

## A

- Absorption** The penetration or apparent disappearance of molecules or ions of one or more substances into the interior of a solid or liquid. For example, in hydrated bentonite, the planar water that is held between the mica-like layers is the result of absorption.
- Acid** Any chemical compound containing hydrogen capable of being replaced by positive elements or radicals to form salts. In terms of the dissociation theory, it is a compound which, on dissociation in solution, yields excess hydrogen ions. Acids have a pH value below 7 and will lower the pH of a solution. Examples of acids or acidic substances are: hydrochloric acid, tannic acid and sodium acid pyrophosphate.
- Adhesion** The force which holds together unlike molecules.
- Adsorption** A surface phenomenon exhibited by a solid (adsorbent) to hold or concentrate gases, liquids or dissolved substances (adsorptive) upon its surface, a property due to adhesion. For example, the water held to the outside surface of hydrated bentonite is adsorbed water.
- Aeration** The technique of injecting air or gas in varying amounts into a drilling fluid for the purpose of reducing hydrostatic head. *Compare Air Cut.*
- Agglomerate** The larger groups of individual particles usually originating in sieving or drying operations.
- Agglomeration** The grouping of individual particles.
- Aggregate** A group of two or more individual particles held together by strong forces. Aggregates are stable to normal stirring, shaking or handling as powder or a suspension. They may be broken by drastic treatment such as ball milling a powder or by shearing a suspension.
- Aggregation** Formation of aggregates. In drilling fluids, aggregation results in the stacking of the clay platelets face to face. The viscosity and gel strength decrease in consequence.
- Air Cut** The inadvertent mechanical incorporation and dispersion of air into a drilling-fluid system. *Compare Aeration.*
- Alkali** Any compound having marked basic properties yielding a pH value above 7. *See Base.*
- Alkalinity** The combining power of a base measured by the maximum number of equivalents of an acid with which it can react to form a salt. In water analysis, it represents the carbonates; bicarbonates; hydroxides; and occasionally the borates, silicates and phosphates in the water. It is determined by titration with standard acid to certain datum points. *See API RP 13B\* for specific directions for determination of phenolphthalein ( $P_p$ ) and methyl orange ( $M_p$ ) alkalities of the filtrate in drilling fluids and the alkalinity of the mud itself ( $P_m$ ). Also see  $P_f$ ,  $M_f$  and  $P_{mr}$ .*
- Aluminum Stearate** An aluminum salt of stearic acid used as a defoamer. *See Stearate.*
- Anhydrite ( $\text{CaSO}_4$ )** Often encountered while drilling. It may occur as thin stringers or massive formations. *See Calcium Sulfate.*
- Anhydrous** Without water.
- Aniline Point** The lowest temperature at which equal volumes of freshly distilled aniline and an oil which is being tested are completely miscible. This test gives an indication of the character (paraffinic, naphthenic, asphaltic, aromatic, mid-continent, etc.) of the oil. The aniline point of diesels or crudes used in drilling mud is also an indication of the deteriorating effect these materials may have on natural or synthetic rubber. The lower the aniline point of an oil the more severe it usually is in damaging rubber parts.
- Anion** A negatively charged atom or radical, such as  $\text{Cl}^-$ ,  $\text{OH}^-$ ,  $\text{SO}_4^{2-}$ , etc., in solution of an electrolyte. Anions move toward the anode (positive electrode) under the influence of an electrical potential.
- Annular Velocity** The velocity of a fluid moving in the annulus.
- Annulus or Annular Space** The space between the drillstring and the wall of the hole or casing.
- Antifoam** A substance used to prevent foam by greatly increasing the surface tension. *Compare Defoamer.*
- API Gravity** The gravity (weight per unit volume) of crude oil or other related fluids as measured by a system recommended by the American Petroleum Institute. It is related to Specific Gravity (SG) by the following formula:  
Degrees API = 
$$\frac{141.5}{\text{SG } 60^\circ\text{F}} - 131.5$$
- Apparent Viscosity** The viscosity a fluid appears to have on a given instrument at a stated rate of shear. It is a function of the plastic viscosity and the yield point. The apparent viscosity in centipoises, as determined by the direct-indicating viscometer, is equal to  $\frac{1}{2}$  the 600-RPM reading. In a Newtonian fluid, the apparent viscosity is numerically equal to the plastic viscosity. *See also Viscosity, Plastic Viscosity and Yield Point.*
- Aqueous** Refers to water or water based.

**Asphalt** A natural or mechanical mixture of solid or viscous bitumens found in natural beds or obtained as a residue from petroleum. Asphalt, blends containing asphalt, and altered asphaltic materials (e.g., air-blown, chemically modified, etc.) have been added to certain drilling fluids for such widely different purposes as a component in oil-base muds, lost-circulation material, emulsifier, fluid-loss-control agent, wall-plastering agent, etc.

**Atom** According to the atomic theory, the smallest quantity of an element which is capable

of entering into chemical combination or that can exist alone.

**Atomic Number** The number of protons in an atom of an element.

**Atomic Weight** The relative weight of an atom of an element as compared with the weight of one atom of carbon, using 12 as the weight of one atom of carbon.

**Attapulgite Clay** A colloidal, viscosity-building clay used principally in salt-water muds. Attapulgite, a special fullers earth, is a hydrous magnesium aluminum silicate.

## B

**Balance, Mud** A beam-type balance used in determining mud density. It consists primarily of a base, graduated beam with constant-volume cup, lid, rider, knife edge and counterweight.

**Barite, Barytes or Heavy Spar** Natural barium sulfate used for increasing the density of drilling fluids. If required, it is usually upgraded to a specific gravity of 4.20. The barite mineral occurs in white, grayish, greenish and reddish ores or crystalline masses.

**Barium Sulfate (BaSO<sub>4</sub>)** *See Barite.*

**Barrel** A volumetric unit of measure used in the petroleum industry consisting of 42 U.S. gallons.

**Barrel Equivalent** A laboratory unit used for evaluating or testing drilling fluids. One gram of material, when added to 350 ml of fluid, is equivalent to 1 lb of material when added to one 42-gal barrel of fluid.

**Base** A compound of a metal, or a metal-like group, with hydrogen and oxygen in the proportion to form an OH radical, which ionizes in aqueous solution to yield excess hydroxyl ions, pH value above 7. Bases are formed when metallic oxides react with water. Bases increase the pH. Examples are caustic soda and lime.

**Base Exchange** The replacement of cations associated with the clay surface by those of another species, e.g., the conversion of sodium clay to calcium clay.

**Bentonite** A plastic, colloidal clay, largely made up of the mineral sodium montmorillonite, a hydrated aluminum silicate. For use in drilling fluids, bentonite has a yield in excess of 85 bbl/ton. The generic term "bentonite" is neither an exact mineralogical name, nor is the clay of definite mineralogical composition.

**Bicarb** *See Sodium Bicarbonate.*

**Bloobie Line** Flow line for air or gas drilling.

**Blowout** An uncontrolled escape of drilling fluid, gas, oil or water from the well caused by the formation pressure being greater than the hydrostatic head of the fluid in the hole.

**Boilerhouse** To make up a report on a condition as fact without knowledge of its accuracy. Sometimes referred to as "doghouse."

**Bonding** Chemically attaching one substance to another, as in bonding a coating.

**Brackish Water** Water containing low concentrations of any soluble salts.

**Break Circulation** To start movement of the drilling fluid after it has been quiescent in the hole.

**Breakout, Oil** Oil that has risen to the surface of the mud which previously had been combined in the mud as emulsion.

**Bridge** An obstruction in a well formed by intrusion of subsurface formations.

**Brine Water** saturated with or containing a high concentration of common salt (sodium chloride); hence, any strong saline solution containing such other salts as calcium chloride, zinc chloride, calcium nitrate, etc.

**Buffer** Any substance or combination of substances which, when dissolved in water, produces a solution which resists a change in its hydrogen ion concentration upon the addition of acid or base.

