluid with a vapor pressure less than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if less than 20% w/w of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20°C. then the fluid is defined as a heavy liquid.
9. LIST CO, H2S, mineral acids, NO, SO, etc. DO NOT LIST H, H2O, N, O, and Noble Gases.
10. Include all process valves whether in-line or on an open-ended line such as sample, drain and purge valves. Do not include safety-relief valves, or leakless valves such as check, diaphragm, and bellows seal valves.
11. Do not include a safety-relief valve if there is a rupture disk in place upstream of the valve, or if the valve vents to a control device.
12. Open-ended lines include purge, drain and vent lines. Do not include sampling connections, or lines sealed by plugs, caps, blinds or second valves.
13. Do not include closed-purge sampling connections.

ATTACHMENT L

Emissions Unit Data Sheet(s)

“28. Fill out the **Emissions Unit Data Sheet(s)** as Attachment L.”

- Natural Gas Compressor/Generator Engine Data Sheet
 - CAT G3516B Compressor Engine – Vendor Data
 - Natural Gas Glycol Dehydration Unit Data Sheet
 - 40 CFR Part 63; Subpart HH & HHH Registration Form
 - Storage Tank Data Sheet
 - Model Results - Storage Tank - ProMax
 - Flowchart
 - Workbook
 - Bulk Liquid Transfer Operations
-

WGGG COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment L - Emission Unit Data Sheet**NATURAL GAS COMPRESSOR/GENERATOR ENGINE DATA SHEET**

Compressor Station		WGGG CS		WGGG CS			
Source Identification Number ¹		CE-01/1E		CE-02/2E			
Engine Manufacturer and Model		CAT G3516B		CAT G3516B			
Manufacturer's Rated bhp/rpm		1,380 / 1,400		1,380 / 1,400			
Source Status ²		ES		ES			
Date Installed/Modified/Removed ³		2013		2013			
Manufactured/Reconstruction Date ⁴		2012		2012			
Certified Engine (40CFR60 NSPS JJJJ) ⁵		No		No			
Engine, Fuel and Combustion Data	Engine Type ⁶	LB4S		LB4S			
	APCD Type ⁷	AFRC / OXCAT		AFRC / OXCAT			
	Fuel Type ⁸	RG		RG			
	H ₂ S (gr/100 scf)	0.2		0.2			
	Operating bhp/rpm	1,380 / 1,400		1,380 / 1,400			
	BSFC (Btu/bhp-hr)	7,427		7,427			
	Fuel (ft ³ /hr)	11,141		11,141			
	Fuel (MMft ³ /yr)	97.59		97.59			
	Operation (hrs/yr)	8,760		8,760			
Reference ⁹	PTE ¹⁰	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
MD	NOX	1.52	6.66	1.52	6.66		
MD	CO	0.64	2.82	0.64	2.82		
MD	VOC	2.16	9.45	2.16	9.45		
AP	SO2	0.01	0.03	0.01	0.03		
AP	PM10/2.5	0.11	0.50	0.11	0.50		
AP	Benzene	3.2E-03	0.01	3.2E-03	0.01		
AP	Ehtylbenzene	2.9E-04	1.3E-03	2.9E-04	1.3E-03		
MD	Formaldehyde	0.30	1.31	0.30	1.31		
AP	n-Hexane	0.01	0.04	8.2E-03	0.04		
AP	Methanol	0.02	0.08	0.02	0.08		
AP	Toluene	3.0E-03	0.01	3.0E-03	0.01		
AP	2,2,4-TMP	1.8E-03	0.01	1.8E-03	0.01		
AP	Xyelene	1.4E-03	0.01	1.4E-03	0.01		
AP	Other HAP	0.11	0.47	0.11	0.47		
Sum	Total HAP	0.44	1.94	0.44	1.94		
MD	CO2	1,518	6,649	1,518	6,649		
MD	CH4	8.06	35.31	8.06	35.31		
AP	N2O	2.5E-03	0.01	2.5E-03	0.01		
Weighted Sum	CO2e	1,720	7,536	1,720	7,536		

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment L - Emission Unit Data Sheet

NATURAL GAS COMPRESSOR/GENERATOR ENGINE DATA SHEET

(Continued)

Notes to **NATURAL GAS COMPRESSOR/GENERATOR ENGINE DATA SHEET**

1. Enter the appropriate Source Identification Number for each natural gas-fueled reciprocating internal combustion compressor/generator engine located at the compressor station. Multiple compressor engines should be designated CE-1, CE-2, CE-3 etc. Generator engines should be designated GE-1, GE-2, GE-3 etc. If more than three (3) engines exist, please use additional sheets.
2. Enter the Source Status using the following codes:
 - NS = Construction of New Source (installation)
 - ES = Existing Source
 - MS = Modification of Existing Source
 - RS = Removal of Source
3. Enter the date (or anticipated date) of the engine's installation (construction of source), modification or removal.
4. Enter the date that the engine was manufactured, modified or reconstructed.
5. Is the engine a certified stationary spark ignition internal combustion engine according to 40CFR60 Subpart JJJJ. If so, the engine and control device must be operated and maintained in accordance with the manufacturer's emission-related written instructions. You must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required. If the certified engine is not operated and maintained in accordance with the manufacturer's emission-related written instructions, the engine will be considered a non-certified engine and you must demonstrate compliance according to 40CFR§60.4243a(2)(i) through (iii), as appropriate.
Provide a manufacturer's data sheet for all engines being registered.
6. Enter the Engine Type designation(s) using the following codes:
 - LB2S = Lean Burn Two Stroke
 - RB4S = Rich Burn Four Stroke
 - LB4S = Lean Burn Four Stroke
7. Enter the Air Pollution Control Device (APCD) type designation(s) using the following codes:
 - A/F = Air/Fuel Ratio
 - IR = Ignition Retard
 - HEIS = High Energy Ignition System
 - SIPC = Screw-in Precombustion Chambers
 - PSC = Prestratified Charge
 - LEC = Low Emission Combustion
 - NSCR = Non-Selective Catalytic Reduction
 - SCR = Lean Burn & Selective Catalytic Reduction
8. Enter the Fuel Type using the following codes:
 - PQ = Pipeline Quality Natural Gas
 - RG = Raw Natural Gas
9. Enter the Potential Emissions Data Reference designation using the following codes. Attach all referenced data to this Compressor/Generator Data Sheet(s).
 - MD = Manufacturer's Data
 - AP = AP-42
 - GR = GRI-HAPCalcTM
 - OT = Other (please list) _____
10. Enter each engine's Potential to Emit (PTE) for the listed regulated pollutants in pounds per hour and tons per year. PTE shall be calculated at manufacturer's rated brake horsepower and may reflect reduction efficiencies of listed Air Pollution Control Devices. Emergency generator engines may use 500 hours of operation when calculating PTE. PTE data from this data sheet shall be incorporated in the Emissions Summary Sheet.

G3516B

GAS COMPRESSION APPLICATION

GAS ENGINE SITE SPECIFIC TECHNICAL DATA**Williams / Caiman**

ENGINE SPEED (rpm): 1400
COMPRESSION RATIO: 8:1
AFTERCOOLER - STAGE 2 INLET (°F): 130
AFTERCOOLER - STAGE 1 INLET (°F): 201
JACKET WATER OUTLET (°F): 210
ASPIRATION: TA
COOLING SYSTEM: JW+OC+1AC, 2AC
IGNITION SYSTEM: ADEM3
EXHAUST MANIFOLD: DRY
COMBUSTION: Ultra Lean Burn
NOx EMISSION LEVEL (g/bhp-hr NOx): 0.5
SET POINT TIMING: 28

FUEL SYSTEM:

SITE CONDITIONS:

FUEL:
FUEL PRESSURE RANGE(psig):
FUEL METHANE NUMBER:
FUEL LHV (Btu/scf):
ALTITUDE(ft):
MAXIMUM INLET AIR TEMPERATURE(°F):
STANDARD RATED POWER:

CAT WIDE RANGE
 WITH **AIR FUEL RATIO CONTROL**

Gas Analysis
 7.0-50.0
 59.3
1080
 1000
 105

1380 bhp@1400rpm

RATING	NOTES	LOAD	MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
			100%	100%	75%	50%
ENGINE POWER (WITHOUT FAN)	(1)	bhp	1380	1380	1035	690
INLET AIR TEMPERATURE		°F	106	105	105	105

ENGINE DATA							
FUEL CONSUMPTION (LHV)		(2)	Btu/bhp-hr	7427	7427	7955	8544
FUEL CONSUMPTION (HHV)		(2)	Btu/bhp-hr	8204	8204	8787	9438
AIR FLOW (77°F, 14.7 psia)	(WET)	(3)(4)	scfm	3149	3149	2470	1727
AIR FLOW	(WET)	(3)(4)	lb/hr	13963	13963	10953	7658
INLET MANIFOLD PRESSURE		(5)	in Hg(abs)	93.4	93.4	75.8	53.3
EXHAUST TEMPERATURE - ENGINE OUTLET		(6)	°F	1004	1004	998	1017
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(7)(4)	ft ³ /min	9213	9213	7205	5112
EXHAUST GAS MASS FLOW	(WET)	(7)(4)	lb/hr	14450	14450	11345	7938

EMISSIONS DATA - ENGINE OUT							
NOx (as NO2)		(8)(9)	g/bhp-hr	0.50	0.50	0.50	0.50
CO		(8)(9)	g/bhp-hr	2.89	EMIT: 3.02 g/bhp-hr	3.10	3.04
THC (mol. wt. of 15.84)		(8)(9)	g/bhp-hr	4.60	4.60	4.93	5.00
NMHC (mol. wt. of 15.84)		(8)(9)	g/bhp-hr	1.55	EMIT: 1.95 g/bhp-hr	1.66	1.68
NMNEHC (VOCs) (mol. wt. of 15.84)		(8)(9)(10)	g/bhp-hr	0.62	EMIT: 0.94 g/bhp-hr	0.67	0.68
HCHO (Formaldehyde)		(8)(9)	g/bhp-hr	0.41	0.41	0.40	0.40
CO2		(8)(9)	g/bhp-hr	499	499	532	578
EXHAUST OXYGEN		(8)(11)	% DRY	9.1	9.1	8.8	8.4

HEAT REJECTION							
HEAT REJ. TO JACKET WATER (JW)		(12)	Btu/min	22462	22462	20856	19434
HEAT REJ. TO ATMOSPHERE		(12)	Btu/min	6110	6110	5092	4074
HEAT REJ. TO LUBE OIL (OC)		(12)	Btu/min	4475	4475	3978	3363
HEAT REJ. TO A/C - STAGE 1 (1AC)		(12)(13)	Btu/min	12518	12518	10411	3709
HEAT REJ. TO A/C - STAGE 2 (2AC)		(12)(13)	Btu/min	5654	5654	5312	3445

COOLING SYSTEM SIZING CRITERIA			
TOTAL JACKET WATER CIRCUIT (JW+OC+1AC)	(13)(14)	Btu/min	43221
TOTAL AFTERCOOLER CIRCUIT (2AC)	(13)(14)	Btu/min	5936
A cooling system safety factor of 0% has been added to the cooling system sizing criteria.			

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature. 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature. Max. rating is the maximum capability for the specified fuel at site altitude and reduced inlet air temperature. Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

For notes information consult page three.

PREPARED BY:

Data generated by Gas Engine Rating Pro Version 4.01.02
 Ref. Data Set DM8800-05-001, Printed 10Aug2012

G3516B

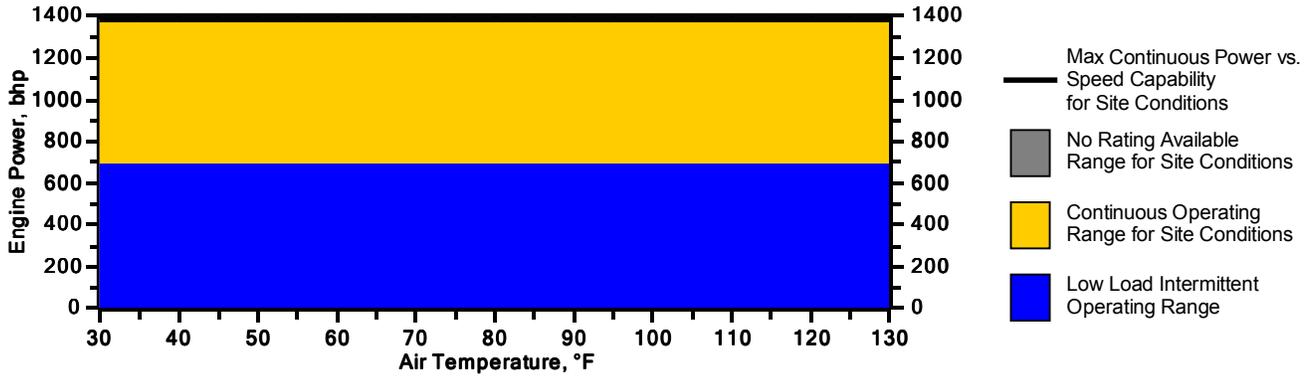
GAS COMPRESSION APPLICATION

GAS ENGINE SITE SPECIFIC TECHNICAL DATA Williams / Caiman



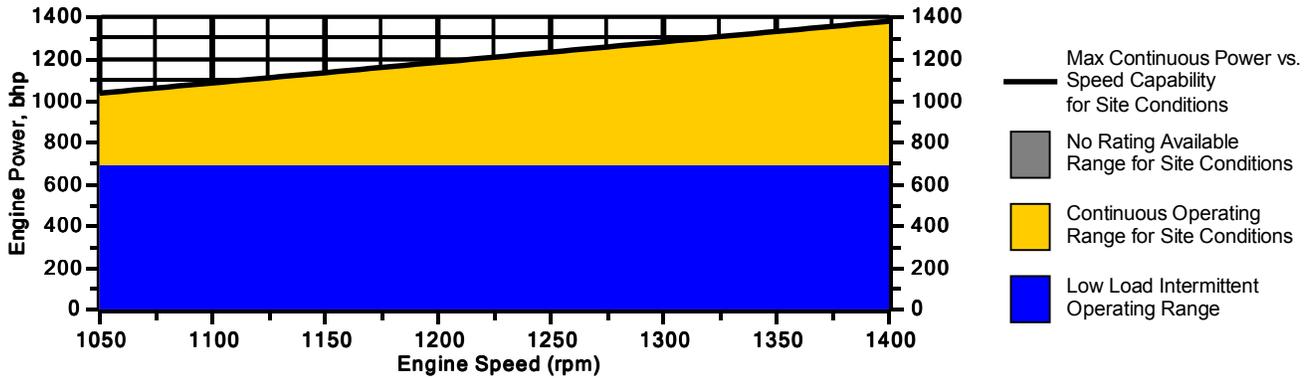
Engine Power vs. Inlet Air Temperature

Data represents temperature sweep at 1000 ft and 1400 rpm



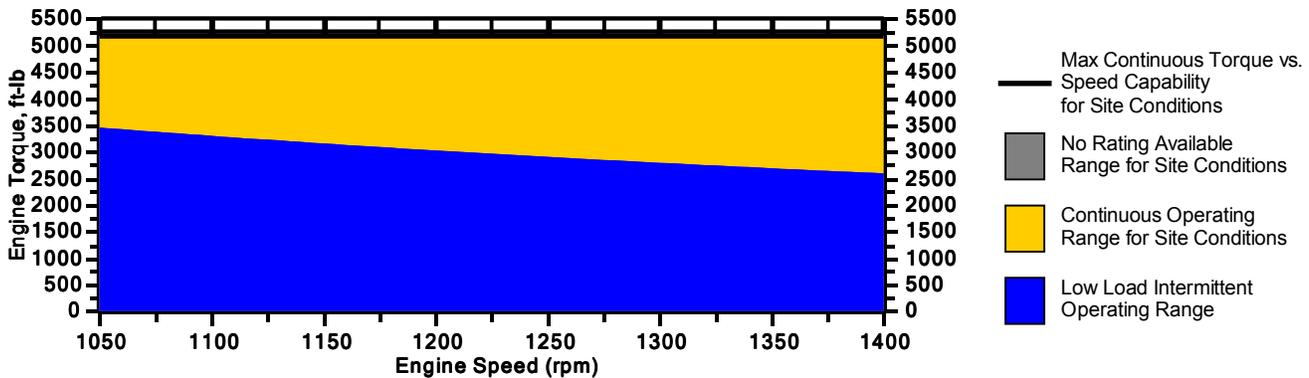
Engine Power vs. Engine Speed

Data represents speed sweep at 1000 ft and 105 °F



Engine Torque vs. Engine Speed

Data represents speed sweep at 1000 ft and 105 °F



Note: At site conditions of 1000 ft and 105°F inlet air temp., constant torque can be maintained down to 1050 rpm. The minimum speed for loading at these conditions is 1050 rpm.

G3516B

GAS COMPRESSION APPLICATION

GAS ENGINE SITE SPECIFIC TECHNICAL DATA Williams / Caiman



NOTES

1. Engine rating is with two engine driven water pumps. Tolerance is $\pm 3\%$ of full load.
2. Fuel consumption tolerance is $\pm 3.0\%$ of full load data.
3. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of $\pm 5\%$.
4. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.
5. Inlet manifold pressure is a nominal value with a tolerance of $\pm 5\%$.
6. Exhaust temperature is a nominal value with a tolerance of $(+)63^{\circ}\text{F}$, $(-)54^{\circ}\text{F}$.
7. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of $\pm 6\%$.
8. Emissions data is at engine exhaust flange prior to any after treatment.
9. Emission values are based on engine operating at steady state conditions. Fuel methane number cannot vary more than ± 3 . Values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate "Not to Exceed" values. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.
10. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
11. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NO_x level. Tolerance is ± 0.5 .
12. Heat rejection values are nominal. Tolerances, based on treated water, are $\pm 10\%$ for jacket water circuit, $\pm 50\%$ for radiation, $\pm 20\%$ for lube oil circuit, and $\pm 5\%$ for aftercooler circuit.
13. Aftercooler heat rejection includes an aftercooler heat rejection factor for the site elevation and inlet air temperature specified. Aftercooler heat rejection values at part load are for reference only. Do not use part load data for heat exchanger sizing.
14. Cooling system sizing criteria are maximum circuit heat rejection for the site, with applied tolerances.

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	82.2037	82.2037
Ethane	C2H6	12.4750	12.4750
Propane	C3H8	3.2121	3.2121
Isobutane	iso-C4H10	0.4323	0.4323
Norbutane	nor-C4H10	0.6192	0.6192
Isopentane	iso-C5H12	0.1644	0.1644
Norpentane	nor-C5H12	0.1392	0.1392
Hexane	C6H14	0.2382	0.2382
Heptane	C7H16	0.0000	0.0000
Nitrogen	N2	0.3801	0.3801
Carbon Dioxide	CO2	0.1093	0.1093
Hydrogen Sulfide	H2S	0.0000	0.0000
Carbon Monoxide	CO	0.0000	0.0000
Hydrogen	H2	0.0000	0.0000
Oxygen	O2	0.0265	0.0265
Helium	HE	0.0000	0.0000
Neopentane	neo-C5H12	0.0000	0.0000
Octane	C8H18	0.0000	0.0000
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		100.0000	100.0000

Fuel Makeup:

Gas Analysis

Unit of Measure:

English

Calculated Fuel Properties

Caterpillar Methane Number:	59.3
Lower Heating Value (Btu/scf):	1080
Higher Heating Value (Btu/scf):	1193
WOBBE Index (Btu/scf):	1315
THC: Free Inert Ratio:	255.31
Total % Inerts (% N2, CO2, He):	0.49%
RPC (%) (To 905 Btu/scf Fuel):	100%
Compressibility Factor:	0.997
Stoich A/F Ratio (Vol/Vol):	11.23
Stoich A/F Ratio (Mass/Mass):	16.63
Specific Gravity (Relative to Air):	0.675
Specific Heat Constant (K):	1.289

CONDITIONS AND DEFINITIONS

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Caterpillar Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets generated by the Caterpillar Gas Engine Rating Pro program take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for Btu/scf calculations are at 60F and 14.696 psia.

Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

FUEL LIQUIDS

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.



G3516B LE Gas Petroleum Engine

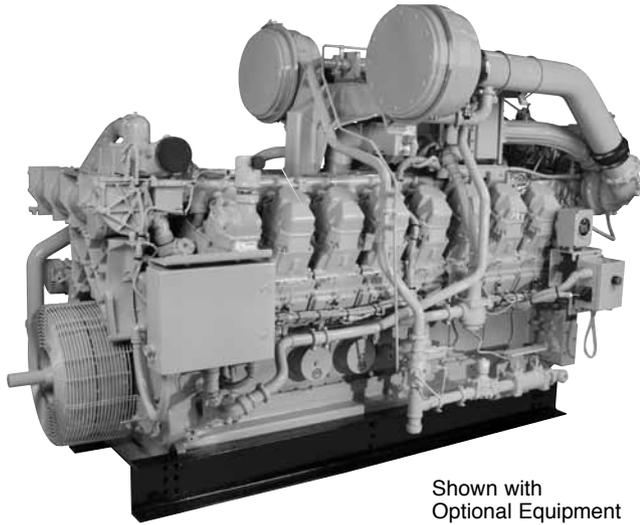
1029 bkW (1380 bhp)
1400 rpm

0.5 g/bhp-hr NO_x or 1.0 g/bhp-hr NO_x (NTE)

CAT® ENGINE SPECIFICATIONS

V-16, 4-Stroke-Cycle

Bore	170 mm (6.7 in.)
Stroke	190 mm (7.5 in.)
Displacement	69.3 L (4230 cu. in.)
Aspiration	Turbocharged-2 Stage Aftercooled Digital Engine Management
Governor and Protection	Electronic (ADEM™ A3)
Combustion	Low Emission (Lean Burn)
Engine Weight, net dry (approx)....	8401 kg (18,520 lb)
Power Density	8.2 kg/kW (13.4 lb/hp)
Power per Displacement	19.9 bhp/L
Total Cooling System Capacity	221.5 L (58.5 gal)
Jacket Water	204.4 L (54 gal)
SCAC	17 L (4.5 gal)
Lube Oil System (refill)	424 L (112 gal)
Oil Change Interval	1000 hour
Rotation (from flywheel end)	Counterclockwise
Flywheel and Flywheel Housing	SAE No. 00
Flywheel Teeth	183



Shown with
Optional Equipment

FEATURES

Engine Design

- Built on G3500 LE proven reliability and durability
- Ability to burn a wide spectrum of gaseous fuels
- Robust diesel strength design prolongs life and lowers owning and operating costs
- Broad operating speed range at lower site air densities (high altitude/hot ambient temperatures)
- Higher power density improves fleet management
- Quality engine diagnostics
- Detonation-sensitive timing control for individual cylinders

Ultra Lean Burn Technology (ULB)

ULB technology uses an advanced control system, a better turbo match, improved air and fuel mixing, and a more sophisticated combustion recipe to provide:

- Lowest engine-out emissions
- Highest fuel efficiency
- Improved altitude and speed turndown
- Stable load acceptance and load rejection

Emissions

- Meets U.S. EPA Spark Ignited Stationary NSPS emissions for 2010
- Lean air/fuel mixture provides best available emissions and fuel efficiency for engines of this bore size

Advanced Digital Engine Management

ADEM A3 engine management system integrates speed control, air/fuel ratio control, and ignition/detonation controls into a complete engine management system. ADEM A3 has improved: user interface, display system, shutdown controls, and system diagnostics.

