PRRC 02-11

QUARTERLY TECHNICAL PROGRESS REPORT
(26th Quarter)

ADVANCED OIL RECOVERY TECHNOLOGIES FOR IMPROVED RECOVERY FROM SLOPE BASIN CLASTIC RESERVOIRS, NASH DRAW BRUSHY CANYON POOL, EDDY COUNTY, NM

DOE Cooperative Agreement No. DE-FC-95BC14941

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Date of Report:	April 30, 2002
Award Date:	September 25, 1995
Anticipated Completion Date:	September 24, 1998 - Budget Period I
	December 31, 2003 - Budget Period II
Award Amount for Current Fiscal Year:	$2,017,435
Award Amount for Budget Period II:	$5,013,760
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Reporting Period:	January 1, 2002-March 31, 2002

US/DOE Patent Clearance is not required prior to the publication of this document.

OBJECTIVE

The overall objective of this project is to demonstrate that a development program based on advanced reservoir management methods can significantly improve oil recovery at the Nash Draw Pool (NDP). The plan includes developing a control area using standard reservoir management techniques and comparing its performance to an area developed using advanced reservoir management methods. Specific goals are (1) to demonstrate that an advanced development drilling and pressure maintenance program can significantly improve oil recovery compared to existing technology applications and (2) to transfer these advanced methodologies to oil and gas producers in the Permian Basin and elsewhere throughout the U.S. oil and gas industry.

SUMMARY OF TECHNICAL PROGRESS

This is the twenty-sixth quarterly progress report on the project. Results obtained to date are summarized.

Geology and Engineering

The production database was updated through February 2002. These data were added to the history of each well to update the decline curves and to project ultimate recoveries as well as to assess the effects of interference and production strategies.

Nash Draw #36 Completion

Evaluation of the completion, stimulation, and production testing and analysis of the Nash Draw #36 horizontal well is continuing. Three intervals at the toe of the well were initially completed. The intervals are 9786–9805 ft, 9464–9470 ft, and 9123–9129 ft.

The instant shut-in pressures (ISIP) observed after the frac treatments were similar to vertical well shut-ins, but treating pressures were 2000 psi above normal vertical well treating pressures. With the ISIP of 900 psi, the frac gradient is estimated to be 0.57 psi/ft. with the resulting closure pressure of 3860 psi (Figure 1). This correlates closely to frac gradients and closure pressures observed in vertical wells in the field. The additional treating pressure is attributed to: high friction pressure because of a tortuous path of the induced fracture from a horizontal point to large vertical fracture, multiple narrow induced fractures, and near wellbore fracture geometry and stresses that are different from a vertical wellbore. The same mechanism (or combination of mechanisms) that contributes to the higher treating pressures also causes narrow fracture widths, as evidenced by the pressure increases when sand concentrations were stepped up. Maximum sand concentrations were only 3 to 4 PPG for this well, with indications that higher concentrations would not be tolerated. For vertical wells in the field, maximum sand concentrations are routinely run at 6 PPG.

After the wellbore pressure was drawn down, the crushed frac sand that was recovered indicates high closure pressures near the wellbore. Crushing of the proppant may have been aided by cyclical loading due to high flow rates and pressure drawdowns coupled with shut-in periods and wellbore pressure buildup.

A bottomhole pressure buildup test (Figure 2) was performed and analyzed. The test indicated a low permeability zone with little or no stimulation.

After analyzing the rapid decline in production, recovery of crushed proppant, and the BHP test, the conclusion is that the sand proppant was crushed in the near wellbore region and that the zone is not effectively stimulated.

A restimulation treatment was designed to clear the damaged proppant in the near wellbore region, create additional frac height, and place a high strength proppant to reestablish communication with the existing treatments. The treatment design consisted of 59,000 gallons of 35 lbs./1000 gallons crosslinked fluid carrying 150,000 pounds of C-Lite ceramic proppant at 70 to 75 BPM.

The treatment was successfully performed on April 11, 2002. Initial pressures built up to 4284 psi before the crushed proppant was displaced, and the treatment was pumped at 2650 psi (Figure 3). There was still 700 psi of excess pressure attributable to torturosity/closure pressure. The lower treating pressures indicate that the refrac entered the existing induced fracture and the effects of the near-wellbore tortuosity/closure pressure have been reduced on the order of 1300 psi by the erosion effects of pumping large quantities of proppant.

The results of the restimulation will be reported in the next quarterly report.

