

## ***Drilling Terms and Abbreviations***

***Abandon*** - A well is “abandoned” if it is found to be a dry hole, noncommercial, or once it ceases to produce oil and/or natural gas in commercial quantities. The costs associated with abandoning a well or production facility are referred to as the “Abandoning Costs,” which costs typically cover the plugging of wells; removal of well equipment, production tanks and associated installations; and surface remediation.

***Abnormal Pressure*** - The term is usually associated with higher than normal pressure, increased complexity for the well designer and an increased risk of well control problems. Pressure gradients more than around 10 pounds per gallon equivalent fluid density are considered abnormal.

***Acidizing*** - The pumping of acid into the wellbore to remove near-well formation damage and other damaging substances. This procedure commonly enhances production by increasing the effective well radius.

***Adjustable Choke (“ADJCK”)*** - A valve, located on or near the christmas tree, that is used to control the production of fluid from a well. Opening or closing the variable valve influences the rate and pressure at which production fluids progress to the facilities.

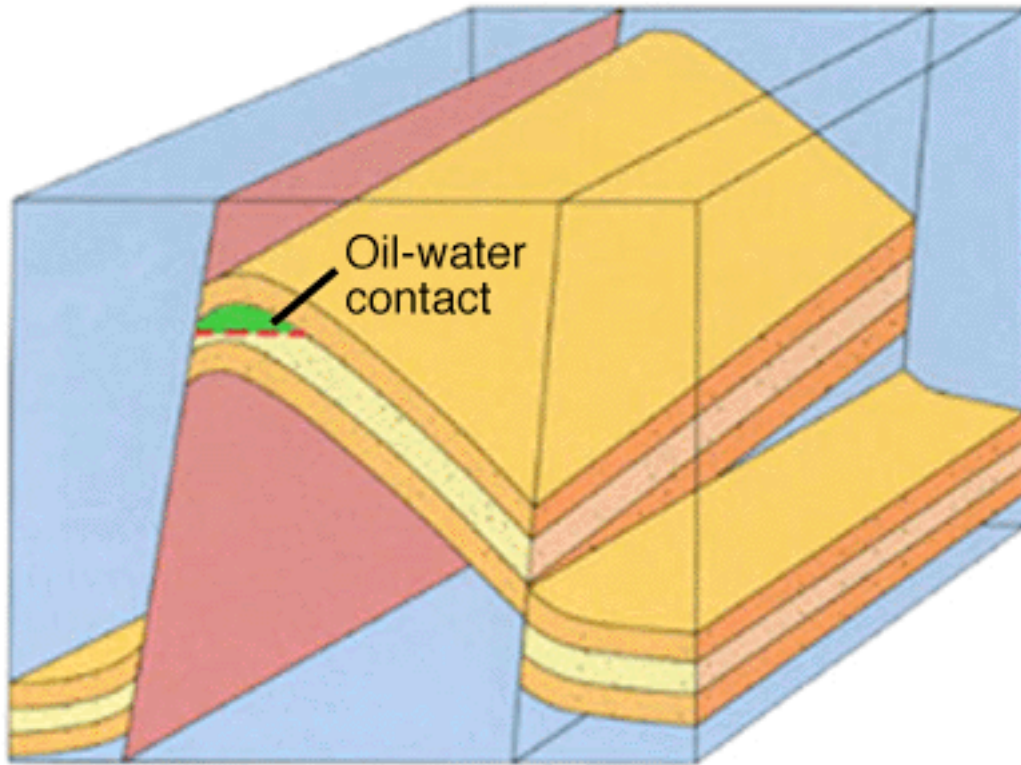


***Allowable*** - The amount of oil and/or natural gas a well or a leasehold is permitted to produce under pro ration orders of a state regulatory body.

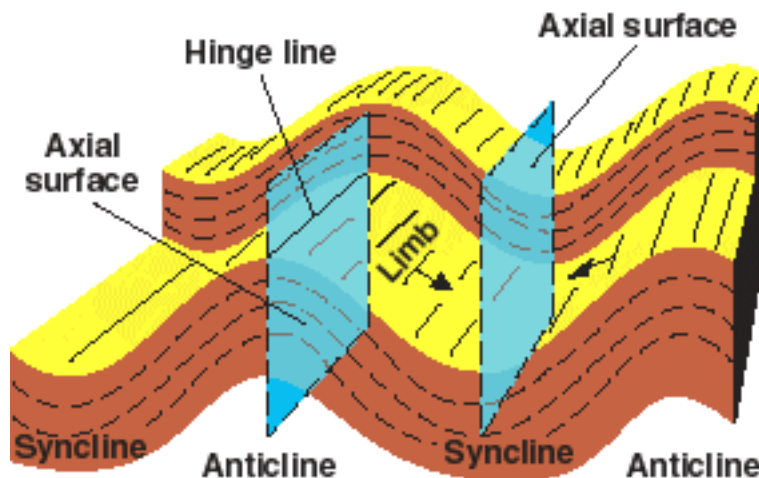
***Amplitude Anomaly*** - An abrupt increase in seismic amplitude that can indicate the presence of hydrocarbons. Amplitude anomalies that indicate the presence of hydrocarbons can result from sudden changes in acoustic impedance, such as when a gas sand underlies a shale, and in that case, the term is used synonymously with hydrocarbon indicator.

Annulus - The space between two concentric lengths of pipe or between pipe and the hole in which it is located.

**Anticlinal Trap** - A type of structural hydrocarbon trap whose closure is controlled by the presence of an anticline.



**Anticline** - An arch-shaped fold in rock in which rock layers are upwardly convex. Anticlines form many excellent hydrocarbon traps, particularly in folds with reservoir-quality rocks in their core and impermeable seals in the outer layers of the fold. A syncline is the opposite type of fold.



**API Gravity** - A specific gravity scale developed by the American Petroleum Institute (API) for measuring the relative density of various petroleum liquids, expressed in degrees. API gravity is graduated in degrees on a hydrometer instrument and was designed so that most values would fall between 10° and 70° API gravity.

**Associated Gas** - Natural gas that is produced from the same reservoir along with crude oil, either as free gas or in solution.

**Authority for Expenditure (“AFE”)** - A budgetary document to list estimated expenses of drilling a well to a specified depth, casing point or geological objective, and then either completing or abandoning the well. Such expenses may include excavation and surface site preparation, the daily rental rate of a drilling rig, costs of fuel, drillpipe, bits, casing, cement and logging, and coring and testing of the well, among others. This estimate of expenses is provided to partners for approval before commencement of drilling or subsequent operations. Failure to approve an AFE may result in delay or cancellation of the proposed drilling project or subsequent operation.

**Back Off (“BO”)** - To unscrew drillstring components downhole. The drillstring, including drillpipe and the bottomhole assembly, are coupled by various thread forms known as connections or tool joints. Often when a drillstring becomes stuck it is necessary to “back off” the string as deep as possible to recover as much of the drillstring as possible. To facilitate the fishing or recovery operation, the back off is usually accomplished by applying reverse torque and detonating an explosive charge inside a selected threaded connection.

**Back-in** - The right to receive a reversionary interest at some future time, upon fulfillment of contractually specified conditions. This clause allows a non participating partner to reserve the option to participate in a well after it has produced enough to pay the operator’s expenses of drilling and completing that well. This clause is typically used in participation agreements to convert the overriding royalty interest of a non participating partner (the Generator) into a working interest upon payout of the well. When the election to convert the overriding royalty interest to working interest takes place, it is known as a “back-in after payout.”

**Bailer** - A cylindrical, bucket-like piece of equipment used to evacuate its liquid content in, or remove mud and rock cuttings from, the hole or wellbore.

**Barrels of Condensate Per Day (“BCPD”)** - A common unit of measurement for the daily volume of condensate produced by a well. The volume of a barrel is equivalent to 42 U.S. gallons.

**Barrels of Oil Per Day (“BOPD”)** - A common unit of measurement for the daily volume of crude oil produced by a well. The volume of a barrel is equivalent to 42 U.S. gallons.

**Barrels of Water Per Day (“BWPD”)** - A common unit of measurement for the daily volume of water produced by a well. The volume of a barrel is equivalent to 42 U.S. gallons.

**Basic Sediment and Water (“BS&W”)** - A combination of impurities and water which is often produced with crude oil. BS&W is heavier than oil and will settle to the bottom of a tank.

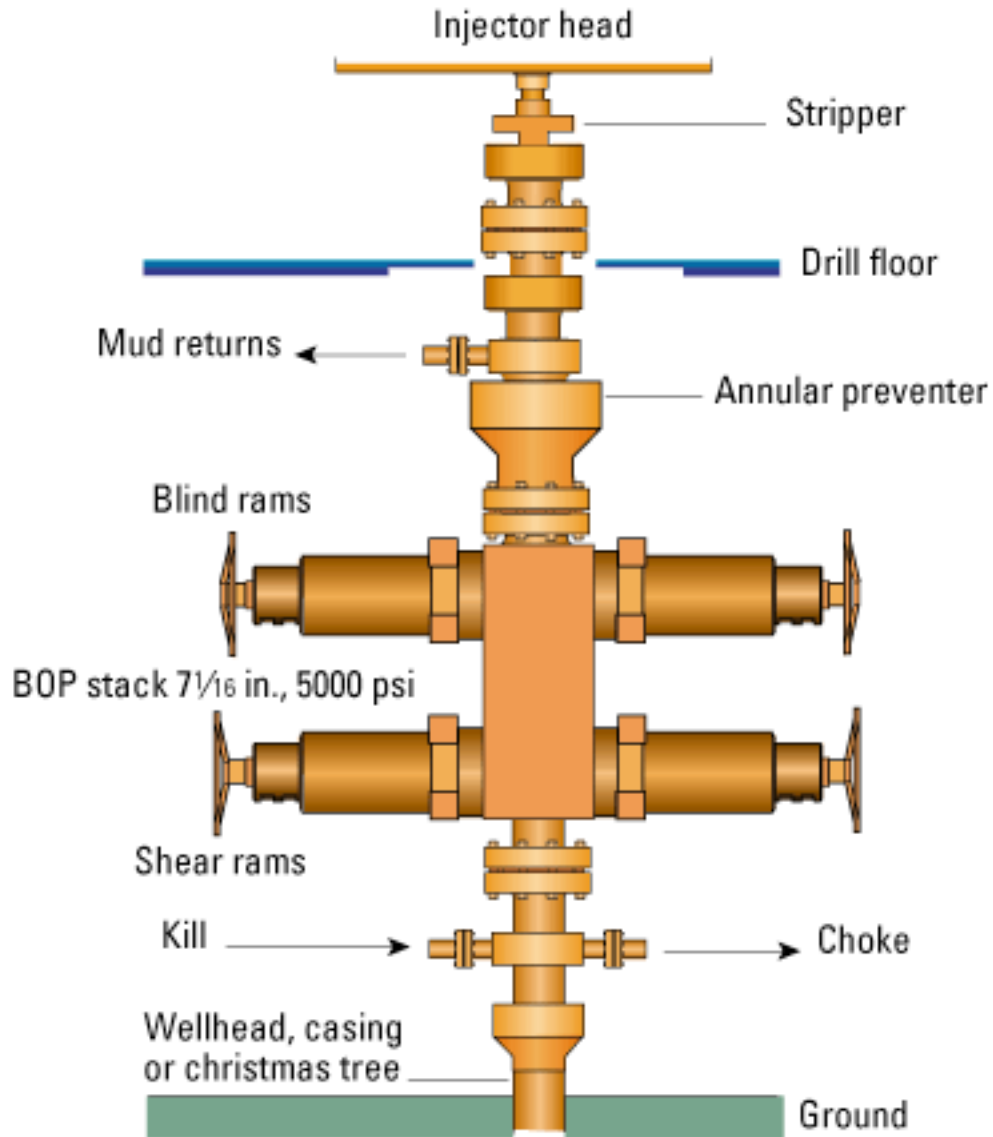
**Bit** - The tool used to crush or cut rock. Everything on a drilling rig directly or indirectly assists the bit in crushing or cutting the rock.



**Blind Ram** - A thick, heavy steel component of a conventional ram blowout preventer. The blind ram has no space for pipe and is instead blanked off to be able to close over a well that does not contain a drillstring. It may be loosely thought of as the sliding gate on a gate valve.

**Blowout** - An uncontrolled flow of reservoir fluids into the borehole, and sometimes catastrophically to the surface. A blowout may consist of saltwater, oil, natural gas or a mixture of these. Blowouts occur in all types of exploration and production operations, not just during drilling operations. (see “Underground Blowout”)

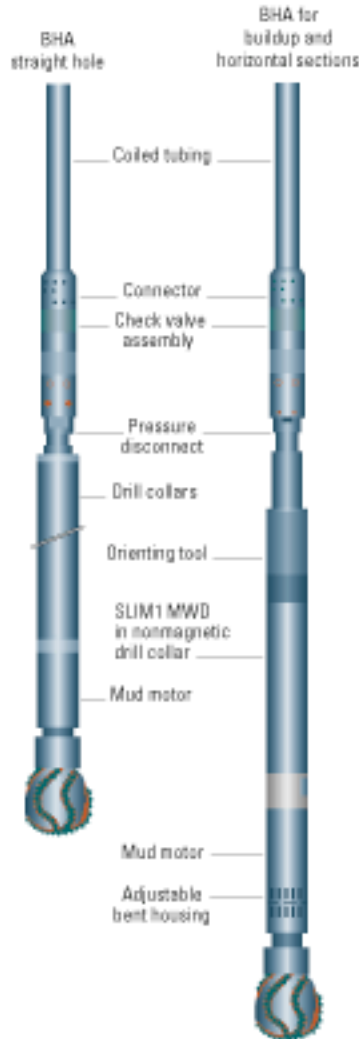
**Blowout Preventer (“BOP” or “BOPE”)** - A large valve at the top of a well that may be closed if the drilling crew loses control of formation fluids. By closing this valve (usually operated remotely by hydraulic actuators), the drilling crew usually regains control of the reservoir, and procedures can then be initiated to increase the mud weight until it is possible to open the BOP and retain pressure control of the formation. A BOP comes in a variety of styles, sizes and pressure ratings. Since a BOP is critically important to the safety of the crew, the rig and the hole or wellbore itself, the BOP is inspected, tested and refurbished at regular intervals.



**Borehole** - The hole itself, including the openhole or uncased portion of the well. Borehole may refer to the inside diameter of the hole wall, the rock face that bounds the drilled hole.

**Bottomhole Assembly (“BHA”)** - The lower portion of the drillstring, consisting of (from the bottom up) the bit, bit sub, a mud motor (in certain cases), stabilizers, drill collars, heavyweight drillpipe, jarring devices (“jar”) and crossovers for various thread forms. The bottomhole assembly can also include directional drilling and measuring equipment, measurements-while-drilling tools, logging-while-drilling tools and other specialized devices.

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**Bottomhole Location (“BHL”)** - The actual location of a hole or wellbore at its deepest point.

**Bottomhole Pressure (“BHP”)** - The pressure at or near the depth of the producing formation.

**Bottoms-up** - Pertaining to the drilling mud and cuttings that are calculated or measured to come from the bottom of the hole since the start of circulation.

**Break Circulation** - To establish circulation of drilling fluids after a period of static conditions. Circulation may resume after a short break, such as taking a survey or making a mousehole connection, or after a prolonged interruption, such as after a round trip.

**Break Out** - To unscrew drillstring components, which are coupled by various thread forms known as connections, including tool joints and other threaded connections.

**Bridge** - A wellbore obstruction caused by a buildup of material such as scale, wellbore fill or cuttings that can restrict borehole access or, in severe cases, eventually close the borehole.

**Bridge-off** - The accumulation or buildup of material, such as sand or scale, within a wellbore, insofar as the flow of fluids or passage of tools or downhole equipment is severely obstructed. In extreme cases, the wellbore can become completely plugged or bridged-off, requiring some remedial action before normal production can be resumed.

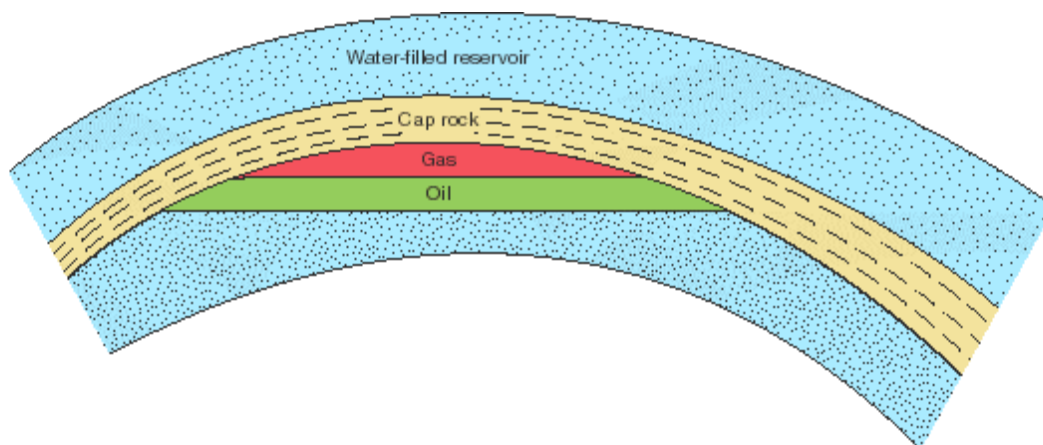
**Bridge Plug (“BP”)** - A downhole tool that is located and set to isolate the lower part of the wellbore. Bridge plugs may be permanent or retrievable, enabling the lower wellbore to be permanently sealed from production or temporarily isolated from a treatment conducted on an upper zone.

**Bright Spot** - A seismic amplitude anomaly or high amplitude that can indicate the presence of hydrocarbons. Bright spots result from large changes in acoustic impedance and tuning effects, such as when a gas sand underlies a shale, but can also be caused by phenomena other than the presence of hydrocarbons, such as a change in lithology. The term is often used synonymously with hydrocarbon indicator.

**Bullhead** - To forcibly pump fluids into a formation, usually formation fluids that have entered the wellbore during a well control event.

**Bump the Plug** - To observe the increase in pump pressure indicating that the top cement plug has been placed on the bottom plug or landing collar. Bumping the plug concludes the cementing operation.

**Cap Rock** - A relatively impermeable rock, commonly shale, anhydrite or salt, that forms a barrier or seal above and around reservoir rock so that fluids cannot migrate beyond the reservoir. It is often found on top of salt domes.





**Cap the Well** - To regain control of a blowout well by installing and closing a valve on the wellhead.

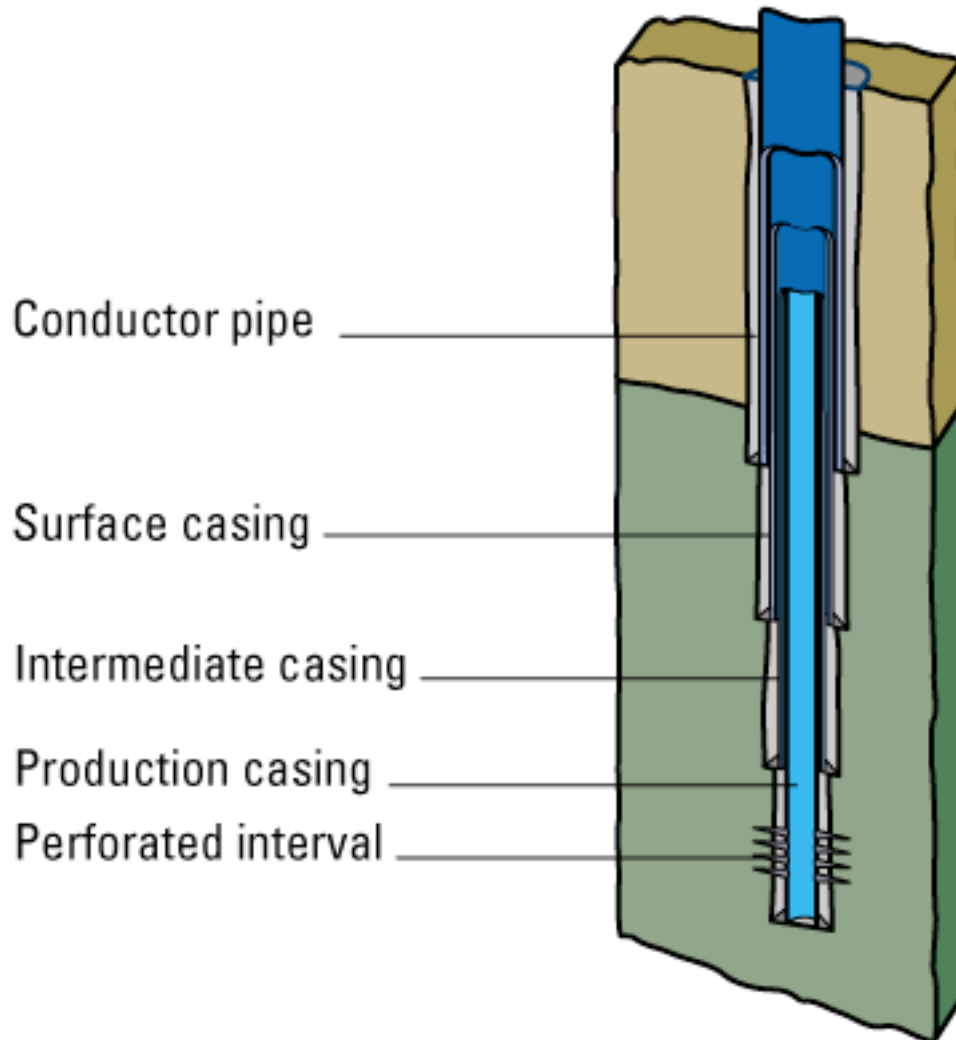
**Carried Working Interest** - A working interest generally paid in consideration for work related to the prospect. This interest is paid, or *carried*, for the drilling and/or completion costs as specified in the contract between the parties, by another working interest owner typically until casing point is reached, or *through the tanks*, meaning through completion of the well, as agreed upon contractually.

**Cased Hole** - A wellbore lined with a string of casing or liner. Although the term can apply to any hole section, it is often used to describe techniques and practices applied after a casing or liner has been set across the reservoir zone, such as cased-hole logging or cased-hole testing.

**Casing (“Csg”)** - *In the case of drilling*, a large-diameter pipe lowered into an openhole and cemented in place. Casing is run to protect freshwater formations (“surface casing”), isolate a zone of lost returns or isolate formations with significantly different pressure gradients (“intermediate casing”). Casing is usually manufactured from plain carbon steel that is heat-treated to varying strengths, but may be specially fabricated of stainless steel, aluminum, titanium, fiberglass and other materials. *In the case of completion*, a large-diameter pipe cemented in place during the construction process to stabilize the wellbore. The casing forms a major structural component of the wellbore and serves important functions, such as preventing the formation wall from caving into the wellbore and isolating the different formations to prevent the flow or cross flow of formation fluids. The casing string provides a means of securing surface pressure control equipment and downhole production equipment, such as the production packer. The operation of installing casing is commonly referred to as “running pipe” or “setting pipe.”