**Bullhead** Actively pumping down drill pipe or tubing, directly to an intended point.

**Bump** Apply and hold extra pressure, over and above hydrostatic pressure.

## C

- Cable-Tool Drilling** A method of drilling a well by allowing a weighted bit at the bottom of a cable to fall against the formation being penetrated. *See Rotary Drilling.*
- Cake Consistency** According to API RP 13B\*, such notations as “hard,” “soft,” “tough,” “rubbery,” “firm,” etc., may be used to convey some idea of filter-cake consistency.
- Cake Thickness** The measurement of the thickness of the filter cake deposited by a drilling fluid against a porous medium, most often following the standard API filtration test. Cake thickness is usually reported in 32nd of an inch. *See Filter Cake and Wall Cake.*
- Calcium** One of the alkaline earth elements with a valence of 2 and an atomic weight of about 40. Calcium compounds are a common cause of the hardness of water. It is also a component of lime, gypsum, limestone, etc.
- Calcium Carbonate (CaCO<sub>3</sub>)** An insoluble calcium salt sometimes used as a weighting material (limestone, oyster shell, etc.) in specialized drilling fluids. It is also used as a unit and/or standard to report hardness.
- Calcium Chloride (CaCl<sub>2</sub>)** A very soluble calcium salt sometimes added to drilling fluids to impart special properties, but primarily to increase the density of the fluid phase.
- Calcium Contamination** Dissolved calcium ions in sufficient concentration to impart undesirable properties in a drilling fluid, such as flocculation, reduction in yield of bentonite, increase in fluid loss, etc. *See also Calcium Sulfate, Gyp, Anhydrite, Lime and Calcium Carbonate.*
- Calcium Hydroxide (Ca(OH)<sub>2</sub>)** The active ingredient of slaked lime. It is also the main constituent in cement (when wet). This material is referred to as “lime” in field terminology.
- Calcium Sulfate (CaSO<sub>4</sub>)** Occurs in muds as a contaminant anhydrite or may be added to certain muds (as gyp) to impart special properties.
- Calcium-Treated Mud** Drilling fluids to which quantities of soluble calcium compounds have been added or allowed to remain from the formation drilled in order to impart special properties.
- Cation** The positively charged particle in the solution of an electrolyte which, under the influence of an electrical potential, moves toward the cathode (negative electrode). Examples are: Na<sup>+</sup>; H<sup>+</sup>; NH<sub>4</sub><sup>+</sup>; Ca<sup>2+</sup>; Mg<sup>2+</sup> and Al<sup>3+</sup>.
- Caustic or Caustic Soda** *See Sodium Hydroxide.*
- Cave-In** A severe form of sloughing. *See Sloughing.*
- Cavernous Formations** A formation having voluminous voids, usually the result of dissolving by formation waters which may or may not be still present.
- CBL Cement Bond Log**, used to evaluate the effectiveness of a cement job.
- Cement** A mixture of calcium aluminates and silicates made by combining lime and clay while heating. Slaked cement contains about 62.5% calcium hydroxide, which is the major source of trouble when cement contaminates mud.
- Centipoise (cP)** A unit of viscosity equal to 0.01 poise. A poise equals 1 g per meter-second, and a centipoise is 1 g per centimeter-second. The viscosity of water at 20°C is 1.005 cP (1 cP = 0.000672 lb/ft-sec).
- Centrifuge** A device for the mechanical separation of high-specific gravity solids from a drilling fluid. Usually used on weighted muds to recover weight material and discard drill solids. The centrifuge uses high-speed mechanical rotation to achieve this separation, as distinguished from the cyclone-type separator in which the fluid energy alone provides the separating force. *See Desander.*
- Chemicals** In drilling-fluid terminology, a chemical is any material that produces changes in the viscosity, yield point, gel strength and fluid loss, as well as surface tension.
- Chemical Barrel** A container in which various chemicals are mixed prior to addition to the drilling fluid.
- Chrome Lignite** Mined lignite, usually leonardite, to which chromate has been added and/or reacted. The lignite can also be causticized with either sodium or potassium hydroxide.
- Circulation** The movement of drilling fluid from the suction pit through pump, drill pipe, bit, annular space in the hole and back again to the suction pit. The time involved is usually referred to as circulation time.
- Circulation, Loss of (or Lost)** The result of drilling fluid escaping into the formation by way of crevices, porous media or into fractures.
- Circulation Rate** The volume flow rate of the circulating drilling fluid usually expressed in gallons or barrels per minute.
- Clabbered** A slang term commonly used to describe moderate to severe flocculation of mud due to various contaminants; also called “gelled-up.”
- Clay** A plastic, soft, variously colored earth, commonly a hydrous silicate of alumina, formed by the decomposition of feldspar and other aluminum silicates. Clay minerals are essentially insoluble in water but disperse under hydration, shearing forces such

- as grinding, velocity effects, etc., into the extremely small particles varying from submicron to 100-micron sizes. *See also Attapulgite Clay, Bentonite, High-Yield Drilling Clay, Low-Yield Clays and Natural Clays.*
- Clay Extender** Any of several substances, usually high molecular weight polymer compounds that, when added in low concentrations to a bentonite or to certain other clay slurries, will increase the viscosity of the system, e.g., PHPA. *See Low-Solids Muds.*
- CMC** *See Sodium Carboxymethylcellulose.*
- Coagulation** In drilling-fluid terminology, usually associated with flocculation and dewatering.
- Coalescence** The change from a liquid to a thickened curd-like state by chemical reaction. Also the combination of globules in an emulsion caused by molecular attraction of the surfaces.
- Cohesion** The attractive force between the same kind of molecules, i.e., the force which holds the molecules of a substance together.
- Coiled Tubing** A long, thin (normally up to about 2.5-in. OD) piece of tubing, wound on a large spooling device. It is used in place of drill pipe for certain appropriate operations.
- Colloid** A state of subdivision of matter which consists either of single large molecules or of aggregations of smaller molecules dispersed to such a degree that the surface forces become an important factor in determining its properties. The size and electrical charge of the particles determine the different phenomena observed with colloids, e.g., Brownian movement. The sizes of colloids range from  $1 \times 10^{-7}$  to  $5 \times 10^{-5}$  cm (0.001 to 0.5 microns) in diameter, although the particle size of certain emulsoids can be in the micron range.
- Colloidal Suspension** Finely divided particles of ultramicroscopic size swimming in a liquid.
- Communication** Refers to connection or continuity between separate areas. It can refer to geologic zones, sections of pipe, etc.
- Compatibility** A measure of the tendency of two substances (solids, liquids, mixed, etc.) to perform or react synergistically or not at all. (As opposed to incompatibility, where any materials react antagonistically, resulting in negative effects.)
- Conductivity** A measure of the quantity of electricity transferred across unit area per unit potential gradient per unit time. It is the reciprocal of resistivity. Electrolytes may be added to the drilling fluid to alter its conductivity for logging purposes.
- Coning** Refers to vertical migration of a reservoir fluid, as opposed to radial flow, the normal, preferable flow.
- Connate** Literally "born with," it refers to fluids (usually water in our industry) which exist with in-situ oil. Water that probably was laid down and entrapped with sedimentary deposits, as distinguished water from migratory waters that have flowed into deposits after they were laid down.
- Consistency** The viscosity of a non-reversible fluid, in poises, for a certain time interval at a given pressure and temperature.
- Consistometer** A thickening-time tester having a stirring apparatus to measure the relative thickening time for mud or cement slurries under predetermined temperatures and pressures.
- Contact Time** Time one substance is in contact with another, usually fluid against formation.
- Contamination** The presence in a drilling fluid of any foreign material that may tend to produce detrimental properties of the drilling fluid.
- Continuous Phase** The fluid phase which completely surrounds the dispersed phase that may be colloids, oil, etc.
- Copolymer** A substance formed when two or more substances polymerize at the same time to yield a product which is not a mixture of separate polymers but a complex having properties different from either polymer alone. Examples are PHPA-amps and acrylate-amps copolymers.
- Corrosion** The adverse chemical alteration on a metal or the eating away of the metal by air, moisture or chemicals; usually an oxide is formed.
- Crater** The formation of a large funnel-shaped cavity at the top of a hole resulting from a blowout or occasionally from caving.
- Crystallization Point** The temperature at which salt in a liquid becomes insoluble, forms crystals and may settle out of solution, resulting in a lower liquid specific gravity (q.v.). In some cases the liquid may solidify.
- Cubic Centimeter (cm<sup>3</sup>)** A metric-system unit for the measure of volume. It is essentially equal to the milliliter and commonly used interchangeably. One cubic centimeter of water at room temperature weighs approximately 1 g.
- Cuttings** Small pieces of formation that are the result of the chipping, scraping and/or crushing action of the bit.
- Cycle Time, Hole** The time of a cycle, or down the hole and back, is the time required for the pump to move the drilling fluid in the hole. The cycle in minutes equals the barrels of mud in the hole divided by barrels per minute.

## D

- Darcy** A unit of permeability. A porous medium has a permeability of 1 darcy when a pressure of 1 atom on a sample 1-cm long and 1 cm<sup>2</sup> in cross section will force a liquid of 1-cP viscosity through the sample at the rate of 1 cm<sup>3</sup> per sec.
- Deflocculation Breakup** of flocs of gel structures by use of a thinner.
- Defoamer** Any substance used to reduce or eliminate foam by reducing the surface tension. *Compare Antifoam.*
- Dehydration** Removal of free or combined water from a compound.
- Deposition** Literally “laid down,” it refers to the method by which sediments reach their position in a geologic formation.
- Deliquescence** The liquefaction of a solid substance due to the solution of the solid by adsorption of moisture from the air, e.g., calcium chloride.
- Density Matter** measured as mass per unit volume expressed in pounds per gallon (lb/gal), kilograms per liter (kg/l) and pounds per cubic ft (lb/ft<sup>3</sup>). Density is commonly referred to as “weight.”
- Desander, Desilter** Hydrocyclone-based, solids-removal device to separate sand or silt from the mud.
- Diatomaceous Earth** An infusorial earth composed of siliceous skeletons of diatoms and being very porous. Sometimes used for combatting lost circulation and as an additive to cement; also used in filtering completion brines.
- Differential Pressure** The difference in pressure between the hydrostatic pressure of the drilling-fluid column and the formation pressure at any given depth in the hole. It can be positive, zero or negative.
- Differential-Pressure (Wall) Sticking** Sticking which occurs because part of the drillstring (usually the drill collars) becomes embedded in the filter cake resulting in a non-uniform distribution of pressure around the circumference of the pipe. The conditions essential for sticking require a permeable formation and a pressure differential.
- Diffusion** The spreading, scattering or mixing of a material (gas, liquid or solid).
- Dilatant Fluid** A dilatant or inverted plastic fluid is usually made up of a high concentration of well-dispersed solids which exhibits a non-linear consistency curve passing through the origin. The apparent viscosity increases instantaneously with increasing rate of shear. The yield point, as determined by conventional calculations from the direct-indicating viscometer readings, is negative; however, the true yield point is zero.
- Diluent** Liquid added to dilute or thin a solution.
- Dispersant** Any chemical which promotes dispersion of the dispersed phase.
- Dispersed Phase** The scattered phase (solid, liquid or gas) of a dispersion. The particles are finely divided and completely surrounded by the continuous phase.
- Dispersion (of Aggregates)** Subdivision of aggregates. Dispersion increases the specific surface of the particle; hence results in an increase in viscosity and gel strength.
- Dissociation** The splitting up of a compound or element into two or more simple molecules, atoms or ions. Applied usually to the effect of the action of heat or solvents upon dissolved substances. The reaction is reversible and not as permanent as decomposition; i.e., when the solvent is removed, the ions recombine.
- Distillation** Process of first vaporizing a liquid and then condensing the vapor into a liquid (the distillate), leaving behind non-volatile substances, the total solids of a drilling fluid. The distillate is the water and/or oil content of a fluid.
- Dogleg** The “elbow” caused by a sharp change of direction in the wellbore.
- Drawdown** A decrease in pressure, usually referring to the difference in pressure between a producing formation and the production tubing into which it produces.
- Drilling In** The operation during the drilling procedure at the point of drilling into the pay formation. Often using special non-damaging or easily removable drill-in fluids.
- Drilling Mud or Fluid** A circulating fluid used in rotary drilling to perform any or all of various functions required in the drilling operation.
- Drilling Out** The operation during the drilling procedure when the cement is drilled out of the casing before further hole is made or completion attempted.
- Drill-Stem Test (DST)** A test to determine whether oil and/or gas in commercial quantities has been encountered in the wellbore.
- Dynamic** The state of being active or in motion; opposed to static.

