GEOPRESSURE INDUSTRIAL FORUMS,
NEWSLETTER AND LEASE SUPPORT

FINAL REPORT

For Period

April 7, 1981 - December 31, 1983

December 1983

Dr. Carroll F. Knutson

Work Performed Under Contract
DE-AC08-81nV10194

C. K. GeoEnergy Corporation
3376 S. Eastern Avenue, Suite 145
Las Vegas, Nevada 89109

MASTER

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Prepared for the

U. S. Department of Energy
Division of Geothermal/Hydropwer

UNDER CONTRACT #DE-AC08-81NV10194

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ABSTRACT

C. K. GeoEnergy has completed the work scheduled under DOE Contract #DE-AC08-81NV10194. The primary objective of this effort was to keep industry informed on the progress of DOE's Geopressure Geothermal Resource Development Program and to provide an interchange of technical data and ideas among DOE management personnel, DOE contractors and the industrial firms which will be the ultimate developers of the geopressured geothermal energy resource.

In the course of this contract C. K. GeoEnergy with DOE assistance: (1) planned, organized, conducted, and reported on six DOE/Industry Forum meetings where the progress of DOE's resource development program was outlined and discussed (these six forum meetings included three meetings of the Drilling and Testing Subgroup and three meetings of the Overview Group), (2) prepared and distributed 15 newsletters, and (3) prepared three reports for DOE lease support.

This final report includes summaries of each of the forum meetings as well as the three lease support meetings and the newsletter program.

The attendees at forums and newsletter recipients represent a broad cross section of industry, state and federal agencies and interested research organizations.

The DOE geopressure geothermal program continues to generate valuable data and, along with the information exchange, should be continued.

EXECUTIVE SUMMARY

INTRODUCTION

C. K. GeoEnergy Corporation (CKG) has completed Department of Energy (DOE) contract DE-AC08-81NV10194. This contract had three principle tasks: (1) prepare, conduct, and provide minutes for six DOE/Industry Forum meetings, (2) develop and distribute 15 technical progress newsletters, and (3) develop three lease support reports.

FORUM MEETINGS

CKG with DOE assistance has been responsible for setting up, conducting, and reporting on these six forum meetings with verbatim minutes provided to participants as soon as possible after the meetings.

The purpose of these DOE/Industry Forums has been to keep industry advised of the progress of the DOE Geopressured Geothermal Program and to provide an interchange through which industry will contribute its experience and expertise in drilling, reservoir evaluation and testing to help speed up and maximize the results obtained from the DOE program. The forums have been successful in establishing a close working relationship between DOE and industry and in incorporating industry experience into the DOE evaluation program. The six DOE/Industry Forums included three of the Drilling and Testing Group, and three of the Overview Group.

Drilling and Testing

The June 16, 1981 Drilling and Testing Meeting consisted of three major elements: (1) a summary of the current status of the Wells of Opportunity (WOO) Program, (2) a summary of the status of the Design Well (DW) Program and (3) an overall review of the Drilling and Testing Program.

Eaton Industry and IGT personnel reported that the test on the four current WOO wells, Crown Zellerbach, Saldana, Prairie Canal and Pauline Kraft, have provided additional data on brine characteristics, gas content in the brine and reservoir performance of geopressure geothermal aquifers. DOE is prepared to do long term testing on any WOO wells that warrant this additional expense. To date, none of these tests have been made. The program has tested aquifers that have been undersaturated, saturated and supersaturated with respect to natural gas (methane).

Three DW wells the Sweezy, Sweet Lake, and Gladys McCall are being drilled and the Pleasant Bayou No. 1 has completed Phase I testing. This test averaged 13,500 B/D of brine for a 45 day period. The gas/brine ratio averaged 22 scf/B and more than 36,000 acres of aquifer was detected.

The three major information elements presented at the December 2, 1982 Drilling and Testing Meeting were a "to date" review of the Drilling and

Testing Program, a review of the entire WOO program which has been terminated, and a "to date" review of the four DW projects.

About half of the DW testing has been performed and areas of high temperatures and pressures have been defined. The WOO program has tested aquifers with gas water ratios as high as 33 to 55 scf/B. Bottom hole temperatures were generally 7 to 16% higher than log estimates and brine salinities varied widely from log calculated values.

The Louisiana DW wells have experienced rate and leak problems. Reservoir testing is developing interesting information on aquifer sizes and producing characteristics. The production of heavy hydrocarbon in the gas and brine poses an interesting problem as does the anomalous reservoir drive behavior at the Parcperdue Project site.

The June 9, 1983 Drilling and Testing meeting contained two major themes, a Drilling and Testing Program review and a "to date" summary of the DW testing.

The Drilling and Testing Program has encountered some unanticipated problems and results. The problems are associated with the DW packer and tubing leaks and the results are the ubiquitous production of heavy hydrocarbons in the DW wells and the complex reservoir behavior encountered in the Parcperdue Project.

The DW Program is now down to three active projects after the Parcperdue wells sanded up and the project was terminated. Some of the "interesting" phenomena reported from this project were voluminous sand production, changing productivity index, a leaking brine pit and heavy hydrocarbon production.

The other three DW wells are all currently shut in with tubing leaks. Testing prior to the failures has provided significant information. The closing boundaries for the Brazoria reservoir has not been detected even after significant cumulative brine production. Reservoir properties have been pretty well defined by the tests and analyses, and scale inhibition parameters have been ascertained.

The Gladys McCall No. 9 reservoir seems to be rather small, apparently due to a pinchout and not faulting. The general reservoir volume in the Gladys McCall area will have to be evaluated by testing additional zones. The Sweet Lake well has limited production rates apparently because of a small flow angle, 25°, or a permeability change.

The three DW wells will be placed back in the testing mode as soon as the remedial programs are approved and funds are made available.

Overview Meetings

The June 16, 1981 Overview Meeting reviewed the geopressure geothermal program and the related research.

The DOE is currently being restructured by the new administration and the budget for FY 1982 has not been defined. GRI has been funding geopressure geothermal research with a program that compliments DOE's. GRI will continue their research in a cooperative manner with DOE and at a level that will be determined by their FY 1982 budget.

The WOO program is preparing to test wells number 6 and 7, and the DW program of four wells has been awarded to Technadril/Fenix and Scisson.

A number of additional potential sites have been identified in both Texas and Louisiana and detailed evaluations are being carried out at Blessing and Point Comfort in Texas and Bayou Hebert and LaFourche Crossing in Louisiana.

The environmental monitoring program is continuing at the Louisiana and Texas DW sites and the university and IGT research is continuing on reservoir fluid and rock characterization.

The December 2, 1982 Overview meeting concentrated on an overall "to date" review of the geopressure geothermal program since an appreciable time had passed between meetings. The program emphasis had shifted from an emphasis on gas production to an evaluation of total energy utilization. The three priority areas for FY 1983 are continuation of (1) DW testing, (2) environmental monitoring and (3) program support type research.

Site selection activities in Texas are aimed at evaluating Frio and Wilcox trend reservoir size and producing characteristics, while the Louisiana program has been terminated and funds transfer to environmental monitoring.

Rock mechanics work on shale characteristics and reservoir creep behavior is continuing in an effort to explain the complex behavior observed in the Parcedue reservoir.

The associated GRI research is principally concerned with scale and corrosion inhibition and a new coproduction project at Port Arthur, Texas.

The final Overview Meeting was held on June 9, 1983. Some of the points made in the review of the geopressure geothermal program were, (1) a number of sizeable reservoirs have been identified that are approximately saturated with high methane content gas, (2) brine salinities can now be approximated from logs, (3) high volume brine production rates can be sustained, (4) significant volumes of gas can be recovered from brine streams, (5) large volumes of spent brine can be injected and (6) large volumes of technical data have been electronically archived. Some continuing points of concern and evaluation are, (1) subsidence, (2) tubing and packer leaks and similar mechanical problems (3) system corrosion and scale control and (4) efficient total energy utilization.

The Electric Power Research Institute (EPRI) is interested in a joint wellhead conversion project to more efficiently utilize the energy from the geopressure geothermal stream. The concept involves utilizing part of the

gas stream to generate electricity and high level exhaust heat which would be used to raise the temperature of a geothermal fluid cycle. A hydraulic turbine would act in a pressure reduction mode. An example 20,000 B/D brine stream would produce 230 Mcf/D of gas, 600 kW from the combustion cycle, 400 kW from the geothermal bottoming cycle and 200-300 kW from the turbine.

The current creep modeling and log interpretation research holds promise for better reservoir evaluation and simulation results, while the scale inhibition research has lead to a better understanding of some of the factors necessary in long term production.

The studies of the heavy liquid hydrocarbons and their partition in the brine and exsolved gas streams were of particular interest to some of the industry observers, who felt that this bit of serendipitous research had greatly increased their understanding of petroleum migration and trapment.

NEWSLETTERS

The newsletters which provide a summary of DOE geopressure geothermal activities and related research were distributed on a monthly basis during the first nine months of the contract and on a quarterly basis for the final six quarters. The news releases were distributed to an average of about 300 individuals that constituted a good cross section of industry, state and federal agencies, DOE contractors and interested organizations and technical news media.

LEASE SUPPORT REPORTS

Three general support tasks were performed as part of this contract. The three resulting reports were: (1) "Evaluation of Land Ownership, Lease Status and Surface Features in Five Geopressure Geothermal Prospects" by William N. Hackenbracht, May 1981, (2) "Analysis of Three Geopressure Geothermal Aquifer-Natural Gas Fields: Duson, Hollywood and Church Point, Louisiana", by Leo A. Rogers and Charles R. Boardman, May 1981 and (3) "Screening of Three Geopressure Geothermal Aquifer-Natural Gas Project Areas for Potential Conflicting Commercial Production: Freshwater Bayou, Lake Theriot and Kaplan, Louisiana" by C. F. Knutson and L. A. Rogers, February 1982.

CONCLUSIONS

This DOE contract has been concluded successfully with excellent relationships between DOE and Industry. Effectiveness of the DOE/Industry interchange can be judged by the participation in the forums and the large roster who have asked for and receive the newsletters. From Appendix II and III it is apparent that almost all the major oil companies are represented on the Forum or Newsletter lists. Thus, the information about the program is reaching the appropriate audience, since the potential users and their support organization have been so intimately involved.

RECOMMENDATIONS

The program should be continued with special emphasis on optimum utilization of all the energy components carried in the geopressure geothermal producing streams. Development design and economic parameters should be ascertained that will allow a more precise evaluation of commercial development prospects.

DISCUSSION

I. INTRODUCTION

This report covers the work done by C. K. GeoEnergy Corporation (CKG) under DOE contract DE-AC08-81NV10194 during the period April 7, 1981 through December 31, 1983. The primary objective of this effort was to provide an interchange of technical data and concepts among DOE management personnel, DOE contractors, service companies, and potential geopressured geothermal energy developers.

In pursuit of this objective, C. K. GeoEnergy Corporation's work effort was concentrated on the following tasks:

- DOE/INDUSTRY FORUM MEETINGS
- TECHNICAL PROGRESS NEWSLETTERS
- LEASE/LAND OWNERSHIP EVALUATION
- ANALYSIS/SCREENING OF PROPOSED GEOPRESSURE GEOTHERMAL AREAS FOR POTENTIALLY CONFLICTING COMMERCIAL PRODUCTION
- PROJECT PROGRESS REPORTS TO DOE

The results of work on these tasks is reported and analyzed in this final report; and recommendations are presented for optimizing the benefits from continued interaction between DOE and industry.

II. FORUM MEETINGS

Three Overview Working Group and three Drilling and Testing Subgroup meetings were held during the contract period. Meeting dates, locations, and number of attendees were as follows:

<u>GROUP</u>	<u>DATE</u>	<u>LOCATION</u>	<u>ATTENDEES</u>
Drilling & Testing	6/16/81	New Orleans, LA	66
Overview Group	6/16/81	New Orleans, LA	64
Drilling & Testing	12/02/82	Houston, TX	38
Overview Group	12/02/82	Houston, TX	48
Drilling & Testing	6/09/83	Houston, TX	58
Overview Group	6/09/83	Houston, TX	61

In carrying out this task, CKG developed the agendas in concert with Mr. Keith Westhusing or Dr. Fred Goldsberry. CKG personnel arranged for meeting accommodations and solicited speakers for presentations from DOE, industry and DOE contractors and on a number of occasions, presented technical data as well. Meetings were chaired by a CKG coordinator. Minutes were taken, edited, published and distributed. A tour of the Crown Zellerbach Well was conducted on Wednesday, June 17, 1981, and a tour of the Pleasant Bayou Site was conducted on Friday December 3, 1982.

Complete sets of the minutes along with the attendee lists were distributed to all of the forum attendees.

Summaries of the proceedings from these forum meetings are presented in the following section of this report.

- Drilling and Testing Working Subgroup Meetings -
June 16, 1981

The agenda for the June 16, 1981 Drilling and Testing meeting is included in Appendix I. The meeting consisted of three principle information elements: Wells of Opportunity (WOO) Program Summary, Design Well (DW) Program Summary and a Drilling and Testing Program Review.

Dan Langford, Kim Peterson and Dick Klauzinski of Eaton Industries and Phil Randolph of IGT reported on the completion and testing of the four currently active wells in the WOO Program: the Crown Zellerbach, Saldana, Prairie Canal and Pauline Kraft.

These most recent four well tests have provided additional data on the brine, gas content and reservoir performance of geopressured aquifers. The DOE has been prepared to do long term tests on these wells but so far none of them have had sufficient production to warrant testing beyond the scheduled two week flow test.

The WOO Program has now tested wells that are undersaturated, exactly saturated and supersaturated with natural gas. Besides providing statistical data on the different types of reservoirs, the tests are providing data for interpretation and possible revision of the geological theories about the origin of the gas and how it migrates and becomes trapped.

The DW program is comprised of wells that are drilled specifically for production from geopressure geothermal aquifers. There are two broad aspects to this program. The first is to locate and acquire suitable test sites and the second is to drill the wells and perform the flow tests. At this forum meeting the current status of the four active projects was summarized, along with a brief review of the current efforts to locate new project sites.