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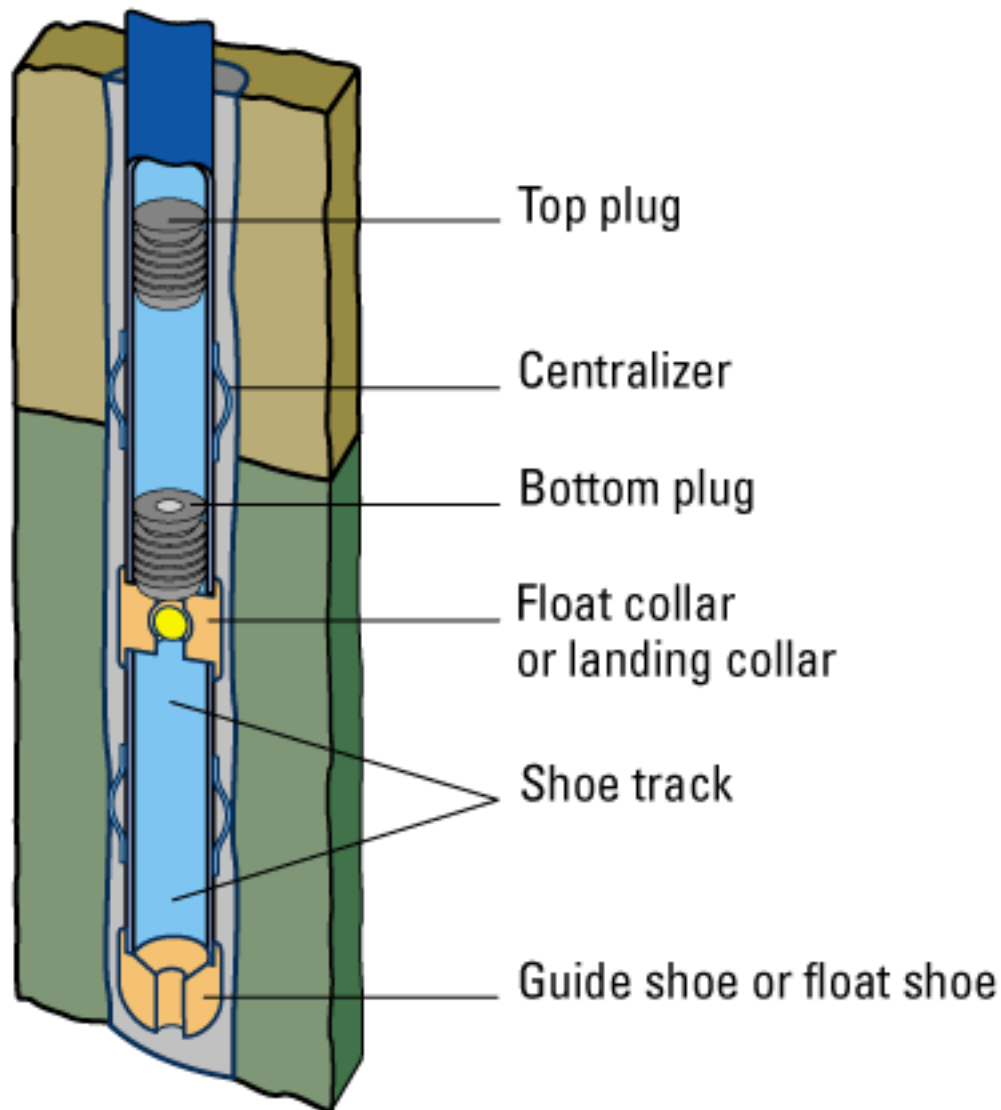


**Casing Joint** - A length of steel pipe, generally around 40 feet long with a threaded connection at each end. Casing joints are assembled to form a casing string of the correct length and specification for the hole in which it is installed.

**Casing Patch** - A downhole assembly or tool system used in the remedial repair of casing damage, corrosion or leaks. In some cases, such as in depleted wells, a casing patch may be an economic means of safely deepening a well.

**Casing Point** or **Pressure Point** - *In the case of drilling*, the location (or depth) at which “intermediate casing” is run to protect the openhole and control unstable formations or over pressure zones deeper in the hole. *In the case of completion*, the point at which a decision must be made to either complete the well, as a well capable of producing oil and/or natural gas in commercial quantities, or to plug and abandon the well as a dry hole or noncommercial.

**Casing Shoe** - The bottom of the casing string, including the cement around it, or the equipment run at the bottom of the casing string.



**Casing Shoe Test** or **Testing the Shoe** - A pressure test applied to the formation directly below a casing shoe. The test is generally conducted soon after drilling resumes after an intermediate casing string has been set. The purpose of the test is to determine the maximum pressures that may be safely applied without the risk of formation breakdown.

**Cement Bond Log (“CBL”)** - A representation of the integrity of the cement job, especially whether the cement is adhering solidly to the outside of the casing.

**Cement Plug** - A balanced plug of cement slurry placed in the hole or wellbore. Cement plugs are used for a variety of applications including hydraulic isolation, provision of a secure platform, and in window-milling operations for sidetracking a new hole or wellbore.

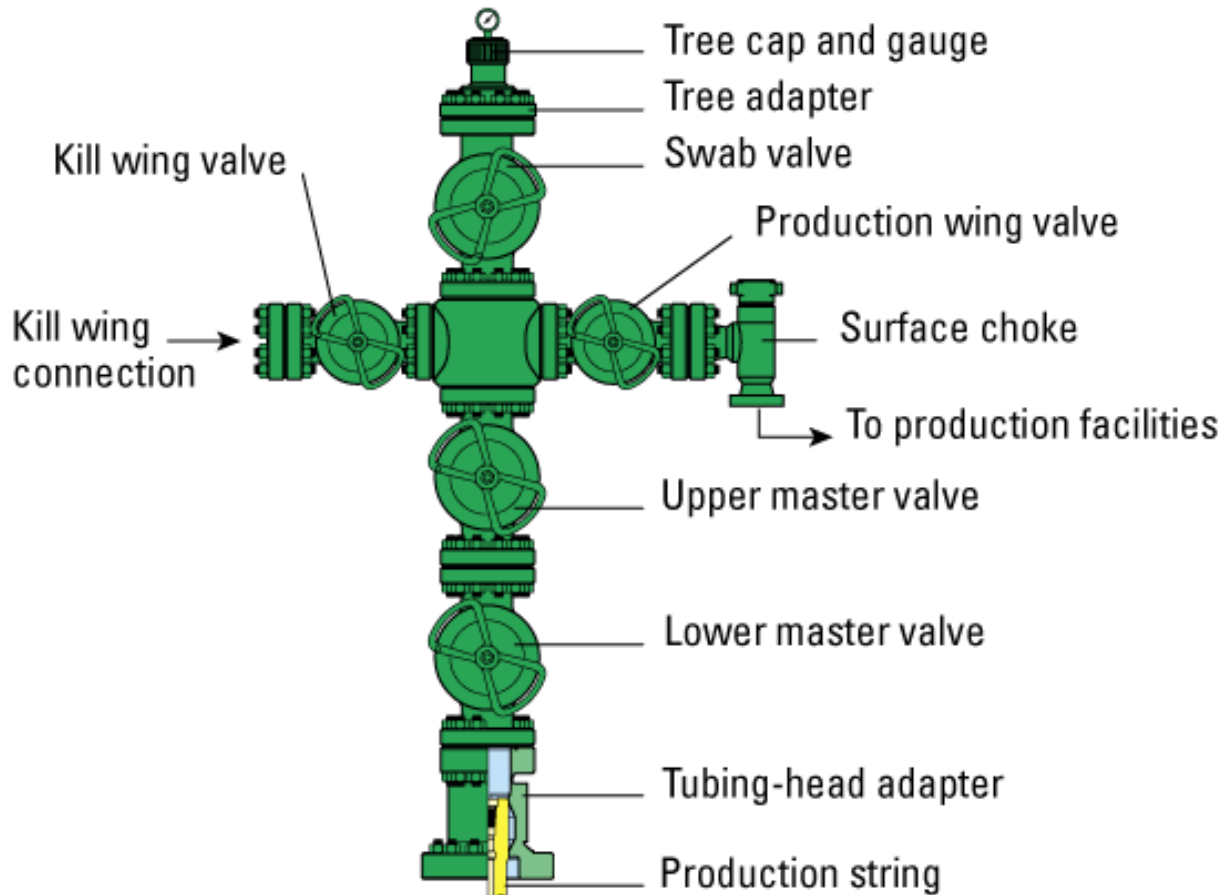
**Cement Squeeze** or **Squeeze Job** - A remedial cementing operation designed to force cement into leak paths in wellbore tubulars. The required squeeze pressure is achieved by carefully controlling pump pressure. Squeeze cementing operations may be performed to repair poor primary cement jobs, isolate perforations or repair damaged casing or liner.

**Channeling** - The condition in which cement flows in a channel only on some sides of the casing or borehole annulus, and thus does not provide adequate hydraulic isolation in all radial azimuths.

**Choke** - A device incorporating an orifice that is used to control fluid flow rate or downstream system pressure. Chokes are available in several configurations for both fixed and adjustable modes of operation. Adjustable chokes enable the fluid flow and pressure parameters to be changed to suit process or production requirements. Fixed chokes do not provide this flexibility, although they are more resistant to erosion under prolonged operation or production of abrasive fluids.

**Christmas Tree** - An assembly of valves, spools, pressure gauges and chokes fitted to the wellhead of a completed well to control production. Christmas trees are available in a wide range of sizes and configurations, such as low or high-pressure capacity and single or multiple-completion capacity.

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**Circulate** or **Circulation (“Circ”)** - To pump drilling fluid through the whole active fluid system. The round trip made by drilling fluid; down through the drillstring, up on the outside of the drillstring (between the drillpipe and the walls of the hole), through the mud system and then back down the drillstring again.

**Circulate and Condition Mud (“C&CM”)** - The operation of circulating the drilling fluids to either increase or decrease the mud weight.

**Cleanup** - A period of controlled production, generally following the perforating of a zone or a stimulation treatment, during which time completion/treatment fluids return from the reservoir formation.

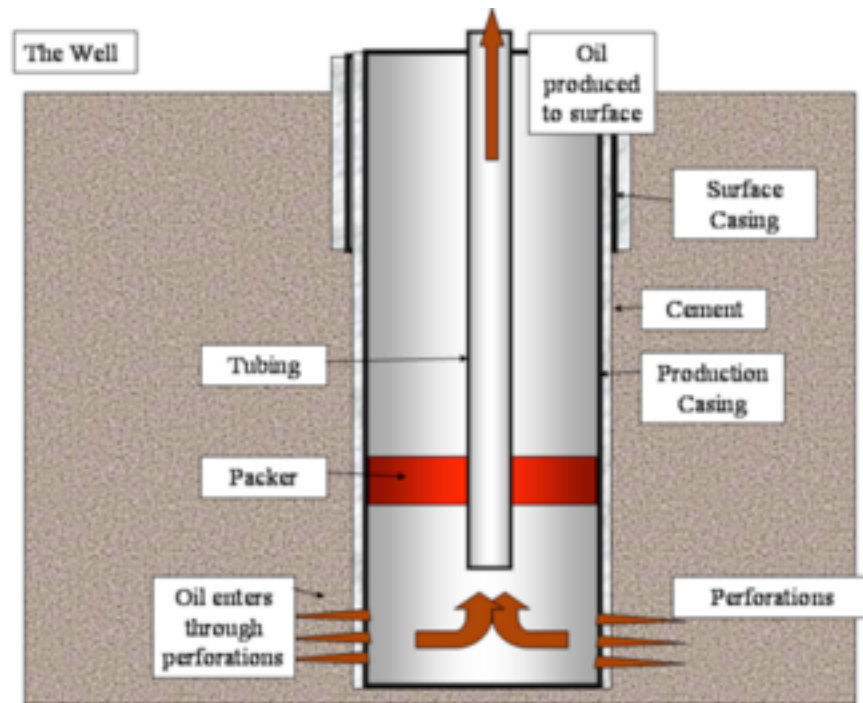
**Closed Mud System** or **Closed Loop System** - A mud and solids-control system in which the only discarded waste is moist, drilled-up rock materials. Such systems are used for drilling wells in environmentally sensitive areas.

**Coiled Tubing** - A continuous, jointless hollow steel cylinder that is stored on a reel and can be uncoiled or coiled repeatedly as required; coiled tubing is increasingly being used in well

completion and servicing instead of traditional tubing, which is made up of joined sections of pipe.

**Company Man** - The representative of the oil company or operator on a drilling location, who is responsible for the safety and efficiency of the project.

**Completion** - A generic term used to describe the assembly of downhole tubulars and equipment required to enable safe and efficient production from an oil and/or natural gas well.

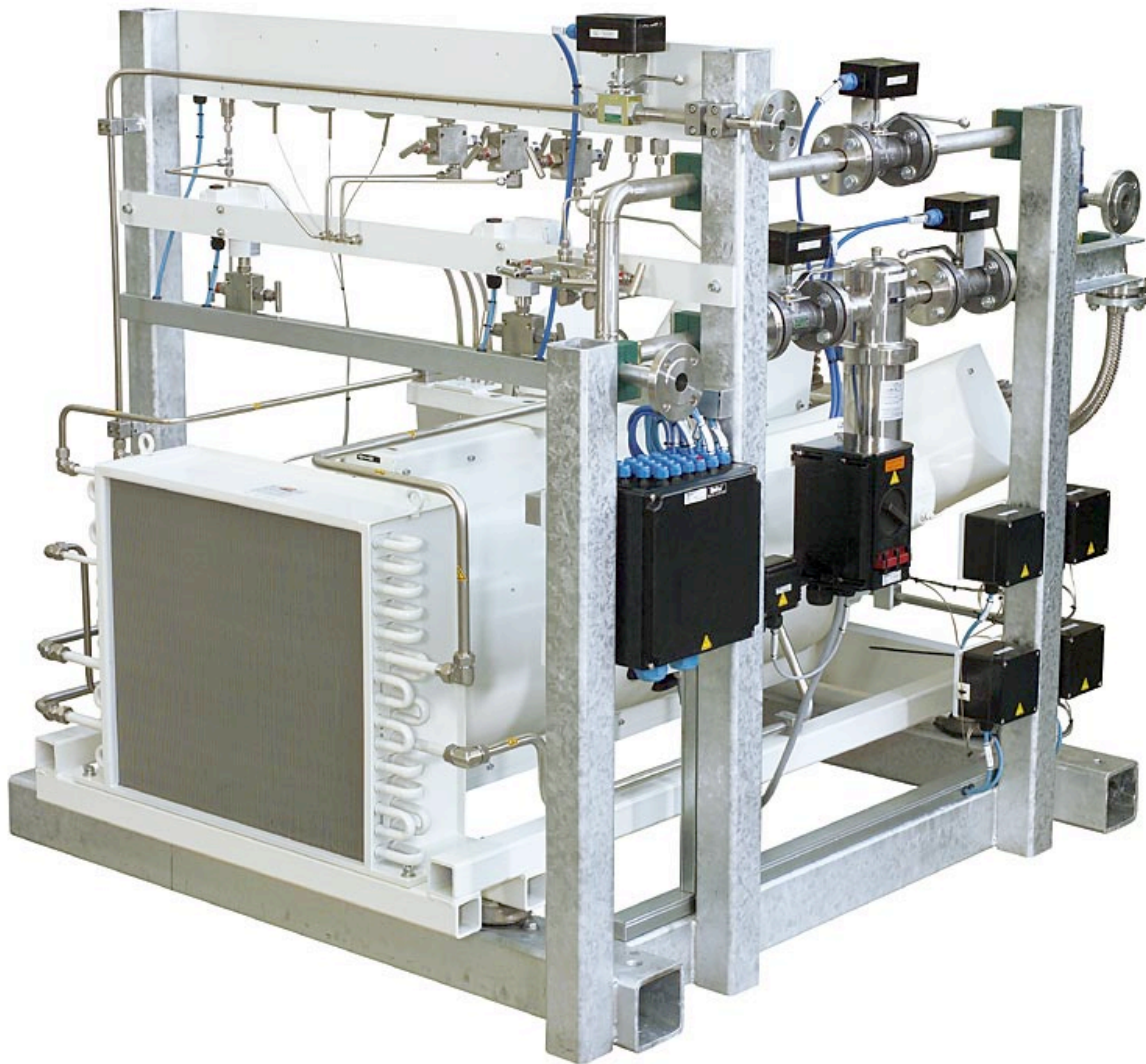


**Completion Fluid** - A solids-free liquid used to “complete” an oil and/or natural gas well. This fluid is placed in the wellbore to facilitate final operations before initiation of production, such as setting screens, production liners, packers, downhole valves or shooting perforations into the producing zone.

**Composite Log** - A single log created by splicing together two logs of the same type run at different times in the well; or by splicing two different types of log run at the same time.

**Compression Set Packer** - A type of downhole packer that is made active or set by applying compressive force to the packer assembly. (see Packer)

**Compressor** - A device that raises the pressure of air or natural gas. A compressor normally uses positive displacement to compress the natural gas to higher pressures so that the gas can flow into pipelines and other facilities.

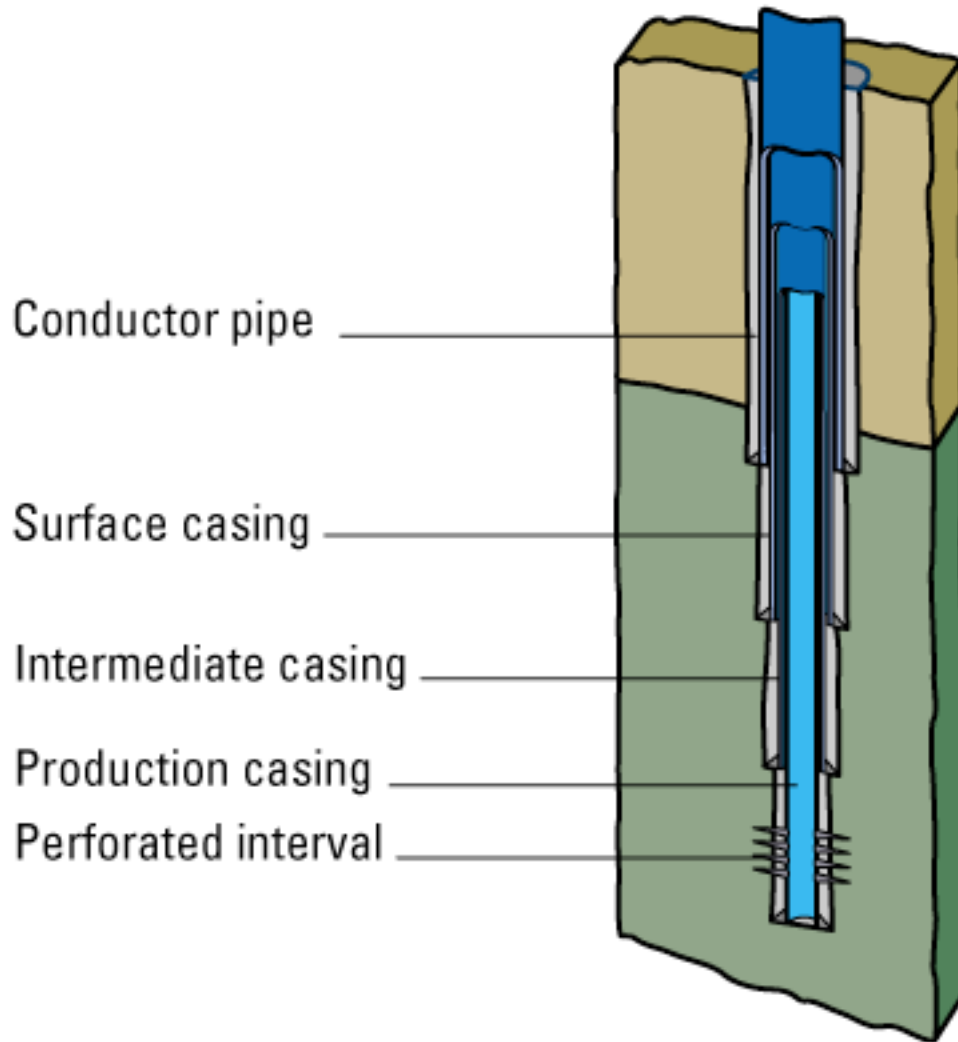


**Condensate** - A hydrocarbon that is in the gaseous phase at reservoir conditions but condense into liquid as it travels up the wellbore and reaches separator conditions.

**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 Pipe** or **Conductor Casing** - The casing string that is usually put into the borehole first to prevent the sides of the hole from caving into the borehole. This casing, sometimes called drive pipe, is generally a short length and is sometimes driven into the ground.