**E**

**Electrolyte** A substance which dissociates into charged positive and negative ions when in solution or a fused state and which will then conduct an electric current. Acids, bases and salts are common electrolytes.

**Emulsifier or Emulsifying Agent** A substance used to produce an emulsion of two liquids which do not mix. Emulsifiers may be divided, according to their behavior, into ionic and non-ionic agents. The ionic types may be further divided into anionic, cationic and amphoteric, depending upon the nature of the ion-active groups.

**Emulsion** A substantially permanent heterogeneous liquid mixture of two or more liquids which do not normally dissolve in each other but which are held in suspension or dispersion, one in the other, by mechanical agitation or, more frequently, by adding small amounts of substances known as emulsifiers. Emulsions may be mechanical, chemical or a combination of the two. They may be oil-in-water or water-in-oil types.

**End Point** Indicates the end of some operation or when a definite change is observed. In titration this change is frequently a change in color of an indicator which has been added to the solution or the disappearance of a colored reactant.

**Engineer, Mud or Drilling-Fluid** One versed in drilling fluids whose duties are to manage, carry through and maintain the various types of oil-well mud programs.

**EP Additive** See *Extreme-Pressure Lubricant*.

**Equivalent Circulating Density (ECD)** For a circulating fluid, the equivalent circulating density in lb/gal equals the hydrostatic head (psi) plus the total annular pressure drop (psi) divided by the depth (ft) and by 0.052.

**Equivalent Weight or Combining Weight** The atomic or formula weight of an element, compound or ion divided by its valence. Elements entering into combination always do so in quantities proportional to their equivalent weights.

**Equivalents per Million (EPM)** Unit chemical weight of solute per million unit weights of solution. The EPM of a solute in solution is equal to the ppm (parts per million) divided by the equivalent weight. Refer also to ppm.

**Extreme-Pressure Lubricant Additives** which, when added to the drilling fluid, impart lubrication to the bearing surfaces when subjected to extreme pressure conditions.

**F**

**Fault** Geological term denoting a formation break, upward or downward, in the subsurface strata. Faults can significantly affect the area mud and casing programs.

**Fermentation** Decomposition process of certain organic substances, e.g., starch in which a chemical change is brought about by enzymes, bacteria or other micro-organisms. Often referred to as "souring."

**Fiber or Fibrous Materials** Any tough stringy material used to prevent loss of circulation or to restore circulation. In field use, fiber generally refers to fibers of plant origin.

**Filling the Hole** Pumping drilling fluid continuously or intermittently into the wellbore to maintain the fluid level in the hole near the surface. The purpose is to avoid danger of blowout, water intrusion and/or caving of the wellbore, e.g., as the pipe is withdrawn.

**Fill-Up Line** The line through which fluid is added to the hole.

**Filter** A device which uses a coating of some type to separate solids from a liquid. Solids plate out on the surface and near the surface of the device's coating. The coating can be diatomaceous earth, cloth, paper or a number of other substances.

**Filter Cake** The suspended solids that are deposited on a porous medium during the process of filtration. See also *Cake Thickness*.

**Filter-Cake Texture** The physical properties of a cake as measured by toughness, slickness and brittleness. See also *Cake Consistency*.

**Filter-Cake Thickness** A measurement of the solids deposited on filter paper in 32nd of an inch during the 30-min API filtration tests. See *Cake Thickness*.

**Filter Loss** See *Fluid Loss*.

**Filter Paper** Porous unsized paper for filtering liquids. API filtration test specifies one thickness of 9-cm filter paper Whatman No. 50, S & S No. 576 or equivalent.

**Filter Press** A device for determining fluid loss of a drilling fluid having specifications in accordance with API RP 13B.

- Filtrate** The liquid that is forced through a porous medium during the filtration process.
- Filtration** The process of separating suspended solids from their liquid by forcing the latter through a porous medium. Two types of fluid filtration occur in a well: dynamic filtration while circulating and static filtration when at rest.
- Filtration Qualities** The filtration characteristics of a drilling mud. Generally these qualities are inverse to the thickness of the filter cake deposited on the face of a porous medium and the amount of filtrate allowed to escape from the drilling fluid into or through the medium.
- Filtration Rate** *See Fluid Loss.*
- Fishing Operations** on the rig for the purpose of retrieving from the wellbore sections of pipe, collars, junk or other obstructive items which are stuck or dropped in the hole.
- Flat Gel** A condition wherein the 10-min gel strength is substantially equal to the initial gel strength.
- Flipped** When the opposite occurs of what is intended in a drilling fluid. In an invert water-in-oil emulsion, the emulsion is said to be flipped when the continuous and dispersed phases reverse.
- Flocculates** Groups of aggregates or particles in suspension subject to being broken up by normal shaking and stirring and reforming on standing.
- Flocculating Agent Substances**, such as most electrolytes, some polysaccharides, and certain natural or synthetic polymers, that bring about the thickening of the consistency of a drilling fluid. In Bingham plastic fluids, the yield point and gel strength increase.
- Flocculation** Loose association of particles in lightly bonded groups, non-parallel association of clay platelets. In concentrated suspensions, such as drilling fluids, flocculation results in gelation. In some drilling fluids, flocculation may be followed by irreversible precipitation of colloids and certain other substances from the fluid, e.g., red beds.
- Flocs** *See Flocculates.*
- Flooding** Injecting a liquid, usually water, with or without special additives, into a formation to enhance oil recovery.
- Fluid** A substance readily assuming the shape of the container in which it is placed. The term includes both liquids and gases. It is a substance in which the application of every system of stresses (other than hydrostatic pressure) will produce a continuously increasing deformation without any relation between time rate of deformation at any instant and the magnitude of stresses at that instant. Drilling fluids are usually Newtonian and plastic, seldom pseudoplastic and rarely dilatant fluids.
- Fluid Flow** The state of fluid dynamics of a fluid in motion is determined by the type of fluid (e.g., Newtonian, plastic, pseudoplastic, dilatant), the properties of the fluid such as viscosity and density, the geometry of the system, and the velocity. Thus, under a given set of conditions and fluid properties, the fluid flow can be described as plug flow, laminar (called also Newtonian, streamline, parallel or viscous) flow or turbulent flow. *See above terms and Reynolds Number.*
- Fluidity** The reciprocal of viscosity. The measure of rate with which a fluid is continuously deformed by a shearing stress. Ease of flowing.
- Fluid Loss** Measure of the relative amount of fluid lost (filtrate) through permeable formations or membranes when the drilling fluid is subjected to a pressure differential.
- Fluorescence** Instantaneous re-emission of light of a greater wave length than that light originally absorbed.
- Foam** A two-phase system, similar to an emulsion, where the dispersed phase is a gas or air.
- Foaming Agent** A substance that produces fairly stable bubbles at the air-liquid interface due to agitation, aeration or ebullition. In air or gas drilling, foaming agents are added to help remove water influxes and prevent mud rings.
- Formation Damage** Damage to the productivity of a well resulting from invasion into the formation by mud particles or mud filtrates. Asphalt from crude oil will also damage some formations. *See Mudding Off.*
- Formation Sensitivity** The tendency of certain producing formations to adversely react with invading mud filtrates.
- Functions of Drilling Fluids** The most important function of drilling fluids in rotary drilling is to bring cuttings from the bottom of the hole to the surface. Some other important functions are: control subsurface pressures, cool and lubricate the bit and drillstring, deposition of an impermeable wall cake, etc.
- Funnel Viscosity** *See Marsh Funnel Viscosity.*

