

PROJECT FACT SHEET

CONTRACT TITLE: Enhanced Oil Recovery Front Tracking Using Electromagnetic Induction

DATE REVIEWED: 06/13/91

DATE REVISED: 02/01/91

OBJECTIVE: To develop field techniques to monitor in-situ changes in electrical conductivity in oil bearing strata occurring during Enhanced Oil Recovery (EOR). Using cross-borehole electromagnetic induction, an image of an injected steam, chemical, or salt water front can be mapped as it propagates from the injection well toward the producers.

<p>CONTRACT NO: FEW 6038 B & R CODE: AC1505100</p> <hr/> <p>CONTRACT PERFORMANCE PERIOD: 10/01/84 to 09/30/91 PROGRAM:Hvy Oil RESEARCH AREA: Thermal Recovery</p> <hr/> <p>DOE PROGRAM MANAGER: NAME: Ralph Avellant FTS PHONE NO: 233-2737 COMMERCIAL NO: (301) 353-2737</p> <hr/> <p>DOE PROJECT MANAGER NAME: Reid, Thomas B. LOCATION: BPO FTS PHONE NO: 745-4233 COMMERCIAL NO: (918) 337-4233</p>	<p>CONTRACTOR: Lawrence Livermore</p> <p>ADDR: P.O. Box 808 Livermore CA 94550</p> <p>CONTRACT PROJECT MANAGER:</p> <p>NAME: Mike Wilt ADDR: P.O. Box 808 L-228 Lawrence Livermore Laboratory Livermore CA 94550 PHONE: (415) 422-3152</p> <hr/> <p>PROJECT SITE Livermore, CA 94550</p>
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SCHEDULE MILESTONES:

Conduct EM field test at Mobil's Lost hill Steamflood	12/90
Continue development of numerical modeling codes.	12/90
Develop software for improved interpretation of cross-bore hole EM data collected through steel casing.	02/91
Design and construct receiver to collect cross-borehole data in high temperature environments.	03/91
Design and construct transmitter for applications to high temperature conditions.	03/91

FUNDING (1000'S)	DOE	OTHER	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	1,844.	391.0	0.0	2,235.
FISCAL YR 1991	350.0	0.0	0.0	350.0
FUTURE FUNDS	0.0	0.0	0.0	0.0
TOTAL EST'D FUNDS	2,194.	391.0	0.0	2,585.0

PROJECT DESCRIPTION: The purpose of this experiment was to determine if high sensitivity seismic arrays coupled with active noise cancellation and state-of-the-art array processing algorithms can be used to effectively cancel the large amplitude background seismic noise field, typical of an oil production environment, to detect and locate the small seismic signal expected from the in-situ movement of an EOR process such as steamfront or waterflood front.

PRESENT STATUS: The project is completed. The experiment was designed for a site on a Mobil Oil Company lease in the Lost Hill Field, California. Unfortunately Mobil delayed the test until the Spring of 1991. Unocal Research was contacted and a new site was selected in Unocal's Geyser Steam Field, California, where water is being injected into the reservoir. The test was run in August 1990.

ACCOMPLISHMENTS: The equipment was set-up on August 20 around a water injection well and measurements from the seismic arrays began on August 24. Data was taken for three-weeks and then taken to LLNL for interpretation where it was analyzed and the Final Report was written.

BACKGROUND: The Lawrence Livermore National Laboratories (LLNL) Treat Verification Program has been conducting research on seismic arrays and array processing techniques to monitor low-yield nuclear testing treaties for a number of years. As a result, LLNL has developed extensive seismic array processing software, seismometer and data acquisition hardware, and expertise in seismic array design and deployment. In looking for new application for their seismic array technology, LLNL has considered the possibility of using seismic arrays to passively monitor the in-situ movement of a steamfront or a waterflood. LLNL feels the successful application of seismic arrays to monitor a steamflood or a waterflood depends on being able to sufficiently cancel the expected large amplitude background seismic noise field typical of the production environment so that the small amplitude from a steamflood or a waterflood can be detected. The cancellation of background noise can be accomplished using three independent techniques: adaptive noise cancellation, array processing techniques, and analog summing of clustered seismometers.