Full Range of Attachments

Large variety of factory-installed engine attachments reduces packaging time.

Testing

Every engine is full-load tested to ensure proper engine performance.

Gas Engine Rating Pro

GERP is a PC-based program designed to provide site performance capabilities for Cat® natural gas engines for the gas compression industry. GERP provides engine data for your site's altitude, ambient temperature, fuel, engine coolant heat rejection, performance data, installation drawings, spec sheets, and pump curves.

Product Support Offered Through Global Cat Dealer Network

More than 2,200 dealer outlets

Cat factory-trained dealer technicians service every aspect of your petroleum engine

Cat parts and labor warranty

Preventive maintenance agreements available for repair-before-failure options

S•O•SSM program matches your oil and coolant samples against Caterpillar set standards to determine:

- Internal engine component condition
- Presence of unwanted fluids
- Presence of combustion by-products
- Site-specific oil change interval

Over 80 Years of Engine Manufacturing Experience

Over 60 years of natural gas engine production

- Ownership of these manufacturing processes enables Caterpillar to produce high quality, dependable products
- Cast engine blocks, heads, cylinder liners, and flywheel housings
 - Machine critical components
 - Assemble complete engine

Web Site

For all your petroleum power requirements, visit www.catoilandgas.cat.com.

**G3516B LE****GAS PETROLEUM ENGINE**1029 bkW **(1380 bhp)**

STANDARD EQUIPMENT

Air Inlet System

Axial flow air cleaners
Service indicator
Cleanable

Cooling System

Two-stage charge air cooling:
First stage — JW + OC + 1st stage AC
Second stage — 2nd stage AC
Engine cooling and charge air cooling thermostats

Exhaust System

Dry exhaust manifolds and turbocharger housings

Flywheels and Housings

SAE 00 flywheel
SAE 00 flywheel housing
SAE standard rotation

Fuel System

Electronic fuel metering valve
Requires 7-50 psig gas supply
Gas pressure regulator
Gas shutoff valve

Instrumentation

Remote-mounted Advisor control panel
Interconnect harness

Lube System

Top-mounted crankcase breathers
Oil cooler
Oil filter and oil sampling valve
Drain valve
Turbo oil accumulator
API B16.3 approved gas/air-driven pre-lube system

Torsional Vibration Analysis

Caterpillar provided
Required through first quarter 2010

Mounting

Rails

Control Panels

4" LCD Advisor display panel
Shipped loose

Starting System

90 psi TDI starter
150 psi TDI starter

Power Take-Offs

Front housing, two sided
Front lower LH accessory drive

Protection System — Display/Alarm/Shutdown

Low oil pressure
Oil filter differential pressure
High fuel or oil temperature
Engine oil to engine coolant
Differential temperature
High coolant temperature
Engine speed
Engine load
Battery voltage
Detonation
Manifold air temperature
Coolant JW inlet/outlet pressure
Left turbo inlet temperature
Right turbo inlet temperature
Cylinder port temperature

Protection System — Display Only

Service hours
Oxygen level

General

Paint — Cat yellow
Dual 23" vibration damper with guard
CSA Certification, Class 1 Division 2 Groups C and D

OPTIONAL EQUIPMENT

Air Inlet System

Rectangular air inlet adapter
Circular air inlet adapter

Charging System

Battery Charger 20 amp

Connections

Mechanical joint assembly
Inlet connection

Exhaust System

Flexible fittings available at first production build
Elbows and mufflers

Instrumentation

Optional interconnect harness

Lube System

Shipped with lube oil

Mounting System

Rails

Power Take-Offs

Front stub shaft

Literature

Options available

Packing



G3516B LE GAS PETROLEUM ENGINE

1029 bkW (1380 bhp)

TECHNICAL DATA

G3516B LE Gas Petroleum Engine — 1400 rpm***

Fuel System		0.5 g NOx NTE Rating DM8800-03	1.0 g NOx NTE Rating DM8850-02
Engine Power @ 100% Load	bkW (bhp)	1029 (1380)	1029 (1380)
Engine Speed	rpm	1400	1400
Max Altitude @ Rated Torque and 38°C (100°F)	m (ft)	1219.2 (4000)	1828.8 (6000)
Speed Turndown @ Max Altitude, Rated Torque, and 38°C (100°F)	%	25	25
Aftercooler Temperature			
Stage 1 (JW)	°C (°F)	98.9 (210)	98.9 (210)
Stage 2 (SCAC)	°C (°F)	54 (130)	54 (130)
Emissions*			
NOx	g/bkW-hr (g/bhp-hr)	0.67 (0.50)	1.34 (1.00)
CO	g/bkW-hr (g/bhp-hr)	3.26 (2.43)	3.75 (2.80)
CO ₂	g/bkW-hr (g/bhp-hr)	635 (474)	603 (449)
VOC**	g/bkW-hr (g/bhp-hr)	0.64 (0.48)	0.51 (0.38)
Fuel Consumption*** @ 100% Load	MJ/bkW-hr (Btu/bhp-hr)	10.33 (7301)	9.97 (7050)
Heat Balance			
Heat Rejection to Jacket Water @ 100% Load			
JW	bkW (Btu/mn)	412.37 (23,451)	418.9 (23,820)
OC	bkW (Btu/mn)	78.2 (4449)	78.2 (4449)
Heat Rejection to Aftercooler @ 100% Load			
1st Stage AC	bkW (Btu/mn)	94.23 (5359)	78.55 (4467)
2nd Stage AC	bkW (Btu/mn)	176.7 (10,047)	157.9 (8984)
Heat Rejection to Exhaust @ 100% Load LHV to 25° C (77° F)	bkW (Btu/mn)	1098 (62,428)	1021.9 (58,113)
Heat Rejection to Atmosphere @ 100% Load	bkW (Btu/mn)	107.34 (6110)	107.34 (6110)
Exhaust System			
Exhaust Gas Flow Rate @ 100% Load	m ³ /min (cfm)	258.4 (9126)	246.8 (8716)
Exhaust Stack Temperature @ 100% Load	°C (°F)	533.33 (992)	532.22 (990)
Intake System			
Air Inlet Flow Rate @ 100% Load	m ³ /min (scfm)	88.52 (3126)	84.70 (2991)
Gas Pressure	kPag (psig)	48-345 (7-50)	48-345 (7-50)

*at 100% load and speed, all values are listed as not to exceed

**Volatile organic compounds as defined in U.S. EPA 40 CFR 60, subpart JJJJ

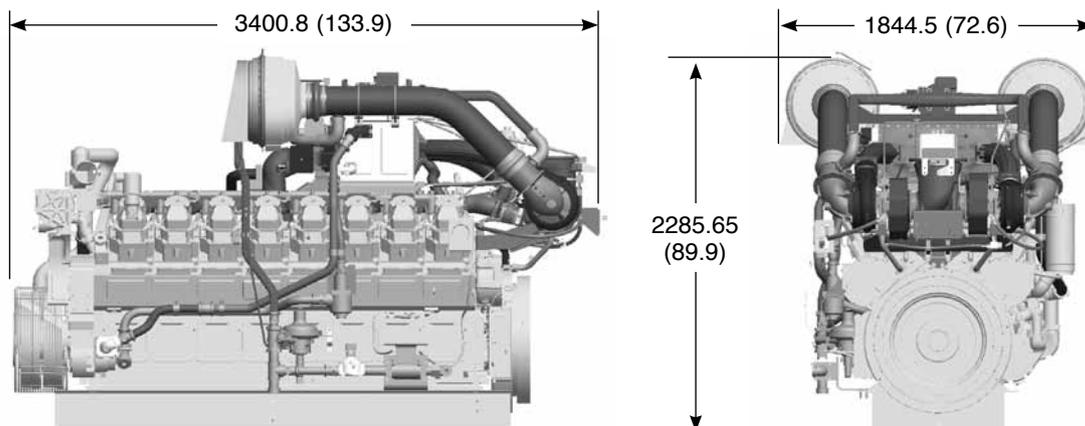
***ISO 3046/1



G3516B LE GAS PETROLEUM ENGINE

1029 bkW (1380 bhp)

DIMENSIONS



DIMENSIONS		
Length	mm (in.)	3400.8 (133.9)
Width	mm (in.)	1844.55 (72.6)
Height	mm (in.)	2285.65 (89.9)
Shipping Weight	kg (lb)	8401 (18,520)

Note: General configuration not to be used for installation.

Dimensions are in mm (inches).

RATING DEFINITIONS AND CONDITIONS

Engine performance is obtained in accordance with SAE J1995, ISO3046/1, BS5514/1, and DIN6271/1 standards.

Transient response data is acquired from an engine/generator combination at normal operating temperature and in accordance with ISO3046/1 standard ambient conditions. Also in accordance with SAE J1995, BS5514/1, and DIN6271/1 standard reference conditions.

Conditions: Power for gas engines is based on fuel having an LHV of 33.74 kJ/L (905 Btu/cu ft) at 101 kPa (29.91 in. Hg) and 15° C (59° F). Fuel rate is based on a cubic meter at 100 kPa (29.61 in. Hg) and 15.6° C (60.1° F). Air flow is based on a cubic foot at 100 kPa (29.61 in. Hg) and 25° C (77° F). Exhaust flow is based on a cubic foot at 100 kPa (29.61 in. Hg) and stack temperature.

Materials and specifications are subject to change without notice. The International System of Units (SI) is used in this publication. CAT, CATERPILLAR, their respective logos, ADEM, "Caterpillar Yellow" and the "Power Edge" trade dress, as well as corporate and product identity used herein, are trademarks of Caterpillar and may not be used without permission.

WGGG COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment L - Emission Unit Data Sheet**NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET**

		Compressor Station		WGGG CS			
		Manufacturer and Model		---			
General Glycol Dehydration Unit Data		Max Dry Gas Flow Rate (MMscf/day)		40.0			
		Design Heat Input (MMBtu/hr) - LHV		1.0			
		Design Type (DEG or TEG)		TEG			
		Source Status ²		ES			
		Date Installed/Modified/Removed ³		2013			
		Regenerator Still Vent APCD ⁴		CD			
		Fuel HV (Btu/scf) - LHV		920			
		H ₂ S Content (gr/100 scf)		0.2			
		Operation (hrs/yr)		8,760			
		Source ID # ¹	Vent	Reference ⁵	PTE ⁶	lbs/hr	tons/yr
		Dehydrator 01	Flash Tank (DFT-01/5E) and Still Vent (DSV-01/6E) Combined	GRI-GLYCalc	VOC	12.27	53.75
GRI-GLYCalc	Benzene			0.04	0.17		
GRI-GLYCalc	Ethylbenzene			0.04	0.18		
GRI-GLYCalc	n-Hexane			0.19	0.82		
GRI-GLYCalc	Toluene			0.13	0.48		
GRI-GLYCalc	2,2,4-TMP			0.01	0.02		
GRI-GLYCalc	Xylenes			0.21	0.91		
Sum	Total HAP			0.61	2.58		
GRI-GLYCalc	CO ₂			1.17	5.10		
GRI-GLYCalc	CH ₄			62	273		
Weighted Sum	CO ₂ e			1,559	6,828		
Reboiler Vent 01	RBV-01/7E	AP-42	NOX	0.10	0.43		
		AP-42	CO	0.08	0.36		
		AP-42	VOC	0.01	0.02		
		AP-42	SO ₂	5.9E-04	2.6E-03		
		AP-42	PM _{10/2.5}	0.01	0.03		
		AP-42	Benzene	2.1E-06	9.0E-06		
		AP-42	Ethylbenzene	---	---		
		AP-42	HCHO	7.4E-05	3.2E-04		
		AP-42	n-Hexane	1.8E-03	0.01		
		AP-42	Methanol	---	---		
		AP-42	Toluene	3.3E-06	1.5E-05		
		AP-42	2,2,4-TMP	---	---		
		AP-42	Xylenes	---	---		
		AP-42	Other HAP	1.9E-06	8.2E-06		
		Sum	Total HAP	1.8E-03	0.01		
		AP-42	CO ₂	118	515		
		AP-42	CH ₄	2.3E-03	0.01		
		AP-42	N ₂ O	2.2E-03	0.01		
Weighted Sum	CO ₂ e	118	518				

WGGG COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment L - Emission Unit Data Sheet

NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET

(Continued)

Notes to **NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET**

1. Enter the appropriate Source Identification Numbers for the glycol dehydration unit Reboiler Vent and glycol Regenerator Still Vent. The glycol dehydration unit Reboiler Vent and glycol Regenerator Still Vent should be designated RBV-1 and RSV-1, respectively. If the compressor station incorporates multiple glycol dehydration units, a Glycol Dehydration Unit Data Sheet shall be completed for each, using Source Identification #s RBV-2 and RSV-2, RBV-3 and RSV-3, etc.

2. Enter the Source Status using the following codes:

NS = Construction of New Source

ES = Existing Source

MS = Modification of Existing Source

RS = Removal of Source

3. Enter the date (or anticipated date) of the glycol dehydration unit's installation (construction of source), modification or removal.

4. Enter the Air Pollution Control Device (APCD) type designation using the following codes:

NA = None

CD = Condenser

FL = Flare

CC = Condenser/Combustion Combination

TO = Thermal Oxidizer

5. Enter the Potential Emissions Data Reference designation using the following codes:

MD = Manufacturer's Data

AP = AP-42

GR = GRI-GLYCalcTM

OT = Other (please list): _____

6. Enter the Reboiler Vent and glycol Regenerator Still Vent Potential to Emit (PTE) for the listed regulated pollutants in lbs per hour and tons per year. The glycol Regenerator Still Vent potential emissions may be determined using the most recent version of the thermodynamic software model GRI-GLYCalcTM (Radian International LLC & Gas Research Institute). Attach all referenced Potential Emissions Data (or calculations) and the GRI-GLYCalc Aggregate Calculations Report to this Glycol Dehydration Unit Data Sheet(s). This PTE data shall be incorporated in the Emissions Summary Sheet.

Include a copy of the GRI-GLYCalcTM analysis. This includes a printout of the aggregate calculations report, which shall include emissions reports, equipment reports, and stream reports.

***An explanation of input parameters and examples, when using GRI-GLYCalcTM is available on our website.**

WGGG COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment L**40 CFR Part 63; Subpart HH & HHH Registration Form**

West Virginia Department of Environmental Protection

Division of Air Quality

40 CFR Part 63; Subpart HH & HHH Registration Form

DIVISION OF AIR QUALITY : (304) 926-0475

WEB PAGE: <http://www.wvdep.org>

Complete this form for any oil and natural gas production or natural gas transmission and storage facility that uses an affected unit under HH/HHH, whether subject or not.

Section A: Facility Description		
Affected facility actual annual average natural gas throughput (scf/day):	40.0 MM	
Affected facility actual annual average hydrocarbon liquid throughput: (bbl/day):	na	
The affected facility processes, upgrades, or stores hydrocarbon liquids prior to custody transfer.	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
The affected facility processes, upgrades, or stores natural gas prior to the point at which natural gas (NG) enters the NG transmission and storage source category or is delivered to the end user.	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
The affected facility is:	<input checked="" type="checkbox"/> prior to a NG processing plant <input type="checkbox"/> NG processing plant <input type="checkbox"/> prior to the point of custody transfer and there is no NG processing plant	
The affected facility transports or stores natural gas prior to entering the pipeline to a local distribution company or to a final end user (if there is no local distribution company).	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
The affected facility exclusively processes, stores, or transfers black oil with an initial producing gas-to-oil ratio (GOR): na scf/bbl API gravity: na degrees	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

Section B: Dehydration Unit (if applicable)¹			
Description: 40.0 MMscfd - Dehydrator 01 (DFT-01/5E and DSV-01/6E)			
Date of Installation: 2013	Annual Operating Hours: 8,760	Burner rating (MMBtu/hr): 1.00	
Exhaust Stack Height (ft): 10.0	Stack Diameter (ft): 0.6	Stack Temp. (oF): 120	
Glycol Type:	<input checked="" type="checkbox"/> TEG <input type="checkbox"/> EG <input type="checkbox"/> Other: na		
Glycol Pump Type:	<input type="checkbox"/> Elect <input checked="" type="checkbox"/> Gas If Gas, what is the volume ratio?: 0.08 acfm/gpm		
Condenser installed?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Exit Temp: 150 oF	Condenser Pressure: 14.0 psia	
Incinerator/flare installed?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Destruction Eff.: na		
Other controls installed?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Describe: JATCO BTEX Eliminator Skid (≥ 95%)		
Wet Gas ² : (Upstream of Contact Tower)	Gas Temperature: 80 oF	Gas Pressure: 900 psig	
	Saturated Gas?: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, water content?: na		
Dry Gas: (Downstream of Contact Tower)	Gas Flowrate: Actual: 40.0 MMscfd	Design: 40.0 MMscfd	
	Water Content: 7.0 lb/MMscf		
Lean Glycol:	Circulation Rate: Actual ³ : 7.50 gpm	Max ⁴ : 7.50 gpm	
	Pump make/model: Kimray 45020PV		
Glycol Flash Tank (if applicable):	Temp: 160.0 oF Press: 40.0 psig	Vented: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	If no, describe vapor control: A minimum of 50% of the Flash Tank off-gas is recycled as fuel in the reboiler.		
Stripping Gas (if applicable):	Source of Gas na	Rate: na	

Williams Ohio Valley Midstream LLC
WGGS COMPRESSOR STATION
Application for 45CSR13 NSR Modification Permit
Attachment L

40 CFR Part 63; Subpart HH & HHH Registration Form - Continued

Please attach the following required dehydration unit information:

1. System map indicating the chain of custody information. See Page 43 of this document for an example of a gas flow schematic. It is not intended that the applicant provide this level of detail for all sources. The level of detail that is necessary is to establish where the custody transfer points are located. This can be accomplished by submitting a process flow diagram indicating custody transfer points and the natural gas flow. However, the DAQ reserves the right to request more detailed information in order to make the necessary decisions.
2. Extended gas analysis from the Wet Gas Stream, including mole percent of C1-C8, benzene, ethylbenzene, toluene, xylene and n-hexane, using Gas Processors Association (GPA) 2286 (or similar). A sample should be taken from the inlet gas line, downstream from any inlet separator, and using a manifold to remove entrained liquids from the sample and a probe to collect the sample from the center of the gas line. GPA standard 2166 reference method or a modified version of EPA Method TO-14, (or similar) should be used.
3. GRI-GLYCalc Ver. 3.0 aggregate report based on maximum Lean Glycol circulation rate and maximum throughput.
4. Detailed calculations of gas or hydrocarbon flow rate.

Section C: Facility NESHAPS Subpart HH/HHH status

- Subject to Subpart HH -- However, *EXEMPT* because the facility is an area source of HAP emissions *and* the actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere is < 0.90 megagram per year (1.0 tpy); see 40CFR§63.764(e)(1)(ii).

Affected facility status:
(choose only one)

- Subject to Subpart HHH

Not Subject
Because:

- < 10/25 TPY
- Affected facility exclusively handles black oil.
- Facility-wide actual annual average NG throughput is < 650 thousand scf/day and facility-wide actual annual average hydrocarbon liquid is < 250 bpd.
- No affected source is present.

Attachment L EMISSIONS UNIT DATA SHEET STORAGE TANKS

Provide the following information for each new or modified bulk liquid storage tank as shown on the *Equipment List Form* and other parts of this application. A tank is considered modified if the material to be stored in the tank is different from the existing stored liquid.

IF USING US EPA'S TANKS EMISSION ESTIMATION PROGRAM (AVAILABLE AT www.epa.gov/tnn/tanks.html), APPLICANT MAY ATTACH THE SUMMARY SHEETS IN LIEU OF COMPLETING SECTIONS III, IV, & V OF THIS FORM. HOWEVER, SECTIONS I, II, AND VI OF THIS FORM MUST BE COMPLETED. US EPA'S AP-42, SECTION 7.1, "ORGANIC LIQUID STORAGE TANKS," MAY ALSO BE USED TO ESTIMATE VOC AND HAP EMISSIONS (<http://www.epa.gov/tnn/chief/>).

