

**FISCAL YEAR 1992
ANNUAL OPERATING PLAN
FOR THE
GEOPRESSURED-GEOTHERMAL RESEARCH PROGRAM
(\$4.3 MILLION BUDGET)**

**August 1991
Modification 1**

**Prepared By
Idaho National Engineering Laboratory**

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**For
U.S. Department of Energy
Geotechnology Programs
and
Idaho Operations Office**

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EXECUTIVE SUMMARY

This plan describes the Geopressured-Geothermal Research Program. A geopressured well in Texas (Pleasant Bayou) will undergo a ^{slow test and a} pressure buildup test. A geopressured well in Louisiana (Gladys McCall) ^{will be} flow tested for a short period, logged, plugged and abandoned or turned over to industry ^{early} in FY-92. A second deep geopressured well in Louisiana, the Hulin Well, is being *Kept on standby.* RF

Related university research in geology, numerical reservoir modeling, subsidence, microseismicity, and water quality will continue, with program data reviews initiated in appropriate areas. Increased emphasis on integrated reservoir engineering will be implemented. The well activities coupled with the related university research are designed to improve the ability to forecast reservoir productive capacity, to verify the reliability of the resource as a long-term energy resource, and to determine the environmental effects of long-term production. By these means, the Geopressured-Geothermal Research Program is developing a solid technology base that private industry can use to evaluate the geopressured- geothermal resource. The Industrial Consortium for utilization of the resource will be continued. Use projects in Louisiana and Texas will be evaluated. A geopressured reservoir review will be *managed* by RF

INEL. The DOE Field Office, Idaho will make preparations to complete the Program.

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INTRODUCTION

1.1 Geopressured-Geothermal Objectives at the Category Level

The category objective for Geopressured-Geothermal research is to improve the technology to the point where electricity could be produced commercially from a substantial number of geopressured resource sites via wells of opportunity. In some instances, industry may decide to sell only methane and thermal energy.

The present Geopressured-Geothermal Program is scheduled to be completed in FY-1993 with environmental monitoring extending into FY-1994. This will involve completing the testing and analysis at all three well sites and Plugging and Abandoning the wells. In addition, the present university research will be completed in FY-1993. The goal of this long standing program was to determine this vast energy resource. To that goal, three wells have been produced. Two of the wells have been produced in excess of three years. This data has been used by researchers to produce reservoir models and geopressured markers which can be used by future developers. In addition, a 1 MWe Hybrid Power System was designed, constructed, and tested under using the geopressured resource from the Pleasant Bayou reservoir.

1.2 Strategy Statement

The research program focuses on relatively narrow technical issues unique to geopressured resources, such as development of a capability to predict reservoir productive capacity based on preliminary flow tests.

1.3 Program Background Information

For a variety of reasons, thousands of oil and gas wells have been abandoned in the Gulf Coast region. Many of those wells penetrated geopressured zones whose resource potential was undervalued or ignored. It is possible that in some instances the research may provide a basis for extension of the economic lives of some depleted or dry hydrocarbon wells, if those wells are recompleted as geopressured wells.

1.4 Scientific Approach

The technical feasibility of extracting geopressured fluids has been demonstrated at a number of wells in Louisiana and Texas. Research to date has shown that the geopressured-geothermal resource is large and widespread; it is saturated or nearly saturated with methane; and it can be produced, used, and the residual brines disposed of with minimal operational and environmental problems. However, several technical and economic questions still remain. These are the focus of the present research program. The research and development is concentrated on:

- Conducting and analyzing flow tests of geopressured wells to ascertain reservoir drive parameters and operating conditions.
- Improving system control and energy conversion technology to optimize the rates and economics of energy extraction.

1.5 Justification

The U.S.G.S. estimates that sandstone aquifers onshore along the Gulf of Mexico Coast contain 5700 quads of methane and > 73,000 quads of thermal energy. Development of a solid technology base will enable private industry to evaluate the geopressured-geothermal resource as part of a balanced and mixed set of energy resource options for future energy market places.

1.6 Key Task Objectives

The category objective for geopressured-geothermal research is to improve the technology to the point where energy could be produced commercially from a substantial number of geopressured resource sites via wells of opportunity. The task objectives related to this category objective are covered in the following.

1.6.1 Well Operations Task:

The task objectives for Well Operations are:

Prove the long term injectability of large volumes of spent fluid at multiple sites by 1992.

Develop surface fluid handling facilities (pumps, separators, valves, compressors, etc.) which can be safely operated from a remote monitoring location by 1993.

Develop material specifications, equipment specifications, and maintenance procedures which will allow over 95% annual availability with only annual shutdown for routine maintenance by 1993.

1.6.2 Geoscience and Engineering Support Task

The task objective for Geoscience and Engineering Support is:

Develop techniques to increase confidence in the ability to locate and evaluate geopressured-geothermal resources by 1992 such that at least 90 percent of wells recompleted for geopressured - geothermal development are subsequently shown to be economic.

Determine the drive mechanisms for the design of well reservoirs by 1992.

Determine source and flow mechanisms for the liquid hydrocarbons and methane being obtained from producing geopressured reservoirs by 1992.

Develop a test procedure which has sufficient accuracy to predict the capability of any geopressured reservoir to be produced for a period five times as long as the test period by 1993.

Determine if fluids can be disposed of in an environmentally acceptable manner by 1995.

1.6.3 Energy Conversion Task

The task objective for Energy Conversion is:

Develop conversion technology with thermal efficiency at 20% greater than that from separate combustion and geothermal power cycles by 1992.

This task has been completed.

1.6.4 Management Task

The task objective for management is: Supply management and technical support to DOE-ID.

1.7 Work Breakdown Structure

Category: Geopressured-Geothermal

Task: Well Operation

- Project: Gladys McCall (Completed)
- Project: Pleasant Bayou
- Project: Hulin

Task: Geoscience and Engineering

- Project: Rock Mechanics (Completed) *RZ*
- Project: Liquid Hydrocarbons ~~(Continue at Hulin if flow test beings)~~
- Project: Reservoir Engineering
- Project: Logging (Completed)
- Project: Environmental Assessment

Task: Energy Conversion

- Project: Pleasant Bayou Hybrid Power System Testing (Completed)

Task: Management Support

- Project: General Administration
- Project: Alternative Use
- Project: Technology Transfer to Industry

Develop conversion technology with thermal efficiency at 20% greater than that from separate combustion and geothermal power cycles by 1992.

This task has been completed.

