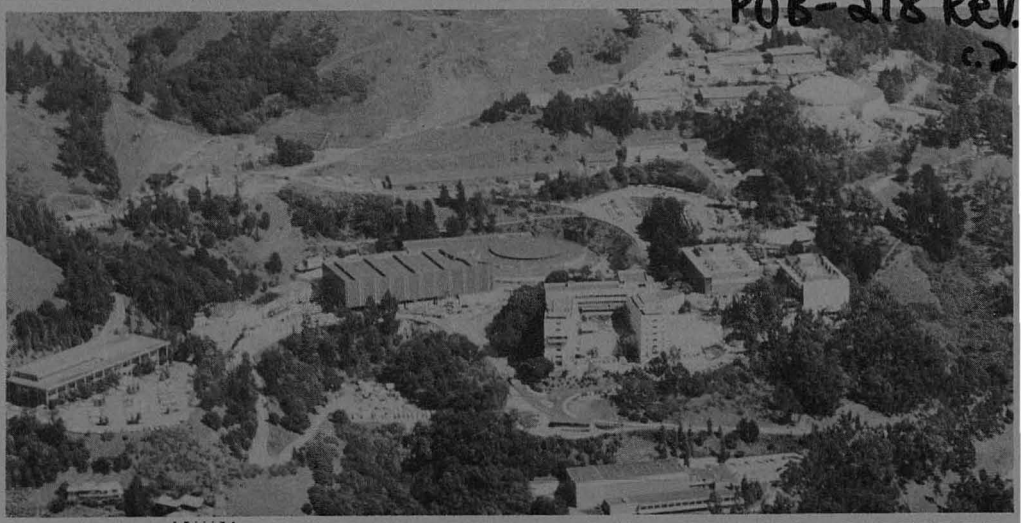

WELL-TESTING SYMPOSIUM

PURPOSE
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GLOSSARY OF TERMS

October 19-21, 1977

Horizon Room
Claremont Hotel
Berkeley, California

Sponsored by
U.S. ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION,
DIVISION OF GEOTHERMAL ENERGY
through the
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LAWRENCE BERKELEY LABORATORY
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Well-Testing Symposium

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PURPOSE

The purpose of the symposium is to advance the science of well testing through the exchange of ideas and the presentation of new information relating to well testing. The symposium will provide a forum for about 100 invited participants who have been directly involved in the fields of geothermal, hydrological, or oil and gas well testing. The emphasis will be on reviewing existing capabilities, identifying current limitations, and on generating new ideas for extending well-test capabilities.

The goal of the symposium is to bring together well-testing experts from the fields of geothermal energy, the oil and gas industries, and ground water hydrology. The invited participants from these three disciplines will be chosen to provide coverage of instrumentation, technique development, and well-test analysis. In addition to identifying problem areas where additional research and development are necessary, the aim is to unify the ideas and methods, where possible, in the three different disciplines.

PERMEABILITY

ρ_ω = 1 viscosity = 1 centipoise

	cm^2	m^2	ft^2	Darcy	cm/sec	ft/sec	ft/year	litres/ $sec \cdot m^2$	gpd[U.S.]/ft^2 (Meinzer)	Ebhlm*
cm^2	1	10^{-4}	1.076×10^{-3}	1.014×10^{8}	9.804×10^{4}	3.216×10^{3}	1.015×10^{11}	8.698×10^{5}	1.845×10^{9}	0.9
m^2	10^{4}	1	1.076×10^{1}	1.014×10^{12}	9.804×10^{8}	3.216×10^{7}	1.015×10^{15}	8.697×10^{9}	1.845×10^{13}	0.8
ft^2	9.294×10^{2}	9.294×10^{-2}	1	9.417×10^{10}	9.109×10^{7}	2.988×10^{6}	9.430×10^{13}	8.080×10^{8}	1.714×10^{12}	0.7
Darcy	9.862×10^{-9}	9.862×10^{-13}	1.062×10^{-11}	1	9.66×10^{-4}	3.173×10^{-5}	1.001×10^{3}	8.58×10^{-3}	1.82×10^{1}	0.6
cm/sec	1.020×10^{-5}	1.020×10^{-9}	1.097×10^{-8}	1.035×10^{3}	1	3.281×10^{-2}	1.035×10^{6}	9.985×10^{0}	2.118×10^{4}	0.5
ft/sec	3.109×10^{-4}	3.109×10^{-8}	3.347×10^{-7}	3.152×10^{4}	3.048×10^{1}	1	3.156×10^{7}	2.704×10^{2}	5.736×10^{5}	0.4
ft/year	9.852×10^{-12}	9.852×10^{-16}	1.060×10^{-14}	9.990×10^{-4}	9.662×10^{-7}	3.169×10^{-8}	1	8.570×10^{-6}	1.818×10^{-2}	0.3
litres/ $sec \cdot m^2$	1.150×10^{-6}	1.150×10^{-10}	1.238×10^{-9}	1.166×10^{2}	1.001×10^{-1}	3.698×10^{-3}	1.167×10^{5}	1	2.121×10^{3}	0.2
gpd[U.S.]/ft^2 (Meinzer)	5.420×10^{-10}	5.420×10^{-14}	5.834×10^{-13}	5.494×10^{-2}	4.721×10^{-5}	1.743×10^{-6}	5.500×10^{1}	4.714×10^{-4}	1	0.1
Ebhlm*	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	1