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name WGGS Compressor Station	2. Tank Name 210 bbl Produced Water Tank
3. Tank Equipment Identification No. (as assigned on <i>Equipment List Form</i>) T01	4. Emission Point Identification No. (as assigned on <i>Equipment List Form</i>) T-01/8E
5. Date of Commencement of Construction (for existing tanks)	
6. Type of change <input checked="" type="checkbox"/> New Construction <input type="checkbox"/> New Stored Material <input type="checkbox"/> Other Tank Modification	
7. Description of Tank Modification (if applicable)	
7A. Does the tank have more than one mode of operation? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (e.g. Is there more than one product stored in the tank?)	
7B. If YES, explain and identify which mode is covered by this application (Note: A separate form must be completed for each mode).	
7C. Provide any limitations on source operation affecting emissions, any work practice standards (e.g. production variation, etc.): na	

II. TANK INFORMATION (required)

8. Design Capacity (specify barrels or gallons). Use the internal cross-sectional area multiplied by internal height. 210 barrels	
9A. Tank Internal Diameter (ft) 10	9B. Tank Internal Height (or Length) (ft) 15
10A. Maximum Liquid Height (ft) 14	10B. Average Liquid Height (ft) 8
11A. Maximum Vapor Space Height (ft)	11B. Average Vapor Space Height (ft)
12. Nominal Capacity (specify barrels or gallons). This is also known as "working volume" and considers design liquid levels and overflow valve heights. 210 barrels	

13A. Maximum annual throughput (gal/yr) 172.498	13B. Maximum daily throughput (gal/day) 172.498 / 10 = 17.2498
14. Number of Turnovers per year (annual net throughput/maximum tank liquid volume) 19	
15. Maximum tank fill rate (gal/min)	
16. Tank fill method <input type="checkbox"/> Submerged <input checked="" type="checkbox"/> Splash <input type="checkbox"/> Bottom Loading	
17. Complete 17A and 17B for Variable Vapor Space Tank Systems <input checked="" type="checkbox"/> Does Not Apply	
17A. Volume Expansion Capacity of System (gal)	17B. Number of transfers into system per year
18. Type of tank (check all that apply): <input type="checkbox"/> Fixed Roof ___ vertical ___ horizontal ___ flat roof ___ cone roof ___ dome roof ___ other (describe) <input type="checkbox"/> External Floating Roof ___ pontoon roof ___ double deck roof <input type="checkbox"/> Domed External (or Covered) Floating Roof <input type="checkbox"/> Internal Floating Roof ___ vertical column support ___ self-supporting <input type="checkbox"/> Variable Vapor Space ___ lifter roof ___ diaphragm <input type="checkbox"/> Pressurized ___ spherical ___ cylindrical <input type="checkbox"/> Underground <input type="checkbox"/> Other (describe)	

III. TANK CONSTRUCTION & OPERATION INFORMATION (optional if providing TANKS Summary Sheets)

19. Tank Shell Construction: <input type="checkbox"/> Riveted <input type="checkbox"/> Gunitite lined <input type="checkbox"/> Epoxy-coated rivets <input type="checkbox"/> Other (describe)		
20A. Shell Color	20B. Roof Color	20C. Year Last Painted
21. Shell Condition (if metal and unlined): <input type="checkbox"/> No Rust <input type="checkbox"/> Light Rust <input type="checkbox"/> Dense Rust <input type="checkbox"/> Not applicable		
22A. Is the tank heated? <input type="checkbox"/> YES <input type="checkbox"/> NO		
22B. If YES, provide the operating temperature (°F)		
22C. If YES, please describe how heat is provided to tank.		
23. Operating Pressure Range (psig): to		
24. Complete the following section for Vertical Fixed Roof Tanks		<input type="checkbox"/> Does Not Apply
24A. For dome roof, provide roof radius (ft)		
24B. For cone roof, provide slope (ft/ft)		
25. Complete the following section for Floating Roof Tanks		<input type="checkbox"/> Does Not Apply
25A. Year Internal Floaters Installed:		
25B. Primary Seal Type: <input type="checkbox"/> Metallic (Mechanical) Shoe Seal <input type="checkbox"/> Liquid Mounted Resilient Seal <input type="checkbox"/> Vapor Mounted Resilient Seal <input type="checkbox"/> Other (describe):		
25C. Is the Floating Roof equipped with a Secondary Seal? <input type="checkbox"/> YES <input type="checkbox"/> NO		
25D. If YES, how is the secondary seal mounted? (check one) <input type="checkbox"/> Shoe <input type="checkbox"/> Rim <input type="checkbox"/> Other (describe):		
25E. Is the Floating Roof equipped with a weather shield? <input type="checkbox"/> YES <input type="checkbox"/> NO		

25F. Describe deck fittings; indicate the number of each type of fitting:		
ACCESS HATCH		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:
AUTOMATIC GAUGE FLOAT WELL		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:
COLUMN WELL		
BUILT-UP COLUMN – SLIDING COVER, GASKETED:	BUILT-UP COLUMN – SLIDING COVER, UNGASKETED:	PIPE COLUMN – FLEXIBLE FABRIC SLEEVE SEAL:
LADDER WELL		
PIP COLUMN – SLIDING COVER, GASKETED:	PIPE COLUMN – SLIDING COVER, UNGASKETED:	
GAUGE-HATCH/SAMPLE PORT		
SLIDING COVER, GASKETED:	SLIDING COVER, UNGASKETED:	
ROOF LEG OR HANGER WELL		
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	SAMPLE WELL-SLIT FABRIC SEAL (10% OPEN AREA)
VACUUM BREAKER		
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	
RIM VENT		
WEIGHTED MECHANICAL ACTUATION GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	
DECK DRAIN (3-INCH DIAMETER)		
OPEN:	90% CLOSED:	
STUB DRAIN		
1-INCH DIAMETER:		
OTHER (DESCRIBE, ATTACH ADDITIONAL PAGES IF NECESSARY)		

26. Complete the following section for Internal Floating Roof Tanks <input type="checkbox"/> Does Not Apply	
26A. Deck Type: <input type="checkbox"/> Bolted <input type="checkbox"/> Welded	
26B. For Bolted decks, provide deck construction:	
26C. Deck seam: <input type="checkbox"/> Continuous sheet construction 5 feet wide <input type="checkbox"/> Continuous sheet construction 6 feet wide <input type="checkbox"/> Continuous sheet construction 7 feet wide <input type="checkbox"/> Continuous sheet construction 5 × 7.5 feet wide <input type="checkbox"/> Continuous sheet construction 5 × 12 feet wide <input type="checkbox"/> Other (describe)	
26D. Deck seam length (ft)	26E. Area of deck (ft ²)
For column supported tanks:	26G. Diameter of each column:
26F. Number of columns:	

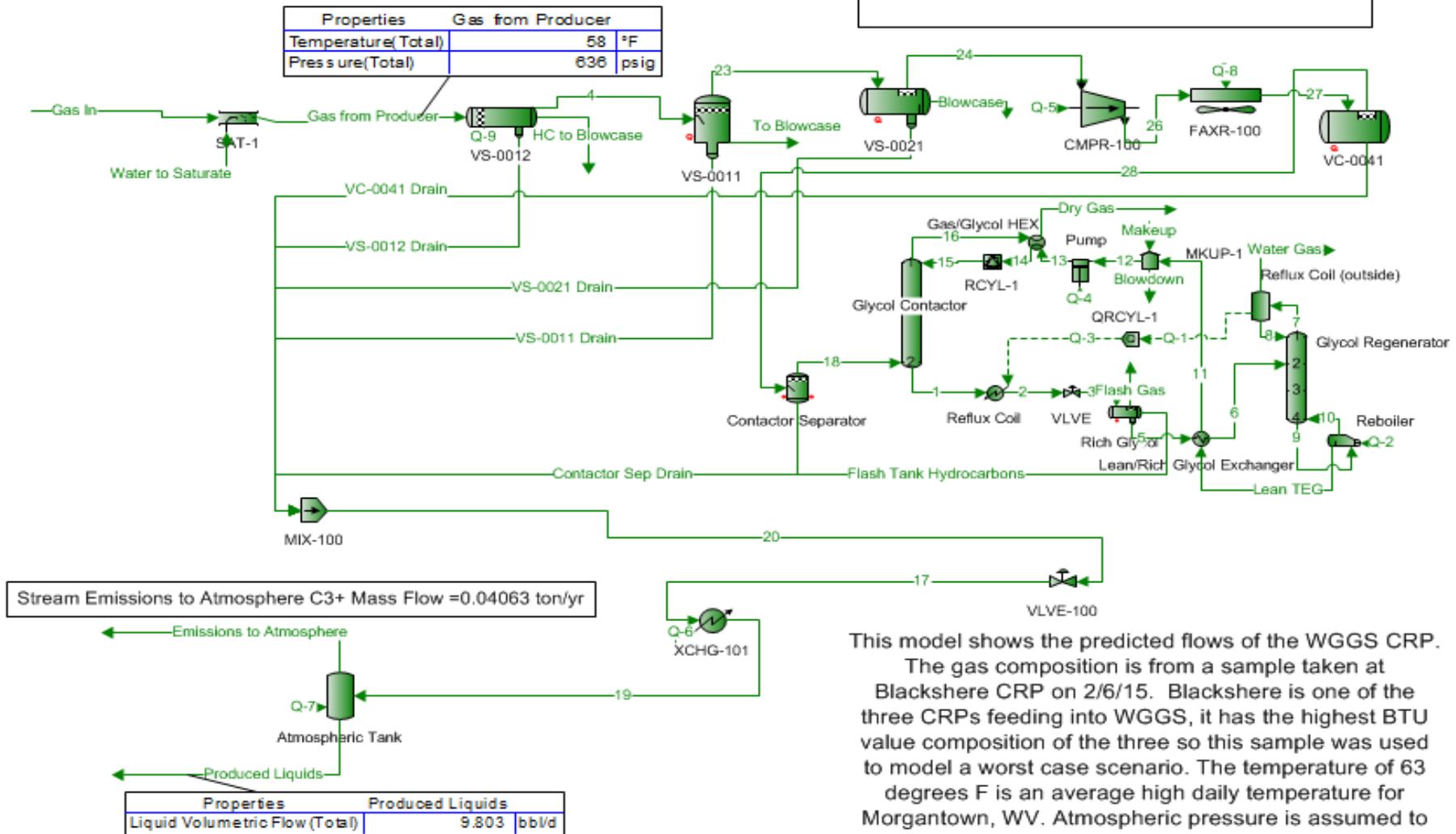
IV. SITE INFORMATION (optional if providing TANKS Summary Sheets)

27. Provide the city and state on which the data in this section are based.
28. Daily Average Ambient Temperature (°F)
29. Annual Average Maximum Temperature (°F)
30. Annual Average Minimum Temperature (°F)
31. Average Wind Speed (miles/hr)
32. Annual Average Solar Insulation Factor (BTU/(ft ² -day))
33. Atmospheric Pressure (psia)

V. LIQUID INFORMATION (optional if providing TANKS Summary Sheets)

34. Average daily temperature range of bulk liquid:			
34A. Minimum (°F)		34B. Maximum (°F)	
35. Average operating pressure range of tank:			
35A. Minimum (psig)		35B. Maximum (psig)	
36A. Minimum Liquid Surface Temperature (°F)		36B. Corresponding Vapor Pressure (psia)	
37A. Average Liquid Surface Temperature (°F)		37B. Corresponding Vapor Pressure (psia)	
38A. Maximum Liquid Surface Temperature (°F)		38B. Corresponding Vapor Pressure (psia)	
39. Provide the following for <u>each</u> liquid or gas to be stored in tank. Add additional pages if necessary.			
39A. Material Name or Composition			
39B. CAS Number			
39C. Liquid Density (lb/gal)			
39D. Liquid Molecular Weight (lb/lb-mole)			
39E. Vapor Molecular Weight (lb/lb-mole)			

WGGS CRP



This model shows the predicted flows of the WGGS CRP. The gas composition is from a sample taken at Blackshere CRP on 2/6/15. Blackshere is one of the three CRPs feeding into WGGS, it has the highest BTU value composition of the three so this sample was used to model a worst case scenario. The temperature of 63 degrees F is an average high daily temperature for Morgantown, WV. Atmospheric pressure is assumed to be 14.7 psia.

Location: WGGS
 Condensate Volume: 3578.095 bbl/yr
 Total VOC's: 0.04 ton/yr

Emissions to Atmosphere		
Temperature	°F	63
Pressure	psig	0
Mole Fraction Vapor	%	100

Produced Liquids		
Temperature	°F	63
Pressure	psig	0
Liquid Volumetric Flow	bbl/d	9.803

Emissions to Atmosphere	
Component	tons/year
Water	0.01
TEG	0.00
Oxygen	0.00
Nitrogen	0.00
Methane	0.49
CO2	0.02
Ethane	0.10
Propane	0.03
i-Butane	1.6E-03
n-Butane	4.1E-03
i-Pentane	9.2E-04
n-Pentane	5.2E-04
2,2-Dimethylbutane	2.3E-05
2,3-Dimethylbutane	5.0E-05
2-Methylpentane	1.0E-04
3-Methylpentane	1.7E-04
Hexane	5.8E-05
Methylcyclopentane	1.5E-04
Benzene	3.2E-04
Cyclohexane	1.3E-04
2-Methylhexane	4.3E-05
2,3-Dimethylpentane	1.6E-05
3-Methylhexane	3.2E-05
Heptane	3.2E-05
Methylcyclohexane	1.2E-04
Toluene	6.2E-04
m-Xylene	9.2E-04

Produced Liquids	
Component	mass fraction
Water	99.99
TEG	0.00
Oxygen	0.00
Nitrogen	0.00
Methane	0.00
CO2	0.00
Ethane	0.00
Propane	0.00
i-Butane	0.00
n-Butane	0.00
i-Pentane	0.00
n-Pentane	0.00
2,2-Dimethylbutane	0.00
2,3-Dimethylbutane	0.00
2-Methylpentane	0.00
3-Methylpentane	0.00
Hexane	0.00
Methylcyclopentane	0.00
Benzene	0.00
Cyclohexane	0.00
2-Methylhexane	0.00
2,3-Dimethylpentane	3.41E-08
3-Methylhexane	4.61E-08
Heptane	5.11E-08
Methylcyclohexane	1.02E-06
Toluene	0.000326542
m-Xylene	0.000479458

Attachment L
EMISSIONS UNIT DATA SHEET
BULK LIQUID TRANSFER OPERATIONS

Furnish the following information for each new or modified bulk liquid transfer area or loading rack, as shown on the *Equipment List Form* and other parts of this application. This form is to be used for bulk liquid transfer operations such as to and from drums, marine vessels, rail tank cars, and tank trucks.

Identification Number (as assigned on <i>Equipment List Form</i>): TLO				
1. Loading Area Name: WGGC Compressor Station				
2. Type of cargo vessels accommodated at this rack or transfer point (check as many as apply): N/A <input type="checkbox"/> Drums <input type="checkbox"/> Marine Vessels <input type="checkbox"/> Rail Tank Cars <input checked="" type="checkbox"/> Tank Trucks				
3. Loading Rack or Transfer Point Data:				
Number of pumps	1			
Number of liquids loaded	1			
Maximum number of marine vessels, tank trucks, tank cars, and/or drums loading at one time	1			
4. Does ballasting of marine vessels occur at this loading area? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <u>Does not apply</u>				
5. Describe cleaning location, compounds and procedure for cargo vessels using this transfer point: N/A				
6. Are cargo vessels pressure tested for leaks at this or any other location? N/A <input type="checkbox"/> Yes <input type="checkbox"/> No If YES, describe:				
7. Projected Maximum Operating Schedule (for rack or transfer point as a whole):				
Maximum	Jan. - Mar.	Apr. - June	July - Sept.	Oct. - Dec.
hours/day	24	24	24	24
days/week	7	7	7	7
weeks/quarter	13	13	13	13

9. Proposed Monitoring, Recordkeeping, Reporting, and Testing

Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING

RECORDKEEPING

REPORTING

TESTING

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

ATTACHMENT M
Air Pollution Control Device Sheet(s)

“29. Fill out the **Air Pollution Control Device Sheet(s)** as Attachment M.”

- Air Pollution Control Device Sheet - 01-OXCAT and 02-OXCAT
 - EMIT Technologies Oxidation Catalyst (01-OXCAT and 02-OXCAT)
 - JATCO BTEX Eliminator Skid (01-BTEX)
-

Attachment M
Air Pollution Control Device Sheet
(OTHER COLLECTORS)

Control Device ID No. (must match Emission Units Table): 01-OxCat and 02-OxCat

Equipment Information

1. Manufacturer: EMIT Technologies Model No. RE-3050-Z-1416F-30CE0-241(or equiv.)	2. Control Device Name: Catalytic Converter Type: OxCat
3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.	
4. On a separate sheet(s) supply all data and calculations used in selecting or designing this collection device.	
5. Provide a scale diagram of the control device showing internal construction.	
6. Submit a schematic and diagram with dimensions and flow rates.	
7. Guaranteed minimum collection efficiency for each pollutant collected: 100%	
8. Attached efficiency curve and/or other efficiency information.	
9. Design inlet volume: 9,268 CFM	10. Capacity:
11. Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any.	
12. Attach any additional data including auxiliary equipment and operation details to thoroughly evaluate the control equipment.	
13. Description of method of handling the collected material(s) for reuse or disposal.	

Gas Stream Characteristics

14. Are halogenated organics present?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Are particulates present?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Are metals present?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
15. Inlet Emission stream parameters:	Maximum	Typical	
Pressure (mmHg):			
Heat Content (BTU/scf):			
Oxygen Content (%):			
Moisture Content (%):			
Relative Humidity (%):			

27. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification):

28. Describe the collection material disposal system:

29. Have you included **Other Collectores Control Device** in the Emissions Points Data Summary Sheet?

30. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING:

RECORDKEEPING:

REPORTING:

TESTING:

MONITORING: Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment or air control device.
RECORDKEEPING: Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING: Please describe any proposed emissions testing for this process equipment on air pollution control device.
TESTING: Please describe any proposed emissions testing for this process equipment on air pollution control device.

31. Manufacturer's Guaranteed Control Efficiency for each air pollutant.
CO: ≥ 93% NMNEHC: ≥ 35% HCHO: ≥ 76%

32. Manufacturer's Guaranteed Control Efficiency for each air pollutant.

33. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.



Prepared For:

David Bishop
 EXTERRAN

QUOTE: QUO-07204-Z8V2

INFORMATION PROVIDED BY CATERPILLAR

Engine: G3516B
 Horsepower: 1380
 RPM: 1400
 Compression Ratio: 8.0:1
 Exhaust Flow Rate: 9268 CFM
 Exhaust Temperature: 1016 °F
 Reference: DM8800-05
 Fuel: Natural Gas
 Annual Operating Hours: 8760

Uncontrolled Emissions

	<u>g/bhp-hr</u>	<u>Tons/Year</u>
NOx:	0.50	6.66
CO:	3.02	40.24
THC:	4.29	57.17
NMHC	1.95	25.99
NMNEHC:	0.94	12.53
HCHO:	0.38	5.06
O2:	9.10 %	

POST CATALYST EMISSIONS

	<u>% Reduction</u>	<u>g/bhp-hr</u>	<u>Tons/Year</u>
NOx:	Unaffected by Oxidation Catalyst		
CO:	>93 %	<0.21	<2.82
VOC:	>35 %	<0.61	<8.14
HCHO:	>76 %	<0.09	<1.22

CONTROL EQUIPMENT

Catalytic Converter

Model: **ELS-3050Z-1416F-30CE0-241**
 Catalyst Type: Oxidation, Precious group metals
 Manufacturer: EMIT Technologies, Inc.
 Element Size: Rectangle 24 x 15 x 3.5
 Catalyst Elements: 0
 Housing Type: 3 Element Capacity
 Catalyst Installation: Accessible Housing
 Construction: 10 gauge Carbon Steel
 Sample Ports: 6 (0.5" NPT)
 Inlet Connections: 14" Flat Face Flange
 Outlet Connections: 16" Flat Face Flange
 Configuration: End In / Side Out
 Silencer: Integrated
 Silencer Grade: Critical
 Insertion Loss: 25-30 dBA

Replacement Catalyst Element

Model: **RT-2415-Z**
 Catalyst Type: Oxidation, Precious group metals
 Substrate Type: BRAZED
 Manufacturer: EMIT Technologies, Inc.
 Element Quantity: 2
 Element Size: Rectangle 24 x 15 x 3.5



2040 Afton Place
Farmington, NM 87401
Office: 505.327.4945 | Direct: 307.675.5077
jmartindale@emittechnologies.com

WARRANTY

EMIT Technologies, Inc. warrants that the goods supplied will be free from defects in workmanship by EMIT Technologies, Inc. for a period of one (1) year from date of shipment. EMIT Technologies, Inc. will not be responsible for any defects which result from improper use, neglect, failure to properly maintain or which are attributable to defects, errors or omissions in any drawings, specifications, plans or descriptions, whether written or oral, supplied to EMIT Technologies, Inc. by Buyer.

Catalyst performance using an EMIT Air/Fuel ratio controller is dependent upon properly defined set-points, variable with engine and fuel gas composition. Air/fuel ratio controller performance is guaranteed, but not limited, to fuel gas with a HHV content of 1400 BTU/SCF.

Catalyst performance will be guaranteed for a period of 1 year from installation, or 8760 operating hours, whichever comes first. The catalyst shall be operated with an automatic air/fuel ratio controller. The performance guarantee shall not cover the effects of excessive ash masking due to operation at low load, improper engine maintenance, or inappropriate lubrication oil. The performance guarantee shall not cover the effects of continuous engine misfires (cylinder or ignition) exposing the catalyst to excessive exothermic reaction temperatures. In most cases, excluding thermal deactivation, catalyst performance is redeemable by means of proper washing (refer to EMIT Catalyst/Silencer Housing Manual for element wash information, or contact a local EMIT Sales representative).

The exhaust temperature operating range at the converter inlet is a minimum of 600°F for oxidation catalyst and 750 °F for NSCR catalyst, and a maximum of 1250°F.

If a properly functioning, high temperature shut down switch is not installed, thermal deactivation of catalyst at sustained temperatures above 1250°F is not covered. If excessive exposure to over oxygenation of NSCR catalyst occurs due to improperly functioning or non-existent Air/Fuel ratio control, then deactivation of catalyst is not warranted.

The catalyst conversion efficiencies (% reduction) will be guaranteed for engine loads of 50 to 100 percent. Standard Oxidation Catalyst conversion efficiencies (% reduction) will be guaranteed for fuel gas containing less than 1.5% mole fraction of non-methane, non-ethane hydrocarbons. Applications where fuel gas exceeds this level will require a Premium Oxidation Catalyst to maintain guaranteed VOC conversion efficiencies.

Engine lubrication oil shall contain less than 0.5 wt% Sulfated Ash with a maximum allowable specific oil consumption of 0.7 g/bhp-hr. The catalyst shall be limited to a maximum ash loading of 0.022 lb/ft³. Phosphorous and zinc additives are limited to 0.03 wt%. New or Reconstructed engines must operate for a minimum of 100 hours prior to catalyst installation, otherwise the warranty is void.

