

RECEIVED

memo |  
from |

GARY FRANTZ  
OCT 30 1984

TO:

TOM LINDENUTH  
**T.E. Lindenuth**

Information.


Here are the media clips we've collected so far on the Salton Sea project.

The clipping service we use will usually lag about a month behind, so I would expect more stories about the project will show up sometime near the end of November.

I'll keep you posted. And I'm still trying to obtain a copy of the news broadcast from the Yuma television station.

We also had another TV station call about the project. KSMB (the CBS affiliate in San Diego) wants to come out to the jobsite and do a story when we conduct the next press tour.

10/29/84

  
Gary Frantz

GLOO608

Wallace  
RMW  
3/6/84

**Status of Geothermal Deep Well Experiment**

The Department is proceeding with a competitive solicitation to provide a deep well in the Salton Sea geothermal area for scientific investigations. Several responses are expected. The RFP release is planned for mid March, with contract award expected by the end of July. Planning for scientific experiments associated with the well is under way.

R.S.H.T.

3-5-84

5/16/84

for Hotel's MBO

Salton Sea Scientific Drilling ProjectDescription

The objective of the project is to penetrate the roots of a known geothermal system in the Salton Trough, Imperial County, California by drilling a new well or deepening an existing one 6000 feet beyond the depth at which a temperature of 300°C is reached. The well will allow tests and measurements to be performed for determination of the nature of potential reservoirs that underlie a known high temperature hydrothermal reservoir. A better understanding of the genesis and structure of hydrothermal resources will be achieved, and theories that the nation's hydrothermal resources are far larger than previously estimated will be assessed. It is also the intention of the project to make the well available for scientific measurements for a limited time during drilling and for about one year after completion. The science community wishes to characterize the natural system in order to achieve expanded knowledge and understanding of the uppermost part of the earth's crust to address scientific and societal problems.

Background

The project is a congressionally mandated initiative for which \$5.9 million was appropriated in FY 1984 funds. Only the drilling operation was funded. Scientific testing and experimentation was not covered. Congress expected the project to be a sole source procurement. However, this was not possible. A request for proposals was issued on March 14 to attract bidders.

Status

Proposals were received on May 4, 1984 at the DOE's San Francisco Operations Office. They were evaluated May 7-9, 1984. Selection of a potential contractor for negotiation is expected by June 6, 1984, with contract execution projected by July 31, 1984. A ground-breaking ceremony is planned in conjunction with Geothermal Program Review III to be held at El Centro, California, October 16-19, 1984. Drilling of the well is expected to commence early in 1985. Scientific tests, measurements and experimentation will continue for about one year after well completion in mid-1985. Milestones are subject to change, (1) during contract negotiations; and (2) to enhance the project value during operations, as determined by the project management structure.

Aspects Meriting Secretary's Attention

1. The project, funded and managed through DOE/ASCE, can only be successful if fully coordinated with NSF, USGS and DOE/OER to meet the science objectives.
2. The project is one of the first wells of opportunity in the National Academy's program of Continental Scientific Drilling. Others may be funded through DOE/ASCE's geothermal program because GHTD is developing the technology base (drilling, instrumentation, geosciences) to make them practicable.
3. OSTP has expressed high interest, and the project has high visibility throughout the science community.



memo  
from

T. E. LINDEMUTH  
October 30, 1984

RLH  
11/5/84

TO: John Crawford (DOE)

10/31

Ray Z

Attached are the  
news clippings collected  
by Bechtel to date on  
the Salton Sea project.

John

For your information.

Encs.

## Drilling to assess deep geothermal resource

The U.S. government and industry have launched a project to tap the deeper potential of California's big geothermal resource with what will be one of the hottest geothermal wells drilled in the U.S.

Department of Energy let a \$5.3 million contract to Bechtel National Inc., a unit of Bechtel Engineers & Constructors, to spearhead a program to gather geological/geochemical data from and assess the resource potential of deep geothermal reservoirs near the Salton Sea in California's Imperial Valley.

Project drilling is expected to encounter high temperatures, pressures, and salinities in combinations never before dealt with, Bechtel says.

Geothermal experts have dubbed the Imperial Valley the "Saudi Arabia" of geothermal power potential. A number of projects have been launched in recent years to tap the huge geothermal potential in the valley (OGJ, May 3, 1982, p. 91).

Deeper reservoir potential in the Imperial Valley could yield 25 million kw of geothermal electric power capacity during the next 50 years vs. current shallow reserves potential there of about 5-7 million kw, says Robert W. Rex, president and chief executive officer of Republic Geothermal Inc., Santa Fe Springs, Calif.

Moreover, DOE says the Bechtel contract may represent the first of a government sponsored series of U.S. research efforts under the joint DOE-U.S. Geological Survey-National Science Foundation continental scientific drilling program, which entails other exploration and study of the earth's crust.

**Project details.** Bechtel's contract covers planning and managing the Salton Sea drilling program; data acquisition, design, and construction of a geothermal brine treatment plant; and comprehensive resource assessment.

Plans call for drilling of two wells, one to reinject the hot geothermal brine. Well sites would be provided by Kennecott, a unit of Standard Oil Co. (Ohio).

Preliminary engineering is under way in Bechtel's San Francisco offices, with well drilling expected to start in February 1985. Drilling would be completed next June and flow testing wrapped up the following August. Resource evaluation would continue through October 1985, and the site would be closed May 1986.

Drilling will go out for bid during December and January, with the award expected at the end of January.

The exploratory well would extend through the geothermal reservoir in the Niland area to 6,000 ft below the 300° C. isotherm at about 4,000 ft—a likely total depth of about 10,000 ft. Brine salinities are expected to be 250,000-300,000 mg/l. The well is programmed to tap the area where subsurface magma comes into contact with an underground aquifer.

The exploratory well would have 30 in. surface conductor set to about 60 ft and 20 in. surface casing set to 500 ft, with a 17½ in. hole drilled to about 4,000 ft. After logging, 13½ in. production casing would be set and cemented back prior to drilling to total depth of 10,000 ft. Two short term flow tests at initial depth are planned, with logging limited to the well's tem-

perature conditions but, if possible, to bottom. About 15% of the hole would be cored. Two 30 day tests would follow completion. The lower 6,000 ft of the hole would be uncased.

Plans also call for two stage flash separation of brine and vapor plus brine stabilization facilities.

That would assess the vertical extension of the reservoir underlying the Salton Sea known geothermal resource area, in addition to making the well available for data gathering and further experimentation.

**Technical challenges.** Anticipated special problems include drilling/coring at that depth, temperature, and salinity and difficulty in solids handling after flashdown.

The combination of high salinities and supercritical temperatures also could create brine properties never before encountered, causing severe corrosion and scaling. In addition, the most rugged well logging equipment is rated at about 150° C. less than the 400° C. expected at great depths.

"Some of the technical challenges in the program may provide opportunities for improvements in drilling and data acquisition technology," said John Crawford, DOE project manager. "We also may be able to learn how the reservoir recharges itself and gather information about how the grinding of plates in the earth's crust—and the heat that's created—affects a geothermal resource." In addition, some of the data could aid study of ore formation, says Thomas E. Lindemuth, Bechtel project manager. Typical shallower geothermal wells don't contain brines with the high mineral content expected in the project.

# Project to hunt energy resources near Salton Sea

By Michael Richmond  
Tribune Staff Writer

6714  
The growing geothermal industry in Imperial Valley has been bolstered by a \$5.3 million federal contract awarded to Bechtel National Inc. for drilling of a 10,000-foot-deep well to explore the heart of a geothermal resource near the Salton Sea.

The two-year contract awarded by the U.S. Department of Energy calls for drilling into the hot magma, or molten rock, beneath the earth's surface, near Niland, where temperatures of up to 750 degrees Fahrenheit are expected to be encountered, said Bechtel spokesman Gary Frantz.

He said the well depth and expected temperatures are much greater than those normally attained in a geothermal well.

In some areas of the Imperial Valley where geothermal brine and steam have been harnessed to produce electrical energy, temperatures of 150 to 500 degrees Fahrenheit are more common and the wells are generally shallower.

Frantz said the idea behind the deeper well is to drill through the molten rock to get an idea of what is below the geothermal resource.

A groundbreaking ceremony is scheduled at the project site at 9 a.m. Thursday.

Bechtel National Inc. is an affiliate company of the San Francisco-based Bechtel Group Inc., which includes Bechtel Power Corp. and Bechtel Petroleum Inc.

Project manager Thomas E. Lindemuth, of Bechtel's Research and Engineering Department, said the Imperial Valley project will evaluate the geothermal resource's attractiveness as a source of power plant steam.

Other objectives are to collect data about the geology and geochemistry of the resource, Lindemuth said in a statement regarding the contract award.

A Department of Energy spokesman said the contract may represent the first in a series of government-sponsored nationwide research efforts under a federal scientific drilling program which is jointly sponsored by the department, the U.S.

Geological Survey and the National Science Foundation Continental Scientific Drilling Program.

Under the Bechtel contract, two wells will be drilled; one serving as the scientific exploratory well and the other for reinjection of the hot geothermal brine.

John Crawford, project manager for the Department of Energy, said it is hoped the exploratory well will be "deep enough to tap the area inside the earth that is close to where magma comes into contact with an aquifer, which is the heart of a geothermal reservoir."

The information gained from the drilling program could help improve drilling and data acquisition technology, Crawford said.

He also said scientists may be able to learn how the underground reservoir recharges itself and gather information "about how the grinding of plates in the earth's crust... affects a geothermal resource."

The multimillion-dollar project is the latest in a number of federal and private geothermal programs to be launched in Imperial County, which is reported by government agencies to be underlain by one of the world's largest geothermal energy resources.

Union Oil Co. and Southern California Edison Co. have developed two geothermal power plants in the valley, one of which opened near Brawley in 1980 and the other southwest of Niland, which was dedicated last year.

## Geothermal contract 6714

THE U.S. Department of Energy awarded a \$5.3 million contract to Bechtel National Inc. to explore the heart of a geothermal resource 10,000 feet beneath California's Imperial Valley near the Salton Sea.

The 24-month research project calls for one of the hottest geothermal wells ever developed in the United States and may reach areas just above partially cooled magma inside the earth. ✓

The U.S. Department of Energy has awarded a \$5.3 million contract to Bechtel National Inc. to explore the heart of a geothermal resource 10,000 feet beneath California's Imperial Valley near the Salton Sea, the company reported Wednesday.

The 24-month research project calls for one of the hottest geothermal wells ever developed in the United States and may reach areas just above partially cooled magma inside the earth.

October 19, 1984

# 'Geothermal well may be hottest

NILAND — More than 100 scientists, engineers, government officials and four busloads of citizens turned out Wednesday to witness the groundbreaking of a Salton Sea geothermal research well that is expected to be one of the hottest in the world.

Located two miles southwest of Niland on the south shore of the Salton Sea, the \$6 million well is expected to answer many of the problems faced in past geothermal projects as well as provide scientific data about the geology and geochemistry of geothermal resources.

W. Patrick Collins, under secretary of the U.S. Department of Energy, said the excitement of the groundbreaking ceremony was the culmination of years of hard work.

Collins said the extreme temperature that the well is predicted to reach will "challenge and strain the equipment to its limit and beyond" thus providing a test of the equipment and gaining knowledge needed for further geothermal exploration.

Collins is the chief advocate of renewable energy resources, and he said geothermal energy was the signpost of the U.S. renewable re-

source base.

The 10,000-foot-deep exploratory well may reach into areas just above partially cooled magma, or molten rock, making it one of the hottest and deepest geothermal wells ever drilled in the United States, said Thomas E. Lindemuth, of Bechtel National Inc.

Lindemuth, Bechtel's project manager, said two wells will be drilled. In addition to the 10,000 scientific exploration well, there will also be a 3,500 to 5,000 foot injection well that will be used to reinject hot geothermal brine.

"We will try and run this project as clean as it can possibly be," said Lindemuth. And he added that Bechtel has been coordinating with federal, state and county officials to inauew concerns about the environmental impact of the well are met.

Bechtel has received a two-year, \$5.3 million geothermal exploration contract for the project from the U.S. Department of Energy. The total actual testing time of the well will last only two to three months, Lindemuth said.

The well is being drilled on land on which geothermal rights are held by Kennecott, an operating company of the Standard Oil Company.

In addition, the National Science Foundation gave the University of California Riverside a \$250,000 grant to coordinate scientific studies related to the drilling. Those conducting the studies include scientists from the U.S. Geological Survey, the government's national laboratory system and several universities.

Imperial Valley Press  
El Centro, CA  
Oct. 18, 1984

## Niland research project well is off and running

An official groundbreaking this morning for the new Salton Sea Scientific Drilling Program project opens the way for work on the new geothermal research well southwest of Niland. Assisting in the groundbreaking are Richard Du Val, manager of the San Francisco office of U.S. Department of Energy; Wilbur Thompson, representative of the California State Lands Commission; W. Patrick Collins, under-secretary of Department of Energy; Robert Dimock Jr., vice president of project development of Kennecott; John Mock, director of geothermal technologies, Department of Energy; Dr. Wilfred Elders, project chief scientist; George Wang, manager of research and engineering, Bechtel; and Harvey Brush, executive vice president of Bechtel. The project is a combination of efforts and a contract between the Department of Energy, Bechtel and Kennecott (of Standard Oil). The well is expected to reach a depth of 10,000 feet and is projected to be the hottest geothermal well in the world.



Geothermal research well groundbreaking today in the Valley.

Coachella Valley Sun  
Indio, CA  
Oct. 18, 1984

# *Bechtel wins Niland geothermal well contract*

Bechtel National Inc., of San Francisco has been awarded a \$5.3-million contract by the U.S. Department of Energy San Francisco operations office to explore the heart of a deep geothermal resource near the Salton Sea some 10,000 feet beneath the Imperial Valley.

The 24-month research project, which calls for one of the hottest geothermal wells ever developed in the U.S., may reach into areas just above partially cooled magma deep inside the earth, according to project manager Thomas E. Lindemuth, of Bechtel's research and engineering department.

"We're going to examine this potential geothermal resource from several angles," Lindemuth explained. "Part of our job will be to evaluate its attractiveness as a source of power plant steam. Other tasks will be to collect data about the geology and geochemistry of this deep resource."

Bechtel's responsibility for the Salton Sea Scientific Research Program covers planning and managing the drilling program and data acquisitions, as well as design and construction of brine treatment installations, and a comprehensive resource evaluation.

The Bechtel contract may represent the first of a government-sponsored series of nationwide research efforts under the joint Department of Energy/U.S. Geo-

logical Survey/National Science Foundation Continental Scientific Drilling Program that could include similar scientific endeavors exploring other areas of the earth's crust, explained DOE project manager John Crawford.

Researchers and leading scientists from the Geological Survey, national laboratories and universities will conduct various experiments and assessments of scientific interest, he added. These will be in addition to the DOE geothermal investigations under Bechtel's cognizance.

The project will start with a groundbreaking ceremony at 9 a.m. today at the project site near the intersection of McDonald and Davis roads, south of Niland.

Scheduled to attend the groundbreaking ceremony are: W. Patrick Collins, undersecretary, U.S. Department of Energy; Richard P. Godwin, president, Bechtel Civil & Minerals Inc.; Richard R. Dimock Jr., vice president, project development, Kennecott, an operating company of Standard Oil Co. of Ohio; Claire T. Dedrick, executive officer, California State Lands Commission; and Dr. Wilfred A. Elders, Institute of Geophysics and Planetary Physics, University of California Riverside.

The work is being undertaken at locations provided by Kennecott.

"For this project we plan to

drill two wells," Crawford noted. "The scientific exploration well will extend through the geothermal resource to a depth of 10,000 feet. There also will be a second well drilled to re-inject the hot geothermal brine."

Crawford explained that the project participants hope to drill a scientific well deep enough to tap the area inside the earth close to where magma comes into contact with an aquifer, which is the heart of a geothermal reservoir.

"Some of the technical challenges in the program may provide opportunities for improvements in drilling and data acquisition technology," he said.

Oakland Tribune  
October 12, 1984

### Bechtel awarded geothermal project

SAN FRANCISCO — The U.S. Department of Energy has awarded a \$5.3 million contract to Bechtel National Inc. to explore the heart of a geothermal resource 10,000 feet beneath California's Imperial Valley near the Salton Sea, the company has reported.

The 24-month research project calls for one of the hottest geothermal wells ever developed in the United States and may reach areas just above partially cooled magma inside the Earth.

Ground-breaking for the project is set for next Thursday. Drilling is expected to start in February 1985.

Independent Journal  
San Rafael, CA  
October 12, 1984

### Bechtel awarded geothermal contract

SAN FRANCISCO — The U.S. Department of Energy has awarded a \$5.3 million contract to Bechtel National Inc. to explore the heart of a geothermal resource 10,000 feet beneath California's Imperial Valley near the Salton Sea, the company reported Wednesday.

The 24-month research project calls for one of the hottest geothermal wells ever developed in the United States and may reach areas just above partially cooled magma inside the earth.

San Francisco Examiner  
October 11, 1984

### Today's briefs:

Bechtel National Inc., part of San Francisco-based Bechtel, said it received a \$5.3 million U.S. Department of Energy contract to explore a geothermal area near the Salton Sea.

San Francisco Chronicle  
October 11, 1984

### Contract for Bechtel

Bechtel Group Inc. has been awarded a \$5.3 million contract by the U.S. Department of Energy San Francisco operations office to explore the heart of a deep geothermal resource near the Salton Sea some 10,000 feet beneath California's Imperial Valley. The 24-month research project calls for one of the hottest geothermal wells ever developed in the United States.

R F ZYVZYVWYF

AM-BECHTEL-SALTON SEA, 320

ENERGY CONTRACT AWARDED FOR GEOTHERMAL EXPLORATION

LNTM1

SAN FRANCISCO (AP) -- THE U.S. DEPARTMENT OF ENERGY HAS AWARDED A \$5.3 MILLION CONTRACT TO BECHTEL NATIONAL INC. TO EXPLORE THE HEART OF A GEOTHERMAL RESOURCE 10,000 FEET BENEATH CALIFORNIA'S IMPERIAL VALLEY NEAR THE SALTON SEA, THE COMPANY REPORTED WEDNESDAY.

THE 24-MONTH RESEARCH PROJECT CALLS FOR ONE OF THE HOTTEST GEOTHERMAL WELLS EVER DEVELOPED IN THE UNITED STATES AND MAY REACH DEPTHS JUST ABOVE PARTIALLY COOLED MAGMA INSIDE THE EARTH.

GROUND-BREAKING FOR THE PROJECT IS SET FOR NEXT THURSDAY. WELL DRILLING IS EXPECTED TO START IN FEBRUARY 1985.

"PART OF OUR JOB WILL BE TO EVALUATE ITS ATTRACTIVENESS AS A SOURCE OF POWER PLANT STEAM," SAID PROJECT MANAGER THOMAS E. LINDEMUTH OF BECHTEL'S RESEARCH AND ENGINEERING DEPARTMENT. "OTHER TASKS WILL BE TO COLLECT DATA ABOUT THE GEOLOGY AND GEOCHEMISTRY OF THIS DEEP RESOURCE."

THE BECHTEL CONTRACT MAY BE THE FIRST OF A SERIES OF GOVERNMENT-SPONSORED NATIONAL RESEARCH EFFORTS UNDER THE ENERGY DEPARTMENT, THE U.S. GEOLOGICAL SURVEY AND THE NATIONAL SCIENCE FOUNDATION CONTINENTAL SCIENTIFIC DRILLING PROGRAM.

JOHN CRAWFORD, PROJECT MANAGER FOR THE DEPARTMENT OF ENERGY, SAID PROJECT OPERATORS HOPE TO DRILL A WELL DEEP ENOUGH TO TAP THE AREA OF THE EARTH CLOSE TO WHERE MAGMA COMES INTO CONTACT WITH AN OIL RESERVOIR, WHICH IS THE HEART OF A GEOTHERMAL RESERVOIR.

"WE...MAY BE ABLE TO LEARN HOW THE RESERVOIR RECHARGES ITSELF AND GATHER INFORMATION ABOUT HOW THE GRINDING OF PLATES IN THE EARTH'S CRUST...AFFECTS A GEOTHERMAL RESOURCES," SAID CRAWFORD.

OTHER DATA OBTAINED FROM THE WELL MAY BE USED TO EXAMINE THE PHENOMENA OF ORE FORMATIONS, SAID LINDEMUTH.

"THIS OCCURS IN A GEOTHERMAL RESERVOIR WHEN MINERALS ARE DISSOLVED BY THE HOT FLUID IN THE DEEPER REACHES OF A GEOLOGICAL FORMATION AND ARE REDEPOSITED IN SHALLOWER AREAS," HE SAID.

LINDEMUTH SAID DRILLERS ARE EXPECTED TO ENCOUNTER A COMBINATION OF HIGH TEMPERATURE, PRESSURE AND SALINITY NEVER BEFORE ENCOUNTERED.

AP-LA-10-11-84 1225PDT



DATE November 29, 1984  
TIME 5:00-6:00 PM  
STATION KFMB-TV (CBS)  
LOCATION San Diego  
PROGRAM News Eight

Marty Levin, anchor:

The shore of the Salton Sea in Imperial County could possibly be the hottest geothermal energy source in the country. For that reason the state Lands Commission today approved a proposal to drill a ten-thousand-foot well. The six-million-dollar project will be done by the Bechtel Group of San Francisco under a grant from the federal government. The company has already drilled four thousand feet and found temperatures topping five hundred seventy-five degrees.

LOS ANGELES DAILY NEWS  
Nov. 30, 1984

### Southern California report

## Salton Sea drilling project approved

SACRAMENTO (UPI) — A plan to drill a 10,000-foot well on the shore of the Salton Sea in Southern California to test what may be one of the hottest geothermal energy sources in the nation won state approval Thursday.

The proposed \$5.9 million project will be conducted by the Bechtel Group of San Francisco under a grant by the U.S. Department of Energy, said W.M. Thompson, who handles such projects for the State Lands Commission.

The initial project was begun in March 1983 by the Bear Creek Mining Co. of Tucson, Ariz., which earlier this year included Bechtel National Inc. and the federal energy department in the venture.

"This is purely an experiment — to see how the monitoring equipment and drill bits survive," Thompson said. "This could be the hottest temperature hole drilled in the continental United States."

Thompson said the companies involved have already drilled to

4,000 feet on the southeastern shore of the Salton Sea in Imperial County and found brine temperatures topping 575 degrees Fahrenheit.

Normally, he said, the temperature increases one degree for each 100-feet drilled. In the Salton Sea test, the temperature has increased by 10 degrees for each 100-foot section.

He said a deeper hole, 40,000 feet, is being drilled in the Soviet Union, but the temperature of the brine — salty water heated by molten lava — in the Salton Sea would surpass the Soviet effort.

"We can't know how hot it gets at 10,000 feet until we drill it," he said.

Thompson said drilling to the 10,000 foot depth could begin by next spring, but state officials will not know until late summer how successful the effort was.

After that, he said, the well will be capped — probably at the 4,000 foot level — and the project studied and other energy companies express an interest.

# Deepest Geothermal Well in U.S. OK'd

The drilling of a 10,000-foot-deep geothermal well near the Salton Sea—the deepest such well in the nation—has been approved by the state Lands Commission. The federal Energy Department will pay Bechtel Corp. to drill the well to measure underground temperatures and test the drilling equipment. The \$5.9-million project is located on 40 acres of state land on the southeast shore.

CORONA (CA) INDEPENDENT  
Nov. 30, 1984

## Geothermal test at Salton Sea

SACRAMENTO—The state has approved a plan to drill a 10,000-foot well on the shore of the Salton Sea in Southern California to test what may be one of the hottest geothermal energy sources in the nation.

Approved by the State Lands Commission yesterday, the proposed \$5.9 million project will be conducted by the Bechtel Group of San Francisco under a grant by the U.S. Department of Energy.

"This is purely an experiment — to see how the monitoring equipment and drill bits survive," said W.M. Thompson, who handles such projects for the Lands Commission. "This could be the hottest temperature hole drilled in the continental United States."

DAILY COMMERCIAL NEWS, S.F.  
Nov. 30, 1984

## State approves geothermal test in Salton Sea

The State Lands Commission approved a proposal Thursday in Sacramento to drill a 10,000-foot well on the shore of the Salton Sea in Southern California to test what may be the hottest geothermal energy source in the country.

The proposed \$5.9 million project will be conducted by the Bechtel Group of San Francisco under a grant by the U.S. Department of Energy, said W.M. Thompson, who handles such projects for the state agency.

"This is purely an experiment — to see how the monitoring equipment and drill bits survive," Thompson said. "This could be the hottest temperature hole drilled in the continental United States."

Thompson said the company has already drilled to 4,000 feet on the southeastern shore of the Salton Sea in Imperial County.

— United Press

THE ARIZONA REPUBLIC  
Dec. 4, 1984

## Drilling is OK'd for geothermal energy source

United Press International

SACRAMENTO, Calif. — The state has approved a plan to drill a 10,000-foot well on the shore of the Salton Sea in southern California to test what may be one of the hottest geothermal-energy sources in the nation.

Approved by the state Lands Commission, the proposed \$5.9 million project will be conducted by the Bechtel Group Inc. of San Francisco under a grant by the U.S. Department of Energy.

The initial project was begun in March 1983 by the Bear Creek Mining Co. of Tucson, which earlier this year included Bechtel National Inc., a division of the Bechtel Group, and the Department of Energy in the venture.

"This is purely an experiment — to see how the monitoring equipment and drill bits survive," said W.M. Thompson, who handles such projects for the Lands Commission. "This could be the hottest-temperature hole drilled in the continental United States."

Thompson said the companies involved already have drilled to 4,000 feet on the southeastern shore of the Salton Sea in Imperial County and found brine temperatures topping 575 degrees Fahrenheit.

## Venture To Probe Secrets Of Salton Sea

A geologist at the University of California, Riverside will lead scientists in a \$6 million drilling venture to probe the secrets of one of the largest geothermal fields in the world - the hot brine and rock beneath Southern California's Salton Sea.