*Standard Ethiopian buckets per hectare per lunar month.

Dimensions: k, Absolute Permeability [L^2]

K, Hydraulic Conductivity [L/t]

k/μ, Mobility [L^3t/M]

COMPRESSIBILITY

$[Lt^2/M]$

	m^2/N (Pascals)$^{-1}$	m^2/kg_f	in^2/lb_f (psi)$^{-1}$	Bars^{-1}	Atm^{-1}	(ft of water)$^{-1}$ at 68°F	(m of water)$^{-1}$ at 68°F
m^2/N (Pascals)$^{-1}$	1	9.807	6.897×10^{3}	10^{5}	1.0133×10^{5}	2.984×10^{3}	9.794×10^{3}
m^2/kg_f	1.020×10^{-1}	1	7.031×10^{2}	1.0197×10^{4}	1.0332×10^{4}	3.042×10^{2}	9.980×10^{2}
$in.^2/lb_f$ (psi)$^{-1}$	1.450×10^{-4}	1.4223×10^{-3}	1	14.504	14.696	0.4327	1.419
Bars^{-1}	10^{-5}	9.8068×10^{-5}	6.895×10^{-2}	1	1.01325	2.984×10^{-2}	9.790×10^{-2}
Atm^{-1}	9.8692×10^{-6}	9.6787×10^{-5}	6.805×10^{-2}	0.98692	1	2.945×10^{-2}	9.662×10^{-2}
(ft of water)$^{-1}$ at 68°F	3.351×10^{-4}	3.287×10^{-3}	2.311	33.512	33.956	1	3.281
(m of water)$^{-1}$ at 68°F	$1.021\ 10^{-4}$	$1.002\ 10^{-3}$	.7044	10.214	10.349	0.3048	1

TEMPERATURE

°C to °F

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
0	32	100	212	200	392	300	572	400	752
5	41	105	221	205	401	305	581	405	761
10	50	110	230	210	410	310	590	410	770
15	59	115	239	215	419	315	599	415	779
20	68	120	248	220	428	320	608	420	788
25	77	125	257	225	437	325	617	425	797
30	86	130	266	230	446	330	626	430	806
35	95	135	275	235	455	335	635	435	815
40	104	140	284	240	464	340	644	440	824
45	113	145	293	245	473	345	653	445	833
50	122	150	302	250	482	350	662	450	842
55	131	155	311	255	491	355	671	455	851
60	140	160	320	260	500	360	680	460	860
65	149	165	329	265	509	365	689	465	869
70	158	170	338	270	518	370	698	470	878
75	167	175	347	275	527	375	707	475	887
80	176	180	356	280	536	380	716	480	896
85	185	185	365	285	545	385	725	485	905
90	194	190	374	290	554	390	734	490	914
95	203	195	383	295	563	395	743	495	923

VOLUME
$[L^3]$

	m^3	litre	bbl	Gallon (U.S.)	Gallon (Imp.)	ft^3
m^3	1	10^3	6.289	2.642×10^2	2.20×10^2	35.315
litre	10^{-3}	1	6.289×10^{-3}	0.2642	0.220	3.5315×10^{-2}
bbl	.1590	1.590×10^2	1	42.0	34.97	5.6146
gallons (U.S.)	3.7854×10^{-3}	3.7854	2.381×10^{-2}	1	0.8327	0.13368
gallons (IMP)	4.546×10^{-3}	4.546	2.860×10^{-2}	1.2009	1	0.16054
ft^3	2.832×10^{-2}	28.32	0.178	7.481	6.229	1

