

# MATERIAL SAFETY DATA SHEET

## 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION (rev. 9-04)

**Trade Number:** Compressed Natural Gas

**CAS Number:** 68410-63-9

**Synonyms:** Natural Gas (dry), Liquid Natural Gas, Liquefied Natural Gas (LNG), LNG, Methane, cryogenic liquid.

**Use/Description:** Fuel for combustion applications, raw material for chemical reactions

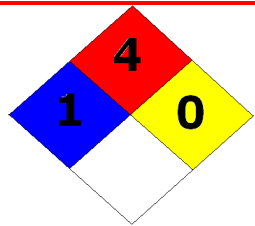
Corporate Identification Physical	Company Identification Mailing	Emergency Telephone Numbers
Piedmont Natural Gas 1915 Rexford Road Charlotte, NC 28211	Piedmont Natural Gas PO Box 33068 Charlotte, NC 28233	Safety Officer [8:00 am – 5:00 pm]: 1(704)-731-4376 CIC: 1(704) 525-3882 Gas Control [24 hour]: 1(704) 731-4253 or 1(800)-694-0750

## 2. COMPOSITION/INFORMATION ON INGREDIENTS (rev. 9-04)

Components	CAS No.	Mole %	Exposure Limits			
			ACGIH TLV (ppm)		OSHA PEL (ppm)	
<b>Base Gas:</b>						
Methane	78-82-8	87.0-96%	None established by OSHA or ACGIH Simple asphyxiant; exposure limited by oxygen and flammability			
<b>Balance Gases:</b>						
Ethane	78-84-0	1.8-5.1%	None established by OSHA or ACGIH Simple asphyxiant; exposure limited by oxygen and flammability			
Propane	74-98-6	0.1-1.5%	2500	TWA	1000	TWA
Nitrogen	7727-37-9	1.3-5.6	1000	TWA		
Carbon Dioxide	124-38-9	0.1-1.0	5000	TWA	5000	TWA

NOTE: No permissible exposure limits (PEL) or threshold limit values (TLV) exist for natural gas. The above listing is a summary of the gases in natural gas which can be found at concentrations greater than 1 mole % . Because natural gas is a natural product, composition can vary greatly.

## 3. HAZARDS IDENTIFICATION (rev. 9-04)

<p><b>EMERGENCY OVERVIEW</b></p> <p><b>DANGER!</b></p> <p><b>EXTREMELY FLAMMABLE GAS – MAY CAUSE FLASH FIRE OR EXPLOSION!!</b></p> <p>Keep away from heat, sparks, flames, or other sources of ignition (e.g. static electricity, pilot lights, mechanical / electrical equipment)</p>	
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**WARNING:** This product is a simple asphyxiant. In high concentrations it will displace oxygen from the breathing atmosphere, particularly in confined spaces. Signs of asphyxiation will be noticed when oxygen is reduced to below 16%, and may occur in several stages. Symptoms may include rapid breathing and pulse rate, headache, dizziness, visual disturbances, mental confusion, uncoordinated movement, mood changes, muscular weakness, tremors, cyanosis, narcosis and numbness of the extremities. Unconsciousness leading to central nervous system injury and possibly death will occur when the atmospheric oxygen concentration is reduced to about 6% to 8% or less.

**WARNING:** The burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

**WARNING:** Liquid natural gas is a liquid at -259°F and is capable of expanding up to 600 times the original volume when heated. In addition, direct contact to skin or mucous membranes with liquefied or pressurized vapor may cause freeze burns ("cold" burn) and / or frostbite. Caution should be used when handling liquid cryogenic natural gas.

#### **4. HEALTH HAZARDS IDENTIFICATION (rev. 9-04)**

##### **Potential Health Effects**

Note: Natural gas in its gaseous state under normal conditions and at very low concentrations, does not present an inhalation, ingestion or skin hazard. However, contact with pressurized vapor, cryogenic liquid, or exposure at high concentrations will result in health hazards. At high concentrations, natural gas will reduce the available oxygen in the air, thus resulting in symptoms of headache, nausea, dizziness, fatigue and possibly coma and / or death. Exposure to cryogenic liquids can result in immediate freezing of the exposed body part. Caution should be used when handling cryogenic liquids.

##### **Primary Routes of Exposure**

Eye and skin contact, inhalation.

##### **EYES**

Contact with liquefied or pressurized gas may result in momentary freezing followed by swelling and eye damage. Contact with copious amounts of pressurized vapor may cause frostbite, freeze burns, and permanent eye damage.

