



# GEOENERGY CORPORATION

GEOLOGY • HYDROLOGY • PETROLEUM ENGINEERING • ENVIRONMENTAL & RESOURCE EVALUATION

DOE/INDUSTRY GEOPRESSURED GEOTHERMAL  
ENERGY FORUM

QUARTERLY NEWSLETTER

JUNE 1982

## GENERAL COMMENT

Newsletters have been reduced to one every three months. We will attempt to present important events that occur throughout the three month intervals but concentrate on the present status of the DOE Resource Development Program.

The next DOE/Industry Forum will be scheduled for September 1982 in Houston. We will send out notices of time and place and include an outline of the program.

Other geothermal meetings scheduled this year are 1) Fractures in Geothermal Reservoirs - Workshop, Honolulu. Geothermal Resources Council, Box 98, Davis, Ca. 95617. August 27-28, 1982. Phone 916/758-2360, and 2) Geothermal Energy - Annual Meeting, San Diego, Ca. Geothermal Resources Council, Box 98, Davis, Ca. 95617. October 11-14, 1982. Phone 916/758-2360.

Dr. Fred Goldsberry, Director of the Geopressure Projects Office in Houston was invited to make a technical presentation to the European Economic Community on the geopressure geothermal research program in the U. S. by Mr. C. J. Audland, Director General for Energy, Commission of the European Communities. The presentation and discussions were held in Brussels on June 16. The EC is considering a similar research management approach for the evaluation of deep European Gas Resources.

## WELLS OF OPPORTUNITY - Eaton Operating Co.

The eighth well for the DOE program was cancelled due to budget restrictions. This DOE contract is being closed out and the final report is in preparation. Eaton is presently cleaning up the last of their test locations returning them to the original owners.

For GRI, Eaton Engineering is preparing a prospectus for a gas water co-production test well. They are reviewing their data banks looking at possible test sites in Texas where gas fields have watered out prematurely.

## DESIGN WELL PROGRAM

- Dow Chemical - L. R. Sweezey (Parcperdue) Well

Short term flow tests at 10,000 BWPD are continuing. Flowing surface pressure is 5000# with a temperature of 200°F. Gas content remains constant at approximately 20 cu. ft./bbl of water.

Some trouble was experienced with their injection well when a slug of grease clogged the sand face. A small acid job solved the problem. They have installed a sand filter downstream of the separator to eliminate fine material.

Otis Engineering is running pressure buildup analysis to determine the boundaries of the reservoir.

Dow plans to continue flowing at a low rate since if the rate is increased sand problems develop.

- Magma Gulf/Technadril Amoco Fee #1 (Sweet Lake) Well

Phase I, the initial flow test, has been completed from the interval 15,387 feet to 15,414 feet. A flow rate of 5,000 BWPD was sustained for several months.

In the six months flowing period from the one sand the well produced more than 1 million barrels of water. Gas recovery was approximately 20 SCF per barrel of water. Limited high rate tests were carried out with rates as high as 38,000 BWPD obtained.

They were preparing to perforate a second sand zone when the discovered a leak in their 5½" tubing around 5,900 feet. They have set a bridge plug above the producing formation and are preparing to repair the tubing.

- Technadril/Fenix & Scisson - Gladys McCall Well

The production well has been perforated. They opened only 30 feet of the planned 60 feet. Pressure began to build up on casing due to a tubing leak at 9,992 feet.

After pulling the 5" tubing they plan to replace any bad joints and resume the testing. Bottom hole temperature is 315°F and there is 5300 psi on surface tubing and casing.

It looks like it will be a good test well with high temperature and high flow rates.

- Gruy Federal/Fenix & Scisson - Pleasant Bayou Well

The production well is still down for repairs. The tubing

## GAS RESEARCH INSTITUTE

GRI has enlarged its research program in geopressured geothermal resource development. They are concentrating primarily on the concept of gas-water coproduction from watered out gas fields or fields that may achieve enhanced ultimate gas production by increasing water production and inhibiting water encroachment until low reservoir pressures are obtained.

GRI is currently using the expertise of DOE contractors to carry out their studies and find possible sites in the field of experimentation.

Eaton Engineering is scanning their computer data banks for possible coproduction fields and preparing a prospectus for field operations. The Bureau of Economic Geology is looking for potential prospects from Texas. Dr. Bebout at LSU is looking for prospects in Louisiana. IGT is completing a survey of watered out gas fields to determine those which are best suited for field testing.