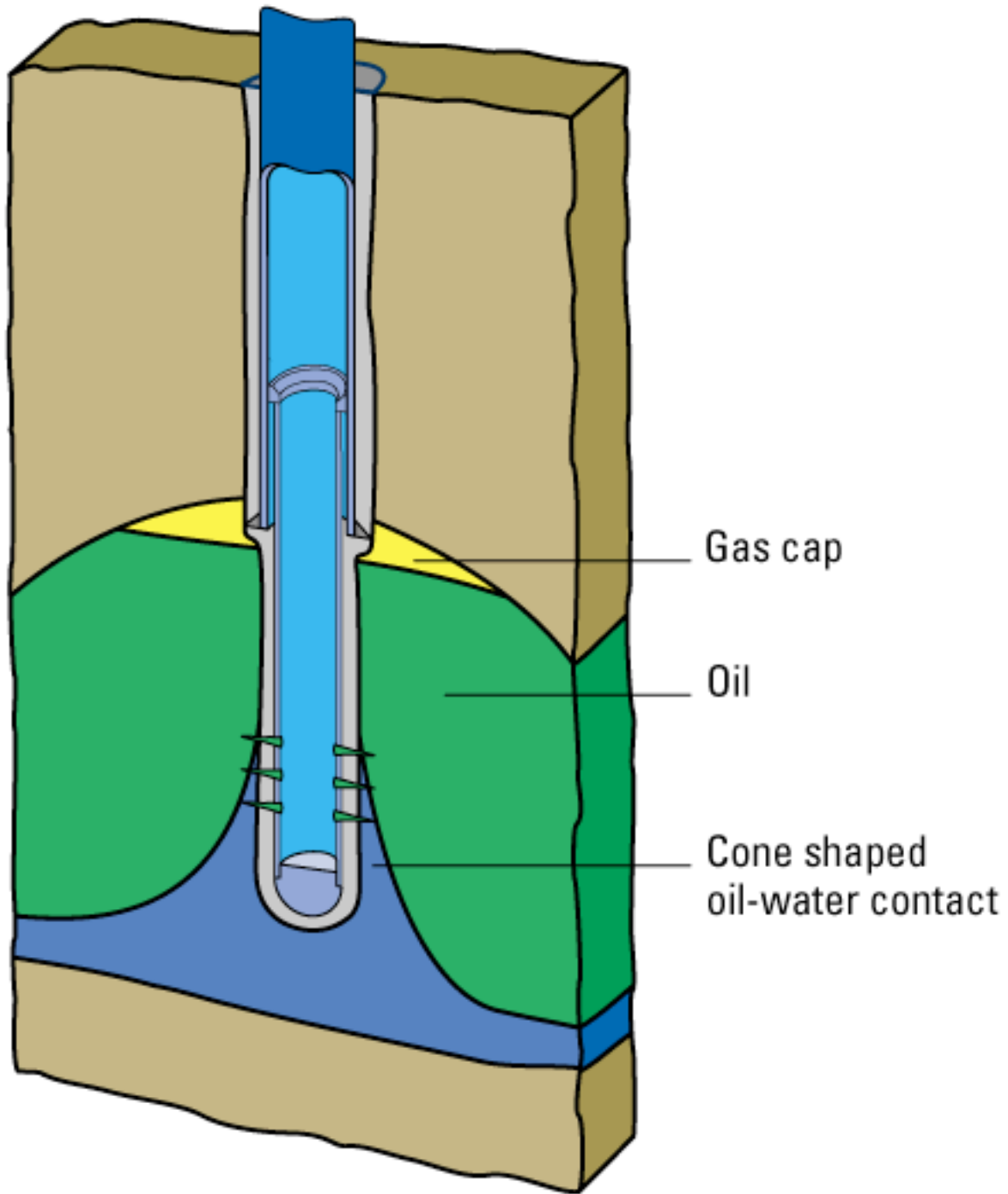
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***Coning*** - The change in oil-water or gas-oil contact profiles as a result of drawdown pressures during production. Coning occurs in vertical or slightly deviated wells and is affected by the characteristics of the fluids involved and the ratio of horizontal to vertical permeability. Coning can also result from producing a well at high rate of production.

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**Core** - A continuous cylinder of rock, usually from 5 to 10 centimeters in diameter, cut from the bottom of a borehole as a sample of an underground formation. (See "Sidewall Core")

**Crude Oil ("Oil")** - A general term for unrefined petroleum or liquid petroleum.

**Cuttings** - Small pieces of rock that break away due to the action of the bit. Cuttings are screened out of the drilling mud system at the “shale shakers” and are monitored for composition, size, shape, color, texture, hydrocarbon content and other properties.



**Day Rate** - The daily cost to the operator of renting the drilling rig and the associated costs of personnel and routine supplies. This cost may or may not include fuel, and does not include capital goods, such as casing and wellheads, or special services, such as logging or cementing. In most of the world, the day rate represents roughly half of the cost of the well. Similarly, the total daily cost to drill a well (spread rate) is roughly double what the rig day rate amount is.

**Delay Rental** - Consideration paid to the lessor by a lessee to extend the terms of an oil, gas and mineral lease in the absence of operations and/or production that is contractually required to hold the lease. This consideration is usually required to be paid on or before the anniversary date of the oil, gas and mineral lease during its primary term, and typically extends the lease for an additional year. Nonpayment of the delay rental without production or commencement of operations will result in abandonment of the lease after its primary term has expired.

***Deliverability Test*** - Tests in an oil and/or gas well to determine its flow capacity at specific conditions of reservoir and flowing pressures. The absolute open flow potential can be obtained from these tests, and then the inflow performance relationship can be generated. A deliverability test also is called a productivity test.

***Depletion*** - The drop in reservoir pressure or hydrocarbon reserves resulting from production of reservoir fluids.

***Deposit*** - An accumulation of oil and/or natural gas which is capable of commercial production.

***Derrick*** - The structure used to support the crown blocks and the drillstring of a drilling rig.

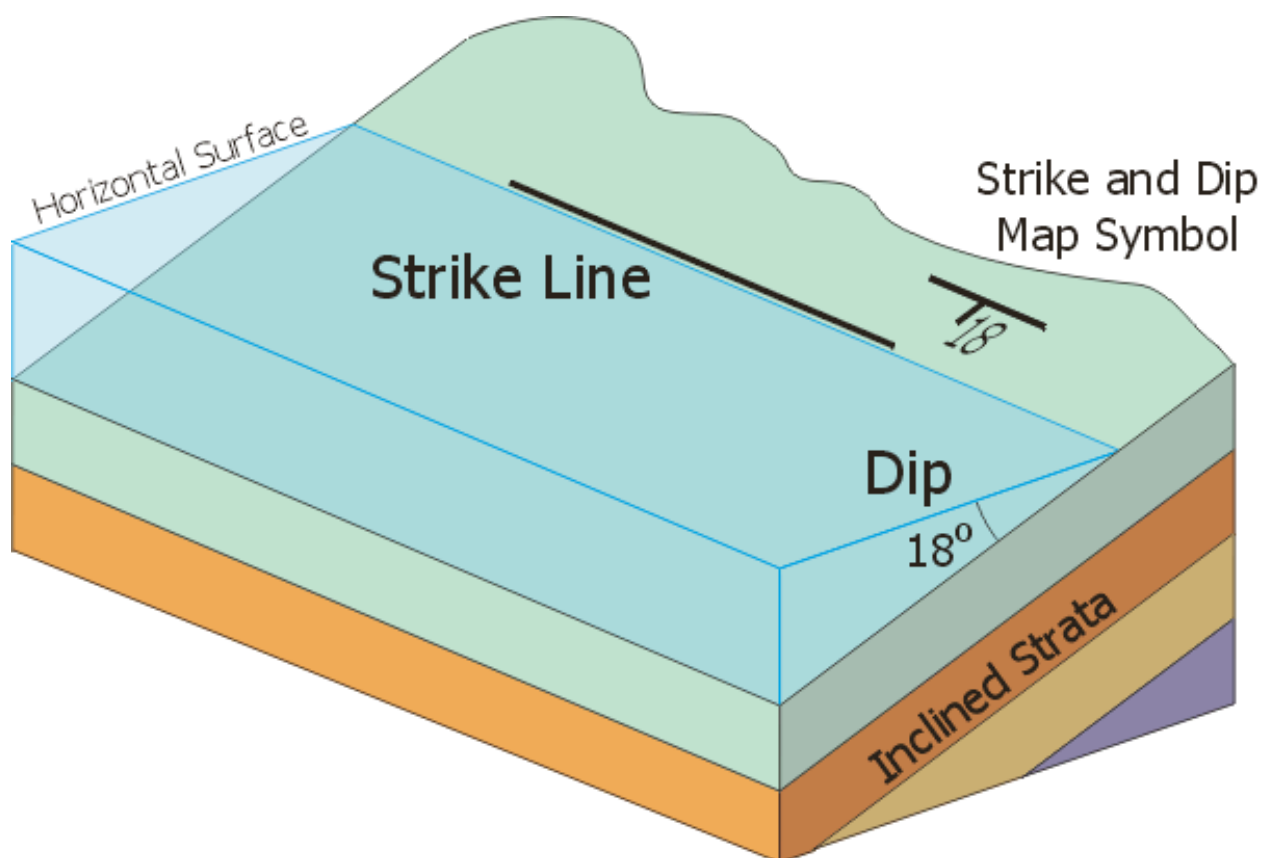


***Development*** - The phase of petroleum operations that occurs after exploration has proven successful, and before full-scale production. The newly discovered oil or natural gas field is assessed during an appraisal phase, a plan to fully and efficiently exploit it is created, and

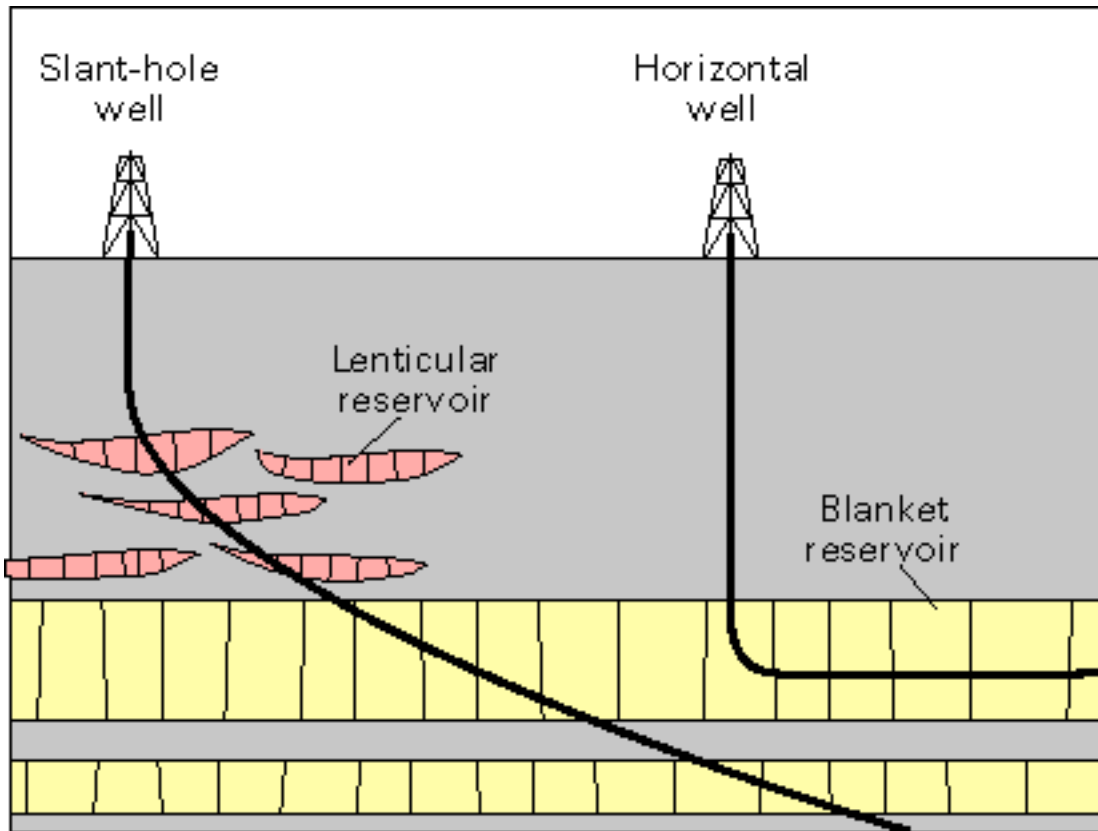
additional wells are usually drilled (a “development well”). A development well is drilled specifically into a previously discovered field for the purpose of producing oil and/or natural gas.

**Deviation** - The angle at which a hole or wellbore diverges from vertical. Wells can deviate from vertical because of the dips in the beds being drilled through. Wells can also be deliberately deviated with the use of a whipstock or other steering mechanism. Wells are often deviated or turned to a horizontal direction to increase exposure to producing zones, intersect a larger number of fractures, or to follow a complex structure.

**Dip** - The magnitude of the inclination of a plane from horizontal. True, or maximum, dip is measured perpendicular to strike. Apparent dip is measured in a direction other than perpendicular to strike.



**Directional Drilling** - The intentional “deviation” of a hole from the path it would naturally take. This is accomplished with the use of whipstocks, bottomhole assembly configurations, instruments to measure the path of the hole in three-dimensional space, data links to communicate measurements taken downhole to the surface, mud motors and special bottomhole assembly components and drill bits. In some cases, such as drilling steeply dipping formations or unpredictable deviation in conventional drilling operations, directional drilling techniques may be employed to ensure that the hole is drilled vertically.



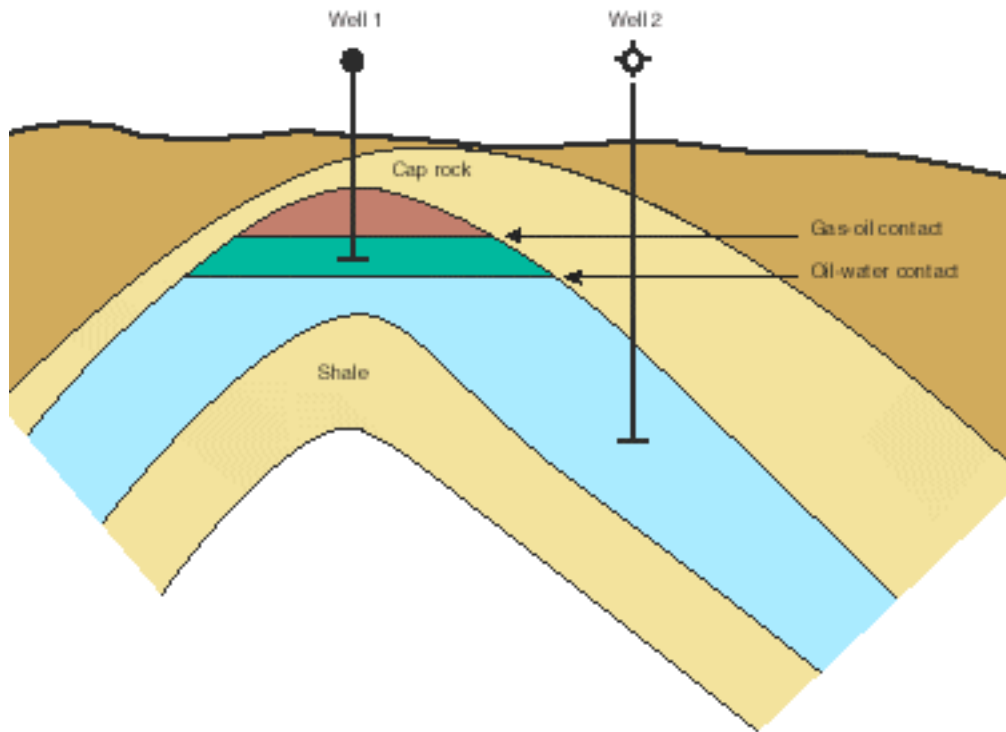
**Division Order** - An agreement between the operator and net revenue interest owner in which the parties specify the fractional type of interest attributed to the revenue interest owner by the operator after an examination of title.

**Dope** - Any of various viscous materials used on pipe or tubing threads as a lubricant, and to prevent corrosion; a tar base coating for pipelines to prevent corrosion.

**Downdip** - Located down the slope of a dipping plane or surface. In a dipping (not flat-lying) hydrocarbon reservoir that contains natural gas, oil and water, the natural gas is updip, the gas-oil contact is downdip from the natural gas, and the oil-water contact is still farther downdip. (See "Updip")

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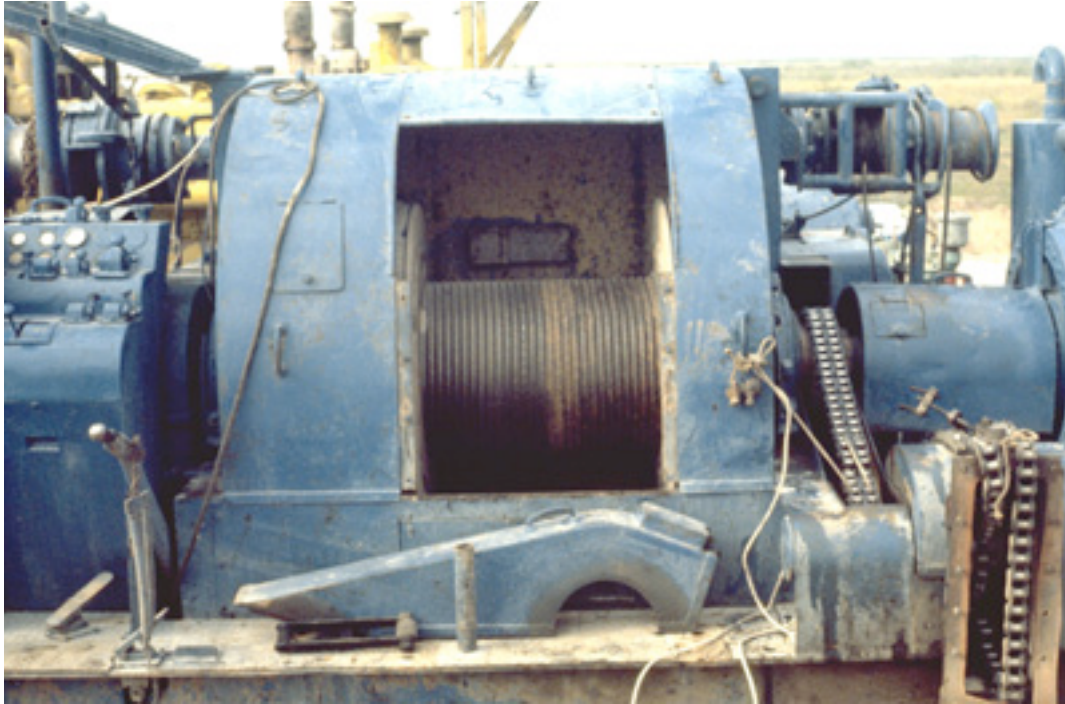




***Downhole*** - A term to describe tools, equipment, and instruments used in the hole or wellbore, also, conditions or techniques applying to the hole or wellbore.

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

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***Drill Collars (“DC”)*** - A component of a drillstring that provides weight on the bit for drilling.



***Driller*** - One who operates a drilling rig; the person in charge of drilling operations and who supervises the drilling crew.



**Drilling Mud** or **Drilling Fluid** - A special mixture of clay, water, and chemical additives pumped downhole through the drillpipe and drill bit. The mud cools the rapidly rotating bit; lubricates the drillpipe as it turns in the hole; carries rock cuttings to the surface; and serves as a plaster to prevent the wall of the hole from crumbling or collapsing. Drilling mud also provides the weight or hydrostatic head to prevent extraneous fluids from entering the hole and to control downhole pressures that may be met with.



**Drilling Procedure** - The engineering plan for constructing the wellbore. The plan includes well geometries, casing programs, mud considerations, well control concerns, initial bit selections, offset well information, pore pressure estimations, economics and special procedures that may be needed during the well. Although drilling procedures are carefully developed, they are subject to change if drilling conditions dictate.

**Drillpipe (“DP”)** - Steel pipe screwed together and used to carry and rotate the drilling tools in a well, and to permit the circulation of drilling fluid. Drillpipe comes in lengths of approximately 30 feet. As the well is drilled deeper, they must constantly disconnect the drillstring, thread on another 30 foot section and then drill deeper.



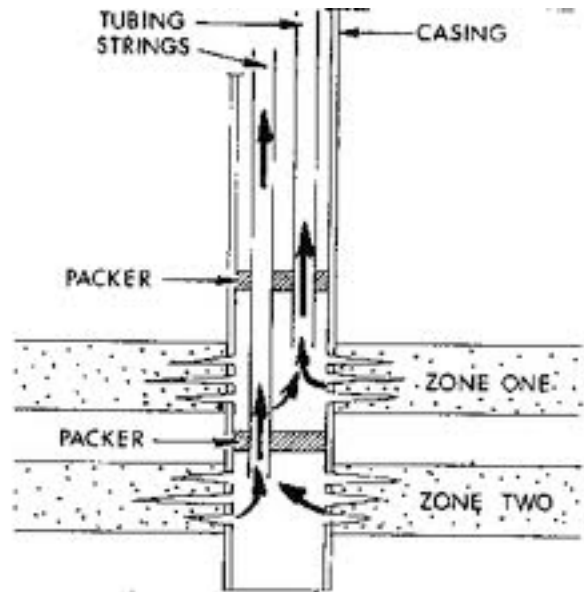
***Dry and Abandon (“D&A”)*** - A well which is drilled and did not encounter oil and/or natural gas in commercial quantities and is subsequently abandoned.

***Dry Gas*** - Natural gas from a well that is free of liquid hydrocarbons, or gas that has been treated to remove all liquids; pipeline gas.

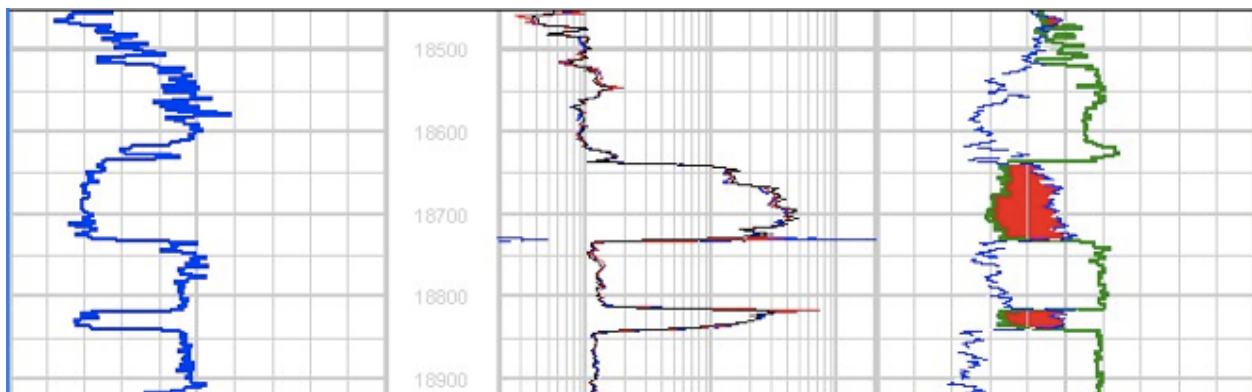
***Dry Hole*** - A well that has not encountered hydrocarbons in economically producible quantities.

***Dual Completion*** - A single wellbore having tubulars and equipment that enable production from two segregated zones. In most cases, two tubing strings will be used to provide the necessary level of control and safety for the fluids from both zones. However, in some simple dual completions, the second or upper zone is produced up the tubing-casing annulus.

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**Electrical Log (“ELOG”)** - An electrical survey of an uncased hole which reflects the degree of resistance of the rock strata to electric current. From the results of the survey, geologists are able to determine the nature of the rock penetrated in the hole and some indications of its permeability.



**Elevator** - A hinged mechanism that may be closed around drillpipe or other drillstring components to facilitate lowering them into the hole or lifting them out of the hole.