##### **SKIN**

Direct contact to skin or mucous membranes with liquefied or pressurized vapor may cause freeze burns ("cold" burn) and / or frostbite. Signs of frostbite include a change in the color of the skin to gray or white, possibly followed by blistering. This material is a gas under normal atmospheric conditions. Large exposures to the skin may cause the skin to become inflamed and painful.

Any flesh that comes in contact with a cryogenically cooled material can stick to that material, similar to the way some children stick their tongues to flagpoles in the winter. Where cryogenics is involved, however, metallic materials are not the only ones that cause this risk. It is important to remember that even nonmetallic materials are extremely dangerous to touch. Removal of the skin from any material can cause tearing of the flesh when attempted. To minimize the chances of freezing materials to skin, all watches and jewelry on the hands and wrists should be removed.

##### **INGESTION**

Risk of ingestion is extremely unlikely.

##### **INHALATION**

This product is considered to be non-toxic by inhalation. The effects of inhalation of high concentrations may cause the same effects as asphyxiation. This includes central nervous system depression such as dizziness, drowsiness, headache, and similar narcotic symptoms, but no long-term effects if removed from

exposure area. Numbness, a "chilly" feeling, and vomiting have been reported from accidental exposures to high concentrations.

When cryogenic liquids warm and revert to their gaseous state, oxygen can be displaced. Oxygen-deficient atmospheres can cause dizziness, nausea, vomiting, unconsciousness, confusion and death. However, not all symptoms will necessarily be present depending on the rapidity of the gas expansion. Unconsciousness could occur without any preceding signs of danger.

### **CHRONIC and CARCINOGENICITY**

Methane and ethane, the main components of natural gas, are considered practically inert in terms of physiological effects. At high concentrations these materials act as simple asphyxiants and may cause death due to lack of oxygen.

### **CARCINOGENICITY:**

**OSHA: NO    IARC: NO    NTP: NO    ACGIH: NO**

### **MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE**

Individuals with pre-existing conditions of the heart, lungs, and blood may have increased susceptibility to symptoms of asphyxia.

## **5. FIRST AID MEASURES (rev. 9-04)**

If a person is overcome by loss of oxygen while working with cryogenic liquids, that person should be moved to a well-ventilated area immediately. A self contained breathing apparatus (SCBA) may be required for rescue so the rescuer does not also fall victim. Artificial respiration should be applied if breathing has stopped. If the person is having difficulty breathing, oxygen should be supplied. Emergency medical help should be summoned.

### **EYES**

If the eyes are affected, flush them with warm water for at least 15 minutes. In case of freeze burn cover eyes to protect from light. Seek immediate medical attention.

### **SKIN**

You should obtain medical assistance as soon as possible when cryogenics contact your skin. Immediately upon exposure, the frozen skin appears waxy and yellow and the burn usually is not painful. Then, it painfully swells and blisters while the skin defrosts. This is a sign of frostbite and / or freeze burns which requires **IMMEDIATE** medical attention. Immediately follow these first aid procedures until you get medical assistance.

- Take the victim away from the cryogen hazard.
- Any clothing that may interfere with the circulation of blood to the frozen tissues should be removed in a slow, careful manner to prevent salvageable skin from being pulled off.
- Do NOT rub or massage the affected parts of the body. Rubbing may further damage the tissue.
- Immerse the affected area in a warm water bath not to exceed 105 °F or exposure to warm air
- The re-warming, or thawing, of affected area(s) should be done gradually. It may take up to 60 minutes to thaw the affected area(s) and bring back the natural color of the skin.

If the body has been exposed to either a cryogenic liquid or gas, the tissues should be restored to normal body temperature by running warm liquid (108°F) over the affected part. Water should never be more than 112°F and the affected part should not be rubbed at any time. This can cause further damage to the area. The victim should get emergency care as quickly as possible to minimize further damage and for damage assessment.

### **INGESTION**

Though risk of ingestion is extremely unlikely, in case of frostbite or freeze burns due to oral exposure seek immediate medical attention.

**INHALATION**

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

**6. FIRE FIGHTING MEASURES (rev. 9-04)****FLAMMABLE PROPERTIES:** (NFPA Natural Gas)

FLASH POINT: Flammable gas  
AUTOIGNITION POINT: 900 - 1170 °F (482 - 632 °C)  
OSHA/NFPA FLAMMABILITY CLASS: FLAMMABLE GAS  
LOWER EXPLOSIVE LIMIT (%): 3.8 - 6.5  
UPPER EXPLOSIVE LIMIT (%): 13 - 17

**FIRE AND EXPLOSION HAZARDS**

Dangerous fire and explosion hazard when exposed to heat, sparks or flame. Natural gas is lighter than air and may travel long distances to a point of ignition and flash back. Container may explode in heat or fire. Liquefied Natural Gas (LNG) releases flammable gas at well below ambient temperatures and readily forms a flammable mixture with air.