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1.7 Work Breakdown Structure

Category: Geopressured-Geothermal

Task: Well Operation

- Project: Gladys McCall (Completed)
- Project: Pleasant Bayou
- Project: Hulin

Task: Geoscience and Engineering

- Project: Rock Mechanics (Completed)
- Project: Liquid Hydrocarbons (Continue at Hulin if flow test beings)
- Project: Reservoir Engineering
- Project: Logging (Completed)
- Project: Environmental Assessment

Task: Energy Conversion

- Project: Pleasant Bayou Hybrid Power System Testing (Completed)

Task: Management Support

- Project: General Administration
- Project: Alternative Use
- Project: Technology Transfer to Industry

2.0 PRIOR YEAR DATA

2.1 Well Operations Task

2.1.1 Task Description and Overview:

Three Gulf Coast geopressured-geothermal wells are being utilized to obtain information on reservoir performance under production conditions, surface handling systems, disposal well injection procedures, brine chemistry and scale inhibitor treatment, and automation. The well operations data are utilized by the universities in reservoir modeling, brine chemistry, and cryocondensate research. Complete pressure buildups and short-term flow test at Gladys McCall design well, P & A or turn over to industry. Commence high flow rate flow test (30,000 bpd) at Pleasant Bayou design well with the future plan to pass to industry, ~~or use as test bed for industry energy conversion projects.~~ *RZ* Ready Hulin well for flow test and place on standby.

2.1.2-3 Funding and Manpower:

	Funding <u>(\$)</u>	Manpower <u>(man/yr)</u>
FY-90	3,393K	15.0
FY-91	3,374K	15.0

2.1.4 Accomplishments:

For the Pleasant Bayou site in Texas: Significant FY-89, FY-90, and FY-91 accomplishments are:

- Pleasant Bayou surface facilities were constructed and flow testing begun. Tests 1-15 detailed in FY-88 AOP have been completed, and Test 23 is on-going.
- The Hybrid Power System was successfully tested for eight months.

- Scaling and corrosion have been successfully monitored and controlled.
- Eaton has operated the Pleasant Bayou production well over 99% of the available time for the fiscal year. Rates have been up to over 25,000 BPD.
- The scale inhibitor squeezes done on the Pleasant Bayou production well have been very successful. As of April, the well has produced 16,000,000 barrels of brine, with no scale deposition in the well or in the surface production facilities.
- The corrosion treatment program at Pleasant Bayou has been very successful. There have been no corrosion failures in the fiscal year.

For the Gladys McCall site in Louisiana. Significant accomplishments for FY-89, FY-90 and FY-91 are:

- RT • The pressure buildup test was continued through FY-91 to within ²⁰⁰ 200 psia of original pressure before drawdown.
- Well site evaluation was completed prior to flow test and turning over to industry.
- RT ~~Final testing was completed and the well P&A'd or turned over to industry~~

For the Hulin site in Louisiana. Significant accomplishments for FY-89, FY-90, and FY-91 are:

- Workover was completed. The well was put in a safe condition in preparation for flow testing.
- Short term initial test was run, and the disposal well completed. Samples were taken and the flow rate tested was about 5000 bpd.

- The well was placed on standby and the facilities prepared for long term testing.

The general accomplishments are as follows:

- Eaton completed the final contract report for the first five years of the current DOE "Contractor for Geopressured-Geothermal Sites."
- Eaton has performed the operation with an excellent safety and environmental record. Through March 1991 of the fiscal year, there had been 15,877 man hours of work, with no lost time accidents.
- Construction of surface facilities for long term flow testing was completed.

2.2 Geoscience and Engineering Support Task

2.2.1 Task Description and Overview:

The geoscience and engineering support is focused on analyzing geopressured well data and understanding how geopressured-geothermal reservoirs respond to long-term, high-volume production. Reservoir analysis and the continuing refinement of the reservoir model will determine reservoir characteristics and drive mechanisms and ultimately allow the prediction of long-term production on the basis of short-term tests. Refinement of the geology at the well sites will delineate reservoir size and volume, information necessary for an accurate reservoir model. Deformation of the reservoir rock samples under in situ stresses in the laboratory will yield rock mechanics data also necessary for the reservoir model. This work has been completed. Accurate evaluation of logs is necessary for acquiring basic information such as salinity and porosity. This work has been completed. Researchers will examine the effects of rock stress, shale content, and wettability on rock resistivity, and the effects of trace elements on neutron logs. This work has been completed. The variation of cryocondensates with time will be measured for produced geopressured brine. This work has been

completed. Environmental monitoring at the geopressured well sites and archiving of geopressured data and reports is continuing.

2.2.2-3 Funding and Manpower:

	Funding <u>(\$)</u>	Manpower <u>(man/yr)</u>
FY-90	1,370K	11
FY-91	465K	3

2.2.4 Accomplishments:

The Geoscience and Engineering Support accomplishments for FY-90 and FY-91 are as follows:

UTA-BEG:

- The FY 89 effort has been focused on compiling a preliminary hydrologic model in the depth interval equivalent to the Pleasant Bayou #2 well. Base map of pressure distribution in oil and gas fields in the vicinity of Pleasant Bayou and their alteration due to pressure depletion are being evaluated. The selection of production fields was guided by the geologic model which identified the location of major faults in the Pleasant Bayou area.
- Pressure-production history for Pleasant Bayou #2 is being compiled for correlating pressure depletion with production. This could be used for material balance calculations and decline curve analysis for reserves estimation. This will also be matched with chemical data to see any changes in trends.
- Collocation studies of geopressured brine and oil on the Deep Wilcox reservoirs and the Jackson Group were initiated and completed. Extensive well data were obtained from Fanion Oil Company for the regional trends of the Deep Wilcox and Jackson Group Cole and Mirando sandstones.

UTA-CES:

- Experimental apparatus was modified to measure three-dimensional rock mechanics parameters under three-dimensional stresses, which information will be needed to assess the production stability, especially in the vicinity of the wellbore, with continued fluid production from a geopressured reservoir.
- Illustrative values of water production for an example reservoir pressure change for a cubic mile of original reservoir rock were shown using pore water expansion; uniaxial compaction values; and pore volume compressibility values measured in the laboratory at insitu conditions.
- A review of geopressured-geothermal rock compaction mechanics has been initiated to develop a report for publication on creep studies.
- Designed, built, and installed internal axial displacement calibration assembly in Torsion Test apparatus.
- Obtained BOAST II Simulator from the Department of Energy Bartlesville Project Office. The model has been modified to calculate well productivity.

The Logging Project accomplishments include the following:

- Designed and monitored data acquisition for logging program, DOE Hulin #1 Well.
- Carried out computer analysis (ELAN Program of new logs) from DOE Hulin Well in 1989, as well as ELAN analysis of open hole logs on this well obtained by Superior Oil Co. in 1978.

- Gathered rock samples, cement samples, and cement additive samples to measure trace amounts of boron from West Texas formations. Boron analyses have been completed.
- A paper has been developed by Dr. Henry Dunlap on the Evaluation of a Geopressured-Geothermal Reservoir.

