

MICHIGAN GEOSEARCH, INC.

Oil and Gas Exploration & Production Professionals

Glossary

----- A -----

Absorption is a process used by older gas processing plants and in many refinery gas plants to remove natural gas liquids from natural gas. The gas is run through oil of a proper character that absorbs the liquid components of the gas. This process is not as efficient as cryogenic processing and only 70% propane and all of the butane and natural gasoline are recovered.

Acoustic logs record sound waves through the rocks and indicates the rock's porosity.

In an **Acreage Contribution Agreement** the contributing party agrees to contribute leases or interests in the area of the test well to the drilling party in exchange for information, if a well is drilled to an agreed depth.

Alkylation is a refinery process in which butylene or propylene is combined with isobutane to form an iso-paraffin. The process is used to improve the octane quality. The resulting alkylate is a valuable gasoline blending component.

The **American Petroleum Institute (API)** is the trade organization representing the largest US oil and gas companies. The API defines tests to measure various hydrocarbon qualities.

Ammonia is a colorless, nonflammable and liquefied gas with a strong smell (NH₃); is easily liquefied by compression or by cooling to about -33° C (-27.4° F). In returning to the gaseous state, it absorbs substantial amounts of heat from its surroundings (i.e., one gram of ammonia absorbs 327 calories of heat). Because of this property, it is frequently employed as a coolant in refrigerating and air-conditioning equipment; used in the manufacture of urea and other fertilizers.

Anticline is a subsurface geological structure in the form of a sine curve or an elongated dome. The formation is favorable to the accumulation of oil and /or gas.

Anticline Traps are formed when the rock layers have been folded upward to form a dome. The trap looks like an inverted bowl with the upper layer of seal rock holding the fluids in the reservoir rock in place.

API gravity is a measure of the specific gravity of the petroleum fraction relative to water. API gravity bears a relationship to true specific gravity but is more convenient to work with than the decimal fractions that would result if petroleum were expressed in specific gravity.

Aquifers are water reservoirs that are conditioned to hold the gas. Natural gas must be brought in to "condition" the site and it takes four years before the site can be used.

Aromatics are a group of hydrocarbon fractions that form the basis of most organic chemicals so far synthesized. The name 'aromatics' is derived from their rather pleasant odor. The unique ring structure of their carbon atoms makes it possible to transform aromatics into an almost endless number of chemicals.

Artificial lift is a way of bringing oil to the surface when the reservoir pressure has declined. The method involves pumping oil well with a rod, tubing, or bottom-hole centrifugal pump.

Asphalt is a solid hydrocarbon that is dark brown or black in color. Asphalt may be found as as a deposit, but is more typically produced from vacuum residua in the refinery.

Auto-refrigeration is the process in which LNG is kept at its boiling point, so that any added heat is countered by energy lost from boil off.

----- **B** -----

Basins are natural depressions in the earth's surface, in which sediments have accumulated over millions of years. Sedimentary basins are regarded as good prospects for oil and gas exploration.

Batch is a measured amount of crude oil or refined products in a pipeline or storage tank.

Benzene (C₆H₆) is a colorless liquid hydrocarbon made from coal tar. Used in the manufacture of styrene, nylon, detergents and other compounds, it is also a component of high-octane gasoline.

Blending is a process of mixing two or more petroleum fractions to produce a finished refined product that satisfies the product specifications.

Boil off is the LNG that evaporates during storage and transport. Typically, any rise in temperature of LNG during storage and transport will be countered by allowing evaporated LNG to vent from storage tank. Boil off gas is sometimes used to supplement fuel for tankers, or as a fuel at storage facilities.

Bonus is the money paid by the lessee for the execution of an oil and gas lease by the lessee for the execution of an oil and gas lease by the landowner. Bonus payments are also made to governments by oil and gas companies after concessions are awarded.

In a **Bottom Hole Contribution** the contributing party agrees to make a cash contribution to the drilling party in exchange for geological or drilling information, if a well is drilled to an agreed depth.

British Thermal Unit is traditionally defined as the amount of heat required to raise the temperature of 1 pound (lb) of water by 1 degree Fahrenheit. One Btu is more precisely defined as the amount of heat equivalent to 1,055.06 Joule.

BTX is the acronym used for the aromatics mixture of benzene, toluene, and xylene.

Btu is the acronym for British Thermal Units which is a measure of energy.

Bullet tanks are horizontal pressure tanks that are the shape of a very fat bullet. Bullet tanks are used to store normal butane, propane, and propylene.

Bunker fuel oil is a heavy, residual fuel oil used in ships' boilers and large electric power generating plants.

The **Bureau of Land Management (BLM)** owns the mineral rights of federal lands and administers leasing and drilling.

Butane (C₄H₁₀) is a chemical used as a fuel, petrochemical feedstock and for vapor pressure control in gasoline blending.

Butylene (C₄H₈) is a colorless, flammable and liquefied gas with detectable odor. Butylenes are formed during the cracking (breaking down of large molecules) of petroleum fractions. It is used for the production of high-octane gasoline, secondary and tertiary butyl alcohols, and synthetic rubber.