**EXTINGUISHING MEDIA**

To extinguish a natural gas fire, stop the flow of natural gas, use dry chemical, carbon dioxide, halon or water. Special note, the fire should not be extinguished unless flow of gas can be immediately stopped.

**FIRE FIGHTING INSTRUCTIONS**

Gas fires should not be extinguished unless flow of gas can be immediately stopped. Shut off gas source and allow gas to burn out. If spill or leak has not ignited, determine if water spray may assist in dispersing gas or vapor to protect personnel attempting to stop leak.

Use water to cool equipment, surfaces and containers exposed to fire and excessive heat. For large fire the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure.

Isolate area, particularly around ends of storage vessels. Let vessel, tank car or container burn unless leak can be stopped. Withdraw immediately in the event of a rising sound from a venting safety device. Large fires typically require specially trained personnel and equipment to isolate and extinguish the fire.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

See Section 16 for the NFPA 704 Hazard Rating.

**7. ACCIDENTAL RELEASE MEASURES (rev. 9-04)**

ACTIVATE FACILITY'S EMERGENCY RESPONSE PLAN.

**EVACUATE NONESSENTIAL PERSONNEL** and secure all ignition sources. No road flares, smoking or flames in hazard area. Consider wind direction, stay upwind, if possible. Evaluate the direction of product travel. Cold vapor cloud may be white, but color will dissipate as cloud disperses - fire and explosion hazard is still present!

Stop the source of the release, if safe to do so. Consider the use of water spray to disperse vapors. Isolate the area until gas has dispersed. Ventilate and gas test area before entering.

**8. HANDLING AND STORAGE (rev. 9-04)****HANDLING and STORAGE PRECAUTIONS**

### Cold Embrittlement

At cryogenic temperatures many materials, such as rubber, plastic and carbon steel can become so brittle that very little stress can break the material. Avoid using these materials at cryogenic temperatures. Do not dispose of cryogenic liquids down the drain! Polyvinyl chloride (PVC) piping in laboratory sinks may not be able to resist cryogenic temperatures. Let cryogenic liquids evaporate in a fume hood.

### Asphyxiation

The air we breathe consists of 78% nitrogen, 21% oxygen, and trace gases making up the remaining 1%. If sufficient liquid natural gas is vaporized so as to reduce the oxygen percentage to below 19.5%, there is a risk of oxygen deficiency. In confined or poorly ventilated areas (such as a laboratory, transport elevator or storage area), the expanding gas will displace oxygen, presenting an asphyxiation hazard to personnel working in the area.

Simple asphyxiants such as natural gas do not have good warning properties! One might not feel "light-headed," but may simply pass out without any warning whatsoever, and then die without regaining consciousness. To prevent asphyxiation hazards, make sure that the room is well ventilated when using cryogenics indoors. If large quantities of cryogenic vapors are released, the areas suspected of being oxygen deficient shall be evacuated immediately.

### Pressure Buildup and Explosions

Without adequate venting or pressure-relief devices on the containers, enormous pressures can build up on cryogen evaporation. Cryogenics boil as they sit in their storage vessels by absorbing heat energy from the (much warmer) surroundings. The gas boiling out of the liquid must either expand or the pressure will increase. Users must make certain that cryogenic liquids are never contained in a closed system. Use a pressure relief vessel or a venting lid to protect against pressure build-up.

Liquid dewar flasks are non-pressurized, vacuum-jacketed vessels, somewhat like a "Thermos bottle". Dewars are designed with either loose-fitting caps or pressure relief valves, that prevents air and moisture from entering, yet allows excess pressure to vent. Do not connect the tank and the dewar tightly to avoid pressure build up in the dewar. Do not use any stopper or other device that would interfere with venting of gas.

### Handling

Transfer or pour cryogenics slowly to minimize boiling and splashing. Use a phase separator or special filling funnel (the top of the funnel should be partly covered to reduce splashing). If the liquid cannot be poured, use a cryogenic liquid withdrawal device for the transfer (be sure to follow all instructions provided with the device).

When hand-carrying cryogen-containing dewar, ensure the dewar is your only load (no books, coffee or other items). Watch carefully for people who may run into you, and ensure that the dewar is carried with both hands and as far away from your face as comfortably possible.

### Storage

Keep away from flame, sparks and excessive temperatures. Store only in approved containers. These containers must meet the requirements as specified in 49 CFR 173.302.