Keith Westhusing reviewed the Phase I testing effort and discussed the upcoming Phase II tests for the Pleasant Bayou Number 2 well (Brazoria

County, Texas). The Phase I test produced for 45 days at a rate of about 13,500 B/D. The gas content of the brine averaged about 22 scf/B and the areal extent of the reservoir was calculated to be greater than 36,000 acres. Dave Riney with S-Cubed and Ken Ancell with Intercomp summarized their interpretation of the Phase I test results.

The Phase II test is designed to produce for 15 weeks at flow rates up to 30,000 B/D. Reservoir performance, corrosion and scaling inhibitor requirements, and separator performance will be evaluated during this test.

The gas produced during Phase II testing will be dehydrated and sold to Houston Pipeline Company for \$2.87/Mcf.

Jack Wilson with Dow reported on the drilling of the Parcperdue Project DOE/Sweezy well. This project, to be completed in a small closed aquifer, is expected to provide reservoir depletion behavior in a relatively short period of time. The project is currently behind schedule and over budget because of a number of drilling problems.

Clay Durham and Karen Hoffman with Magma Gulf reported on the Sweet Lake Well. The recently completed well has been perforated and final preparation is being made for the first phase testing. This test will start the evaluation of a commercial size reservoir.

Keith Westhusing with DOE reported that the Gladys McCall design well was drilling at 6,700 ft and anticipates five producing formations between depths of 14,500 and 17,000 feet. This is also a test of a commercial site reservoir.

Keith Westhusing with DOE also briefly reviewed the DOE drilling and testing program beginning with the DelCambre Well. He noted that when the Design Well Program is compared to the Wells of Opportunity Program it is seen that the design wells have been more expensive and more risky than the wells of opportunity tests. He also noted the program emphasis is on the testing of low salinity wells which should contain more dissolved gas than the high salinity reservoirs generally encountered by the WOO wells. Design wells are costing in the range of \$12-\$15 million each and the wells of opportunity are costing about \$2.5 million each. While the flow test periods for the wells of opportunity have all been short (only a few weeks) Keith noted that the DOE was prepared to extend the test periods should they be judged worthy of longer testing. So far, however, none of the wells of opportunity tests have been judged worthy of extended testing. If the Godchaux well proves to be as good as the current pre-test information indicates then it will be considered for longer term testing.

- Overview Group Meeting - June 16, 1981

The agenda for this meeting is included in Appendix I. Bob Holiday with DOE started the discussion by stating that DOE was being restructured by the new administration. The Geopressure Program is still under the Division of Geothermal Energy and Small Scale Hydropower, both of which are under the Office of the Assistant Secretary for Conservation and Renewable

Energy. He stated that the Reagan DOE 1982 budget has been recommended by the Senate Authorization Committee but the House Authorization Committee has indicated possible modifications. The final word on the 1982 fiscal budget will probably be received during the summer.

John Sharer with GRI reviewed their geopressure geothermal related program. That program is divided into four areas of endeavor: western tight sands, Devonian shale, coalbed degasification and what GRI calls geopressure aquifers rather than geopressure geothermal because GRI's primary emphasis is on gas. Of GRI's total 1981 budget of \$10 million, \$3 million is allocated for its geopressure geothermal program which supports the DOE research and in some instances expands on DOE investigations. Sharer stated that if GRI expands its budget as anticipated their work will continue to compliment DOE efforts in a cooperative manner.

Dan Langford with Eaton Operating Company (EOC) reviewed the Wells of Opportunity (WOO) Program. They are currently developing WOO Numbers 6 and 7. WOO Number 7 is the Number 1 Frank Godchaux III well located 11.5 miles south of Abbeville, LA. They hope to soon procure the rig for reentry, and to test the well in August or September. Final reports on all the WOO projects through the Godchaux well will be submitted by the end of 1981. EOC will continue to monitor industry drilling activity to obtain a candidate for WOO project Number 8.

Frank O'Brien of Technadril stated that Technadril/Fenix & Scisson (T/F&S) was awarded a contract to drill and test four geopressured wells in four years. At the same time the first two sites (Gladys McCall and LaFourche Crossing) were released to T-F&S. The DOE has placed the LaFourche Crossing site on hold, pending completion of a seismic survey to better define subsurface structure. Paladin Exploration from New Orleans has been contracted by LSU to perform the prospect survey. A detailed test plan for Gladys McCall is being prepared.

Bob Morton of the Texas Bureau of Economic Geology (BEG) discussed the Blessing Prospect, which is west of the Brazoria Prospect, and the Point Comfort area, which is west of the Blessing Prospect. These prospects are both part of the Frio trend. The Blessing area is relatively shallow, 11,500 ft, the Point Comfort area has most reservoir properties similar to Blessing but with higher permeability.

The BEG is also looking for watered out thin virgin gas reservoirs for GRI. They found several Hackberry sands of Frio age in the Port Arthur area which meet the specified requirements. The wells in the area had a fair amount of gas and water production and were abandoned at fairly high pressures because of large volumes of produced water. The fact that the water was produced with very minor drawdowns in pressure suggests lateral continuity and good permeabilities. Pressure gradients, porosity, and permeability are fairly good and salinities are 65,000 to 79,000 ppm in the two target wells.

Don Bebout reported that the Louisiana Geological Survey and LSU have completed the study on the geology on the Bayou Hebert and the LaFourche

Prospect areas, but that they are having difficulty in getting permits to run Vibroseis surveys in the latter area. He said that log calculated salinities of approximately 115,000 ppm at the Bayou Hebert Prospect have discouraged them and it is now on hold. Bebout also said that the Freshwater Bayou Prospect, which is near the Southeast Pecan Island Prospect, is very encouraging geologically with log calculated salinities of 60,000 ppm to 80,000 ppm and with good fairly thick sands.

A number of research areas were discussed by several investigations. Leo Rogers discussed sand continuity and possible interference with commercial production in design well prospect areas. Carroll Knutson discussed the effects of shale dewatering on aquifer performance and suggested two reservoirs, Tepatate and Rayne Fields, where these effects had been reported. Leo Rogers also summarized Charles Blount's study of methane solubility in high pressure and temperature brines. Blount's correlations are scheduled for publication as a paper at the 5th Geopressure Geothermal Conference, October, 1981.

Chip Groat with the State of Louisiana/LSU reviewed the environmental monitoring programs for the Parcperdue and Gladys McCall areas. Beside the usual public concern for air and water pollution, there is real concern about subsidence. Hence, subsidence monitoring will have a major place in the environmental program.

Zaki Bassiouni with LSU and Henry Dunlap with the University of Texas at Austin, discussed their work on upgrading the prediction of aquifer brine salinity using geophysical logs. The calculated pretest and measured test brine salinities generally show large discrepancies. The Bassiouni correction techniques utilizes the resistivity of the shales adjacent to the aquifer and an empirical chart to develop a corrected water resistivity that is used to calculate salinity.

The Dunlap method is to obtain an empirically derived mud filtrate resistivity which is then used to calculate the salinity by conventional methods. This salinity is then corrected using a correlation based upon formation age.

Phil Randolph with IGT reported on their efforts to obtain accurate gas/brine ratios. Recombined sample from five wells have indicated that three brines were supersaturated, one saturated and one undersaturated. Methane content and separation depends upon separator pressures and temperatures and the composition of the other gases, especially CO₂, that are dissolved in the brine.

- Drilling and Testing Subgroup Meeting-December 2, 1982

The agenda for the December 2, 1982 Drilling Testing meeting is included as part of Appendix I. The major information elements in this meeting were the review of the Drilling and Testing Program by Fred Goldsberry, the review of results from the Wells of Opportunity Program by Dan Langford and the status reports on the Design Well Program.

Fred Goldsberry with DOE stated that the DOE program was formulated to evaluate the geopressed geothermal resources along the Texas and Louisiana Gulf Coast. DOE objectives were to acquire data that would reduce investment uncertainty associated with the development of the geopressed geothermal resources rather than to develop, demonstrate or promote commercialization of such resources. Fred noted that approximately one half of the total design well testing has been performed and that all four of the wells should be flowing by March 1983.

Dan Langford of Eaton Operating Company reported that the Wells of Opportunity Program terminated in August 1982. Eaton Operating Company began its participation in the program in December 1979, and of the 33 wells they recommended for acquisition, 7 were acquired for testing of which 5 produced worthwhile tests. Dan stated that although the WOO Program provided very good data for relatively low cost, the value of the geopressed geothermal resource will be determined by the design wells because they were drilled looking for water reservoirs rather than oil or gas.

In general, the areas of high temperature and pressure are well known and there are good quality thick sands in these areas. The rare thing was to find a reservoir with the desired characteristics and a low salinity brine. Gas water ratios found varied from 33 to 55 scf/B. Bottom hole temperatures were 7 to 16% higher than estimated from the open hole logs. One major conclusion from the Wells of Opportunity Program was, that for this geopressed geothermal resource to be economically attractive, methods had to be developed to utilize the heat and kinetic energy of the brine as well as the gas content.

Frank O'Brien with Technadril discussed the Amoco Fee No. 1 (Sweet Lake) well status. Although the well was currently shut in and didn't achieve the high production rates anticipated, extended production at rates of about 13,000 B/D should be possible. The test analyses indicated nearby boundaries on the northeast and southeast. However, no boundaries were found to the west to the explored distance of 24,000 ft. More than one million barrels of brine were produced during the previous testing. The flowing pressure was drawn down faster than expected, but the pressure returned to its original value after being shut in. Perforating additional sands should allow future tests to be carried out at higher rates.

Frank O'Brien also reported on the Gladys McCall well status. The leak problem should be resolved shortly and the well should be on production before the end of the year. This well encountered the best looking suite of reservoir rocks encountered to date by the design wells. Only one 50 ft zone, in the 1,000 ft aquifer sequence, is scheduled for the initial test. The 12,900 psi pressure and 315°F reservoir temperature are expected to produce methane production rates and revenues that will offset operating costs.

Jack Hamilton with the Dow Chemical Company reported on the L. R. Sweezy (Parcperdue) project. Production rates have remained below 10,000 B/D because of sand production associated with higher rates. Heavy

hydrocarbons and trace metals produced in the brine are being investigated. Twelve drawdown/buildup tests are targeted. Results of calculation from earlier tests on the 50 ft sand located at 13,350 ft indicate an original reservoir pressure of 11,400 psi, temperature of 235°F, salinity of 100,000 mg/l and a reservoir volume of about 72 million barrels. Production to date is about 1.3 million barrels of brine and 23 Mcf of gas.

A seismic project directed by Gary Kinsland at University of Southwestern Louisiana is attempting to develop and compare pre and post test 3-D seismic "pictures" of the reservoir being depleted by the Parcperdue project.

Reservoir simulation studies reported by Sabodh Garg of S-Cubed indicated anomalous pressure reduction behavior. Additional "drive" may be due to higher compressibilities, shale dewatering, water influx across a fault, etc, working singly or in concert.

- Overview Group Meeting-December 2, 1982

The agenda for the December 2, 1982 Overview Group Meeting is included as part of Appendix I. Ron Stearns with DOE/NVOO provided a status report on the DOE Geopressure Geothermal Program. The initial multisource program recently has concentrated on gas production, but recent evaluation indicates that maximizing total energy utilization will probably be necessary for ultimate commercialization. The anticipated FY 1983 program has three priority areas, (1) continuation of design well testing, (2) continuation of environmental monitoring and (3) continuation of the basic research elements in the program.

Bob Morton with the Texas Bureau of Economic Geology and Chip Groat with the Louisiana Geological Survey reviewed site selection activities in their respective states. Bob Morton stated that the BEG had turned up a number of attractive projects including Pleasant Bayou. They are currently concentrating on determining reservoir size and potential producing characteristics for fault blocks in the Frio and Wilcox trends. They believe that the average fault block size averages slightly less than 10 square miles, and that the characteristic salinities in the trends can be mapped.

Chip Groat reported that site selection activities in Louisiana were terminated October 31, 1982. The residual funding will be used for environmental monitoring around the design wells, and for environmental studies associated with the potential sites that have been pinpointed during the earlier phases of their site selection project.

Tom Kraemer with the U. S. Geological Survey reported on the results of measurements on shale samples, from a depth of about 15,400 ft, cored in the DOW Sweezy well. The reported porosities, surface areas, cation exchange capacities and permeabilities were unexpectedly high. Resonance studies indicated that the water was predominately adsorbed in the first few layers attached to the solid surfaces. The second layer probably had some appreciable mobility at ambient temperatures and pressures.

Carroll Knutson with C. K. GeoEnergy Corp. reviewed some shale dewatering concepts and tied in the current studies with this background information.

Mason Tomson with Rice University summarized the work they were doing on carbonate scale inhibition at the Brazoria (Pleasant Bayou) site. The saturation index model they have developed seem quite useful in anticipating the scaling tendencies. Their screening studies have indicated that ideal inhibitor concentrations in the order of $\frac{1}{4}$ to 1 mg/L should be adequate for Brazoria brines. Some commercial inhibitors approach ideal, hence new inhibitor development seems unnecessary.

Evan Hughes with Electric Power Research Institute (EPRI) reviewed their geothermal program. They are focusing on five areas, (1) binary cycle development, (2) wellhead power plants, (3) critical components of conversion plants, (4) chemistry and scale control, and (5) advanced resource development, including geopressure. The Heber California plant is their major binary cycle project. They have completed initial tests on the first wellhead power plant, and work is underway in their other priority areas. Possible EPRI interaction in the geopressure geothermal program is envisioned as work on the Hybrid Power System. They have some conceptual designs and cost estimates made for a combined cycle where some of the methane is burned on site to produce power and the waste heat contributes to the high temperature part of the heat supply needed in a flash or binary cycle. The pressure energy is also converted to electricity in a hydraulic turbine. Using optimized design, a 10 megawatt plant would produce about 5 megawatts from the methane, 4 megawatts from the heat in the brine and 1 megawatt from the hydraulic energy.

Bill Thompson with University of Texas at Austin (UTA) reported on two areas of UTA research, reservoir simulation and rock mechanics. Their initial Sweet Lake simulation analysis used values of 17 md for the permeability, porosity of 24%, gas saturation of 31 scf/B and $.5 \times 10^{-6}$ for the compaction coefficient. They found that gas production was insensitive to porosity but highly dependent on compaction coefficients and permeabilities.

Most of the continuing work at the University of Texas is in the rock mechanics area. They have found that the bulk compressibilities are highly stress sensitive, and that most of the other characteristics are not very sensitive to temperature changes.

