

**Bent Pegs and Round Holes:  
New Concerns for Oil and Gas Commissions**

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A new strain of "gold rush fever" appears to be infecting the oil and gas industry in the Rocky Mountain states. Recent articles in oil and gas trade publications have extolled the virtues of horizontal drilling, and the technique is firing the imaginations of a number of producers. Reporting that over 60 horizontal wells were drilled in North America in 1987, the October 1988 issue of World Oil projected that "these figures will increase logarithmically in future years, due to the production successes occurring in these wells."

Indeed, at least one operator appears to be batting 1000.00 in the horizontal well game being played in the Rockies. The December 15, 1988, Montana Oil Journal reported that Meridian Oil Inc., had successfully completed more than one-half dozen horizontal wells in North Dakota, three in Montana, and had run production casing on the first wildcat horizontal well in the Williston Basin. Subsequent issues of the Journal have outlined an ambitious horizontal well drilling program planned by another substantial operator in the same area.

#### Horizontal Drilling

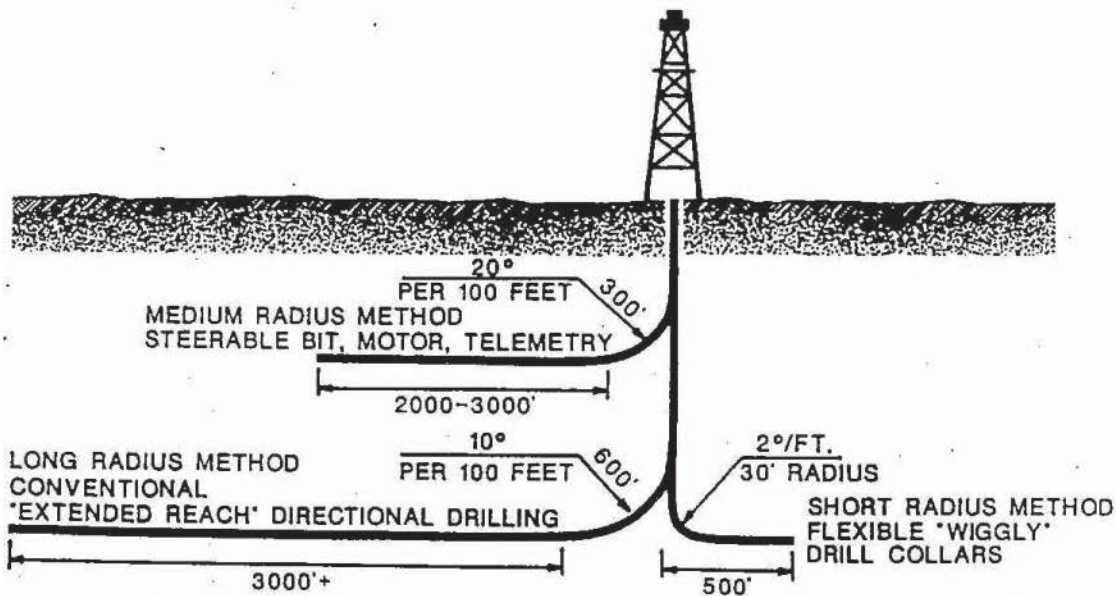
Modern horizontal (lateral) drilling is essentially the application of new technology and equipment to the "drain hole"

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concept developed in the 1920s and '30s. By utilizing unique methods of directional control which differ from those employed in conventional directional drilling, and measurement-while-drilling tools and steerable motors, operators are now able to drill vertically to a target formation, turn on a surprisingly short radius into the formation, and extend the borehole for thousands of feet in the formation. The three major horizontal well completion methods were recently graphically described to the Interstate Oil Compact Commission at its 1988 mid-year meeting. (Fig. 1)\*\*