UTA-S-Cubed:

- Developed a reservoir simulation model for the Pleasant Bayou resource based on synthesis of the following data: geologic studies by the Bureau of Economic Geology, laboratory rock mechanics measurements on core specimens by the UTA rock mechanics group, fluid properties measured in various laboratories, data from the 1988-90 testing of Pleasant Bayou Well No. 2, and S-Cubed's interpretation of the new flow test data in conjunction with downhole pressure measurements made during the 1990 Phase I flow test of the well. The simulation matches the production data to date; it has been modified and improved as indicated by new test data.
- A paper was published in the Journal of Energy Resources Technology regarding behavior of Gladys McCall reservoir during the 3.5-year depletion phase (October 7, 1983 to April 21, 1987). Behavior during the recovery phase is not matched by the model that matched the behavior during the depletion phase. S-Cubed is monitoring the pressure/temperature logging of Gladys McCall Well No. 1 during the on-going long-term shut-in test and performing a series of parametric reservoir simulations in an effort to determine the mechanism(s) responsible for the sustained pressure maintenance.
- S-Cubed prepared a formal topical report summarizing the results of the Gladys McCall reservoir through April, 1990.
- Scoping calculations for Willis Hulin Well No. 1.

USL:

- Over 150 scrubber samples were picked-up on six visits to the Pleasant Bayou Well. The samples were returned to USL laboratory for analyses.
- A rapid, accurate system with high accuracy was developed to analyze the scrubber samples.
- Made precision measurements on the solubility of certain aromatic hydrocarbons and their distribution between a standard "oil" and water as a function of ionic strength and temperature. Specifically measurements were made for ethylbenzene and the isomers of xylene.
- The Pleasant Bayou Design Well was sampled on a monthly basis to determine the cryocondensate concentrations in the brine stream.
- A new sampling device designed to measure the benzene concentration in the gas stream on a daily basis was developed and installed at the Pleasant Bayou Well.
- The cryocondensate concentration in the brine stream at the Pleasant Bayou Well has been analyzed and compared with production models.
- The development of a harsh environment pH monitor based on ion-selective field effect transistor (ISFET) technology was shown to have excellent stability under pressures up to ≥ 6000 psig, and up to 3000 hours.

LSU:

- Maintenance of established systems for monitoring subsidence, seismicity, and water quality around test wells in Louisiana and Texas is continuing. Stations around Gladys McCall are scheduled to come down by the end of the FY-91 contract year pending completion of the final flow test.

Microseismic monitoring:

- Monitoring is continuing at Pleasant Bayou and Hulin wells. New stations in closer proximity to the Hulin site are being established throughout the contract year. Currently (as of April 1990), three sites have been installed within 10 km of the well site. An additional station should be in place on Week's Island, located approximately 14 km southeast of the Hulin prospect, by middle summer 1990.

Water Quality Monitoring:

- Water quality monitoring is continuing at all three sites. Ground water and surface water samples are being collected and analyzed from each of the three prospect sites. Currently, sampling is being done on a quarterly basis with chemical analysis being bid out to commercial laboratories. The Operating Company is now responsible for this work. DOE-ID is performing quarterly checks.

Subsidence Monitoring:

- Data from leveling surveys at Gladys McCall and Pleasant Bayou during FY-88 were analyzed. Leveling was performed in summer 1990 at the Hulin site on benchmarks installed in January 1989. No credible effects of geopressured-geothermal testing have been found. Anomalous changes in benchmark elevations around Pleasant Bayou are being further investigated. The Hulin Well levelling data have been received from the subcontractor and are being reviewed.

Geological Investigations:

- Excellent quality reflection seismic data was found for the Hulin area and purchase of approximately 22 miles was accomplished. A new seismic - structure map incorporating well log and other geological data was completed for the Hulin prospect incorporating the new seismic data.

- Evaluation of previously tested geopressed-geothermal prospects in Louisiana has been initiated in order to evaluate any relationship that might exist between geopressed-geothermal sand reservoirs and the association of free gas.
- Reports on collocation studies of geopressed reservoirs with oil in southern Louisiana and Texas were completed.

Well Operations - General

- Eaton completed the final contract report for the first five years of the current DOE "Contractor for Geopressed-Geothermal Sites".
- Eaton has performed the operation with an excellent safety and environmental record. Through June 1991 of this fiscal year, there had been 24,508 man hours of work, with no lost time accidents.
- All project Eaton-IGT employees have received 40 hours of hazardous materials handling training, CPR, fire safety, and first aid training.
- Establishing plans for environmental self-assessment at all three sites.
- Have conducted the yearly recalibration of all production gauges and relief valves at all sites.
- Eaton Deputy Program Director and Site Engineering and Testing Manager have current well control training.
- Have conducted quarterly surface water sampling to ensure there has been no ground water contamination from operations.

Gladys McCall Well

- Revised conceptual model based on recovery data.

- Performed series of parametric calculations to begin quantifying conceptual model.
- Model modified based on shut-in pressure buildup and bottomhole pressure data. Reservoir volume estimate increased to 8 billion barrels.
- Developed depositional model for Gladys McCall geopressured sands.
- Concluded that environmental monitoring Gladys McCall has not shown any detrimental environmental effects attributable to the long term testing at Gladys McCall (microseismic, water quality, and subsidence).
- Site evaluation was completed prior to final testing.
- Completed Design Review with DOE-ID for the Gladys McCall short-term testing project.

Pleasant Bayou Well

- Measured time-dependence variation of the cryocondensates in geopressured reservoirs.
- Measured the solubility and distribution of aromatic compounds in brine.
- Established a preliminary reservoir model based on chemical analyses of fluids of the geopressured wells.
- Initiated long term flow testing.
- Completed workover of the injection well and initiated higher flow rates.

- Eaton has operated the Pleasant Bayou production well over 99% of the available time for the fiscal year. Rates have been up to over 25,000 BPD.
- The scale inhibitor squeezes done on the Pleasant Bayou production well have been very successful. As of July, the well has produced 17,776,000 barrels of brine, with no scale deposition in the well or in the surface production facilities.
- The corrosion treatment program at Pleasant Bayou has been very successful. There have been no corrosion failures in the fiscal year.
- Conducted an electrical self-assessment at Pleasant Bayou and corrected all deficiencies. This will also be done at the other two sites.

Hulin Well

- Developed depositional model for Hulin submarine channel sand or unstable shelf data.
- Completed difficult workover, completed preliminary short-term flow test. Well on standby.
- Completed difficult workover, completed preliminary short-term flow test. Well and facilities prepared for long term flow testing.
- Model of Hulin geology of being modified as a result of newly acquired seismic lines.
- Completed construction of surface facilities for long term flow testing. The boards were removed and the location "permatized" at the Hulin site.

Publications

See Appendix A.

2.3 Energy Conversion Task

2.3.1 Task Description and Overview:

Geopressured-geothermal fluid contains chemical (methane), hydraulic and thermal energy. The methane, hydraulic energy and heat can be used to produce electricity. The methane can be sold to a pipeline, compressed or liquefied, or converted to methanol. The heat can be used to produce electricity or for direct use. If the methane is used for electricity production, then waste heat from its combustion can be utilized for increased energy efficiency in a hybrid power system, producing more electricity than separate power cycles using the same amount of gas and geothermal heat.

In cooperation with industry, construct and operate a hybrid 1-MWe power system for up to one year at the Pleasant Bayou site. Analyze operational data.

2.3.2-3 Funding and Manpower:

	<u>Funding</u> <u>(\$K)</u>	<u>Manpower</u> <u>(man/yr)</u>
FY-90	808	4
FY-91	1,000	5

2.3.4 Accomplishments:

The project is completed.