Much of their latest rock mechanic work has been on the change of compressibilities with time (creep). They see the same effect in cores from Pleasant Bayou and Sweet Lake. In analyzing the data, they are defining the two behaviors observed as instantaneous compressibility and delayed compressibility. Future work involves more high temperature testing and incorporation of their creep information into their reservoir simulators.

Leo Rogers discussed a GRI report - entitled, "The Well Testing Project for Co-Production Gas & Water at the Port Arthur Field, Jefferson County, Texas." The area is near Port Arthur, Texas. The report describes a

watered out geopressured reservoir that was produced for a number of years. The reservoir currently appears to contain large amounts of bypassed gas that should be obtainable with coproduction.

Leo Rogers with Gas Research Institute and Ben Eaton with Eaton Operation Company summarized the status of the GRI coproduction project at Port Arthur. A limited partnership is being put together to conduct the field project. It will be non-registered with the SEC, but the goal is to put together between 35-45 units of \$100,000 a piece to conduct this test. There are indications of good support so far for the prospectus which was issued the previous day. GRI has committed funds for this but to date Eaton has "spiced" putting the partnership together and obtaining an option on the leases for the initial four month period.

- Drilling and Testing Subgroup Meeting-June 9, 1983

The agenda for the June 9, 1983 Drilling and Testing Subgroup Meeting is included as part of Appendix I. The meeting consisted of two main information elements, a Geopressure Geothermal Program review by Fred Goldsberry and a review of the status of the design well testing presented by project personnel associated with each design well .

Fred Goldsberry, in reviewing the current status of the DOE Geopressure Geothermal Program, stated that they have encountered some unanticipated problems and information. The problems are associated with the tubing leaks in design wells, the information is the ubiquitous appearance of liquid hydrocarbons associated with long term brine production in the design wells.

Jack Hamilton with Dow Chemical reported in his overview of the Parcperdue project that the Sweezy well produced about two million barrels of brine and achieved about one-half of the anticipated pressure reduction. Among the interesting phenomena observed were heavy sand production, changing productivity index, a leaking brine pit and liquid hydrocarbon production.

Jack Storm provided details about the continued sand production that (1) eroded lines and equipment and finally plugged off the Sweezy well, (2) filled the separators and filters and (3) covered the perforated interval in the injection well. He also discussed the discovery and documentation of the liquid hydrocarbon production and the essentially scale and corrosion free operation of the surface equipment.

An interesting environment indicator used at the Parcperdue project was the monitoring of minnows in the water filled ditch surrounding the site. On three different occasions the minnows were the first indication of a brine containment problem. The LSU monitoring of the water wells around the site showed that the remedial measures taken were timely enough to prevent any contamination of the fresh ground water.

The production and disposal wells were plugged and abandoned and the site was restored without any major problems. LSU will continue the

environmental monitoring to document any long term effects such as delayed subsidence.

Larry Cole discussed testing results. Reservoir characteristics determined were - 26% porosity, ~ 200 md permeability, 11,475 psia initial reservoir pressure, 228°F reservoir temperature, 17.1 scf/B solution GWR, 5,037 psia bubblepoint pressure, 1.0693 gm/ml @ 60°F water density, 1.04 RB/STB water volume factor, 0.437 cp average water viscosity, and a productivity index then increased from ~ 11 to 30 B/D/psi during the course of the test. Additional rock mechanics tests and simulations are being carried out in an effort to evaluate the cause of the rather anomalous reservoir performance.

Redd Smith briefly reviewed the Parcperdue rock mechanics studies being carried out at Terra Tek. During the preliminary testing, the permeabilities show a irreversible reduction and the samples show creep under increased confining pressures. The creep results in a non-recoverable deformation and a time dependent pore compressibility which may be appreciably higher than the reversible values of 3 to 10×10^{-6} psi⁻¹ which was considered characteristic of these formations. The creep and resulting decreased pore space could account for part or perhaps all of the anomalous productivity index behavior noted at Parcperdue.

John Meriwether presented information on the evaluation of brine and liquid hydrocarbon composition using the Proton Induced X-ray Emission (PIXIE) technique. Detection of trace elements at the 2 to 10 ppb range has been achieved on chemically separated fractions. This appears to be a promising method for fingerprinting the well effluents.

Dean Keeley provided information on the chiefly aromatic hydrocarbons, benzene, toluene, ethylbenzene, para-meta and ortho-xylenes, etc., comprising the liquid hydrocarbons sampled in the Sweezy well. This composition was quite similar to that of samples obtained in the Gladys McCall and Pleasant Bayou wells. The volumes of these aromatics ranged from the 10's to the 100's of ml/Mcf in the gas with a calculated 2/3 or 3/4 of the volume remaining in the brine.

Dave Riney presented the results of the S-Cubed simulation of the Parcperdue test results. The first few drawdown/buildup tests provided useful information and later tests indicated transient behavior and doubtful reservoir pressure extrapolations. Calculated reservoir parameters used by S-Cubed were total pore and water compressibility $\sim 10 \times 10^{-6}$ psi⁻¹, permeability ~ 125 md, $\sim 27\%$ porosity, and 9,950 psi final extrapolated reservoir pressure. The pressure vs cumulative production behavior can be characterized by two straight line segments, one through tests 3 to 9 and the second through tests 9 to 11.

A sensitivity study of factors potentially responsible for the anomalous reservoir behavior zeroed in on the leaky aquifer case as being most probable. Trapped and settling sand in the wellbore was suggested as being a likely cause for the anomalous buildup behavior.

Gary Kinsland summarized the current state of the 2D and 3D seismic evaluation of the Parcedue project area. Current data is providing better apparent resolution compared to the previously available data, however the inability to adequately handle the static error correction is yielding sine curve type oscillations in the time slices and less than satisfactory structural and fault interpretations. Work is continuing on the processing techniques in an attempt to develop a high quality 2D and 3D seismic picture of the project's subsurface environment.

Larry Durrett presented an up-to-date overview of the Gladys McCall project. The initial zone selected for production was unit Number 9, a ~130 foot thick sand zone at a datum depth of 15,460 ft. After a few mechanical problems, the zone was tested and the following reservoir parameters were determined - 12,910 psia initial pressure, 12,360 psia reservoir pressure after testing for 24 days at an average rate of 4,100 B/D, 300°F reservoir temperature, 245°F maximum surface temperature, 32.3 scf/STB GWR with ~10% CO₂ and ~13 ppm H₂S, and 95,500 ppm TDS in brine. The well did not produce sand and scaling and corrosion were minimal.

The reservoir appears to be small, ~100-200 million barrels, probably due to pinching out and not faulting. The calculated 11,800 foot radius of investigation failed to detect multiple faults.

A packer seal leak was a continuing problem prior and during the test. The well is currently shut in pending remedial action which will completely plug the Number 9 zone, repair any packer-tubing leak problems and open the 325 foot thick Number 8 zone for production testing.

Don Clark presented the detailed reservoir analysis of the Number 9 zone test. The test was designed to provide reservoir data starting about 130 feet from the well. This was apparently achieved and the following additional reservoir parameters were developed - 1.0479 RB/STB water volume factor, 0.388 cp viscosity, 3.22×10^{-6} psi⁻¹ total compressibility and 10,000 md-ft flow capacity. The test provided consistent results, although the actual operations were plagued with pressure recording instrument failures.

Larry Durrett also discussed the status of the Sweet Lake well. This well displays about 250 ft of net sand in the interval between 15,000-15,700 ft. All testing to date has been carried out on the Number 5 sand in this interval. The reservoir parameters are 12,052 psia initial reservoir pressure, 299°F reservoir temperature, 4,749 psia original surface pressure, 15,387-414 ft perforated interval, 160,000 ppm brine TDS and 19% porosity. The bottom hole pressure pulled down very rapidly during production testing - to 7,800 psia after a production of only 226,300 bbl of brine. The calculated brine permeability was 344 md. The problem appeared to be a rather small flow angle, ~25° and/or a permeability changes. The radial distance explored was 22,467 ft and the reservoir volume explored was ~300 million barrels.

A flow test of one of the other zones will help resolve the flow angle vs permeability question.

The brine tended to scale but was inhibited by 1 to 3 ppm AMP-20. The produced GWR of 23-27 scf/B was somewhat below the calculated saturation ratio of 34 scf/B.

The gas contained 8-9% CO₂ and 15-30 ppm H₂S, and will require treatment before pipelining.

Sand influx in the disposal well required a plug back and recompletion in a shallower (4,500 ft) interval.

When funds become available, the well will be cleaned out, the tubing leak will be repaired and the well recompleted and tested in the Number 3 sand.

Howard Blumhardt reported that the Pleasant Bayou well had been shut in on April 13, 1983 after surface pressure reached zero on one of the gauges. An obstruction was found in the wellhead loop upstream of the choke and scale and corrosion inhibitor injection point. The flow lines and valves were cleaned out and a caliper was run in the tubing to check subsurface scale buildup. Scale decreased from more than 1/2 in. at the surface to less than 1/4 in. at 5,000 ft. Small restrictions were found at 3,600 and 5,600 ft and a major restriction at 9,200 ft. The tubing parted at 5,225 ft during the caliper run.

The well was killed with mud. The tubing leak will be repaired and the well put back on production as soon as the agreed upon remedial program is approved.

The well produced ~ 3.5 million barrels of brine at an average rate of 17,314 B/D with an average gas production of 382 MMcf/D during the test. The well was on stream 95.8% of the time during the 200+ day test.

Scale has not been a problem in the inhibited areas, but valve and gasket leaks and turbine meter problems have necessitated a constant surveillance/maintenance program for the surface equipment.

Kathy Sloan discussed the Rice University GRI funded geopressure geothermal scaling and corrosion control program. A saturation index relationship has been worked up and has proven useful in predicting the scaling tendencies of the brines. The values used in the equation are calcium concentration, alkalinity, CO₂ content, ionic strength, temperature, and pressure and are easily measured in the field. Changes in either alkalinity or pH are used to monitor minimum effective inhibitor concentration levels. An automatic inhibitor control feedback system is being developed to provide an optimum cost/effect field system. Current effective inhibitor concentrations for the design well projects have ranged from a fraction to several parts per million of an efficient chemical such as AMP or Dequest 2000.

A field kit is being developed that, in conjunction with the saturation index concept and a nomograph, should allow field personnel to evaluate, treat and monitor chemical scale tendencies and treatments.

- Overview Group Meeting-June 9, 1983

The agenda for the June 9, 1983 Overview meeting is included as part of Appendix I.

Dave Lombard reviewed the Washington perspectives of the DOE geopressure geothermal program. Among the points demonstrated by the program to date are (1) a number of sizeable geopressure geothermal aquifers contain brine saturated or nearly saturated with methane, (2) brine salinities can be approximated from log calculations, (3) high volume brine producing rates can be sustained, (4) significant quantities of gas can be recovered from the brine streams, (5) large volumes of spent brine can be injected and (6) in addition, large volumes of technical data have been electronically archived. It also appears that there are reservoirs large enough to make good targets but that reservoir behavior might be relatively complex. Some points of continued concern and evaluation are (1) subsidence, (2) mechanical problems such as tubing and packer leaks, (3) system corrosion and scale control and (4) efficient total energy utilization.

The current program plans will attempt to provide additional data in a cost effective manner at whatever funding level is designated for subsequent fiscal years.

Evan Hughes reported on the Electric Power Research Institute (EPRI) wellhead conversion subprogram to develop viable single geothermal well power plants. One step has been taken in this effort by the installation and testing of a 1.6 MW rotary separator turbine at Roosevelt Hot Springs in Utah. Another major milestone would be a geopressure hybrid plant (probably at Pleasant Bayou). The hybrid refers to a combustion-geothermal combination. The low quality gas would be burned in an internal combustion engine or gas turbine. This would drive a generator and the hot exhaust gases would be used to raise the temperature of the geothermal fluid cycle. This type of system would result in a very efficient utilization of the energy from the geopressure geothermal wells. As an example a 20,000 B/D brine stream could produce about 600 kW from combustion (1/2 gas stream to combustion) 400 kW from the geothermal bottoming cycle and 200-300 kW from a hydraulic turbine that acted in a pressure reduction mode.

The feasibility of this project is currently being assessed, and if approved - an attempt will be made to field this type of program.

EPRI currently has only partial funding available and is actively seeking co-sponsors for this interesting resource utilization project.

Myron Dorfman with the University of Texas at Austin provided a brief introduction to the university's geopressure geothermal research program.

Bill Thompson started off the discussions on individual research efforts with a review of the rock mechanics study program and a specific discussion of the very pertinent creep testing. Temperature associated

changes in rock properties were only found in such parameters as formation factor and permeability.

The current creep model seems to fit reservoir rock behavior. It uses the concept of maximum creep at any set of in situ parameters. This "capping strain" is calculated, and the expected behavior is predicted by tracking the stress history and extrapolating the strain, utilizing the exponential capping strain relationships.

Henry Dunlap reviewed the logging research and zeroed in on the effects of the additives on the salinity of the mud systems. The critical mud properties are those exhibited by the mud when the particular interval of interest is drilled. Large amounts of sodium chloride occur as contaminants in barite and ligno-sulphate mud additives. Thus, any addition of water or solids to the system can have a marked effect on mud salinity. A running record of mud salinity should be kept. Frequent sodium ion activity measurements on the mud is all that is needed for a comprehensive evaluation of the system's salinity. Calculations using header information resulted in 40-50% standard deviations in R_m and R_{mf} between log and measured values.

Bob Schneider reviewed the computer data base for geopressure geothermal information under development at the University. This Geopressure Geothermal Information System (GGIS) will provide assistance in such in-house studies as graphics, log digitization, well log analysis and reservoir engineering. The system also includes a bibliographic and thesaurus data base. The goal for the information system is to provide the broad spectrum of information and services not only to the university researchers, but also to any interested party with a compatible computer/modem access capability.

Bob Morton reviewed the work in progress at the Bureau of Economic Geology, predominately formation assessment, continuity, diagenesis and water salinity studies. The continuity studies show promise for the facies identification techniques being used. Reservoir heterogeneity and trend directions are recognizable. General salinity trends have also been mapped and water movement and source problems are being worked out. This problem also ties into the cementation/solution history of the aquifer rocks.

