DISCLAIMER

DOE/NV/10425--T2

QUARTERLY STATUS REPORT

July, August, September, 1990

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FUNDING AGENCY: US Department of Energy

COOPERATIVE AGREEMENT NO.: DE-FC07-85NV10425

RECIPIENT: Louisiana Geological Survey, School of Geoscience
Louisiana State University

PROJECT TITLE: Environmental Monitoring at Designed Geopressured-Geothermal Well Sites, Louisiana and Texas

BUDGET PERIOD: 01 January, 1990 - 31 December, 1990

Research Objectives

Implement and maintain the ongoing environmental monitoring program around DOE geopressured - geothermal test wells in Louisiana and Texas. Analyze and interpret collected data for evidence of subsidence and induced microearthquakes which may be brought about by geopressured - geothermal well testing and development. Continue geological - geophysical studies of the Hulin and Gladys McCall sites incorporating new siesmic data. Continue review of previously identified and tested geopressured - geothermal prospects in Louisiana to determine if any link exists between such reservoirs and the existence of free gas in commercial or subcommercial quantities. Initiate review of geology, co-location and properties of geopressured brines with medium and heavy oil reservoirs in Louisiana utilizing existing maps, databases, reports, and journal articles.

Contract Tasks:

Microearthquake and Subsidence Monitoring

Background

Subsidence and induced faulting are key environmental issues associated with the withdrawal of large volumes of geopressured - geothermal fluids in the Gulf Coast Region. It is of particular concern in coastal Louisiana

and Texas, where a combination of man's activities and natural processes has accelerated rates of marshland deterioration and estuary enlargement. Land-surface subsidence causes damage and value losses to coastal property, as inundation by tidal waters is increased and the potential for flooding is intensified. Also, growth faults may be activated as a result of massive fluid withdrawal and injection. Accelerated movement along fault planes can damage pipelines, roads, levees, and buildings.

Direct field measurements have been used to determine baseline rates of subsidence at each prospect before well testing and to monitor changes during and after testing. Networks of first-order elevation benchmarks and microearthquake monitoring stations have been installed in the immediate vicinity of each test well.

Microearthquake Arrays: Each continuous recording network consists of four to six short-period vertical motion seismometers installed in boreholes up to 30 m deep. The seismic signals detected at each site are amplified and transmitted via phone lines to the Louisiana Geological Survey seismological laboratory in Baton Rouge. Records are scanned daily to detect possible microearthquake activity.

Benchmarks: Networks around each well consist of closely spaced benchmarks installed to intersect the projected surface positions of major faults. These benchmarks are surveyed and tied to the regional National Geodetic Survey (NGS) vertical control network every other year.

Current Reporting Period

Microearthquake monitoring is continuing at the Gladys McCall, Hulin, and Pleasant Bayou test wells. All field sites have been up and running without incident throughout the third quarter. We received the new PDAS event detectors in early September. We are currently planning the fabrication of an integrated instrument package incorporating the new PDAS. This package will be installed at Pleasant Bayou in an effort to save on phone line charges for data transmission..
All subsidence monitoring work is continuing on schedule. The next round of leveling for the Gladys McCall benchmark network was completed in late July. The report from the subcontractor was received in early September. and the new data is currently being incorporated into the existing data base for interpretation and analysis. The levelling subcontract for levelling at Pleasant Bayou was awarded in mid August. The relevelling at Pleasant Bayou is currently scheduled to be completed during the month of October.

Geological Investigations

Background

The Louisiana Geological Survey has been involved with geological

investigations of the geopressured-geothermal resource in Louisiana since the beginning of the DOE geopressured-geothermal research program. These studies have provided documentation on the regional geology of sites selected and listed as being suitable for geopressured-geothermal well drilling, testing, and development. Currently, LGS/LSU investigations are continuing and are centered around the DOE/Superior Hulin #1 well and the Gladys McCall #1 well. Co-location of geopressured reservoirs with medium to heavy oil in the state of Louisiana has been added and included as a new task for this year's contract.

