DOE/NV/10425--T4

QUARTERLY STATUS REPORT

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January, February, March, 1991

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, 1991 - 31 December, 1991

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

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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 first quarter.

All subsidence monitoring work has continued on schedule. The levelling data and report for Pleasant Bayou was received from our subcontractor at the end of March. This work was completed in November, 1990.

Currently, we have four levelling surveys from the Pleasant Bayou area (1984, 1985, 1988, and 1990). An interesting trend seems to be emerging with the addition of 1990 data. There is a suggestion of **uplift** in the area of the well rather than subsidence. When we look at data from the 1984 survey and the subsequent changes in elevation for the two longest time periods 1988 and 1990 (four and five years respectively) it seems as though the benchmarks located in close proximity to the geopressured– geothermal well are rising in relation to the benchmarks off–site. Figure 1 shows a graph of the change in elevation of the various benchmarks from 1984 to 1988 and 1984 to 1990 (the Liverpool benchmark C–1209, Figure 2, is held constant). The positive area of the graph indicates uplift compared to the

other off-site stations of the benchmark network. The magnitude of change within this area remains a somewhat uniform 5.7 mm over the five years of data collection. It should be noted that general area-wide subsidence has been reported throughout the Houston-Galveston region and the apparent small uplifting trend observed in our most recent data is compared only to the benchmarks within our network. It is probable that when compared regionally the small area around the well may be subsiding at a slower rate rather than actually uplifting. Reasons for this apparent uplifting are not currently known. One possible cause could be related to injection disposal of brine from the Geopressured-Geothermal well.

A preliminary conclusion offered by the newest data suggests that brine production from great depths, coupled with disposal at shallower depths may not contribute to subsidence as much as was originally thought, at least for the area around the Pleasant Bayou well. More time and additional levelling data should substantiate or disprove this. However, one complicating aspect of data interpretation around the Pleasant Bayou well is the fact that disposal by injection has been taking place at the chemical plant, just southeast of the prospect (refer to map Fig.2), for many years, even before the operation of Pleasant Bayou commenced. Details regarding the depth of disposal, length of time, quantities, and nature of the the waste chemicals injected into the subsurface by the chemical plant are unknown. Furthermore, we do not know if the area south, near the chemical plant, is showing the same trend of uplift. There are no benchmarks covering that area. We suspect, however, that the trend may continue to the south east.

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.

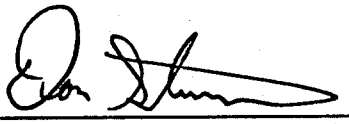
Current Reporting Period

Information and data related to the collocation of geopressured brines with medium and heavy oil reservoirs in south Louisiana has been assembled from the state's computer data base. Using this information general trend

maps showing areas producing medium and heavy oils in Louisiana have been completed.These maps also incorporate the prelimenary information that was presented at the DOE program review meeting held in Washington DC December 1990.

ADDITIONAL PROJECT RELATED ACTIVITIES:

Preparations for the upcoming Geopressure – Geothermal Industrial Consortium Conference at LSU on May 16, 1991 are progressing. The brochure containing the meeting agenda and other details has been prepared and mailed by EG&G, ID to consortium members and all others who may be interested in the conference. We feel that there is a high level of interest in the activities of this industrial consortium and expect the meeting to be very well attended.



