

**PERMIT DETERMINATION FORM
SMALL PRODUCTION DEHYDRATION UNIT
U.S. ROUTE 60 SITE
KANAWHA COUNTY, WEST VIRGINIA**

Prepared for:

Reserve Oil & Gas, Inc.
929 Charleston Road
Spencer, West Virginia 25276

Prepared by:

Potesta & Associates, Inc.
7012 MacCorkle Avenue, SE
Charleston, West Virginia 25304
Phone: (304) 342-1400 Fax: (304) 343-9031
Email: potesta@potesta.com

Project No. 0101-15-0343

October 2015

POTESTA

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SECTION I
PERMIT DETERMINATION FORM



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

**PERMIT DETERMINATION FORM
(PDF)**

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

1. NAME OF APPLICANT (AS REGISTERED WITH THE WV SECRETARY OF STATE'S OFFICE): Reserve Oil & Gas, Inc.		
2. NAME OF FACILITY (IF DIFFERENT FROM ABOVE): Route 60 Dehydration Unit		3. NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS) CODE: 211111 (SIC 1311)
4A. MAILING ADDRESS: 929 Charleston Road Spencer, West Virginia 25276		4B. PHYSICAL ADDRESS: Beside Route 60 (see area map) South Charleston, West Virginia
5A. DIRECTIONS TO FACILITY (PLEASE PROVIDE MAP AS ATTACHMENT A): Take I-64 West from Charleston to Exit 54. Take Exit 54 and then a right turn onto U.S. Route 60, drive approximately 0.45 miles to the which is located on the right side of the road.		
5B. NEAREST ROAD: U.S. Route 60 MacCorkle Avenue, SW	5C. NEAREST CITY OR TOWN: South Charleston	5D. COUNTY: Kanawha
5E. UTM NORTHING (KM): 4,246.43197	5F. UTM EASTING (KM): 438.07209	5G. UTM ZONE: 17
6A. INDIVIDUAL TO CONTACT IF MORE INFORMATION IS REQUIRED: Doug Douglass		6B. TITLE: Land Manager
6C. TELEPHONE: (304) 483-8340	6D. FAX: NA	6E. E-MAIL: ddouglass@reserveoilandgas.com
7A. DAQ PLANT I.D. NO. (FOR AN EXISTING FACILITY ONLY): Not Applicable (NA)		7B. PLEASE LIST ALL CURRENT 45CSR13, 45CSR14, 45CSR19 AND/OR TITLE V (45CSR30) PERMIT NUMBERS ASSOCIATED WITH THIS PROCESS (FOR AN EXISTING FACILITY ONLY): NA
7C. IS THIS PDF BEING SUBMITTED AS THE RESULT OF AN ENFORCEMENT ACTION? IF YES, PLEASE LIST: No		
8A. TYPE OF EMISSION SOURCE (CHECK ONE): <input checked="" type="checkbox"/> NEW SOURCE <input type="checkbox"/> ADMINISTRATIVE UPDATE <input type="checkbox"/> MODIFICATION <input type="checkbox"/> OTHER (PLEASE EXPLAIN IN 11B)		8B. IF ADMINISTRATIVE UPDATE, DOES DAQ HAVE THE APPLICANT'S CONSENT TO UPDATE THE EXISTING PERMIT WITH THE INFORMATION CONTAINED HEREIN? <input type="checkbox"/> YES <input type="checkbox"/> NO N/A
9. IS DEMOLITION OR PHYSICAL RENOVATION AT AN EXISTING FACILITY INVOLVED? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
10A. DATE OF ANTICIPATED INSTALLATION OR CHANGE: 11/15/2015		10B. DATE OF ANTICIPATED START-UP: 11/22/2015
11A. PLEASE PROVIDE A DETAILED PROCESS FLOW DIAGRAM SHOWING EACH PROPOSED OR MODIFIED PROCESS EMISSION POINT AS ATTACHMENT B.		
11B. PLEASE PROVIDE A DETAILED PROCESS DESCRIPTION AS ATTACHMENT C.		
12. PLEASE PROVIDE MATERIAL SAFETY DATA SHEETS (MSDS) FOR ALL MATERIALS PROCESSED, USED OR PRODUCED AS ATTACHMENT D. FOR CHEMICAL PROCESSES, PLEASE PROVIDE A MSDS FOR EACH COMPOUND EMITTED TO AIR.		

13A. REGULATED AIR POLLUTANT EMISSIONS:

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

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

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

POLLUTANT	HOURLY PTE (LB/HR)	YEARLY PTE (TON/YR) (HOURLY PTE MULTIPLIED BY 8760 HR/YR) DIVIDED BY 2000 LB/TON
PM	0.0015	0.0066
PM ₁₀	0.0015	0.0066
VOCs	1.3549	5.9350
CO	0.0168	0.0736
NO _x	0.0200	0.0876
SO ₂	0.0001	0.0004
Pb		
HAPs (AGGREGATE AMOUNT)	0.3531	1.5463
TAPs (INDIVIDUALLY)* Formaldehyde	9.19E-6	4.03E-5
Benzene	1.84E-2	8.06E-2
OTHER (INDIVIDUALLY)*		

* ATTACH ADDITIONAL PAGES AS NEEDED

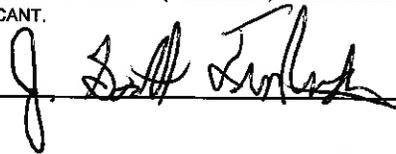
13B. PLEASE PROVIDE ALL SUPPORTING CALCULATIONS AS ATTACHMENT E.

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

14. CERTIFICATION OF DATA

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

SIGNATURE OF RESPONSIBLE OFFICIAL: _____



TITLE: Vice President

DATE: 10 / 21 / 15

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

NOTE: PLEASE CHECK ENCLOSED ATTACHMENTS

ATTACHMENT A ATTACHMENT B ATTACHMENT C ATTACHMENT D ATTACHMENT E

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

THE PERMIT DETERMINATION FORM WITH THE INSTRUCTIONS CAN BE FOUND ON DAQ'S PERMITTING SECTION WEB SITE:
www.dep.wv.gov/daq

ATTACHMENT A

AREA MAP



Facility Location

Tyer Island

Wilson Island

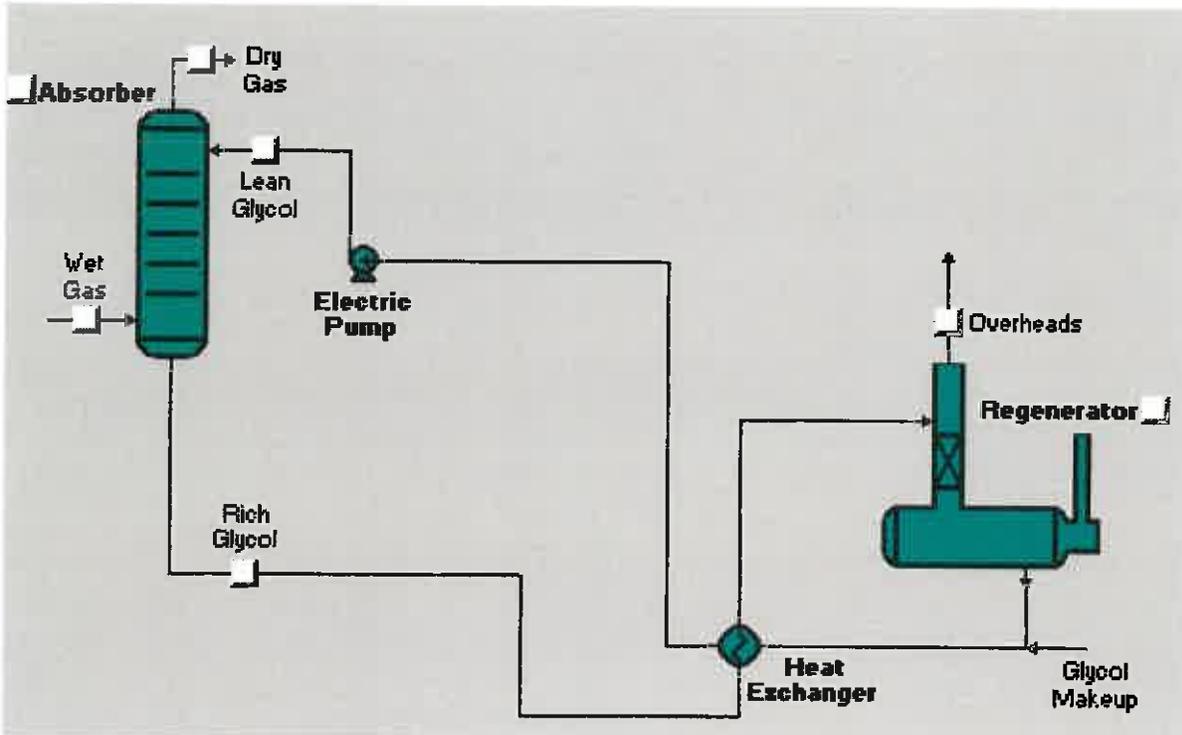
Waste Water Retention Pond



7012 MacCorkle Avenue, S.E
Charleston, West Virginia 25304
Phone: (304) 342-1400
Fax: (304) 343-9031

Area Map
US Route 60 Site
Reserve Oil & Gas, Inc.
Kanawha County, West Virginia

ATTACHMENT B
PROCESS FLOW DIAGRAM



Reference: TEG Dehydration Process Flow Diagram from GRI-GLYCalc Version 4.0



7012 MacCorkle Avenue, S.E.
 Charleston, West Virginia 25304
 Phone: (304) 342-1400
 Fax: (304) 343-9031

Process Flow Diagram
US Route 60 Site
 Reserve Oil & Gas, Inc.
 Kanawha County, West Virginia

ATTACHMENT C
PROCESS DESCRIPTION

ATTACHMENT C

PROCESS DESCRIPTION

Reserve Oil & Gas, Inc. (Reserve) owns and operates a natural gas gathering system located in Kanawha County, West Virginia. The natural gas is collected and delivered to a transmission pipeline at a meter where the proposed facility will be located as shown on the area map. The proposed dehydration system will be placed prior to the existing meter. The natural gas gathering system and the transmission pipeline already exist.

The transmission pipeline operators are requiring that Reserve reduce the water content of the gas to the standard level of seven pounds per thousand cubic feet of gas delivered to the pipeline. The water content in the gathering system can run up to approximately 250 pounds per thousand cubic feet. To reduce the water content of the natural gas a small triethylene glycol (TEG) dehydration unit is being proposed.