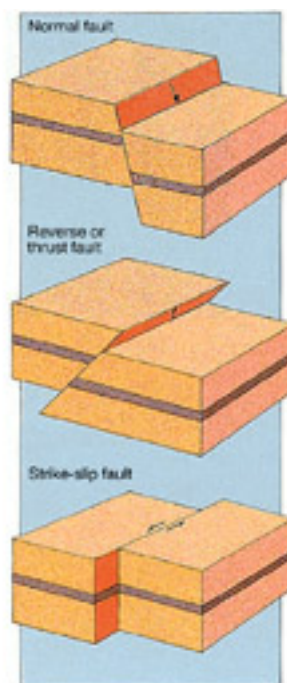
**Event** - An appearance of seismic data as a diffraction, reflection, refraction or other similar feature produced by an arrival of seismic energy. An “event” can be a single wiggle within a trace, or a consistent lining up of several wiggles over several traces. An event in a seismic section can represent a geologic interface, such as a fault, unconformity or change in lithology.

**Expendable Gun** - A perforating gun assembly that disintegrates upon firing, thereby reducing the volume and dimensions of retrieved components. Expendable guns are typically used where wellbore restrictions allow only limited access, as in through-tubing applications. The distortion

caused to the gun assembly during firing would typically prevent recovery of a conventional gun design through the limited clearances. The expendable gun assembly breaks into small pieces that drop to the bottom of the well, leaving only a relatively small subassembly that is easily recovered to surface.

**Expendable Plug** - A temporary plug, inserted in the completion assembly before it is run, to enable pressure testing of the completed string. With the operation complete, the expendable plug can be pumped out of the assembly, thereby avoiding a separate retrieval run.

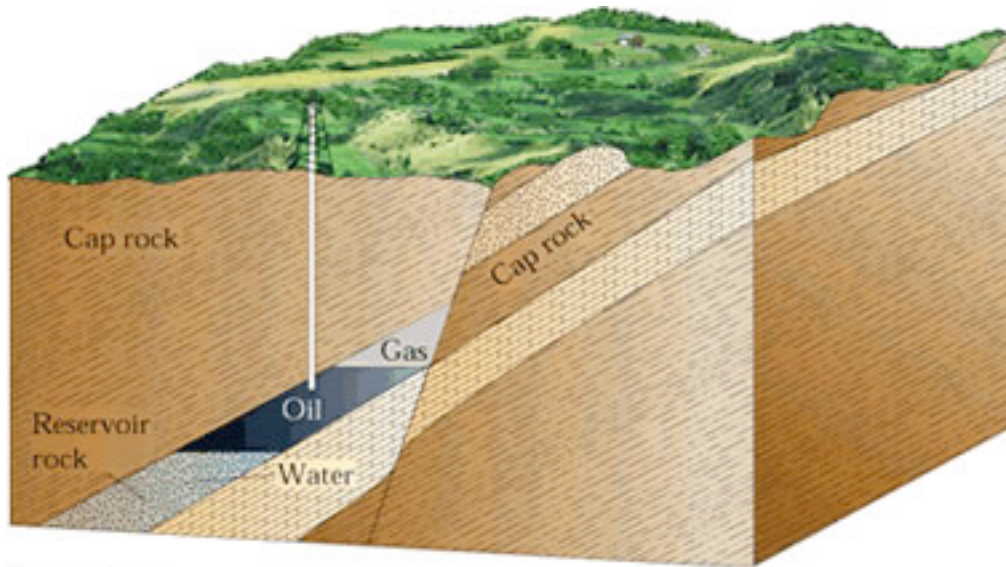
**Fault** - A break or planar surface in brittle rock across which there is observable displacement. Depending on the relative direction of displacement between the rocks, or fault blocks, on either side of the fault, its movement is described as normal, reverse or strike-slip.



**Fault Trap** - A type of structural hydrocarbon trap in which closure is controlled by the presence of at least one fault surface.

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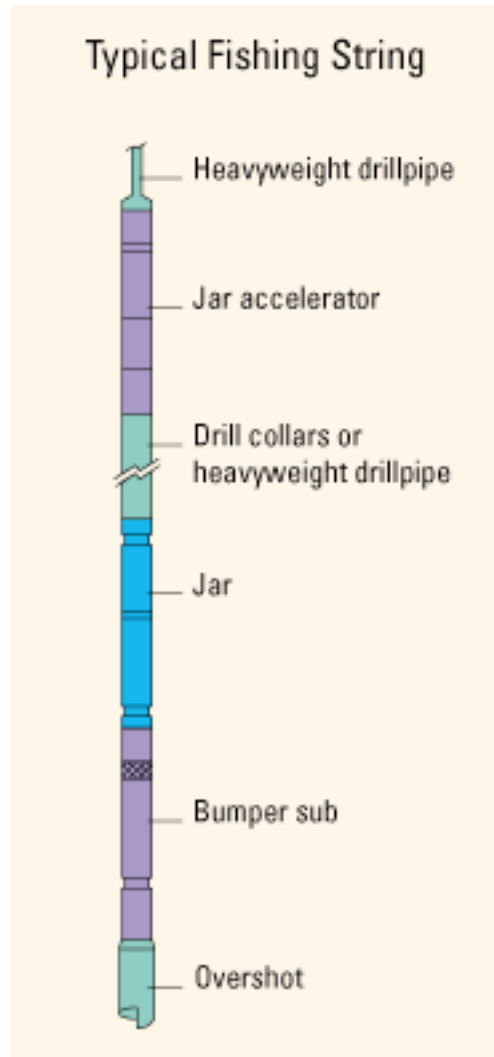


**B. Fault trap**

**Field (“FLD”)** - The area encompassing a group of producing oil and/or gas wells, generally from the same pool. (see “Pool”)

**Fish (“Fsh”)** - Anything left in a hole or wellbore. It does not matter whether “the fish” consists of junk metal, a hand tool, a length of drillpipe or drill collars, or an expensive mud motor and directional drilling package. Once the component is lost, it is properly referred to as simply “the fish.” Typically, anything put into the hole is accurately measured and sketched, so that appropriate fishing tools can be selected if the item must be fished out of the hole.

**Fishing Tool** - A general term for special mechanical devices used to aid the recovery of equipment lost downhole. These devices generally fall into four classes: diagnostic, inside grappling, outside grappling, and force intensifiers or jars. Diagnostic devices may range from a simple impression block made in a soft metal, usually lead, that is dropped rapidly onto the top of the fish so that upon inspection at the surface, the crew may be able to custom design a tool to facilitate attachment to and removal of the fish. Other diagnostic tools may include electronic instruments and even downhole sonic or visual-bandwidth cameras. Inside grappling devices, usually called spears, generally have a tapered and threaded profile, enabling the crew to first guide the tool into the top of the fish, and then thread the fishing tool into the top of the fish so that recovery may be attempted. Outside grappling devices, usually called “overshots” (*see below*), are fitted with threads or another shape that “swallows” the fish and does not release it as it is pulled out of the hole. Overshots are also fitted with a crude drilling surface at the bottom, so that the overshot may be lightly drilled over the fish, sometimes to remove rock or metallic junk that may be part of the sticking mechanism. Jars are mechanical downhole hammers, which enable the crew to deliver high-impact loads to the fish, far more than what could be applied in a quasi-static pull from the surface.



**Flare** - To burn unwanted natural gas through a pipe or stack.

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***Flowing Tubing Pressure (“FTP”)*** - The pressure on the tubing as a well flows oil and/or natural gas.

***Flowing Well*** - A well capable of producing oil by its own energy, without the aid of a pump or other means.

***Flowline*** - A surface pipeline carrying oil, natural gas or water that connects the christmas tree to a manifold or to production facilities, such as a heater-treater and separator.

***Fluid Level*** - The depth, or distance from surface, that the fluid in a well incapable of natural flow will reach under static conditions.

***Formation*** - A general term for the rock around the borehole. In the context of formation evaluation, the term refers to the volume of rock seen by a measurement made in the borehole, as in a log or a well test.

***Formation Damage*** - A general term to describe the reduction in permeability to the near-wellbore area of a reservoir formation. There are several recognized damage mechanisms, such as the invasion of incompatible fluids swelling the formation clays, or fine solids from dirty fluids plugging the formation matrix.

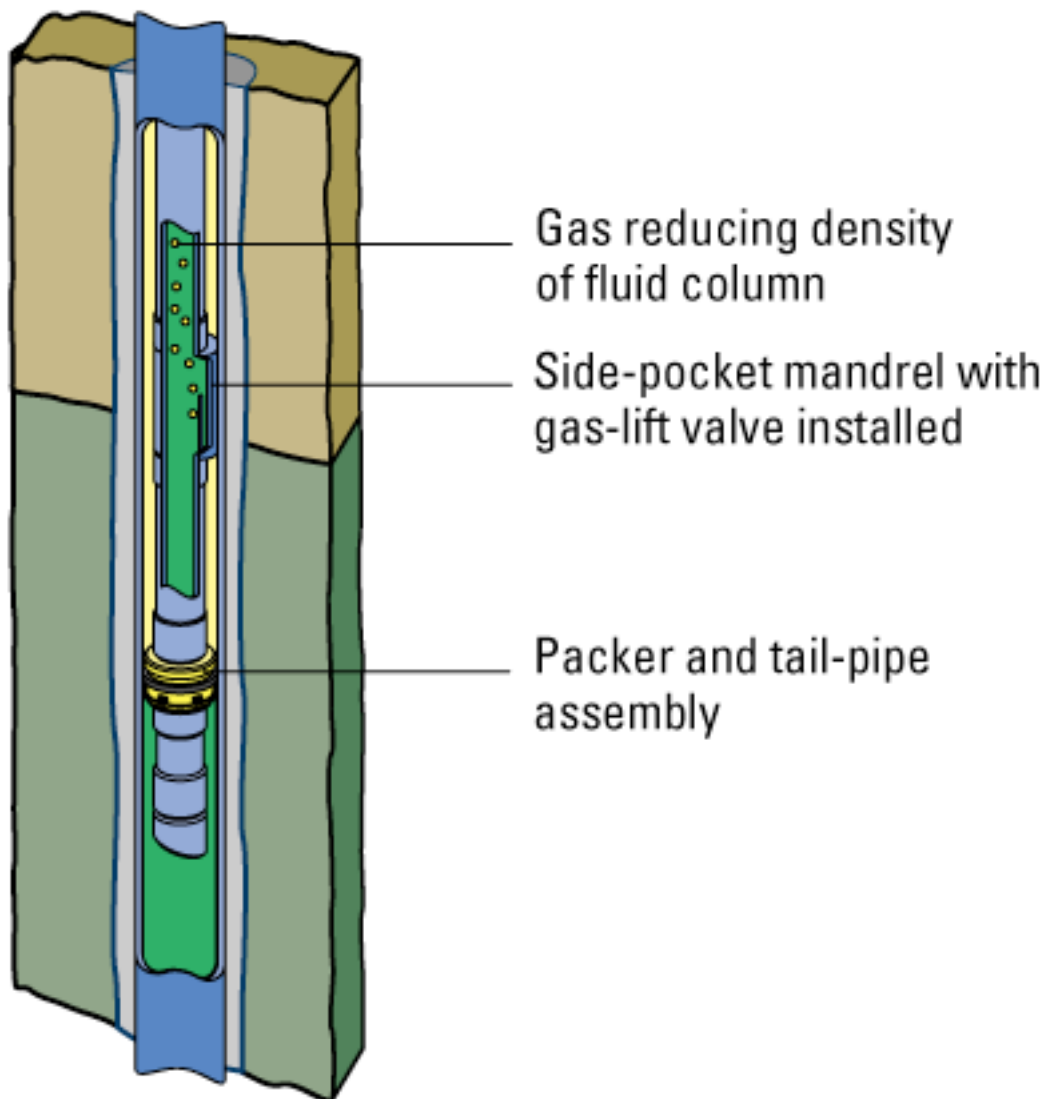
***Gamma Ray Log (“GR”)*** - A well logging technique wherein a hole is bombarded with gamma rays from a gamma ray emitting device to induce output signals that are then recorded and



transmitted to the surface. The gamma ray signals thus picked up indicate to the geologist the relative density of the rock formation penetrated by the hole at different intervals. (see “Electrical Log”)

**Gas Cap** - The natural gas that accumulates in the upper portions of a reservoir where the pressure, temperature and fluid characteristics are conducive to free natural gas.

**Gas Lift (“G/L”)** - An artificial-lift method in which gas is injected into the production tubing to reduce the hydrostatic pressure of the fluid column. The resulting reduction in bottomhole pressure allows the reservoir liquids to enter the wellbore at a higher flow rate. The injection gas is typically conveyed down the tubing-casing annulus and enters the production train through a series of “gas-lift valves.” The gas-lift valve position, operating pressures and gas injection rate are determined by specific well conditions.

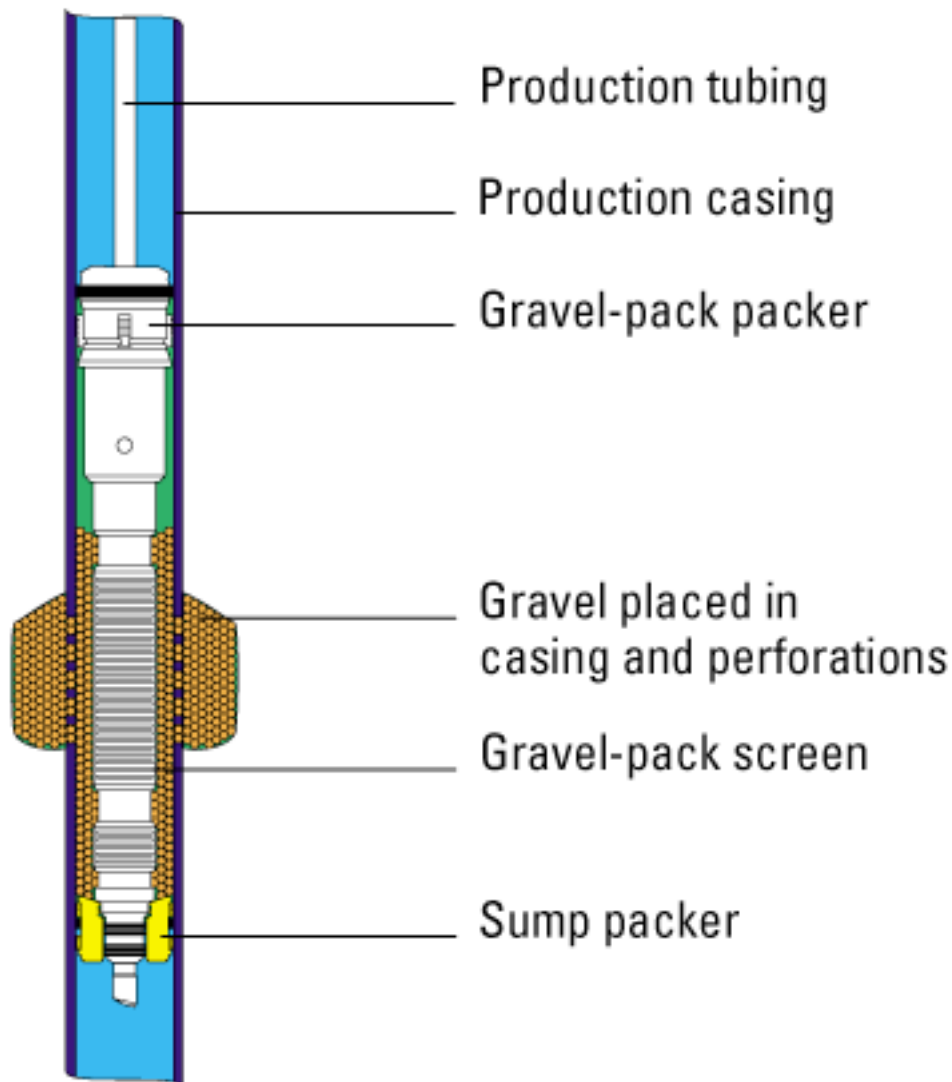


**Gathering Lines** - The pipes used to transport oil and/or gas from a field to the main pipeline in the area.

**Generator** - The person or company that assembles and prepares the geological data necessary to drill an oil and/or natural gas well. The generator usually earns a Carried Working Interest or a Back-in After Payout Working Interest in the well.

**Going in the Hole (“GIH”)** - An operation whereby the drillstring or any tools are lowered into the hole or wellbore.

**Gravel Pack** - A sand-control method used to prevent production of formation sand. In gravel pack operations, a steel screen is placed in the wellbore and the surrounding annulus packed with prepared gravel of a specific size designed to prevent the passage of formation sand. The primary objective is to stabilize the formation while causing minimal impairment to well productivity.



**Gross Pay** - The total thickness of a reservoir rock, including the impervious layers which do not contain hydrocarbons.

**Hook** - The high-capacity J-shaped equipment used to hang various other equipment, particularly the swivel and kelly and the elevator bails. The hook is attached to the bottom of the traveling block and provides a way to pick up heavy loads with the traveling block. The hook is either locked (the normal condition) or free to rotate, so that it may be mated or decoupled with items positioned around the rig floor, not limited to a single direction.

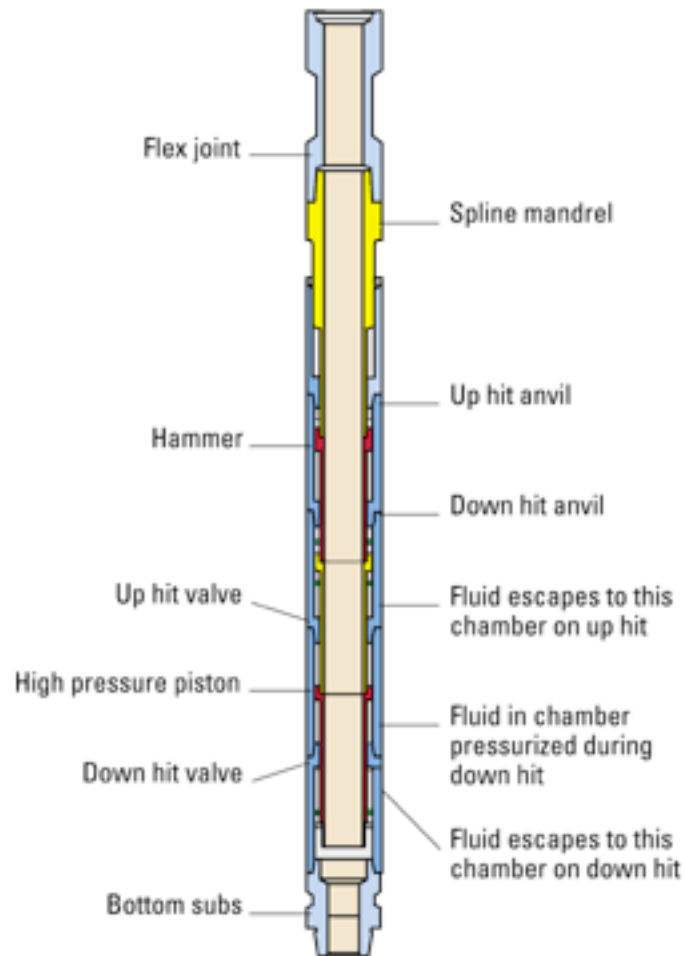
**Horizon** - An informal term used to denote a surface in or of rock, or a distinctive layer of rock that might be represented by a reflection in seismic data. The term is often used incorrectly to describe a zone from which hydrocarbons are produced.

**Hot Oiling** - Circulation of heated fluid, typically oil, to dissolve or dislodge paraffin deposits from the production tubing.

**Jar** - A mechanical device used downhole to deliver an impact load to another downhole component, especially when that component is stuck.

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## Hydraulic Jar

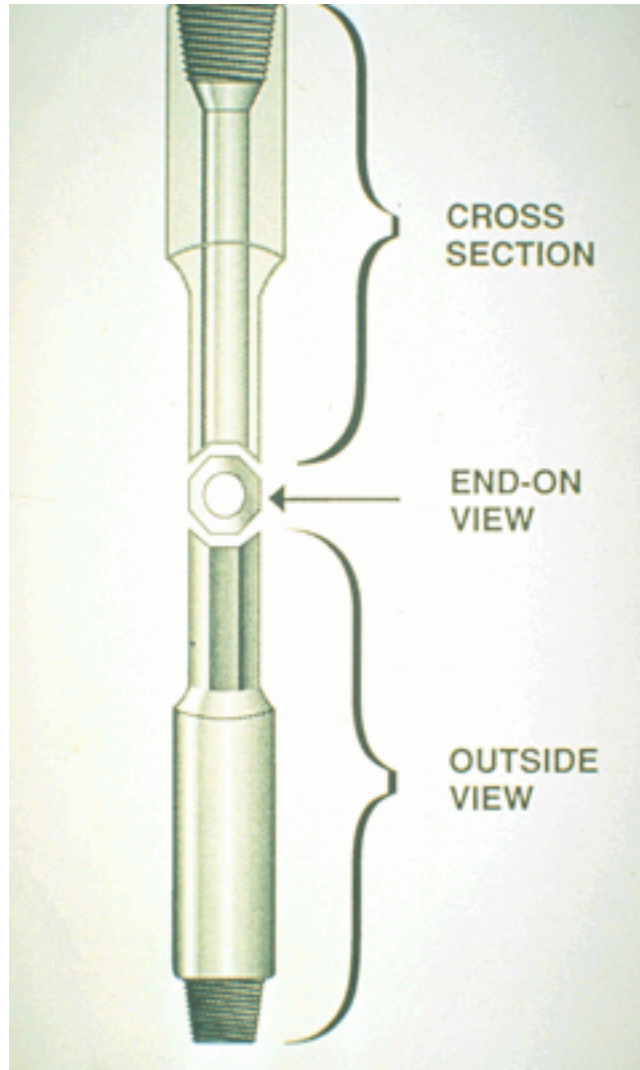


**Joint (“Jt”)** - A length of pipe, usually referring to drillpipe, casing or tubing.

**Junk** - Anything in the hole or wellbore that is not supposed to be there. The term is usually reserved for small pieces of steel such as hand tools, small parts, bit nozzles, pieces of bits or other downhole tools, and remnants of milling operations.

**Junk Basket** - A tool run into the wellbore to retrieve junk from the bottom of the hole.

**Kelly** - 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 be lowered or raised during rotation. The kelly goes through the kelly bushing, which is driven by the rotary table. The kelly bushing has an inside profile matching the kelly’s outside profile (either square or hexagonal), but with slightly larger dimensions so that the kelly can freely move up and down inside.



***Kelly Bushing (“KB”)*** - An adapter that serves to connect the rotary table to the kelly. The kelly bushing has an inside diameter profile that matches that of the kelly, usually square or hexagonal. It is connected to the rotary table by four large steel pins that fit into mating holes in the rotary table. The rotary motion from the rotary table is transmitted to the bushing through the pins, and then to the kelly itself through the square or hexagonal flat surfaces between the kelly and the kelly bushing. The kelly then turns the entire drillstring because it is screwed into the top of the drillstring itself. Depth measurements are commonly referenced to the KB, such as 8,327 feet KB, meaning 8,327 feet below the kelly bushing.

