Oil and Gas Glossary of Terms

Abandon
The proper plugging and abandoning of a well in compliance with all applicable regulations, and the cleaning up of the wellsite to the satisfaction of any governmental body having jurisdiction with respect thereto and to the reasonable satisfaction of the operator.

Abandonment Costs
The costs associated with abandoning a well or production facility. Such costs are specified in the authority for expenditure (AFE), and typically cover the plugging of wells; removal of well equipment, production tanks and associated installations; and surface remediation that includes revegetation. (See Plugging and Abandonment).

Acid Stimulation (type of completion procedure or workover procedure)
The treatment of a reservoir formation with a stimulation fluid containing a reactive acid. In sandstone formations the acid reacts with soluble substances in the formation matrix to enlarge the pore spaces. In carbonate formations (limestones, limey sandstones, dolomites) the acidizing treatment dissolves the entire formation matrix. In each case, the acid treatment improves formation permeability to enhance production of oil and gas.

Act
Means the Oil and Gas Conservation Act of the State of Colorado.

Alluvial Aquifer
The water-bearing sand and gravel adjacent to a stream that can yield large amounts of groundwater.

Ambient Air Quality
Refers to the quality of outdoor air in the surrounding environment. It is typically measured near ground level, away from direct sources of pollution.

Annulus
The void between piping (casing) and the wall of the borehole. The annulus is continuously cemented between the casing and the borehole over the aquifers, to a depth of 50 feet below the deepest aquifer. The wellbore is also cemented over the producing formation to isolate the wellbore and prevent migration of formation fluids into the casing. After casing and cementing through the interval to be produced, the casing is perforated. The perforations extend through the cement and fluids flow from the formation, through the perforations, and into the production casing or production tubing.

Application for Permit to Drill (APD)
Prior to building the oil and gas location or pad, an Application for Permit to Drill (APD) is required by the Colorado Oil and Gas Conservation Commission (COGCC Form 2), as well as a location permit (COGCC Form 2A).

Aquifer
A geologic formation or group of formations that can both store and transmit water. Subsurface aquifers (as opposed to alluvial aquifers in sediments at the surface) are separated by impermeable layers, also call aquitards.

Barrel (bbl)
42 U.S. gallons at 60^0F and atmospheric pressure. Most oil and gas operations list fluid volumes in barrels.

Baseline Water Sampling (See Colorado Oil and Gas Conservation Commission Rule 609).
Initial (predrilling) baseline water samples collected from available water sources, up to a maximum of four (4), within a one-half (1/2) mile radius of a proposed Oil and Gas well, multi-well site, or dedicated injection well. The initial baseline testing includes pH, specific conductance, total dissolved solids (TDS), dissolved gases (methane, ethane, propane), alkalinity (total bicarbonate and carbonate as CaCO3), major anions (bromide, chloride, fluoride, sulfate, nitrate and nitrite as N, phosphorus), major cations (calcium, iron, magnesium, manganese, potassium, sodium), other elements (barium, boron, selenium and strontium), presence of bacteria (iron related, sulfate reducing, slime forming), total petroleum hydrocarbons (TPH) and BTEX compounds (benzene, toluene, ethylbenzene and xylenes). Field observations such as odor, water color, sediment, bubbles, and effervescence are also documented.

Basin
A large bowl-shaped depression in the subsurface under the land surface that has the potential to contain oil and gas. The Denver Basin, sometimes called the Denver-Julesburg Basin or the D-J Basin is centered in eastern Colorado and extends into southeast Wyoming, western Nebraska, and western Kansas. It underlies the Denver-Aurora Metropolitan Area on the eastern side of the Rocky Mountains. Most of the oil and gas production on the eastern side of Colorado comes from sedimentary layers that were deposited in the Denver Basin.

Best Management Practice (BMP)
Practices that are designed to prevent or reduce impacts caused by oil and gas operations to air, water, soil, or biological resources, and to minimize adverse impacts to public health, safety and welfare, including the environment and wildlife resources.

Biogenic Gas
Biogenic methane gas is formed at shallow depths and low temperatures by anaerobic bacterial decomposition of sedimentary organic matter. (Also see thermogenic gas).

Blowout Preventer (BOP)
A large valve at the top of a well that may be closed if the drilling crew loses control of formation fluids. By closing this valve (usually operated remotely), the drilling crew usually regains control of the reservoir and procedures can then be initiated to increase the density of the drilling fluid (also known as drilling mud). BOPs come in a variety of styles, sizes, and pressure ratings. Some can effectively close over an open wellbore, some are designed to seal around tubular components in the well (drillpipe, casing, or tubing) and others are fitted with hardened steel shearing surfaces that can cut through the drillpipe. Since BOPs are critical to the safety of the crew, the rig, and the wellbore itself, BOPs are inspected, tested, and refurbished at regular intervals.

BMP or Best Management Practice
A BMP is a state-of-the-art mitigation measure applied to oil and natural gas drilling and production to help ensure that energy development is conducted in a responsible manner and to reduce impacts. BMPs can be mandatory or voluntary. Oil and gas operations BMPs can be related to air quality,

community, biological resources, cultural and historic resources, agriculture, health and safety, surface disturbance, soils, vegetation, noise, wildlife, visual aesthetics, water quality and pollution.

BMP is a term used in the United States and Canada to describe a type of water pollution control and includes silt fences, straw wattles, sediment traps, check dams, water bars, and temporary and permanent seeding.

Bonus
Cash consideration paid to a landowner or mineral owner on the execution of an oil, gas or mineral lease that is in addition to any rental or royalty obligations specified in the lease.

Bridge plug
A downhole tool that is located and set to isolate the lower part of the wellbore. Bridge plugs may be permanent or retrievable, enabling the lower wellbore to be permanently sealed from production or temporarily isolated from a treatment conducted on an upper zone.

Brine Water
Formation waters are salty, due to the fact that the geologic formations originated in inland seas. The formation water (or Produced Water) is representative of the water in the inland sees and is sometimes called "connate water". Operators often define brine water as having Total Dissolved Solids (known as TDS, see definition of TDS) of greater than 20,000 mg/l and TDS of 30,000 mg/l is not uncommon. Modern day sea water has a TDS content in the range of 30,000 to 35,000 mg/l. Arapahoe County defines "brine water" as water produced from an oil and gas well with a TDS content of more than 5,000 mg/l and containing no exploration and production waste.

BTEX
An acronym that stands for benzene, toluene, ethylbenzene, and xylenes. These compounds are some of the volatile organic compounds (VOCs) found in petroleum derivatives such as gasoline. Toluene, ethylbenzene, and xylenes have harmful effects on the central nervous system. Benzene is found in the air from emissions from burning coal and oil, gasoline service stations, and motor vehicle exhaust. Acute (short-term) inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidence of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. EPA has classified benzene as a known human carcinogen for all routes of exposure.

Building Unit
A Residential Building Unit; and every five thousand (5,000) square feet of building floor area in commercial facilities or every fifteen thousand (15,000) square feet of building floor area in warehouses that are operating and normally occupied during working hours. Residential Building Units are designed for use as a place of residency by a person, family, or families. The definition includes manufactured, mobile, and modular homes unless they are intended for temporary occupancy or for business. Oil and gas wells must be located no closer than 500 feet from a building unit, unless an exception is granted by COGCC.

Casing
The large diameter pipe that is assembled and inserted into a recently drilled section of a borehole and is typically held in place with cement.

Cement Bond Log
Performed by lowering an acoustic survey tool into the well after the surface casing is set and cemented in place to a depth of 50 feet below the lowest aquifers. The cement bond log records the quality or hardness of the cement used in the annulus to bond the casing and the formation. Operators are required to re-cement any places between the casing and the borehole where the cement is not sufficient.

Cement casing
To fill the annulus between the casing and wall of the hole with cement to support the casing and prevent fluid migration between permeable zones.

Christmas Tree
An assembly of valves mounted on the casinghead through which a well is produced. The Christmas tree also contains valves for testing the well and shutting it in if necessary.

Circulation System
The complete, circuitous path that the drilling fluid travels. Starting at the main rig pumps, major components include surface piping, the standpipe, the kelly hose (rotary), the kelly, the drillpipe, drill collars, bit nozzles, the various annular geometries of the openhole and casing strings, the bell nipple, the flowline, the mud-cleaning equipment, the mud tanks, the centrifugal precharge pumps and, finally, the positive displacement main rig pumps.