A study was undertaken to evaluate the design and economics of processing the gas at Nash Draw to recover liquids and reinject lean gas for pressure maintenance. The study indicates that stable gas volumes of 3 MMCFGD or larger would be economical to process. Recovery of liquids from a -10^{o} F plant would be 4.08 gal/MCFG of the 6.13 gal/MCFG that is available.

Two (2) more workovers, to add additional pay zones, are planned for the Nash Draw #1 and #20 wells. The results of this work will be reported in the next Quarterly Report.

3-D Seismic

The design of the 3-D seismic survey for the north end of the Nash Draw Unit is awaiting evaluation of a new design that will incorporate receivers located in the playa lakes. Dawson Geophysical and the Bureau of Land Management representatives met in the field during the later part of March to identify areas where receiver lines could be laid into the playa lakes. This will increase the number of receivers and sources by 50%. This design should yield adequate resolution to provide useful data for targeting the next series of wells. Final designs will be reported in the next quarterly report.

Technology Transfer

Disseminating technical information generated during the course of this project is a prime objective of the project. A summary of technology transfer activities during this quarter is outlined below.

Internet Homepage: The address of the Website for the Nash Draw project is http://baervan.nmt.edu/REACT/Links/nash/strata.html. This site includes the annual reports and the final Phase I report, including graphics.

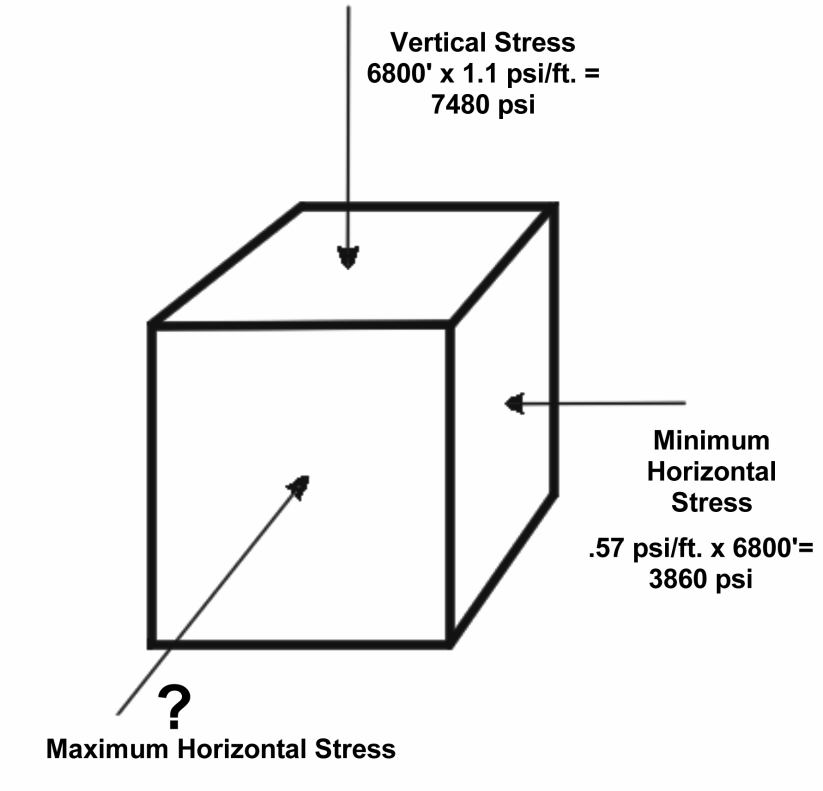

Fig. 1. Rock stresses.