The TEG dehydration unit is made by Energy Weldfab with a model number of 125M12204PT. The dehydration unit comes with a reboiler rated at 125,000 Btu/hr. The unit is designed to process a maximum of 1.0 million cubic feet of gas per day with an average expected rate of 250,000 cubic feet per day. The glycol pump is rated to 3.0 gallons per pound of water. There are no control devices for this unit so the system has two point source emissions (still vent and reboiler stack) and fugitive emissions from equipment leaks.

A natural gas sample was obtained and analyzed to aid in estimating the emissions. The still vent emissions were estimated with GRI-GLYCalc Version 4.0. The natural gas analysis results and the GRI-GLYCalc Aggregate Report are included at the back of Attachment E of this application. The reboiler emissions are based on natural gas combustion contained in AP-42, Section 1.4, Natural Gas Combustion. Fugitives have been estimated based on an estimate of the count of connections, etc. using the Protocol for Equipment Leak Emission Estimates contained in Chapter 5 of AP-42.

The following is a review of the regulations for emissions levels triggering permitting and a substantive requirement requiring a permit:

- The total emissions for the site are less than 6 pound per hour and 10 tons per year for criteria pollutants (NO_x, CO, PM, SO₂, and VOC), less than 2 pounds per hour or 5 tons per year for total hazardous air pollutants, and less than the Table 45-13A toxic emissions thresholds. Therefore, we do not believe a permit is required based on Regulation 13, "Permits for Construction, Modification, Relocation, and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permit.

- The reboiler heat input is 125,000 Btu per hour. Regulation 2, “To Prevent and Control Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers” and Regulation 10, “To Prevent and Control Air Pollution from the Emission of Sulfur Oxides” have exemptions from most of the requirements in the rules for sources that are less than 10 million Btu per hour. The reboiler meets the exemptions under Regulation 2 and 10 based on heat input. Therefore, the rules are not considered substantive requirements under Regulation 13.
- Additionally, the TEG dehydration unit has benzene emissions of less than 1.0 tons per year (0.90 Mg/yr) and has a throughput of less than 3.0 million cubic feet per day (85,000 standard cubic meters per day). The unit meets both of the requirements for exemptions under Section 63.764.e.1. of 40CFR63 Subpart HH, “National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities”. Therefore, it is our understanding that the remaining recordkeeping requirements (required to keep records of the determinations that they are exempt) are not considered substantive requirements under Regulation 13.

Based on this review, we are requesting that the Division of Air Quality concur with our request for no permit required based on the overall size and resulting emissions from the facility.

ATTACHMENT D
MATERIAL SAFETY DATA SHEETS

MATERIAL SAFETY DATA SHEET – NATURAL GAS (PIPELINE QUALITY - MSDS #526)



Revision Date: February 05, 2015
Supersedes Date: January 26, 2012

Section 1: PRODUCT AND COMPANY IDENTIFICATION

FortisBC
16705 Fraser Highway
Surrey, BC
V3S 2X7

Company Phone Number: (604) 576-7000
Emergency Phone Number: 1-800-663-9911

Product Name: Natural Gas (Pipeline Quality)
Material Use: Fuel

Manufacturer: Duke Energy Inc.
1333 West Georgia Street
Vancouver, BC
V6E 3K9

Supplier: FortisBC
16705 Fraser Highway
Surrey, BC
V3S 2X7

WHMIS Class: A – Compressed Gas;
B1 – Flammable and Combustible Material – Division 1 Flammable Gases
UN/PIN Number: 1971
TDG Classification: Class 2.1 Flammable Gases
TDG Shipping Name: Natural gas, compressed with high methane content
Chemical Family: Simple hydrocarbon
Chemical Formula: Natural gas (considered a complex mixture)
Molecular Weight: Not applicable (natural gas is considered a complex mixture)
CAS Number: 8006-14-2
Trade Names / Synonyms: Methane, marsh gas

Section 2: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Appearance/Odour: Gas like odour and colourless gas
Flammable: Yes. Can cause flash fire
Potential Health Effects: See Section 11 for more information
Potential Environmental Effects: See Section 12 for more information
Likely Routes of Exposure: Acute inhalation
Acute Inhalation: At high concentrations, natural gas can displace oxygen causing asphyxiation and cause central nervous system (CNS) depression and cardiac sensitization.
Eye and Skin Contact: None
Chronic- Inhalation: None
Ingestion: None
Skin Adsorption: None

Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	% by Wt.	Exposure Limits ^{NOTE 1}
Methane	74-82-8	95	Simple asphyxiant
Ethane	74-84-0	3	Simple asphyxiant
Propane	74-98-6	1	Simple asphyxiant
Inert Gas	Not available	<1	Not available
Sulphur Compounds	Not available	Trace	Not available
Mercaptan Odourant	Mixture	3 ppm	0.5 ppm (ethyl mercaptan) 0.5 ppm (methyl mercaptan)

MATERIAL SAFETY DATA SHEET – NATURAL GAS (PIPELINE QUALITY - MSDS #526)

NOTE 1. See Section 8 for additional exposure limit information for C₁ to C₃ Aliphatic Hydrocarbon Gases (i.e., methane, ethane, propane).

Section 4: FIRST AID MEASURES

Skin Contact: First aid is not normally required.
Eye contact: If irritation/redness develops, move victim away from exposure into fresh air and flush eyes with clean water.
Inhalation: Ensure your own safety before attempting rescue. Move victim to fresh air. Administer oxygen if breathing has stopped. If heart beat can not be detected begin CPR. If person is overcome or been adversely affected by the emergency, obtain medical attention immediately.
Ingestion: Unlikely route of exposure as this is a gas at normal room temperature and pressure.
General Advice: Use extreme care in handling due to high flammability.

Section 5: FIRE FIGHTING MEASURES

Flammability: Flammable gas and can be ignited by heat, flames, sparks or other sources of ignition (e.g., static electricity, pilot lights or mechanical/electrical equipment).
Suitable Extinguishing Media: Dry chemical, carbon dioxide, water spray or fog.
Special Procedures: Shut off flow of gas from a safe location. Use full protective equipment and self-contained breathing apparatus (SCBA). Do not extinguish flame until gas flow is shut off. Use gas detectors in confined spaces. Evaporate area if cooling of containers is not possible. For large fires nonessential personnel should be evacuated beyond 750 metres.
Products of Combustion: Carbon dioxide and carbon monoxide
Protection of Firefighters: Firefighters should wear SCBA in case of oxygen deficient atmosphere.
Sensitivity to Static Discharge: Flammable
Sensitivity to Mechanical Impact: None
Explosive Power: Not available
Rate of Burning: Not available
TDG Flammability Class 2.1

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions: Use personal protection recommended in Section 8.
Environmental Precautions: Not applicable
Leak and Spill Procedure: Evacuate area. Call emergency services and gas supplier. For large releases nonessential personnel should be evacuated beyond 750 metres. Eliminate any source of ignition.
Methods for Containment: Stay away and upwind of spill/release.
Waste Disposal: Vent to outside atmosphere.
Other Information: Allow to vapourize and disperse to atmosphere.

In case of an emergency and no response at FortisBC, call SERVICE CENTER: 1 (800) 663-9911.

Section 7: HANDLING AND STORAGE

Handling: Observe handling regulations for compressed gases and flammable materials. To be handled by trained personnel only and followed with approved operating procedures.
Storage: Comply with storage regulations for compressed gases and flammable materials. No smoking or open flames in storage area.

MATERIAL SAFETY DATA SHEET – NATURAL GAS (PIPELINE QUALITY - MSDS #526)

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits: Simple asphyxiant - Maintain a minimum 19.5% oxygen (O₂) content (below 19.5% O₂ is considered to be O₂ deficient).

Constituent ^{NOTE 2}	ACGIH (8-hour TWA)	WorkSafeBC (8-hour TWA)
Methane	Minimum O ₂ content	1000 ppm
Ethane	Minimum O ₂ content	1000 ppm
Propane	Minimum O ₂ content	1000 ppm
Mercaptan Odourant	0.5 ppm (ethyl mercaptan) 0.5 ppm (methyl mercaptan)	0.5 ppm (ethyl mercaptan) 0.5 ppm (methyl mercaptan)

NOTE 2. Mercaptan odourant mixtures commonly contain ethyl mercaptan and/or methyl mercaptan (both ethyl mercaptan and methyl mercaptan have 8-hour TWA exposure limits of 0.5 ppm).

Personal Protective

Equipment: Ensure use of proper personal protective equipment (PPE) at all times when handling this product.

Eye/face: Eye protection (e.g., safety glasses) and/or face shields.

Skin: Safety work boots. Chemical resistant gloves are not required but recommended as good practice when handling chemicals. Flame retardant clothing should be worn in potentially flammable areas.

Respiratory: If engineering controls and work practices are not effective in controlling exposure to natural gas, then wear suitable respiratory protection. Supplied air or SCBA.

Other Considerations: None

Engineering Controls: All installations (i.e., mechanical ventilation) must conform to code requirements. Provide adequate ventilation to maintain below exposure limits and explosive limits.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Gas
Colour:	Colourless
Odour:	Gas odour
Specific Gravity (Water = 1):	Not applicable
Odour Threshold (ppm):	2500
Vapour Pressure (mm Hg):	Not applicable
Vapour Density (Air = 1):	0.59
Evaporation Rate (nButAC = 1):	Not applicable (gas at room temperature)
Boiling Point (°C):	-160
Freezing Point (°C):	Not applicable
Solubility in water (20°C):	Slight
Percent Volatile (by volume):	Not available
pH:	Not available
Density (g/ml):	Not available
Partition Coefficient (water/oil):	Not available
Flash Point (°C):	Flammable gas
Flammability (solid, gas):	Flammable gas
Lower Explosion Limit (%):	5 (by volume)
Upper Explosion Limit (%):	15 (by volume)
Auto-ignition Temperature (°C):	537

Section 10: STABILITY AND REACTIVITY

Chemical Stability: Yes

MATERIAL SAFETY DATA SHEET – NATURAL GAS (PIPELINE QUALITY - MSDS #526)

Conditions to Avoid: High heat
Incompatibility with Other Substances: Avoid contact with strong oxidizing agents
Hazardous Decomposition Products: COx, luminous clean flame on combustion
Reactivity (and Under What Conditions): Strong oxidizing agents increase risk of fire (peroxides, perchlorates, chlorine, liquid oxygen).

