

# Technology Development and Demonstration of Microhole Oil Production/Microholes for Designer Seismic in Support of CO<sub>2</sub> EOR

**FEW03FE06-04/  
FEW03FE06-06**

## Goal

The primary goal of the first project is to show that microholes provide downhole access at significantly lower cost than conventional wells and provide superior acoustic performance when compared with the use of temporarily converted production or injection wells. The second—and related—project’s goal is to adapt microhole systems for deploying microseismic arrays in CO<sub>2</sub> enhanced oil recovery operations.

## Performers

*Los Alamos National Laboratory (LANL)  
Los Alamos, NM*

*Lawrence Berkeley National Laboratory (LBNL)  
Berkeley, CA*

*Dennis Tool Company  
Houston, TX*

*Quality Tubing  
Houston, TX*

*Rocky Mountain Oilfield Testing Center (RMOTC), Casper, WY*

## Results

Researchers have demonstrated the technical feasibility of microdrilling 1¼-2½-inch holes to depths of as much as 1,310 feet using coiled tubing-deployed drilling assemblies consisting of PDC (polycrystalline diamond compact) bits and PDM (positive displacement) motors.

Field demonstrations have been conducted at RMOTC’s Teapot Dome oilfield at the Naval Petroleum Reserve No. 3 in Central Wyoming using a prototype coiled tubing unit, an off-the-shelf drilling-mud cleaning unit, and a surplus shallow-well cementing unit to simulate a highly mobile, self-contained, microhole drilling system.

## Benefits

Micro-instrumentation holes potentially could cost as little as a quarter to a tenth that of conventional boreholes. Successful demonstration of a nonmetallic casing such as PVC line pipe may reduce acoustic



LANL microdrilling at the RMOTC-operated Teapot Dome Field at NPR No. 3. The microdrilling rig includes the coiled tubing drilling unit on the right, mud cleaning system on the left, and the RMOTC drilling-water truck in the center.

noise and improve the performance of micro-instrumentation holes dedicated to reservoir-monitoring service.

## Background

LANL’s experience with seismic data acquisition in oilfields indicates that low-cost, dedicated microholes for deployment of seismic sensors are needed to enhance acoustic data monitoring of the subsurface. Dedicated data acquisition holes provide reduced natural surface and cultural noise, reduced or eliminated seismic-signal travel paths through highly attenuating surface layers, and a greatly improved signal-to-noise ratio.

Accordingly, microholes promise a low-cost alternative to conventional wells; they can be placed in the desired location and designed for optimal acquisition of seismic data.

## Summary

Project researchers are demonstrating the technical and economic feasibility of developing a highly mobile, self-contained, microhole drilling system for seismic data acquisition and other applications. Using prototype systems to simulate the concept microhole drilling system, LANL has

drilled and completed six microwells at the RMOTC Teapot Dome field.

LANL is evaluating commercial equipment with the potential to enhance the performance of microdrilling. Two demonstrations are ongoing with good early results:

- Quality Tubing Inc.’s QT16Cr80 stainless steel coiled tubing as a drill stem for microdrilling.
- Dennis Tool Company’s low-torque, low weight-on-bit drilling assembly.

## Current Status (August 2005)

The LANL drilling team has completed drilling a four-microinstrumentation-hole pattern to field LBNL microseismic arrays at Teapot Dome field. Researchers presently are preparing to deploy to—as yet undetermined—CO<sub>2</sub> EOR sites that very likely will require more adaptations of the microdrilling systems to operated in new drilling conditions and possibly different regulatory requirements.

The project has completed early-stage demonstrations. The research effort to demonstrate the applications will begin in the new project FEW03FE06-06.

**Project Start / End:** 3-15-03 / 3-14-06      2-15-06 / 2-14-07  
**DOE / Performer Cost:** \$1,300,000 / \$0      \$550,000 / \$0

### Contact Information:

NETL – Daniel Ferguson (daniel.ferguson@netl.doe.gov or 918-699-2047)  
LANL – Donald Dreesen (dreesen@lanl.gov or 505-667-1913)