Clean Air Act (CAA)
A Federal law designed to control air pollution on a national level. It requires the Environmental Protection Agency (EPA) to develop and enforce regulations to protect the public from airborne contaminants known to be hazardous to human health.

The first federal legislation to actually pertain to "controlling" air pollution was the Clean Air Act of 1963. In 1967, the Air Quality Act enabled the federal government to increase its activities to investigate enforcing interstate air pollution transport, and to perform far-reaching ambient monitoring studies and stationary source inspections. The 1967 act also authorized expanded studies of air pollutant emission inventories, ambient monitoring techniques, and control techniques.

Major amendments to the law, requiring regulatory controls for air pollution, passed in 1970, 1977 and 1990. The 1970 amendments greatly expanded the federal mandate, requiring comprehensive federal and state regulations for both stationary (industrial) pollution sources and mobile sources. It also significantly expanded federal enforcement. The 1990 amendments addressed acid rain, ozone depletion, and toxic air pollution, established a national permits program for stationary sources, and increased enforcement authority. The amendments also established new auto gasoline reformulation requirements.

Clean Water Act (CWA)
The primary federal law in the United States governing water pollution, passed in 1972. The objective of the Federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA), is to restore and maintain the chemical, physical, and biological integrity of the nation's waters by preventing point and nonpoint pollution sources, providing assistance to publicly owned treatment works for the improvement of wastewater treatment, and maintaining the integrity of wetlands.

Closed-loop drilling system
Closed-loop systems use above-ground portable tanks instead of earthen pits. A typical closed-loop system includes a series of linear-motion shakers, mud cleaners and centrifuges followed by a dewatering system. Waste water is pumped directly into enclosed steel storage containers and held for processing. The equipment typically results in a "dry" location where a reserve pit is not required, used fluids are sometimes recycled, and solid wastes can be landfarmed, hauled off, or injected downhole. Up to 50 percent of the frack water can potentially be recovered and reused.

COGA (Colorado Oil and Gas Association)
COGA is an oil and gas industry organization. They list their mission as representing and advocating industry views while promoting the beneficial, efficient, responsible, and environmentally sound development, production and usage of Colorado oil and natural gas.

COGCC (Colorado Oil and Gas Conservation Commission)
The COGCC is the state regulatory agency governing oil and gas exploration, financial assurance, safety, permitting, setbacks, baseline water sampling, completions, production, reporting, remediation, waste water injection, enhanced recovery, and well abandonment. The COGCC is to foster the responsible development of Colorado's oil and gas natural resources. Responsible development results in the following:

- The efficient exploration and production of oil and gas resources in a manner consistent with the protection of public health, safety and welfare
- The prevention of waste
- The protection of mineral owners' correlative rights
- The prevention and mitigation of adverse environmental impacts

Completion
The process of making a well ready for production or injection. This principally involves preparing the bottom of the hole to the required specifications, running in the production tubing and its associated downhole tools as well as perforating the casing, stimulating as required and cementing the casing. Hydraulic fracturing, also known as fracking, is one of the completion activities.

Compressor Station
Any combination of facilities that supply the energy to move gas in transmission or distribution lines or into storage by increasing the pressure.

Condensate
Natural gas condensate is a low-density mixture of hydrocarbon liquids that are present as gaseous components in the raw natural gas produced from wells. It condenses out of the raw gas if the temperature or pressure is reduced. Condensate is very similar in composition to refined gasoline.

Condensate Liquids
Hydrocarbons that are in the gaseous phase at reservoir conditions but condense into liquid as they travel up the wellbore and reach separator conditions.

Conductor Casing
Generally, the first string of casing in a well. It may be lowered into a hole drilled into the formations near the surface and cemented in place; it may be driven into the ground by a special pile driver. Its purpose is to prevent the soft formations near the surface from caving in and to conduct drilling mud from the bottom of the hole to the surface when drilling starts. Also called conductor pipe.

Correlative Rights Doctrine
A legal doctrine that limits the rights of landowners to a share of a resource such as oil, gas, or groundwater, to a reasonable share. The reasonable share for oil and gas operations is based on mineral rights ownership. This rule comes into play for oil and gas production because it may be proved that part of the oil and gas produced from a well migrated from adjoining lands. Interfering with one's neighbor's rightful extraction of their subsurface minerals can trigger legal liability.

CPW
The Colorado Parks and Wildlife Division of the Colorado Natural Resources Department.

Crude Oil
A mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Depending upon the characteristics of the crude stream, it may also include 1. Small amounts of hydrocarbons that exist in gaseous phase in natural underground reservoirs but are liquid at atmospheric pressure after being recovered from oil well gas in lease separators and are subsequently comingled with the crude stream without being separately measured. Lease condensate recovered as a liquid from natural gas wells in lease or field separation facilities and later mixed into the crude stream is also included; 2. Small amounts of nonhydrocarbons produced with the oil, such as sulfur and various metals; 3. Drip gases, and liquid hydrocarbons produced from tar sands, oil sands, gilsonite, and oil shale.

Crude oil forms over millions of years from the remains of tiny aquatic plants and animals that are exposed to the combined effects of time, burial, and temperature. As these organisms died, they settled to the ocean floor and were covered with mud. If the mud did not contain enough oxygen for the soft parts of the organisms to decay, they were converted into kerogen, which is later converted into oil.

Crude oil is refined to produce a wide array of petroleum products, including heating oils; gasoline, diesel and jet fuels; lubricants; asphalt; ethane, propane, and butane; and many other products used for their energy or chemical content.

Cuttings
Small pieces of rock that break away from the drilled hole from the action of the drill bit teeth. Cuttings are screened out of the liquid mud system at the shale shakers at the surface and are monitored for composition, size, shape, color, texture, hydrocarbon content and other properties by the mud engineer or the mud logger. The mud logger collects samples of cuttings for subsequent analysis and archiving.

Decibel
A logarithmic unit used to measure sound level. The symbol for the unit is dB. Humans typically hear sounds in the range of 20 to 50 dB in conversation, and upwards of 90 dB when exposed to heavy machinery or aircraft.

Dehydrator
A device used to remove water and water vapors from gas. Gas dehydration can be accomplished through a glycol dehydrator or a dry-bed dehydrator, which use a liquid desiccant and a solid desiccant, respectively. Gas dehydrators are designed to handle only water and gas vapors. If liquid water or oil enters the dehydrator, the device cannot work properly.

Designated Outside Activity Area
A public outdoor venue or recreation area, such as a playground, permanent sports field, amphitheater, trail, open space or other similar place of public assembly.

Development Plan
A plan to develop oil or gas resources at one or more Oil and Gas pads, consistent with the requirements of COGCC's Rule 303.

Directional well
A well purposely deviated from the vertical, using controlled angles to reach an objective location other than directly below the surface location. A directional well may be the original hole or a directional "sidetrack" hole that deviates from the original bore at some point below the surface. Each of the deviations from the common bore is reported as a separate well.

Disposal Well
A well, often a depleted oil or gas well, into which waste fluids can be injected for safe disposal. Disposal wells are subject to regulatory requirements to avoid contamination of fresh water aquifers or producing horizons. (Also see Injection Well).

Dog House
The steel-sided room adjacent to the rig floor, usually having an access door close to the driller's controls. This general-purpose shelter is a combination tool shed, office, communications center, coffee room, lunchroom and general meeting place for the driller and his crew. It is at the same elevation as the rig floor, usually cantilevered out from the main substructure supporting the rig.

Domestic Gas Well
A gas well that produces solely for the use of the surface owner. The produced gas cannot be sold, traded, or bartered.

Downstream
The oil and gas operations that take place after the production phase, through to the point of sale. Downstream operations can include oil and gas pipelines, refining crude oil and distributing the by-products down to the retail level.

Drilling Mud
A heavy, viscous fluid mixture that is used in oil and gas drilling operations to carry rock cuttings to the surface and also to lubricate and cool the drill bit. Drilling mud is pumped down the hollow drill pipe to the drill bit, where it exits the pipe and then is flushed back up the borehole to the surface. The drilling mud, by hydrostatic pressure, also helps prevent the collapse of unstable strata into the borehole and the intrusion of water from water-bearing strata that may be encountered.