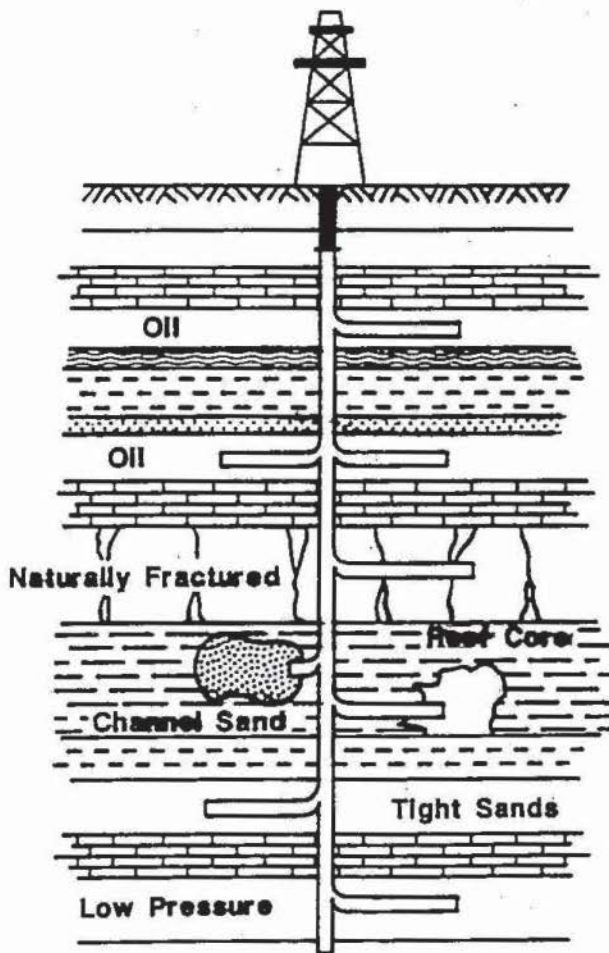
HORIZONTAL DRILLING — 3 MAJOR METHODS



\*\* Figures 1, 2, and 6 are reproduced with permission from "Horizontal Drilling--A Key to Enhanced Recovery," by James C. Allen, in The Interstate Oil and Gas Compact & Committee Bulletin, June 1988.

On paper, and apparently now in practice, horizontal well completion techniques have given operators an ability to obtain optimum primary production from thin, discontinuous formations, and formations with low permeability or matrix porosity by exposing much more of the formation to the pressure differential which occurs at perforation points. (Fig. 2)

HORIZONTAL DRILLING A PROBLEM SOLVING COMPLETION TECHNOLOGY



It is the addition of new target formations that has caused much of the excitement in the oil and gas community, and put landmen back in the field seeking to lease acreage that was dropped in the downturn of oil prices in the mid-1980s.

However, it is the economics of horizontal wells that have brought to issue the manner in which such wells should be treated from a regulatory standpoint. Performance multiples of 2 - 10 times vertical well productivity at costs of 1.5 to two times the cost of drilling a traditional vertical well raise questions in the minds of offset operators as to how horizontal wells fit into the scheme of well spacing already in place in the Rocky Mountain states.

#### **Conservation Regulation**

The oil and gas conservation acts of nearly all Rocky Mountain states are the offspring of the 1950 model legislation promulgated by the Legal Committee of the Interstate Oil Compact Commission. The model act suggested three ways of preventing (or at least controlling) waste and protecting correlative rights--- (1) well spacing, (2) individual well or field production restrictions, and (3) proration based upon market demand. However, the legislatures in most of the Rocky Mountain states rejected the concept of market demand proration, and have delegated only spacing and production restriction authority to the respective oil and gas conservation boards and commissions. In turn, most state commissions in the Rocky Mountain region find the imposition of production restrictions distasteful, and have

routinely resorted to well spacing as the primary means of achieving waste prevention and the protection of correlative rights.