Section 11: TOXICOLOGICAL INFORMATION

LD50: Not applicable
LC50: Not applicable
Acute Effects: Simple asphyxiant: at high concentrations, natural gas can displace oxygen and cause asphyxiation. The ACGIH TLV-TWA for C₁ to C₃ Aliphatic Hydrocarbon Gases is believed to be protective against potential health effects that include CNS depression and cardiac sensitization. The TLV-TWA is based upon the abilities of these gases (methane, ethane, propane) to produce weak depressant effects on the CNS at high concentration levels approaching the lower explosive limit. It has also been reported that ethane and propane can induce cardiac arrhythmias under certain conditions leading to ventricular fibrillation which can result in death in the presence of high epinephrine levels.
Chronic Effects: None
Carcinogenicity: Not considered carcinogenic by IARC, NTP, ACGIH or OSHA.
Reproductive Effects: Not available
Teratogenicity: Not available
Mutagenicity: Not available
Irritant: Not available
Sensitizer: Not available
Synergistic Effects: Not available

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Not available
Persistence/ Degradability: Not available
Bioaccumulation/ Accumulation: Not available

There is no information available on the ecotoxicological effects of natural gas. Because of the high volatility of natural gas, it is unlikely to cause ground or water pollution. Natural gas released into the environment will disperse rapidly into the atmosphere and undergo photochemical degradation.

Section 13: DISPOSAL CONSIDERATIONS

Disposal: Allow to dissipate to the atmosphere (if permitted by federal/provincial/municipal requirements). Dispose in a safe location, preferably by burning with a flare. If disposal of natural gas cannot be flared, care must be taken to ensure complete dissipation of the gas to a concentration below its flammable limits.

Section 14: TRANSPORT INFORMATION

TDG Classification: Class 2.1 Flammable Gases
UN/PIN Number: 1971
TDG Shipping Description: Natural gas, compressed with high methane content
Special Shipping Information: Handle as extremely flammable gas. Electronically ground/bond during transfer to avoid static accumulation. Precaution should be taken to minimize inhalation of natural gas.

MATERIAL SAFETY DATA SHEET – NATURAL GAS (PIPELINE QUALITY - MSDS #526)

Section 15: REGULATORY INFORMATION

DSL (Canada): This product is on the DSL list (Canada).
WHMIS Class: A – Compressed Gas;
B1 – Flammable and Combustible Material – Division 1 Flammable Gases

Section 16: OTHER INFORMATION

National Fire Protection Association (NFPA 704) Ratings:

Health	1	LEGEND	0 = minimal hazard
Flammability	4		1 = slight hazard
Instability	0		2 = moderate hazard
<i>(For natural gas from NFPA 325)</i>			3 = severe hazard
			4 = extreme hazard

Hazardous Materials Identification System (HMIS) Ratings:

Health	1	LEGEND	0 = minimal hazard
Flammability	4		1 = slight hazard
Physical Hazard	3		2 = moderate hazard
<i>(For methane from HMIS Chemical Ratings Guide)</i>			3 = serious hazard
			4 = severe hazard

Prepared by: AMEC Foster Wheeler
Environment & Infrastructure
Occupational Hygiene and Safety Group

Phone Number: (604) 294-3811
Preparation Date: February 05, 2015

Additional Information and Comments: This MSDS has been revised and updated from the last revision date of January 26, 2012. All sections and the order that which they appear have been documented as per American National Standard – *For Hazardous Industrial Chemicals – Material Safety Data Sheets Preparation (ANSI Z400.1-2004)*.

The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for their own particular use.

Information Sources: Various



Material Safety Data Sheet

The Dow Chemical Company

Product Name: Triethylene Glycol

Issue Date: 05/10/2010
Print Date: 11 May 2010

The Dow Chemical Company encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. Product and Company Identification

Product Name
Triethylene Glycol

COMPANY IDENTIFICATION
The Dow Chemical Company
2030 Willard H. Dow Center
Midland, MI 48674
USA

Customer Information Number: 800-258-2436

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: 989-636-4400
Local Emergency Contact: 989-636-4400

2. Hazards Identification

Emergency Overview

Color: Colorless

Physical State: Liquid.

Odor: Mild

Hazards of product:

CAUTION! May cause skin irritation.

OSHA Hazard Communication Standard

This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Potential Health Effects

Eye Contact: May cause slight temporary eye irritation. Mist may cause eye irritation.

Skin Contact: Prolonged contact may cause skin irritation with local redness. May cause more severe response if skin is abraded (scratched or cut).

Skin Absorption: Prolonged skin contact is unlikely to result in absorption of harmful amounts. Massive contact with damaged skin or of material sufficiently hot to burn skin may result in absorption of potentially lethal amounts.

®(TM) Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

Inhalation: At room temperature, exposure to vapor is minimal due to low volatility. Mist may cause irritation of upper respiratory tract (nose and throat). Vapor from heated material may cause adverse effects.

Ingestion: Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. May cause nausea and vomiting. May cause abdominal discomfort or diarrhea. May cause dizziness and drowsiness. Oral toxicity is expected to be greater in humans due to triethylene glycol even though tests in animals show a lower degree of toxicity.

Aspiration hazard: Based on physical properties, not likely to be an aspiration hazard.

Effects of Repeated Exposure: Based on available data, repeated exposures are not expected to cause significant adverse effects except at very high aerosol concentrations. Repeated excessive aerosol exposures may cause respiratory tract irritation and even death.

Birth Defects/Developmental Effects: Triethylene glycol did not cause birth defects in animals; reduced fetal body weight effects were seen only at very high doses.

3. Composition Information

Component	CAS #	Amount
Triethylene glycol	112-27-6	> 98.0 %
Diethylene glycol	111-46-6	<= 1.0 %

4. First-aid measures

Eye Contact: Flush eyes thoroughly with water for several minutes. Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.

Skin Contact: Immediately flush skin with water while removing contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Destroy contaminated leather items such as shoes, belts, and watchbands. Safety shower should be located in immediate work area.

Inhalation: Move person to fresh air; if effects occur, consult a physician.

Ingestion: Do not induce vomiting. Seek medical attention immediately. If person is fully conscious give 1 cup or 8 ounces (240 ml) of water. If medical advice is delayed and if an adult has swallowed several ounces of chemical, then give 3-4 ounces (1/3-1/2 Cup) (90-120 ml) of hard liquor such as 80 proof whiskey. For children, give proportionally less liquor at a dose of 0.3 ounce (1 1/2 tsp.) (8 ml) liquor for each 10 pounds of body weight, or 2 ml per kg body weight [e.g., 1.2 ounce (2 1/3 tbsp.) for a 40 pound child or 36 ml for an 18 kg child].

Notes to Physician: Due to structural analogy and clinical data, this material may have a mechanism of intoxication similar to ethylene glycol. On that basis, treatment similar to ethylene glycol intoxication may be of benefit. In cases where several ounces (60 - 100 ml) have been ingested, consider the use of ethanol and hemodialysis in the treatment. Consult standard literature for details of treatment. If ethanol is used, a therapeutically effective blood concentration in the range of 100 - 150 mg/dl may be achieved by a rapid loading dose followed by a continuous intravenous infusion. Consult standard literature for details of treatment. 4-Methyl pyrazole (Antizol®) is an effective blocker of alcohol dehydrogenase and should be used in the treatment of ethylene glycol (EG), di- or triethylene glycol (DEG, TEG), ethylene glycol butyl ether (EGBE), or methanol intoxication if available. Fomepizole protocol (Brent, J. et al., New England Journal of Medicine, Feb. 8, 2001, 344:6, p. 424-9): loading dose 15 mg/kg intravenously, follow by bolus dose of 10 mg/kg every 12 hours; after 48 hours, increase bolus dose to 15 mg/kg every 12 hours. Continue fomepizole until serum methanol, EG, DEG, TEG or EGBE are undetectable. The signs and symptoms of poisoning include anion gap metabolic acidosis, CNS depression, renal tubular injury, and possible late stage cranial nerve involvement. Respiratory symptoms, including pulmonary edema, may be delayed. Persons receiving significant exposure should be observed 24-48 hours for signs of respiratory distress. In severe poisoning, respiratory support with mechanical ventilation and positive end expiratory pressure may be required. Maintain adequate ventilation and oxygenation of the patient. If lavage is performed, suggest endotracheal and/or esophageal control. Danger from lung aspiration must be weighed against toxicity when considering emptying the stomach. If burn is present, treat as any thermal burn,

after decontamination. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

Emergency Personnel Protection: First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.

5. Fire Fighting Measures

Extinguishing Media: Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Do not use direct water stream. May spread fire. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Move container from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage.

Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

Unusual Fire and Explosion Hazards: Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Hazardous Combustion Products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide.

6. Accidental Release Measures

Steps to be Taken if Material is Released or Spilled: Small spills: Absorb with materials such as: Dirt. Sand. Sawdust. Vermiculite. Perlite. Zorb-all®. Oil-Dri or equivalent filler. Large spills: Dike area to contain spill. Pump into suitable and properly labeled containers. See Section 13, Disposal Considerations, for additional information.

Personal Precautions: Keep unnecessary and unprotected personnel from entering the area. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental Precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

7. Handling and Storage

Handling

General Handling: Avoid contact with skin and clothing. Wash thoroughly after handling. Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Storage

Do not store near food, foodstuffs, drugs or potable water supplies. Additional storage and handling information on this product may be obtained by calling your sales or customer service contact. Ask for a product brochure.

8. Exposure Controls / Personal Protection

Exposure Limits

Component	List	Type	Value
Triethylene glycol	Dow IHG	TWA Total	100 mg/m3

Personal Protection

Eye/Face Protection: Use safety glasses (with side shields). If there is a potential for exposure to particles which could cause eye discomfort, wear chemical goggles.

Skin Protection: When prolonged or frequently repeated contact could occur, use protective clothing chemically resistant to this material. Selection of specific items such as faceshield, boots, apron, or full-body suit will depend on the task. When handling hot material, protect skin from thermal burns as well as from skin absorption.