## G

- Galena Lead sulfide (PbS).** Technical grades (specific gravity about 7) are used for increasing the density of drilling fluids to points impractical or impossible with barite.
- Gas Cut Gas** entrained by a drilling fluid.  
*See Air Cut.*
- Gas Hydrate** A solid ice-like mixture of a gas in an aqueous liquid. Forms more readily at higher pressures and lower temperatures. Normally associated with deepwater drilling or arctic locations.
- Gel** A state of a colloidal suspension in which shearing stresses below a certain finite value fail to produce permanent deformation. The minimum shearing stress that will produce permanent deformation is known as the shear or gel strength of the gel. Gels commonly occur when the dispersed colloidal particles have a great affinity for the dispersing medium, i.e., are lyophilic. Thus, gels commonly occur with bentonite in water. *For their measurement, see Gel Strength, Initial and Gel Strength, 10-min.*  
A term used to designate highly colloidal, high-yielding, viscosity-building commercial clays, such as bentonite and attapulgite clays.
- Gelation** Association of particles to form a continuous structure.
- Gel Cement** Cement having a small to moderate percentage of bentonite added as a filler and/or to reduce the slurry weight. *See Gunk Plug.*
- Gelled Up** Oilfield jargon usually referring to any fluid with high gel strength and/or highly viscous properties. Often a state of severe flocculation.
- Gel Strength** The ability or the measure of the ability of a colloid to form gels. Gel strength is a pressure unit usually reported in lb/100 ft<sup>2</sup>. It is a measure of the same interparticle forces of a fluid as determined by the yield point except that gel strength is measured under static conditions, yield point under dynamic conditions. The common gel-strength measurements are initial and the 10-min gels. *See also Shear (Shearing Stress) and Thixotropy.*
- Gel Strength, Initial** The measured initial gel strength of a fluid is the maximum reading (deflection) taken from a direct-reading viscometer after the fluid has been quiescent for 10 sec. It is reported in lb/100 ft<sup>2</sup>.
- Gel Strength, 10-Min** The measured 10-min gel strength of a fluid is the maximum reading (deflection) taken from a direct-reading viscometer after the fluid has been quiescent for 10 min. The reading is reported in lb/100 ft<sup>2</sup>.
- Granule or Granular** A small, rough piece of substance. The word is usually used to describe the physical appearance of the small pieces of rock in a matrix (q.v.).
- Gravity, Specific** The weight of a particular volume of any substance compared to the weight of an equal volume of water at a reference temperature. For gases, air is usually taken as the reference substance.
- Greasing Out** Certain organic substances, usually fatty-acid derivatives, which are added to drilling fluids as emulsifiers, e.p. lubricants, etc., may react with such ions as calcium and magnesium that are in or will subsequently come into the system. An essentially water-insoluble greasy material forms and coats barite which may separate out.
- Gum** Any hydrophilic plant polysaccharides or their derivatives which, when dispersed in water, swell to produce a viscous dispersion or solution. Unlike resins, they are soluble in water and insoluble in alcohol.
- Gumbo** Any relatively sticky formation, such as clay, encountered in drilling.
- Guar Gum** A naturally occurring hydrophilic polysaccharide derived from the seed of the guar plant. The gum is chemically classified as a galactomannan. Guar gum slurries made up in clear, fresh or brine water possess pseudoplastic flow properties.
- Gunk Plug** A slurry in crude or diesel oil containing any of the following materials or combinations: bentonite, cement, attapulgite and guar gum (never with cement). Used primarily in combatting lost circulation. The plug may or may not be squeezed.
- Gyp or Gypsum** Encountered while drilling and often used as a source of calcium when treating carbonate contamination. *See Calcium Sulfate.*



## H

- Hardness (of Water)** The hardness of water is due principally to the calcium and magnesium ions present in the water and is independent of the accompanying acid ions. The total hardness is measured in terms of parts per million of calcium carbonate or calcium and sometimes equivalents per million of calcium.
- Heaving** The partial or complete collapse of the walls of a hole resulting from internal pressures due primarily to swelling from hydration or formation gas pressures. *See Sloughing.*
- Heterogeneous** A substance that consists of more than one phase and is not uniform, such as colloids, emulsions, etc. It has different properties in different parts.
- High-pH Mud** A drilling fluid with a pH range above 10.5. A high-alkalinity mud.
- High-Yield Drilling Clay** A classification given to a group of commercial drilling-clay preparations having a yield of 35 to 50 bbl/ton and intermediate between bentonite and low-yield clays. High-yield drilling clays are usually prepared by peptizing low-yield calcium montmorillonite clays or, in a few cases, by blending some bentonite with the peptized low-yield clay.
- Homogeneous** Of uniform or similar nature throughout; or a substance or fluid that has at all points the same property or composition.
- Hopper, Jet** A device to hold or feed drilling-mud additives. *See Mud-Mixing Devices.*
- Humic Acid** Organic acids of indefinite composition in naturally occurring Leonardite lignite. The humic acids are the most valuable constituent. *See Lignins, Mined.*
- Hydrate** A substance containing water combined in the molecular form (such as  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ). A crystalline substance containing water of crystallization. Also used as an abbreviation for "gas hydrate."
- Hydration** The act of a substance to take up water by means of absorption and/or adsorption.
- Hydrogen Ion Concentration** A measure of the acidity or alkalinity of a solution, normally expressed as pH. *See pH.*
- Hydrolysis** The reaction of a salt with water to form an acid and base. For example, soda ash ( $\text{Na}_2\text{CO}_3$ ) hydrolyzes basically, and hydrolysis is responsible for the increase in the pH of water when soda ash is added.
- Hydrometer** A floating instrument for determining the specific gravity or density of liquids, solutions and slurries. A common example is the mudwater hydrometer used to determine the density of mud.
- Hydrophile** A substance usually in the colloidal state or an emulsion, which is wetted by water; i.e., it attracts water or water adheres to it.
- Hydrophilic** A property of a substance having an affinity for water or one that is wetted by water.
- Hydrophilic-Lipophilic Balance (HLB)** One of the most important properties of emulsifiers. It is an expression of the relative attraction of an emulsifier for water and oil, determined largely by the chemical composition and ionization characteristics of a given emulsifier. The HLB of an emulsifier is not directly related to solubility, but it determines the type of an emulsion that tends to be formed. It is an indication of the behavior characteristics and not an indication of emulsifier efficiency.
- Hydrophobe** A substance, usually in the colloidal state, not wetted by water.
- Hydrophobic** Descriptive of a substance which repels water.
- Hydrostatic Head** The pressure exerted by a column of fluid, usually expressed in pounds per square inch ( $\text{lb}/\text{in}^2$ ). To determine the hydrostatic head at a given depth in psi, multiply the depth in feet by the density in pounds per gallon by 0.052.
- Hydroxide** A designation that is given for basic compounds containing the  $\text{OH}^-$  radical. When these substances are dissolved in water, they increase the pH of the solution. *See Base.*
- Hygroscopic** The property of a substance enabling it to absorb water from the air.

## I

- Indicator Substances** in acid-base titrations which, in solution, change color or become colorless as the hydrogen ion concentration reaches a definite value; these values vary with the indicator. In other titrations such as chloride, hardness and other determinations, these substances change color at the end of the reaction. Common indicators are phenolphthalein, potassium chromate, etc.
- Inhibited Mud** A drilling fluid having an aqueous phase with a chemical composition that tends to retard and even prevent (inhibit) appreciable hydration (swelling) or dispersion of formation clays and shales through chemical and/or physical means. *See Inhibitor (Mud).*
- Inhibitor (Corrosion)** Any agent which, when added to a system, slows down or prevents a chemical reaction or corrosion. Corrosion inhibitors are used widely in drilling and producing operations to prevent corrosion of metal equipment exposed to hydrogen sulfide, carbon dioxide, oxygen, saltwater, etc. Common inhibitors added to drilling fluids are filming amines, oxygen scavengers, passivating inhibitors and pH buffering chemicals.
- Inhibitor (Mud)** Substances generally regarded as drilling-mud contaminants, such as salt and calcium sulfate, are called inhibitors when purposely added to mud so that the filtrate from the drilling fluid will prevent or retard the hydration of formation clays and shales.
- Initial Gel** *See Gel Strength, Initial.*
- Interfacial Tension** The force required to break the surface between two immiscible liquids. The lower the interfacial tension between the two phases of an emulsion, the greater the ease of emulsification. When the values approach zero, emulsion formation is spontaneous. *See Surface Tension.*
- Interstitial Water** Water contained in the interstices or voids of formations.
- Invasion Movement** of a liquid out of its assigned area, into another area, possibly resulting in a physical or chemical change in the invaded area. Usually it refers to movement of brine, mud or mud filtrate into a geologic formation.
- Invert Oil-Emulsion Mud** An invert emulsion is a water-in-oil emulsion where freshwater or saltwater is the dispersed phase and diesel, crude or some other oil is the continuous phase. Water increases the viscosity and oil reduces the viscosity.
- Ion** Acids, bases and salts (electrolytes) when dissolved in certain solvents, especially water, are more or less dissociated into electrically charged ions or parts of the molecules, due to loss or gain of one or more electrons. Loss of electrons results in positive charges producing a cation. A gain of electrons results in the formation of an anion with negative charges. The valence of an ion is equal to the number of charges borne by it.

## J

- Jetting** The process of periodically removing a portion of, or all of, the water, mud and/or solids, from the pits, usually by means of pumping through a jet nozzle arrangement.
- Jewelry** A slang term referring to stabilizers and tools on the bottom-hole assembly, completion string packers, mandrills, and any other equipment used to isolate or safely produce oil.

## K

- Kelly or Kelly Joint** A heavy square pipe or other configuration that works through a like hole in the rotary table and rotates the drill stem.
- Key Seat** That section of a hole, usually of abnormal deviation and relatively soft formation, which has been eroded or worn by drill pipe to a size smaller than the tool joints or collars. This keyhole-type configuration will now allow these members to pass when pulling out of the hole.
- Killing a Well** Bringing a well under control that is blowing out. Also, the procedure of circulating water and mud into a completed well before starting well-service operations.

**Kill Line** A line connected to the annulus below the blowout preventers for the purpose of pumping into the annulus while the preventers are closed.