Drilling muds are traditionally based on water, either fresh water, seawater, naturally occurring brines, or prepared brines. A typical water-based drilling mud contains a clay, usually bentonite, to give it enough viscosity to carry cutting chips to the surface, as well as a mineral such as barite, to increase the weight of the column enough to stabilize the borehole. Many muds are oil-based, using direct products of petroleum refining such as diesel oil or mineral oil as the fluid matrix. For economic and environmental reasons, oil- and synthetic-based muds are usually cleaned and recirculated

Drill Pipe
Tubular steel conduit fitted with special threaded ends called tool joints. The drillpipe connects the rig surface equipment with the bottomhole assembly and the bit, both to pump drilling fluid to the bit and to be able to raise, lower and rotate the bottomhole assembly and bit.

Drilling
The act of boring a hole (1) to determine whether minerals are present in commercially recoverable quantities and (2) to accomplish production of the minerals (including drilling to inject fluids).

Exploratory: Drilling to locate probable mineral deposits or to establish the nature of geological structures; such wells may not be capable of production if minerals are discovered.

Developmental: Drilling to delineate the boundaries of a known mineral deposit to enhance the productive capacity of the producing mineral property.

Directional: Drilling that is deliberately made to depart significantly from the vertical.

Drilled and Abandoned
A well that was abandoned by plugging shortly after drilling because it was not sufficiently capable of producing at economic rates.

Drilling Fluid
Any of a number of liquid and gaseous fluids and mixtures of fluids and solids (as solid suspensions, mixtures and emulsions of liquids, gases and solids) used in operations to drill boreholes into the earth. Synonymous with "drilling mud" in general usage, although some prefer to reserve the term "drilling fluid" for more sophisticated and well-defined "muds."

Drilling Pits
Pits used during drilling or initial completion operations at a well. The four types are: ancillary, completion, flowback, and reserve pits.

Ancillary Pits: Used to contain fluids during drilling operations and initial completion procedures.

Completion Pits: Used to contain fluids and solids from initial completion operations and not constructed for drilling operations.

Flowback Pits: Used to contain fluids and solids produced from initial completion operations (e.g. fluids that come out of the formation immediately after fracking). Flowback pits must be lined, per COGCC standards.

Multi-Well Pits Often the size of two football fields or larger, these pits generally start out with fresh water or groundwater provided from water wells, or purchased from a municipality or water-provider. As the water is recycled, for use over and over, with subsequent drilling and completions, the water becomes more saline (higher TDS; see TDS definition) because the pit water is in contact with formation water (saline due to the origin of the sediments in inland seas or deep ocean water). The trace amounts of hydrocarbons in the pit water also increase with each completion due to contact between the water and the oil- and gas-bearing formations.

Reserve Pits: Used to store drilling fluids or to contain wastes generated during drilling operations and initial completion.

E & P Waste (Exploration and Production Waste)
Defined as drilling wastes, salt water and other wastes associated with the exploration, development, and production of crude oil or natural gas. E & P wastes are exempt from the Federal Resource Conservation and Recovery Act (RCRA), as amended, but are regulated by COGCC.

Enhanced Recovery
The implementation of various techniques for increasing the amount of crude oil that can be extracted from an oil field. Enhanced oil recovery is also called improved oil recovery or tertiary recovery (as opposed to primary and secondary recovery). According to the US Department of Energy, there are three primary techniques for EOR: thermal recovery, gas injection, and chemical injection.

Environmental Impact Statement
A report that documents the information required to evaluate the environmental impact of a project. It informs decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the environment.

EPA (Environmental Protection Agency)
The Environmental Protection Agency (EPA) was established in December 1970. The EPA is an agency of the federal government whose mission is to protect human and environmental health. The EPA is responsible for conducting environmental assessment, monitoring, standard-setting, research and education to create and enforce standards and laws that will promote the health of individuals and the environment. In addition, the EPA is charged with determining safe tolerance levels for chemicals and other pollutants in food, animal feed and water. The EPA is able to enforce its findings through fines, sanctions and other procedures.

EPCRA (Emergency Planning and Community Right-To-Know Act)
The objective of EPCRA is to: (1) allow state and local planning for chemical emergencies, (2) provide for notification of emergency releases of chemicals, and (3) address communities' right-to-know about toxic and hazardous chemicals.

Exception Zone
The concentric area around a proposed well location that is 500 feet or less from a building unit. For COGCC approval to drill in an exception zone, delivery notification must be documented and increased mitigation measures are required.

Facility
Defined by Arapahoe County as related to oil and gas exploration, completion, production, storage, and processing. Facilities include oil and gas wells with associated separators and combusters, tank batteries, lease roads, pipelines, compressor stations, gas plants, and storage facilities. Pipelines (Gathering Systems), Salt Water Disposal wells and Injection wells are not included in the County's use of the term.

Fee Interest
The absolute, legal possession and ownership of land, property, or rights, including mineral rights. A fee interest can be sold (in its entirety or in part) or passed on to heirs or successors.

Fee Simple
An interest in land. Land owned in fee simple is owned completely, without any limitations or conditions. This type of unlimited estate is called absolute. A fee simple is generally created when a deed gives the land with no conditions, usually using the words like "to John Doe" or "to John Doe and his heirs".

Financial Assurance
A surety bond, cash collateral, certificate of deposit, letter of credit, escrow account, lien on property, security interest, guarantee, or other instrument or method acceptable to the County for liability concerns related to public health, safety, welfare and the environment. The term encompasses general liability insurance and pollution insurance.

Flaring
The intentional, controlled combustion of volatile hydrocarbons during exploration and production. Flaring is usually used as a safety measure to burn off flammable gas released by pressure release valves but can be used when wells are not hooked into a pipeline.

Floodplain
Any land area that will in inundated or flooded from the 100-year flood, as defined by any Colorado municipality or county, State agency or Federal agency.

Flowback
After a well is drilled, a mixture of water, sand, and chemical additives is injected under pressure to fracture the shale reservoir, which enhances the flow of oil and gas for collection. Most of the water used in fracturing remains thousands of feet underground, however, about 20 percent returns to the surface through a steel-cased well bore and is temporarily stored in steel tanks or lined pits. The wastewater which returns to the surface after hydraulic fracturing is called flowback. Flowback pits contain a mixture of fresh water purchased from water suppliers, brine water (produced water), and fracing fluids (water, often recycled, plus sand and chemicals).

Natural gas also comes to the surface during flowback. The natural gas can't be routed to a pipeline because the initial gas from the well is not pipeline quality. "Green" flowback techniques include routing that natural gas and the flowback liquids to closed tanks, in order to reduce emissions.

Flowlines
A surface pipeline carrying oil, gas or water that connects the wellhead to a manifold or to production facilities, such as heater-treaters and separators.

Formation
A body of rock that is sufficiently distinctive and continuous that it can be mapped. In stratigraphy, a formation is a body of strata (layers) of predominantly one type or combination of types. Subdivisions of formations are called members.

FracFocus Chemical Disclosure Registry
This website provides a central location for public and industry to communicate and relay information on the chemicals used during the process of hydraulic fracturing of oil or gas wells. The FracFocus website provides impartial and balanced education tools to the public on the topic of hydraulic fracturing.

Fractionation
The process by which saturated hydrocarbons are removed from natural gas and separated into distinct products, or "fractions," such as propane, butane, and ethane.

Fracturing ("fracing", pronounced fracking, aka hydraulic fracking). Fracking is a technique used to stimulate production in oil and gas wells. Fluid is pumped into the well at pressures high enough to fracture the oil/gas bearing formation. This allows injection of propant (sand) into the formation which props open the fracture and enhances flow of oil and gas back into the well bore. (Also see Hydraulic Fracturing).

Freeboard
Storage volume required in a pit for containment of fluids above the normal fluid storage line, measured from the lowest elevation of the top of the pit. Generally, pits are constructed with 2 feet of freeboard and must be able to contain precipitation in addition to drilling or completion fluids. COGCC requires continuous mechanical monitoring of freeboard for both lined and unlined pits.

Fresh Water
Fresh water is defined by Arapahoe County as a having Total Dissolved Solids (TDS) concentration of less than 5,000 mg/l and containing no E & P Waste. Operators often define "fresh water" as having TDS of up to 10,000 mg/l and brackish water as having TDS in the range of 5,000 – 20,000. (See "Brine Water" definition).

Fugitive Emissions
Unintended leaks of gas from the production, processing, transmission, and/or transportation of fossil fuels.

Gas STAR Program
A flexible, voluntary partnership that encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce methane emissions.

Gathering System
The network of pipes and process facilities that transport and control the flow of oil or gas from the wells to a main storage facility, processing plant or shipping point. A gathering system includes pumps, separators, emulsion treaters, tanks, regulators, compressors, dehydrators, valves and associated equipment.