Hand protection: Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. If hands are cut or scratched, use gloves chemically resistant to this material even for brief exposures. Use gloves with insulation for thermal protection, when needed. Examples of preferred glove barrier materials include: Butyl rubber. Natural rubber ("latex"). Neoprene. Nitrile/butadiene rubber ("nitrile" or "NBR"). Polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Polyvinyl alcohol ("PVA"). Polyvinyl chloride ("PVC" or "vinyl"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Respiratory Protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In misty atmospheres, use an approved particulate respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

Ingestion: Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering Controls

Ventilation: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

9. Physical and Chemical Properties

Physical State	Liquid.
Color	Colorless
Odor	Mild
Odor Threshold	No test data available
Flash Point - Closed Cup	177 °C (351 °F) <i>ASTM D93</i>
Flammability (solid, gas)	Not applicable to liquids
Flammable Limits In Air	Lower: 0.9 %(V) <i>Calculated</i> Upper: 9.2 %(V) <i>Estimated.</i>
Autoignition Temperature	349 °C (660 °F) <i>Literature</i>
Vapor Pressure	< 0.01 mmHg @ 20 °C <i>Literature</i>
Boiling Point (760 mmHg)	288 °C (550 °F) <i>Literature</i> <i>Decomposes.</i>
Vapor Density (air = 1)	5.2 <i>Literature</i>
Specific Gravity (H2O = 1)	1.1255 20 °C/20 °C <i>Literature</i>
Freezing Point	-4.3 °C (24.3 °F) <i>Literature</i>
Melting Point	No test data available

Solubility in water (by weight)	100 % <i>Literature</i>
pH	8 <i>Literature</i>
Molecular Weight	150.18 g/mol <i>Literature</i>
Molecular Formula	HO(C ₂ H ₄ O) ₃ H
Decomposition Temperature	No test data available
Evaporation Rate (Butyl Acetate = 1)	<0.01 <i>Literature</i>

10. Stability and Reactivity

Stability/Instability

Stable under recommended storage conditions. See Storage, Section 7.

Conditions to Avoid: Exposure to elevated temperatures can cause product to decompose. Generation of gas during decomposition can cause pressure in closed systems.

Incompatible Materials: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.

Hazardous Polymerization

Will not occur.

Thermal Decomposition

Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Aldehydes. Ketones. Organic acids.

11. Toxicological Information

Acute Toxicity

Ingestion

LD50, Rat 16,800 - 22,060 mg/kg

Dermal

LD50, Rabbit > 18,016 mg/kg

Inhalation

Maximum attainable concentration. LC50, 4 h, Aerosol, Rat > 4.5 mg/l

Eye damage/eye irritation

May cause slight temporary eye irritation. Mist may cause eye irritation.

Skin corrosion/irritation

Prolonged contact may cause skin irritation with local redness. May cause more severe response if skin is abraded (scratched or cut).

Sensitization

Skin

No relevant information found.

Respiratory

No relevant information found.

Repeated Dose Toxicity

Based on available data, repeated exposures are not expected to cause significant adverse effects except at very high aerosol concentrations. Repeated excessive aerosol exposures may cause respiratory tract irritation and even death.

Chronic Toxicity and Carcinogenicity

Did not cause cancer in laboratory animals.

Developmental Toxicity

Triethylene glycol did not cause birth defects in animals; reduced fetal body weight effects were seen only at very high doses.

Reproductive Toxicity

In animal studies, did not interfere with reproduction.

Genetic Toxicology

In vitro genetic toxicity studies were negative.

12. Ecological Information

ENVIRONMENTAL FATE

Data for Component: Triethylene glycol

Movement & Partitioning

Bioconcentration potential is low (BCF less than 100 or log Pow less than 3). Potential for mobility in soil is very high (Koc between 0 and 50).

Henry's Law Constant (H): 4.37E-10 atm*m3/mole; 25 °C Estimated.

Partition coefficient, n-octanol/water (log Pow): -1.75 Estimated.

Partition coefficient, soil organic carbon/water (Koc): 10 Estimated.

Persistence and Degradability

Material is ultimately biodegradable (reaches > 70% mineralization in OECD test(s) for inherent biodegradability). Material is readily biodegradable. Passes OECD test(s) for ready biodegradability.

Indirect Photodegradation with OH Radicals

Rate Constant	Atmospheric Half-life	Method
3.64E-11 cm3/s	3.5 h	Estimated.

OECD Biodegradation Tests:

Biodegradation	Exposure Time	Method
25 - 92 %	28 d	OECD 301C Test
> 70 - 95 %	2 - 14 d	OECD 302B Test

Biological oxygen demand (BOD):

BOD 5	BOD 10	BOD 20	BOD 28
12 - 32 %	15 - 64 %	17 - 86 %	

Theoretical Oxygen Demand: 1.60 mg/mg

Data for Component: Diethylene glycol

Movement & Partitioning

Bioconcentration potential is low (BCF less than 100 or log Pow less than 3). Potential for mobility in soil is very high (Koc between 0 and 50). Given its very low Henry's constant, volatilization from natural bodies of water or moist soil is not expected to be an important fate process.

Henry's Law Constant (H): 7.96E-10 atm*m3/mole; 25 °C Estimated.

Partition coefficient, n-octanol/water (log Pow): -1.47 Estimated.

Partition coefficient, soil organic carbon/water (Koc): < 1 Estimated.

Persistence and Degradability

Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Material is ultimately biodegradable (reaches > 70% mineralization in OECD test(s) for inherent biodegradability).

Indirect Photodegradation with OH Radicals

Rate Constant	Atmospheric Half-life	Method
2.23E-11 cm3/s	5.7 h	Estimated.

OECD Biodegradation Tests:

Biodegradation	Exposure Time	Method
92 %	28 d	OECD 301C Test
82 - 98 %	28 d	OECD 302C Test

Theoretical Oxygen Demand: 1.51 mg/mg

ECOTOXICITY

Data for Component: Triethylene glycol

Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).

Fish Acute & Prolonged Toxicity

LC50, bluegill (*Lepomis macrochirus*), 96 h: 61,000 mg/l

Aquatic Invertebrate Acute Toxicity

EC50, water flea *Daphnia magna*, 48 h: 49,000 mg/l

Toxicity to Micro-organisms

EC50; bacteria, Growth inhibition (cell density reduction), 16 h: > 10,000 mg/l

Aquatic Invertebrates Chronic Toxicity Value:

ChV Value mg/l	Species	Test Type	Endpoint	Exposure Time
10607 mg/l	water flea <i>Daphnia magna</i>	static renewal	growth	21 d

Data for Component: Diethylene glycol

Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).

Fish Acute & Prolonged Toxicity

LC50, rainbow trout (*Oncorhynchus mykiss*), 96 h: > 1,000 mg/l

Aquatic Invertebrate Acute Toxicity

EC50, water flea *Daphnia magna*, 48 h, immobilization: 48,900 mg/l

Aquatic Plant Toxicity

EC50, green alga *Pseudokirchneriella subcapitata* (formerly known as *Seienastrum capricornutum*), biomass growth inhibition, 7 d: > 100 mg/l

Toxicity to Micro-organisms

IC50, OECD 209 Test; activated sludge, respiration inhibition, 3 h: > 1,000 mg/l

13. Disposal Considerations

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Reclaimer. As a service to our customers, we can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Please contact our Customer Information Group (telephone number in Section 1 of this document) for further details.

14. Transport Information

DOT Non-Bulk
NOT REGULATED

DOT Bulk
NOT REGULATED

IMDG
NOT REGULATED

ICAO/IATA
NOT REGULATED

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. Regulatory Information

OSHA Hazard Communication Standard

This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	No
Delayed (Chronic) Health Hazard	No
Fire Hazard	No
Reactive Hazard	No
Sudden Release of Pressure Hazard	No

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:

The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

Component	CAS #	Amount
Triethylene glycol	112-27-6	> 98.0 %
Diethylene glycol	111-46-6	<= 1.0 %

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Component	CAS #	Amount
Formaldehyde	50-00-0	0.0047 %
Acetaldehyde	75-07-0	15.6 PPM

US. Toxic Substances Control Act

All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30

CEPA - Domestic Substances List (DSL)

All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

16. Other Information**Product Literature**

Additional information on this and other products we offer may be obtained by contacting our Customer Information Group. Ask for a product information brochure or data on how to access our website.

Recommended Uses and Restrictions

For industrial use only. Gas treating. It is recommended that you use this product in a manner consistent with the recommended use. If your intended use is not consistent with the recommended use, please contact our Customer Information Group (telephone number in Section 1 of this document).

Revision

Identification Number: 2150 / 0000 / Issue Date 05/10/2010 / Version: 4.0

Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

N/A	Not available
W/W	Weight/Weight
OEL	Occupational Exposure Limit
STEL	Short Term Exposure Limit
TWA	Time Weighted Average
ACGIH	American Conference of Governmental Industrial Hygienists, Inc.
DOW IHG	Dow Industrial Hygiene Guideline
WEEL	Workplace Environmental Exposure Level
HAZ DES	Hazard Designation
Action Level	A value set by OSHA that is lower than the PEL which will trigger the need for activities such as exposure monitoring and medical surveillance if exceeded.

The Dow Chemical Company urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

ATTACHMENT E
EMISSIONS CALCULATIONS

By: PEW
 Date: 10/15/2015

Checked By: JJD
 Date: 10/19/2015

Potential to Emit

Pollutant	Emissions			
	Uncontrolled		Controlled	
	lb/hr	ton/year	lb/hr	ton/year
PM	0.0015	0.0066	0.0015	0.0066
PM10	0.0015	0.0066	0.0015	0.0066
PM2.5	0.0015	0.0066	0.0015	0.0066
SO ₂	0.0001	0.0004	0.0001	0.0004
NO _x	0.0200	0.0876	0.0200	0.0876
CO	0.0168	0.0736	0.0168	0.0736
VOC	1.3549	5.9350	1.3549	5.9350
Formaldehyde	9.19E-06	4.03E-05	9.19E-06	4.03E-05
Ethylbenzene	2.07E-02	9.05E-02	2.07E-02	9.05E-02
Hexane	1.58E-02	6.93E-02	1.58E-02	6.93E-02
Benzene	1.84E-02	8.06E-02	1.84E-02	8.06E-02
Toluene	7.14E-02	3.13E-01	7.14E-02	3.13E-01
Xylene	2.27E-01	9.93E-01	2.27E-01	9.93E-01
Total Other HAPS	9.14E-07	4.00E-06	9.14E-07	4.00E-06
Total HAPS	0.3531	1.5463	0.3531	1.5463

By: PEW
Date: 10/15/2015

Checked By: JJD
Date: 10/19/2015

Regenerator Emissions from GRI-GlyCalc Version 4.0

Pollutant	Emissions			
	Uncontrolled		Controlled	
	lb/hr	ton/year	lb/hr	ton/year
VOC	1.1472	5.0246	1.1472	5.0246
n-Hexane	0.0152	0.0667	0.0152	0.0667
Benzene	0.0184	0.0805	0.0184	0.0805
Toluene	0.0714	0.3127	0.0714	0.3127
Ethylbenzene	0.0207	0.0905	0.0207	0.0905
Xylene	0.2267	0.9930	0.2267	0.9930
Total HAPS	0.3524	1.5434	0.3524	1.5434

Reboiler for Dehydration Unit

Maximum Burner Rating =	125,000	Btu/hr - From Weldfab Quote
Heat Content of Fuel =	1,042	Btu/scf - From N.G. Analysis
Fuel Use =	120	scf/hr
Hours of Operation =	8,760	hrs/year
Fuel Usage =	0.0002	10 ⁶ scf per hour
	1.75	10 ⁶ scf/year

Criteria Emissions

Emission Type	EF ⁽²⁾ lb/10 ⁶ scf	Emissions		EF
		lb/hr	ton/year	Reference
PM	7.6	0.0015	0.0066	Table 1.4-2
PM10 ⁽¹⁾	7.6	0.0015	0.0066	See Note 1
PM2.5 ⁽¹⁾	7.6	0.0015	0.0066	See Note 1
SO ₂	0.6	0.0001	0.0004	Table 1.4-2
NOx	100	0.0200	0.0876	Table 1.4-2
CO	84	0.0168	0.0736	Table 1.4-2
VOC	5.5	0.0011	0.0048	Table 1.4-2

Rounding to = 4

Notes:

- 1 - It is assumed that PM10 and PM2.5 are equal to TSP (PM).
- 2 - Emission factors from AP-42, Section 1.4 dated 7/98.