----- C -----

Caprock is a hard impervious formation that forms a cap over permeable layers of sedimentary rock. This prevents the further upward migration of oil and gas and traps the hydrocarbon.

Carbon black is also known as Channel black, Lamp black, Furnace black, Thermal black or Acetylene black. It is an odorless solid; mainly used in automobile tire manufacture and road construction.

Carbonate rocks are "Chemical or Biochemical" in origin; they form within the basin of deposition, and are called Intrabasinal Rocks; composed of calcite and aragonite; has high porosity and permeability and where scientist usually find oil and gas.

Carried Interest is interest created from an oil and gas lease that is free of some or all of the costs.

Casing is installed during the drilling process to: protect potable water zones near the surface from contamination, provide a smooth conduit for moving tools into and out of the hole, isolate down hole zones so they can be produced separately and protect the hole

from the drilling fluids.

Chemical formula Gives the number and type of atoms making up a a chemical compound. It indicates the number of atoms of each element that are part of the compound.

Circulation process is the round trip made by the drilling mud; down through the drillpipe and back up the annulus between the pipe and the wall of the borehole. If circulation is lost, the flow out of the well is less than the flow into the well; the mud may be escaping into some porous formation or a cavity downhole.

The **circulating system** pumps drilling fluids down the hole, out of the nozzles in the drilling bit, and returns them to the surface where the debris is separated from the fluid.

Compressed natural gas (CNG) is natural gas that is under pressure. The pressure reduces the volume occupied for the gas so it can be contained in a smaller vessel.

Conveyance is a transfer of ownership of a property from one party to another.

Crude oil is the petroleum liquids as they come from the ground; formed from animal and vegetable material which collected at the bottom of ancient seas.

Cryogenic recovery processes are done at temperatures lower than -150 °F. The low temperatures allow the plant to recover over 90% of the ethane in the natural gas. Most new gas processing plants use cryogenic recovery technology.

Custody relates to when the ownership of oil changes. A run ticket is prepared for the receiver and the shipper to record the transaction.

Cuttings are chips and small fragments of rocks as the result of drilling that are brought to the surface by the flow of drilling mud as it is circulated. Cuttings are important to geologist, who examines them for information concerning the type of rock being drilled.

----- D -----

Darcy is a unit of permeability of rock. A rock of one Darcy permeability is one in which fluid centipoise viscosity will flow at a velocity of one centimeter. Since a Darcy is too large a unit for most oil producing rocks, permeabilities used in the oil industry are expressed in units one thousands as large i.e. millidarcies (0.001 Darcy). Commercial oil and gas exhibit permeabilities ranging from a few millidarcies to several thousand.

Deadweight is the weight in tons that a an oil tanker can carry.

Depleted fields are the used up oil reservoirs that are used most often to store natural gas and comprise the majority of storage.

A **derrick** is a wooden or steel structure built over a well site to provide support for the drilling equipment and a tall mast for raising and lowering drillpipe and casing. A derrick is also referred to as a drilling rig.

A **derrickhand** is a member of the crew who works upon in the derrick on the tubing board racking tubing or the drillpipe as it is pulled from the well and unscrewed by the other crew members on the derrick floor.

Desiccant Drying The use of drying agent to remove moisture from a stream of oil or gas. In certain product pipelines great effort is made to remove all the water vapor before putting the line into service. To accomplish this, desiccant-dried air or an inert gas is pumped through is pumped through the line to absorb the moisture that may be present even in the ambient air in the line.

Development Well is a well drilled within the proved area of an oil or gas reservoir to the depth of a stratigraphic horizon known to be productive.

A **diamond drill bit** is made by setting man-made diamonds in the tip or the cutting surface of the bit. Diamonds are many times harder than the harder than the hardest steel, so diamond bit makes it possible longer bits run before a round trip is necessary to change the bits.

Diesel fuel is a middle distillate fuel similar to home heating oil that is used for fuel in trucks, trains, and ship engines.

Distillation is a process that uses the difference in boiling points of molecules and petroleum fractions to separate the compounds and streams.

A **division order** is a statement executed by all parties who claim an interest stipulating how proceeds of production are to be distributed.

Drawworks is the name for the hoisting drum, cable, shaft, clutches, power take off, brakes, and other machinery used on the drilling rig. Drawworks are located on one side of the derrick floor and serve as a power control center for the hoisting gear and the rotary elements of the drill column.

Drill bit is the mechanism that cuts into the ground layers to reach the gas deposit or to cut a core sample. Bits rotate 50-300 revolutions per minute depending upon the hardness of the strata through which it is boring. The diameter of a hole may be up to 24 inches but it is usually five to eight and one-half inches.

The **drill collar** is a heavy, tubular connector between drillpipe and a bit. Originally, the drill collar was a means of attaching the drill bit to the drillpipe and to strengthen the lower end of the drill column, which is subject to extreme compression, torsion, and bending stresses. Now the drill collar is used to concentrate a heavy mass near the lower end of the drill column. Drill collars were once a few feet long and weighed 400 or 500 pounds. Today because of the increased bit pressure and rapid rotation, collars are made up in

1000-foot lengths and weigh 50 to 100 tons.