**Kill Pill** A saturated salt pill used to isolate a producing zone from completion fluids.

## L

**Laminar Flow** Fluid elements flowing along fixed streamlines which are parallel to the walls of the channel of flow. In laminar flow, the fluid moves in plates or sections with a differential velocity across the front which varies from zero at the wall to a maximum toward the center of flow. Laminar flow is the first stage of flow in a Newtonian fluid; it is the second stage in a Bingham plastic fluid. This type of motion is also called parallel, streamline or viscous flow. *See Plug Flow and Turbulent Flow.*

**Leonardite** A naturally occurring oxidized lignite. *See Lignins, Mined or Humic Acids.*

**Lignins, Mined** Naturally occurring special lignite, e.g., leonardite, that are produced by strip mining from special lignite deposits. The active ingredient is the humic acids. Mined lignins are used primarily as thinners, which may or may not be chemically modified. However, they are also widely used as emulsifiers. *See Humic Acid.*

**Lignosulfonates** Organic drilling fluid additives derived from by-products of sulfite paper manufacturing process from coniferous woods. Some of the common salts, such as the ferro-chrome, chrome, calcium and sodium, are used as universal dispersants while others are used selectively for calcium-treated systems. In large quantities, the ferro-chrome and chrome salts are used for fluid-loss control and shale inhibition.

**Lime** Commercial form of calcium hydroxide.

**Lime-Treated Muds** Commonly referred to as "lime-base" muds. These high-pH systems contain most of the conventional freshwater additives to which slaked lime has been added to impart special properties. The alkalinities and lime contents vary from low to high.

**Limestone** *See Calcium Carbonate.*

**Kinematic Viscosity** The kinematic viscosity of a fluid is the ratio of the viscosity (e.g., cP in g/cm-sec) to the density (e.g., g/cm<sup>3</sup>) using consistent units. Frequently used to evaluate the viscosity of oils.

**Lipophile** A substance usually colloidal and easily wetted by oil.

**Lipophilic** Having an affinity for oil.

**Live Oil** Crude oil that contains gas and has not been stabilized or weathered. This oil can cause gas cutting when added to mud and is a potential fire hazard.

**Load Fill** a drill pipe or tubing, displacing gas or other liquid out.

**Logging** A process of measuring the physical and chemical properties of the formation and formation fluids.

**Loss of Circulation** *See Circulation, Loss of (or Lost).*

**Lost-Circulation Additives** Materials added to the mud to control or prevent lost circulation. These materials are added in varying amounts and are classified as fiber, flake or granular.

**Lost Returns** *See Circulation, Loss of (or Lost).*

**Low-Solids Muds** A designation given to any type of mud where high performing additives, e.g., CMC, have been partially or wholly substituted for commercial or natural clays. For comparable viscosity and densities (weighted with barite), a low-solids mud will have a lower volume-percent solids content.

**Low-Yield Clays** Commercial clays chiefly of the calcium montmorillonite type having a yield of approximately 15 to 30 bbl/ton.

**Lyophilic** Having an affinity for the suspending medium, such as bentonite in water.

**Lyophilic Colloid** A colloid that is not easily precipitated from a solution and is readily dispersible after precipitation by an addition of the solvent.

**Lyophobic Colloid** A colloid that is readily precipitated from a solution and cannot be redispersed by an addition of the solution.

## M

- Marsh Funnel** An instrument used in determining the Marsh funnel viscosity. The Marsh funnel is a container with a fixed orifice at the bottom so that when filled with 1,500 cm<sup>3</sup> freshwater, 1 qt (946 ml) will flow out in 26±0.5 sec. For 1,000 cm<sup>3</sup> out, the efflux time for water is 27.5±0.5 sec.
- Marsh Funnel Viscosity** Commonly called the funnel viscosity. The Marsh funnel viscosity is reported as the number of seconds required for a given fluid to flow 1 qt through the Marsh funnel. In some areas, the efflux quantity is 1,000 cm<sup>3</sup>.
- Matrix** The pattern of grains in a rock or formation.
- Mechanisms** The way in which something occurs. In our industry we usually refer to formation damage mechanisms, the way an oil producing zone is damaged.
- Meniscus** The curved upper surface of a liquid column, concave when the containing walls are wetted by the liquid and convex when not.
- Mesh** A measure of fineness of a woven material, screen or sieve; e.g., a 200-mesh sieve has 200 openings per linear inch. A 200-mesh screen with a wire diameter of 0.0021 in. (0.0533 mm) has an opening of 0.074 mm or will pass a particle of 74 microns. *See Micron.*
- M<sub>f</sub>** The methyl orange (M<sub>f</sub>) alkalinity of the filtrate, reported as the number of milliliters of 0.02 Normal (N/50) acid required per milliliter of filtrate to reach the methyl orange end point (pH 4.3).
- Mica** A naturally occurring flake material of varying size used in combatting lost circulation. Chemically, an alkali aluminum silicate.
- Micelles** Organic and inorganic molecular aggregates occurring in colloidal solutions. Long chains of individual structural units chemically joined to one another and laid side by side to form bundles. When bentonite hydrates, certain sodium or other metallic ions go into solution, the clay particle plus its atmosphere of ions is technically known as a micelle.
- Micron (μ)** A unit of length equal to one millionth part of a meter or one thousandth part of a millimeter.
- Milk Emulsion** *See Oil-Emulsion Water.*
- Millidarcy** 1/1,000 darcy. *See Darcy.*
- Milliliter (ml)** A metric system unit for the measure of volume. Literally 1/1,000th of a liter. In drilling-mud analysis work, this term is used interchangeably with cubic centimeter (cm<sup>3</sup>). One quart is about equal to 946 ml.
- Mist Drilling** A method of rotary drilling whereby water and/or oil is dispersed in air and/or gas as the drilling fluid.
- Molecular Weight** The sum of the atomic weights of all the constituent atoms in the molecule of an element or compound.
- Molecule** When atoms combine they form a molecule. In the case of an element or a compound, a molecule is the smallest unit that chemically still retains the properties of the substance in mass.
- Montmorillonite** A clay mineral commonly used as an additive to drilling muds. Sodium montmorillonite is the main constituent in bentonite. The structure of montmorillonite is characterized by a form that consists of a thin plate-type sheet with the width and breadth indefinite, and thickness that of the molecule. The unit thickness of the molecule consists of three layers. Attached to the surface are ions that are replaceable. Calcium montmorillonite is the main constituent in low-yield clays.
- Mud** A water- or oil-base drilling fluid whose properties have been altered by solids — commercial and/or native, dissolved and/or suspended. Used for circulating out cuttings and many other functions while drilling a well. Mud is the term most commonly given to drilling fluids.
- Mud Additive** Any material added to a drilling fluid to achieve a particular purpose.
- Mudding Off** Commonly thought of as the sealing or plastering effect of a drilling fluid.
- Mudding Up** Process of mixing mud additives to achieve some desired purpose not possible with the former fluid, which usually has been water, air or gas.
- Mud House** A structure at the rig to store and shelter sacked materials used in drilling fluids.
- Mud Logging** A method of determining the presence or absence of oil or gas in the various formations penetrated by the drill bit. The drilling fluid and the cuttings are continuously tested on their return to the surface, and the results of these tests are correlated with the depth of origin.
- Mud-Mixing Devices** The most common device for adding solids to the mud is by means of the jet hopper. Some other devices for mixing are: educators, paddle mixers, electric stirrers, mud guns, chemical barrels, etc.

**Mud Pit** Earthen or steel storage facilities for the surface mud system. Mud pits which vary in volume and number are of two types: circulating and reserve. Mud testing and conditioning is normally done in the circulating pit system.

**Mud Program** A proposed or followed plan or procedure for the type(s) and properties of drilling fluid(s) used in drilling a well with respect to depth. Some factors that influence the mud program are the casing

program and such formation characteristics as type, competence, solubility, temperature, pressure, etc.

**Mud Pumps** Pumps at the rig used to circulate drilling fluids.

**Mud Scales** *See Balance, Mud.*

**Mud Still** A retort or distillation instrument used to distill oil, water and other volatile material in a mud to determine oil, water and total solids content in volume-percent.

## N

**Natural Clays** Natural clays, as opposed to commercial clays, are clays that are encountered when drilling various formations. The yield of these clays varies greatly, and they may or may not be purposely incorporated into the mud system.

**Neat Cement** A slurry composed of Portland cement and water.

**Neutralization** A reaction in which the hydrogen ion of an acid and the hydroxyl ion of a base unite to form water, the other ionic product being a salt.

**Newtonian Flow** *See Newtonian Fluid.*

**Newtonian Fluid** The basic and simplest fluids from the standpoint of viscosity consideration in which the shear force is directly proportional to the shear rate. These fluids

will immediately begin to move when a pressure or force in excess of zero is applied. Examples of Newtonian fluids are water, diesel oil and glycerine. The yield point as determined by direct-indicating viscometer is zero.

**Non-Conductive Mud** Any drilling fluid, usually oil-base or invert-emulsion muds, whose continuous phase does not conduct electricity, e.g., oil. The Spontaneous Potential (SP) and normal resistivity cannot be logged, although such other logs as the induction, acoustic velocity, etc., can be run.

**Normal Solution** A solution of such a concentration that it contains 1 gram-equivalent of a substance per liter of solution.

## O

**Oil Content** The oil content of any drilling fluid is the amount of oil in volume-percent.

**Oil-Emulsion Water** A drilling fluid in which the oil content is usually kept between 3 to 7% and seldom over 10% (it can be considerably higher). The oil is emulsified into freshwater or saltwater with a chemical emulsifier. Sometimes CMC, starch or

gum may be added to the freshwater and saltwater systems. *See Milk Emulsion.*

**Oil-in-Water Emulsion Mud** Commonly called "emulsion mud." Any conventional or special water-based mud to which oil has been added. The oil becomes the dispersed phase and may be emulsified into the mud either mechanically or chemically.

## P

**Packer Fluid** Any fluid placed in the annulus between the tubing and casing above a packer. Along with other functions, the hydrostatic pressure of the packer fluid is utilized to reduce the pressure differentials between the formation and the inside of the casing and across the packer itself.