FLOW RATE $[L^3/t]$ or $[M/t]$

	m^3/sec	litres/min	bbl/day	gallons/min (U.S.)	gallons/min (Imp.)	ft^3/sec	klb/hr (ρ_w=1.0)	klb/hr (ρ_w=.9)
m^3/sec	1	6×10^{4}	5.434×10^{5}	1.585×10^{4}	1.320×10^{4}	35.315	7.94×10^{3}	7.15×10^{3}
litres/min	1.667×10^{-5}	1	9.058	0.2642	0.220	5.885×10^{-4}	1.32×10^{-1}	1.19×10^{-1}
bbl/day	1.840×10^{-6}	1.10×10^{-1}	1	2.917×10^{-2}	2.428×10^{-2}	6.498×10^{-5}	1.46×10^{-2}	1.31×10^{-2}
gallons/min (U.S.)	6.31×10^{-5}	3.785	34.28	1	0.8327	2.2280×10^{-3}	0.50	0.45
gallons/min (Imp.)	7.58×10^{-5}	4.546	41.19	1.2009	1	2.676×10^{-3}	0.601	0.541
ft^3/sec	2.8317×10^{-2}	1.699×10^{3}	1.539×10^{4}	4.488×10^{2}	3.737×10^{2}	1	2.25×10^{2}	2.03×10^{2}
klb/hr ρ_w=1.0	1.26×10^{-4}	7.56	68.5	2.00	1.66	4.45×10^{-3}	1	0.900
klb/hr ρ_w=0.9	1.40×10^{-4}	8.42	76.2	2.22	1.85	4.93×10^{-3}	1.11	1

PRESSURE

$[M/Lt^2]$

	N/m^2 (Pascals)	kg_f/m^2	lb_f/in^2 (psi)	Bars	Atm	ft of water (at 68°F)	m of water (at 68°F)
N/m^2 (Pascals)	1	1.020×10^{-1}	1.450×10^{-4}	10^{-5}	9.8692×10^{-6}	3.351×10^{-4}	1.021×10^{-4}
kg_f/m^2	9.804	1	1.4223×10^{-3}	9.8068×10^{-5}	9.6787×10^{-5}	3.287×10^{-3}	1.002×10^{-3}
lb_f/in^2 (psi)	6.895×10^{3}	7.031×10^{2}	1	6.895×10^{-2}	6.805×10^{-2}	2.311	0.7042
Bars	10^{5}	1.0197×10^{4}	14.504	1	0.98692	33.512	10.214
Atm	1.0133×10^{5}	1.0332×10^{4}	14.696	1.01325	1	33.956	10.349
ft of water (at 68°F)	2.984×10^{3}	3.042×10^{2}	0.4328	2.984×10^{-2}	2.945×10^{-2}	1	0.3048
m of water (at 68°F)	9.794×10^{3}	9.980×10^{2}	1.419	9.790×10^{-2}	9.662×10^{-2}	3.281	1

GLOSSARY OF TERMS

GW: Terms commonly used in Hydrogeology

PE: Terms commonly used in Petroleum Engineering

AFTER FLOW, (PE) See "Wellbore Storage".

AFTER INJECTION, (PE) See "Wellbore Storage".

AFTER PRODUCTION, (PE) See "Wellbore Storage".

ANNULUS UNLOADING, (PE) The unloading of fluid stored between tubing and casing. See "Wellbore Storage".

ANISOTROPY, Term used to denote the dependence of properties such as permeability on spacial orientation. Anisotropy is usually expressed as a tensor. When the principal axes are perpendicular to each other, the material is said to be orthotropic.

AQUICLUDE, (GW) A body of saturated but relatively impermeable material that does not yield appreciable amounts of water to wells. Characterized by very low "leakance" (the ratio of vertical hydraulic conductivity to thickness) and very low rates of yield from compressible storage.

AQUIFER SYSTEM, (GW) A heterogeneous body consisting of two or more permeable beds seperated at least locally by aquitards that impede groundwater movement but do not greatly affect the regional hydraulic continuity of the system.

AQUITARD, (GW) A saturated, but poorly permeable, bed that impedes groundwater movement and does not yield water freely to wells, but which may transmit water between aquifers and may constitute an important storage unit. Leakance values can range from relatively low to relatively high. When low, an aquitard may function as a boundry to an aquifer flow system.

AREA OF INFLUENCE, (GW) Defined by Meinzer to be the land area of the same horizontal extent as the portion of the potentiometric surface that is perceptibly lowered due to withdrawal of water by a production well.