Green Completions
Practices intended to reduce emissions of salable gas and condensate vapors during cleanout and flowback operations prior to the well being placed on production. Green completion essentially requires natural gas companies to capture the gas at the well head immediately after well completion instead of releasing it into the atmosphere or flaring it.

Groundwater
Water that collects or flows beneath the earth's surface, filling the pore spaces in soil, sediment, and rocks. Groundwater originates from rain and melting snow and is the source water for aquifers, springs, and wells. The upper surface of groundwater is the water table. Groundwater can be brought to the surface through wells, springs, seeps or other discharge areas.

H_2S (Hydrogen Sulfide) Gas
Hydrogen Sulfide gas is highly poisonous, and even fatal, in very low concentrations. It is associated with the production of oil and gas, particularly in West Texas and Southeast New Mexico. In the early days of oil and gas, drillers kept canaries in cages at the drilling platform. If the canary dropped off its perch, all hands would leave the area immediately.

Hazardous Waste
A waste that is dangerous or potentially harmful to health or the environment. Hazardous wastes can be liquids, solids, gases, or sludges. They can be discarded commercial products, like cleaning fluids or pesticides, or the by-products of manufacturing processes.

High Occupancy Building Unit
Defined by COGCC as any public school, non-public school, nursing facility, hospital, correctional facility or child care center. The COGCC requires a setback of 1,000 feet from wells to high occupancy buildings. Exceptions can be granted by COGCC but have not been so far.

High Priority Habitat
As used herein shall have the same definition as stated in the Colorado Oil and Gas Conservation Commission Rules of Practice and Procedure, 100 Series Definitions (2 CCR 404-1 and as may be duly amended).

Hydraulic Fracturing (aka Fracking)
A controlled operation that pumps a fluid and a propping agent through the wellbore to the target geological formation at high pressure in multiple stages, in order to create fractures in the formation to facilitate the flow of hydrocarbons into the well. The fractures which are created in the rock act as flow channels for the oil and gas to the well. The process has been used throughout the oil and gas industry for about 60 years; however, recent technological advances in hydraulic fracturing and horizontal drilling have made it possible to produce from formations that were previously unproductive.

Hydrocarbon
A substance (such as coal, oil or natural gas) that contains only hydrogen and carbon.

Initial well completion
For an oil or gas well facility producing oil, the date when the first oil is produced through wellhead equipment into lease tanks from the ultimate producing interval after casing has been run; and for an oil or gas well facility producing gas, the date when the oil or gas well facility is capable of producing gas through wellhead equipment from the ultimate producing interval after casing has been run.

Injection Well
Any hole drilled into the earth into which oil and gas liquids or gasses are injected for the purpose of secondary recovery, storage, pressure maintenance, or disposal, pursuant to authorization granted by the COGCC. Produced water disposal is safely injected beneath any fresh water zones.

Intermediate Casing
The string of casing set in a well after the surface casing but before production casing is set to keep the hole from caving and to seal off formations. In deep wells, one or more intermediate strings may be required.

Kelly and Kelly Bushing (KB)
A long square or hexagonal steel bar with a hole drilled through the middle for a fluid path. The Kelly is used to transmit rotary motion from the rotary table or Kelly Bushing to the drillstring, while allowing the drillstring to the lowered or raised during rotation. The Kelly goes through the Kelly Bushing, which is driven by the rotary table. The Kelly Bushing has slightly larger dimensions so that the Kelly can move freely up and down inside. The Kelly Bushing elevation relative to sea level is used for reporting well elevations.

Kick
A kick is a well control problem in which the pressure found within the drilled rock is higher than the mud hydrostatic pressure acting on the borehole or rock face. When this occurs, the greater formation pressure has a tendency to force formation fluids into the wellbore. This forced fluid flow is called a kick. If the flow is successfully controlled, the kick is considered to have been killed. An uncontrolled kick that increases in severity may result in what is known as a "blowout."

Landman
A landman or "petroleum landman" is an individual who performs various services for oil and gas exploration and production companies. These services include: negotiating for the acquisition or divestiture of mineral rights; negotiating business agreements that provide for the exploration and/or development of minerals; determining ownership in minerals through the research of public and private records; reviewing the status of title, curing title defects and otherwise reducing title risk associated with ownership in minerals; managing rights and/or obligations derived from ownership of interests in minerals; and unitizing or pooling of interests in minerals.

In simple terms, a landman is a person who negotiates with mineral owners regarding the leasing of their mineral rights on behalf of an oil company or as an independent contractor.

Landowner
Any owner of record of federal, tribal, state, county, municipal, or private land. Ownership is commonly divided into "surface owner" and "mineral owner". In Colorado, most mineral rights have been severed from the surface rights.

Lithology
The lithology of a rock unit is a description of its physical characteristics visible at outcrop, in hand or core samples or with low magnification microscopy, such as color, texture, grain size, or composition.

LGD (Local Government Designee)
The Local Government Designee receives all notifications of oil and gas operations under the rules and regulations of the Colorado Oil and Gas Conservation Commission (COGCC). The Designee is responsible for distributing notifications to affected departments within the local government and provides a coordinated response to oil and gas operators and the COGCC.

Local Emergency Planning Committees (LEPCs)
Community-based organizations that assist in preparing for emergencies, particularly those concerning hazardous materials. Under the Emergency Planning and Community Right-to-Know Act (EPCRA), Local Emergency Planning Committees (LEPCs) must develop an emergency response plan, review the plan at least annually, and provide information about chemicals in the community to citizens. Plans are developed by LEPCs with stakeholder participation. There is one LEPC for each of the more than 3,000 designated local emergency planning districts. The LEPC membership must include (at a minimum):

Elected state and local officials; Police, fire, civil defense, and public health professionals;
Environment, transportation, and hospital officials; Facility representatives; Representatives from community groups and the media.

Some required elements of the community emergency response plan, developed by the LEPC, include:

- Identification of facilities and transportation routes of extremely hazardous substances;
- Description of emergency response procedures, on and off site;
- Designation of a community coordinator and facility emergency coordinator(s) to implement the plan;
- Outline of emergency notification procedures;
- Description of how to determine the probable affected area and population by releases;

- Description of local emergency equipment and facilities and the persons responsible for them;
- Outline of evacuation plans;
- A training program for emergency responders (including schedules);
- Methods and schedules for exercising emergency response plans.

Though LEPCs were created with the Federal law EPCRA, through EPA, they are often funded partially by the U.S. Department of Transportation's Hazardous Materials Emergency Preparedness grant program. Other sources of funding may include local jurisdictions, industry, businesses, NGOs, and other public or private grants.

Location
A definable area where an operator has disturbed or intends to disturb the land surface in order to locate an oil and gas facility. Industry refers to well pads as "locations".

Log or Well Log or Well Bore Log
A detailed record of geological formations penetrated during drilling. The term refers to all of the following: the record of borehole cuttings, drill stem tests, and electric, acoustic, and radioactivity logs.

Mechanical Integrity Test
The act of setting a packer or retrievable bridge plug above the perforations in a wellbore and applying pressure to the annulus in order to ensure soundness of the casing.

Methane or CH_4
The lightest and most abundant of the hydrocarbon gases and the principal component of natural gas. Methane is a colorless, odorless gas that is stable under a wide range of pressure and temperature conditions.

Midstream
The midstream sector involves the transportation (by pipeline, rail, barge, oil tanker or truck), storage, and wholesale marketing of crude or refined petroleum products.

Mineral
An element or chemical compound that has been formed as a result of geological processes. For the purpose of this glossary, the word "minerals" refers to crude oil and natural gas products.

Mineral Owner
A person who owns the minerals under a tract of land but may not own the surface.

Mineral Rights
Property rights that confer to the holder the right to exploit an area for the minerals it contains. Minerals include oil and gas. Mineral rights are usually severed from surface property rights; however, in Arapahoe County some surface owners are also mineral rights owners.

MIRU
Abbreviation for move in and rig up.

Mitigate/Mitigation
Measures that compensate for unavoidable direct, indirect, and cumulative adverse Impacts. As used in regulations, mitigation applies to best management practices to minimize the impacts of development relating to noise, light pollution, odors, traffic, intrusion into wildlife habitat and encroachment on residential, commercial or agricultural properties.