Wilfred Elders, who with UCR colleague Lewis Cohen has studied the Imperial Valley fields for more than a decade, will coordinate scientific studies nationwide under a \$250,000 grant from the National Science Foundation.

A consortium headed by Bechtel National, Inc., has received a \$5.3 million contract from the U.S. Department of Energy (DOE) to drill the well on the south shore of the Salton Sea and carry out associated engineering activities.

The well may reach temperatures of 750 degrees Fahrenheit at a depth of about 10,000 feet, making it one of the world's hottest.

Samples taken at that depth could unlock the secrets of geothermal processes and help engineers to harness a vast potential power source for Southern California.

By conservative estimates, these underground reservoirs of very hot brines could provide several thousand megawatts for cen-

tures.

"This is a unique opportunity to gather scientific data about the unknown depths of this geothermal field," Elders said.

"Until now, resource companies carried out this activity, and the resulting information was proprietary. We expect to generate a large body of scientific data in the public domain, making this a landmark geothermal study."

Elders was a participant in DOE's official groundbreaking. Scientists, engineers and federal and local officials attended the ceremonies and toured the site near Niland where drilling is expected to begin next February.

Two years ago Elders began lobbying Congress to fund a scientific drilling venture in the Salton Sea.

His eventual success, he says, was largely due to the persistent efforts of Riverside Congressman George Brown, Jr., Imperial Valley Congressman Duncan Hunter and UC's Washington representative Peter Goldschmidt.

Last fall the needed \$6 million appropriation became law, with the Department of Energy administering the funds.

As chief scientist of the Salton Sea Scientific

Drilling Project, Elders now heads a committee coordinating the nationwide scientific response to this research opportunity.

Geothermal research involves the study of water which is heated by molten rocks inside the earth.

Conversion of this heat source into electricity is now going on at geysers near Santa Rosa in Northern California where engineers have installed an 1,100 megawatt capacity.

The Imperial Valley appears to offer another vast resource of geothermal energy.

Huge amounts of very hot brines lie thousands of feet below the surface, but technology is still being developed that could make their conversion to steam a profitable venture on a larger scale.

"One of our main goals is to characterize this resource," Elders said.

"If you understand a resource, you can more intelligently exploit it. You have to know how big the resource is, determine its degree of permeability and pinpoint the areas of higher flow rates."

"You need to know if

drilling deeper will get you higher power production. We think the answer is yes, but it remains to be demonstrated if this good economics."

"Scientists will be studying extreme pressures and temperatures as well as brines that contain unusually high levels of metals like manganese, lithium, lead, zinc, silver, and platinum.

Research will also contribute to scientists' basic understanding of volcanic activity and earthquakes.

The Salton Sea zone of high heat flow, rifting, earthquakes and faults is unique in North America - and accessible, too.

It is one of two places in the world where sea-floor spreading is affecting a continent.

Elders has invited research proposals from a "wide array of scientists" nationwide and abroad.

"This is a natural laboratory for carrying out a wide range of scientific experiments. The drilling project represents the first time we've been able to explore this particular chemical and pressure-temperature regime in nature."

## Bechtel Gets Geothermal Job

Bechtel National Inc. has been awarded a \$5.3 million contract by the U.S. Department of Energy (DOE), San Francisco operations office to explore the heart of a deep geothermal resource near the Salton Sea some 10,000 feet beneath California's Imperial Valley.

The 24-month research project, which calls for one of the hottest geothermal wells ever developed in the U.S., may reach into areas just above partially cooled magma deep inside the earth, according to project manager, Thomas E. Lindemuth, of Bechtel's Research and Engineering department.

"We're going to examine this potential geothermal resource from several angles," Lindemuth explained. "Part of our job will be to evaluate its attractiveness as a source of power plant steam. Other tasks will be to collect data about the geology and geochemistry of this deep resource." Bechtel's responsibility for the Salton Sea Scientific Research Program covers planning and managing the drilling program and data acquisitions, as well as design and construction of brine treatment facilities, and a comprehensive resource evaluation.

The Bechtel contract may represent the first of a government-sponsored series of nationwide research efforts under the joint DOE/Geological Survey/National Science Foundation Continental Scientific Drilling Program that could include similar scientific endeavors exploring other areas of the earth's crust, explained DOE project manager, John Crawford.

Researchers and leading scientists from the Geological Survey, National Labs and Universities will conduct various experiments and assessments of scientific interest, he added, in addition to DOE's geothermal investigations, under Bechtel's cognizance. The project will kick off with a groundbreaking ceremony scheduled for Thursday, October 18, 1984, beginning at 9:00 a.m. at the project site. The work is being undertaken at locations provided by Kennecott, an operating company of the Standard Oil Company (Ohio).

"For this project we plan to drill two wells," noted Crawford. "The scientific exploration well will extend through the geothermal resource to a depth of 10,000 feet. There also will be a second well drilled to reinject the hot geothermal brine."

Crawford explained that the project hopes to drill a scientific well deep enough to tap the area inside the earth close to where magma comes into contact with an aquifer, which is the heart of a geothermal reservoir. "Some of the technical challenges in the program may provide opportunities for improvements in drilling and data acquisition technology. We also may be able to learn how the reservoir recharges itself, and gather information about how the grinding of plates in the earth's crust - and the heat that's created - affects a geothermal resource."

Some of the data obtained from the well may also be used to examine the phenomena of ore formation, Bechtel's Lindemuth added. "This occurs in a geothermal reservoir when minerals are dissolved by the hot fluid in the deeper reaches of a geological formation and are redeposited in shallower areas."

The project is unique because of its bilateral focus, basic geoscience studies and geothermal research, and because the drilling is expected to encounter a combination of high temperature, pressure and salinity conditions never before dealt with, Lindemuth said. Wells for commercial geothermal plants, such as The Geysers development in Northern California, normally extend to substantially shallower depths and do not contain brines with such a high mineral content.

Preliminary engineering is under way in Bechtel's San Francisco offices. Well drilling is expected to begin in February 1985.

# Exploring A Deep Geothermal Resource

By BILL RINTOUL

Sometime in February 1985, drilling is scheduled to begin at a unique well near the Salton Sea that has as its mission the exploration of the heart of a deep geothermal resource beneath the Imperial Valley.

The proposed 10,000-foot hole is to be drilled at a site near Niland at the southeast end of the Salton Sea. It will be looking for information that not only could help unlock a huge geothermal resource often described as "the Saudi Arabia of the world's geothermal energy resources" but also provide scientists with their first opportunity to study such a thermal regime in the earth's crust.

The approximately \$6 million venture represents the first of a government-sponsored series of research efforts under the joint Department of Energy-U.S. Geological Survey-National Science Foundation's Continental Scientific Drilling Program that could include similar endeavors exploring other areas of the earth's crust.

The 24-month special project at Niland will examine the potential geothermal resource of the area by drilling into an area where magma from deep inside the earth has been injected into the crust.

The overall objectives are to provide an assessment of the deep geothermal resource and to afford an opportunity for the scientific community to conduct tests during and after the drilling of the deep hole.

Bechtel is the prime contractor under a \$5.3 million contract awarded the company by the federal government. The contract calls for the Bechtel Group Inc., San Francisco, to design, drill and assess the deep geothermal well. The well is expected to encounter a unique combination of high temperature, pressure and salinity factors.

Kennecott Corp., through its Bear Creek mining division, is supplying the sites for the deep well and a brine reinjection well that will be drilled nearby.

At an October 18 groundbreaking ceremony at the project site near Niland, Pat Collins, under Secretary of the Department of Energy, described the drilling project as "a challenge that will strain existing equipment and techniques to their limits, and beyond them." Collins added, "It's a challenge that will require the development of new technologies and creative solutions. It's the quintessence of scientific exploration, but without the luxury of the controlled conditions of a laboratory."

"The Salton Sea Scientific Drilling Project stands to make a major contribution to our understanding of the geothermal resources

advancing the technology which will be able to harness more of our geothermal resources."

Harvey F. Brush, executive vice president of Bechtel Group Inc., characterized the project "as a very important first step in the Continental Deep Drilling Program."

Brush added that Bechtel has long been interested in geothermal energy as an important renewable energy resource worldwide and projects a worldwide growth of geothermal power capacity of about 700 megawatts per year over the next decade.

"In California," Brush said, "geothermal energy represents a low cost power generation option of great potential. There are large geothermal resources at The Geysers, and in the Imperial Valley and with a continuing need for power, geothermal energy development remains an important energy alternative for California."

The site where the well will be drilled - the general vicinity where the Alamo River enters the Salton Sea - is a region where some of the hottest wells ever drilled in the Imperial Valley have been located. Temperatures as high as 600 degrees Fahrenheit have been encountered at depths ranging from approximately 4,200 to 5,600 feet. At the site selected for the deep well, it's believed that maximum temperatures in excess of 660 degrees Fahrenheit may be achieved at a depth of approximately 4,000 feet, along with brine salinities of 250,000 to 300,000 milligrams per liter.

According to the timetable set up for the project, both the deep well and the injection well are expected to be completed in June 1985, with the majority of flow tests to be completed in August. Resource evaluation will be scheduled for completion by October 1985. To provide maximum opportunity for scientific experiments, the site will be kept open and available for experimentation until May 1986.

The tentative program for the deep well calls for setting 30-inch surface conductor to approximately 60 feet and 20-inch surface casing to 500 feet, after which 17½ inch hole will be drilled to about 4,000 feet. After cooling and logging to that depth, 13½ inch production casing will be run and cemented back to the surface.

After casing has been run, the well will be drilled to a total depth of 10,000 feet in 11½ inch open hole. During the drilling of the lower portion of the well, plans call for two short-term flow tests. In addition, logging will be conducted to the extent possible,

well. During the downward probe, approximately 15 percent of the hole will be cored. This will include about five 30-foot sections in the first 4,000 feet and the balance in the deep portion of the hole.

As presently planned, the lower 6,000 feet of the well will not be cased. This is due to the expected difficulty in cementing casing at the temperatures to be encountered in the lower portion of the well, possibly as high as 750 degrees Fahrenheit, plus budget limitations.

After the well reaches total depth, the hole will be logged to the extent possible. As much as 60 days of flow testing may be conducted. It's anticipated that testing will be in at least two intervals. While the rig is on the location, a total of 15 days has been allocated for experimentation not currently in the detailed plan. In addition, the hole will be available for testing for approximately one year after the drilling rig has been released.

The project faces many challenges. The first is drilling and coring at the combination of depth, temperature and salinity expected. To gain maximum information about the geology of the deep formation, attempts will be made to core as much as possible within budget limitations. Depending on the degree of fracturing in the lower part of the hole, core recovery may be difficult. Also, the expected hardness of the materials in the lower portion of the hole, plus high temperature, may make bit life lower than normal.

The high salinity in the deeper portions of the reservoir will likely cause problems with corrosion of drilling equipment, as well as scaling of process components throughout the system. The combination of high salinity plus the possibility of reaching supercritical temperatures might provide brine properties never before observed.

Bechtel's original proposal calls for conducting several commercial suites of logs in both the cased and uncased hole. The acquisition of these log data is highly dependent on the ability to cool the hole to within the temperature limitations of available equipment. For even the most rugged logging equipment, the temperature limitation is still about 500 degrees Fahrenheit, which may be about 200 to 300 degrees lower than ambient temperatures in the lower portion of the resource.

In addition to corrosion and scaling the high salinity of the brine may cause unusual problems in solids handling. Because of the expected high flashdown as the brine reacts

many minerals will be exceeded and substantial amounts of solid precipitates are expected in the brine handling equipment. This is a potential trouble spot in operation of the system. However, this precipitation of solids may provide a long-term economic advantage, if the brine from the deep resource contains valuable minerals. While mineral recovery studies are not part of the current project, data from the project may provide input for interesting work in the future.

The current program at the Salton Sea evolved from earlier initiatives to the National Science Foundation and the U.S. Congress by Professor Wilfred Elders of the University of California at Riverside and Dr. Robert Rex of Republic Geothermal.

Elders, who with UCR colleague, Lewis Cohen, has studied the Imperial Valley geothermal fields for more than a decade, is coordinating scientific studies nationwide under a \$250,000 grant from the National Science Foundation.

"This is a unique opportunity to gather scientific data about the unknown depths of this geothermal field," Elders said. "Until

now, resource companies carried out this activity, and the resulting information was proprietary. We expect to generate a large body of scientific data in the public domain, making this a landmark geothermal study."

The Imperial Valley appears to offer a vast resource of geothermal energy. Huge amounts of very hot brines lie thousands of feet below the surface, but technology is still being developed that could make their conversion to steam a profitable venture on a larger scale.

"One of our main goals is to characterize this resource," Elders said. "If you understand a resource, you can more intelligently exploit it. You have to know how big the resource is, determine its degree of permeability and pinpoint the areas of higher flow rates. You need to know if drilling deeper will get you higher power production. We think the answer is yes, but it remains to be demonstrated if this is good economics."

Along with extreme pressures and temperatures, scientists will be studying brines that contain unusually high levels of metals like manganese, lithium, lead, zinc, silver

and platinum.

"The mining industry needs precious metals," Elders said. "Utilities need a cheap source of electricity. There are a lot of practical spinoffs to the research. For instance, we will be developing the use of instruments, capable of taking samples and measurements under conditions of extreme heat, pressure and corrosion."

Research is also expected to contribute to scientists' basic understanding of volcanic activity and earthquakes. The Salton Sea zone of high heat flow, rifting, earthquakes and faults is unique in North America. It is one of two places in the world where seafloor spreading is affecting a continent.

Elders has invited research proposals from a wide array of scientists nationwide and abroad.

"This is a natural laboratory for carrying out a wide range of scientific experiments," he said. "The drilling project represents the first time we've been able to explore this particular chemical and pressure-temperature regime in nature. It's a rare opportunity to explore the processes which form geological systems."

LOS ANGELES DAILY JOURNAL OF COMMERCE

Nov. 30, 1984

## Salton Sea Geothermal Test OK'd

By PENNY SPAR

6714 FRONT PAGE

SACRAMENTO (UPI) — A plan to drill a 10,000-foot well on the shore of the Salton Sea in Southern California to test what may be one of the hottest geothermal energy sources in the nation won state approval Thursday.

The proposed \$5.9 million project will be conducted by the Bechtel Group of San Francisco under a grant by the U.S. Department of Energy, said W.M. Thompson, who handles such projects for the State Lands Commission.

The initial project was begun in March 1983 by the Bear Creek Mining Co. of Tucson, Ariz., which earlier this year included Bechtel National, Inc. and the federal energy department in the venture.

"This is purely an experiment — to see how the monitoring equipment and drill bits survive," Thompson said. "This could be the hottest temperature hole drilled in the continental United States."

Thompson said the companies involved have already drilled to 4,000 feet on the southeastern shore of the Salton Sea in Imperial County and found brine temperatures topping 575 degrees Fahrenheit.

Normally, he said, temperature increases 1 degree for each 100-feet drilled. In the Salton Sea test, the temperature has increased by 10 degrees for each 100-foot section.

He said a deeper hole, 40,000 feet, is being drilled in the Soviet Union, but the temperature of the brine — salty water heated by molten lava — in the Salton Sea would surpass the Soviet effort.

Thompson said drilling to the 10,000-foot depth could begin by next spring, but state officials will not know until late summer how successful the effort was.

After that, he said, the well will be capped — probably at the 4,000-foot level — and the project studied until other energy companies express an interest.

# Study to assess geothermal potential

By STEPHEN SWANSON  
Daily News Staff Writer

FRONT PAGE

A vast research project exploring the geothermal energy production potential of the Salton Sea area will begin Thursday.

Researchers, including Dr. Wilfred Elders of the University of California at Riverside, believe the area — long known to be one of the largest geothermal fields in the world — could hold enough power to supply all the electricity needs of Southern California.

Bechtel National of San Francisco has been awarded a \$5.3 million contract by the U.S. Department of Energy to explore the geothermal power potential of a site located about five miles south of Niland along the eastern shore of the Salton Sea. The work is being undertaken at locations provided by Kennecott Corp., part of the Standard Oil Co., which has been active in geothermal exploration in the entire Imperial Valley.

Geothermal power is generated by water which is heated by molten rocks inside the earth's crust. The heat energy produced is converted to electrical power.

Elders, associated with UCR's Institute of Geophysics and Planetary Physics, has been studying the potential of the area for about 10 years, university officials said. His studies indicate extensive underground pools of hot brine in the Imperial Valley could supply several thousand megawatts of electrical power for centuries to come.

But there are a number of problems to overcome.

Unlike some California geothermal fields — such as The Geysers near Santa Rosa — Imperial Valley's hot brine is not near the surface and wells of

some 10,000 feet may be needed to reach the superheated water.

Additionally, the Imperial Valley geothermal reservoir is highly saline which could cause a number of corrosion problems and place additional strain on equipment, Bechtel Project Manager Thomas E. Lindemuth said.

"We're going to examine this potential geothermal resource from several angles," Lindemuth said. "Part of our job will be to evaluate (the Imperial Valley's) attractiveness as a source of power plant steam. Other tasks will be to collect data about the geology and geochemistry of this deep resource."

Temperatures of some 750 degrees Fahrenheit are expected when the brine pools are reached.

In addition to power, Lindemuth said other benefits of the exploration could include recovery of valuable minerals such as silver and zinc.

Elders, along with UCR associate Lewis Cohen will coordinate the studies under a \$250,000 grant from the National Science Foundation.

Bechtel's responsibility includes planning and managing the drilling program and data collection as well as design and construction of brine treatment facilities (typically after the brine is removed from the earth it is reinjected into the earth), Bechtel spokesman Gary Frantz said.

Well drilling is not expected to get under way until February 1985.

Scheduled to attend the 9 a.m. opening ceremony at the project site Thursday are a number of federal, state and local officials.

memo  
from

GARY FRANTZ

RHW  
12/21

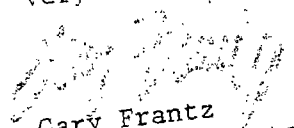
TO:

JOHN CRAWFORD

Information.

Attached are additional media clips that we have received over the past month publicizing the Salton Sea Scientific Drilling Project.

Very truly yours,



Gary Frantz  
Media Representative  
Bechtel

12/3/84



## Geothermal source explored

As part of a research project begun last month, Bechtel National, Inc., will oversee the drilling of two wells to explore a source of hot geothermal brine 10,000 ft below California's Imperial Valley.

The U.S. Department of Energy awarded a \$5.3-million contract to Bechtel for the two-year study. Bechtel will collect information about the geology and geochemistry of the area and will try to determine whether heat from the brine can be used to run a powerplant.

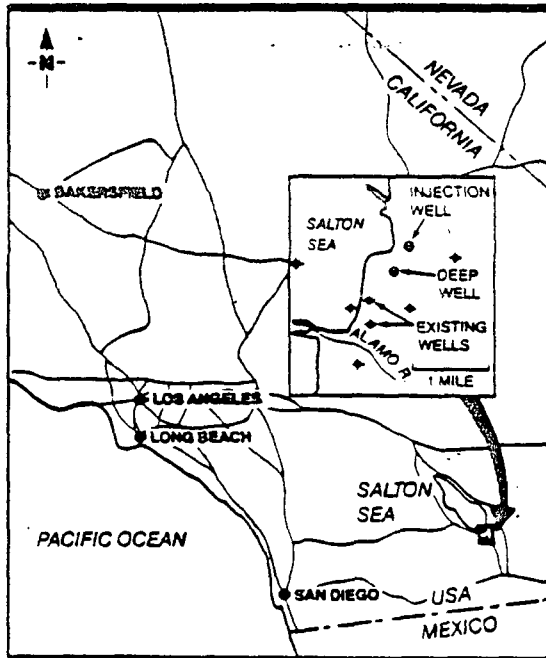
In fulfilling its contract with DOE, Bechtel will plan and manage the drilling program and collection of data at the site, near the Salton Sea. The firm will also design and build brine treatment equipment.

The wells will be the first in a federally sponsored Continental Scientific Drilling Program. DOE, the U.S. Geological Survey and the National Science Foundation signed an accord setting up the program earlier this year.

One well at the Salton Sea site will be an exploration well that will extend through the geothermal resource. A second well will be used to reinject the hot geothermal brine collected from the first well.

In the Imperial Valley, magma from deep within the earth has leaked upward into the earth's crust and come into contact with an aquifer.

The researchers hope to learn something about how the grinding of the earth's plates generates heat to create the magma and how the underground



water reservoir is recharged. They also hope to learn about the process of ore formation—which occurs when minerals are dissolved by the hot fluid deep in the geological formation and are deposited closer to the surface.

Bechtel is now doing the preliminary engineering work in its San Francisco offices.

The deep drilling is expected to produce hotter brine—possibly at temperatures as high as 750 F—than previous geothermal projects. The corrosive brine will be high in dissolved minerals.

"It's a challenge that will require the development of new technologies and creative solutions," said DOE Under Secretary W. Patrick Collins at a groundbreaking ceremony at the site. ■

Executive Report Los Angeles, CA  
KFAC and KFAC-FM Oct. 11, 1984

Bechtel National Inc. of San Francisco reported receipt of a \$5.3 million contract from the U. S. Department of Energy to explore the heart of a deep geothermal resource near the Salton Sea, some 10,000 feet beneath California's Imperial Valley.

Daily Commercial News  
San Francisco, CA  
Oct. 12, 1984

## Bechtel given research contract

### Commercial News Staff

A \$5.3 million federal contract has been awarded to the San Francisco's Bechtel Group Inc. to design, drill and assess a deep geothermal well in the Salton Sea geothermal area of California's Imperial Valley.

The contract was made public Thursday by the San Francisco operations office of the U.S. Department of Energy.

The 24-month special project will examine the potential geothermal resource of the area by drilling a well into an area where magma from deep inside the earth has been injected into the crust.

Besides evaluating the site as a potential source of power, the research will provide scientists with their first opportunity to study such a thermal regime in the earth's crust.

The project is unique because of its bilateral focus, basic geoscience study and geothermal research, and because the drilling is expected to encounter a unique combination of high temperature, pressure and salinity factors.

The contract represents the first of a series of government-sponsored research efforts under the joint DOE - Geological Survey - National Science Foundation Continental Scientific Drilling Program and could include similar endeavors exploring other areas of the earth's crust.

San Francisco Chronicle  
December 1, 1984

### ***State OKs Geothermal Project***

A plan to drill a 10,000-foot well on the shore of the Salton Sea in Southern California to test what may be one of the hottest geothermal energy sources in the nation won state approval Thursday. The \$5.9 million project will be conducted by Bechtel Group of San Francisco under a grant by the U.S. Department of Energy, said W.M. Thompson, who handles such projects for the State Lands Commission. United Press reported from Sacramento that the initial project was begun in March 1983 by Bear Creek Mining Co. of Tucson, Ariz., which earlier this year included Bechtel in the venture.

Ray W.  
1/31/85

# The Geysers

TM VOLUME 9 ISSUE 3 DECEMBER 1984

## BECHTEL BEGETS \$5.3 MILLION

The United States government and industry have joined forces to launch a project to tap the geothermal potential of what could be the hottest field in the United States. The federal government has executed a 5.3 million dollar contract in favor of Bechtel Group, Inc., San Francisco, California to design, drill and access a geothermal well in the Imperial Valley of California, potentially the geothermal Saudi Arabia of the U.S.

Deeper reservoir exploration could yield 25 million kilowatts of geothermal power within the next 50 years, as compared to the current capacity of 5-7 million kilowatts., says Robert W. Rex, president of Republic Geothermal Inc., of Santa Fe Springs, California.

Preliminary efforts are underway in Bechtel's offices with an anticipated drilling starting date set for February 1985. Completion of the drilling is scheduled for the following June; flow testing will continue through October of 1985. Drilling is expected to go out for bid in December 1984 and January 1985, with the award granted sometime in January.

Technical difficulties are anticipated in the execution of this project. According to the Oil & Gas Journal, "...Project drilling is expected to encounter high temperatures, pressures, and salinities in combinations never before dealt with..." However, officials at the Department of Energy are optimistic about the project and anticipate success. According to John Crawford, DOE project manager, "...some of the technical challenges in the program may provide opportunities for improvements in drilling and data acquisition technology..."

This contract is the first of a government-sponsored series, under the Joint DOE Geological Survey and the National Science Foundation Continental Scientific Drilling Program. For further information contact John Crawford at DOE, 1333 Broadway, Oakland, Ca. 95612, or telephone him at (415) 273-7944.

## UNION UNIFIES ITS INTEREST

In a move to expand its energy reserve, Union Oil has agreed to pay Diamond Shamrock Corporation \$285 million for an additional 25% interest in their Geysers field holdings. Before the sale agreement, Union Oil and Diamond Shamrock held equal shares in the Geysers. As a result of the sale, Union Oil will hold a 75% stake in the field, thereby reducing Diamond's interest to 25%.

The Geysers is the largest geothermal energy field in the world, bar none. According to a spokesman from Diamond Shamrock, Diamond sold part of its interest to make funds available for other planned geothermal ventures.

Union Oil, a subsidiary of Unocal, sells its output of geothermal steam to Pacific Gas and Electric Co. to produce approximately one million kilowatts of electricity.

## WHAT NEVADA NEEDS

A senate subcommittee hearing in April, 1984 examined the current status of Nevada's geothermal energy industry. According to the Geothermal Resources Council Bulletin, October, 1984, Nevada has great potential in that it contains the most geothermal lease acreage of any state, one million acres. However, the major drawbacks which Nevada must face are derived from the impact which the federal government has on existing leases and acreage limitations. Ed Spang, State Director of the Bureau of Land Management of Nevada says that Nevada faces the termination of existing leases with "producible wells, under 10-years lease terms, and federal acreage limitations."

However, the federal government has shown signs of their intentions to cooperate with Nevada's pursuit of alternative modes of energy. On October 9, 1984, the federal government gave the official go-ahead on the first federally-approved geothermal power plant. Spang stated that the Federally-approved 9-megawatt plant will be constructed by Phillips Petroleum Company and will be located at the Desert Peak Federal Geothermal unit in Churchill County, just 30 miles north-east of Fernly. Construction on the plant is expected to be complete by late 1985.