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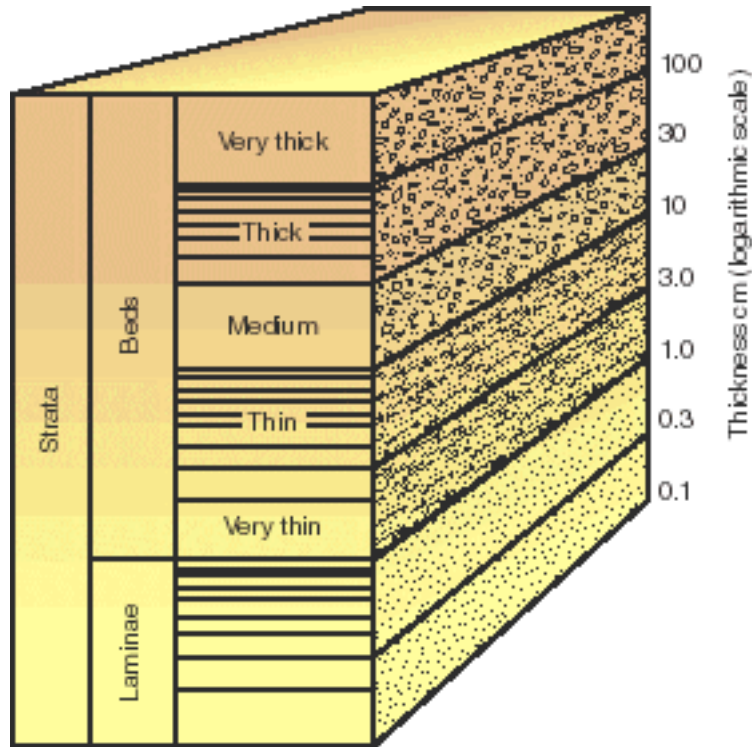
***Kelly Hose*** - A large-diameter, high-pressure flexible line used to connect the standpipe to the swivel. This flexible piping arrangement permits the kelly (and, in turn, the drillstring and bit) to be raised or lowered while drilling fluid is pumped through the drillstring. The simultaneous lowering of the drillstring while pumping fluid is critical to the drilling operation.

***Kick*** - A flow of reservoir fluids into the hole during drilling operations. The “kick” is physically caused by the pressure in the hole being less than that of the formation fluids, thus causing flow.

***Kill*** - To stop a well from flowing (or having the ability to flow) into the hole or wellbore. Kill procedures typically involve circulating reservoir fluids out of the hole or pumping higher density mud into the wellbore, or both.

***Lamination*** - A fine layer in strata, also called a lamina, common in fine-grained sedimentary rocks such as shale, silt stone and fine sandstone. A sedimentary bed comprises multiple laminations, or laminae.

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**Lease Automatic Custody Transfer (“L.A.C.T.” or “L.A.C.T. Unit”)** - A system of oil handling on a lease; receiving into tankage, measuring, testing, and turning into a pipeline the oil produced on a lease.

**Lease Operating Expense (“LOE”)** - The customary expenses incurred with the operation and maintenance of a well and the production and marketing of oil, natural gas or other minerals therefrom.

**Line Heater** - Equipment that transfers heat to the produced gas stream. Heaters are especially used when producing natural gas or condensate to avoid the formation of ice and gas hydrates. These solids can plug the wellhead, chokes and flowlines. The production of natural gas is usually accompanied by water vapor. As this mixture is produced, it cools down on its way to the surface and also when the mixture passes through a surface production choke. This reduction of fluid temperature can favor the formation of gas hydrates if heaters are not used. Heaters may also be used to heat emulsions before further treating procedures or when producing crude oil in cold weather to prevent freezing of oil or formation of paraffin accumulations.

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**Liner (“Lnr”)** - Another name for casing, particularly intermediate casing.

**Log** - Detailed depth related records of certain significant details of an oil or gas well; usually obtained by lowering measurement instruments into a well. (See “*Electrical Log*,” “*Resistivity Log*” and “*Sonic Log*”)

**Lost Circulation** or **Lost Returns** - A lack of mud returning to the surface after being pumped down a hole. Lost circulation occurs when the drill bit encounters natural fissures, fractures or caverns, and mud flows into the newly available space. Lost circulation may also be caused by applying more mud pressure (that is, drilling overbalanced) on the formation than it is strong enough to withstand, thereby opening up a fracture into which mud flows.

**Lost Circulation Material (“LCM”)** - The collective term for substances added to drilling fluids when drilling fluids are being lost to the formations downhole. Commonly used lost circulation materials include are fibrous (cedar bark, shredded cane stalks, mineral fiber and hair), flaky (mica flakes and pieces of plastic or cellophane sheeting) or granular (ground and sized limestone or marble, wood, nut hulls, formica, corncobs and cotton hulls). Laymen have likened lost-circulation materials to the “fix-a-flat” materials for repair of automobile tires.

**Lubricator** - A long, high-pressure pipe fitted to the top of a wellhead or christmas tree so that tools may be put into a high-pressure well. The top of the lubricator assembly includes a high-pressure grease-injection section and sealing elements. The lubricator is installed on top of the tree and tested, the tools placed in the lubricator and the lubricator pressurized to wellbore

pressure. Then the top valves of the tree are opened to enable the tools to fall or be pumped into the wellbore under pressure.

**Make a Connection** - To add a length of drillpipe to the drillstring to continue drilling.

**Make Hole** - To deepen a hole with the drill bit. To drill ahead.

**Make Up (“M/U”)** - To screw a pipe or other threaded connection together or to assemble tools.

**Mcf and Mmcf** - The standard unit for measuring volumes of natural gas. Mcf is one thousand cubic feet and Mmcf is one million cubic feet.

<b><i>Cubic Feet of Gas</i></b>	<b><i>Abbreviation</i></b>
1,000	1 Mcf
10,000	10 Mcf
100,000	100 Mcf
1 Million	1 Mmcf
1 Billion	1 Bcf
1 Trillion	1 Tcf

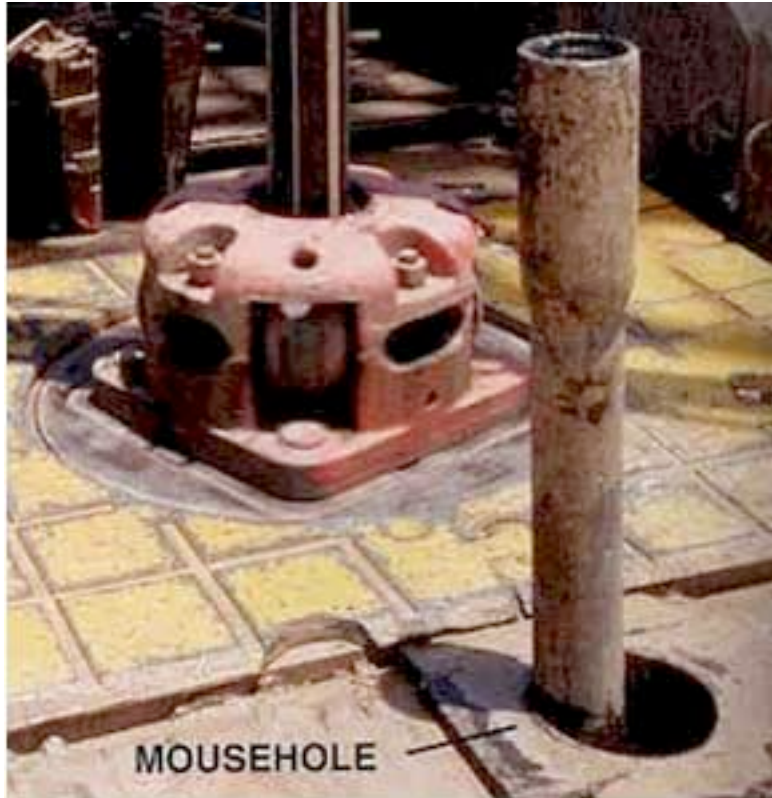
**Measured Depth (“MD”)** - The length of the borehole, as if determined by a measuring stick. This measurement differs from the “true vertical depth” of the well in all but vertical wells.

**Measurement-while Drilling (“MWD”)** - The evaluation of physical properties, usually including pressure, temperature and wellbore trajectory in three-dimensional space, while extending a borehole. The measurements are made downhole, stored in solid-state memory for some time and later transmitted to the surface. Data transmission methods vary from company to company, but usually involve digitally encoding data and transmitting to the surface as pressure pulses in the mud system. These pressures may be positive, negative or continuous sine waves.

**Mill (“MI”)** - A tool that grinds metal downhole. A mill is usually used to remove junk in the hole or to grind away all or part of a casing string.

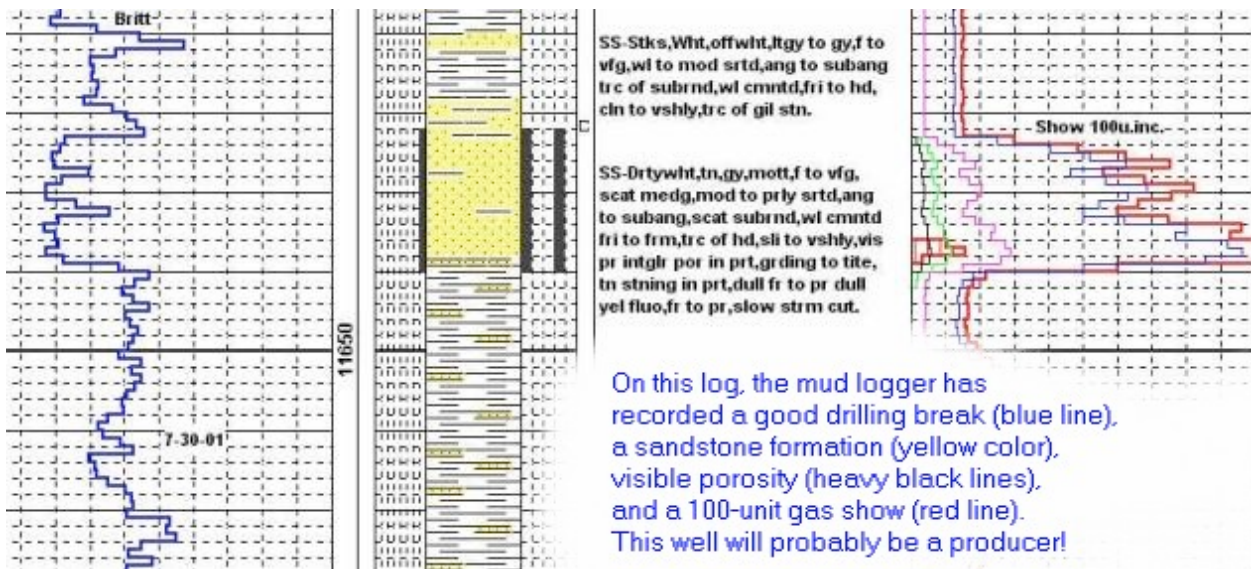
**Mousehole** - A shallow borehole under the rig floor, usually lined with pipe, in which joints of drillpipe are temporarily placed.

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**Move In (“MI”)** - The process of moving the rig and other equipment onto the location.

**Mud Log** - A progressive analysis of the borehole cuttings washed up from the hole by the drilling mud, plus a record of the variations in drilling rate, mud pumping pressure, depths of formation changes and an analysis of the mud for oil and natural gas traces.



**Mud Motor** - A downhole drilling motor that is powered by the force of the drilling mud pushed through the motor by the mud pumps at the surface.

**Mud Tanks** or **Pits** - A large tank that holds drilling fluid for the rig. For land rigs, most mud pits are rectangular steel construction, with partitions that hold about 200 barrels each. Earthen mud pits were the earliest type of mud pit, but environmental protection concern has led to less frequent use of open pits in the ground. Today, earthen pits are used only to store used or waste mud and cuttings before disposal and remediation of the site of the pit.

**Mud Weight (“MW”)** - The mass per unit volume of a drilling fluid, synonymous with mud density. Mud weight controls hydrostatic pressure in a hole and prevents unwanted flow into the hole. The weight of the mud also prevents collapse of an openhole.

**Natural Gas (“NG”)** - A naturally occurring mixture of hydrocarbon gases that is highly compressible and expandable. Methane is the chief constituent of most natural gas (constituting as much as 85% of some natural gases), with lesser amounts of ethane, propane, butane and pentane. Impurities can also be present in large proportions, including carbon dioxide, helium, nitrogen and hydrogen sulfide.

**Net Pay** - The aggregate thickness of only those parts of the reservoir which contain and produce hydrocarbons.

**Net Revenue Interest (“NRI”)** - A share of production after all burdens, such as royalty and overriding royalty, have been deducted from the working interest. It is the percentage of production that each party actually receives.

**Nipple Down (“N/D”)** - To take apart fittings in making a hook up; to assemble a system of pipe, valves, and nipples as in a christmas tree or a blowout preventer.

**Nipple Up (“N/U”)** - To put together fittings in making a hook up; to assemble a system of pipe, valves, and nipples as in a christmas tree or a blowout preventer.

**Noncommercial** - A well or zone that is not capable of producing enough oil or natural gas to pay for the costs of drilling, completing, and hooking up or to operate the well.

**Non-operator** - The working interest owner or owners other than the one designated as the operator of a well.

**Off-loading** - Another term for unloading.

**Offset Well** - An existing wellbore close to a proposed well that provides information for planning the proposed well.

**Oil** - A liquid hydrocarbon. (See “Crude Oil”)

**Oil, Gas and Mineral Lease (“OGML”)** - A contract between an operator and a landowner which gives the operator the right to drill for oil and natural gas on his property for a consideration.

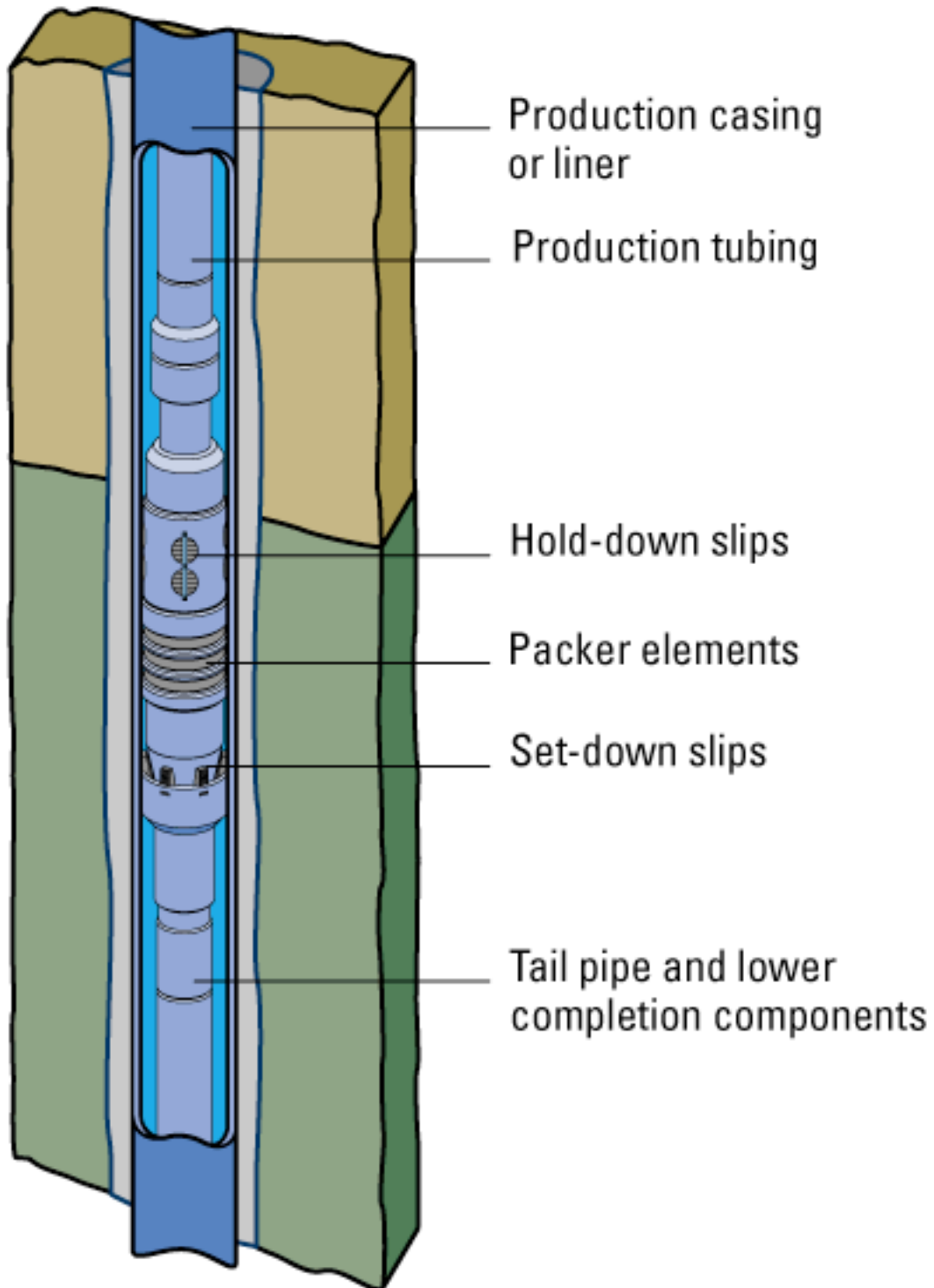
**Openhole (“OH”)** - The uncased portion of a borehole.

**Operator** - The company responsible for managing the exploration, development and production operations on behalf of the non-operators. In some cases the operator does not own an interest in the well it operates.

**Overshot** - A downhole tool used in fishing operations to engage on the outside surface of a tube or tool. A grapple, or similar slip mechanism, on the overshot grips the fish, allowing application of tensile force and jarring action. If the fish cannot be removed, a release system within the overshot allows the overshot to be disengaged and retrieved.

**Packer (“Pkr”)** - A downhole device used in almost every completion to isolate the annulus from the production conduit, enabling controlled production, injection or treatment. A typical packer assembly incorporates a means of securing the packer against the casing or liner wall, such as a slip arrangement, and a means of creating a reliable hydraulic seal to isolate the annulus, typically by means of an expandable elastomeric element. Packers are classified by application, setting method and possible retrievability. They may be run on wireline, pipe or coiled tubing.

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**Pad** - The area of the “location” directly under the rig, usually constructed of extra layers of wood. The pad is installed to support the extra weight of the rig.

**Paraffin** - A hydrocarbon compound that often precipitates on production components as a result of the changing temperatures and pressures within the production system. Heavy paraffin's 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. Nevertheless, it can form at the perforations, or even inside the formation, especially in depleted reservoirs or reservoirs under gas-cycling conditions.

**Paraffin Control** - A set of techniques used to prevent or considerably reduce paraffin deposition. Paraffin control might involve the following options: (i) use of paraffin inhibitors; (ii) maintaining pipe surfaces in a water-wet condition because paraffin will not adhere to water; (iii) coating the pipe with plastic to provide a smooth surface and reduce paraffin adhesion; or (iv) reducing heat transfer to maintain the oil temperature above its cloud point.

**Paraffin Inhibitor** - A chemical injected into the wellbore to prevent or minimize paraffin deposition. The effectiveness of paraffin inhibitors is strongly dependent on crude oil composition.

**Parts Per Million (“ppm”)** - For solid and liquid concentrations, “ppm” is stated in weight (mass) units.

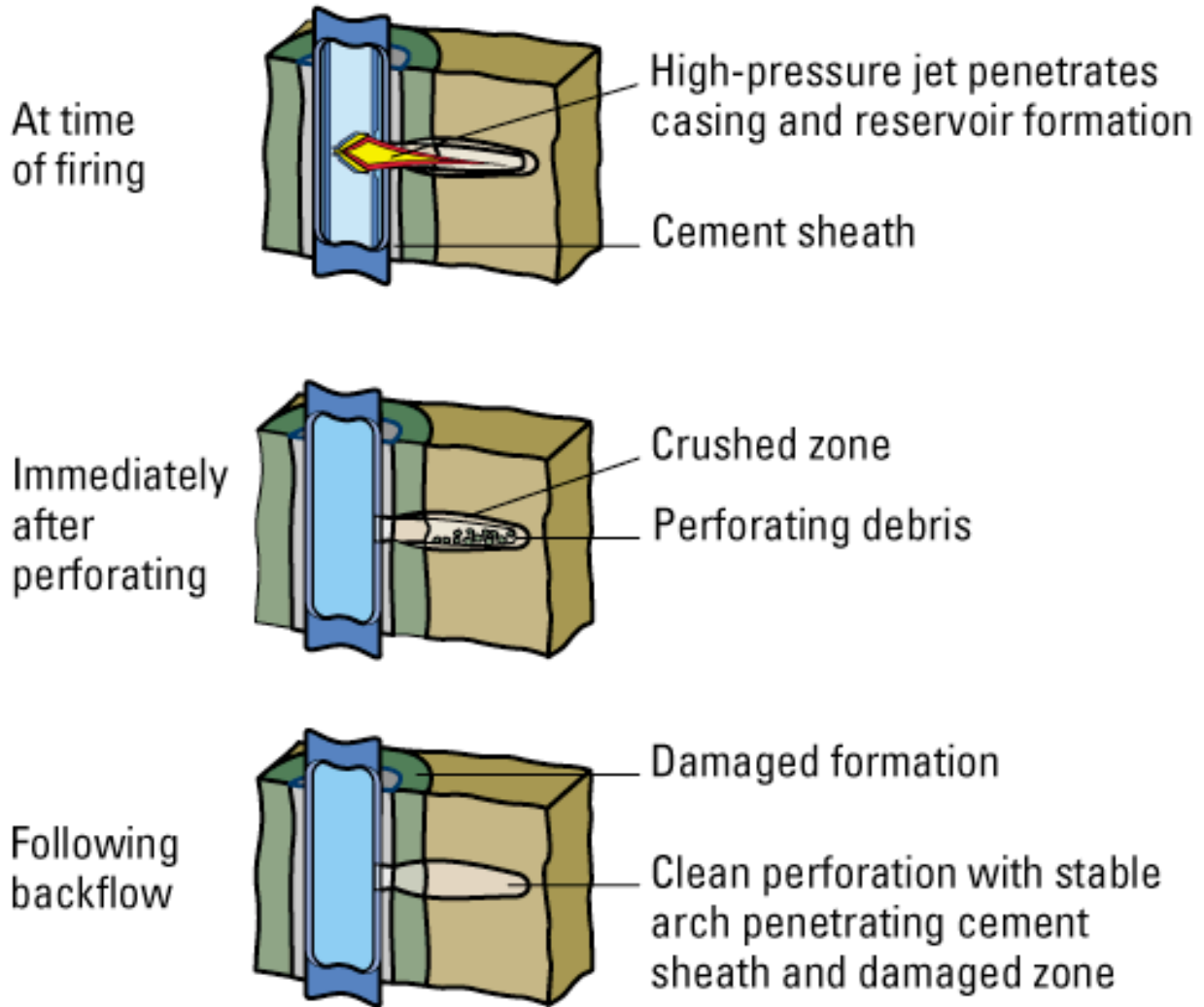
**Pay** - A reservoir or portion of a reservoir that contains economically producible hydrocarbons. The term derives from the fact that it is capable of “paying” an income. Pay is also called “pay sand” or “pay zone.” The overall interval in which pay sections occur is the gross pay; the smaller portions of the gross pay that meet local criteria for pay (such as minimum porosity, permeability and hydrocarbon saturation) are net pay.