By: PEW
Date: 10/15/2015

Checked By: JJD
Date: 10/19/2015

Reboiler Natural Gas Combustion HAPS

Burner Rating =	125,000	Btu/hr
Operating Hours =	8,760	hrs/yr
Conversion from lb/10 ⁶ scf to lb/MMBtu (divide by) ⁽¹⁾ =	1,020	Btu/cf

CAS No.	Hazardous Air Pollutants	EF (1)		Emissions	
		lb/10 ⁶ scf	lb/MMBtu	lb/hr	ton/year
91-57-6	2-Methylnaphthalene	2.40E-05	2.35E-08	2.94E-09	1.29E-08
56-49-5	3-Methylchloranthrene	1.80E-06	1.76E-09	2.21E-10	9.66E-10
57-97-6	7,12-Dimethylbenz(a)anthracene	1.60E-05	1.57E-08	1.96E-09	8.59E-09
83-32-9	Acenaphthene	1.80E-06	1.76E-09	2.21E-10	9.66E-10
203-96-8	Acenaphthylene	1.80E-06	1.76E-09	2.21E-10	9.66E-10
120-12-7	Anthracene	2.40E-06	2.35E-09	2.94E-10	1.29E-09
56-55-3	Benz(a)anthracene	1.80E-06	1.76E-09	2.21E-10	9.66E-10
71-43-2	Benzene	2.10E-03	2.06E-06	2.37E-07	1.13E-06
50-32-8	Benzo(a)pyrene	1.20E-06	1.18E-09	1.47E-10	6.44E-10
205-99-2	Benzo(b)fluoranthene	1.80E-06	1.76E-09	2.21E-10	9.66E-10
191-24-2	Benzo(g,h,i)perylene	1.20E-06	1.18E-09	1.47E-10	6.44E-10
205-82-3	Benzo(k)fluoranthene	1.80E-06	1.76E-09	2.21E-10	9.66E-10
218-01-9	Chrysene	1.80E-06	1.76E-09	2.21E-10	9.66E-10
53-70-3	Dibenzo(a,h)anthracene	1.20E-06	1.18E-09	1.47E-10	6.44E-10
25321-22-6	Dichlorobenzene	1.20E-03	1.18E-06	1.47E-07	6.44E-07
206-44-0	Fluoranthene	3.00E-06	2.94E-09	3.68E-10	1.61E-09
86-73-7	Fluorene	2.80E-06	2.75E-09	3.43E-10	1.50E-09
50-00-0	Formaldehyde	7.50E-02	7.35E-05	9.19E-06	4.03E-05
110-54-3	Hexane	1.80E+00	1.76E-03	2.21E-04	9.66E-04
193-39-5	Indeno(1,2,3-cd)pyrene	1.80E-06	1.76E-09	2.21E-10	9.66E-10
91-20-3	Naphthalene	6.10E-04	5.98E-07	7.48E-08	3.27E-07
85-01-8	Phenanthrene	1.70E-05	1.67E-08	2.08E-09	9.13E-09
129-00-0	Pyrene	5.00E-06	4.90E-09	6.13E-10	2.68E-09
108-88-3	Toluene	3.40E-03	3.33E-06	4.17E-07	1.83E-06
7440-38-2	Arsenic	2.00E-04	1.96E-07	2.45E-08	1.07E-07
7440-41-7	Beryllium	1.20E-05	1.18E-08	1.47E-09	6.44E-09
7440-43-9	Cadmium	1.10E-03	1.08E-06	1.35E-07	5.90E-07
7440-47-3	Chromium	1.40E-03	1.37E-06	1.72E-07	7.51E-07
7440-48-4	Cobalt	8.40E-05	8.24E-08	1.03E-08	4.51E-08
7439-96-5	Manganese	3.80E-04	3.73E-07	4.66E-08	2.04E-07
7439-97-6	Mercury	2.60E-04	2.55E-07	3.19E-08	1.40E-07
7440-02-0	Nickel	2.10E-03	2.06E-06	2.57E-07	1.13E-06
7782-49-2	Selenium	2.40E-05	2.35E-08	2.94E-09	1.29E-08
VOC HAPS Subtotal =				2.31E-04	1.01E-03
Metal HAPS Subtotal =				6.81E-07	2.98E-06
Total HAPS =				2.31E-04	1.01E-03
Total Other HAPS (2) =				9.14E-07	4.00E-06

References:

1. AP42 Table 1.4-3 and Table 1.4-4.
2. Total Other HAPS is the total of the hazardous air pollutants without the HAPS that are highlighted in blue which are included individually on the totals page of this calculation set.

By: PEW
 Date: 10/15/2015

Checked By: JJD
 Date: 10/19/2015

Estimation of Fugitive Equipment Leaks

Source Type	Number of Sources	Emission Factor ⁽¹⁾ (kg/hr/source)	TOC Emissions (lb/hr)	TOC Emissions (ton/yr)	VOC Emissions (lb/hr)	VOC Emissions (ton/yr)
Valves	14	4.50E-03	0.1389	0.6088	0.1389	0.6088
Pump Seals	0	2.40E-03	0.0000	0.0000	0.0000	0.0000
Others	1	8.80E-03	0.0194	0.0850	0.0194	0.0850
Connectors	55	2.00E-04	0.0243	0.1063	0.0243	0.1063
Flanges	28	3.90E-04	0.0241	0.1055	0.0241	0.1055
Open Ended Lines	0	2.00E-03	0.0000	0.0000	0.0000	0.0000
		Total TOC	0.2066	Total VOC	0.2066	0.9056

Total HAP from Gas Service Leaks			
HAP	HAP Concentration (wt %)	HAPS (lb/hr)	HAPS (ton/yr)
n-Hexane	0.1759	0.000363	0.00159
Benzene	0.0055	0.000011	0.00005
Toluene	0.0122	0.000025	0.00011
Ethylbenzene	0.0019	0.000004	0.00002
o-Xylene	0.0180	0.000037	0.00016
	Total HAP	0.000500	0.00200

1. AP42, Chapter 5, Protocol for Equipment Leak Emission Estimates, Table 2-4.

lb/kg = 2.2046

2. HAP emissions based on weight percent of the HAP contained in the gas from the analysis and the total organic emissions from the emissions factors.

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: 15-343

File Name: V:\RJAmmirato\15-343 Reserve Spencer\Rt 60 Dehy (15-343).ddf

Date: October 15, 2015

DESCRIPTION:

Description: Rt 60 Station located downstream of the
compressor across the river.

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0596	1.431	0.2612
Ethane	0.0609	1.461	0.2666
Propane	0.0848	2.035	0.3714
Isobutane	0.0162	0.390	0.0712
n-Butane	0.0604	1.448	0.2643
Isopentane	0.0188	0.450	0.0822
n-Pentane	0.0237	0.569	0.1038
n-Hexane	0.0152	0.366	0.0667
Cyclohexane	0.0157	0.376	0.0687
Other Hexanes	0.0159	0.381	0.0695
Heptanes	0.0686	1.647	0.3007
Methylcyclohexane	0.0010	0.024	0.0044
Benzene	0.0184	0.441	0.0805
Toluene	0.0714	1.714	0.3127
Ethylbenzene	0.0207	0.496	0.0905
Xylenes	0.2267	5.441	0.9930
C8+ Heavies	0.4898	11.754	2.1451
Total Emissions	1.2677	30.424	5.5524
Total Hydrocarbon Emissions	1.2677	30.424	5.5524
Total VOC Emissions	1.1472	27.532	5.0246
Total HAP Emissions	0.3524	8.457	1.5435
Total BTEX Emissions	0.3372	8.092	1.4767

EQUIPMENT REPORTS:

ABSORBER

Calculated Absorber Stages: 1.61
 Specified Dry Gas Dew Point: 7.00 lbs. H2O/MMSCF
 Temperature: 70.0 deg. F
 Pressure: 100.0 psig
 Dry Gas Flow Rate: 1.0000 MMSCF/day
 Glycol Losses with Dry Gas: 0.0013 lb/hr
 Wet Gas Water Content: Saturated
 Calculated Wet Gas Water Content: 155.41 lbs. H2O/MMSCF

Specified Lean Glycol Recirc. Ratio: 3.00 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	4.49%	95.51%
Carbon Dioxide	99.92%	0.08%
Nitrogen	100.00%	0.00%
Methane	100.00%	0.00%
Ethane	99.98%	0.02%
Propane	99.96%	0.04%
Isobutane	99.92%	0.08%
n-Butane	99.89%	0.11%
Isopentane	99.86%	0.14%
n-Pentane	99.81%	0.19%
n-Hexane	99.61%	0.39%
Cyclohexane	98.38%	1.62%
Other Hexanes	99.72%	0.28%
Heptanes	99.06%	0.94%
Methylcyclohexane	97.68%	2.32%
Benzene	84.69%	15.31%
Toluene	73.86%	26.14%
Ethylbenzene	55.71%	44.29%
Xylenes	42.80%	57.20%
C8+ Heavies	94.53%	5.47%

 REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	29.60%	70.40%
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	0.50%	99.50%
n-Pentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Cyclohexane	3.20%	96.80%
Other Hexanes	1.00%	99.00%
Heptanes	0.50%	99.50%
Methylcyclohexane	4.00%	96.00%
Benzene	5.00%	95.00%
Toluene	7.90%	92.10%
Ethylbenzene	10.40%	89.60%
Xylenes	12.90%	87.10%
C8+ Heavies	12.00%	88.00%

 STREAM REPORTS:

WET GAS STREAM

Temperature: 70.00 deg. F
 Pressure: 114.70 psia
 Flow Rate: 4.18e+004 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	3.27e-001	6.50e+000
Carbon Dioxide	3.19e-002	1.55e+000
Nitrogen	2.85e+000	8.79e+001
Methane	8.10e+001	1.43e+003
Ethane	1.01e+001	3.35e+002
Propane	3.91e+000	1.90e+002
Isobutane	3.25e-001	2.08e+001
n-Butane	8.59e-001	5.50e+001
Isopentane	1.69e-001	1.35e+001
n-Pentane	1.60e-001	1.28e+001
n-Hexane	4.10e-002	3.89e+000
Cyclohexane	1.05e-002	9.70e-001
Other Hexanes	5.96e-002	5.66e+000
Heptanes	6.60e-002	7.28e+000
Methylcyclohexane	3.99e-004	4.31e-002
Benzene	1.40e-003	1.20e-001
Toluene	2.69e-003	2.73e-001
Ethylbenzene	3.99e-004	4.66e-002
Xylenes	3.39e-003	3.96e-001
C8+ Heavies	4.77e-002	8.96e+000
Total Components	100.00	2.18e+003

DRY GAS STREAM

Temperature: 70.00 deg. F
 Pressure: 114.70 psia
 Flow Rate: 4.17e+004 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.47e-002	2.92e-001
Carbon Dioxide	3.20e-002	1.55e+000
Nitrogen	2.86e+000	8.79e+001
Methane	8.13e+001	1.43e+003
Ethane	1.01e+001	3.35e+002
Propane	3.92e+000	1.90e+002
Isobutane	3.26e-001	2.08e+001
n-Butane	8.61e-001	5.50e+001
Isopentane	1.70e-001	1.34e+001
n-Pentane	1.61e-001	1.27e+001
n-Hexane	4.09e-002	3.87e+000
Cyclohexane	1.03e-002	9.55e-001
Other Hexanes	5.96e-002	5.64e+000
Heptanes	6.56e-002	7.22e+000
Methylcyclohexane	3.91e-004	4.21e-002
Benzene	1.19e-003	1.02e-001
Toluene	1.99e-003	2.02e-001
Ethylbenzene	2.23e-004	2.60e-002
Xylenes	1.46e-003	1.70e-001
C8+ Heavies	4.53e-002	8.47e+000
Total Components	100.00	2.17e+003

LEAN GLYCOL STREAM

Temperature: 70.00 deg. F
 Flow Rate: 3.09e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.84e+001	1.71e+002
Water	1.50e+000	2.61e+000
Carbon Dioxide	7.04e-014	1.22e-013
Nitrogen	2.04e-013	3.55e-013
Methane	1.15e-018	2.00e-018
Ethane	1.65e-008	2.87e-008
Propane	1.98e-009	3.45e-009
Isobutane	2.80e-010	4.87e-010
n-Butane	8.60e-010	1.50e-009
Isopentane	5.42e-005	9.43e-005
n-Pentane	6.84e-005	1.19e-004
n-Hexane	4.40e-005	7.66e-005
Cyclohexane	2.98e-004	5.18e-004
Other Hexanes	9.21e-005	1.60e-004
Heptanes	1.98e-004	3.45e-004
Methylcyclohexane	2.40e-005	4.17e-005
Benzene	5.56e-004	9.68e-004
Toluene	3.52e-003	6.12e-003
Ethylbenzene	1.38e-003	2.40e-003
Xylenes	1.93e-002	3.36e-002
C8+ Heavies	3.84e-002	6.68e-002
Total Components	100.00	1.74e+002

RICH GLYCOL STREAM

Temperature: 70.00 deg. F
 Pressure: 114.70 psia
 Flow Rate: 3.24e-001 gpm
 NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.44e+001	1.71e+002
Water	4.86e+000	8.82e+000
Carbon Dioxide	6.75e-004	1.22e-003
Nitrogen	1.96e-003	3.55e-003
Methane	3.29e-002	5.96e-002
Ethane	3.36e-002	6.09e-002
Propane	4.68e-002	8.48e-002
Isobutane	8.96e-003	1.62e-002
n-Butane	3.33e-002	6.04e-002
Isopentane	1.04e-002	1.89e-002
n-Pentane	1.31e-002	2.38e-002
n-Hexane	8.45e-003	1.53e-002
Cyclohexane	8.93e-003	1.62e-002
Other Hexanes	8.84e-003	1.60e-002
Heptanes	3.81e-002	6.90e-002
Methylcyclohexane	5.75e-004	1.04e-003
Benzene	1.07e-002	1.94e-002

Toluene	4.28e-002	7.75e-002
Ethylbenzene	1.27e-002	2.30e-002
Xylenes	1.44e-001	2.60e-001

C8+ Heavies	3.07e-001	5.57e-001
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Total Components	100.00	1.81e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
 Pressure: 14.70 psia
 Flow Rate: 1.37e+002 scfh

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

Water	9.53e+001	6.21e+000
Carbon Dioxide	7.69e-003	1.22e-003
Nitrogen	3.50e-002	3.55e-003
Methane	1.03e+000	5.96e-002
Ethane	5.59e-001	6.09e-002
Propane	5.32e-001	8.48e-002
Isobutane	7.73e-002	1.62e-002
n-Butane	2.87e-001	6.04e-002
Isopentane	7.19e-002	1.88e-002
n-Pentane	9.08e-002	2.37e-002
n-Hexane	4.89e-002	1.52e-002
Cyclohexane	5.15e-002	1.57e-002
Other Hexanes	5.09e-002	1.59e-002
Heptanes	1.89e-001	6.86e-002
Methylcyclohexane	2.82e-003	1.00e-003
Benzene	6.51e-002	1.84e-002
Toluene	2.14e-001	7.14e-002
Ethylbenzene	5.38e-002	2.07e-002
Xylenes	5.90e-001	2.27e-001
C8+ Heavies	7.95e-001	4.90e-001

Total Components	100.00	7.48e+000



Element Material Technology
 2129 West Willow Street
 Scott, LA
 70583-5301 USA

P 337 232 3568
 F 337 232 3621
 T 888 786 7555
 info.scott@element.com
 element.com

Gas Analysis Report No: 225268

225268-1 -42

Reported Date: 9/9/2015

For: SOUTHERN HYDROCARBONS CORP

Attn: TODD SHREWSBURY
 934 LITTLE COAL RIVER ROAD
 ALUM CREEK, WV 25003

Sample Identification:

Company: SOUTHERN HYDROCARBONS CORP
 Field: NP
 Lease: UGP
 STA #: NP

Sample Data: Date Collected: 08/17/2015
 PSIG: 50

Date Received: 09/02/2015

By: S. H.

Temp: N/P DEG. F.

Remarks:

CYL # SH-1

Sample Type: SPOT

Analyst: MP

Hydrocarbon Analysis - GPA 2261-13

Component Name	Mol Percent	GPM @ 14.730 PSIA
Carbon Dioxide (CO2)	0.032	
Nitrogen (N2)	2.858	
Methane (C1)	81.321	
Ethane (C2)	10.133	2.717
Propane (C3)	3.922	1.083
Iso-Butane (IC4)	0.326	0.107
N-Butane (NC4)	0.862	0.273
Iso-Pentane (IC5)	0.170	0.062
N-Pentane (NC5)	0.161	0.059
Hexanes Plus (C6+)	0.215	0.095
Total	100.000	

Mol Weight: 19.77

BTU/LB: 22314.42

Ethane + GPM: 4.396

Propane + GPM: 1.679

Iso-Pentane + GPM: 0.216

Compressibility Factor: 0.9970

Specific Gravity @ 60 Deg. F. (Air = 1): 0.684

BTU/Cuft. (Real) 60 Deg. F. - PSIA:	14.650	14.696	14.730	15.025
Dry:	1162.3	1165.9	1168.6	1192.1
Sat:	1142.4	1146.0	1148.7	1171.8

Reviewed By:

[Signature]

Data Reviewer

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 2129 W. Willow St. Scott, LA 70583 337-232-3568



Element Material Technology
2129 West Willow Street
Scott, LA
70583-5301 USA

P 337 232 3568
F 337 232 3621
T 888 786 7555
info.scott@element.com
element.com

Gas Analysis Report No: 225268

225268-1 -

Date: 9/9/2015

For: SOUTHERN HYDROCARBONS CORP

Attn: TODD SHREWSBURY
934 LITTLE COAL RIVER ROAD
ALUM CREEK, WV 25003

Sample Identification:

Company: SOUTHERN HYDROCARBONS CORP

Field:

Lease: UGP

STA # :

225268-1

CAPILLARY ANALYSIS - METHOD GPA 2286-95
COMPONENT AS % OF TOTAL SAMPLE

COMPONENT NAME	MOL %	WEIGHT %
METHANE	0.0000	0.0000
ETHANE	0.0000	0.0000
PROPANE	0.0000	0.0000
ISO-BUTANE	0.0000	0.0000
N-BUTANE	0.0000	0.0000
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.0000	0.0000
ISOPENTANE	0.0000	0.0000
N-PENTANE	0.0000	0.0000
2,2-DIMETHYLBUTANE (NEOHEXANE)	0.0021	0.0090
2,3-DIMETHYLBUTANE	0.0099	0.0383
CYCLOPENTANE		
2-METHYLPENTANE	0.0311	0.1329
3-METHYLPENTANE	0.0167	0.0714
N-HEXANE	0.0411	0.1759
2,2-DIMETHYLPENTANE	0.0008	0.0037
METHYLCYCLOPENTANE	0.0135	0.0565
2,4-DIMETHYLPENTANE	0.0001	0.0004
2,2,3-TRIMETHYLBUTANE	0.0002	0.0009
BENZENE	0.0014	0.0055
3,3-DIMETHYLPENTANE	0.0003	0.0017
CYCLOHEXANE	0.0105	0.0438
2-METHYLHEXANE	0.0077	0.0384
2,3-DIMETHYLPENTANE	0.0018	0.0090
1,1-DIMETHYLCYCLOPENTANE	0.0087	0.0434
3-METHYLHEXANE		