The lease **drilling-delay rental** clause ensures that the lessee has no obligation to drill during the primary term. The drilling-delay clause includes "Unless" or "Or" clauses. The "Unless" clause says that the lease terminates unless a well is begun or delay rentals are paid prior to a specified date. The "Or" clause states that a lessee must either commence drilling or pay rentals or surrender the lease prior to the due date.

Drill pipe is heavy, thick-walled steel pipe used in rotary drilling to turn the drill bit and to provide a conduit for the drilling mud. Joints of drill pipe are about 30 feet long.

Drill string As the hole gets deeper, pipe is added to the drill bit to allow it to dig further. These lengths of drill pipe form the drill string.

Driller is the member of the drilling crew who operates a drilling rig; the person in charge of drilling operations and who supervises the drilling crew.

Drilling contractor/Service company is a person or a company whose business is drilling wells. Wells are drilled on a per foot basis, others are contracted for a day rate.

The **drilling crew** is composed of a toolpusher, a driller, a derrickhand, and several roughnecks.

Drilling fluid/mud is a special mixture of clay, water, and chemical additives pumped down-hole through the drillpipe and the drill bit. The mud cools the rapidly rotating bit; lubricates the drill pipe as it turns in the wellbore; carries rock cuttings to the surface; and serves as a plaster to prevent the wall of the borehole from crumbling or collapsing. It also provides the weight or hydrostatic head to prevent extraneous fluids from entering the wellbore and to control downhole pressures that may be encountered.

Drilling line are pipes that are made in even sizes from 2 inches to 48 inches. There are larger sizes in use however; some large gravity loading lines for crude oil tankers are 56 inches. Most line pipe either is lap welded or butt welded. Seamless pipe is usually only for drilling wells. Line pipes especially the large sizes, has beveled weld ends so the joints can be welded together. Large-diameter screw pipe (12 inches) went out of style in the late 1920's, along with the 200-man pipe handling and pipelaying crews. Gas welding and then electric welding put them out of business.

Dry-bed adsorption is used to remove water and some of the natural gas liquids from the natural gas. The liquids are adsorbed on the surface of the desiccant such as silica gel.

A **dry hole** is an unsuccessful well. The well does not contain enough hydrocarbons to warrant completion.

A **Dry Hole Agreement** is where contributing party agrees to make a cash contribution if the drilling party drills a dry-hole. The drilling party generally agrees to provide geological and drilling information whether or not the well is a dry hole.

Dry Natural Gas is natural gas that has been conditioned, treated and natural gas liquids (ethane and heavier molecules) removed.

----- E -----

Electric Logs record weak electrical currents that flow in the rock next to the wellbore and shows the thickness and boundaries of the rock layers. These logs help determine the amount of salt water present and the permeability.

Ethane (C₂H₆), The saturated hydrocarbon which is primarily extracted from natural gas, but also from recovered refinery gases. The United States and Canada have long been the dominant producers and consumers of ethane. The largest end use for ethane is as a feedstock for ethylene production.

Ethanol(C₂H₃OH) is a colorless liquid that burns to produce water and carbon dioxide. The vapors form an explosive mixture with air and may be used as a fuel in the internal combustion engine. It is most easily produced by the fermentation of carbohydrates. Ethanol has replaced MBTE as the source of oxygenates in the gasoline pool.

Ethylene(C₂H₄) is a colorless, flammable gas, with a faint odor. It is an unsaturated chemical formed by cracking of ethane and other feedstocks in an ethylene plant. It is an important raw material in manufacture of numerous petrochemicals.

Ethylene glycol (C₂H₆O₂) is a colorless, sweet-tasting liquid completely miscible with water and many organic liquids. Ethylene glycol markedly reduces the freezing point of water. It is used primarily as an anti-freeze and in the manufacture of polyester fiber and film, as heat-transfer fluid, dehydrating agent for natural gas.

Ethylene oxide ([CH₂] 2O) is a colorless, flammable and liquefied gas with a sweet odor. It is primarily used as a chemical intermediate for ethylene glycol and other chemicals such as nonionic surfactants, glycol ethers, ethanolamines, triethylene glycol, and diethylene glycol. It is used as a sterilant and fumigant in the health product and medical fields.

Exploratory well is a well that is not a development well, a service well, or a stratigraphic test well. Wells drilled to find the limits of an oil-bearing formation, often referred to as a pool, only partly developed.

Ex-ship refers to the delivery basis for most traditional long-term LNG contracts. Agreed price includes cost of freight and insurance for transporting the LNG by tanker to buyers' facilities. Usually contrasted with Free On Board (FOB).

----- F -----



A **Farmout Agreement** is an agreement to assign an interest in acreage in return for drilling or testing operation on that acreage.

A **fault** is a fracture in the earth's crust accompanied by a shifting of one side of the fracture with respect to the other side; the point at which a geological strata "breaks off" or is sheared off by dropping of a section of the strata by settling.

A **fault trap** is formed by rock movement along a fault line.

