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DRILLING PRACTICES IN THE SAN JUAN BASIN

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Pictured Cliffs Gas Production

Both rotary and cable tools are now being used to drill gas wells to the Pictured Cliffs formation. Rotary tools are used more often and they are more economical than cable tools. Cable tools require at least four to five strings of different-sized casing in order to land the production string at the critical point. Using rotary tools about 100 feet of 8-5/8 or 9-5/8 inch surface pipe is cemented and the 1,800 to 2,000 feet of 5-1/2 inch production casing is landed at the casing point. The general practice is to install a standard machine after setting the producing string and drill in with the use of cable tools. Usually about 85 feet of Pictured Cliffs sandstone is drilled before "shooting" the gas zone with 50 to 250 quarts of nitroglycerin. It has been found that the most satisfactory way in which to "shoot" the wells is to load the hole with water, run the shot, and place 50 feet of "cal-seal" tamp which fills parts of the bore hole and casing. Cleaning-out operations are done with the use of cable tools. The well is cleaned out to the total depth and a one-inch siphon line is installed in order to keep the well dry of condensate and moisture. In using rotary tools it has been found that the cost of mud is not excessive, that little to no lost circulation is experienced, and that a 2,000-foot well can be drilled with about seven to eight 7-3/4 inch rock bits. It is estimated that the average cost of completing wells to the Pictured Cliffs sandstone in the San Juan Basin ranges from $12,000 to $16,000. The average initial open-flow potential from wells that have been "shot" with nitroglycerin is approximately three-fourths of a million cubic feet of gas daily. Formation pressures range from 450 to 600 pounds per square inch.

Mesaverde Gas Production

Rotary tools are used exclusively to set the producing string on wells for gas production found in the Cliff House sandstone and Point Lookout sandstone of the Mesaverde group. The present drilling practice is to set about 200 feet of 10-3/4 inch surface casing followed by drilling a nine-inch hole to the desired casing point which might be either the top of the Cliff House sandstone or the top of the Point Lookout sandstone. It requires approximately 30 to 35 nine-inch rock bits to drill about 5,000 feet in the La Plata pool. Water that is used during drilling operations must be hauled from irrigation ditches or rivers inasmuch as water found in the shallow wells has a high salt content and is not suitable for drilling. In the Blanco field it has been the practice to set seven-inch casing on top of the Cliff House sandstone, drill the entire Mesaverde section with cable tools, and "shoot" the Point Lookout sandstone with approximately 500 to 800 quarts of nitroglycerin. The well is "shot" with unloaded hole and allowed to clean itself in order to eliminate the use of a siphon line. Two-inch or two and one-half inch tubing is generally used. Wells stabilize slowly after a "shot" and show large open flows for short periods. The loss of circulation encountered while drilling the Menefee formation often makes it impractical to employ rotary tools to the top of the Point Lookout sandstone. Most instances of lost circulation above the Cliff House sandstone occur in the Lewis shale which is apparently much fractured.

In the La Plata pool it has been found that the Cliff House sandstone contains water and in all probability water is also present in the Menefee formation. In this area the present practice is to set the seven-inch producing string on or near the top of the Point Lookout sandstone. Lost circulation is often experienced during drilling, and this may occur anywhere between the surface and the casing point. Cotton-seed hulls are used to re-establish circulation when it is lost. It has been found that the cementing of extremely critical zones saves considerable time and money. Cable tools are used to drill the Point Lookout sandstone, and after drilling approximately 200 to 300 feet of open hole below the "shoe" the gas zone is "shot" with approximately 1,000 quarts of nitroglycerin in an unloaded hole. The average initial open-flow potential of gas wells completed in the Point Lookout sandstone in the La Plata area after a "shot" is approximately three-fourths of a million cubic feet daily. The formation pressure is 1,100 pounds per square inch. It is estimated that the costs of wells completed in the Mesaverde formation range from $50,000 to $65,000.

Paradox Gas Production.

It is the practice in the drilling of gas wells to the Paradox formation of Pennsylvanian age at Barker dome to set about 300 to 500 feet of 13-inch surface casing. An intermediate string of 9-5/8 inch casing is then set to the base of the Dakota formation at depths ranging from 2,500 to 3,300 feet. A string of seven-inch production casing is run close to the base of the Paradox formation at approximately 8,900 to 9,600 feet and cemented with approximately 700 sacks of cement. Trouble has not been experienced with lost circulation to this date and the cost of drilling mud has not been excessive. It has been found that the conventional core-barrel obtains very poor recovery because of the large amount of

fracturing present in the Paradox "pay" zones and that to obtain better recovery the diamond drill core-barrel can be used more successfully. Lane Wells and Schlumberger electric logs are both run, and the seven-inch casing is perforated at the selected gas "pay" zones. Two and one-half inch tubing is run, the mud displaced and acidized with 500 gallons of mud acid which is followed with a 10,000-gallon, two-stage treatment. The well is allowed to clean itself after each acid treatment. Approximately 125 to 150 rock bits are used in drilling these wells. The average cost of gas wells completed in the Paradox formation is approximately $250,000. The initial open-flow potential of completed gas wells ranges from 50 to 150 million cubic feet of gas daily. The rock pressure is approximately 2,800 pounds per square inch.

Some of the difficulties of wildcat exploration in the San Juan Basin are poor roads, scarcity of water, remoteness of operations, limited number of service companies, scarcity of supplies, lack of communications, and weather conditions. The area is experiencing a rapid increase in drilling and exploration activity which is bringing improvements in all of these factors but the weather. Recent reports indicate that the Navajo medicine men are bringing in some assistants from the California Institute of Technology to do something about the last.

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