**Particle** A minute unit of matter, usually a single crystal or of regular shape with a specific gravity approximating that of a single crystal.

**Particle Distribution** A listing of all the particles in a sample by size. Usually reported as a population percent or volume-percent per micron range.

**Particle Size** The diameter of a particle, which is assumed to be spherical. (While we assume particles are spherical, this is rarely the case.) Size is usually defined in microns (q.v.).

**Parts per Million (ppm)** Unit weight of solute per million unit weights of solution (solute plus solvent), corresponding to weight-percent except that the basis is a million instead of a hundred. The results of standard API titrations of chloride, hardness, etc. are correctly expressed in milligrams (mg) of unknown per liter but not in ppm. At low concentrations, mg/l is about numerically equal to ppm. A correction for the solution specific gravity or density in g/ml must be made as follows:

$$\text{ppm} = \frac{\text{mg/l}}{\text{soln den, g/ml}}$$

$$\% \text{ by wt} = \frac{\text{mg/l}}{(10,000)(\text{soln den, g/ml})}$$

$$= \frac{\text{ppm}}{10,000}$$

Thus, 316,000 mg/l salt is commonly called 316,000 ppm or 31.6%, which correctly should be 264,000 ppm and 26.4% respectively.

**Payzone or Pay Formation** The formation drilled into that contains oil and/or gas in commercial quantities.

**Penetration, Rate of (ROP)** The rate in feet per hour at which the drill proceeds to deepen the wellbore.

**Peptization** An increased dispersion due to the addition of electrolytes or other chemical substances. *See Deflocculation and Dispersion of Aggregates.*

**Peptized Clay** A clay to which an agent has been added to increase its initial yield. For example, soda ash is frequently added to calcium montmorillonite clay.

**Percent** For weight-percent, see ppm. Volume-percent is the number of volumetric parts

of any liquid or solid constituent per 100 like volumetric parts of the whole. Volume-percent is the most common method of reporting solids, oil and water contents of drilling fluids.

**Permeability** Normal permeability is a measure of ability of a rock to transmit a one-phase fluid under conditions of laminar flow. Unit of permeability is the darcy.

**P<sub>f</sub>** The phenolphthalein alkalinity of the filtrate, reported as the number of milliliters of 0.02 Normal (N/50) sulfuric acid required per milliliter of filtrate to reach the phenolphthalein end point.

**pH** An abbreviation for potential hydrogen ion. The pH numbers range from 0 to 14, 7 being neutral, and are indices of the acidity (below 7) or alkalinity (above 7) of the fluid.

The pH of a solution offers valuable information as to the immediate acidity or alkalinity, as contrasted to the total acidity or alkalinity (which may be titrated).

**Phosphate** Certain complex phosphates, usually sodium tetraphosphate (Na<sub>6</sub>P<sub>4</sub>O<sub>13</sub>) and sodium acid pyrophosphate (SAPP, Na<sub>2</sub>H<sub>2</sub>P<sub>2</sub>O<sub>7</sub>), are used either as mud thinners or for treatment of various forms of calcium and magnesium contamination.

**Photomicrograph** A photograph taken through a microscope.

**Pilot Testing** A method of predicting behavior of mud systems by mixing small quantities of mud and mud additives, then testing the results.

**Plastic Fluid** A complex, non-Newtonian fluid in which the shear force is not proportional to the shear rate. A definite pressure is required to start and maintain movement of the fluid. Plug flow is the initial type of flow and only occurs in plastic fluids. Most drilling muds are plastic fluids. The yield point as determined by direct-indicating viscometer is in excess of zero.

**Plasticity** The property possessed by some solids, particularly clays and clay slurries, of changing shape or flowing under applied stress without developing shear planes or fractures. Such bodies have yield points, and stress must be applied before movement begins. Beyond the yield point, the rate of movement begins. Beyond the yield point, the rate of movement is proportional to the stress applied, but ceases when the stress is removed. *See Fluid.*

**Plastic Viscosity** The plastic viscosity is a measure of the internal resistance to fluid flow attributable to the amount, type and size of

solids present in a given fluid. It is expressed as the number of dynes per  $\text{cm}^2$  of tangential shearing force in excess of the Bingham yield value that will induce a unit rate of shear. This value, expressed in centipoises, is proportional to the slope of the consistency curve determined in the region of laminar flow for materials obeying Bingham's Law of Plastic Flow. When using the direct-indicating viscometer, the plastic viscosity is found by subtracting the 300-RPM reading from the 600-RPM reading.

- Plug Flow** The movement of a material as a unit without shearing within the mass. Plug flow is the first type of flow exhibited by a plastic fluid after overcoming the initial force required to produce flow.
- P<sub>m</sub>** The phenolphthalein alkalinity of the mud reported as the number of milliliters of 0.02 Normal (N/50) sulfuric acid required per milliliter of mud.
- Polarized** Refers to light which is scattered at an angle of 90°. Commonly used in core study reports, where many of the photomicrographs (q.v.) are taken using a polarizer for better definition.
- Polymer** A substance formed by the union of two or more molecules of the same kind linked end to end into another compound having the same elements in the same proportion but a higher molecular weight and different physical properties. *See Copolymer.*
- Pore** A volume of space in a solid substance. In our industry it refers to void space in a rock or matrix (q.v.).
- Porosity** The amount of void space in a formation rock, usually expressed as percent voids per bulk volume. Absolute porosity refers to the total amount of pore space in a rock, regardless of whether or not that space is accessible to fluid penetration. Effective porosity refers to the amount of connected pore spaces, i.e., the space available to fluid penetration. *See Permeability.*
- Potassium** One of the alkali metal elements with a valence of 1 and an atomic weight of about 39. Potassium compounds, most

commonly potassium hydroxide (KOH) are sometimes added to drilling fluids to impart special properties, usually inhibition.

- Pound Equivalent** A laboratory unit used in pilot testing. One gram or pound equivalent, when added to 350 ml of fluid, is equivalent to 1 lb/bbl.
- Precipitate** Material that separates out of solution or slurry as a solid. Precipitation of solids in a drilling fluid may follow flocculation or coagulation, such as the dispersed red-bed clays upon addition of a flocculation agent to the fluid or chemical precipitation such as removing calcium with bicarb or soda ash as calcium carbonate.
- Preflush** A liquid pumped ahead of another liquid for cleaning purposes.
- Preservative** Any material used to prevent starch or any other substance from fermenting through bacterial action.
- Pressure-Drop Loss** The pressure lost in a pipeline or annulus due to the velocity of the liquid in the pipeline, the properties of the fluid, the condition of the pipe wall and the alignment of the pipe. In certain mud-mixing systems, the loss of head can be substantial.
- Pressure Surge** A sudden, usually short-duration increase in pressure. When pipe or casing is run into a hole too rapidly, an increase in the hydrostatic pressure results, which may be great enough to create lost circulation.
- Pressure Up** Increase pressure. *See also Bump.*
- Pseudoplastic Fluid** A complex non-Newtonian fluid that does not possess thixotropy. A pressure or force in excess of zero will start fluid flow. The apparent viscosity or consistency decreases instantaneously with increasing rate of shear until at a given point the viscosity becomes constant. The yield point as determined by direct-indicating viscometer is positive, the same as in Bingham plastic fluids; however, the true yield point is zero. An example of a pseudoplastic fluid is guar gum in freshwater or saltwater.

## Q

**Quebracho** A drilling fluid additive used extensively for thinning or dispersing to control viscosity and thixotropy. It is a crystalline extract of the quebracho tree consisting essentially of tannic acid.

**Quicklime** Calcium oxide (CaO). Used in certain oil-base muds to neutralize the organic acid.

**Quiescence** The state of being quiet or at rest (being still). Static.

## R

**Radical** Two or more atoms behaving as a single chemical unit, i.e., as an atom; e.g., sulfate, phosphate, nitrate.

**Rate of Shear** The rate at which an action, resulting from applied forces, causes or tends to cause two adjacent parts of a body to slide relatively to each other in a direction parallel to their plane of contact. Commonly given in RPM.

**Reaction, Exothermic** A chemical reaction which gives off heat.

**Reaction, Endothermic** A chemical reaction in which heat is absorbed.

**Recycle Re-use**; usually refers to brines or muds.

**Red Mud** A clay, water-base drilling fluid containing sufficient amounts of caustic soda and tannates to give a pronounced red appearance. Normally a high-pH mud.

**Resin** Semi-solid or solid complex, amorphous mixture of organic compounds having no definite melting point nor tendency to crystalize. Resins may be a component of compounded materials that can be added to drilling fluids to impart special properties to the system, wall cake, etc.

**Resistivity** The electrical resistance offered to the passage of a current, expressed in

ohm-meters; the reciprocal of conductivity. Freshwater muds are usually characterized by high resistivity, saltwater muds by a low resistivity.

**Resistivity Meter** An instrument for measuring the resistivity of drilling fluid and their cakes.

**Reverse Circulate** The method by which the normal flow of a drilling fluid is reversed by circulating down the annulus and up and out the drillstring.

**Reynolds Number** A dimensionless number,  $Re$ , that occurs in the theory of fluid dynamics.

The number is important in fluid hydraulics calculations for determining the type of fluid flow, i.e., whether laminar or turbulent. The transitional range occurs approximately from 2,000 to 4,000; below 2,000 the flow is laminar, above 4,000 the flow is turbulent.

**Rheology** The science that deals with deformation and flow of water.

**Rotary Drilling** The method of drilling wells that depends on the rotation of a column of drill pipe to the bottom of which is attached a bit. A fluid is circulated to remove the cuttings.