- Development of a hybrid power system test plan.
- Assured compliance with all DOE safety and environmental compliance issues.

- Developed design and constructed design the hybrid power system.
- Completed successful eight months testing of the hybrid power system.
- Final report completed. Presentations were made at the GRC meetings. The EICEC meeting and program reviews. News releases were made as appropriate.
- Issued bids (August) for dismantling of the Hybrid Power System.

Status

All operation and reporting has been completed.

The facility was dismantled in FY-1991.

2.4 INEL Management

2.4.1 Task Description and Overview

Supply technical and management support to DOE-ID on the Geopressured-Geothermal Program.

2.4.2-3 Funding and Manpower

	Funding <u>(\$K)</u>	Manpower <u>(Man/Hrs)</u>
FY 90	565	3.5
FY 91	565	3.5

2.4.4 Accomplishments

- Presented paper on industrial participation at the Geothermal Program Reviews VII, VIII, and IX in San Francisco.
- Completed a paper on resource economics for DOE-HQ.

- Completed four feasibility reports on Utilization;
 - 1) Direct Use, 2) Thermal Enhanced Oil Recovery, 3) Use of Super-Critical Fluid Processes in Detoxification of Organic Wastes, and 4) Conversion of Hydraulic Energy.
- Continued organizing and conducting meetings of the Industrial Consortium on Resource Utilization (9/89, 1/90, 9/90). Developed consortium brochures.
- Supplied technical and managerial program support to DOE-ID.
- Completed a special report on corrosion.
- Completed a special report on the HPS.
- Completed modification of the HPS test plan.
- Developed and issued 2 two-volume consortium proceedings sets and mailed to over 350 interested parties.
- Organized a seven paper session on the geopressured-geothermal resource for the geothermal resource council meetings in Hawaii.
- Presented papers on the Geopressured Reservoir and Utilization at the annual GRC meetings.
- Presented a paper on direct use at the GRC meetings.
- Presented papers on the Industrial Consortium at the Washington reviews.
- Presented papers on the four feasibility studies at the Washington review.
- Developed a review panel for university proposal review.

- Presented a poster/paper session at The American Association of Petroleum Geologists (AAPG) at Dallas, Texas, with 6500 participants.

~~• Developed a Pelton turbine test for Pleasant Bayou site.~~

RZ

- Developed a joint proposal with Los Alamos National Laboratory on an evaluation unit for destruction of petroleum wastes by Supercritical Fluid Processing using the geopressured resource.
- Prepared a Site Evaluation prior to final testing of Gladys McCall Well.
- Developed review panel to make recommendations for the future well testing and program direction.
- Presented a paper on Pleasant Bayou geology at the panel review.
- Developed a review committee for the operations proposals.
- Assisted in review of the Gladys McCall Well test design.
- Completed a TETRAD reservoir model for the Pleasant Bayou Well.
- Completed the first draft of a paper on The Geopressured Habitat.
- Completed a 16-page color brochure on the Geopressured Resource.
- Presented a paper on the Geopressured Habitat and the brochure at the Program Review in Washington, D.C.
- Paper on TEOR accepted for the International AAPG meetings in London.

3.0 FUNDING YEAR RESEARCH PLAN

3.1 Project: Pleasant Bayou

3.1.1 Issue

Reduce the cost of production of geopressured-geothermal energy. In addition, operational data from the flow testing of Geopressured Wells is needed to improve understanding and prediction of geopressured well behavior.

3.1.2 Project Description

There are several ways in which the cost of production in a geopressured well can be reduced. One of the primary ways is through a reduction in the number of operators through process automation. In addition, control of scale and corrosion can improve cost efficiency by improving brine flow rate and by reducing shutdowns. Increased experience in surface handling facilities can also impact the resultant energy cost.

3.1.3 Statement of Work

The Pleasant Bayou Well will be *slow* tested in FY-1992 with appropriate downhole pressure measurements using calibrated logging tools, and a pressure buildup test, if indicated. The contractor will prepare to conclude the Pleasant Bayou experiment.

3.1.4 Milestones

Monitor and evaluate surface facilities.

RJ

3.1.5 Deliverables

See Table 3.

3.1.6 Expected Accomplishments

Obtain pressure ^{drawdown and} buildup information.

RJ

3.1.7 Funding Requirement

See Table 4.

3.1.8 Manpower Requirement

See Table 4.

3.2 Project: Hulin Reservoir

3.2.1 Issues

The Hulin Well is the deepest, hottest geopressed well in the program. It may have free gas in the top reservoir sands. The Hulin Well needs to be tested.

3.2.2 Project Description

Workover of the Hulin Well has been completed.

The entire interval of interest needs to be perforated and flow testing initiated. Test planning beyond flow testing and future use of the Hulin resource needs to be addressed with a consensus for future work.

3.2.3 Statement of Work

The contractor will be directed to keep the Hulin well on standby status in FY92. The contractor will conduct periodic site inspections and record readings of well head pressure gauges and other site instruments as appropriate.

3.2.4 Milestones

NA

RH

3.2.5 Deliverables

See Table 3.

3.2.6 Expected Accomplishments

NA

RT

3.2.7 Funding Requirement

See Table 4.

3.2.8 Manpower Requirement

See Table 4.

3.3 Project: Liquid Hydrocarbons

3.3.1 Issue

Production of hydrocarbons from geopressured-geothermal DOE design wells has shown a relationship to flow rate in the geopressured wells. Research suggests that cryocondensates can be indicators of the geochemistry of the geopressured reservoir and possibly of the dynamics of the reservoir production.

3.3.2 Project Description

Complete assessment of hydrocarbon occurrence as a marker in geopressured brines. A final report will be written summarizing the many years of DOE supported work in this area and the project will be closed out. This will be performed by USL.

3.3.3 Statement of Work

Complete a topical ^{final} report summarizing work to date in these areas: Cryocondensate in brine, amounts, types vs. brine volume produced, and vs. brine rate. This report should be focused at drawing conclusions from analyses done to date on assessment of hydrocarbon occurrence at a marker in geopressured brines. If flow testing is initiated at Hulin, the hydrocarbons will be measured, analyzed, and interpreted. *As the Pleasant Bayou well is slow tested, the contractor will take hydrocarbon samples and perform the appropriate measurements and analyses on them.*

3.3.4 Milestones

Completed final reports.

RT

3.3.5 Deliverables

See Table 6.

3.3.6 Expected Accomplishments

Final report completed.

3.3.7 Funding Requirement

See Table 4.

3.3.8 Manpower Requirement

See Table 4.

3.4 Project: Reservoir Engineering

3.4.1 Issues

The well test data needs to be analyzed, synthesized, and integrated with pertinent related research. Integrated reservoir data needs to be utilized to improve and evaluate existing reservoir simulation for geopressured-geothermal wells. The evolving model must be validated, through examination of data, conceptual models, and methods of simulation.

Geologic studies need to be conducted on reservoirs for the operational wells to provide specific integrated data for reservoir simulation; integration of geoscience data is needed to improve understanding of the geopressure-geothermal reservoirs.