INTERNATIONAL GEOTHERMAL ENERGY NEWSLETTER



Department of Energy  
San Francisco Operations Office  
1333 Broadway  
Oakland, California 94612

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(For CommCtr. Only)

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TO: RAY WALLACE, CE-323

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FROM: ROBERT HUGHEY, ACTING DIRECTOR, FGS

DOE/SAN PH# 273-6364

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*Robert Hughey*  
(Signature)

UNCLASSIFIED

White / House

# NEWS FROM BECHTEL

Engineers and Constructors  
Fifty Beale Street  
San Francisco, CA 94105

For Release: IMMEDIATE  
For Further Information Contact:

Dan Purnell (415) 768-6050 (Bechtel)  
Wolfgang Rosenberg (415) 273-7829 (DOE)  
Janet White (714) 787-5304 (UC Riverside)

*Gene, 2 m of  
122nd*

SAN FRANCISCO, October 23, 1985 -- Under a \$6.13 million contract with the U.S. Department of Energy, Bechtel has begun drilling a two-mile deep well that will reach into one of the hottest geothermal fields in the United States.

The Salton Sea Scientific Drilling Program (SSSDP) is the first major enterprise of the Continental Scientific Drilling Program, a joint research effort by the DOE, the National Science Foundation and the U.S. Geological Survey. It is located near the Salton Sea in California's Imperial Valley.

The well will probe a region where geological conditions allow magma to approach the surface, heating reservoirs of highly saline, mineral rich brine to more than 700 degrees Fahrenheit. The well will be the first U.S. drilling project ever to encounter the combination of such extreme temperatures and salinities at this depth.

"In addition to the extreme geological conditions, this project is unique because of the dominant priority placed on scientific objectives," said Dr. Charles Harper, project manager from Bechtel's Research and Development Division.

The scientific objectives are being carried out by 37 groups of scientists, funded by three federal agencies. Dr. Wilfred Elders, geologist from the University of California at Riverside, has been named chief scientist.

Dr. Elders and his colleagues will be performing research under a special grant from the National Science Foundation. His group has studied the Imperial Valley for more than a decade.

"Until now, resource companies <sup>have</sup> carried out this activity, and the resulting information <sup>is</sup> proprietary," Elders said. "The Salton Sea project is a unique opportunity to gather new scientific data about the depths of a geothermal field and make it available to all concerned."

MORE

Principal Operating Companies of Bechtel Group, Inc.



Bechtel Power Corporation  
Bechtel Petroleum, Inc.  
Bechtel Civil & Minerals, Inc.

181/1

In addition to the U.S., scientists from Japan, Canada, Great Britain, Australia and Belgium will conduct specific studies of the samples and of the data collected during drilling and flow testing.

The studies, selected and awarded from more than 60 proposals, will investigate geochemistry, petrology, geophysics, and the activity of micro-organisms in hot, saline environments. The mechanisms of ore formation from geothermal brine will also be studied, providing additional information for future studies of the potential for commercial mineral recovery.

The Salton Sea Geothermal Field is potentially one of the world's most extensive reservoirs of geothermal energy. Scientists estimate that if its heat were converted into electricity it could provide as much as ~~5,000~~<sup>2,000</sup> megawatt-centuries -- enough to supply the energy needs for a city of five million people for a hundred years.

6,791 Mwe/30yrs

2,264 MWC  
037.3

28 1/2

Drilling will continue through March 1986. A six-month standby period will follow to allow scientists to monitor temperature and pressure changes in the well and take additional samples. More than 2,000 feet of core samples will be withdrawn during and after the drilling.

The lease holder on the site, Kennecott, has the option to pursue further commercial testing after the SSSDP is completed.

The Imperial Valley is part of the Gulf of California rift system. It's one of only two places in the world where sea-floor spreading affects a continent. The Salton Sea geothermal field is caused by this spreading of the earth's crust. Intrusions of magma thousands of feet below the surface heat brines to very hot temperatures at the site.

03751

###

181/2

# memorandum

DATE: October 15, 1985

REPLY TO  
ATTN OF: Fossil & Geothermal Branch


SUBJECT: Salton Sea Spud in Press Release

TO: Wilf Elders, UC Riverside  
Charles Harper Bechtel

The attached release is a draft of the release to be sent out to announce spud of the Deep Well. It will be polished by DOE's PR group.

If you have any serious problems with it, please contact me.

I recommend that U.C. Riverside, Bechtel and DOE all send out the same release concurrently. In this manner we may duplicate some recipients but an important entity will not be overlooked.

  
Anthony J. Adduci, Chief  
Fossil, Geothermal & Solar  
Energy Programs Division

cc: Ray Wallace ✓

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From: Janet White Phone (714) 787-5304 Rm., Bldg. \_\_\_\_\_

Date/Time 10/15/85

Instruction: 415 273-7957  
Please make one extra copy and send to Tony Adduci.  
(273-6365)

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WASHINGTON, DC

7. Raymond Wallace  
(Signature of authorizing official)

8. DATE 10/19/85 10:00 AM

9. TO

DONALD KLICK  
U.S. GEOLOGICAL SURVEY  
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October 23, 1985

The Salton Sea Scientific Drilling Program (SSSDP) began the drilling of a well which will reach almost two miles into one of the hottest geothermal fields in the U.S. located in the Imperial Valley of California.

The SSSDP is the first major undertaking of the Continental <sup>the</sup> Scientific Drilling Program; a joint research effort by U.S. Dept. of Energy, National Science Foundation and the U.S. Geological Survey.

U.S. DOE has contracted with the Bechtel Corp. to manage the drilling of the well and surrounding facilities to support scientific data acquisition and experiments.

~~The~~ Kennecott Corp. <sup>owner</sup> of the geothermal lease, through agree- <sup>drilling ops</sup> ment with Bechtel, has agreed to allow ~~the~~ SSSDP ~~program~~ to take place on its lease and to use its permits for the program.

The well will probe a region where geological conditions <sup>have</sup> allowed molten magma to come near the surface, heating reservoirs of highly saline, mineral rich brine to more than 700 degrees Fahrenheit. The well will be the first U.S. drilling project ever to encounter the combination of such extreme temperatures and salinities at this depth.

"In addition to the extreme geological conditions, the project is unique of the dominant priority placed on scientific objectives," said Charles Harper, project manager for Bechtel's Research and Development Division.

The scientific objectives of the SSSDP program will be carried out by 37 groups of scientists funded by the National Science Foundation, U.S. Geological Survey and the U.S. Dept. of Energy.

The studies, selected and awarded from more than 60 proposals, will investigate geochemistry, petrology, geophysics, and the activity of micro-organisms in hot, saline environments. The mechanisms of ore formation from geothermal brine will also be studied, providing additional information for future studies of the potential for commercial mineral recovery.

Dr. Wilfred Elders, geologist from the University of California, Riverside, has been named Chief Scientist. He and his colleagues have studied the Imperial Valley for more than a decade and will be performing research under a special grant from the National Science Foundation.

"Until now, resource companies carried out this activity, and the resulting information was proprietary," said Elders. "The Salton

Sea Scientific Drilling Project is a unique opportunity to gather scientific data about the depths of a geothermal field."

In addition to the U.S. scientists, scientists from research groups in Japan, Canada, Great Britain, Australia and Belgium will conduct specific studies of the samples and data collected during drilling and flow testing of the well.

The well will penetrate into temperatures expected to reach 750° F. The Salton Sea Geothermal Field is potentially one of the world's most extensive reservoirs of geothermal energy. Scientists estimate that if this heat were converted to electricity, it could provide as much as 5,000 megawatt-centuries--enough to supply the energy needs of a city of 5 million people for a hundred years.

The Imperial Valley is part of the Gulf of California rift system, one of only two places in the world where sea-floor spreading is affecting a continent. The Salton Sea Geothermal Field is caused by this spreading of the earth's crust. Intrusions of molten rock or magma thousands of feet below the surface heat brines to very hot temperatures.

During and after the drilling over 2,000 feet of core will be withdrawn from the well; several instruments will be lowered into the well to gather scientific data; and fluid samples will be taken by both flowing the well at selected depths and by placing sampling instruments into the well.

The drilling operation will continue through March 1986 and then a six month post drilling period will begin. The entire SSSDP is scheduled to be completed by November 1986 but the scientific evaluation of the data and samples will be the basis for years of study.

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October 15, 1985

Hold for release Wednesday, Oct. 23, 1985

SUBJECT: DRILLING BEGINS IN \$8 MILLION RESEARCH VENTURE

RIVERSIDE -- Drilling of a research well two miles deep began today (Oct. 23) as scientists and engineers launched an \$8 million research venture to probe <sup>the roots of</sup> one of the hottest geothermal fields in the world, near the Salton Sea in the Southern California desert.

Wilfred Elders, a University of California, Riverside geologist, is the chief scientist coordinating an international team of 37 scientific groups who will conduct \$2 million of research and instrumentation projects at the site. A consortium headed by Bechtel National, Inc., will perform drilling and engineering activities under a \$6.1 million contract awarded by the Department of Energy.

The borehole in Southern California's Imperial Valley is the first major project to get underway in the nationwide Continental Scientific Drilling Program. The drilling program is made possible by joint sponsorship of the National Science Foundation, the U.S. Geological Survey and the Energy Department, and through cooperation of Kennecott, the leaseholder on the site.

The well may reach temperatures of 750 degrees Fahrenheit at its projected depth of 10,000 feet, making it one of the hottest on earth. Situated on the south shore of the Salton Sea, the borehole will be the first deep geothermal well in the United States drilled for strictly scientific purposes.

"Until now, resource companies carried out this activity, and the resulting information was proprietary," said Elders. "The Salton Sea

*wrong !!  
Gov't doesn't do  
jobs done by  
industry !!!*

--more--

Scientific Drilling Project is a unique opportunity to gather scientific data about the <sup>roots</sup> ~~depths~~ of a geothermal <sup>reservoirs</sup> ~~field~~ <sup>systems</sup>.

The Salton Sea Geothermal Field is potentially one of the world's most extensive reservoirs of geothermal energy. Scientists estimate that if this heat were converted to electricity, it could provide as much as 5,000 megawatt-centuries -- enough to supply the energy needs of a city of 5 million people for a hundred years.

The Imperial Valley is part of the Gulf of California rift system, one of only two places in the world where sea-floor spreading is affecting a continent. The Salton Sea Geothermal Field <sup>results from</sup> ~~is caused by~~ this spreading of the earth's crust. Intrusions of molten rock or magma thousands of feet below the surface heat brines to very <sup>high</sup> hot temperatures.

The Salton Sea project will enable engineers to research and develop drilling technology. The well will be among the first U.S. research drilling projects ever to encounter such extreme temperatures and <sup>corrosive brines</sup> ~~depths~~. ?

Elders and his UCR colleague Lewis Cohen will coordinate scientific studies nationwide under a \$225,000 grant from the National Science Foundation. He and his associates at UCR will carry out individual research projects on the site under grants exceeding \$700,000 in the coming year.

The drilling and research activities are projected to continue through November of 1986, including a six-month period to continue monitoring and sampling after drilling is completed. Kennecott, the lease holder, has the option to pursue further commercial testing after the project is completed.

One million dollars is budgeted for coring, which could yield over 2,000 feet of core. Engineers and scientists at the site will log temperature, pressure, and geophysical measurements, and take downhole samples during drilling. Three tests of the flow rate of steam and brine from the well are

planned.

Samples taken from the borehole could unlock the secrets of geothermal processes, and help engineers harness a vast potential power source for Southern California.

"One of our main goals is to characterize this resource," Elders said. "If you understand a resource, you can more intelligently exploit it. You have to know how big the resource is, determine its degree of permeability and pinpoint the areas of higher flow rates. You need to know if drilling deeper will get you higher power production per well. We think the answer is yes, but it remains to be demonstrated if this is good economics."

Participants in research include scientists from Japan, Canada, Britain, Australia, and Belgium. The scientists are investigating geochemistry, petrology, geophysics, and the activity of microorganisms in hot environments.

Charles Harper, project manager at Bechtel, noted, "The drilling is expected to encounter an unprecedented combination of high temperature, pressure and salinity conditions. We hope to tap the area inside the earth close to where magma comes into contact with an aquifer, which is the heart of a geothermal reservoir. Drilling at those temperatures and in contact with highly corrosive brines is reaching the limits of current technology."

Elders attributes the slow pace of commercial development of this geothermal field to the technical difficulty and high cost of handling the Salton Sea brines, which contain up to 25 percent of dissolved salts.

"However this disadvantage may, in the future, become an even stronger incentive to develop the resource for combined power production and minerals recovery," he said. "If 90 percent of the mineral values in the brine were to be recovered, their market value would be \$500 to \$1,500 million a year. It remains to be seen if it can be done profitably."

This brine field could potentially constitute the largest reserve of platinum in the United States and a 1,000 megawatt plant could supply 14 to 31 percent of the U.S. demand for manganese, a strategic metal, he added. Data will also aid scientists' understanding of ore formation.

"From earlier studies we know this field contains ores of iron, lead, zinc and copper. Ore formation is being studied because we believe important ores form from such brines. The brine contains abnormally high concentrations of iron, manganese, lithium, zinc, lead and silver," Elders said.

Other plans of the Continental Scientific Drilling Program involve drilling a deep well in the Southern Appalachian Mountains, in an ore body in Colorado, and in the vicinity of the San Andreas Fault in Cajon Pass, California.

Simultaneous releases have been issued by Bechtel, Inc. and the Department of Energy. For more information, please contact:

Janet White, University of California, Riverside, (714) 787-5304,

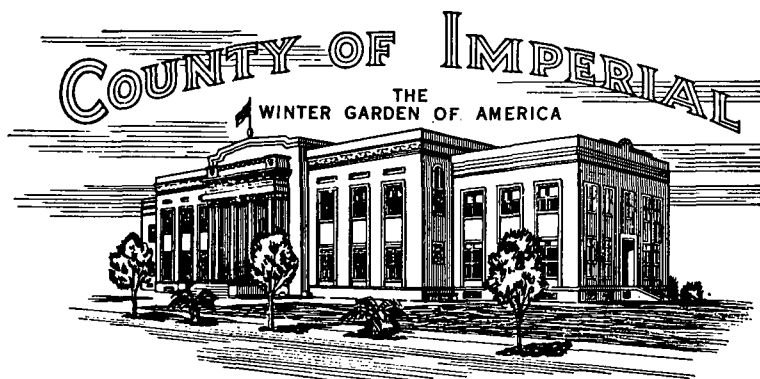
Dan Purnell, Bechtel, Inc., (415) 768-6050, or

Wolfgang Rosenberg, Dept. of Energy, (415) 273-7829

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December 30, 1985

United States Department of Energy  
Office of Renewable Energy Technologies  
Geothermal Technology Division  
Washington, D.C. 20585

SUBJECT: Change of Name and Address For Mailing Salton  
Sea Scientific Drilling Program Information

Dear Sir or Madam:

This Department receives the information on the Salton Sea Scientific Drilling Program from your Division. We would appreciate you updating your mailing list to assure the information is received by the proper persons within our organization. Please make the following correction:

DELETE: Ms. Margaret Rands  
Geothermal Coordinator  
Courthouse  
El Centro, CA 92243

ADD: S. Harry Orfanos  
County of Imperial  
Director of Public Works  
155 South 11th Street  
El Centro, CA 92243-2853

Thank you for your assistance in correcting the mailing of your publications.

Sincerely yours,

S. Harry Orfanos  
Director of Public Works

By:

Jean Mavity  
Deputy Director of Public Works



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Geothermal Coordinator  
Courthouse  
El Centro, CA 92243

## WORLD'S DEEPEST GEOTHERMAL WELL PROPOSED:

### THE SALTON SEA SCIENTIFIC DRILLING PROJECT

A consortium of federal agencies which sponsor earth sciences research and energy technology development is considering a proposal by scientists from the University of California, Riverside, to study the deepest, and probably hottest, geothermal well in the world. In the Imperial Valley of southern California several geothermal fields are being actively developed by industry as non-polluting sources of electric power. The largest and hottest of these is at the south end of the Salton Sea. Subterranean temperatures in this field exceed 690°F at 7,000 feet depth over a wide area. Formerly, the high salinity of the water encountered, which contain up to 25% of dissolved salts, has been a barrier to the development of this enormous resource. New technological developments now hold promise of overcoming this problem.

A 10 megawatt electric generating plant has operated in the Salton Sea field since August 1982 with a 96% availability factor. Two 50 megawatt plants are now planned by other industrial concerns. There is also interest in extracting chemicals from the brines, which contain unusually high contents of metals such as copper, lead, zinc, and even silver. This rare association of high temperatures and high salinities is similar to the recently discovered deep ocean-floor hot springs in the East Pacific. These precipitate a wide array of metallic ores.

Up to now, scientific study of these unusual phenomena in the Salton Sea field has been difficult. This is because information from the thirty proprietary geothermal wells drilled by industry so far in the field is confidential. However, in the fall of 1982 one developer, Republic Geothermal, Inc. (RGI), recognized the need for research on such geothermal fields and responded favorably to a request to collaborate with researchers at the University of California, Riverside (UCR), Drs. W. A. Elders and L. H. Cohen. These investigators have a contract with the Office of Nuclear Waste Isolation to study naturally-occurring radioactive elements in hot brines. They are investigating geothermal fields as natural analogs of possible conditions in a nuclear waste repository. The idea is to obtain data to model the potential for migration of dissolved radionuclides away from proposed waste repositories in salt mines.

Further discussion between the UCR group and RGI led to the even more ambitious plan to "add-on" to a well to be drilled by RGI in the spring of 1983. This well, in the eastern part of the field, is scheduled to reach 12,000 feet depth. As a first step, the UCR proposal requests funds to pay added costs of obtaining rock and brine samples and other data from this well. Funds are also requested to explore the roots of this geothermal system by deepening the well to 18,000 feet, the limit of the available drilling rig. All of the information obtained would be released to the scientific community.

The most ambitious aim of the proposed experiment is to approach the heat source which the UCR group believes to be intrusions of molten rock from below. The first 12,000 feet of the well will yield more samples and data to the public domain than are available from any commercial geothermal well yet

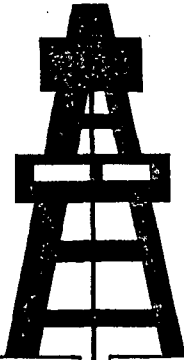
drilled in the U.S.A. Deepening the well to 18,000 feet will explore an extreme environment of pressure and temperature never before investigated directly. The well would explore for steam at depths and pressures (and probably temperatures) greater than any other geothermal well anywhere in the world. The UCR scientists speculate that the well may encounter "superconvection." According to a recent theory, at high enough pressures and temperatures, fluids can flow much faster than is possible at less extreme conditions. Although such deep wells are more expensive to drill, if "superconvection" were to occur, the power output from them would be many times greater than that from shallower wells.

The data and samples obtained from this deep well will be used to interpret the three-dimensional geological structure and hydrology of the this geothermal resource. However, just as important, it will help develop necessary technology and experience in drilling and producing steam from wells which are much deeper and hotter than those currently employed by the geothermal industry. Drs. Elders and Cohen believe that such experiments have the potential, in the long term, of enormously increasing the size of the known geothermal energy resources of the country.

They point out that RGI will have invested some \$15 million in developing this site by the time it is brought into steam production. The UCR researchers propose to "piggy-back" on this investment by seeking a further \$6 million of government and other funds to cover the additional engineering and scientific costs of the proposed experiment. Dr. Elders stated, "This is a wonderful opportunity for collaboration between industry and government with a high potential for important new scientific returns. In my opinion, it is exactly the kind of high risk basic and applied research which should be supported by the appropriate federal agencies."

ESTIMATED BUDGET FOR THE SALTON SEA SCIENTIFIC DRILLING PROJECT

	<u>DOE RGI \$K</u>	<u>NSF UCR \$K</u>	<u>TOTAL \$K</u>
<u>Phase 1 - FY 83 Expenditures</u>			
Coring, sampling, logging Mechanical modifications	225.0	130.0	
Salaries, expendibles, curation, administration, science support		50.6	
TOTALS PHASE 1	<u>225.0</u>	<u>180.6</u>	<u>405.6</u>
 <u>Phase 2 - FY 84 Expenditures</u>			
<u>2A</u> Deepening well, etc.	3,280.0		
<u>2B</u> Fracture stimulation, experiment Curation, administration, science support	965.0	276.0	
<u>2C</u> Restoring well to production	440.0		
TOTALS PHASE 2	<u>4,685.0</u>	<u>276.0</u>	<u>4,970.0</u>
 <u>Phase 3 - FY 84 Expenditures</u>			
Science, salaries, etc.		477.0	
Overhead		117.0	
TOTALS PHASE 3		<u>594.0</u>	<u>594.0</u>
 <u>TOTAL PROPOSED COSTS PHASE 1, 2, 3,</u>			
	<u>\$4,910.0</u>	<u>\$1,050.6</u>	<u>\$5,969.6</u>



# World's Deepest Geothermal Well Proposed at Salton Sea

*Editor's Note: If it is funded, this proposed deep well project could be one of the most important research events of the decade. Let us keep in mind that projects such as this are the life blood of a growing industry.*

A proposal to drill the world's deepest well (18,000 ft) into the Salton Sea geothermal anomaly near Niland in the Imperial Valley of California was submitted to the National Science Foundation. The "Salton Sea Scientific Drilling Project" submitted on November 5, 1982, was co-authored by Drs. Wilfred Elders and Lewis Cohen of the University of California, Riverside. On December 8, 1982, the Continental Scientific Drilling Committee met in San Francisco in an open meeting to discuss the proposal. (Another proposal to do deep drilling and related research in the Valles Caldera of New Mexico is reported to be in preparation by an ad-hoc group that met in New Mexico in early October of 1982.)

The project—a three-way effort between the University of California, Riverside, the National Science Foundation, and Republic Geothermal, Inc. of Santa Fe Springs, California—will begin in March 1983. Republic plans to drill a third well on its fee lease which is centered about 1-1/2 miles southwest of Niland. There are two existing wells on Republic's Niland property. The well is scheduled to 12,000 ft and will eventually become a producer for a planned 49 MW power plant that should be operational in late 1985.

The proposal calls for the drilling and completion of this well with larger diameter hole and casing that would allow its deepening to 18,000 ft. Republic is receptive to the

interim use of the well ("add ons") as a research project.

Following is a description of the three Project Phases together with an outline of the proposed budget:

### PHASE I

Republic plans to drill its well to 12,000 ft at a cost of \$2.6 million. The first phase would "add on" the following components:

1. Limited coring and water sampling during the drilling operation to 12,000 ft, and

2. Increasing the hole diameter to provide for a special casing completion program that will allow the well to be deepened to 18,000 ft.

Cost ..... \$ 410,000

### PHASE II

*Phase II A* - continuous coring and limited fluid sampling of the well as it is deepened from 12,000 to 18,000 ft. Open-hole wireline logging and production testing. No casing is to be run.

Cost ..... \$3,280,000

*Phase II B* - Perform a fracture dilation and well stimulation experiment.

Cost ..... \$ 970,000

*Phase II C* - Restoration of the well to a production mode and other related costs.

Cost ..... \$ 720,000

### PHASE III

Study of down-hole core samples and preparation of final report.

Cost ..... \$ 590,000

Total Cost ..... \$5,971,000

Finally, there will be a period of time set aside from August 1984 to June 1985 when the well will be available for research projects sponsored by other parties.

The benefits of this research project could be far-reaching and have a positive impact on the development of geothermal energy world-wide. Among the numerous

primary data collection possibilities are:

1. The possible existence of superconvecting geothermal systems and the economic implications thereof,

2. The nature of the heat source and its lithologic characteristics, and

3. The possibility of solution mining and metal recovery from deep circulating brines.

If you wish to know more about this proposed project, contact Wilfred Elders, Ph.D., Institute of Geophysics and Planetary Physics, University of California, Riverside, CA 92521, 1-714/787-3439. G.T.

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INSTITUTE OF GEOPHYSICS  
AND PLANETARY PHYSICS

RIVERSIDE, CALIFORNIA 92521

February 14, 1983

To: Recipients of the Proposal "Salton Sea  
Scientific Drilling Project: Phase 1"

From: W. A. Elders

WE

Re: Revised Timetable

Attached is the latest revision of the proposed timetable for the entire Salton Sea Scientific Drilling Project. Now that the Federal Loan Guarantee has been negotiated, Republic Geothermal, Inc. proposes to order well casing in mid-April. Phase 1 drilling would be concluded in December 1983 and Phase 2 drilling would begin in July 1984, allowing 6 months for surface and downhole studies of the first 12,000 ft. of hole. The remainder of the drilling/production schedule will permit a total of 12 months for various studies of the interval between 12,000 and 18,000 ft.