BANK STORAGE, (GW) The change in storage in an aquifer resulting from a change in stage of an adjacent surface water body.

BAROMETRIC EFFICIENCY OF A WELL, The ratio of water-level changes in the well to the water-level changes in a water barometer.

BOUNDARY PRESSURE, (PE) Pressure at boundary of drainage area.

CAPILLARY FRINGE, (GW) A zone whose lower part is completely saturated, but with water under less than atmospheric pressure. May range in thickness from a small fraction of an inch in gravel to more than 5 feet in silt. The water table forms its lower boundary.

CAPTURE, (GW) The decrease in discharge plus the increase in recharge of an aquifer. A term usually used in reference to the after-effects of artificial withdrawal of water from an aquifer.

COEFFICIENT OF PERMEABILITY, (GW) See "Hydraulic Conductivity".

COEFFICIENT OF SPECIFIC STORAGE, (GW) See "Specific Storage".

COEFFICIENT OF STORAGE, (GW) See "Storage Coefficient".

COEFFICIENT OF TRANSMISSIBILITY, (GW) See "Transmissibility".

COEFFICIENT OF VOLUME COMPRESSIBILITY, (GW) The compression of a lithologic unit, per unit of original thickness, per unit increase of effective stress, in the load range exceeding preconsolidation stress.

COMMINGLED SYSTEMS, (PE) Two-layered or multiple layer reservoirs with communication taking place between layers, either through the wellbore alone or directly across the layer interface. (cf: "multi-aquifer well)

COMPACTION, (GW) Decrease in volume of sediments, as a result of compressive stress, usually resulting from continued deposition of them. Also called "one-dimensional consolidation".

COMPACTION, RESIDUAL, (GW) The difference between 1) the amount of compaction that will occur ultimately for a given increase in applied stress, once steady-state pore pressures are achieved, and 2) that which has occurred so far as of a specified time.

COMPACTION, SPECIFIC, (GW) The decrease in thickness of deposits, per unit increase in applied stress, during a specific time period.

COMPACTION, SPECIFIC UNIT, (GW) The compaction of deposits, per unit thickness, per unit increase in applied stress, during a specific time period.

COMPACTION, UNIT, (GW) The compaction per unit thickness of the deposit.

COMPOSITE SYSTEM, (PE) An injection well where the injected fluid bank is surrounded by an oil bank, and in which the locations of the fluid banks move.

COMPRESSIBILITY, TOTAL SYSTEM, (PE) A term representing the combined compressibility of all the elements in an aquifer system. Accounts for the compressibilities of the oil phase, water phase, gas phase, and of the rock formation itself, according to the relative fraction of the total system volume occupied by each.

CONDITION RATIO, (PE) Also called flow efficiency, indicates approximate fraction of a well's undamaged producing capacity. Ratio of actual productivity index to the productivity index if there were no skin (ideal conditions).

CONFINING BED, (GW) A body of relatively impermeable material stratigraphically adjacent to one or more aquifers. Can be either an "aquitard" or an "aquiclude".

CONSOLIDATION, (GW) See "compaction".

CONSTANT DRAWDOWN TEST, (GW) Also known as constant pressure test in petroleum engineering. A test in which flow rate is gradually varied in time to maintain a constant drawdown (or constant pressure) in the producing well.

CONSTANT PRESSURE TESTING, (PE) Also known as constant drawdown test in groundwater hydrology. Involves recording change in flow rate with time while bottom-hole pressure is held constant.

CRITICAL FLOW, (PE) Occurs in high-permeability zones; the rate of flow into the drill pipe is independent of drawdown during a drill-stem test.

CRITICAL FLOW PROVER, (PE) Device that measures flow rate of a gas through an orifice under critical conditions (velocity is constant at a maximum value despite downstream pressure variations).

DAMAGE FACTOR, A measure of wellbore damage obtained by subtracting the condition ratio from 1.

DAMAGE RATIO, (PE) Inverse of condition ratio. Indicates wellbore condition.

DELAYED DRAINAGE, (GW) Term used to identify the slow release of water from the unsaturated zone in an unconfined aquifer.

DELIVERABILITY TESTING OF OIL WELLS, (PE) Determines capability of a well to deliver against a specific flowing bottom-hole pressure. Two main types: 1) flow-after-flow test; flowing pressure is recorded for three or more successive flow rates. Each flow rate is held constant until pressure has stabilized. 2) modified isochronal flow test; used for systems where stabilization time

time is too long for flow-after-flow test. For each flow rate, the well is shut-in after pressure transience is recorded, but before stabilization occurs. At each step the final flowing pressure and then the final shut-in pressure are observed. At the final flow rate, the well is allowed to produce until the pressure stabilizes, and this pressure is recorded.