3.4.2 Project Description

RT
~~Interpret~~ Reservoir Engineering *data*. This task involves taking flow data from the well sites and interpreting it with models developed by program researchers. The work will be performed by S-Cubed, INEL and *LBL*.

3.4.3 Statement of Work

In FY-1992, the reservoir engineering researchers will *interpret* reservoir engineering *data*. The task includes taking flow data from the

RT

computer
^

well sites and interpreting it with models developed by program researchers at S-Cubed, INEL, and LBL.

3.4.4 Milestones

Completed final reports.

3.4.5 Deliverables

See Table 3.

3.4.6 Expected Accomplishments

Final reports completed.

3.4.7 Funding Requirement

See Table 4.

3.4.8 Manpower Requirement

See Table 4.

RT

3.5 Project Vertical Seismic Profile at Pleasant Bayou site

3.5.1 Issues

The ultimate goal of reservoir modeling is the determination of reservoir volumes, drive mechanisms, and productivity; thus providing industrial, financial, and governmental entities with data for investment, utilization, and policy decisions. The determination of the nature and location of geopressed reservoir boundaries by seismic methods can serve as powerful constraints on reservoir models.

Vertical seismic profiling is a relatively inexpensive seismic technique which involves placing a seismometer (receiver) in the well at some depth which records the arrival time of seismic pulses generated by a source at surface. Vertical seismic profiling (VSP) can yield high resolution data of immediate use in the description of geopressed reservoirs with potential future benefits in the processing and acquisition of seismic profiling data.

3.5.2 Project Description

A four direction survey will be used to delineate the reservoir in three dimensions in the vicinity of the well. The proper acquisition, processing, and interpretation of the VSP data will require the integration of existing seismic, reservoir, well log, geologic, and rock mechanics data.

3.5.3 Statement of Work

RTJ Researchers will conduct a VSP experiment at the Pleasant Bayou well site, and will search for seismic, reservoir, well log, geologic, and rock mechanics data pertinent to the design of the VSP experiment. They will also interpret the experiment results.

Wavelet processing will include velocity modeling, well-log processing, postmigration-wavelet processing, and seismic inversion. Data interpretation will involve the inversion of seismic data to derive seismic velocity, density, overburden pressure, and formation-pressure logs for comparison with drill stem tests and sonic, density, porosity, or other well logs that may serve as point sources of formation pressure data. High resolution will also be obtained with processing techniques including pattern recognition using multi-variate statistical analysis, principal component analysis using the Karhunen-Loeve Transform, high resolution velocity analysis using a signal detection algorithm based on covariance, and amplitude variation with offset. The direct detection of a gas cap will also be investigated with amplitude variation with offset.

3.5.4 Milestones

Completed final reports.

3.5.5 Deliverables

See Table 3.

3.5.6 Expected Accomplishments

Final reports completed.

3.5.7 Funding Requirements

See Table 4.

3.5.8 Manpower Requirement

See Table 4.

3.6 Project Environmental Effect

3.6.1 Issue

Environmental monitoring needs to be continued at the geopressured-geothermal well sites in Louisiana and Texas. Environmental components that the well tests are likely to effect were previously identified and a monitoring program was instituted.


3.6.2 Project Description

Acquisition of pretest baseline data, data during testing, and post-test monitoring data to assure there are no adverse long term effects. Continue theoretical work to fit monitoring results to models of the

geopressured-geothermal reservoirs and the surrounding geological formations. This work will be performed by LSU.

3.6.3 Statement of Work

Microseismic monitoring:

 Monitoring will continue for evidence of induced microseismic activity at Pleasant Bayou and Hulin wells. Efforts to *interpret the* recorded signals *also will* continue.

Water Quality Monitoring:

Water quality monitoring will continue at all three sites. Ground water and surface water samples will be collected and analyzed as in previous years. All water sample collecting and analysis will be the responsibility of the operating company. Rubidium and lithium will be included in the list of analyzed constituents as they are commonly found in Gulf Coast brines and should serve as good indicators of brine contamination of ground water or surface water.

Subsidence Monitoring:

Subsidence monitoring will continue at Pleasant Bayou and Hulin sites.

3.6.4 Milestones

Microseismic monitoring continued at the Pleasant Bayou and Hulin wells.

Water quality monitoring continued at all three sites (operating company).

Integration continued of site specific data with regional leveling data.

3.6.5 Deliverables

See Table 3.

3.6.6 Expected Accomplishments

Continued monitoring subsidence, seismicity, and water quality (operating company) around Pleasant Bayou and Hulin wells in Louisiana and Texas for FY-92. Water quality monitoring will be continued around the Gladys McCall site.

3.6.7 Funding Requirement

See Table 4.

3.6.8 Manpower Requirement

See Table 4.

3.7 Project: Strategies for Resource Utilization

3.7.1 Issues

The petroleum geochemistry relationships to geopressed compartments and physics and chemistry constraints of the geopressed-geothermal resource need to be understood and made available to the industrial community to assist

them in commercial utilization. This includes hydrocarbon maturation and occurrence under temperature and pressures of the geopressured reservoirs, effect of total dissolved solids on gas saturation, geological trends in temperature and pressure, dissolved solid concentrations and hydrocarbons, and expected recharge causes and rates in the Gulf Coast reservoirs.

3.7.2 Project Description

A review study of the geopressured habitat, occurrence, geological and geochemical attributes, hydrocarbon association, and reservoir response to production will provide a basic tool for understanding and decision making on the part of industrial entrepreneurs interested in utilizing the geopressured resource. These aspects have not been pulled together synthesized, and interpreted in program research. The relationship of hydrocarbon maturation to the development of geopressured compartments and implications to recharge and reservoir life expectancy will be examined in the context of geopressure as a phase in the evolution of basinal development where organic source material is available.

3.7.3 Statement of Work

The Idaho National Engineering Laboratory (INEL) will complete development of a geopressured-geothermal resource review to include the physics, chemistry, geology, hydrocarbons, and reservoir response associated with the production. This review will include synthesis and interpretation of research within the program and related published research outside the program. INEL will develop and apply the geopressured habitat study to a geologic reservoir model in support ^{of the} reservoir simulation effort. RT

3.7.4 Milestones

Complete peer reviewed report on the geopressured resource for publication in a recognized journal. Present peer reviewed paper at appropriate society meeting and modify according to reviews and response. Complete geologic reservoir model for reservoir simulation.

3.7.5 Deliverables

See Table 3.

3.7.6 Expected Accomplishments

Completed peer reviewed report on the geopressed resource for publication in an appropriate journal and make report available to industry.
Complete geologic reservoir module for reservoir simulation.

3.7.7 Funding Requirement

See Table 4.

3.7.8 Manpower Requirement

See Table 4.

~~3.8 Project: Alternative Use~~

(Deleted) RZ 9-20-91

~~3.8.1 Issues~~

The extensive geopressed resource has been identified, characterized, and its size estimated. The feasibility of utilizing the gas, hydraulic, and thermal energy has been studied. The actual utilization of the resource needs to be demonstrated and evaluated for industry. Direct use projects, cost-shared by industry and state funds can implement transition to commercial use of the resource for the benefit of the United States.