Modified Closed Loop drilling system (Arapahoe County definition, based on Anadarko's definition)
A combination of open pit and closed looped systems. Air or fresh water is used to drill the first part of the hole (just below all fresh water aquifers) when a closed loop system of closed tanks is used for the remainder of the drilling and/or completion or recompletion procedures. See the definition of closed-loop drilling systems.

Monitoring Wells
A groundwater monitoring well consists of a pipe installed in the ground, after boring into a groundwater source, which collects water for testing purposes.

An oil and gas stratigraphic test well (or monitor well) is drilled to obtain information on the thickness, lithology, porosity, and permeability of the rock layers. Monitor wells are drilled vertically rather than horizontally.

MSDS (Material Safety Data Sheet more recently referred to as SDS)
Required by OSHA, it summarizes information about a chemical or chemical product, including other names for the chemical, chemical composition, safety precautions for use, such as personal protective equipment, and a medical response synopsis, in case of exposure. Recently the term has been changed to Safety Data Sheet (SDS).

Mud (Drilling Mud)
A mixture of clays, water, and chemicals pumped down the drill string while an oil well is being drilled to lubricate and cool the drill bit, carry away rock cuttings, and maintain pressure so that oil or gas does not escape from the formations encountered prior to setting casing and cementing.

Mud Logger
An engineer, geologist, or technician in the oil and gas industry who works on a drilling location and collects samples of cuttings for subsequent analysis and archiving. A mud logger looks for traces of oil and gas and records their respective depths as the drill bit progresses through hydrocarbon-bearing formations.

National Environmental Policy Act (NEPA)
The National Environmental Policy Act was signed into law on January 1, 1970. The Act establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment and provides a process for implementing these goals within the federal agencies. The Act also establishes the Council on Environmental Quality (CEQ).

The NEPA process consists of an evaluation of the environmental effects of a federal undertaking including its alternatives. There are three levels of analysis: categorical exclusion determination; preparation of an environmental assessment/finding of no significant impact (EA/FONSI); and preparation of an environmental impact statement (EIS).

Categorical Exclusion: At the first level, an undertaking may be categorically excluded from a detailed environmental analysis if it meets certain criteria which a federal agency has previously determined as having no significant environmental impact. A number of agencies have developed lists of actions which are normally categorically excluded from environmental evaluation under their NEPA regulations.

EA/FONSI: At the second level of analysis, a federal agency prepares a written environmental assessment (EA) to determine whether or not a federal undertaking would significantly affect the environment. If the answer is no, the agency issues a finding of no significant impact (FONSI).

FONSI may address measures which an agency will take to mitigate potentially significant impacts.

EIS: If the EA determines that the environmental consequences of a proposed federal undertaking may be significant, an EIS is prepared. An EIS is a more detailed evaluation of the proposed action and alternatives. The public, other federal agencies and outside parties may provide input into the preparation of an EIS and then comment on the draft EIS when it is completed.

If a federal agency anticipates that an undertaking may significantly impact the environment, or if a project is environmentally controversial, a federal agency may choose to prepare an EIS without having to first prepare an EA. After a final EIS is prepared and at the time of its decision, a federal agency will prepare a public record of its decision addressing how the findings of the EIS, including consideration of alternatives, were incorporated into the agency's decision-making process.

New Source Performance Standard
Pollution control standards issued by the United States Environmental Protection Agency (EPA). The term is used in the Clean Air Act Extension of 1970 (CAA) to refer to air pollution emission standards, and in the Clean Water Act (CWA) referring to standards for discharges of industrial wastewater to surface waters.

Niobrara Formation
The Niobrara formation is roughly 82-87 Million years old (Upper Cretaceous Geologic time period) and is still in the early stages of development. The formation is part chalk and part shale. While the Niobrara formation extends from Canada to New Mexico, only certain parts of the formation are capable of producing oil and natural gas. Currently, the most productive zones are in the Denver-Julesberg basin of northeast Colorado and southeastern Wyoming. The average depth for Niobrara petroleum producing zones are approximately 7,000 feet deep. Recent innovation in horizontal drilling and multi-stage hydraulic fracturing have made this formation an economically viable resource.

NOV (Notice of Violation)
Issued by a regulatory agency for an item or items of non-compliance, generally identified during an inspection by the agency.

Occupied Structure
Any building, structure or appurtenance to a building or structure that is intended and suitable for human occupancy, at least part-time, whether or not a person is actually present, to include homes, garages, work sheds, hobby sheds, office buildings, businesses, commercial and industrial structures and excluding structures used solely for storage.

Oil Base Mud
An invert-emulsion mud, or an emulsion whose continuous phase is oil (see Drilling Mud).

Oil Lease or Oil and Gas Lease
An oil lease is essentially an agreement between parties to allow a Lessee (the oil and gas company and their production crew) to have access to the property and minerals (oil and gas) on the property of the Lessor. The lease agreement is a legal contract of terms. It contains certain elements, which confirm all the terms of the agreement.

The lease must be dated and the lease also sets the time that the lease is effective. It establishes the primary term of the lease. The date clause is an essential.
The parties section of the lease lists the names of all parties who are bound to the lease.

In the consideration section of the lease it gives the legal terms and ensures that the lease is legally enforceable by all parties.

The use of the property and the purpose for the leasing are in the granting clause. This clause states what rights the lessee has and what is the property subject to the lease.

An important part of the lease is the Lessee rights and how long these rights are in force. There may be other provisions including drilling, delay rental, pooling, shut-in royalty, and continuous drilling clauses among others.

Of great importance to the landowner, the Lessor, is the royalty clause. This clause states the percentage or share of production proceeds that the Lessor receives and how the royalty is received.

Occupational Safety and Health Administration (OSHA)
A federal agency created in 1970 that oversees the federal laws requiring employers to provide employees with a workplace free from hazardous conditions. OSHA laws protect safety and health of workers and give workers the right to know what materials they are handling.

Oil and Gas Location
The definable area where an operator has disturbed or intends to disturb the land surface in order to locate an oil and gas facility. Facilities include oil and gas wells, tank batteries, lease roads, pipelines, compressor stations, gas plants, and storage facilities.

Oil and Gas Location Assessment (OGLA or Form 2A)
The COGCC Form 2A that is required to be submitted for approval prior to any ground disturbance activity associated with oil and gas operations. Approval of the OGLA will allow for construction of the location; however, it does not supersede any land use rules applied by the local land use authority.

Operations
Oil and gas operations means exploration for oil and gas, including the conduct of seismic operations and the drilling of test bores, the siting, drilling, deepening, recompletion, reworking, or abandonment of an oil and gas well, underground injection well, or gas storage well and the generation, transportation, storage, treatment, or disposal of exploration and production wastes, as well as any construction, site preparation, or reclamation activities associated with such operations. Production operations are also included in the term, including the installation of flowlines and gathering systems.

Operator
In the Oil and Gas industry, Operator means the individual, company, trust, or foundation that conducts or manages exploration, development, and production of an oil or gas well or lease. Generally, it is the oil company by whom the drilling contractor is engaged.

Ordinary High-Water Line or Mark
The ordinary high water level is an elevation delineating the highest water level that has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial. For watercourses, the ordinary high water level is the elevation of the top of the bank of the channel. The ordinary high water mark (OHWM) defines the boundaries of aquatic features for a variety of federal, state, and local regulatory purposes.

Ozone
Ozone is a gas composed of three atoms of oxygen. Ozone occurs both in the Earth's upper atmosphere and at ground level. Ozone can be good or bad, depending on where it is found.

Good Ozone. Ozone occurs naturally in the Earth's upper atmosphere 6 to 30 miles above the Earth's surface, where it forms a protective layer that shields us from the sun's harmful ultraviolet rays. Manmade chemicals are known to destroy this beneficial ozone. An area where the protective "ozone layer" has been significantly depleted-for example, over the North or South Pole, is sometimes called "the ozone hole." The United States, along with over 180 other countries, recognized the threats posed by ozone depletion and in 1987 adopted a treaty called the Montreal Protocol to phase out the production and use of ozone-depleting substances. EPA has established regulations to phase out ozone-depleting chemicals in the United States.

Bad Ozone: In the Earth's lower atmosphere, near ground level, ozone is formed when pollutants emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sources react chemically in the presence of sunlight. Ozone at ground level is a harmful air pollutant.

Packer
An expanding plug used in a well to seal off certain sections of the tubing or casing when cementing and acidizing or when a production formation is to be isolated.

