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SALTON SEA SCIENTIFIC

DRILLING PROGRAM

Report of the First Quarter
FY 1985

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

SALTON SEA SCIENTIFIC DRILLING PROGRAM
Report of the 1st Quarter FY85
October 1, 1984 thru December 31, 1984

EXECUTIVE SUMMARY

The understanding of the deep continental crust and of those processes that have shaped it over four billion years of geological history is a major scientific challenge that is gaining worldwide importance. The "superdeep" Kola well being drilled in the Murmansk region of the Soviet Union has shed new light on the interpretation of the earth's crust as the well exceeds depths of 12 kilometers. The Salton Sea Scientific well, like the Kola well, will serve to provide data from a unique hostile environment never before investigated. Derivatives from the program are expected to advance drilling and downhole data gathering technologies as new barriers for instrumentation and materials are transcended.

The establishment by DOE of a solid management plan for the Salton Sea Scientific Drilling Program (SSSDP), whereby the scientific and engineering programs are joined together by an Interagency Accord between DOE, USGS, and NSF, has laid the foundation for a high probability of success for the project.

The prime project contractor for the drilling and engineering program, Bechtel National, Inc., has a proven performance record for excellence in managing and operating large-scale development projects. Their wealth of experience, coupled with the technical qualities provided by the other industry subcontractors, is a welcome asset to the program.

Proposals for experiments to be performed in the program were provided by researchers to the funding agencies after a number of informative meetings were held to solicit participation. The proposed experiments were evaluated based upon their scientific merit and probability for success.

It is anticipated that this program will mark the first major project of a

series of studies through the Interagency Accord to investigate the geodynamic processes within the earth's crust. By drilling deeper into active thermal areas such as the Salton Sea geothermal system, we will gain a better insight into the processes that have shaped mineral deposits, produced deformation at the earth's surface, formed existing thermal anomalies, and created natural hazards.

INTRODUCTION

General Statement

The Salton Sea Scientific Drilling Program is the first major drilling project to be performed under the Interagency Accord on Continental Scientific Drilling involving all three signatories (the U.S. Department of Energy (DOE), U.S. Geological Survey (USGS), and the National Science Foundation (NSF)) to achieve a better basic understanding of the earth's continental crust. The program is designed to investigate (through drilling and testing) the subsurface thermal, chemical, and mineralogical environments of the Salton Sea geothermal area, located in California's Imperial Valley. It was initially conceived by researchers to collect subsurface scientific information and evaluate the geothermal potential beneath the known hydrothermal system of the Salton Sea area.

The program has evolved from efforts by researchers and geothermal industry scientists who believe that significant benefits can be derived from drilling deeper into the Salton Sea geothermal system. One of the possible benefits, a significant upward revision of the estimated geothermal resource base, may be realized by penetrating into higher pressure and temperature regimes. In addition, data generated from the experiments could shed light on the genesis of ore deposits and the origin of fluid pressure induced earthquakes.

The overall goals of the program are to be gained through a two phased approach. One part of the program, the "Drilling and Engineering" phase, will involve the actual drilling and reservoir testing of an experimental geothermal well to be drilled to depths greater than the present producing horizon within the Salton Sea hydrothermal system. The second part of the program, the "Scientific Experiments" phase, will involve a series of coordinated scientific studies to be performed within the experimental well. The scientific studies will be conducted by researchers from universities, industry, national laboratories,

and Federal agencies whose scientific expertise will provide data to help to achieve the overall program goals.

Program Goals

The overall program goals have been established based upon the common interests of the participating parties. These interests are directly related to the solution of certain national problems such as ensuring adequate supplies of energy, efficient development of water and mineral resources, basic understanding of the earth's thermal systems, and protection against natural hazards.

The goals of a deep scientific drilling program within the Salton Sea geothermal system are summarized below.

- Better define the volume of the Salton Sea hydrothermal system and test for an extension of the system to greater depths.
- Improve hydrothermal energy resource estimates.
- Develop a better understanding of the genesis of hydrothermal ore deposits.
- Investigate the possibility of the occurrence of "superconvection."
- Study the origin, nature, and occurrence of earthquake swarms generated during hydrothermal convection.

Test Site

The site selected for the deep test well is located on a Kennecott Corporation leasehold situated approximately 4 miles southwest of the town of Niland, California. The scientific well location designation shown in Figure 3 is "State 2-14." Drilling is anticipated to begin in April 1985.

The scientific test well will be drilled to a depth of about 10,000 feet. The well will be drilled to a planned "initial depth" of about 4000 feet where the 300°C isotherm is expected to be encountered and then deepened an additional 6000 feet.

An injection well will be drilled at a site ("Imperial 1-13") approximately

2000 feet northeast of the scientific well (Figure 3).

Industry Contractors

Industry contractors for the program and their associated responsibilities are:

- Bechtel National, Inc. - (a subsidiary of Bechtel Engineers and Constructors). Responsible for overall project management; reporting to DOE; permit application; site preparation; design and drilling of the wells; surface facilities design and construction; site support and maintenance; environmental monitoring; data acquisition; and resource evaluation.