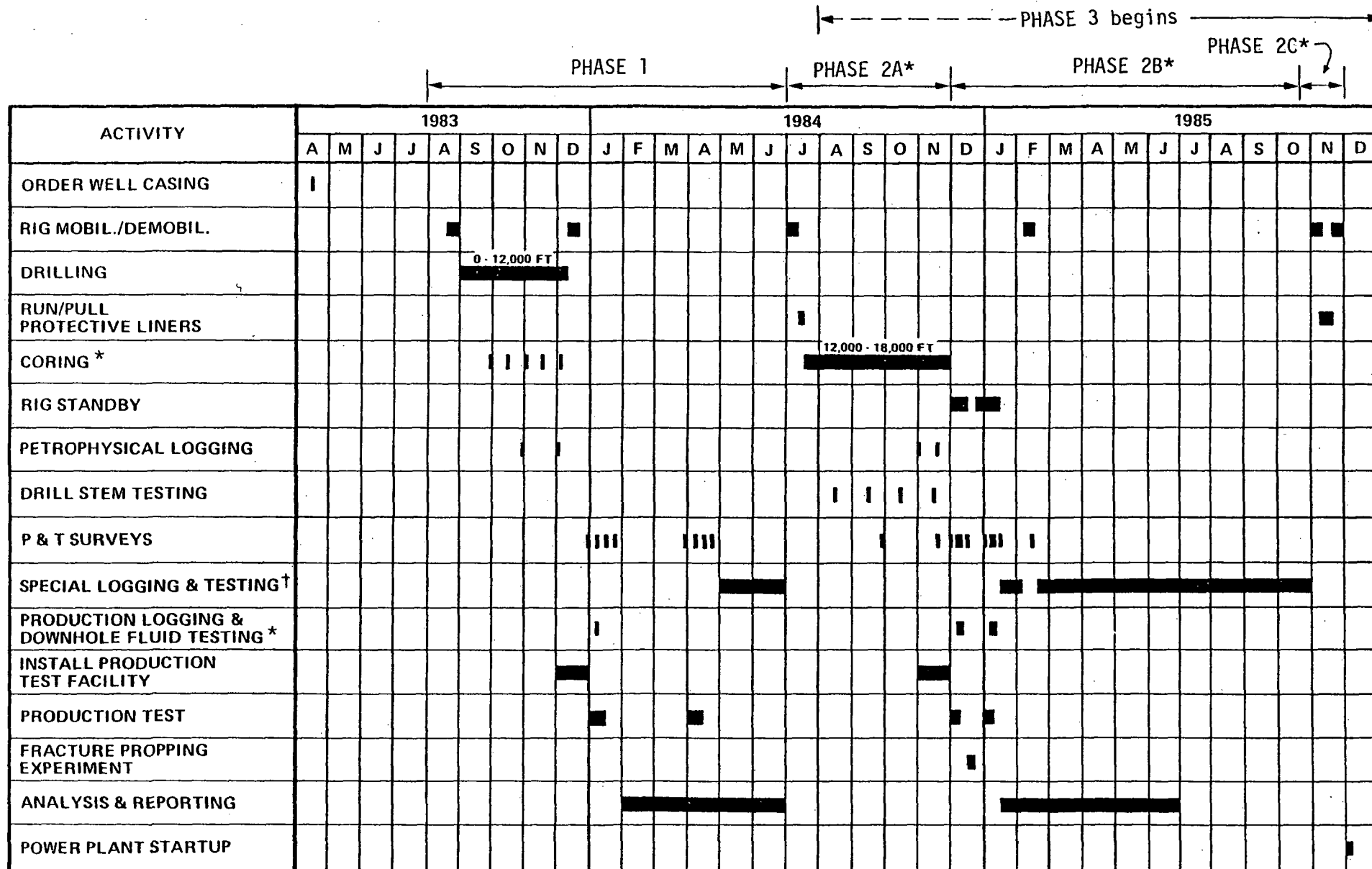
We would again like to emphasize that the range of possible scientific and reservoir engineering investigations is not limited to those specifically mentioned in our proposal. We would welcome participation by other investigators for whom 11 1/2 months is specifically allotted in the timetable under the heading of "Special Logging and Testing". As mentioned in our proposal, the Steering Committee will oversee the project planning, coordinate experiments, and distribute samples and data among the different investigators.

The management of Republic Geothermal, Inc. have indicated that if this project goes forward they will release data on the two adjacent wells on the site and would consider the possibility of well-to-well experiments by other investigators if consistent with sound engineering practices.



Figure 5. Proposed timetable

## SALTON SEA SCIENTIFIC DRILLING PROJECT



\* Continental Scientific Drilling Program Sponsored Activities.

† Funds for these activities not requested in this proposal.



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Brace  
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February 14, 1983

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FILE

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Scientific Drilling Project: Phase 1"

From: W. A. Elders *WAE*

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A GUIDE TO THE  
SALTON SEA SCIENTIFIC DRILLING PROJECT

from

The Institute of Geophysics and Planetary Physics  
University of California  
Riverside, CA 92521

Principal Investigator: W. A. Elders (714) 787-3439  
Co-Principal Investigator: L. H. Cohen (714) 787-5029

January 1983

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A GUIDE TO THE  
SALTON SEA SCIENTIFIC DRILLING PROJECT

from

The Institute of Geophysics and Planetary Physics  
University of California, Riverside, CA 92521

Principal Investigator: W. A. Elders (714) 787-3439

Co-Principal Investigator: L. H. Cohen (714) 787-5029

Abstract

We propose to perform an "add-on" experiment to a commercial geothermal well to be drilled this spring in the Salton Sea geothermal field in the Imperial Valley of California. By deepening it to 18,000 ft we would be able to study the deepest, and hopefully the hottest, geothermal well in the world. One aim of the experiment is to try to reach pressures and temperatures where "super-convection" may exist, i.e., zones where extremely high flow rates of very hot fluid are postulated to occur. If successful this would increase the potential of geothermal resources enormously.

Brines produced from this field contain unusually high contents of metals. Therefore this study is also important to understanding the formation of hydrothermal metal ore deposits similar to those known to be forming at the recently discovered submarine hot springs on mid-ocean spreading centers.

1.0 SUMMARY OF THE AIMS AND BENEFITS OF THE PROJECT

We plan to drill the deepest geothermal well in the world in the hottest geothermal field so far discovered in North America. The Salton Sea geothermal field is one of a series of geothermal fields in the Salton Trough, at

the head of the Gulf of California, whose origin appears to be due to processes similar to those which give rise to high-temperature hot spring (hydrothermal) systems in ocean rift systems (sea-floor spreading centers). The geologic setting of this geothermal field in this zone of rifting, earthquakes and faults, where the earth's crust is being pulled apart, presents the only opportunity in North America to study processes akin to sea-floor spreading on land. There are obvious cost advantages to doing so.

In this environment, the rifting of the continental crust is accompanied by intrusions of molten rock (magma) from below. Such intrusions are the most likely explanation of the high temperatures already measured in geothermal wells in the Salton Sea geothermal field which exceed 690°F at 7,000 ft. For more than a decade many earth scientists have enthusiastically discussed the concept of deep drilling to penetrate such bodies of molten rock and the zones of convecting groundwater above them. Penetrating such hydrothermal-magmatic systems could unlock enormous sources of energy. However an experiment to drill into an actual magma chamber at depth would require extensive technological improvements to drill into such a hostile environment (temperatures exceeding 2,000°F at more than 25,000 ft depth). Some preliminary cost estimates suggest that to successfully drill into a deep magma chamber, even in a favorable environment such as a young volcanic terrane, might cost more than \$100 million and require ten years of development work.

Our proposal is a modest preliminary step on the way to that long term goal. In the spring of this year Republic Geothermal, Inc. will drill a geothermal well to 12,000 ft in the eastern part of the Salton Sea field. We are requesting funds to study this well and deepen it to 18,000 ft. Situated

as it is towards the flanks of the known geothermal field, we do not expect this well to reach a large magma chamber at only 18,000 ft depth. We aim to explore closer to the heat source in the roots of a hydrothermal system to look for possible zones of recharge where colder water is descending to be heated by the magma at greater depth, and to obtain samples of rock and water which will be used to interpret geophysical data obtained at the surface. These data will be used to model the three dimensional structure and hydrology of the whole field. This in turn will help us to better define future deeper exploration targets in the center of the field. The experiment will also help develop the necessary technology and experience of drilling and producing steam from wells which are deeper and hotter than those currently drilled by the geothermal industry.

The first 12,000 ft of the well will yield more samples and data to the public domain than are available from any commercial geothermal well yet drilled. Deepening the well to 18,000 ft will provide samples from a unique pressure/temperature environment never before investigated directly anywhere in the world. We would be exploring for permeable zones at depths and pressures never before explored in geothermal systems. We would also test the possibility of creating fractures artificially and propping them open to generate permeability in the indurated rocks believed to exist at depth. Although such drilling is considerably more expensive than drilling to the more usual shallower depths, if successful, it may enter zones of "superconvection." According to a recent theory, at the appropriate (supercritical) high pressures and temperatures, fluid flow rates should be many times greater than those possible in less extreme conditions. Thus the speculation is such deep wells, although more expensive to drill, could yield

much higher power output than wells drilled to lesser depths, because of the expected effect of higher pressure and temperature on flow rates.

A further important aim is to explore more deeply one of the most saline geothermal fields in the world, where brines contain more than 25% of the dissolved salts. Salinity-controlled density gradients permit very high temperature gradients because they tend to inhibit thermally-driven convection. These brines contain very high metal contents and are actively precipitating copper, lead, zinc and silver ores. Their study should provide considerable insight into ore genesis in hydrothermal systems. We plan to pay particular attention to the content of naturally-occurring radioactive elements in the rock and brine samples we will obtain from this well. One geological situation which is a likely candidate for the host rock for a mined repository for hot nuclear waste is salt, which occurs as beds or domes in various sedimentary basins in the USA. The temperatures found in the Salton Sea geothermal field equal or exceed those predicted to occur in such a waste repository. With this in mind the Office of Nuclear Waste Isolation has funded us to study geothermal fields as analogs of possible behavior around a waste repository. We are studying the extent to which radioactive elements are transported by the movement of hot brines in sedimentary rocks. Thus the samples obtained by the drilling discussed here will be an invaluable addition to this study of possible radionuclide migration in and near future nuclear waste repositories in salt mines.

Our estimated budget for the incremental costs of this project are approximately \$6 million. The cost advantage of doing this as an "add-on" experiment to a well which is to be drilled anyway are obvious. Republic Geothermal, Inc. will have invested \$15,000,000 in this site by the time



development is completed. We estimate that the cost of acquiring a 40 acre site in the center of the Salton Sea field, paying for a lease, paying royalties, compensating the operators for loss of revenues from steam production, drilling a well to 18,000 ft, drilling a disposal well, building brine handling and pumping facilities, and operating this dedicated facility for five years would be in excess of \$20,000,000. Costs of doing science in this facility would be additional to this estimate. We believe therefore that the plan we have proposed is exciting scientifically, technically feasible, and cost-effective. Furthermore we can begin immediately.

## 2. OUTLINE OF THE PROPOSAL

### 2.1 Introduction

Early in the spring of this year a private company, Republic Geothermal, Inc., will begin drilling a 12,000 ft (3.7 km) deep steam well, which will be the deepest well in the Salton Sea Geothermal Field in the Imperial Valley of California. This well will be used to supply steam to a power plant to be built by Parsons Engineering in the fall of 1985. We propose to "piggy-back" on this commercial well and pay for deepening it to 18,000 ft (5.5 km) for scientific purposes. Our aims are to drill the deepest geothermal well in the world. We wish to explore the roots of this intense hydrothermal system where temperatures reach 665°F at 7,000 ft (365°C at 2 km), and thus explore a regime of pressure and temperature never before directly studied in nature.

By the time this well is brought into steam production late in 1985, Republic Geothermal, Inc. will have invested some \$15 million in developing this site. We are requesting a further \$6 million of government funds will cover the additional engineering and scientific costs of our proposed experiment. Our proposal to the National Science Foundation requesting the

first \$405,000, which must be committed in FY83 to fit the timetable of the operating company, is under consideration. However, before committing these funds the NSF needs some assurance that funding for deepening the well to 18,000 ft will be forthcoming. We anticipate that these funds could come in FY84 and FY85 from a consortium of government agencies including the Department of Energy, the United States Geological Survey, and the National Science Foundation and others. Appendix I, the proposal submitted to NSF, gives a fuller documentation of the proposed project.

## 2.2 Background to the Proposal

The report entitled "Continental Scientific Drilling Program", published in 1979 by the U.S. Geodynamics Committee of the National Research Council, outlined the scientific reasons for drilling the continental crust for scientific purposes. The Continental Scientific Drilling Committee (CSDC) was subsequently established by the National Research Council - National Academy of Sciences to provide communication, coordination, and advice concerning implementation of such a program.

Four major scientific objectives were identified in the report (U.S. Geodynamics Committee, 1979): (a) Basement Structures and Deep Continental Basins, (b) Thermal Regimes, (c) Mineral Resources, and (d) Earthquakes. Both the Thermal Regimes Panel and Mineral Resources Panel of the U.S. Geodynamics Committee specifically mentioned the Salton Sea Geothermal Field (SSGF) as a desirable target for continental drilling: (USGC Report, 1979, p. 97 and p. 118-119).

Thermal regimes are manifestations of the earth's internal heat, the energy source for earthquakes, volcanoes and geothermal areas. The USGC Report (1979, p. 11) states:

"The Panel on Thermal Regimes identified two major objectives. The first is to produce three-dimensional understanding of heat sources and products of thermally driven processes and to improve the boundary conditions of predictive models. The second is to remove barriers to the understanding of high heat-flow geothermal systems."

Similarly, according to the Mineral Resources Panel (USGC Report, 1979, p. 11),

"The essential path to finding mineral deposits is to understand how the ore-forming processes have operated in the crust... Many important mineral deposits are concentrations of valuable elements mobilized and transported with energy derived from hot magma (molten rock) driving reactions between aqueous fluids and rocks within the earth. Such centers of magma-geothermal activity may be sampled in depth by drilling in two types of situations: (a) Currently active systems of interest in connection with fundamental principles regarding sources of geothermal energy... (b) Ancient mineralized hydrothermal systems that have yielded significant ore deposits.

In discussing scientific drilling the USGC Report pointed out the advantages of drilling "dedicated holes", i.e., holes drilled solely for scientific purposes but also encouraged "maximum use of holes of opportunity (holes drilled for specific mission purposes)" (USGC Report, 1979, p. 9). Even though they are expensive the advantages of "dedicated holes" are obvious. The advantage of "holes of opportunity" is that the largest part of the costs are borne by the operator.

In October 1982 we became aware that Republic Geothermal, Inc. (RGI) was planning to drill the deepest well yet sited in the Salton Sea Geothermal Field, and that the company was sympathetic to allowing scientific experiments to be carried out on this well if the well was deepened. After consultation with the RGI engineers we proposed to the CSDC, at its meeting on October 22, 1982, a technically feasible and cost effective plan for "add on" experiments in this hole of opportunity. The CSDC responded favorably to our proposal and appointed W. A. Elders as chairman of a steering committee to implement and

oversee the project (see Appendix I). On November 8, 1982, a proposal entitled "Salton Sea Scientific Drilling Project, Phase 1" was submitted to the National Science Foundation (Appendix I). This proposal was discussed at an open forum convened by the Thermal Regimes Panel of the CSDC held at the annual meeting of the American Geophysical Union in San Francisco on December 8, 1982.

Approximately \$225,000 of the funds requested in the Phase 1 proposal are the added costs of drilling the 12,000 ft deep hole at a larger diameter to permit deepening it to 18,000 ft. The remainder would be for sample collection and other studies in the first 12,000 ft of the well. We now face the following dilemma: the National Science Foundation is reluctant to commit the funds to drill the wider diameter hole to 12,000 ft unless funds to continue to 18,000 ft are to become available; on the other hand, unless we drill to 12,000 ft using the wider diameter bits and well casings, it will not be possible to continue below 12,000 ft. Thus, in order to get funds to begin our project, we must simultaneously obtain funds to complete it.

### 2.3 The Scientific Importance of the Salton Trough

By far the most important thermal regimes on earth are mid-ocean rift systems (sea-floor spreading centers) found in all of the world's oceans. Recent work suggests that the total heat flow through all the ocean rift systems amounts to about a quarter of the total internal heat flow out to the surface. The discovery of widespread intense outpourings of submarine hot springs on the East Pacific Rise is one manifestation of this activity. It is estimated that such hydrothermal circulation drives a volume of sea water equal to the total volume of the oceans through the mid-ocean rifts in about 10 million years. These hydrothermal systems at sea-floor spreading centers

are important scientifically because they have profound effects on the chemistry of the oceans. Also we now recognize that certain kinds of economic metallic ore deposits, now found on land as the result of plate tectonic activity, were initially formed at such rifts.

Such oceanic hydrothermal systems are new and exciting targets for oceanographic research. However there are obvious cost advantages to studying these systems on land in the few rare instances where sea floor spreading centers affect land masses. The only opportunity for such a study in North America is in the Salton Trough, the landward extension of the Gulf of California (Figure 1). The Salton Trough appears to be in every way similar to the Gulf of California except that has been partially filled by the sedimentary deposits by the Colorado River. The Gulf of California is, in turn, a region transitional between the sea-floor spreading system of the East Pacific Rise and the southern end of the San Andreas Fault System. The Gulf contains numerous depressions such as the Guaymas Basin, where sea-floor spreading is occurring and submarine vents discharging hydrothermal brines at 650°F have been observed. These basins are connected by faults which continue north into the Colorado Delta and merge into the San Andreas Fault.

The Salton Trough is the site of numerous geothermal fields, now being developed for electrical power production (Figure 2). It also contains young volcanoes at Cerro Prieto, Mexico, and at the Salton Buttes, California, and is subject to frequent major earthquakes and earthquake swarms. These earthquake swarms are thought to be produced by intrusions of magma (molten rock) into the sedimentary section; indeed the most likely source of heat for the geothermal fields is igneous intrusions at depth. In several of the geothermal fields dike rocks, i.e., small solidified igneous intrusions, have been encountered in drillholes.

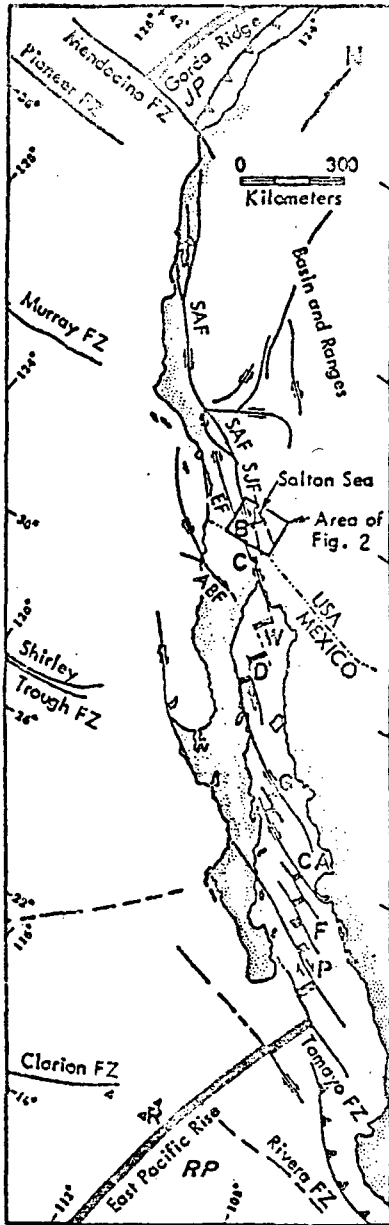


Figure 1. Gross tectonic environment of the Salton Trough. The Pacific Coast of North America is dominated by transform fault systems, which connect the Mendocino triple junction to the Rivera triple junction. Also shown are pull-apart basins between en echelon fault segments in the Gulf of California. Oceanic fracture zones (FZ) and continental faults (F) are solid black lines, dashed where uncertain. Other abbreviations: SAF = San Andreas Fault; EF = Elsinore Fault; SJF = San Jacinto Fault; ABF = Agua Blanca Fault; JP = Juan de Fuca Plate; RP = Rivera Plate; W = Wagner Basin; D = Delfin Basin; G = Guaymas Basin; CA = Carmen Basin; F = Farallon Basin; P = Pescadero Basin; ▲ = Holocene volcanoes; B = Salton Buttes; C = Cerro Prieto; and R = Revillagigedo. From Elders, et al., 1972.

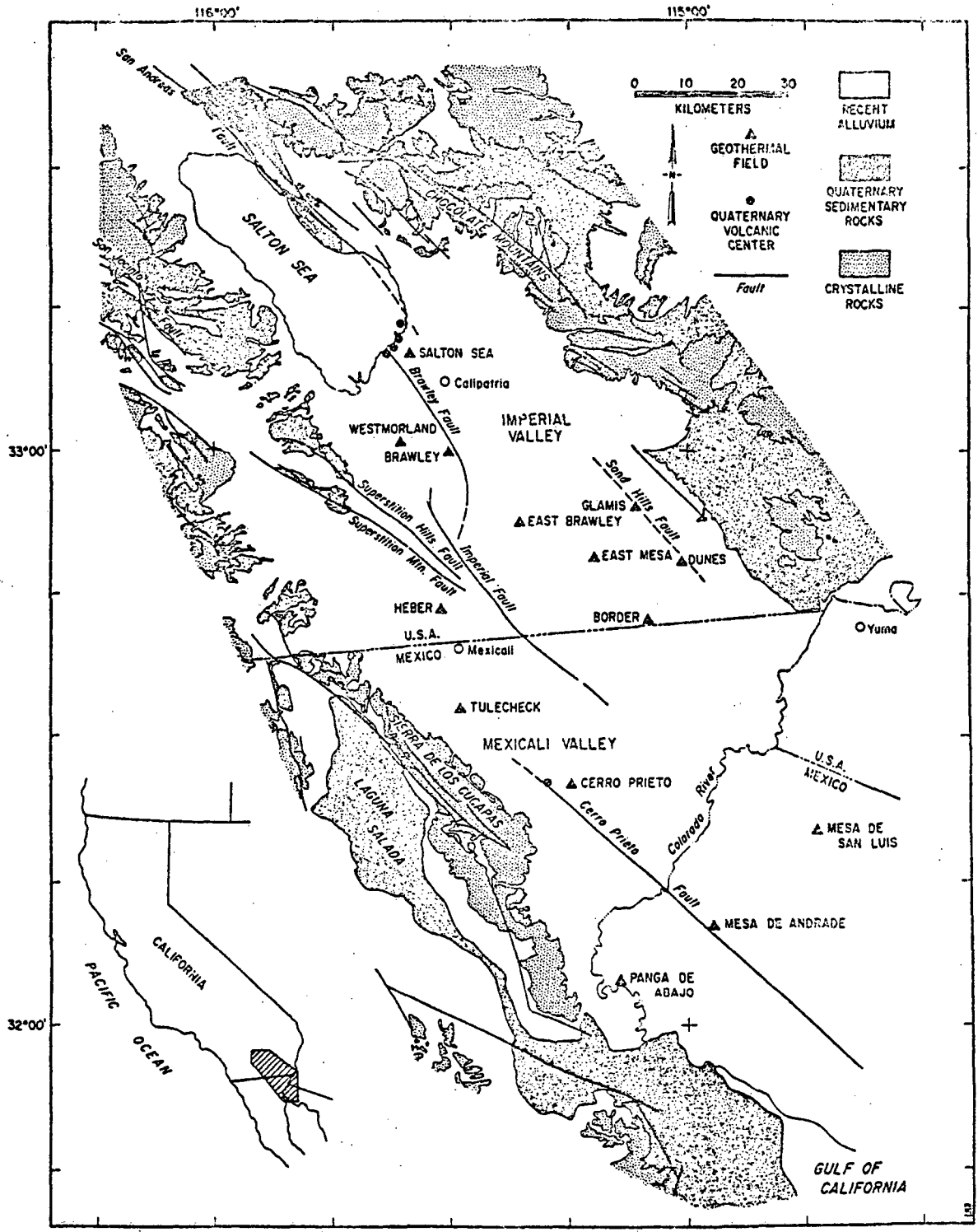


Figure 2.  
 Geothermal fields of the Salton Trough.

#### 2.4 The Salton Sea Geothermal Field

The Salton Sea Geothermal Field is the largest of the series of geothermal fields so far explored in the Salton Trough (Figure 2). At least 32 wells deeper than 3,300 ft penetrate the system, making it the most extensively explored field in the Trough north of the international border (Figure 3). Since the summer of 1982 an electrical generating plant of 10 MWe has been in operation by Southern California Edison, with steam supplied by Union Geothermal Inc. Two plants of approximately 50 MWe each with steam to be supplied by Republic Geothermal, Inc. and Magma Power Company are planned.

The Salton Sea field exhibits the highest temperatures so far recorded in any geothermal field in North America, 690°F at 7,070 ft. Such high temperatures would cause pure water to boil even at the pressures encountered at depth. However the reservoir is occupied by hot brine rather than steam, because boiling is inhibited by the high salt content of the brine (up to 25 weight per cent of salt). These salts are themselves a potential resource as they contain high concentrations of ore-forming metals such as lithium, zinc, copper, lead and even silver. Ore minerals are abundant in cores and cuttings taken from these wells.

It is estimated that the value of the dissolved solids in the hot brine necessary to supply steam to a 50 MWe power plant for a year would have a value of more than \$1 million. Since economic methods of recovery are lacking, the salt content of the hydrothermal fluid is at present more of a liability than an asset. Expensive brine-handling facilities are required both to produce clean steam for power generation and to inject the spent brine into disposal wells so that the power generating system is non-polluting.



These potential ore-forming fluids are of great interest to students of the genesis of hydrothermal ore deposits. Currently the University of California-Riverside is funded by the Office of Nuclear Waste Isolation to study the migration of naturally-occurring radio-active elements in these hot brines as analogs of possible behaviors in the near field of a nuclear waste isolation facility in salt. In both a geothermal field and a nuclear waste repository hot concentrated solutions may cause migration of dissolved chemical elements.

Recently suggestions have been put forward that at high enough temperatures and pressures a "superconvecting regime" may exist. According to this hypothesis, near the critical point of water, where the distinction between water and steam disappears, the physical properties of water are discontinuous (Figure 4). Specifically it is postulated that the ratio of the driving force for convection (buoyancy) to the forces resisting fluid flow (viscosity) increases by a factor of a thousand. The implication is that this would cause very high fluid flow rates and efficient heat transfer. Such "superconvection", if it exists, would have a revolutionary impact on the economics of geothermal power production. As an example, deepening a well in order to reach supercritical fluid at several times the cost of a conventional well would be economic if it produced at a rate considerably greater than that of the conventional well.

Superconvecting regimes have not yet been encountered in nature. However the temperatures and pressures in the Salton Sea geothermal field come closer to the critical point of water than in any other field known to us. The critical point is of course elevated in temperature and pressure by the high salinity. However the steep temperature gradient in the Britz #3 well

Figure 3. Location of existing and proposed geothermal wells in the Salton Sea and Westmorland geothermal areas (from Geothermal Resources Council, 1981).