The screening program involves looking for watered out gas fields that went to water while reservoir pressures were high leaving behind large volumes of trapped free gas. The field project would involve drilling new wells to produce water and gas simultaneously and try to develop a new gas bubble and thus resume production of free gas from the reservoir.

## UNIVERSITY OF SOUTHWEST LOUISIANA

The planned preproduction seismic surveys have been run at the Parcperdue Well area. Second computer output map of surveyed positions of points and phone locations was inspected and returned to processing facility in Pasadena for correction and processing of the preproduction data. A processing backlog at the company has prevented processing up to the present. The post production surveys will be run concurrently with and after production testing. The preproduction seismic surveys will serve as a baseline for the study that correlates microseismicity and production activities.

## UNIVERSITY OF TEXAS

- Coordination

The monthly report has been delayed due to the press of final activities in the school year. In addition, all design wells have been plagued with budgetary restrictions or small mechanical difficulties and have not been on test during the last month. They anticipate that these delays will shortly be

string slipped out of its hanger. A rig is being brought to make needed repairs, then production testing can continue.

### INTERCOMP

A petrophysical Analysis and Log Data Test Program for the MGT-DOE Amoco Fee No. 1 (Sweet Lake) design well was completed. Pressure history matches were completed for both the Amoco Fee No. 1 Design Well and the Lear-Koelemay well of opportunity. A sensitivity analysis was performed for perforating the lower sand at the Amoco Fee No. 1 well. A petrophysical analysis was performed for the Gladys McCall No. 1 Design Well and the results were provided to Magma Gulf. Data from two drawdown tests and one buildup test at the Girouard well of opportunity has been analyzed. The results of a petrophysical analysis for the Gladys McCall No. 1 design well have been provided to Magma Gulf. A 60-day simulated drawdown test was completed for McCall No. 1.

### SYSTEMS, SCIENCE, AND SOFTWARE

A topical report, "Analysis of Flow Data from the MGT/DOE Amoco Fee No. 1 Well," has been finalized and submitted to DOE for distribution. A review of the preliminary geological report on the Gladys McCall No. 1 well is being reviewed for Technadril/Fenix & Scisson. Shale property data and information on energy conversion schemes are being collected and reviewed to support Task 7, "Development of Energy Recoverability Factors for Geopressured Systems."

### INSTITUTE OF GAS TECHNOLOGY

IGT has completed testing of their core flow test apparatus and are beginning flow tests using field cores. At first they calibrated the apparatus using porcelain discs for their flow measurements. When they substituted Berea sandstone cores for the porcelain discs, they found that fines from the cores migrated to different positions. The movement of fines in the cores had changed the flow measurements. They are now beginning a series of tests using lower Morrow sandstone cores. With the apparatus they can control the flow of free gas and gas saturated brines to measure changes of viscosity as the concentration of free gas in the flowing fluids is varied.

IGT has completed development of an equilibrium thermodynamic computer code in cooperation with a subcontractor JACOR which provides upstream and downstream calculations from a sample taken at any point in the system.

For GRI, IGT is continuing their survey of watered out gas fields that might have potential for gas and water coproduction.

overcome and the newly drilled design wells in Louisiana as well as the Pleasant Bayou well will be returned to testing shortly.

- Geological Studies

The annual report has been prepared by the Bureau of Economic Geology on "Salinity Variations and Chemical Compositions of Waters of the Frio Formation, Texas Gulf Coast," and this report has been submitted to the Department of Energy. In addition, a quarterly report entitled "Exploration and Production Program for Locating and Producing Prospective Aquifers Containing Solution Gas and Free Gas, Texas Gulf Coast," has been submitted to the Gas Research Institute by the Bureau of Economic Geology.

- Continuity of Geopressured Sandstone Reservoirs

Plots of porosity and permeability measurements were plotted on electric logs of wells with whole-core analyses and core descriptions. The Vicksburg Formation in the McAllen Ranch field was selected for comparison with the Corpus Christi area because data are abundant, permeabilities are markedly different, and previous work on sandstone consolidation has been completed for the producing geopressured reservoirs. A letter requesting data are abundant, permeabilities are markedly different, and previous work on sandstone consolidation has been completed for the producing geopressured reservoirs. A letter requesting additional porosity and permeability data in the Chocolate Bayou field (Brazoria County) was sent to Phillips Petroleum Company.

- Environmental Monitoring

Environmental monitoring at the Brazoria test-well site, Pleasant Bayou No. 2, continued through April. Air quality and surface/ground-water quality monitoring terminated at the end of February 1981. Monitoring of microseismic events continued.