- Berkeley Group, Inc. - Responsible for, providing well designs and specifications to Bechtel.

- GeothermEx, Inc. - Responsible for developing and supervising the tests and measurements plan, and providing preliminary analysis of geothermal resource potential to Bechtel.

- Kennecott Corporation - (an operating company of the Standard Oil Company, Ohio). Responsible for providing leaseholds and two permitted well sites for the scientific and injection wells. (Also have offered to provide thermal gradient logs, lithologic logs and mud samples from 39 shallow, < 300 ft, and 3 deep, 1500 ft, thermal gradient holes drilled in the Salton Sea area.)

- Well Production Testing, Inc. - Responsible for providing on-site drilling and engineering consulting services to the U.S. Department of Energy's San Francisco Operations Office, including review of well designs and specifications.

BACKGROUND

Relation to the Continental Scientific Drilling Program (CSDP)

Interest in studying the geodynamic processes occurring beneath the Salton Trough has come about over the last two decades as part of the overall scientific interest in understanding the evolution of continental land masses. In 1968 a major scientific effort was begun with the Deep Sea Drilling Project (DSDP) to investigate, through drilling, the evolutionary history of the deep ocean basins. This was continued in 1975 with the International Phase of Ocean Drilling (IPOD). Information gained from these programs helped bring together the rapidly emerging theories on continental drift and plate tectonics.

Over the past few years, scientists have recognized an increasing need for a coordinated drilling program on the continents. The continental crust has evolved to its present state over a much longer time span than have the deep ocean basins, and has been subject to a greater number of diverse geological processes. The DSDP made significant contributions to the understanding of the last 200 million years, or 5 percent, of the earth's history. However, the program has been less effective in explaining the previous 95 percent.

The concept of plate tectonics, as an outgrowth of the DSDP, led to a strong rationale justifying a major coordinated effort for a Continental Scientific Drilling Program (CSDP). The foundations provided by the DSDP were: (1) a framework was generated whereby scientists from many disciplines could relate their data, thereby leading to effective multidisciplinary research; and 2) the realization was evolved that although the continental crust is complex, it is not beyond the realm of understanding.

Private industry and the Federal government have also been committed in recent years to programs that have led to the enhanced ability to drill deeper into more hostile environments and search broader areas using remote geological, geophysical and geochemical methods. This, in addition to the foundations from

the DSDP, has provided a new rationale for the CSDP.

The major research areas of the CSDP have been defined by domestic and international scientific bodies. The areas can be characterized as follows:

- o BASEMENT STRUCTURES AND DEEP CONTINENTAL BASINS - The continental crust has persisted over a much broader period of time than the oceanic crust. The understanding of the crystalline basement comprising the core of continents is important as the principal sources of all raw materials are associated with the structural and temporal relations of this crystalline basement.

- o THERMAL REGIMES - The processes that combine to produce deformation at the surface are the result of the earth's internal heat which drives convection within its interior. Conversely, erosion and weathering at the continent's surface acts to counterbalance the deformation process.

  The understanding of the earth's thermal regimes is a major goal of earth science research. The two most important objectives being: 1) to produce a three dimensional understanding of heat sources and products, and 2) to remove the barriers to the understanding of high heat flow geothermal systems.

- o MINERAL RESOURCES - Although minerals have been mined from the continental crust for thousands of years, complete understanding of their nature and occurrence requires information from depths yet to be investigated. In order to more fully understand the distribution of economic concentrations of minerals in the crust (the products of past geothermal activity), studies of active "ore forming" environments must be made. The Salton Sea geothermal area is potentially one of the largest "ore forming" systems active today.

- o EARTHQUAKES - Better understanding of earthquakes and their causes has importance on a national scale. The siting of major dams, nuclear power plants, and nuclear waste repositories is critically dependent on the stability of the crust and the potential for earthquakes. Gathering of information regarding in situ stresses and pore fluid pressures near active seismic areas is important to the understanding of earthquake producing forces.

The Salton Sea geothermal area and the variety of tectonic conditions that exist there make it an attractive drilling site for the CSDP. Drilling deep into the Salton Sea hydrothermal system should provide the much needed data that are required for achieving a better understanding of several of the CSDP research areas.

Evolution of the Program

Initially, the Salton Sea Scientific Drilling Program (SSSDP) was brought

about largely as a result of the efforts of Dr. Wilfred A. Elders of the University of California, Riverside (UCR), and Dr. Robert W. Rex of Republic Geothermal, Inc., who presented the merits of such a program to various members of Congress. In cooperation with UCR, Republic proposed (through an unsolicited proposal, first to NSF and then to DOE, in April of 1983) the deepening of one of their wells (Fee No. 7) at Niland, California, from 12,000 to 18,000 feet to study "a unique high-pressure/high-temperature environment as yet never before encountered by geothermal wells."

In addition to drilling, coring, testing and sampling, other major goals of the program as initially proposed were defined as follows.

1) To test for a deep extension of the Salton Sea reservoir that would expand the known reserves.