DIMENSIONLESS PRESSURE, (PE) A dimensionless solution to the diffusivity equation. Directly proportional to physical pressure, where the scaling factor is dependent on flow rate and reservoir properties. Usually denoted by $P_D = \frac{2\pi kH\Delta P}{q\mu}$

DIMENSIONLESS TIME, (PE) A scaled version of real time. Scaling factor depends on reservoir properties and distance to point of observation $t_D = \frac{kt}{\phi\mu cr^2}$, where k is intrinsic permeability; t is time; ϕ is porosity; μ is viscosity; c is total compressibility; r is distance to point of observation.

DRAWDOWN, (GW) Difference in water level (or pressure) between the static condition and that at any given instant during discharge.

DRAWDOWN TESTING, (PE) Involves recording the lowering of bottom-hole pressure when a shut-in production well is switched to production at constant flow rate.

DRILLSTEM TESTING - DST, (PE) Used in testing uncompleted wells. An arrangement of packers seals off the interval to be tested, allowing a pressure to be built up as formation fluid flows into the drillstem and surface-actuated valves are closed. Pressure changes are observed by a pressure gauge located in the test interval. See "Single Packer Test", "Straddle Packer Test".

DYNAMIC PRESSURE, (PE) The pressure at a given time and location in a reservoir during a period of transient pressure distribution, such as during a build-up or drawdown test.

EFFECTIVE WELL RADIUS, (GW) The radius of an imaginary cylinder centered at the wellbore in which the permeability is much higher than in the reservoir. In a gravel-packed well it may often denote the probable radius of the gravel pack.

EQUIVALENT INJECTION TIME, (PE) In a fall-off test on an injection well where the injection rate before shut-in varies, this is equivalent to the length of time it would have taken to inject the same volume of fluid at constant flow rate as was injected at a variable flow rate since the last pressure equalization.

EXCESS PORE PRESSURE, (GW) Transient pore pressure at any point in an aquitard or aquiclude in excess of the pressure that would exist under steady-flow condition.

EXPANSION, SPECIFIC, (GW) The increase in thickness of deposits per unit decrease in applied stress.

EXPANSION, SPECIFIC UNIT, The expansion (increase in volume) of deposits, per unit thickness, per unit decrease in applied stress.

EXPONENTIAL INTEGRAL, (PE) See "Theis Solution".

FALLOFF TESTING, (PE) Involves shutting in an injection well and observing the decrease in bottom-hole pressure with time.

FALSE PRESSURE, (PE) Obtained by extrapolating the straight-line section of a Horner plot of pressure build-up data to infinite shut-in time. Approximates average reservoir pressure in an infinite system and can be used to estimate average drainage region pressure in a bounded system.

FIVE-SPOT PATTERN, (PE) An arrangement of production and injection wells with four production wells at the corners of a square and one injection well in the center.

FLOW-AFTER-FLOW TESTING, (PE) See "Deliverability Testing of Oil Wells".

FLOW EFFICIENCY, (PE) See "Condition Ratio".

FLUID POTENTIAL, (GW) The mechanical energy per unit mass of a fluid at any given point in space and time with respect to an arbitrary state and datum.

FORMATION VOLUME FACTOR, (PE) A factor to account for changes in volume in each phase upon transition from reservoir to standard surface conditions. The ratio of the volume at reservoir conditions to the volume at standard surface conditions.

GROUNDWATER, PERCHED, (GW) confined groundwater seperated from an underlying body of groundwater by an unsaturated zone. It is held up by a "perching bed" of low permeability, and its water table is a "perched water table".

HEAD, STATIC, (GW) The height (above a datum) of a column of water that can be supported by the static pressure at a given point. The sum of the "elevation head" and the "pressure head". See "Head, Total".

HEAD, TOTAL, (GW) The sum of three components: 1) "elevation head", which is the elevation of the point above a datum; 2) "pressure head", the height of a column of static water that can be supported by the static pressure at the point; 3) "velocity head", the height the kinetic energy of the liquid is capable of lifting the liquid.

HORNER PLOT, (PE) A plot of pressure build-up versus log $\frac{t+\Delta t}{t}$ where t is time since production and Δt is time since shut-in. A similar plot was proposed in groudwater hydrology by Theis to analyze recovery data.