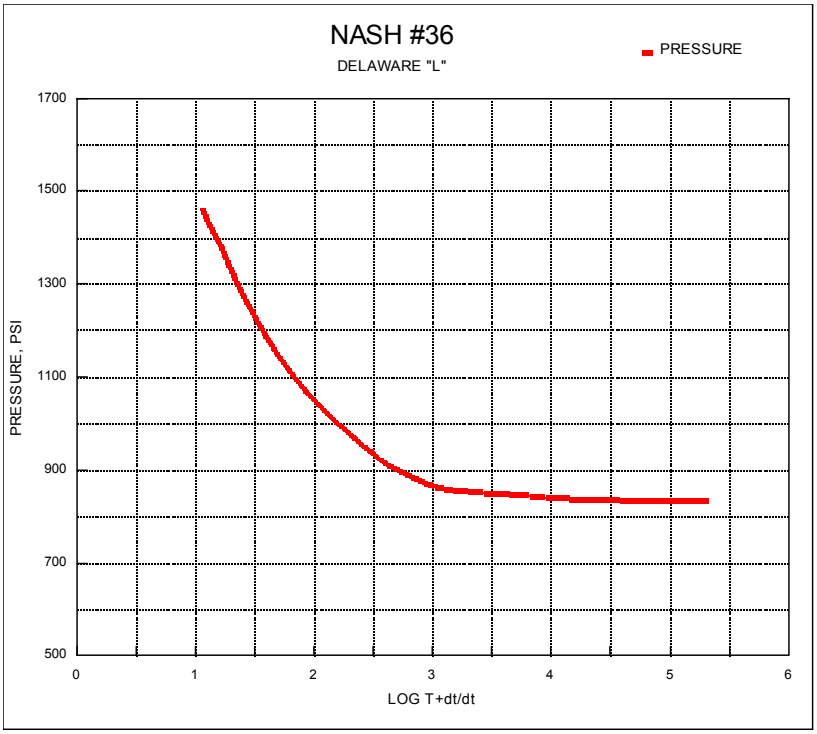

Fig. 2. BHP build-up test.

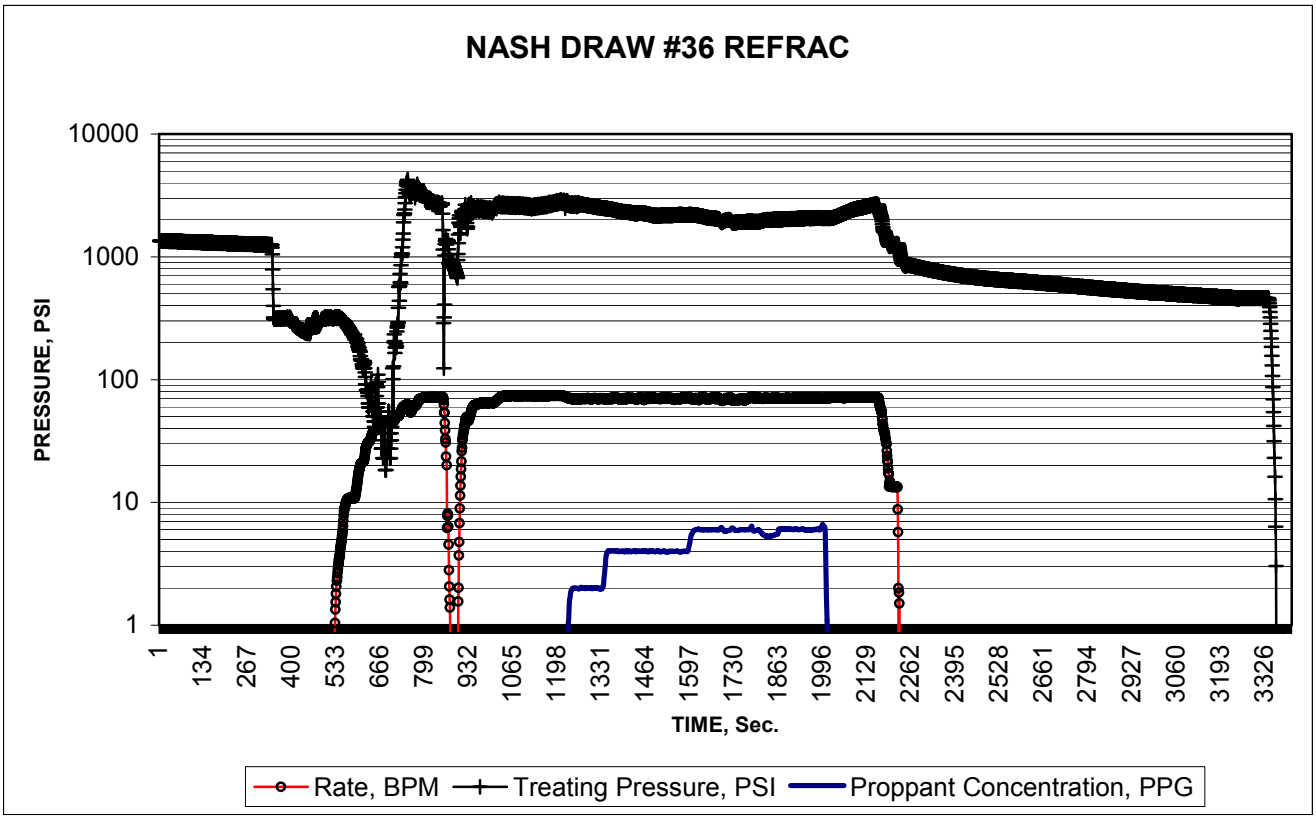

Fig. 3. Refrac treatment.