2) To test the hypothesis of "superconvecting" fluid flow in geothermal reservoirs and the possibility of extraordinary well productivities.

3) To perform an experiment in fracture permeability behavior and fracture productivity enhancement to test the suggested possibility of doubling or tripling the flow of already commercial wells.

4) To provide a unique environment for downhole and well-to-well experimentation in the geosciences.

At the time of the proposal, it was recognized that neither NSF nor DOE had a clear mandate to fund the activity, nor were sufficient funds available. DOE's Division of Geothermal and Hydropower Technologies (DOE/GHTD) initiated several meetings with NSF, USGS, and DOE's Office of Basic Energy Sciences (DOE/OBES) at which it was agreed that DOE/GHTD had the management skills and technological expertise to pursue the engineering aspects of the project and that NSF, USGS and DOE/OBES had a sufficient mandate to pursue the scientific aspects.

Congressional funding for the Drilling and Engineering Program was appropriated in FY 1984 to DOE/GHTD. Based upon the original proposal to deepen the hole offered by Republic Geothermal from 12,000 to 18,000 feet, Congress appro-

priated $5.9 million for the project. Due to Federal procurement regulations and time constraints placed upon Republic and its field development partner (Parsons Engineering), it was not possible for Republic to hold open its offer for deepening the well.

By December of 1983, DOE/GHTD determined that under Federal procurement regulations, a contract could not be sole-sourced to Republic, but a solicitation for competitive bidding would be required to meet the Congressional intent. DOE/ GHTD set up a Federal Steering Committee comprised of DOE/GHTD, DOE/OBES, NSF, and USGS, and worked out guidelines for soliciting outside participation. Project responsibilities where delegated to DOE's San Francisco Operations Office (DOE/ SAN).

A request for proposals (RFP) was subsequently issued in March of 1984 by DOE/SAN, which solicited industry participation in the Drilling and Engineering phase of the program. The RFP called for drilling to a depth 6,000 feet below the depth at which a temperature of 300°C was first encountered, and required proposers to provide extensive opportunities for scientific investigations while drilling, followed by a period of 12 months of further availability for scientific experiments. Proposers could offer to deepen an existing well or to drill a new well, provided that the 300°C horizon was no deeper than 12,000 feet. An injection well would also be drilled for disposal of spent geothermal fluids.

A preproposal conference was held at DOE/SAN on April 3, 1984. Proposals received by May 4, 1984 were evaluated by the Technical Evaluation and Business Evaluation Committees during the period of May 7-11, 1984. On June 6, 1984, Bechtel National, Incorporated of San Francisco, California, was selected for further negotiations as the prime contractor while Kennecott Corporation, in cooperation with Bechtel, agreed to provide the leaseholds where the wells would be sited. Republic Geothermal, the early champion of the program, was to

provide, through a subcontract, the well designs and specifications, and drilling supervision (Republic later dropped out of the project).

At present, the "Drilling and Engineering" part of the program will utilize the expertise of a number of groups. Bechtel has subcontracted the well design and specification work to Berkeley Group, Inc. (BGI). On-site supervision of well drilling and completion for Bechtel will be subcontracted to another firm by competitive bid. Well Production Testing, Inc. (WPT) of Carlsbad, California, has been contracted by DOE/SAN as the On-Site Drilling and Engineering Consultant. WPT will review the well design and specification plans developed by BGI. GeothermEx, Inc., has been subcontracted by Bechtel to develop and supervise the DOE/GHTD geothermal tests and measurements plan for the SSSDP, and to provide a preliminary analysis and interpretation of results in regard to geothermal resource potential.

Informational Meetings

A number of meetings have been held by DOE/GHTD to inform the scientific community of this unique research opportunity and to encourage their participation. Among others:

o Preproposal Conference was held April 3, 1984 in San Francisco, California, where the proposed program was presented by DOE to potential participants. Questions were answered concerning program plans, objectives and schedules, and the RFP content.

o Ogle Meeting was held May 16, 1984 at Stanford University, where a description of the program was given and preliminary discussions were held on experimentation and instrumentation in the context of the SSSDP project.

o International Symposium on Observation of the Continental Crust through Drilling, May 20-25, 1984, was held at Tarrytown, New York, where the rationale for a coordinated national effort for deep drilling on the continental

land mass was discussed.

o SSSDP Information Meeting was held on August 29, 1984 at Reno, Nevada, where a wide range of items was presented and discussed. Topics ranged from the SSSDP Management Plan to the anticipated project schedule. The interrelation of the various agencies, their involvement in the project, and the procedures for submitting and evaluating research proposals were also outlined at this time.

o American Geophysical Union meeting on December 5, 1984, in San Francisco, California, where the SSSDP was discussed as part of a one-day symposium on targets for continental scientific drilling.

In addition to these informational meetings, SSSDP program announcements have been published in EOS, Geotimes, Geothermal Resources Council Bulletin, Oil and Gas Journal, Geothermal Report, and the Drilling Early Warning (DEW) Newsletter of the National Academy of Sciences.