225268-1

CAPILLARY ANALYSIS - METHOD GPA 2286-95
COMPONENT AS % OF TOTAL SAMPLE

COMPONENT NAME	MOL %	WEIGHT %
1,i3-DIMETHYLCYCLOPENTANE	0.0017	0.0081
1,c3-DIMETHYLCYCLOPENTANE 3-ETHYLPENTANE	0.0019	0.0094
1,i2-DIMETHYLCYCLOPENTANE 2,2,4-TRIMETHYLPENTANE	0.0021	0.0102
N-HEPTANE	0.0155	0.0770
METHYLCYCLOHEXANE 1,1,3-TRIMETHYLCYCLOPENTANE 2,2-DIMETHYLHEXANE	0.0004	0.0019
1,c2-DIMETHYLCYCLOPENTANE	0.0000	0.0000
2,5-DIMETHYLHEXANE	0.0007	0.0037
2,4-DIMETHYLHEXANE 2,2,3-TRIMETHYLPENTANE ETHYLCYCLOPENTANE	0.0015	0.0077
1,i2,c4-TRIMETHYLCYCLOPENTANE 3,3-DIMETHYLHEXANE	0.0007	0.0041
1,i2,c3-TRIMETHYLCYCLOPENTANE	0.0004	0.0021
2,3,4-TRIMETHYLPENTANE	0.0001	0.0005
TOLUENE	0.0027	0.0122
2,3-DIMETHYLHEXANE	0.0006	0.0034
1,1,2-TRIMETHYLCYCLOPENTANE	0.0035	0.0193
2-METHYLHEPTANE	0.0012	0.0070
4-METHYLHEPTANE	0.0002	0.0012
3,4-DIMETHYLHEXANE	0.0033	0.0185
3-METHYLHEPTANE 3-ETHYLHEXANE	0.0022	0.0123
1,c3-DIMETHYLCYCLOHEXANE 1,c2,i3-TRIMETHYLCYCLOPENTANE 1,c2,i4-TRIMETHYLCYCLOPENTANE	0.0011	0.0060
1,i4-DIMETHYLCYCLOHEXANE	0.0001	0.0003
2,2,5-TRIMETHYLHEXANE	0.0004	0.0027
1,1-DIMETHYLCYCLOHEXANE 1,methyl-i3-ETHYLCYCLOPENTANE	0.0001	0.0005
1-methyl-c3-ETHYLCYCLOPENTANE	0.0002	0.0009
1-methyl-i2-ETHYLCYCLOPENTANE 2,2,4-TRIMETHYLHEXANE	0.0001	0.0004
1-methyl-1-ETHYLCYCLOPENTANE CYCLOHEPTANE N-OCTANE	0.0006	0.0035
1,i2-DIMETHYLCYCLOHEXANE	0.0000	0.0000
UNKNOWN	0.0001	0.0004
1,i3-DIMETHYLCYCLOHEXANE 1,c4-DIMETHYLCYCLOHEXANE 1,c2,c3-TRIMETHYLCYCLOPENTANE	0.0007	0.0037
2,4,4-TRIMETHYLHEXANE	0.0000	0.0003
ISOPROPYLCYCLOPENTANE	0.0001	0.0004

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CAPILLARY ANALYSIS - METHOD GPA 2286-95
COMPONENT AS % OF TOTAL SAMPLE

COMPONENT NAME	MOL %	WEIGHT %
UNKNOWN	0.0002	0.0010
2,2-DIMETHYLHEPTANE	0.0003	0.0022
2,4-DIMETHYLHEPTANE	0.0000	0.0003
1-methyl-c2-ETHYLCYCLOPENTANE		
2,2,3-TRIMETHYLHEXANE	0.0005	0.0030
1,c2-DIMETHYLCYCLOHEXANE	0.0002	0.0013
2,6-DIMETHYLHEPTANE		
N-PROPYLCYCLOPENTANE	0.0001	0.0009
1,c3,c5-TRIMETHYLCYCLOHEXANE		
2,5-DIMETHYLHEPTANE	0.0019	0.0106
3,5-DIMETHYLHEPTANE		
ETHYLCYCLOHEXANE		
1,1,3-TRIMETHYLCYCLOHEXANE	0.0005	0.0031
2,3,3-TRIMETHYLHEXANE		
3,3-DIMETHYLHEPTANE		
1,1,4-TRIMETHYLCYCLOHEXANE	0.0002	0.0010
UNKNOWN	0.0000	0.0002
2,3,4-TRIMETHYLHEXANE	0.0001	0.0004
ETHYLBENZENE	0.0004	0.0019
1,12,14-TRIMETHYLCYCLOHEXANE	0.0005	0.0032
1,c3,15-TRIMETHYLCYCLOHEXANE		
2,3-DIMETHYLHEPTANE		
M-XYLENE	0.0026	0.0139
P-XYLENE		
3,4-DIMETHYLHEPTANE		
2-METHYLOCTANE	0.0018	0.0117
4-METHYLOCTANE		
UNKNOWN	0.0000	0.0001
3-METHYLOCTANE	0.0013	0.0085
UNKNOWN	0.0000	0.0002
1,12,c3-TRIMETHYLCYCLOHEXANE	0.0002	0.0010
1,12,c4-TRIMETHYLCYCLOHEXANE		
O-XYLENE	0.0008	0.0041
1,1,2-TRIMETHYLCYCLOHEXANE	0.0003	0.0016
UNKNOWN	0.0004	0.0031
ISOBUTYLCYCLOPENTANE	0.0003	0.0016
N-NONANE	0.0037	0.0237
UNKNOWN	0.0000	0.0003
1,c2,c3-TRIMETHYLCYCLOHEXANE	0.0000	0.0002
1,c2,13-TRIMETHYLCYCLOHEXANE		
UNKNOWN	0.0003	0.0019
ISOPROPYLBENZENE	0.0001	0.0008
2,2-DIMETHYLOCTANE	0.0001	0.0004
ISOPROPYLCYCLOHEXANE	0.0004	0.0021
CYCLOOCTANE		
UNKNOWN	0.0000	0.0003

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CAPILLARY ANALYSIS - METHOD GPA 2286-95
COMPONENT AS % OF TOTAL SAMPLE

COMPONENT NAME	MOL %	WEIGHT %
N-BUTYLCYCLOPENTANE	0.0005	0.0034
N-PROPYLCYCLOHEXANE		
3,3-DIMETHYLOCTANE	0.0001	0.0005
UNKNOWN	0.0001	0.0006
N-PROPYLBENZENE	0.0009	0.0052
UNKNOWN	0.0001	0.0006
M-ETHYLTOLUENE	0.0001	0.0007
P-ETHYLTOLUENE	0.0002	0.0010
2,3-DIMETHYLOCTANE		
4-METHYLNONANE	0.0007	0.0046
5-METHYLNONANE		
1,3,5-TRIMETHYLBENZENE		
2-METHYLNONANE	0.0008	0.0057
3-ETHYLOCTANE	0.0005	0.0038
O-ETHYLTOLUENE	0.0004	0.0025
3-METHYLNONANE		
UNKNOWN	0.0001	0.0004
1,2,4-TRIMETHYLBENZENE	0.0002	0.0010
t-BUTYLBENZENE		
METHYLCYCLOOCTANE		
tert-BUTYLCYCLOHEXANE	0.0006	0.0043
ISO-BUTYLCYCLOHEXANE	0.0000	0.0002
N-DECANE	0.0017	0.0118
ISOBUTYLBENZENE	0.0001	0.0007
sec-BUTYLBENZENE	0.0002	0.0011
UNKNOWN	0.0001	0.0011
1-METHYL-3-ISOPROPYLBENZENE	0.0001	0.0008
1,2,3-TRIMETHYLBENZENE	0.0002	0.0013
1-METHYL-4-ISOPROPYLBENZENE		
UNKNOWN	0.0001	0.0008
1-METHYL-2-ISOPROPYLBENZENE	0.0000	0.0003
UNKNOWN	0.0001	0.0005
N-BUTYLCYCLOHEXANE	0.0002	0.0012
UNKNOWN	0.0001	0.0006
1,3-DIETHYLBENZENE	0.0001	0.0004
1-METHYL-3-PROPYLBENZENE		
1,2-DIETHYLBENZENE	0.0001	0.0009
N-BUTYLBENZENE		
1-METHYL-4-PROPYLBENZENE		
1,4-DIETHYLBENZENE	0.0000	0.0002
1-METHYL-2-PROPYLBENZENE	0.0002	0.0010
1,4-DIMETHYL-2-ETHYLBENZENE	0.0001	0.0009
UNKNOWN	0.0001	0.0011

225268-1

CAPILLARY ANALYSIS - METHOD GPA 2286-95
 COMPONENT AS % OF TOTAL SAMPLE

COMPONENT NAME	MOL %	WEIGHT %
1,2-DIMETHYL-4-ETHYLBENZENE	0.0001	0.0006
1,3-DIMETHYL-2-ETHYLBENZENE	0.0002	0.0011
UNKNOWN	0.0000	0.0001
1,2-DIMETHYL-3-ETHYLBENZENE	0.0000	0.0003
UNKNOWN	0.0000	0.0002
N-UNDECANE	0.0006	0.0048
UNKNOWN	0.0000	0.0004
1,2,4,5-TETRAMETHYLBENZENE	0.0001	0.0004
1,2,3,5-TETRAMETHYLBENZENE	0.0000	0.0001
UNKNOWN	0.0000	0.0001
1,2,3,4-TETRAMETHYLBENZENE	0.0000	0.0001
CYCLODECANE		
UNKNOWN	0.0000	0.0002
NAPHTHALENE	0.0001	0.0003
N-DODECANE	0.0000	0.0002
ISOTRIDECANES PLUS	0.0001	0.0013
Total:	0.2150	1.0224

TOTAL HEXANES	0.1009	0.4275
TOTAL HEPTANES	0.0662	0.3082
TOTAL OCTANES	0.0188	0.1082
TOTAL NONANES	0.0171	0.1031
TOTAL DECANES PLUS	0.0110	0.0753