## S

**Salt** In mud terminology, the term salt is applied to sodium chloride, NaCl. Chemically, the term salt is also applied to any one of a class of similar compounds formed when the acid hydrogen of an acid is partly or wholly replaced by a metal or a metallic radical. Salts are formed by the action of acids on metals, or oxides and hydroxides, directly with ammonia, and in other ways.

**Saltwater Clay** See *Attapulgate Clay*.

**Saltwater Mud**s A drilling fluid containing dissolved salt (brackish to saturated). These fluids may also include native solids, oil and/or such commercial additives as clays, starch, etc.

**Sample Mud** A drilling fluid possessing properties to bring up suitable samples.

**Samples Cuttings** obtained for geological information from the drilling fluid as it emerges from the hole. They are washed, dried and labeled as to the depth.

**Sand** A loose granular material resulting from the disintegration of rocks, most often silica.

**Sand Content** The sand content of a drilling fluid is the insoluble abrasive solids content rejected by a 200-mesh screen. It is usually expressed as the percentage bulk volume of sand in a drilling fluid. This test is an elementary type in that the retained solids are not necessarily silica nor may not be



- altogether abrasive. For additional information concerning the kinds of solids retained on the 200-mesh screen, more specific tests would be required. *See Mesh.*
- Saturated Solution** A solution is saturated if it contains at a given temperature as much of a solute as it can retain. At 68°F it takes 126.5 lb/bbl salt to saturate 1 bbl of freshwater. *See Supersaturation.*
- Screen Analysis** Determination of the relative percentages of substances, e.g., the suspended solids of a drilling fluid, passing through or retained on a sequence of screens of decreasing mesh size. Analysis may be by wet or dry methods. Referred to also as "sieve analysis." *See Mesh.*
- Sealing Agents** Any of many materials added to drilling fluids to restore circulation.
- Seawater Muds** A special class of saltwater muds where seawater is used as the fluid phase.
- Sediments** Solids in a solution which settle out or have settled out. It can refer to the bottom of a sample jar to a developing or developed geologic formation.
- Selective** Choosing one particular zone of a formation. Usually refers to completing zones separately.
- Sensitive** Affected chemically or physically by a particular substance. It is usually used in the context of formation damage, indicating a source of damage.
- Sequestration** The formation of stable calcium, magnesium, iron complex by treating water or mud with certain complex phosphates.
- Set Casing** The installation of pipe or casing in a wellbore. Usually requires mudding up, reconditioning or at least checking the drilling fluid properties.
- Shale** Fine-grained clay rock with slate-like cleavage, sometimes containing an organic oil-yielding substance.
- Shale Shaker** Any of several mechanical devices utilizing screens for removing cuttings and other large solids from the mud.
- Shear (Shearing Stress)** An action, resulting from applied forces, which causes or tends to cause two contiguous parts of a body to slide relatively to each other in a direction parallel to their plane of contact.
- Shearometer** A device used as an alternative method for measuring gel strengths.
- Shear Strength** A measure of the shear value of the fluid. The minimum shearing stress that will produce permanent deformation. *See Gel Strength.*
- Sidetracking** To directionally drill around a fish or away from an existing wellbore.
- Sieve Analysis** *See Screen Analysis.*
- Silica Gel A** A porous substance consisting of SiO<sub>2</sub>. Used on occasion as a dehydrating agent in air or gas drilling where small amounts of water are encountered.
- Silt** Materials that exhibit little or no swelling whose particle size generally falls between 2 microns and API sand size, or 74 microns (200 mesh). A certain portion of dispersed clays and barite for the most part also fall into this same particle size range.
- Skid Moving** A rig from one location to another, usually on tracks where little dismantling is required.
- Skin Damage** Formation damage, loss of permeability and possibly porosity on the face of the wellbore, due to drilling or completion fluids or practices.
- Slip Velocity** The difference between the annular velocity of the fluid and the rate at which a cutting is removed from the hole.
- Sloughing** The partial or complete collapse of the walls of a hole resulting from incompetent, unconsolidated formations; high angle or repose; and wetting along internal bedding planes. *See Heaving and Cave-In.*
- Slotted Liner** A completion liner that has factory cut slots when run. It does not need to be perforated. The slots are usually chosen according to expected sand-control measures.
- Sludge** It is a mixture of oil, water and solids which has a thick, gunky consistency. It usually settles to the bottom of a tank.
- Slug the Pipe** A procedure before pulling the drill pipe whereby a small quantity of heavy mud is pumped into the top section to cause an unbalanced column. As the pipe is pulled, the heavier column in the drill pipe will fall, thus keeping the inside of the drill pipe dry at the surface when the connection is unscrewed.
- Soap** The sodium or potassium salt of a high-molecular-weight fatty acid. When containing some metal other than sodium or potassium, they are called "metallic" soaps. Soaps are commonly used in drilling fluids to improve lubrication, emulsification, sample size, defoaming, etc.
- Soda Ash** *See Sodium Carbonate.*
- Sodium** One of the alkali metal elements with a valence of 1 and an atomic weight of about 23. Numerous sodium compounds are used as additives to drilling fluids.
- Sodium Bicarbonate (NaHCO<sub>3</sub>)** A material used extensively for treating cement contamination and occasionally other calcium contamination in drilling fluids. It is the half-neutralized sodium salt of carbonic acid.
- Sodium Carbonate (Na<sub>2</sub>CO<sub>3</sub>)** A material used extensively for treating out various types of calcium contamination. It is commonly

- called "soda ash." When sodium carbonate is added to a fluid, it increases the pH of the fluid by hydrolysis.
- Sodium Carboxymethylcellulose (CMC)** Available in various viscosity grades and purity. An organic material used to control filtration, suspend weighting material and build viscosity in drilling fluids. Used in conjunction with bentonite where low-solids muds are desired.
- Sodium Chloride (NaCl)** Commonly known as salt. Salt may be present in the mud as a contaminant or may be added for any of several reasons. *See Salt.*
- Sodium Hydroxide (NaOH)** Commonly referred to as "caustic" or "caustic soda." A chemical used primarily to impart a higher pH.
- Sodium Polyacrylate** A synthetic high-molecular-weight polymer of acrylonitrile used primarily as a fluid-loss-control agent.
- Sodium Silicate Muds** Special class of inhibited chemical muds using as their bases sodium silicate, salt, water and clay.
- Sol** A general term for colloidal dispersions, as distinguished from true solutions.
- Solids Concentration** The total amount of solids in a drilling fluid as determined by distillation includes both the dissolved and the suspended or undissolved solids. The suspended solids content may be a combination of high and low-specific-gravity solids and native or commercial solids. Examples of dissolved solids are the soluble salts of sodium, calcium and magnesium. Suspended solids make up the wall cake; dissolved solids remain in the filtrate. The total suspended and dissolved solids contents are commonly expressed as percent by volume, and less commonly as percent by weight.
- Solids, Dissolved Solids**, usually salts in our industry but the term is not restricted to salts, which are dissolved in a fluid. In a brine there are dissolved salts which we add and other dissolved solids like iron oxide, calcium carbonate and sulfate, etc. The numbers of potential types of dissolved salts are limitless. The total amount of dissolved salts is limited by crystallization point (q.v.).
- Solids, Suspended Solids** which are not dissolved and which stay in suspension in a drilling, workover or completion fluid.
- Solubility** The degree to which a substance will dissolve in a particular solvent.
- Soluble, Water** Indicates a solid is soluble in water.
- Solute** A substance which is dissolved in another (the solvent).
- Solution** A mixture of two or more components that form a homogeneous single phase. Example solutions are solids dissolved in liquid, liquid in liquid, gas in liquid.
- Solvent** Liquid used to dissolve a substance (the solute).
- Souring** A term commonly used to mean fermentation.
- Spacer** A volume of liquid, which may or may not contain solids, and is used to separate two fluids from each other. One example is using a spacer between a water-base and an oil-base mud during displacement to prevent intermixing.
- Specific Gravity (SG)** *See Gravity, Specific.*
- Specific Heat** The number of calories required to raise 1 g of a substance 1°C. The specific heat of a drilling fluid gives an indication of the fluid's ability to keep the bit cool for a given circulation rate.
- Spudding In** The starting of the drilling operations of a new hole.
- Spud Mud** The fluid used when drilling starts at the surface, often a thick bentonite-lime slurry.
- Spurt Loss** The initial filtrate and mud invasion as a filter cake is being deposited.
- Squeeze** A procedure whereby slurries of cement, mud, gunk plug, etc. are forced into the formation by pumping into the hole while maintaining a back pressure, usually by closing the rams.
- Stability (Electrical) Meter** An instrument to measure the breakdown voltage of invert emulsions.
- Stacking a Rig** Storing a drilling rig upon completion of a job when the rig is to be withdrawn from operation for a period of time.
- Starch** A group of carbohydrates occurring in many plant cells. Starch is specially processed (pregelatinized) for use in muds to reduce filtration rate and occasionally to increase the viscosity. Without proper protection, starch can ferment.
- Static** Opposite of dynamic. *See Quiescence.*
- Streaming Potential** The electrokinetic portion of the SP (Spontaneous Potential) electric-log curve which can be significantly influenced by the characteristics of the filtrate and mud cake of the drilling fluid that was used to drill the well.
- Streamline Flow** *See Laminar Flow.*
- Stearate Salt** of stearic acid, which is a saturated, 18-carbon fatty acid. Certain compounds such as aluminum stearate, calcium stearate and zinc stearate have been used in drilling fluids for one or more of the following purposes: defoamer, lubrication, air drilling in which a small amount of water is encountered, etc.