Leo Rogers presented a brief overview of the GRI geothermal activities, which are currently associated with coproduction, chemical inhibition, brine chemistry, downhole sampling and prospect identification and evaluation. Several coproduction projects are in the negotiation phase and information on the other programs will be presented during this session by the principal investigators.

Fred Mauk summarized the seismic monitoring program at the Pleasant Bayou and Parcperdue sites. The microseismic events (scale 2 or less) being recorded can be classified into (1) normal or body wave, (2) surface wave and (3) rumble type events. The events all (1) occur at depths less than the producing horizons, (2) cluster near faults and (3) correlate with production/disposal activity but with a time delay. The rumble events appear to be a leaky mode surface wave and it appears that all three types

of events can be handled by synthetic seismic analysis. Further study on the identification and source location of these events will be carried out.

Dru Trahan summarized the Louisiana Geological Survey's environmental program activities. Water quality testing is now being carried out on a quarterly schedule. Seismic monitoring is still on line and the leveling to evaluate subsidence is on schedule with the reference point located on the Monroe Uplift in northern Louisiana. The extensive leveling line data demonstrate the continuing uplift and subsidence in the general area, and points out the criticality of an adequate baseline behavior model.

Mason Tomson reviewed the Rice University program to understand scaling and scale prevention. This program uses a three pronged approach - field, laboratory and theory. The saturation index appears to be a useful tool for system scale evaluation and treatment evaluation. Their theoretical study of inhibitors indicates that current chemicals are near maximum efficiency and that treating concentrations should be in the fractional to few ppm range.

Future plans include (1) a corrosion study along the lines of the scale study, (2) inhibition of casing/tubing strings, (3) disposal aquifer protection programming, (4) reductions in data acquisition and development times, and (5) optimized computer controlled chemical inhibition at the well sites.

Dean Keeley reviewed USL future plans dealing predominately with the study of hydrocarbon partition in multiphase systems and chemical analyses of high salinity brines. The partition studies should be particularly interesting since they would also impact models of petroleum origin, migration and accumulation in reservoirs.

Oleh Weres summarized two general areas of the GRI funded activities at Berkeley - downhole sampling and brine system evaluations. The downhole geothermal brine sampler is now operational and provides the opportunity to obtain downhole samples at temperature and pressure conditions beyond the range of other samplers. If industrial representatives wish to take advantage of this development they should contact Leo Rogers at GRI and make arrangements. The field parameters for their sampler are 2-3/4 in. diameter, 31 ft length, 390 lbs weight, and a 7/16 in. MP 35 shielded cable to run.

The laboratory hydrocarbon generation and maturation studies have been made at temperatures between 200°C and 350°C. Oil shale samples cooked with brine at 350°C yielded a yellow Parcperdue like condensate. A very similar fraction was obtained when the Sweezy gas was cooled with liquid nitrogen. The composition of both fractions matched that obtained by Keeley and Meriwether at USL. When this material is dissolved in brine and the brine is placed in contact with gas such as CO₂ or methane, the heavier components are partitioned between the two phases. This behavior was previously discussed in both the USL and Rice presentations.

The partition behavior needs further study as does the composition of the heavier organics found dissolved in the geopressure geothermal brines.

Charles Matthews with Shell gave a brief presentation summarizing the evaluation of the program by one industrial participant. He stated some aspects of the program are considering phenomena believed by industry to be non-problems or non-questions. However, other aspects of the program have been well handled and have yielded important information. Some of these positive contributions are in the area of reservoir size, continuity and producing characteristics. Another area that was of particular personal interest is the evaluation of the heavy hydrocarbon concentrations and partitions in geopressure geothermal brine and gases and the impact of this information on concepts dealing with petroleum origin and migration.

III. NEWSLETTERS

Newsletters were periodically prepared and distributed. The first nine newsletters were developed on a monthly schedule, May 1981 through January 1982. Six subsequent newsletters were distributed on a quarterly schedule covering the second quarter of 1982 through the third quarter of 1983.

The newsletters, providing a summary of DOE geopressure geothermal activities and research results as well as related geopressure geothermal activities, were distributed, on the average, to about 300 individuals. The currently active mailing list is presented as Appendix II.

The company affiliation of individuals receiving the mailing lists constitutes a good cross section of the oil and gas industry, thus information about the program seems to be reaching the right audience. A breakdown of the number of recipients in each category is presented in the following table.

<u>Category</u>	<u>Number of Recipients</u>
Major Oil & Gas Companies	74
Major Industrial Firms	31
Industry Supported Research Institutes	7
Small Business	18
Independent Oil & Gas Companies	10
DOE Contractors	86
Consultants	14
Technical News Media	4
Federal Agencies	39
State Agencies	13
Interested Parties	3

IV. GENERAL GEOPRESSURE GEOTHERMAL SUPPORT

Three general support tasks were performed as part of this contract, (1) "Evaluation of Land Ownership, Lease Status and Surface Features in Five Geopressure Geothermal Prospects" by William N. Hackenbracht, May 1981, (2) "Analysis of Three Geopressure Geothermal Aquifer-Natural Gas Fields: Dusen,

Hollywood and Church Point, Louisiana", by Leo A. Rogers and Charles R. Boardman, May 1981 and (3) "Screening of Three Geopressure Geothermal Aquifer-Natural Gas Project Areas for Potential Conflicting Commercial Production: Freshwater Bayou, Lake Theriot and Kaplan, Louisiana" by C. F. Knutson and L. A. Rogers, February 1982.

William Hackenbracht's report summarized the lease ownership and access and drilling site development problems in the (1) East and West Lake Theriot, (2) Kaplan, (3) Bayou Hebert, (4) Freshwater Bayou and (5) Blessing prospects. The first four projects are in Louisiana. Although land ownership and the potential leases do not appear to be excessively fragmented, the access and drilling and production site development could constitute problem areas for the Louisiana sites.

The Rogers and Boardman report indicated that over the depth intervals of the geopressured zone most of the sands of any substantial thickness had gas production someplace in the prospective fault block. The one noteworthy exception was a deep sand in the Hollywood field. Calculations of potential production rates from this sand fell below 10,000 B/D. Thus, the required gas price to profitably produce this zone is well above the current market price.

The Knutson and Rogers report indicates interference problems only in the Kaplan field, but suggests a more comprehensive study be made before a project is initiated in either of the other two field passing this first screening test.

V. INDUSTRY PARTICIPATION IN FORUM MEETINGS

Attendance at the DOE/Industry Forum meetings have averaged around 56. A list of names, affiliation, address and phone number of each participant was attached to the minutes of each meeting. This was done to increase the amount of cross communication between the DOE contractors and industry. We feel it has been effective in keeping industry apprised of the latest developments by providing a list of contacts that can be used to obtain up-to-date information.

A review of the attendees affiliations shows a reasonable cross section between Industry, DOE Contractors, State and Federal Agencies. An alphabetical list of attendees with addresses and affiliations is presented as Appendix III. Attached as Appendix IV is a breakdown of attendee affiliations into categories of Major and Independent Oil and Gas Companies, Major Industrial Firms, Small Business, DOE Contractors, State and Federal Agencies.

Effectiveness of the DOE/Industry interchange can be judged by the participation in the forums and the roster of those who ask for and receive the newsletters. From Appendix III it is apparent that a number of the major and smaller oil and gas companies (14) have been involved in this part of the program.

The major oil companies have also been quite cooperative in providing data, when requested, that could be used in the support projects associated with evaluating leases and potential interference between geopressure geothermal projects and conventional oil and gas recovery.

Industry participation in the forum meetings fell off markedly in the December 2, 1982 sessions. We feel this was because (1) there had been an interval of almost a year and a half between meetings, (2) the newsletters were no longer coming out on a monthly basis, and (3) interest in high cost gas was not as high as had been the case in the previous few years. Thus, a feeling that the program was no longer very active pervaded the group of potential attendees. Attendance was back up in the June 9, 1983 meeting. There had been a period of only a little more than six months between the last two meetings and the potential attendees were reminded that the program was still ongoing and was providing very interesting (and in some areas-exciting) information.

VI. CONCLUSIONS

This report has summarized the information presented by DOE and its contractors on the evaluation of the potential of the geopressured geothermal resource. It shows that the DOE has done an excellent job in keeping industry current with the information developed and the thrust of the resource evaluation program.

Natural gas, heat and kinetic energy all can readily be extracted from the enormous aquifers underlying much of southern Louisiana and Texas Gulf Coast. Recoverable reserves in each of these categories are large, trillions of feet of methane and many thousands of megawatts of electrical energy.

Industry is currently not vitally interested in developing high cost-high price natural gas. The so called "gas bubble" caused in part by the increased gas development that was stimulated by higher prices, will probably "burst" in a few years. Thus, the interest in long term enhanced gas recovery projects such as geopressure geothermal is continuing but is felt to be an area that will not become active for several years.

Interest seems to be developing in a broader program, one which looks at the total energy development instead of looking at only gas production. The cost of geopressure geothermal gas will be lower if it is only one of the revenue sources that will pay back the cost of the well and its production.

Thus, the continuation of the current emphasis of the program on optimum energy development and associated research would seem to be a prudent course of action.

VII. RECOMMENDATIONS

1. The Federal Government should continue the geopressured

geothermal resource evaluation until a true measure of the size and economics of the resource is known.

2. Following completion of the current design well reservoir testing, extended testing aimed at providing design and economic parameters for full energy utilization should be carried out.
3. DOE/Industry Forums should be continued on a frequency that keeps industry apprised of current developments in the evaluation of the geopressure geothermal resource. Personal contact should be maintained with the industry participants to insure (1) appropriate personnel are aware of the meetings and (2) areas of particular interest to industry are covered during the meetings.

Intervals between forums of greater than 6-8 months seem to result in a loss of contact and interest in the program.

4. Newsletters should be continued and should include summations of current DOE programs and other related efforts such as the GRI and EPRI programs.

AGENDA

DOE/INDUSTRY GEOPRESSURED GEOTHERMAL ENERGY FORUM INFORMAL
DRILLING AND TESTING SUBGROUP MEETING - TUESDAY MORNING -
JUNE 16, 1981

HOLIDAY INN - AIRPORT - 2929 WILLIAMS
NEW ORLEANS, LA. (504) 467-5611

- 8:30 Introductions
- 8:40 Wells of Opportunity Program (Eaton Industries
 & IGT) Geology, Geophysics and Well Testing
- Crown Zellerbach - Prairie Canal
 - Saldana - Pauline Kraft
- Dan Langford, Kim Peterson, Dick Klauzinski and
 Phil Randolph
- 10:00 COFFEE BREAK
- 10:15 Design Wells
- 1- Parcperdue (Jack Wilson)
 - 2- Magma Gulf (Clay Durham/Karen Hoffman)
 - 3- Brazoria (S³/Dave Riney
 (Intercomp/Ken Ansel)
 (DOE/Keith Westhusing)
- 11:15 DOE Drilling and Testing Programs Wrapup
 (Keith Westhusing)
- 11:30 Adjourn for LUNCH

AGENDA

DOE/INDUSTRY GEOPRESSURED GEOTHERMAL ENERGY FORUM INFORMAL
OVERVIEW MEETING - TUESDAY AFTERNOON - JUNE 16, 1981

- 1:00 Introductions
- 1:05 DOE Geopressured Geothermal Program (Bob Holliday)
- 1:15 Gas Research Institute Geopressured Geothermal Program
(John Sharer)
- 1:30 Wells of Opportunity Plans (Eaton Industries)
- 1:45 Design Well Plans (Frank O'Brien)
- 2:00 Site Selection Update: Texas Sites- R. Morton
Louisiana Sites- D. Bebout
Selected Prospect Analysis- L. Rogers
- 2:30 Environmental Problems and Plans (C. Groat)
- 2:45 COFFEE BREAK
- 3:15 Research Programs
 - Logging in Brine Saturated Formations
 - 1 - Henry Dunlap
 - 2 - Zaki Bassiouni
- 3:45 Research at University of Texas (M. Dorfman)
Research at Louisiana State University (D. Bebout)
Research at University of SW Louisiana (G. Kinsland)
Shale Dewatering (C. Knutson)
- 4:45 Meeting Plans
- 5:00 HAPPY HOUR

Site Tour of the Crown Zellerbach Well was conducted
Wednesday morning, June 17, 1981.

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FIGURES AND TABLES are within each presentation of the text.	