- ⊙ Geothermal wells for which samples and/or logs exist at UCR
- Other geothermal wells
- \* Proposed well Fee #7

<u># on map</u>	<u>Well name</u>
1	Britz #3
2	River Ranch #1
3	Sportsman #1
4	I.I.D. #1
5	I.I.D. #2
6	State of California #1
7	Elmore #1
8	Magmax #3
9	Magmax #2
10	Magmax #1
11	Woolsey #1
12	Sinclair #4
13	Sinclair #1
14	Sinclair #3
15	Landers #1
16	Landers #2
17	Dearborn Farms
18	Kalin Farms
19	Fee #1

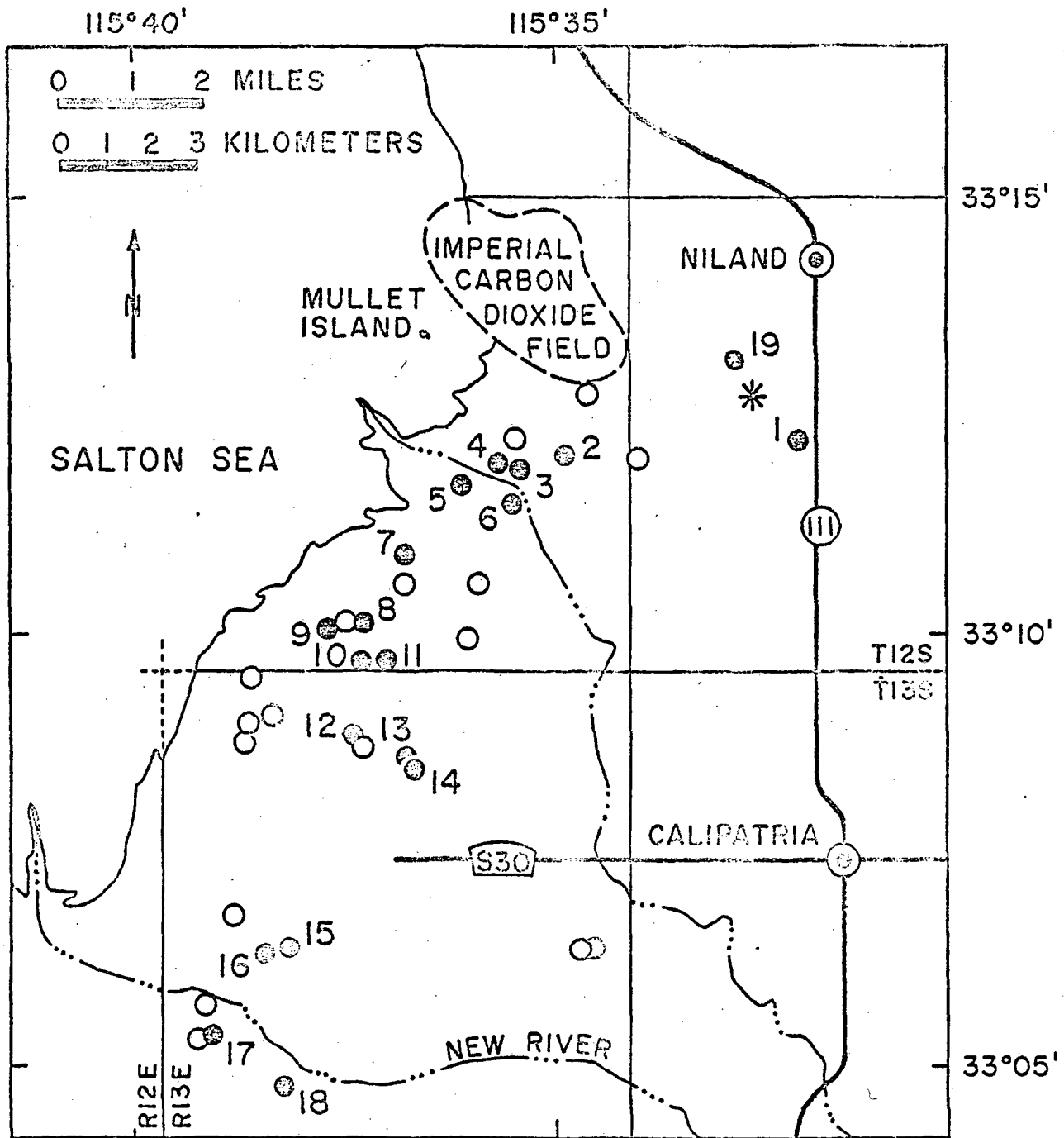


Figure 3.

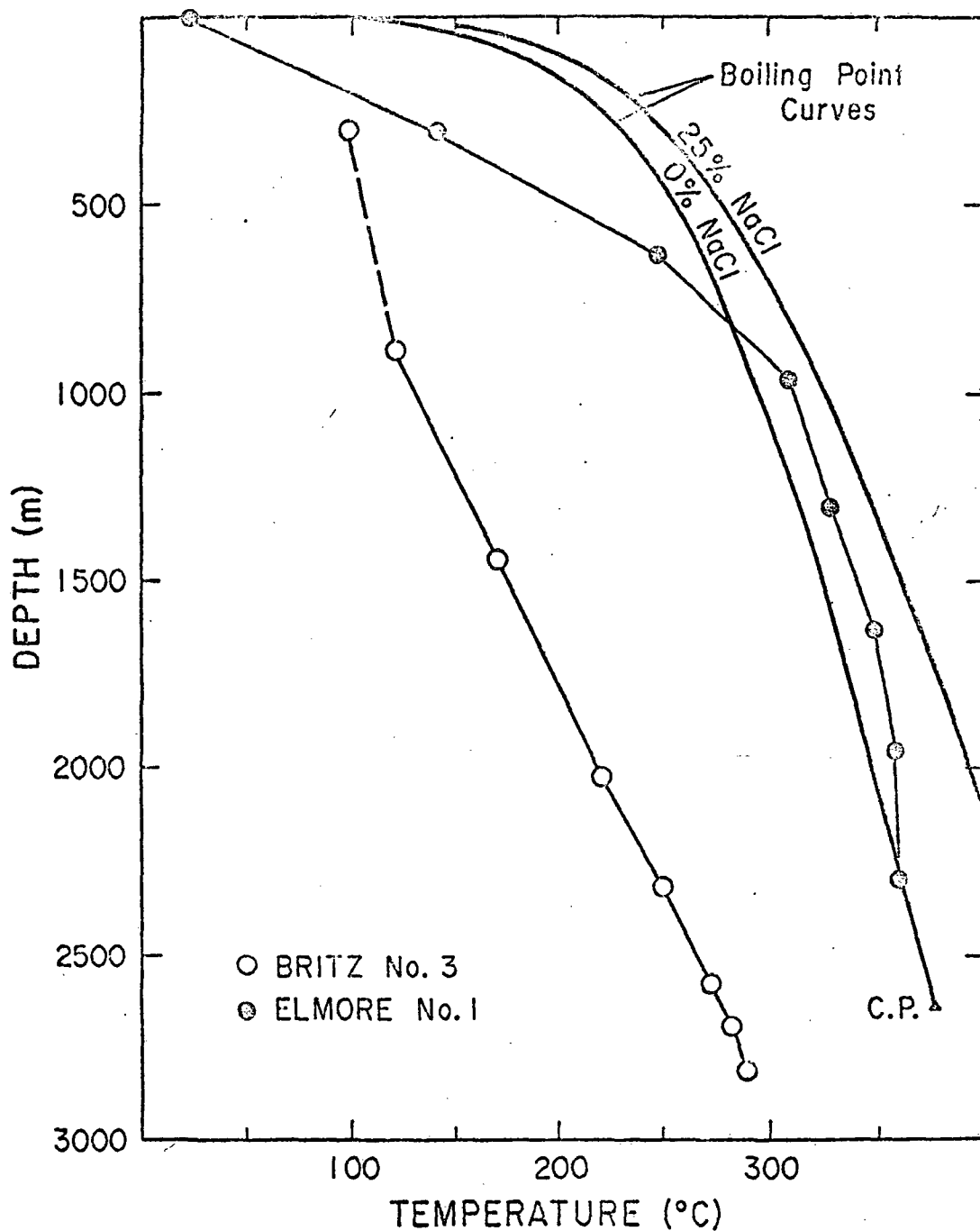


Figure 4. Equilibrium temperature logs for Elmore #1 and Britz #3 wells, together with the boiling point curves for pure water and a 25% NaCl solution (Ellis and Mahon, 1977). CP = critical point of pure water. For well locations see Figure 4.

adjacent to our proposed well (Figure 4) offers the exciting possibility that by drilling deeper supercritical conditions might be encountered for the first time in nature.

### 3.0 THE SPECIFIC PLAN

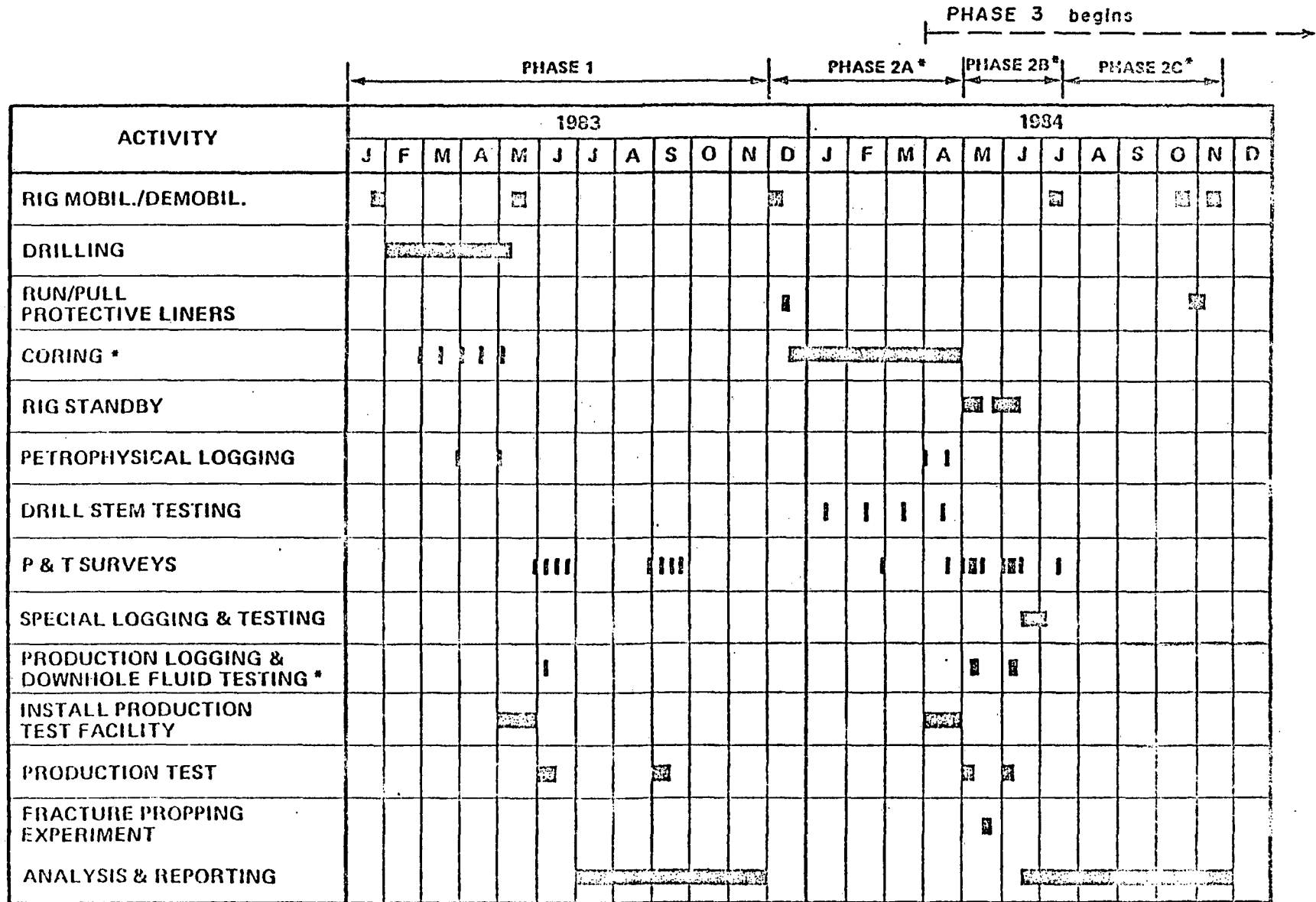
Republic Geothermal, Inc. has drilled the Fee #1 and the Britz #3 wells on their company-owned land in the eastern portion of the Salton Sea geothermal field to depths of 6,000 to 8,000 ft (Figures 3 and 4). They plan next to drill a new well, the Fee #7, between these two wells, to a depth of 12,000 ft. Their aim is to explore for higher temperatures and deeper steam zones than those found in the Fee #1 and Britz #3, where temperatures slightly less than 555°F were measured at 8,000 ft (Figure 4). It was originally planned to begin drilling Fee #7 in February 1983 but current planning suggests this will now begin in March or April. (Thus the dates in Figure 5 will be adjusted).

Given the willingness of RGI to collaborate with our scientific goals we proposed the following research plan and timetable (see Figure 5, the timetable we proposed in October 1982).

#### 3.1 Phase 1

(1) Using funding requested from the National Science Foundation, we will obtain rock cores (five 30 ft long cores), water samples and temperature and wireline logs from the 12,000 ft well. The incremental costs for this would be \$130,000. Geothermal developers do not normally recover rock cores. The 150 ft of core thus made available to the public domain will exceed the total amount of core currently available for study from the entire Salton Sea geothermal field. These samples will be by far the most important material available to the Office of Nuclear Waste Isolation study on radionuclide

Figure 5. Proposed timetable for Phases 1 & 2 of the SSSDP



\* CONTINENTAL SCIENTIFIC DRILLING PROGRAM SPONSORED ACTIVITIES.

migration referred to above. In addition they will be available for petrophysical studies. Measuring the physical properties of these rocks will enable us to calibrate and help interpret both surface and downhole geophysical surveys, and so generalize the information obtained from this well into three dimensions across the field.

(2) The most crucial activity for the succeeding activities will be to pay the incremental costs of drilling this 12,000 ft well at a wider diameter and for using wider diameter casing. This is necessary in order that the well can be re-entered to deepen it to 18,000 ft in Phase 2. These added costs are estimated to be \$225,000.

The total costs of Phase 1 including salaries, travel, overhead and the activities mentioned above will be \$405,657. As can be seen in Figure 5, its total duration including analysis and reporting would be 11 months.

### 3.2 Phase 2

(1) In Phase 2A of the project, which could begin as soon as Phase 1 is concluded (probably in January 1984), RGI will deepen the well using funding from this project. If funds permit, this could go to the limit of the capability of the drilling rig, i.e., 18,000 ft. Because thermal effects indurate (harden) the rocks, this section would not need to be cased. Similarly because the rocks will be hard enough, drilling would be done with diamond bits and cored continuously. This avoids problems with lost circulation zones and provides the best kind of samples. The well would be logged using commercial logging services and repeated water samples would be taken. The cost of deepening the hole to the target depth, insurance, sampling and logging would be \$3,280,000 and the estimated duration would be five to six months, thus it could be concluded by June 1984.

(2) In Phase 2B scientific studies in the well would be performed. These could run from June or July 1984 until the fall of 1985, i.e., between 1 and 1-1/2 years. Possibly the most important of these studies would be an attempt at fracture stimulation and propping. When hot rocks are encountered which lack permeability it is necessary to create artificial fractures by pumping fluids into the hole at pressures high enough to fracture the rocks. To these fluids sand-size grains of hard minerals are added. These enter the fractures and keep them open when the pressure is relieved. Such fracture stimulation is fairly common in certain oil fields and has been carried out in hot granites in the Fenton Hill, NM, hot dry rock project. It has not been attempted in the hot indurated sedimentary rocks of the Imperial Valley. We estimate the cost of this study to be \$965,000.

We anticipate that there will be a number of different scientific investigations carried on in this hole by other interested groups. Fracture mapping, borehole televiwer surveys, downhole seismometry, downhole water sampling, etc., would be of widespread interest. We have not attempted to anticipate the costs of such activities at this time. However we expect that such costs could be partly borne by redirecting activities already programmed and funded by various agencies. We will invite the broadest possible participation consistent with the safety of the well and maximizing the scientific yield for the mutual advantage of all concerned. The steering committee will oversee the scheduling of these experiments during the 12 to 18 months available for Phase 2B.

At this stage, rather than preparing a detailed technical program plan and budget for these as yet unspecified experiments, we will simply invite suggestions for both experiments and funding by outside investigators. We



will, of course, encourage and support these investigators in seeking funding, rather than our assuming responsibility for planning and funding all potential downhole experiments. We will, however, take responsibility for curation and distribution of the samples, and for administration of Phase 2B. Our estimated budget for this would be \$276,000.

(3) Because RGI is drilling the Fee #7 as a steam production well, it will be necessary to prepare it for steam production by the late fall or end of 1985. The cost of such restoration to production status would be \$440,000. However this cost could be reduced if the interval below 12,000 ft is a producing zone which does not need to be sealed off.

The experienced personnel of RGI believe that these proposed activities do not depend upon any advancements in the current state-of-the-art technology of drilling and testing geothermal wells. The total cost of Phases 2A, 2B and 2C including administration and overhead is estimated to be \$4,970,000. However because all drilling activities are subject to uncertainties, equipment failures and delays, a contingency allowance of 20% would be desirable.

### 3.3 Phase 3

Phase 3 of our proposal comprises the analysis of the samples and data obtained in Phases 1 and 2 of the project and the interpretation and reporting of the results. Detailed geochemical, petrological and petrophysical studies of 6,000 ft (1,800 m) of cores, numerous water samples, downhole logs and other data may take several years. We propose, however, to perform a preliminary geochemical and petrological study at UCR and expect to conclude it in 1985-86. The costs of this two year study (including \$200,000 for upgrading laboratory facilities) would be approximately \$594,000. We

confidently expect that these results of Phases 1, 2, and 3 will stimulate further surface geophysical and modelling studies of the field. However such costs are not included here. The total budget for what we have proposed is still subject to revision, negotiation, and improvement. It is summarized in Section 4.0 below.

4.0

## ESTIMATED BUDGET FOR THE PROJECT

	<u>Subcontractor</u> \$K	<u>UCR</u> \$K	<u>Total</u> \$K
<u>Phase 1</u>			
Coring, sampling, logging	130.0		
Mechanical modifications	<u>225.0</u>		
	355.0		
Salaries, expendibles, curation, administration, etc.		40.1	
Overhead		<u>10.5</u>	
		50.6	
			<u>405.6</u>
<u>Phase 2</u>			
<u>2A</u> Deepening well, etc.	3,280.0		
<u>2B</u> Fracture stimulation	965.0		
Curation, administration, salaries, etc.		201.0	
Overhead		75.0	
<u>2C</u> Restoring well to production	<u>440.0</u>		
	4,685.0	<u>276.0</u>	
			<u>4,970.0</u>
<u>Phase 3</u>			
Science, salaries, etc.		477.0	
Overhead		<u>117.0</u>	
			<u>594.0</u>
TOTAL PROPOSED COSTS			<u>\$5,969.6</u>





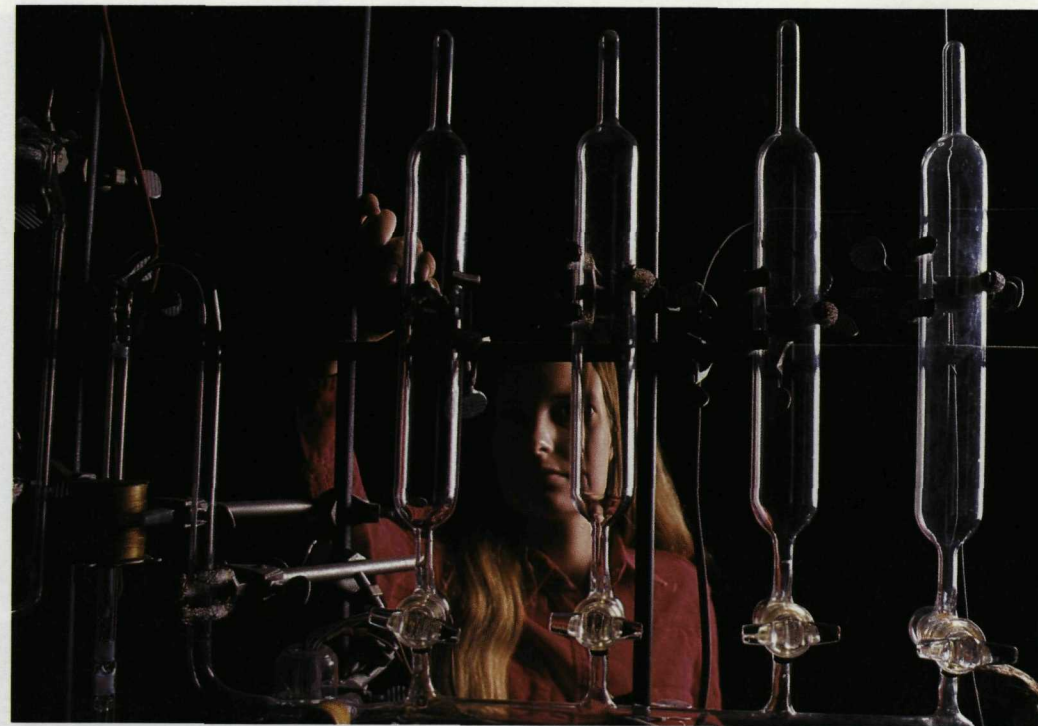
# Bechtel Briefs

March 1986

Scientists  
Are on a  
Trip of  
Discovery  
That is  
10,000 Feet  
Deep



Right, graduate student Ann Lilje, in the U.C. lab, preparing a water sample for analysis



Among the areas of interest to the scientists is the minerals content of the brine. Above, Lori Robison of the U.S. Geological Survey examines a sample

and this activity, in turn, causes abnormally high temperatures to occur relatively close to the earth's surface. As one of the world's largest geothermal fields, this region is a prime source of geothermal energy. And recently, with the drilling of the research well, interest in the Salton Sea area has increased even beyond its geothermal potential.

"It is one of the first big drilling projects to be carried out for purely scientific purposes in the United States," says Wilfred Elders, professor of geology at the University of California, Riverside. Dr. Elders was instrumental in getting the project under way and as chief scientist of the Salton Sea Scientific Drilling Program, he is coordinating an international team of 37 scientific groups who, with grants totaling \$2 million, will conduct research on samples taken from the site in such areas as geochemistry, petrology and geophysics.

"It may not lead to TV spectacles like the first steps on the moon," says Elders, "but I am not exaggerating when I say that it is an important project. And it is just the beginning of a continuing program of scientific drilling to understand the world beneath us. Whatever the Salton Sea project contributes to our body of scientific knowledge, it is just the tip of the iceberg."

In addition to increased knowledge about the geothermal resource itself, the combination of extreme salinity and high temperatures is expected to yield an array of data. Information received from the project could lead, for example, to a better understanding of stresses in underground rock, knowledge about the activity of microorganisms in hot, saline environments, and information about the mineral content of the extremely hot brines, which contain abnormally high concentrations of iron, manganese, lithium, zinc, lead and silver.

For Bechtel Project Manager Charles Harper, the Salton Sea Scientific Drilling Program presents a special challenge. "If we encounter the extremely high temperatures (which may get as hot as 700 degrees Fahrenheit) and highly saline geothermal fluids that are expected, we will be taking current drilling technology to its limits," says Dr. Harper. "To optimize our chances of success," he



Trays of core samples fill a room of shelves. With them is U.C. lab technician Jose Abreu





*The drift of Baja California away from the main mass of Mexico has created a geological hot spot beneath the Salton Sea, which scientists think may be an enormous untapped power resource*

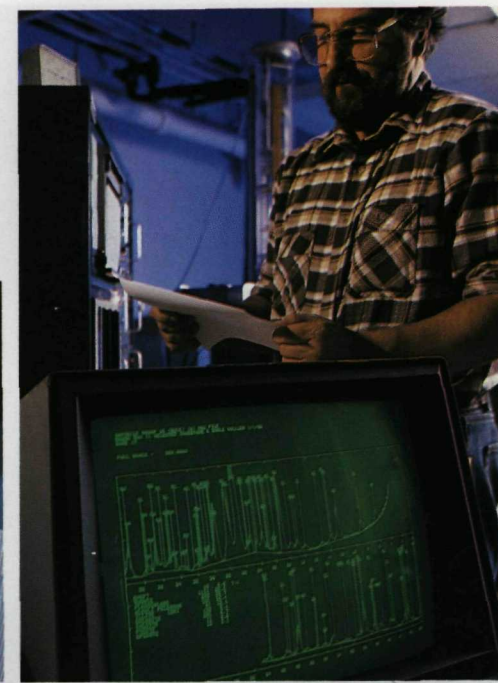
explains, "we have gotten the best equipment and the most experienced people we could."

The complexity of the task is mind-boggling. Equipment has been imported from all over the country, some of it specially made to withstand the extreme conditions expected. Over 60 subcontracts and purchase orders are required to sustain the drilling operation. Another critical element of the project is the on-site coordination of drilling and scientific activities. Daily meetings are held to discuss progress, to coordinate the various aspects of the drilling, coring, logging and fluid sampling, and to update and revise schedules. Detailed charts are kept showing the depth reached and temperatures measured, as well as the geologic composition of core samples and other scientific data.