Pad Boundary or Well Pad Boundary
The outer limit of the disturbed ground created for the operation of an Oil and Gas Facility.

Paraffin
A hydrocarbon compound that often precipitates on production components as a result of the changing temperatures and pressures within the production system. Heavy paraffins occur as wax-like substances that may build up on the completion components and may, if severe, restrict production. Paraffin is normally found in the tubing close to surface; however, it can form at the perforations, or even inside the formation.

Payout
When the costs of drilling, producing, and operating have been recouped from the sale of products from a well.

Perforation
Holes punched in the well casing by perforating "guns" to connect the well to the oil and gas reservoir. After perforation most oil and gas wells are fracked by injecting pressurized water, sand, and trace levels of chemicals through the perforation holes. See perforating gun definition below.

Perforating gun
A special tool used downhole for shooting holes in the well's casing opposite the producing formation. The gun, a steel tube of various lengths, has steel projectiles placed at intervals over its outer circumference, perpendicular to the gun's long axis. When lowered into the well's casing on a wireline opposite the formation to be produced, the gun is electronically fired, shooting holes in the casing that extend into the formation, and permit the flow of oil or gas into the casing.

Permeability
The ability of a rock to transmit fluids. Formations that transmit fluids readily, such as sandstones, are described as permeable and tend to have many large, well-connected pores. Impermeable formations, such as shales and siltstones, tend to be finer grained or of a mixed grain size, with smaller, fewer, or less interconnected pores.

Pig
A device inserted into a pipeline to clean the pipes or detect leaks. A cleaning pig removes loose sediment or scale buildup. A "smart pig" is used to inspect pipelines for the purpose of preventing leaks that can be explosive and dangerous to the environment.

Pipeline
A crude oil transfer line or gathering line as defined in the COGCC rules. Flowlines (see above) are not included in the definition of pipeline. The pipes are made from steel or plastic tubes and are usually buried.

Pits
Pits used during drilling or initial completion operations at a well are listed here. The four types are: ancillary, completion, flowback, and reserve pits.

Ancillary Pits: Used to contain fluids during drilling operations and initial completion procedures.

Completion Pits: Used to contain fluids and solids from initial completion operations and not constructed for drilling operations.

Flowback Pits: Used to contain fluids and solids produced from initial completion operations (e.g. fluids that come out of the formation immediately after fracking).

Multi-Well Pits Often the size of two football fields or larger, these pits generally start out with drinking water or groundwater provided from water wells, or purchased from a municipality or water-provider. As the water is recycled, for use over and over, with subsequent drilling and completions, the water becomes more

saline (higher TDS – see TDS definition) because the pit water is in contact with formation water (saline due to the origin of the sediments in inland seas or deep ocean water). The trace amounts of hydrocarbons in the pit water also increase with each completion due to contact between the water and the oil- and gas-bearing formations.

Reserve Pits: Used to store drilling fluids or to contain wastes generated during drilling operations and initial completion.

Play
The activities associated with petroleum development in an area. Drilling and production activity in the Niobrara in formation in the Denver Basin is referred to as the Niobrara play.

Plug
To fill a well's borehole with cement 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.

Plugging and Abandonment (P&A)
The cementing of a well, the removal of its associated production facilities, the removal or abandonment in-place of its flowline, and the reclamation of the wellsite.

Pooling
The combination of all or portions of multiple oil and gas leases to form a unit for the drilling of an oil and/or gas well. The unit is generally one or a combination of government survey quarter-quarter sections. Generally the interest owners in the pooled unit share the revenue from the well on the basis of surface acreage or mineral acreage owned by each interest owner in the pooled unit. The oil and gas company can lease these under separate leases and separate terms and then "pool" these parcels to drill the well. Each landowner will receive income based on the terms of their particular lease.

Note that **Forced Pooling**, also referred to as involuntary pooling or statutory pooling, occurs when the company cannot voluntarily pool the necessary tracts or mineral interests to drill the well, so the company uses Colorado's statutory law to obtain pooling consent. In such a situation, the company applies to the Colorado Oil and Gas Conservation Commission for a pooling order. Statutory pooling allows the company to 'force' mineral owners of non-consenting tracts into the pool so it can efficiently produce the minerals under all tracts without incurring unnecessary costs, stranding finite natural resources, or causing additional surface disturbance. If a non-consenting owner decides not to sign the lease, then it can decide to participate or not participate in the well prior to being force pooled. If the owner refuses to pool, then the company must apply for a statutory pooling order from the COGCC to drill through and produce from all of the tracts in the unit. An owner may elect to not participate in the well prior to the hearing. If the tract owner affirmatively elects to become a nonconsenting owner, then its relationship with the company is governed by a separate contract. Each separate contract is different.
In the absence of voluntary pooling, the commission, upon the application of a person who owns, or has secured the consent of the owners of, more than forty-five percent of the mineral interests to be pooled, may enter an order pooling all interests in the drilling unit for the development and operation

of the drilling unit. Once the COGCC approves the order, only then is the non-consenting owner officially 'force pooled.' Colorado statute dictates that the non-consenting owner is entitled to a 16% royalty payment for oil production and a 13% royalty payment for gas production on its proportionate share of the drilling unit after the operator and the consenting mineral owners recover 200% of the associated permitting, drilling and production facility costs. Once the revenue from the well exceeds 200% of the expenses involved (permitting, pad construction, drilling, completion and production equipment) the owner will receive their true proportionate share of production and be responsible for its proportionate share of costs, just as if it participated in the well. At that point the non-consenting owner is also responsible for all liabilities. A mineral owner involved in a pooling order application should contact an experienced oil and gas attorney to determine whether the 'non-consent' option makes sense given all the facts and circumstances of the specific scenario.

Porosity
The percentage of pore volume or void space, or that volume within rock that can contain fluids. Porosity can be a relic of deposition (primary porosity, such as space between grains that were not compacted together completely) or can develop through alteration of the rock (secondary porosity, such as when feldspar grains or fossils are preferentially dissolved from sandstones). Porosity can be generated by the development of fractures, in which case it is called fracture porosity. Shale gas reservoirs tend to have relatively high porosity, but the alignment of platy grains such as clays makes their permeability very low.

Privacy Fencing
Fencing surrounding the pad and constructed to restrict access to and views of the facility pad that is eight feet in height. Privacy fencing shall be Class 5 – Solid fencing as defined in section 4-1.3 of the Arapahoe County Land Development Code.

PPE (Personal Protective Equipment)
Personal Protective Equipment, required by OSHA, as protection from exposure at locations, facilities and plants. PPE includes safety goggles, hearing protection, hard hats, steel-toed shoes and fire retardant clothing. For oil and gas facilities, it can also include respiratory equipment (masks) and personal monitors that emit a warning sound if H_2S gas is known to occur in the area (Hydrogen Sulfide gas is highly poisonous and even fatal, in very low concentrations).

Produced Water
Naturally-occurring ("connate") water that exists in the formation and is "produced" along with hydrocarbons. This water is generally saline (due to formation deposition in marine environments), containing minerals such as barium, calcium, iron, and magnesium, in addition to sodium chloride (NaCl). Produced water is generally disposed in disposal wells. When drilling and hydraulic fracturing occur, produced water flows are high due to "flowback" of water injected during the completion operations. Approximately 50% of all produced water that is released from drilling and stimulation comes out of the well in the first few days to a week, and is stored in holding and treatment tanks. After the well is serviced, water can keep flowing from the well for long periods of time depending on the quantity of water in the target formation. The remainder of this water is stored in holding tanks, for eventual disposal.

Production Casing
The innermost casing string that straddles and isolates the producing interval.

Production tubing
A kind of casing tube used in a wellbore through which production fluids are produced. Production tubing is run into the drilled well after the casing is run and cemented in place. Production tubing protects wellbore casing from wear, tear, corrosion, and deposition of by-products, such as sand/silt, paraffins, and asphaltenes. Along with other components that constitute the production string, it provides a continuous bore from the production zone to the wellhead through which oil and gas can be produced. It is usually between five and ten centimeters in diameter and is held inside the casing through the use of expandable packing devices. The purpose and design of production tubing is to enable quick, efficient, and safe installation, removal and re-installation. If there is more than one zone of production in the well, up to four lines of production tubing can be inserted into the well casing.

Pull out of the hole
To remove the drillstring from the wellbore. Synonyms: come out of the hole, trip out

Pump Jack
A pump connected to a source of power to produce fluids from a well that resembles a bobbing horse when operating.