HYDRAULIC CONDUCTIVITY (K), (GW) Has dimensions of length per unit time. A medium has a hydraulic conductivity of unit length per unit time if it will transmit in unit time a unit volume of groundwater at the prevailing viscosity through a cross-section of unit area, measured at right angles to the direction of flow, under a hydraulic gradient of unit change in head through unit length of flow. Replaces the term "coefficient of permeability".

HYDRAULIC CONDUCTIVITY, EFFECTIVE, (GW) The rate of flow of water through a porous medium that contains more than one fluid.

HYDRAULIC DIFFUSIVITY, (GW) The ratio between hydraulic conductivity and specific storage.

HYDRAULIC GRADIENT, (GW) The change in static head per unit of distance in a given direction.

HYDROCOMPACTION, (GW) The process of volume decrease and density increase that occurs when moisture-deficient deposits are wetted for the first time.

IMAGE METHOD (METHOD OF IMAGES), (PE) The technique of using image wells to generate no-flow and constant pressure boundaries in an infinite system.

IMAGE WELL, (GW) An imaginary well which effectively produces the same drawdown (or recovery) as a linear boundary limiting the aquifer. See "Image Method".

INFLOW PERFORMANCE RELATIONSHIP, (PE) Used to predict a well's deliverability when deliverability test data is not available. A relationship between flow-rate, bottom-hole pressure, average reservoir pressure, and a productivity index.

INFLUENCE REGION, (PE) The region surrounding a well or wells whose properties influence transient tests performed on those wells. (Not to be confused with Meinzer's "area of influence".)

INJECTIVITY TESTING (INJECTION WELL TESTING), (PE) Pressure transient testing during injection into a well. Bottom-hole pressure is recorded while injection rate is held constant.

INTERFERENCE TESTING, (PE) A multiple-well transient test which involves the production of an active well (injection) and observing the resulting pressure changes in an observation well.

INTERPOROSITY FLOW PARAMETER, (PE) A dimensionless property of a fractured system. Dependent on the well radius, a matrix-to-fracture geometric factor, and the ratio of the formation matrix permeability to the effective fracture permeability.

ISOCHRONAL TESTING, (PE) See "Deliverability Testing of Oil Wells".

JACOB'S METHOD, (GW) Also known as asymptotic solution. Involves a semi-logarithmic plot of drawdown as a function of the log of time.

LEAKANCE, (GW) The ratio of vertical hydraulic conductivity to thickness of aquiclude.

LEAKY AQUIFER, (GW) An aquifer into which overlying and/or underlying aquitards discharge water as the potentiometric head in the aquifer is lowered.

MEINZER UNIT, (GW) A unit of hydraulic conductivity defined as the flow of water in gallons per day through a cross-sectional area of 1 square foot under a hydraulic gradient of 1 at a temperature of 60°F.

MOBILITY, (PE) The ratio of absolute permeability to viscosity.

MOBILITY RATIO, The ratio of the mobility of the injected fluid to that of the in-situ fluid.

MULTI-AQUIFER WELL, (GW) A well which is screened to produce fluids from more than one aquifer, seperated by aquicludes. (cf: "commingled systems")

MULTIFLOW EVALUATOR, (PE) A tool used in drillstem testing which allows unlimited sequences of production and shut-in. Includes a fluid chamber to recover an uncontaminated formation-fluid sample under pressure at the end of the flow period.

MULTIPLE RATE TESTING, (PE) Tests involving a variable flow-rate. Testing at a series of constant flow-rates, or testing at constant bottom-hole pressure with continuously changing flow-rate.

ORTHOTROPY, (GW) See "Anisotropy".

PERMEABILITY, EFFECTIVE, (GW) See. "Hyraulic Conductivity, Effective".

PERMEABILITY, INTRINSIC, Same as "Permeability". Term adopted by U. S. Geological Survey to indicate that it is a property of the medium alone, independent of the fluid properties. Has dimensions of L^2. Also called "Absolute Permeability".

PIEZOMETRIC SURFACE, (GW) See "Potentiometric Surface".

POROSITY, (GW) The property of a rock or soil of containing interstices. Expressed as the ratio of the volume of interstices to the total volume.

POROSITY, EFFECTIVE, (GW) Refers to the amount of interconnected pore space available for fluid transmission. Expressed as the percentage of total volume occupied by interconnecting interstices.

POTENTIOMETRIC SURFACE, A surface which represents the static head. An imaginary surface connecting points to which water would rise in tightly cased wells from a specified surface or stratum in the aquifer.