~~3.8.2 Project Description~~

DOE-ID will award a contract for Geopressed Utilization in FY-1992. The contract is estimated to be a 3 year contract with a minimum of 65% industry cost share. The total cost of the contract over the 3 years is anticipated to be \$4.5 million.

~~3.8.3 Statement of Work~~

DOE-ID will award a contract for Geopressed Utilization following an RFP solicitation. The project will be implemented in FY-1992.

~~3.8.4 Milestones~~

Complete contract award.

Initiate project.

~~3.8.5 Deliverables~~

~~See Table 3.~~

~~3.8.6 Expected Accomplishments~~

~~Contract award completed.~~

~~Project initiated.~~

~~3.8.7 Funding Requirement~~

~~See Table 4.~~

RT

3.9 Project: INEL Management/Technical Support/Technical Transfer

3.9.1 Issues

Technical and managerial support to DOE-ID is needed in the areas of technical expertise, specific investigations, day-to-day project management, litigation, and program planning and development.

3.9.2 Project Description

Support to DOE-ID will be provided by EG&G/INEL in the following areas:

Long Range Planning,

Preparation of AOP,

Preparation of Reports,

Overall Program Budget Analysis,

Preparation of Test Plans and Work Scopes,

Quality and Safety Review of Testing Operations,

Assistance in Program Management,

Technical Monitoring and Support of University research efforts,

Assistance in the Transfer of Technical Data to the Industrial

Arena, and Procurement of Special Services or Equipment.

~~Assist in monitoring well operations at the Hulin Well, planning of
future utilization of Hulin based on long term flow testing. Integration,~~

RT

coordination, and technical support of reservoir engineering. Development of an industry review committee.

RF

3.9.3 Statement of Work

The INEL will support researchers and DOE in their effort to *prepare the* present program ~~for~~ completion. This will involve researcher oversight, assistance with final environmental assessments at well sites, and completion of a formal technical report summarizing the results of research *to date* conducted by the Geopressure Program.

Specific documents and tasks include the following:

Plan to bring the program to a conclusion.

Prepare AOP.

Prepare program reports.

Analyze overall program budget.

Prepare test plans and work scopes.

Review quality and safety of testing operations.

Assist in day-to-day program management and provide a DOE presence at the University and operations sites on a monthly basis.

Provide technical monitoring and support of University research efforts.

Assist in the transfer of technical data to the industrial arena.

Procure special services or equipment.

~~Assist in monitoring Hulin Well operations and assist in evaluation and determination of reservoir; assist in planning future utilization of Hulin based on test results.~~

RF

Provide coordination, integration, and technical support (in reservoir predictability) to the Reservoir Engineering.

3.9.4 Milestones

Long Range Research planned.

AOP prepared.

Program reports prepared as required: GRC Meeting, Program Reviews, Geothermal Program Review, Industrial Consortium Presentations.

Monthly Report: overall program budget analyzed, twice a year and monthly tracking, day-to day management provided in FY-90 and technical monitoring and support of and support of University research efforts provided.

Test plans and work scopes prepared. On-going review carried out on Quality and Safety of Testing Operations.

Assistance provided in the transfer of technical data to the industrial arena (Industrial Consortium).

Special services and equipment procured as needed.

Coordination, integration, and technical support to the Reservoir Engineering project provided.

3.9.5 Deliverables

See Table 36.

3.9.6 Expected Accomplishments

Completion of long range research plans.

Completion of AOP preparation.

Program reports completed.

Budget for overall program analyzed.

Preparation of test plans and work scopes completed.

Quality and safety review continued.

Day-to-day management and technical assistance provided in FY-1992.

3.9.7 Funding Requirements

See Table 4.

3.9.8 Manpower Requirements

See Table 4.

4.0 MANAGEMENT PLAN

4.1 Overview of Management System

The responsibility for management of the DOE Geopressured-Geothermal Program is that of DOE-ID with support from INEL.

Thomas Williams with DOE-ID is the contract Technical Director and Program Coordinator. Ken Taylor with DOE-ID is Project Manager for the operations area and for the research area. Directives to INEL, the well operating company, and the universities come from Thomas Williams and Ken Taylor.

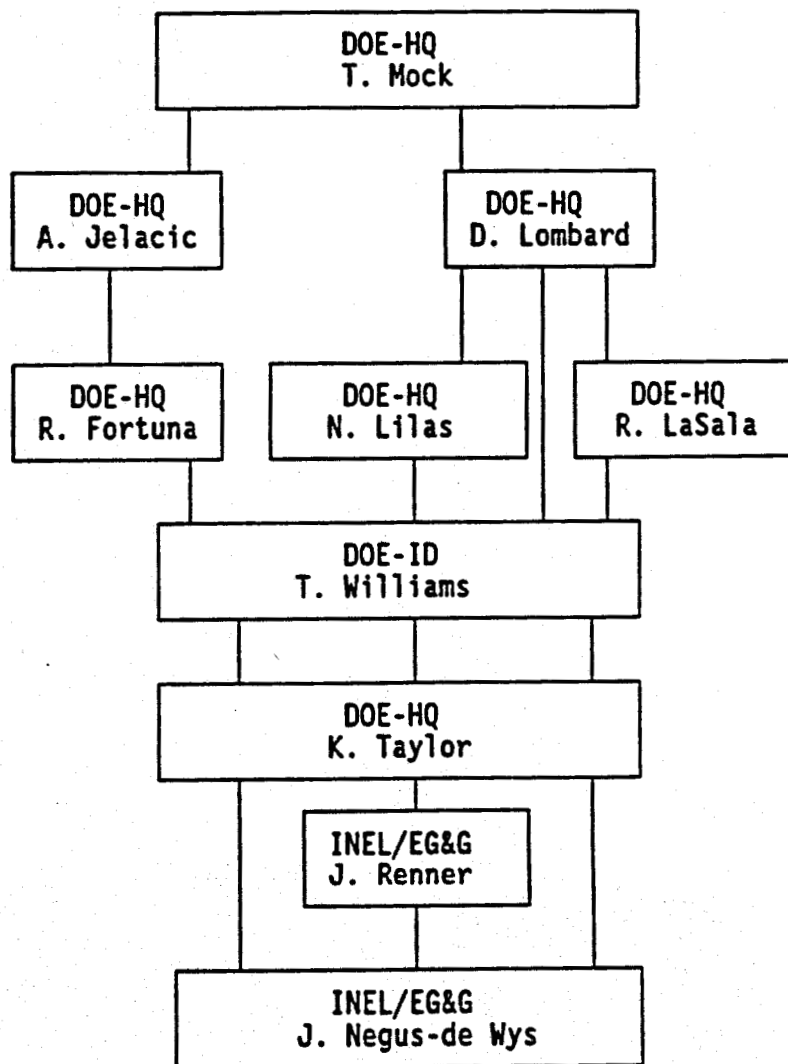
The day-to-day management of the Geopressured-Geothermal Program is the responsibility of DOE-ID with support from the EG&G, Idaho Inc. at INEL, Idaho Falls, Idaho. The Program Coordinator is Dr. Jane Negus-de Wys who monitors, tracks, coordinates and integrates the research. She visits the research facilities and coordinates visits to well operations; she contacts the principals in research at least once a week, and the operations office. Weekly Significant Events are reported; and a Monthly Progress Report is submitted with reports on research and operations. Well operations are monitored daily. One review per year with DOE-HQ is held, at which the principal research operations and management are represented.