- Stuck** A condition whereby the drill pipe, casing or other devices inadvertently become lodged in the hole. May occur while drilling is in progress, while casing is being run in the hole or while the drill pipe is being hoisted. Frequently a fishing job results.
- Summer Blend** Refers to a brine blended for summer temperature conditions, where crystallization is usually not a problem. The summer blend is usually a less expensive fluid than a winter blend, which contains less low-specific-gravity salt.
- Supersaturation** If a solution contains a higher concentration of a solute in a solvent that would normally correspond to its solubility at a given temperature, this constitutes supersaturation. This is an unstable condition, as the excess solute separates when the solution is seeded by introducing a crystal of the solute. The term "supersaturation" is frequently used erroneously for hot salt muds.
- Surface-Active Materials** *See Surfactant.*
- Surfactant** A material which tends to concentrate at an interface. Used in drilling fluids to control the degree of emulsification, aggregation, dispersion, interfacial tension, foaming, defoaming, wetting, etc.
- Surface Tension** Generally, the force acting within the interface between a liquid and its own vapor which tends to maintain the area of the surface at a minimum and is expressed in dynes per centimeter. Since the surface tension of a liquid is approximately equal to the interfacial tension between the liquid and air, it is common practice to refer to values measured against air as surface tension, and to use the term "interfacial tension" for measurements at an interface between two liquids, or a liquid and a solid.
- Suspensoid** A mixture consisting of finely divided colloidal particles floating in a liquid. The particles are so small that they do not settle but are kept in motion by the moving molecules of the liquid.
- Swabbing** When pipe is withdrawn from the hole in a viscous mud or if the bit is balled, a suction is created.
- Swelling** *See Hydration.*
- Synergism, Synergistic Properties** Term describing an effect obtained when two or more products are used simultaneously to obtain a certain result. Rather than the results of each product being additive to the other, the the result is a multiple of the effects.
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- T**
- Tannic Acid** Tannic acid is the active ingredient of quebracho and other quebracho substitutes such as mangrove bark, chestnut extract, hemlock, etc.
- Temperature Survey** An operation to determine temperatures at various depths in the hole. This survey is used to find the location of inflows of water into the hole, where doubt exists as to proper cementing of the casing and for other reasons.
- Ten-Minute Gel** *See Gel Strength, 10-Min.*
- Thermal Decomposition** The chemical breakdown of a compound or substance by temperature into simple substances or into its constituent elements.
- Thinner** Any of various organic agents (tannins, lignins, lignosulfonates, etc.) and inorganic agents (pyrophosphates, tetraphosphates, etc.) that are added to a drilling fluid to reduce the viscosity and/or thixotropic properties.
- Thixotropy** The ability of fluid to develop gel strength with time. That property of a fluid which causes it to build up a rigid or semi-rigid gel structure if allowed to stand at rest, yet can be returned to a fluid state by mechanical agitation. This change is reversible.
- Tighten Up Emulsion or Mud Drilling** fluid jargon to describe condition in some systems to which oil has been added and the oil breaks out and rises to the surface. Any chemical or mechanical means which will emulsify the free oil is known as "tightening up."
- Titration** A method or the process of using a standard solution for the determination of the amount of some substance in another solution. The known solution is usually added in a definite quantity to the unknown until a reaction is complete.
- Tool Joint** A drill pipe coupler consisting of a pin and box of various designs and sizes. The internal design of tool joints has an important effect on mud hydrology.
- Torque** A measure of the force or effort applied to a shaft causing it to rotate. On a rotary rig this applies especially to the rotation of the drill stem in its action against the bore of the hole. Torque reduction can usually be accomplished by the addition of various drilling fluid additives.
- Total Depth (TD)** The greatest depth reached by the drill bit.
- Total Hardness** *See Hardness (of Water).*

- Tour A** A person's turn in an orderly schedule. The word, which designates the shift of a drilling crew, is pronounced as if it were spelled t-o-w-e-r.
- Tubular Goods Tubing** of various physical composition. Size determines production rates, and vice versa.
- Turbidity Unit** A standardized unit of measure (usually NTU), it refers to a measure of increasing solids content in a liquid. The more solids a liquid has, the higher the turbidity would be. The actual measure is accomplished by directing a light beam through the liquid. When the beam hits suspended solids (q.v.) it is scattered. Usually turbidity meters have two light receptors, located at 90° to the main light path. The receptors pick up the scattered light and convert it to an NTU reading.
- Turbulent Flow** Fluid flow in which the velocity at a given point changes constantly in magnitude and the direction of flow; pursues erratic and continually varying courses. Turbulent flow is the final stage of flow in a fluid. *See Velocity, Critical; and Reynolds Number.*
- Twist-Off** The severing in two of a joint of drill pipe by excessive force applied by the rotary table.
- 
- V**
- Valence** The valence is a number representing the combining power of an atom, i.e., the number of electrons lost, gained or shared by an atom in a compound. It is also a measure of the number of hydrogen atoms with which an atom will combine or replace, e.g., an oxygen atom combines with two hydrogens, hence has a valence of 2. Thus, there are mono-, di-, tri-, etc. valent ions.
- Valence Effect** In general, the higher the valence of an ion, the greater the loss of stability to emulsions, colloidal suspensions, etc. these polyvalent ions will impart.
- Velocity** Time rate of motion in a given direction and sense. It is a measure of the fluid flow and may be expressed in terms of linear velocity, mass velocity, volumetric velocity, etc. Velocity is one of the factors which contribute to the carrying capacity of a drilling fluid.
- Velocity, Critical** That velocity at the transitional point between laminar and turbulent types of fluid flow. This point occurs in the transitional range of Reynolds numbers of approximately 2,000 to 3,000.
- V-G Meter or Viscosity Gravity Viscometer** The name commonly used for the direct indicating mud viscometer.
- Viscometer (Viscosimeter)** An apparatus to determine the viscosity of a fluid or suspension. Viscometers vary considerably in design and methods of testing.
- Viscometer, Direct-Indicating** The instrument is a rotational-type device powered by means of an electric motor or handcrank, and is used to determine the apparent viscosity, plastic viscosity, yield point and gel strengths of drilling fluids.
- Viscosity** The internal resistance offered by a fluid to flow. This phenomenon is attributable to the attractions between molecules of a liquid, and is a measure of the combined effects of adhesion and cohesion to the effects of suspended particles, and to the liquid environment. The greater this resistance, the greater the viscosity. *See Apparent Viscosity and Plastic Viscosity.*
- Viscosity, Funnel** *See Funnel Viscosity.*
- Viscous Flow** *See Laminar Flow.*
- Volatile Matter** Normally gaseous products, except moisture, given off by a substance, such as gas breaking out of live crude oil that has been added to a mud. In distillation of drilling fluids, the volatile matter is the water, oil, gas, etc., that are vaporized, leaving behind the total solids which can consist of both dissolved and suspended solids.

## W

**Wall Cake** The solid material deposited along the wall of the hole resulting from filtration of the fluid part of the mud into the formation.

**Wall Sticking** See *Differential-Pressure (Wall) Sticking*.

**Water-Base Mud** Common conventional drilling fluids. Water is the suspending medium for solids and is the continuous phase, whether or not oil is present.

**Water Block Reduction** of the permeability of a formation caused by the invasion of water into the pores (capillaries). The decrease in permeability can be caused by swelling of clays, thereby shutting off the pores, or in some cases by a capillary block of the pores due to surface tension phenomena.

**Water-in-Oil Emulsion** See *Invert Oil-Emulsion Mud*.

**Water Loss** See *Fluid Loss*.

**Weight In** mud terminology, this refers to the density of a drilling fluid. This is normally expressed in either lb/gal, lb/ft<sup>3</sup> or kg/l.

**Weight Material** Any of the high specific gravity materials used to increase the density of drilling fluids. This material is most commonly barite but can be hematite,

etc. In special applications limestone is also called a weight material.

**Wet, Oil** Indicates that the surface of a solid has an oil coating.

**Wet, Water** Indicates that the surface of a solid has a water coating.

**Wettability** Indicates the ability of the surface of a solid to be coated with a liquid.

**Wetting** The adhesion of a liquid to the surface of a solid.

**Wetting Agent** A substance or composition which, when added to a liquid, increases the spreading of the liquid on a surface or the penetration of the liquid into a material.

**Whipstock** A device inserted in a wellbore used for deflecting or for directional drilling.

**Wildcat** A well in unproved territory.

**Winter Blend** A brine which has a low crystallization point due to use of more costly, high specific gravity salts (q.v.). In design these blends are the antithesis of summer blends, where expensive, high-specific-gravity salt use is minimized and crystallization point is generally quite high.

**Workover Fluid** Any type of fluid used in the workover operation of a well.

## X, Y

**X-Ray Diffraction** An analytical method in which X-rays are used to determine composition of crystalline substances. In our industry it is one of the main stays for determining composition percentages of brine and formation solids.

**Yield** A term used to define the quality of a clay by describing the number of barrels of a given centipoise slurry that can be made from a ton of the clay. Based on the yield, clays are classified as bentonite, high-yield, low-yield, etc., types of clays. Not related to yield value below.

**Yield Point** In drilling fluid terminology, yield point means yield value. Of the two terms, yield point is by far the most commonly used expression.

**Yield Value** The yield value (commonly called "yield point") is the resistance to initial flow or represents the stress required to start fluid movement. This resistance is due to electrical charges located on or near the surfaces of the particles. The values of the yield point and thixotropy, respectively, are measurements of the same fluid properties under dynamic and static states. The Bingham yield value, reported in lb/100 ft<sup>2</sup>, is determined by the direct indicating viscometer by subtracting the plastic viscosity from the 300-RPM reading.

\*Standard Procedure for Testing Drilling Fluids, American Petroleum Institute, Dallas, Texas, Nov. 1962, 1st Ed.