CURRENT PROGRAM

Management Scheme

Through the original Federal Steering Committee (now called the Executive Steering Committee), DOE/GHTD developed and implemented a comprehensive management structure giving clear lines of authority, with appropriately designated points of coordination.

The interaction of the various organizations is outlined on the Salton Sea Scientific Drilling Program Management Plan (Figure 1). The project participants for the DOE/GHTD Geothermal Drilling and Engineering Program are listed in Table 1 while the participants in the Scientific Experiments Program are listed in Table 2. The overall effect of project operations is to maximize the value of the subsequent scientific experiments that will be performed.

The responsibility of the Executive Steering Committee (ESC), which represents the three sponsoring agencies, is to assure proper coordination between the Drilling and Engineering Program and the Scientific Experiments Program. The Science Coordinating Committee (SCC), also consisting of representatives from USGS, NSF, and DOE, is responsible for the establishment of the Scientific Experiments Committee (SEC) comprised of a wide range of technical expertise from industry, universities, and national labs. The SEC advises the SCC in putting together a cost effective, integrated science package. The Science Services and Support Manager functions as chief liaison between the SEC, and the drilling and engineering segment of the SSSDP. The On-Site Science Manager will work closely with the Chief Scientist and the Science Services and Support Manager to provide the science community with continuous representation at the well site.

Project Plan

The overall project schedule (Figure 2) was designed by DOE/GHTD to perform

and complete those basic scientific and engineering studies that are associated with exploratory drilling and well completion. Competitive bids will be solicited by Bechtel for the drilling activity during late January and early February 1985 with an award expected in March 1985. The expected spud date at location "State 2-14" (Figure 3) will likely occur sometime in April 1985 with projected well completion approximately four months following spudding. The injection well will be drilled at location "Imperial 1-13." The scientific well is projected to be intermittently cored at five selected 30 foot intervals in the first 4000 feet. Also, two short term flow tests are planned at selected fracture zones within this interval. Fifteen days each are allocated for geothermal tests and measurements, and scientific experimentation during drilling operations. Two long-term (30 day) flow tests are scheduled upon well completion. The well will then be available for further scientific experimentation for one year.

The SSSDP Drilling and Engineering Program plan can be briefly summarized by the following points.

- o "Initial Depth" (300°C) expected at approximately 4000 feet.
- o Five 30 foot sections of core are to be taken in the first 4,000 feet.
- o Hole will be logged prior to casing to 4000 feet.
- o Two short term flow tests are scheduled at selected fracture zones within the first 4000 feet.
- o Geophysical and mechanical logs and fluid samples will be obtained (if possible) after reaching the target depth.
- o Coring will occur over at least 15 percent of the total drilled interval.
- o Two 30 day flow tests are scheduled upon completion.
- o The well will be available for approximately 15 days each for geothermal tests and measurements, and scientific experiments while the rig is on-site.
- o The well will be open and available for scientific experiments up to one year after completion.

- o An injection well to handle spent fluids will be drilled at location "Imperial 1-13," to a depth of approximately 4000 ft.
- o Brine handling facilities will be constructed adjacent to the scientific well to provide two stage flash separation of brine and vapor plus stabilize the brine against supersaturation.

Scientific Experiments Program

Fifty-seven proposals from researchers to study the engineering, geothermal resource, and scientific aspects of the well have been received and were evaluated on November 15-16, 1984, by the Scientific Experiments Committee to determine the feasibility, timeliness, and potential for success of each experiment. The thirty-eight qualifying proposals submitted to DOE's Office of Basic Energy Sciences and the National Science Foundation were evaluated and ranked for scientific merit by a joint DOE/OBES-NSF Peer Review Panel on November 27, 1984. The Science Coordinating Committee will make the final selection of experiments to be conducted and will establish funding levels in January 1985.

Drilling and Engineering Program

Of the twenty-four proposals submitted to the DOE/GHTD, only thirteen were ranked and evaluated by the joint DOE/OBES-NSF Peer Review Panel on November 27. However, all were examined by the Scientific Experiments Committee (SEC) November 15-16 to determine feasibility and potential for success. Several proposals were submitted to more than one funding organization (e.g., DOE/GHTD and DOE/OBES). Prior to evaluation by the SEC, the DOE/GHTD conducted an independent in-house review of those proposals involving downhole instrumentation, fluid sampling and coring. In addition, a workshop on downhole measurements and fluid sampling was held at DOE/SAN on December 6, 1984, to help identify available and developable equipment (including equipment that can be easily and inexpensively modified) for use in subsurface studies and sample retrieving. The results of the meeting and discussions produced a number of recommendations that will need to be addressed in the next few weeks in order to assure the

success of the project.