A research proposal review committee has been developed to review the program plan and the university proposals. In addition, EG&G/INEL provides daily technical support to DOE-ID and to DOE-HQ as requested. In-depth technical effort and consulting is sought and supplied as needed. Special reports are developed as needed or requested.

4.2 Management Structure

<u>DOE Headquarters:</u>		
Director, Geothermal Technology Division	Dr. J. Mock	(202) 586-5340 FTS 896-5340
Team Leader, Geoscience	Dr. Alan Jelacic	(202) 586-6054 FTS 896-6054
Program Manager, Geopressured (excluding Conversion)	Ray Fortuna	(202) 586-1711 FTS 896-1711
Team Leader, Conversion Technology	Dr. Dave Lombard	(202) 586-4952 FTS 896-4952
Program Manager Geopressured Conversion	Raymond LaSala	(202) 586-4198 FTS 896-4198
Program Manager, Direct Use	Nick Lilas	(202) 586-8021 FTS 896-8021
<u>DOE-ID:</u>		
Program Coordinator, IDO Advanced Technology Division	Thomas E. Williams	(202) 526-0577 FTS 583-0577
Program Manager, Geopressured-Geothermal Program Advanced Technology Division	Ken Taylor	(208) 526-9063 FTS 583-9063
<u>Contractors:</u>		
INEL Program Manager	Dr. J. Negus-de Wys	(208) 526-1744 FTS 583-1744
UTA Project Leader	Dr. Mark Miller	(512) 471-3250 FTS 471-3250
USWL Project Leader	Dr. John Meriwether	(318) 231-6691 FTS 231-6691
LSU Project Leader	Dr. Chacko J. John	(504) 388-8681 FTS 388-8683
Well Operating Company	To be determined.	

Management Structure Diagram:



4.3 Management Resource Requirements

Management (INEL, operating company, S-Cubed, University and Environmental) for the entire program requirement for FY-1992 is 2.0 FTEs.

4.4 Procurement Plan Summary

DOE has gone out with an RFP for a well operations contractor and has reviewed the responses with an Advisory Committee. This five year contract was awarded in the summer of 1991. This activity will follow the guidelines for such bids within EG&G and in accordance with the U.S. Government subcontracting regulations.

4.5 Subcontracting Plan

- The operating company subcontracts a part of surface facility operation. The new contract award for well operations is not known at the time of this writing.
- INEL subcontracts, as needed, Dr. Hank Coffey or other selectees for specific technical support, and technical advisors for proposal review, and for advisory panels.

4.6 Schedules of Conferences and Technical Reviews

- Meeting of the Industrial Consortium on Geopressured-Geothermal Resource Utilization (Spring 92).
- Research integration and review-semi annually.
- American Association of Petroleum Geologists (6/21-24). (Sections related to geopressure-geothermal)
- Society of Petroleum Engineers (Spring 1992).
- Geothermal Resource Council meeting.

- Geothermal Program Review (4/15/92).

4.7 Schedule of Planned Foreign Travel

**International Meeting of the American Association of Petroleum Geologist:
London, England (9/27 - 10/3). Paper on TEOR accepted.**

5.0 OUTYEAR RESEARCH PLAN (FY-92 through FY-94)

5.1 Goals/Objectives

The basic present Geopressured-Geothermal Program will be brought to a completion in FY-1993, with environmental activities continuing through FY-1995. The final deliverables are the following:

- Well Data
- Reservoir Model
- Summary Report on the Geopressured Resource
- Final Technology Report and Papers

RJ

~~Commencing in FY-1993 geopressured geothermal resource utilization project(s) will be initiated, following contract award in FY-1992~~

FY-1992-1993

Operation of the Pleasant Bayou Well will be terminated after the reservoir pressure decline is established and a scientific program of variable flow rate testing, diagnostic logging, geochemistry analysis, cryocondensate analysis, downhole pressure measurements, and sidehole coring is completed. Following the scientific experiments, the well will be plugged and abandoned.

RJ

~~The Hulin well will be flow tested at a rate of 6,000 barrels per day for the first six months of FY-1993. The well will then be shut in for two months so that the reservoir pressure recovery can be determined. This flow testing and pressure buildup will allow researchers to approximate the size of this reservoir and determine the feasibility of long term flow testing in this area. Following the flow testing and buildup, ^{Hulin} The well will either be passed to industry or Plugged and Abandoned. The cost for this activity excluding Plug and Abandon cost will be \$900K.~~

The supporting research program will be concluded, final reports written on all tasks and a final reservoir models completed. A complete final report summarizing the Geopressured-Geothermal Program will be written and industry coordination meetings will be held.

Final deliverables will include:

- Well Data
- Reservoir Model
- Summary Report on the Geopressured Resource
- Final Technology Report and Papers

5.2 - 5.3 Key Issues, Strategy, and Broad Task Descriptions

The key issues and strategies are:

5.2.1 Issue

Production of geopressured fluid in commercial quantities requires long-term flow rates of 20 to 40 thousand barrels per day per well. These fluids must be disposed of in an environmentally safe manner.

5.2.1.1 Broad task description and strategy

Inject fluids from geopressured design wells into relatively shallow normally-pressured injection wells. Monitor injection well pressure for changes affecting the ability of the injection zone to accept fluids.

5.2.2 Issue

Full-time operators are presently required for surface brine handling. Surface facilities at both the Gladys McCall and Pleasant Bayou design well sites have shown susceptibility to corrosion and erosion. Once operational problems are brought under control, geopressured facilities should be able to function without continuous observation.

5.2.1.1 Broad task description and strategy

Instrumentation and control companies will design and verify automated control systems for the production of brine, separation of gas, and disposal of spent brine. Verify operation of automated systems with field tests.

5.2.3 Issue

The mechanisms driving the production of geopressured-geothermal fluids are ill-defined. Without knowledge of how and when these mechanisms function, the reliability of geopressured-geothermal reservoirs will remain uncertain. Confident predictions of reservoir productivity will enable better estimates of economic viability.

5.2.3.1 Broad task description and strategy

Continue production tests at the Pleasant Bayou design well, ~~and make plans for possible tests at the Hulin Well.~~ Incorporate reservoir data into numerical reservoir simulator. Analyze reservoir stress state for the design well reservoirs using an improved geological reservoir model, rock compressibility, and reservoir pressure data. Model the test results to ascertain the presence of one or more theoretically-possible drive mechanisms.

Integrate the knowledge gained about reservoir measurements, models, and drive mechanisms into reservoir testing guidelines suitable for industry use.

