

MEMORANDUM

*Bill Carr  
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TO: Donald L. Garey

DATE: November 16, 1979

RE: Engineering Evaluation and Update of  
Minerals, Inc.'s Llano 34 State Com. No. 1

This memorandum is an engineering summary of the probable and actual producing pays encountered during the drilling of the subject well. Also included is an update of the completion work performed thus far and estimates of possible future courses of actions to re-establish acceptable production rates.

Evaluation of Productive Zones

Strawn: The Strawn Lime Reef was encountered in the interval 11,700' to 11,800'. A drillstem test over this interval indicated small amounts of gas flow plus oil recovery in the drillpipe. The initial completion attempt of this well was made in this interval. The reef was perforated and acidized twice, resulting in a potential after the second acid job of swabbing 11 barrels of oil and 203 MCF gas per day. This indicated a very marginal oil zone and these perforations were squeezed with cement. Prior to abandonment of the well, this particular zone should be re-perforated and treated as necessary to pump an estimated 15 to 20 barrels of oil per day and flow an estimated 250 to 350 MCF of gas per day.

Atoka: Two zones of interest were encountered in the Atoka Formation. The first zone at 12,200', a limey dolomite, with marginal porosity, is considered a salvage zone. This zone produced minor amounts of gas on drillstem test; and it is estimated that after perforating and treating, it may be capable of producing 250 to 300 MCF of gas per day.

The second Atoka Zone covers the interval 12,400' to 12,475', consisting of 15 feet of net pay of five to six percent porosity. Schlumberger considers this zone to be a very good prospect for producing gas in commercial quantities. On drillstem test this interval flowed 60 MCF per day at a back pressure of 29 psi. Being a limey dolomite, Schlumberger is of the opinion that this zone after treatment may be capable of producing 1,500 to 2,000 MCF per day. Following the depletion of the known productive Morrow gas intervals, this appears to be the next producing interval in which a recompletion attempt should be made.

Morrow: Detailed mechanical pressure measurements downhole, log analysis and actual flow tests upon completion indicate the Morrow to be productive in the following zones:

Upper Morrow (Morrow "A"): The Upper Morrow has 14 feet of net sand pay with a porosity range of 14 to 18 percent at a depth of 12,824'. A bottomhole pressure obtained exclusively in this interval indicated 6,044 psig. Since virgin Morrow pressures in this area are higher and log analysis indicates the two east offset wells (Getty 35 State No. 1 and Getty 36 State No. 1) are producing from a correlative interval, it is concluded that the Getty wells are in communication with the subject

well and are able to drain this Upper Morrow interval. Following the completion attempt in the Strawn Reef, the Upper Morrow was perforated and dual tubing strings were run into the well. After the well had been flanged up, the Upper Morrow was swabbed in and within a few hours flowed at the rate of 3,600 MCFPD with a flowing tubing pressure of 1350 psi. The Upper Morrow remained at this sustained rate for a period of four hours and indications were that the zone had cleaned up; and, therefore, the well was shut in. Two days later a four-point back pressure test, as required by the New Mexico Oil Conservation Division, was run and the Upper Morrow at the highest selected flow rate during this test flowed 2,346 MCF per day with a flowing tubing pressure of 1453 psi. This zone was then shut in to await pipeline connection.

Morrow "B": The Morrow "B" Zone was developed in this well across the interval 12,895' to 12,902'. An independent pressure measurement on this interval showed that the bottomhole pressure of the Morrow "B" is 3597 psi. This indicates that at the subject well's location the Morrow "B" Zone is in direct communication with the Llano-operated Grama Ridge Morrow Underground Gas Storage System; and therefore, as stipulated in the farmout agreement, the Morrow "B" will not be produced from the subject wellbore.

Lower Morrow (Morrow "D", "E" and "F"): The Lower Morrow Zone in the Llano "34" consists of the Morrow "D" and "E" and a producing sand newly-identified as the Morrow "F" Zone. The Lower Morrow interval may have approximately 25 feet of net sand pay over a gross interval of 12,986' to 13,170' with porosity ranging from 7 to 13 percent. Each of the three zones making up the Lower Morrow indicated individual virgin bottomhole pressure; for example, the "D" recorded 7286 psi, the "E" 7536 psi and the "F" 8139 psi. After the Upper Morrow had been flowed at sustained rates and shut in, the Lower Morrow was perforated across the three Morrow Zones and shortly afterwards was flowing 1,600 MCFPD at a flowing tubing pressure of 750 psi. The well also indicated the capability of flowing five barrels of oil per hour. Two days later on a four-point back pressure test the well flowed 1,594 MCF per day at a flowing tubing pressure of 1595 psi with 3½ to 5 barrels of oil per hour.

#### Update of Well Completion

Analysis of the Upper Morrow indicates direct communication with the east offset wells and the reservoir pressures encountered in the Lower Morrow are substantially higher than the Upper Morrow; therefore, dual completion equipment consisting of a permanent packer between the two zones and two strings of tubing with related tools were installed in the well. The well was successfully completed and tested in the Upper Morrow and Lower Morrow as noted above and then shut in while waiting for approximately two weeks for a pipeline connection. This shut-in period apparently has resulted in blocking off the Upper Morrow with fine sands to the point where this zone is incapable of producing at the present time. The Lower Morrow was put on line to the purchaser and flowed at an initial rate of 800 MCFPD but declined to a rate of 350 MCF per day within a few days. During the past week an acid treatment was performed on the Lower Morrow.

The Lower Morrow is now flowing into the pipeline 430 MCFPD along with 8 barrels of distillate and 12 barrels of water to the tanks. Present plans call for continuing to flow the Lower Morrow for some time to allow it to clean up further. This occurrence of Morrow flowing at good sustained rates and being unable to re-establish original flow after a shut-in is not totally uncommon in southeast New Mexico. The Upper Morrow is thought to be blocked with fine sand in the annulus between the Lower Morrow tubing string and the 4½" liner. Evaluation of the most economical way to return the Upper Morrow to its full producing potential is in progress.

#### Possible Future Course of Action

The possible future actions to be taken on the Lower Morrow are the following:

Reperforate the Lower Morrow producing interval and/or, consider an alcohol-acid treatment of the Lower Morrow depending on the final outcome of the last acid job performed on this interval.

Re-establishment of production from the Upper Morrow may be accomplished through a sliding sleeve on the Lower Morrow tubing string which is situated in close proximity to the Upper Morrow perforations. It is conceivably possible to open the sliding sleeve on the Lower Morrow tubing string and produce the Upper Morrow through this Lower Morrow string. Another alternative available and under consideration is to perforate the Lower Morrow tubing string immediately opposite the Upper Morrow perforations and in that way produce the Upper Morrow through the Lower Morrow string.

If none of these remedial efforts result in the desired production from the Morrow interval, the one remaining course of action is to pull the dual tubing strings and recomplate the well jointly in the Upper and Lower Morrow as a single completion. Recompletion cost of the well as a single Morrow well after pulling both tubing strings is estimated to cost in the range of \$150,000. It is anticipated that an improved rate from the Morrow may be achieved through the other above enumerated alternatives at an estimated cost of less than \$50,000.

You will be timely advised as remedial efforts proceed.



Al Klaar

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