The **Federal Energy Regulatory Commission (FERC)** is the federal agency that regulates interstate gas pipelines and interstate gas sales under the Natural Gas Act. The FERC is considered an independent regulatory agency responsible primarily to Congress, but it is housed in the Department of Energy.

The landowner is the **fee simple owner** of a tract of land holds the right to use, occupy and enjoy the surface of the land, and the air space above it (surface rights), plus all rights to minerals beneath it (mineral rights).

Field gathering systems consist of pipelines that move oil from the wellhead to storage tanks and treatment facilities where the oil is measured and tested.

Fixed roof tanks are the refinery tanks used to store diesel, kerosene, catalytic cracker feedstock, and residual fuel oil.

Floating roof tanks are tanks with a flat roof that floats on the surface of the oil thus reducing evaporation to the minimum. The roof rests on a series of pontoons whose buoyancy supports the roof proper; a floater. These are used for storage of high volatile components such as gasoline, naphtha and benzene.

Fossil fuel is an energy source formed in the earth's crust from decayed organic material. The common fossil fuels are petroleum, coal, and natural gas.

FPSO stands for Floating Production, Storage and Offloading. This operation, based on a tanker, is used as a semi-permanent storage and loading facility for crude oil production in offshore fields.

A **floating roof tank** is a storage tank with a flat roof that floats on the surface of the oil thus reducing evaporation to the minimum. The roof rests on a series of pontoons whose buoyancy supports the roof proper; a floater. These are used for storage of high volatile components such as gasoline, naphtha and benzene.

Free On Board (FOB) refers to the costs associated with delivery, inspection and loading involved in putting crude oil, refined products or LNG on a tanker at sellers' facilities are included in agreed price. The buyer pays all additional costs to transport and unload the cargo.

----- G -----

Gasoline is a light hydrocarbon mixture having C4 - C9 carbon atom hydrocarbons, which are used as, fuel for internal combustion engines.

Gathering stations receive oil through a gathering system from the producer's tanks.

Geologists are scientists who study the origin, history, composition, and structure of the earth and its life as recorded in rocks and other solid matter.

Geology is the science that involves the study of the earth and the earth's origin, composition, structure and history. Geology is the key to finding new sources of useful earth materials and to understanding earth processes that affect our lives.

Geophones are sensitive sound-detecting instruments used in conducting seismic surveys. A series of geophones is placed on the ground at intervals to detect and transmit to the amplifier-recording system the reflected sound waves created by explosions set off in the course of seismic exploration work.

The **Granting Clause** defines the rights that are "granted" by the mineral interest owner to the lessee.

----- H -----

The **Habendum Clause** defines the period of time for which the rights given in the granting clause will extend. The habendum clause provides for a primary term which is a fixed term of years during which the lessee has the right, without any obligation, to operate on the premises. It also describes a secondary term is the extended period of time for which rights are granted to the lessee once production is obtained.

Heating Value is the amount of energy or heat that is generated when a hydrocarbon is burned (chemically combined with oxygen). It is usually expressed in terms of Btus per unit of measurement.

The **hoisting system** is used to raise and lower pipe in and out of the hole and to support the drill string to control the weight on the drill bit during drilling.

Home heating oil is prepared from the middle distillate fractions of crude oil and is used to heat homes and businesses.

Hydrocarbons are molecules composed of hydrogen and carbon atoms... hence the name "hydro-carbons."

Hydrophones are sound detecting instruments used in underwater seismic exploration activities. Hydrophones are attached to cable towed by seismic vessel. Sound waves

generated by the blasts from air gun reflect from the formations below the sea floor and are picked up by the hydrophones and transmitted to the mother ship.

----- I -----

Inorganic theory says that oil and gas were produced during the formation of the solar system and the earth. The inorganic theory is often used to explain why oil and gas are found in unexpected places and differences in chemical composition.

----- J -----

Jet fuel is a kerosene-based fuel that is used as a fuel for turbine engines in airplanes.

Joint Operating Agreement is a contract between co-tenants or separate owners of oil and gas properties being jointly operated. It defines the agreement with respect to initial drilling, further development, operations and accounting.

----- K -----

The **kelly** is the first and the sturdiest joint of the drill column. It is a thick wall, hollow steel forging with two flat sides and two rounded sides that fits into the square hole in the rotary table that rotates the kelly joint and the drill column.

----- L -----

A **landman** is a position in the oil and gas industry the responsibilities of which include acquiring oil and gas leases, negotiating arrangements for development of leases, and general management of leased property.

Landowner's Royalty is an interest in production free of production costs retained by the lessor.

Large Range (LR) and **Very Large Crude Carriers (VLCC)** are employed in international crude oil trade. The size of tanker that can be used in any trade (commercial voyage between a port of origin and destination) is dependent on the tanker's length and loaded depth and the size of the loading and unloading ports. The larger ships are used because they reduce the cost to transport a barrel of crude oil.

Lease Automatic Custody Transfer (LACT) is a system of monitoring and transferring oil production for receiving into tankage, measuring, testing and turning into the pipeline the crude produced on a lease.

Leasehold interest is the right to the mineral interest granted by an oil and gas lease and

is also called a working or operating interest.

