

PROJECT FACT SHEET

CONTRACT TITLE: Enhanced Oil Recovery with Downhole Vibration Stimulation in Osage County, OK

ID NUMBER: DE-FG26-00BC15191 **CONTRACTOR:** Oil & Gas Consultants Int'l, Inc.

B&R CODE: AC1005000

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PROJECT SITE

CITY: Tulsa **STATE:** OK
CITY: Pawhuska **STATE:** OK
CITY: **STATE:**

CONTRACT PERFORMANCE PERIOD:

7/13/2000 to 5/12/2002
PROGRAM: Exploration & Production
RESEARCH AREA:
PRODUCT LINE: DCS

CO-PARTICIPANTS:

PERFORMER:	CITY:	STATE:	CD:
PERFORMER:	CITY:	STATE:	CD:
PERFORMER:	CITY:	STATE:	CD:
PERFORMER:	CITY:	STATE:	CD:

FUNDING (1000'S)	DOE	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	676	345	1021
FY 2002 CURRENT OBLIGATIONS	0	0	0
FUTURE FUNDS	0	0	0
TOTAL EST'D FUNDS	676	345	1021

OBJECTIVE: The project will field test the impact of downhole vibration stimulation on oil production rates in the North Burbank Unit Field, a mature, waterflood on the Mineral Estate of the Osage Nation, in Osage County, Oklahoma. A new well will be drilled and cored and will then serve as the vibration stimulation well. The core will be supplied to Phillips Petroleum, who will conduct proprietary sonic core tests on the fresh core. During the lab tests the core will be subjected to various low frequencies stimulation (between 50 to 500 Hz) in a "sonic" core test cell to determine the dominant excitation frequencies. The downhole vibration tool, a patented, orbital vibrator, will be operated to sweep through those frequencies, generating both shear and compression waves. The injection and production wells in the pilot test area will be closely monitored for any changes in injectivity/productivity and water cut.

On September 18, 2001, the project budget and delivery were extended by amendment to the grant contract to include laboratory core work by Las Alamos National Laboratory and field work by Lawrence Berkeley National Laboratory.

PROJECT DESCRIPTION:

Background: It is a well established fact that the majority of the U.S. oil will remains underground because of inadequate, economically viable recovery techniques.

"One hundred forty years after the discovery of oil and the birth of the U.S. oil and gas industry, petroleum resources remaining in the ground are still double the amount producers have extracted. Recovering these remaining oil and gas resources poses formidable technical and financial challenges.

Many oil field are in danger of being abandoned, even though they retain one-half to two-thirds of their original oil. The high capital cost of drilling well and then difficulty of restoring production leases makes it unlikely that abandoned fields will ever be reopened, even if future oil prices increase significantly. Premature abandonment of wells, in effect, permanently cuts off access to valuable oil assets"

U.S. Department of Energy February 1999

"Oil and Gas RD&D Programs"

Billions of barrels of oil remain trapped in thousands of well-known producing formations. This oil has not yet been recovered because it has been by passed by channeling water in mature waterfloods or is immobile-still held in small pore spaces by capillary pressure.

The Osage Tribal Council (Pawhuska, OK), Oil and Gas Consultants International (OGCI), Calumet Oil Company (both of Tulsa, OK) and Phillips Petroleum Company (Bartlesville, OK) have joined together to propose field testing of a downhole vibration stimulation enhanced oil recovery tool and technique.

In 1906, the Osage Tribe negotiated tribal ownership of minerals on their reservation when they agreed to accept division of their reservation land into individual allotments. This established tribal mineral ownership for what was to become one of the largest oil reserves in Oklahoma.

Beginning in 1935 with one of the first field pressure maintenance programs in the industry, many Osage fields have been the sites for testing improved oil recovery techniques. Waterflooding and hydraulic fracturing were introduced during the 1950's. These methods helped to increase production, but more importantly, they added reserves by tapping into oil that would have otherwise been left in the producing formation when the wells reached their economic limits. In the 1970s, experiments with polymer floods were conducted.

This project proposes to test the impact of downhole vibration stimulation on production rates in a mature, producing Osage Nation waterflood field. The potential economic impact of a successful trial is truly staggering, both for the Osage and for all similar US fields. This project will both test the technical concept and build a working downhole vibration tool.

OGCI will manage the project, supply a downhole vibration tool and provide technology transfer of the project results. OGCI will also provide their patented downhole vibration tool to be installed in a new well drilled for the purpose of vibrating the producing formation during the test. Conducted in close cooperation with the Tribe, the tests will be conducted in the North Burbank Unit Filed, the largest filed in Osage County. This field, at one time was operated by Phillips Petroleum Company, but it is now operated by Calumet Oil Company. Phillips will contribute their proprietary sonic core analysis to help determine the optimum vibration frequency with which to stimulate the reservoir.

Work to be Performed: Install monitoring systems, including geophones in selected wells and a production monitoring system to measure the effects on individual offset wells in the pilot area. This work will be conducted in conjunction with Lawrence Berkeley National Laboratory providing the surface and downhole geophones to record the signal generated by the DHVT.

Install the vibrating tool using a conventional well service rig.

Run the vibrating tool continuously to stimulate the pilot area wells. Calumet Oil Co. field personnel will monitor the surrounding wells for changes in oil and water production and injection characteristics.

Perform an assessment of the vibration stimulation impact on the oil production.

Present technical articles and conduct workshops in the area to inform other oil operators of this novel oil recovery technique.

PROJECT STATUS:

Current Work: We have been conducting shallow DHVT operational tests in a well near Wynona, in Osage County, OK. The field test in the North Burbank Unit, pilot test area are scheduled to start in January 2002.

Scheduled Milestones:

Pilot test area and vibration stimulation well location determined	05/01
Vibration well is drilled and cored	08/01
"Sonic" core tests determine the dominant frequencies for stimulation	01/02
Vibration toll is built to produce desired frequencies and intensities determined from "sonic" core tests	07/01
Downhole and surface monitoring equipment installed	01/02
Downhole vibration tool is installed and operated for three-month field test	01/02
Vibration effects on oil production in the mature waterflood are assessed	03/02
Technology transfer activities are delivered	04/02

Accomplishments: The lab results of the sonic core tests indicated that the field test should have better results by moving the test to the North Burbank Unit Field, in Osage County, OK. The operator of that field , Calumet Oil Company, has agreed to

participate in the project and has agreed to contribute the additional funds required to drill the deeper well in the North Burbank Unit. A pilot test area has been selected in the NBU field.
The vibration test well location has been drilled, cored, logged, cased and cemented.
The 7" Downhole Vibration Tool has ben built and is now undergoing reliability testing , prior to being installed in the test well.

TECHNOLOGY TRANSFER:

Technology/Information Transfer: Presented SPE Paper 67303 at the Oklahoma City Production Operations Symposium Meeting March 25-27, 2001. Presented the project status to the NGOTP Seismic Stimulation Meeting April 25, 2001, Berkeley, CA.

The SPE/DOE Thirteenth Symposium on Improved Oil Recovery will have a one day Short Course on Seismic Stimulation April 13-17, 2002, Tulsa OK.

Public Relations:

Updated By: Ginny Weyland

Date: 1/18/2002