- Study of Log Derived Water Resistivity Data in Geopressured Formations

Summary: Lab work has been continued and activities for reconstituted waters and mud filtrates have been obtained. Five sets of data are presented with comparisons between SSP's calculated from log measurements and SSP's calculated by the millivolt difference between the mud filtrate and reconstituted water samples.

Problems continue with the double junction ion selective electrode. They are awaiting delivery of single junction electrodes that they have reason to believe will be more reliable.

A statistical evaluation of the data recently supplied by Chevron has been compared to a similar set of statistics for the Grims County well described in Progress Report #18, August 1981.

The Grims well data first called attention to the marked short term mud and mud filtrate variations.

## LOUISIANA STATE UNIVERSITY

### Resource Assessment

- Rockefeller Refuge: Correlations of logs on the dip and strike cross sections chosen for the detailed study of the Rockefeller Refuge project are in progress.

- Detailed Studies: A program has been written for the Hewlett-Packard HP-41C-41CV desk calculator for calculating the salinity from electrical logs using the Silva-Bassiouni method. This program considerably reduces the time necessary to make this calculation. Salinities are presently being calculating for many sandstones on all wells on the regional cross sections in order to identify regional trends.

### Site-Specific Studies

- Micropaleontology: Lower, middle, and upper Miocene samples from five wells in southern Louisiana demonstrate conspicuous variations in the abundance of dominant species; some of these variations have apparent paleoecological significance. The wells, drilled by various oil companies, were located in St. Mary, Assumption, Terrebone, and Lafourche Parishes; the samples span the stratigraphic range between the Planulina palmerana and Bigenerina floridana marker horizons.

Overall, the bulk of the stratigraphic section represents environments ranging from the middle shelf to the upper slope. However, evidence of an inner shelf environment, including the dominance of Ammonia beccarii, is present in upper Miocene samples. Their preliminary data does not indicate any drastic faunal change at the boundary between the hydro pressured and the geopressed strata, which occurs in these wells at depth between 11,710 and 17,620 feet, (3570 and 5370 meters).

### Rock Mechanics and Subsidence Modeling

Dr. Dale Carver and Jim Janssen have developed a model in which subsidence due to pressure depletion in a subsurface reservoir may be predicted. The model is constructed in such a way that it numerically describes the actual processes involved in the pressure depletion/subsidence problem and uses this information with a computer to model various production situations. In the original model, the change in pressure was held constant throughout the entire reservoir. A new model was developed which more nearly describes the initial stages of the pressure depletion process.

In this new model, pressure drawdown is greatest at the bore hole and falls off to zero at the most distant edge of the

reservoir. To express this in terms which can be incorporated into the computer program, a pressure draw-down curve equation,  $P + C \times (1 - 2R/L + R^2/L^2)$  is used. In this equation, R is the distance from a given point to the bore hole, and L is the distance from the bore hole to the point of greatest distance in the reservoir. The constant C is dependent on the amount of pressure which is to be depleted from the reservoir.

To test this model, a reservoir 4 miles square, 50 feet thick, and at a constant depth of 7000 feet was numerically described. A well was placed at the center of this block and the pressure was depleted a maximum of 3000 psi. This resulted in a maximum subsidence of about 5 inches at the well head location at the surface. This subsidence fell off to zero approximately four miles away from this central location.

Note that this model applies to the initial stages of pressure depletion in a reservoir. That is, it represents a point in the process where the effects of the drawdown first appear at the outer-most limit of the sandstone body. It is not known when subsidence will first appear over a depleted reservoir. If it occurs after the drawdown has been completed and the pressure has equalized throughout the reservoir, then perhaps the first model in which pressure is held constant is the most valid. However, if subsidence occurs soon after the initial depletion process is started, then this second model would most nearly describe the pressure depletion/subsidence relationship.

### Environmental Monitoring

Work continued on the computerized data base for water-quality and subsidence monitoring of the three geopressured-geothermal design wells. A visit was made to the Parcperdue site on April 28, 1982, for observation of the initial flow test and for arranging the acquisition of flow data for incorporation into the water-quality monitoring data base.

The National Geodetic Survey (NGS) completed its vertical control surveys in the vicinity of Rockefeller Refuge and Sweet Lake and tied into the project's subsidence monitoring networks there.

Contract modifications for water-quality monitoring at Sweet Lake and Parcperdue were affirmed and finalized with representatives from IHI Kemron and Petroleum Laboratories.

### ANNOUNCEMENT

A limited number of copies of the final report on the Wells of Opportunity contract recently completed by Eaton Industries are available on request through NTIS, Oak Ridge, Tennessee. Microfiche copies will also be available from NTIS on a continuing basis.