Containers should be bonded and ground when filling or discharging. Use only in well ventilated areas. See also applicable OSHA regulations for the handling and storage of this product, including, but not limited to, 29 CFR 1910.110 Storage and Handling of Liquefied Petroleum Gases.

When storing natural gas, use explosion proof or intrinsically safe electrical equipment designed for the atmosphere in accordance with applicable codes, industrial recommended practices, and local, state and federal regulations. Do not smoke or use spark-producing tools in the area of use.

## **9. EXPOSURE CONTROLS AND PERSONAL PROTECTION (rev. 9-04)**

### **ENGINEERING CONTROLS**

Use adequate ventilation to keep gas concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces. Use explosion-proof equipment and lighting in classified/controlled areas.

Because these liquids vaporize extremely rapidly, a different danger surfaces as they warm up. They are capable of producing huge amounts of gases, which could produce explosions or vessel ruptures.

Containers should never be plugged or covered. This interferes with the needed venting of the container to prevent explosions.

Only use containers that are made specifically for cryogenic liquids, such as Dewar flasks. Dewar flasks consist of two flasks, with one inside the other. There is a space between the two flasks, which provides a layer of insulation. This insulation keeps the liquid from warming quickly and causing rapid expansion of the gas. And while these products are made to specifically withstand the stress of extreme temperature changes, they should still be filled very slowly to protect the containers from excessive internal stress that can cause damage and weaken the container.

Cryogenic containers should not be filled past 80% of capacity to account for the expansion of gases.

This rapid expansion of gas can lead to asphyxiation (except for oxygen) in an enclosed area. The gases can displace the oxygen and a person can be overtaken rapidly. Most cryogenic liquids—including liquid nitrogen—become colorless, odorless and tasteless gases, which makes them undetectable to human senses. Air with less than 18% oxygen can cause dizziness and continued lower levels quickly progress to unconsciousness and death. Always work with these liquids in a well-ventilated, open area.

If it is impossible to work with cryogenic liquids in an open area, air monitoring devices are available to measure oxygen levels. These are available in personal, handheld or fixed models. These units will alarm when oxygen levels get below 19.5%, alerting anyone in the room of the oxygen-deficient atmosphere before dangerous levels are reached.

Cryogenic liquids boil at room temperatures. This boiling can cause eruptions and splashes, so tongs need to be used when removing anything immersed in the liquid.

### **EYE/FACE PROTECTION**

Protect your eyes by wearing safety goggles whenever working with cryogen fluids. Full face shields shall be used in the following situations: i) when a cryogen is poured; ii) for open transfers; iii) if fluid in an open container is likely to bubble.

Splash-proof safety goggles and/or face shield for protection from pressurized gas.

### **SKIN PROTECTION**

Personal protective equipment is critical when working with cryogenics. Always wear chemical splash goggles and face shields during the transfer and handling process to guard against splashes and the possibility of vessel rupture causing flying debris.

Loose fitting, insulated gloves made to withstand extremely low temperatures should also be worn. The gloves should fit loosely enough so that if a splash occurs inside the gloves they can be thrown off easily and rapidly.

To protect all parts of the skin, long-sleeve shirts and trousers are also recommended. Pant legs should go over the tops of footwear so spills cannot get into boots or shoes and cause extreme tissue damage before the footwear can be removed.

- Do not transfer liquefied gases from one tank to another the first time without supervision.
- Use care when filling portable dewars and do not overfill them.
- You are advised to remove metal jewelry/watches on your hands and wrists before working with cryogens. If exposed to cryogenic liquids or boil-off gases, the jewelry can freeze to the skin.
- Wear a cryogen apron when working with cryogen liquids.
- Try to cover all exposed skin by wearing long sleeve shirts, long pants (skirts), a long sleeve lab coat, well-fitted leather shoes (no sneakers) and gloves. Gloves should be loose-fitting, lightweight, flexible, and insulated so that they can be quickly removed if cryogenic fluids are spilled on them.
- Ensure dewars are properly labeled with the identity of the cryogen. Do not mix different cryogen dewars.
- To avoid asphyxiation, an oxygen monitor in a good working order is recommended if you are working with a cryogen in a confined space.
- Do not permit smoking or open flame in any area where liquid natural gas is stored, handled or used.

**RESPIRATORY PROTECTION**

Use a NIOSH/MSHA approved positive-pressure, supplied air respirator with escape bottle or self-contained breathing apparatus (SCBA) for gas concentrations above occupational exposure limits, for potential for uncontrolled release, if exposure levels are not known, or in an oxygen-deficient atmosphere.

