

CONTROLLING GAS PRODUCTION FROM A DEEP GROUNDWATER

TEST HOLE NEAR RED DEER, ALBERTA

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by

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An exploratory groundwater test hole drilled near Red Deer, Alberta in Lsd.12, Sec.25, Tp.38, R.27, W.4th Mer. for the Alberta Research Council encountered three feet of porous gas-producing sand in the Lower Cretaceous Paskapoo Formation. Total depth of the hole, drilled with a Bucyrus-Erie 22-W cable-tool rig owned by Forrester Water Well Drilling Ltd. of Red Deer, was 775 feet. Construction details at the time the gas zone was encountered are shown on Figure 1. The Three casing strings had been set at various times during the drilling operation to prevent caving.

At 10.15 a.m. on June 13, 1967, the driller reported to the engineer at the well that a slight "blow" of gas was issuing from the casing head. The engines were immediately shut down and the gas discharging from the well was tested with an MSA Explosimeter. The results indicated a 100 per cent combustible mixture.

Since a dangerous situation existed, immediate control of the gas was of prime importance. A makeshift "well head" (Fig.2) was constructed by welding a plate over the end of a short length of 45/8" casing. A nipple into which a flow-line and valve could be installed was welded into the side of the casing. All welding was done a considerable distance upwind from the well.

The flow of gas was controlled in the following manner: first, the wellhead was threaded into the casing head; second, a 12 foot length of 1" black pipe containing an open globe valve was connected to the nipple welded into the casing; and, third, after all the joints were tightened, the globe valve was closed.

Further testing by engineers of the Alberta Oil and Gas Conservation Board indicated a well-head pressure of 65psig and a gas flow rate of approximately 51,300 cubic feet per day.

With the flow of gas controlled, the next problem was to shut off the producing formation with a cement plug so the the well could be abandoned safely. A cement slurry was made by mixing one bag of construction cement with 7 gallons of water. This yielded a slurry weighing approximately 14 pounds per gallon which was considered adequate to seal off the 3-foot gas zone penetrated by the well. The well head was carefully removed and the slurry poured down the casing. Since all water-bearing sands were cased off there was no water in the well. A bailer was run down on top of the slurry to "feel" if it was in place. The well head wa- reinstalled in the casing and the valve closed. After 8 hours the globe valve on the well head was opened to see if the cement plug had sealed off the gas zone. It hadn't; the well head was again removed and two more sacks of 14pound cement slurry were poured into the well. The well head was again replaced and the valve shut off.

The next morning, 16 hours later, the valve was again opened and only a slight blow of gas issued from the flow line. Confident that the problem was nearly solved the well head was removed so that more slurry



could be added but before the cement could be mixed the plug which had been run the previous day failed and the well was blowing wide open once more. It was determined that the cement slurry had had enough time to set but that because of the pressuring effect of gas bubbles constantly moving upward through the slurry had probably given it a sponge-like texture.

As a last resort before calling on professional assistance, it was decided to run another plug and to fill the casing with water to supply enough hydrostatic pressure on the gas zone to prevent bubble formation and migration while the slurry was setting. This was done, and after about 30 minutes the water column in the well ceased to "bubble", indicating that we had succeeded in applying enough slurry in the well to cement the 45/8" casing into the hole and make its recovery almost impossible without blasting which was considered very dangerous under the circumstances. It was therefore decided to pull back the 45/8" casing before the slurry hardened to a point above the top of the plug. This created another potential problem in that pulling back the 45/8" casing might break the seal between the casing shoe and the drill hole wall and allow gas to blow up between the casing strings. It was decided that if we pulled back the casing and the fluid level remained stationary, then the slurry was being placed in the open hole and the danger of gas being emitted from between the casing strings would be very slight.

This technique proved successful and the gas flow was controlled. The 45/8" and 65/8" casing were subsequently removed and a pump run in the well to test the water sands penetrated at 268 to 314 feet and 460 to 548 feet (Fig.1). Results of the aquifer test indicated and estimated safe yield of 250 imperial gallons per minute.

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