**Payout** - The point at which all costs of leasing, exploring, drilling, completing, equipping and operating have been recovered from production of a well or wells as defined by contractual agreement.

**Perforate (“Perf”)** - To create holes in the production casing or liner to achieve efficient communication between the reservoir and the wellbore. The characteristics and placement of the communication paths (perforations) can have significant influence on the productivity of the well. Therefore, a robust design and execution process should be followed to ensure efficient creation of the appropriate number, size and orientation of perforations. A perforating gun assembly with the appropriate configuration of shaped explosive charges and the means to verify or correlate the correct perforating depth can be deployed on wireline, tubing or coiled tubing.

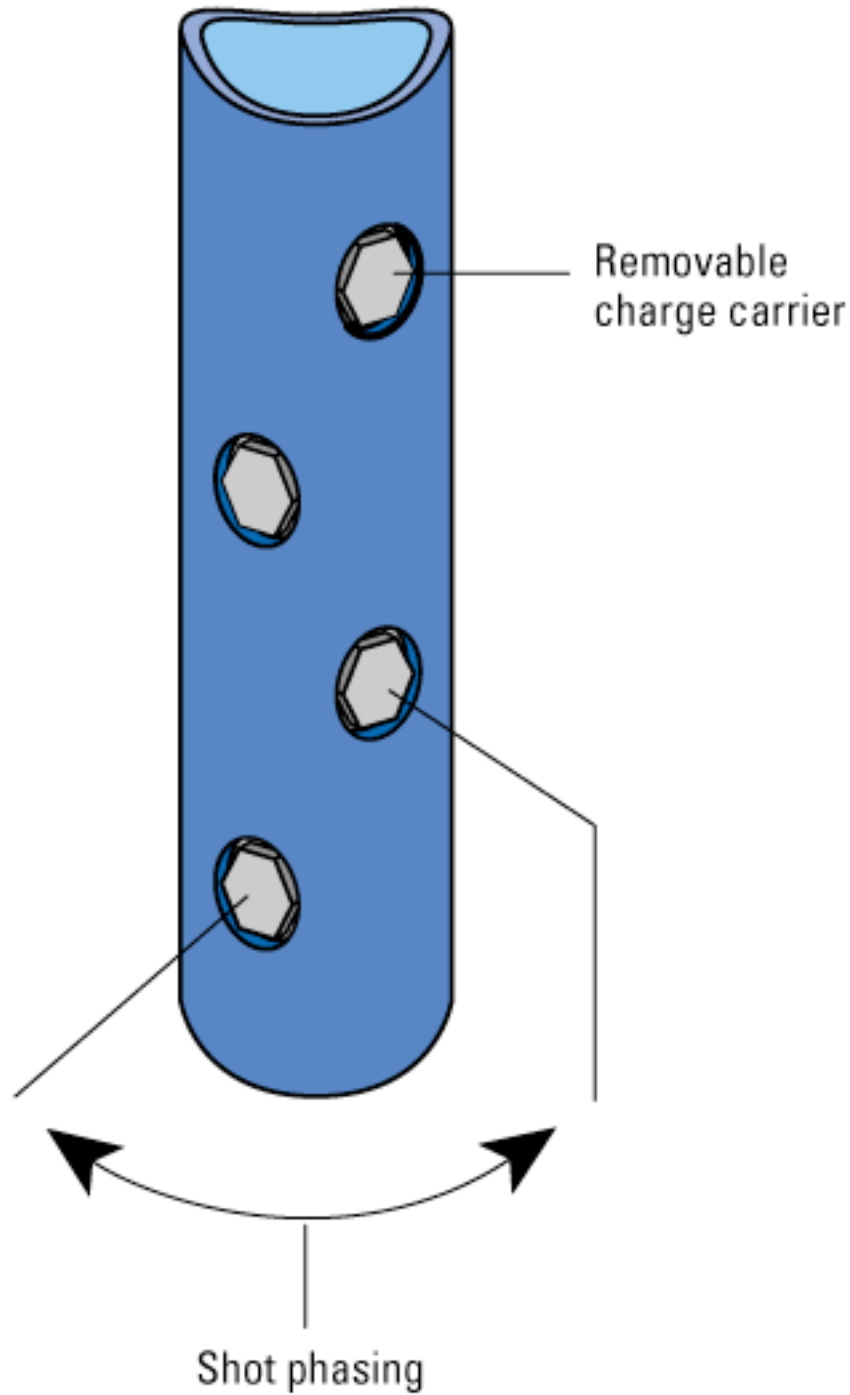
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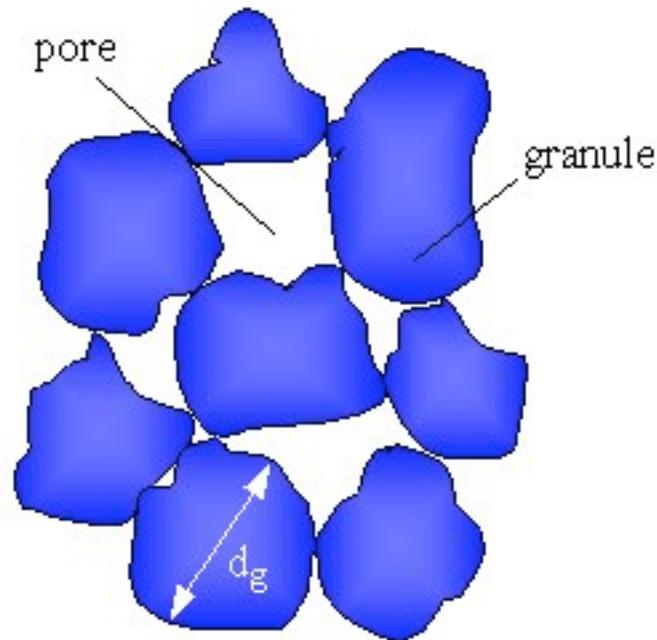
**Perforating Gun** - A device used to perforate the production casing in the wellbore of an oil and/or natural gas well in preparation for production. Containing several shaped explosive charges, perforating guns are available in a range of sizes and configurations. The diameter of the gun used is typically determined by the presence of wellbore restrictions or limitations imposed by the surface equipment.

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**Perforation** - The communication tunnel created from the casing into the reservoir formation, through which oil and/or natural gas is produced. The most common method uses jet perforating guns equipped with shaped explosive charges. However, other perforating methods include bullet perforating, abrasive jetting or high-pressure fluid jetting.

**Permeability** - A measure of the resistance of rock to the movement of fluids. Rocks may have holes or void spaces in them (see “Porosity”), but if these holes do not connect, the permeability can be drastically reduced.



**Pick Up (“P/U”)** - The operation of lifting something with the draw works of the rig in order to enter the hole or wellbore.

**Pig** - A cylindrical device inserted into a pipeline to inspect the pipe or to sweep the line clean of water, rust or other foreign matter; pipeline inspection and cleaning devices are called pigs because early models squealed as they moved through the pipe.

**Pill** - A small volume of drilling mud used for a specific purpose in a drilling operation. Various types of pills are needed from time to time on the rig, such as to stop circulation loss or free stuck drillpipe.

**Pipeline** - A tube or system of tubes used for transporting crude oil or natural gas from the field or gathering system to the refinery.

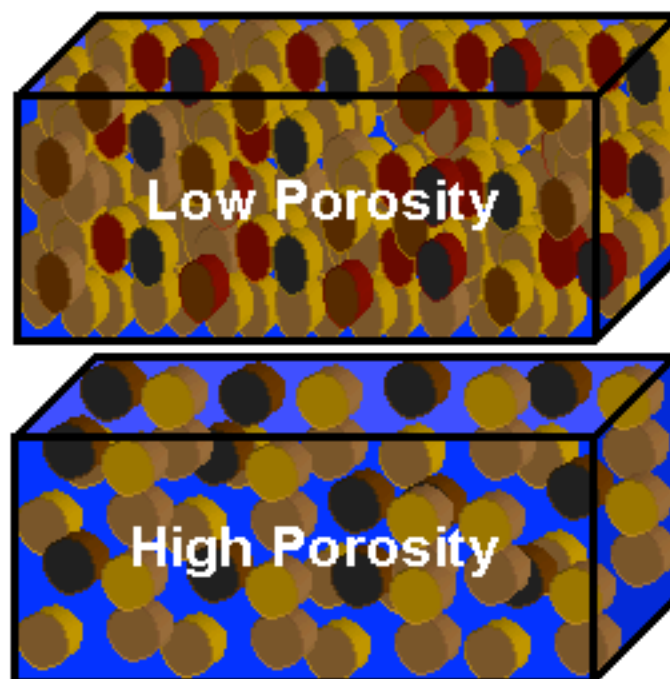
**Plug (“Plg”)** - A seal of cement (or other impervious material) deliberately placed in a wellbore to prevent the flow of water, natural gas, or oil from one strata to another when a well is abandoned in one zone.

**Plug Back (“PB”)** - To plug off or fill up the lower section of the wellbore to produce from a formation higher up.

**Plug and Abandon (“P&A”)** - The act of plugging a well for the purposes of abandoning the hole or wellbore.

**Pool** - A “pool” is a single, separate reservoir with its own pressure system so that wells drilled in any part of the pool affect the reservoir pressure throughout the pool.

**Porosity** - The percentage of pore volume or void space, or that volume within rock that can contain fluids. Effective porosity is the interconnected pore volume in a rock that contributes to fluid flow in a reservoir. It excludes isolated pores. Total porosity is the total void space in the rock whether it contributes to fluid flow. Thus, effective porosity is typically less than total porosity.



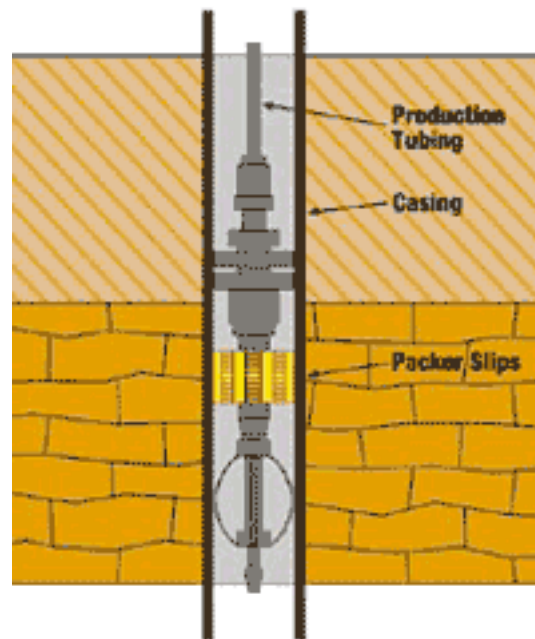
**Positive Choke** - A choke that cannot be manually adjusted.

**Pounds Per Gallon (“ppg”)** - Pounds-per-gallon, more correctly written lb/gal. For example, the density of water is 8.33 ppg at 60°F.

**Pounds per Square Inch (“PSI”)** - A force of one pound-force is applied to an area of one square inch.

**Production Casing** - The last string of casing set in a well; production casing is tubular steel pipe connected by threads and couplings that lines the total length of the wellbore to ensure safe control of production, prevent water from entering the wellbore and keep rock formations from “sloughing” into the wellbore.

**Production Tubing** - Steel pipe inside the casing used to flow the petroleum from the producing zone to the surface.



**Proposed Bottomhole Location (“PBHL”)** - The proposed bottomhole location of a directionally drilled well.

**Proposed Total Depth (“PTD”)** - The proposed total depth of a well to be drilled.

**Proven Reserves** - Oil and natural gas which has been discovered and determined to be recoverable but is still in the ground.

**Pull Out Of Hole (“POOH”)** - The operation of pulling the drillstring or any other equipment out of the hole or wellbore.

**Pumper or Gauger** - An employee of an operator who is responsible for gauging the oil and/or natural gas sold from the wells he has been assigned and who is also responsible for maintaining and reporting the daily production.

**Rabbit** - A term for an internal drift diameter gauge typically used to check casing or tubing joints before they are picked up and run into the hole or wellbore. Can also mean a tool put through a flowline, tubing or casing for the purpose of cleaning rust or other foreign matter.

**Rathole** - A storage place for the kelly, consisting of an opening in the rig floor fitted with a piece of casing with an internal diameter larger than the outside diameter of the kelly, but less

than that of the upper kelly valve so that the kelly may be lowered into the rathole until the upper kelly valve rests on the top of the piece of casing.

**Ream (“Rm”)** - To enlarge a hole. Reaming may be necessary for several reasons. Perhaps the most common reason for reaming a section of a hole is that the hole was not drilled as large as it should have been at the outset. This can occur when a bit has been worn down from its original size, but might not be discovered until the bit is tripped out of the hole, and some under gauge hole has been drilled. Some plastic formations may slowly flow into the hole over time, requiring the reaming operation to maintain the original hole size.

**Recompletion** - The operation of sealing off old perforations in order to complete the well in another formation higher in the wellbore.

**Recovery** - The fraction of hydrocarbons that can or has been produced from a well, reservoir or field; also, the fluid that has been produced.

**Reserve Pit** - An earthen-berm storage area for discarded drilling mud. These small reservoirs are used for several reasons. First, when properly arranged, most of the solids in the mud settle out and a suction hose may be placed in the reserve pit to have additional fluid available to pump into the hole in an emergency. At the end of drilling operations, and perhaps at intermediate times during drilling, the fluids and solids in the reserve pit must be carefully discarded, usually by transfer to a properly certified landfill. If the mud is benign, the solids (mostly clay), and liquids (water), may be plowed and tilled back into the local soil. This technique of disposal and reclamation is known as “land farming.”

**Reserve Mud Pit** - Any pit not part of the active (circulatory) system. The reserve pit may be used to store spare or waste mud, base oil or brine. In operations on land, the reserve pit is usually a plastic-lined, earthen pit, in which waste mud is stored until final disposal.

**Reservoir** - A subsurface body of rock having sufficient porosity and permeability to store and transmit fluids. Sedimentary rocks are the most common reservoir rocks because they have more porosity than most igneous and metamorphic rocks and form under temperature conditions at which hydrocarbons can be preserved. A reservoir is a critical component of a complete petroleum system.

**Resistivity Log** - A log of the resistivity of the formation, expressed in ohm-m. The resistivity can take a wide range of values, and, therefore, for convenience is usually presented on a logarithmic scale from, for example, 0.2 to 2000 ohm-m. The resistivity log is fundamental in formation evaluation because hydrocarbons do not conduct electricity while all formation waters do. Therefore a large difference exists between the resistivity of rocks filled with hydrocarbons and those filled with formation water. Clay minerals and a few other minerals, such as pyrite, also conduct electricity, and reduce the difference. Some measurement devices, such as



induction and propagation resistivity logs, may respond more directly to conductivity, but are presented in resistivity.

**Retrievable Bridge Plug** - A type of downhole isolation tool that may be unset and retrieved from the wellbore after use, such as may be required following treatment of an isolated zone. A retrievable bridge plug is frequently used in combination with a packer to enable accurate placement and injection of stimulation or treatment fluids.

**Retrievable Packer** - A type of packer that is run and retrieved on a running string or production string, unlike a permanent production packer that is set in the casing or liner before the production string is run.

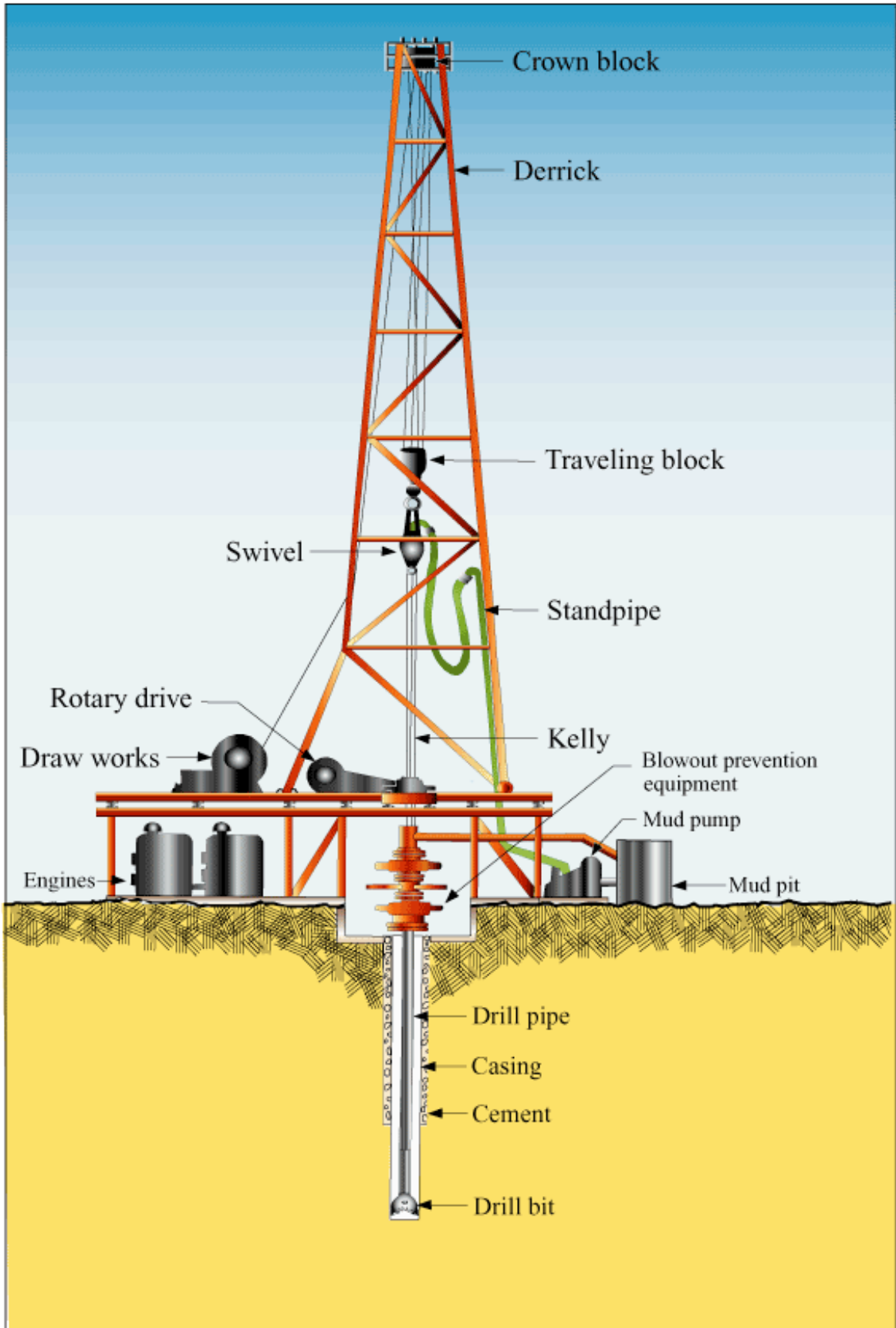
**Returns** - Mud that comes back to the surface and exits through the flowline after being pumped down the drillpipe. “Lost Returns” is the situation in which some or all the mud does not come back to the surface, which indicates that mud is being lost into weak or fractured formations downhole.

**Reverse Circulation** or **Reversing Out** - To circulate fluid down the wellbore annulus, with returns being made up the tubing string. Reverse circulation often is used to remove debris from the wellbore since the high fluid flow rate inside the tubing string enables the recovery of large or dense debris particles that are difficult or impossible to remove with conventional circulation.

**Rework** - To restore production where it has fallen off substantially or ceased altogether, cleaning out an accumulation of sand and silt from the bottom of the wellbore.

**Rig** - The machine used to drill a well. The rig includes virtually everything except living quarters. Major components of the rig include the mud tanks and pumps, the derrick, the draw works, the rotary table, the drillstring, the power generation equipment and auxiliary equipment.

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**Rig Down (“R/D”)** - To take apart equipment for storage and portability. Equipment typically must be disconnected from power sources, de-coupled from pressurized systems, disassembled and moved off the rig floor or even off location.

**Rig Floor** - The relatively small work area in which the rig crew conducts operations, usually adding or removing drillpipe to or from the drillstring. Drillstring connections are made or broken on the drill floor, and the driller’s console for controlling the major components of the rig are located there. Attached to the rig floor is a small metal room (the “doghouse”), where the rig crew can meet, take breaks and take refuge from the elements during idle times.



**Rig Up (“R/U”)** - To make ready for use. Equipment must typically be moved onto the rig floor, assembled and connected to power sources or pressurized piping systems.