BTEX COMPONENTS

N-HEXANE	0.0411	0.1759
BENZENE	0.0014	0.0055
TOLUENE	0.0027	0.0122
ETHYLBENZENE	0.0004	0.0019
XYLENE	0.0034	0.0180



Element Material Technology
2129 West Willow Street
Scott, LA
70583-5301 USA

P 337 232 3588
F 337 232 3621
T 888 786 7555
info.scott@element.com
element.com

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CAPILLARY ANALYSIS - METHOD GPA 2286-95
HEAVY END FRACTION

COMPONENT NAME	MOL %	WEIGHT %
METHANE	0.000	0.000
ETHANE	0.000	0.000
PROPANE	0.000	0.000
ISO-BUTANE	0.000	0.000
N-BUTANE	0.000	0.000
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.000	0.000
ISOPENTANE	0.000	0.000
N-PENTANE	0.000	0.000
2,2-DIMETHYLBUTANE (NEOHEXANE)	0.974	0.877
2,3-DIMETHYLBUTANE	4.587	3.744
CYCLOPENTANE		
2-METHYLPENTANE	14.447	13.004
3-METHYLPENTANE	7.757	6.982
N-HEXANE	19.116	17.206
2,2-DIMETHYLPENTANE	0.350	0.367
METHYLCYCLOPENTANE	6.282	5.522
2,4-DIMETHYLPENTANE	0.042	0.044
2,2,3-TRIMETHYLBUTANE	0.088	0.092
BENZENE	0.661	0.539
3,3-DIMETHYLPENTANE	0.155	0.163
CYCLOHEXANE	4.878	4.288
2-METHYLHEXANE	3.590	3.758
2,3-DIMETHYLPENTANE	0.845	0.885
1,1-DIMETHYLCYCLOPENTANE	4.065	4.246
3-METHYLHEXANE		
1,1,3-DIMETHYLCYCLOPENTANE	0.771	0.791
1,3-DIMETHYLCYCLOPENTANE	0.895	0.920
3-ETHYLPENTANE		
1,1,2-DIMETHYLCYCLOPENTANE	0.961	1.001
2,2,4-TRIMETHYLPENTANE		
N-HEPTANE	7.200	7.536
METHYLCYCLOHEXANE	0.183	0.191

CAPILLARY ANALYSIS - METHOD GPA 2286-95
HEAVY END FRACTION

COMPONENT NAME	MOL %	WEIGHT %
1,1,3-TRIMETHYLCYCLOPENTANE		
2,2-DIMETHYLHEXANE		
1,C2-DIMETHYLCYCLOPENTANE	0.000	0.000
2,5-DIMETHYLHEXANE	0.305	0.364
2,4-DIMETHYLHEXANE	0.696	0.749
2,2,3-TRIMETHYLPENTANE		
ETHYLCYCLOPENTANE		
1,2,C4-TRIMETHYLCYCLOPENTANE	0.344	0.404
3,3-DIMETHYLHEXANE		
1,2,C3-TRIMETHYLCYCLOPENTANE	0.173	0.203
2,3,4-TRIMETHYLPENTANE	0.039	0.047
TOLUENE	1.242	1.195
2,3-DIMETHYLHEXANE	0.280	0.334
1,1,2-TRIMETHYLCYCLOPENTANE	1.610	1.887
2-METHYLHEPTANE	0.576	0.687
4-METHYLHEPTANE	0.102	0.121
3,4-DIMETHYLHEXANE	1.515	1.808
3-METHYLHEPTANE	1.010	1.206
3-ETHYLHEXANE		
1,C3-DIMETHYLCYCLOHEXANE	0.498	0.583
1,C2,t3-TRIMETHYLCYCLOPENTANE		
1,C2,t4-TRIMETHYLCYCLOPENTANE		
1,t4-DIMETHYLCYCLOHEXANE	0.027	0.031
2,2,5-TRIMETHYLHEXANE	0.198	0.266
1,1-DIMETHYLCYCLOHEXANE	0.038	0.045
1-methyl-t3-ETHYLCYCLOPENTANE		
1-methyl-C3-ETHYLCYCLOPENTANE	0.073	0.085
1-methyl-t2-ETHYLCYCLOPENTANE	0.034	0.043
2,2,4-TRIMETHYLHEXANE		
1-methyl-1-ETHYLCYCLOPENTANE	0.283	0.338
CYCLOHEPTANE		
N-OCTANE		
1,t2-DIMETHYLCYCLOHEXANE	0.000	0.000
UNKNOWN	0.026	0.035
1,t3-DIMETHYLCYCLOHEXANE	0.311	0.364
1,C4-DIMETHYLCYCLOHEXANE		
1,C2,C3-TRIMETHYLCYCLOPENTANE		
2,4,4-TRIMETHYLHEXANE	0.023	0.030
ISOPROPYLCYCLOPENTANE	0.031	0.036
UNKNOWN	0.072	0.096
2,2-DIMETHYLHEPTANE	0.162	0.216
2,4-DIMETHYLHEPTANE	0.023	0.029
1-methyl-C2-ETHYLCYCLOPENTANE		

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**CAPILLARY ANALYSIS - METHOD GPA 2286-95
HEAVY END FRACTION**

COMPONENT NAME	MOL %	WEIGHT %
2,2,3-TRIMETHYLHEXANE	0.222	0.297
1,c2-DIMETHYLCYCLOHEXANE	0.102	0.123
2,6-DIMETHYLHEPTANE		
N-PROPYLCYCLOPENTANE	0.069	0.086
1,c3,c5-TRIMETHYLCYCLOHEXANE		
2,5-DIMETHYLHEPTANE	0.874	1.040
3,5-DIMETHYLHEPTANE		
ETHYLCYCLOHEXANE		
1,1,3-TRIMETHYLCYCLOHEXANE	0.231	0.307
2,3,3-TRIMETHYLHEXANE		
3,3-DIMETHYLHEPTANE		
1,1,4-TRIMETHYLCYCLOHEXANE	0.071	0.094
UNKNOWN	0.015	0.020
2,3,4-TRIMETHYLHEXANE	0.027	0.036
ETHYLBENZENE	0.166	0.184
1,12,14-TRIMETHYLCYCLOHEXANE	0.235	0.310
1,c3,15-TRIMETHYLCYCLOHEXANE		
2,3-DIMETHYLHEPTANE		
M-XYLENE	1.224	1.362
P-XYLENE		
3,4-DIMETHYLHEPTANE		
2-METHYLOCTANE	0.852	1.142
4-METHYLOCTANE		
UNKNOWN	0.005	0.007
3-METHYLOCTANE	0.618	0.828
UNKNOWN	0.012	0.018
1,12,c3-TRIMETHYLCYCLOHEXANE	0.077	0.101
1,12,c4-TRIMETHYLCYCLOHEXANE		
O-XYLENE	0.359	0.398
1,1,2-TRIMETHYLCYCLOHEXANE	0.117	0.154
UNKNOWN	0.203	0.302
ISOBUTYLCYCLOPENTANE	0.117	0.155
N-NONANE	1.728	2.315
UNKNOWN	0.017	0.025
1,c2,c3-TRIMETHYLCYCLOHEXANE	0.012	0.016
1,c2,t3-TRIMETHYLCYCLOHEXANE		
UNKNOWN	0.132	0.185
ISOPROPYLBENZENE	0.063	0.080
2,2-DIMETHYLOCTANE	0.023	0.035
ISOPROPYLCYCLOHEXANE	0.168	0.210
CYCLOOCTANE		
UNKNOWN	0.022	0.031
N-BUTYLCYCLOPENTANE	0.253	0.334
N-PROPYLCYCLOHEXANE		

**CAPILLARY ANALYSIS - METHOD GPA 2286-95
HEAVY END FRACTION**

COMPONENT NAME	MOL %	WEIGHT %
3,3-DIMETHYLOCTANE	0.035	0.052
UNKNOWN	0.041	0.057
N-PROPYLBENZENE	0.403	0.506
UNKNOWN	0.042	0.059
M-ETHYLTOLUENE	0.055	0.070
P-ETHYLTOLUENE	0.078	0.098
2,3-DIMETHYLOCTANE		
4-METHYLNONANE	0.335	0.452
5-METHYLNONANE		
1,3,5-TRIMETHYLBENZENE		
2-METHYLNONANE	0.372	0.553
3-ETHYLOCTANE	0.251	0.372
O-ETHYLTOLUENE	0.180	0.247
3-METHYLNONANE		
UNKNOWN	0.026	0.037
1,2,4-TRIMETHYLBENZENE	0.076	0.100
t-BUTYLBENZENE		
METHYLCYCLOOCTANE		
tert-BUTYLCYCLOHEXANE	0.289	0.424
ISO-BUTYLCYCLOHEXANE	0.013	0.019
N-DECANE	0.779	1.158
ISOBUTYLBENZENE	0.046	0.065
sec-BUTYLBENZENE	0.074	0.103
UNKNOWN	0.069	0.112
1-METHYL-3-ISOPROPYLBENZENE	0.055	0.077
1,2,3-TRIMETHYLBENZENE	0.099	0.129
1-METHYL-4-ISOPROPYLBENZENE		
UNKNOWN	0.048	0.078
1-METHYL-2-ISOPROPYLBENZENE	0.022	0.030
UNKNOWN	0.031	0.050
N-BUTYLCYCLOHEXANE	0.083	0.122
UNKNOWN	0.033	0.054
1,3-DIETHYLBENZENE	0.026	0.037
1-METHYL-3-PROPYLBENZENE		
1,2-DIETHYLBENZENE	0.065	0.091
N-BUTYLBENZENE		
1-METHYL-4-PROPYLBENZENE		
1,4-DIETHYLBENZENE	0.017	0.024
1-METHYL-2-PROPYLBENZENE	0.072	0.101
1,4-DIMETHYL-2-ETHYLBENZENE	0.061	0.085
UNKNOWN	0.065	0.107

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**CAPILLARY ANALYSIS - METHOD GPA 2286-95
HEAVY END FRACTION**

COMPONENT NAME	MOL %	WEIGHT %
1,2-DIMETHYL-4-ETHYLBENZENE	0.039	0.055
1,3-DIMETHYL-2-ETHYLBENZENE	0.076	0.107
UNKNOWN	0.004	0.007
1,2-DIMETHYL-3-ETHYLBENZENE	0.022	0.031
UNKNOWN	0.010	0.017
N-UNDECANE	0.277	0.452
UNKNOWN	0.023	0.040
1,2,4,5-TETRAMETHYLBENZENE	0.025	0.035
1,2,3,5-TETRAMETHYLBENZENE	0.008	0.011
UNKNOWN	0.008	0.015
1,2,3,4-TETRAMETHYLBENZENE CYCLODECANE	0.006	0.009
UNKNOWN	0.013	0.022
NAPHTHALENE	0.024	0.033
N-DODECANE	0.013	0.024
ISOTRIDECANES PLUS	0.057	0.126
Total:	100.000	100.000

Specific Gravity @ 60 Deg. F. (Air = 1)	3.2924
Molecular Weight	95.81
Compressibility Factor	0.8655
Summation Factor	0.0957
Cu. Ft. Vapor/Gal @ 14.696 & 60 Deg. F.	23.906
Cu. Ft. Vapor/Gal @ 14.730 & 60 Deg. F.	23.851
Cu. Ft. Vapor/Gal @ 14.650 & 60 Deg. F.	23.981
Btu/cu. Ft. @ 14.696 PSIA, Dry	5192.88
Btu/cu. Ft. @ 14.730 PSIA, Dry	5204.89
BTU/LB	20614