Colorado's well spacing statute typifies the "generic" spacing authority granted to regulatory agencies:

[1] TO PREVENT OR TO ASSIST IN PREVENTING WASTE; [2] TO AVOID THE DRILLING OF UNNECESSARY WELLS, OR [3] TO PROTECT CORRELATIVE RIGHTS---

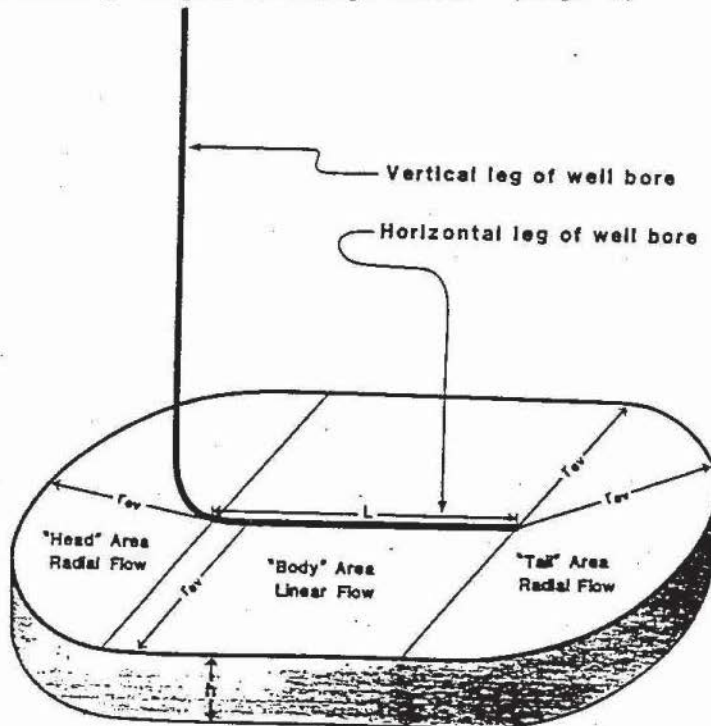
The Commission [may] establish drilling units---

- [a] of specified and approximately uniform size and shape---
- [b] no drilling unit shall be smaller than the maximum area that can be efficiently and economically drained by one well---
- [c] only one well [shall] be drilled and produced from the common source of supply on a drilling unit.  
(Colo. Rev. Stat. Sec. 34-60-116)

#### Well Spacing

Typically, the scenario played out when a commission or board is considering the spacing applicable to a given area following discovery is that the areal extent of the common pool subject to drainage is determined, and testimony is received concerning oil in place, recoverable reserves, projected rates of recovery, and the number of wells that can be economically drilled given well costs and projected rates of return on investment. In practice, operator-applicants will request---and the commissions will usually grant---spacing units of the size and shape historically assigned to a given formation at similar depth.

Given this normal well spacing procedure, spacing today is largely the spacing of yesteryear, which is the product of vertical drilling operations. Historic spacing patterns normally utilize subdivisions (or combinations thereof) of the governmental rectangular survey system which is in place in all of the Rocky Mountain states, and such utilization has its roots in the uniformly-accepted engineering principle that vertical wells are presumed to have circular drainage patterns. In contrast, horizontal wells will (assuming reservoir homogeneity) display an oblong-shaped drainage area. (Fig. 3)

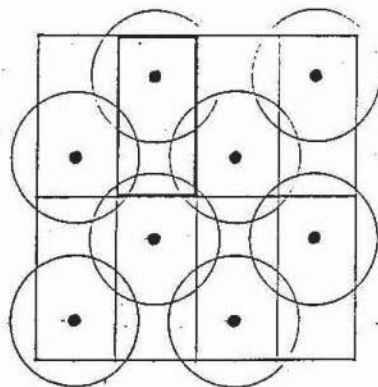


$$\begin{aligned} \text{AREA} &= \text{head} + \text{body} + \text{tail} \\ &= \frac{1}{2} \pi r_{ev}^2 + 2r_{ev}L + \frac{1}{2} \pi r_{ev}^2 \end{aligned}$$

Conceptual Description of Drainage Area for a Horizontal Well

Traditionally, conservation boards have attempted to meld the circular drainage concept with mineral and leasehold ownerships which normally employ rectangular survey subdivision boundaries by the unspoken notion of "compensated" drainage. That is, although a round drainage pattern does not fit neatly into a square spacing unit, if all other wells in the surrounding spacing units have a similar theoretic drainage pattern, then each owner is, ideally, compensated for any drainage of acreage within his unit by the well of another unit.