The **Lessee** is an organization or individual who obtains a lease from a fee simple owner. In oil and gas, an organization or individual who obtains the mineral rights (the opportunity to look for oil and gas and produce the oil and gas found).

The **Lessor** is the fee simple owner or mineral rights owner who allows an individual or organization to explore for and produce oil and gas on mineral rights that he owns.

Liquefaction is the process by which gaseous natural gas is converted into liquid natural gas.

Liquefied Natural Gas (LNG) is natural gas that has been cooled to -260 F. and converted into a liquid so that its volume will be reduced for transportation.

Liquefied Petroleum Gas (LPG) is a mixture of propane, propylene, butane and butylenes. When compressed moderately at normal temperature it becomes a liquid. It is obtained as light ends from fractionation of crude oil. It has a good caloric value; used as cooking fuel; because LPG has no natural odor, a distinctive odorant is added so that it will be noticeable should a leak occur.

LNG Tankers are double-hulled ships specifically designed to handle the low temperature of LNG, insulated to limit the amount of LNG that boils off. LNG carriers are up to 1,000 feet long, and require a minimum water depth of 40 feet when fully loaded.

Local distribution companies (LDCs) take possession of natural gas at the city gate distribute it to residential, commercial, industrial, and utility power users.

Lubricants (lubes) are specially formulated oils that reduce friction between moving parts and help maintain the mechanical parts. Lubricating oils are used in gasoline and other engines.

----- M -----

Market aggregators are the marketers who collect customers and find suppliers to meet their demand. They work either on margin basis or on commission.

Methane is the primary ingredient of natural gas. The chemical formula is CH₄.

The **Minerals Management Service (MMS)** of the Department of the Interior (DOI) is responsible for OCS leasing and production programs and royalty management.

The **Mother Hubbard Clause** "covers and includes any and all lands owned or claimed by the lessor adjacent or contiguous to the land." It typically allows for additional 10% coverage of lands not included in the lease description.

----- N -----

Natural gas is an odorless, colorless, tasteless, nontoxic clean-burning fossil fuel. Natural gas is largely methane (CH₄) a naturally occurring gas that can also be produced by coal gasification. At times it contains ethane, propane, butane, pentane, helium and hexane.

Natural gas conditioning and treating removes solids (sand, pipe scale, dirt), water (dehydration), acid gases (hydrogen sulfide), and carbon dioxide and nitrogen.

Natural gas liquids (NGLs) are the heavier hydrocarbons or ethane (C₂H₆), propane (C₃H₈), butane (C₄H₁₀), and natural gasoline which are need to separated before transportation of natural gas in pipelines.

Non-Participating Royalty is a royalty “carved out” of the mineral interest that is often used by mineral interest owners who sell their rights.

Nuclear logs record natural and induced radioactivity and measures the amount of oil, gas and water; the type of rock and porosity; and the salt content.

----- O -----

Organic theory says that oil and gas were formed from the remains of plants and animals. Scientists, who support this theory, think that oil and gas were formed from the remains of small or microscopic plants and animals that lived in prehistoric rivers and seas. When these plants and animals died they combined with mud, silt, and sand to form layers of the mixture called sediments. After thousands of years, a thick layer of sediment formed on the bottom of the sea. As more layers were added the weight of the new layers applied pressure to the lower layers and turned them into sedimentary rock. Scientists believe that high heat and pressure, bacteria, chemical reactions, and other forces transformed these sediments into oil and gas.

Original Oil/Gas in Place (OOIP or OGIP) is an estimate of the amount of oil or gas contained in the reservoir based on physical features of the reservoir. Not all of these hydrocarbons can be recovered.

The Federal Government controls the area from the states’ inland waters out to 200 miles or 8,200 ft. of water depth. This region is known as the **Outer Continental Shelf** or **OCS**.

Overriding Royalty is an interest “carved out” of the lessee’s leasehold interest and is often used to compensate people who structured the drilling venture

----- P -----

Petrochemicals are a class of chemicals that are derived from crude oil and natural gas. The primary petrochemical "building blocks" are benzene, toluene, and xylene (BTX) and ethylene. Over 3,000 chemical products are synthesized from these chemicals.

Permeability is a measure of the resistance offered by the rock to the movement of fluids through it. Permeability is one of the important properties of sedimentary rock containing petroleum deposits. The oil contained in the pores cannot flow into the wellbore if the rock in the formation lacks sufficient permeability. Such a formation is referred to as "tight."

A **permeability trap** occurs when a change of permeability within a trap seals off hydrocarbons in a portion of the rock layer. The changes may be caused by the uneven distribution of sand and clay as the sediment was deposited. This type of stratigraphic trap is also called a lenticular trap.

Petroleum coke is a solid carbon substance that is deposited on the catalyst in fluid catalytic cracking and is isolated in the thermal coking process.

Petroleum geologists study the earth and as such they are important in the search for mineral resources and petroleum. Petroleum geologists are employed by oil companies to determine whether a region may produce oil or gas.