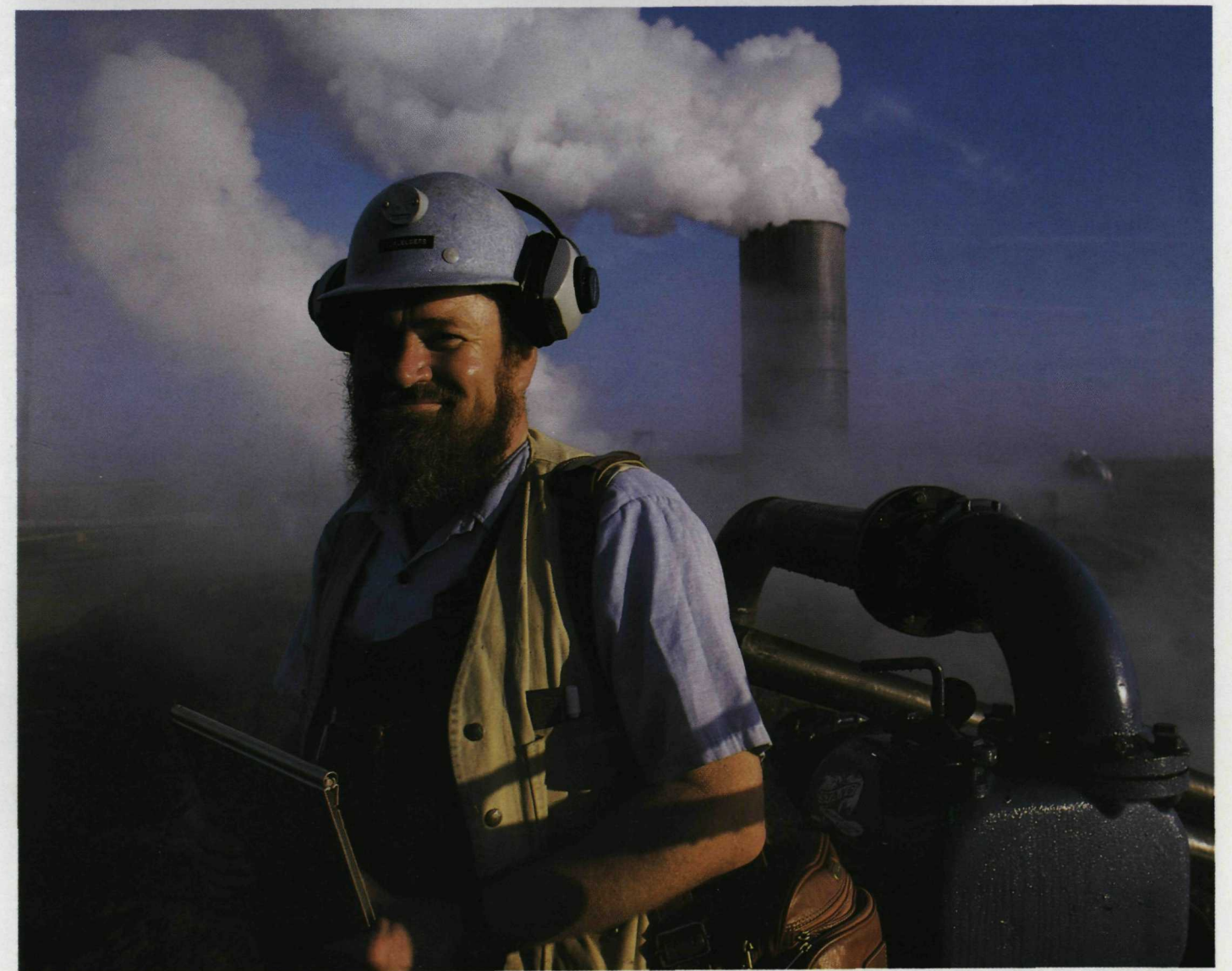
From the platform of the drilling rig, you can watch the "shale shaker," a wire mesh sifter, separate mud from the drilling cuttings that are then analyzed in a nearby trailer, before being sent off to the University of California, Riverside, for distribution and study. You can see the huge piping system that was constructed to carry the hot brine from the depths of the earth during flow testing of the well. At intervals, valves have been placed where some of the geothermal fluid is collected as gas or steam for scientific study, while the rest continues along the pipes, into a man-made basin. Instruments along the flow line provide additional information for scientific purposes.

There is a feeling of ordered activity here, of people knowing exactly what has to be done and doing it with expert precision. And there is an excitement, too. Drilling of this sort has been done before, but for commercial purposes; the information gleaned has been in private hands. What makes the Salton Sea Scientific Drilling Program so unique and so important is that for the first time in United States history, the knowledge gained from this sort of exploration will be fully public.

"Research of this type," adds Dr. Harper, "will ultimately aid us in understanding how the earth's crust has formed and how we may better utilize the mineral and energy resources that occur below our feet." □



*Far left, Engineering Supervisor Dave Rabb, and Project Manager Charles Harper. At the computer, Peter Collier, staff research associate at U.C. Riverside. Below, U.C. Professor Wilfred Elders, chief scientist and coordinator of the program*





March 24, 1986

Draft Press Release

"RESEARCH GEOTHERMAL WELL COMPLETED-TESTING UNDERWAY"

Niland, California

Tests are underway of a highly successful research well <sup>that</sup> ~~which~~ reached two miles deep into the Salton Sea geothermal field in the Imperial Valley of Southern California. On March 17th <sup>the</sup> drill bit reached the depth of 10,564 <sup>feet</sup> and preparations began to test the resource penetrated. On March 20th & 21st <sup>at</sup> steam and brine roared from the <sup>bottom of the</sup> well at rates of up to 580,000 lbs/hr <sup>and</sup> pressures of up to 500 psi <sup>and</sup> temperatures of 485°F at the well-head. An intense period of downhole testing and logging is now underway.

These tests are the culmination of a \$6.5 million drilling project <sup>that</sup> ~~which~~ began in October of 1985 with Bechtel National, Inc. of San Francisco as prime contractor. Charles A. Harper, Bechtel's Project Manager said, "We are very pleased to have met or exceeded all of the objectives <sup>that</sup> ~~which~~ launched this complex cooperative effort between government, academia and industry".

The flow rate and heat content of the steam produced in this short term test suggest that the well could produce energy equivalent to 9 to 10 megawatts of electric power <sup>(?)</sup> the power consumption of about 10 to 12,000 people. This is more than twice the power output of wells in typical geothermal fields. Wilfred Elders, of the University of California, Riverside, the Chief Scientist of the project, said, "While this once

Draft Press Release

Page 2

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more confirms the great commercial potential of the Salton Sea Geothermal Field, this <sup>was</sup> ~~is~~ not the purpose <sup>for</sup> ~~of~~ drilling the well. Instead, the aim was to carry out a broad spectrum of studies of geothermal phenomena and to advance the technology of studying and testing geothermal wells. This project is a major step in a national program of drilling the continental crust for scientific purposes. In the past, information from geothermal wells drilled by industry has not been easily available and this has been a limitation on studies aimed at understanding the nature and origin of geothermal fields. The large amount of core samples, brine and steam samples, pressure and temperature data and other subsurface information will make this Salton Sea Scientific Drilling Project a landmark in geothermal investigations.

Approximately fifty scientists and technicians are participating <sup>#</sup> in testing the well. Their work is made difficult by temperatures as high as 6<sup>6</sup>10°F and pressures of 4,300 psi at the bottom of the hole, coupled with the presence of corrosive brine containing <sup>about</sup> up to 23% of dissolved salts. ( ? ) 227,360

The Salton Sea Scientific Drilling Project is a joint effort of the U. S. Department of Energy, National Science Foundation, and the U. S. Geological Survey. Some 35 different groups of scientists from government laboratories and universities are involved in analysis of the samples and data produced. After a further six months of tests, the well will revert to Kennecott, Inc. the lease holder for the geothermal rights at the well site.



March 24, 1986

Press Release

"RESEARCH GEOTHERMAL WELL COMPLETED-TESTING UNDERWAY"

Niland, California

Tests are underway of a highly successful research well which reached two miles deep into the Salton Sea geothermal field in the Imperial Valley of Southern California. On March 17th the drill bit reached the depth of 10,564' and preparations began to test the resource penetrated. On March 20th & 21st steam and brine roared from the well at rates of up to 580,000 lbs/hr and pressures of up to 500 psi at temperatures of 485°F at the well-head. An intense period of downhole testing and logging is now underway.

These tests are the culmination of a \$6.5 million drilling project which began in October of 1985 with Bechtel National, Inc. of San Francisco as prime contractor. Charles A. Harper, Bechtel's Project Manager said, "We are very pleased to have met or exceeded all of the objectives which launched this complex cooperative effort between government, academia and industry".

The flow rate and heat content of the steam produced in this short term test suggest that the well could produce energy equivalent to 9 to 10 megawatts of electric power, the power consumption of about 10 to 12,000 people. This is more than twice the power output of wells in typical geothermal fields. Wilfred Elders, of the University of California, Riverside, the Chief Scientist of the project, said, "While this once more confirms the great commercial potential of the Salton Sea

Press Release  
Page 2

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Approximately fifty scientists and technicians are participating in testing the well under the direction of a science management team from the U. S. Geological Survey. Their work is made difficult by temperatures up to 670°F and pressures of 4,300 psi at the bottom of the hole, coupled with the presence of corrosive brine containing up to 23% of dissolved salts.

The Salton Sea Scientific Drilling Project is a joint effort of the U.S. Department of Energy, National Science Foundation, and the U.S. Geological Survey. Some 35 different groups of scientists from government laboratories and universities are involved in analysis of the samples and data produced. After a further six months of tests, the well will revert to Kennecott, Inc. the lease holder of the geothermal rights at the well site, under a permit from the State of California Lands Commission.

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U.S. DEPARTMENT OF ENERGY

**memorandum**

DATE: **APR 21 1986**

REPLY TO  
ATTN OF: **CE-1**

SUBJECT: **Continental Scientific Drilling Program: Salton Sea Scientific Drilling  
Project (SSSDP)**

TO: **R. A. DuVal, Manager  
San Francisco Operations Office**

Thank you for your memorandum of March 11 calling my attention to the opportunity to deepen the Salton Sea Scientific well. I agree that significant scientific and technological gains could be achieved with a modest investment, and strongly support the scientific community's proposal to deepen this well. However, the primary benefits from such a project would be largely scientific and outside the mission of the Geothermal Technology Division. Moreover, funding to accomplish this task is neither presently available nor expected to be available next fiscal year. Should funding become available from the other participants (DOE/OBES, USGS, NSF), we would be pleased to cooperate in making this venture a success.

The San Francisco Operations Office has managed the Salton Sea Scientific Drilling Project in an exemplary manner, and is commended on having exceeded the objectives.

**Donna R. Fitzpatrick  
Assistant Secretary  
Conservation and Renewable Energy**

# Bechtel National, Inc.

Engineers—Constructors

Fifty Beale Street  
San Francisco, California

Mail Address: P.O. Box 3965, San Francisco, CA 94119



15th May, 1986

Mr. Ronald S. H. Toms  
U.S. Department of Energy  
1000 Independence Avenue, S.W.  
Washington, D.C. 20585

Dear Ron:

To commemorate the Salton Sea Scientific Drilling Project, we have had a belt buckle (or paperweight) prepared, depicting the project site during the first flow test. We would like to share one of these mementos with you as a reminder of your contribution. The continuing efforts and support of you and your colleagues were a key part of the overall team effort that has made this, the first major well in the Continental Scientific Drilling Program, a success.

Sincerely,

Janet L. Owen  
Business Development  
Representative  
Research and Development

CAH/jak

Enclosure

# Commerce Business Daily



A daily list of U.S. Government procurement invitations, contract awards, subcontracting leads, sales of surplus property and foreign business opportunities

## U.S. GOVERNMENT PROCUREMENTS

### Services

Experimental, Developmental, Test and Research Work (Research includes both basic and applied research)

Space Div (AFSC)/PMJ, Los Angeles AF, Force Station, POB 92960, Los Angeles CA 90009-2960

**DMSP BLOCK 6 CONCEPT STUDIES** Sol F04701-87-R0003; Contact Capt. Joseph L. Jenkins, Contracting Officer, 213/643-2377. The Defense Meteorological Satellite Program (DMSP) System Program Office is seeking qualified space system contractors to design a new satellite system to meet a variety of mission requirements in the post-2007 timeframe. This satellite system is currently identified as Block 6 (previously referred to as DMSP II). Four contractors are anticipated to be selected to perform conceptual studies starting in Q288. Firm fixed price contracts are anticipated. A draft RFP will be released for contractor comment. The final tech requirements for Block 6 will be generated from the results of these studies. Two contractors are anticipated to be selected to perform validation phase efforts thru preliminary design. One contractor shall be chosen for full-scale engineering developments and initial production. The objective of this study is to develop a new cost effective satellite system concept for satisfying DDO environmental requirements. A flexible spacecraft design should be investigated to accommodate changes in sensor payloads. The DMSP Block 6 satellites will be designed to be launched on the most cost effective expendable launch vehicle available. The Space Transportation System will be considered as a possible option for the launch vehicle. Repair on orbit techniques as well as reliability improvements should be investigated for possible cost reductions. Increased survivability against projected threats is another major objective. The survivability area includes command and control links, data links and the satellite itself. Reduction in operation and maintenance costs is another objective in decreasing system life cycle costs. Techniques for making the ground software more user friendly should be studied. The last objective is to increase the timeliness of data distributed to various users. Satellite constellation configuration, satellite internetting, on-board processing and data compression techniques are alternatives that should be investigated. Any changes to the ground command and control hardware or data handling hardware need to be identified. Data from sensors is to be developed into a useful data product for fixed and mobile users. In preparation for these studies and to allow qualified contractors to enhance their competitive stance, the DMSP Satellite System Program Office has made available at Block 6 contractor's library classified at the Secret level. The library will consist of current and projected meteorological, ionospheric and oceanographic requirements as well as current spacecraft and sensor descriptions and projected threat documents. The above requirements may be modified in the final RFP. Previous trade-off study results (Block 6) have been included in the library. Firms desiring to compete either as primary contractors or as subcontractors are invited to submit a written notification of intent and evidence of qualification and experience in the following areas: Spacecraft and Space system design; Development and integration of environmental sensors of special subsystems on spacecraft; Communications; command and control operations; On-board processing capabilities.

ties; And/or experience in designing space-based meteorological, ionospheric, or oceanographic sensors. And/or experience in developing based active sensors, such as Doppler or differential absorption radar for the measurement of wind, moisture or temperature profiles. Space shuttle payload integration. Notifications of interest and qualification statements are to be received within 15 days from the date of publication of this notice. This synopsis is for info and planning purposes and does not constitute an IFB or RFP. All statements of qualifications have been screened. A sol will be issued to those prospective sources who, in the sole judgement of the purchasing activity, have the potential of successfully fulfilling the requirements of the planned contract. Contractors should send their clearances to: 6592 ABG/SPV-POB 92960, Los Angeles CA 90009-2960 with an info copy sent to SO/CHDMX, Capt. Dawn Lutacs, same address. Contractors will be notified of their access to the Block 6 contractor's library after the notification of interest and qualification statements have been screened. Contact Missy Mitchell, SO/PMJ, at 213/643-2377 for further info (see Notes 26, 58 and 99). This is a re-issue of notice originally published 29 Jul 86. Those responding to that notice need not respond again. (20)

**US - DOE; Pittsburgh - Energy - Technology - Ctr.; POB: 10940; MS900-33, Pittsburgh PA 15236**

**A - ADVANCED COAL RESEARCH AT U.S. COLLEGES AND UNIVERSITIES** Sol DE-PS22-87PC9999, CRD 032087, Contact Dana Sheehan, A12/675-5918, cost officer Gregory Kawalko, A12/675-6039. Advanced coal research, competitive program available on a restricted eligibility basis, to US colleges, universities, and university-affiliated research institutions. All applications must relate to coal research in 1 of the following 8 tech categories: 1) coal science: structure and reactivity of coal; influence of depositional history on the geochemical and geophysical properties of coal, e.g., gas content and permeability; relation of reactivity of coal to weathering during preparation, transportation, and storage; physical and chemical characteristics of coal and coal-derived matrix; analytical techniques and instruments applied to coal, coal mineral matter and coal-derived matrix; nature of the oxygen-nitrogen and sulfur-binding in coal. 2) coal surface science: surface properties of coal and mineral matter pertinent to cleaning, coking and utilization; surface enhanced beneficiation, desulfurization and pelletization; the gas stability of coal and coal-water slurries. 3) reaction chemistry: fundamental research directed toward an understanding of organic and inorganic chemistry of coal w/ respect to catalyzed and uncatalyzed conversion and utilization; vaporization of alkalis in pressurized coal gasification; ash fusion behavior under the conditions prevalent in coal gasifiers; selected coal cleaning; chemistry of microbial coal liquefaction and desulfurization; level reactions for dipolymerization; coal-ash reactions in supercritical fluids. 4) advanced process concepts: improvements in practical chemical reactions through novel chemical and/or reactor systems; advanced mechanism or process concepts for coal pyrolysis, preoxidation, combustion, direct and indirect liquefaction, surface and under ground gasification; quantitative investigations of microbial coal conversion. 5) thermodynamic: measurement and correlation of thermodynamic and transport properties pertinent to coal conversion and utilization; supercritical phase behavior. 6) engineering fundamentals: transport phenomena, eq. at high temperatures and/or high pressures with or without chemical reactions; transport in 3-phase slurry reactors; formation and transport and colloidal properties of aerosols. 7) environmental science: chemistry of formation and/or elimination of gaseous and liquid pollutants arising from coal conversion and utilization reactions at high temperature; methods for eliminating COS, CS2 and Mercaptan sulfur from coal gasification products; sulfur, nitrogen, halide, alkali, and heavy metal chemistry related to gas or liquid cleanup; size and composition of particulates in combustion products; as a function of the properties of coal or coal-derived fuel and combustion temperature; collection/removal of particulates from aerosols. 8) fuel cells: exploratory research on advanced cell concepts; reactants, electrolytes; catalysts/enzymes; useful products; structural materials for cell system components and diagnostics. DOE anticipates awarding grants for a proj subject to the availability of funds. Approx \$5.61 million is avail for the pgn sol, which includes \$661.0 thousand for historically black colleges and universities, and which should provide support for approx 30 proposals. (016)

the extent to which the COOPs II, research bases and NCI implement and manage these new requirements, (2) the impact of the COOP II program on cancer control research and (3) the impact of the cancer control interventions on community practices and (4) the effect of COOP II on cancer control activities in the community not specifically driven by the clinal research conducted. The contractor will be responsible for design and implementation and analyses of all phases of the evaluation. The project will include primary collection by the Contractor of detailed descriptive info about ea COOP II, as well as the supervision of multi-institutional data collection, quality control, and reporting and statistical analysis of both biomedical data. Officers should have experience in large-scale program evaluation studies in health related fields; experience in managing large-scale cancer data bases, and statistical analysis using the data bases and data quality control; and experience in conducting research in the study of diffusion and knowledge transfer in the area of health services/biomedical research especially related to cancer and/or cancer control. The personnel requirements include (1) a physician with a m.d. of three years of clinical experience in multi-institutional clinical trials with a demonstrated competence through publications in refereed journals, and (2) a doctorate level person in Biostatistics, Epidemiology (or equivalent) with substantial experience in the development and analysis of large-scale clinical data bases and the technical design and implementation of health services research in operational settings, and (3) a doctorate level person in health policy/medical sociology or the equivalent and substantial experience in the conduct of studies of health care organizations and their role in changing physician behavior. It is anticipated that a four-year intrinsically-funded cost-reimbursement type contract will be awarded to the successful bidder. RFP NCI-CN-75415-43 will be available fifteen days after this announcement appears in the CBD with responses due 45 cal days from actual date of issuance. A request form will be made avail. Copies of the RFP may be obtained by sending a written request citing the RFP number to Diana Wheeler, Contr Spec. (020).

**ESD/PKR (AFSC), Attn: Colin Gray, Hanscom AFB, MA 01731; 5320; 617/377-4019**

**A - SCIENTIFIC BALLOON ENGINEERING AND LAUNCH SUPPORT** Sol F19628-87-R-0014, BOO 20 Feb 87, Contract: Colin Gray 617/377-4019; Contracting Officer: CAPT Mark Fragan 617/377-4842. The Air Force intends to issue an unrestricted competition sol in support of the Air Force Geophysics Laboratory (AFGL) to design, fabricate, prepare, test, launch, and recover scientific balloons at Holloman AFB, NM, Roswell, NM and other sites. This effort calls for the operation and maintenance of Government-furnished telemetry and command control equipment, launch equipment and vehicles. Additional tasks include integration of scientific tracking, parachute recovery systems and command control equipment into balloon flight systems as well as launch, flight and payload recovery support. Consideration of ensuring air and ground safety of persons and property is of critical importance; consequently, respondents must presently and regularly be engaged in the area described above and more specifically show that their intended principal investigators, on-site supervisor, instrumentation engineers and technicians, launch crew chiefs and crew members, recovery crew members and control center technicians all have this experience. The charter of a light sol for balloon tracking is also required for operations. The forecasted RFP release date is scheduled for a 20 Jan 87. Previously synopsis 28 May 86. Organizations that responded to the 28 May 86 synopsis need not respond to this contract action. A 24 month effort is contemplated. Organizations with required experience who are interested in receiving an RFP should respond in writing within 15 days of this publication. Reference RFP F19628-87-R-0014. Firms responding should indicate if they are qualified as socially or economically disadvantaged. Respondents should also identify a point of contact regarding this action. See Notes 89 and 68. (016)

**US Dept of Energy San Francisco Operations Office, 1333 Broadway, Oakland, CA 94612; 415/778-1200**  
**A - WELL BORE DAMAGE REPAIR** POC: B. Moore, 415/273-4113. The San Francisco Operations Office of the Dept. of Energy (DOE) intends to contract with Bechtel Inc.

**CBD ELECTRONIC EDITION**  
 An electronic edition of the COMMERCE BUSINESS DAILY is available from the following. Interested parties may contact them for full details.  
 WORLD-BIDUSA, 1121-12th St. NW, Washington, DC 20005, Ga. Niles  
 703/683-5454; NATIONAL BID GUIDE, Inc. 6868 N. Nantona, Tucson, AZ 85704, 602/575-1856; BIDNET, 5 Choke Cherry Rd., Rockville, MD 02850, 301/330-7000, or toll free 1-800/325-6811; CBD: SEARCH SERVICES, INC., Automated Off-line Service, 7777 Leesburg Pike, Suite 300, South Falls Church, VA 22043 703/883-2510 or toll free 1-800-CBD-4750; UNITED COMMUNICATIONS GROUP, 4550 Montgomery Ave., Suite 700, North Bethesda, MD 20814 301/656-6666; SOFTSHARE, a Div. of WCR Technology Inc., 95 Depot Rd., Solieta, CA 93117, 415/851/5583; 3841 (Collect); MCGRAW HILL/DATA RESOURCES INC. (DR), 234 Hawthell Ave., Lexington, MA 02173, 617/863-5100; DIALOG INFORMATION SERVICES, INC., 3450 Hillview Ave., Palo Alto, CA 94304, toll free 800/134-2564.