"Patterned" spacing dramatically demonstrates how boards and commissions employ the compensated drainage idea. When rectangular (80 acre or 320 acre tracts) spacing units are created rather than square spacing units (40 acre, 160 acre or 640 acre tracts), the spacing order normally will require that the permitted wells for adjoining spacing units offset one another diagonally rather than directly. An overlay of a circular drainage pattern upon each well reflects that a major portion of the production for each well will come from the adjoining unit, thus resulting in "compensation" on a field-wide basis. (Fig. 4)



RECTANGULAR SPACING  
(80 - 320 ACRE)  
"PATTERNED"  
COMPENSATED DRAINAGE



Use of compensated drainage in the configuration of spacing units is one of the means by which boards and commissions provide for the protection of the correlative rights of interest owners within the field area. Colorado has codified the concept as follows:

"Correlative rights" means that each owner and producer in a common pool or source of supply of oil and gas shall have an equal opportunity to obtain and produce his just and equitable share of the oil and gas underlying such pool or source of supply. (Colo. Rev. Stat. Sec. 34-60-103(4)).

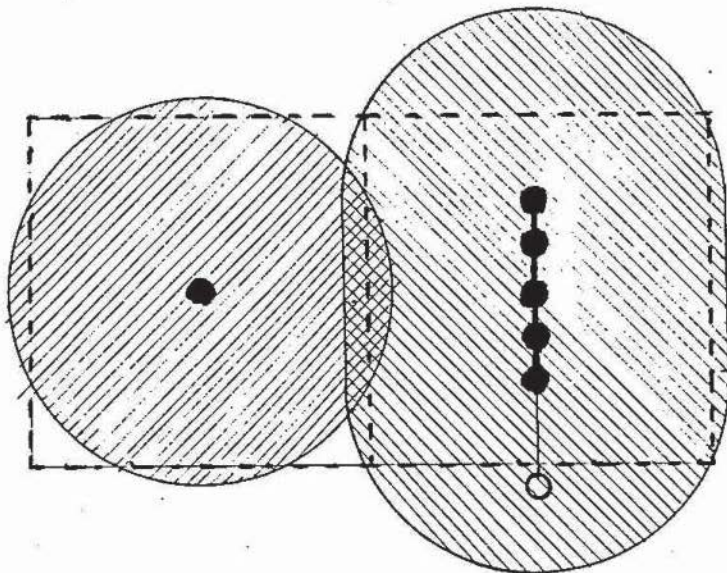
The definition of "equal opportunity" in practice is imprecise, but the language employed by the Interstate Oil Compact Commission in its 1942 Standards of Allocation of Oil Production gives a flavor for the thought process that should be utilized by the regulatory agency in its spacing decisions:

Within reasonable limits, each operator should have an opportunity, equal to that afforded other operators, to recover the equivalent of the amount of recoverable oil underlying his property. The aim should be to prevent reasonably avoidable drainage of oil and gas across property lines that is not offset by counterdrainage.

#### **Spacing for Horizontal Wells**

With the growing popularity of the horizontal well concept, conservation agencies must come to grips with the manner in which

such wells will be integrated into the historical methods of well spacing. More specifically, if operators have the option of drilling either a horizontal or a vertical well, does this voluntary option satisfy the "equal opportunity" standard, or should the assignment of spacing unit size take into consideration the fact that horizontal drainage patterns will likely encompass a larger area than the circular pattern of the traditional vertical well? (Fig. 5)



An even harder question is whether the Rocky Mountain boards and commissions will be forced to consider proration of production from horizontal wells drilled in fields developed via vertical drilling and spaced accordingly.

Of course, there are many aspects of both drilling methods which the regulatory agencies will need to take into account when considering these issues. For example, Oklahoma's Corporation Commission is the first agency to adopt regulations governing horizontal "drainholes", and it seized upon the similarity of a stimulation technique commonly employed in vertical wells to the practical result of horizontal drilling in the adoption of rules treating horizontal wells as a "single wellbore":

3.1 . . . Lateral drilling is an alternative to vertically drilling and hydraulically fracturing the productive interval in a well. . .