PRESSURE, AVERAGE RESERVOIR, The pressure a reservoir would attain if all wells were shut in for infinite time, assuming no natural influx of fluid.

PRESSURE BUILDUP TESTING, (PE) Involves shutting in a producing well and analyzing the resultant pressure buildup curve for reservoir properties and wellbore condition

PRESSURE, INITIAL RESERVOIR, (PE) Stabilized pressure of a shut-in well.

PRESSURE, INTERWELL, (PE) The pressure halfway between an injection well and a production well. Sometimes used to approximate average reservoir pressure.

PRESSURE, PSEUDOCRITICAL, For a mixture of gases, calculated from relative amounts and critical pressures of the components.

PRESSURE, PSEUDOREDUCED, (PE) The ratio of the pressure of interest to the pseudocritical pressure.

PRODUCTIVITY INDEX, (PE) Also known as the specific capacity of a well. Denotes, in petroleum engineering, the productivity of a well per unit drawdown.

PSEUDO SKIN FACTOR, (PE) The apparent skin factor in a well which has no true physical damage (or improvement) but is not drilled completely through the formation thickness or is only partially completed, thus appearing damaged.

PSEUDO STEADY STATE, (PE) A transient flow regime in which the rate of pressure change with time is constant at all points in the reservoir.

PULSE TESTING, (PE) A multiple-well transient test, in which flow rate pulses are produced in an active well and the resulting pressure changes are recorded in an observation well. Provides reservoir information for the region around and between the two wells. (Because of the shorter time intervals, the influence region for a pulse test is less than that for an interference test, and thus information is gained about a smaller portion of the reservoir.)

RADIUS OF DRAINAGE, (PE) Defines a circular system around a well in which a pseudo steady state pressure distribution exists.

RECOVERY TEST, (GW) Also known as build-up test in petroleum engineering. Denotes a test which involves the measurement of recovery in a well after the well is shut in following a known period of production.

RELATIVE PERMEABILITY, (PE) Also called effective permeability in groundwater hydrology. Denotes the permeability of the porous medium to a particular fluid when more than one fluid is present.

RESIDUAL DRAWDOWN, (GW) During recovery, the difference between the static water level and the water level at any instant during recovery.

SAFE YIELD , (GW) Given a variety of meanings, but originally defined (by Meinzer) as the rate at which groundwater can be withdrawn year after year from a given aquifer system without depleting the supply to the point where withdrawal at this rate is no longer economically feasible.

SEEPAGE FACE, (GW) For a well piercing an unconfined aquifer, seepage face denotes that segment of the well screen over which the total head equals elevation above datum and water flows from the aquifer into the well.

SEEPAGE FORCE, See "Stress, Seepage".

SHAPE FACTOR, (PE) A geometric factor, characteristic of the system shape and well location.

SLUG METHOD, (GW) Used to determine transmissivity of an aquifer. A known volume or "slug" of water is suddenly injected into or removed from a well and the decline or recovery of the water level is measured at closely spaced time intervals during the ensuing minute or two.

SINGLE-PACKER TEST, (PE) A drillstem test utilizing one packer in which fluid flows through the perforated anchor pipe into the drillstring.

SKIN, (PE) A zone of decreased permeability near the wellbore created by drilling and completion practices.

SKIN FACTOR, (PE) A constant which relates the pressure drop across the skin to the dimensionless rate of flow. A measure of wellbore damage.

SPECIFIC CAPACITY, (GW) The rate of discharge of water from a well divided by the drawdown of water level within the well. Varies slowly with duration of discharge. Also called Productivity Index in Petroleum Engineering.

SPECIFIC DISCHARGE or SPECIFIC FLUX, (GW) The rate of discharge of groundwater per unit area measured at right angles to the direction of flow.

SPECIFIC RETENTION, (GW) The ratio of the volume of water a saturated rock or soil will retain against the pull of gravity to its own volume.

SPECIFIC STORAGE, (GW) The volume of water released from or taken into storage per unit volume of the porous medium per unit change in head.

SPECIFIC YIELD, (GW) The water yielded by water-bearing material by gravity drainage, as occurs when the water table declines. The ratio of the volume of water a saturated rock or soil will yield by gravity to its own volume.

STABILIZATION TIME, (PE) The time corresponding to the start of the pseudo steady state period.

STATIC WATER LEVEL, (GW) The static position of the potentiometric surface in a well prior to the commencement of discharge. (cf: Initial reservoir pressure in petroleum engineering.)