The downhole sampling and measuring devices must be able to withstand the hostile chemical, pressure, and thermal environment that will be encountered in the Scientific Well. Equipment must be able to withstand a temperature near 400°C for a minimum of 12 hours and make accurate, reliable, and repeatable measurements. It will also be necessary that the equipment survive a highly corrosive, chemical environment containing Ca, Na and K chlorides, and H_2S. Sampling equipment must: 1) not contaminate the natural rock/fluid environment; 2) recover both liquid and gas samples; and 3) retrieve a fluid sample of nearly two liters. It is also hoped that the sampling equipment can provide in situ temperature, pressure and fluid flow measurements.

Another critical concern addressed at the meeting was whether or not a cable/cablehead assembly could be obtained to withstand such a hostile environment. Several experiments could be destroyed by the failure of a cable/cablehead assembly -- particularly when a backup system is not available.

It was decided that the single conductor cable currently available through the Geopressured Program should be acquired and sent to the Geothermal Test Facility at East Mesa, California. The cable, designated by the code MP35N, consists of a teflon insulated copper wire that is sheathed and armored by a chromium-molybdenum-nickel-cobalt alloy that has been designed to resist cable degradation by H_2S embrittlement in corrosive environments.

Other items under consideration as a result of discussions focus attention on sampling of geologic materials and wellbore conditioning. The current questions are: 1) is it feasible within budget to obtain "continuous core" over the total drilled interval; 2) how will induced cooling of the wellbore affect the subsurface environment; and 3) is it desirable and feasible within budget to case and cement the lower part of the well?

Executive Steering Committee

The Executive Steering Committee has met a number of times during the past year in order to assure that coordination exists for reaching the common goals of the program. The dates of these meetings and a brief summary of the results are listed below.

January 23, 1984: The major item of business was the discussion of the impact of an offer, by Union Oil Company, of a (10 to 40 acre) land tract as a wellsite location. Other items under consideration included: 1) the merits of a centralized well location versus a location at the Salton Sea field margin; 2) ratification of the assignment of individual members to the "Elders" Scientific Advisory (Experiments) Committee; 3) responsibilities of DOE/OBES and NSF within the Scientific Experiments phase of the project (NSF had $250 K earmarked for scientific research, DOE/OBES estimated that scientific experiments within the well could total nearly $2 million, USGS estimated that in any given year, USGS, NSF and DOE/OBES would have $1 million for science in the SSSDP well); and 4) handouts were provided of a recent announcement in the Commerce Business Daily (December 13, 1983) with responses, the RFP statement of work, and the Niland Geothermal Letter (January 10, 1984).

April 12, 1984: Discussion of the management plan for the overall project was the major item of business. The final plan clearly separated the overall program into two subprograms for Drilling and Engineering, and Scientific Experiments on the basis of functional and funding responsibilities. Other items of business included: 1) discussions of the involvement of Sandia National Laboratories' Geoscience Research Drilling Office and Lawrence Livermore Laboratory; and 2) individual assignments to the Science Coordinating Committee.

July 19, 1984: The initial topic of discussion was the likelihood of a January/February 1985 spud date for the scientific well and the problems and costs that could be avoided by spudding January 1 versus March 1. Other items

of business included: 1) on-site logistical support; 2) status of the procurement (including a budget of $5.3 million with a 25% drilling contingency); 3) anticipated funding level by DOE/OBES ($500K); 4) selecting and funding an on-site science manager, and 5) core curation.

October 5, 1984: The major purpose of the meeting was the reporting of the recent signing of contracts between Bechtel and DOE, and Well Production Testing and DOE. A briefing was presented by invitation to the planned DOE Geothermal Program Review III meeting and the SSSDP ground breaking ceremony scheduled for October 16-19, 1984, at El Centro, California. Other items of consideration included: 1) the signing of an agreement between Bechtel and Kennecott (September 21, 1984) whereby suitable drillsites for the scientific and injection wells would be provided; 2) Kennecott's agreement to release both existing and future thermal gradient hole data; 3) the upcoming subcontracting of the "well tests and measurements plan" to GeothermEx, Inc.; 4) the contracting of Well Production Testing, Inc. (September 26, 1984) as DOE's On-Site Drilling and Engineering Consultant; 5) anticipated funding levels by OBES and GHTD; 6) concern over the coring program as outlined and a recommendation that a much greater interval of the scientific hole should be cored; and 7) the need for obtaining an undisturbed temperature profile and recovery of pristine fluid samples.

Weekly reports to DOE/GHTD are provided by the DOE/SAN project manager. The reports provide an up-to-date tracking of the significant events that affect the Drilling and Engineering Program.