Robert K. Aaker
Manager - Geology
Conoco, Inc.
Box 2197
Houston, TX 77001

Frank Ashby
Dept. of Natural Resources
P. O. Box 44396
Baton Rouge, LA 70804

Perle Beck
Texaco
P. O. Box 430
Houston, TX 77401

Foster H. Abney, President
W. K. Technology Inc.
9777 Harwin Dr., Ste. 408
Houston, TX 77036

T. L. Aubin, Jr.
United Gas Pipeline Co.
P. O. Box 1478
Houston, TX 77001

Ron Becker
Market Research Manager
Gardner-Denver/Cooper Ind.
P. O. Box 26208
Dallas, TX 75226

S. Marshall Adams
Environmental Science Division
Oak Ridge National Lab
Oak Ridge, TN 37830

Ann Bachman
Louisiana State University
Energy Programs Office
105 Hill Memorial
Baton Rouge, LA 70803

Sam Becker
Chief, Facilities Compliance
U. S. EPA Region 6
1201 Elm
Dallas, TX 75270

Daniel Akpanumoh
Eaton Operating Co.
3100 Edloe, Ste. 205
Houston, TX 77027

Ami Banker
Louisiana State University
Dept. of Chemistry Eng.
105 Hill Memorial
Baton Rouge, LA 70803

Robert Benner
Sun Exploration Company
Two Lincoln Centre
5420 LBJ Freeway/LB2
Dallas, TX 75240

Andrew C. Alpha
Mobil Oil Company
1101 Monaco
Denver, CO 80220

Zaki Bassiouni
Louisiana State University
Dept. Petroleum Engineering
105 Hill Memorial
Baton Rouge, LA 70803

Rich Bennett
Columbia Gas Research Dept.
1600 Dublin Road
Columbus, OH 43215

Mike Andre
Hewlett Packard
10535 Harwin Drive
Houston, TX 77036

H. R. Battin, Jr.
Project Manager
Fenix & Scisson, Inc.
Route 7, Box 693
Alvin, TX 77511

Bill Bernard
Louisiana State University
Dept. Petroleum Engineering
105 Hill Memorial
Baton Rouge, LA 70803

Sharda Arya
Texas Southern University
Assistant Prof.
3100 Cleburne
Houston, TX 77023

Joe Battle
AMF Tuboscope
P. O. Box 808
Houston, TX 77001

Jonne Berning
Technadril
Operation & Testing Manager
9700 Harwin
Houston, TX 77036

R. L. Bidwell
Director of Energy Resources
P. O. Box 27003
Richmond, VA 23261

Jack Burnett
Louisiana Land & Exploration
225 Baronne
New Orleans, LA 70112

Raymond E. Chavanne
McNeese State University
Lake Charles, LA 70601

Michael Birch
Natural Gas Pipeline Co.
122 South Michigan Ave.
Chicago, IL 60603

E. G. (Bo) Byers
Branch General Manager
Hewlett Packard
10535 Harwin Drive
Houston, TX 77036

R. W. Christopher
United Gas Pipeline Co.
Box 1478
Houston, TX 77001

Howard J. Blumhardt
Fenix & Sicsson
Route 7, Box 693
Alvin, TX 77511

D. R. Byrne
District Engineer
Texaco, Inc.
1834 North Main St.
Liberty, TX 77575

Bob Clarke
Department of Energy
Nevada Operations Office
P. O. Box 14110
Las Vegas, Nevada 89114

L. C. Bonham
Manager, Geology Division
Chevron Oil Field Research Co.
Box 446
La Habra, CA 90631

John Cagle
Conoco, Inc.
Room 2400-Box 2196
Houston, TX 77001

J. Donald Clark
Consulting Petroleum Engineer
5959 West Loop South
Suite 232
Bellaire, TX 77401

William D. Boyd
Research Project Manager
Southern California Gas Co.
Box 3249, Terminal Annex
Los Angeles, CA 90051

Curtis E. Carlson, Jr.
Director
Dallas Support Office
U. S. Dept. of Energy
P. O. Box 36228
Dallas, TX 75235

George Claypool
U. S. G. S.
Geological Division
Federal Center, MS 977
Denver, CO 80225

Dr. James Bresee
Department of Energy
Geothermal Hydropower Div.
1000 Independence Avenue
Washington, D. C. 20585

Dale Carver
Louisiana State University
Energy Programs Office
105 Hill Memorial
Baton Rouge, LA 70803

James R. Clements
President
United Enertec Inc.
8235 Douglas, Suite 1202
Dallas, TX 75225

Larry Browning
EPA Water Supply
1201 Elm Street
Dallas, TX 75202

Arnold C. Chauviere
Geological Consultant
755 Magnolia Woods Dr.
Baton Rouge, LA 70808

Larry L. Cole
Prairie View A&M University
Associate Professor & Director
P. O. Box 2787
Prairie View, TX 77445

Larry E. Coble
Otis Engineering
Manager, Res. Eng. Dist.
P. O. Box 34380
Dallas, TX 75075

D. P. Cullen
Milestone Petroleum Inc.
5613 South DTC Parkway
P. O. Box 3309
Englewood, CO 80155

John N. Dew
Director - Special Projects
Conoco, Inc.
Box 1267
Ponca City, OK 74603

H. L. Cook
Transco Companies
P. O. Box 1396
Houston, TX 77001

Paul F. Damek
Mobil Exploration Co., Inc.
Manager Drilling & Engineering
P. O. Box 2252
Houston, TX 77001

George Domahidy
Supervisor
Process Engineering
Stone & Webster
P. O. Box 5406
Denver, CO 80217

W. G. Cooper
Monsanto Chemical Co.
Box 1311
Texas City, TX 77590

D. A. Danielson
Texaco, Inc.
P. O. Box 60252
New Orleans, LA 70160

Dr. Billie Dopslaug
Mgr. Exploration Svcs.
Atlantic Richfield Co.
P. O. Box 2819
Dallas, TX 75221

Marshall R. Conover
Radian Corporation
P. O. Box 9148
Austin, TX 78766

Grant Darnell
Guaranty Energy Corporation
3300 W. Esplanade, Suite 214
Box 18
Metairie, LA 70002

Myron H. Dorfman
Center for Energy Studies
Dept. Petroleum Engineering
University of Texas at Austin
Austin, TX 78712

James B. Cotter
U. S. Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, NV 89114

Alan Davis
Teledyne Geotech
Geophysicist
3401 Shiloh Rd.
Garland, TX 75041

Henry Dunlap
Petroleum Engineering Dept.
University of Texas
P. O. Box 98
Wimberley, TX 78676

Chapman Cronquist
Oil & Gas Consultant
P. O. Box 35070
Houston, TX 77235

Ken E. Davis
Ken E. Davis Associates
3121 Jan Jacinto, Suite 102
Houston, TX 77004

Charles Dunn
Fenix & Scisson
1401 So. Boulder
Tulsa, OK 74119

Neil B. Crow
Lawrence Livermore Laboratory
P. O. Box 808, L-224
Livermore, CA 94550

Stan DeMoss
Louisiana Land & Exploration
225 Baronne Street
New Orleans, LA 70160

Joe Dunphy
News Editor
Chemical Week Magazine
1221 Avenue of Americas
New York, NY 10020

Clay Durham
Magma Gulf Company
30 Highway 6 South, #208
Houston, TX 77079

E. G. H. Emery
Petroleum Engineer ETS Group
Texaco Inc.
Box 457
New Iberia, LA 70560

Scott Ewing
Exxon Production Research
P. O. Box 2189
Houston, TX 77001

Larry R. Durrett
Manager-Testing
Technadril-Fenix & Scisson
3 Northpoint Drive, Suite 200
Houston, TX 77060

Rod Emmer
Coastal Environments, Inc.
1260 Main Street
Baton Rouge, LA 70802

R. R. Faul
Hailliburton Service
365 Canal Street
Suite 2600
New Orleans, LA 70130

Lincoln F. Elkins
Sohio Petroleum Co.
50 Penn Place, Suite 1100
Oklahoma City, OK 73118

Richard Epstein
Amoco Production Co.
P. O. Box 50879
New Orleans, LA 70150

L. L. Faulkner
Battelle Columbus Labs
505 King Avenue
Columbus, OH 43201

Ben A. Eaton
President
Eaton Industries
3104 Edloe, Suite 205
Houston, TX 77027

M. D. "Mike" Erwin
Production Engineer II
Superior Oil
P. O. Box 51108 OCS
Lafayette, LA 70505

D. H. Fessler
Texaco
P. O. Box 52332
Houston, TX 77036

Richard J. Ebens
Manager, Geological Research
Marathon Research Center
P. O. Box 269
Littleton, CO 80160

Archie Estess
Vinson & Elkins
Attorneys At Law
First City National Bank Bldg.
Houston, TX 77002

Donald F. X. Finn
Managing Director
Geothermal Energy Institute
Box 1287
Natchez, MS 39120

Guy R. B. Elliott, President
Los Alamos Consultants
133 La Senda Road
Los Alamos, NM 87544

J. E. Evans
Eaton Operating Co.
3104 Edloe, Suite 205
Houston, TX 77027

John L. Fitch
Group Manager
Mobil R & D Corporation
P. O. Box 900
Dallas, TX 75221

Glenn K. Ellis
U. S. Department of Energy
Manager - Geopressure Program
MS 68025
Washington, D. C. 20585

Orde R. Evans
DOE Consultant
P. O. Box 51301
Lafayette, LA 70505

John A. Fleniken
Ken E. Davis Associates
P. O. Box 80558
Baton Rouge, LA 70898

R. Q. Foote
M.M.S.
P. O. Box 6732
Corpus Christi, TX 73411

Jay Gallia
United Gas Pipeline Co.
Box 1478
Houston, TX 77001

O. W. Girard
U.S.G.S., Geologic Division
National Center, MS 915
12201 Sunrise Valley Drive
Reston, VA 22092

William A. Fowler, Jr.
Staff Specialist
Phillips Petroleum Co.
263 Geoscience Bldg. P.R.C.
Bartlesville, OK 74004

Sabodh K. Garg
Senior Scientist
Systems, Science Software
P. O. Box 1620
La Jolla, CA 92014

Thomas E. Goebel
Program Manager
Technadril-Fenix & Scisson
3 Northpoint Drive, Ste. 200
Houston, TX 77060

David Frederick
Center for Energy Studies
ENS 143
University of Texas
Austin, TX 78712

John Garner
AMF Tuboscope
P. O. Box 808
Houston, TX 77001

Dr. T. Gold
Center for Radial Physics
and Space Research
Cornell University
Ithaca, NY 14853

Keith Frey
FE-30
Germantown
U. S. Department of Energy
Washington, D. C. 20805

Donald W. Garrett
Eaton Operating Co.
3100 Edloe, Suite 205
Houston, TX 77027

Fred Goldsberry
Zapata Exploration Co.
Zapata Tower
P. O. Box 4240
Houston, TX 77210

William L. Gabelmann
R. R. Commission of Texas
P. O. Box 10783
Houston, TX 77018

Ernest C. Geer
Chief Engineer - Process
Transco Energy Co.
Box 1396
Houston, TX 77251

O. N. Goode, Jr.
Vice President - Engineering
R. J. Walker Oil Co., Inc.
3524 N.W. 56th Street
Suite 150
Oklahoma City, OK 73112

Robert K. Gabrysch
U. S. G. S.
2320 La Branch
Houston, TX 77004

Mark S. Gerding
Engineer
Texas Railroad Commission
5397- B DeSoto
Houston, TX 71091

Laurel T. Gorman
Louisiana Geological Survey
P. O. Box G
Baton Rouge, LA 70893

Robert Galbraith
Lawrence Berkeley Lab.
Bldg. 90, Room 1042
Berkeley, CA 94720

J. A. Gilreath
Schlumberger Offshore Svcs.
1555 Poydras, Suite 1800
New Orleans, LA 70112

Doug Graham
Eaton Operating Co.
3104 Edloe, Suite 205
Houston, TX 77027

K. E. Gray
Professor
University of Texas at Austin
Dept. Petroleum Engineering
Austin, Tx 78712

Russell Ham
McNeese State University
Chemical Department
Lake Charles, LA 70609

Bob Harris
Railroad Commission of Texas
P. O. Box 12967
Austin, TX 78711

John Greenip
Hydril Company
3300 North Belt
Box 60458
Houston, TX 77056

Jack Hamilton
Technical Manager-Parcperduee
The Dow Chemical Company
Box 4322
Houston, TX 77210

Adelene Harrison
Regional Administrator
E.P.A.
1201 Elm Street
Dallas, TX 75270

Michael Grimes
Associate Professor
Louisiana State University
105 Hill Memorial
Baton Rouge, LA 70803

Honorable Joe Hanna
Committee of Energy Resources
State of Texas
House of Representative
P. O. Box 2910
Austin, TX 78767

Doug Harrison
Dept. Chemical Engineering
Louisiana State University
105 Hill Memorial
Baton Rouge, LA 70803

Charles G. Groat
Director
Louisiana Geological Survey
Box G, University Station
Baton Rouge, LA 70893

B. E. Hankins
Dean, College of Science
McNeese State University
Lake Charles, LA 70609

J. H. Harrison
Supreme Sugar Co.
P. O. Box 68
Labadieville, LA 70372

Frank R. Groves, Jr.
Professor Chemical Engineering
Louisiana State University
Chemical Engineering Dept.
105 Hill Memorial
Baton Rouge, LA 70803

Margaret Hare
Dresser/Magcobar
601 Jefferson, Suite 2507
Houston, TX 77002

Robert P. Hartley
U. S. EPA
5555 Ridge Avenue
Cincinnati, Ohio 45268

Tom Gustavson
Bureau of Economic Geology
University of Texas at Austin
Austin, TX 78712

Richard C. Harding
Earth Sciences Associates
701 Welch Road
Palo Alto, CA 94304

J. A. Hartman
Shell Oil Company
Box 60124
New Orleans, LA 70160

Mark Haisfield
3638 Adrian St.
New Corralton, MD 20784

Tom Harrell
Law Center
Louisiana State University
105 Hill Memorial
Baton Rouge, LA 70803

Jim Hartsock
Gruy Federal
2500 Tanglewilde, Ste. 150
Houston, TX 77063

Dr. Norman L. Helgeson
Principal Scientist
Biphase Energy Systems
4800 Airport Avenue
Santa Monica, CA 90405

Leo W. Hough
Louisiana State University
611 Centenary Drive
Baton Rouge, LA 70808

C. J. Jenkins
Completion Technology Co.
4200 Westheimer #211
Houston, TX 77027

E. L. Herbst
Holmes & Narver
P. O. Box 14340
Las Vegas, NV 89114

Chieh-Hang Hsieh
Continental Oil Co.
333 R & D W
Ponca City, OK 74601

Cliff Jensen
Texaco, Inc.
Box 430
Bellaire, TX 77401

Robert J. Hester
America Petrofina Co.
1 Houston Center, Ste. 1200
Houston, TX 77002

Evan Hughes
Project Manager
Electric Power Research Inst.
P. O. Box 10412
Palo Alto, CA 94303

Adrian E. Johnson, Jr.
Chemical Engineering Dept.
Louisiana State University
105 Hill Memorial
Baton Rouge, LA 70803

George Higgins
DOW Chemical
Building 566
Midland, MI 48640

Don Hunsater
Oakridge National Labs
Building 2001
Mail Stop 2 - Bcx X
Oak Ridge, TN 37830

Charles E. Jones
General Crude & Oil
P. O. Box 252
Houston, TX 77001

Brian Hodgson
Senior Editorial Staff
National Geographic Magazine
17th & M Streets, N.W.
Washington, D.C. 20036

Peter Hunt
Energy Power Subcommittee
House Annex #2, Room 3217
Washington, D. C. 20515

Nile O. Jones
Holmes & Narver, Inc.
2753 So. Highland Dr.
P. O. Box 14340
Las Vegas, Nevada 89114-4340

Karen Hoffman
Geologist
Magma Gulf
430 Highway 6 South, #208
Houston, TX 77079

Calvin Jackson
U. S. Department of Energy
San Francisco Operations
1333 Broadway
Oakland, CA 94612

P. N. Jugi
CESE Balcores Research Ctr.
University of Texas at Austin
10,100 Barnet Road
Austin, TX 78758-4497

W. D. Horton
Texaco, Inc.
P. O. Box 52332
Houston, TX 77052

Alan Jelacic
Program Manager
MS CE-324
U. S. Department of Energy
1000 Independence Ave., SW
Washington, D. C. 20585