A **pinchout trap** is an unconformity where the older, eroded layer of rock is igneous and the newer layer is sedimentary. An unconformity trap can form if part of a porous layer of rock is eroded and then covered with an impermeable caprock. A good example of this structural trap is the East Texas field.

Pipelines are tubular arrangement for the transmission of crude oil, refined products, and natural gas from the wellhead, refinery, and storage facility to the customer. Pipeline measures 14 to 42 inches in diameter, but is usually 20 to 36 inches. It is often composed of 40-foot lengths but lengths may be as long as 60 or 80 feet. The pipe is wrapped and coated for protection against corrosion, especially since it runs underground. About half of all gas and oil is moved by pipeline.

To **plug** a well is to fill a well's borehole with cement or other impervious material to prevent the flow of water, gas or oil from one strata to another when a well is abandoned; to screw a metal plug into a pipeline to shut off drainage or to divert the stream of oil to a connecting line; to stop the flow of oil or gas.

Polyethylene ($-C_2H_2-C_2H_2-$)_n is a petroleum derived plastic material used for packaging, plastic household-ware, and toys. The main ingredient of polyethylene is the petrochemical gas ethylene.

Polystyrene (C_8H_8)_n is a white colored polymer made from polymerization of a styrene monomer.

Polyvinyl chloride (PVC) ($CH_2=CHCl$)_n is a hard, amber-colored material; precise properties depend on formulation. It is made from polymerization of vinyl chloride. Heat

and light degrade all PVC polymers.

Pores are the minute or microscopic voids in porous rock. Rocks containing pores are able to hold oil, gas and water. If the pores are interconnected, the rock is permeable and a good reservoir rock.

Porosity is a measure of the volume contained in a rock. The volume of the pore space expressed as a percent of the total volume of the rock mass and is an important property of hydrocarbon-bearing formations. Good porosity indicates an ability to hold large amounts of oil and gas in the rock.

Pounds per Square Inch (psi) is pressure measured with respect atmosphere pressure. This is a pressure gauge reading in which the gauge is adjusted to read zero at the surrounding atmospheric pressure.

A drilling rig receives its **power** from a system comprised of the diesel engine-DC generator-DC motor. A typical engine generator-motor include four such sets: two for the mud pumps, one for the drawworks and the rotary table, and one somewhat smaller size for the lighting and auxiliary loads. Another type of electric rig uses the same power-flow system but the generators are AC, whose current is converted to DC current to drive the DC motors for the variable speed drilling operations.

Pressure, Absolute (PSIA) is the gauge pressure plus barometric or atmospheric pressure. Absolute pressure can be zero only in a perfect vacuum. The pressure due to the weight of the atmosphere (air and water vapor) on the earth's surface. The average atmospheric pressure at sea level has been defined as 14.696 pounds per square inch absolute.

Propane(C₃H₈) is a hydrocarbon that is gaseous at ordinary atmospheric conditions but readily converted to a liquid. When in liquid state propane must be stored in a high-pressure metal container. Propane is odorless, colorless, and highly volatile. It is used as a household fuel beyond the gas mains.

Propylene(C₃H₆), can be obtained from petroleum oils during the refining of gasoline or by catalytic or thermal cracking of naphtha or natural gas liquids, or by catalytic dehydrogenation of propane; used in the manufacture of plastics; food storage containers, diapers and children's toys.

Propylene oxide (C₃H₆O) is a is a colorless liquid with an ether-like odor that is used mainly as a chemical intermediate in the production of polyurethane polyols, which are used to make polyurethane foams, coatings, and adhesives.

Propylene glycol(C₃H₈O₂) is a clear colorless viscous liquid produced commercially from propylene oxide; has been widely used in pharmaceutical manufacturing as a solvent and vehicle especially for drugs unstable or insoluble in water industrial antifreeze.

Proved reserves are oil and gas that have been discovered and determined to be recoverable under prevailing economic and technical conditions.

----- Q -----

Quad is shorthand for quadrillion (10¹⁵) and is usually used in association with measuring energy consumption and supply in Btus.

----- R -----

A **refinery** is a large plant composed of many different processing units that are used to convert crude oil into finished or refined products. These processes include heating, fractionating, reforming, cracking, and hydrotreating.

Refined products are the various hydrocarbons obtained as a result of refining process separation from crude oil. Typical refined products are LPG, naphtha, gasoline, kerosene, jet fuel, home heating oil, diesel fuel, residual fuel oil, lubricants and petroleum coke.

Refrigeration is the process used to remove the natural gas liquids by cooling or refrigerating the natural gas until the liquids are condensed out. The plants use Freon or propane to cool the gas.

A **Regasification terminal** is a facility for receiving, unloading, storing and re-gasifying LNG, usually including breakwaters, tanker berthing and other marine facilities.

Reserves are the supply of an oil or gas resource. Reserves are qualified to show degree of certainty such as proven reserves to possible and speculative reserves.

Reserve lifetime or **R/P ratio** is the ratio of the reserves of crude oil or natural gas in units of barrels or cubic feet to the annual production in barrels per year or cubic feet per year. The units of this ratio are years and is equivalent to the number of years of production left in the reserve at the current production rate.