SALTON SEA SCIENTIFIC DRILLING PROGRAM MANAGEMENT PLAN

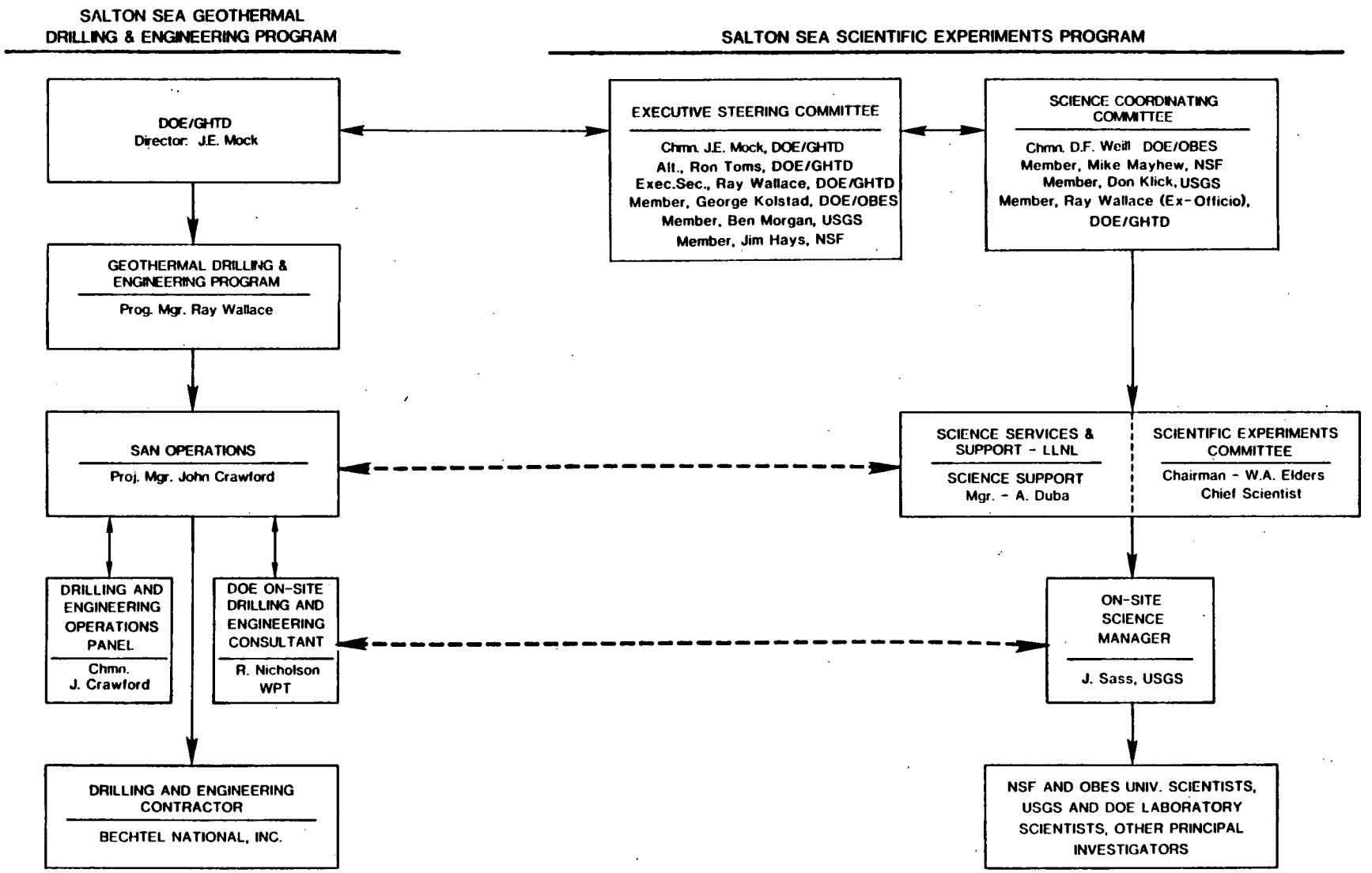

Figure 1

SSSDP PROJECT SCHEDULE

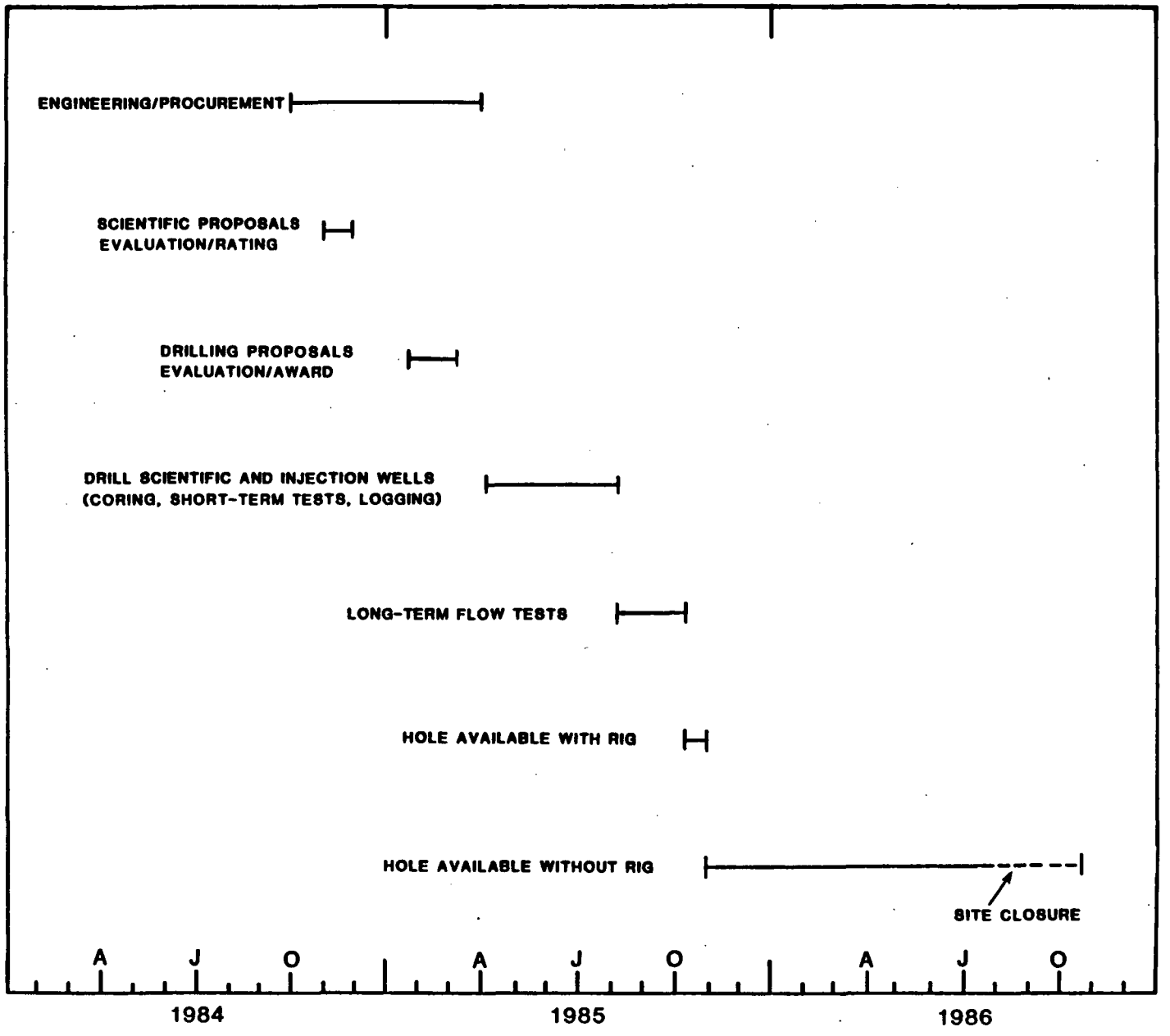

Figure 2

SALTON SEA SCIENTIFIC DRILLING PROJECT SITE LOCATIONS

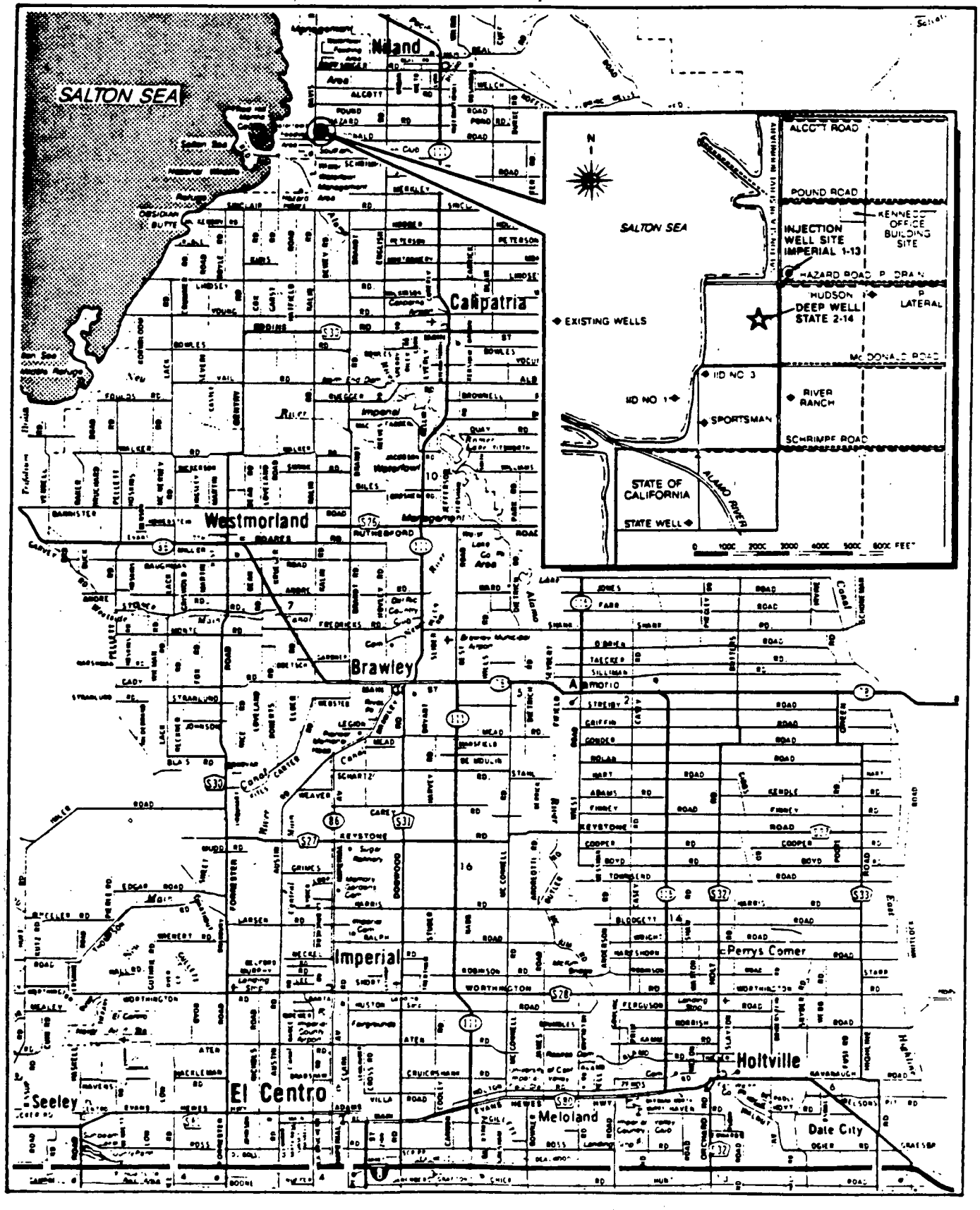

Figure 3

TABLE 1

SALTON SEA DRILLING & ENGINEERING PROGRAM

MANAGEMENT PLAN RESPONSIBILITY		INDIVIDUAL	ORGANIZATION
Director/GHTD		John Mock	DOE/GHTD
Drilling and Engineering Program Manager		Ray Wallace	DOE/GHTD
DOE Project Manager San Francisco Operations Office		John Crawford	DOE/SAN
On-Site Drilling & Engineering Consultant		Bob Nicholson	WPT
Drilling and Engineering Operations Panel	Chairman	John Crawford	DOE/SAN
	Alternate Chairman	Harold Lechtenberg	DOE/SAN
	Member	Porter Grace	DOE/ABOO
	Member	Joe Fiore	DOE/NVOO
	Member	Susan Prestwich	DOE/IDOO
	Member	James Kelsey	SNL
	Member	Morton Smith	LANL
	Member	Doug Stockton	CDOG
	Member	Dennis Trexler	UNV
	Member	Norman Goldstein	LBL
	Member	Forest Bacon	CDMG