C. Ray Kamman
Petroleum Engineer
Texaco, Inc.
P. O. Box 60252
New Orleans, LA 70160

O. Carroll Karkalits
Dean - Engineering
McNeese State University
Lake Charles, LA 70609

Gary L. Kinsland
Associate Professor Geology
University of SW Louisiana
P. O. Box 44530
Lafayette, LA 70504

Louis Landry
Engineer
Supreme Sugar Company
P. O. Box 68
Labadieville, LA 70372

Dean F. Keeley
Professor of Chemistry
University of SW Louisiana
Box 44250, USL
Lafayette, LA 70504

Richard Klauzinski
Chief Petroleum
Eaton Operating Co.
3104 Edloe, Suite 205
Houston, TX 77027

R. N. Lane
Gruy Federal
2500 Tanglewilde, Ste. 150
Houston, TX 77063

L. R. Kern
Atlantic Richfield Oil Co.
P. O. Box 2819
Dallas, TX 75221

Donald W. Klick
Deputy Chief
Geothermal Research
U. S. G. S.
906 National Center
Reston, VA 22092

Dan A. Langford
Eaton Industries of Houston
3104 Edloe, Suite 205
Houston, TX 77027

Dr. Rashid A. Khalid
Mel Inc. Cons. Engineers
Director, Environ. Sciences
2728 Woodale Bend
Baton Rouge, LA. 70805

Riki Kobayashi
Rice University
P. O. Box 1892
Houston, TX 77001

Jim Laubach
Area Geologist
Conoco, Inc.
P. O. Box 2197
Houston, TX 77252

Billie Kimball
Teledyne-Geotech
3401 Shiloh Road
Garland, TX 75041

Michael Kohn
American Cyanamid Company
10800 River Road
West Wego, LA 70094

Ben Lee
Research & Development
Consolidated Edison Co.
4 Irving Place, Room 1136
New York, NY 10003

Barry Kime
U. S. Govt. Accounting Office
Room A2-2200
Century 21 Building
20020 Century Blvd.
Germantown, MD 20545

Thomas F. Kraemer
Hydrologist
U. S. Geological Survey
Gulf Coast Hydrosience Center
NSTL Station, MS 39529

Linda M. Lee
Earth Sciences Associates
1116 California Avenue
Palo Alto, CA 94306

Edward J. King
Chevron, U.S.A.
P. O. Box 6056
New Orleans, LA 70174

Rufus LaBlanc
P. O. Box 481
Houston, TX 77001

Jeff Leonard
Gulf Publishing
P. O. Box 2608
Houston, TX 77001

Dr. E. Alan Lohse
69 Litchfield Lane
Houston, TX 77024

Alexander Maish
Sandia Laboratory
Box 5800
Albuquerque, NM 87185

Curtis W. McDonald
Texas Southern University
Head, Chemistry Department
3301 Cleborne
Houston, TX 77004

David B. Lombard
Program Manager-MS GB 025
U. S. Department of Energy
Geothermal Hydropower Division
1000 Independence Ave.
Washington, C. D. 20585

Steve Mamerow
Amoco Production Company
P. O. Box 50879
New Orleans, LA 70150

Larry M. McGaughey
Research Assistant
Dept. Civil Engineering
University of Houston
Houston, TX 77004

Bob Loucks
Research Geologist
Cities Service Research
Cities Service Tech. Center
P. O. Box 3908
Tulsa, OK 74102

Ben Marchive
Prod. Engineering Supervisor
Superior Oil
P. O. Box 51108 OCS
Lafayette, LA 70505

Richard E. Mead
Ames Oil & Gas
5051 Western, Suite 1000
Houston, TX 77056

Dr. L. P. Loudon
Louden/Rehm Resource &
Development
1726 Augusta #110
Houston, TX 77057

Dr. Jack V. Matson
Central Campus
College of Civil Engineering
University of Houston
Houston, TX 77004

John Meriwether, Professor
Center for Energy Studies
University of SW Louisiana
P. O. Box 44210
Lafayette, LA 70504

Ed Luper
Bureau of Geology
Subsurface Geologists
P. O. Box 5348
Jackson, MS 39216

C. S. Matthews
Shell Oil Company
P. O. Box 2463
Houston, TX 77001

Richard T. Meyer, Ph D
President
Western Energy Planners, Ltd.
11111 East Mississippi #208
Aurora, CO 80012

Robert L. Macy
Sunedco
12700 Park Central, Ste. 150
Dallas, TX 75251

Fred Mauk
Senior Research Scientist
Teledyne Geotech
P. O. Box 401676
Garland, TX 75040-1676

Walter E. Michalke
Aluminum Company of America
P. O. Box 472
Rockdale, TX 76567

Jeffery Mahan
Senior Scientist
Geraghty & Miller Inc.
844 West Street
Annapolis, MD 21401

Donald McCubbin
Marathon Oil Company
Box 269
Littleton, CO 80160

John Morrison
Bechtel, Inc.
P. O. Box 2166
Houston, TX 77001

Robert Morton
Associate Director
Bureau of Economic Geology
University of Texas at Austin
Box X, University Station
Austin, TX 78712

Robin Neesham
Platts Oilgram
601 Jefferson
Houston, TX 77002

Frank D. O'Brien
Technadril Division
WK Technology, Inc.
9777 Harwin Drive, Suite 408
Houston, TX 77036

L.J.P. Muffler
Program Coordinator
U.S.G.S. MS 90C
345 Middlefield Road
Menlo Park, CA 94025

John Nelson
AMF Tuboscope
P. O. Box 808
Houston, TX 77001

James Oliver
Mechanical Engineering
Louisiana State University
105 Hill Memorial
Baton Rouge, LA 70803

Robert Muller
Institute for Envir. Studies
Louisiana State University
105 Hill Memorial
Baton Rouge, LA 70803

Margaret Nelson
Mustang Production Co.
1100-1st National Center East
Oklahoma City, OK 73102

Franklin Olmstead
U.S.G.S.
345 Middlefield Road
Menlo Park, CA 94025

Joe Mundis
Senior Research Engineer
Cities Service Company
Box 3908
Tulsa, OK 74112

Raymond Netherton
Mechanical Technician
Lawrence Livermore Laboratory
3776 Maderia Way
Livermore, CA 94450

Ken Ortego
Fenix & Scisson
P. O. Box 498
Mercury, NV 89023

V. S. Murty
Texas Southern Univesity
Assistant Prof. Physics
3100 Cleburne
Houston, TX 77023

Edwin Newchurch
Director
Energy Programs Office
Louisiana State University
105 Hill Memorial
Baton Rouge, LA 70803

Dr. Joe Osaba
Petroleum Engineering Dept.
Texas A & M University
College Station, TX 77843

Robert Myers
Chief Engineer
Exchange Oil & Gas Corporation
24th Floor
1250 Poydras Street
New Orleans, LA 70112

Lynn Northrup
4312 Westway
Dallas, TX 75207

Terry Osif
Institute of Gas Technology
3424 South State Street
Chicago, IL 60616

Riley B. Needham
Production Branch Manager
Phillips Petroleum
216 GB - PRC
Bartlesville, OK 74004

Martin Novil
Institute of Gas Technology
3424 South State Street
Chicago, IL 60616

Lawrence B. Owen
Terra Tek
420 Wakara Way
Salt Lake City, UT 84108

Jerrold M. Pachman
Regional Administration &
Economics Manager
Amoco Production Co. (USA)
P. O. Box 50879
New Orleans, LA 70150

Nadir Poonawaza
Institute of Gas Technology
3424 South State Street
Chicago, IL 60616

Andrea W. Reed
Research Assistant
Union Carbide-DOE Oak Ridge
National Lab.
Building 4500 N, D-33
Oak Ridge, TN 37830

Jon Pangborn
Institute of Gas Technology
3424 South State Street
Chicago, IL 60616

David E. Powley
Senior Research Assistant
Amoco Production Co.
P. O. Box 591
Tulsa, OK 74102

Joe Reich
Texaco, Inc.
P. O. Box 430
Bellaire, TX 71401

Kim Peterson
Eaton Operating
3100 Edloe, Suite 205
Houston, TX 77027

Bob Pressey
Marketing Representative
Stone & Webster
P. O. Box 5406
Denver, CO 80217

Fred C. Repper
Vice President Public Affairs
Gulf States Utilities Co.
P. O. Box 2951
Beaumont, TX 77704

P. Eric Peterson
Engineer
Terra Tek
420 Wakana Way
Salt Lake City, UT 84108

Paul Purser
Gulf Universities Research
5909 West Loop South
Bellaire, TX 77401

J. R. Ridgway, Jr.
Senior Consulting Engineer
Houston Lighting & Power
P. O. Box 1700
Houston, TX 77001

D. R. Perry, Jr.
President
D & S Petroleum Consultants
4200 Westheimer
Houston, TX 77027

Steve Ramsey
Holmes & Narver, Inc.
2753 So. Highland Dr.
P. O. Box 14340
Las Vegas, Nevada 89114-4340

T. D. Riney
Vice President
Systems, Science Software
P. O. Box 1620
La Jolla, CA 92038

William A. Poe
Senior Explor. Geologist
Exxon Company, USA
P. O. Box 2180
4550 Dacoma - Room 761
Houston, TX 77001

Phil L. Randolph
Institute of Gas Technology
3424 South State Street
Chicago, IL 60616

Vasel Roberts
Electric Power Research Inst.
P. O. Box 10412
3412 Hillview Avenue
Palo Alto, CA 94303

David M. Poole
Matt Whitney, MS AOB-15
400 M. Street
East Hartford, CT. 06018

Meena Ravipundi
Woodward Clyde Consultants
3 Embarcadero Ct. #700
San Francisco, CA 94111

J. A. Rodgers
2214 Cherry Bend
Houston, TX 77077

R. W. Rodgers
Vice President
Magma Gulf Company
130 Hwy 6 South
Houston, TX 77079

J. O. Salvesson
Division Manager-Geothermal
Chevron Resources Co.
P. O. Box 3722
San Francisco, CA 94119

Peter A. Scholle
Chief, Branch of Oil and
Gas Resources
U.S.G.S.
Box 25046 - MS 934
Denver, CO 80225

Leo A. Rogers
Manager Coproduction Gas/Water
Gas Research Institute
8600 West Bryn Mawr Avenue
Chicago, IL 60631

Kerry D. Savage
Texaco, Inc.
P. O. Box 425
Bellaire, TX 77401

Carolyn Sekula
PetroFinance, Inc.
614 Americana Building
811 Dallas Street
Houston, TX 77002

William A. Romane
Magma Gulf Company
Box 65011
Baton Rouge, LA 70896

L. H. Sawatsky
Geological Engineering Advsr.
Shell Oil Company
Box 60124
New Orleans, LA 70160

John C. Sharer
Assistant Director
Gas Research Institute
8600 West Bryn Mawr
Chicago, IL 60631

Bob Rose
Logging Engineer
Institute of Gas Technology
3424 South State Street
Chicago, IL 60616

John Schatz
Terra Tek, Inc.
420 Wakara Way
Salt Lake City, UT 84108

Dennis F. Sharp
Asst. Division Land Manager
Superior Oil
P. O. Box 51108 OCS
Lafayette, LA 70505

Walter Rose
E G & G Continental Labs.
7700 E. Iliff Avenue
Suite D
Denver, CO. 80231

A. E. Schlemmer
Texas Eastern Corporation
P. O. Box 2521
Houston, TX 77001

Herschell Sheely
Prairie View A & M University
Professor of Engineering
P. O. Box 2404
Prairie View, 77445

Hollie H. Rushing
Michigan Wisconsin Pipe Line
5075 Westheimer, Suite 1100
Galleria Towers West
Houston, TX 77058

George Schnerk
Sun Gas Company
P. O. Box 20
Dallas, TX 75221

Robert C. Shopland
Western Geophysical
P. O. Box 2469
Houston, TX 77001

Ronald Saidikowski
Exxon Production Research Co.
P. O. Box 2189
Houston, TX 77001

Robert Schneider
Center for Energy Studies
Programmer Analyst
University of Texas
Austin, Tx. 78712

John N. Sicking
Exxon Production Research
Box 2189
Houston, TX

W. E. (Gene) Simmons
Completion Technology Co.
200 Westheimer, Suite 211
Houston, TX 77027

Mike Sorrells
Teledyne GeoTech
3401 Shiloh Road
Garland, TX 75228

Tom Stoy
Union Oil Company
4635 Southwest Freeway
Houston, TX 77027

Katherine Sloan
Rice University
Dept. Environmental Science
P. O. Box 1892
Houston, TX 77251

Jill Spross
University of SW Louisiana
P. O. Box 44210
Lafayette, LA. 70504

P. Stryker
INFORM
381 Park Avenue South
New York, NY 10016

Derrell A. Smith
Geological Engineering Advsr.
Shell Oil Company
P. O. Box 60123
New Orleans, LA. 70160

Glen A. Stafford
Project Director
Parsons-Redpath
3040 Riverside Dr.
Columbus, Ohio 43221

R. J. Sullivan
Phillips Petroleum Co.
P. O. Box 1967
Houston, TX 77001

Redd H. Smith
Engineer
Terra Tek Research
420 Wakara Way
Salt Lake City, UT 84104

J. G. Stanley
Project Business Manager
DOW Chemical
400 West Belt S.
Houston, TX. 77042

Glenn Suter
Oak Ridge National Lab
P. O. Box X
Oak Ridge, TN 37830

Wesley W. Smith
Senior Consultant
Ken E. Davis Associates
3121 San Jacinto
Suite 102
Houston, Texas 77004

Ronald T. Stearns
Chief, Measurement & Detection
Nuclear Systems Division
U. S. Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, NV 89114

Ray T. Sutton
Commissioner of Conservation
P. O. Box 44275
Baton Rouge, LA 70804

Robert E. Snyder
Completion Technology Co.
4200 Westheimer, Suite 211
Houston, TX 77027

John Stevens
Mobil G C Corporation
Route 4, Box 199
Dayton, TX 77535

R. K. Swanson
Director Elec. & Physics
Southwest Research Institute
P. O. Drawer 28510
San Antonio, TX 78284

J. W. Soderman
Monsanto Company
1300 Post Oak Tower
5051 Westheimer
Houston, TX 77056

Randall Q. Storm
Project Manager
DOW Chemical
P. O. Box 4322
Houston, TX 77210

Dr. William E. Sweet
USGS, Conservation Division
P. O. Box 7944
Metairie, LA 70010