Charles Groat or Don Stevenson
Co–Principal Investigators

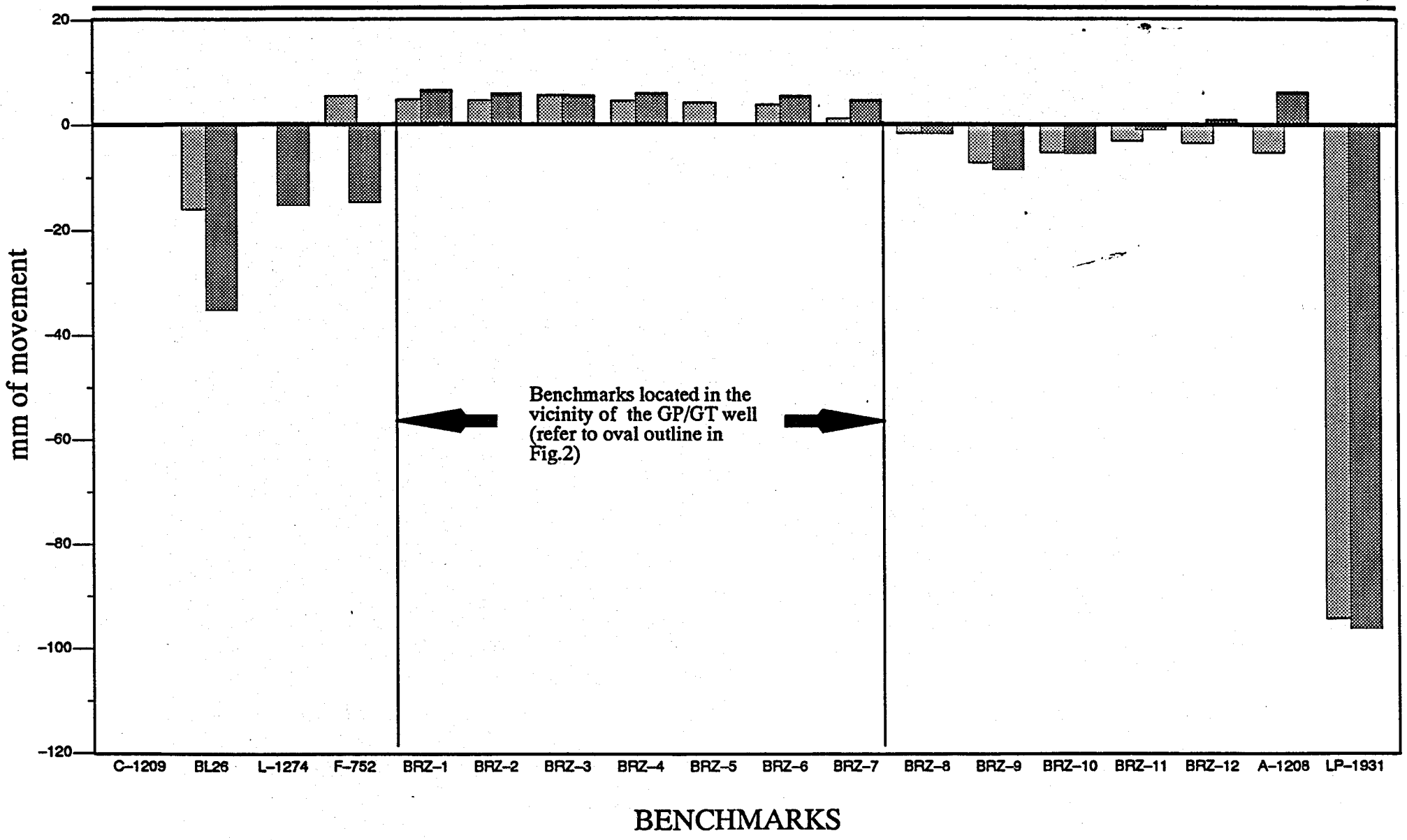


Fig. 1. Elevation changes of benchmarks in the Pleasant Bayou area relative to C-1209 (held constant).

1984 – 1988

1984 – 1990

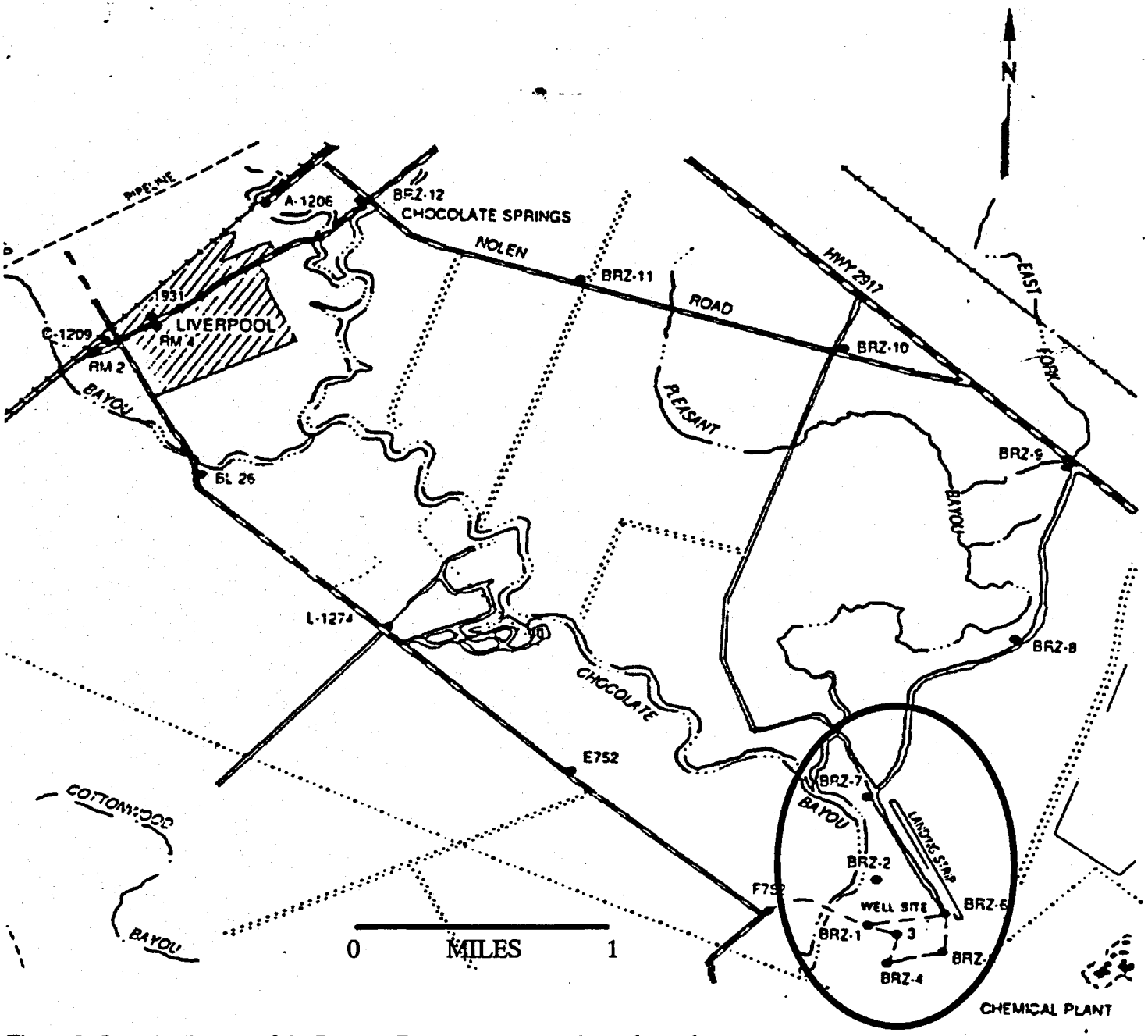


Figure 2. Locatin diagram of the Pleasant Bayou geopressured–geothermal well benchmark locations. Benchmarks located within the oval shaped outline are showing relative uplift compared to others within the network.