The catalyst must not be exposed to the following know poisoning agents, including: antimony, arsenic, chromium, copper, iron, lead, lithium, magnesium, mercury, nickel, phosphorous, potassium, silicon, sodium, sulfur, tin, and zinc. Total poison concentrations in the fuel gas must be limited to 0.25 ppm or less for catalyst to function properly.

Shipment - Promised shipping dates are approximate lead times from the point of manufacture and are not guaranteed. EMIT Technologies, Inc. will not be liable for any loss, damage or delay in manufacture or delivery resulting from any cause beyond its control including, but not limited to a period equal to the time lost by reason of that delay. All products will be crated as per best practice to prevent any damage during shipment. Unless otherwise specified, Buyer will pay for any special packing and shipping requirements. Acceptance of goods by common carrier constitutes delivery to Buyer. EMIT Technologies, Inc. shall not be responsible for goods damaged or lost in transit.

Terms: Credit is extended to purchaser for net 30 time period. If payment is not received in the net 30 timeframe, interest on the unpaid balance will accrue at a rate of 1.5% per month from the invoice date.

Order Cancellation Terms: Upon cancellation of an order once submittal of a Purchase Order has occurred, the customer will pay a 25% restocking fee for Catalyst Housings, Catalyst Elements, and Air/Fuel Ratio Controllers; 50% restocking fee for Cooler Top Solutions, Exhaust System Accessories, and other Custom Built Products; 100% of all associated shipping costs incurred by EMIT; 100% of all project expenses incurred by EMIT for Field Services.

JATCO Vertical Panel Air Cooled Heat Exchangers



Full stainless steel condenser with stainless steel skid base, using stainless steel aluminum wound 1" 1.0 fin tubes. A multi-pass tube construction with each pass draining to the lower liquid line, that is connected to a JATCO automatic blowcase. Units can be configured in series to increase cooling capacity.

Specifications:

Test pressure:	20 psi
Operating pressure:	1 psi
Max operating temp:	225° F
Max Condenser Vapor Outlet Temp:	10° F Approach to Ambient Temp.
Headers:	304 Stainless Steel
Fin Tube Description:	1" x 16 ga x SA249 TP316 Aluminum L-Foot
Fin Tube Length:	6' 0"
Fin Dimension:	.015" x 2.5"

Model #	No. of Passes	Max H₂O Removed	# of Tubes	Maximum Regen Compatibility
System I	3	834 lbs./D	8	125,000 BTU/HR
System II	5	2,500 lbs./D	16	375,000 BTU/HR
System III	7	3,334 lbs./D	24	500,000 BTU/HR

JATCO BTEX Eliminator Guarantee

The system operation of the JATCO BTEX “Eliminator” is able to achieve stack test results in **excess of 95% destruction efficiency** by routing the pre-condensed still column vapors to the main burner and inducing the 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 BTEX Systems Units and will purchase any unit back that does not perform to these standards.



BTEX Eliminator Shell & Tube System

The Shell and Tube Eliminator System is a counter flow stainless steel tube and bundle heat exchanger condensing system used to capture and recycle BTEX and VOC vapors from the dehydrator still column. [\(more\)](#)

Recent blog entries

Dec 10, 2010, posted by Admin

[Guess who got in on the blogging game???](#)

Nov 30, 1999, posted by

[WE WILL BE AT THE DUG SHOW](#)

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ATTACHMENT N

Supporting Emissions Calculations

“30. Provide all **Supporting Emissions Calculations** as Attachment N.”

- **Emission Summary Spreadsheets**
 - Controlled Emissions - Criteria Pollutants
 - Controlled Emissions - Hazardous Air Pollutants (HAP)
 - Greenhouse Gas (GHG) Emissions
 - PRE-Controlled Emissions - Criteria Pollutants
 - PRE-Controlled Emissions - Hazardous Air Pollutants (HAP)
 - **Unit-Specific Emission Spreadsheets**
 - Compressor Engine – 1,380 bhp CAT G3516B (CE-01/1E and CE-02/2E)
 - Compressor Rod Packing/Engine Crankcase Leaks (RPC/3E)
 - Start/Stop/Maintenance (Blowdown) (SSM/4E)
 - Dehydrator 01 (Flash Tank (DFT-01/5E) and Regenerator/Still Vent (DSV-01/6E))
 - Dehydrator 01 (Combined) - 40.0 MMscfd
 - Reboiler 01 - 1.00 MMBtu/hr (RBV-01/7E)
 - Storage Tank - Produced Water (T-01/8E)
 - Representative Tank 01/8E Flash Emissions - ProMax
 - Truck Load-Out - Produced Water (TLO/9E)
 - Piping and Equipment Fugitives - Gas & Water/Oil (FUG-G/1F and FUG-W/2F)
 - **AP-42 and GHG Emission Factors**
 - **Model Results - Dehydrator - GRI-GLYCalc 4.0**
 - Summary of Emissions
 - Summary of Input Values
 - Aggregate Calculations Report
-

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment N - Supporting Emissions Calculations

Controlled Emissions - Criteria Pollutants

Unit ID	Point ID	Control ID	Description	Design Capacity	NOx		CO		VOC		SOx		PM10/2.5	
					lb/hr	tpy								
CE-01	1E	01-OxCat	Compressor Engine - CAT G3516B	1,380 bhp	1.52	6.66	0.64	2.82	2.16	9.45	0.01	0.03	0.11	0.50
CE-02	2E	02-OxCat	Compressor Engine - CAT G3516B	1,380 bhp	1.52	6.66	0.64	2.82	2.16	9.45	0.01	0.03	0.11	0.50
RPC	3E	na	Compressor Rod Packing/Engine Crankcase	2,760 bhp	---	---	---	---	0.79	3.44	---	---	---	---
SSM	4E	na	Start/Stop/Maintenance (Blowdown)	2,760 bhp	---	---	---	---	---	10.03	---	---	---	---
DFT-01	5E	na	TEG Dehydrator - Flash Tank	40.0 MMscfd	---	---	---	---	12.11	53.05	---	---	---	---
DSV-01	6E	01-BTEX	TEG Dehydrator - Still Vent	40.0 MMscfd	---	---	---	---	0.16	0.70	---	---	---	---
RBV-01	7E	na	TEG Dehydrator - Reboiler Vent	1.00 MMBtu/hr	0.10	0.43	0.08	0.36	0.01	0.02	5.9E-04	2.6E-03	0.01	0.03
T-01	8E	na	Storage Tank - Produced Water	210 bbl	---	---	---	---	0.03	0.11	---	---	---	---
TLO	9E	na	Truck Load-Out - Produced Water	3,578 bbl/yr	---	---	---	---	---	0.12	---	---	---	---
TOTAL POINT SOURCE PTE:					3.14	13.76	1.37	5.99	17.41	86.39	0.01	0.06	0.23	1.03
WV-DEP Permit Threshold:					6 lb/hr <u>AND</u> 10 tpy									
Title V Permit Threshold:					---	100	---	100	---	100	---	100	---	100

FUG-G	1F	na	Process Piping Fugitives - Gas	1,737 fittings	---	---	---	---	0.58	2.55	---	---	---	---
FUG-W	2F	na	Process Piping Fugitives - Water/Oil	873 fittings	---	---	---	---	0.88	3.84	---	---	---	---
TOTAL FUGITIVE SOURCE PTE:					---	---	---	---	1.46	6.39	---	---	---	---

BOLD and Shaded Cells Indicate Control Technology used to establish emission limitation.

TOTAL PTE:					3.14	13.76	1.37	5.99	18.86	92.78	1.4E-02	0.06	0.23	1.03
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- Notes:
- 1 - Emissions are based on operation at 100% of rated load for 8,760 hrs/yr; except that Start/Stop/Maintenance (SSM/3E) and Truck Load-Out (TLO/7E) emission generating activities are infrequent.
 - 2 - VOC is volatile organic compounds, as defined by EPA, and includes HCHO (formaldehyde).
 - 3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5.
 - 4 - Fugitive criteria pollutant emissions from compressor stations are not considered in major source determinations (45CSR30 Section 2.26.b.)

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Application for 45CSR13 NSR Modification Permit

Attachment N - Supporting Emissions Calculations

Controlled Emissions - Hazardous Air Pollutants (HAP)

Unit ID	Point ID	Benzene		Ethylbenzene		HCHO (HAP)		n-Hexane		Methanol		Toluene		2,2,4-TMP		Xylenes		Other HAP		Total HAP	
		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	lb/hr	tpy
CE-01	1E	3.2E-03	0.01	2.9E-04	1.3E-03	0.30	1.31	0.01	0.04	0.02	0.08	3.0E-03	0.01	1.8E-03	0.01	1.4E-03	0.01	0.11	0.47	0.44	1.94
CE-02	2E	3.2E-03	0.01	2.9E-04	1.3E-03	0.30	1.31	0.01	0.04	0.02	0.08	3.0E-03	0.01	1.8E-03	0.01	1.4E-03	0.01	0.11	0.47	0.44	1.94
RPC	3E	2.5E-03	0.01	2.5E-03	0.01	0.02	0.09	2.5E-03	0.01	---	---	2.5E-03	0.01	2.5E-03	0.01	2.5E-03	0.01	---	---	0.04	0.16
SSM	4E	---	0.01	---	0.01	---	---	---	0.10	---	---	---	0.01	---	0.01	---	0.01	---	---	---	0.15
DFT-01	5E	0.03	0.14	0.03	0.15	---	---	0.18	0.81	---	---	0.11	0.39	0.01	0.02	0.17	0.73	---	---	0.53	2.24
DSV-01	6E	0.01	0.03	0.01	0.03	---	---	2.5E-03	0.01	---	---	0.02	0.09	1.2E-04	2.4E-04	0.04	0.18	---	---	0.08	0.34
RBV-01	7E	2.1E-06	9.0E-06	---	---	7.4E-05	3.2E-04	1.8E-03	0.01	---	---	3.3E-06	1.5E-05	---	---	---	---	1.9E-06	8.2E-06	1.8E-03	0.01
T-01	8E	7.5E-04	3.3E-03	7.5E-04	3.3E-03	---	---	2.5E-03	0.01	---	---	7.5E-04	3.3E-03	7.5E-04	3.3E-03	7.5E-04	3.3E-03	---	---	6.3E-03	0.03
TLO	9E	---	6.0E-03	---	6.0E-03	---	---	---	6.0E-03	---	---	---	6.0E-03	---	6.0E-03	---	6.0E-03	---	---	---	0.04
Subtotal:		0.05	0.23	0.04	0.22	0.62	2.71	0.21	1.02	0.04	0.16	0.14	0.54	1.3E-02	0.07	0.21	0.95	0.21	0.93	1.54	6.84
FUG-G	1F	6.7E-04	2.9E-03	6.7E-04	2.9E-03	---	---	0.01	0.02	---	---	6.7E-04	2.9E-03	6.7E-04	2.9E-03	6.7E-04	2.9E-03	---	---	0.01	0.04
FUG-W	2F	0.03	0.12	0.03	0.12	---	---	0.09	0.38	---	---	0.03	0.12	0.03	0.12	0.03	0.12	---	---	0.22	0.96
Subtotal:		0.03	0.12	0.03	0.12	---	---	0.09	0.41	---	---	0.03	0.12	0.03	0.12	0.03	0.12	---	---	0.23	1.00
TOTAL PTE:		0.08	0.35	0.07	0.33	0.62	2.71	0.30	1.43	0.04	0.16	0.16	0.66	0.04	0.19	0.24	1.07	0.21	0.93	1.76	7.84
WV-DEP:		2 lb/hr <u>OR</u> 0.5 tpy		2 lb/hr <u>OR</u> 5 tpy		2 lb/hr <u>OR</u> 0.5 tpy		2 lb/hr <u>OR</u> 5 tpy		2 lb/hr <u>OR</u> 5 tpy		2 lb/hr <u>OR</u> 5 tpy		3 lb/hr <u>OR</u> 5 tpy		2 lb/hr <u>OR</u> 5 tpy		3 lb/hr <u>OR</u> 5 tpy		2 lb/hr <u>OR</u> 5 tpy	
Title V:		---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	25

BOLD and Shaded Cells Indicate Control Technology used to establish emission limitation.

- Notes: 1 - Emissions are based on operation at 100% of rated load for 8,760 hrs/yr; except that Start/Stop/Maintenance (SSM/3E) and Truck Load-Out (TLO/7E) emission generating activities are infrequent.
- 2 - HCHO is formaldehyde; Total HAP includes HCHO, n-hexane, BTEX (benzene, toluene, ethylbenzene, xylene), acetaldehyde, acrolein, and methanol.

Williams Ohio Valley Midstream LLC
WGGS COMPRESSOR STATION
 Application for 45CSR13 NSR Modification Permit
Attachment N - Supporting Emissions Calculations

Greenhouse Gas (GHG) Emissions

Unit ID	Point ID	Control ID	Description	Heat Input MMBtu/hr (HHV)	Hours of Operation hr/yr	kg/MMBtu: 53.06		kg/MMBtu: 1.00E-03		kg/MMBtu: 1.00E-04		TOTAL CO2e tpy
						GWP: 1	CO2e tpy	GWP: 25	CO2e tpy	GWP: 298	CO2e tpy	
CE-01	1E	01-OxCat	Compressor Engine - CAT G3516B	11.36	8,760	6,649	6,649	35.31	883	0.01	3.27	7,536
CE-02	2E	02-OxCat	Compressor Engine - CAT G3516B	11.36	8,760	6,649	6,649	35.31	883	0.01	3.27	7,536
RPC	3E	na	Compressor Rod Packing/Engine Crankcase	---	8,760	111	111	26.14	654	---	---	765
SSM	4E	na	Start/Stop/Maintenance (Blowdown)	---	8,760	0.39	0.39	81.57	2,039	---	---	2,040
DFT-01	5E	na	TEG Dehydrator - Flash Tank	---	8,760	4.79	4.79	272.73	6,818	---	---	6,823
DSV-01	6E	01-BTEX	TEG Dehydrator - Still Vent	---	8,760	0.31	0.31	0.19	5	---	---	5
RBV-01	7E	na	TEG Dehydrator - Reboiler Vent	1.00	8,760	515	515	0.01	0.2	0.01	2.82	518
T-01	8E	na	Storage Tank - Produced Water	---	---	0.02	0.0	0.49	12	---	---	12
TLO	9E	na	Truck Load-Out - Produced Water	---	---	---	---	---	---	---	---	---
TOTAL POINT SOURCE PTE:											25,234	

FUG-G	1F	na	Process Piping Fugitives - Gas	---	8,760	0.10	0.10	24	595	---	---	595
FUG-W	2F	na	Process Piping Fugitives - Water/Oil	---	---	---	---	---	---	---	---	---
TOTAL FUGITIVE SOURCE PTE:											595	

BOLD and Shaded Cells Indicate Control Technology used to establish emission limitation.

TOTAL FACILITY-WIDE PTE:	13,931	- OR -	476	- OR -	3.1E-02	- AND -	25,829
WV-DEP Threshold:	na		na		na		na
Title V Permit Threshold:	na		na		na		na

- Notes:
- 1 - Emissions are based on operation at 100% of rated load.
 - 2 - Engine CO2 and CH4 emissions are based on vendor specifications.
 - 3 - Fugitive CH4 emissions are based on EPA Fugitive Emission Factors for Oil and Gas Production Operations.
 - 4 - All other GHG emissions are based on default values in 40CFR98, Subpart C, Table C-1.
 - 5 - GHG NSR/PSD Thresholds and Title V Major Source Thresholds are applicable only if other regulated air pollutants exceed the corresponding Thresholds.

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment N - Supporting Emissions Calculations

PRE-Controlled Emissions - Criteria Pollutants

Unit ID	Point ID	Control ID	Description	Design Capacity	NOx		CO		VOC		SOx		PM10/2.5	
					lb/hr	tpy								
CE-01	1E	01-OxCat	Compressor Engine - CAT G3516B	1,380 bhp	1.52	6.66	9.19	40.24	4.11	17.99	0.01	0.03	0.11	0.50
CE-02	2E	02-OxCat	Compressor Engine - CAT G3516B	1,380 bhp	1.52	6.66	9.19	40.24	4.11	17.99	0.01	0.03	0.11	0.50
RPC	3E	na	Compressor Rod Packing/Engine Crankcase	2,760 bhp	---	---	---	---	0.79	3.44	---	---	---	---
SSM	4E	na	Start/Stop/Maintenance (Blowdown)	2,760 bhp	---	---	---	---	---	10.03	---	---	---	---
DFT-01	5E	na	TEG Dehydrator - Flash Tank	40 MMscfd	---	---	---	---	12.11	53.05	---	---	---	---
DSV-01	6E	01-BTEX	TEG Dehydrator - Still Vent	40 MMscfd	---	---	---	---	9.59	42.02	---	---	---	---
RBV-01	7E	na	TEG Dehydrator - Reboiler Vent	1 MMBtu/hr	0.10	0.43	0.08	0.36	0.01	0.02	5.9E-04	2.6E-03	0.01	0.03
T-01	8E	na	Storage Tank - Produced Water	210 bbl	---	---	---	---	0.03	0.11	---	---	---	---
TLO	9E	na	Truck Load-Out - Produced Water	3,578 bbl/yr	---	---	---	---	---	0.12	---	---	---	---
TOTAL POINT SOURCE PTE:					3.14	13.76	18.46	80.85	30.74	144.78	0.01	0.06	0.23	1.03
WV-DEP Permit Threshold:					6 lb/hr AND 10 tpy									
Title V Permit Threshold:					---	100	---	100	---	100	---	100	---	100

FUG-G	1F	na	Process Piping Fugitives - Gas	1,737 fittings	---	---	---	---	0.58	2.55	---	---	---	---
FUG-W	2F	na	Process Piping Fugitives - Water/Oil	873 fittings	---	---	---	---	0.88	3.84	---	---	---	---
TOTAL FUGITIVE SOURCE PTE:					---	---	---	---	1.46	6.39	---	---	---	---

BOLD and Shaded Cells Indicate Control Technology used to establish emission limitation.

TOTAL PTE:					3.14	13.76	18.46	80.85	32.19	151.17	1.4E-02	0.06	0.23	1.03
-------------------	--	--	--	--	-------------	--------------	--------------	--------------	--------------	---------------	----------------	-------------	-------------	-------------

- Notes:
- 1 - Emissions are based on operation at 100% of rated load for 8,760 hrs/yr; except that Start/Stop/Maintenance (SSM) and Truck Load-Out (TLO) emission generating activities are infrequent.
 - 2 - VOC is volatile organic compounds, as defined by EPA, and includes HCHO (formaldehyde).
 - 3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5.
 - 4 - Fugitive criteria pollutant emissions are not considered in major source determinations (45CSR30 Section 2.26.b.)

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment N - Supporting Emissions Calculations

PRE-Controlled Emissions - Hazardous Air Pollutants (HAP)

Unit ID	Point ID	Benzene		Ethylbenzene		HCHO (HAP)		n-Hexane		Methanol		Toluene		2,2,4-TMP		Xylenes		Other HAP		Total HAP		
		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	lb/hr	tpy	
CE-01	1E	5.0E-03	0.02	4.5E-04	2.0E-03	1.25	5.46	0.01	0.06	0.03	0.12	4.6E-03	0.02	2.8E-03	0.01	2.1E-03	0.01	0.16	0.72	1.47	6.43	
CE-02	2E	5.0E-03	0.02	4.5E-04	2.0E-03	1.25	5.46	0.01	0.06	0.03	0.12	4.6E-03	0.02	2.8E-03	0.01	2.1E-03	0.01	0.16	0.72	1.47	6.43	
RPC	3E	2.5E-03	0.01	2.5E-03	0.01	2.1E-02	0.09	2.5E-03	0.01	---	---	2.5E-03	0.01	2.5E-03	0.01	2.5E-03	0.01	---	---	0.04	0.16	
SSM	4E	---	0.01	---	0.01	---	---	---	0.10	---	---	---	0.01	---	0.01	---	0.01	---	---	---	0.15	
DFT-01	5E	0.03	0.14	0.03	0.15	---	---	0.18	0.81	---	---	0.11	0.39	0.01	0.02	0.17	0.73	---	---	0.53	2.24	
DSV-01	6E	0.27	1.17	0.71	3.11	---	---	0.07	0.29	---	---	1.13	4.93	1.9E-03	0.01	4.78	20.91	---	---	6.94	30.42	
RBV-01	7E	2.1E-06	9.0E-06	---	---	7.4E-05	3.2E-04	1.8E-03	7.7E-03	---	---	3.3E-06	1.5E-05	---	---	---	---	1.9E-06	8.2E-06	1.8E-03	8.1E-03	
T-01	8E	7.5E-04	3.3E-03	7.5E-04	3.3E-03	---	---	2.5E-03	0.01	---	---	7.5E-04	3.3E-03	7.5E-04	3.3E-03	7.5E-04	3.3E-03	---	---	6.3E-03	0.03	
TLO	9E	---	6.0E-03	---	6.0E-03	---	---	---	6.0E-03	---	---	---	6.0E-03	---	6.0E-03	---	6.0E-03	---	---	---	0.04	
Subtotal:		0.31	1.38	0.75	3.29	2.52	11.02	0.28	1.34	0.06	0.25	1.25	5.40	0.02	0.09	4.95	21.69	0.33	1.44	10.45	45.90	
FUG-G	1F	6.7E-04	2.9E-03	6.7E-04	2.9E-03	---	---	0.01	0.02	---	---	6.7E-04	2.9E-03	6.7E-04	2.9E-03	6.7E-04	2.9E-03	---	---	0.01	0.04	
FUG-W	2F	0.03	0.12	0.03	0.12	---	---	0.09	0.38	---	---	0.03	0.12	0.03	0.12	0.03	0.12	---	---	0.22	0.96	
Subtotal:		0.03	0.12	0.03	0.12	---	---	0.09	0.41	---	---	0.03	0.12	0.03	0.12	0.03	0.12	---	---	0.23	1.00	
TOTAL PTE:		0.34	1.49	0.77	3.41	2.52	11.02	0.38	1.75	0.06	0.25	1.27	5.52	0.04	0.21	4.98	21.81	0.33	1.44	10.68	46.90	
WV-DEP:		2 lb/hr	OR	0.5 tpy	2 lb/hr	OR	5 tpy	2 lb/hr	OR	0.5 tpy	2 lb/hr	OR	5 tpy	2 lb/hr	OR	5 tpy	3 lb/hr	OR	5 tpy	2 lb/hr	OR	5 tpy
Title V:		---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	25	

BOLD and Shaded Cells Indicate Control Technology used to establish emission limitation.