Current Reporting Period

The areal extent of the Hulin prospect continues to be studied. A preliminary revised structure map made at the top of the geopressured sandstone using deep reflection siemic data around the Hulin prospect has been completed. This latest structural interpretation shows a reasonable estimate of the Hulin prospect's areal extent to be approximately 2.6 mi^2. Assuming a volumetric reservoir of 2.6 mi^2 by 470 feet thick (from well log analysis)and and a porosity of 20% a total volume of approximately 1 billion barrels was obtained.
This figure was obtained using a standard calculation for recoverable fluids:

A= 7,758 barrels in an acre-foot
B= 0.20 ; assumed porosity
C= 0.80 : assumed recovery factor

A x B x C = 1,241 barrels/acre

T= 470 ; assumed thickness in feet (from log)
F= 1,665 : areal extent from structure map (acres)
X= 1,241 barrels/acre

T x F x X = 971,114,000 barrels of brine

Rounding off of the above gives an approximate value of **1 billion barrels of brine** reserves in the Hulin geopressured-geothermal target reservoir. As experience has shown, applying a general recoverable fluid calculation to brine is not very reliable. The Hulin prospect sits on a closed high conture bounded to the north, south, and east by faults. However the western

boundary is not presently defined. Upon production testing unlimited recharge may come from the west across bounding faults or from interconnected reservoirs. How far the sand continues areally from the well remains unknown. No other well in the area has been drilled deep enough to encounter the Hulin target sand.

Information and data related to the colocation of geopressured brines with medium and heavy oil reservoirs in south Louisiana continues to be gathered. Work on collecting the relevant data from published summaries of field statistics and drilling operations from the Department of Natural Resources, State of Louisiana has been completed. The published summaries only include data through 1978. Field information data after 1978 is available in the computerized PARS data base at the State Department of Conservation. A new computer program is currently being written to extract pertinant information from this data base regarding medium to heavy oil reservoirs. Preliminary work indicates a large number of sites having heavy (8° to 25° API) and medium (20° to 25° API) oil especially in the southwest part of Louisiana. In the next quarter we will complete data collection and maked up-to-date general trend maps showing areas of co-location of geopressured brines with medium and heavy oils in Louisiana.I

ADDITIONAL PROJECT RELATED ACTIVITIES:

A poster paper entitled 'A Review of Current well testing and environmental monitoring at geopressured-geothermal prospect sites in South Louisiana' (by C.J. John, D.A. Stevenson, C.G. Groat, and G.F. Hart) was presented at the Fifth Circum Pacific Conference for Energy and Mineral Resources held at Honolulu, Hawaii (July 29-August 3,1990).

Industrial Consortium Meeting

LSU researchers attended the 'Second Industrial Consortium meeting for the Utilization of the Geopressured-Geothermal Resource' held in Austin, Texas (September 11, 1990). At this meeting Damson Oil Co. (Mr. Merlin Verret/Mr. Paul Dore) made a presentation describing the general geology of the Hulin prospect area. During conversations with them, they revealed that there were plans to drill a 21,000' deep well to the north-northeast of Hulin. According to their geologic interpretation, the Hulin geopressured-geothermal sandstone was structurally higher in that direction. Our interpretation of the Hulin area seismic lines shows that this is not the case and that the Hulin well was drilled at an optimum structural location. However, we would like to state that we feel Damson is more concerned or interested in DOE testing plans for Hulin and how those plans may effect their proposed well, than any interest in the geopressured - geothermal resource. During testing, a large volume of brine will be pumped

from the Hulin geopressured-geothermal sandstone reservoir, thereby reducing reservoir pressure. If free gas is present, it will migrate back into the reservoir and **gas would be produced from the Hulin well.** This possibility will greatly diminish Damson's chances of making a successful gas well north-north east of the DOE Hulin well. We would like DOE to take this **very** important factor into consideration when thinking of the Hulin testing schedule. We would suggest that testing should commence as early as possible in view of Damson's plan to drill their well next year.

The next Industrial Consortium Meeting, originally proposed for January 8, 1991 at Louisiana State University, Baton Rouge, has been postponed. Currently, the general consensus appears to favor annual rather than biannual meetings. Therefore, LSU is planning to host the next industrial consortium meeting sometime late September-early October 1991.

Don Stevenson

Charles Groat or Don Stevenson
Co-Principal Investigators