Perry Tatum
Mudlogging Specialist
5835 West End Blvd.
New Orleans, LA 70124

Mason Tomson
Rice University
Environmental Eng. Dept.
P. O. Box 1892
Houston, TX 77001

Virginia Van Sickle
Louisiana Geological Survey
P. O. Box G
University Station
Baton Rouge, LA 70893

Dan Tearpot
Atwater Consultants, Ltd.
318 Camp Street
New Orleans, LA. 70130

Edward G. Tonn
Crown Zellerbach
1 Bush Street
San Francisco, CA 94104

Linda K. Veal
Research Associate
Center for Energy Studies
Louisiana State University
East Fraternity Circle
Baton Rouge, LA 70803

Kevin Terry
Gulf Exploration & Production
P. O. Box 1635
Houston, TX 77001

William J. Toth
Supervisor Tech. Transfer
EG & G Idaho, Inc.
P. O. Box 1625 WCB E-3
Idaho Falls, Idaho 83415

Saul Vela
Exxon Production Research Co.
P. O. Box 2189
Houston, TX 77001

Elmer A. Thomas
Stone & Webster Engineering
Senior Power Engineer
7501 E. Marvin Drive
Englewood, CO 80100

Drukell Trahan
Research Geologist
Louisiana Geological Survey
Box G University Station
Baton Rouge, LA 70893

Roxie Voran
Texaco, USA
P. O. Box 430
Bellaire, TX 77401

Mike Thomasso
Odyssey Exploration
8584 Katy Freeway, Suite 401
Houston, TX 77024

Barbara L. Turner
Bechtel Civil & Minerals
P. O. Box 3965
San Francisco, CA 94119

Sid Walker
Eaton Operating Co.
3100 Edloe, Suite 205
Houston, TX 77027

T. William Thompson
Associate Professor
Dept. Petroleum Engineering
University of Texas at Austin
Austin, TX 78712

L. J. Tydlaska
Amoco Production Co.
P. O. Box 50879
New Orleans, LA 70150

Raymond H. Wallace, Jr.
Hydrologist
U.S.G.S. - WRD
Gulf Coast Hydrosience Ctr.
NSTL Station, MS 39529

Larry Thorne
Transco
P. O. Box 1396
Houston, TX 77001

Tony Usibelli
Building 90
Room 3125
Lawrence Berkeley Lab.
Berkeley, CA 94720

Carol Wallin
Librarian
Center for Energy Studies
University of Texas at Austin
Austin, TX 78712-1084

Sheldon Watsky
Manager, Frontier Production
Penneco Oil Exploration
P. O. Box 2511
Houston, TX 77001

Ronald E. Wilcox
Associate Professor
Institute for Environmental
Studies
P. O. Box 17140A
Baton Rouge, LA 70893

Lewis A. Wilson
Middle South Services
P. O. Box 61000
New Orleans, LA 70161

Ernest Watson
Sun Gas Company
P. O. Box 20
Dallas, TX 75221

Bert Wilkins, Jr.
Consulting Engineer
Bert Wilkins & Associates
10341 Parkview Drive
Baton Rouge, LA 70815

Charles Winkler
Department of Geoscience
University of Arizona
Tucson, AZ 85721

J. Warren Webb
Environmental Science Div.
Oak Ridge National Lab
Oak Ridge, TN

Huw Williams
University of Texas at Austin
Research Assistant
1701 B. W. Braker Lane
Austin, TX 78758

Weldon Winsauer
Exxon
P. O. Box 2180
Houston, TX 77001

Oleh Weres
Staff Scientist
Lawrence Berkeley Laboratory
1 Cyclotron Road, 50A-1140
Berkeley, CA 94720

Ernest Williams
Weintritt Testing Lab.
P. O. Box 30162
Lafayette, LA

Doug Wolters
Eaton Operating Co.
3100 Edloe, Suite 205
Houston, TX 77027

Keith Westhusing
Chief, Gas Research Branch
Division of Extraction
U. S. Department of Energy
B.E.T.C.
P. O. Box 1398
Bartlesville, OK 74003

John R. Williams
Professor
Prairie View A & M University
Department of Chemistry
Prairie View, TX 77445

H. P. Woods
Engineering Associate
Exxon Research & Engineering
P. O. Box 101
Florham Park, NJ 07932

James White
Program Manager
UGR FE-33
U. S. Department of Energy
Washington, D. C. 20545

Gary V. Wilson
Geologist
Geological Survey of Alabama
P. O. Drawer O
University, AL 35436

R. E. (Earle) Wright
Texaco, Inc.
P. O. Box 52332
Houston, TX 77052

William A. White
Bureau of Economic Geology
University of Texas at Austin
Austin, Texas 78712

John S. Wilson
DOW Chemical
P. O. Box 53073
Lafayette, LA 70505

Fred M. Wrighton
Energy Programs Office
Louisiana State University
105 Hill Memorial
Baton Rouge, LA 70803

Jack Yates
Bechtel National Lab.
50/15 B 18
P. O. Box 3965
San Francisco, CA 94110

Ron Youngblood
Schlumberger
2-3-4 Loyola Bldg.
Suite 1010
New Orleans, LA 70112

Rick Zimmerman
GURC
5909 West Loop South
Suite 600
Bellaire, TX 77401

Edward X. Zuniga
U. S. Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

ATTENDEES OF DOE/INDUSTRY GEOPRESSURED GEOTHERMAL
ENERGY FORUMS

It should be noted this attendee list is in alphabetical order by individual name, followed by company affiliation. This list represents forums attended from June 1981 through June 1983.

Robert K. Aaher
Manager-Geology
Conoco
Box 2197
Houston, TX 77001
(713) 965-1287

Foster H. Abney, President
WK Technology, Inc.
9777 Harwin Drive, Ste.408
Houston, TX 77036
(713) 266-6411

K. L. Ancell
Intercomp
Manager- Gas Project
1201 Dairy Ashford
Houston, TX 77079
(713) 497-8400

Sharda Arya
Assistant Professor
Texas Southern University
3100 Cleburne
Houston, TX 77023
(713) 527-7131

Ann Bachman
Louisiana State University
Sr. Research Associate
Energy Programs Office
105 Hill Memorial
Baton Rouge, LA 70803
(504) 388-6094

Ami Banker
Louisiana State University
Graduate Assistant
Dept. of Chemical Engineering
Baton Rouge, LA 70803
(504) 388-1426

Zaki Bassiouni
Dept. of Petroleum Engineering
Louisiana State University
Associate Professor
105 Hill Memorial
Baton Rouge, LA 70803
(504) 388-5215

Don Bebout
Louisiana Geological Survey
P. O. Box G
University Station
Baton Rouge, LA 70893
(504) 342-6759

Robert I. Benner
Sun Gas Company
Director, Technology
P. O. Box 20
Dallas, TX 75221
(214) 739-7875

Jonne Berning
Operation & Testing Manager
Technadril
9700 Harwin
Houston, TX 77036
(713) 439-9976

Michael Birch
Natural Gas Pipeline Company
Research Geologist
122 South Michigan Avenue
Chicago, Illinois 60603
(312) 431-7538

Howard Blumhardt
Project Manager
Fenix & Scisson, Inc.
Pleasant Bayou
Rt. 7, Box 693
Alvin, TX 77511
(713) 393-1354

Dale R. Carver
Louisiana State University
Professor
Energy Programs Office
105 Hill Memorial
Baton Rouge, LA 70803
(504) 388-6816

J. Donald Clark
Consulting Petroleum Engineer
5959 West Loop South,
Suite 232
Bellaire, TX 77401
(713) 666-8895

Larry E. Coble
Manager, Res. Engineering Dist.
Otis Engineering
P. O. Box 34380
Dallas, TX 75075
(214) 323-3256

Hank Coffey, President
C. K. GeoEnergy Corporation
3376 South Eastern, Suite 145
Las Vegas, NV 89109
(702) 737-7570

Larry L. Cole
Associate Professor & Director
Prairie View A & M University
P. O. Box 2787
Prairie View, TX 77445
(709) 857-3914

D. A. Danielson
Texaco, USA
Senior Explor. Geologist
Box 60252
New Orleans, LA 70160
(504) 595-1999

Grant Darnell
Amoco Production Company
Drilling Engineering Associate
P. O. Box 50879
New Orleans, LA 70150
(504) 586-6153

Alan Davis
Geophysicist
Teledyne Geotech
3401 Shiloh Rd.
Garland, TX 75041
(214) 271-2561

Mark Doherty
Manager
Institute of Gas Technology
3424 S. State Street
Chicago, IL 60616
(312) 567-5861

George Domahidy
Supervisor Process Engineering
Stone & Webster
P. O. Box 5406
Denver, CO 80217
(303) 770-7700 Ext.2249

Myron Dorfman
University of Texas at Austin
Dept of Petroleum Engineering
PEB 211
Austin, TX 78712
(512) 471-1162

Henry F. Dunlap
University of Texas
Petroleum Engineering Dept.
Adjunct Professor
P. O. Box 98
Wimberley, TX 78676
(512) 847-2520

Clay Durham, President
Magma Gulf Co.
430 Highway 6 South, 208
Houston, TX 77079
(713) 870-1480

Larry R. Durrett
Manager-Testing
Technadril-Fenix & Scisson
3 North Point Drive, Suite 200
Houston, TX 77060
(713) 999-6464

Ben A. Eaton
President
Eaton Operating Company
3104 Edloe
Houston, TX 77027
(713) 627-9764

Guy R. B. Elliott, President
Los Alamos Consultants
133 LaSenda Road
Los Alamos, NM 87544
(505) 672-3603

Rod Emmer
Coastal Environments, Inc.
Partner
1260 Main Street
Baton Rouge, LA 70802
(504) 383-7455

L. L. Faulkner
Battelle Columbus Laboratories
Projects Manager
505 King Avenue
Columbus, Ohio 43201
(614) 424-5280

Sabodh K. Garg
Senior Scientist
Systems, Science Software
P. O. Box 1620
LaJolla, CA 92014
(714) 481-8609

Ernest C. Geer
Chief Engineer - Process
Transco
P. O. Box 1396
Houston, TX 77251
(713) 439-2333

Mark S. Gerding
Engineer
Texas Railroad Commission
5387-B DeSoto
Houston, TX 77091
(713) 683-3461

Fred L. Goldsberry, Director
Geopressure Projects Office
U. S. Department of Energy
3 Northpoint Drive, Ste. 200
Houston, TX 77060
(713) 999-0745

Laurel T. Gorman
Louisiana Geological Survey
Research Geologist
P. O. Box G
University Station
Baton Rouge, LA 70893
(504) 388-6940

A. T. Green, President
Green Exploration Company
626 Girod Bldg., Ste 200
New Orleans, LA 70130
(504) 523-6521

Michael D. Grimes
Louisiana State University
Associate Professor
105 Hill Memorial
Baton Rouge, LA 70803
(504) 388-1645

C. G. Groat
Louisiana Geological Survey
Director & State Geologist
Box G, University Station
Baton Rouge, LA 70893
(504) 342-6754

Frank R. Groves, Jr.
Louisiana State University
Professor, Chemical Engineering
Chemical Engineering Dept.
105 Hill Memorial
Baton Rouge, LA 70803
(504) 388-1426

William Hackenbracht
C. K. GeoEnergy Corporation
Attorney-Geologist
3376 South Eastern, Suite 145
Las Vegas, NV 89109
(702) 737-7570

Jack Hamilton
Dow Chemical
Senior Geologist
Box 4322
Houston, TX 77210
(713) 978-3830

B. E. Hankins
McNeese State University
Dean, College of Science
Lake Charles, LA 70609
(318) 474-0157

Margaret Hare
Dresser/Magcobar
Acct. Representative
601 Jefferson, Suite 2507
Houston, TX 77002
(714) 750-3781

Jackson E. Harrar, L.325
Lawrence Livermore Lab
Chemist
P. O. Box 808
Livermore, CA 94550
(415) 422-6367

Christopher G. Hayden
Institute of Gas Technology
Chemist
3424 South State Street
Chicago, IL 60616
(312) 567-5868

George Higgins
Research Lender
Dow Chemical Company
Bldg. 566
Midland, MI 48640
(517) 636-6773

Karen Hoffman
Magma Gulf Company
Geologist
430 Highway 6 South, #208
Houston, TX 77079
(713) 870-1480

Bob Holliday
Department of Energy
Program Manager
MS 7124 Federal Building
12th & Penn
Washington, D.C. 20461
202) 633-9471

Evan Hughes
Project Manager
Electric Power Research Inst.
P. O. Box 10412
Palo Alto, CA 94306
(415) 855-2179

Adrian E. Johnson, Jr.
Louisiana State University
Professor, Chemical Engineering
Chemical Engineering Dept.
105 Hill Memorial
Baton Rouge, LA 70803
(504) 388-1426

O. Carroll Karkalits
McNeese State University
Dean - Engineering
Lake Charles, LA 70609
(318) 478-8070

Dean F. Keeley
University of SW Louisiana
Professor of Chemistry
Box 44250, USL
Lafayette, LA 70504
(318) 231-5671

Dr. Rashid A. Khalid
Director, Environ. Services
Mel Inc. Consulting Engineers
2728 Wooddale Blvd.
Baton Rouge, LA 70805
(504) 927-7240

Gary L. Kinsland
University of SW Louisiana
Associate Professor - Geology
P. O. Box 44530
Lafayette, LA 70504
(318) 231-6824

Dick Klauzinski
Eaton Operating Company
Chief Petroleum Engineer
3104 Edloe, Suite 205
Houston, TX 77027
(713) 627-9764

Carroll F. Knutson
Executive Vice President
C. K. GeoEnergy Corporation
3367 S. Eastern Ave., Ste. 145
Las Vegas, NV 89109
(702) 737-7570

Thomas F. Kraemer
Hydrologist
U. S. G. S.
Gulf Coast Hydrosience Ctr.
NSTL Station, MS 39529
(601) 688-1501

Dan A. Langford
Eaton Operating Company
Deputy Project Manager
3104 Edloe, Suite 205
Houston, TX 77027
(713) 627-9764