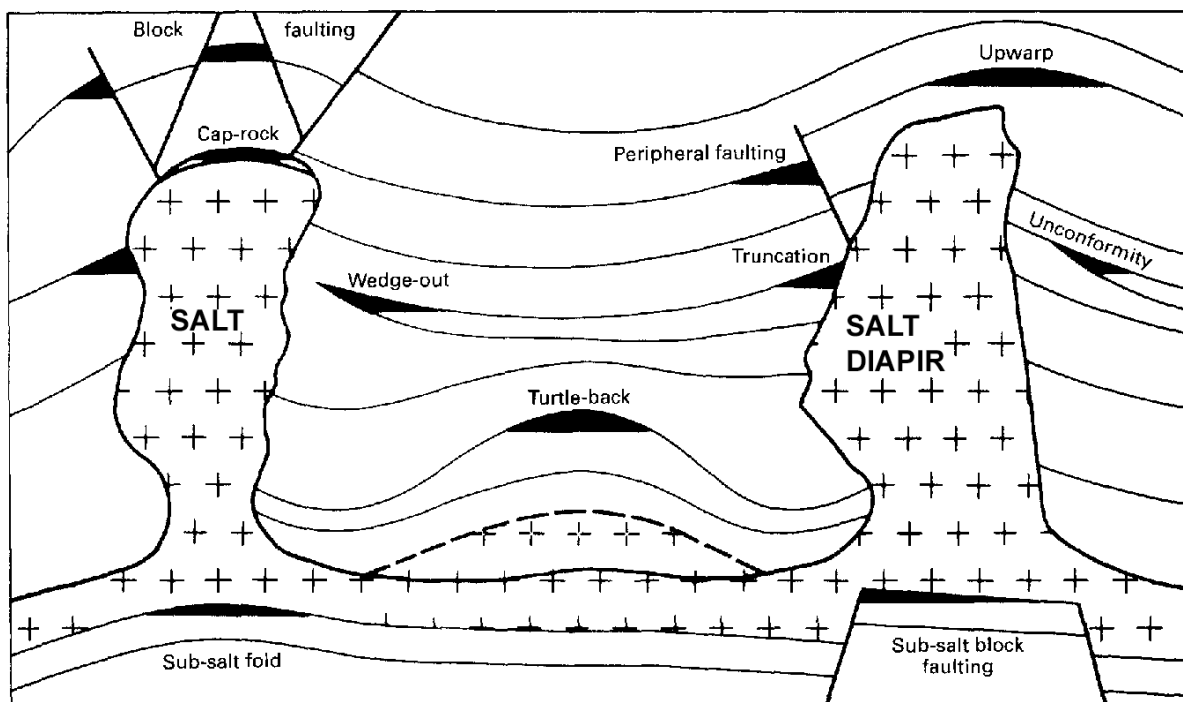
**Rotary Table** - The revolving or spinning section of the drill floor that provides power to turn the drillstring in a clockwise direction. The rotary motion and power are transmitted through the kelly bushing and the kelly to the drillstring. When the drillstring is rotating, the drilling crew commonly describes the operation as simply, “rotating to the right” or “turning to the right.”

**Roughneck** - A member of the drilling crew; the driller's assistants who work on the derrick floor, up in the derrick racking pipe, tend to the drilling engines and mud pumps, and on a "trip" operate the pipe tongs breaking out or unscrewing the stands of drillpipe.

**Roustabout** - A production employee who works on a lease or around a drilling rig doing manual labor.

**Royalty Interest (Landowner or Override)** - A "landowner" royalty interest is an ownership of some part of production or production revenues, produced from leased acreage. The owner of this share of production does not bear any of the cost of exploration, drilling, producing, operating, marketing or any other expense associated with drilling and producing an oil and/or natural gas well. An "overriding" royalty interest is an ownership in some part of production or production revenues, free of the cost of production, created by the lessee, company and/or working interest owner and paid by the lessee, company and/or working interest owner out of revenue from the well.

**Salt Dome** - A mushroom-shaped or plug-shaped diapir made of salt, commonly having an overlying cap rock. Hydrocarbons are commonly found around salt domes because of the abundance and variety of traps created by salt movement and the association with evaporite minerals that can provide excellent sealing capabilities.



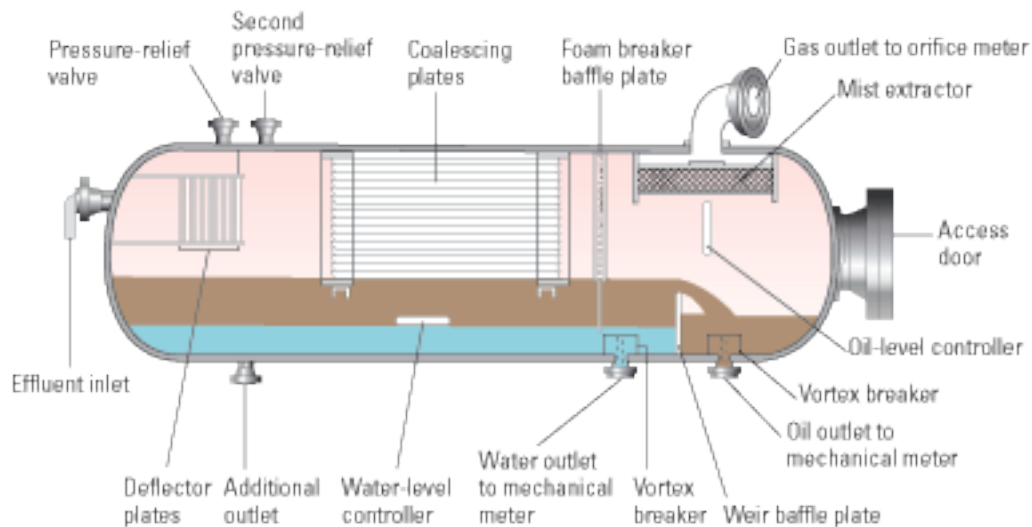
**Saltwater Disposal Well** - A well drilled for the sole purpose of disposing saltwater waste. The saltwater is pumped down the wellbore into saltwater formations deep enough not to pollute shallow fresh water sands.

**Sand (“Sd”)** - 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. Common terminology for oil and/or natural gas-bearing sandstone formations.

**Sanded Up** - A well clogged by sand that has drifted and washed into the wellbore from the producing formation by the action of the oil.

**Seismic Section (“Seismic”)** - A display of seismic data along a line, such as a 2D seismic profile or a profile extracted from a volume of 3D seismic data. A seismic section consists of numerous traces with location given along the x-axis and two-way travel time or depth along the y-axis. The section is called a depth section if the section has been converted from time to depth and a time section if this has not been done.

**Separator** - A cylindrical or spherical vessel used to separate oil, natural gas and water from the total fluid stream produced by a well. Separators can be either horizontal or vertical.



**Set Pipe or Casing** - To cement casing in the hole. The cement is pumped downhole (inside the casing) to the bottom of the borehole and forced up into the annular space between casing and the rock wall of the borehole. The decision to “set pipe” is an indication that the well is deemed commercial.

**Shale (“Sh”)** - A fine-grained, fissile, detrital sedimentary rock formed by consolidation of clay and silt-sized particles into thin, relatively impermeable layers. It is the most abundant sedimentary rock. Its typical fine grain size and lack of permeability, a consequence of the alignment of its platy or flaky grains, allow shale to form a good cap rock for hydrocarbon traps.

***Shale Shaker*** - The primary and probably most important device on the rig for removing drilled solids from the drilling mud. This vibrating sieve is simple in concept, but a bit more complicated to use efficiently. A wire-cloth screen vibrates while the drilling fluid flows on top of it. The liquid phase of the drilling mud and solids smaller than the wire mesh pass through the screen, while larger solids are retained on the screen and eventually fall off the back of the device and are discarded.

***Short Trip*** - An abbreviated recovery of pipe out of, and then the replacement of same back into the hole. Such a trip is normally limited to 10 or 20 stands of drillpipe. Since the short trip is drillpipe only (no bottomhole assembly for the drilling crew to handle), and is limited in length, it can be accomplished quickly and sometimes results in additional information or improved operating conditions. A short trip often is used to gauge whether a hole is clean or whether the mud weight is sufficient to permit a full trip out of the hole.

***Shut Down (“SD”)*** - A well or work is “shut down” when drilling or work ceases, which can happen for many reasons: failure of equipment; waiting on pipe; waiting on cement; waiting on orders from the operator; night time, etc.

***Shut-in (“SI”)*** - To close the valves at the christmas tree so that the well stops flowing or producing.

***Shut-in Bottomhole Pressure (“SIBHP”)*** - The force per unit area exerted at the bottom of a wellbore when it is closed at either the christmas tree or the BOP. The SIBHP is generated by a combination of the hydrostatic pressure from the weight of the liquid in the wellbore and any additional applied pressure. The applied pressure component may be from the formation or from an external source at the surface.

***Shut-in Pressure (“SIP”)*** - The surface force per unit area exerted at the top of a wellbore when it is closed at either the christmas tree or the BOP. The pressure may be from the formation or an external and intentional source. The SIP may be zero, indicating that any open formations are effectively balanced by the hydrostatic column of fluid in the wellbore. If the pressure is zero, the well is considered to be dead, and can normally be opened safely to the atmosphere.

***Sidetrack (“ST”)*** - To drill a secondary borehole away from an original borehole or wellbore. A sidetracking operation may be done intentionally or may occur accidentally. Intentional sidetracks might bypass an unusable section of the original borehole or wellbore or explore a geologic feature nearby. In the bypass case, the secondary borehole is usually drilled substantially parallel to the original borehole, which may be inaccessible due to an irretrievable fish, junk in the hole, or a collapsed borehole.

***Sidewall Core (“SWC”)*** - A core taken from the side of the borehole, usually by a wireline tool. Sidewall cores may be taken using percussion or mechanical drilling. Percussion cores (the most common) are taken by firing hollow bullets into the formation. The bullets are attached to the



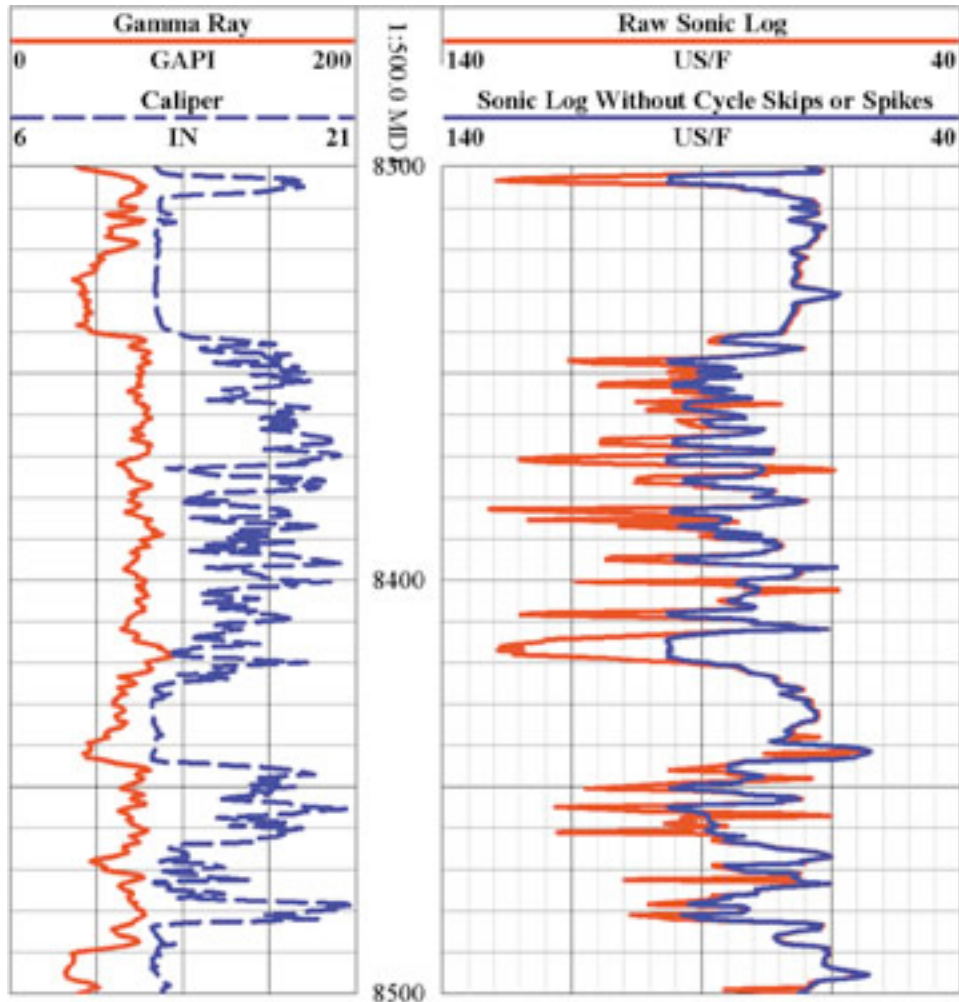
tool by fasteners, and are retrieved, along with the core inside, by pulling up the tool and the fasteners. Percussion coring tools typically hold 20 to 30 bullets, but two or three tools can be combined on one run in the hole. With full recovery, cores from typical percussion tools are 1 inch in diameter by 1 ¾ inch long.

***Slickline (“SL”)*** - A thin single-strand non electric cable used to run and retrieve tools and flow-control equipment in oil and gas wells. The single round strand of wire passes through a stuffing box and pressure-control equipment mounted on the christmas tree to enable slickline operations to be conducted safely on live wellbores. In addition, a slickline can be used to for selective placement and retrieval of wellbore hardware, such as plugs, gauges and valves located in side pocket mandrels. Valves and sleeves can also be adjusted using slickline tools.

***Slug*** - A volume of mud that is more dense than the mud in the drillpipe and hole annulus. A slug is used to displace mud out of the upper part of the drillpipe before pulling pipe out of the hole and is mixed in the pill pit by adding additional weighting material (barite) to a few barrels of mud from the surface pits. The “pill” is pumped into the top of the drillstring to push mud downward, out of the pipe, thus keeping the upper stands of pipe empty.

***Sonic Log (“S/L”)*** - A type of acoustic log that displays travel time of P-waves versus depth. Sonic logs are typically recorded by pulling a tool on a wireline up the wellbore. The tool emits a sound wave that travels from the source to the formation and back to a receiver.

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**Spot (“Spt”)** - To accurately place a fluid, or fluid interface, at a given position within the hole or wellbore. Treatment fluids such as cement slurries and stimulation fluids for localized treatment often require accurate placement. Can also mean to place equipment in its proper place on a location.

**Spotting Fluid** - A small volume or pill of fluid placed in a hole annulus to free differentially stuck pipe. Oil-base mud is the traditional stuck-pipe spotting fluid. Speed in mixing and placing the spot is of primary importance to successfully freeing pipe. A spot frees pipe by covering the stuck region. It presumably breaks up the filter cake, allowing the spot to migrate into cracks in the cake and between the pipe and the cake, reducing the stuck area and allowing pipe to be pulled free.

**Spud (“Spd”)** - To start the actual drilling of a well.

**Spud Mud** - Mud used to drill a well from surface to a shallow depth. Onshore spud mud is usually a water-base mud containing bentonite clay that is flocculated with lime. In a large-

diameter surface hole, a flocculated clay-based mud can remove large gravel cuttings encountered at shallow depths and is simple and inexpensive.

***Squeeze*** - The careful application of pump pressure to force a treatment fluid or slurry into a planned treatment zone. In most cases, a squeeze treatment will be performed at downhole injection pressure below that of the formation fracture pressure. In high-pressure squeeze operations, performed above the formation fracture pressure, the response of the formation and the injection of treatment fluid may be difficult to predict.

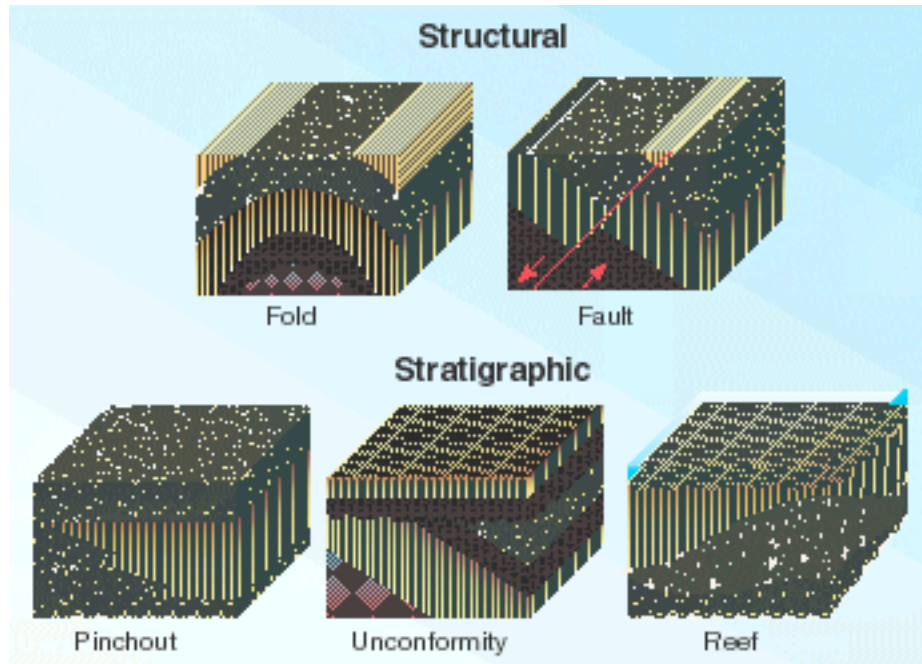
***Stand*** - Two, three or four single joints of drillpipe or drill collars that remain screwed together during tripping operations. The drillpipe or drill collars are stood back upright in the derrick and placed into fingerboards to keep them orderly. This is a relatively efficient way to remove the drillstring from the hole when changing the bit or making adjustments to the bottomhole assembly, rather than unscrewing every threaded connection and laying the pipe down to a horizontal position.

***Standpipe*** - A rigid metal conduit that provides the high-pressure pathway for drilling mud to travel approximately one-third of the way up the derrick, where it connects to a flexible high-pressure hose (kelly hose). Many large rigs are fitted with dual standpipes so that downtime is kept to a minimum if one standpipe requires repair.

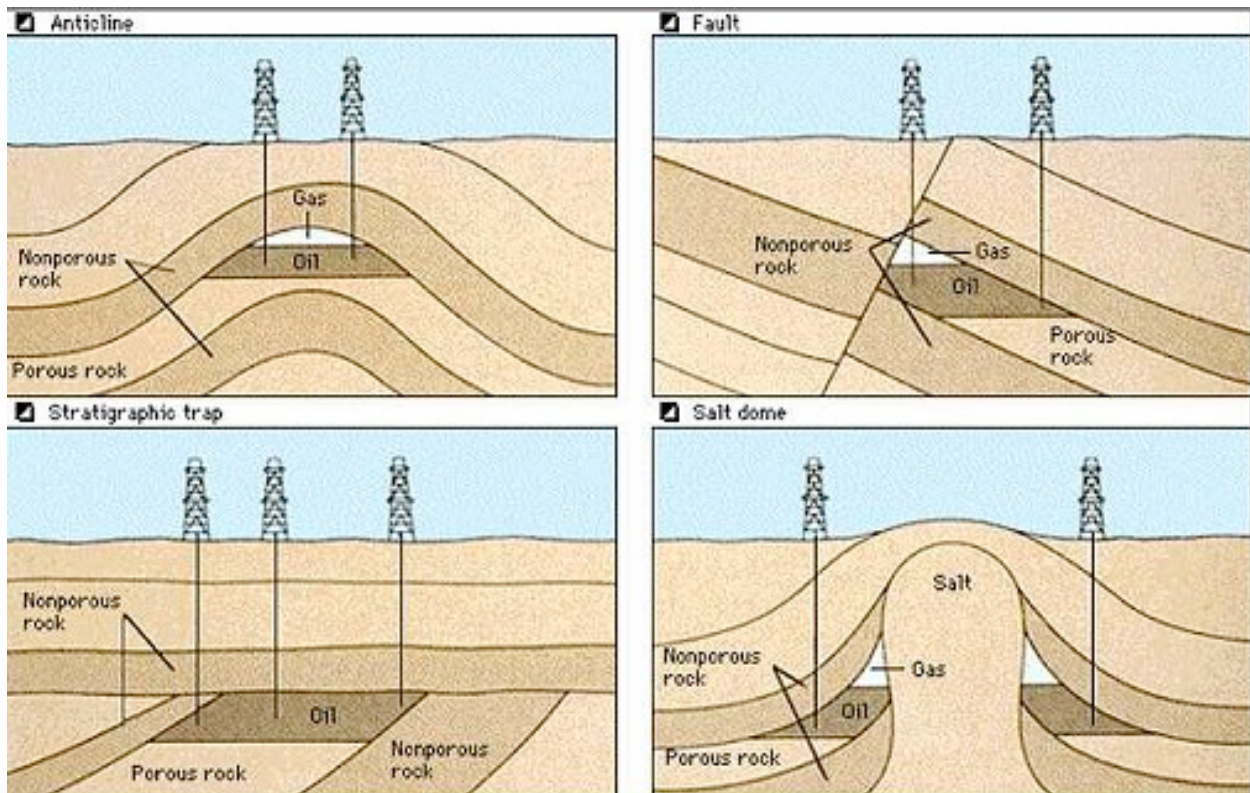
***Storm Choke*** - A downhole valve that operates by fluid velocity and closes when the fluid flow from the well exceeds preset limits. The forerunner to modern subsurface controlled safety valves, storm chokes were used in offshore applications as a contingency device in the event of a catastrophic failure of surface facilities during a storm or hurricane.

***Stratigraphic Trap*** - A variety of sealed geologic container 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.

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**Structural Trap** - A variety of sealed geologic structures capable of retaining hydrocarbons, such as a fault or a fold. Stratigraphic traps form where changes in rock type can retain hydrocarbons.



**Sub** - Any small component of the drillstring, such as a short drill collar or a thread crossover.

**Surface Casing** - The first string of casing put into a well; it is cemented into place and serves to shut out shallow water formations and as a foundation for well control.

**Survey** - A completed measurement of the inclination and azimuth of a location in a hole (typically the total depth at the time of measurement). In both directional and straight holes, the position of the well must be known with reasonable accuracy to ensure the correct borehole path and to know its position in the event a relief well must be drilled. The measurements themselves include inclination from vertical, and the azimuth (or compass heading) of the borehole if the direction of the path is critical. These measurements are made at discrete points in the well, and the approximate path of the borehole computed from the discrete points.

**Swab (“Swb”)** - To unload liquids from the production tubing to initiate flow from the reservoir. A swabbing tool string incorporates a weighted bar and swab cup assembly that are run in the wellbore on heavy wireline. When the assembly is retrieved, the specially shaped swab cups expand to seal against the tubing wall and carry the liquids from the wellbore.

**Sweep or Sweep Pill** - A relatively small volume of viscous fluid, typically a carrier gel, that is circulated to sweep, or remove, debris or residual fluids from the circulation system.

**Swivel** - A mechanical device that must simultaneously suspend the weight of the drillstring, provide for rotation of the drillstring beneath it while keeping the upper portion stationary, and permit high-volume flow of high-pressure drilling mud from the fixed portion to the rotating portion without leaking.