Release
Any unauthorized discharge of any exploration and production waste or other pollutant to the environment, suddenly or over time.

Roughneck
A member of the drilling crew who works under the direction of the driller to make or break connections as drill pipe is tripped in or out of the hole. On most drilling rigs, roughnecks are also responsible for maintaining and repairing much of the equipment found on the drill floor and derrick.

Resource Conservation and Recovery Act (RCRA)
Passed in 1976 and expanded in 1980 as CERCLA, the act regulates land-based disposal of waste. The objectives of RCRA are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, to encourage recycling, and to ensure that wastes are managed in an environmentally sound manner. RCRA regulates the management of solid waste (e.g., garbage), hazardous waste, and underground storage tanks holding petroleum products or certain chemicals and focuses on hazardous waste. Rather than being a ban on land-based disposal, it focuses on the use of "manifests" and the "cradle-to-grave" tracking system. All hazardous waste must obtain an identification number, and be accompanied by a "manifest" which tracks the waste. Each time the waste changes hands, a copy is sent back, ensuring that everyone along the chain is informed, and preventing unidentified wastes from arriving at disposal facilities. Both RCRA and CERCLA are related to the transportation, storage, treatment or disposal of hazardous substances.

Reclamation
The process of returning or restoring the surface of disturbed land as nearly as practicable to its condition prior to the commencement of oil and gas operations or to landowner specifications with an approved variance.

Recompletion
The modification of an existing well for the purpose of producing oil or gas from a different producing formation.

Release
Any unauthorized discharge of E&P waste to the environment over time. Includes spills, leaks, and discharges.

Remediation
The action of remedying something, in particular of reversing or stopping environmental damage.

Reserve Pit
Pit used to store fluids from drilling operations or to contain wastes generated during drilling operations and initial completion.

Reservoir
A porous, permeable sedimentary rock formation or a portion of a formation containing oil and/or gas enclosed or surrounded by layers of less permeable or impervious rock.

Reworking
Conducted to restore economically viable production from a formation already producing, where the production rate has decreased over time.

Rig
The machine used to drill a wellbore. In onshore operations, the rig includes virtually everything except living quarters. Major components of the rig include the mud tanks, the mud pumps, the derrick or mast, the drawworks, the rotary table or topdrive, the drillstring, the power generation equipment and auxiliary equipment. Offshore, the rig includes the same components as onshore, but not those of the vessel or drilling platform itself. Synonym: drilling rig.

Riparian Area
Riparian areas are the portions of the landscape that border streams and other bodies of surface water. Riparian areas include the floodplain and can include wetland and/or upland vegetation, and are distinguished by having different vegetation types (trees, shrubs, forbs, and/or grasses) than the adjacent uplands (e.g., cottonwood gallery vs. shortgrass prairie) due to closer access to the water table (in many cases). The riparian area begins at the edge of the stream channel (measured at the ordinary high water mark) and continues perpendicularly away from the waterbody to the furthest edge of the riparian vegetation. The riparian zone can be wide, short, or absent along a given stream, depending on a variety of environmental or human-induced conditions.

Royalty
Funds received from the production of oil or gas, free of costs, except taxes.

Safe Drinking Water Act (SDWA)
The Safe Drinking Water Act (SDWA) is the main federal law that ensures the quality of Americans' drinking water. Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. The Safe Drinking Water Act, originally enacted into law in 1974, focuses on ensuring that public drinking water meets appropriate

safety standards; in contrast, the Clean Water Act regulates pollution in our nation's lakes, rivers, and other bodies of water.

Safety Data Sheet (SDS)
Required by OSHA, it summarizes information about a chemical or chemical product, including other names for the chemical, chemical composition, safety precautions for use, such as personal protective equipment, and a medical response synopsis, in case of exposure. Recently the term has been changed to Safety Data Sheet (SDS).

Salt Water Disposal Well
A well, often a depleted oil or gas well, into which produced water can be injected for safe disposal. Disposal wells are subject to regulatory requirements to avoid contamination of fresh water aquifers or producing horizons. (Also see Injection Well).

Sand
A detrital grain between 0.0625 mm and 2 mm in diameter. Sand is larger than silt but smaller than a granule according to the Udden-Wentworth scale. Sand is also a term used for quartz grains or for sandstone.

Scale Inhibitor
A chemical treatment used to control or prevent scale deposition in the production conduit or completion system. Scale-inhibitor chemicals may be continuously injected through a downhole injection point in the completion, or periodic squeeze treatments may be undertaken to place the inhibitor in the reservoir matrix for subsequent commingling with produced fluids.

Scrubber
A device to remove dirt, water, foreign matter, or undesired liquids that are part of the gas flowstream. A scrubber is used to protect downstream rotating equipment or to recover valuable liquids from gas.

Secondary Recovery
The second stage of hydrocarbon production during which an external fluid, such as water or gas, is injected into the reservoir through injection wells into rock that has fluid communication with production wells. The purpose of secondary recovery is to maintain reservoir pressure and to displace hydrocarbons toward the producing wellbore. The most common secondary recovery techniques are gas injection and waterflooding.

Seismic Survey
A seismic survey is a technique similar to an ultrasound that is used to develop images of the rock layers below ground. Combined with information from a test well, seismic surveys help in determining the location and size of oil and gas reservoirs. Sound waves are bounced off underground rock formations and the waves that reflect back to the surface are captured by recording sensors. Analyzing the time the waves take to return provides valuable information about rock types and possible gases or fluids in rock formations.

Separator
A cylindrical vessel used to separate oil, gas, and water from the total fluid stream produced by the well. Separators can either be vertical or horizontal units. Gravity segregation is the main force that

accomplishes the separation which means the heaviest fluid settles to the bottom and the lightest fluid rises to the top.

Setback
Regulated distance from an oil and gas well location to residences, schools, nursing homes or community buildings. Measured from the center of the well to the nearest wall of the residence or other building. Setbacks do not take the size of the drilling or production pad into account so the actual distance between a building and the well pad equipment can be approximately 200 feet less than the measured setback.

COGCC requires a 500-foot setback from most buildings, and 1,000 feet from schools and high-occupancy buildings.

Severed Mineral Interest
An interest in the minerals in, on and under a given tract of land owned by a person other than the surface owner.

Shale
A sedimentary rock that forms from the compaction of silt and clay-size mineral particles that we commonly call "mud". Shales are deposited by water in low velocity environments such as deep ocean basins, lakes, and swamps. Black shales contain organic material that sometimes breaks down to form natural gas or oil.

Shoe
A short assembly typically manufactured from a heavy steel collar and profiled cement interior, that is screwed to the bottom of a casing string. The rounded profile helps guide the casing string past any ledges or obstructions that would prevent the string from being correctly located in the wellbore.
Synonyms: casing shoe.

Shut-in
To close the valves at the wellhead so the well stops flowing or producing. Wells can be shut in on a temporary basis. A shut-in well is capable of production or injection by opening valves, activating existing equipment or supplying a power source. Under COGCC rules, a shut in well is capable of producing or injection by opening valves and must have a mechanical integrity test within 2 years of shut in status.

Slickwater Frack
Slickwater or slick water fracturing is a method or system of hydro-fracturing which involves adding chemicals to water to reduce the viscosity and increase the fluid flow. It is typically used in highly-pressurized, deeper shales, **w**hile fracturing fluids containing nitrogen foam are more common in shallower shales and those that have lower reservoir pressure.

Slugs
Under certain operating conditions, gas and liquid in a pipeline are not evenly distributed throughout the pipeline, but travel as distinct large quantities with mostly liquid or mostly gas.

Slug Catcher
Pipelines can produce large quantities of condensed liquids which can damage pipeline equipment. The slug catcher is a vessel that crudely separates the fluids so that they can be slowly drained off.

Solid Waste Disposal Facility
A facility designed and licensed under applicable state and local law and regulation for the purpose of storage, treatment, processing, or final disposal of solid wastes. Note that "solid waste" can be liquid or solid in form.

SPCC
Spill Prevention, Control and Countermeasures Plan. A plan prepared in compliance with the EPA's Rule for spill prevention control and counter measures, 40 CFR 112 and shall constitute the Oil and Gas Facility's plan to prevent an unwanted discharge of oil, condensate or produced water.

Spill
Any unauthorized sudden discharge of any exploration and production waste or other pollutant to the environment.

Stratigraphic Test Well
A well drilled to obtain information pertaining to a specific geological condition that might lead toward the discovery of an accumulation of hydrocarbons. Such wells are customarily drilled without the intention of being completed for hydrocarbon production.