- Notes: 1 - Emissions are based on operation at 100% of rated load for 8,760 hrs/yr; except that Start/Stop/Maintenance (SSM/3E) and Truck Load-Out (TLO/7E) emission generating activities are infrequent.
- 2 - HCHO is formaldehyde; Total HAP includes HCHO, n-hexane, BTEX (benzene, toluene, ethylbenzene, xylene), acetaldehyde, acrolein, and methanol.

Williams Ohio Valley Midstream LLC
WGGG COMPRESSOR STATION
Application for 45CSR13 NSR Modification Permit
Attachment N - Supporting Emissions Calculations
Compressor Engine – 1,380 bhp CAT G3516B

Unit ID	Description	Reference	Pollutant	Pre-Controlled Emissions				Control Efficiency	Controlled Emissions			
				g/bhp-hr	lb/MMBtu	lb/hr	tpy		g/bhp-hr	lb/MMBtu	lb/hr	tpy
CE-01/1E CE-02/2E (Each)	Engine 01 and 02 (Each) Caterpillar (CAT) G3516B 1,380 bhp (Site Rating) 1,400 rpm 264 in3/cyl V-16 / 4SLB / AFRC EMIT OxCat NSPS JJJJ Affected 8,760 hr/yr 920 Btu/scf (LHV) 1,020 Btu/scf (HHV) 7,427 Btu/bhp-hr (LHV) 8,234 Btu/bhp-hr (HHV) 10.25 MMBtu/hr (LHV) 11.36 MMBtu/hr (HHV) 89,784 MMBtu/yr (LHV) 99,543 MMBtu/yr (HHV) 11,141 scf/hr 0.27 MMscfd 97.59 MMscf/yr	Vendor Guarantee	NOX	0.50	0.13	1.52	6.66	0.0%	0.50	0.13	1.52	6.66
		Vendor Guarantee	CO	3.02	0.81	9.19	40.24	93.0%	0.21	0.06	0.64	2.82
		Vendor Guarantee	THC	4.60	1.23	13.99	61.30	7.2%	4.27	1.14	12.99	56.91
		Vendor Guarantee	NMHC	1.95	0.52	5.93	25.98	16.9%	1.62	0.43	4.93	21.60
		Vendor Guarantee	NMNEHC	0.94	0.25	2.86	12.53	35.0%	0.61	0.16	1.86	8.14
		NMNEHC+HCHO	VOC	1.35	0.30	4.11	17.99	47.5%	0.71	0.18	2.16	9.45
		AP-42 Table 3.2-2	SO2	2.2E-03	5.9E-04	0.01	0.03	---	2.2E-03	5.9E-04	0.01	0.03
		AP-42 Table 3.2-2	PM10/2.5	0.04	0.01	0.11	0.50	---	0.04	0.01	0.11	0.50
		AP-42 Table 3.2-2	Benzene	1.64E-03	4.4E-04	5.0E-03	0.02	35.0%	1.1E-03	2.9E-04	3.2E-03	0.01
		AP-42 Table 3.2-2	Ethylbenzene	1.5E-04	4.0E-05	4.5E-04	2.0E-03	35.0%	9.6E-05	2.6E-05	2.9E-04	1.3E-03
		Vendor Guarantee	HCHO	0.41	0.05	1.25	5.46	76.0%	0.10	0.01	0.30	1.31
		AP-42 Table 3.2-2	n-Hexane	4.1E-03	1.1E-03	0.01	0.06	35.0%	2.7E-03	7.2E-04	0.01	0.04
		AP-42 Table 3.2-2	Methanol	0.01	2.5E-03	0.03	0.12	35.0%	0.01	1.6E-03	0.02	0.08
		AP-42 Table 3.2-2	Toluene	1.5E-03	4.1E-04	4.6E-03	0.02	35.0%	9.9E-04	2.7E-04	3.0E-03	0.01
		AP-42 Table 3.2-2	2,2,4-TMP	9.3E-04	2.5E-04	2.8E-03	0.01	35.0%	6.1E-04	1.6E-04	1.8E-03	0.01
		AP-42 Table 3.2-2	Xylenes	6.9E-04	1.8E-04	2.1E-03	0.01	35.0%	4.5E-04	1.2E-04	1.4E-03	0.01
		AP-42 Table 3.2-2	Other HAP	0.05	0.01	0.16	0.72	35.0%	0.04	0.01	0.11	0.47
		Sum	Total HAP	0.48	0.07	1.47	6.43	35.0%	0.15	0.03	0.44	1.94
		Vendor Guarantee	CO2	499	134	1,518	6,649	---	499	134	1,518	6,649
		THC-NMHC	CH4 (GWP=25)	2.65	0.71	8.06	35.31	---	2.65	0.71	8.06	35.31
40CFR98 - Table C-2	N2O (GWP=298)	8.2E-04	2.2E-04	2.5E-03	0.01	---	8.2E-04	2.2E-04	2.5E-03	0.01		
40CFR98 - Table A-1	CO2e	565	151	1,720	7,536	---	565	151	1,720	7,536		

- Notes:
- 1 - The emissions are based on operation at 100% of rated load for 8,760 hr/yr.
 - 2 - As per Engine Specifications, emission values are based on adjustment to specified NOX level, all other emission values are "Not to Exceed" (i.e., Vendor Guarantee).
 - 3 - As per Engine Specifications, NMNEHC (non-methane/non-ethane hydrocarbon) does not include HCHO. VOC is the sum of NMNEHC and HCHO.
 - 4 - PM10/2.5 is Filterable and Condensable Particulate Matter; including PM10 and PM2.5
 - 5 - HCHO is Formaldehyde; Other HAP includes Acetaldehyde, Acrolein, 1,3-Butadiene, Methanol, Methylene Chloride, and traces of other HAP.
 - 6 - The control efficiency (CE) for each HAP is assumed to be the same as the CE for NMHC, except for HCHO where the vendor provides specific data.
 - 7 - The fuel heating value will vary, 920 Btu/scf (LHV) is at the low end of the range and results in a high (conservative) fuel consumption estimate.
 - 8 - Only the calculations based on Vendor Guarantees should be used to establish emission limitations.

Williams Ohio Valley Midstream LLC
WGGS COMPRESSOR STATION
 Application for 45CSR13 NSR Modification Permit
Attachment N - Supporting Emissions Calculations

Compressor Rod Packing/Engine Crankcase Leaks (RPC)

Compressor Rod Packing Leaks (Natural Gas)

Unit ID	Unit Description	Number of Compressors*	Cyl's per Compressor	scfh per Cyl	Contingency	Total Fugitive Leak Rate MMscf/yr	VOC		HCHO		BTEX, n-Hex, 2,2,4-TMP (ea)		Total HAP		CO2		CH4		CO2e	
							lb/MMscf	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
RPC/3E	Rod Packing Leaks	2	4	15	15%	1.21	0.72	3.14	na	na	1.8E-03	0.01	0.01	0.05	0.03	0.1	6	26	146	639

*Each Compressor Engine (CE-01/1E and CE-02/2E) Drives One (1) Reciprocating Compressor.

Engine Crankcase Emissions (Combustion Gas)

Unit ID	Unit Description	Total Reciprocating Engine Horsepower (bhp)	Crankcase Leak Rate 0.50 scf/bhp-hr MMscf/yr	Safety Factor	VOC		HCHO		BTEX, n-Hex, 2,2,4-TMP (ea)		Total HAP		CO2		CH4		CO2e	
					lb/MMscf	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
RPC/3E	Crankcase Emissions	2,760	12.09	250%	0.07	0.30	0.02	0.09	6.1E-04	2.7E-03	0.02	0.11	25	111	0.13	0.59	29	126

TOTAL RPC EMISSIONS:

VOC		HCHO		BTEX, n-Hex, 2,2,4-TMP (ea)		Total HAP		CO2		CH4		CO2e	
lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
0.79	3.44	0.02	0.09	2.5E-03	0.01	0.04	0.16	25	111	6	26	175	765

- Notes:
- 1 - Fugitive equipment leaks from misc. equipment is a broad category covering leaks of natural gas from sealed surfaces, such as packing and gaskets, resulting from the wear of mechanical joints, seals, and rotating surfaces over time.
 - 2 - Emission are based upon 40CFR98, Subpart W and manufacturer's data.
 - 3 - To be conservative, and to account for potential future changes, the following "worst-case" gas characteristics were assumed:

Pollutant	Gas Analysis	Worst-Case Assumption
CO2	135 lb/MMscf	200 lb/MMscf
CH4	37,185 lb/MMscf	42,275 lb/MMscf
VOC	4,330 lb/MMscf	5,200 lb/MMscf
BTEX, n-Hex, TMP (ea)	9 lb/MMscf	13 lb/MMscf
Total HAP	55 lb/MMscf	80 lb/MMscf

4 - Total Misc. Equipment Fugitive Leak Rate (scf/yr) =
 No. of Compressors * Cylinders/Compressor *
 scfh/Cylinder * 8760 hr/yr * (1 + Contingency)

- 5 - Engine crankcase emissions are based on vendor data: "As a general rule, blow-by (i.e., crankcase emissions) on a new engine is approximately 0.5 scf/bhp-hr." A "safety factor" is used to account for increasing blow-by as the engines "wear".

- 6 - Crankcase emissions are estimated as follows:

(Data from CAT G3516B Data Sheet and Emissions Calculation Spreadsheet.)

Total Engine Exhaust (TEEx) (Volume)	9,628 ft3/min (acf/min)	1,810 MMscf/yr TEEEx*
Pollutant	G3516B PTE	Crankcase Emission Factor**
Crankcase THC emissions (Mass)	61.30 tpy THC	67.72 lb THC / MMscf TEEEx
Crankcase VOC emissions (Mass)	17.99 tpy VOC	19.88 lb VOC / MMscf TEEEx
Crankcase HCHO emissions (Mass)	5.46 tpy HCHO	6.04 lb HCHO / MMscf TEEEx
Crankcase BTEX (ea) emissions (Mass)	0.16 tpy BTEX (ea)	0.18 lb BTEX (ea) / MMscf TEEEx
Crankcase HAP emissions (Mass)	6.43 tpy HAP	7.10 lb HAP / MMscf TEEEx
Crankcase CO2 emissions (Mass)	6,649 tpy CO2	7,346 lb CO2 / MMscf TEEEx
Crankcase CH4 emissions (Mass)	35 tpy CH4	39 lb CH4 / MMscf TEEEx
Crankcase CO2e emissions (Mass)	7,536 tpy CO2e	8,325 lb CO2e / MMscf TEEEx

* Conversion from acf/min to scf/yr based on 8,760 hr/yr, 1016 oF exhaust temp, and 68 oF std temp.

** Crankcase Emission Factor = PTE (tpy) from a G3516B Engine ÷ Total Engine Exhaust (TEEx) (MMscf/yr).

WGGS COMPRESSOR STATION

Application for 45CSR13 NSR Modification Permit

Attachment N - Supporting Emissions Calculations

Start/Stop/Maintenance (Blowdown)

Unit ID (Point ID)	Description	No of Compressor Units*	Total bhp	SSM and Blowdown Events/yr	a. Engine "Cold-Start" Gas Volume	b. Blowdown Gas Volume	Total Gas Vented MMscf/yr	VOC	n-Hexane	BTEX, Hex, TMP (Ea)	Total HAP	CO2	CH4	CO2e
					scf/SSM	scf/SSM		lb/MMscf tpy	lb/MMscf tpy	lb/MMscf tpy	lb/MMscf tpy	lb/MMscf tpy	lb/MMscf tpy	lb/MMscf tpy
SSM/4E	a. Cold Start (Engine)	2	2,760	208	1,400	---	0.29	0.76	0.01	8.7E-04	1.2E-02	0.03	6	154
	b. Blowdown (Recip Comp)			208	---	17,154	3.57	9.28	0.09	0.01	0.14	0.36	75	1,886

TOTAL FACILITY-WIDE SSM EMISSIONS:

10.03	0.10	0.01	0.15	0.39	82	2,040
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*Each Compressor Engine (CE-01/1E and CE-02/2E) Drives One (1) Reciprocating Compressor.

- Notes: 1 - SSM Emissions are the sum of: a. Unburned fuel resulting from "cold-start" of idle gas-fired engine; and
b. Natural gas that is purged (aka blowdown) from the compressor and associated piping and equipment.

2 - Starting Gas Quantity and Blowdown (B-D) Gas Quantity as per Engineering Department.

(e.g., 8,577 scf/B-D of a compressor with a 1,380 bhp engine equals 6.22 scf/bhp/B-D.)

Engines	a. Unburned "Cold-Start" Gas is Constant at:	700 scf/start
	b. Blowdown Gas is Related to bhp at:	6.22 scf/bhp/B-D

3 - To be conservative, the following gas characteristics were assumed:

Pollutant	Inlet Gas Analysis	Estimated
Carbon Dioxide	135 lb/MMscf	200 lb/MMscf
Methane	37,185 lb/MMscf	42,275 lb/MMscf
VOC (Propane)	4,330 lb/MMscf	5,200 lb/MMscf
n-Hexane	41 lb/MMscf	50 lb/MMscf
BTEX, TMP (ea)	3 lb/MMscf	6 lb/MMscf
Total HAP:	55 lb/MMscf	80 lb/MMscf

- 4 - Emission estimates are conservatively based on:
- | | |
|------------|-------------------------------------|
| 4.0 | Cold-Starts per week per Engine. |
| 4.0 | Blowdown(s) per week per Compressor |

Williams Ohio Valley Midstream LLC
WGGS COMPRESSOR STATION
 Application for 45CSR13 NSR Modification Permit
Attachment N - Supporting Emissions Calculations

Dehydrator 01 (Flash Tank (DFT-01/5E) and Regenerator/Still Vent (DSV-01/6E)) - 40.0 MMscfd

Unit ID	Description	Reference	Pollutant	Pre-Control - GLYCalc		Pre-Control x 120%		Control Eff	Controlled Emissions	
				lb/hr	tpy	lb/hr	tpy	%	lb/hr	tpy
DFT-01/5E	Dehydrator 01 Flash Tank (DFT-01/5E) (Minimum of 50% Flash Tank Off-Gas is used as Fuel in the Reboiler) 40.0 MMscfd 8,760 Hr/yr 1.67 MMscf/hr 14,600 MMscf/yr NESHAP HH - Exempt	---	NOX	---	---	---	---	---	---	---
		---	CO	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	VOC	10.09	44.21	12.11	53.05	---	12.11	53.05
		---	SO2	---	---	---	---	---	---	---
		---	PM10/2.5	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Benzene	0.03	0.11	0.03	0.14	---	0.03	0.14
		GRI-GLYCalc 4.0	Ethylbenzene	0.03	0.13	0.03	0.15	---	0.03	0.15
		---	HCHO	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	n-Hexane	0.15	0.67	0.18	0.81	---	0.18	0.81
		GRI-GLYCalc 4.0	Methanol	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Toluene	0.09	0.33	0.11	0.39	---	0.11	0.39
		GRI-GLYCalc 4.0	2,2,4-TMP	4.6E-03	0.02	0.01	0.02	---	0.01	0.02
		GRI-GLYCalc 4.0	Xylenes	0.14	0.61	0.17	0.73	---	0.17	0.73
		GRI-GLYCalc 4.0	Other HAP	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Total HAP	0.44	1.87	0.53	2.24	---	0.53	2.24
		GRI-GLYCalc 4.0	CO2	0.91	3.99	1.09	4.79	---	1.09	4.79
		GRI-GLYCalc 4.0	CH4	51.89	227.28	62.27	272.73	---	62.27	272.73
GRI-GLYCalc 4.0	N2O	---	---	---	---	---	---	---		
40CFR98 - Table A-1	CO2e	1,298	5,686	1,558	6,823	---	1,558	6,823		
Unit ID	Description	Reference	Pollutant	Pre-Control - GLYCalc		Pre-Control x 120%		Control Eff	Controlled Emissions	
				lb/hr	tpy	lb/hr	tpy	%	lb/hr	tpy
DSV-01/6E	Dehydrator 01 Regenerator/Still Vent (DSV-01/6E) (Still Vent Emissions Controlled by BTEX Skid) 40.0 MMscfd 8,760 Hr/yr 1.67 MMscf/hr 14,600 MMscf/yr NESHAP HH - Exempt	---	NOX	---	---	---	---	---	---	---
		---	CO	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	VOC	7.99	35.01	9.59	42.02	98%	0.16	0.70
		---	SO2	---	---	---	---	---	---	---
		---	PM10/2.5	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Benzene	0.22	0.97	0.27	1.17	97%	0.01	0.03
		GRI-GLYCalc 4.0	Ethylbenzene	0.59	2.59	0.71	3.11	99%	0.01	0.03
		---	HCHO	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	n-Hexane	0.06	0.24	0.07	0.29	96%	2.5E-03	0.01
		GRI-GLYCalc 4.0	Methanol	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Toluene	0.94	4.11	1.13	4.93	98%	0.02	0.09
		GRI-GLYCalc 4.0	2,2,4-TMP	1.6E-03	0.01	1.9E-03	0.01	97%	1.2E-04	2.4E-04
		GRI-GLYCalc 4.0	Xylenes	3.98	17.43	4.78	20.91	99%	0.04	0.18
		GRI-GLYCalc 4.0	Other HAP	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Total HAP	5.79	25.35	6.94	30.42	99%	0.08	0.34
		GRI-GLYCalc 4.0	CO2	0.06	0.26	0.07	0.31	---	0.07	0.31
		GRI-GLYCalc 4.0	CH4	0.71	3.11	0.85	3.73	95%	0.04	0.19
GRI-GLYCalc 4.0	N2O	---	---	---	---	---	---	---		
40CFR98 - Table A-1	CO2e	18	78	21	94	95%	1	5		

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Dehydrator 01 (Combined) - 40.0 MMscfd

Unit ID	Description	Reference	Pollutant	Pre-Control - GLYCalc		Pre-Control x 120%		Control Eff %	Controlled Emissions		
				lb/hr	tpy	lb/hr	tpy		lb/hr	tpy	
DEHY-01	Dehydrator 01 (Combined - Flash Tank (DFT-01/5E) and Regenerator/Still Vent (DSV-01/6E))	---	NOX	---	---	---	---	---	---	---	
		---	CO	---	---	---	---	---	---	---	
		GRI-GLYCalc 4.0	VOC	18.09	79.22	21.70	95.06	43.5%	12.27	53.75	
		---	SO2	---	---	---	---	---	---	---	
		---	PM10/2.5	---	---	---	---	---	---	---	
		GRI-GLYCalc 4.0	Benzene	0.25	1.08	0.30	1.30	87.2%	0.04	0.17	
		GRI-GLYCalc 4.0	Ethylbenzene	0.62	2.71	0.74	3.26	94.4%	0.04	0.18	
		40.0 MMscfd	HCHO	---	---	---	---	---	---	---	
		8,760 Hr/yr	GRI-GLYCalc 4.0	n-Hexane	0.21	0.92	0.25	1.10	25.3%	0.19	0.82
			GRI-GLYCalc 4.0	Methanol	---	---	---	---	---	---	---
			GRI-GLYCalc 4.0	Toluene	1.03	4.44	1.23	5.33	90.9%	0.13	0.48
			GRI-GLYCalc 4.0	2,2,4-TMP	0.01	0.03	0.01	0.03	25.3%	0.01	0.02
			GRI-GLYCalc 4.0	Xylenes	4.12	18.04	4.94	21.64	95.8%	0.21	0.91
		1.67 MMscf/hr 14,600 MMscf/yr	GRI-GLYCalc 4.0	Other HAP	---	---	---	---	---	---	---
		NESHAP HH - Exempt	GRI-GLYCalc 4.0	Total HAP	6.23	27.22	7.47	32.66	92.1%	0.61	2.58
	GRI-GLYCalc 4.0		CO2	0.97	4.25	1.17	5.10	---	1.17	5.10	
	GRI-GLYCalc 4.0		CH4	52.60	230.39	63.12	276.47	1.3%	62.31	272.92	
	GRI-GLYCalc 4.0		N2O	---	---	---	---	---	---	---	
40CFR98 - Table A-1	CO2e		1,316	5,764	1,579	6,917	1.3%	1,559	6,828		

Notes: 1 - To be conservative, and to account for potential future changes in gas quality, the following worst-case emissions were assumed:

40.0 MMscfd Dehydrator 01	GRI-GLYCalc 4.0* Model Results		Worst-Case (W/ 120% Margin)		*Dehydrator Operating Parameters (See Attachments H - Extended Gas Analysis and L - GRI-GLYCalc Model results)			
	THC	73.38 lb/hr	321.40 tpy	88.06 lb/hr	385.68 tpy	Dry Gas Flow Rate:	40.0 MMscfd	Extended Gas Analysis:
NMNEHC = VOC	10.23 lb/hr	44.79 tpy	12.27 lb/hr	53.75 tpy	Wet Gas Temperature:	80 oF	Flash Tank Temperature:	160 oF
Benzene	0.03 lb/hr	0.14 tpy	0.04 lb/hr	0.17 tpy	Wet Gas Pressure:	900 psig	Flash Tank Pressure:	40 psig
Ethylbenzene	0.03 lb/hr	0.15 tpy	0.04 lb/hr	0.18 tpy	Wet Gas Water Content:	Saturated	Flash Tank Off-Gas:	50% Recycle
HCHO	---	---	---	---	Dry Gas Water Content:	7.00 lb-H2O/MMscf	Stripping Gas:	na
n-Hexane	0.16 lb/hr	0.68 tpy	0.19 lb/hr	0.82 tpy	Lean Glycol Water Content:	1.50 wt% H2O	Regen Overhead Control:	JATCO BTEX Skid
Methanol	---	---	---	---	Glycol Pump Type:	Gas Injection	Condenser Temperature:	150 oF
Toluene	0.09 lb/hr	0.40 tpy	0.11 lb/hr	0.48 tpy	Glycol Pump Model:	Kimray 45020PV	Condenser Pressure:	14.0 psia
2,2,4-TMP	0.01 lb/hr	0.02 lb/hr	0.01 lb/hr	0.02 lb/hr	Lean Glycol Circulation Rate:	7.50 gpm	Control Efficiency:	≥ 95% Efficient
Xylenes	0.17 lb/hr	0.75 tpy	0.21 lb/hr	0.91 tpy	Additional GRI-GLYCalc 4.0 Model Results:			
Other HAP	---	---	---	---	Wet Gas Water Content:	34.62 lb/MMscf	Flash Tank Stream:	2,920 scfh
Total HAP	0.49 lb/hr	2.15 tpy	0.59 lb/hr	2.59 tpy	Lean Glycol Recirc Ratio:	8.14 gal/lb-H2O	Regen Overhead Stream:	1,210 scfh
CO2	0.97 lb/hr	4.25 tpy	1.17 lb/hr	5.10 tpy				
CH4	51.93 lb/hr	227.43 tpy	62.31 lb/hr	272.92 tpy				
CO2e	1,299 lb/hr	5,690 tpy	1,559 lb/hr	6,828.12 tpy				