Reserve Replacement is the ratio of additions to reserves divided by production. It is a measure of the extent to which production is being replaced.

Reserves are the amount of an oil or gas resource. Reserves are qualified to show degree of certainty such as proven reserves to possible and speculative reserves.

Reservoir rock is a layer of rock with interconnected holes and voids, into, and out of which, petroleum can flow.

Reservoirs are discrete sections of porous rock containing an accumulation of oil/gas, either separately or as a mixture.

Residual fuel oil is a low grade of fuel oil; used in the industry as boiler fuel; also known as bunker fuel in large ocean-going tankers.

A **rig barge** is a drilling rig mounted on a barge-like vessel for drilling in shallow water or swampy locations. Barge rigs are not self propelled and must be towed or pushed by a towboat. In addition to all necessary drilling equipment, barges also have quarters for the drilling crew.

A **roller drill bit** is a rock cutting tool on the bottom of the drillstring made with three or four shanks welded together to form a tapered body. Each shank supports a cone-like wheel with casehardened teeth that rotate on steel bearings.

The **rotary table** is a heavy, circular structure mounted on a steel platform just above the derrick floor with an opening in the center through which the drillpipe and casing must pass. The table is rotated by power transmitted from the drawworks and the drilling engines. In drilling, the kelly joint fits into the square opening of the table. As the table rotates, the kelly is turned, rotating the drill column and the drill bit.

Roughnecks are members of the drilling crew who work on the derrick floor and up in the derrick racking pipe. They operate and maintain the drilling engines and the mud pumps. They operate the pipe tongs to break out or unscrew the stands of the drill pipe during "trips."

Royalty Interest is a share of production free from the costs of production, when and if there is oil and gas production on the property.

A **run ticket** is used in buying and selling crude oil. When the ownership or custody of oil changes, a run ticket is prepared for the receiver and the shipper to record the transaction. The ticket is made in triplicate by the gauger and is witnessed by the lease owner's representative, usually the pumper. The run ticket, an invoice for oil delivered shows opening and closing gauge, API gravity and temperature, tank temperature and BS&W. The original of the ticket goes to the purchaser; copies go to the pumper and one for the gauger.

----- S -----

Salt caverns are solution mined in sufficiently thick salt formations - bedded salt or salt domes - penetrated by boreholes down to depths of 2000 meters. The dimensions of the caverns normally extend to 300 meters in height and 60 meters in diameter, with volumes which generally range from 100, 000 - 800,000 cubic meters.

A **salt dome** is a subsurface mound or dome of salt. Two types of salt domes are recognized: the piercement and non-piercement. Piercement domes thrust upwards into the formations above them, causing faulting; non-piercement domes are produce by local thickening of the salt beds and merely lift the overlying formations to form an anticline.

Sandstones are generally considered the most porous and permeable rocks and are therefore where scientists usually find oil and gas.

Seal rock is a layer of rock through which oil and gas cannot flow.

When the demand for a product changes during different periods of the year, the product is said to be **seasonal**. The consumption of natural gas is seasonal. We use more gas in the winter to heat our homes than we do in the summer.

Sedimentary rocks are formed in horizontal layers when sediments from rivers are washed into lakes or oceans. The weight of the additional sediments compresses the earlier deposits and minerals cement them together into sedimentary rocks such as sandstone, limestone (carbonate) and shale.

Seeps provide evidence of hydrocarbons. Seeps occur along fractures in reservoirs or at places where the earth's surface cuts the formation.

2D seismic is a two-dimensional picture of the subsurface. It generates a seismic section, which is a two-dimensional slice from the surface of the earth downward. This section is known as 2D seismic because it shows the width and depth.

3D seismic is a new technique that scientists are now applying seismic technology to produce three-dimensional images of the earth's subsurface. Three-dimensional seismic or 3D seismic creates an image that includes length, width, and depth. Seismic crews obtain data on a 2 or 3 mile square of the earth's surface. Large, high-speed computers analyze the data and create a picture of the surface. Scientists can then take slices of this in a variety of directions to examine the formation.

4D seismic is a technique that is used at different time periods to study the movements of hydrocarbons. This produces a 4D seismic history of the formation with time as the fourth dimension.

Seismic surveys are geophysical information on subsurface rock formations gathered by means of a seismograph; the investigation of underground strata by recording and analyzing shock waves artificially produced and reflected from the subsurface bodies of the rock.

A seismograph amplifies and records the electrical signal and produces a picture or **seismogram**.

The **seismograph** is a device that records vibrations from the earth. In the exploration for oil and gas, a seismograph records shock waves set off by explorations detonated in the shot holes and picked up by geophones. This allows geoscientists to develop a map of the rock formations below the earth's surface.

Seismology is the science of study of the rocks below the surface of the earth.

Shale shaker is a vibrating screen for sifting out rock cuttings from the drilling mud. Drilling mud returning from downhole carrying rock chips in suspension flows over and through the mesh of the shale shaker, leaving small fragments of rocks and are collected and examined by the geologist for information on the formation being drilled.