Stratigraphic Trap
A variety of geologic features capable of retaining hydrocarbons, formed by changes in rock type or pinch-outs, unconformities, or sedimentary features such as reefs. Structural traps, in contrast, consist of geologic structures in deformed strata such as faults and folds whose geometries permit retention of hydrocarbons.

Stimulation
A treatment performed to restore or enhance the productivity of a well. Stimulation falls into 2 groups: Hydraulic Fracturing treatments or Matrix treatments (acidizing).

Surface Casing
The first string of casing (after the conductor casing) that is set in a well. It varies in length from a few hundred to several thousand feet and extends below all known drinking water sources. It is cemented in place before the remaining portion of the well is drilled, in order to cement and protect the aquifers. After the surface casing cement has dried, the remaining portion of the well is drilled.

Surface Use Agreements
Contracts that dictate how an operator will interact with the surface owner when developing the land and extracting resources from the mineral estate. The surface owner commonly receives compensation for signing the surface use agreement.

Surface Water
A perennial or intermittent stream or any perennial surface water body.

Tank
A stationary vessel constructed of non-earthen materials such as concrete, steel or plastic, that is designed and operated to store fluids or exploration and production waste. Examples include, but are not limited to, condensate tanks, crude oil tanks, and produced water tanks.

TD
Total Depth of a well measured along the wellbore.

TDS
Total Dissolved Solids, measured in a liquid sample, in parts per million (ppm). Generally used to quantify "saltiness" of produced water (water that is produced from a well along with oil and gas). The most common chemical constituents are calcium, phosphates, nitrates, sodium, potassium, and chloride.

Temporarily Abandoned (T&A)
A well may be temporarily abandoned under COGCC rules for a period not to exceed 6 months. After the 6 months has expired, the operator is required to plug and abandon the well with removal of borehole equipment and placement of cement into the well bore.

Thermogenic Gas
Formed at deeper depths (see biogenic gas) by thermal cracking of sedimentary organic matter into hydrocarbon liquids and gas or by thermal cracking of oil at high temperatures into gas.

Toxic Substances Control Act (TSCA)
A United States law, passed by Congress in 1976 and administered by the Environmental Protection Agency. It regulates the introduction of new or already existing chemicals. When the TSCA was put into place, all existing chemicals were considered to be safe for use and subsequently grandfathered in. Its three main objectives are to assess and regulate new commercial chemicals before their entrance into the market, to regulate chemicals (which were already existing in 1976) that posed an "unreasonable risk to health or to the environment", and to regulate these chemicals' distribution and use.

Upset Condition
A sudden unavoidable failure, breakdown, event or malfunction, beyond the reasonable control of the Operator, of any equipment or process that results in abnormal operations and requires correction.

Upstream
The oil sector commonly known as the exploration and production (E&P) sector. Midstream operations consist of the pipelines and related facilities. Downstream facilities are the processing plants.

Urban Mitigation Area
An area where: (A) At least twenty-two (22) Building Units or one High Occupancy Building Unit, existing or under construction, are located within a 1,000' radius of the proposed Oil and Gas Location; or (B) At least eleven (11) Building Units or one High Occupancy Building Unit, existing or under construction, are located within any semi-circle of the 1,000 radius mentioned in section (A) above. The Urban Mitigation Area basically describes the setbacks in a subdivision.

Vapor Recovery
A means of recovering natural gas vapor, reducing emissions, and making the gas a useable and profitable product. Both Vapor Recovery Units (VRUs) and Vapor Recovery Towers (VRTs) are used in Colorado.

Venting
Venting is the direct release of methane gas to the atmosphere. Venting occurs at a number of points in the oil and gas development process (well completion; well maintenance; pipeline maintenance; tank maintenance; etc.). During oil and gas development, huge quantities of gas may vent to the atmosphere. For example, during well completion, after a well is fracked, the wellbore and surrounding formation must be cleaned out. The solids and fluids from the well go into pits, while the gases are allowed to escape into the atmosphere, or they are burned off (flared). It has been estimated that a single well in Wyoming's Jonah field will emit 115 tons of VOCs, and 4 tons of hazardous air pollutants such as benzene, toluene, ethylbenzene, xylene and hexanes. If the gas is flared, rather than vented, the emissions of VOCs and HAPs are reduced to 29 and 1 ton, respectively; but flaring of completion gases also results in the release of more than a ton of nitrogen oxides, and almost half a ton of carbon monoxide per well.

VOC (Volatile Organic Compound)
Organic compounds that have a high vapor pressure at ordinary room temperature. Their high vapor pressure results from a low boiling point, which causes large numbers of molecules to evaporate or sublimate from the liquid or solid form of the compound and enter the surrounding air. Most scents or odors are of VOCs.

Underground Natural Gas Storage
Most existing gas storage in the United States is in depleted natural gas or oil fields that are close to consumption centers. Conversion of a field from production to storage duty takes advantage of existing wells, gathering systems, and pipeline connections. Depleted oil and gas reservoirs are the most commonly used underground storage sites because of their wide availability.

Wastewater Cleanup
A process in which dirty water is stripped of its solids and made suitable for recycling into a mud system or disposal into sewer systems or other places. In closed mud systems, water containing colloidal matter can be cleaned and recycled.

Water Base Mud
A drilling fluid (mud) in which water or saltwater is the major liquid phase as well as the wetting (external) phase. General categories of water-base muds are fresh water, seawater, salt water, lime, potassium and silicate.

Waterflood
A method of secondary oil recovery whereby water is pumped into reservoir rock to force out oil that has ceased to flow under its own pressure.

Water Source
A surface water body or groundwater that includes streams, ponds or springs and water wells that are registered with the Colorado Division of Water Resources, including household, domestic, livestock, irrigation, municipal/public, and commercial wells, permitted or adjudicated springs, or monitoring

wells installed for the purpose of complying with groundwater baseline sampling and monitoring requirements.

Well
A well with the principal production of which at the mouth of the well is oil or gas, as defined by the Colorado Oil and Gas Conservation Act.

Well Log
A continuous measurement of formation properties with electrically powered instruments to infer formation properties and make decisions about drilling and production operations. The record of measurement is a long strip of paper. Measurements include electrical properties (resistivity and conductivity at various frequencies), sonic properties, active and passive nuclear measurements, dimensional measurements of the wellbore, and wireline-conveyed sidewall coring tools. The logging tool is lowered into the open wellbore on a wireline. Once lowered to the bottom of the interval of interest, the measurements are taken on the way out of the wellbore. This is done in an attempt to maintain tension on the cable (which stretches) as constant as possible for depth correlation purposes.

Well Pad/Well Site
The areas that are directly disturbed during drilling and subsequent operations, or affected by production facilities directly associated with any oil well, gas well or injection well and its associated pad. COCC refers to well pads/well sites as locations.

Wildcat Well
An exploration well. Often far from known productive wells. The significance of this type of well is that by definition, little if anything about the subsurface geology is known with certainty. This higher degree of uncertainty necessitates that the drilling crews be appropriately skilled, experienced and aware of what various well parameters are telling them about the formations they drill. The crews must operate top-quality equipment, especially the blowout preventers, since a kick could occur at virtually any time. A "kick" without a functioning blowout preventer was one of the reasons for the 2010 Deepwater Horizon oil spill in the Gulf of Mexico.

Working Interest
The right granted to the lessee of a property to explore, produce and own oil, gas or other minerals. The working interest owners bear the exploration, development, and operating costs on either a cash, penalty or carried basis.

Workover
Remedial work to the equipment within a well, pipework, or relating to attempts to increase the rate of flow.

Zone
An interval or unit of rock differentiated from surrounding rocks on the basis of its fossil content or other features, such as faults or fractures. For example, a fracture zone contains numerous fractures. A biostratigraphic zone contains a particular fossil or fossils.

Partial List of Sources of Terms:
COGCC's 100 Series Definitions

https://cogcc.state.co.us/reg.html#/rules
http://www.eia.gov/tools/glossary/index.cfm?id=G
http://www.earthworksaction.org/issues/detail/flaring_and_venting#.VYm08_lVhBc
http://www.glossary.oilfield.slb.com/en/Terms/o/operator.aspx
http://www.usmineralexchange.com/education/oil-and-gas-terminology
http://www.dec.ny.gov/docs/materials_minerals_pdf/dgeisv1ch11.pdf