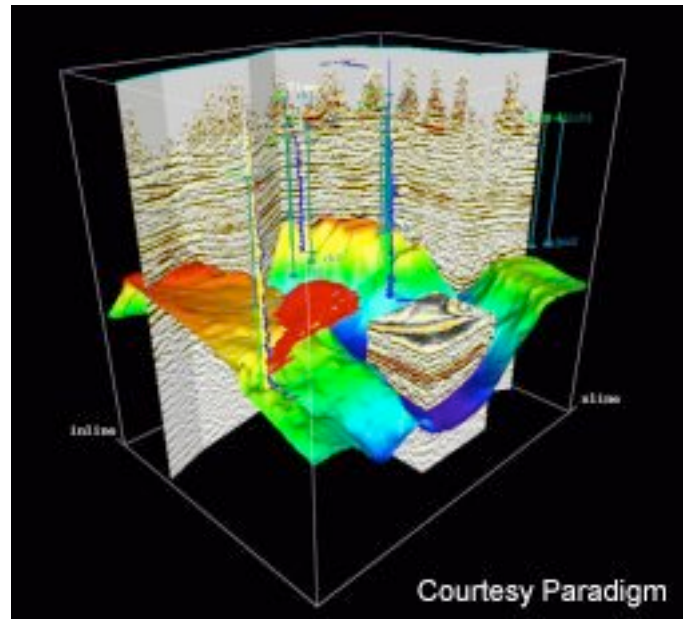


**Tag** - To contact a known reference point or obstruction in the hole or wellbore with the tubing string, wireline or other intervention equipment.

**Three-dimensional Seismic Data (“3-D” or “3-D seismic”)** - A set of numerous closely spaced seismic lines that provide a high spatially sampled measure of subsurface reflectivity. Typical receiver line spacing can range from 1,000 feet to over 2,000 feet and typical distances between shot points and receiver groups is 110 feet or 220 feet. The resultant data set can be “cut” in any direction but still display a well sampled seismic section. The original seismic lines are called



in-lines. Lines displayed perpendicular to in-lines are called cross-lines. In a properly migrated 3-D seismic data set, events are placed in their proper vertical and horizontal positions, providing more accurate subsurface maps than can be constructed on the basis of more widely spaced 2-D seismic lines, between which significant interpolation might be necessary. In particular, 3-D seismic data provides detailed information about fault distribution and subsurface structures.



***Tieback Liner*** - A section of liner that is run from a liner hanger back to the wellhead after the initial liner and hanger system have been installed and cemented. A tieback liner may be required to provide the necessary pressure capacity during a flow-test period or for special treatments, and is typically not cemented in place. In some cases, a tieback liner will be installed as a remedial treatment when the integrity of the intermediate casing string is in doubt.

***Tie-in*** - An operation in pipeline construction in which two sections of line are connected: a loop tied into the main line; a lateral line to a trunk line.

***Tight (“Tite”)*** - Describing a relatively impermeable reservoir rock from which hydrocarbon production is difficult.

***Tight Hole*** - A well that the operator requires be kept as secret as possible, especially the geologic information.

***Tongs*** - Large-capacity, self-locking wrenches used to grip drillstring components and apply torque. As with opposing pipe wrenches for a plumber, the tongs must be used in opposing pairs. As a matter of efficiency, one set of tongs is essentially tied off with a cable or chain to the derrick, and the other is actively pulled with mechanical cat heads.





***Tool Pusher*** - A supervisor of drilling operations on a well. Drillers are directed in their work by the tool pusher.

***Top Drive*** - Hydraulic or electric motors that are suspended in the derrick above the rig floor to rotate the drill string and bit.



***Total Depth (“TD”)*** - The bottom of a particular hole section, hole or wellbore.

***Trap*** - A mass of porous, permeable rock - sealed on top and both sides by nonporous, impermeable rock that halts the migration of oil and natural gas, causing them to accumulate.

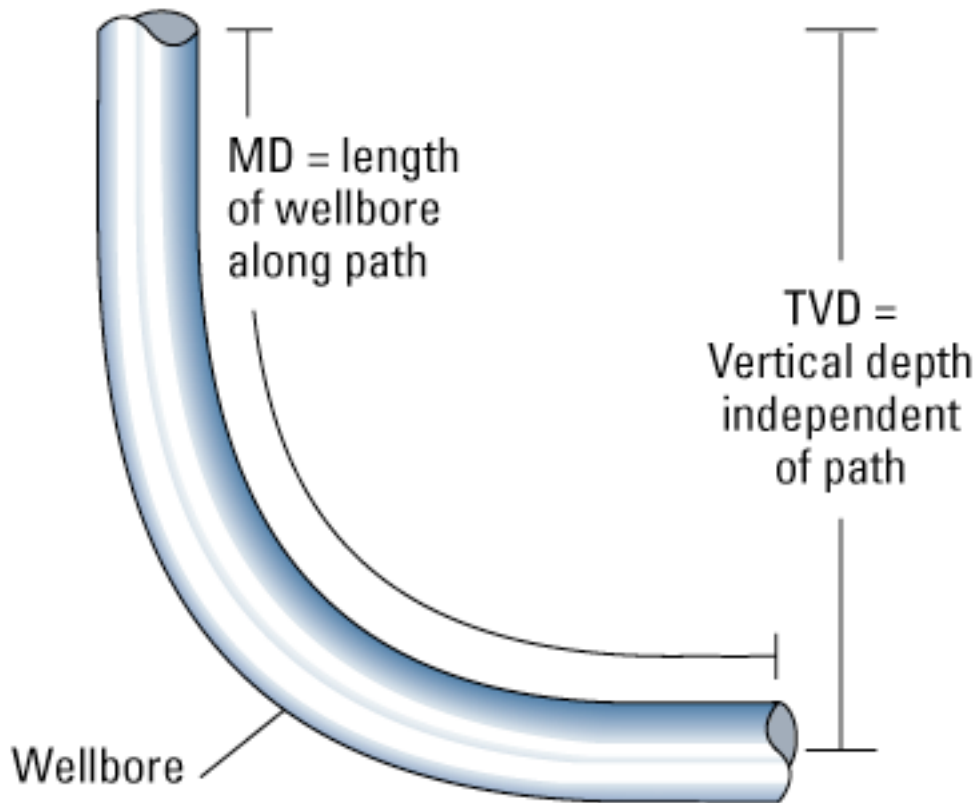
***Traveling Block*** - The large, heavy-duty block hanging in the derrick and to which the hook is attached. The traveling block supports the drillstring and “travels” up and down as it hoists the drillstring out of the hole and lowers it in.



***Trip*** - The complete operation of removing the drillstring from the hole and running it back in the hole. This operation is typically undertaken when the bit becomes dull or broken. The rig crew removes the drillstring 90-120 feet at a time (a “stand”), by unscrewing every third or fourth drillpipe or drill collar connection. When the stand is unscrewed from the rest of the drillstring, it is carefully stored upright in the derrick by the fingerboards at the top and careful placement on wooden planks on the rig floor. After the drillstring has been removed from the hole, the bit is unscrewed and a new bit is screwed onto the bottom of the drill collars. The drill collars and drillpipe are “run in the hole” (RIH). Once on bottom, drilling starts again. The duration of this operation depends on the total depth of the hole. A general estimate for a round trip requires one hour per thousand feet of hole, plus an hour or two for handling collars and bits. At that rate, a round trip in a 10,000 foot well might take 12 hours.

***True Vertical Depth (“TVD”)*** - The vertical distance from a point in the well (usually the current or final depth) to a point at the surface, usually the elevation of the rotary kelly bushing (RKB).

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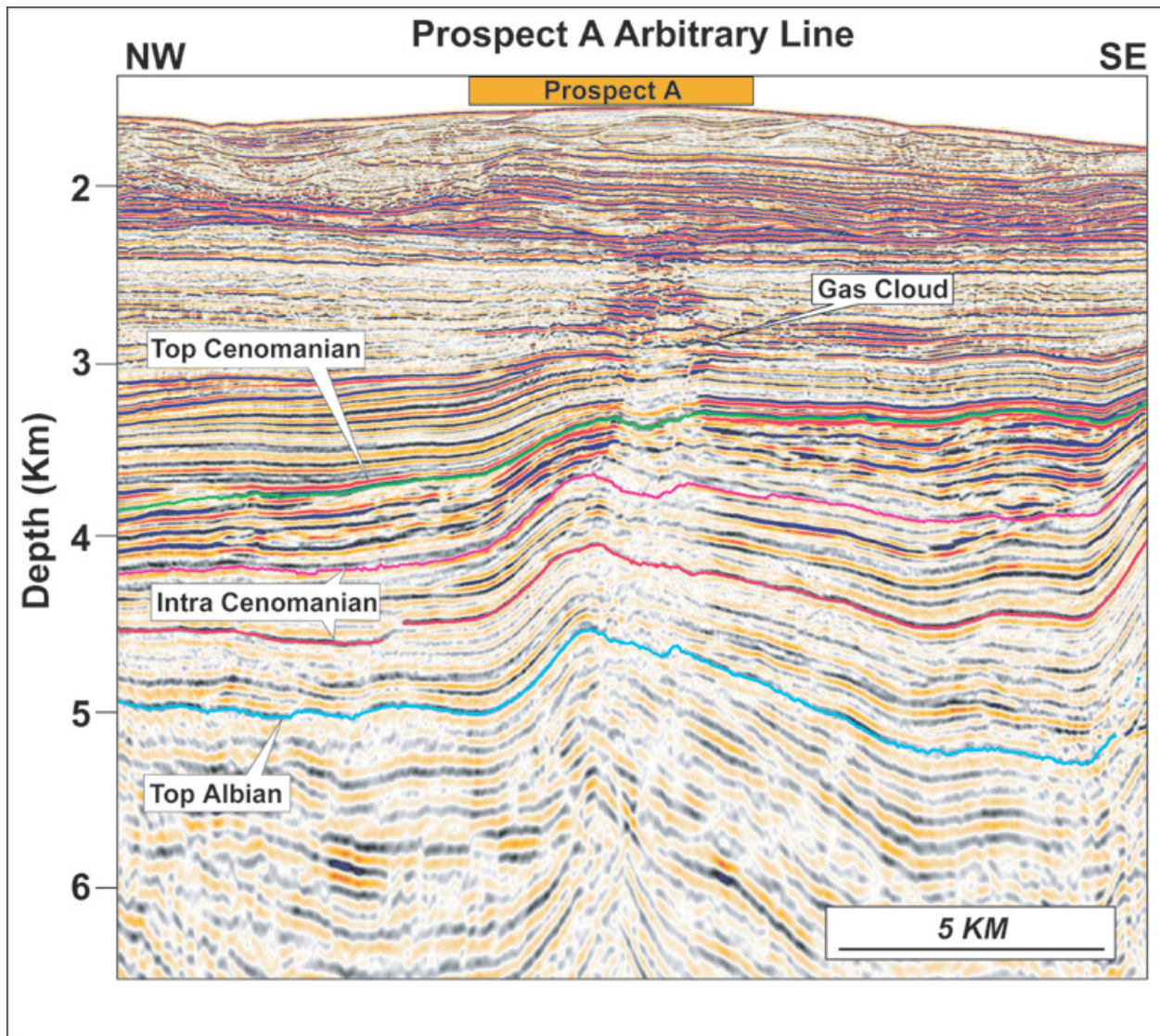
**Tubing (“Tbg”)** - A wellbore tubular used to produce reservoir fluids. Tubing is assembled with other completion components to make up the production string. The production tubing selected for any completion should be compatible with the wellbore geometry, reservoir production characteristics and the reservoir fluids. (See “Production Tubing”)

**Tubing Pressure** - Pressure on the tubing in a well, as measured at the wellhead.

**Turnkey Contract** - A contract in which an operator or drilling contractor agrees to furnish all labor and materials necessary to drill a well to a certain depth or stage of completion for a specified sum of money. The operator or contractor assumes all the responsibility and risks involved in completing the operation.

**Twist-off** - To part or break the drillstring downhole due to either fatigue or excessive torque.

**Two-dimensional Seismic Data (“2-D” or “2-D seismic”)** - A vertical section of seismic data consisting of numerous adjacent traces acquired sequentially. A group of 2-D seismic lines acquired individually, as opposed to the multiple closely spaced lines acquired together that constitute 3-D seismic data.

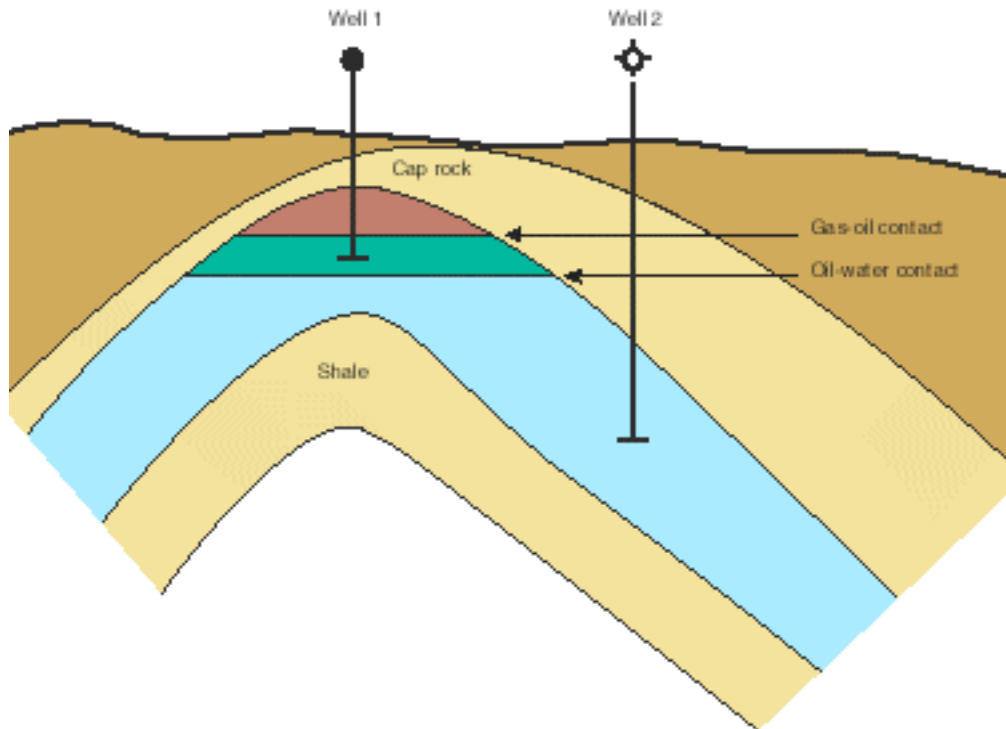


**Underground Blowout** - The uncontrolled flow of reservoir fluids from one reservoir into the wellbore, along the wellbore, and into another reservoir. This cross flow from one zone to another can occur when a high-pressure zone is encountered, the well flows, and the drilling crew reacts properly and closes the blowout preventer. Pressure in the annulus then builds up to the point at which a weak zone fractures. Depending on the pressure at which the fracturing occurs, the flowing formation can continue to flow and losses continue to occur in the fractured zone. Underground blowouts are historically the most expensive problem in the drilling arena, eclipsing the costs of even surface blowouts. It may prove necessary to drill a second kill well to remedy an underground blowout.

**Unload** - To initiate flow from a reservoir by removing the column of kill fluid from the wellbore.



**Updip** - Located up the slope of a dipping plane or surface. In a dipping (not flat-lying) hydrocarbon reservoir that contains natural gas, oil and water, the gas is updip, the gas-oil contact is downdip from the gas, and the oil-water contact is still farther downdip. (See “Downdip”)



**Virgin Pressure** - The original, undisturbed pressure of a reservoir before fluid production.

**Viscosity (“Vis”)** - The resistance of fluid to flow. A high viscosity fluid will not flow as easily as a low viscosity fluid (mud will not move as easily as water).

**Wait On Cement (“WOC”)** - To suspend drilling operations while allowing cement slurries to solidify, harden and develop compressive strength. The drilling crew usually uses this time to catch up on maintenance items, to rig down one BOP and rig up another one for the new casing, to get tools and materials ready for the next hole section, and other non-drilling tasks. The WOC time ranges from a few hours to several days, depending on the difficulty and criticality of the cement job in question. WOC time allows cement to develop strength, and avert development of small cracks and other fluid pathways in the cement that might impair zonal isolation.

**Wait On Completion Rig (“WOCR”)** - To wait on a completion rig.

**Wait On Orders (“WOO”)** - To suspend any operations to wait on orders from the operator.

**Washout** - An enlarged region of a borehole. A washout in an openhole section is larger than the original hole size or size of the drill bit. Washout enlargement can be caused by excessive bit jet velocity, soft or unconsolidated formations, in-situ rock stresses, mechanical damage by BHA components, chemical attack and swelling or weakening of shale as it contacts fresh water.

**Washover (“WO”)** - To release pipe that is stuck in the hole by running washover pipe. The washover pipe must have an outside diameter small enough to fit into the borehole but an inside diameter large enough to fit over the outside diameter of the stuck pipe. A rotary shoe, which cuts away the formation, mud, or whatever is sticking the pipe, is made up on the bottom joint of the washover pipe, and the assembly is lowered into the hole. Rotation of the assembly frees the stuck pipe. Several washovers may have to be made if the stuck portion is very long.

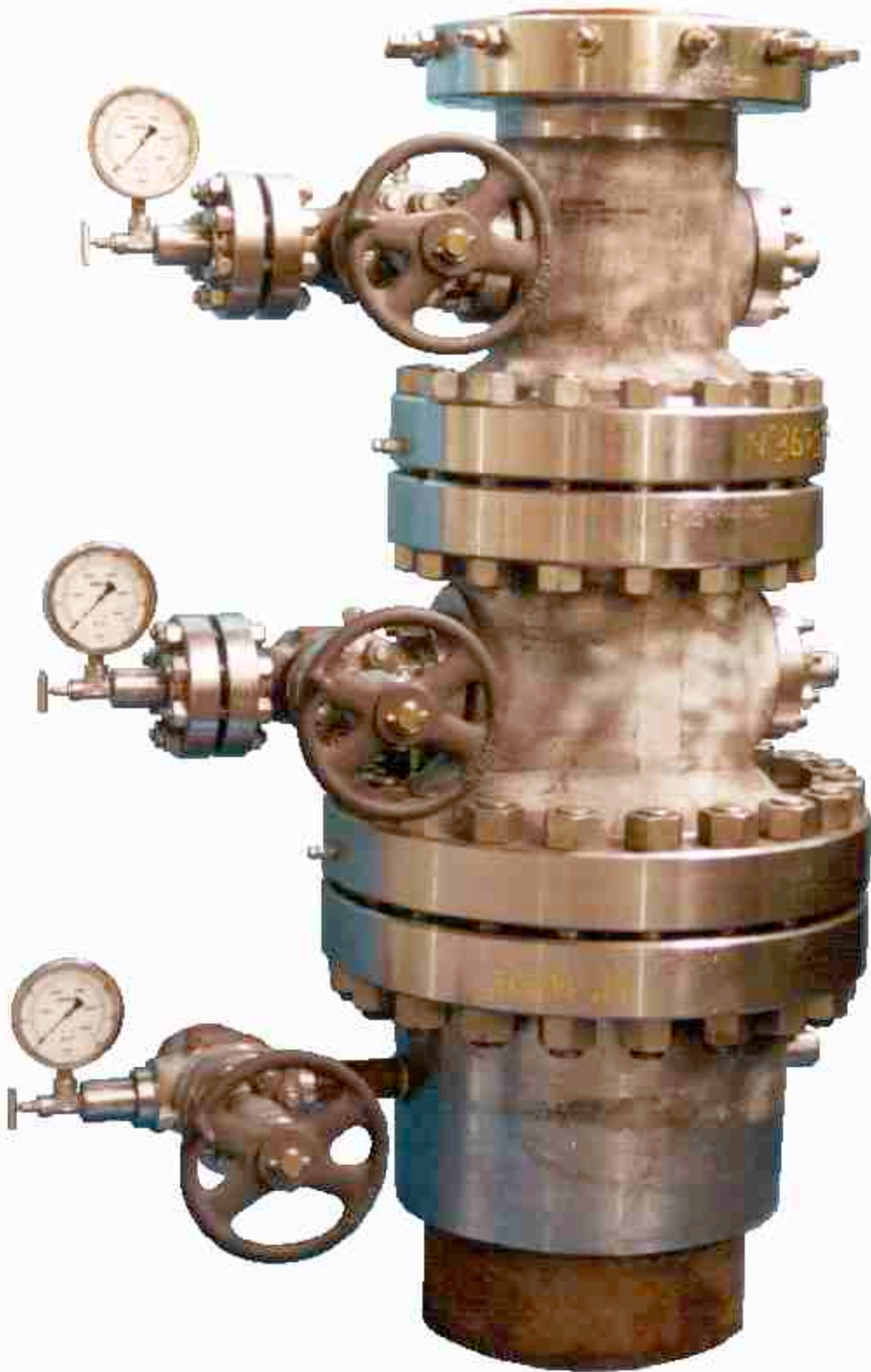
**Washover Pipe (“W/P”)** - In fishing operations, a large-diameter pipe fitted with an internal grappling device and tungsten carbide cutting surfaces on the bottom. The washover pipe can be lowered over a fish in the hole or wellbore and to latch onto and retrieve the fish. Since the washover pipe is relatively thin-walled and large in diameter, and may be prone to sticking itself, the washover operation is usually reserved as a measure of last resort before abandoning the fish altogether.

**Wellbore** - The cased portion of a borehole.

**Wellhead** - The equipment used to maintain surface control of a well.

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**Whipstock** - An inclined wedge placed in a hole to force the drill bit to start drilling in a direction away from the hole axis. The whipstock must have hard steel surfaces so that the bit will preferentially drill through either casing or rock rather than the whipstock itself. Most whipstocks are set on the bottom of the hole or on top of a high-strength cement plug.

**Wildcat** - An exploration well. The significance of this type of well to the well planners is that by definition, little if anything about the subsurface geology is known with certainty. If a wildcat is especially far from another wellbore, it may be described as a “rank wildcat.”

**Wiper Trip** - An abbreviated recovery and replacement of the drillstring in the wellbore that usually includes the bit and bottomhole assembly passing by all the openhole, or at least all the openhole that is thought to be potentially troublesome. This trip varies from the short trip or the complete trip only in its function and length. Wiper trips are commonly used when a particular zone is troublesome or if hole-cleaning efficiency is questionable.

**Wireline (“WL”)** - A general term used to describe well-intervention operations conducted using single-strand or multi-strand wire or cable for intervention in oil or gas wells. Although applied inconsistently, the term commonly is used in association with electric logging and cables incorporating electrical conductors. Similarly, the term slickline is commonly used to differentiate operations performed with single-strand wire or braided lines.

**Wireline Measurement (“WLM”)** - The measurement of the hole or wellbore by way of the wireline.

**Working Interest** - A working interest in an oil or gas property is one that is burdened with the cost of development and operation of the same.

**Workover** - The repair or stimulation of an existing production well for the purpose of restoring, prolonging or enhancing the production of hydrocarbons.

**Xylene** - An aromatic hydrocarbon molecule containing a benzene ring with two methyl side chains. Xylene is an excellent solvent, especially for aromatic solids such as paraffin and asphaltic materials. It is used as a solvent and emulsion breaker in workover operations to clean up reservoirs.

**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 bio-stratigraphic zone contains a particular fossil or fossils.

March 17, 2011