	Member	Hank Ramey	STANFORD
	Member	Marty Molloy	DOE/SAN
	Member	William Holman	DOE/SAN
Drilling and Engineering Project Management		Tom Lindemuth	BECHTEL

TABLE 2

SALTON SEA SCIENTIFIC EXPERIMENTS PROGRAM

MANAGEMENT PLAN RESPONSIBILITY		INDIVIDUAL	ORGANIZATION
Executive Steering Committee	Chairman	John Mock	DOE/GHTD
	Alternate Chairman	Ron Toms	DOE/GHTD
	Executive Secretary	Ray Wallace	DOE/GHTD
	Member	George Kolstad	DOE/OBES
	Member	Ben Morgan	USGS
	Member	Jim Hays	NSF
Science Coordinating Committee	Chairman	Dan Weill	DOE/OBES
	Member	Mike Mahew	NSF
	Member	Don Klick	USGS
	Member	Ray Wallace (Ex-Officio)	DOE/GHTD
Science Services and Support Manager		Al Duba	LLNL
Scientific Experiments Committee	Chairman	W.A. Elders	UCR
	Secretary & Alternate Chairman	Louis Cohen	UCR
	Member	Al Duba	LLNL
	Member	Paul Witherspoon	LBL
	Member	Robert Fournier	USGS
	Member	Larry Cathles	CHEVRON
	Member	Kier Becker	SCRIPPS
	Member	Mark Mathews	LANL
On-Site Science Manager		John Sass	USGS

INDEX TO ORGANIZATION ABBREVIATIONS

BECHTEL	Bechtel National, Inc.
CDMG	California Division of Mines and Geology
CDOG	California Division of Oil and Gas
DOE/NVOO	U.S. Department of Energy/Nevada Operations Office
CHEVRON	Chevron Research
DOE/ABOO	U.S. Department of Energy/Albuquerque Operations Office
DOE/GHTD	U.S. Department of Energy/Geothermal and Hydropower Technologies Division
DOE/IDOO	U.S. Department of Energy/Idaho Operations Office
DOE/NVOO	U.S. Department of Energy/Nevada Operations Office
DOE/OBES	U.S. Department of Energy/Office of Basic Energy Sciences
DOE/SAN	U.S. Department of Energy/San Francisco Operations Office
LANL	Los Alamos National Lab
LBL	Lawrence Berkeley Laboratory
LLNL	Lawrence Livermore National Laboratory
NSF	National Science Foundation
SCRIPPS	Scripps Institute of Oceanography
SNL	Sandia National Laboratories
STANFORD	Stanford University
UCR	University of California at Riverside
UNV	University of Nevada
USGS	U.S. Geological Survey
WPT	Well Production Testing, Inc.