**Natl Cancer Institute, Research Contrs Branch, Bldg Rm 2A07, NIH, Bethesda, MS 20892**  
**A - ASSESSMENT OF THE IMPLEMENTATION AND IMPACT OF THE COMMUNITY CLINICAL ONCOLOGY PROGRAM, PHASE II** POC: Diana E. Wheeler. The Natl Cancer Institute, Prevention and Control Contrs Section is soliciting RFPs for assessment of the implementation and impact of the Community Clinical Oncology Program, hereafter referred to as COOP II in this document. Under COOP II, approx 50 COOPs and 10 research bases will be supported for three years to conduct clinical treatment and other cancer control research. The COOP II will place new requirements on existing COOPs, new COOP applicants, research bases and NCI. The purpose of this acquisition is to assess (1)

**Content**

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tion, Inc., on a sole source basis as a follow on effort to maintain continuity of access to, and obtain additional scientific data from, state 2-14 geothermal well. The well was drilled by Bechtel for DOE under Contr DE-AC03-84S12194 on leased land owned by Kennecott Corp. A large amount of scientific data has been accumulated during the drilling of the well and is presently being analyzed by numerous scientists funded by the Govt. The DOE desires to repair the well bore damage, and if required, sidetrack the well bore construct flow test facilities, and perform a 30 day flow test of a deep productive zone and gather additional scientific data to characterize the fluids and the resource. Potential contractors who believe they can perform the above research work must submit written evidence in response to this synopsis. Such evidence must include as a minimum, a description of in-house tech capabilities which qualify the responder to perform the work (including labor categories, facilities, etc.); Descriptions of any past or present work efforts demonstrating an established capability in this research field; available personnel and their qualifications and experience; and cost info responses which do not provide info adequate to permit complete evaluation of the responder's capabilities will not be evaluated or considered. No sol document is avail. The DOE POC is Betty Anne Moore. Any response of question concerning this notice must be received within 45 days of pub of this notice. Tel inquiries will not be honored. See Note 22. (020)

NASA/GSFC, Attn: James King, Code 286, Greenbelt, MD 20771, 301/286-9403

**A - DATA ACQUISITION AND ANALYSIS FROM THE HOT PLASMA COMPOSITION EXPERIMENT (HPCE) ON BOARD THE AMPTE/CHARGED COMPOSITION EXPLORER SPACECRAFT** RFPs 21284/215 will issue on a sole source basis to Lockheed Missiles and Space Co. Inc. (LMSC), Palo Alto, CA to provide for a continuation of work performed during the prime AMPTE mission and applying to the Extended Mission Phase. The contractor will analyze data transmitted by the HPCE which was built by LMSC. This analysis required detailed knowledge of the basic physical principles, and of the design and operating principles of the instrument, the instrument's calibration, and its limitations. The scope of this investigation was originally defined by LMSC's Dr. E. G. Shelley. Because of LMSC's unique understanding of the objectives of this investigation and extensive knowledge of the HPCE instrument, LMSC is the only known source capable of appropriate scientific data analysis. The period of performance of this effort will be ten months. The statutory authority for other than full and open competition is 10 U.S.C. 2304(c)(1). Only one responsible source. Any other firms desiring consideration must fully identify their capability to provide these services and must submit their proposal within 15 days of the publication of this synopsis to the GSFC address and individual listed above. See Note 22. (016)

The Pentagon, SDO/CT, Washington, DC 20301-7100

**A - MISSION ANALYSIS AND BM/C3 SUPPORT FOR THE STRATEGIC DEFENSE INITIATIVE ORGANIZATION.** POC Capt Phil W. Parker, 202/653-0061, Ref No. SDO-87-04. To SRS Technologies, 1811 Quail St, POB 9219, Newport Beach CA 92660. This effort will be an extension of Contr DASG80-84-C-0102, to continue providing Mission Analysis and BM/C3 support for the Strategic Defense Initiative Organization thru 30 Sep 87. Negotiations with SRS Technologies will be conducted on a sole source basis, under the authority of 10 USC 2304(c)(1), only one responsible source. Any other firm desiring consideration must fully identify their capability to provide these services within 30 days from the date of publication of this synopsis. See Note 22. Notice: This announcement does not cancel the CBD announcement for BM/C3 support (28 Apr 86) or mission analysis support (24 Sep 86). This acquisition serves as the bridging effort until the other requirements are sufficiently mature to permit competitive procurements. SDO plans to purchase new CBD announcements prior to releasing RFPs for those new procurements. (020)

Contracting Officer, Naval Research Laboratory, 4555 Overlook Ave., SW Washington, DC 20375-5000

**A - DEVELOPMENT OF COMPUTATIONAL MODELS FOR ADVANCED MILITARY APPLICATIONS** Sol N00014-87-R-PY02. RFP closing, 30 days after release date. Contact: Contract Specialist, V. Paul Young, Code 1234 FY, 202/767-3698. Multi-year contract for the Development, Implementation, and use on the Laboratory for Computational Physics (LCP) NRL computer system such simulation models, numerical algorithms, and diagnostic appropriate to quantify the time-dependent description of complex systems of military interest. Specific areas of interest include the use of monotonic logical grid database in surveillance, correlation, and tracking for battle mgmt.; molecular dynamics and/or image processing. The period of performance is estimated to be 1 Base Year with 2 one Year Options. Tel requests for this sol will not be honored. If nonavailability notice is desired, furnish self-addressed stamped envelope. See Notes 11, 32, 57. Send requests Attn: Code 1232 VC, Telex 89-2778 or TWX 710-822-9600. NRL Ref: No. 133, (016)

Naval Ocean Systems Center, San Diego, CA 92152-5000; Attn: Code 216

**A - ENGINEERING AND TECHNICAL SUPPORT FOR ACOUSTIC RESEARCH CENTER** POC: Joyce Currie, 619/225-6758/6462 (For copies of sol) Notice: Only writ-

ten requests will be honored. Timothy J. Warren, Negotiator, Julie L. Brooke, Contr Officer. To continue current performance period through 9 May 88. Modification to existing CPFF contract N66001-85-D-0189 to be issued on a sole source basis with Vertana Sciences, Inc. 8001 Forbes Place, Springfield, VA 22151. Mod will be for continue tasks for ARC such as software development/modification, processing and analysis. Place of Performance, San Diego, CA. Reason for sole source is that contr developed software and competition would lead to prohibitive duplication costs. See Note 46. (016)

Naval Underwater Systems Ctr, Code 09, Commercial Acquisition Dept, Bldg 11, Newport RI 02841-5047

**A - WAVELENGTH DIVISION MULTIPLEXING SYSTEM** Sol N6604-87-R-1194. BOD 27 Feb 87. POC Alice Haas, 401/841-4684. Design, develop, build, test, del. and provide documentation for a single mode fiber wavelength div multiplexing system. This system shall consist of matching multiplexer, demultiplexer and fiber-polarized laser sources. Laser sources shall be supplied at 4 of the WDM channel wavelengths. The gov't also wishes to price the option of procuring laser sources at all 11 of the WDM channel wavelengths. A cost plus fixed fee type contr is anticipated. Reqs must be made in writing, specifying sol no.; tel reqs will not be honored. (016)

Naval Ocean Systems Center, San Diego, CA 92152-5000; Attn: Code 216

**A - NUSS ACOUSTIC DISPLAY CONSOLE (ADC) SUPPORT** Sol N66001-86-D-0011. POC Joyce Currie, 619/225-6758/6462 (for copies of sol) notice: Only written requests will be honored Deanna Overross negotiator, Julie L. Brooke, Contracting Officer. Modification to existing contract N66001-86-D-0011 to be issued on a sole source basis with Rockwell International Corp., Autonetics Marine Systems Div., 3370 Mira Loma Ave., Anaheim, CA 92803. Modification will be for continued acoustic display console support and improvement effort through 15 Dec 87. (016)

US Army Natick Res, Dev and Eng Ctr, Natick Procurement Div, Natick, MA 01760-5011

**A - DESIGN, CONSTRUCT, TEST AND DEL TWO SONIC NOZZLE OR BURNERS** for use with a Powered Tray Pack Heater and will be used as part of the Marine Corps Combat Field Feeding Sys. All work shall be completed within a period of nine months after award of contract. Technical data will be required. Doc No 19-00010 will be avail o/b 3 Feb 87. Sol DAAK60-87-R-0031N, BOD 020387, contact Jeanine Duhamel, Contr Spec, 617/651-4458, Contracting Officer, Thomas G. Jacques, 617/651-4959. See Notes 11 and 68. (020)

Conts Br, ACT-51, FAA Tech Ctr, Atlantic City Airport NJ 08409

**A - NON-VAPOR EXPLOSIVE DETECTION CONCEPTS** DTFA03-87-R-70011. POC Donna Land 609/484-4082. Submit new ideas for detection of explosives in baggage, in cargo, or on passengers. Can be totally new tech approach or a major innovative mod of a tech approach which has previously been is or currently being investigated by the Govt. 2-phase, multi-yr effort is planned for the development of the anticipated system. Proof of feasibility shall be demonstrated under Phase I and, if warranted, a prototype system will be developed under Phase II (016)

Naval Underwater Sys Ctr, Code 09, Commercial Acquisition Dept, Bldg 11, Newport, RI 02841-5047

**A - SINGLE MODE OPTICAL FIBER ROTARY JOINT** Sol N66504-87-R-1195. due 28 Feb 87. POC Alice H. Haas, 401/841-4684. This procurement is for the development of a rotary joint for use in a single mode optical fiber data link. The rotary joint will be capable of continuous single rotation in either direction and will experience a rotation rate of not greater than 10 RPM. A cost plus fixed fee type contr is anticipated. Requests must be made in writing, specifying sol number; tel requests will not be honored. (016)

US Army Tank Automotive Material Readiness Command, Warren, MI 48397-5000 313/574-6802 or 6807

**A - SOFTWARE MODIFICATIONS TO THE UNIVERSAL DEPOT INSPECTION SYS (UDIS) COMPUTER** to prevent accumulated data loss during power outages. Sol (RFP) DAA07-87-Q-8008. Sole source; Hamilton Test Sys, 2301 N. Forbes Blvd, Tucson, AZ 85745. US Army Tank Automotive Command, AMSTA-IRRA, Attn: Steven Fritz, Contr Spec, 313/574-8854, Contracting Officer, Scott A. Sinelli, 313/574-6368. Est release date 11 Feb 87. Est closing date 11 Mar 87. See Note 22. (020)

Chief, Supply Service (90C) VA Medical Center Bldg. 41 North, Little Rock, AR 72114

**A - ELECTROGYROGRAPHIC INCONTINENCE ALERT DEVICE** RFP 598-83-87. POC Louis A. Watts. Firms having ability to design, develop, build prototype of electrogyrographic incontinence alert device. See Note 22. (016)

## H Expert and Consultant Services

**US Army Eng Waterways Experiment Station, Corps of Engineers, POB 631, Vicksburg MS 39180-0631; Mary Holman, 601/634-2423**

**H - MARKET SURVEY: TECHNOLOGY TRANSFER** The FY 84 Energy and Water Development Appropriations Act provided funding for the Corps to cont w/an existing non-profit entity to seek out new applications of technology developed by Corps research and development and to provide hands-on adaptive engineering required to transfer this technology to the public and private sectors. Southeastern and South Central OK was selected as the region for the prototype transfer study because of its lack of industry high unemployment, and low per capital income and the existence of a unique non-profit organization knowledgeable of the study area. A cont was awarded to Rural Enterprises Development Corp, Durant OK, the only known non-profit entity located in the area of inter-

est w/the existing capability to actively seek out and transfer Corps developed tech to the public and private sectors in this region. Rural Enterprises Inc had established contacts and connections w/business ctrs, state and local agencies, banks, community organizations, state universities, and private entrepreneurs within the area w/private contributors who provide financial assistance necessary to establish businesses. These contacts and connections were absolutely necessary for the engineering required to transfer Corps research and development technology to the public and private sectors in rural economically depressed areas. Under this contract Rural Enterprises developed a technology transfer demo proj for application to the area. The proj consists of 2 phase III databases: 1) for business problems; and another for avail Corps of Engineers technologies, and a routine for identifying and reaching technologies w/business needs. The new work proposed consists of a team to make potential users of the test area aware of the proj's capabilities; 2) identifying new problems/applications and technologies to update the databases; 3) solutions to user's problems in the Corps of Engineers technologies database; 4) carry out upon other resources to find solutions to the user's problem. The success to include actual engineering/design assistance, only POC and avail literature. Since Rural Enterprises developed the proj and has an intimate familiarity w/the process and methodology, they are in a unique position to provide these avail svcs. In the event other sources are found, the Govt intends to issue a mod to the existing cont w/Rural Enterprises Inc, under authority of 10 USC 2304(C)(1). Any inquiries should be received within 2 wks from the date of pub of this notice. See Note 22. (016)

Ali Nademin, Chief, Material Management Div, Office of Management Services, Dept of Public Works, 2000 14th St, NW, Arlington DC 20009, 202/939-8042

**H - SYSTEM FOR PROCESSING OF PARKING AND MOVING TICKETS** open and/or implementation of a system for the processing of parking and tickets for the Transportation Systems Administration (TSA). The project's objectives provide the District Govt with an automated system for handling the Traffic Administration and Parking Enforcement ticket processing functions. The automated system shall be a system design, system software, and system documentation. The system must be able to interface with the Dept's Motor Vehicles software system. The contractor shall also be responsible for the operation of the system including data entry, database management, and all aspects of ticket processing including sending notices, report generation and other functions listed in the RFP. The system shall be expandable and able to interface with the Districts Ticket Collection System within DPM. The cost for this procurement is to be over \$1,000,000. The system will include, but is not limited to, the following functions: Provide a means of storing, locating and retrieving info regarding issued tickets to include appropriate audit trails; Provide a means of computer-assisted issuing thru a method of fill-in masks (form), including verification of data validity at time from multiple interactive CRT type digital display terminals; Provide a means of creating, storing, and operating other application software and programs to be defined in a future date; Computer system software, both specific applications and system software shall be "user oriented". The term "user oriented" implies that user personnel shall be able to use the system to locate data records or indexing info with a minimal amount of and without continuous supervision. All elements of the computer system shall be based on established commercial product lines. All system and custom software shall be based on established non-proprietary programming languages. All communications and interfaces shall utilize established non-proprietary techniques and protocols. This procurement requires a min of a 35% participation by minority vendors certified by the District's Minority Business Opportunity Commission (MBOC). Info regarding certification to be obtained from the MBOC at 202/939-8780. A pre-proposal conference will be held 10 Feb 87. The RFP will detail method and submission timing for all questions. Proposal submission is 5 Mar 87. (016)

DHHS, 389 East High Rise Bldg, 6325 Security Blvd, Baltimore MD 21207

**H - EST OF PHILANTHROPIC SPENDING FOR HEALTH CARE** Sol HCFA 022/JD. RFP will be released 2/87. POC Joyce Divers, Contr Specialist, 301/594-1190. In FYs 86 through 87, HCFA is undertaking a systematic review of the National Health accounts and related estimating methodologies. This process, called a "benchmarking" study, includes a review of the concepts and definitions underlying the accounts and an upgrade of data sources, estimation techniques, and data handling and manipulation used to estimate national spending. Review of the underpinnings of the health care area has been prompted by major structural changes occurring in the health industry in particular that has changed more rapidly than our ability to track is that of health care for health care. Through the early years of Medicare and Medicaid, philanthropy funded a considerable fraction of health care spending. As public program responsibility for providing care for indigents, however, and as charitable giving for the major philanthropies changed the focus of their activity from the provision of development of infrastructure. The small local charities that continued to support care del are not represented in the traditional sources of data, and HCFA staff have been trending for philanthropic share of health spending for several years. This sol is the need for revised and enhanced ests of, and methodologies for est philanthropic share of health end will result in the collection of data already compiled by organizations, associations, etc and preparation of ests. Proposed cont period is six months. RFP avail in Feb 87. Requests for a copy of the RFP must be received within 15 cal days of the date of this pub. Availability of the sol is limited and will be furnished on a first-come first-served basis. Award of a cont will be made pending receipt by HCFA of required internal/external clearances. (016)

Bureau of the Census, Procurement Office, Rm 1547, FE Washington, DC 20233, Attn: Polly Beeler, 301/763-5234

**H - ASSIST IN PLANNING 1990 CENSUS** The Bureau of the Census intends to negotiate a sole-source procurement with the National Academy of Sciences, Center for National Statistics to assist the Bureau in planning for the 1990 decennial census. Assistance will include coverage measurement evaluation and adjustment standards; a native coverage improvement methodologies and research/evaluation/experimentation program design. The committee will review materials on coverage evaluation results from test surveys and assess the status and adequacy of the development of the BOC's

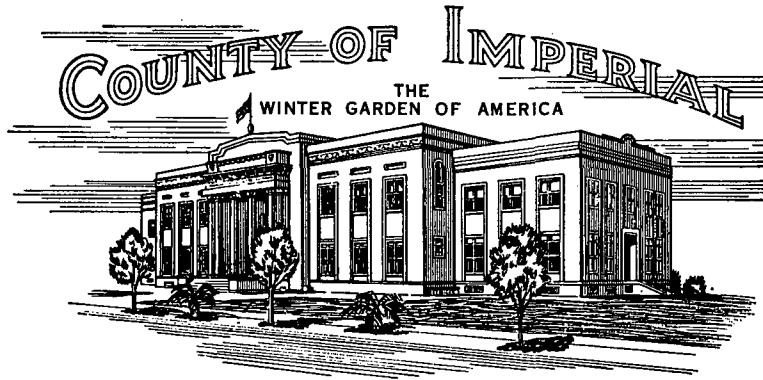
The Commerce Business Daily (USPS 966-360) is published daily, except Saturdays, Sundays and holidays, for \$243 a year (1st Class mailing) or \$173 a year (2nd Class mailing) by the U.S. Government Printing Office, Washington, DC 20402. Second Class postage paid at Washington, DC and additional mailing offices. POSTMASTER: Send address changes to Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9373, with entire mailing label from last issue received.

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through 30 September 1987.



*"The Largest Irrigated District in the World"*

S. HARRY ORFANOS  
DIRECTOR OF PUBLIC WORKS  
COUNTY ROAD COMMISSIONER  
COUNTY SURVEYOR  
COUNTY ENGINEER



TELEPHONE  
619-339-4462

*Phoned to King  
2/25/87*

February 18, 1987

DEPARTMENT OF PUBLIC WORKS  
155 SOUTH 11TH STREET  
EL CENTRO, CALIFORNIA 92243-2853

United States Department of Energy  
Office of Renewable Energy Technologies  
Geothermal Technology Division  
Washington, D. C. 20585

SUBJECT: Update of Mailing List

Gentlemen:

The Imperial County Department of Public Works received the reports on the SALTON SEA SCIENTIFIC DRILLING PROGRAM. Attached for you assistance is a Xerox copy of the face sheet of the latest report we have received. In order to assist us in routing this report to the proper channel, please make the following change to your mailing list:

DELETE:

Ms. Margaret Rands  
Geothermal Coordinator  
Courthouse  
El Centro, CA 92243

ADD:

S. Harry Orfanos  
Director of Public Works  
155 South 11th Street  
El Centro, CA 92243

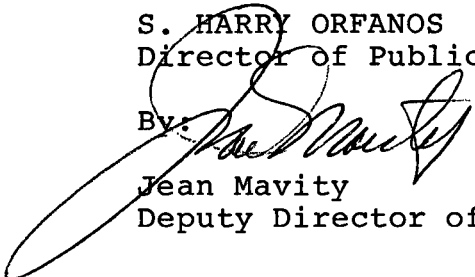
Thank you for your assistance. Ms. Rands no longer works for the County of Imperial and has not been replaced at this

time. Routing the report to the Department Head will aid in our receiving the information in a timely manner.

Sincerely yours,

S. HARRY ORFANOS  
Director of Public Works

By:



Jean Mavity  
Deputy Director of Public Works

Ms. Margaret Rands  
Geothermal Coordinator  
Courthouse  
El Centro, CA 92243

*Delate*

SALTON SEA SCIENTIFIC  
DRILLING PROGRAM

Report of the Fourth Quarter

FY 1986

RECEIVED  
FEB 09 1987

IMPERIAL COUNTY  
DEPT. OF PUBLIC WORKS

January 1987

U.S. DEPARTMENT OF ENERGY  
Office of Renewable Energy Technologies  
Geothermal Technology Division

RHW  
4/16/87

MAGMA POWER COMPANY

OFFICE OF  
JOSEPH W. AIDLIN  
VICE PRESIDENT, SECRETARY  
GENERAL COUNSEL

5143 SUNSET BOULEVARD  
LOS ANGELES, CALIFORNIA 90027  
TELEPHONE (213) 666-1910

April 9, 1987

Office of Renewable Energy Technology  
Geothermal Technology Division  
Department of Energy  
1000 Independence Avenue, S.W.  
Washington, D.C. 20585

Attention: CE-342

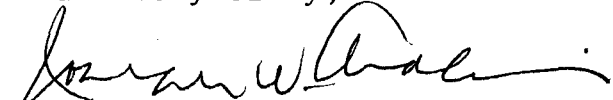
Gentlemen:

You have been mailing to Tom Hinrichs of Magma Power Company the Salton Sea Scientific Drilling Program. I have in turn been forwarding them to Tom Hinrichs at our other Magma Power office.

I suggest that you mail the reports directly to Mr. Hinrichs at the new Magma Power Company office, which address is: 11770 Bernardo Plaza Court, Suite 366, San Diego, CA 92128.

← Kerry  
change of  
address.

Yours very truly,

  
JOSEPH W. AIDLIN

JWA:ac

U.S. DEPARTMENT OF ENERGY  
CORRESPONDENCE CONTROL FORM  
OFFICE OF THE EXECUTIVE SECRETARY

*RAY W*

ACTIVITY ADD DO NOT DETACH FROM ORIGINAL CORRESPONDENCE

14:09

SOURCE CODE PM PUBLIC MAIL

SPEC INT: \_\_\_\_\_

CONTROL NO: ES87-002109

DATE CORR: 02/24/87 DATE RECD: 02/26/87 DATE CNTRL: 02/26/87 DATE DUE: \_\_\_\_\_

LETTER: X MEMO: \_\_\_\_\_ TWX: \_\_\_\_\_ OTHER: \_\_\_\_\_ TO: SECY: X DEP SEC: \_\_\_\_\_ UN SEC: \_\_\_\_\_ OTHER: \_\_\_\_\_

FROM: FINN, DONALD F NY 0  
GEOHERMAL ENERGY INSTITURE

REMARKS: THIS IS THE SECRETARY'S COPY  
OF A LETTER TO THE WALL STREET  
JOURNAL.

SUBJ: RESOURCES  
GEOHERMAL  
POTENTIAL GEOHERMAL ENERGY  
RESOURCES IN THE WESTERN  
UNITED STATES.

FOR USE BY ACTION OFFICE ONLY

	ACTION REFERRED TO	DATE	RETURN TO	DUE DATE
1	RET	2/4		
2	<i>Dr. Mack</i>	3/5		
3				

ACTION TO: CE

TYPE ACTION: For your information

SIG OF: \_\_\_\_\_

CONCURRENCE:

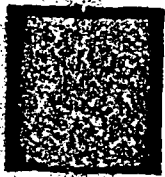
INFORMATION: DS US OS/GRAY FE CE/DF CE/GG MA/29 DO/3

FILE CODE: PMFINN-ES87002109

CONTROL ANALYST: TRAVIS HULSEY, 506

ALL DOCUMENTS FOR OSE PRINCIPALS  
MUST BE FORWARDED TO ES FOR FINAL PROCESSING

MA-293



February 24, 1987

Mr. Norman Pearlstine  
Managing Editor  
The Wall Street Journal  
200 Liberty Street  
New York, New York 10281

Dear Sir:

What the National Petroleum Council and John Baden (WSJ, Feb. 24, p. 32) overlook is the 500,000 MWe potential of geothermal energy resources, primarily located in the Western United States.

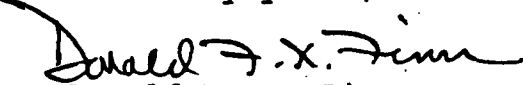
The DOI's Federal Geothermal Leasing program takes about \$2 million a year to fund and is currently generating about \$7 - \$8 million in royalties, rents and fees. A leasing moratorium put in place on October 15, 1986 will extend to at least April 15, 1987 and has virtually eliminated new applications for geothermal leases even though Congress preferred geothermal development in the Tax Reform Act of 1986 (ITC's, IDC's, depletion, preferred depreciation).

In California alone, where geothermal development has just begun, some 14 Federal geothermal leases covering 12,363 producing acres are supporting 745 MWe of electrical generation. Federal royalties are \$16.3 million a year (12.5% of steam sales). 25% of that goes back to the State, 25% to the local County.

Imagine what could be done to support development on the other 331 leases covering 573,876 acres in California and some 42 leases in Nevada covering 636,700 acres (where 65 MW is about to come on stream in Dixie Valley).

With about 690,000 MWe installed in the U.S.A., what could we do with 10 - 20,000 MWe of geothermal generation over the next decade, as the Nation comes to grips with a growing perception that coal and nuclear generation may fall short of actual needs?

Sincerely yours,

  
Donald F. X. Finn  
Managing Director  
Geothermal Energy Institute  
342 Madison Avenue - Suite 733  
New York, NY 10173

212-490-7910

# Oil and Ecology Do Mix

By JOHN BADEN

America's increasing dependence upon foreign oil clearly is cause for concern, a concern reflected in a National Petroleum Council report that is scheduled to be released today. Given current geological theories, all of the lower 48 states' huge "elephant fields" of more than a billion barrels have been discovered. But there is a promising area yet to be tapped—federal lands. And their exploration and development would work best under the aegis of private environmental groups.

Most people assume there is an inherent conflict between oil and gas development and environmental quality, but these concerns can be complementary. The challenge is to create new decision-making processes and incentive structures for the management of federal lands. Environmental quality and the development of oil and natural gas on federal lands can coexist, but not under the matrix of existing institutions. Although the production of oil and gas can present significant environmental risks to some of the most pristine areas of the country, these risks can be dramatically reduced. The oil- and gas-producing lands owned by environmental groups and managed primarily for wildlife provide excellent models.

## Closed to Leasing

In a country that prides itself on the private ownership of land, the government is a surprisingly large owner of real estate. The 760 million acres of federally owned land represent about one-third of the land area of the U.S., and less than one-fourth of it has been explored for oil and gas. Some 600 million of these acres are administered by the U.S. Forest Service and the Bureau of Land Management. Given the possibility of supply interruptions from the Middle East, the potential of the federal lands is of great importance.

Today, between 40% and 65% of all federal lands are closed to oil and gas leasing. Yet the Government Accounting Office estimates that as many as 261 million acres of federal land outside Alaska have productive oil and gas potential. Mean estimates are for 15 billion barrels of recoverable oil in the lower 48 states.

The best geological prospect in North America is in Alaska's 18-million-acre Arctic National Wildlife Refuge (ANWR). A U.S. Fish and Wildlife Service report last December estimated that there is a 95% chance that the ANWR's coastal plain contains more than 4.8 billion barrels of oil.

Some of the potentially productive Alaskan properties are home to the last great caribou herds in North America. Potential producing properties in the lower 48 states include the Greater Yellowstone Ecosystem (outside the national parks) and other ecologically fragile areas in the northern Rocky Mountains.

But the government's record on preserving the environment is, at best, spotty. And the Forest Service and the Bureau of Land Management have no incentive to encourage the use of federal lands for development of oil and gas.

Energy development doesn't add to the agencies' budgets since any payments go to the U.S. Treasury, not to the Forest Service or the Bureau of Land Management. Neither is the agencies' political

Land Management's permit program for livestock grazing on federal ranges. The prices paid for the limited number of assigned federal permits commonly range from 10% to 50% of those for grazing on adjacent private property. Grazing fees, like oil production royalties, go to the U.S. Treasury, not to the Bureau of Land Management. There is no incentive to seek fair market value for these permits. Underpriced grazing rights serve to build political constituencies that in turn foster the bureau's pursuit of greater budget allocations to manage the land.

It would be far better to turn over management of these wilderness and ecologically sensitive federal lands to private, nonprofit environmental concerns. Such groups as the Audubon Society and the

The boards would face incentives to dispose of land with low wilderness or wildlife value but high commercial potential and to acquire land of low commercial value but high wilderness potential. Revenues generated from land sales and oil and gas royalties would be deposited into accounts managed by each board for wilderness purchases and wildlife management. Like the boards of the Audubon and Welder refuges, the boards administering what are now federal lands would have incentives to develop oil and gas prospects in an environmentally sensitive manner.

The environmental record of oil exploration and production in the Arctic is highly encouraging. The National Wildlife Federation states that, "The oil industry spent the last 15 years profitably developing Prudhoe Bay and did a commendable job in protecting its wildlife resources." Audubon's Rainey Preserve in Louisiana successfully supports drilling by several different companies on a "mere" 26,000 acres. Surely the 1% of the 1.5-million-acre coastal plain that would be disturbed by drilling on the 18-million-acre ANWR can also be developed while preserving environmental values.

## Incentives Would Change

Major environmental groups, including the Sierra Club and the Wilderness Society, adamantly oppose any development on the ANWR. But if these organizations were given control over the ANWR and royalties from its oil production, their incentives would change dramatically. The nation and its wildlife would surely be ahead if environmental groups managed—or even owned—these lands. These groups would then face incentives to develop the area with reasonable environmental constraint much as Audubon developed Rainey.

The Reagan administration, however, seems immune to creative ideas in environmental policy. It seems that when officials hear the words "environmental politics," they can think only of Jane Fonda chaining herself to a tree.

As we approach the 1988 presidential election, the twin concerns of energy and environment offer huge potentials for policy reform. The candidates who articulate visions that bring these good things together will indeed be attractive.