Sour crude oil containing a degree of sulfur as hydrogen sulfide and other sulfur compounds. Has a pungent smell and sulfur content is controlled before fractionation of crude oil.

Source rock is a layer of rock containing organic material that naturally transforms into petroleum.

Spherical tanks can withstand higher pressures per square inch; they are used for storage of isobutane and normal butane.

Stratigraphic trap is a type of reservoir capable of holding oil and gas, formed by a change in characteristics of the formation – loss of porosity and permeability, or a break in its continuity-which forms the trap or reservoir.

Sulfur is a yellowish white solid. Sulfur appears in oil and gas in the form of hydrogen sulfide or in combination with a hydrocarbon to form a mercaptan. Sulfur is an undesirable component because when the product is burned it forms sulfur oxides, which contribute to air pollution.

Supply aggregator is a description applied to natural gas marketers who collect natural gas production from producers and find markets for the gas.

Surface geology uses physical features on the earth's surface to give an indication of the presence of structural traps such as anticlines.

Surfactants or surface-active agents are substances with special properties that are used in detergents, cosmetics, dyes, and dispersants.

Sweet crude gets its name because it has a "sweet" or pleasant smell. Sweet crude has a sulfur content less than 1%. It is more valuable than sour crude because it costs less to process the crude into finished products.

The **swivel** is part of the well-drilling system. It is a heavy, steel casting equipment with a bail-held by the hook of the traveling block-containing the wash pipe, gooseneck, and bearings on which the kelly joint hangs and rotates. It is the heavy link between the hook and the drill string onto which the mud house is attached.

----- T -----

Tankers are used to transport crude oil and refined products in waterborne trade. The tankers can be used in either "clean" (light refined products such as gasoline and diesel

fuel) or "dirty" (residual fuel and crude oil) trade. The tankers range in size from the small vessels used to transport refined products to huge crude carriers. Tanker sizes are expressed in terms of deadweight tons (dwt). The smallest tankers are General Purpose which range from 10 to 25,000 tons and the largest are . These tankers are used to transport refined products. Tankers are unloaded/loaded at the jetties or the specially build piers.

Terminals are strategic locations owned by the refineries for storage and distribution of their refined products. The products are taken to pumps via tankers from the terminals. They keep record of the inventory coming in and out.

Toluene An aromatic hydrocarbon resembling benzene but less volatile and flammable. It is used as a solvent and as an antiknock agent in gasoline.

A **toolpusher** is the supervisor of drilling operation in the field. A toolpusher may have one drilling well or several under his direct supervision. Drillers are directed in their work by the toolpusher.

An LNG **train** is a processing unit that converts natural gas into a liquid. An LNG plant comprises one or more LNG trains, each of which is an independent unit for gas liquefaction.

A **trap** prevents oil and gas from rising to the earth's surface. A trap consists of a layer of rock that oil and gas cannot penetrate (impermeable) above a porous, permeable layer that holds the oil and gas. These traps can take many forms but a common type would be in the shape of an inverted bowl formed from impermeable rock. Traps are formed by changes in the earth's crust such as folding or faulting.

Traveling and crown blocks are the large, heavy-duty block hanging in the derrick and to which the hook is attached. The travelling block supports the drill column and "travels" up and down as it hoists the pipe out of the hole and lowers it in. The traveling block may contain from three to six sheaves depending upon the loads to be handled and the mechanical advantage necessary. The wireline from the hoisting drum on the drawworks runs to the derrick's crown block and down to the traveling block's sheaves. The crown block is a stationary pulley located at the top of the derrick.

Trunkline stations receive oil from the gathering station and move the oil to the refineries and shipping terminals. Booster pumps are located along the line to maintain system pressure.

----- V -----

Vacuum Distillation is a refinery process that separates atmospheric residua into a light and heavy fraction. It takes place under reduced pressure (less than atmospheric) which allows the distillation to take place at a lower temperature. The lower temperature prevents cracking and coke formation.

Vinyl acetate (C₄H₆O₂) is a colorless, clear liquid with a sweet fruity; it does not occur naturally in the environment. Vinyl acetate readily evaporates into air and dissolves easily in water; it is flammable and may be ignited by heat, sparks, or flames. It is primarily used in the production of polyvinyl acetate and polyvinyl alcohol, which are widely used in adhesives for packaging and construction, and in water-based paints.

Vinyl chloride is a colorless, flammable gas (CH₂=CHCl) with a faintly sweet odor. It liquefies in a freezing mixture, and polymerizes in light, air, or heat unless stabilized by inhibitors such as phenol. It is industrially important because of the inherent flame-retardant properties of its polymer. It is a monomer for polyvinyl chloride (PVC), a plastic resin used in innumerable consumer and industrial products.

----- **W**-----

Wet natural gas is natural gas from the wellhead. The gas may have undergone some conditioning and treating to remove water, solids and carbon dioxide but it still contains heavier hydrocarbons (ethane and heavier).

Wireline logs use a wire and conductor line to lower a logging tool into the completed well.

----- **X** -----

Xylene (C₈H₁₀) is a flammable, toxic aromatic hydrocarbon liquid. Xylene is related to benzene and can be distilled or synthesized.