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Reboiler 01 - 1.00 MMBtu/hr

Unit ID	Description	Reference	Pollutant	Emission Factor		Pre-Controlled		Control	Controlled	
				lb/MMscf	lb/MMBtu	lb/hr	tpy	%	lb/hr	tpy
RBV-01/7E	Reboiler 01	EPA AP-42 Table 1.4-2	NOX	100.00	0.10	0.10	0.43	na	0.10	0.43
		EPA AP-42 Table 1.4-2	CO	84.00	0.08	0.08	0.36	na	0.08	0.36
		EPA AP-42 Table 1.4-2	VOC	5.68	0.01	0.01	0.02	na	0.01	0.02
		EPA AP-42 Table 1.4-2	SO2	0.60	5.88E-04	5.9E-04	2.6E-03	na	5.9E-04	2.6E-03
		EPA AP-42 Table 1.4-2	PM10/2.5	7.60	0.01	0.01	0.03	na	0.01	0.03
	1.00 MMBtu/hr (HHV)	EPA AP-42 Table 1.4-3	Benzene	2.1E-03	2.06E-06	2.1E-06	9.0E-06	na	2.1E-06	9.0E-06
		EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	---	---	---	---	---
	8,760 hr/yr	EPA AP-42 Table 1.4-3	HCHO	0.08	7.35E-05	7.4E-05	3.2E-04	na	7.4E-05	3.2E-04
		EPA AP-42 Table 1.4-3	n-Hexane	1.80	1.76E-03	1.8E-03	0.01	na	1.8E-03	0.01
	1,020 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	Methanol	---	---	---	---	---	---	---
		EPA AP-42 Table 1.4-3	Toluene	3.4E-03	3.33E-06	3.3E-06	1.5E-05	---	3.3E-06	1.5E-05
		EPA AP-42 Table 1.4-3	2,2,4-TMP	---	---	---	---	na	---	---
		EPA AP-42 Table 1.4-3	Xylenes	---	---	---	---	---	---	---
		EPA AP-42 Table 1.4-3	Other HAP	1.9E-03	1.86E-06	1.9E-06	8.2E-06	na	1.9E-06	8.2E-06
		EPA AP-42 Table 1.4-3	Total HAP	1.88	1.85E-03	1.8E-03	0.01	na	1.8E-03	0.01
		980 scf/hr	EPA AP-42 Table 1.4-2	CO2	120,000	118	118	515	na	118
	23.53 Mscfd	EPA AP-42 Table 1.4-2	CH4	2.30	2.25E-03	2.3E-03	0.01	na	2.3E-03	0.01
8.59 MMscf/yr	EPA AP-42 Table 1.4-2	N2O	2.20	2.16E-03	2.2E-03	0.01	na	2.2E-03	0.01	
	40CFR98 - Table A-1	CO2e	120,713	118	118	518	na	118	518	

- Notes:
- 1 - The combustion emission factors are based on a default fuel heat content of 1,020 Btu/scf (HHV).
 - 2 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5.
 - 3 - Total HAP includes HCHO, n-hexane, BTEX (benzene, toluene, ethylbenzene, xylene), acetaldehyde, acrolein, and methanol.

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Storage Tank - Produced Water

Unit ID (Point ID)	Material Stored	Capacity bbl	Turn-overs /yr	T-Put bbl/yr	EPA-450/ (Working and Breathing Losses)	ProMax (Flashing Losses)	VOC		n-Hexane		BTEX, TMP-ea		Total HAP		ProMax				CO2e	
							100.00 Wgt% lb/hr tpy		10.00 Wgt% lb/hr tpy		3.00 Wgt% lb/hr tpy		25.00 Wgt% lb/hr tpy		CO2		CH4		GWP = 25	
							lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
T-01/8E	Prod H2O	210	17.0	3,578	0.039 lb/bbl	0.009 lb/hr	0.03	0.11	2.5E-03	0.01	7.5E-04	3.3E-03	0.01	0.03	4.8E-03	0.02	0.11	0.49	2.80	12
TOTAL VOLUME:		210	17.0	3,578																
TOTAL EMISSIONS:							0.03	0.11	2.5E-03	0.01	7.5E-04	3.3E-03	0.01	0.03	4.8E-03	0.02	0.11	0.49	2.80	12

- Notes:
- 1 - EPA-450/3-85-001a – "Volatile Organic Compound Emissions from Petroleum Refinery Wastewater Systems - Background Information for Proposed Standards" is a reasonable protocol for estimating potential water/oil storage tank working and breathing losses. EPA-450/3-85-001a, page 3-39, gives a VOC emission factor of 420 kg/MMgal wastewater produced in an oil-water separator. (0.420 g/gal * 0.0022 lb/g * 42 gal/bbl = 0.03889 lb/bbl)
 - 2 - These emission estimates are nearly 4X more conservative than emission factors required by the TCEQ on the Barnett Shale produced water tanks at gas-only sites.

Table 1. Produced Water Storage Tank Flash Loss Emissions Factors for Barnett Shale Special Inventory Purposes ONLY

Pollutant	Average Produced Water Emission Factor (lb/bbl)	
	Gas Production Only Sites	Liquid Hydrocarbon and Gas Production Sites
VOC	0.01	0.0402
Benzene	0.0001	0.000054
Toluene	0.0003	0.000130
Ethylbenzene	0.000006	0.000003
Xylene(s)	0.00006	0.000049
n-Hexane	NA	0.000987

- 3 - Total HAP is estimated at 25.0% of VOC emissions. This is a very conservative estimate based on an investigation of other produced water emission estimating protocols, as exemplified above (e.g., (0.0001+0.0003+0.000006+0.00006)*100 = 4.7%).
- 4 - The ProMax Simulation software was used to estimate flashing losses from the produced water storage tank.
- 5 - The total storage tank capacity at the facility is:

210

 bbl =

8,820

 gal.
- 6 - It is estimated that each tank will be emptied up to:

17

 t-o/yr =

3,578

 bbl/yr

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Attachment N - Supporting Emissions Calculations**Representative Tank 01/8E Flash Emissions - ProMax**

WGGS Compressor Station - ProMax Results	
Component	Tank 01 - lb/hr
Water	0.002869
TEG	---
Oxygen	0.000000
Nitrogen	0.000459
Methane	0.111842
CO2	0.004763
Ethane	0.022014
Propane	0.006997
i-Butane	0.000367
n-Butane	0.000937
i-Pentane	0.000209
n-Pentane	0.000118
2,2-Dimethylbutane	0.000005
2,3-Dimethylbutane	0.000011
2-Methylpentane	0.000023
3-Methylpentane	0.000038
Hexane	0.000013
Methylcyclopentane	0.000034
Benzene	0.000074
Cyclohexane	0.000030
2-Methylhexane	0.000010
2,3-Dimethylpentane	0.000004
3-Methylhexane	0.000007
Heptane	0.000007
Methylcyclohexane	0.000028
Toluene	0.000142
m-Xylene	0.000211
TOTAL lb/hr	0.15
tpy	0.66
CO2e lb/hr	2.80
tpy	12.27
VOC lb/hr	0.009
tpy	0.04
HAP lb/hr	0.0004
tpy	0.002

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Attachment N - Supporting Emissions Calculations

Truck Load-Out - Produced Water

Unit ID	Description	S	P	M	T	CE	L _L	T-Put	VOC AP-42 Sect 5.2 tpy	n-Hexane, BTEX, and 2,2,4-TMP (Ea) 5.00% of VOC tpy	Total HAP 30.00% of VOC tpy
		sat. fac.	psia	lb/lb-mol	°R	%	lb/Mgal	Mgal/yr			
TLO/9E	Truck Load-Out - Produced Water	1.45	1.5	30.0	510	0.0%	1.59	150	0.12	6.0E-03	0.04
TOTAL:									0.12	6.0E-03	0.04

239.5684041

Notes: 1 - Emission factors and formulas are from AP-42 Section 5.2 "Transportation and Marketing of Petroleum Liquids":

$$L_L = 12.46 \times S \times P \times M / T \times (1 - CE)$$

- where:
- L_L = loading loss, lb/1000 gal of liquid loaded
 - S = saturation factor, use 1.45 for splash loading
 - P = true vapor pressure of liquid loaded, psia.
(Conservative estimate - Measured RVP (100 °F) ranges from 1.0 to 1.3 psia;
so the actual TVP is expected to be less than 0.7 psia at common storage temperature.)
 - M = molecular weight of vapors, lb/lb-mol (Conservative estimate.)
 - T = temperature of bulk liquid loaded, °R = °F + 460 (Conservatively assumed 50 °F.)
 - CE = overall emission reduction efficiency (collection efficiency x control efficiency)

2 - Molecular weight and vapor pressure are based on operator experience and sampling data at various locations in the Marcellus Shale basin.

3 - The total storage tank capacity at the facility is:

210	bbl =	8,820	gal.
17	t-o/yr =	3,578	bbl/yr

4 - It is estimated that each tank will be emptied up to:

5 - n-Hexane, each BTEX, and 2,2,4-TMP components are estimated at 5% of VOC emissions and Total HAP is estimated at 30% of VOC emissions. □

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Attachment N - Supporting Emissions Calculations

Piping and Equipment Fugitives - Gas & Water/Oil

Unit ID	Description	Component (Unit) Type (Gas)	Unit Count	THC Factor lb/hr/Unit	LDAR Control Credit	Hydrocarbons (THC)		VOC 10.73 Wgt%		n-Hexane 0.10 Wgt%		BTEX, TMP-ea 0.01 Wgt%		Total HAP 0.17 Wgt%		CO2 0.41 Wgt%		CH4 100.00 Wgt%		CO2e GWP = 25		
						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
FUG-G/1F	Process Piping Fugitives (Gas)	Valves	386	0.00992	0%	3.82	16.75	0.41	1.80	3.9E-03	0.02	4.7E-04	2.1E-03	0.01	0.03	0.02	0.07	3.82	16.75	96	419	
		Pump Seals	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Other	45	0.01940	0%	0.87	3.82	0.09	0.41	9.0E-04	3.9E-03	1.1E-04	4.7E-04	1.4E-03	0.01	3.6E-03	0.02	0.87	3.82	22	96	
		Connectors	1,106	0.00044	0%	0.49	2.13	0.05	0.23	5.0E-04	2.2E-03	6.0E-05	2.6E-04	8.0E-04	3.5E-03	2.0E-03	0.01	0.49	2.13	12	53	
		Flanges	180	0.00086	0%	0.15	0.68	0.02	0.07	1.6E-04	7.0E-04	1.9E-05	8.4E-05	2.6E-04	1.1E-03	6.4E-04	2.8E-03	0.15	0.68	4	17	
		Open-ended	21	0.00441	0%	0.09	0.41	0.01	0.04	9.5E-05	4.2E-04	1.1E-05	5.0E-05	1.5E-04	6.7E-04	3.8E-04	1.7E-03	0.09	0.41	2	10	
Subtotal:			1,737			5.43	23.79	0.58	2.55	0.01	0.02	6.7E-04	2.9E-03	0.01	0.04	0.02	0.10	5.43	23.79	136	595	

Unit ID	Description	Component (Unit) Type (Water/Oil)	Unit Count	THC Factor lb/hr/Unit	LDAR Control Credit	Hydrocarbons (THC)		VOC 100.00 Wgt%		n-Hexane 10.00 Wgt%		BTEX, TMP-ea 3.00 Wgt%		Total HAP 25.00 Wgt%		CO2 --- Wgt%		CH4 --- Wgt%		CO2e GWP = 25	
						lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
FUG-W/2F	Process Piping Fugitives (Water/Oil)	Valves	193	0.00022	0%	0.04	0.18	0.04	0.18	4.2E-03	0.02	1.2E-03	0.01	0.01	0.05	---	---	---	---	---	---
		Pump Seals	4	0.00005	0%	2.1E-04	9.3E-04	2.1E-04	9.3E-04	2.1E-05	9.3E-05	6.3E-06	2.8E-05	5.3E-05	2.3E-04	---	---	---	---	---	---
		Other	23	0.03086	0%	0.69	3.04	0.69	3.04	0.07	0.30	0.02	0.09	0.17	0.76	---	---	---	---	---	---
		Connectors	553	0.00024	0%	0.13	0.59	0.13	0.59	0.01	0.06	4.0E-03	0.02	0.03	0.15	---	---	---	---	---	---
		Flanges	90	0.00001	0%	5.8E-04	2.5E-03	5.8E-04	2.5E-03	5.8E-05	2.5E-04	1.7E-05	7.6E-05	1.4E-04	6.3E-04	---	---	---	---	---	---
		Open-ended	11	0.00055	0%	0.01	0.03	0.01	0.03	5.8E-04	2.5E-03	1.7E-04	7.6E-04	1.4E-03	0.01	---	---	---	---	---	---
Subtotal:			873			0.88	3.84	0.88	3.84	0.09	0.38	0.03	0.12	0.22	0.96	---	---	---	---	---	---

TOTAL FUGITIVE EMISSIONS:	6.31	27.63	1.46	6.39	0.09	0.41	0.03	0.12	0.23	1.00	0.02	0.10	5.43	23.79	136	595
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- Notes: 1 - Assumed 8,760 hours per year of fugitive emissions.
 2 - Gas and Water/Oil emissions calculated using EPA Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017, Nov 1995.

- 3 - Components in Gas Service are based on GRI-HAPCalc estimates, plus a **50%** margin
 4 - Components in Water/Oil Service are based on Gas Component count, times a **50%** reduction
 5 - "Other" components include compressor seals, relief valves, diaphragms, drains, meters, etc.
 6 - To be conservative, the following gas and water/oil characteristics were assumed:

TABLE 2.4 O&G PROD (AVE)	Gas		Water/Oil	
	kg/hr	lb/hr	kg/hr	lb/hr
Valves	4.5E-03	0.00992	9.8E-05	0.00022
Pump Seals	na	na	2.4E-05	0.00005
Others*	8.8E-03	0.01940	1.4E-02	0.03086
Connectors	2.0E-04	0.00044	1.1E-04	0.00024
Flanges	3.9E-04	0.00086	2.9E-06	0.00001
Open-Ended Lines	2.0E-03	0.00441	2.5E-04	0.00055

*These high "Others" emission factors are almost certainly an error in the EPA Protocol.

Pollutant	Gas		Water/Oil	
	Analysis	Estimated	Analysis	Estimated
Carbon Dioxide	0.28 Wgt%	0.41 Wgt%	---	---
Methane	76.70 Wgt%	100.00 Wgt%	---	---
VOC	8.93 Wgt%	10.73 Wgt%	---	100.00 Wgt%
n-Hexane	0.09 Wgt%	0.10 Wgt%	---	10.00 Wgt%
BTEX, TMP-ea	0.01 Wgt%	0.01 Wgt%	---	3.00 Wgt%
Total HAP	0.11 Wgt%	0.17 Wgt%	---	25.00 Wgt%

Potentially Applicable
AP-42 and GHG EMISSION FACTORS
(Preferentially use test data or vendor data where available)

Pollutant		GAS-FIRED ENGINE			GAS-FIRED TURBINE		
		AP-42 Table 3.2-1; 3.2-2; 3.2-3 07/00			AP-42 Table 3.1-1; 3.1-2a; 3.1-3 04/00		
		2SLB lb/MMBtu	4SLB lb/MMBtu	4SRB lb/MMBtu	Uncontrolled lb/MMBtu	Water Injection lb/MMBtu	Lean Pre-Mix# lb/MMBtu
CRITERIA	NOX (≥ 90% Load)	3.170E+00	4.080E+00	2.210E+00	3.200E-01	1.300E-01	9.900E-02
	CO (≥ 90% Load)	3.860E-01	3.170E-01	3.720E+00	8.200E-02	3.000E-02	1.500E-02
	THC (TOC)	1.640E+00	1.470E+00	3.580E-01	1.100E-02	1.100E-02	1.100E-02
	NMHC (THC-CH4)	1.900E-01	2.200E-01	1.280E-01	2.400E-03	2.400E-03	2.400E-03
	NMNEHC (NMHC-C2H6)	1.191E-01	1.150E-01	5.760E-02	2.100E-03	2.100E-03	2.100E-03
	VOC	1.200E-01	1.180E-01	2.960E-02	2.100E-03	2.100E-03	2.100E-03
	SO2*** (2,000 gr-S/MMscf)	5.880E-04	5.880E-04	5.880E-04	3.400E-03	3.400E-03	3.400E-03
	PM10/2.5 (Filter+Cond)	4.831E-02	9.987E-03	1.941E-02	6.600E-03	6.600E-03	6.600E-03
HAPS	Benzene	1.940E-03	4.400E-04	1.580E-03	1.200E-05	1.200E-05	9.100E-07
	Ethylbenzene	1.080E-04	3.970E-05	2.480E-05	3.200E-05	3.200E-05	3.200E-05
	Formaldehyde (HCHO)	5.520E-02	5.280E-02	2.050E-02	7.100E-04	7.100E-04	2.000E-05
	n-Hexane	4.450E-04	1.110E-03	---	---	---	---
	Methanol (MeOH)	2.480E-03	2.500E-03	3.060E-03	---	---	---
	Toluene	9.630E-04	4.080E-04	5.580E-04	1.300E-04	1.300E-04	1.300E-04
	TMP, 2,2,4- (i-Octane)	8.460E-04	2.500E-04	---	---	---	---
	Xylenes	2.680E-04	1.840E-04	1.950E-04	6.400E-05	6.400E-05	6.400E-05
	Other HAPs	1.715E-02	1.443E-02	6.359E-03	1.061E-04	1.061E-04	1.061E-04
GHG	CO2**** (GWP=1)	1.170E+02	1.170E+02	1.170E+02	1.170E+02	1.170E+02	1.170E+02
	CH4 (GWP=25)	1.450E+00	1.250E+00	2.300E-01	8.600E-03	8.600E-03	8.600E-03
	N2O (GWP=298)	2.205E-04	2.205E-04	2.205E-04	3.000E-03	3.000E-03	3.000E-03
	CO2e	1.533E+02	1.483E+02	1.228E+02	1.181E+02	1.181E+02	1.181E+02

(#Lean Pre-Mix - aka: Dry Low Emissions (DLE or DLN) and SoLoNOx)

Pollutant		GAS-FIRED EXTERNAL COMBUSTION			FLARE	DIESEL ENGINE
		AP-42 Table 1.4-1; 1.4-2; 1.4-3 (<100 MMBtu/hr) 07/98			13.5-1 04/15	3.3-1; 3.3-2 10/96
		Uncontrolled lb/MMBtu	LoNOx Burners lb/MMBtu	Flue Gas Recirc lb/MMBtu	Combustion lb/MMBtu	Uncontrolled lb/MMBtu
CRITERIA	NOX	9.804E-02	4.902E-02	3.137E-02	6.800E-02	4.410E+00
	CO	8.235E-02	8.235E-02	8.235E-02	3.100E-01	9.500E-01
	THC (TOC)	1.078E-02	1.078E-02	1.078E-02	≥98%	3.600E-01
	NMHC (THC-CH4)	8.529E-03	8.529E-03	8.529E-03	Destruction and Removal Efficiency	3.534E-01
	NMNEHC (NMHC-C2H6)	5.490E-03	5.490E-03	5.490E-03		3.503E-01
	VOC (NMNEHC+HCHO)	5.564E-03	5.564E-03	5.564E-03	5.882E-04	3.600E-01
	SO2 (2,000 gr-S/MMscf)	5.882E-04	5.882E-04	5.882E-04	7.451E-03	2.900E-01
	PM10/2.5 (Filter+Condense)	7.451E-03	7.451E-03	7.451E-03	---	3.100E-01
HAPS	Benzene	2.059E-06	2.059E-06	2.059E-06	≥98% Destruction and Removal Efficiency	9.330E-04
	Ethylbenzene	---	---	---		---
	HCHO (Formaldehyde)	7.353E-05	7.353E-05	7.353E-05		1.180E-03
	n-Hexane	1.765E-03	1.765E-03	1.765E-03		---
	Methanol (MeOH)	---	---	---		---
	Toluene	3.333E-06	3.333E-06	3.333E-06		4.090E-04
	2,2,4-TMP (i-Octane)	---	---	---		---
	Xylenes	---	---	---		2.850E-04
Other HAPs	1.861E-06	1.861E-06	1.861E-06	1.050E-03		
GHG	CO2 (GWP=1)	1.176E+02	1.176E+02	1.176E+02	1.176E+02	1.640E+02
	CH4 (GWP=25)	2.255E-03	2.255E-03	2.255E-03	98% DRE	6.614E-03
	N2O (GWP=298)	2.157E-03	6.275E-04	6.275E-04	2.157E-03	1.323E-03
	CO2e	1.183E+02	1.179E+02	1.179E+02	1.183E+02	1.646E+02

40 CFR 98 - DEFAULT EMISSION FACTORS				
Fuel Type	Table C-1 to Subpart C of Part 98		Table C-2 to Subpart C of Part 98	
	Default HHV	Carbon Dioxide lb CO2/MMBtu	Methane lb CH4/MMBtu	Nitrous Oxide lb N2O/MMBtu
Fuel Oil No. 2 (Diesel)	0.138 MMBtu/gal	163.054	6.614E-03	1.323E-03
Propane	0.091 MMBtu/gal	138.605	6.614E-03	1.323E-03
Natural Gas	1,026 Btu/scf	116.977	2.205E-03	2.205E-04

Conversion Factors
<http://www.onlineconversion.com/>

1.0 lb =	453.592 g
1.0 kg =	2.205 lb
1.0 hp =	2,544.433 Btu/hr
1.0 hp =	745.700 Watt
1.0 kW =	3,412.142 Btu/hr
1.0 kW-hr =	1.340 hp-hr
1.0 cf =	7.481 gal
1.0 gal H2O =	8.338 lb
1.0 cf H2O =	62.371 gal
1.0 m =	3.281 ft
1.0 km =	0.621 mi
1.0 acre =	43,560.174 ft2
1.0 °F =	(°C*9/5)+32
1.0 °R =	°F+459.67
1.0 % =	10,000 ppm
UGC (stp) =	379.48 scf/lb-mol

Global Warming Potential (100 Yr) (GWP)		
Table A-1 to Subpart A of Part 98		
CO2	CH4*	N2O#
1.00	25.00	298.00

#Revised by EPA on 11/29/13

*Converted Ext Comb Emission Factors to lb/MMBtu by dividing lb/MMscf by AP-42 default HHV of 1,020 Btu/scf.