A verification of extant technology could be accomplished at the Hulin Well. This well was drilled by industry through several geopressured-geothermal zones. Verification would be measured by the ability to predict brine quality and longevity from logs and a short-term flow test.

5.2.4 Issues

Numerous oil and gas wells penetrate geopressured horizons, but the operators seldom evaluate the geopressured resource potential. Simplified, inexpensive means of evaluating that potential would increase the likelihood of resource production from wells of opportunity.

5.2.4.1 Broad task description and strategy

Routine geological information (e.g., logs, geophysical surveys, cores, fluid samples) is available for most Gulf Coast wells. Synthesize that information in such a way that geopressured resources may be identified and evaluated more readily. Develop well-logging techniques which in conjunction

with existing geology and geophysical techniques permit the location and evaluation of potentially economic geopressured- geothermal resources. Study the effect of rock stress, shale content, and wetability on rock resistivity, and determine the effect of trace elements on neutron logs to improve the interpretation of logs from geopressured wells. Stress reservoir core samples to determine basic rock properties at in situ conditions. The techniques will be combined into a standard procedure that operators can use during or immediately after drilling operations to indicate resource potential.

5.2.5 Issue

The removal of large volumes of fluid from deep reservoirs may cause surface subsidence while the injection of fluid may cause uplift and induce earthquakes. Leaking surface equipment or well casing could contaminate fresh surface and ground waters.

5.2.5.1 Broad task description and strategy

Monitor surface subsidence, induced seismicity, and water quality in aquifers above the injection zones and in surface waters. Develop a model for reservoir compression which can verify whether adverse environmental effects will occur from the planned production and disposal methods over a ten-year period of operation.

5.2.6 Issues

The issues for the FY-1993 - FY-1994 Outyear Research Plan are:

- Reservoir predictability
- Economics/Automation
- Industrial participation in geopressure-geothermal energy utilization.
- Confidence/Reliability
- Materials selection/compatibility

~~5.2.6.1 Broad task description and strategy~~

~~In cooperation with industry, develop and test power systems for up to one year. Analyze operational data.~~

KJ

5.4 Funding Requirements

RF

	FY-92	FY-93	FY-94
Well Operations	2,900	1,700	0
Geoscience and Engineering Support	895	1,000	500
Energy Conversion	0	0	0
HBU	0	0	0
Management and Technical Support and Tech Transfer	370	365	300
Other Research	150	0	0
Alternative Use Project	1,136	2,000	2,000
Minus DIA Funds Available	1,200		
TOTAL	<i>RF</i> 4,400	5,065	2,800

4,315

5.5 Manpower Requirements

	FY-91	FY-92	FY-93	FY-94
Well Operations	3.5	3.5	1.5	0
Geoscience and Engineering Support	8.8	2.75	8.8	0
Energy conversion	0.5	0	0	0
Management Support and Tech Transfer	2.5	2.5	2.5	2.0
Other Research	0	0.25	0	0
Alternative Use Project	0	<i>RF</i> 2.0	4.0	4
TOTAL FTEs	15.3	12.0	16.8	6.0

Table 1. FY-92 Milestone Summary.

	O	N	D	J	F	M	A	M	J	J	A	S
Pleasant Bayou												C₂
Hulin		C ₁		C ₃								
Other location				C₃								
Supporting Research and Analysis		K ₁ , K₂ , K ₃							K ₄			
DOE-HQ Review						R ₁			R ₂			

Control Milestones

C₁ Complete high rate flow testing at Pleasant Bayou.

~~C₂ Decision at any time to begin direct use at project at Hulin.~~ *RT*

~~C₃ Decision to initiate Direct Use Project.~~ *RT*

Key Milestones

K₁ Decision at any time to inject a pill at scale inhibitor or to shutdown for data acquisition.

~~K₂ Decision on whether to conduct an electrical generation project during FY-1993.~~ *RT*

K₃ Review research integration and status of computer modeling.

K₄ Begin planning/preparation of FY-1993 AOP.

DOE-HQ Review

R₁ February Program Review at DOE-ID

R₂ July Program Review at DOE-HQ, Washington, D.C.

Table 2. Overall Outyear Schedule and Control Milestones.

Geopressured-Geothermal Tasks

	FY-92	FY-93	FY-94	FY-95
Pleasant Bayou	C ₁ , C ₆			C ₅
Hulin	C₂, C₃ , C ₄ , C ₆			C ⁵
Other location projects	C ₇		C ₈	

Milestone No. and Description

~~C₂ Update Hulin test plan, and plan utilization buildup tests.~~

~~C₃ Decision on whether to conduct an electrical generation project during FY 1992.~~

C₄ Decision to transfer well to industry or to plug and abandon Hulin Well (1992).

C₅ Decision to stop environmental monitoring.

C₆ Final Hulin Report.

C₇ Initiate Utilization Project in new area.

C₈ Final Use Report.

Table 3. Deliverables Summary

<u>QUARTERLY/ MONTH</u>	<u>ANNUAL</u>	<u>RESEARCH PAPERS PRESENTATIONS ANALYSES/DATA</u>	<u>REQUESTS/REVIEW CONTRIBUTIONS</u>
<p>All research contractors (UTA-BEG, USL, and LSU) will submit quarterly progress reports including progress status, accomplishments, oral and written presentations and publications, travel and expenses. These reports should be received at DOE-ID/EG&G by the 15th of the month following quarterly report. The Well Operating Company will submit a monthly progress report including the stipulated information above.</p>	<p>The Annual Report concentrating on accomplishments (research operations, and publications with budget summary will be submitted by contractors no later than November 1, 1992. An overview, comprehensive annual report will be submitted by EG&G by January 1, 1993.</p>	<p>Copies of research presentations and publications will be submitted prior to or very shortly after presentations or publication. Analyses, well monitoring and environmental data will be routinely collected and submitted as scheduled.</p>	<p>Unspecified analyses, reports or advisory documents shall be supplied by the contractors as requested, within reason. Two DOE-HQ reviews shall be attended, to which contractors will contribute as required.</p>

Management Structure Diagram:

RF

Table 4. Funding and manpower by project and contractor
(\$5,000K Budget - \$4,400 Net)

Category	Task	Project	Contractor	FY-92	
				Manpower (FTEs)	Funds (\$K)
Geopressured- Geothermal	Well Operations				
		Pleasant Bayou Reservoir	TBD	2.0	1,000
		Hulin Res. Management	TBD	3	1,200 700
	Geoscience and Engineering Support				
		Hulin Liquid Hydrocarbons	USL	TBD	100
		Seismic Studies	TBD	2.5	120
		Geological Studies	UTA	2.0	100
		Reservoir Engineering	INEL	0.5	40
		Environmental Effects	LSU	3.0	275
		Water Quality	TBD	3.0	150
	Management and Technical Support Tech Transfer	INEL Mgmt.	EG&G		250
		Technical Support & Technical Transfer			60
		NEPA Documentation Hulin			60
	TOTAL				4,055

LBL

260
4,315