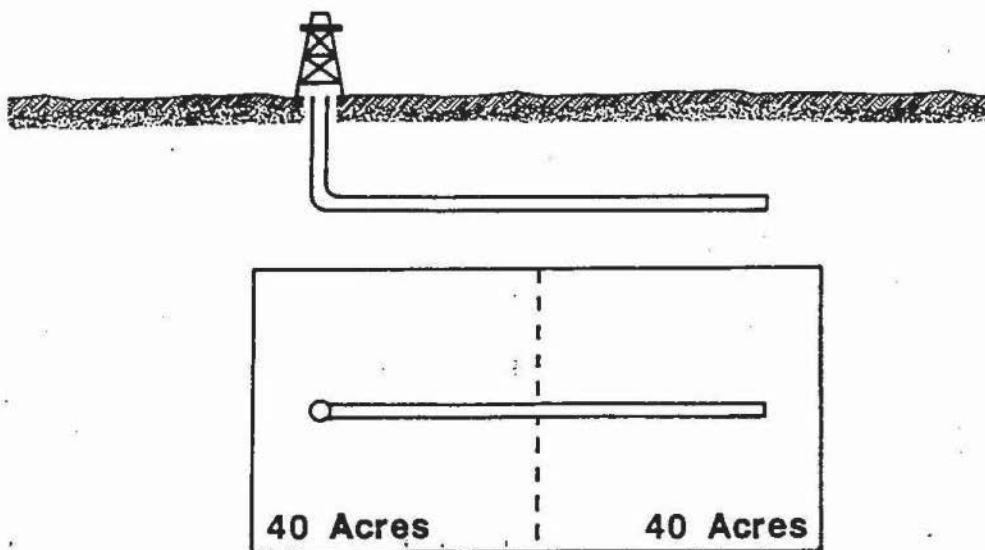
3.2 The final rules treat a well with one or more horizontal drainholes as a single wellbore because of the similarity in performance between lateral completion and hydraulic fracture stimulation of a vertically drilled well. Okla. Corp. Comm. Order No. 326344 (June 1, 1988) (The new rule concerning horizontal drilling is OCC-OGR Rule 3-211).<sup>1</sup>

#### **IOCC Recommendation**

The Interstate Oil Compact Commission's Council of State Regulatory Officials Horizontal Drilling Sub-Committee has

drafted a "model form" horizontal well rule identical to the new Oklahoma rule (Sub-Committee Memorandum, December 6, 1988), but at the 1989 mid-year meeting of the Council adoption of the form was postponed at the request of officials of a market proration state pending further study of the need to incorporate the concept of allowables in the recommended form. The IOCC received a comprehensive report on horizontal drilling at its 1988 mid-year meeting (Allen, Horizontal Drilling--A Key to Enhanced Recovery, 1988 Interstate Oil & Gas Compact & Committee Bulletin, Vol. II, No. 1), and received recommendations concerning spacing (maintenance of traditional minimum distances); possible use of allowables or production restrictions as a means of factoring length of the horizontal drainhole into spacing decisions; and the assignment of multiple spacing units to a horizontal well.<sup>2</sup> (Fig. 6).

SINGLE DRAIN HOLE/MULTIPLE UNITS



In conclusion, the challenge to the oil and gas boards and commissions of the Rocky Mountain states is clear---their ingenuity and imaginations must be exercised in such a manner as to assimilate horizontal wells within the regulatory structure and at the same time honor their obligation to protect the correlative rights of all concerned.

1. The Montana Board of Oil and Gas Conservation recently determined to initiate proposed rulemaking to (1) treat horizontal wells as a single wellbore; and (2) allow operators to designate "optional" wildcat drilling units to accommodate horizontal wells, such units to be comprised of two normal exploratory drilling units. (June 29, 1989 Meeting of Montana Board of Oil and Gas Conservation, Billings, Montana)
2. The possibility of utilizing multiple spacing units would, in states such as Montana where by statute all spacing units must be of equal size and shape, require that product produced from the bore be shared by the respective spacing units penetrated by the horizontal well. The well would be considered as the producing well for each such spacing unit.