STEADY STATE, Pressure is constant at all points in the reservoir.

STEP DRAWDOWN TEST, (GW) Also known as productivity index test or step-rate test in petroleum engineering. Involves producing a well at different rates for predetermined periods of time and monitoring drawdown.

STEP-RATE TESTING, (PE) A multiple-rate injection well test in which fluid is injected at a series of increasing rates, each rate lasting an equal amount of time. Injection pressure at the end of each rate is plotted versus injection rate.

STORAGE COEFFICIENT, The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.

STRADDLE-PACKER TEST, (PE) A drillstem test in which the tested interval lies between two packers.

STRESS, APPLIED, The downward stress imposed at the aquifer boundary by 1) the weight (per unit area) of sediments and moisture above the water table, 2) the submerged weight of the saturated sediments overlying the boundary, and 3) the net seepage stress due to flow within the saturated sediments above the boundary .

STRESS, EFFECTIVE, Stress that is borne by and transmitted through the grain to grain contacts of a deposit. The effective stress at a point in an aquifer differs from the applied stress at the aquifer boundary by the submerged weight (per unit area) of the intervening sediments and the net seepage stress due to flow within the intervening sediments.

STRESS, SEEPAGE, Stress created by the seepage force, which is transferred from the water to the porous medium by viscous friction. Seepage force is exerted in direction of flow.

SUBSIDENCE, Sinking or settlement of the land surfaces, due to any of several processes, but most importantly due to artificial withdrawal of sub-surface fluids.

TEMPERATURE: PSEUDOCRITICAL; PSEUDOREDUCED, (PE)
Pseudocritical Temperature: For a mixture of gases, calculated from the relative amounts and critical temperatures of the components.
Pseudoreduced Temperature: The ratio of the temperature of interest to the pseudocritical temperature.

THEIM EQUATION, (GW) Represents steady-state radial flow solution to a well in the center of a circular, homogeneous, horizontal aquifer with prescribed potential at the circular boundary.

THEIS SOLUTION, (GW) Represents the solution to a continuous line source in a homogeneous, horizontal, infinite, isotropic aquifer. (Also known as exponential intergral in petroleum engineering.)

TIDAL EFFICIENCY, A measure of the response of the water level in a well to changes in ocean level. Equal to the barometric efficiency subtracted from 1.

TRANSIENT TESTING, The study of pressure variation with time in an active well (production or injection) under a variety of conditions and possible operating procedures.

TRANSMISSIVITY (T), (GW) The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient.

TWO-RATE TESTING, (PE) A multiple-rate test on a production well using only two different flow-rates.

TWO-ZONE SYSTEMS, See "Composite Systems".

U, (GW) Dimensionless quantity related to the reciprocal of dimensionless time, t_D, used in petroleum engineering.

$$u = \frac{r^2 s}{4Tt} = \frac{1}{4t_D}$$

UNCONFINED AQUIFER, (GW) Also called water table aquifer. An aquifer which contains a water table, at which it is in direct contact with the atmosphere.

UNIFORM-FLUX FRACTURE, (PE) One in which fluid enters at a uniform flow-rate per unit area. A first approximation to the behavior of a vertically fractured well.

VERTICAL PULSE TESTING, (PE) Used to determine vertical permeability of a formation. Fluid is injected in pulses above a packer, escapes the wellbore through flow perforations and re-enters below the packer through observation perforations where pressure changes are observed with a pressure gauge.

VOID RATIO, (GW) The ratio of the volume of the interstices in a rock or soil to the volume of its mineral particles.

WATER DRIVE RESERVOIRS, (PE) Reservoirs in direct communication with an active aquifer.

WELLBORE STORAGE, (PE) Fluid stored in the wellbore above reservoir level. Usually occurs when a production well is shut-in without packers used to maintain fluid level. Affects pressure build-up data at early time as fluid continues to flow into the wellbore after shut-in.

WELL FUNCTION OF U, (GW) Equal to twice the value of P_D, dimensionless pressure, which denotes the value of the exponential integral.

WELL LOSSES, (GW) Denotes drawdowns at the well in excess of the theoretical capability of the reservoir. Such well losses may be due to poor development of the well, excessive entrance velocities and casing damages due to skin, scaling, or corrosion.

WIRELINE FORMATION TESTING, (PE) A tool is lowered into the well on a logging cable. The mechanism establishes communication with formation fluid and measures pressure response. Slightly more qualitative than a DST.

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