**Converted GHG Emission Factors to lb/MMBtu by multiplying kg/MMBtu by 2.2046 lb/kg.

***Assumes 100% conversion of fuel sulfur to SOX (2,000 gr/MMscf).

****Assumes 99.5% conversion of fuel carbon to CO2 for natural gas.

GRI-GLYCalc VERSION 4.0 - EMISSIONS SUMMARY

Case Name: WGGC CS - Dehy-01 - 40 MMscfd

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM -
WGGC CS\10.558 - WGGC CS - NSR-Mod - 06.12.15\02 - Att-Lbb - WGGC - NSR-App - 40 MMscfd
Dehy-01 GLYCalc - 06.12.15 - FIRST DRAFT.ddf

Date: June 18, 2015

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0355	0.852	0.1554
Ethane	0.0248	0.594	0.1084
Propane	0.0227	0.544	0.0993
Isobutane	0.0061	0.146	0.0267
n-Butane	0.0116	0.278	0.0508
Isopentane	0.0040	0.096	0.0175
n-Pentane	0.0034	0.081	0.0147
n-Hexane	0.0021	0.050	0.0092
Cyclohexane	0.0057	0.138	0.0251
Other Hexanes	0.0038	0.090	0.0165
Heptanes	0.0060	0.143	0.0261
Methylcyclohexane	0.0048	0.116	0.0211
2,2,4-Trimethylpentane	<0.0001	0.001	0.0002
Benzene	0.0067	0.162	0.0295
Toluene	0.0172	0.412	0.0752
Ethylbenzene	0.0059	0.142	0.0260
Xylenes	0.0337	0.810	0.1477
C8+ Heavies	0.0002	0.005	0.0009
Total Emissions	0.1941	4.659	0.8503
Total Hydrocarbon Emissions	0.1941	4.659	0.8503
Total VOC Emissions	0.1339	3.213	0.5864
Total HAP Emissions	0.0657	1.577	0.2879
Total BTEX Emissions	0.0636	1.526	0.2785

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.7106	17.054	3.1124
Ethane	0.4973	11.934	2.1780
Propane	0.4630	11.111	2.0278
Isobutane	0.1264	3.034	0.5537
n-Butane	0.2433	5.838	1.0655
Isopentane	0.0883	2.118	0.3866
n-Pentane	0.0781	1.874	0.3420
n-Hexane	0.0550	1.321	0.2410
Cyclohexane	0.1642	3.940	0.7191
Other Hexanes	0.0928	2.227	0.4064
Heptanes	0.2132	5.117	0.9339
Methylcyclohexane	0.1813	4.352	0.7943
2,2,4-Trimethylpentane	0.0016	0.039	0.0071
Benzene	0.2218	5.324	0.9716
Toluene	0.9388	22.531	4.1119
Ethylbenzene	0.5910	14.185	2.5887
Xylenes	3.9792	95.502	17.4290
C8+ Heavies	0.5561	13.347	2.4358

Total Emissions	9.2020	220.849	40.3049
Total Hydrocarbon Emissions	9.2020	220.849	40.3049
Total VOC Emissions	7.9942	191.860	35.0144
Total HAP Emissions	5.7875	138.901	25.3494
Total BTEX Emissions	5.7309	137.541	25.1013

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	51.8901	1245.362	227.2786
Ethane	11.2026	268.862	49.0673
Propane	5.2096	125.031	22.8181
Isobutane	1.0003	24.008	4.3815
n-Butane	1.5189	36.454	6.6528
Isopentane	0.5148	12.356	2.2550
n-Pentane	0.3725	8.941	1.6317
n-Hexane	0.1540	3.695	0.6744
Cyclohexane	0.1171	2.811	0.5129
Other Hexanes	0.3412	8.189	1.4945
Heptanes	0.3088	7.411	1.3525
Methylcyclohexane	0.1058	2.538	0.4633
2,2,4-Trimethylpentane	0.0046	0.111	0.0202
Benzene	0.0258	0.618	0.1129
Toluene	0.0747	1.792	0.3271
Ethylbenzene	0.0288	0.691	0.1260
Xylenes	0.1385	3.323	0.6065
C8+ Heavies	0.1773	4.256	0.7768
Total Emissions	73.1854	1756.449	320.5520
Total Hydrocarbon Emissions	73.1854	1756.449	320.5520
Total VOC Emissions	10.0927	242.226	44.2062
Total HAP Emissions	0.4263	10.231	1.8671
Total BTEX Emissions	0.2677	6.425	1.1726

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	103.7802	2490.724	454.5571
Ethane	22.4051	537.724	98.1345
Propane	10.4192	250.062	45.6363
Isobutane	2.0007	48.016	8.7630
n-Butane	3.0378	72.907	13.3056
Isopentane	1.0297	24.713	4.5100
n-Pentane	0.7451	17.882	3.2635
n-Hexane	0.3079	7.390	1.3487
Cyclohexane	0.2342	5.621	1.0259
Other Hexanes	0.6824	16.378	2.9889
Heptanes	0.6176	14.822	2.7050
Methylcyclohexane	0.2115	5.077	0.9265
2,2,4-Trimethylpentane	0.0092	0.221	0.0404
Benzene	0.0515	1.237	0.2257
Toluene	0.1494	3.585	0.6542
Ethylbenzene	0.0576	1.381	0.2521
Xylenes	0.2770	6.647	1.2131
C8+ Heavies	0.3547	8.513	1.5536

Total Emissions	146.3708	3512.899	641.1041
Total Hydrocarbon Emissions	146.3708	3512.899	641.1041
Total VOC Emissions	20.1855	484.451	88.4124
Total HAP Emissions	0.8526	20.461	3.7342
Total BTEX Emissions	0.5354	12.850	2.3451

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr

Methane	51.9256	1246.214	227.4340
Ethane	11.2273	269.456	49.1757
Propane	5.2323	125.575	22.9174
Isobutane	1.0064	24.154	4.4082
n-Butane	1.5305	36.732	6.7036
Isopentane	0.5188	12.452	2.2725
n-Pentane	0.3759	9.022	1.6465
n-Hexane	0.1561	3.745	0.6835
Cyclohexane	0.1228	2.948	0.5381
Other Hexanes	0.3450	8.279	1.5109
Heptanes	0.3147	7.554	1.3786
Methylcyclohexane	0.1106	2.654	0.4844
2,2,4-Trimethylpentane	0.0047	0.112	0.0204
Benzene	0.0325	0.780	0.1424
Toluene	0.0919	2.204	0.4023
Ethylbenzene	0.0347	0.833	0.1520
Xylenes	0.1722	4.133	0.7543
C8+ Heavies	0.1775	4.261	0.7777

Total Emissions	73.3795	1761.108	321.4023
Total Hydrocarbon Emissions	73.3795	1761.108	321.4023
Total VOC Emissions	10.2266	245.439	44.7926
Total HAP Emissions	0.4920	11.808	2.1549
Total BTEX Emissions	0.3313	7.951	1.4510

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: WGGs CS - Dehy-01 - 40 MMscfd

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM -
WGGs CS\10.558 - WGGs CS - NSR-Mod - 06.12.15\02 - Att-Lbb - WGGs - NSR-App - 40 MMscfd
Dehy-01 GLYCalc - 06.12.15 - FIRST DRAFT.ddf

Date: June 18, 2015

DESCRIPTION:

Description: Wet Gas: 80oF 900 psig
Pump: 45020PV, 7.5 gpm
Flash: 160oF, 40 psig, 50% recycle
Regen: 95% BTEX Skid

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 80.00 deg. F
Pressure: 900.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
-----	-----
Carbon Dioxide	0.1162
Nitrogen	0.3945
Methane	87.9625
Ethane	8.2577
Propane	2.2945
Isobutane	0.2948
n-Butane	0.3939
Isopentane	0.1087
n-Pentane	0.0685
n-Hexane	0.0182
Cyclohexane	0.0057
Other Hexanes	0.0470
Heptanes	0.0224
Methylcyclohexane	0.0045
2,2,4-Trimethylpentane	0.0005
Benzene	0.0005
Toluene	0.0012
Ethylbenzene	0.0005
Xylenes	0.0025
C8+ Heavies	0.0077

DRY GAS:

Flow Rate: 40.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 1.5 wt% H2O
Flow Rate: 7.5 gpm

PUMP:

Glycol Pump Type: Gas Injection
Gas Injection Pump Volume Ratio: 0.080 acfm gas/gpm glycol

FLASH TANK:

Flash Control: Combustion device
Flash Control Efficiency: 50.00 %
Temperature: 160.0 deg. F
Pressure: 40.0 psig

REGENERATOR OVERHEADS CONTROL DEVICE:

Control Device: Condenser
Temperature: 150.0 deg. F
Pressure: 14.0 psia

Control Device: Combustion Device
Destruction Efficiency: 95.0 %
Excess Oxygen: 5.0 %
Ambient Air Temperature: 60.0 deg. F

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: WGGs CS - Dehy-01 - 40 MMscfd

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - WGGs CS\10.558 - WGGs CS - NSR-Mod - 06.12.15\02 - Att-Lbb - WGGs - NSR-App - 40 MMscfd Dehy-01 GLYCalc - 06.12.15 - FIRST DRAFT.ddf

Date: June 18, 2015

DESCRIPTION:

Description: Wet Gas: 80oF 900 psig
 Pump: 45020PV, 7.5 gpm
 Flash: 160oF, 40 psig, 50% recycle
 Regen: 95% BTEX Skid

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0355	0.852	0.1554
Ethane	0.0248	0.594	0.1084
Propane	0.0227	0.544	0.0993
Isobutane	0.0061	0.146	0.0267
n-Butane	0.0116	0.278	0.0508
Isopentane	0.0040	0.096	0.0175
n-Pentane	0.0034	0.081	0.0147
n-Hexane	0.0021	0.050	0.0092
Cyclohexane	0.0057	0.138	0.0251
Other Hexanes	0.0038	0.090	0.0165
Heptanes	0.0060	0.143	0.0261
Methylcyclohexane	0.0048	0.116	0.0211
2,2,4-Trimethylpentane	<0.0001	0.001	0.0002
Benzene	0.0067	0.162	0.0295
Toluene	0.0172	0.412	0.0752
Ethylbenzene	0.0059	0.142	0.0260
Xylenes	0.0337	0.810	0.1477
C8+ Heavies	0.0002	0.005	0.0009
Total Emissions	0.1941	4.659	0.8503
Total Hydrocarbon Emissions	0.1941	4.659	0.8503
Total VOC Emissions	0.1339	3.213	0.5864
Total HAP Emissions	0.0657	1.577	0.2879
Total BTEX Emissions	0.0636	1.526	0.2785

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.7106	17.054	3.1124
Ethane	0.4973	11.934	2.1780
Propane	0.4630	11.111	2.0278
Isobutane	0.1264	3.034	0.5537
n-Butane	0.2433	5.838	1.0655
Isopentane	0.0883	2.118	0.3866

Page: 2

n-Pentane	0.0781	1.874	0.3420
n-Hexane	0.0550	1.321	0.2410
Cyclohexane	0.1642	3.940	0.7191
Other Hexanes	0.0928	2.227	0.4064
Heptanes	0.2132	5.117	0.9339
Methylcyclohexane	0.1813	4.352	0.7943
2,2,4-Trimethylpentane	0.0016	0.039	0.0071
Benzene	0.2218	5.324	0.9716
Toluene	0.9388	22.531	4.1119
Ethylbenzene	0.5910	14.185	2.5887
Xylenes	3.9792	95.502	17.4290
C8+ Heavies	0.5561	13.347	2.4358

Total Emissions	9.2020	220.849	40.3049
Total Hydrocarbon Emissions	9.2020	220.849	40.3049
Total VOC Emissions	7.9942	191.860	35.0144
Total HAP Emissions	5.7875	138.901	25.3494
Total BTEX Emissions	5.7309	137.541	25.1013

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	51.8901	1245.362	227.2786
Ethane	11.2026	268.862	49.0673
Propane	5.2096	125.031	22.8181
Isobutane	1.0003	24.008	4.3815
n-Butane	1.5189	36.454	6.6528
Isopentane	0.5148	12.356	2.2550
n-Pentane	0.3725	8.941	1.6317
n-Hexane	0.1540	3.695	0.6744
Cyclohexane	0.1171	2.811	0.5129
Other Hexanes	0.3412	8.189	1.4945
Heptanes	0.3088	7.411	1.3525
Methylcyclohexane	0.1058	2.538	0.4633
2,2,4-Trimethylpentane	0.0046	0.111	0.0202
Benzene	0.0258	0.618	0.1129
Toluene	0.0747	1.792	0.3271
Ethylbenzene	0.0288	0.691	0.1260
Xylenes	0.1385	3.323	0.6065
C8+ Heavies	0.1773	4.256	0.7768

Total Emissions	73.1854	1756.449	320.5520
Total Hydrocarbon Emissions	73.1854	1756.449	320.5520
Total VOC Emissions	10.0927	242.226	44.2062
Total HAP Emissions	0.4263	10.231	1.8671
Total BTEX Emissions	0.2677	6.425	1.1726

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	103.7802	2490.724	454.5571
Ethane	22.4051	537.724	98.1345
Propane	10.4192	250.062	45.6363
Isobutane	2.0007	48.016	8.7630
n-Butane	3.0378	72.907	13.3056
Isopentane	1.0297	24.713	4.5100

Page: 3

n-Pentane	0.7451	17.882	3.2635
n-Hexane	0.3079	7.390	1.3487
Cyclohexane	0.2342	5.621	1.0259
Other Hexanes	0.6824	16.378	2.9889
Heptanes	0.6176	14.822	2.7050
Methylcyclohexane	0.2115	5.077	0.9265
2,2,4-Trimethylpentane	0.0092	0.221	0.0404
Benzene	0.0515	1.237	0.2257
Toluene	0.1494	3.585	0.6542
Ethylbenzene	0.0576	1.381	0.2521
Xylenes	0.2770	6.647	1.2131
C8+ Heavies	0.3547	8.513	1.5536

Total Emissions	146.3708	3512.899	641.1041
Total Hydrocarbon Emissions	146.3708	3512.899	641.1041
Total VOC Emissions	20.1855	484.451	88.4124
Total HAP Emissions	0.8526	20.461	3.7342
Total BTEX Emissions	0.5354	12.850	2.3451

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	51.9256	1246.214	227.4340
Ethane	11.2273	269.456	49.1757
Propane	5.2323	125.575	22.9174
Isobutane	1.0064	24.154	4.4082
n-Butane	1.5305	36.732	6.7036
Isopentane	0.5188	12.452	2.2725
n-Pentane	0.3759	9.022	1.6465
n-Hexane	0.1561	3.745	0.6835
Cyclohexane	0.1228	2.948	0.5381
Other Hexanes	0.3450	8.279	1.5109
Heptanes	0.3147	7.554	1.3786
Methylcyclohexane	0.1106	2.654	0.4844
2,2,4-Trimethylpentane	0.0047	0.112	0.0204
Benzene	0.0325	0.780	0.1424
Toluene	0.0919	2.204	0.4023
Ethylbenzene	0.0347	0.833	0.1520
Xylenes	0.1722	4.133	0.7543
C8+ Heavies	0.1775	4.261	0.7777

Total Emissions	73.3795	1761.108	321.4023
Total Hydrocarbon Emissions	73.3795	1761.108	321.4023
Total VOC Emissions	10.2266	245.439	44.7926
Total HAP Emissions	0.4920	11.808	2.1549
Total BTEX Emissions	0.3313	7.951	1.4510

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	457.6695	227.4340	50.31
Ethane	100.3125	49.1757	50.98
Propane	47.6641	22.9174	51.92
Isobutane	9.3167	4.4082	52.69

n-Butane	14.3710	6.7036	53.35
Isopentane	4.8966	2.2725	53.59
n-Pentane	3.6054	1.6465	54.33
n-Hexane	1.5897	0.6835	57.00
Cyclohexane	1.7450	0.5381	69.17
Other Hexanes	3.3953	1.5109	55.50
Heptanes	3.6389	1.3786	62.12
Methylcyclohexane	1.7208	0.4844	71.85
2,2,4-Trimethylpentane	0.0474	0.0204	57.04
Benzene	1.1974	0.1424	88.11
Toluene	4.7662	0.4023	91.56
Ethylbenzene	2.8408	0.1520	94.65
Xylenes	18.6421	0.7543	95.95
C8+ Heavies	3.9894	0.7777	80.51

Total Emissions	681.4089	321.4023	52.83
Total Hydrocarbon Emissions	681.4089	321.4023	52.83
Total VOC Emissions	123.4268	44.7926	63.71
Total HAP Emissions	29.0836	2.1549	92.59
Total BTEX Emissions	27.4464	1.4510	94.71

EQUIPMENT REPORTS:

CONDENSER AND COMBUSTION DEVICE

Condenser Outlet Temperature: 150.00 deg. F
 Condenser Pressure: 14.00 psia
 Condenser Duty: 1.62e-002 MM BTU/hr
 Hydrocarbon Recovery: 0.43 bbls/day
 Produced Water: 3.70 bbls/day
 Ambient Temperature: 60.00 deg. F
 Excess Oxygen: 5.00 %
 Combustion Efficiency: 95.00 %
 Supplemental Fuel Requirement: 1.62e-002 MM BTU/hr

Component	Emitted	Destroyed
Methane	4.99%	95.01%
Ethane	4.98%	95.02%
Propane	4.90%	95.10%
Isobutane	4.82%	95.18%
n-Butane	4.77%	95.23%
Isopentane	4.52%	95.48%
n-Pentane	4.31%	95.69%
n-Hexane	3.81%	96.19%
Cyclohexane	3.49%	96.51%
Other Hexanes	4.05%	95.95%
Heptanes	2.79%	97.21%
Methylcyclohexane	2.66%	97.34%
2,2,4-Trimethylpentane	2.86%	97.14%
Benzene	3.04%	96.96%
Toluene	1.83%	98.17%
Ethylbenzene	1.00%	99.00%
Xylenes	0.85%	99.15%
C8+ Heavies	0.04%	99.96%

ABSORBER

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages: 1.25
 Calculated Dry Gas Dew Point: 1.47 lbs. H2O/MMSCF

Temperature: 80.0 deg. F
 Pressure: 900.0 psig
 Dry Gas Flow Rate: 40.0000 MMSCF/day
 Glycol Losses with Dry Gas: 0.2382 lb/hr
 Wet Gas Water Content: Saturated
 Calculated Wet Gas Water Content: 34.62 lbs. H2O/MMSCF
 Calculated Lean Glycol Recirc. Ratio: 8.14 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	4.24%	95.76%
Carbon Dioxide	99.72%	0.28%
Nitrogen	99.98%	0.02%
Methane	99.98%	0.02%
Ethane	99.94%	0.06%
Propane	99.91%	0.09%
Isobutane	99.87%	0.13%
n-Butane	99.82%	0.18%
Isopentane	99.83%	0.17%
n-Pentane	99.77%	0.23%
n-Hexane	99.62%	0.38%
Cyclohexane	98.26%	1.74%
Other Hexanes	99.71%	0.29%
Heptanes	99.31%	0.69%
Methylcyclohexane	98.13%	1.87%
2,2,4-Trimethylpentane	99.72%	0.28%
Benzene	84.22%	15.78%
Toluene	77.75%	22.25%
Ethylbenzene	72.34%	27.66%
Xylenes	63.65%	36.35%
C8+ Heavies	98.57%	1.43%

FLASH TANK

Flash Control: Combustion device
 Flash Control Efficiency: 50.00 %
 Flash Temperature: 160.0 deg. F
 Flash Pressure: 40.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.31%	0.69%
Carbon Dioxide	6.09%	93.91%
Nitrogen	0.66%	99.34%
Methane	0.68%	99.32%
Ethane	2.17%	97.83%
Propane	4.25%	95.75%

Isobutane	5.94%	94.06%
n-Butane	7.41%	92.59%
Isopentane	8.14%	91.86%
n-Pentane	9.76%	90.24%
n-Hexane	15.46%	84.54%
Cyclohexane	42.95%	57.05%
Other Hexanes	12.55%	87.45%
Heptanes	25.97%	74.03%
Methylcyclohexane	48.16%	51.84%
2,2,4-Trimethylpentane	15.78%	84.22%
Benzene	82.08%	17.92%
Toluene	87.35%	12.65%
Ethylbenzene	92.05%	7.95%
Xylenes	94.33%	5.67%
C8+ Heavies	65.34%	34.66%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	53.71%	46.29%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	3.31%	96.69%
n-Pentane	3.10%	96.90%
n-Hexane	2.32%	97.68%
Cyclohexane	6.88%	93.12%
Other Hexanes	5.24%	94.76%
Heptanes	1.58%	98.42%
Methylcyclohexane	7.71%	92.29%
2,2,4-Trimethylpentane	6.24%	93.76%
Benzene	6.04%	93.96%
Toluene	8.99%	91.01%
Ethylbenzene	11.25%	88.75%
Xylenes	13.64%	86.36%
C8+ Heavies	16.84%	83.16%

STREAM REPORTS:

WET GAS STREAM

Temperature: 80.00 deg. F
 Pressure: 914.70 psia
 Flow Rate: 1.67e+006 scfh

Component	Conc.	Loading
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	(vol%)	(lb/hr)
Water	7.29e-002	5.78e+001
Carbon Dioxide	1.16e-001	2.25e+002
Nitrogen	3.94e-001	4.85e+002
Methane	8.79e+001	6.20e+004
Ethane	8.25e+000	1.09e+004
Propane	2.29e+000	4.45e+003
Isobutane	2.95e-001	7.53e+002
n-Butane	3.94e-001	1.01e+003
Isopentane	1.09e-001	3.45e+002
n-Pentane	6.84e-002	2.17e+002
n-Hexane	1.82e-002	6.89e+001
Cyclohexane	5.70e-003	2.11e+001
Other Hexanes	4.70e-002	1.78e+002
Heptanes	2.24e-002	9.86e+001
Methylcyclohexane	4.50e-003	1.94e+001
2,2,4-Trimethylpentane	5.00e-004	2.51e+000
Benzene	5.00e-004	1.72e+000
Toluene	1.20e-003	4.86e+000
Ethylbenzene	5.00e-004	2.33e+000
Xylenes	2.50e-003	1.17e+001
C8+ Heavies	7.69e-003	5.76e+001
Total Components	100.00	8.09e+004

DRY GAS STREAM

Temperature: 80.00 deg. F
 Pressure: 914.70 psia
 Flow Rate: 1.67e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	3.09e-003	2.45e+000
Carbon Dioxide	1.16e-001	2.24e+002
Nitrogen	3.95e-001	4.85e+002
Methane	8.80e+001	6.20e+004
Ethane	8.25e+000	1.09e+004
Propane	2.29e+000	4.44e+003
Isobutane	2.94e-001	7.52e+002
n-Butane	3.93e-001	1.00e+003
Isopentane	1.09e-001	3.44e+002
n-Pentane	6.84e-002	2.17e+002
n-Hexane	1.81e-002	6.87e+001
Cyclohexane	5.60e-003	2.07e+001
Other Hexanes	4.69e-002	1.77e+002
Heptanes	2.22e-002	9.79e+001
Methylcyclohexane	4.42e-003	1.90e+001
2,2,4-Trimethylpentane	4.99e-004	2.50e+000
Benzene	4.21e-004	1.45e+000
Toluene	9.33e-004	3.78e+000
Ethylbenzene	3.62e-004	1.69e+000
Xylenes	1.59e-003	7.42e+000
C8+ Heavies	7.59e-003	5.68e+001
Total Components	100.00	8.08e+004

LEAN GLYCOL STREAM

 Temperature: 80.00 deg. F
 Flow Rate: 7.50e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	4.16e+003
Water	1.50e+000	6.33e+001
Carbon Dioxide	1.50e-012	6.34e-011
Nitrogen	2.46e-013	1.04e-011
Methane	9.20e-018	3.88e-016
Ethane	7.32e-008	3.09e-006
Propane	4.07e-009	1.72e-007
Isobutane	7.10e-010	3.00e-008
n-Butane	1.04e-009	4.40e-008
Isopentane	7.16e-005	3.02e-003
n-Pentane	5.92e-005	2.50e-003
n-Hexane	3.09e-005	1.30e-003
Cyclohexane	2.87e-004	1.21e-002
Other Hexanes	1.22e-004	5.13e-003
Heptanes	8.13e-005	3.43e-003
Methylcyclohexane	3.59e-004	1.52e-002
2,2,4-Trimethylpentane	2.55e-006	1.08e-004
Benzene	3.38e-004	1.43e-002
Toluene	2.20e-003	9.27e-002
Ethylbenzene	1.78e-003	7.49e-002
Xylenes	1.49e-002	6.29e-001
C8+ Heavies	2.67e-003	1.13e-001
Total Components	100.00	4.22e+003

RICH GLYCOL AND PUMP GAS STREAM

 Temperature: 80.00 deg. F
 Pressure: 914.70 psia
 Flow Rate: 7.95e+000 gpm
 NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.38e+001	4.16e+003
Water	2.68e+000	1.19e+002
Carbon Dioxide	2.19e-002	9.71e-001
Nitrogen	1.88e-002	8.32e-001
Methane	2.36e+000	1.04e+002
Ethane	5.17e-001	2.29e+001
Propane	2.45e-001	1.09e+001
Isobutane	4.80e-002	2.13e+000
n-Butane	7.40e-002	3.28e+000
Isopentane	2.53e-002	1.12e+000
n-Pentane	1.86e-002	8.26e-001
n-Hexane	8.22e-003	3.64e-001
Cyclohexane	9.26e-003	4.11e-001
Other Hexanes	1.76e-002	7.80e-001
Heptanes	1.88e-002	8.34e-001
Methylcyclohexane	9.20e-003	4.08e-001
2,2,4-Trimethylpentane	2.47e-004	1.09e-002

Benzene	6.49e-003	2.88e-001
Toluene	2.66e-002	1.18e+000
Ethylbenzene	1.63e-002	7.24e-001
Xylenes	1.10e-001	4.88e+000
C8+ Heavies	2.31e-002	1.02e+000

Total Components	100.00	4.43e+003

FLASH TANK OFF GAS STREAM

 Temperature: 160.00 deg. F
 Pressure: 54.70 psia
 Flow Rate: 2.92e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)

Water	5.95e-001	8.24e-001
Carbon Dioxide	2.69e-001	9.12e-001
Nitrogen	3.84e-001	8.26e-001
Methane	8.41e+001	1.04e+002
Ethane	9.69e+000	2.24e+001
Propane	3.07e+000	1.04e+001
Isobutane	4.48e-001	2.00e+000
n-Butane	6.80e-001	3.04e+000
Isopentane	1.86e-001	1.03e+000
n-Pentane	1.34e-001	7.45e-001
n-Hexane	4.65e-002	3.08e-001
Cyclohexane	3.62e-002	2.34e-001
Other Hexanes	1.03e-001	6.82e-001
Heptanes	8.02e-002	6.18e-001
Methylcyclohexane	2.80e-002	2.12e-001
2,2,4-Trimethylpentane	1.05e-003	9.21e-003
Benzene	8.58e-003	5.15e-002
Toluene	2.11e-002	1.49e-001
Ethylbenzene	7.05e-003	5.76e-002
Xylenes	3.39e-002	2.77e-001
C8+ Heavies	2.71e-002	3.55e-001

Total Components	100.00	1.49e+002

FLASH TANK GLYCOL STREAM

 Temperature: 160.00 deg. F
 Flow Rate: 7.63e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)

TEG	9.70e+001	4.16e+003
Water	2.75e+000	1.18e+002
Carbon Dioxide	1.38e-003	5.91e-002
Nitrogen	1.29e-004	5.53e-003
Methane	1.66e-002	7.11e-001
Ethane	1.16e-002	4.97e-001
Propane	1.08e-002	4.63e-001
Isobutane	2.95e-003	1.26e-001
n-Butane	5.68e-003	2.43e-001
Isopentane	2.13e-003	9.13e-002

n-Pentane	1.88e-003	8.06e-002
n-Hexane	1.31e-003	5.63e-002
Cyclohexane	4.11e-003	1.76e-001
Other Hexanes	2.29e-003	9.79e-002
Heptanes	5.06e-003	2.17e-001
Methylcyclohexane	4.59e-003	1.97e-001
2,2,4-Trimethylpentane	4.03e-005	1.73e-003
Benzene	5.51e-003	2.36e-001
Toluene	2.41e-002	1.03e+000
Ethylbenzene	1.55e-002	6.66e-001
Xylenes	1.08e-001	4.61e+000
C8+ Heavies	1.56e-002	6.69e-001

Total Components	100.00	4.28e+003

FLASH GAS EMISSIONS

Flow Rate: 6.46e+003 scfh
 Control Method: Combustion Device
 Control Efficiency: 50.00

Component	Conc. (vol%)	Loading (lb/hr)

Water	4.99e+001	1.53e+002
Carbon Dioxide	2.76e+001	2.07e+002
Nitrogen	1.73e-001	8.26e-001
Methane	1.90e+001	5.19e+001
Ethane	2.19e+000	1.12e+001
Propane	6.94e-001	5.21e+000
Isobutane	1.01e-001	1.00e+000
n-Butane	1.54e-001	1.52e+000
Isopentane	4.19e-002	5.15e-001
n-Pentane	3.03e-002	3.73e-001
n-Hexane	1.05e-002	1.54e-001
Cyclohexane	8.17e-003	1.17e-001
Other Hexanes	2.33e-002	3.41e-001
Heptanes	1.81e-002	3.09e-001
Methylcyclohexane	6.33e-003	1.06e-001
2,2,4-Trimethylpentane	2.37e-004	4.61e-003
Benzene	1.94e-003	2.58e-002
Toluene	4.76e-003	7.47e-002
Ethylbenzene	1.59e-003	2.88e-002
Xylenes	7.66e-003	1.38e-001
C8+ Heavies	6.12e-003	1.77e-001

Total Components	100.00	4.34e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
 Pressure: 14.70 psia
 Flow Rate: 1.21e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)

Water	9.53e+001	5.46e+001
Carbon Dioxide	4.22e-002	5.91e-002
Nitrogen	6.21e-003	5.53e-003

Methane	1.39e+000	7.11e-001
Ethane	5.20e-001	4.97e-001
Propane	3.30e-001	4.63e-001
Isobutane	6.84e-002	1.26e-001
n-Butane	1.32e-001	2.43e-001
Isopentane	3.85e-002	8.83e-002
n-Pentane	3.40e-002	7.81e-002
n-Hexane	2.01e-002	5.50e-002
Cyclohexane	6.14e-002	1.64e-001
Other Hexanes	3.39e-002	9.28e-002
Heptanes	6.69e-002	2.13e-001
Methylcyclohexane	5.81e-002	1.81e-001
2,2,4-Trimethylpentane	4.46e-004	1.62e-003
Benzene	8.94e-002	2.22e-001
Toluene	3.21e-001	9.39e-001
Ethylbenzene	1.75e-001	5.91e-001
Xylenes	1.18e+000	3.98e+000
C8+ Heavies	1.03e-001	5.56e-001

Total Components	100.00	6.38e+001

CONDENSER PRODUCED WATER STREAM

Temperature: 150.00 deg. F
 Flow Rate: 1.08e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)	(ppm)
Water	1.00e+002	5.39e+001	999595.
Carbon Dioxide	6.37e-004	3.43e-004	6.
Nitrogen	1.91e-006	1.03e-006	0.
Methane	4.41e-004	2.38e-004	4.
Ethane	3.32e-004	1.79e-004	3.
Propane	3.70e-004	2.00e-004	4.
Isobutane	5.25e-005	2.83e-005	1.
n-Butane	1.28e-004	6.92e-005	1.
Isopentane	2.98e-005	1.61e-005	0.
n-Pentane	2.66e-005	1.43e-005	0.
n-Hexane	1.30e-005	7.01e-006	0.
Cyclohexane	1.82e-004	9.84e-005	2.
Other Hexanes	1.92e-005	1.03e-005	0.
Heptanes	1.98e-005	1.07e-005	0.
Methylcyclohexane	7.15e-005	3.85e-005	1.
2,2,4-Trimethylpentane	1.05e-007	5.66e-008	0.
Benzene	5.23e-003	2.82e-003	52.
Toluene	1.04e-002	5.63e-003	104.
Ethylbenzene	2.61e-003	1.41e-003	26.
Xylenes	1.99e-002	1.07e-002	199.
C8+ Heavies	2.61e-007	1.41e-007	0.

Total Components	100.00	5.39e+001	1000000.

CONDENSER RECOVERED OIL STREAM

Temperature: 150.00 deg. F
 Flow Rate: 1.25e-002 gpm

Component	Conc. (wt%)	Loading (lb/hr)
Water	5.79e-002	3.07e-003
Carbon Dioxide	2.81e-003	1.49e-004
Nitrogen	2.07e-004	1.10e-005
Methane	1.23e-002	6.55e-004
Ethane	3.78e-002	2.00e-003
Propane	1.77e-001	9.36e-003
Isobutane	8.74e-002	4.64e-003
n-Butane	2.14e-001	1.13e-002
Isopentane	1.60e-001	8.50e-003
n-Pentane	2.03e-001	1.08e-002
n-Hexane	2.47e-001	1.31e-002
Cyclohexane	9.32e-001	4.94e-002
Other Hexanes	3.33e-001	1.76e-002
Heptanes	1.77e+000	9.41e-002
Methylcyclohexane	1.60e+000	8.50e-002
2,2,4-Trimethylpentane	1.31e-002	6.92e-004
Benzene	1.59e+000	8.42e-002
Toluene	1.11e+001	5.90e-001
Ethylbenzene	8.88e+000	4.71e-001
Xylenes	6.21e+001	3.29e+000
C8+ Heavies	1.04e+001	5.52e-001
Total Components	100.00	5.30e+000

CONDENSER VENT STREAM

Temperature: 150.00 deg. F
 Pressure: 14.00 psia
 Flow Rate: 5.10e+001 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	2.67e+001	6.46e-001
Carbon Dioxide	9.91e-001	5.86e-002
Nitrogen	1.47e-001	5.52e-003
Methane	3.29e+001	7.10e-001
Ethane	1.23e+001	4.95e-001
Propane	7.65e+000	4.53e-001
Isobutane	1.56e+000	1.22e-001
n-Butane	2.97e+000	2.32e-001
Isopentane	8.23e-001	7.97e-002
n-Pentane	6.94e-001	6.73e-002
n-Hexane	3.62e-001	4.19e-002
Cyclohexane	1.01e+000	1.15e-001
Other Hexanes	6.49e-001	7.52e-002
Heptanes	8.85e-001	1.19e-001
Methylcyclohexane	7.30e-001	9.63e-002
2,2,4-Trimethylpentane	6.03e-003	9.26e-004
Benzene	1.28e+000	1.35e-001
Toluene	2.77e+000	3.43e-001
Ethylbenzene	8.32e-001	1.19e-001
Xylenes	4.73e+000	6.75e-001
C8+ Heavies	1.74e-002	3.98e-003
Total Components	100.00	4.59e+000

COMBUSTION DEVICE OFF GAS STREAM

 Temperature: 1000.00 deg. F
 Pressure: 14.70 psia
 Flow Rate: 1.84e+000 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Methane	4.56e+001	3.55e-002
Ethane	1.70e+001	2.48e-002
Propane	1.06e+001	2.27e-002
Isobutane	2.16e+000	6.09e-003
n-Butane	4.11e+000	1.16e-002
Isopentane	1.14e+000	3.99e-003
n-Pentane	9.62e-001	3.36e-003
n-Hexane	5.01e-001	2.09e-003
Cyclohexane	1.41e+000	5.73e-003
Other Hexanes	8.99e-001	3.76e-003
Heptanes	1.23e+000	5.96e-003
Methylcyclohexane	1.01e+000	4.82e-003
2,2,4-Trimethylpentane	8.36e-003	4.63e-005
Benzene	1.78e+000	6.74e-003
Toluene	3.84e+000	1.72e-002
Ethylbenzene	1.15e+000	5.94e-003
Xylenes	6.55e+000	3.37e-002
C8+ Heavies	2.41e-002	1.99e-004
Total Components	100.00	1.94e-001

ATTACHMENT O

Monitoring/Recordkeeping/Reporting/Testing Plans

“31. **Monitoring, Recordkeeping, Reporting and Testing Plans.** Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as Attachment O.”

- **Monitoring/Recordkeeping/Reporting/Testing Plans**
 - A. Monitoring
 - B. Recordkeeping
 - C. Reporting
 - D. Testing
-

Williams Ohio Valley Midstream LLC
WGGS COMPRESSOR STATION
Application for 45CSR13 NSR Modification Permit

Attachment O
MONITORING/RECORDKEEPING/REPORTING/TESTING PLANS

Williams Ohio Valley Midstream LLC proposes the following monitoring, recordkeeping, testing and reporting requirements at the subject facility:

A. Monitoring

1. Monitor and record quantity of natural gas combusted in each engine.
2. Monitor and record quantity of natural gas treated in the dehydrator.
3. Monitor and record quantity of produced water transferred from the storage tank.

B. Recordkeeping

1. Maintain records of the amount of natural gas consumed and hours of operation for each engine.
2. Maintain records of the amount of natural gas treated in the dehydrator.
3. Maintain records demonstrating the actual annual average benzene emissions are less than one ton per year.
4. Maintain records of the amount of produced water transferred from the storage tank.
5. Maintain records of testing conducted in accordance with the permit.
6. Maintain a record of all potential to emit (PTE) HAP calculations for the entire facility. These records shall include the natural gas compressor engines, dehydration unit and ancillary equipment.
7. The records shall be maintained on site or in a readily available off-site location for a period of five (5) years.

C. Reporting

1. Any deviations from the allowable emissions limitations, including visible emissions.
2. Any and all application forms, reports, or compliance certifications required by this Permit shall be certified by a responsible official.

D. Testing

Emissions testing will be performed on the two Caterpillar G3516B compressor engines in accordance with NSPS JJJJ requirements.

ATTACHMENT P

Public Notice

“32. **Public Notice.** At the time that the application is submitted, place a **Class I Legal Advertisement** in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and Example Legal Advertisement for details). Please submit the **Affidavit of Publication** as Attachment P immediately upon receipt.”

The applicant shall cause such legal advertisement to appear a minimum of one (1) day in the newspaper most commonly read in the area where the facility exists or will be constructed. The notice must be published no earlier than five (5) working days of receipt by this office of your application. The original affidavit of publication must be received by this office no later than the last day of the public comment period.

Types and amounts of pollutants discharged must include all regulated pollutants (PM, PM10, VOC, SO2, Xylene, etc.) and their potential to emit or the permit level being sought in units of tons per year (including fugitive emissions).

- Legal Advertisement (as shown) will be placed in a newspaper of general circulation in the area where the source is located (See 45CSR§13-8.3 thru 45CSR§13-8.5).
 - An Affidavit of Publication shall be submitted immediately upon receipt.
-

Williams Ohio Valley Midstream LLC
WGGS COMPRESSOR STATION
Application for 45CSR13 NSR Modification Permit
Attachment P - Public Notice

AIR QUALITY PUBLIC NOTICE
Notice of Application

Notice is given that Williams Ohio Valley Midstream LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a 45CSR13 NSR Modification Permit for an existing compressor station, located on the southwest side of Buffalo Run Road, approximately 3.7 miles south of Jacksonburg, in Wetzel County, West Virginia.

The latitude and longitude coordinates are 39.4886° North and -80.6336° West.

The applicant estimates the increased potential to regulated air pollutants will be as follows:

0.07	tons of nitrogen oxides per year
0.28	tons of carbon monoxide per year
68.13	tons of volatile organic compounds per year
0.13	tons of particulate matter per year
0.26	tons of benzene per year
0.09	tons of formaldehyde per year
4.31	tons of total hazardous air pollutants per year
9,796	tons of carbon dioxide equivalent per year

Modifications will be implemented immediately upon permit issuance.

Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality (DAQ), 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 _____ day of _____, 2015.

By: Williams Ohio Valley Midstream LLC
Mr. Don Wicburg
Vice President and General Manager
100 Teletech Drive, Suite 2
Moundsville, WV 26041

ATTACHMENT Q
Business Confidential Claims
(NOT APPLICABLE)

also

ATTACHMENT R
Authority Forms
(NOT APPLICABLE)

also

ATTACHMENT S
Title V Permit Revision Information
(NOT APPLICABLE)

******* End of Application for 45CSR13 NSR Permit *******

Williams Ohio Valley Midstream LLC

WGGS COMPRESSOR STATION

Application for 45CSR13 New Source Review (NSR) Modification Permit



WILLIAMS FIELD SERVICES GROUP, INC
 PO BOX 21218
 TULSA, OK 74121-1218

COMPANY NUMBER: 4000

CHECK NUMBER: 4000119748

PAY DATE	SUPPLIER NO.	SUPPLIER NAME	CHECK TOTAL
11-SEP-15	526257	WV DEP - DIVISION OF AIR QUALITY	4,500.00

Invoice Date	Invoice Or Credit Memo / Invoice Description	Gross	Discount	Net
10-SEP-15	10-SEP-2015 / AIR PERMIT APPLICATION FEE FO WGGS	4,500.00	0.00	4,500.00
Supplier Support 1-866-778-2665		Page Totals	0.00	4,500.00

VERIFY THE AUTHENTICITY OF THIS MULTI-TONE SECURITY DOCUMENT.

CHECK BACKGROUND AREA CHANGES COLOR GRADUALLY FROM TOP TO BOTTOM.



WILLIAMS FIELD SERVICES GROUP, INC
 PO BOX 21218
 TULSA, OK 74121-1218
 Company Number: 4000

JPMorgan Chase Bank, N.A. 70-2322/719
 Chicago, IL

Check Number: 4000119748

Check Date: 11-SEP-15

Four Thousand Five Hundred Dollars And Zero Cents

Pay To The Order Of:

WV DEP - DIVISION OF AIR QUALITY
 601 57TH ST SE
 CHARLESTON, WV 25304 United States

PAY (USD)	\$4,500.00
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Donna R. Chappell
 Authorized Signature

⑈4000119748⑈ ⑆071923226⑆

009401167⑈

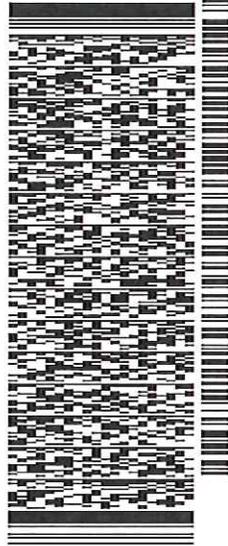
ORIGIN ID: OLLA (412) 787-4197
DANIEL ZAWASKI
WILLIAMS
2000 COMMERCE DRIVE
PARK PLACE 2
PITTSBURGH, PA 15275
UNITED STATES US

SHIP DATE: 16SEP15
ACTWGT: 1.00 LB
CAD: 104269589/NET3670
BILL SENDER

TO BEVERLY MCKEONE
WV DIV OF AIR QUALITY PERMITTING
601 5TH STREET, SE

CHARLESTON WV 25304
INV/ (304) 926-0499 X 1260 REF: 60000006200060034 6228 8325
PO: DEPT:

539.I2/CB59.31.D0



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WV-US HTS



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