If working in an oxygen-deficient atmosphere, you must use an oxygen-supplying respirator, such as an airline respirator with an egress bottle or a self-contained breathing apparatus (SCBA.) A cartridge-style respirator would not be appropriate because the problem with the atmosphere is the loss of oxygen, which cannot be added by filtration.

**HEARING**

During a high-pressure release, the release may cause a whistling noise. Hearing protection may be required for high-pressure releases of natural gas.

**CAUTION:** Flammability limits (i.e., explosion hazard) should be considered when assessing the need to expose personnel to concentrations requiring respiratory protection.

Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the Manufacturer for additional guidance on respiratory protection selection.

**10. PHYSICAL AND CHEMICAL PROPERTIES (rev. 9-04)****APPEARANCE**

Colorless gas. Cold vapor cloud may be white but the lack of visible gas cloud does not indicate absence of gas.

**ODOR**

Natural gas has a distinctive, disagreeable "natural gas" type odor when treated with an odorizing agent (typically < 0.1% ethyl mercaptan).

**BASIC PHYSICAL PROPERTIES (for methane)**

BOILING POINT:	-259 °F (-162 °C)
LIQUID DENSITY:	425 g/L
GAS DENSITY (27°C):	0.72 g/L
CRITICAL PRESSURE (PSIG):	673
LIQUID TO GAS EXPANSION:	650
VAPOR PRESSURE:	40 atm. @ -187 °F (-86 °C)
VAPOR DENSITY (air = 1):	0.6
SPECIFIC GRAVITY (H <sub>2</sub> O = 1):	0.4 @ -263 °F (-164 °C)
SOLUBILITY (H <sub>2</sub> O):	3.5%

**11. STABILITY AND REACTIVITY (rev. 9-04)****CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS**

Keep away from strong oxidizers, ignition sources and heat.

**STABILITY:** Stable. Hazardous polymerization will not occur.

**CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS**

Keep away from strong oxidizers. Oxidizers to avoid include bromine pentafluoride, oxygen difluoride, and nitrogen trifluoride, and hydrogen peroxide at concentrations greater than 30%.

Keep away from ignition sources and heat. Thermal decomposition may release toxic oxides of carbon dioxide and carbon monoxide.

Keep away from chlorine gas. Natural gas will spontaneously ignite when mixed with chlorine gas. In addition, the products of the reaction of methane and chlorine are carbon, hydrogen chloride, and various chlorocarbons. Hydrogen chloride is otherwise known as hydrochloric acid.

**HAZARDOUS DECOMPOSITION PRODUCTS**

Thermal decomposition may release carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Chemical decomposition (chlorine) may release carbon and hydrogen chloride.

**12. ECOLOGICAL INFORMATION (rev. 9-04)**

This product is expected to exist entirely in the vapor phase in ambient air.

**13. DISPOSAL CONSIDERATIONS (rev. 9-04)**

Consult federal, state and local waste regulations to determine appropriate disposal methods.

**14. TRANSPORTATION INFORMATION (rev. 9-04)**

PROPER SHIPPING NAME: NATURAL GAS, COMPRESSED (*with high methane content*)  
 HAZARD CLASS: 2.1  
 DOT IDENTIFICATION NUMBER: UN 1972  
 DOT SHIPPING LABEL: FLAMMABLE GAS  
 CONTAINERS: AS SPECIFIED IN 49 CFR 173.302, 49 CFR 173.306 OR 49 CFR 173.318 WHERE APPLICABLE  
 QUANTITY LIMITATIONS: AS SPECIFIED IN THE HAZARDOUS MATERIALS TABLE LISTED IN PART 49 OF THE CODE OF FEDERAL REGULATIONS (49 CFR)  
 PASSENGER AIRCRAFT: FORBIDDEN  
 PASSENGER RAILCAR: FORBIDDEN  
 CARGO AIRPLANE: FORBIDDEN EXCEPT AS SPECIFIED IN THE HAZARDOUS MATERIALS TABLE LISTED IN 49 CFR.

**15. REGULATORY INFORMATION (rev. 9-04)**

**U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION**

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the state and/or local level. Consult those regulations applicable to your facility/operation.

**CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)**

This product does not contain any chemicals subject to the reporting requirements of CERCLA Section 103 or SARA 304. In addition, the CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts natural gas and synthetic gas usable for fuel and any indigenous components of such from the CERCLA Section 103 reporting requirements.

**SARA SECTION 311/312 - HAZARD CLASSES**

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
		APPLIES	APPLIES	

**SARA SECTION 313 - SUPPLIER NOTIFICATION**

This product does not contain any chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372.

**CANADIAN REGULATORY INFORMATION**

Class A (Compressed Gas) Class B, Division 1 (Flammable Gas)