*The 760 million acres of federally owned land represent about one-third of the land area of the U.S., and less than one-fourth of it has been explored for oil and gas.*

power augmented by increases in land value that result from the discovery of recoverable oil and gas. In fact, a significant disincentive may arise to the extent that the agencies are diverted from timber cutting and grazing by the necessity of managing oil and gas exploration and production.

The result of this failed incentive system has been a woeful misuse of the resources over which these agencies exercise administrative authority. For example, the Forest Service currently is conducting extensive, money-losing logging operations in the Big Hole River drainage of Montana and the 16.4-million-acre Tongass National Forest of southwest Alaska. The economic costs of harvesting timber in these areas far exceed the commercial value of the timber. Furthermore, much of the timber is harvested by environmentally destructive methods and there is extensive road building to submarginal, remote timber stands. These permanent roads—with eight times the mileage of the U.S. Interstate Highway System—cause substantial erosion and destroy wilderness. No private logging firm would consider such operations, due to the excessive road-access and management costs. Unlike the Forest Service, firms that pursue such objectives become bankrupt.

Another prime example of the failure of agency incentive structure is the Bureau of

Welder Wildlife Foundation Refuge have demonstrated an ability to foster energy production and environmental quality.

For example, the Audubon Society operates the 26,000-plus acre Rainey Sanctuary Preserve in southern Louisiana. Natural-gas wells have operated within the preserve for more than 25 years without measurable damage to the surrounding ecosystem. The preserve is home to ducks, geese, and a variety of mammals including mink, otter and deer. On the Welder Wildlife Foundation Refuge in Texas—the country's largest private refuge—an oil and gas field has been operating since the 1930s with no significant disturbance of the indigenous wildlife.

In fact, oil and gas production has actually benefited these preserves. Royalties from oil and gas production have allowed Audubon to purchase additional wildlife habitats while improving the management and ecological integrity of the Rainey Preserve. Revenues from the Welder Refuge wells have contributed to wildlife research and the operation of the foundation itself. These relationships are symbiotic, not confrontational.

This model could be expanded to the federal lands with the creation of "wilderness endowment boards" made up of environmentalists and sportsmen. These boards would foster environmental values and have the authority to sell, buy and manage specific wilderness lands.

Mr. Baden, a member of the National Petroleum Council, heads the Maguire Oil and Gas Institute at Southern Methodist University in Dallas. Pat Spillman assisted with this article.

214-690-2000 1376

Spring 1987 AGU - May 18-22

## Special Sessions:

### Volcanology, Geochemistry, and Petrology (V)

Continental Scientific Drilling Program (CSDP) in Thermal Regimes

Salton Sea Scientific Drilling Project (SSSDP): Initial Results

Mineral Spectroscopy and Remote Sensing Progress in Analytical Techniques With the Ion Microprobe

Isotopic Evolution of Seawater Through Geologic Time (O)

Geochemical Mapping of the Oceans (O)

\*Scientific Investigations of the Cameroon Phenomenon

\*Personal Computer Applications in Volcanology, Geochemistry, and Petrology (Posters)

### Volcanology, Geochemistry, and Petrology

#### Salton Sea Scientific Drilling Project (SSSDP) Initial Results

This session will report the first scientific results of a research borehole drilled between October 1985 and March 1986 in the Salton Sea geothermal field, California. The well reached a depth of 3.2 km, where temperatures of up to 355°C were encountered. Flow tests at 1.8-km and 3.2-km depths produced saline brines containing 23 weight % total dissolved solids. A broadly interdisciplinary program of geophysical experiments was performed at the well. This was followed by geochemical studies of the brines and petrological investigations of cores and drill cuttings, which demonstrate transitions from lake sediments to hornfelsic rocks with greenschist facies mineralogy. Researchers interested in contributing to this session should contact Wilfred Elders, IGPP, University of California, Riverside, CA 92521 or John Sass, U.S. Geological Survey, Menlo Park, CA 94025.

#### Scientific Investigations of the Cameroons Phenomenon

In this session the results from the scientific team that investigated the 1986 Cameroon lake disaster will be presented, as will talks dealing with related processes. For information contact, Paul Krumpke, AID, Washington, DC 20523 (telephone: 202-647-9758); or Jack Lockwood, U.S. Geological Survey, Hawaiian Volcano Observatory, Hawaii (telephone: 808-967-7328).



DRAFT

IMMEDIATE

Gary Frantz: 768-4591

Get rid of the word "deep" !!

SAN FRANCISCO, September 00, 1984 -- Bechtel Group, Inc. has been awarded a \$5.3 million contract by the U.S. Department of Energy (DOE) <sup>San Francisco Operations Office</sup> to explore the heart of a <sup>known</sup> ~~deep~~ <sup>occurrence</sup> geothermal ~~deposit~~ at the foot of the San Andreas Fault near the the Salton Sea, some 10,000 feet <sup>under</sup> ~~below~~ <sup>beneath</sup> California's Imperial Valley.

The 24-month research project, which calls for one of the <sup>hottest</sup> ~~deepest~~ geothermal wells ever developed in the U.S., may reach into areas of <sup>just above</sup> ~~of~~ partially cooled magma <sup>where has been injected</sup> ~~deep inside the earth~~, according to Project Manager Thomas E. Lindemuth of the firm's Research and Engineering department.

and to provide scientists with their first opportunity to study such a thermal regime in the earth's crust.

"We're going to examine this <sup>potential</sup> ~~geothermal~~ <sup>resource</sup> ~~deposit~~ from several angles," Lindemuth explained. "Part of our job will be to evaluate its attractiveness as a source of power plant steam. Other tasks will be to collect data about the geology and geochemistry of this deep resource." Bechtel's <sup>responsibility covers</sup> ~~managing~~ <sup>planning and</sup> the drilling program and data acquisition, as well as design and construction of brine treatment facilities, <sup>and a comprehensive resource evaluation.</sup> ~~and a comprehensive resource evaluation.~~

To permit fluid disposal in injection well.

The Bechtel contract may represent the first of a government-sponsored <sup>under the joint DoE - Geological Survey - National Science Foundation Continental Scientific Drilling Program</sup> series of nationwide research efforts that could include similar scientific endeavors exploring other areas of the earth's crust, explained DOE Project Manager John Crawford. Researchers and leading scientists from <sup>the Geological Survey, National Labs and Universities</sup> ~~around the~~ world also will work with the DOE and Bechtel on the project and will conduct various experiments and assessments of scientific interest, he added, <sup>in addition to DoE's geothermal investigations, under Bechtel's cognizance</sup> ~~in addition to DoE's geothermal investigations, under Bechtel's cognizance~~.

The project will kick off with a ground-breaking ceremony scheduled for Thursday, October 18, 1984, beginning at 9:00 a.m. at the project site. The work is being undertaken at locations provided by Kennecott Corporation.

research

"For this project we plan to drill two wells," noted Crawford. "The <sup>known geothermal resource</sup> ~~scientific exploration~~ well will extend through the ~~deposit~~ to a depth of 10,000 feet. There also will be a second well drilled to reinject the hot produced geothermal brine ~~back into the formation.~~"

~~formation.~~  
formation.  
(more)

News From Bechtel  
Deep Geothermal Drilling  
Page Two

Crawford explained that the project hopes to drill a scientific well deep enough to tap the area inside the earth <sup>close to</sup> where magma comes into contact with an aquifer, which is the heart of a geothermal <sup>reservoir</sup> deposit. "Drilling <sup>at</sup> into those temperatures and <sup>in contact with highly corrosive brines</sup> depths is reaching the limits of current technology. We anticipate brine temperatures that may exceed 750° F. We also may be able to learn how the <sup>reservoir</sup> (deposit) recharges itself, and gather information about how the grinding of plates in the earth's crust -- and the heat that's created -- affects a geothermal resource."

Some of the data obtained from the well may also be used to examine the phenomena of ore formation, Bechtel's Lindemuth added. "This occurs in a geothermal <sup>reservoir</sup> deposit when minerals are dissolved <sup>by the hot fluid in</sup> from the lower reaches of a geological formation and are redeposited <sup>in</sup> <sup>shallower</sup> higher areas."

The project is unique because of its <sup>bilateral</sup> <sup>is expected to</sup> research focus, and because the drilling <sup>will</sup> encounter a combination of high temperature, pressure and salinity <sup>basic geoscience studies and geothermal research</sup> factors never before dealt with, Lindemuth said. Wells for commercial geothermal plants such as The Geysers development in Northern California normally extend to substantially shallower depths, and do not contain brines with such a high mineral content.

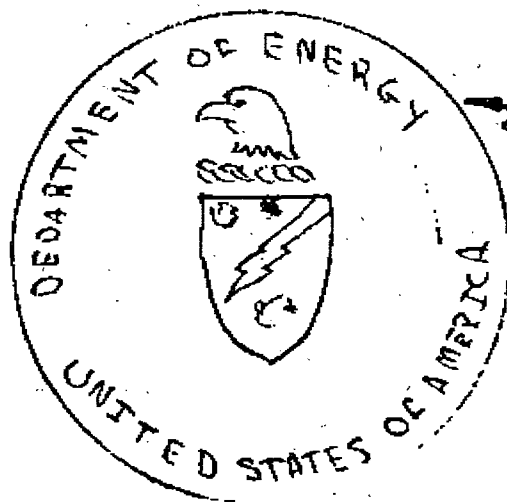
Conditions

Republic Geothermal Inc., Santa Fe Springs, CA, will be a major subcontractor providing drilling engineering services.

delete the contract in place

Preliminary engineering is underway in Bechtel's San Francisco offices. The project expected to begin field work in February 1985.

? Well Drilling is



**DRAFT**

Note

We have 12" diameter adhesive-backed, full color, water resistant seals. You can have a number of these, if the dimensions are O.K.

Smaller sizes are also available.

# U.S. DEPARTMENT OF ENERGY

San Francisco Operations Office  
Geothermal Deep Drilling Project

RESEARCH

Contract No. DE-AC03-84-SF12194

Site Provided By  Kennecott Corporation

Prime Contractor:  Bechtel National, Inc.

Job No. 16937

The blaze broke out about 12:15 a.m. in the 100-room downtown hotel occupied by about 300 permanent residents and transients, many of them clients of "various agencies of government," Graves said. The fire was under control at 3:40 a.m. Some residents jumped from windows, some climbed

(residents) were so old they couldn't get out," Comer said. "There was very poor visibility, panicky people, unconscious people lying on floors," said Battalion Chief Frank Crampton. "We took them out of all the windows and down all the staircases."

s measured at an intensity about 4.0. People in high-rise buildings in Salt Lake City felt the quake, there were reports of broken china in western Nebraska.

Wheeler said the firm plans to market an innovative cooking oil processing system for restaurants and fast food outlets that dramatically See JOBS, Page A2

The letter from the state Department of Mental Health lists records keeping and physician participation as areas out of compliance. The See COUNTY, Page A2

## Niland research project well is off and running

An official groundbreaking this morning for the new Salton Sea Scientific Drilling Program project opens the way for work on the new geothermal research well southwest of Niland. Assisting in the groundbreaking are Richard Du Val, manager of the San Francisco office of U.S. Department of Energy; Wilbur Thompson, representative of the California State Lands Commission; W. Patrick Collins, undersecretary of Department of Energy; Robert Dimock Jr., vice president of project development of Kennecott; John Mock, director of geothermal technologies, Department of Energy; Dr. Wilfred Elders, project chief scientist; George Wang, manager of research and engineering, Bechtel; and Harvey Brush, executive vice president of Bechtel. The project is a combination of efforts and a contract between the Department of Energy, Bechtel and Kennecott (of Standard Oil). The well is expected to reach a depth of 10,000 feet and is projected to be the hottest geothermal well in the world.



Geothermal research well groundbreaking today in the Valley.

## Weissman gets E.C. hospital nod

Councilman Harry Weissman is the new chairman of El Centro Community Hospital board.

The city council Wednesday approved by a 3-1 vote Mayor Randall Horton's appointment of Weissman to succeed the late Councilman Tony Beltran.

Beltran died Oct. 8 following a heart attack.

Horton said Weissman "is one of the senior members of the council and has indicated a strong interest in the policies of the hospital. I feel that he will serve us well in this capacity."

Weissman, who did not vote, said he was surprised at the appointment. "I have been very interested in the hospital, and I will do my best and thank you for your confidence in me," Weissman said.

The council put off to next week any action regarding additional funding for completion of the reorganization legal analysis report for the hospital.

Horton also told the council it

needs to "recruit the best person possible" to succeed Beltran.

"I personally am going to be recruiting, and I feel that each of you are free to do as your conscience dictates. But I want the ground rules clear from the start," Horton said, "so there won't be any misunderstanding."

Councilwoman Sedalia Sanders, who was appointed to fill the vacancy created when Ron Hull resigned, said she was in favor of appointees, but said she felt the "responsibility should be left to those officials who were elected."

Weissman said he would not object to any appointee "who would just serve out the term in case one of us does — heaven forbid ... I'll be looking around for someone in that particular area."

Councilman Jack Dunnam said, "As a former appointee and as an elected (official), I wouldn't have any real problem leaving it vacant," but "I'll certainly be looking," he added.

# Feds promise bilingual education funds — again

By Becky Hanks

They got it! Maybe. The Brawley School District was informed Wednesday by telephone that it will indeed receive the \$140,000 bilingual educational funding that was suddenly taken from it last week, but district officials are holding back from celebrating until the formal paper work and appropriation from Washington, D.C., is received.

District Superintendent Steve Wilson said he received a phone call just before noon Wednesday from Frank Boldon, supervisor of bilingual grants in the U.S. Department of Education. Wilson said Boldon informed him that the "department would make good" the Title VII (bilingual education) funding for the Brawley district, but the school district could not legally spend or distribute the funding until they received written confirmation.

Confirmation of the funding is expected within three to four weeks,

according to a district spokeswoman.

Wilson said he was confident the district would actually received the funding this time.

Last week, the elementary school district learned that the Title VII funds they had been awarded Sept. 19 would not be available to them after all because of a computer glitch that showed more funding available than what was actually there. Officials from the bilingual educational department of the Department of Education maintained that the school received notification over the phone and the award was not official until they had received written confirmation.

In all, 36 school districts were affected by the computer glitch and had verbally confirmed bilingual funding revoked.

Besides the Brawley School District, the Holtville Unified School District was also involved in the funding mix-up.

According to Robert Lasley, superintendent of the Holtville district, the southend district had also been informed verbally in September it would receive Title VII funding. Lasley said they then were told that a computer glitch had provided false information, and they would not receive the funding as promised.

Lasley said Holtville was informed Wednesday, like Brawley, that the bilingual funding would be forthcoming in about four weeks.

"I'll wait until I see it," Lasley said. He added the district would not do anything until it received written confirmation of the grant.

The funds are awarded to school districts to aid in educating limited or non-English speaking children. Imperial County schools have the highest percentage of students with limited proficiency in English in the state.

Officials in Washington were unavailable for comment or unable to say where the additional funding came from.

GROUND-BREAKING: Words for P. Collins

The Salton Sea Scientific Drilling Project is the first well drilling project to be attempted under the auspices of the Interagency Accord on Continental Scientific Drilling, signed in April, 1984, between the U.S. Department of Energy, the U.S. Department of the Interior and the National Science Foundation. This project should serve as a model for similar and more ambitious projects in the future by demonstrating that cooperation between the various agencies of Government, in hand with industry and academia, will derive maximum scientific and economic benefit to the Nation as a whole.

By drilling and testing a 10,000 foot well here, the Department of Energy seeks to determine the nature of potential geothermal reservoirs that underlie a known high-temperature reservoir, in order to better understand the genesis and structure of hydrothermal-geothermal resources and to assess theories that the nation's hydrothermal resources are far larger than previously estimated.

This well will be made available to the science community so that they may achieve expanded knowledge and understanding of the uppermost part of the crust of the earth in the United States in order to address scientific and societal problems in four broad areas.

1. Basement structures and Deep Continental Basins -- to answer broad and specific questions related to understanding the earth's continental crust.
2. Thermal Regimes -- To obtain a basic understanding of geothermal systems.
3. Mineral Resources -- To obtain a basic understanding of ore-forming processes.
4. Earthquakes -- To obtain a basic understanding of earthquake and faulting mechanisms.

The hostile environment expected to be encountered beneath this site will severely try our ability to collect scientific data. New and novel equipment, methods and techniques will be required. Success will provide developers of the geothermal resource with new tools for more economical extraction of this valuable resource.

## WORLD'S DEEPEST GEOTHERMAL WELL PROPOSED:

### THE SALTON SEA SCIENTIFIC DRILLING PROJECT

A consortium of federal agencies which sponsor earth sciences research and energy technology development is considering a proposal by scientists from the University of California, Riverside, to study the deepest, and probably hottest, geothermal well in the world. In the Imperial Valley of southern California several geothermal fields are being actively developed by industry as non-polluting sources of electric power. The largest and hottest of these is at the south end of the Salton Sea. Subterranean temperatures in this field exceed 690°F at 7,000 feet depth over a wide area. Formerly, the high salinity of the water encountered, which contain up to 25% of dissolved salts, has been a barrier to the development of this enormous resource. New technological developments now hold promise of overcoming this problem.

A 10 megawatt electric generating plant has operated in the Salton Sea field since August 1982 with a 96% availability factor. Two 50 megawatt plants are now planned by other industrial concerns. There is also interest in extracting chemicals from the brines, which contain unusually high contents of metals such as copper, lead, zinc, and even silver. This rare association of high temperatures and high salinities is similar to the recently discovered deep ocean-floor hot springs in the East Pacific. These precipitate a wide array of metallic ores.

Up to now, scientific study of these unusual phenomena in the Salton Sea field has been difficult. This is because information from the thirty proprietary geothermal wells drilled by industry so far in the field is confidential. However, in the fall of 1982 one developer, Republic Geothermal, Inc. (RGI), recognized the need for research on such geothermal fields and responded favorably to a request to collaborate with researchers at the University of California, Riverside (UCR), Drs. W. A. Elders and L. H. Cohen. These investigators have a contract with the Office of Nuclear Waste Isolation to study naturally-occurring radioactive elements in hot brines. They are investigating geothermal fields as natural analogs of possible conditions in a nuclear waste repository. The idea is to obtain data to model the potential for migration of dissolved radionuclides away from proposed waste repositories in salt mines.

Further discussion between the UCR group and RGI led to the even more ambitious plan to "add-on" to a well to be drilled by RGI in the spring of 1983. This well, in the eastern part of the field, is scheduled to reach 12,000 feet depth. As a first step, the UCR proposal requests funds to pay added costs of obtaining rock and brine samples and other data from this well. Funds are also requested to explore the roots of this geothermal system by deepening the well to 18,000 feet, the limit of the available drilling rig. All of the information obtained would be released to the scientific community.

The most ambitious aim of the proposed experiment is to approach the heat source which the UCR group believes to be intrusions of molten rock from below. The first 12,000 feet of the well will yield more samples and data to the public domain than are available from any commercial geothermal well yet

drilled in the U.S.A. Deepening the well to 18,000 feet will explore an extreme environment of pressure and temperature never before investigated directly. The well would explore for steam at depths and pressures (and probably temperatures) greater than any other geothermal well anywhere in the world. The UCR scientists speculate that the well may encounter "superconvection." According to a recent theory, at high enough pressures and temperatures, fluids can flow much faster than is possible at less extreme conditions. Although such deep wells are more expensive to drill, if "superconvection" were to occur, the power output from them would be many times greater than that from shallower wells.

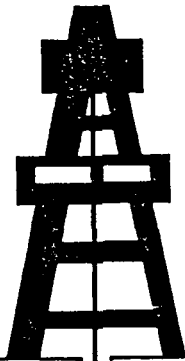
The data and samples obtained from this deep well will be used to interpret the three-dimensional geological structure and hydrology of the this geothermal resource. However, just as important, it will help develop necessary technology and experience in drilling and producing steam from wells which are much deeper and hotter than those currently employed by the geothermal industry. Drs. Elders and Cohen believe that such experiments have the potential, in the long term, of enormously increasing the size of the known geothermal energy resources of the country.

They point out that RGI will have invested some \$15 million in developing this site by the time it is brought into steam production. The UCR researchers propose to "piggy-back" on this investment by seeking a further \$6 million of government and other funds to cover the additional engineering and scientific costs of the proposed experiment. Dr. Elders stated, "This is a wonderful opportunity for collaboration between industry and government with a high potential for important new scientific returns. In my opinion, it is exactly the kind of high risk basic and applied research which should be supported by the appropriate federal agencies."

ESTIMATED BUDGET FOR THE SALTON SEA SCIENTIFIC DRILLING PROJECT

	<u>DOE RGI \$K</u>	<u>NSF UCR \$K</u>	<u>TOTAL \$K</u>
<u>Phase 1 - FY 83 Expenditures</u>			
Coring, sampling, logging Mechanical modifications	225.0	130.0	
Salaries, expendibles, curation, administration, science support		50.6	
TOTALS PHASE 1	<u>225.0</u>	<u>180.6</u>	<u>405.6</u>
<u>Phase 2 - FY 84 Expenditures</u>			
<u>2A</u> Deepening well, etc.	3,280.0		
<u>2B</u> Fracture stimulation, experiment Curation, administration; science support	965.0	276.0	
<u>2C</u> Restoring well to production	440.0		
TOTALS PHASE 2	<u>4,685.0</u>	<u>276.0</u>	<u>4,970.0</u>
<u>Phase 3 - FY 84 Expenditures</u>			
Science, salaries, etc.		477.0	
Overhead		117.0	
TOTALS PHASE 3		<u>594.0</u>	<u>594.0</u>
<u>TOTAL PROPOSED COSTS PHASE 1, 2, 3,</u>	<u>\$4,910.0</u>	<u>\$1,050.6</u>	<u>\$5,969.6</u>





# World's Deepest Geothermal Well Proposed at Salton Sea

*Editor's Note: If it is funded, this proposed deep well project could be one of the most important research events of the decade. Let us keep in mind that projects such as this are the life blood of a growing industry.*

A proposal to drill the world's deepest well (18,000 ft) into the Salton Sea geothermal anomaly near Niland in the Imperial Valley of California was submitted to the National Science Foundation. The "Salton Sea Scientific Drilling Project" submitted on November 5, 1982, was co-authored by Drs. Wilfred Elders and Lewis Cohen of the University of California, Riverside. On December 8, 1982, the Continental Scientific Drilling Committee met in San Francisco in an open meeting to discuss the proposal. (Another proposal to do deep drilling and related research in the Valles Caldera of New Mexico is reported to be in preparation by an ad-hoc group that met in New Mexico in early October of 1982.)

The project—a three-way effort between the University of California, Riverside, the National Science Foundation, and Republic Geothermal, Inc. of Santa Fe Springs, California—will begin in March 1983. Republic plans to drill a third well on its fee lease which is centered about 1-1/2 miles southwest of Niland. There are two existing wells on Republic's Niland property. The well is scheduled to 12,000 ft and will eventually become a producer for a planned 49 MW power plant that should be operational in late 1985.

The proposal calls for the drilling and completion of this well with larger diameter hole and casing that would allow its deepening to 18,000 ft. Republic is receptive to the

interim use of the well ("add ons") as a research project.

Following is a description of the three Project Phases together with an outline of the proposed budget:

### PHASE I

Republic plans to drill its well to 12,000 ft at a cost of \$2.6 million. The first phase would "add on" the following components:

1. Limited coring and water sampling during the drilling operation to 12,000 ft, and

2. Increasing the hole diameter to provide for a special casing completion program that will allow the well to be deepened to 18,000 ft.

Cost ..... \$ 410,000

### PHASE II

*Phase II A* - continuous coring and limited fluid sampling of the well as it is deepened from 12,000 to 18,000 ft. Open-hole wireline logging and production testing. No casing is to be run.

Cost ..... \$3,280,000

*Phase II B* - Perform a fracture dilation and well stimulation experiment.

Cost ..... \$ 970,000

*Phase II C* - Restoration of the well to a production mode and other related costs.

Cost ..... \$ 720,000

### PHASE III

Study of down-hole core samples and preparation of final report.

Cost ..... \$ 590,000

Total Cost ..... \$5,971,000

Finally, there will be a period of time set aside from August 1984 to June 1985 when the well will be available for research projects sponsored by other parties.

The benefits of this research project could be far-reaching and have a positive impact on the development of geothermal energy world-wide. Among the numerous

primary data collection possibilities are:

1. The possible existence of superconvecting geothermal systems and the economic implications thereof.

2. The nature of the heat source and its lithologic characteristics, and

3. The possibility of solution mining and metal recovery from deep circulating brines.

If you wish to know more about this proposed project, contact Wilfred Elders, Ph.D., Institute of Geophysics and Planetary Physics, University of California, Riverside, CA 92521, 1-714/787-3439. G.T.

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AND PLANETARY PHYSICS

RIVERSIDE, CALIFORNIA 92521

February 14, 1983

To: Recipients of the Proposal "Salton Sea  
Scientific Drilling Project: Phase 1"

From: W. A. Elders **WE**

Re: Revised Timetable

Attached is the latest revision of the proposed timetable for the entire Salton Sea Scientific Drilling Project. Now that the Federal Loan Guarantee has been negotiated, Republic Geothermal, Inc. proposes to order well casing in mid-April. Phase 1 drilling would be concluded in December 1983 and Phase 2 drilling would begin in July 1984, allowing 6 months for surface and downhole studies of the first 12,000 ft. of hole. The remainder of the drilling/production schedule will permit a total of 12 months for various studies of the interval between 12,000 and 18,000 ft.

We would again like to emphasize that the range of possible scientific and reservoir engineering investigations is not limited to those specifically mentioned in our proposal. We would welcome participation by other investigators for whom 11 1/2 months is specifically allotted in the timetable under the heading of "Special Logging and Testing". As mentioned in our proposal, the Steering Committee will oversee the project planning, coordinate experiments, and distribute samples and data among the different investigators.

The management of Republic Geothermal, Inc. have indicated that if this project goes forward they will release data on the two adjacent wells on the site and would consider the possibility of well-to-well experiments by other investigators if consistent with sound engineering practices.