Jim Laubach
Area Geologist
Conoco, Inc.
P. O. Box 2197
Houston, TX 77252
(713) 965-2416

Linda M. Lee
Earth Sciences Associates
Geologist
1116 California Ave.
Palo Alto, CA 94306
(415) 321-3071

Dave Lombard
Program Manager - MS GB025
U. S. Department of Energy
Geothermal Hydropower Division
Washington, D. C. 20585
(202) 252-8070

Dr. L. R. Loudon
President
Louden/Rehm Resource &
Development Corp.
1726 Augusta #110
Houston, TX 77057
(713) 789-2274

James Malott
C. K. GeoEnergy Corporation
Consultant
2929 Buffalo Speedway, #603
Houston, TX 77098
(713) 961-1911

Jack Matson
Associate Professor
University of Houston
Civil Engineering
Houston, TX 77004
(713) 749-1348

Charles Matthews
Sr. Petroleum Eng. Consultant
Shell Oil Company
P. O. Box 2463
Houston, TX 77001
(713) 241-4097

Fred Mauk
Teledyne Geotech
Senior Research Scientist
P. O. Box 401676
Garland, TX 75040-1676
(214) 231-2561

Curtis W. McDonald
Head, Chemistry Department
Texas Southern University
3301 Cleburne
Houston, TX 77004
(713) 527-7003

John R. Meriwether, Professor
University of SW Louisiana
P. O. Box 44210
Lafayette, LA 70504
(318) 231-6691

Robert A. Morton
Bureau of Economic Geology
Associate Director
Box X, University Station
Austin, TX 78712
(512) 471-7721

Joe Mundis
Cities Service Company
Senior Research Engineer
Box 3904
Tulsa, OK 74112

V. S. Murty
Asst. Professor Physics
Texas Southern University
3100 Cleburne
Houston, TX 77023
(713) 527-7131

Robert E. Myers
Exchange Oil and Gas Corp.
Chief Engineer
24th Floor 1250 Poydras
New Orleans, LA. 70112
(504) 581-4111

Raymond Netherton
Lawrence Livermore Lab
Mechanical Technician
3776 Madeira Way
Livermore, CA 94550
(415) 447-9385

Edwin J. Newchurch
Louisiana State University
Director
Energy Programs Office
105 Hill Memorial
Baton Rouge, LA 70803
(504) 388-6094

Frank O'Brien
General Manager
WK Technology Inc.
9777 Harwin Dr.
Suite 408
Houston, TX 77036
(713) 266-6411

John E. Oddo
Rice University
Research Assistant
Dept. of Environ. Science
Houston, TX 77001
(713) 527-4951

Larry Owen
Terra Tek, Inc.
Program Manager
420 Wakara Way
Salt Lake City, UT 84108
(801) 584-2424

Carl Patton
Prairie Canal
Vice Pres. & General Manager
P. O. Box 1048
Lake Charles, LA 70602
(318) 439-8836

D. Raymond Perry, Jr.
President
D & S Petroleum Consultants
4200 Westheimer, #201
Houston, TX 77027
(713) 629-7770

Kim P. Peterson
Eaton Operating Co.
Geological Manager
3104 Edloe, Suite 205
Houston, TX 77027
(713) 627-9764

P. Eric Peterson
Engineer
Terra Tek
420 Wakana Way
Salt Lake City, UT 84108
(801) 584-2400

Bob Pressey
Marketing Representative
Stone & Webster
P. O. Box 5406
Denver, CO 80217
(303) 770-7700

Arthur J. Pyron
Technadril
Chief Geologist
3 North Point, Suite 200
Houston, TX 77088
(713) 627-9764

P. L. Randolph
Institute of Gas Technology
3424 S. State Street
Chicago, Illinois 60616
(312) 567-3766

Joe Mundis
Cities Service Company
Senior Research Engineer
Box 3904
Tulsa, OK 74112

Joe Reich
Texaco, Inc.
Coordinator
P. O. Box 430
Bellaire, TX 71401
(713) 666-8000 ext. 2939

J. R. Ridgway
Sr. Consulting Engineer
Houston Lighting & Power Co.
P. O. Box 1700
Houston, TX 77036
(713) 481-7597

T. David Riney
Vice President
S-Cubed
P. O. Box 1620
LaJolla, CA 92038
(619) 453-0060

W. H. Roberts III
Senior Tech. Staff
Gulf Oil E & P Co.
Box 36506
Houston, TX 77236
(713) 754-0193

John A. Rodgers
Consultant
2214 Cherry Bend
Houston, TX 77077
(713) 496-5463

R. W. Rodgers
Vice President
Magma Gulf Co.
430 Hwy 6 South, Suite 208
Houston, TX 77079
(713) 870-1480

Leo A. Rogers
Gas Research Institute
8600 West Bryn Mawr
Chicago, IL 60631
(313) 399-8269

Walter Rose
Vice President
EG&G Continental Labs
7700 E. Iliff, Suite D
Denver, CO. 80231
(303) 751-0180

Kerry D. Savage
Senior Research Association
Texaco, Inc.
P. O. Box 425
Bellaire, TX 77401
(713) 666-8000

A. E. Schlemmer
Texas Eastern Corporation
Research Advisor
P. O. Box 2521
Houston, TX 77001
(713) 759-5466

Robert Schneider
Programmer Analyst
Center for Energy Studies
University of Texas
Austin, TX 78712
(512) 471-4946

George Schnerk
Sun Gas Company
Project Engineer
P. O. Box 20
Dallas, TX 75221

Carolyn Sekula
Executive Assistant
Petrofinance, Inc.
811 Dallas St., Suite 614
Houston, TX 77002
(713) 658-1108

John Sharer
Gas Research Institute
Assistant Director
8600 West Bryn Mawr
Chicago, IL 60631
(312) 399-8218

Herschell Sheely
Prof. of Engineering
Prairie View A & M University
P. O. Box 2404
Prairie View, TX 77445
(409) 857-3923

Katherine Sloan
Rice University
Research Assistant
Dept. of Environmental Sciences
P. O. Box 1892
Houston, TX 77251
(713) 527-8108 Ext 2606

Redd H. Smith
Engineer
Terra Tek Research
420 Wakara Way
Salt Lake City, UT 84108
(801) 584-2400

Mike Sorrells
Teledyne Geotech
Technical Director
3401 Shiloh Road
Garland, TX 75228
(214) 271-2561

J. G. Stanley
Project Business Manager
Dow Chemical Company
400 West Belt S.
Houston, TX 77042
(713) 987-3617

Ronald T. Stearns
Chief, Geothermal Branch
Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, NV 89114
(702) 734-3424

Winnie Stoberski
C. K. GeoEnergy Corporation
Administrative Assistant
3376 S. Eastern Avenue
Las Vegas, NV 89109
(702) 737-7570

Randall O. Storm
Project Manager
Dow Chemical Company
P. O. Box 4322
Houston, TX 77210
(713) 978-3616

Kevin Terry
Gulf Oil
Senior Geologist
P. O. Box 1635
Houston, TX 77001
(713) 754-1948

Elmer A. Thomas
Sr. Power Engineer
Stone & Webster Engineering
7501 E. Marin Drive
Englewood, CO 80110
(303) 770-7700

T. William Thompson
Associate Professor
University of Texas
Dept. of Petroleum Engineering
Austin, TX 78712
(512) 471-3884

Larry E. Thorne
Transco Energy
Corporate Attorney
P. O. Box 1396
Houston, TX 77001
(713) 871-2326

Mason Tomson
Rice University
Environmental Engineering
P. O. Box 1892
Houston, TX 77001
(713) 527-4951

Edward G. Tonn
Crown Zellerbach
Assistant Vice President
1 Bush Street
San Francisco, CA 94104
(415) 823-5240

Drukell B. Trahan
Louisiana Geological Survey
Research Geologist
P. O. Box G
Baton Rouge, LA 70893
(504) 342-6754

Virginia Van Sickle
Assistant to Director
Louisiana Geological Survey
P. O. Box G
University Station
Baton Rouge, LA 70893
(504) 342-6754

Roxie L. Voran
Texaco, U.S.A.
Petroleum Geologist
P. O. Box 430
Bellaire, TX 77401
(713) 666-8000

Nora Lee Walker
Rice University
Technician
Dept. of Environ. Engineering
Box 1892
Houston, TX 77001
(713) 527-8108 Ext.2397

Raymond H. Wallace, Jr.
U.S.G.S., WRD
Hydrologist
Gulf Coast Hydrosience Ctr.
NSTL Station, MS 39529
(601) 688-1502

Oleh Weres
Staff Scientist
Lawrence Berkeley Laboratory
1 Cyclotron Road, 50A-1140
Berkeley, CA 94720
(415) 486-5625 FTS 451-5625

Keith Westhusing
Department of Energy
Deputy Director
B.E.T.C.
P. O. Box 1398
Bartlesville, OK 74003
(918) 337-4206

Huw Williams
Research Asst/Gr. Student
University of Texas at Austin
1701 B. W. Braker Ln.
Austin, TX 78758
(512) 835-9217

John R. Williams
Professor
Prairie View A & M University
Department of Chemistry
Prairie View, TX 77445
(409) 857-3910

John S. Wilson
Dow Chemical
Project Manager
P. O. Box 53073
Lafayette, LA 70505
(318) 856-7223

Fred M. Wrighton
Louisiana State University
Senior Research Associate
Energy Programs Office
105 Hill Memorial
Baton Rouge, LA 70803
(504) 388-6094

Ron Youngblood
Schlumberger
Sales Engineer
2-3-4 Loyola Bldg. Suite 1010
New Orleans, LA 70112
(504) 586-8666

Ed Zuniga
Petroleum Engineer
U. S. Dept. of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, NV 89114
(702) 734-3424

MAJOR OIL AND GAS COMPANIES

Amoco Production Co.

Grant Darnell

Cities Service Oil

Joe Mundis

Conoco, Inc.

Robert K. Aaher
Jim Laubach

Gulf Exploration

W. H. Roberts III

Gulf Oil

Kevin Terry

Houston Lighting & Power

J. R. Ridgway

Natural Gas Pipeline Co.

Michael Birch

Shell Oil Company

Charles Matthews

Sun Gas Company

Robert I. Benner
George Schnerk

Texaco, Inc.

D. A. Danielson
Joe Reich
Kerry Savage
Roxie Voran

Texas Eastern Corporation

A. E. Schlemmer

Transco

Ernest C. Geer
Larry Thorne

MAJOR INDUSTRIAL FIRMS

Battelle Columbus Labs

L. L. Faulkner

Dow Chemical Co.

Jack Hamilton
George Higgins
James G. Stanley
Randall Storm
John S. Wilson

Dresser-Magcobar

Margaret Hare

EG & G Continental Labs

Walter Rose

Schlumberger

Ron Youngblood

Stone & Webster

George Domahidy
Bob Pressey
Elmer A. Thomas

Teledyne

Alan Davis
Fred Mauk
Billie Kimball
Mike Sorrels

Union Carbide-DOE/Oakridge Nat'l Lab

Andrea Wargo Reed

INDEPENDENT (SMALL) OIL AND GAS COMPANIES

Exchange Oil and Gas Corp.

Robert Myers

Green Exploration

A. T. Green

Louden/Rehm Resources & Development Co.

Dr. L. R. Louden

INDUSTRY SUPPORTED RESEARCH INSTITUTES

Electric Power Research Institute

Evan Hughes

Gas Research Institute

Leo A. Rogers
John Sharer

SMALL BUSINESS

Coastal Environments

Rod Emmer

Earth Sciences Associates

Linda M. Lee

DOE CONTRACTORS

C. K. GeoEnergy Corporation

Henry F. Coffey
William N. Hackenbrach
Carroll F. Knutson
James P. Malott
Winnie Stoberski

Crown Zellerbach

Ed Tonn

Eaton Operating Company

Ben A. Eaton
Richard Klauzinski
Dan A. Langford
Kim Peterson

Fenix & Scisson

Howard Blumhardt

Institute of Gas Technology

Mark Doherty
Christopher G. Hayden
Phil Randolph

Intercomp

K. L. Ancell

Louisiana State University

Ann Bachman
Ami Banker
Zaki Bassiouni
Michael Grimes
Frank R. Groves, Jr.
Adrian Johnson
Edwin J. Newchurch
Dru Trahan
Fred M. Wrighton

Magma Gulf

Clay Durham
Karen Hoffman
R. W. Rodgers

McNeese University

B. E. Hankins
O. Carroll Karkalits

Otis Engineering

Larry E. Coble

Prairie Canal

Carl Patton

Prairie View A & M University

Larry L. Cole
Herschell Sheely
John R. Williams

Rice University

John Oddo
Katherine Sloan
Mason Tomson
Nora Lee Walker

S-Cubed

T. Dave Riney
Sabodh Garg

Southern University

Sharda Arya

Technadril, Inc.

Jonne Berning
Arthur J. Pyron

(DOE CONTRACTORS continued)

Technadril-Fenix & Scisson

Larry Durrett

Terra-Tek

Larry Owen
P. Eric Peterson
John Schatz
Redd Smith

Texas Southern University

Curtis W. McDonald
V. S. Murty

University of Houston

Jack V. Matson

University of SW Louisiana

Dean F. Keeley
Gary L. Kinsland
John Meriwether

University of Texas-Austin

Myron H. Dorfman
Henry F. Dunlap
Robert Schneider
T. William Thompson
Huw Williams

WK Technology, Inc.

Foster H. Abney
Frank O'Brien

FEDERAL GOVERNMENT AGENCIES

Department of Energy

Fred L. Goldsberry
Robert Holliday
Dave Lombard
Ronald T. Stearns
Keith Westhusing
Ed Zuniga

Lawrence Berkeley Laboratory

Oleh Weres

Lawrence Livermore National Laboratory

Jackson Harrar
Raymond Netherton

U. S. Geological Survey

Thomas F. Kraemer
Raymond H. Wallace, Jr.

STATE AGENCIES

Bureau of Economic Geology

Robert Morton

Louisiana Geological Survey

Don Bebout
Laurel T. Gorman
G. Chip Groat
Virginia Van Sickle

Railroad Commission of Texas

Mark Gerding

INTERESTED PARTIES

Consultants

J. Don Clark
Guy R. B. Elliott
Dr. Rashid A. Khalid
D. Raymond Perry
John A. Rogers